Evaluating morphological and metrical methods for sex estimation on isolated human skeletal material

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Göttingen, 25.01.2022

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Chapter 1

1 Introduction

1.1 Background and Applications of Forensic Anthropology

Forensic Anthropology refers to the application of the sub-fields of biological anthropology in a legal context. It attempts to identify human remains in a forensic context (Krishan et al., 2016). Forensic anthropologists involve the knowledge right from the spectrum of osteology, serology, dermatoglyphics and even human physiognomy. The identification is of utmost importance when the remains are highly decomposed, fragmented, and unrecognisable. These remains are skeletonized, and forensic anthropologists are called in when skeletal remains are found during archaeological or forensic anthropological excavation or brought in by the members of law enforcement from the sites of natural or man-made disasters. The forensic anthropologists are involved in incidents of mass fatality like the Haiti earthquake in 2010 (McEntire et al., 2012), the Boxing Day tsunami in Southern Asian countries in 2004, or terrorist attacks in 2001 at the World Trade Center (Christensen et al., 2019). According to Christensen et al. (2019), the identification of these unidentified skeletal remains is important for both human rights and humanitarian grounds but Guyomarc'h & Congram (2017) suggest that forensic anthropology in all its forms is more about human rights.

There are steps involved in the identification procedure that includes the evaluation of group and individual traits. The remains are assessed based on separating skeletal and non-skeletal material and elimination of non-human elements. Then follows the step of separating based on how easy it is to recognize and if not, they might be subjected to DNA analysis (de Boer et al., 2019). In order to re-articulate different body parts and find out a minimum number of individuals, it is important to identify commingled remains (Osterholtz et al., 2014). If they are human skeletal remains and it shows the advanced phase of decomposition, the initial examination becomes necessary. It provides information on group traits such as sex, age, stature, ancestry, and trauma (Spradley, 2021). It is followed by individual characteristics of the person such as any scars, marks, breaks that healed, deformity or pathological developments. The process narrows down from a group to an individual (Krishan et al., 2016).

Forensic Anthropology works in concurrence with other fields like forensic pathology, forensic odontology, radiology, molecular biology, forensic photography, and techniques of mortuary (Congram & Fondebrider, 2016). In the case of mass disasters, different phases are observed in a disaster victim identification (DVI) process. The site, scale, and time of disaster impact the DVI operation (de Boer et al., 2019). Human remains come in different forms, soft tissues and non-soft tissues and it needs to be decided which field of research comes in the picture (Mundorff et al., 2016) and the vital assistance of different fields helps in reducing the generation of huge data as the collection involves only osseous items and eliminating non-human remains (Mundorff, 2012).

Among different supporting fields, the role of forensic radiology has been proven advantageous in the identification process that uses radiographs and CT scans to find out individualising characteristics such as dental implants and skeletal trauma (Vallis, 2017). Forensic anthropological methods like morphological assessment help obtain results comparable to methods of imaging techniques utilised in forensic radiology and forensic odontology (Sitchon & Hoppa, 2005). At sites of mass disasters, it is important to have the skill to understand the scale of fragmentation and distinguish among highly commingled skeletal remains (Buck & Briggs, 2016). When it becomes difficult to anatomically identify heavily fragmented and undetectable skeletal material, forensic anthropologists assist forensic biologists in applying the knowledge of osteology and taphonomy. They can retrieve bone or tooth samples best suited for DNA analysis (Johnston & Stephenson, 2016).

Often the work of forensic archaeology overlaps with forensic anthropology. Forensic archaeology uses the knowledge system of mapping the disaster or crime scene site, which helps forensic anthropologists search and process that area (de Boer et al., 2019). There are guides to apply certain methodologies (*Disaster Victim Identification (DVI)*, 2018) especially with respect to the gridding system which is mostly specific to the USA. This helps the process of recovery of bodies or body parts, skeletonised or otherwise. The mainstream practices in forensic archaeology involve the use of advanced drones or GPS devices, that helps map a site and document the setting of human remains (Dupras et al., 2011). Forensic anthropologists on the other hand would use the merit of low-tech methodology to recover remains by printing the labels to record and document the scene (Dirkmaat et al., 2012).

1.2 What is Sex Determination?

The process that involves the integral step of developing a biological profile while examining the skeletal remains is sex determination. The biological profile exhibits characteristics that represent the genotype, and it ultimately makes up the final appearance. The determination minds the important steps that include the aspects influencing the morphology, the different bones exhibiting the varying features amongst male and female, and the approaches used in estimating sex (Krishan et al., 2016). The aspects influencing the sex estimation include the extent of a growth spurt, what the growth pattern was like, muscle attachment, and the biomechanical movement based on the strength loading in males and females. These factors have an impact on the bones to demonstrate good sexual dimorphism (J. Singh et al., 2012).

If the preservation rate of the skeleton is good, the size and robustness of the bones can influence the initial estimation. Ideally, the bones of male individuals display greater size and robustness compared to females. The other important aspect is the age that can lead to reliable and sometimes inaccurate deductions. It is easier to estimate the sex of an adult skeleton rather than sub-adults as the features are not fully developed during the pre-pubertal phase. The estimation among adult skeletons could still be inaccurate as females in old age have the possibility of developing features that are more masculine; whereas males as well have no easy estimation when young as they have gracile features. By and large, the estimation of sex depends on the availability of the skeletal elements, but the pelvis of an adult is reported to be the most reliable element in sexing followed by the cranium. Apart from the pelvis and cranium, long bones are also studied along with postcranial elements like sternum, ribs, clavicle, vertebrae, and carpal and tarsal bones (Krishan et al., 2016). While Pelvis is a good indicator for sex estimation in an isolated case but skulls population background should be known (Ross & Kimmerle, 2009).

There are continuous improvements in the empirical methods of sexing along with the introduction of other novel methods. Practically every skeletal element has been used in developing methods of sex estimation, yet the most used methods are morphological and metrical. The identification carried using molecular methods might have more reliability, but they involve time and higher cost and not to forget, destruction of the sample. Some other non-invasive methods have already been reviewed by forensic anthropologists and they are digital radiography, CT and MRI, neural network method (Corsini et al., 2005), geometric morphometrics, and DSP (Diagnose Sexuelle Probabiliste) (Murail et al., 2005).

The preference of practitioners to estimate sex with a particular method, how it is applied, and the way outcomes are conveyed varies significantly. There have been attempts made by the community of forensic anthropology to standardize sex estimation as other individual profile traits like ancestry, stature, and age at death, depend on accurate sex estimation. The inconsistency in biological anthropology questions sex estimation protocols (Klales, 2020a). The investigation was conducted by Klales, (2020a) with the participation of 152 individuals with different levels of experience for sex estimation. The author concluded that 62.6% of participants would use both morphological and metrical methods but they would give preference to qualitative (morphological) methods. The author adds, if multiple methods do not show the same sex estimation, only 42% of observers present results for each method, 29.8% would prefer one skeletal element or method, and 12.2% would estimate with the average of all the considered methods. The ranked regions of skeletal elements based on the order of preference were pelvis, then skull, long bones, and feet bones (Klales, 2020a).

The skeletal analysis is addressed to be sex specific or based on parameters of a particular sex estimate (Christensen et al., 2019). In case sex estimation methods are not standardised, the chances that an estimate of sex or any prior sex misclassification can influence other parameters. These parameters are age, ancestry, and stature and the influence has been studied by Messer & Getz, (2020). According to the authors the age range for an individual is assessed, based on traits or the development of these traits, it means sexual dimorphism is related to male and female age differences and its distribution in the sample concerned and not vice-versa. If cranial sutures are to be used for age estimation, sex-specific methods are not necessary and have little impact on the final age range concluded (Messer & Getz, 2020).

The transition analysis (TA) method which is based on skeletal material and traits available, performed on identified individuals shows that sex misclassification does not have a big effect on individualised age and errors produced from the sex-specific calculation of age is insignificant (Boldsen et al., 2002). The interplay between sex and ancestry shows that if the individuals with no known sex are assessed with methods based on a single assumed sex, the conclusion comes out to be completely false. The individuals identified as white males when examined with all-female group methods in FORDISC 3.0 (Jantz & Ousley, 2005), the classification turned out to be all white female. The biggest effect of sex misclassification has been observed on stature estimation. The stature equation based on incorrect sex produces a relatively small but significant difference. So in forensic cases where sex is unknown the range of stature should include the estimation of both sexes (Messer & Getz, 2020).

Certain sex misclassifications might lead to an even greater deal of misunderstanding. In bioarchaeology, the incorrect sex of remains from an archaeological site might change the whole model of interpretation about the site's cultural perspective. The example of Machu Picchu in Peru highlights that how explorers published the questionable estimates of sex from the skeletal sample recovered, like in the monograph by Eaton (1916). The anthropologists discover skeletal remains of both modern humans as well as from fossil species going back thousands of years, where applying sex estimation methods meant for modern humans cannot guarantee an estimation for prehistoric remains. The other factors that complicate the estimation in palaeoanthropology are not having multiple skeletal elements, species differences might become an issue to assess sexually dimorphic traits like it is performed in humans. If palaeoanthropologists, at all manage to figure out that the samples in question belong to the same species, the norm of applying the framework of binary sex limits the research and it removes the opportunity of asking how intersex might have also contributed to our evolution (Bethard & VanSickle, 2020).

1.3 State of the Art (Review of the Current State of Knowledge – Indication of Gaps, Shortcomings, Problems in Research to Date)

There is always a debate about the applicability of American and European approaches. The European procedure mentions determining sex first so that the methods could be used to determine age and stature, specific to males or females; whereas the American approach stands with the same position to estimate ancestry first, then sex, age, and stature with methods specific to a particular population (Bruzek & Murail, 2006). Ross et al. (2010) in their report justify that determining ancestral information expedites identification of the victim in question and the search for any questioned or missing individual gets narrowed. It is evident that the development of forensic anthropology in two continents is divergent, which could be understood from the research penned down by Ubelaker (2018) about the history of forensic anthropology.

Gualdi-Russo (2007) discusses that the foremost issue that comes up while identifying, it is to understand how different methods are population-specific, particularly sex determination based on metrical measurements. While Guyomarc'h & Bruzek (2011) talk about metrical methods, how these from specific population affinity are not reliable worldwide, they try to focus on sex determination independent from the population origin. Their goal was to test the efficiency of Fordisc 3.0 where sex and ancestry are not considered together, so population origin was taken into consideration even though the study was focused on sex determination. Above it is mentioned that there is a demarcation between European and American approaches. Consequently, Fordisc 3.0 being an American creation includes the data from a select number of population groups in a repository called Forensic Data Bank (FDB). Considering that the American approach assesses the ancestry first in order to estimate sex, Guyomarc'h & Bruzek, (2011) used groups that FDB does not include.

One of the tasks in the presented study focuses on proving how effective and objective metrical methods are, what pitfalls arise while working with discriminant functions (DF) and the analysis, it is important to draw inferences from the study of Guyomarc'h & Bruzek (2011) about the applicability of applying DF from one population group to others. According to their study, applying DFs calculated from the samples of the United States on sub samples of French and Thai population groups resulted in poor reliabilities. Since assessing the sex of the subsamples without assigning a geographical origin is not possible so they compare French subjects with White subjects from FDB (forensic data bank) and Thai samples with Japanese, Vietnamese, Chinese, and American Indian groups. The accuracy was enhanced by 2.2% for Thai samples with the selection of groups but the accuracies of 74.4% and 86% for Thai and French sub-samples respectively still could not reach the threshold of 95%. This threshold makes an identification method more reliable to use.

There is a lack of a reliable sex estimation method that assesses samples from different ancestries not present in Forensic Data Bank (Ousley & Jantz, 1998). It is interesting to notice that in forensic contexts, origin or ancestry could be a decisive factor but the field of bioarchaeology rejects estimating ancestry, as the morphology of skeleton based on a particular population group is not stable over time (Spradley et al., 2008).

Guyomarc'h & Bruzek (2011) discuss how sexual dimorphism based on shape-related and size-related variations differ, like in their study French population groups did much better in terms of accuracy even if the discriminant functions from both African-American and White groups of Fordisc 3.0 were applied on it than it did for Thai sub-sample. They also computed specific DF for the French sample and argue that there is a size-related variation as DFs from the French sample could not be replicated on the Thai sample and it showed lower sexual dimorphism. While on one hand, the forensic anthropologists call upon the need to re-evaluate the use of discriminant function analysis (DFA) and linear measurement based on cranial measurements to assess sexual dimorphism, on the other hand, it is interesting to notice how (Murail et al., 2005) showed that DFA works successfully on the hip bones as their shape is necessitated by the fact of females giving birth and is also reproducible in different samples with more reliability.

In a similar light of attempting to achieve more reliance on postcranial elements, (Steyn & Patriquin, 2009) studied pelvis in South African Whites, South African Blacks and Greeks. After these three population samples were analysed separately the authors tried to combine the samples from all the groups. The accuracies calculated from the combined population groups and separate ones show a small variance. What stimulates the curiosity, even more, is that there are seven measurements considered in the study and a stepwise discriminant function was applied to create functions with possible combinations of measurements. Out of different functions created, the accuracy is highest for the function that included all the variables or measurements. Generally, the DFA drops certain variables to predict the best possible combination of measurements. Surprisingly the first function included all seven variables and have the highest accuracy in both cases of combined and separate groups when compared with the functions that include a fewer number of variables.

Employing a large sample size from combined groups and functions using more variables that are highly sexually dimorphic may eliminate the need of creating population-specific standards. Although it proved to be useful, contributing to the argument of not creating a population-specific standard in the case of pelvis but other postcranial elements might be less sexually dimorphic, and it may still be necessary to use the population-specific standards.

While many forensic anthropologists support the argument of population-specific standards, (Steyn & Patriquin, 2009) argue that it is practically impossible to create population-specific standards from different regions of the world that vary broadly. With the difficulties of not having enough skeletons representing different regions, the next problem comes with not having enough data on them to create population-specific formulae. In addition, ancestry may not be known in the medico-legal or archaeological case of isolated human skeletal material, in order to decide what formulae, need to be applied. The utilisation of population-specific standards, in the first place, stems from the motivation that population groups differ regarding their degree of robustness, sexual dimorphism, and shape & size. Thus, for many, applying standards from one population to another can produce unreliable results.

When we talk about discriminant functions, it is imperative that DFs must require validation. Garcia (2012) show how DFs derived from a Spanish population when validated on two Portuguese samples, the accuracy rates exceed 90%. The accuracy does not differ much when variables are isolated. That means when single measurements are cross validated, the accuracies achieved are 89.1% and 87%. Although Garcia cross-validated successfully the DFs from their study but performed on groups with similar sexual dimorphism. That means that Spanish and Portuguese have similar physical traits. Similarly, Mastrangelo et al. (2011) who also worked with a Spanish population sample, argue that discriminant functions can be the most reliable sex estimation method if applied to samples displaying comparable sexual dimorphism.

Sexual dimorphism and the methods of assessment are often based on the differences caused by shape and size, either they can be the signs of childbearing in women, found in pelvis or other differences of robustness that are prominent in males, for example, skull (Glucksmann, 1981). Nevertheless, sex estimation includes another debate, which is about the utility of cranial and postcranial elements over each other. Trautmann et al. (2014) pointed out that most of the skeletal elements are either incomplete or fragmented; due to poor preservation of pelvis and skull, it is vital to test the postcranial elements for sex estimation. In their study of sacrum and clavicle, the authors show that when multiple population groups are compared, sacrum from males of one population group is broader than females of all the other groups. Therefore, they argue that sexual dimorphism for a particular skeletal element based on measurements is better suited within the same population. Hence, supporting more population-specific arguments.

When a forensic anthropologist performs analysis on skeletal elements, "ideally the pelvis should be assessed first, because its evolutionary predisposition to parturition and absence of ancestral traits lead to greater reliability than is possible from assessing the skull, which should be assessed second" (Blau & Ubelaker, 2016; Rowbotham, 2016). That indicates the literature often cites the skull as the second-best indicator giving less importance to other postcranial elements (Bass, 2005). The fact that a visual approach is performed first on skull if pelvis is missing and not on any other postcranial elements, clarifies the fact, why the debate about metric and nonmetric methods persists and these methods are always a part of some validation study. According to Spradley & Jantz (2011), the literature in forensic anthropology dealing with postcranial elements in the west are based on Robert J. Terry and Hamann-Todd collections which saw emergence around the same time as described by Hunt & Albanese (2005). These collections are old and due to secular change, they do not represent contemporary forensic cases (Jantz & Moore-Jansen, 1988).

To overcome the issue of old collections Spradley & Jantz (2011) studied the collection of individuals who were born after 1929. They attempt to find out the hierarchy of skeletal elements with better sex estimation reliability. They conclude that using the multivariate (or multiple measurements on each element) data on long bones perform better than the multivariate data obtained from the cranium in both population groups of American Blacks and American whites. Furthermore, Spradley & Jantz (2011) notes, "The top three univariate estimators of sex for American Whites are tibia proximal epiphyseal breadth (90% classification rate), scapula height (89% classification rate), and femur head diameter (88% classification rate)". That means even a single measurement from the proximal tibia in the American White population group provides the same classification rate as it is obtained from multivariate analysis performed on the cranium (90.1%).

The results show how well the postcranial elements, i.e., mostly the long bones outperform the cranium in sex estimation. Spradley & Jantz (2011) conclude that postcranial elements should be preferred over cranium in the absence of pelvis. The finding from Tise et al. (2013) for post cranial sex estimation on Hispanics shows that tibia proximal breadth had a lower Mahalanobis distance score (1.58) and cross-validated classification rate (83.09%) as compared to radius with a high classification rate of 89.43%. Reporting the accuracy for proximal breadth as a single measurement used to classify Mediterranean populations of Greeks (80.9%), Spanish (93%), and Italians (85.2%), Kranioti & Apostol (2015) imply that tibia is extremely discriminatory. With 86% accuracy from proximal tibia breadth classified on a combined sample of South African black, white, and coloured groups, Krüger et al.

(2017) suggest that that discriminatory power of breadth measurements between sexes is better than the length measurements.

As mentioned earlier, like Jantz and Spradley (2011) touch upon the issue of old collections and secular change, Ubelaker & DeGaglia (2017) continue the discussion that how population variation could be related to human growth and development when subjected to sexual dimorphism. It is clear why sex estimation is performed on adult skeletons since juveniles do not have sexual dimorphic features fully developed. Population variation for sexual dimorphism is assessed on adult skeletons and juvenile growth patterns are hardly discussed in different population groups. Important understanding adding to the debate of juvenile sexual dimorphism that how secular change plays an important role - regionally understood, that population variation with respect to sexual dimorphism has been noticed in studies before and after puberty both (Eveleth et al., 1990).

For example, Ashizawa et al. (1996) found out the difference in the maturation of skeletons when the authors compared radius-ulna radiographs of children from Tokyo with data from the UK, Belgium, China, and India. Children from Tokyo reached maturity 1-2 years before the ones of European and Chinese descents. While Ubelaker & DeGaglia (2017) initiated the discussion about population variation in juveniles in their paper, they reference Buikstra from 1994. The author in 1994 added that for long it has been taken for granted that childbearing post-birth marks on pelvis indicate the best trait for sex estimation, but key pelvic traits can also be applied to individuals with the termination of growth and not only on complete adult skeletons. In 2002, while conducting a study on human facial skeleton regional differences Viðarsdóttir et al. suggest that with early maturity age or morphology development, it cannot be justified that it is adult morphology as there are environmental effects that can still have certain influence later on.

Pelvis being the first choice by forensic anthropologists for sex estimation adds an interesting finding to the debate. In a study done on Later Stone Age (LSA) forager in South Africa along with European Americans and Portuguese population groups by Kurki, the author found that females of different population groups exhibit comparable size of pelvic canals and males have considerable differences (Kurki, 2007). The author concluded that the pelvis could have an overall effect of size on birth-related traits in females, which means sexually dimorphic in the same population group but there can be less population variation in female pelvises.

Krogman (1962) offers an interesting insight that adds to the discussion of size-based methods for sex estimation. In visual assessment, if a morphological series is created, extreme values achieved with methods based on size enhance the possibility of more reliable sex estimation. Looking at the robusticity of supraorbital ridges and other cranial traits would help sort out the male and females easily depending on how prominent the feature is. Then, comes the specimen with less prominence for the same trait, which increases the bias. Similarly, in metrical methods, the intermediate values like sectioning points are shared by both sexes and may bias the estimation.

Spradley & Jantz (2011) also touch upon the specificity of data analysis done with metric and nonmetric data, and the terminology that comes along with it. They point out the difference between an assessment and estimation with respect to finding sex. Using morphological characteristics would be subject to visual assessment and that does not provide any error rates or any related statistics, thus, it should be considered an assessment. Whereas using the measurements on one bone or a combination of bones provides an error rate or an accuracy rate in the form of an estimate, which justifies the use of 'sex estimation' in the application of metric methods (Christensen & Crowder, 2009).

The accuracy rates derived from old collections make a way to study other similar old collections of known sex and conclude with new estimation methods or validate an existing method. Most of these studies produce a research-based accuracy rate as this term has been used by Thomas et al. (2016). The authors discuss how estimation methods are based on skeletal collections of known sex and never on actual forensic cases. They tested methods from the literature on 360 individuals, whose DNA results were taken as the true determination to validate the methods applied. The study concluded with 94% of accuracy and interestingly the accuracy rate increased when only 226 individuals were assessed where pelvis, crania, long bones were included in the assessment.

Like Thomas et al. (2016) attempted to validate the methods using DNA results, it is clear that there is a heavy reliance of the scientific community on the molecular approach. It is viewed to be the key component for reducing the error and producing a conclusive result. Out of different effective methods, the use of the Amelogenin marker is widespread as it is part of the most commercially available typing kit and it involves the analysis of X and Y-specific target sequences (Butler & Li, 2014). In fact, in order to be accepted into the Combined DNA Index System (CODIS) the attempt at the amelogenin test is necessary (*National DNA Index System (NDIS) Operational Procedures Manual*, 2013.). However, reliance on a standardized method is hard to find even if the skeleton is preserved, the presence of DNA can be degraded, and the number of copies is low.

Butler & Li (2014) expand the picture of success and failures associated with amelogenin and review other Y-chromosome markers. Some of these markers show a promising advantage over Amelogenin. What makes amelogenin unique is, that it is expressed on both the X and Y chromosome and there has been 89% homology found, so the PCR products of both alleles (AMELX, AMELY) on AMEL locus is used for identification (Nakahori et al., 1991; Salido et al., 1992). Other advantages include the fact that 6 bp deletion in AMELX can help differentiate PCR products of AMELX and AMELY (Nakahori et al., 1991), a single reaction is sufficient to amplify both X and Y fragments (Steinlechner et al., 2002).

What is the biggest challenge here though? Using amelogenin to determine sex from degraded DNA. The challenge to sex-typing degraded material has been explored by different researchers (Haas-Rochholz & Weiler, 1997; Li et al., 2012; Tschentscher et al., 2008) where they utilise various primer sets with base-pair deletions on amplicons of different sizes on both AMELX and AMELY. The testing of these newly designed primers was conducted by (Codina et al., 2009) and the authors report successful amplification of target length of DNA that was artificially degraded. Like allelic dropout, further issues were noted with amelogenin testing which included mutation at amelogenin locus due to deletion at AMELY, despite the presence of Y-DNA, the failure to amplify DNA persists and it results in incorrect DNA sample identification (Kashyap et al., 2006; Steinlechner et al., 2002).

Other Y-chromosome markers are SRY, TSPY, DXYS156, and STSP1. SRY has a strong association with the development of the male sex. So, when amelogenin tests do not work, SRY is used to confirm the sex (Drobnič, 2006; Tozzo et al., 2013). The disadvantage with SRY is, that it lacks a homologous sequence of the X chromosome or autosomal chromosome to amplify with the same set of primers (E. Butler & Li, 2014). But using different markers amplification might accurately and successfully type the sample. Tozzo et al. (2013) suggest amplifying SRY along with AMEL X and Y markers. The sex assigning probability increases in case there is a deletion of the Y marker from amelogenin (Schmidt et al., 2003). Unlike single copy in amelogenin and SRY, TSPY has got multiple copies per Y chromosome, which increases its sensitivity in identifying Y-chromosome DNA (Kamodyová et al., 2013).

There has been an attempt made to amplify the TSPY4 marker where it allowed for detection of DNA whose concentration was lower than the single copy SRY marker (Jacot et al., 2013). (Butler & Li, 2014) add that TSPY markers can be advantageous for highly weathered sample sex identification or a low concentration of male DNA in a mixture of male and female. In the case of choosing a positive control, DXYS156 works better as it is present on both X and Y chromosomes like amelogenin. The advantage over amelogenin includes the fact that DXYS156 is multi-allelic and this polymorphic locus has a higher accuracy of discrimination and may possibly give information about the geographic origin (E. Butler & Li, 2014).

Another marker that stands as a strong contender in DNA identification is STS. This gene is X chromosome-linked, where the size of an exon is between 120 and 160 bp and there is a pseudogene present on the Y-chromosome called STSP1 which is sized as 100 kb (Furrow et al., 2011). In a demonstration performed by Morikawa et al. (2011), it appears that male control DNA amplified two peaks and female-only one. Additionally, from amplification of the AMELY-deleted male sample, there were two peaks both for STS and for STSP1.

While there are several promising methods available, it is important to understand that it is not plausible extracting and amplify nuclear DNA in all situations. Depending on the case, mitochondrial DNA may be needed for the investigation (Latham & Miller, 2019). mtDNA is seen as an advantageous target as it provides a high copy number (Edson et al., 2018). Concerning multiple Y-chromosome based methods discussed above, Latham & Madonna (2013) mention that while Y-chromosome is a nuclear genome but follows the family's male consanguinity, mtDNA follows the family's female line. Due to this fact, mtDNA analysis can be limited to conditional identification.

Adding to the exploration of the comparatively better methods, one can say that SNP typing methods due to short targets are not affected by DNA degradation as it happens with multiplex STR typing (Hofreiter et al., 2015). SNPs can provide more information as compared to STRs. The size of SNP ranges from 60-80 but SNP is not equally polymorphic like STR and the DNA profiles are not comparable (Budowle & Van Daal, 2008). The DNA profiles from the usual STR loci uses longer targets. However, is longer targets always better? The problem of DNA degradation has been the focus of the research done by authors dealt by Butler (2001), Hummel (2003), where they show that samples with 200 bp showed incomplete STR profiles but with 300 bp the amplification failed and this was overcome by introducing mini-STR kits with reduced targets of 280 bp (Seidenberg et al., 2012).

One of the issues surrounding DNA degradation is the fragmentation of double helix structure which may lead to amplification failure (Fondevila et al., 2008; Schmidt et al., 2020). The end effect of degraded DNA in the analysis is clear but Latham & Miller (2019) shed light on what are the different factors leading to DNA degradation. The DNA persists longer in bones and teeth as opposed to soft tissue. The defence against DNA degradation is due to the rigid structure of bones and teeth. However, the state of preservation and intactness might not always yield DNA. There are factors like temperature, moisture level, oxygen level, microorganism activity, soil composition, pH, bone type which might increase or slow down the degradation (Pokines & Symes, 2013). There are different preservation rates at different sites on a skeleton and even on the same bone (Latham & Miller, 2019).

Even though DNA analysis is viewed as a component for reducing the error and produce a conclusive result, with degraded DNA and low template samples the possibility of error in DNA typing is still present, where the contamination can lead to allele drop-in (Carracedo et al., 2012). The other common causes apart from contamination are human errors, technical problems, incidents of sample mix up, and storing samples without tagging them with the correct location or source. (Kloosterman et al., 2014). The heavy reliance on DNA analysis is often regarded as the “golden standard”, still, the error rates in different casework are not being discussed much and are not published in detail. The authors think that there are multiple reasons for that, such as the reputation of almost accurate DNA analysis might take damage, the definition and relevance aren't clear and how it can be explained to the legal system if needed (Kloosterman et al., 2014).

While understanding the efficacy of different available molecular methods, it is clear that there are limitations as well that fosters the discussion of improving morphological and osteometric methods. When we talk of univariate analysis, the authors like Spradley and

Jantz recommend using univariate metrical methods on fragmentary remains, but the challenge arrives when there are not many validated discriminant functions based on a single variable in the literature, which would arrive at the same conclusion of high classification rate from the same skeletal element as the multivariate analysis does. In order to utilize multivariate discriminant functions, the bones need to be recovered intact which is the opposite of an ideal scenario. Tuller & Đurić’ (2006) highlight the challenge of keeping the skeletal elements together while exploring different excavation methodologies. Factors that lead to fragmented or incomplete recovery of skeletons include - different bodies having various degrees of decomposition, skeletons are mixed with soil, clothes, sometimes garbage, and previous attempts to destroy the bodies with fire, chemical or other methods. If the previous state is not highly disturbed, then the construction machines to unearth the gravesites affect the soil matrix of the burial greatly and hence the bodies even more.

The understanding of choosing a particular number of variables while applying metrical methods is complex. Coelho & Curate (2019) discuss models for sex estimation and according to them, the diverse modelling systems can be used to classify the same groups of males and females but as the data sets vary, the error rates would change as well. Not every model or discriminant function found in different literature are evaluated on the basis of multiple factors to mark the proficiency of that model. So that they can classify individuals with no specified groups or sex (Larose, 2015). The ability of models was assessed in the study of Coelho & Curate (2019) through the measures of Cohen’s Kappa, sensitivity, and specificity. They built an interactive platform called CADOES (http://osteomics.com/CADOES/) for creating models for sex estimation based on the number of variables chosen.

In their study, CADOES creates models using 38 variables that have been initially included. The results highlight those models based on a different number of variables among the selected 38 provide similar accuracy rates. The authors suggest using models obtained using just three to six variables as performance for different metrics appear to be similar. Since applying a high number of variables require more intact specimens and using a smaller number of variables can mitigate the problem of fragmented material. However, they advise that univariate models should be avoided as they can have reduced accuracy with increased bias. Coelho & Curate (2019) support the statement of Mahakkanukrauh et al. (2017) that generally two to eleven variables could produce accurate functions or models for sex estimation.

Against advising univariate models, when the traditional recommendation is to be taken into account, Stewart (1954) writes that single approaches like the vertical height of femur's head or humerus or maximum length of the long bones remain in use widely. In the opinion of (Peckmann et al., 2015), a single measurement has lesser importance in sex assessment though. The values from males and females derived from functions with a single measurement overlap each other. Coelho & Curate (2019) worked on pelvis with respect to multiple variables but when other postcranial elements are assessed in the same light, humerus as a single bone with multiple variables showed better accuracy with all the variables combined as published by Kranioti & Michalodimitrakis (2009). They investigated Greek individuals that included 168 left humeri and they achieved an accuracy of 92.9%. Srivastava et al. (2013) examined ulna bone from the samples of North India achieving 84.9% and 84% accuracy with single variables but with combined stepwise variables analysis reached 88.7%.

Speaking of measurements and validation, the reliability of metrical methods improves if they are validated. Ross et al. (2011) point out that the methods pertaining to population biology; the standards for those methods need continuous updating, in order to consider the influence of population variation and secular changes. What does it mean to consider fact that secular trend does influence sex estimation? It helps to know that there would be a chance of errors when the population specificity of methods is not taken into account while classifying individuals of unknown ancestry (Kotěrová et al., 2017).

In a study done by (Richard et al., 2014) to test the accuracy of traditional cranial measurements, they used multiple formats to retrieve data with the help of medical imaging technologies. They collected data from the scans and created a prototype of the original skull based on the scan. On this prototype, the craniometric measurements were taken with the traditional approach. Comparing the data from traditional measurements on the original skull with the prototype fared better than medical scans. The measurement values from the prototype, CT scan, and the laser scan that was used to create the prototype, each was subtracted from the traditional osteometric values for every individual. The mean difference was lowest for the prototype at <0.01 and medical images considerably much greater standard deviation.

On a similar note of validation and comparison, it is established well in literature, that in respect to metrical methods, there are very data-centric discriminant functions published, but analysis of non-metric methods is different. The selection of the morphological trait list completely depends on the observer who makes the decision. The observer has to decide if the trait or expression of the skeletal element represents the correct biological sex, any individual peculiarity, or it is indefinable (Stewart, 1979). An interesting turn of analysis combines the data from metric and non-metric methods. The variables in metrical methods take the form of continuous data and non-metric variables are stored as categorical data (Hefner et al., 2014). The literature does not boast of such communion often but Richtsmeier et al. (1984) talk about the connection between morphological and metrical data and suggest, “cranial metric variables are good predictors of nonmetric trait expression”.

Hefner et al. (2014) show how individual methods of metrical variables and morphological variables produce the accuracy of 78% and 75% respectively; whereas when both types of variables are combined, the accuracy of nearly 86% is achieved. The analysis of data and interpretation often face the challenge of data normality. For achieving 86% accuracy, the authors ignored the statistical norms, yet DFA (Discriminant Function Analysis) performs relatively well. Nevertheless, DFA has its limitations. According to the literature, most of the research in forensic anthropology considers the population groups that do not have a big sample size for the data and DFA too cannot work with a high number of metrical variables. So stepwise discriminant function reduces the variable number to keep the ratio of a variable number to sample size fitting or appropriate. Thus, it can have better predictors with the reduction of variables (Hefner & Ousley, 2014).

The literature recognises that DFA gives metrical methods an edge over nonmetric traits since forensic anthropologists analyse both methods separately in order to reduce the biases in reaching a conclusion. Feldesman (2002) points out that combining two datasets from metric and nonmetric in one DFA analysis would violate the assumption i.e., Normal distribution and would be difficult to apply classification statistics. Hefner et al. (2014) discuss in their study that Random Forest Model (RFM) could outperform DFA in the case of a combined dataset. DFA in general would drop the individuals with missing data even for a single variable and RFM would drop the individual only when a particular variable is missing and uses the median value to substitute the missing one. That will help to reduce the classification errors and increase the accuracy for better.

In the arena of forensic anthropology, so much documented research is related to methods validation. Perini et al. (2005) emphasize that not only validation of methods but also the precision and accuracy of performing the measurement, do result in further reliable data. The technical execution of measurements helps to understand the replication of methods. How well a technique has been executed, can be known with an inter-observer error rate that can highlight the precision and accuracy. While the execution of metrical methods does not require the observer to be a subject expert but there can be a higher rate of error due to the following factors involved – not applying sufficient interval between two measurements with respect to inter-observer error, the unpredictability in locating the same anatomical points, and variation of measurement procedure execution. The error rate between two measurements done by the same researcher or different researchers can be observed in terms of Technical Error Measurement (TEM) (Perini et al., 2005). TEM is an index that shows the error rate in anthropometry. It verifies the accuracy when the measurements are repeated and compared with other observers' measurements.

The meaning of error is different in courtroom and research situations, thus creating a scientific certainty appears to be a challenge (Bird, 2001). What is an error in the first place though? Christensen et al. (2014) define an error as "…an act, assertion, or belief that unintentionally deviates from what is correct, right, or true; the condition of having incorrect or false knowledge; the act or an instance of deviating from an accepted code of behaviour; or a mistake" (pg.1). The concern what Bird (2001) raised, can be well reflected in the National Academy Sciences' report that due to lack of testing, validity, or development of errors there is misinterpretation and misunderstanding around the theme of error (Council, 2009). Page et al. (2011) focus on the question - what is reliability and validity and how a US court has issued new guidelines based on which reliability and validity are taken into consideration while including or excluding a method of forensic identification? According to Page et al. (2011), validity can be understood as the likelihood of concluding the correct result irrespective of any definitive method chosen and what the data is. Reliability is seen by Hand (2004) as to how different observers observe the same measurement differently. It is interesting to see what role error plays in understanding validity and reliability. A technique's validity can be understood in terms of identified error rate, whereas the observation with high reliability means it shows small or no interobserver error (Christensen et al., 2014).

Understanding the role of error is important but what are the sources of those errors? Christensen et al. (2014) simplify the different sources as "practitioner error, instrumental error, statistical error, and method error". Practitioner error discusses the mistakes that happened during the use of an instrument, observing data, or choosing unsuitable methods. Instrument error happens when the instrument is not well calibrated, but a satisfactory amount of error still exists, and it is understood and recognized. Statistical error is considered to be variability between true and observed results. At last, method error could be understood with a simple example of skull and pelvis. There is more number of traits that overlap in a skull for males and females than it does in a pelvis. In terms of sexual dimorphism, pelvis is considered to perform better than the skull. So, a method error is more of a limitation and not an error per se. Method error cannot be minimized as the given error rate is based on previous results and the error rate currently estimated works only for the present cases. (Christensen et al., 2014).

First, the error rate must be low in any scientific method but despite having a great research design and models, reporting those errors and limitations is even more important to clarify issues for the significance of results (Christensen et al., 2014). "Amongst legal communities, forensic practitioners have claimed that their technique has zero error rate" according to the report of U.S.A. v. Mitchell, 145 F.3d 572 (3d Cir. 1998). Claiming a zero-error rate at the first attempt of analysing something is difficult or some might suggest it is completely unscientific as it might be impossible. Christensen et al. (2014) further argue that as forensic anthropologists or a part of the scientific community, we ought to be active in bringing the awareness forth to the legal community about the knowledge and differences of error and limitations, along with a strategy to alleviate the issue of error. The best way to accomplish it, is to fully understand and report the causes of error in our research.

Training and experience impact hugely on the chance of errors. Perini et al. (2005) also suggest that not having the subject expertise is acceptable but the osteometrists need to be trained further. Vegelin et al. (2003) studied anthropometrists with different levels of skill. They verified that observers having experience of more than six years obtained the best accuracy for measurements. As for nonmetric methods, it demands a rigorous practice to assess a skeletal element visually, it is interesting to notice that most of the forensic anthropology literature do not stress the intermittent checks on the measurement technique.

The performance check and training might help reach improved accuracy and reliability on measurements also increases.

1.4 Statement of the Aim of the Research

Forensic identification of human skeletal material requires sex determination. In principle for sex determination, three approaches are available – morphological, metrical, and molecular. Although the molecular method is the most advanced one, DNA is often so strongly degraded, that it cannot be applied. In such cases, it must approach the classical methods that are morphological and metrical. However, there are various published methods in forensic medicine and forensic anthropology, but there are discrepancies in the accuracy rates for the same methods and they have not been tested thoroughly by applying classification methods from one population group to others of different ancestries. The samples from the 20th century have been heavily utilised and the trend drawn from these accuracies on modern samples have not been cross validated on samples from medieval and postmedieval times. The primary focus of this research is to determine the sex of human skeletal materials by applying both morphological and metrical methods published in the various forensic and anthropological literature on different skeletal series in association with molecular testing. Those methods are published in various forensic and anthropological literature claiming to identify the sex of an individual from single skeletal elements. The skeletal materials used in the respective publications originate from individuals of different ancestries, mainly European and African.

Garcia (2012) advises the use of sample-specific methods and similarly, other publications do not state either, whether the methodology and the respective discriminant functions could be replicated and reproduce the similar reliability regarding the individuals of different ancestry. Most of the published research investigates cranial elements and pelvis, giving less focus on postcranial elements like long bones namely humerus, radius, ulna, femur, and tibia. The here presented study includes both cranial and postcranial elements including long bones. All data have been collected from an early modern (Inden) and a medieval (Lübeck) skeletal series housed at the Department of Historical Anthropology and Human Ecology, the University of Göttingen, Germany and the School of Anatomical Sciences, the University of Witwatersrand, South Africa. The research has been embarked on in a way that the evaluation of 17 morphological traits and the assessment of 59 metrical measurements were investigated independent from each other. The sex determination results obtained from this initial part of the study which comprises one skeletal series from Inden in Germany are proved by using molecular genetic typing and data from a church book register of the concerning skeletal series. For the genetic typing, DNA was extracted from teeth and clavicle bone and different X and Y chromosomal genetic markers were amplified by PCR.

1.5 Justification of the Project

With increasing attempts of validating and improving methods in forensic anthropology, it is important to understand that validation studies are not free of problems. The researchers tend to adjust or adapt the procedures instead of testing the methods as it was presented originally. In other disciplines of forensic sciences like forensic biology, questioned documents, dactyloscopy, experts utilise the empirical knowledge as well as the results of published validated studies for any particular technique. Considering there is a different sample size, statistics, intra- and inter-observer error, validation studies in the discipline of forensic anthropology will not just result in a binary response, but rather end with a precision level and an accuracy rate. It helps determine the method reliability (Christensen & Crowder, 2009). Sex estimation has primarily been used in biological and legal contexts. The methods adopted more recently into the field of physical anthropology cannot be used in other disciplines unless standardized based on evidence and framework (de Boer et al., 2020).

The heavy reliance on DNA and the idea that it will eventually resolve the case is the reason, unrecognisable remains are not often fully assessed with traditional anthropological methods, whether metrical or morphological (de Boer et al., 2020). Although to date, proven applications of metrical methods in the field of forensic anthropology are few, practitioners in this field are now beginning to recognize the potential power of these techniques for human identification. This is especially important in light of the changing demographics of such rapidly growing populations around and that it will assist in the identification of undocumented human remains. The traditional anthropological methods are particularly more important in cases of provenance research, the methods with bone destruction could not be employed on these samples. The collections must be sent back to the place of origin following the protocol of burial repatriation.

By using these modern methods along with informative prior knowledge such as census or demographic information into standard forensic practice could produce a much more informative assessment of the unidentified human remains. The current methods use a greater number of landmarks coordinated than used in the traditional approach. By working on this dissertation, the increased number of landmarks will be used for the final reliable development. As adopted from the literature there are new measurements, which are to be tested. Since Martin & Saller (1957) is considered to be a standard platform of defined measurements and these new measurements are not present in Martin and Saller, hence it calls for contributing an argument whether these new measurements can produce a better result or not.

Over the years the methods used in physical anthropology have greatly increased the significance, particularly in studies of morphological change due to human evolution (Bruner & Manzi, 2007). Such research will not only contribute to the field of forensic anthropology solely but also to those areas which work on the same methodology as archaeology and palaeoanthropology, as the whole field of anthropology is quite interdisciplinary. The interpretation of outcomes requires significant statistical background, and with anthropological methods, the number of studies presenting those frameworks are limited (Berger et al., 2020). Given these difficulties, it seemed appropriate to attempt a study of the question of sexual differentiation of skeletal elements in different population groups.

1.6 Research Question/Objectives

- General: To test the reliability and respective value of the various methods of sexual identification, the first objective adopts a set of measurements and traits that are well-recognized procedures in physical anthropology. It encounters the methods as published in the literature for two approaches of metrical and morphological. Most of these methods argue about creating population-specific standards. Therefore, the methods derived from these works of literature have mostly been performed on homogenous groups. In the present study, the morphological traits will be used as widely assessed and metrical methods will be used on different population groups with the same set of discriminant functions derived.

- Specifics –

    1) To evaluate the morphological methods and compare the accuracies when applied to population groups of German and South African african ancestries.

2) To evaluate the metrical methods and compare the accuracies from population groups of German and South African african ancestries.

3) To determine the inter-observer error on a sample of Inden series.

4) To derive new discriminant functions on cranial and post-cranial elements of Inden series representing German ancestry and apply on Lübeck and South African series representing German and South African african ancestries.

Chapter 2

2 Materials

Identification of the research samples – Presentation of the different series to be studied.

2.1 Inden Skeletal Series

The information regarding the documented skeletal series from Inden in West Germany has been sourced from the paper 'Evaluation of entheseal changes in a modern identified skeletal collection from Inden (Germany)' by (Salega & Grosskopf, 2021).

Location of the series – The Inden collection is currently housed at the Department of Historical Anthropology, the University of Göttingen, Germany. The collection has been excavated from a cemetery of an old church St. Clemens in Alt-Inden village. That is located in the district of Düren (State: North Rhine-Westphalia) as shown in Figure 1 (Salega & Grosskopf, 2021).

State of preservation – The skeletal material in the collection is preserved to an extent, well preserved in some cases and in some not. The appearance of bones shows a great deal of taphonomical processes. The rate of decomposition is visible as the area of spongiosa has been eroded along with fragmented os coxae (pelvic area), vertebral column bones, and ribs (Salega & Grosskopf, 2021).

Sample size – Out of 236 individuals recovered in Inden collection the sample size for analysis makes up 182 individuals. The sample sizes for morphological assessment (Crania = 108, Mandible = 93, Os coxae = 123) and metrical assessment (Crania = 56, Mandibles = 72, Os coxae = 49, Humerus = 98, Radius = 91, Ulna = 103, Femur = 106, Tibia = 110) vary. The ancestry of the series is German, also referred to be European in the forensic anthropology context. This modern skeletal collection comes from the period of 1877 and 1924 when the church St Clemens cemetery was used. The excavations were done under the supervision of Dr Birgit Grosskopf (University of Göttingen) between 1999 and 2004 (Salega & Grosskopf, 2021). The burial information includes names, age at death, and date of burial for many individuals but not for all. Molecular analysis performed for some individuals also assist the assessment of morphological and metrical sex estimation.

2.2 Lübeck Skeletal Series

The source of the information providing the location, history, and total sample size has been referenced from the master's dissertation titled, 'Inventory and Morphological Sexing in a Medieval Skeletal Series from Lübeck' submitted by Maria Feicke (2013) at the University of Göttingen and Hummel & Grosskopf (2022).

Location of the series – The Lübeck collection is currently housed at the Department of Historical Anthropology, the University of Göttingen. During the period of 1989 and 1992, the skeletal series with more than a thousand individuals were excavated by the Institute of Pre- and Early History, Lübeck as marked in Figure 1. The series belongs to the middle age with northern German ancestry, specifically assessed as European in the forensic anthropological context. For research and analysis, the series was handed over by the Institute of Human Biology, the University of Hamburg to the Department of Historical Anthropology (Feicke, 2013).

State of preservation – The series were excavated from two big mass graves found with 696 individuals and two small mass graves found with 120 individuals. A total of 816 skeletons from these graves have been carbon-dated to the years between 1260 and 1390. The big mass graves are certain to be affected by the Black Death (Feicke, 2013). The plague that started in the 14th century (1347-1351 and 1361-1362) as a deadly pandemic is referred to as the Black Death (Dewitte & Kowaleski, 2017). There are two sections of the series, the section starting with identifying numbers 1500 and above are in a well-preserved state with the least erosion of bony sex indicators and no commingling of bones. The section below 1500 have individuals who have fractured bones as most of the individuals do not have complete skeletons, so they have been boxed together. There is a high commingling and the defined features of morphological and metrical landmarks in a lot of bones are fragmented. The fragmentation can mostly be found on the skull and pelvis with intact postcranial elements, so these individuals have been included in the study.

Sample size – According to the original data as held by Museum Lübeck there are 1255 individuals in the series. Out of 1255, the series housed at the University of Göttingen has 1044 individuals. The series contains a large number of individuals but for the sample size to be studied, only 287 individuals have been considered owing to the time and objectives of this study. The individuals included for morphological assessment (Crania = 118, Mandible =

97, Ossa coxae = 193) and metrical assessment (Crania= 118, Mandibles= 97, Ossa coxae= 206, Humerus= 175, Radius= 161, Ulna= 166, Femur= 204, Tibia= 155) vary.

Figure 1 Map of Germany highlighting the origin of population groups Inden (1) and Lübeck (2). Source: Google Maps.

2.3 South Africa Skeletal Series

The information regarding the documented skeletal series from South Africa has been sourced from the paper 'The History and Composition of the Raymond A. Dart Collection of Human Skeletons at the University of the Witwatersrand, Johannesburg, South Africa by Dayal et al. (2009).

Location of the series – The Raymond A. Dart Collection of Human Skeletons also known as Dart Collection is housed at Human Variation and Identification Research Unit in the School of Anatomical Sciences, the University of the Witwatersrand, Johannesburg, South Africa, see Figure 2 (Dayal et al., 2009).

State of preservation – The bones are well preserved as they are cadaver-origin specimens. The bones have been prepared and recorded after removing the soft tissues. Since they have never been buried they have no signs of wear and tear. The cadavers that have been utilised for dissection in the medical academic programme were manually cleaned, labelled, catalogued, and stored in the collection area (Dayal et al., 2009).

<u>Sample size</u> – The Raymond A. Dart collection comprises 2605 cadaver-origin skeletons with different population group affinities. The demography of these skeletons includes 76% South African Africans, 15% South African whites, and South African coloured population groups making a small proportion of 4%. There are 1840 (71%) skeletons representing males and 756 (29%) females, and 9 unknowns, where the age at death has been recorded between the first year to over 100 years. The birth years extend in a period of more than one century between 1827-1980. The present study and analysis of the Dart Collection aim at cadavers from South African africans. The total sample size consists of 163 individuals and the age at death as per record is between 20 and 60 years (Dayal et al., 2009). Depending on the availability of skeletal material and feasibility of apply the morphological (Crania = 159, Mandibles = 160, Ossa coxae = 154) and metrical sample (Crania = 159, Mandibles = 160, Ossa coxae = 154, Humerus = 154, Radius = 155, Ulna = 154, Femur = 155, Tibia = 156) sizes vary from each other.

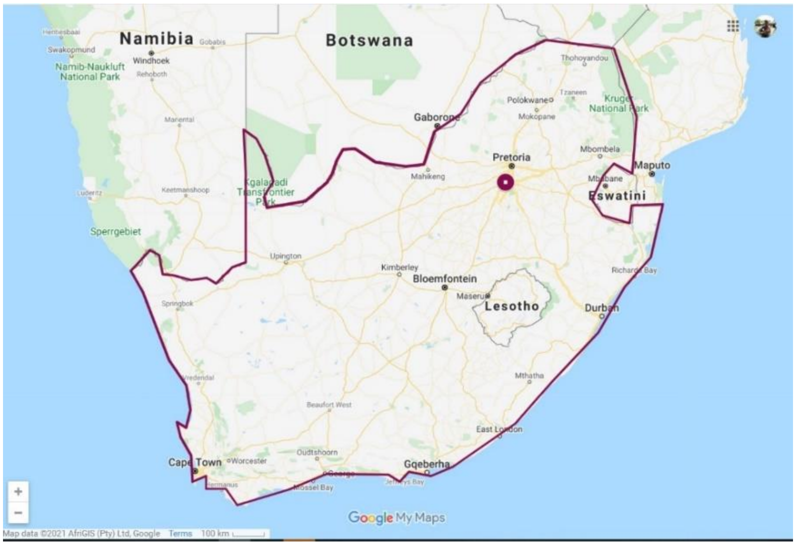


Figure 2 Map of South Africa pointing the location of third sample of data based in Johannesburg. Source: Google Maps

Chapter 3

3 Methods

3.1 Morphological Methods

The assessment of skeletal elements based on visual subjectivity for distinguishing sexually dimorphic characteristics is the way for sex estimation by morphological method (Krishan et al., 2016). There is some rigid importance for visual assessment when it comes to features like mandibular ramus flexure (S.R. Loth & Henneberg, 1996), and robustness on cranial and pelvic features. The biggest pitfall for morphological methods is subjectivity. The analysis may be biased depending on the experience of the observer. Moreover, morphological methods work better with complete and intact bones but more often it is not the case whether in a field or an academic classroom setting, this is where the experience has a greater influence.

3.1.1 Samples Involved – Inclusion and Exclusion Criteria

Since individual morphological characteristics have been applied on isolated skeletal material, the inclusion of material in the sample size has both intact and complete and also partially complete bones. The crania, mandibles, and pelves have been used for morphological analysis. Although the term pelvis refers to multiple bones forming the whole structure with os coxae, sacrum, and coccyx, in the morphological analysis only ossa coxae have been included. For applying the morphological traits, a morphological series would be created with crania, mandibles, and pelves. It would exclude the material that are damaged at the landmarks specified to be used in the study. For every landmark there is to be a new morphological series, so in partially broken material, even if there is a presence of at least one landmark, it will be included in the study. It is, as well, important to exclude the material with no known demographic study or genetic data for successfully validating the methods and evaluating the accuracy.

3.1.2 Methods of Analysis

Four traits of the os coxae were used. These chosen traits reflect the functional morphology of pubic, ischial, and iliac bones and manifest sexual dimorphism (Bruzek, 2002). There are more than 30 sex-specific pelvic traits present for a morphological sex estimation but sometimes few like four shown in Table 1 are sufficient and dependable for a positive sex identification (Grupe et al., 2015).

There are 9 cranial and 5 mandibular traits shown in Table 2 and Table 3, which do not have any hierarchy and they have been taken from (Herrmann et al., 1990)and other sources mentioned below in the tables. These traits have been consulted from various literature and they have been internationally accepted. In terms of choosing traits for crania and mandible, there have been some modifications made. The traits have been considered together for an overall assessment, a couple of them clubbed together, and the rest independent from each other. When all the traits are combined and assessed together, the results become very homogenous, and the accuracy improves (Bruzek, 2002). So, the traits like cranial overall and mandible overall have been included in the study to understand its impact. Buikstra & Ubelaker (1994) note "Maximal expression involves a massive glabellar prominence, forming a rounded, loaf shaped projection that is frequently associated with well-developed supraorbital ridges." Therefore, in this study glabella and supraorbital ridges have also been grouped together. Although the ability to take the information from multiple traits to estimate sex is greatly limited at present (Klales, 2020) but to increase the probability of sex and reduce the subjectivity the traits in a particular region have been considered together for example the traits forehead steepness and frontal eminences in crania and prominence of gonion and mandibular ramus flexure in mandible.

General procedure of data collection – Sexing of skeleton involves creating a morphological series based on the standards, morphological traits, and sex-specific characteristics proposed by the authors mentioned in Tables 1, 2, and 3. The assessment of an individual specimen can be divided into three steps – 1) observing the trait, 2) evaluating the form of the trait (in regard to male and female characteristics), and 3) sex estimation. The observation includes a single trait as well as grouping of two traits together. A concept of morphological series, the preferred traits with their corresponding sources as described in Tables 6 and 7 from the publication of Klales (2020a) could be used as a reference to cover the basic methods that have already been applied.

Morphological series – Those individuals that have pronounced male and female characteristics, can be used as a reference to observe, and evaluate the rest of the individuals in the skeletal series. The formation of morphological series involves comparing the shapes of traits. Since absolute and significant differences between males and females rarely exist (Bass, 1995), so it should be observed in any specific population by concluding, which morphological traits are more pronounced and which ones are less. The individuals are ranked for a given trait with more masculine traits on the extreme left side and with more feminine traits on the extreme right. The rest of the individuals with less pronounced traits are placed between the two extremes and it creates a spectrum of traits highlighting sexual dimorphism. One of the advantages of morphological series is that individuals with underdeveloped or less pronounced traits can easily be placed in the range. The observation and evaluation are based on the scoring done in a particular range, i.e., Male, Tendency Male, Indifferent, Tendency Female, Female. The trait pronunciation can vary among populations. It leads to weighing of a particular trait over the other but for this study, no trait order has been followed. In case of strong fragmentation at the site of a particular trait, the individual is recorded as indeterminate or undetermined sex. With overlapping of both male and female characteristics the sex is recorded as indifferent (Feicke, 2013).

<u>Challenges</u> – The biggest challenge for the pelvis is that our ability is limited in terms of taking multiple traits together and conclude with probable sex considering not every trait has been proven valid and reliable. Considering population differences and the availability of about 20 traits in the literature (Klales, 2020), the use of three pelvic traits from Phenice, (1969) continue to be utilised widely by the community of Forensic Anthropologists. The approach of scoring bones with presence/absence or binomial (only male and female) characteristics, it fails to include aspects of variation. Due to which the individuals assessed as intermediate could be excluded. The challenge of commingling of bones remains relevant when trying to include the aspect of state of preservation. In instance of Lübeck series there have been multiple finds for a single element like cranium or pelvis. With less preserved individual skeletons, the fracture and fragmentation of bones and the missing of sex indicating features hinder sex estimation. The morphological sex estimation using single trait could create a bias and put more individuals in one group or shift the male individuals more towards female or vice-versa.

<u>Optimisation</u> – In order to overcome the issue of validity and reliability we include characteristics that have already got a place in the ranking of pelvic traits by Herrmann et al., (1990), Bruzek (2002), Ferembach et al. (1980) and Buikstra & Ubelaker (1994). To

morphologically estimate sex, a single view or perception is important to avoid errors and maintain uniformity for different methods (Feicke, 2013). In order to remedy binomial sex estimation, several studies (Klales et al., 2012; Walker, 2005) have included five categories (male, tendency male, indeterminate, tendency female, female) or ordinal ranking of five points. In this study, there is one more category included which is called indifferent that includes ambiguous individuals and the indeterminate category includes individuals having missing or fragmented sex indicators. For resolving the issues of commingling of bones, sub numbers were added if there are more than one element for a particular bone. In cases where there are missing bony sex indicators, the application of a single variable or trait for morphological and metrical analysis plays an important role. Although the preference has been given to the skeletons that are complete but if the skull and os coxae are partially complete, they have been nonetheless included in the study to calculate the accuracy of sex determination from a single variable. To avoid the bias created by a single variable or trait favouring to one sex, this study also involves sex estimation from multiple traits together. In results it will be seen that margo orbitalis (supraorbital margin) has low accuracy rate. It means it favours a particular sex more than the other. Here the group of traits could provide a larger picture, helping reduce the biasness and estimate the right sex. The Table 1, Table 2 and Table 3 have already been published in Gupta et al. (2022) with CC-BY 4.0 license.

Table 1 Morphological pelvic traits used for sex estimation.

Traits	Common Sources
Greater sciatic notch Arc composé (Composite arch) Sub-pubic angle Iliac crest	(Bruzek, 2002; Buikstra & Ubelaker, 1994; Ferembach et al., 1980; Grupe et al., 2015; Klepinger, 2006; Novotný, 1981)

Table 2 Morphological mandibular traits used for sex estimation.

Traits	Common Sources
Mandible overall Condylar process Mentum Gonion and Ramus flexure Corpus height	(Buikstra & Ubelaker, 1994; Ferembach et al., 1980; Grupe et al., 2015; Herrmann et al., 1990; Klepinger, 2006; Loth & Henneberg, 1996)

Table 3 Morphological cranial traits used for sex estimation.

Traits	Common Sources
Cranium overall Frontal tuberosity (eminence) and Forehead Steepness Glabella and Supraorbital ridges (superciliary arch) Eye orbitals Zygomatic arch Margo orbitalis (supraorbital margin) Mastoid process	(Buikstra & Ubelaker, 1994; Ferembach et al., 1980; Grupe et al., 2015; Herrmann et al., 1990; Klepinger, 2006)

3.2 Metrical Methods

The linear measurements and circumferences make up the basics of metrical studies. That leads to the derivation of certain models and statistical equations depicting the dimorphism between males and females. The metrical method involves the utility of dimensions to use the approaches of sectioning points, identification points, demarking points, logistic regression analysis and discriminant function analysis for sex estimation (Dabbs & Moore-Jansen, 2010; Krishan et al., 2016). The literature argues that metrical approaches are easier to evaluate and derive inferences from. In fact, there are alternatives to traditional anthropometric methods that employ measuring techniques but provide better accuracies. Metrical methods utilising digital radiography, CT (Computer Tomography), MRI (Magnetic Resonance Imaging), DSP (Diagnose Sexuelle Probabiliste method) (Murail et al., 2005) have produced differing accuracies. They have been evaluated by observers in multiple studies and the results are encouraging. The utility and advantage of metrical methods vary based on the bones being dealt with. Pelvis being the most sexually dimorphic bone region allows sex estimation with high accuracy, but the pelvis has a poor conservation rate compared to the skull. Skull is seen as sexually dimorphic based on both morphological and metrical criteria. Considering the limit of the visual approach, metrical methods appear to be more objective and reproducible. It does not require definite skills except the know-how of osteometric measurements and equipment (Guyomarc'h & Bruzek, 2011).

3.2.1 Samples Involved – Inclusion and Exclusion Criteria

The cranium, mandible, os coxae, humerus, radius, ulna, femur, and tibia have been used for metrical analysis. Although the term pelvis refers to multiple bones forming the whole structure with os coxae, sacrum, and coccyx but in metrical analysis only ossa coxae have been included. Since discriminant functions require both single measurements and group measurements on isolated skeletal material, the inclusion of material in the sample size has both intact and complete, and also partially complete bones where single measurements could be applied. In case of long bones particularly diaphysis is better preserved than epiphysis (İşcan & Miller-Shaivitz, 1984)**.**

3.2.2 Methods of Analysis

Selection of measurements – As published in the relevant literature, 59 that have produced high classification rates for sex estimation in forensic anthropology, have been chosen. The other factors are – 1) parts of bones that are likely to be found intact and 2) easy to locate landmarks. That included circumferences and length, as they were part of corresponding discriminant functions. The list of measurements along with abbreviations and references has been attached as a part of the appendix. The chosen measurements have mostly been defined based on the English adaptation of Martin and Saller that has been written by I. P. Singh & Bhasin (1968) and in some cases taken as published by the concerned authors.

Procedures for Data Collection, Challenges and Optimisation – Description with Pictures

Procedure for data collection – With some practice the cranial and postcranial measurements for a single individual takes about an hour to complete. There is no specific order of bones for measuring and recording the data. For measurement preparation, the anatomical order of the available skeletal material needs to be arranged. As a standard practice, the left side of the long bones and os coxae have been measured. The right side was used as a substitute for missing left bones or in case of extreme pathological reactions and erosions. All the measurements have been measured in centimetres (cm) and recorded in millimetres (mm) and for measurements that are between two mm markings, the value is rounded to the nearest mm (Langley et al., 2016).

Challenges – One of the issues that is evident in literature is that the data is difficult to reproduce for some landmarks. The reproducibility gets low with how landmarks are evaluated for getting the same measurement from different observers. Along with repeating the measurement, to be able to repeat the placement of landmarks for a particular measurement becomes a huge challenge considering the landmark is not fixed on the surface of the bone. Ross et al. (2010) talk about type 1, 2, and 3 landmarks with respect to how they have little information about their positions with well-defined points. The authors in their report even recommend that there can be an error while using the type 3 landmarks such as euryons.

Optimisation – As suggested by Richard et al. (2014) and along with our observation, there are more than one pair of landmarks or endpoints on the skeletal element that can produce the same value for a particular measurement. For example, the use of landmark euryon, in one dimension offers maximum linear measurement. The anthropometrical measurement has been defined in a way that directs the observer to move the ends of spreading calliper around euryons up and down and note the maximum value to be the right one.

List of measurements and definitions

Basal view of Cranium

Figure 3 Cranial (basal) measurements highlighted along with their sources

1) *Depth of infratemporal fossa*: It is the width of an irregularly shaped cavity; situated below and medial to the zygomatic arch (Keen, 1950).

Instrument used: Sliding calliper

2) *Biasterionic breadth or greatest occipital breadth* (ast-ast): “It measures the straight distance between two asterion (ast)” (I. P. Singh & Bhasin, 1968).

Instrument used: Spreading calliper

Asterion (ast): “It is the point where lambdoid suture, occipito mastoidal suture and parietomastoidal suture meet” (I. P. Singh & Bhasin, 1968).

Note: Place the skull with occipital view facing towards you, when taking the measurement.

<u>Frontal view of Cranium</u>

1) *Maximum bizygomatic for the facial part of the skull*(zy-zy): “It is the direct distance between most lateral points on the zygomatic arches (zy-zy)” (I. P. Singh & Bhasin, 1968).

Instrument: spreading or sliding calliper.

Zygion (zy): “It is the most laterally placed point of the zygomatic bone. Zygion is determined while taking the bizygomatic breadth” (I. P. Singh & Bhasin, 1968).

2) *Minimum Frontal Breadth* (ft-ft): “It direct distance between the two frontotemporale (ft)” (I. P. Singh & Bhasin, 1968).

Instrument: sliding calliper.

Fronto temporale (ft): “It is the most projected and inward point of the superior temporal line” (I. P. Singh & Bhasin, 1968).

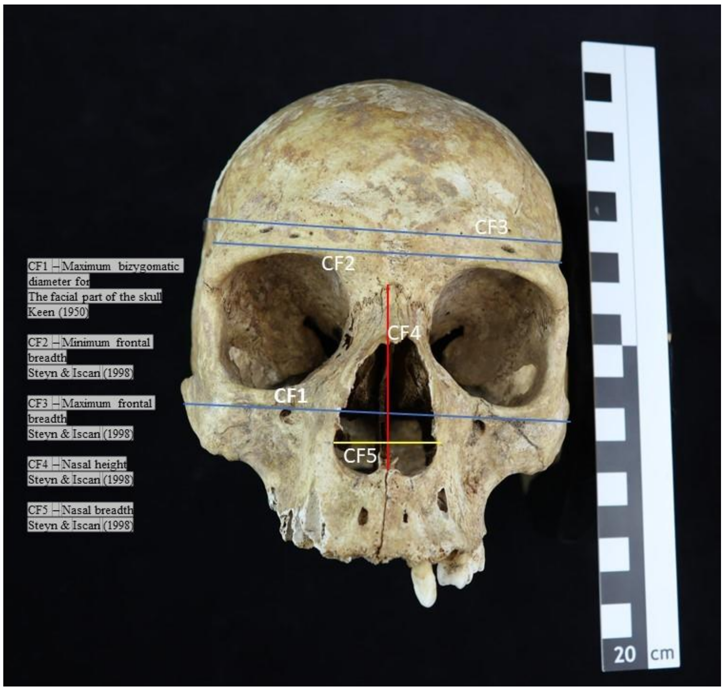


Figure 4 Cranial (frontal) measurements highlighted along with their sources

3) *Maximum Cranial Breadth* (eu-eu): “It is the maximum width of skull perpendicular to midsagittal plane wherever it is located, with the exception of the inferior temporal lines and the area immediately surrounding them” (I. P. Singh & Bhasin, 1968).

Instrument: spreading calliper

Euryon (eu): "It is the point which lies most laterally on the skull. The landmark can only be determined while taking the maximum cranial breadth. This measurement is to be taken at the parietal bones" (I. P. Singh & Bhasin, 1968).

4) *Nasal Height* (n-ns): "It is the direct distance from nasion (n) to the midpoint of a line connecting the lowest points of the inferior margin of the nasal notches (ns)" (I. P. Singh & Bhasin, 1968).

Instrument: sliding calliper

Nasion (n): "It is the point where the frontonasal suture meets the midsagittal plane" (I. P. Singh & Bhasin, 1968).

Nasospinale (ns): "It is the deepest point on the lower margin of the pyriform aperture projected in the mid-sagittal plane" (I. P. Singh & Bhasin, 1968).

5) *Nasal Breadth* (al-al): "It is the maximum breadth of the nasal aperture (al-al)" (I. P. Singh & Bhasin, 1968).

Instrument: sliding calliper.

Alare (al): "It is the lateral surface of the external nose, cartilaginous in makeup, and flares out to form a rounded eminence around the nostril" (I. P. Singh & Bhasin, 1968).

Note: Be certain that this measurement is perpendicular to the midsagittal plane. The sliding calliper with the sliding end should be placed on the aperture with sharp protruding margin.

<u>Lateral view of cranium</u>

Figure 5 Cranial (lateral) measurements highlighted along with their sources

1) *Maximum length of vault or Maximum cranial length* (g-op): “It is the staright distance between glabella (g) and opisthocranion (op) in the midsagittal plane, measured in a straight line” (I. P. Singh & Bhasin, 1968).

Instrument: spreading calliper.

Glabella (g): “It is the point which lies on the roof of the nose and between the supra-orbital ridges of the forehead. It is the most projecting point on the mid-sagittal plane” (I. P. Singh & Bhasin, 1968).

Opisthocranion (op): “It is the most posteriorly projecting point in the mid-sagittal plane. Exact position of the landmark can only be determined by means of measuring the maximum cranial length by spreading calliper” (I. P. Singh & Bhasin, 1968).

Note: Place skull on side, holding one end of calliper at glabella and extending calliper until maximum diameter at posterior aspect of skull is obtained.

2) *Mastoid Length or Length of the mastoid process*: “It is the vertical projection of the mastoid process below and perpendicular to the eye-ear (Frankfurt) plane” (Keen, 1950).

Instrument: sliding calliper (or craniophore).

Note: Rest skull on its right side and apply the calibrated bar of the calliper just behind the mastoid process, with the fixed flat arm tangent to the upper border of the external auditory meatus and pointing to the lower border of the orbit. Slide the measuring arm until it is level with the tip of the mastoid process. If craniophore is available, this should be used to establish the ear-eye (Frankfurt) plane ((I. P. Singh & Bhasin, 1968).

3) *Basion-Prosthion Length* (ba-pr): “It is the direct distance from basion (ba) to prosthion (pr)” (I. P. Singh & Bhasin, 1968).

Instrument: spreading or sliding calliper

Basion (ba): “It is the point where the anterior margin of the foramen magnum is cut by the mid-sagittal plane” (I. P. Singh & Bhasin, 1968).

Prosthion (pr): “It is the point which lies on the alveolar margin of the upper jaw in the mid-sagittal plane, projecting most anteriorly between the two central incisors” (I. P. Singh & Bhasin, 1968).

4) *Cranial Base Length or basion nasion length* (ba-n): “It is the direct distance from nasion (n) to basion (ba)” (I. P. Singh & Bhasin, 1968).

Instrument: spreading calliper

Nasion (n): “It is the point where the frontonasal suture meets the midsagittal plane” (I. P. Singh & Bhasin, 1968).

Basion (ba): “It is the point where the anterior margin of the foramen magnum is cut by the mid-sagittal plane” (I. P. Singh & Bhasin, 1968).

5) *Nasion prosthion height* (n-pr): “It is the direct distance between nasion (na) and prosthion (pr)” (I. P. Singh & Bhasin, 1968).

Instrument used: Sliding calliper

Nasion (n): “It is the point where the frontonasal suture meets the midsagittal plane” (I. P. Singh & Bhasin, 1968).

Prosthion (pr): “It is the point which lies on the alveolar margin of the upper jaw in the mid-sagittal plane, projecting most anteriorly between the two central incisors” (I. P. Singh & Bhasin, 1968).

6) *Basion bregma height* (ba-b): “It is the direct distance from the lowest point on the anterior margin of foramen magnum (ba) to bregma (b)” (I. P. Singh & Bhasin, 1968).

Instrument: Spreading calliper

Basion (ba): “It is the point where the anterior margin of the foramen magnum is cut by the mid-sagittal plane” (I. P. Singh & Bhasin, 1968).

Bregma (b): “It is the point where sagittal suture meets the coronal suture. If the sagittal suture deviates at the end, the landmark must be taken in the mid-sagittal plane” (I. P. Singh & Bhasin, 1968).

<u>Mandible</u>

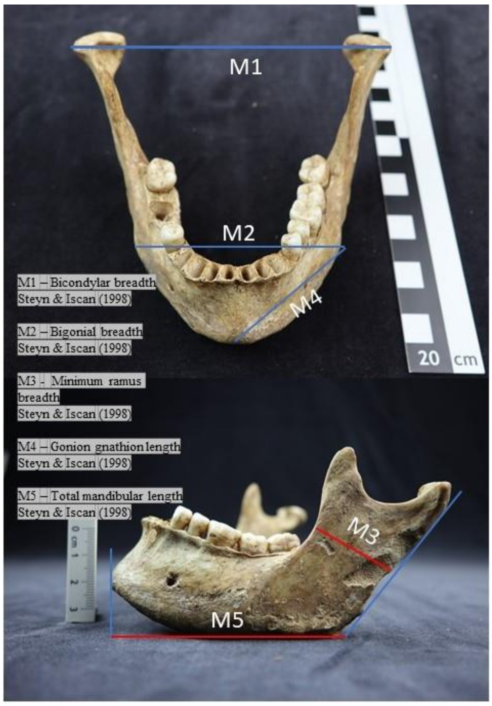


Figure 6 Mandible measurements highlighted along with their sources

1) *Bicondylar Breadth* (cdl-cdl): “It measures the direct distance between the most lateral points on the two condyles or condylion laterals (cdl)” (I. P. Singh & Bhasin, 1968).

Condyle (cdl): “The most lateral point on the mandibular condyle” (Franklin et al., 2008).

Instrument used - Sliding calliper

2) *Bigonial Width* (go-go): “It measures the direct distance between right and left gonion (go)” (I. P. Singh & Bhasin, 1968).

Instrument used - Sliding calliper.

Gonion (go): “It is the most downward, backward and upward point of the nagle odf the lower jaw made by the basal margin of the body and posterior margin of the ramus” (I. P. Singh & Bhasin, 1968).

Note: Place the blunt points of the calliper to the most prominent external points at the mandibular angles.

3) *Minimum Ramus Breadth*: “It measures the least breadth of the mandibular ramus measured perpendicular to the height of the ramus” (Steyn & İşcan, 1998).

Instrument: Sliding calliper

4) *Gonion-gnathion length* (go-gn): “It measures the straight distance between gonion (go) and gnathion (gn) of the mandible” (Steyn & İşcan, 1998).

Gonion (go): “It is the most downward, backward and upward point of the nagle odf the lower jaw made by the basal margin of the body and posterior margin of the ramus” (I. P. Singh & Bhasin, 1968).

Gnathion (gn): “It is the lowest point on the lower margin of the lower jaw in the mid-sagittal plane” (I. P. Singh & Bhasin, 1968).

Instrument used – Sliding calliper

5) *Total mandibular length or Mandibular Length*: “It measures the straight distance of the anterior margin of the chin from a centre point on the protected straight line placed along the posterior border of the two mandibular angles” (Steyn & İşcan, 1998).

Instrument: Mandibulometer.

Note: Apply movable board of the mandibulometer to the posterior borders of the mandibular rami and the fixed board against the most anterior point of the chin. Mandible may be stabilized by gently applying pressure (one or two fingers) to the left second molar.

<u>Pelvis</u>

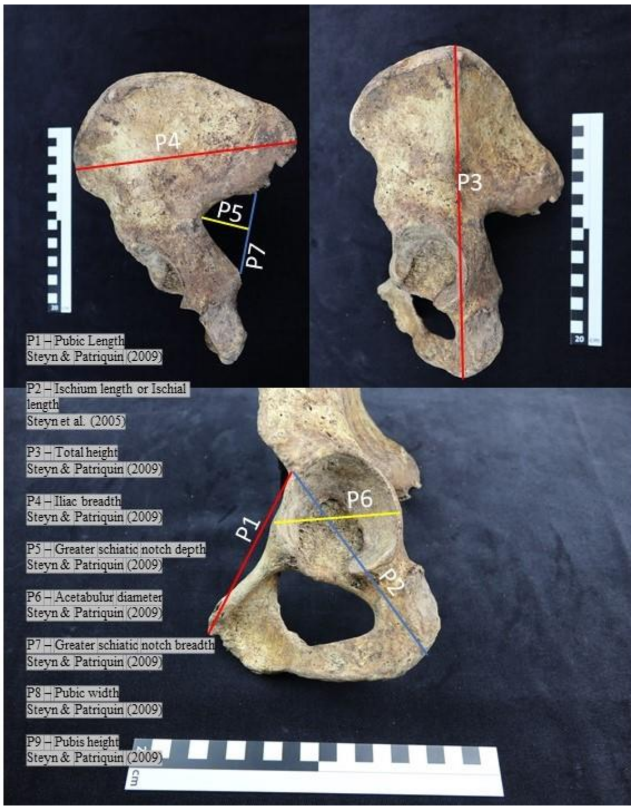


Figure 7 Pelvic measurements highlighted along with their sources

1) *Pubic length*: "It is measured using a sliding calliper from the point on the superior border of the acetabulum at the center of the origin of the iliac blade to the most medio-superior point on the pubic crest" (Patriquin et al., 2005).

Instrument used: Sliding calliper

2) *Ischium length*: "It is measured using a sliding calliper from the point on the superior ridge of the acetabulum at the center of the origin of the iliac blade to the deepest point on the ischial tuberosity" (Patriquin et al., 2005).

Instrument: Sliding calliper.

Note: The traditional measurement *Ischium Length* and *Length of Pubis* has been modified to maintain consistency as it is problematic locating the point on acetabulum where three bones of innominate meet (Patriquin et al., 2005).

3) *Total height or Pelvic height*: "It is the distance from the most superior point on the iliac crest to the most inferior point on the ischial tuberosity" (I. P. Singh & Bhasin, 1968).

Instrument: spreading calliper or osteometric board

4) *Iliac breadth or Breadth of Ilium*: "It is the distance from the anterior-superior iliac spine to the posterior-superior iliac spine" (I. P. Singh & Bhasin, 1968).

Instrument: Spreading calliper

5) *Greater sciatic notch depth*: “It is measured by placing the set arm of the calliper to recreate the line measuring the width of the notch, while the additional arm is adjusted to intersect the notch at the greatest depth” (Patriquin et al., 2005).

Instrument: Sliding calliper

6) *Acetabulur diameter or Maximum breadth of Acetabulum*: “It measures the straight distance between the margins of acetabulum” (I. P. Singh & Bhasin, 1968).

Instrument used: Sliding calliper

7) *Greater sciatic notch breadth*: “It is measured from the base of the ischial spine to the posterior inferior iliac spine stopping at a point before the curvature of the spine angles to the posterior” (Patriquin et al., 2005).

Instrument used: Sliding calliper

8) *Pubic breadth*: “It is measured on the dorsal aspect of the bone from the most inferior point on the face of the pubic symphysis, horizontally to the medial aspect in the obturator foramen” (Patriquin et al., 2005).

Instrument used: Sliding calliper

9) *Pubic height or Symphisial height*: “It measures the straight distance between the upper margin and lower margin of symphysis” (I. P. Singh & Bhasin, 1968).

Instrument used: Sliding calliper

<u>Humerus</u>

Figure 8 Humerus bone measurements highlighted along with their sources

1) *Maximum humerus length*: “It measures the straight distance between the highest point of the head of the humerus and deepest point on trochlea” (I. P. Singh & Bhasin, 1968).

Instrument used – Osteometric board

Note: “The head of the humerus should touch the short vertical wall and moveable cross-piece touch the trochlea” (I. P. Singh & Bhasin, 1968).

2) *Vertical head diameter*: “It measures the straight distance between the highest and lowest points on the articular surface, taken at right angle to the transverse diameter” (I. P. Singh & Bhasin, 1968).

Instrument used – Sliding calliper

3) *Humeral epicondylar width*: “It measures the distance between the highest laterally placed point on the lateral epicondyle to the tip of the medial epicondyle” (I. P. Singh & Bhasin, 1968).

Instrument used – Osteometric board

Note: “The bone should be kept in the same position as in the previous measurement. The moveable cross-piece should touch the lateral epicondyle” (I. P. Singh & Bhasin, 1968).

4) *Minimum circumference of the humerus*: “It mesures the least circumference in the shaft, found usually at the lower half of deltoid tuberosity” (I. P. Singh & Bhasin, 1968)

<u>Radius</u>

Figure 9 Radius bone measurements highlighted along with their sources

1) *Maximum radial length*: “It measures the greatest length between the most proximal point on the head of radius and the tip of the styloid process” (I. P. Singh & Bhasin, 1968).

Instrument used – Osteometric board

Note: This measurement is taken without any regard to the longitudinal axis of the bone.

2) *Maximum radial proximal width*: It measures the distance between the lateral and medial margins of the head (Martin & Saller, 1957).

Instrument used – Sliding calliper

3) *Maximum radial distal width*: It measures the distance between styloid lateral margin of styloid process and medial margin of incisura ulnaris radiale (Martin & Saller, 1957).

Instrument used – Sliding calliper

4) *Circumference at radial tuberosity*: It measures the circumference at the proximal half of the the bone at radial tuberosity (Martin & Saller, 1957).

Ulna (from Langley et al. 2016 also the landmarks for all bones)

1) *Maximum ulnar length*: “It measures the distance between the highest point of olecranon and the deepest point of the styloid process” (I. P. Singh & Bhasin, 1968).

Instrument used – Osteometric board

2) *Maximum ulnar proximal width on coronoid process*: “It measures the straight distance between the anterior end-point of the ridge on the coronoid process and the anterior most point of the crest formed by semilunar and radial incisulare” (I. P. Singh & Bhasin, 1968).

Instrument used – Sliding calliper

Note: Measure the maximum width of the head from the lateral to the medial side by moving sliding calliper up and down and notice wherever the value comes as maximum.

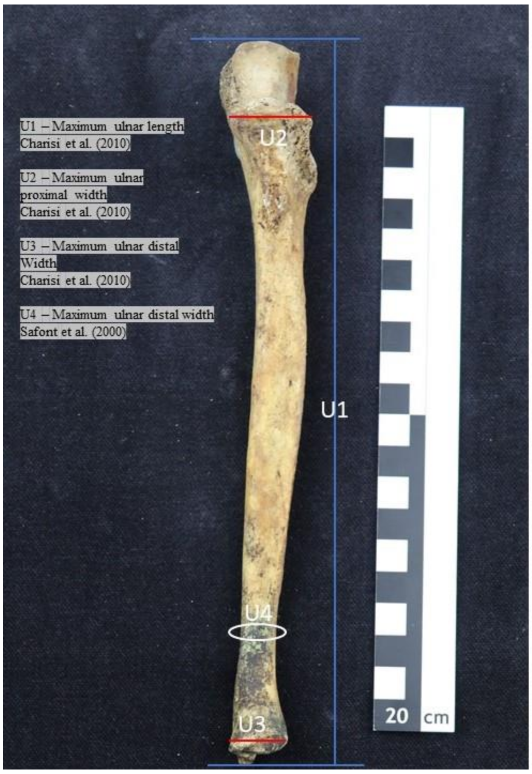


Figure 10 Ulna bone measurements highlighted along with their sources

3) *Maximum ulnar distal width* – It measures the distance between lateral and medial margins of distal end of the bone near styloid process (Martin & Saller, 1957).

Instrument used - Sliding calliper

4) Minimal circumference of the ulna: "It measures the least circumference, generally found at the distal end of the bone" ((I. P. Singh & Bhasin, 1968).

<u>Femur</u>

1) *Femoral midshaft circumference*: "It measures the circumference in the middle of the shaft" (I. P. Singh & Bhasin, 1968).

Instrument used – Measuring tape

Note: That if crest shows a strong projection on one side, then this measurement may be taken 10 mm. above the projection.

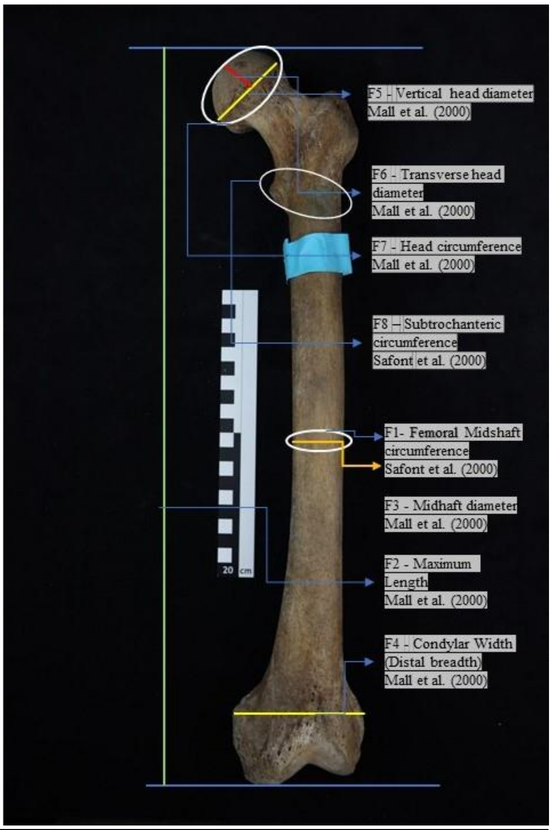


Figure 11 Femur bone measurements highlighted along with their sources

2) *Maximum Length*: "It measures the straight distance between the highest point of the head and the deepest point on the lateral medial condyle" (I. P. Singh & Bhasin, 1968).

Instrument used – Osteometric board

Note: "Femur should be placed with its posterior side upwards on the osteometric board in such a manner that the medial condyle touches the short vertical wall; the moveable cross-piece should touch the highest point of the head" (I. P. Singh & Bhasin, 1968).

3) *Midshaft diameter (Transverse)*: "It measures the distance between the lateral margins of the bone at right angle to the sagittal diameter of the middle of the shaft" (I. P. Singh & Bhasin, 1968).

Instrument use: Sliding calliper

4) *Condylar width*: "It measures the distance between the most projected points on the epicondyles" (I. P. Singh & Bhasin, 1968).

Instrument used – Osteometric board.

Note: "Place the bone in such a manner on the osteometric board with its posterior surface downwards, that one of the epicondyles touches the vertical long wall while the moveable cross-piece touches the other lateral epicondyle" (I. P. Singh & Bhasin, 1968).

5) *Vertical head diameter*: “It measures the straight distance between the highest and deepest points of the head” (I. P. Singh & Bhasin, 1968).

Instrument used – Sliding calliper

Note: “The two points lie in the equatorial plane of the head. Hold the bone in such a manner that you can see the fovea centralis” (I. P. Singh & Bhasin, 1968).

6) *Transverse head diameter*: “It measures the distance between the most laterally projected points on the equatorial plane taken at right angle to the vertical diameter” (I. P. Singh & Bhasin, 1968).

Instrument used – Sliding calliper

7) *Head circumference*: “It measures the circumference of the head at the same position as the diameters” (I. P. Singh & Bhasin, 1968).

Instrument used – Measuring tape

8) Subtronchanteric circumference: It measures the circumference at the point where the transverse diameter of subtronchanterion lies (Martin & Saller, 1957).

<u>Tibia</u>

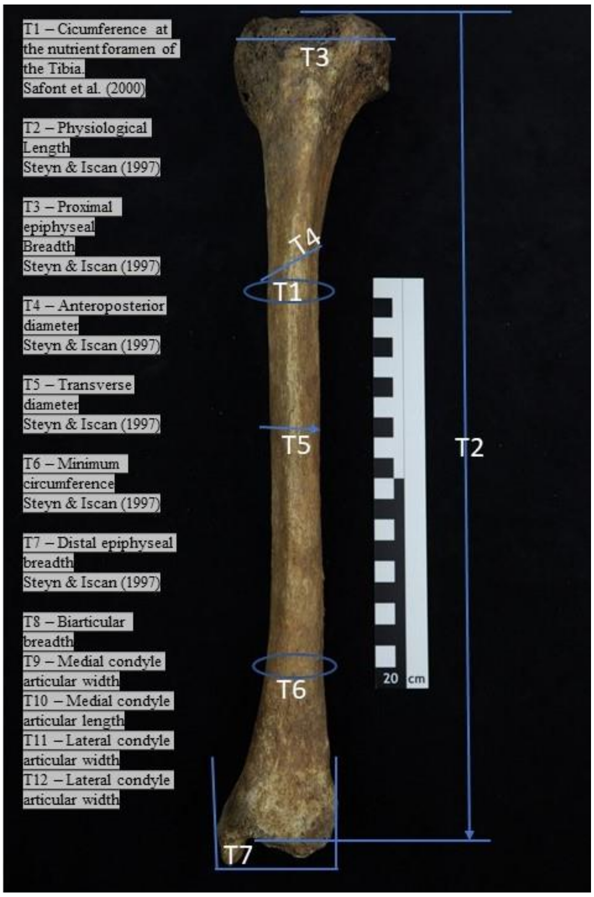


Figure 12 Tibia bone measurements highlighted along with their sources

1) *Circumference at the nutrient foramen of the Tibia*: It measures the circumference at the point above the point of nutrient foramen (Martin & Saller, 1957).

Instrument used – Measuring tape

2) *Physiological length*: “It measures the distance between the mid-point of the articular surface of the medial condyle and the base of tibial malleolus” (I. P. Singh & Bhasin, 1968).

Instrument used – Spreading calliper

Note: distance between the mid-point of the intercondylar eminences of the medial condyle and the base of tibial malleolus.

3) *Maximum proximal epiphyseal breadth*: “It measures the distance between the most laterally placed points on the tibial and fibular condyles” (I. P. Singh & Bhasin, 1968).

Instrument used – Osteomteric board

Note: “The bone is placed in such a manner on the osteometric board that its lateral side touches the long vertical wall and the moveable cross-piece touches the tibial condyle” (I. P. Singh & Bhasin, 1968).

4) *Anteroposterior diameter or maximum diameter in middle of bone*: “It measures the straight distance of anterior crest from the posterior surface in the middle of the bone” (I. P. Singh & Bhasin, 1968).

Instrument used – Sliding calliper

Note: “The middle of the bone should be determined approximately or by dividing the maximum length” (I. P. Singh & Bhasin, 1968).

5) *Transverse diameter*: “It measures the straight distance from the tibial border to the inter-osseous crest in the middle of the bone” (I. P. Singh & Bhasin, 1968).

Instrument used – Sliding calliper

6) *Minimum circumference of shaft*: “It measures the minimum circumference of shaft wherever found. It is usually found at the distal third of the bone approximately 10 cm. proximal to the tip of tibial malleolus” (I. P. Singh & Bhasin, 1968).

Instrument used – Measuring tape

7) *Distal epiphyseal breadth*: “It measures the distance between the most laterally placed points on the tibial malleolus and the lateral surface of the lower epiphysis” (I. P. Singh & Bhasin, 1968).

Instrument used – Osteometric board

Note: "Place the bone in such a manner on the osteometric board that its lateral side touches the long vertical wall and the moveable cross-piece touches the tibial malleolus" (I. P. Singh & Bhasin, 1968).

8) *Biarticular breadth* (BB): Maximum breadth of the proximal articular surface of the tibia as measured from the lateral edge of the lateral condyle to the medial edge of the medial condyle (Holland, 1991).

Instrument used – Sliding calliper

Note: This is not the maximum breadth of the proximal tibia (cf. Martin and Saller, 1957; also, Hanihara, 1958, 1981) but rather the maximum breadth of the articular surface. The callipers should be placed only on the articular surfaces of the condyles.

9) *Medial condyle articular width* (MCW): Maximum transverse width of the medial condyle as measured from the lateral to the medial edges (Holland, 1991).

Instrument used – Sliding calliper

Note: The surface of the condyle generally is circumscribed by a slight rim, and the callipers should be laced on this rim.

10) *Medial condyle articular length* (MCL): Similar but perpendicular to the width. Measurement should record the maximum length from the anterior edge of the medial condyle to the posterior margin (Holland, 1991).

Instrument used: Sliding calliper

11) *Lateral condyle articular width* (LCW): Similar to the width measurement made on the medial condyle but made on the lateral condyle (Holland, 1991).

Instrument used: Sliding calliper

12) *Lateral condyle articular length* (LCL): Maximum length of lateral condyle as measured in a manner similar to that for MCL (Medial condyle articular length) (Holland, 1991).

3.3 Molecular Methods

3.3.1 Sample Preparation

The sample size of Inden series used for morphological and metrical analyses was 182. Out of that sample size, 32 individuals were chosen to perform DNA analysis. The Inden series has been housed at the Department of Historical Anthropology, the University of Göttingen, Germany. Each individual is examined with a priority to find the skeletal material in order of, first teeth from the mandible or cranium and if not, other cranial or post-cranial elements are considered. In all the individuals considered for analysis, DNA was extracted from teeth samples. Because of its weight molars seemed to be of utmost importance and other teeth were considered only in its absence. A full list of each tooth and the corresponding identifier of the individual analysed is attached in the Appendix. To check for contamination, the positive control samples from cells of the buccal mucosa were also extracted.

3.3.2 Contamination Prevention

The source of contamination could be the analyst, from other samples, or external DNA contamination and as observed by Kloosterman et al. (2014) there is an increase in contaminations from other samples that are being tested along with the sample in question. The authors explain if negative control or blank samples are contaminated, then the other simultaneously tested samples need to be screened. This helps to identify and investigate the cause, leading to additional analyses and if the sample in question is contaminated then it can be resolved by analysing backup samples.

In order to prevent contamination, a stringent process is necessary. There are different stages in the entire analysis that are sensitive and pick up contamination easily. The analyses of samples concerning the present study were carried out at the Department of Historical Anthropology, the University of Göttingen where there are defined areas for pre-PCR and post-PCR investigation. The state of art laboratories for ancient DNA has exclusively allocated work areas for two different stages in pre-PCR, which are – 1) sample preparation stage where the tooth or bone material is ground to fine powder; 2) extraction of DNA where the sample is decalcified, cell lysis is performed and, in the end, purified; PCR - 3) amplification of a specific target which creates millions of copies of the concerned sequence (Schmidt et al., 2020).

The contamination from the environment in the form of solutes can inhibit DNA amplification. While the PCR runs, the inhibitors can block the enzymatic process that occurs during the amplification. The techniques are modified and employed in a way so that they eliminate inhibitors before, during the process, and after the DNA extraction. This helps subdue the inhibitors during the PCR (Latham & Miller, 2019). Following a stringent process of cleaning protocol, the working area in laboratories and instruments were cleaned with 6% sodium hypochlorite solution (Aug. Hedinger GmbH & Co. KG, Stuttgart, Germany). To prevent contamination, cleaning often during all aDNA analyses, is of paramount importance.

3.3.3 DNA Extraction

Fragments of teeth were sawed out and placed in a 6% sodium hypochlorite solution (Aug. Hedinger GmbH Co. KG, Stuttgart, Germany). It stayed in the solution for 15 min and was soaked in distilled water for additional 15 minutes. The sample was placed in the oven (B5028, Heraeus, Hanau, Germany) to dry at 30 °C for overnight which is about 12-14 h. The fragments were milled for 10 seconds in a ball triturator (MM 200, Retsch, Haan, Germany). 0.2 g tooth powder was transferred into a Falcon Tube with 1 mL EDTA UltraPure™ 0.5 M pH 8 (Invitrogen™, Carlsbad, CA, USA) and 50 µL Proteinase K (600mAnson-U/mL, Merck, Darmstadt, Germany), the prepared sample was incubated at 37 °C for 18 h in a rotator. The next step involves the addition of another 25 µL of Proteinase K and incubated at 56 °C for 2 h. After a short centrifugation, 25 µL sodium dodecyl sulphate (SDS) (10 mg/mL, Sigma-Aldrich®, St. Louis, MO, USA) was added and incubated at 65 °C for 5 min at 350 rpm, 65 °C with thermomixer. The centrifugation of lysate at 3300 rcf followed the transfer of lysate into two sample tubes for each individual. The first sample tube had 400 µL of MTL buffer (Qiagen) and 500 µL lysate, with second sample tube 1120 µL buffer and 500 µL of lysate. The sample tubes were placed in BioRobot EZ1® (Qiagen). For extraction the software Large Bone Scale Card was used, to perform a Bone Protocol of 1.0 mL. The elution volume was 50 µL and the extracts were stored at -20 °C.

3.3.4 PCR and DNA Amplification

The extracted DNA goes through the protocol of Multiplex X/Y-PCR amplification in order to find the sex. The preparation of PCR cups for amplification includes materials like 12.5 µL Multiplex PCR Master mix (QiagenMM plus), 2.4 µL Primer Set, 1 – 5 µL DNA extracts, and 0.1 – 0.5 µL modern DNA samples for the positive control, and 5 – 5.1 µL RNase-free water (Qiagen). The complete reaction value reached 25 µL to perform the PCR amplifications as showed in Table 3. PCR is performed with two different types of DNA amount. So, the label would have ‘a’ and ‘b’ at the end of the same sample number on top of extract cups. The amount of different sample extracts will be run together.

Table 3 Composition of of per sample for the Multiplex X/Y-PCR

Comosition	µL per sample
Qiagen Master Mix Plus	12.5
Primer Set	2.4
H_2O	5,0 - 5.5
DNA-Extract	0.1 - 0.5
Total Volume	25

The PCR was performed in a Thermocycler Mastercycler gradient (Eppendorf). The parameter as shown in Table 4. has been applied.

Table 4 Cycling Paramter of PCR

Steps	Temperature °C	Duration	Cycles
Initial	95	5	-
Denaturing	94	1	
Annealing	55	1	10
Elongation	72	1	
Denaturing	94	1	
Annealing	50	1	30
Elongation	72	1	
Delay	60	45	-
Soak	10	10	-

Samples were amplified with Amelogenin and six Autosomal STRs in order to conclude male and female better, in the respective cases. The primer set has been developed locally at the Department of Historical Anthropology, the University of Göttingen. This set includes primers DYS392, GATA172D05, DXS9898 and DXS6789 from Multiplex PCR (Sexplex) developed by Schmidt et al. (2003), another primer for Amelogenin as modified by Seidenberg et al. (2012), as well as primers for systems DYS438 and DYS439 taken from the dissertation of Grumbkow (2013). The systems namely, DYS392, DYS438 and DYS439 are Y-chromosome specific and the systems GATA172D05, DXS9898 and DXS6789 are X-chromosome specific. The samples from male individuals show one allele for each STR system as opposed to females exhibiting two alleles for every system (Schmidt et al., 2003).

These products have been chosen for their advantage of short product lengths as they work well with degraded DNA fragments of few hundred base pair lengths. Additionally, fluorescent dyed primers allow differentiation of products of similar length in capillary electrophoresis (Butler, 2001).

Table 5 Primers used in this study: dye, labelling and allele ranges

Primer	**Dye label**	**Size of alleles (bp)**
DXS6789	NED	120-164
DXS9898	HEX	130-155
Amelogenin	6FAM	82-88
GATA172D05	6FAM	134-163
DYS392	6FAM	91-121
DYS438	HEX	78-118
DYS439	NED	87-108

Optimisation for better DNA amplification - From the discussions of Hummel (2003), it is evident that large fragments could lead to amplification failures and thus there is more research needed to find the best method. Another difficulty that arises with amplification is - detection limit if that limit is not reached there could be an allelic dropout or analysis failure. This results in false homozygosity (Butler & Hill, 2010; Hummel, 2003) and this could not be overcome with repeated amplifications but rather by using different primers (Butler, 2001). To prevent false homozygosity in the first place, it is necessary to tweak modifications, either by changing DNA input or increasing the amplification cycles or by replicating the analysis more than once (Butler & Hill, 2010; Hummel, 2003).

3.3.5 Gel Electrophoresis and Fragment-Length Determination

In order to examine the success of PCR, electrophoresis is performed where the negatively charged DNA is pulled along a certain voltage through a gel. The DNA molecules get separated in this process according to their size. The smaller molecules move faster than the larger molecules through the gel. This forms bands of different sizes on the gel for DNA fragment length analysis which is visualised under UV light (Hummel, 2003).

A 2.5% agarose gel stained with ethidium bromide was prepared. To prepare the gel, 1.5 g agarose was cooked in 60 ml 1x TBE buffer (2 g agarose in 80 ml 1x TBE buffer for large gel). Subsequently, 2.25 µl ethidium bromide (3 µl for large gel) was added and the gel solution was transferred to the electrophoresis chamber, where it was allowed to stand for approximately 30 minutes to harden. After the gel was hardened, 1x TBE buffer was poured over the gel. The combs were removed. 8 µl PCR product mixed with 2 µl Loading Dye was pipetted into each gel pockets. Into each of the outer pockets 3 µl of an LMW (low molecular weight) DNA ladder was added, which was introduced as a length standard. The gel was run at a voltage of 100 V (110 V for large gel) for 20 minutes (30 minutes for large gel). Thereafter, the gel was subjected to UV light, which was able to visualise the DNA in the presence of ethidium bromide, photographed with GelJet imager (Intas company). Based on the result of agarose gel electrophoresis, the input amount for STR analysis in capillary electrophoresis could be determined.

3.3.6 Capillary Electrophoresis

The theory behind capillary electrophoresis works similar to agarose gel electrophoresis, however it is a high-resolution technique. DNA fragments are injected into a capillary filled with polymer and the molecules are pulled through a voltage. The smaller molecules migrate through the capillary faster and reach the detection unit first. In order to identify fragments and determine their length, the fluorescent colour markers are excited by the detection unit with a laser. The detection unit measures the emitted light. The fragments of the same length can be differentiated from one another on the basis of different colour markings which were introduced to the PCR products with the respective primers. (Applied Biosystems 3500/3500xL Genetic Analyzer User Guide 06/2010). Please refer to table 6.

The capillary electrophoresis was performed in the 3500 Series Genetic Analyzer (Applied Biosystems). Based on the obtained results from agarose gel electrophoresis, 0.1 – 2.0 µl PCR product was mixed with 12 µl of Hi-Di™ Formamide and 0.25 µl GeneScan™ 500 ROX were added as length standards. Two allelic ladders (YsAL and SexMultiAL) were added, each with 0.5 µl, which was mixed with 2 µl Hi-Di™ formamide and 0.25 µl GeneScan™ 500 ROX in order to be able to determine the alleles of the samples later. The solutions were centrifuged, denatured at 95 °C for 5 min, and then cooled to 4 °C before being added to the Genetic Analyzer for fragment length analysis. The instrument POP7 polymer was used as a separation matrix, Dye Set D for calibration of colour detection, and 50 cm capillaries. For data acquisition during capillary electrophoresis and for the fragment length determination, the programs 3500 Data Collection Software 2 and GeneMapper® Software 5 were used.

3.3.7 Fragment Length Analysis and Allele Determination

A particular sex can be assigned to individuals based on allele determination. In the case of female individuals, the focus lies on determining two X chromosomes. In the case of amelogenin, the formation of X-specific STR one peak is expected and no Y-specific STR shows no amplification. In the case of heterozygous individuals, the X-specific STR systems show two different alleles. For male individuals, there is one X and one Y chromosome, so in the case of amelogenin amplification produces two alleles, and for X- and Y-specific STR systems, there is one allele present in both. The peaks in electropherogram for different STR systems help assess the results of capillary electrophoresis with agarose gel electrophoresis. The individuals that showed pale or no bands on the image produced after gel electrophoresis show similarly few or no peaks in electropherograms (Butler, 2001).

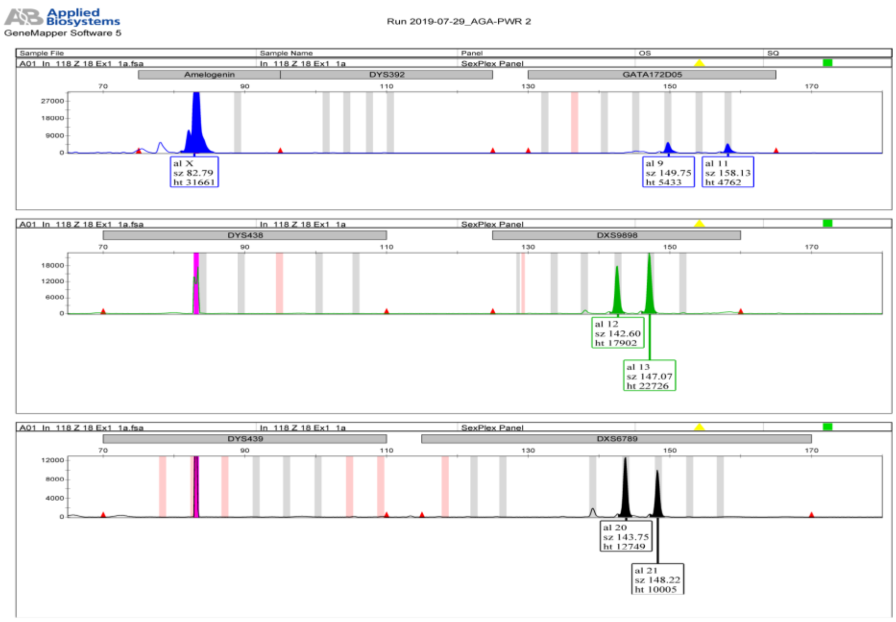


Figure 13 Electropherogram of individual Inden 118: This shows the detected alleles. In this case, only X allele was present for amelogenin and heterozygous alleles were present for GATA172D05, DXS9898, DXS6789 system. This indicates a female individual.

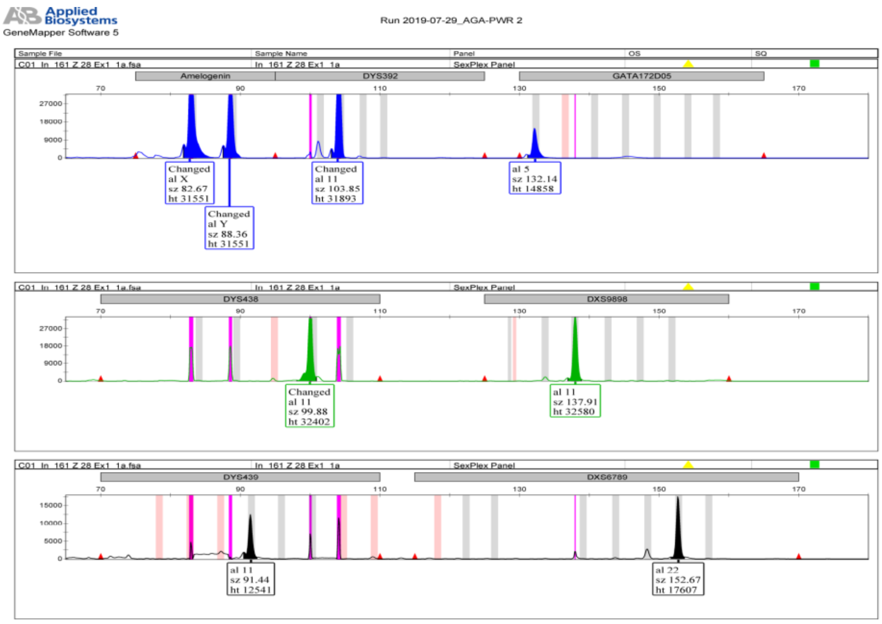


Figure 14 Electropherogram of individual Inden 161: This shows the detected alleles. In this case, both X and Y alleles were present for amelogenin and in the rest of X- and Y-specific systems only one allele has been detected. This indicates a male individual

3.4 Application of Statistics – Tests Performed on the Collected Data

While understanding the utility of metrical methods in section 3.2 of chapter 3, it becomes clear that there are different statistical approaches used for sexing like identification point, demarking values/point, limiting point, sectioning points, logistic regression, and discriminant function analysis. While Navega et al. (2015) try to study machine learning techniques over traditional statistics they mention how discriminant function analysis and logistic regression are the most commonly applied and popular methods to statistically estimate sex. Singh et al. (2012) in their study on postcranial metric methods on sex estimation prove that logistic regression analysis performs better than discriminant function analysis (DFA). The authors conclude that DFA and limiting point (calculated from the identification and demarking points) are one of the most appropriate methods of sex determination in their study.

3.4.1 Discriminant Function Analysis (DFA)

DFA (Discriminant Function Analysis) creates certain equations or functions based on the osteometric measurements to determine sex of unidentified skeletal elements. How does it work? Discriminant functions assign any subject in question to one of the groups. The creation of these functions happens on the basis of multivariate linear measurements (Lachenbruch & Goldstein, 1979). To assess sex DFA gives the best prediction by combining the variables and utilising the group differences. Since the objective of the current study is sex estimation, so the groups here are male and female and the variables are different osteometric measurements. At first it analyses the set of measurements and gives the classification scores. These classification scores differentiate among the groups with the utmost discrimination. Based on these classification scores, the individuals are classified to a particular group.

In field often poorly preserved and fragmented skeletal material are found; in such cases discriminant function plays a significant part in sex estimation. But again, one big disadvantage of DFA is that functions derived are highly population specific. Moreover, the accuracy might conclude differently depending on one set of variables to another set from the same skeletal element, a different skeletal element, or the variables drawn from two elements combined (Krishan et al., 2016, Krogman & Isçan, 1986). It is true that metrical methods are less subjective but there can be inconsistencies with respect to inter and intra-observer differences. So far it is generally seen that the functions created with DFA are specific to the population with which they were created (Bidmos & Dayal, 2004). The identification of sex becomes a major challenge if the population geography is not known (Guyomarc'h & Bruzek, 2011).

Using the measured values obtained for the individual measurements, with the help of discriminant functions the sex for the respective individuals has been calculated using Microsoft Excel. The discriminant functions have been taken from various published research articles, where most of the measurements have been converted from centimetre to millimetre. To determine the sex, only those individuals have been included where the measurements were possible to obtain, which are necessary to calculate the DF value from DF for a given skeletal element. This is because the DFs cannot be applied if one or the other measurement is missing. For this reason, there might be differences in the sample size of a particular skeletal element and the total sample size considered in a single population group.

To obtain the result of a multivariate discriminant analysis, each measured value is multiplied by its coefficient. These values are then added with the constant. The coefficient weights the variables or measurements according to their contribution to the sexual dimophism. The constant has no inherent value and only serves to calibrate the intercept to zero (Patriquin et al., 2005). Formula below shows an example of the basic formula used to calculate the

$$Discriminant\ value = (coefficient\ A) * measurement\ A\ +\ (coefficient\ B) * measurement\ B\ +\ [\dots]\ +\ Constant.$$

The discriminant value is then compared to the specified separation value to identify the individual to be categorized as male, female, or indifferent. The further the result is farther from the separating value, the more likely it is that the sex of the individual has been correctly identified (Steyn & İşcan, 1998).

Table 6 Discriminant functions along with their literature source

Discriminant functions	Sources
F1	Safont et al. (2000) Table 3 Fn.5
F2	Mall et al. (2000) Table 2
F3	Mall et al. (2000) Table 2
F4	Mall et al. (2000) Table 2
F5	Mall et al. (2000) Table 2
F3+F4+F5	Steyn & Iscan (1997) Table 3 Fn.1
F6	Mall et al. (2000) Table 2
F7	Mall et al. (2000) Table 2
F3+F7	Mall et al. (2000) Table 2
T1	Safont et al. (2000) Table 3 Fn.8
T3	Steyn & Iscan (1997) Table 3 Fn.7
T7	Steyn & Iscan (1997) Table 3 Fn.8
T3+T7	Steyn & Iscan (1997) Table 3 Fn.9
T3+T4+T5+T6+T7	Steyn & Iscan (1997) Table 3 Fn.2
T8	Holland (1991) Table 2 Coefficient 1
T9	Holland (1991) Table 2 Coefficient 2
T10	Holland (1991) Table 2 Coefficient 3
T9*T10	Holland (1991) Table 2 Coefficient 6
T11	Holland (1991) Table 2 Coefficient 4
T12	Holland (1991) Table 2 Coefficient 5
T11*T12	Holland (1991) Table 2 Coefficient 7
F3+F4+F5+T4+T6+T2+T7	Steyn & Iscan (1997) Table 3 Fn.3
H1+H2+H3	Charisi et al. (2010) Table 5 Function no. F2 humerus R
H4	Safont et al. (2000) Table 3 Fn.1
R1+R2+R3	Charisi et al. (2010) Table 5 Function no. F6 radius R
R4	Safont et al. (2000) Table 3 Fn.4
U1+U2+U3	Charisi et al. (2010) Table 5 Function no. F10 ulna R
U4	Safont et al. (2000) Table 3 Fn.2
F8+H4+R4+T1	Safont et al. (2000) Table 3 Fn.11
CB1 (Mean)	Keen (1950) Table 1 Measurement 16
CB2 (Mean)	Steyn & Iscan (1998) Table 1 Biasteronic breadth
CF1 (Mean)	Keen (1950) Table 1 Measurement 10
CL1+CF1+CL4+CL6+CF4+CF5	Steyn & Iscan (1998) Table 3 Fn.1
M1+M2+M3+M4+M5	Steyn & Iscan (1998) Table 3 Fn.4
P1+P8	Patriquin et al. (2005) Table 3 Fn.3
P2	Patriquin et al. (2005) Table 3 Fn.5

Discriminant functions	Sources
P1+P2	Steyn & Patriquin (2009) Table 5 Fn.3
P3+P4	Patriquin et al. (2005) Table 3 Fn.4
P5+P7	Patriquin et al. (2005) Table 3 Fn.2
P5+P7 (Greek)	Steyn & Patriquin (2009) Table 5 Fn.4
P6	Steyn & Patriquin (2009) Table 5 Fn.1
P1+P2+P3+P7+P8+P9	Steyn & Patriquin Table 5 Fn.1

Note. **F1** – Femoral Midshaft circumference, **F2** – Maximum length, **F3** – Midshaft diameter, **F4** – Condylar width, **F5** – Vertical head diameter, **F6** – Transverse head diameter, **F7** – Head circumference, **F8** – Subtrochanteric circumference of the femur

T1 – Circumference at the nutrient foramen of the Tibia, **T2** – Physiological Length, **T3** – Proximal epiphyseal breadth, **T4** – Anteroposterior diameter, **T5** – Transverse diameter, **T6** – Minimum circumference, **T7** – Distal epiphyseal breadth, **T8** – Biarticular breadth, **T9** – Medial condyle articular width, **T10** – Medial condyle articular length, **T11** – Lateral condyle articular width, **T12** – Lateral condyle articular width,

H1 – Maximum humeral length, **H2** – Vertical head diameter, **H3** – Humeral epicondylar width, **H4** – Minimum circumference of humerus

R1 – Maximum radial length, **R2** – Maximum radial proximal width, **R3** – Maximum radial distal width, **R4** – Radial tuberosity circumference

U1 – Maximum ulnar length, **U2** – Maximum ulnar proximal width, **U3** – Maximum ulnar distal width, **U4** – Minimal circumference of the ulna

CF1 - Bizygomatic diameter, **CF4** - Nasion height, **CF5** - Nasal breadth, **CB1** - Depth of infratemporal fossa, **CB2** - Biasteronic breadth, **CL1** - Maximum length of vault, **CL4** - Basion Nasion length, **CL6** - Basion Bregma height,

M1 - Bicondylar breadth, **M2** - Bigonial breadth, **M3** - Minimum ramus breadth, **M4** - Gonion Gnathion length, **M5** - Total Mandibular length,

P1 - Pubic length, **P2** - Ischial length, **P3** - Total height, **P4** - Iliac breadth, **P5**- Greater schiatic notch depth, **P6** - Acetabulur diameter, **P7** - Greater schiatic notch breadth, **P8** - Pubis breadth, **P9** - Pubis height.

In order to create new discriminant functions based on the adopted measurements from the literature to apply on the collected data in this study, univariate and multivariate discriminant function analysis was performed using SPSS v22.0 (SPSS, Inc., Chicago, IL). Student's t-test was used to determine the significance of sex and size differences. Direct and stepwise discriminant function analyses can be used to develop discriminant function equations for sex determination. However, only direct discriminant function analysis was used in this study. Using discriminant function analysis, a prediction model for group membership was built based on measurement data. In the event of more than two groups, a discriminant function or collection of discriminant functions based on linear measurements of predictive variables was constructed, which provided the best discrimination between the groups. It also made it easier to choose the best mix of variables when creating discriminant formulas for sex classification. These functions were created using data from an existing sample, namely Inden population group. Even though many of the functions utilized in this study, especially multivariate discriminant functions, were constructed using stepwise discriminant function analysis, the data was analyzed and functions were developed using solely direct discriminant function analysis.

Direct discriminant function analysis – The canonical discriminant coefficients computed by the direct technique, included all those measurements that had been used to create the original discriminant functions adopted from the literature. The discriminant function formulas were calculated using the unstandardised coefficient, often known as the raw coefficient. The standardised coefficient indicates how much a variable contributes to the overall classification (Chatterjee et al., 2019). The significance of the obtained discriminant functions was tested using Wilks' lambda.

Stepwise discriminant function analysis – The variables that are best suited to distinguish between the sexes are chosen using a stepwise discriminant analysis. The variable with the best univariate discrimination is chosen, and the criterion for the remaining variables is re-evaluated. Only variables that fulfill this criterion value are then included in the model. Only a few of the initial variables remain after a stepwise method is run. Wilks' lambda is the ratio of the sum of squares within groups to the total sum of squares. Wilks' lambda value varies from 0 to 1.0; the lower the number, the more it contributes to the discriminant function (variables with lambda values approaching zero indicate high group discrimination) (Kemkes-Grottenthaler, 2005).

3.4.2 Calculation of the Rate of Accuracy

The accuracy rate indicates what percentage of all individuals were correctly grouped in the corresponding male and female categories. To measure this rate, the sex determined by the discriminant analyses is compared to the known sex. The information on actual sex is known from church book records of Inden skeletal series along with the determined sex from STR typing, demographically identified cadavers of South African series, and previous analysis done by former research students on Lübeck skeletal series. In case the information on actual sex of an individual in Inden skeletal series differs between the church book and STR typing, the result from STR typing will be preferred over church book to calculate the accuracy rate.

To find the percentage, the number of correctly categorized or or grouped individuals is divided by the number of all individuals, which were examined with the respective discriminant function.

Rate of accuracy (%) = $\frac{The\ number\ of\ correctly\ classified\ individuals}{Total\ number\ of\ individuals} * 100$

3.4.3 Calculation of Inter-Observer Error (or Technical Error of Measurement – TEM)

TEM (Technical Error of Measurement) is the standard deviation achieved between the values of repeated measurements. It is the perfect index used to calculate the variation of repeated measurements of the same individual or skeletal element performed by the same observer or variation of repeated measurements of by different observers (Perini et al., 2005). According to Perini et al. (2005), there are also prerequisites that must be satisfied in order to make the calculations. The measurements must always have the same unit of measurement mm or cm, they are only applied to same population groups, and at least 20 measurements (20 individuals) must be considered. The exact inter-observer TEM calculation is performed as follows:

a. Deviation (di): the difference between the measurement of Observer 1 and Observer 2 is calculated.
b. Deviation^2 (di^2): the deviation calculated is squared.
c. Sum of the deviations ($\sum di^2$): the squared deviations are summed together
d. Absolute TEM: The summed deviation is applied to the given formula.

   Absolute TEM = $\sqrt{\frac{\sum di^2}{2n}}$

   Where, n is the total number of individuals in the sample size.
e. Variable average value (VAV): In order to convert absolute TEM to relative TEM, the value of VAV is calculated as shown in the formula

   VAV = $\frac{Mean\ value\ of\ a\ single\ measurement\ from\ Observer\ 1 + and\ from\ Observer\ 2}{2}$
f. Relative TEM: The error obtained as absolute TEM is transformed into percentage with this formula = $\frac{absolute\ TEM}{VAV} \times 100$

3.4.4 Descriptive Statistics and Inferential Statistics

The measurement data was first subjected to descriptive statistical analysis to find out the central tendency and dispersion. For the measured values xi of the individual measured sections, the SPSS v22.0 program was used to calculate the *minimum* value, *maximum* value, the *mean* value $\bar{x}$, the *standard deviation* of the mean value σ and the *standard error of the mean* value $\sigma_{\bar{x}}$. The mean value is a fictitious number that sums together and represents all of the measurement data. The variance and standard deviation are dispersion metrics that show how far the actual recorded data deviates from the mean value. As a result, it is possible to determine how well the mean represents the data. If the standard deviation is high, the measured values scatter widely about the mean value, indicating that the data is not representative of the data. The real data is close to the mean value when the standard deviation is low. As a result, the sample is representative of the population (Field, 2009).

The standard error is used to determine how well a sample represents a population. The standard deviation between distinct mean values, or how much the mean values of different samples of the same population varies, is described by the error. A big standard error indicates that there is a great deal of variation between the means of the many samples. As a result, the current sample would not be representative of a population. If the error is small, it suggests that the mean values of multiple samples are similar, indicating that the sample is representative of a population (Obertová et al., 2020). *Skewness* is an asymmetry metric that depicts how the items are distributed around the average. *Kurtosis* is a metric for how flat-topped a curve is (Kothari, 2004). The Shapiro–Wilk test determines whether a score distribution deviates significantly from a normal distribution. A significant value implies a deviation from normalcy, however large samples are typically skewed by tiny deviations from normality yielding a difference (Field, 2009).

In addition, the data analysis in SPSS included a two-sample t-test for dependent samples (*paired-samples t-test*). This test has been applied to analyse data for inter-observer error, it compares the first observer's mean value to the second observer's mean value and looks for a significant difference. When there are two experimental conditions and different individuals are allocated to each condition, the *independent-sample t-test* is utilized. This has been employed to know the difference between male and female samples within a population group (Field, 2009).

The p-value is used in this case, and the significance level is set to 0.05. The null hypothesis in this investigation is that there is no difference between the data of the observers. The null hypothesis is rejected if the determined p-value is less than 0.05, and it is presumed that there is a significant difference between the mean values of the observers. The null hypothesis is rejected if the determined p-value is less than 0.05, and it is presumed that there is a significant difference between the mean values of the observers. The null hypothesis is accepted if the determined p-value is greater than 0.05, and it is considered that there is no significant difference between the mean values of the observers. It's worth noting that p-values aren't always accurate. In some circumstances, the p-values returned by the t-test for analysis of significance can suggest egregiously low p-values (L. Williams & Quave, 2019). In such circumstances, the low p-value is attributable to the sample size and implies that even minor variations are prevalent. Errors of the first and second type can also occur. The null hypothesis is rejected by errors of type I, even though it must be accepted. The null hypothesis is accepted in errors of type II, even when it should be rejected. The significance threshold causes the first type of error. The significance threshold can be reduced to reduce the likelihood of making such an error. The second type of fault is linked to test power (Obertová et al., 2020). If there is a true difference, statistical power indicates the capacity to detect it. The sample size or the significance threshold can be adjusted to increase the test strength and lower the danger of incurring a second type of error. Because hypothesis tests' conclusions are dependent on probabilities, they cannot guarantee 100% certainty, therefore errors are common and can lead to incorrect conclusions (Cohen, 2013).

A significant test statistic does not imply that the effect it measures is meaningful or significant. The remedy to this issue is to use a standardized method to measure the size of the effect we're testing. An *Effect size* is a measurement of the size of an effect, whether it's the size of an experimental manipulation or the strength of a relationship between variables. Cohen's d, Pearson's correlation coefficient r, and the odds ratio are three of the most commonly used effect size measurements (Field, 2009). In this study the effect has been studied with Cohen’s d index, which can be observed as small ($d = 0.2$), medium (0.5), and large effect size (0.8). Cohen (1988) states “When our two populations are so separated as to make $d = .8$, almost half of their areas are not overlapped”.

We can assess interrater and intrarater reliability for nominal and ordinal scale variables using *Cohen's Kappa*. Cohen's kappa is a common statistic for determining how well two raters agree. It ranges between 0 and 1, the higher the value, the higher is the difference between the frequencies of different categories in question. In this study it is used to classify males and females, so if a few individuals in male sample or category have been wrongly assessed as females. So this shift will produce a larger Cohen’s Kappa value and the level of their agreement might then be measured using Cohen's Kappa (Obertová et al., 2020).

McNemar's test is a statistical test for paired nominal data in statistics. It is used to test whether the row and column marginal frequencies are similar in 2 x 2 contingency tables with a dichotomous trait and matched pairs of participants (McNemar, 1947). The range of McNemar test is assessed between 0 and 1. In this study morphological sex acts as a trait with two dichotomous variables, i.e., male and female. In this study morphological sex estimation of an individual is matched with their original sex and if the value is closer to 1, it means most of the individuals have been correctly sex estimated.

For three and more independent samples *Analysis of Variance (ANOVA)* could be applied to compare their means. ANOVA is a bivariate or multivariable statistical analysis with a dependent continuous variable (measurements) and independent categorical variables (in this case ancestry or population group). In ANOVA, the null hypothesis is that group means do not differ, hence the F-test is used (Obertová et al., 2020).

Chapter 4

4 Results

This chapter provides analysis of data collected from the individuals of three population groups – Inden, Lübeck, and South Africa series. The results here presented follows the order of general distribution, descriptive statistics, inferential statistics, accuracy or classification rates for sexual dimorphism using morphological and metrical methods. This follows the results from interobserver study for data on metrical methods only. In the end it highlights what the accuracy rates will be if the new discriminant functions for metrical methods had been devised based on Inden series and applied on the other population groups. The data collected using individual methods is attached in the Appendix section.

4.1 Objective 1: Results for Data from Morphological Methods

An overview of sample size for three skeletal series is shown in Table 7. Along with the information on individuals assessed for sex by morphological methods, it also outlines the number of individuals that are sex known. The multiple sources for the sex originate from the burial record, genetic analyses, and a database on the cadaver. In general, it was possible to assess morphological traits on crania, mandible, pelvis in a lot of individuals but there are many individuals that had one element better preserved than the other. This means that not every individual has been assessed for all the morphological traits. Thus, the numbers for every series or sample size in the Table 7 does not exclude the skeletons with unobservable individual traits.

Table 7 Number of individuals by morphologically estimated and previously known sex

	Population groups		
Source of sex estimate	**Inden**	**Lübeck**	**South Africa**
Morphological	164	236	161
Previously known	109	76	161

Note. The previously known data includes sources aDNA, church book and the cadaver database. Table already Published in Gupta et al. (2022); CC-BY 4.0 license.

The final accuracy rates with indifferent or ambiguous individuals and without them is shown in Table 8 for Inden series, in Table 9 for Lübeck series, and in Table 10 for South African series. The accuracy rate has been calculated once with all the indifferent individuals in the total sample size where they have been wrongly identified and hence producing low accuracy rate and in the second case all the indifferent individuals have been removed, making the sample size smaller and the number of wrongly classified individuals reduces, giving a higher accuracy rate. All the three tables highlight the Cohen's Kappa results for individual traits as well. Cohen's kappa is a statistic that is used to evaluate the agreement between two raters, in this study the result of sex estimation using morphological traits would be considered as rater 1 and the rater 2 would be the correct sex of the individuals. Estimated sex is compared with the correct sex. If there are misclassifications, it could be assessed using Cohen's kappa value, instead of simple accuracy rate. The higher the number of misclassified individuals compared to the correctly classified individuals, the lower will be the value of Cohen's kappa. P-value signified if the misclassification (no match) is by mere chance. The higher the Cohen's kappa value, the lower the p-value gets.

*Table 8 The total number of individuals for skull and os coxae with traits observed, indifferent (ambiguous), and incorrectly identified results as well as the accuracy rates for correctly identified in the **Inden** series*

Trait	Individuals considered with known sex	Match	No match	Raw accuracy (%)	Indifferent	Without indifferent	Match	No match	Accuracy (%)	Cohen's Kappa	p-value
Inden Calvarium - Morphological											
Cranium overall	74	51	23	68.92	13	61	51	10	83.61	0.665	0.000
*Fron. tub. & Steepness	75	59	16	**78.7**	13	62	52	10	83.9	0.665	0.000
**Gla-Supra orbit ridges	75	53	22	70.7	12	63	53	10	**84.1**	0.679	0.000
Supraorbital margin	75	43	32	57.3	17	58	43	15	74.1	0.450	0.000
Eye orbitals	62	43	19	69.4	4	58	43	15	74.1	0.464	0.000
Zygomaticum	69	44	25	63.8	9	60	44	16	73.3	0.444	0.000
Mastoid process	75	43	32	57.3	13	62	42	20	67.7	0.351	0.000
Inden Mandible - Morphological											
Mandible overall	65	50	15	**76.9**	0	65	50	15	**76.9**	0.491	0.000
Condylar process	64	43	21	67.2	0	64	43	21	67.2	0.294	0.019
Corpus height	59	39	20	66.1	0	59	39	20	66.1	0.264	0.040
Mentum	57	40	17	70.2	0	57	40	17	70.2	0.348	0.006
Gonion and angle	54	35	19	64.8	1	53	35	18	66.0	0.183	0.052
Inden Pelvis - Morphological											
Iliac crest	69	47	22	68.1	0	69	47	22	68.1	0.361	0.003
Arc compose	90	67	23	74.4	3	87	67	20	77.0	0.530	0.000
Greater sciatic notch	90	65	25	72.2	7	83	65	18	78.3	0.556	0.000
Sub pubic angle	54	48	6	**88.9**	1	53	48	5	**90.6**	0.797	0.000

Note. The cells inside blue lines are part of raw accuracy calculation with indifferent individuals and the ones within orange lines are for accuracy without indifferent ambiguous individuals. The numbers highlighted in **bold** represent the highest accuracy rate. *Frontal tubercle or eminences and forehead steepness; **Glabella-Supra orbital ridges (superciliary arch). Table already Published in Gupta et al. (2022); CC-BY 4.0 license.

Glabella-Supra orbital ridges show the highest accuracy for crania in the Inden and South African series. Although the combination of features as an overall evaluation performs better than other traits in the Lübeck series, the limited sample size has a significant impact on poor accuracy rates. Furthermore, a similar pattern can be understood from Cohen's Kappa tests, with higher levels of agreement for traits in Inden, South Africa, but not in the Lübeck series. There is no trait in any of the series that displays perfect agreement (k = 1.000). Inden and South Africa series exhibit significant agreement with previously known sex for the Glabella-supra orbital ridges and the Cranium overall generally, but in Lübeck series for all cranial traits the agreement between morphologically estimated sex and previously known is really poor.

Table 9 The total number of individuals for skull and os coxae with traits observed, indifferent (ambiguous), and incorrectly identified results as well as the accuracy rates for correctly identified in the ***Lübeck*** *series*

Trait	Individuals considered with known sex	Match	No match	Raw accuracy (%)	Indifferent	Without indifferent	Match	No match	Accuracy (%)	Cohen's Kappa	p-value
Lübeck Calvarium - Morphological											
Cranium overall	43	23	20	**53.5**	4	39	23	16	59.0	0.273	0.027
*Fron. tub. & Steepness	40	21	19	52.5	3	37	21	16	56.8	0.204	0.121
**Gla-Supra orbit ridges	43	20	23	46.5	8	35	20	15	57.1	0.274	0.018
Supraorbital margin	42	18	24	42.9	7	35	18	17	51.4	0.177	0.128
Eye orbitals	43	23	20	53.5	1	42	23	19	54.8	0.222	0.045
Zygomaticum	43	20	23	46.5	6	37	20	17	54.1	0.209	0.076
Mastoid process	43	20	23	46.5	6	37	20	17	54.1	0.211	0.074
Lübeck Mandible - Morphological											
Mandible overall	31	18	13	**58.1**	0	31	18	13	58.1	0.074	0.675
Condylar process	26	12	14	46.2	1	25	12	13	48.0	0.110	0.405
Corpus height	31	17	14	54.8	0	31	17	14	54.8	0.084	0.609
Mentum	31	13	18	41.9	1	30	13	17	43.3	-0.049	0.745
Gonion and angle	31	22	9	71.0	0	31	22	9	71.0	0.318	0.076
Lübeck Pelvis - Morphological											
Iliac crest	51	31	20	60.8	7	44	31	13	70.5	0.441	0.001
Arc compose	51	40	11	**78.4**	3	48	40	8	83.3	0.652	0.000
Greater sciatic notch	50	36	14	72.0	7	43	36	7	83.7	0.670	0.000
Sub pubic angle	51	32	19	62.7	13	38	32	6	84.2	0.687	0.000

Note. The cells inside blue lines are part of raw accuracy calculation with indifferent individuals and the ones within orange lines are for accuracy without indifferent ambiguous individuals. The numbers highlighted in

bold represent the highest accuracy rate. *Frontal tubercle or eminences and forehead steepness; **Glabella-Supra orbital ridges. Table already Published in Gupta et al. (2022); CC-BY 4.0 license.

Table 10 The total number of individuals for skull and os coxae with traits observed, indifferent (ambiguous), and incorrectly identified results as well as the accuracy rates for correctly identified in the ***South African*** *series*

Trait	Individuals considered with known sex	Match	No match	Raw accuracy (%)	Indifferent	Without indifferent	Match	No match	Accuracy (%)	Cohen's Kappa	p-value
South Africa Calvarium - Morphological											
Cranium overall	160	130	30	**81.3**	0	160	130	30	81.3	0.595	0.000
*Fron. tub. & Steepness	160	125	35	78.1	2	158	125	33	79.1	0.573	0.000
**Gla-Supra orbit ridges	160	130	30	81.3	1	159	130	29	**81.8**	0.613	0.000
Supraorbital margin	160	108	52	67.5	1	159	108	51	67.9	0.299	0.000
Eye orbitals	160	124	36	77.5	2	158	124	34	78.5	0.533	0.000
Zygomaticum	160	124	36	77.5	4	156	124	32	79.5	0.581	0.000
Mastoid process	160	113	47	70.6	1	159	113	46	71.1	0.402	0.000
South Africa Mandible - Morphological											
Mandible overall	160	130	30	**81.3**	4	156	130	26	**83.3**	0.634	0.000
Condylar process	160	114	46	71.3	1	159	114	45	71.7	0.407	0.000
Corpus height	160	117	43	73.1	4	156	117	39	75.0	0.464	0.000
Gonion and angle	160	127	33	79.4	2	158	127	31	80.4	0.604	0.000
Mentum	160	102	58	63.8	5	155	102	53	65.8	0.290	0.000
South Africa Pelvis - Morphological											
Iliac crest	156	109	47	69.9	1	155	109	46	70.3	0.382	0.000
Greater sciatic notch	156	122	34	78.2	2	154	122	32	79.2	0.552	0.000
Arc compose	156	127	29	81.4	1	155	127	28	81.9	0.609	0.000
Sub pubic angle	156	146	10	**93.6**	1	155	146	9	**94.2**	0.879	0.000

Note. The cells inside blue lines are part of raw accuracy calculation with indifferent individuals and the ones within orange lines are for accuracy without indifferent ambiguous individuals. The numbers highlighted in **bold** represent the highest accuracy rate. *Frontal tubercle or eminences and forehead steepness; **Glabella-Supra orbital ridges. Table already Published in Gupta et al. (2022); CC-BY 4.0 license.

Table 11 shows how males and females differ in terms of accuracy rates. It depicts a trait classification comparison across all demographic groups. McNemar's test identifies the systematic difference between morphological and previously known sex estimates which shows a trend in Lübeck cranial traits. In this study it is used to classify males and females, so if a few individuals in male sample or category have been wrongly assessed as females, the value of McNemar will decrease. This works on the principle of having imbalance in the 2x2 contingency for classifying males and females. If the accuracy rate of a particular sex (female) in a population group decreases, this signifies that many individuals in that sex group have been wrongly identified with the other sex (male), thus decreasing the value of McNemar test. The number of matches for male and female individuals shown for every group belongs to the calculation without indifferent individuals. In all three groups, pubic features were the best indicators for identifying males and females.

Table 11 Accuracy rates for individual traits in males and females separately

Trait	Inden					Lübeck					South Africa				
	Male Match	Male Accuracy (%)	Female Match	Female Accuracy (%)	McNemar Test	Male Match	Male Accuracy (%)	Female Match	Female Accuracy (%)	McNemar Test	Male Match	Male Accuracy (%)	Female Match	Female Accuracy (%)	McNemar Test
Cranium - Morphological															
Cranium overall	30	84	21	83.3	0.754	11	91.7	12	44.4	0.001	87	**88.8**	43	69.4	0.200
*Fron. tub. & Steepness	32	**86.5**	20	80	1.000	8	80	13	**48.1**	0.004	75	78.1	50	**80.6**	0.163
**Gla-Supr orbit ridges	30	83.3	23	**85.2**	0.754	11	**100**	9	37.5	0.000	84	86.6	46	74.2	0.711
Supraorbital margin	29	85.3	14	58.3	0.302	10	90.9	8	33.3	0.000	78	80.4	30	48.4	0.092
Eye orbitals	16	66.7	27	79.4	1.000	11	91.7	12	40	0.000	85	88.5	39	62.9	0.058
Zygomaticum	28	77.8	16	66.7	1.000	11	91.7	9	36	0.000	74	78.7	50	**80.6**	0.215
Mastoid process	24	66.7	18	69.2	0.503	10	90.9	10	38.5	0.000	71	73.2	42	67.7	0.461
Mandible - Morphological															
Mandible overall	35	85.4	15	**62.5**	0.607	4	44	14	63.6	0.581	89	**92.7**	41	68.3	0.029
Condylar process	30	75	13	54.2	1.000	4	**80**	8	40	0.003	74	76.3	40	64.5	1.000
Corpus height	28	77.8	11	47.8	0.503	5	55.6	12	54.5	0.180	79	83.2	38	62.3	0.337
Mentum	29	85.3	11	47.8	0.143	5	55.6	8	38.1	0.049	66	69.5	36	60	0.011
Gonion and angle	31	**96.9**	4	19	0.000	5	55.6	17	**77.3**	1.000	74	90.2	53	**86.9**	0.583
Pelvis - Morphological															
Iliac crest	26	66.7	21	70	0.523	14	93.3	17	58.6	0.003	70	73.7	39	65	0.659
Arc compose	40	81.6	27	71.1	0.824	15	83.3	25	**83.3**	0.727	85	88.5	42	71.2	0.215
Greater sciatic notch	39	83	26	72.2	0.815	15	88.2	21	80.8	0.453	82	87.2	40	66.7	0.345
Sub pubic angle	31	**93.9**	17	**85**	1.000	15	**93.8**	17	77.3	0.219	89	**93.7**	57	**95**	0.508

Note. The numbers highlighted in **bold** represent the highest accuracy rate. *Frontal tubercle or eminences and forehead steepness; **Glabella-Supra orbital ridges. Table already Published in Gupta et al. (2022); CC-BY 4.0 license.

For subpubic angle, the likelihood of males being scored or classed as males and females being females is considerably high. It even approaches 95% for South African females, which is significantly higher than the combined accuracy rates for both sexes in all series. In the Inden series, males were identified badly with the mastoid process, which had the lowest accuracy rate, while females were identified poorly with the zygomaticum or zygomatic arch, which was the weakest sex indicator. Although the sample size is small, the glabella-supra orbital ridges in females achieve only 37.5% (see Table 11) accuracy in the Lübeck series, compared to the male-female pooled accuracy rate of 84.1 (see Table 8) percent in Inden, and it is the most accurate sex indicator in the Inden females, with an accuracy rate of 85.2 percent (see Table 11).

4.2 Objective 2: Results for Data from Metrical Methods

In this section the general distribution (chapter - 4.2.1) of the sample size in different skeletal elements, descriptive statistics, and inferential statistics (chapter - 4.2.2), and accuracy rates (chapter – 4.2.3) has been presented in different subsections.

4.2.1 General Distribution Highlighting the Number of Individuals Measured for Different Measurements

For all three different population groups, the number of individuals for each skeletal measurement are shown in Table 12. The number of individuals for different measurements in every population sample varies sometimes. It is due to different preservation rates and the presence or missing of some features on skeletal elements. In order to see the description of measurements as abbreviated here with alphabets and number, refer the chapter 3.2.2 in the methods section.

Table 12 Overview of number of individuals measured in every population group

Femur	F1	F2	F3	F4	F5	F6	F7	F8				
Inden	106	106	106	106	106	106	106	88				
Lübeck	182	151	184	139	177	176	172	179				
South Africa	155	155	155	155	155	155	155	155				
Tibia	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
Inden	110	110	110	110	110	110	110	110	110	110	110	110
Lübeck	140	104	107	140	140	139	111	103	106	103	100	98
South Africa	156	156	156	156	156	156	156	156	156	156	156	156
Humerus	H1	H2	H3	H4								
Inden	98	98	97	93								
Lübeck	122	122	154	159								
South Africa	154	154	154	154								
Radius	R1	R2	R3	R4								
Inden	90	90	91	85								
Lübeck	117	137	122	149								
South Africa	155	155	155	155								
Ulna	U1	U2	U3	U4								
Inden	102	103	102	99								
Lübeck	115	148	119	149								

South Africa	154	154	154	154					
Crania	CB1	CB2	CF1	CF4	CF5	CL1	CL4	CL6	
Inden	56	56	56	56	56	56	56	56	
Lübeck	110	115	108	112	112	116	108	109	
South Africa	159	159	159	159	159	159	159	159	
Mandible	M1	M2	M3	M4	M5				
Inden	71	72	72	72	72				
Lübeck	68	87	92	92	89				
South Africa	158	160	160	160	160				
Pelvis	P1	P2	P3	P4	P5	P6	P7	P8	P9
Inden	48	49	49	49	49	49	49	48	48
Lübeck	131	171	175	175	192	196	194	134	133
South Africa	154	154	154	154	154	154	154	154	154

*Note***.** **F1** – Femoral Midshaft circumference, **F2** – Maximum length, **F3** – Midshaft diameter, **F4** – Condylar width, **F5** – Vertical head diameter, **F6** – Transverse head diameter, **F7** – Head circumference, **F8** – Subtrochanteric circumference of the femur

T1 – Cicumference at the nutrient foramen of the Tibia, **T2** – Physiological Length, **T3** – Proximal epiphyseal breadth, **T4** – Anteroposterior diameter, **T5** – Transverse diameter, **T6** – Minimum circumference, **T7** – Distal epiphyseal breadth, **T8** – Biarticular breadth, **T9** – Medial condyle articular width, **T10** – Medial condyle articular length, **T11** – Lateral condyle articular width, **T12** – Lateral condyle articular width,

H1 – Maximum humeral length, **H2** – Vertical head diameter, **H3** – Humeral epicondylar width, **H4** – Minimum circumference of humerus

R1 – Maximum radial length, **R2** – Maximum radial proximal width, **R3** – Maximum radial distal width, **R4** – Radial tuberosity circumference

U1 – Maximum ulnar length, **U2** – Maximum ulnar proximal width, **U3** – Maximum ulnar distal width, **U4** – Minimal circumference of the ulna

CF1 - Bizygomatic diameter, **CF4** - Nasion height, **CF5** - Nasal breadth, **CB1** - Depth of infratemporal fossa, **CB2** - Biasteronic breadth, **CL1** - Maximum length of vault, **CL4** - Basion Nasion length, **CL6** - Basion Bregma height,

M1 - Bicondylar breadth, **M2** - Bigonial breadth, **M3** - Minimum ramus breadth, **M4** - Gonion Gnathion length, **M5** - Total Mandibular length,

P1 - Pubic length, **P2** - Ischial length, **P3** - Total height, **P4** - Iliac breadth, **P5**- Greater schiatic notch depth, **P6** - Acetabulur diameter, **P7** - Greater schiatic notch breadth, **P8** - Pubis breadth, **P9** - Pubis height.

4.2.2 Descriptive and Inferential Statistics Distributed by Sex and Population

In this subsection, it includes the data on individuals with known sex for considered measurements (see chapter 3.2.2) for metrical methods. For each skeletal element there are two tables highlighting the descriptive statistics – first table is for female sample (here sample has been identified as a group of individuals based on random sampling), hence plural cannot be used) and the second for male sample. Next table shows the inferential statistics, where it compares the data from female and male sample in each population group.

4.2.2.1 **Descriptive and Inferential Statistics on Femur Measurements**

The presentation of data starts with femur bone, with descriptive statistics for femur female sample in Table 13, for femur male sample in Table 15, and the result for t-test comparing the data between femur male and femur female is presented in Table 16. The negative values for t-value, mean difference, and Cohen's d, explain that females have lower mean than males. In the tables the count of individuals (N) is different for every population groups. There is a great difference between minimum and maximum values for every measurement in Inden, Lübeck and South Africa (S.A.) series. The mean values for female samples (here it means female individuals of all three population groups, hence plural) here are representative for the overall population group.

- In Inden the standard deviation (SD) is high for measurements F2 (28.28 mm), F7 (13.15 mm), and F8 (28.74 mm). Similarly, the standard error (SE) is corresponding with the increase and decrease for F2, F7 and F8.
- In Lübeck for F2 (32.26 mm) the SD is higher than in Inden, it means that the variation within the female individuals of the population itself is high. SE is high for F2 (6.10 mm) and F7 (2.14 mm).
- In SA the standard deviation for F2 (21.24 mm) is lower than Inden (13.15 mm) and Lübeck (32.26 mm). For the rest of the individuals SE looks better compared to Inden and Lübeck.

Skewness (-1 to +1), Kurtosis (-1 to +1), and Shapiro Wilks' test ($p \leq 0.05$) confirm that most of the measurement data are normally distributed.

*Table 13 Data (in mm) on Femur bone measurements from **female** samples in Inden, Lübeck, and South African series*

Pop. & Measur.		N	Minimum	Maximum	Mean	Std. Deviation	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
F1	Inden	37	74.00	99.00	86.96	6.21	1.02	0.13	-0.20	.385
	Lübeck	35	68.00	103.00	83.74	7.62	1.29	0.52	0.32	.311
	S.A.	60	71.00	91.00	80.49	4.16	0.54	0.05	-0.02	.794
F2	Inden	37	370.00	488.00	422.51	28.28	4.65	0.24	0.09	.560
	Lübeck	28	372.00	519.00	444.89	32.26	6.10	0.24	0.68	.532
	S.A.	60	378.00	474.00	425.97	21.24	2.74	-0.08	0.01	.570
F3	Inden	37	23.00	34.00	27.34	2.32	0.38	0.46	0.84	.158
	Lübeck	35	20.00	34.00	26.34	2.68	0.45	0.47	1.96	.043
	S.A.	60	21.00	29.00	24.58	1.49	0.19	0.34	0.39	.023
F4	Inden	37	66.00	83.00	73.85	3.84	0.63	0.56	0.27	.193
	Lübeck	26	65.00	85.00	74.81	5.94	1.16	0.17	-0.71	.303
	S.A.	60	64.00	78.00	70.50	3.39	0.44	0.16	-0.79	.173
F5	Inden	37	38.50	55.00	43.26	3.82	0.63	1.56	2.59	.000

Pop. & Measur.		N	Minimum	Maximum	Mean	Std. Deviation	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
	Lübeck	35	36.00	52.00	43.84	4.06	0.69	0.27	-0.39	.512
	S.A.	60	25.00	45.00	39.24	2.95	0.38	-1.71	8.00	.000
F6	Inden	37	38.50	54.00	43.01	3.49	0.57	1.68	3.17	.000
	Lübeck	35	36.00	52.00	43.37	3.86	0.65	0.22	-0.24	.791
	S.A.	60	36.00	44.00	39.29	2.10	0.27	0.23	-0.66	.020
F7	Inden	37	97.00	173.00	135.68	13.15	2.16	0.57	3.39	.001
	Lübeck	35	112.00	165.00	139.36	12.66	2.14	0.15	-0.28	.914
	S.A.	60	115.00	143.00	126.56	6.92	0.89	0.40	-0.27	.177
F8	Inden	41	83,00	195,00	108.69	26,83	4,19	2,33	5,17	,000
	Lübeck	35	88.00	139.00	120.17	11.48	1.94	-0.79	1.01	.144
	S.A.	60	99.00	135.00	112.70	8.04	1.04	0.66	0.37	.037

In Table 15 it displays data for male individuals. The sample size for Lübeck is quite small, considering this fact, the minimum values are similar for F1, F3, F5, F6 and F8 in Inden, Lübeck and SA.

- In Inden series the F2 and F8 measurements show that there is a great variation within the individuals as the difference between minimum and maximum is quite stark. Similarly, SD and SE are high for F2 (44.86 mm; 7.18 mm) and F8 (25.89 mm; 4.32 mm). Skewness, Kurtosis, and Shapiro Wilks' highlight that the data is not normally distributed for F2 and F8.
- In Lübeck series males have high variation with respect to F7 (Minimum=120 – Maximum=165 mm) and F8 (88 – 147 mm). SD and SE are fairly high for F2 (25.19 mm; 6.30 mm) and F8 (17.54 mm; 3.92 mm). The data for almost all measurements is normally distributed.
- In SA, F1 (75 – 103 mm) and F2 (386 – 503 mm) show a stark difference between minimum and maximum values, indicating a great variation which can be confirmed via SD and SE for F2 (24.59 mm; 2.52 mm) but the values for F1(SD = 6.34 mm; SE = 0.65 mm) looks good. The data is normally distributed.

*Table 14 Data (in mm) on Femur bone measurements from **male** samples in Inden, Lübeck, and South African series*

Pop.		N	Minimum	Maximum	Mean	Std. Deviation	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
F1	Inden	39	79.00	104.00	92.28	5.79	0.93	0.22	-0.22	.451
	Lübeck	21	76.00	101.00	86.38	7.06	1.54	0.44	-0.68	.390
	S.A.	95	75.00	103.00	88.77	6.34	0.65	-0.08	-0.42	.442
F2	Inden	39	239.00	492.00	441.28	44.86	7.18	-3.04	11.67	.000
	Lübeck	16	410.00	492.00	453.44	25.19	6.30	-0.08	-0.66	.662
	S.A.	95	386.00	503.00	456.76	24.59	2.52	-0.51	-0.04	.084
F3	Inden	39	23.00	35.00	28.82	2.51	0.40	0.22	0.34	.721
	Lübeck	21	23.70	32.00	27.20	2.52	0.55	0.27	-0.90	.251
	S.A.	95	21.00	33.00	27.02	2.03	0.21	-0.18	0.31	.039
F4	Inden	39	72.00	89.00	81.05	4.26	0.68	-0.27	-0.57	.381
	Lübeck	15	68.00	87.00	76.67	5.65	1.46	0.40	-0.05	.429
	S.A.	95	68.00	90.00	78.25	4.16	0.43	0.12	0.03	.880
F5	Inden	39	43.00	52.00	47.77	2.17	0.35	-0.35	-0.26	.166
	Lübeck	19	38.30	51.00	44.47	3.76	0.86	0.10	-0.73	.684
	S.A.	95	38.00	52.00	44.73	2.65	0.27	0.05	-0.07	.302
F6	Inden	39	41.00	52.00	47.69	2.25	0.36	-0.87	1.22	.007
	Lübeck	19	38.00	51.00	43.93	3.47	0.80	-0.01	-0.38	.842
	S.A.	95	39.00	52.50	44.45	2.45	0.25	0.34	0.60	.045
F7	Inden	39	135.00	165.00	151.31	6.72	1.08	-0.69	0.62	.100
	Lübeck	19	120.00	165.00	139.97	12.08	2.77	0.28	-0.32	.960
	S.A.	95	123.00	168.00	142.57	8.18	0.84	0.13	0.31	.696
F8	Inden	47	92,00	198,00	118,83	20,16	2,94	1,37	3,52	,000
	Lübeck	20	88.00	147.00	118.85	17.54	3.92	-0.38	-0.71	.352
	S.A.	95	106.00	145.00	124.05	8.99	0.92	0.22	-0.64	.289

The *t*-test statistic tests the significant differences between the means of males and females and F-statistic tests if there are any differences between male and female variances. In order to assess *t*-test for equality of means we look at the sig. value for F-statistic in Levene's test for equality of variances. If the sig. value for F-statistic is less than 0.05, it means there is unequal variances (≠ V) between the male and female samples and if $p > 0.05$ it means there are equal variances (= V) for male and female samples. In Table 16 for Inden, F1 (F = 0,01; p = 0.94) has equal variances, so the row of equal variances (= V) will be considered for *t*-test statistic and in case of sig. value for F-statistic, is below 0.05, bottom row of *t*-test statistic will be reported. The negative values for *t*-value, mean difference, and Cohen's d, explains that the females have lower mean than male.

*Table 15 t-test between **Femur male and female** samples from Inden, Lübeck, and South Africa series*

Pop.			Levene's Test for Equality of Variances		*t*-test for Equality of Means							Cohen's d	Effect
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference			
										Lower	Upper		
F1	Inden	= V	0.01	0.94	-3.87	74.00	0.00	-5.32	1.38	-8.07	-2.58	-0.90	Large
		≠ V			-3.86	72.87	0.00	-5.32	1.38	-8.07	-2.57		
	Lübeck	= V	0.00	0.97	-1.29	54.00	0.20	-2.64	2.05	-6.74	1.47		
		≠ V			-1.31	44.86	0.20	-2.64	2.01	-6.68	1.41		
	S.A.	= V	11.33	0.00	-8.97	153.00	0.00	-8.28	0.92	-10.11	-6.46		
		≠ V			-9.82	152.73	0.00	-8.28	0.84	-9.95	-6.62	-1.59	Large
F2	Inden	= V	0.31	0.58	-2.17	74.00	0.03	-18.77	8.66	-36.02	-1.52	-0.50	Medium
		≠ V			-2.19	64.55	0.03	-18.77	8.56	-35.86	-1.68		
	Lübeck	= V	0.25	0.62	-0.91	42.00	0.37	-8.54	9.38	-27.47	10.38		
		≠ V			-0.97	37.83	0.34	-8.54	8.76	-26.29	9.20		
	S.A.	= V	1.84	0.18	-7.99	153.00	0.00	-30.79	3.85	-38.40	-23.18	-1.29	Large
		≠ V			-8.26	138.77	0.00	-30.79	3.73	-38.16	-23.42		
F3	Inden	= V	0.18	0.67	-2.67	74.00	0.01	-1.48	0.56	-2.59	-0.38	-0.62	Medium
		≠ V			-2.67	73.95	0.01	-1.48	0.55	-2.59	-0.38		
	Lübeck	= V	0.11	0.74	-1.19	54.00	0.24	-0.86	0.72	-2.32	0.59		
		≠ V			-1.21	44.27	0.23	-0.86	0.71	-2.30	0.57		
	S.A.	= V	4.99	0.03	-8.07	153.00	0.00	-2.45	0.30	-3.04	-1.85		
		≠ V			-8.64	149.52	0.00	-2.45	0.28	-3.01	-1.89	-1.41	Large
F4	Inden	= V	1.40	0.24	-7.73	74.00	0.00	-7.20	0.93	-9.06	-5.34	-1.80	Large
		≠ V			-7.75	73.81	0.00	-7.20	0.93	-9.05	-5.35		
	Lübeck	= V	0.37	0.55	-0.98	39.00	0.33	-1.86	1.89	-5.69	1.97		
		≠ V			-1.00	30.57	0.33	-1.86	1.87	-5.67	1.95		
	S.A.	= V	1.44	0.23	-12.12	153.00	0.00	-7.75	0.64	-9.02	-6.49	-1.96	Large
		≠ V			-12.69	143.30	0.00	-7.75	0.61	-8.96	-6.54		
F5	Inden	= V	5.32	0.02	-6.37	74.00	0.00	-4.51	0.71	-5.92	-3.10		
		≠ V			-6.29	56.39	0.00	-4.51	0.72	-5.95	-3.07	-1.67	Large
	Lübeck	= V	0.21	0.65	-0.56	52.00	0.57	-0.64	1.13	-2.90	1.63		
		≠ V			-0.58	39.58	0.57	-0.64	1.10	-2.86	1.59		
	S.A.	= V	0.01	0.92	-12.00	153.00	0.00	-5.48	0.46	-6.39	-4.58	-1.94	Large
		≠ V			-11.71	115.59	0.00	-5.48	0.47	-6.41	-4.56		
F6	Inden	= V	2.92	0.09	-6.99	74.00	0.00	-4.68	0.67	-6.01	-3.35	-1.63	Large
		≠ V			-6.91	61.05	0.00	-4.68	0.68	-6.03	-3.33		
	Lübeck	= V	0.29	0.59	-0.53	52.00	0.60	-0.56	1.06	-2.69	1.57		
		≠ V			-0.54	40.58	0.59	-0.56	1.03	-2.64	1.52		
	S.A.	= V	0.28	0.60	-13.47	153.00	0.00	-5.16	0.38	-5.92	-4.40	-2.18	Large
		≠ V			-13.94	139.26	0.00	-5.16	0.37	-5.89	-4.43		
F7	Inden	= V	4.90	0.03	-6.58	74.00	0.00	-15.63	2.38	-20.37	-10.90		
		≠ V			-6.47	52.96	0.00	-15.63	2.41	-20.47	-10.79	-1.78	Large
	Lübeck	= V	0.15	0.70	-0.17	52.00	0.86	-0.61	3.55	-7.74	6.51		
		≠ V			-0.18	38.60	0.86	-0.61	3.50	-7.70	6.47		
	S.A.	= V	1.36	0.25	-12.58	153.00	0.00	-16.01	1.27	-18.52	-13.50	-2.03	Large
		≠ V			-13.06	140.45	0.00	-16.01	1.23	-18.43	-13.59		
F8	Inden	= V	0.18	0.67	-2.02	86.00	0.05	-10.13	5.02	-20.12	-0.15	-0.44	Medium
		≠ V			-1.98	73.60	0.05	-10.13	5.12	-20.34	0.07		
	Lübeck	= V	5.39	0.02	0.34	53.00	0.74	1.32	3.91	-6.53	9.17		
		≠ V			0.30	28.48	0.76	1.32	4.38	-7.64	10.28		
	S.A.	= V	1.15	0.29	-7.97	153.00	0.00	-11.35	1.42	-14.17	-8.54	-1.29	Large
		≠ V			-8.17	135.81	0.00	-11.35	1.39	-14.10	-8.61		

Note. Population groups and Sig. (2-tailed) highlighted in yellow show statistical significance between male and female mean differences. Effect size highlighted in green, quantifies and shows how high the degree of statistically significant mean difference is.

- For Inden series, all the eight measurements have significant differences in males and females with $p \leq 0.05$. Among those eight, Cohen's d (value above 0.8) shows that for F1, F4, F5, F6, and F7 the effect is large. For these measurements the difference between male and female means are highly significant. For every measurement mentioned above, with high Cohen's d value the mean values between males and females stand far from each other and with low Cohen's d value (0.2 – 0.5), there is higher overlapping between males and females.
- For Lübeck series, none of the femur measurements seem to have significant differences in males and females.
- In S.A. the similar trend can be understood for all the femur measurements, where there are significant differences between male and female samples means. F1 to F8, all of them have large effect on significance with high Cohen's d values.

4.2.2.2 **Descriptive and Inferential Statistics on Tibia Measurements**

The descriptive statistics for tibia female sample in Table 16 , for tibia male sample in Table 17, and the result for t-test comparing the data between tibia male and tibia female is presented Table 18.

For female tibia sample T2 is the only measurement, used for physiological length has the highest variability among the individuals. T2 has a big difference between the minimum and maximum values for all the population groups. The positive thing to observe here is, that all the measurements have a similar range for mean values in all the three population groups.

- For every single measurement in Inden series, SD shows that the individual data values are close to the mean value except T2 (SD = 19.59 mm; SE = 3.26 mm). As per SE values for each measurement, it can be alleged that our sample mean is close to the true mean of the overall population. Hence, the mean values are representative of the overall population. The data appears to be normally distributed considering the values of skewness, kurtosis and Shapiro Wilks'.
- For Lübeck series SD confirms a similar picture for T2 like in Inden series. The individual values are far spread from the mean values. The sample mean for T2 (SE = 6.04 mm) and T10 (SE = 1.98 mm) is far from the population mean. The data give the impression for a normal distribution for all the measurements.
- In SA series, T2 has even the highest SD (22.74 mm), indicating the shape of its distribution, even though the sample mean is much closer to the population mean,

than it can be seen in Inden and Lübeck. The data for the T7 and T10 are not normally distributed.

*Table 16 Data (in mm) on Tibia bone measurements from **female** samples in Inden, Lübeck, and South African series*

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
T1	Inden	37	75.50	107.00	94.80	6.55	1.08	-0.61	1.56	.059
	Lübeck	14	76.00	100.00	88.57	6.80	1.82	-0.35	-0.53	.762
	S.A.	95	78.00	120.00	95.02	7.80	0.80	0.32	0.08	.421
T2	Inden	37	319.00	396.00	351.65	21.76	3.58	0.57	-0.79	.023
	Lübeck	10	313.00	378.00	343.70	19.10	6.04	0.25	0.09	.823
	S.A.	95	311.00	429.00	374.63	22.74	2.33	-0.18	-0.27	.466
T3	Inden	37	70.00	84.00	75.89	3.20	0.53	0.04	0.23	.337
	Lübeck	11	65.00	78.00	72.45	3.98	1.20	-0.61	-0.29	.749
	S.A.	95	63.00	85.00	74.97	3.89	0.40	-0.43	0.49	.048
T4	Inden	37	18.00	33.00	28.31	4.03	0.66	-0.91	-0.07	.002
	Lübeck	14	23.00	32.00	27.57	3.18	0.85	0.09	-1.43	.154
	S.A.	95	25.00	37.00	30.77	2.34	0.24	0.16	-0.26	.125
T5	Inden	37	17.00	31.00	23.24	3.06	0.50	0.82	0.50	.012
	Lübeck	14	18.00	25.00	21.36	1.86	0.50	0.22	0.18	.903
	S.A.	95	17.00	29.00	22.06	2.38	0.24	0.21	-0.01	.079
T6	Inden	37	66.00	85.00	75.76	4.63	0.76	-0.08	-0.01	.349
	Lübeck	13	66.00	82.00	74.69	5.22	1.45	-0.45	-0.76	.455
	S.A.	95	63.00	91.00	76.41	6.09	0.62	0.16	-0.53	.461
T7	Inden	37	43.00	56.00	51.62	3.43	0.56	-0.75	-0.01	.026
	Lübeck	11	44.00	60.00	48.00	4.69	1.41	1.86	4.00	.007
	S.A.	95	40.00	56.00	46.97	3.16	0.32	0.28	0.02	.121
T8	Inden	37	70.00	85.00	76.11	3.51	0.58	0.06	0.08	.141
	Lübeck	10	69.00	78.00	73.30	2.95	0.93	0.32	-0.99	.576
	S.A.	95	62.00	82.00	73.75	3.65	0.37	-0.44	0.28	.114
T9	Inden	37	32.00	42.00	36.15	2.06	0.34	0.37	0.48	.249
	Lübeck	11	33.00	40.00	36.00	2.10	0.63	0.32	-0.34	.496
	S.A.	95	30.00	41.00	35.37	2.41	0.25	-0.20	-0.24	.087
T10	Inden	37	43.00	55.00	48.49	3.35	0.55	-0.06	-0.49	.131
	Lübeck	11	30.00	55.00	47.00	6.56	1.98	-1.82	4.69	.022
	S.A.	95	41.00	57.00	48.12	3.17	0.33	0.20	0.07	.420
T11	Inden	37	38.00	51.00	43.68	2.54	0.42	0.01	1.23	.091
	Lübeck	8	38.00	45.00	41.88	2.10	0.74	-0.52	0.87	.434
	S.A.	95	31.00	67.00	41.62	4.21	0.43	2.11	13.42	.000
T12	Inden	37	32.00	40.00	36.45	2.22	0.36	-0.23	-0.28	.066
	Lübeck	8	34.00	40.00	36.25	2.38	0.84	0.71	-1.42	.064
	S.A.	95	27.00	46.00	34.96	2.78	0.29	0.29	2.47	.002

*Table 17 Data (in mm) on Tibia bone measurements from **male** samples in Inden, Lübeck, and South African series*

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
T1	Inden	36	74.00	101.00	86.25	5.87	0.98	0.29	0.47	.672
	Lübeck	19	74.00	90.00	80.32	4.67	1.07	0.84	0.01	.100
	S.A.	61	72.00	99.00	84.74	5.39	0.69	0.38	0.20	.391
T2	Inden	36	280.00	371.00	328.44	19.59	3.26	-0.27	0.60	.556
	Lübeck	11	283.00	363.00	329.09	24.17	7.29	-0.37	-0.38	.821
	S.A.	61	307.00	393.00	346.49	19.94	2.55	0.30	-0.35	.321
T3	Inden	36	60.00	76.00	67.64	3.64	0.61	0.30	0.18	.056
	Lübeck	12	45.00	74.00	64.42	7.46	2.15	-1.65	3.77	.050
	S.A.	61	60.00	74.00	67.08	3.32	0.43	0.08	-0.75	.247
T4	Inden	36	18.00	30.00	25.43	3.50	0.58	-0.72	-0.26	.011
	Lübeck	19	21.00	40.00	26.58	4.32	0.99	1.73	4.27	.009
	S.A.	61	23.00	33.00	27.39	1.94	0.25	0.21	-0.01	.106
T5	Inden	36	17.00	30.00	22.11	2.97	0.49	0.88	0.68	.030
	Lübeck	19	15.00	24.00	20.05	1.77	0.41	-0.61	3.72	.021
	S.A.	61	17.00	29.00	20.47	2.21	0.28	1.67	4.28	.000
T6	Inden	36	58.00	81.00	71.57	5.49	0.92	-0.50	-0.26	.281
	Lübeck	19	17.00	79.00	65.26	12.54	2.88	-3.40	13.60	.000
	S.A.	61	57.00	83.00	69.25	4.90	0.63	0.38	0.24	.160
T7	Inden	36	39.50	53.00	46.01	3.74	0.62	0.06	-0.76	.428
	Lübeck	12	41.00	62.00	45.42	5.62	1.62	2.71	8.11	.000
	S.A.	61	38.00	46.00	41.90	2.01	0.26	0.16	-0.58	.024
T8	Inden	36	62.00	76.00	68.10	3.23	0.54	0.58	0.36	.141
	Lübeck	10	60.00	75.00	66.62	4.48	1.42	0.31	0.11	.818
	S.A.	61	60.00	73.50	65.98	3.19	0.41	0.13	-0.73	.204
T9	Inden	36	28.00	42.00	32.75	2.86	0.48	0.96	2.12	.025
	Lübeck	12	29.00	34.30	32.34	1.75	0.50	-0.68	-0.66	.187
	S.A.	61	29.00	37.00	32.12	1.64	0.21	0.38	0.27	.038
T10	Inden	36	33.00	51.00	43.11	3.42	0.57	0.03	2.29	.010
	Lübeck	11	40.00	46.30	43.60	2.12	0.64	-0.45	-1.07	.387
	S.A.	61	39.00	49.00	43.42	2.59	0.33	0.29	-0.92	.009
T11	Inden	36	35.00	45.00	38.58	2.71	0.45	0.66	-0.27	.021
	Lübeck	10	32.60	41.00	38.55	2.88	0.91	-1.07	0.37	.049
	S.A.	61	31.00	43.00	37.56	2.68	0.34	-0.21	-0.16	.220
T12	Inden	36	28.00	38.00	32.69	2.20	0.37	0.28	0.13	.370
	Lübeck	9	28.00	36.60	33.02	3.19	1.06	-0.47	-1.32	.326
	S.A.	61	23.00	40.00	31.48	2.73	0.35	0.05	1.81	.050

For male tibia individuals, the sex known sample size is quite different for Inden, Lübeck, and SA. An overall impression derived from the minimum, maximum, and mean values, confirms that measurements for Lübeck have got the highest standard deviation values compared to the other two groups.

- For Inden series, the data for male sample paints a similar picture as observed in female tibia sample for T2 with high SD (19.59 mm) and SE (3.26 mm). The data for T1-T12 is more or less normally distributed.
- For Lübeck series, male individuals for T2 (SD = 24.17 mm) and T6 (SD = 12.54 mm) are far from the mean and due to considerably small sample size the mean value is not true to the population mean. The data for T3, T4, T5, T6 are not normally distributed.
- The individual values for T2 in SA series are far from the mean (SD = 19.94 mm) and SE highlights that sample mean for T2 is far from the population mean (346.49 ± 2.55 mm). The data is normally distributed for every measurement.

In Table 19 it can be seen that except T5, all the other eleven measurements have significant differences ($p < 0.05$) in Inden series. The Cohen's d values show that T1, T2, T3, T6, T7, T8, T9, T10, T11, T12 have significantly large differences between tibia male and female samples. In Lübeck series T1, T3, T5, T6, T8, T9, T11, T12 have significant differences. Amongst the significantly different measurements only T5 have a medium difference between male and female samples with Cohen's d (-0.74). For male and female samples in SA series, all the measurements have significantly higher differences except T5 with medium effect (Cohen's d = -0.68).

*Table 18 t-test between **Tibia male and female** samples from Inden, Lübeck, and South Africa series*

Pop.			Levene's Test for Equality of Variances		*t*-test for Equality of Means							Cohen's d	Effect
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference			
										Lower	Upper		
T1	Inden	= V	0,16	0,69	-5,86	71,00	0,00	-8,55	1,46	-11,45	-5,64	-1,39	Large
		≠ V			-5,87	70,52	0,00	-8,55	1,46	-11,45	-5,65		
	Lübeck	= V	3,11	0,09	-4,14	31,00	0,00	-8,26	1,99	-12,32	-4,19	-1,49	Large
		≠ V			-3,91	21,70	0,00	-8,26	2,11	-12,63	-3,88		
	S.A.	= V	8,50	0,00	-9,01	154,00	0,00	-10,28	1,14	-12,54	-8,03		
		≠ V			-9,74	153,12	0,00	-10,28	1,06	-12,37	-8,20	-1,57	Large
T2	Inden	= V	1,61	0,21	-4,78	71,00	0,00	-23,20	4,85	-32,88	-13,53	-1,14	Large
		≠ V			-4,79	70,58	0,00	-23,20	4,84	-32,86	-13,55		
	Lübeck	= V	1,14	0,30	-1,53	19,00	0,14	-14,61	9,58	-34,65	5,43		
		≠ V			-1,54	18,67	0,14	-14,61	9,46	-34,44	5,23		
	S.A.	= V	1,97	0,16	-7,91	154,00	0,00	-28,14	3,56	-35,17	-21,11	-1,27	Large
		≠ V			-8,14	139,80	0,00	-28,14	3,46	-34,98	-21,30		
T3	Inden	= V	0,72	0,40	-10,29	71,00	0,00	-8,25	0,80	-9,85	-6,65	-2,44	Large
		≠ V			-10,27	69,33	0,00	-8,25	0,80	-9,86	-6,65		
	Lübeck	= V	1,67	0,21	-3,18	21,00	0,00	-8,04	2,53	-13,30	-2,78	-1,39	Large

Pop.			Levene's Test for Equality of Variances		*t*-test for Equality of Means							Cohen's d	Effect
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference			
										Lower	Upper		
		≠ V			-3,26	17,08	0,00	-8,04	2,47	-13,24	-2,83		
	S.A.	= V	0,99	0,32	-13,08	154,00	0,00	-7,89	0,60	-9,08	-6,70	-2,11	Large
		≠ V			-13,53	141,88	0,00	-7,89	0,58	-9,04	-6,74		
T4	Inden	= V	0,78	0,38	-3,26	71,00	0,00	-2,88	0,88	-4,64	-1,12	-0,77	Medium
		≠ V			-3,26	70,13	0,00	-2,88	0,88	-4,64	-1,12		
	Lübeck	= V	0,26	0,62	-0,73	31,00	0,47	-0,99	1,37	-3,78	1,80		
		≠ V			-0,76	31,00	0,45	-0,99	1,31	-3,66	1,67		
	S.A.	= V	2,21	0,14	-9,41	154,00	0,00	-3,38	0,36	-4,09	-2,67	-1,52	Large
		≠ V			-9,80	143,97	0,00	-3,38	0,35	-4,07	-2,70		
T5	Inden	= V	0,16	0,69	-1,60	71,00	0,11	-1,13	0,71	-2,54	0,27		
		≠ V			-1,61	71,00	0,11	-1,13	0,71	-2,54	0,27		
	Lübeck	= V	0,39	0,54	-2,05	31,00	0,05	-1,31	0,64	-2,61	-0,01	-0,74	Medium
		≠ V			-2,04	27,33	0,05	-1,31	0,64	-2,63	0,01		
	S.A.	= V	1,63	0,20	-4,20	154,00	0,00	-1,60	0,38	-2,35	-0,85	-0,68	Medium
		≠ V			-4,27	134,64	0,00	-1,60	0,37	-2,34	-0,86		
T6	Inden	= V	1,35	0,25	-3,53	71,00	0,00	-4,19	1,19	-6,55	-1,82	-0,84	Large
		≠ V			-3,52	68,35	0,00	-4,19	1,19	-6,56	-1,81		
	Lübeck	= V	0,45	0,51	-2,55	30,00	0,02	-9,43	3,69	-16,97	-1,89	-0,93	Large
		≠ V			-2,93	25,78	0,01	-9,43	3,22	-16,05	-2,81		
	S.A.	= V	3,80	0,05	-7,72	154,00	0,00	-7,16	0,93	-9,00	-5,33	-1,24	Large
		≠ V			-8,09	146,13	0,00	-7,16	0,89	-8,91	-5,41		
T7	Inden	= V	0,53	0,47	-6,68	71,00	0,00	-5,61	0,84	-7,28	-3,93	-1,58	Large
		≠ V			-6,67	70,12	0,00	-5,61	0,84	-7,28	-3,93		
	Lübeck	= V	0,00	0,95	-1,19	21,00	0,25	-2,58	2,17	-7,09	1,93		
		≠ V			-1,20	20,84	0,24	-2,58	2,15	-7,06	1,89		
	S.A.	= V	10,42	0,00	-11,15	154,00	0,00	-5,07	0,45	-5,96	-4,17		
		≠ V			-12,23	154,00	0,00	-5,07	0,41	-5,89	-4,25	-1,97	Large
T8	Inden	= V	0,29	0,59	-10,13	71,00	0,00	-8,01	0,79	-9,59	-6,43	-2,41	Large
		≠ V			-10,15	70,79	0,00	-8,01	0,79	-9,59	-6,44		
	Lübeck	= V	1,18	0,29	-3,94	18,00	0,00	-6,68	1,69	-10,24	-3,12	-1,86	Large
		≠ V			-3,94	15,56	0,00	-6,68	1,69	-10,28	-3,08		
	S.A.	= V	0,65	0,42	-13,63	154,00	0,00	-7,77	0,57	-8,90	-6,65	-2,20	Large
		≠ V			-14,03	139,97	0,00	-7,77	0,55	-8,87	-6,68		
T9	Inden	= V	1,46	0,23	-5,84	71,00	0,00	-3,40	0,58	-4,56	-2,24	-1,39	Large
		≠ V			-5,81	63,45	0,00	-3,40	0,58	-4,57	-2,23		
	Lübeck	= V	0,18	0,67	-4,56	21,00	0,00	-3,66	0,80	-5,33	-1,99	-1,99	Large
		≠ V			-4,52	19,56	0,00	-3,66	0,81	-5,35	-1,97		
	S.A.	= V	9,09	0,00	-9,25	154,00	0,00	-3,25	0,35	-3,94	-2,56		
		≠ V			-10,02	153,35	0,00	-3,25	0,32	-3,89	-2,61	-1,62	Large
T10	Inden	= V	0,59	0,44	-6,79	71,00	0,00	-5,38	0,79	-6,95	-3,80	-1,61	Large
		≠ V			-6,78	70,83	0,00	-5,38	0,79	-6,96	-3,80		
	Lübeck	= V	2,59	0,12	-1,64	20,00	0,12	-3,40	2,08	-7,73	0,93		

Pop.			Levene's Test for Equality of Variances		*t*-test for Equality of Means							Cohen's d	Effect
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference			
										Lower	Upper		
		≠ V			-1,64	12,06	0,13	-3,40	2,08	-7,92	1,12		
	S.A.	= V	1,31	0,25	-9,68	154,00	0,00	-4,70	0,49	-5,66	-3,74	-1,56	Large
		≠ V			-10,12	145,27	0,00	-4,70	0,46	-5,62	-3,78		
T11	Inden	= V	0,30	0,59	-8,29	71,00	0,00	-5,09	0,61	-6,32	-3,87	-1,97	Large
		≠ V			-8,28	70,40	0,00	-5,09	0,61	-6,32	-3,87		
	Lübeck	= V	1,13	0,30	-2,73	16,00	0,01	-3,33	1,22	-5,91	-0,74	-1,37	Large
		≠ V			-2,83	15,91	0,01	-3,33	1,17	-5,82	-0,83		
	S.A.	= V	1,87	0,17	-6,71	154,00	0,00	-4,06	0,61	-5,26	-2,87	-1,08	Large
		≠ V			-7,36	153,99	0,00	-4,06	0,55	-5,15	-2,97		
T12	Inden	= V	0,02	0,90	-7,25	71,00	0,00	-3,75	0,52	-4,78	-2,72	-1,72	Large
		≠ V			-7,25	70,97	0,00	-3,75	0,52	-4,78	-2,72		
	Lübeck	= V	1,13	0,30	-2,34	15,00	0,03	-3,23	1,38	-6,17	-0,29	-1,21	Large
		≠ V			-2,38	14,60	0,03	-3,23	1,35	-6,12	-0,33		
	S.A.	= V	0,00	0,98	-7,66	154,00	0,00	-3,47	0,45	-4,37	-2,58	-1,24	Large
		≠ V			-7,69	129,78	0,00	-3,47	0,45	-4,37	-2,58		

Note. Population groups and Sig. (2-tailed) highlighted in yellow show statistical significance between male and female mean differences. Effect size highlighted in green, quantifies and shows how high the degree of statistically significant mean difference is.

4.2.2.3 Descriptive and Inferential Statistics on Humerus Measurements

The descriptive statistics for humerus female sample in Table 19, for humerus male sample in Table 20, and the result for t-test comparing the data between humerus male and humerus female is presented in Table 22.

In both Table 19 and Table 20 H1 represents a linear length measurement. Like femur and tibia linear measurement data, the data for H1 in female humerus sample is distributed far from the mean with high difference between minimum and maximum values with very high SD values for Inden (SD = 21,03 mm), Lübeck (SD = 20,49 mm), and SA (SD = 14,91 mm).

Table 19 Data (in mm) on Humerus bone measurements from ***female*** *samples in Inden, Lübeck, and South African series*

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
H1	Inden	34	272.00	357.00	305.06	21.03	3.61	0.60	0.27	0.22
	Lübeck	29	234.00	331.00	303.31	20.49	3.80	-1.49	3.31	0.00
	S.A.	60	265.00	327.00	294.10	14.91	1.92	0.55	-0.35	0.02
H2	Inden	34	36.00	56.00	43.82	3.66	0.63	0.96	2.57	0.01
	Lübeck	29	37.00	62.00	47.93	4.55	0.85	0.59	2.73	0.13

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
	S.A.	60	34.00	55.00	40.15	3.80	0.49	1.82	5.31	0.00
H3	Inden	33	50.00	67.00	56.95	4.13	0.72	0.82	0.05	0.01
	Lübeck	33	49.00	67.00	57.09	4.86	0.85	0.32	-0.74	0.33
	S.A.	60	35.00	60.00	53.47	4.09	0.53	-1.93	7.45	0.00
H4	Inden	33	49.00	68.00	60.02	4.37	0.76	-0.38	0.14	0.73
	Lübeck	34	51.00	70.00	58.49	4.38	0.75	0.86	0.70	0.07
	S.A.	60	51.00	65.00	58.15	3.52	0.45	0.11	-0.27	0.10

*Table 20 Data (in mm) on Humerus bone measurements from **male** samples in Inden, Lübeck, and South African series*

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
H1	Inden	36	238.00	364.00	326.03	21.34	3.56	-1.73	7.49	0.00
	Lübeck	15	305.00	330.00	317.27	6.82	1.76	0.06	-0.29	0.98
	S.A.	94	276.00	360.00	322.55	17.17	1.77	-0.10	-0.45	0.51
H2	Inden	36	41.00	60.00	48.58	4.46	0.74	0.76	0.20	0.10
	Lübeck	15	42.00	59.00	49.87	4.82	1.25	0.39	-0.24	0.75
	S.A.	94	37.00	58.00	44.01	3.07	0.32	1.02	3.78	0.00
H3	Inden	36	55.00	71.00	62.93	4.01	0.67	0.29	-0.19	0.40
	Lübeck	17	55.00	68.00	61.71	3.12	0.76	-0.32	0.67	0.74
	S.A.	94	51.00	69.00	60.47	3.39	0.35	-0.04	-0.35	0.24
H4	Inden	34	54.00	78.00	67.04	4.93	0.85	-0.11	0.56	0.86
	Lübeck	19	55.00	73.00	62.11	4.99	1.14	0.91	0.41	0.03
	S.A.	94	53.00	75.00	63.52	4.91	0.51	0.21	-0.42	0.20

For humerus male sample it can be seen in Table 19 that H2, H3, and H4 have mean values very close to the overall population mean in Inden, Lübeck as well as SA series. For humerus female sample Inden and SA series have better SE for all measurements unlike Lübeck series where SE is high for H1, H2 and H4 because of the small sample size.

Focusing on *t*-test statistics, p-value for H1 to H4 happen to be significant in Inden, Lübeck, and SA. Going with the effect as portrayed by Cohen's d values, it can be assumed that the values for males and females are not far from each other.

*Table 21 t-test between **Humerus male and female** samples from Inden, Lübeck, and South Africa series*

Pop.			Levene's Test for Equality of Variances		t-test for Equality of Means							Cohen's d	Effect
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference			
										Lower	Upper		
H1	Inden	= V	0.54	0.46	-4.14	68.00	0.00	-20.97	5.07	-31.08	-10.86	-0.12	Small
		≠ V			-4.14	67.87	0.00	-20.97	5.07	-31.08	-10.86		
	Lübeck	= V	6.95	0.01	-2.55	42.00	0.01	-13.96	5.46	-24.99	-2.93		
		≠ V			-3.33	37.81	0.00	-13.96	4.19	-22.44	-5.47		
	S.A.	= V	1.42	0.23	-10.54	152.00	0.00	-28.45	2.70	-33.78	-23.12	-0.14	Small
		≠ V			-10.88	138.29	0.00	-28.45	2.62	-33.62	-23.28		
H2	Inden	= V	1.33	0.25	-4.87	68.00	0.00	-4.76	0.98	-6.71	-2.81	-0.14	Small
		≠ V			-4.89	66.76	0.00	-4.76	0.97	-6.70	-2.82		
	Lübeck	= V	0.26	0.62	-1.31	42.00	0.20	-1.94	1.48	-4.92	1.04		
		≠ V			-1.29	27.00	0.21	-1.94	1.51	-5.02	1.15		
	S.A.	= V	1.51	0.22	-6.91	152.00	0.00	-3.86	0.56	-4.96	-2.75	-0.09	Small
		≠ V			-6.60	106.80	0.00	-3.86	0.58	-5.01	-2.70		
H3	Inden	= V	0.01	0.92	-6.10	67.00	0.00	-5.98	0.98	-7.93	-4.02	-0.18	Small
		≠ V			-6.09	66.07	0.00	-5.98	0.98	-7.94	-4.02		
	Lübeck	= V	5.06	0.03	-3.55	48.00	0.00	-4.61	1.30	-7.23	-2.00		
		≠ V			-4.07	45.50	0.00	-4.61	1.14	-6.90	-2.33	-0.18	Small
	S.A.	= V	0.02	0.88	-11.51	152.00	0.00	-7.00	0.61	-8.20	-5.80	-0.15	Small
		≠ V			-11.04	108.83	0.00	-7.00	0.63	-8.26	-5.74		
H4	Inden	= V	0.44	0.51	-6.17	65.00	0.00	-7.03	1.14	-9.30	-4.75	-0.19	Small
		≠ V			-6.18	64.47	0.00	-7.03	1.14	-9.30	-4.76		
	Lübeck	= V	0.36	0.55	-2.74	51.00	0.01	-3.62	1.32	-6.27	-0.97	-0.11	Small
		≠ V			-2.64	33.49	0.01	-3.62	1.37	-6.40	-0.84		
	S.A.	= V	8.97	0.00	-7.35	152.00	0.00	-5.37	0.73	-6.81	-3.93		
		≠ V			-7.90	149.90	0.00	-5.37	0.68	-6.71	-4.03	-0.11	Small

Note. Population groups and Sig. (2-tailed) highlighted in yellow show statistical significance between male and female mean differences. Effect size highlighted in green, quantifies and shows how high the degree of statistically significant mean difference is.

4.2.2.4 Descriptive and Inferential Statistics on Radius Measurements

The descriptive statistics for radius female sample in Table 22, for radius male sample in Table 23, and the result for t-test comparing the data between radius male and radius female is presented in Table 24.

*Table 22 Data (in mm) on Radius bone measurements from **female** samples in Inden, Lübeck, and South African series*

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
R1	Inden	25	195.00	263.00	222.16	16.78	3.36	0.92	0.62	0.09
	Lübeck	27	195.00	257.00	231.39	16.14	3.11	-0.38	-0.64	0.30
	S.A.	60	210.00	262.00	229.65	12.10	1.56	0.52	0.13	0.08
R2	Inden	25	16.00	29.00	20.36	2.51	0.50	1.71	4.99	0.00
	Lübeck	31	17.00	24.00	20.03	1.68	0.30	0.99	0.75	0.00
	S.A.	60	18.00	27.00	20.32	1.60	0.21	1.28	4.23	0.00
R3	Inden	26	18.00	36.00	29.46	3.33	0.65	-1.35	5.04	0.01
	Lübeck	27	25.00	35.00	29.66	2.31	0.44	0.11	-0.02	0.84
	S.A.	60	18.00	35.00	28.08	2.25	0.29	-0.90	6.83	0.00
R4	Inden	24	39.00	60.00	49.27	4.76	0.97	-0.08	0.04	0.45
	Lübeck	32	41.00	59.00	49.38	4.48	0.79	0.19	-0.41	0.77
	S.A.	60	40.00	56.00	46.50	3.56	0.46	0.55	0.39	0.07

*Table 23 Data (in mm) on Radius bone measurements from **male** samples in Inden, Lübeck, and South African series*

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
R1	Inden	39	221.00	268.00	241.18	12.72	2.04	0.43	-0.63	0.17
	Lübeck	17	214.00	248.00	235.59	10.24	2.48	-0.48	-0.57	0.27
	S.A.	95	207.00	296.00	256.38	15.21	1.56	-0.39	0.79	0.37
R2	Inden	39	18.00	34.00	23.27	3.07	0.49	1.73	5.11	0.00
	Lübeck	17	18.00	28.00	21.59	2.35	0.57	1.19	2.36	0.11
	S.A.	95	19.00	27.00	22.49	1.46	0.15	0.24	0.32	0.00
R3	Inden	39	22.00	38.00	32.77	3.38	0.54	-1.40	2.90	0.00
	Lübeck	18	29.00	34.00	31.44	1.50	0.35	0.30	-0.98	0.17
	S.A.	95	26.00	37.00	31.34	2.19	0.22	0.21	-0.15	0.08
R4	Inden	38	49.00	66.00	56.87	4.38	0.71	0.35	-0.67	0.39
	Lübeck	18	46.00	65.00	52.33	5.24	1.23	0.75	0.23	0.17
	S.A.	95	41.00	63.00	51.22	4.74	0.49	0.10	-0.44	0.49

For R1 the mean values are similar for different population groups of Inden, Lübeck, and SA in both male and femal samples, which is the case for R2, R3, and R4 as well. Inden and Lübeck female samples have higher SD for R1 as compared to the male samples. But if SA is to be seen, the situation of R1 is just opposite as male sample has higher SD (15.21 mm) which means they are more spread out and female sample is less spread out with low SD (12.10 mm). The mean values for R2, R3 and R4 in both male and female samples appear to be true to population mean with low SE.

*Table 24 t-test between **Radius male and female** samples from Inden, Lübeck, and South Africa series*

Pop.			Levene's Test for Equality of Variances		t-test for Equality of Means							Cohen's d	Effect
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference			
										Lower	Upper		
R1	Inden	= V	0.60	0.44	-5.15	62.00	0.00	-19.02	3.70	-26.41	-11.63	-1.31	Large
		≠ V			-4.85	41.38	0.00	-19.02	3.93	-26.94	-11.09		
	Lübeck	= V	4.50	0.04	-0.96	42.00	0.34	-4.20	4.39	-13.06	4.66		
		≠ V			-1.06	41.99	0.30	-4.20	3.98	-12.22	3.82		
	S.A.	= V	2.28	0.13	-11.50	153.00	0.00	-26.73	2.32	-31.32	-22.14	-1.86	Large
		≠ V			-12.10	144.94	0.00	-26.73	2.21	-31.09	-22.36		
R2	Inden	= V	0.25	0.62	-3.96	62.00	0.00	-2.91	0.73	-4.38	-1.44	-1.01	Large
		≠ V			-4.14	58.22	0.00	-2.91	0.70	-4.32	-1.50		
	Lübeck	= V	1.94	0.17	-2.67	46.00	0.01	-1.56	0.59	-2.74	-0.38	-0.79	Medium
		≠ V			-2.42	25.23	0.02	-1.56	0.64	-2.89	-0.24		
	S.A.	= V	0.01	0.92	-8.72	153.00	0.00	-2.18	0.25	-2.67	-1.68	-1.41	Large
		≠ V			-8.54	116.93	0.00	-2.18	0.25	-2.68	-1.67		
R3	Inden	= V	0.02	0.88	-3.89	63.00	0.00	-3.31	0.85	-5.01	-1.61	-0.98	Large
		≠ V			-3.90	54.37	0.00	-3.31	0.85	-5.01	-1.61		
	Lübeck	= V	2.22	0.14	-2.88	43.00	0.01	-1.78	0.62	-3.03	-0.54	-0.88	Large
		≠ V			-3.13	42.99	0.00	-1.78	0.57	-2.93	-0.63		
	S.A.	= V	0.83	0.36	-8.93	153.00	0.00	-3.26	0.37	-3.98	-2.54	-1.44	Large
		≠ V			-8.87	123.12	0.00	-3.26	0.37	-3.99	-2.53		
R4	Inden	= V	0.24	0.63	-6.43	60.00	0.00	-7.60	1.18	-9.96	-5.23	-1.66	Large
		≠ V			-6.31	46.00	0.00	-7.60	1.20	-10.02	-5.17		
	Lübeck	= V	1.03	0.32	-2.11	48.00	0.04	-2.96	1.40	-5.78	-0.14	-0.61	Medium
		≠ V			-2.02	30.99	0.05	-2.96	1.47	-5.95	0.03		
	S.A.	= V	6.65	0.01	-6.63	153.00	0.00	-4.72	0.71	-6.13	-3.31		
		≠ V			-7.06	148.33	0.00	-4.72	0.67	-6.04	-3.40	-1.16	Large

Note. Population groups and Sig. (2-tailed) highlighted in yellow show statistical significance between male and female mean differences. Effect size highlighted in green, quantifies and shows how high the degree of statistically significant mean difference is.

In Inden series all four radius measurements are statistically significant. The mean values between males and females are far from each other with large effect as understood from Cohen's d values. For Lübeck series only R3 has a highly significant difference between male and female means with large Cohen's d effect. For SA series the high mean difference for R1 suggests that it is highly significant along with R2, R3, and R4 having statistically significant results with large effect.

4.2.2.5 **Desciptive and Inferential Statistics on Ulna Measurements**

The descriptive statistics for ulna female sample in Table 26, for ulna male sample in Table 26, and the result for t-test comparing the data between ulna male and ulna female is presented in Table 27.

*Table 25 Data (in mm) on Ulna bone measurements from **female** samples in Inden, Lübeck, and South African series*

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
U1	Inden	28	203.00	383.00	244.07	36.79	6.95	2.64	7.95	0.00
	Lübeck	28	218.00	282.00	250.61	15.28	2.89	-0.18	-0.40	0.95
	S.A.	60	230.00	281.00	247.58	12.33	1.59	0.52	-0.20	0.04
U2	Inden	29	18.00	34.00	24.38	4.14	0.77	0.82	0.21	0.03
	Lübeck	33	22.00	30.00	24.73	1.84	0.32	0.70	0.67	0.07
	S.A.	60	22.00	28.00	24.95	1.59	0.21	0.19	-0.65	0.00
U3	Inden	28	13.00	23.00	17.09	2.60	0.49	0.66	0.10	0.14
	Lübeck	28	16.00	22.10	18.80	1.53	0.29	-0.20	-0.24	0.08
	S.A.	60	14.00	20.00	17.00	1.39	0.18	-0.11	-0.24	0.01
U4	Inden	28	30.00	43.00	35.34	2.82	0.53	0.61	0.76	0.34
	Lübeck	33	30.00	42.00	34.83	2.81	0.49	0.36	-0.08	0.45
	S.A.	60	27.00	41.00	32.38	2.94	0.38	0.55	0.68	0.07

The individual data for U1, U2, U3 and U4 in Inden series are far from the mean as understood from the Table 25 with high SD for U1 and U2. This explains the difference between minimum and maximum values for U1 in Inden. The sample mean for U2, U3, and U4 are close to the population mean. Except U1, other measurements have normally distributed data. In Lübeck series U1 has more dispersed data (SD = 15.28 mm) with sample

*Table 26 Data (in mm) on Ulna bone measurements from **male** samples in Inden, Lübeck, and South African series*

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
U1	Inden	40	238.00	285.00	259.15	12.27	1.94	0.23	-0.71	0.54
	Lübeck	16	234.00	273.00	259.06	10.70	2.68	-0.78	0.33	0.36
	S.A.	93	224.00	311.00	273.60	16.26	1.69	-0.29	0.42	0.79
U2	Inden	40	18.00	40.00	28.61	4.93	0.78	0.44	0.57	0.16
	Lübeck	17	22.00	31.00	26.65	2.57	0.62	0.07	-0.53	0.79
	S.A.	93	22.00	31.00	27.27	1.91	0.20	-0.37	-0.26	0.01
U3	Inden	40	14.00	22.00	18.88	2.17	0.34	-0.29	-0.70	0.04
	Lübeck	16	16.00	22.00	19.75	1.73	0.43	-0.62	0.13	0.23
	S.A.	93	16.00	26.00	18.98	1.66	0.17	1.02	2.86	0.00
U4	Inden	39	34.00	47.00	38.41	3.17	0.51	0.92	0.28	0.01
	Lübeck	18	31.00	42.00	35.64	3.27	0.77	0.48	-0.61	0.31
	S.A.	93	28.00	44.00	34.63	3.23	0.33	0.43	0.33	0.05

mean close to the population mean (250.61 ± 2.89 mm). U2, U3, and U4 are not more spread out with low SE. SA series has a similar trend for all the measurements like with Lübeck series.

For male samples in Table 26 Inden series has far less dispersed individual data for U1 with only 12.27 as its SD, as compared to the female sample. For Lübeck the individual data for U1 is also less dispersed as compared to its female counterpart. U2, U3 and U4 have less dispersed data with low SE. In SA series male count is higher than female count for U1. This may explain the high dispersion (SD = 16.26 mm) for U1 in males.

*Table 27 t-test between **Ulna male and female** samples from Inden, Lübeck, and South Africa series*

Pop.			Levene's Test for Equality of Variances		t-test for Equality of Means							Cohen's d	Effect
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference			
										Lower	Upper		
U1	Inden	Inden= V	7.57	0.01	-2.41	66.00	0.02	-15.08	6.25	-27.55	-2.61		
		≠ V			-2.09	31.23	0.04	-15.08	7.22	-29.80	-0.36	-0.75	Medium
	Lübeck	= V	2.54	0.12	-1.95	42.00	0.06	-8.46	4.33	-17.20	0.29		
		≠ V			-2.15	40.08	0.04	-8.46	3.94	-16.41	-0.50		
	S.A.	= V	3.06	0.08	-10.58	151.00	0.00	-26.03	2.46	-30.89	-21.17	-1.72	Large
		≠ V			-11.23	147.02	0.00	-26.03	2.32	-30.61	-21.44		
U2	Inden	= V	0.53	0.47	-3.76	67.00	0.00	-4.23	1.13	-6.48	-1.98	-0.92	Large
		≠ V			-3.86	65.46	0.00	-4.23	1.10	-6.42	-2.05		
	Lübeck	= V	3.23	0.08	-3.05	48.00	0.00	-1.92	0.63	-3.19	-0.65	-0.88	Large
		≠ V			-2.74	24.67	0.01	-1.92	0.70	-3.36	-0.47		
	S.A.	= V	2.47	0.12	-7.83	151.00	0.00	-2.32	0.30	-2.90	-1.73	-1.27	Large
		≠ V			-8.14	141.33	0.00	-2.32	0.28	-2.88	-1.76		
U3	Inden	= V	0.51	0.48	-3.08	66.00	0.00	-1.79	0.58	-2.94	-0.63	-0.76	Medium
		≠ V			-2.98	51.43	0.00	-1.79	0.60	-2.99	-0.58		
	Lübeck	= V	0.06	0.81	-1.90	42.00	0.06	-0.95	0.50	-1.97	0.06		
		≠ V			-1.83	28.22	0.08	-0.95	0.52	-2.02	0.11		
	S.A.	= V	0.54	0.46	-7.67	151.00	0.00	-1.98	0.26	-2.49	-1.47	-1.25	Large
		≠ V			-7.97	141.01	0.00	-1.98	0.25	-2.48	-1.49		
U4	Inden	= V	0.43	0.52	-4.09	65.00	0.00	-3.07	0.75	-4.57	-1.57	-1.01	Large
		≠ V			-4.17	61.99	0.00	-3.07	0.74	-4.54	-1.60		
	Lübeck	= V	0.68	0.41	-0.92	49.00	0.36	-0.81	0.87	-2.56	0.95		
		≠ V			-0.88	30.77	0.38	-0.81	0.91	-2.67	1.06		
	S.A.	= V	0.55	0.46	-4.36	151.00	0.00	-2.25	0.52	-3.27	-1.23	-0.71	Medium
		≠ V			-4.45	134.14	0.00	-2.25	0.51	-3.25	-1.25		

Note. Population groups and Sig. (2-tailed) highlighted in yellow show statistical significance between male and female mean differences. Effect size highlighted in green, quantifies and shows how high the degree of statistically significant mean difference is.

In Inden series all four ulna measurements are statistically significant but only U2 and U4 show large difference between male and female means. For Lübeck series only U2 appears to be statistically significant due to its small sample size. For SA series all measurements are statistically significant with a large effect on the mean differences between male and female samples.

4.2.2.6 **Desciptive and Inferential Statistics on Cranial Basal Measurements**

The descriptive statistics for basal Cranial female sample in Table 28, for Cranial basal male sample in Table 29, and the result for t-test comparing the data between Cranial basal male and Cranial basal female is presented in Table 30.

Table 28 Data (in mm) on Cranial basal bone measurements from ***female*** *samples in Inden, Lübeck, and South African series*

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
CB1	Inden	16	19.00	29.00	23.75	2.77	0.69	0.02	-0.75	0.21
	Lübeck	31	17.00	29.00	21.18	2.78	0.50	0.89	0.98	0.05
	S.A.	62	16.00	26.00	20.74	1.97	0.25	0.14	0.53	0.13
CB2	Inden	16	105.00	122.00	113.00	4.98	1.24	0.02	-0.93	0.78
	Lübeck	32	100.00	119.00	107.63	4.15	0.73	0.36	0.44	0.56
	S.A.	62	93.00	118.00	105.48	4.94	0.63	0.17	0.09	0.90

Table 29 Data (in mm) on Cranial basal bone measurements from ***male*** *samples in Inden, Lübeck, and South African series*

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
CB1	Inden	28	17.00	30.00	24.18	2.75	0.52	-0.07	1.21	0.11
	Lübeck	15	19.00	28.00	22.70	2.56	0.66	0.19	-0.33	0.36
	S.A.	97	17.00	30.00	23.03	2.77	0.28	-0.05	-0.29	0.15
CB2	Inden	28	99.00	124.00	114.21	6.09	1.15	-0.75	0.84	0.15
	Lübeck	15	104.00	125.00	111.14	6.17	1.59	1.46	1.85	0.01
	S.A.	97	95.00	118.00	106.26	4.42	0.45	0.21	-0.09	0.53

In Inden, Lübeck, and SA series, the data for CB1 males and females is not highly dispersed and SE indicates that mean is true to the population mean. For CB2 male sample is bigger and it is more dispersed than female sample in all three series.

*Table 30 t-test between **Cranial basal male and female** samples from Inden, Lübeck, and South Africa series*

Pop.			Levene's Test for Equality of Variances		t-test for Equality of Means							Cohen's d	Effect
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference			
										Lower	Upper		
CB1	Inden	= V	0.60	0.44	-0.50	42.00	0.62	-0.43	0.86	-2.17	1.31		
		≠ V			-0.50	31.17	0.62	-0.43	0.87	-2.19	1.34		
	Lübeck	= V	0.00	0.96	-1.79	44.00	0.08	-1.52	0.85	-3.24	0.19		
		≠ V			-1.84	30.00	0.08	-1.52	0.83	-3.21	0.17		
	S.A.	= V	8.27	0.00	-5.64	157.00	0.00	-2.28	0.40	-3.08	-1.48		
		≠ V			-6.07	155.17	0.00	-2.28	0.38	-3.03	-1.54	-0.97	Large
CB2	Inden	= V	0.34	0.56	-0.68	42.00	0.50	-1.21	1.79	-4.83	2.40		
		≠ V			-0.72	36.69	0.48	-1.21	1.70	-4.65	2.22		
	Lübeck	= V	0.97	0.33	-2.31	45.00	0.03	-3.52	1.52	-6.58	-0.45	-0.69	Medium
		≠ V			-2.00	20.15	0.06	-3.52	1.75	-7.17	0.14		
	S.A.	= V	0.75	0.39	-1.04	157.00	0.30	-0.78	0.75	-2.27	0.70		
		≠ V			-1.01	119.52	0.31	-0.78	0.77	-2.31	0.74		

Note. Population groups and Sig. (2-tailed) highlighted in yellow show statistical significance between male and female mean differences. Effect size highlighted in green, quantifies and shows how high the degree of statistically significant mean difference is.

With respect to *t*-test statistic only SA series is statistically significant ($p < 0.05$) for CB1, where the effect is large, meaning proportionately bigger differences in male and female means. For CB2 with just 47 individuals Lübeck series indicates a statistically significant result with a medium effect ($d = -0.69$) on the mean difference.

4.2.2.7 **Descriptive and Inferential Statistics on Cranial Frontal Measurements**

The descriptive statistics for cranial frontal female sample in Table 32, for Cranial frontal male sample in Table 32, and the result for t-test comparing the data between Cranial frontal male and Cranial frontal female is presented in Table 34.

For CF1, CF4, and CF5 the Inden series has has more dispersed data. For the other two groups, the rest of the measurements have far better distribution of the data with certainly low SE, which translates the sample means closer to the population mean.

*Table 31 Data (in mm) on Cranial frontal bone measurements from **female** samples in Inden, Lübeck, and South African series*

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
CF1	Inden	16	110.00	133.00	119.00	7.42	1.86	0.82	-0.61	0.04
	Lübeck	30	110.00	130.00	118.10	4.50	0.82	0.27	0.40	0.55
	S.A.	62	109.00	135.00	121.81	5.00	0.64	0.20	0.31	0.82
CF2	Inden	16	88.00	102.00	95.13	3.90	0.97	0.15	-0.08	0.82
	Lübeck	32	87.00	102.00	92.27	3.91	0.69	1.03	0.62	0.00
	S.A.	62	81.00	102.00	91.58	3.83	0.49	-0.16	0.85	0.33
CF3	Inden	16	126.00	150.00	138.94	8.28	2.07	-0.44	-1.25	0.09
	Lübeck	32	126.00	146.00	136.66	4.16	0.73	-0.34	0.49	0.18
	S.A.	62	120.00	143.00	129.74	5.40	0.69	0.15	-0.33	0.44
CF4	Inden	16	45.00	71.00	54.50	7.77	1.94	1.13	0.33	0.02
	Lübeck	32	44.00	56.00	49.05	2.71	0.48	0.52	0.18	0.17
	S.A.	62	35.00	52.00	45.45	3.26	0.41	-0.51	1.18	0.09
CF5	Inden	16	23.00	28.00	24.81	1.42	0.36	1.32	1.86	0.00
	Lübeck	32	19.00	26.00	23.36	1.80	0.32	-0.44	-0.21	0.18
	S.A.	62	21.00	32.00	25.68	2.05	0.26	0.25	0.67	0.14

*Table 32 Data (in mm) on Cranial frontal bone measurements from **male** samples in Inden, Lübeck, and South African series*

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
CF1	Inden	28	109.00	146.00	127.50	8.88	1.68	-0.43	-0.07	0.34
	Lübeck	15	108.00	131.00	119.20	6.13	1.58	0.20	-0.25	0.90
	S.A.	97	118.00	160.00	129.85	6.42	0.65	1.52	6.09	0.00
CF2	Inden	28	87.00	104.00	97.36	3.80	0.72	-0.76	0.62	0.24
	Lübeck	15	87.00	101.00	93.33	4.56	1.18	0.21	-1.25	0.40
	S.A.	97	82.00	104.00	93.68	3.83	0.39	0.10	0.27	0.29
CF3	Inden	28	132.00	156.00	144.25	6.40	1.21	-0.10	-0.67	0.59
	Lübeck	15	129.00	148.00	138.87	5.55	1.43	-0.40	-0.67	0.56
	S.A.	97	117.00	150.00	131.34	5.80	0.59	0.27	0.45	0.53
CF4	Inden	28	48.00	73.00	56.36	5.72	1.08	1.75	3.66	0.00
	Lübeck	15	45.00	55.40	49.89	3.29	0.85	0.31	-1.02	0.49
	S.A.	97	40.00	57.00	48.13	3.46	0.35	0.21	0.04	0.28
CF5	Inden	28	21.00	29.00	25.57	2.28	0.43	-0.47	-0.36	0.12
	Lübeck	15	21.10	25.00	23.41	1.11	0.29	-0.90	-0.27	0.00
	S.A.	97	22.00	47.00	27.00	3.03	0.31	3.04	18.68	0.00

For male sample here, the trend for SD and SE is similar to female sample for cranial frontal bone in Inden, Lübeck and SA with moderate dispersion and low SE for all the measurements. Looking at the Table 34 it can be assumed that for Inden series only one measurement CF1 produces a significant result, with a relatively large mean difference. For

CF3 the mean difference appears to have a proportionately medium effect. In Lübeck series none of the measurements are statistically significant different between male and female sample means. For SA series except CF3 every other measurement has statistically significant result but only CF1 has a big mean difference (-8.04; d = -1,34).

*Table 33 t-test between **Cranial frontal male and female** samples from Inden, Lübeck, and South Africa series*

Pop.			Levene's Test for Equality of Variances		t-test for Equality of Means							Cohen's d	Effect
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference			
										Lower	Upper		
CF1	Inden	= V	0.37	0.55	-3.23	42.00	0.00	-8.50	2.63	-13.81	-3.19	-1.00	Large
		≠ V			-3.40	36.16	0.00	-8.50	2.50	-13.57	-3.43		
	Lübeck	= V	2.55	0.12	-0.68	43.00	0.50	-1.10	1.61	-4.34	2.14		
		≠ V			-0.62	21.78	0.54	-1.10	1.78	-4.80	2.60		
	S.A.	= V	0.76	0.38	-8.37	157.00	0.00	-8.04	0.96	-9.94	-6.14	-1.34	Large
		≠ V			-8.83	150.80	0.00	-8.04	0.91	-9.84	-6.24		
CF2	Inden	= V	0.02	0.88	-1.86	42.00	0.07	-2.23	1.20	-4.66	0.19		
		≠ V			-1.84	30.72	0.07	-2.23	1.21	-4.70	0.24		
	Lübeck	= V	1.57	0.22	-0.83	45.00	0.41	-1.07	1.29	-3.67	1.53		
		≠ V			-0.78	24.04	0.44	-1.07	1.37	-3.89	1.75		
	S.A.	= V	0.09	0.77	-3.37	157.00	0.00	-2.10	0.62	-3.33	-0.87	-0.54	Medium
		≠ V			-3.37	130.20	0.00	-2.10	0.62	-3.33	-0.87		
CF3	Inden	= V	3.26	0.08	-2.38	42.00	0.02	-5.31	2.24	-9.82	-0.80	-0.73	Medium
		≠ V			-2.22	25.36	0.04	-5.31	2.40	-10.25	-0.38		
	Lübeck	= V	2.24	0.14	-1.52	45.00	0.13	-2.21	1.45	-5.13	0.71		
		≠ V			-1.37	21.64	0.18	-2.21	1.61	-5.55	1.13		
	S.A.	= V	0.41	0.52	-1.74	157.00	0.08	-1.60	0.92	-3.41	0.22		
		≠ V			-1.77	136.96	0.08	-1.60	0.90	-3.39	0.19		
CF4	Inden	= V	2.05	0.16	-0.91	42.00	0.37	-1.86	2.05	-5.99	2.27		
		≠ V			-0.84	24.43	0.41	-1.86	2.22	-6.44	2.73		
	Lübeck	= V	1.23	0.27	-0.93	45.00	0.36	-0.85	0.91	-2.68	0.98		
		≠ V			-0.87	23.21	0.39	-0.85	0.98	-2.86	1.17		
	S.A.	= V	0.42	0.52	-4.87	157.00	0.00	-2.68	0.55	-3.76	-1.59	-0.78	Medium
		≠ V			-4.93	135.65	0.00	-2.68	0.54	-3.75	-1.60		
CF5	Inden	= V	4.88	0.03	-1.20	42.00	0.24	-0.76	0.63	-2.04	0.52		
		≠ V			-1.36	41.59	0.18	-0.76	0.56	-1.89	0.37		
	Lübeck	= V	3.49	0.07	-0.09	45.00	0.93	-0.05	0.51	-1.06	0.97		
		≠ V			-0.11	41.43	0.91	-0.05	0.43	-0.91	0.82		
	S.A.	= V	2.33	0.13	-3.02	157.00	0.00	-1.32	0.44	-2.19	-0.46	-0.48	Small
		≠ V			-3.28	156.49	0.00	-1.32	0.40	-2.12	-0.53		

Note. Population groups and Sig. (2-tailed) highlighted in yellow show statistical significance between male and female mean differences. Effect size highlighted in green, quantifies and shows how high the degree of statistically significant mean difference is.

4.2.2.8 **Descriptive and Inferential Statistics on Cranial Lateral Measurements**

The descriptive statistics for frontal Cranial female sample in Table 34 for Cranial frontal male sample in Table 35 and the result for t-test comparing the data between Cranial frontal male and Cranial frontal female is presented in Table 36.

The last view a cranium in this study is lateral view. Like in other two views (basal and frontal), the female and male samples for cranial lateral, the first measurement is a linear measurement. In this case it would be CL1, which is more dispersed for Inden series as compared to Lübeck and SA series. Looking at other measurements CL2 to CL6 for all three groups in both male and female samples, it could be assumed to have uniformly dispersed data and the sample means are true to population mean as per the values of SE. With skewness, kurtosis, and Shapiro Wilks' it can be concluded that the data for both male and female samples in Table 34 and Table 35 is normally distributed.

Table 34 Data (in mm) on Cranial lateral bone measurements from ***female*** *samples in Inden, Lübeck, and South African series*

Pop.		N	Minimum	Maximum	Mean	Std. Deviation	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
CL1	Inden	16	166.00	192.00	178.81	6.74	1.68	-0.12	0.12	0.80
	Lübeck	32	170.00	194.00	180.61	5.44	0.96	0.36	0.16	0.60
	S.A.	62	167.00	201.00	179.89	6.39	0.81	0.36	0.58	0.16
CL2	Inden	16	23.00	36.00	29.69	3.20	0.80	0.14	0.55	0.50
	Lübeck	32	22.00	36.00	26.42	2.97	0.52	1.06	1.98	0.03
	S.A.	62	19.00	32.00	25.65	2.83	0.36	0.12	-0.24	0.51
CL3	Inden	16	85.00	110.00	91.25	6.58	1.64	1.66	3.45	0.01
	Lübeck	30	88.00	104.00	94.60	4.40	0.80	0.24	-0.76	0.16
	S.A.	62	83.00	108.00	97.26	5.16	0.66	-0.27	-0.11	0.76
CL4	Inden	16	85.00	109.00	96.50	5.57	1.39	0.26	1.19	0.88
	Lübeck	30	91.00	103.00	97.23	3.54	0.65	0.00	-1.21	0.14
	S.A.	62	85.00	109.00	96.23	3.96	0.50	0.38	1.51	0.16
CL5	Inden	16	55.00	80.00	68.38	6.06	1.52	0.05	1.12	0.53
	Lübeck	32	63.00	77.00	68.23	3.68	0.65	0.83	-0.04	0.02
	S.A.	62	49.00	97.00	64.92	6.67	0.85	1.75	8.22	0.00
CL6	Inden	16	118.00	137.00	129.16	5.56	1.39	-0.69	-0.39	0.20
	Lübeck	30	117.00	136.00	126.02	3.82	0.70	-0.04	1.29	0.49
	S.A.	62	115.00	140.00	128.48	5.52	0.70	-0.01	-0.43	0.61

Table 35 Data (in mm) on Cranial lateral bone measurements from ***male*** *samples in Inden, Lübeck, and South African series*

Pop.		N	Minimum	Maximum	Mean	Std. Deviation	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
CL1	Inden	28	162.00	200.00	185.21	8.85	1.67	-0.72	1.06	0.16
	Lübeck	15	169.00	192.00	182.47	6.35	1.64	-0.57	0.49	0.47

Pop.		N	Minimum	Maximum	Mean	Std. Deviation	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
	S.A.	97	172.00	200.00	185.99	6.48	0.66	-0.07	-0.40	0.40
CL2	Inden	28	24.00	40.00	32.36	3.42	0.65	-0.10	0.43	0.79
	Lübeck	15	19.00	32.00	26.80	3.59	0.93	-0.57	0.13	0.71
	S.A.	97	20.00	41.00	29.08	3.44	0.35	0.54	1.14	0.04
CL3	Inden	28	82.00	104.00	93.50	6.13	1.16	-0.34	-0.86	0.26
	Lübeck	15	89.00	107.00	97.34	5.16	1.33	0.31	-0.14	0.82
	S.A.	97	87.00	113.00	101.22	5.66	0.58	-0.24	-0.46	0.10
CL4	Inden	28	85.00	110.00	100.21	5.15	0.97	-0.75	1.57	0.24
	Lübeck	15	92.00	105.00	98.87	3.38	0.87	-0.51	0.56	0.51
	S.A.	97	90.00	109.00	100.90	4.34	0.44	-0.37	-0.59	0.02
CL5	Inden	28	55.00	83.00	71.57	6.81	1.29	-0.62	0.35	0.31
	Lübeck	15	55.20	77.00	67.11	4.89	1.26	-0.57	2.19	0.24
	S.A.	97	56.00	107.00	68.46	8.51	0.86	2.29	7.70	0.00
CL6	Inden	28	119.00	141.00	130.04	5.22	0.99	-0.04	-0.11	0.93
	Lübeck	15	119.00	140.00	127.47	6.65	1.72	0.60	-0.56	0.28
	S.A.	97	118.00	150.00	132.75	6.20	0.63	-0.14	0.11	0.48

The last view of the cranium in this study is lateral view. Like in other two views (basal and frontal), the female and male samples for cranial lateral, the first measurement is a linear measurement. In this case it would be CL1, which is more dispersed for Inden series as compared to Lübeck and SA series. Looking at other measurements CL2 to CL6 for all three groups in both male and female samples, it could be assumed to have uniformly dispersed data and the sample means are true to population mean as per the values of SE. With skewness, kurtosis, and Shapiro Wilks' it can be concluded that the data for both male and female samples in Table 34 and Table 35 is normally distributed.

Table 36 t-test between ***Cranial lateral male and female*** *samples from Inden, Lübeck, and South Africa series*

Pop.			Levene's Test for Equality of Variances		t-test for Equality of Means							Cohen's d	Effect
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference			
										Lower	Upper		
CL1	Inden	= V	0.67	0.42	-2.50	42.00	0.02	-6.40	2.56	-11.56	-1.24	-0.77	Medium
		≠ V			-2.70	38.43	0.01	-6.40	2.37	-11.21	-1.60		
	Lübeck	= V	0.18	0.68	-1.03	45.00	0.31	-1.86	1.80	-5.47	1.76		
		≠ V			-0.98	24.02	0.34	-1.86	1.90	-5.78	2.06		
	S.A.	= V	0.00	0.96	-5.82	157.00	0.00	-6.10	1.05	-8.17	-4.03	-0.93	Large
		≠ V			-5.84	131.45	0.00	-6.10	1.05	-8.17	-4.04		
CL2	Inden	= V	0.33	0.57	-2.55	42.00	0.01	-2.67	1.05	-4.79	-0.55	-0.79	Medium
		≠ V			-2.60	33.17	0.01	-2.67	1.03	-4.76	-0.58		

Pop.			Levene's Test for Equality of Variances		t-test for Equality of Means							Cohen's d	Effect
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference			
										Lower	Upper		
	Lübeck	= V	0.49	0.49	-0.38	45.00	0.71	-0.38	0.99	-2.38	1.62		
		≠ V			-0.35	23.29	0.73	-0.38	1.07	-2.58	1.83		
	S.A.	= V	1.03	0.31	-6.57	157.00	0.00	-3.44	0.52	-4.47	-2.40	-1.05	Large
		≠ V			-6.86	146.99	0.00	-3.44	0.50	-4.43	-2.45		
CL3	Inden	= V	0.18	0.67	-1.14	42.00	0.26	-2.25	1.97	-6.23	1.73		
		≠ V			-1.12	29.52	0.27	-2.25	2.01	-6.36	1.86		
	Lübeck	= V	0.02	0.90	-1.86	43.00	0.07	-2.74	1.47	-5.71	0.23		
		≠ V			-1.76	24.45	0.09	-2.74	1.56	-5.95	0.47		
	S.A.	= V	0.90	0.34	-4.45	157.00	0.00	-3.96	0.89	-5.72	-2.20	-0.71	Medium
		≠ V			-4.54	138.84	0.00	-3.96	0.87	-5.68	-2.23		
CL4	Inden	= V	0.00	1.00	-2.23	42.00	0.03	-3.71	1.66	-7.07	-0.36	-0.69	Medium
		≠ V			-2.18	29.34	0.04	-3.71	1.70	-7.19	-0.24		
	Lübeck	= V	1.33	0.25	-1.48	43.00	0.15	-1.63	1.10	-3.86	0.59		
		≠ V			-1.50	29.33	0.14	-1.63	1.09	-3.85	0.59		
	S.A.	= V	2.19	0.14	-6.84	157.00	0.00	-4.67	0.68	-6.02	-3.32	-1.09	Large
		≠ V			-6.99	138.83	0.00	-4.67	0.67	-5.99	-3.35		
CL5	Inden	= V	0.32	0.57	-1.56	42.00	0.13	-3.20	2.05	-7.34	0.95		
		≠ V			-1.61	34.45	0.12	-3.20	1.99	-7.24	0.84		
	Lübeck	= V	0.54	0.47	0.87	45.00	0.39	1.12	1.28	-1.47	3.70		
		≠ V			0.79	21.74	0.44	1.12	1.42	-1.83	4.07		
	S.A.	= V	1.97	0.16	-2.78	157.00	0.01	-3.54	1.28	-6.07	-1.02	-0.44	Small
		≠ V			-2.93	150.45	0.00	-3.54	1.21	-5.94	-1.15		
CL6	Inden	= V	0.25	0.62	-0.53	42.00	0.60	-0.88	1.67	-4.26	2.50		
		≠ V			-0.52	29.71	0.61	-0.88	1.70	-4.36	2.60		
	Lübeck	= V	7.42	0.01	-0.93	43.00	0.36	-1.45	1.56	-4.59	1.69		
		≠ V			-0.78	18.76	0.44	-1.45	1.85	-5.33	2.43		
	S.A.	= V	0.35	0.56	-4.41	157.00	0.00	-4.27	0.97	-6.18	-2.36	-0.70	Medium
		≠ V			-4.53	140.92	0.00	-4.27	0.94	-6.13	-2.41		

Note. Population groups and Sig. (2-tailed) highlighted in yellow show statistical significance between male and female mean differences. Effect size highlighted in green, quantifies and shows how high the degree of statistically significant mean difference is.

As seen in Table 36 it shows that in Inden series only CL1, Cl2, and CL4 have statistically significant mean difference. The effect according to Cohen's is medium for three measurements. Interestingly, Lübeck series do not show any significant results for a single measurement. On the other hand, in SA series every measurement has statistically significant result but only CL1, CL2, and CL4 have statistically sig. results. All these three measurements have similar mean difference between male and female samples in Inden series as well.

4.2.2.9 **Descriptive and Inferential Statistics on Mandible Measurements**

The descriptive statistics for mandible female sample in Table 37, for mandible male sample in Table 39 and the result for *t*-test comparing the data between mandible male and mandible female is presented in Table 39.

In female sample for Inden series all the measurements have more dispersed data as compared to Lübeck and SA series. Accordingly, sample means for Lübeck and SA measurements are closer to the population mean as it is the case with Inden. Seeing the skewness, Kurtosis, and Wilks' values the female data samples seem to be normally distributed for every population group.

Table 37 Data (in mm) on Mandible bone measurements from ***female*** *samples in Inden, Lübeck, and South African series*

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
M1	Inden	23	96.00	137.0	115.85	9.19	1.92	0.24	0.65	0.78
	Lübeck	17	104.50	126.0	112.56	5.65	1.37	0.79	0.25	0.15
	S.A.	62	102.00	125.0	110.35	5.47	0.69	0.62	0.41	0.01
M2	Inden	23	81.00	107.0	94.48	6.91	1.44	0.03	-0.39	0.89
	Lübeck	20	85.00	104.0	94.25	4.81	1.08	-0.08	0.04	0.88
	S.A.	63	80.00	102.0	88.92	5.25	0.66	0.58	-0.04	0.03
M3	Inden	23	23.00	35.0	29.39	3.14	0.66	-0.19	-0.58	0.59
	Lübeck	22	27.00	38.0	32.45	2.28	0.49	0.12	1.55	0.39
	S.A.	63	26.00	41.0	33.43	3.31	0.42	-0.15	-0.44	0.14
M4	Inden	23	78.00	101.0	87.30	6.26	1.30	0.47	-0.58	0.39
	Lübeck	22	84.00	94.0	90.13	2.49	0.53	-0.97	0.87	0.08
	S.A.	63	79.00	98.0	89.24	4.71	0.59	-0.14	-0.52	0.36
M5	Inden	23	65.00	85.0	74.57	5.62	1.17	-0.06	-0.89	0.68
	Lübeck	21	69.00	81.0	75.67	3.37	0.73	-0.05	-0.77	0.61
	S.A.	63	67.00	89.0	79.27	4.40	0.55	-0.38	0.04	0.26

In male sample Lübeck series for M1 and M2 show more dispersion in the data, and it can be a direct relation to their extremely small sample size. As per SE values in male sample, the mean values are much further from the population mean, which is not the case in the female samples for three population groups. Taking skewness, kurtosis, and Wilks' values into account, it can be said that not every measurement in each population group is not normally distributed.

*Table 38 Data (in mm) on Mandible bone measurements from **male** samples in Inden, Lübeck, and South African series*

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
M1	Inden	31	95.00	134.0	119.58	8.48	1.52	-0.65	1.33	0.15
	Lübeck	5	98.30	131.0	118.66	12.54	5.61	-1.30	2.01	0.46
	S.A.	96	100.00	129.0	115.19	6.09	0.62	-0.40	-0.06	0.09
M2	Inden	31	80.00	113.0	98.74	8.17	1.47	-0.35	-0.57	0.57
	Lübeck	10	86.00	118.0	98.90	10.91	3.45	0.99	-0.36	0.05
	S.A.	97	76.00	116.0	96.35	6.05	0.61	0.05	1.23	0.10
M3	Inden	31	25.00	36.0	30.65	2.87	0.52	-0.15	-0.70	0.40
	Lübeck	10	27.00	39.0	33.22	3.63	1.15	0.09	-0.22	0.89
	S.A.	97	25.00	41.0	35.08	3.12	0.32	-0.78	0.73	0.00
M4	Inden	31	73.00	106.0	90.87	7.31	1.31	-0.41	0.65	0.35
	Lübeck	10	83.30	103.0	94.33	6.44	2.04	-0.41	-0.59	0.75
	S.A.	97	76.00	107.0	93.88	5.21	0.53	-0.53	1.88	0.00
M5	Inden	31	59.00	84.0	75.97	6.00	1.08	-1.28	1.72	0.00
	Lübeck	10	68.00	84.0	77.20	5.31	1.68	-0.62	-0.61	0.46
	S.A.	97	69.00	95.0	83.14	5.15	0.52	-0.45	0.35	0.08

*Table 39 t-test between **Mandible male and female** samples from Inden, Lübeck, and South Africa series*

Pop.			Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference		Cohen's d	Effect
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper		
M1	Inden	= V	0.11	0.75	-1.54	52.00	0.13	-3.73	2.42	-8.58	1.12		
		≠ V			-1.53	45.30	0.13	-3.73	2.45	-8.66	1.20		
	Lübeck	= V	3.47	0.08	-1.59	20.00	0.13	-6.10		-14.11	1.91		
		≠ V			-1.06	4.49	0.34	-6.10	5.77	-21.46	9.26		
	S.A.	= V	0.61	0.44	-5.07	156.00	0.00	-4.84	0.95	-6.72	-2.95	-0.81	Large
		≠ V			-5.19	140.07	0.00	-4.84	0.93	-6.68	-3.00		
M2	Inden	= V	1.15	0.29	-2.02	52.00	0.05	-4.26	2.11	-8.50	-0.03	-0.56	Medium
		≠ V			-2.07	51.04	0.04	-4.26	2.06	-8.39	-0.13		
	Lübeck	= V	11.05	0.00	-1.63	28.00	0.11	-4.65	2.84	-10.48	1.18		
		≠ V			-1.29	10.79	0.23	-4.65	3.61	-12.62	3.32		
	S.A.	= V	0.53	0.47	-7.99	158.00	0.00	-7.43	0.93	-9.27	-5.59	-1.27	Large
		≠ V			-8.23	145.36	0.00	-7.43	0.90	-9.21	-5.65		
M3	Inden	= V	0.19	0.66	-1.52	52.00	0.13	-1.25	0.82	-2.90	0.40		
		≠ V			-1.50	45.00	0.14	-1.25	0.83	-2.93	0.43		
	Lübeck	= V	3.25	0.08	-0.73	30.00	0.47	-0.77	1.05	-2.92	1.38		
		≠ V			-0.62	12.37	0.55	-0.77	1.25	-3.48	1.94		
	S.A.	= V	1.46	0.23	-3.20	158.00	0.00	-1.65	0.52	-2.67	-0.63	-0.51	Medium
		≠ V			-3.16	126.76	0.00	-1.65	0.52	-2.69	-0.62		
M4	Inden	= V	0.17	0.68	-1.88	52.00	0.07	-3.57	1.89	-7.37	0.23		
		≠ V			-1.93	50.86	0.06	-3.57	1.85	-7.28	0.15		

	Lübeck	= V	11.54	0.00	-2.69	30.00	0.01	-4.20	1.56	-7.39	-1.01		
		≠ V			-2.00	10.24	0.07	-4.20	2.10	-8.88	0.47		
	S.A.	= V	0.02	0.88	-5.71	158.00	0.00	-4.64	0.81	-6.24	-3.03	-0.91	Large
		≠ V			-5.83	141.79	0.00	-4.64	0.80	-6.21	-3.07		
M5	Inden	= V	0.13	0.72	-0.87	52.00	0.39	-1.40	1.61	-4.63	1.82		
		≠ V			-0.88	49.14	0.38	-1.40	1.59	-4.60	1.80		
	Lübeck	= V	2.56	0.12	-0.98	29.00	0.33	-1.53	1.56	-4.73	1.66		
		≠ V			-0.84	12.57	0.42	-1.53	1.83	-5.51	2.44		
	S.A.	= V	1.22	0.27	-4.91	158.00	0.00	-3.87	0.79	-5.43	-2.32	-0.78	Medium
		≠ V			-5.08	146.56	0.00	-3.87	0.76	-5.38	-2.37		

Note. Population groups and Sig. (2-tailed) highlighted in yellow show statistical significance between male and female mean differences. Effect size highlighted in green, quantifies and shows how high the degree of statistically significant mean difference is.

In Inden series only M2 has stat. significant results, that too with a medium mean difference. For Lübeck series it appears that not a single measurement has statistically significant differences. In SA series every measurement has statistically significant result with M1, M2, and M4 having bigger significantly bigger mean difference.

4.2.2.10 **Descriptive and Inferential Statistics on Pelvis Measurements**

The descriptive statistics for mandible female sample in Table 40, for mandible male sample in Table 41, and the result for *t*-test comparing the data between mandible male and mandible female is presented in Table 42.

Table 40 Data (in mm) on Pelvic bone measurements from ***female*** *samples in Inden, Lübeck, and South African series*

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
P1	Inden	13	81.00	114.00	99.23	8.96	2.49	-0.21	0.07	0.82
	Lübeck	23	84.00	103.00	95.22	5.70	1.19	-0.41	-1.14	0.06
	S.A.	58	72.00	98.00	86.48	4.97	0.65	0.01	0.82	0.12
P2	Inden	13	98.00	111.00	104.15	4.22	1.17	-0.11	-0.94	0.42
	Lübeck	31	84.00	117.00	100.42	7.11	1.28	-0.10	0.27	1.00
	S.A.	58	79.00	105.00	94.77	5.34	0.70	-0.36	0.05	0.51
P3	Inden	13	177.00	223.00	203.69	12.66	3.51	-0.22	0.48	0.53
	Lübeck	33	116.00	216.00	193.79	24.52	4.27	-2.13	4.33	0.00
	S.A.	58	163.00	205.00	185.39	9.11	1.20	-0.04	-0.18	0.84
P4	Inden	13	141.00	172.00	158.92	8.34	2.31	-0.26	0.75	0.50
	Lübeck	34	137.00	267.00	158.59	21.11	3.62	4.24	22.13	0.00
	S.A.	58	123.00	164.00	139.67	8.06	1.06	0.26	0.50	0.77
P5	Inden	13	28.50	44.00	34.58	4.37	1.21	0.78	0.59	0.34
	Lübeck	35	28.00	45.00	32.91	3.51	0.59	1.11	2.73	0.02
	S.A.	58	18.00	33.00	24.88	3.55	0.47	-0.05	-0.40	0.46
P6	Inden	13	49.00	60.00	54.23	3.39	0.94	0.11	-0.67	0.64

	Lübeck	35	42.00	63.00	49.65	4.84	0.82	0.84	0.42	0.08
	S.A.	58	43.00	57.00	49.74	3.02	0.40	0.10	-0.67	0.12
P7	Inden	13	47.00	78.00	58.92	9.80	2.72	0.76	-0.55	0.23
	Lübeck	35	43.00	70.00	54.05	6.07	1.03	0.36	0.26	0.81
	S.A.	58	36.00	66.00	48.29	6.63	0.87	0.31	-0.48	0.14
P8	Inden	13	22.00	42.00	33.62	5.41	1.50	-0.55	0.40	0.95
	Lübeck	25	24.00	46.00	32.22	5.26	1.05	0.57	0.53	0.34
	S.A.	58	20.00	34.00	26.76	3.22	0.42	0.17	-0.06	0.10
P9	Inden	13	38.00	51.00	41.69	3.88	1.08	1.35	1.38	0.03
	Lübeck	24	34.00	52.00	41.92	4.92	1.00	0.25	-0.73	0.69
	S.A.	58	28.00	43.00	35.79	3.31	0.43	0.02	-0.21	0.38

In Inden series measurements, P1, P3, and P4 have high dispersion of the individuals' data. P9 is the only measurement that has the least SE value, rest of the measurements do not have their sample means close to the population mean. In Lübeck series the highest distribution appears to be for P3 and P4 even though the sample size for Lübeck series female individuals is more than Inden series. The dispersion of SA measurements data is relatively lower, with most of the SE values below 1. This means, the sample means are closer to the population mean.

*Table 41 Data (in mm) on Pelvic bone measurements from **male** samples in Inden, Lübeck, and South African series*

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
P1	Inden	22	80.20	106.00	96.28	5.80	1.24	-0.88	1.61	0.39
	Lübeck	17	85.00	101.00	93.41	4.62	1.12	-0.01	-0.83	0.86
	S.A.	96	73.00	96.00	84.86	5.01	0.51	-0.20	-0.26	0.22
P2	Inden	23	102.00	125.00	114.04	6.15	1.28	-0.16	-0.54	0.87
	Lübeck	22	95.00	115.00	105.18	5.70	1.21	-0.14	-0.76	0.27
	S.A.	96	88.00	115.00	103.43	5.83	0.59	-0.25	-0.48	0.15
P3	Inden	23	195.00	239.00	217.13	10.98	2.29	0.24	-0.46	0.65
	Lübeck	21	118.00	228.00	194.90	37.11	8.10	-1.50	0.65	0.00
	S.A.	96	172.00	245.00	199.48	12.25	1.25	0.29	0.89	0.13
P4	Inden	23	149.00	173.00	158.83	6.07	1.26	0.37	0.31	0.26
	Lübeck	20	141.00	174.00	157.10	9.70	2.17	0.27	-0.63	0.24
	S.A.	96	120.00	172.00	144.97	9.58	0.98	0.03	0.03	0.82
P5	Inden	23	25.00	45.00	34.39	5.07	1.06	-0.22	-0.11	0.64
	Lübeck	22	25.00	37.00	31.55	3.53	0.75	-0.17	-1.02	0.47
	S.A.	96	18.00	54.00	29.08	4.73	0.48	2.11	9.54	0.00
P6	Inden	23	50.00	68.00	60.04	3.71	0.77	-0.45	1.79	0.28
	Lübeck	23	44.00	60.00	52.17	3.94	0.82	-0.19	-0.30	0.97
	S.A.	96	47.00	65.00	55.54	3.42	0.35	-0.15	0.19	0.17
P7	Inden	23	40.00	69.00	51.70	6.95	1.45	0.75	1.03	0.29
	Lübeck	22	36.00	67.00	50.18	7.53	1.60	0.21	0.34	0.85

Pop.		N	Min.	Max.	Mean	Std. Dev.	Std. Error of Mean	Skewness	Kurtosis	Shapiro-Wik test
	S.A.	96	31.00	62.00	43.42	5.70	0.58	0.41	0.53	0.18
P8	Inden	22	16.00	30.00	23.36	4.58	0.98	-0.15	-1.27	0.18
	Lübeck	17	23.00	37.00	27.59	3.68	0.89	1.33	1.59	0.03
	S.A.	96	18.00	33.00	23.86	2.92	0.30	0.27	-0.07	0.07
P9	Inden	22	32.00	50.00	43.00	4.75	1.01	-0.45	-0.23	0.45
	Lübeck	18	38.00	51.00	45.50	4.23	1.00	-0.26	-1.29	0.15
	S.A.	96	27.00	48.00	38.54	4.07	0.42	-0.21	-0.01	0.27

P3 appears to be one measurement that has high dispersion and Lübeck series for P3 has extremely high value for SD (37.11 mm) and SE of 8.10 mm indicates that the sample mean is nowhere representative of the population mean. The same case follows with P3 of female sample in Lübeck series. In SA series the male sample dispersion for P3 is even higher than female sample which is helpful to assume that there is dimorphism between both the sexes. With respect to SE values, SA series individual measurement means are truer to their population mean values than it is the case in Inden and Lübeck series.

*Table 42 t-test between **Pelvis male and female** samples from Inden, Lübeck, and South Africa series*

Pop.			Levene's Test for Equality of Variances		t-test for Equality of Means							Cohen's d	Effect
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference			
										Lower	Upper		
P1	Inden	= V	3.27	0.08	1.18	33.00	0.24	2.95	2.49	-2.11	8.01		
		≠ V			1.06	18.04	0.30	2.95	2.78	-2.88	8.78		
	Lübeck	= V	1.58	0.22	1.07	38.00	0.29	1.81	1.69	-1.60	5.22		
		≠ V			1.11	37.61	0.27	1.81	1.63	-1.50	5.12		
	S.A.	= V	0.28	0.60	1.95	152.00	0.05	1.62	0.83	-0.02	3.26		
		≠ V			1.95	121.10	0.05	1.62	0.83	-0.02	3.26		
P2	Inden	= V	2.59	0.12	-5.14	34.00	0.00	-9.89	1.93	-13.80	-5.98	-1.76	Large
		≠ V			-5.69	32.54	0.00	-9.89	1.74	-13.42	-6.35		
	Lübeck	= V	0.93	0.34	-2.60	51.00	0.01	-4.77	1.83	-8.44	-1.09	-0.73	Medium
		≠ V			-2.70	50.18	0.01	-4.77	1.76	-8.31	-1.23		
	S.A.	= V	0.81	0.37	-9.22	152.00	0.00	-8.66	0.94	-10.52	-6.80	-1.50	Large
		≠ V			-9.42	128.59	0.00	-8.66	0.92	-10.48	-6.84		
P3	Inden	= V	0.05	0.83	-3.34	34.00	0.00	-13.44	4.03	-21.62	-5.26	-1.15	Large
		≠ V			-3.21	22.19	0.00	-13.44	4.19	-22.13	-4.75		
	Lübeck	= V	4.17	0.05	-0.13	52.00	0.89	-1.12	8.37	-17.92	15.68		
		≠ V			-0.12	31.16	0.90	-1.12	9.15	-19.78	17.55		
	S.A.	= V	4.51	0.04	-7.58	152.00	0.00	-14.09	1.86	-17.76	-10.42		
		≠ V			-8.15	145.45	0.00	-14.09	1.73	-17.51	-10.67	-1.35	Large
P4	Inden	= V	0.92	0.34	0.04	34.00	0.97	0.10	2.41	-4.81	5.00		

Pop.			Levene's Test for Equality of Variances		t-test for Equality of Means							Cohen's d	Effect
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference			
										Lower	Upper		
		$\neq$ V			0.04	19.30	0.97	0.10	2.64	-5.42	5.61		
	Lübeck	= V	0.57	0.45	0.30	52.00	0.77	1.49	5.02	-8.58	11.56		
		$\neq$ V			0.35	49.80	0.73	1.49	4.22	-6.99	9.97		
	S.A.	= V	2.36	0.13	-3.53	152.00	0.00	-5.30	1.50	-8.27	-2.33	-0.57	Medium
		$\neq$ V			-3.68	136.32	0.00	-5.30	1.44	-8.15	-2.45		
P5	Inden	= V	0.48	0.49	0.11	34.00	0.91	0.19	1.68	-3.22	3.59		
		$\neq$ V			0.12	28.29	0.91	0.19	1.61	-3.11	3.48		
	Lübeck	= V	0.35	0.56	1.43	55.00	0.16	1.37	0.96	-0.55	3.29		
		$\neq$ V			1.43	44.59	0.16	1.37	0.96	-0.56	3.30		
	S.A.	= V	0.25	0.62	-5.84	152.00	0.00	-4.20	0.72	-5.63	-2.78	-0.95	Large
		$\neq$ V			-6.26	144.89	0.00	-4.20	0.67	-5.53	-2.88		
P6	Inden	= V	0.01	0.91	-4.65	34.00	0.00	-5.81	1.25	-8.35	-3.27	-1.59	Large
		$\neq$ V			-4.77	26.97	0.00	-5.81	1.22	-8.31	-3.31		
	Lübeck	= V	0.95	0.33	-2.09	56.00	0.04	-2.53	1.21	-4.95	-0.10	-0.56	Medium
		$\neq$ V			-2.18	53.33	0.03	-2.53	1.16	-4.85	-0.20		
	S.A.	= V	0.12	0.73	-10.64	152.00	0.00	-5.80	0.55	-6.88	-4.72	-1.73	Large
		$\neq$ V			-10.98	132.17	0.00	-5.80	0.53	-6.85	-4.76		
P7	Inden	= V	3.23	0.08	2.58	34.00	0.01	7.23	2.80	1.53	12.92	0.88	Large
		$\neq$ V			2.35	18.96	0.03	7.23	3.08	0.78	13.68		
	Lübeck	= V	0.63	0.43	2.13	55.00	0.04	3.86	1.81	0.23	7.50	0.57	Medium
		$\neq$ V			2.03	37.79	0.05	3.86	1.90	0.01	7.72		
	S.A.	= V	4.12	0.04	4.83	152.00	0.00	4.87	1.01	2.88	6.86		
		$\neq$ V			4.65	106.64	0.00	4.87	1.05	2.80	6.95	0.90	Large
P8	Inden	= V	0.15	0.70	5.98	33.00	0.00	10.25	1.71	6.76	13.74	2.08	Large
		$\neq$ V			5.73	22.07	0.00	10.25	1.79	6.54	13.96		
	Lübeck	= V	1.57	0.22	3.15	40.00	0.00	4.64	1.47	1.66	7.61	0.99	Large
		$\neq$ V			3.36	39.94	0.00	4.64	1.38	1.85	7.42		
	S.A.	= V	0.16	0.69	5.74	152.00	0.00	2.90	0.51	1.90	3.90	0.93	Large
		$\neq$ V			5.60	111.13	0.00	2.90	0.52	1.87	3.93		
P9	Inden	= V	0.82	0.37	-0.84	33.00	0.41	-1.31	1.56	-4.48	1.86		
		$\neq$ V			-0.88	29.46	0.38	-1.31	1.48	-4.33	1.71		
	Lübeck	= V	0.25	0.62	-2.47	40.00	0.02	-3.58	1.45	-6.50	-0.65	-0.78	Medium
		$\neq$ V			-2.53	39.18	0.02	-3.58	1.42	-6.44	-0.72		
	S.A.	= V	1.66	0.20	-4.35	152.00	0.00	-2.75	0.63	-4.00	-1.50	-0.71	Medium
		$\neq$ V			-4.57	138.96	0.00	-2.75	0.60	-3.94	-1.56		

Note. Population groups and Sig. (2-tailed) highlighted in yellow show statistical significance between male and female mean differences. Effect size highlighted in green, quantifies and shows how high the degree of statistically significant mean difference is.

In Inden series five (P2, P3, P6, P7, P8) out of nine measurements present statistically significant results. In Lübeck series P2, P6, P7, P8, P9 are statistically significant with P8 as the only measurement with large mean difference. In SA series except P1 all the other measurements present statistically significant mean differences between male and female samples for pelvis.

4.2.3 ANOVA

In order to show overall population differences in the mean values, different measurements have been clubbed together based on skeletal elements. The difference has been showed using bar graphs. In each bar graph, for every measurement there are three bars representing the mean values for the corresponding population groups of Inden, Lübeck and South Africa.

Upon comparing the mean values of Inden and Lübeck, post-hoc test shows that there are significant differences with respect to femur measurements – F1, F2, F3, F4, F6. The mean differences for Lübeck and South Africa groups are significant in measurements of F3, F5, F6, F7. The mean differences for all eight measurements (F1 – F8) have appeared to be significant between Inden and South Africa. The extended comparison among different population groups have been analysed using Tukey HSD post-hoc test and the tables have been included in Appendix (Table 37-46).

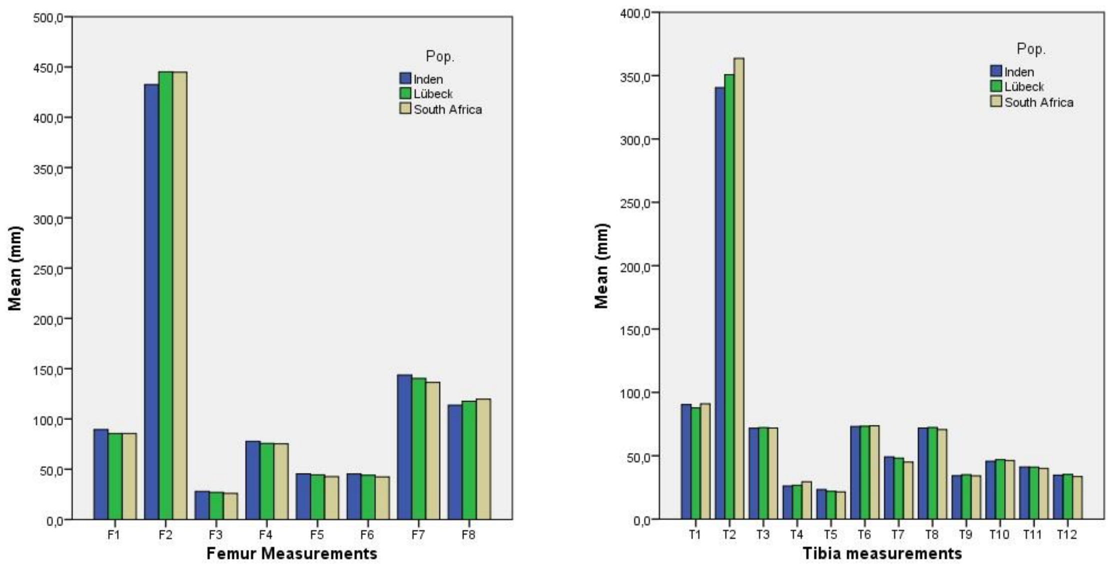


*Figure 15 Group bar graphs representing **mean** values **femur** and **tibia** bone measurements for Inden, Lübeck, and South Africa samples*

In tibia measurements T1, T2, T5, T7 have appeared to show statistically significant differences between Inden and Lübeck samples. T1, T2, T7 have showed significant differences between Lübeck and South African samples, along with T4 and T12. The significant differences between Inden and South Africa could be proved by looking at the measurements of T2, T4, T5, T7, T12.

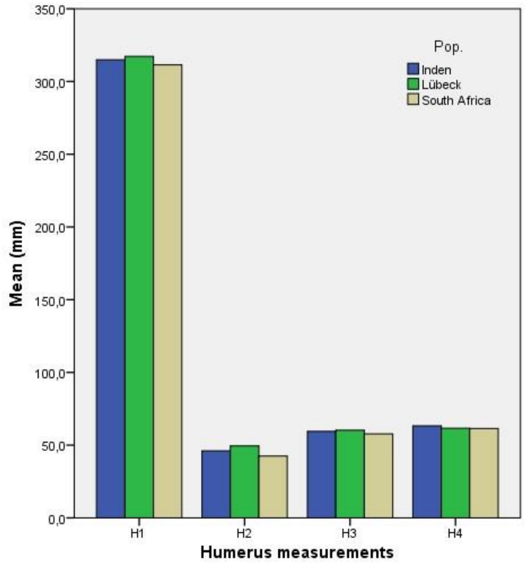
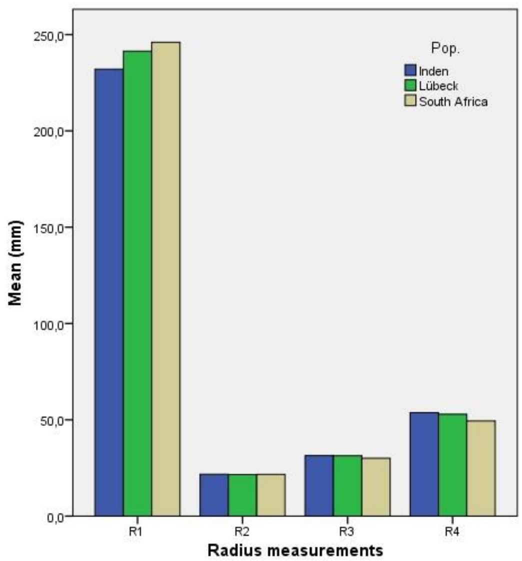


*Figure 16 Group bar graph representing **mean** values for **humerus** bone measurements for Inden, Lübeck, and South Africa samples*

Among four different humerus bone measurements H3 (more clarified by referring to the table 39 in Appendix) is the only measurement that shows statistically significant differences when Inden, Lübeck and South Africa samples are compared to each other.



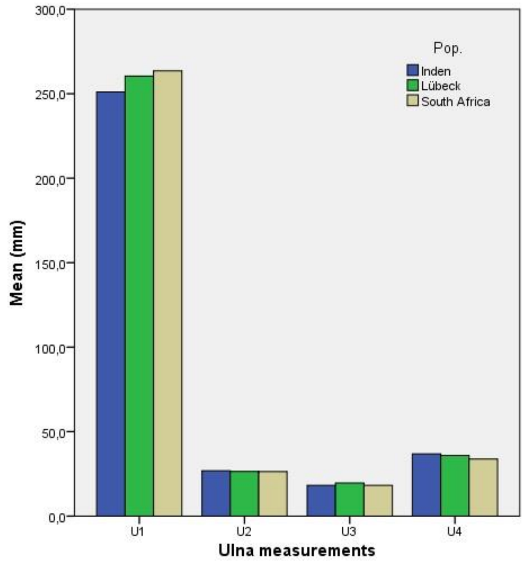


*Figure 17 Group bar graphs representing **mean** values **radius** and **ulna** bone measurements for Inden, Lübeck, and South Africa samples*

With the maximum lengths of radius (R1) and ulna (U1), it is evident from the graphs above that they are statistically significant among all three population groups. R3 and R4 appear to have statistically significant mean differences between Inden-South Africa as well as Lübeck-South Africa. It is expected that R3 and R4 do not have mean differences between Inden and Lübeck, considering they originate from the same European ancestry. As seen in the graph above Inden and South Africa samples do not have any highly significant differences for U3 but for U4 there is.

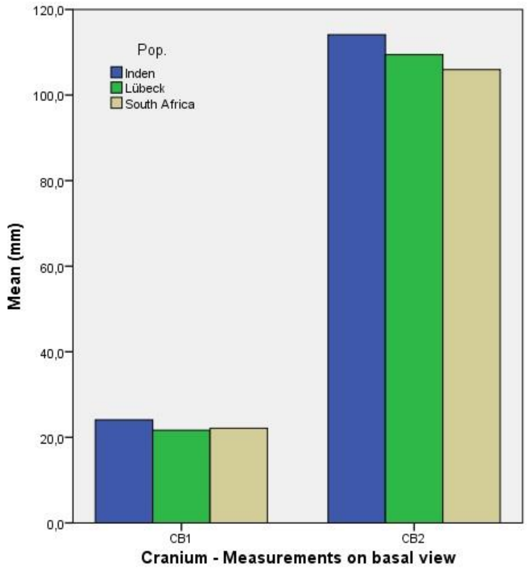
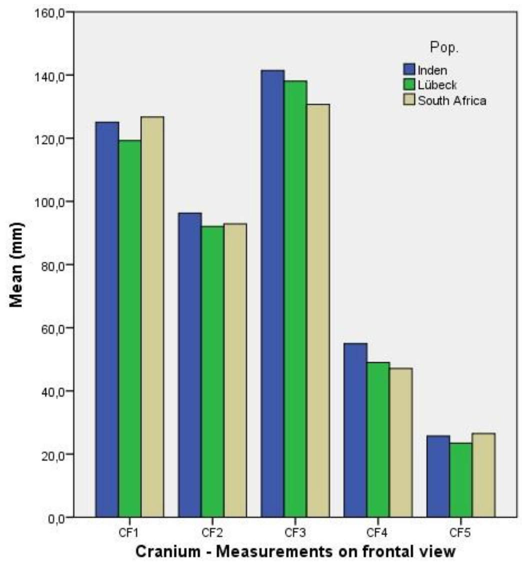


*Figure 18 Group bar graph representing **mean** values **cranial (basal)** measurements for Inden, Lübeck, and South Africa samples*

In the basal view of crania, CB1 does not appear to be statistically different between Lübeck and South Africa but CB2 has statistically significant differences between all the population groups.



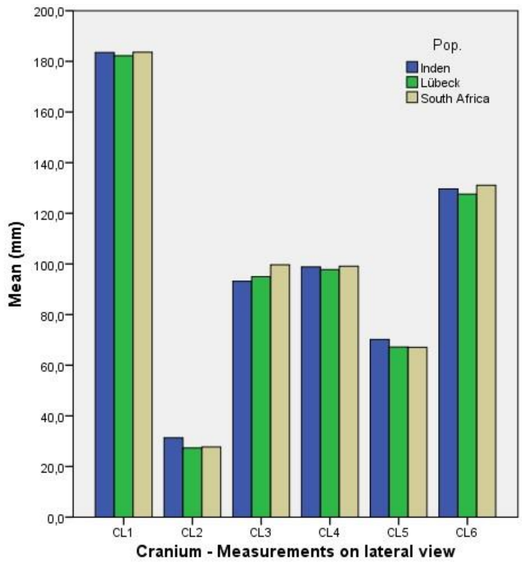


*Figure 19 Group bar graph representing **mean** values **cranial (frontal and lateral)** measurements for Inden, Lübeck, and South Africa samples*

In the frontal view of crania between Inden and Lübeck series all five measurements (CF1 – CF5) appear to have statistically significant mean differences. Between Lübeck and South Africa series CF1, CF3, CF4, CF5 appear to have statistically significant differences and between Inden and South Africa series if the measurements are compared with regards to their mean values, they appear to be statistically significant as well.

For lateral view between Inden and Lübeck samples only CL2 and CL5 conclude to have statistically significant differences. Cl3 and CL6 appear to have significant mean differences between Lübeck and South Africa samples. CL2, CL3, and CL5 are statistically different in Inden and South Africa samples.

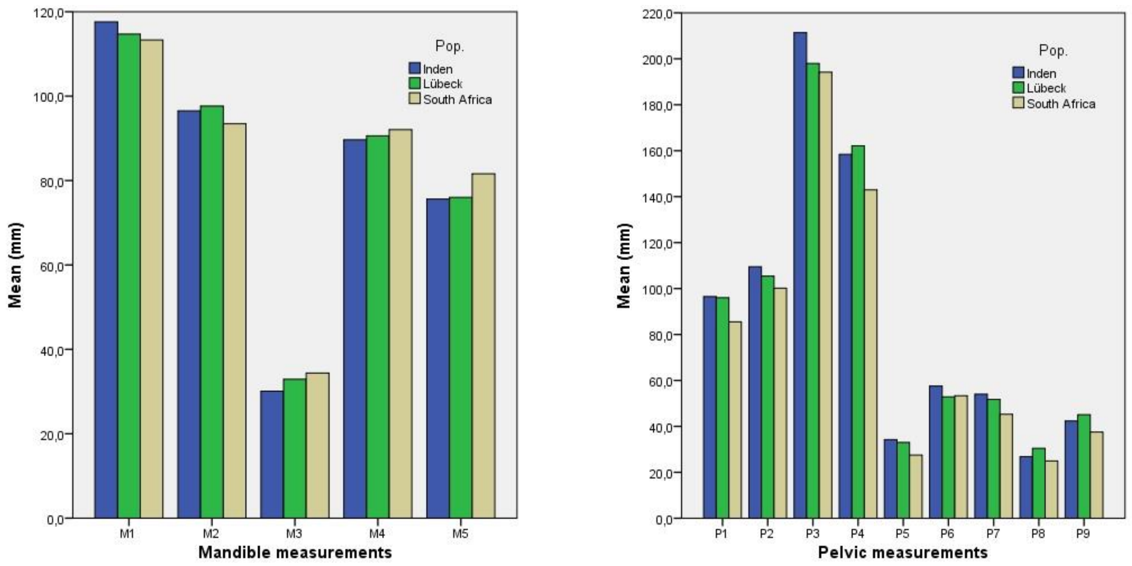


*Figure 20 Group bar graph representing **mean** values for **mandible and pelvic** measurements for Inden, Lübeck, and South Africa samples*

Between Inden and Lübeck samples M3 is the only measurement that appears to have statistically significant mean difference. Looking the mean difference value of 2.6 mm it can be said that the difference could be subjected to errors while taking measurements. M2, M3, and M5 are statistically different between Lübeck and South Africa samples. Looking at the graph above, it can be assessed that nearly every mandible measurement has a significant mean difference between Inden and South Africa samples.

Among pelvic measurements when the differences between Inden and Lübeck are to be assessed, several measurements appear to have statistically significant differences which is also the case between Lübeck and South Africa. So, the population differences with respect to pelvic shape and size is evident from the graph above as well as the post-hoc test results. The extended tables for post-hoc could be found from Table 37 until 46 in the Appendix section.

4.2.4 Accuracy Test Results

The final accuracy rates with indifferent or ambiguous individuals and without them is shown in Table 43 for Inden series, in Table 44 for Lübeck series, and in Table 46 for South African series. In all the tables concerning accuracy rates for metrical discriminant functions (DFs), the initial character for measurements is taken from the corresponding skeletal element. In case of cranium particularly the second letter for the measurement is meant to show the view (CB = basal; CF = frontal; CL = lateral). In Inden series the DF with multiple measurements, namely CL1+CF1+CL4+CL6+CF4+CF5, perform better than the other DFs. Although the accuracy rate for CF1 improves when indifferent individuals are taken out of the accuracy calculation, but it reduces the sample size from 43 to 34. A similar case is to be seen in Lübeck series where multiple measurements perform the as the most accurate but as the number of indifferent individuals are taken out, CB2 performs with 84%. In SA cranium with CL1+CF1+CL4+CL6+CF4+CF5 has not so great good performing result but again scored the highest accuracy rate.

*Table 43 The total number of individuals for Crania, Mandible, Os coxae, Humerus, Radius, Ulna, Femur, and Tibia with discriminant functions applied and indifferent (ambiguous) and incorrectly identified results as well as the accuracy rates for correctly identified in the **Inden** series*

Discriminant functions	Individuals considered with known sex	Match	No match	Raw accuracy (%)	Indifferent	Without indifferent	Match	No match	Accuracy (%)
Calvarium - Metrical									
CF1	43.0	26.0	17.0	60.5	9.0	34.0	26.0	8.0	76.5
CL1+CF1+CL4+CL6+CF4+CF5	43.0	33.0	10.0	**76.7**	0.0	43.0	33.0	10.0	**76.7**
CB2	43.0	29.0	10.0	67.4	12.0	31.0	20.0	11.0	64.5
CB1	43.0	15.0	12.0	34.9	17.0	26.0	15.0	11.0	57.7
Mandible - Metrical									
M1+M2+M3+M4+M5	54.0	23.0	31.0	**42.6**	0.0	na	na	na	na
Pelvis - Metrical									
P1+P2+P3+P7+P8+P9	35.0	34.0	1.0	**97.1**	0.0	35.0	34.0	1.0	**97.1**
P1+P2	35.0	29.0	6.0	82.9	0.0	35.0	29.0	6.0	82.9
P3+P4	36.0	27.0	9.0	75.0	0.0	36.0	27.0	9.0	75.0
P2	36.0	30.0	6.0	83.3	0.0	36.0	30.0	6.0	83.3
P6	36.0	25.0	11.0	69.4	0.0	36.0	25.0	11.0	69.4
P5+P7	36.0	25.0	11.0	69.4	0.0	36.0	25.0	11.0	69.4
P1+P8	35.0	22.0	13.0	62.9	0.0	35.0	22.0	13.0	62.9
P5+P7 (greeks)	36.0	15.0	21.0	41.7	0.0	36.0	15.0	21.0	41.7
Femur - Metrical									
F6	76.0	61.0	16.0	**80.3**	0.0	na	na	na	na
F7	76.0	58.0	19.0	76.3	0.0	na	na	na	na

Discriminant functions	Individuals considered with known sex	Match	No match	Raw accuracy (%)	Indifferent	Without indifferent	Match	No match	Accuracy (%)
F3+F4+F5	76.0	58.0	19.0	76.3	0.0	na	na	na	na
F5	76.0	57.0	20.0	75.0	0.0	na	na	na	na
F3+F7	76.0	55.0	22.0	72.4	0.0	na	na	na	na
F4	76.0	51.0	26.0	67.1	0.0	na	na	na	na
F2	76.0	50.0	27.0	65.8	0.0	na	na	na	na
F3	76.0	42.0	35.0	55.3	0.0	na	na	na	na
F1	76.0	42.0	34.0	55.3	0.0	na	na	na	na
Tibia - Metrical									
T8	73.0	61.0	12.0	**83.6**	0.0	na	na	na	na
T3+T7	73.0	61.0	12.0	83.6	0.0	na	na	na	na
T11	73.0	60.0	13.0	82.2	0.0	na	na	na	na
T3	73.0	60.0	13.0	82.2	0.0	na	na	na	na
T10	73.0	58.0	15.0	79.5	0.0	na	na	na	na
T1	73.0	55.0	18.0	75.3	0.0	na	na	na	na
T7	73.0	55.0	18.0	75.3	0.0	na	na	na	na
T3+T4+T5+T6+T7	73.0	52.0	21.0	71.2	0.0	na	na	na	na
T9	73.0	51.0	22.0	69.9	0.0	na	na	na	na
T12	73.0	45.0	28.0	61.6	0.0	na	na	na	na
T9*T10	73.0	37.0	36.0	50.7	0.0	na	na	na	na
T11*T12	73.0	36.0	37.0	49.3	0.0	na	na	na	na
Tibia and Femur - Metrical									
F3+F4+F5+T4+T6+T2+T7	67.0	41.0	26.0	**61.2**	0.0	na	na	na	na
Humerus - Metrical									
H1+H2+H3	70.0	56.0	14.0	**80.0**	0.0	na	na	na	na
H4	89.0	61.0	28.0	68.5	0.0	na	na	na	na
Radius - Metrical									
R1+R2+R3	63.0	50.0	13.0	**79.4**	0.0	na	na	na	na
R4	85.0	62.0	23.0	72.9	0.0	na	na	na	na
Ulna - Metrical									
U1+U2+U3	67.0	51.0	16.0	**76.1**	0.0	na	na	na	na
U4	85.0	64.0	21.0	75.3	0.0	na	na	na	na
Tibia, Femur, Humerus, Radius - Circumferences									
H4+R4+F8+T1	58.0	41.0	17.0	**70.7**	0.0	na	na	na	na

Note. The cells inside orange lines are part of raw accuracy calculation with indifferent individuals and the ones within green lines are for accuracy without indifferent ambiguous individuals; na – not available.

Mandible measurements perform the poorest compared to every other skeletal element in Inden and SA but for Lübeck individuals mandible DF secures 81%. It is interesting to see that Pelvic DF with more measurements have higher accuracy than individual or even with measurements. In case of P1+P2 and P2, the performance is the third and second best respectively. P1 and P2 are the total length and maximum breadth, these two are a part of

P1+P2+P3+P7+P8+P9 which increases the accuracy rate drastically high. There are no indifferent individuals in the case of pelvis. Unlike morphological methods, DFs generally have a single sectioning point cut off value which removes the possibility of having any indifferent individuals in the sample. This means that for CB1, CB2, and CF1 there are two centroid values around each sex, and they decide to conclude the sex of an individual. The individuals that do not fall around these two centroids would fall into the category of indifferent individuals.

In the case of Inden femur, a single measurement DF like F6 and F7 perform better than multivariate DF. This can be assumed for Lübeck femur as well, where F6 and F7 are the second and the third best performing with univariate DF F5 being the best. In SA femur multivariate F3+F4+F5 has the poorest accuracy rate. The univariate T8 and multivariate T3+T7 in Inden tibia are the best performing with 83.6% and in Lübeck tibia & Lübeck SA, T3+T7 performs really poor with 64.7% and 71.6% respectively. In Inden series when femur and tibia are combined, the result with 67 individuals is not promising, on the other hand with in Lübeck with 15 individuals it calculates as 86.7% accuracy rate.

Interestingly in SA series, with 156 individuals the accuracy rate for femur and tibia appear to be around 80%. Humerus, radius, and ulna in Inden have seemingly better performing results for multivariate DFs but for Lübeck series the accuracy rate decreases. In SA series only, radius performs better among three arm skeletal elements. The accuracy rates for univariate circumference measurements in arms long bones appear to have performed for ulna better than Radius and humerus. In Lübeck individual circumferences for arm bones, humerus performs the best. In SA humerus univariate circumference DF even achieves 80% over the lesser performing radius and ulna. Although humerus does not perform extremely well for Lübeck but the multivariate DF on long bones circumferences performs in Lübeck better than Inden and SA.

Table 44 The total number of individuals for Crania, Mandible, Os coxae, Humerus, Radius, Ulna, Femur, and Tibia with discriminant functions applied and indifferent (ambiguous) and incorrectly identified results as well as the accuracy rates for correctly identified in the ***Lübeck*** *series*

Discriminant functions	Individuals considered with known sex	Match	No match	Raw accuracy (%)	Indifferent	Without indifferent	Match	No match	Accuracy (%)
Calvarium - Metrical									
CL1+CF1+CL4+CL6+CF4+CF5	38.0	28.0	3.0	**73.7**	0.0	na	na	na	na
CB1	41.0	21.0	12.0	51.2	14.0	27.0	21.0	6.0	77.8
CF1	40.0	20.0	11.0	50.0	15.0	25.0	20.0	5.0	80.0

Discriminant functions	Individuals considered with known sex	Match	No match	Raw accuracy (%)	Indifferent	Without indifferent	Match	No match	Accuracy (%)
CB2	42.0	21.0	21.0	50.0	17.0	25.0	21.0	4.0	84.0
Mandible - Metrical									
M1+M2+M3+M4+M5	21.0	17.0	2.0	**81.0**	0.0	na	na	na	na
Pelvis - Metrical									
P3+P4	49.0	38.0	11.0	**77.6**	0.0	na	na	na	na
P2	49.0	36.0	13.0	73.5	0.0	na	na	na	na
P1+P2	36.0	26.0	10.0	72.2	0.0	na	na	na	na
P6	54.0	38.0	16.0	70.4	0.0	na	na	na	na
P5+P7 (greeks)	53.0	35.0	18.0	66.0	0.0	na	na	na	na
P1+P8	37.0	23.0	14.0	62.2	0.0	na	na	na	na
P5+P7	53.0	25.0	28.0	47.2	0.0	na	na	na	na
P1+P2+P3+P7+P8+P9	34.0	7.0	27.0	20.6	0.0	na	na	na	na
Femur - Metrical									
F5	23.0	20.0	3.0	**87.0**	0.0	na	na	na	na
F6	21.0	18.0	3.0	85.7	0.0	na	na	na	na
F7	21.0	18.0	3.0	85.7	0.0	na	na	na	na
F3+F4+F5	20.0	17.0	3.0	85.0	0.0	na	na	na	na
F3+F7	21.0	17.0	4.0	81.0	0.0	na	na	na	na
F4	24.0	19.0	5.0	79.2	0.0	na	na	na	na
F3	32.0	24.0	8.0	75.0	0.0	na	na	na	na
F1	52.0	33.0	19.0	63.5	0.0	na	na	na	na
F2	41.0	25.0	16.0	61.0	0.0	na	na	na	na
Tibia - Metrical									
T10	19.0	16.0	3.0	**84.2**	0.0	na	na	na	na
T1	30.0	23.0	7.0	76.7	0.0	na	na	na	na
T8	17.0	13.0	4.0	76.5	0.0	na	na	na	na
T3	20.0	15.0	5.0	75.0	0.0	na	na	na	na
T12	14.0	10.0	4.0	71.4	0.0	na	na	na	na
T11	15.0	10.0	5.0	66.7	0.0	na	na	na	na
T7	20.0	13.0	7.0	65.0	0.0	na	na	na	na
T9	20.0	13.0	7.0	65.0	0.0	na	na	na	na
T3+T7	17.0	11.0	6.0	64.7	0.0	na	na	na	na
T3+T4+T5+T6+T7	17.0	9.0	8.0	52.9	0.0	na	na	na	na
T9*T10	19.0	9.0	10.0	47.4	0.0	na	na	na	na
T11*T12	14.0	6.0	8.0	42.9	0.0	na	na	na	na
Tibia and Femur - Metrical									
F3+F4+F5+T4+T6+T2+T7	15.0	13.0	2.0	**86.7**	0.0	na	na	na	na
Humerus - Metrical									
H4	48.0	34.0	14.0	**70.8**	0.0	na	na	na	na
H1+H2+H3	38.0	24.0	14.0	63.2	0.0	na	na	na	na
Radius - Metrical									
R1+R2+R3	39.0	28.0	11.0	**71.8**	0.0	na	na	na	na
R4	46.0	27.0	19.0	58.7	0.0	na	na	na	na
Ulna - Metrical									

Discriminant functions	Individuals considered with known sex	Match	No match	Raw accuracy (%)	Indifferent	Without indifferent	Match	No match	Accuracy (%)
U4	47.0	26.0	21.0	**55.3**	0.0	na	na	na	na
U1+U2+U3	41.0	22.0	19.0	53.7	0.0	na	na	na	na
Tibia, Femur, Humerus, Radius - Circumferences									
H4+R4+F8+T1	23.0	18.0	5.0	**78.3**	0.0	na	na	na	na

Note. The cells inside orange lines are part of raw accuracy calculation with indifferent individuals and the ones within green lines are for accuracy without indifferent ambiguous individuals; na – not available.

Table 45 The total number of individuals for Crania, Mandible, Os coxae, Humerus, Radius, Ulna, Femur, and Tibia with discriminant functions applied and indifferent (ambiguous) and incorrectly indentified results as well as the accuracy rates for correctly identified in the ***South Africa*** *series*

Discriminant functions	Individuals considered with known sex	Match	No match	Raw accuracy (%)	Indifferent	Without indifferent	Match	No match	Accuracy (%)
Calvarium - Metrical									
CL1+CF1+CL4+CL6+CF4+CF5	159.0	106.0	53.0	**66.7**	0.0	na	na	na	na
CB1	159.0	69.0	82.0	48.4	58.0	101.0	69.0	32.0	68.3
CF1	159.0	76.0	89.0	44.0	70.0	89.0	76.0	13.0	**85.4**
CB2	159.0	4.0	91.0	42.8	135.0	24.0	4.0	20.0	16.7
Mandible - Metrical									
M1+M2+M3+M4+M5	158.0	63.0	95.0	**39.9**	0.0	na	na	na	na
Pelvis - Metrical									
P6	154.0	124.0	30.0	80.5	0.0	na	na	na	na
P1+P2	154.0	120.0	34.0	77.9	0.0	na	na	na	na
P5+P7	154.0	117.0	37.0	76.0	0.0	na	na	na	na
P5+P7 (greeks)	154.0	108.0	46.0	70.1	0.0	na	na	na	na
P2	154.0	97.0	57.0	63.0	0.0	na	na	na	na
P3+P4	154.0	90.0	64.0	61.0	0.0	na	na	na	na
P1+P8	154.0	74.0	80.0	48.1	0.0	na	na	na	na
P2+P8+P7+P9+P1+P3	154.0	140.0	19.0	**90.9**	0.0	na	na	na	na
Femur - Metrical									
F2	155.0	119.0	36.0	**76.8**	0.0	na	na	na	na
F1	155.0	114.0	41.0	73.6	7.0	148.0	114.0	34.0	77.0
F4	155.0	88.0	67.0	56.8	0.0	na	na	na	na
F7	155.0	88.0	68.0	56.1	0.0	na	na	na	na
F5	155.0	84.0	72.0	53.6	0.0	na	na	na	na
F3+F7	155.0	81.0	74.0	52.3	0.0	na	na	na	na
F6	155.0	78.0	77.0	50.3	0.0	na	na	na	na
F3	155.0	66.0	89.0	42.6	0.0	na	na	na	na
F3+F4+F5	155.0	60.0	95.0	38.7	0.0	na	na	na	na
Tibia - Metrical									
T8	155.0	123.0	33.0	**78.7**	0.0	na	na	na	na
T1	155.0	120.0	35.0	77.4	0.0	na	na	na	na
T10	155.0	120.0	35.0	77.4	0.0	na	na	na	na

Discriminant functions	Individuals considered with known sex	Match	No match	Raw accuracy (%)	Indifferent	Without indifferent	Match	No match	Accuracy (%)
T11	155.0	119.0	36.0	76.8	0.0	na	na	na	na
T3	155.0	119.0	37.0	76.1	0.0	na	na	na	na
T12	155.0	119.0	37.0	76.1	0.0	na	na	na	na
T3+T7	155.0	112.0	44.0	71.6	0.0	na	na	na	na
T9	155.0	110.0	45.0	71.0	0.0	na	na	na	na
T7	155.0	101.0	55.0	64.5	0.0	na	na	na	na
T11*T12	155.0	97.0	58.0	62.6	1.0	154.0	97.0	57.0	63.0
T9*T10	155.0	95.0	60.0	61.3	0.0	na	na	na	na
T3+T4+T5+T6+T7	155.0	70.0	87.0	43.9	0.0	na	na	na	na
Tibia and Femur - Metrical									
F3+F4+F5+T4+T6+T2+T7	156.0	124.0	32.0	**79.5**	0.0	na	na	na	na
Humerus - Metrical									
H1+H2+H3	154.0	109.0	60.0	61.0	0.0	na	na	na	na
H4	157.0	117.0	40.0	**74.5**	0.0	na	na	na	na
Radius - Metrical									
R1+R2+R3	155.0	124.0	31.0	**80.0**	0.0	na	na	na	na
R4	155.0	108.0	47.0	69.7	0.0	na	na	na	na
Ulna - Metrical									
U1+U2+U3	153.0	115.0	58.0	**62.1**	0.0	na	na	na	na
U4	153.0	83.0	70.0	54.3	0.0	na	na	na	na
Tibia, Femur, Humerus, Radius - Circumferences									
H4+R4+F8+T1	152.0	115.0	37.0	**75.7**	0.0	na	na	na	na

Note. The cells inside orange lines are part of raw accuracy calculation with indifferent individuals and the ones within green lines are for accuracy without indifferent ambiguous individuals; na – not available.

For all the metrical DFs applied on sex known individuals, the accuracy rates have been distributed based on sex and population in Table 47. In Inden series accuracy rates for DFs appear to be better performing among male individuals. The multivariate DF in particular has a similar result for both male and female but in Lübeck series it performs extremely well for females with 96.15% and just 25% accurate among males. This has been exactly the case for SA series as well, with respect to CL1+CF1+CL4+CL6+CF4+CF5, females securing 85.48% and male individuals perform far less. The mandible in female samples for all the three groups performs unbelievably different. They secure 100% accuracy rate which is far from the sex combined accuracy rates for Inden (42%), Lübeck (81%) SA (39.6%). The multivariate DF P1+P2+P3+P7+P8+P9 performs better for Inden and SA males than Inden and SA females. P1+P2 perform unanimously similar in males for three series and P1+P8 observe 90% accuracy rate in all three series for females but not for males.

Table 46 Accuracy rates for individual discriminant functions in males and females separately

Population groups (→)	Inden				Lübeck				South Africa			
Discriminant functions (↓)	Male Match	Male Accuracy (%)	Female Match	Female Accuracy (%)	Male Match	Male Accuracy (%)	Female Match	Female Accuracy (%)	Male Match	Male Accuracy (%)	Female Match	Female Accuracy (%)
Crania - Metrical												
CF1	15	75.00	11	**78.57**	1	8.33	19	67.86	57	**58.76**	19	30.65
CL1+CF1+CL4+CL6+CF4+CF5	21	77.78	12	75.00	3	**25.00**	25	**96.15**	53	54.64	53	**85.48**
CB2	15	**78.95**	5	41.67	2	16.67	19	63.33	2	2.06	2	3.23
CB1	11	73.33	4	36.36	2	16.67	19	65.52	28	28.87	41	66.13
Mandible - Metrical												
M1+M2+M3+M4+M5	0	0.00	23	**100.00**	0	0.00	17	**100.00**	1	1.04	62	**100.00**
Pelvis - Metrical												
P1+P2+P3+P7+P8+P9	22	**100.00**	12	**92.31**	6	46.15	1	4.76	94	**97.92**	46	79.31
P1+P2	22	**100.00**	7	53.85	13	**86.67**	13	61.90	93	96.88	27	46.55
P3+P4	17	73.91	10	76.92	11	64.71	27	84.38	34	35.42	56	96.55
P2	21	91.30	9	69.23	12	63.16	24	80.00	39	40.63	58	**100.00**
P6	22	95.65	3	23.08	12	60.00	26	76.47	80	83.33	44	75.86
P5+P7	18	78.26	7	53.85	10	52.63	15	44.12	79	82.29	38	65.52
P1+P8	10	45.45	12	**92.31**	1	6.67	22	**100.00**	21	21.88	53	91.38
P5+P7 (greeks)	8	34.78	12	**92.31**	7	36.84	28	82.35	69	71.88	39	67.24
Femur - Metrical												
F6	29	76.30	32	84.20	0	0.00	18	**100.00**	18	18.95	60	**100.00**
F7	27	71.10	31	81.60	0	0.00	18	**100.00**	28	29.47	60	**100.00**
F3+F4+F5	25	65.80	33	86.80	0	0.00	17	**100.00**	1	1.05	59	98.33
F5	26	68.40	31	81.60	2	40.00	18	**100.00**	24	25.26	60	**100.00**
F3+F7	25	65.80	30	78.90	0	0.00	17	94.44	23	24.21	58	96.67
F4	17	44.70	34	**89.50**	1	16.67	18	**100.00**	28	29.47	60	**100.00**
F2	18	47.40	32	84.20	4	26.67	21	80.77	67	70.53	52	86.67
F3	8	21.10	34	**89.50**	4	36.36	20	95.24	8	8.42	58	96.67
F1	35	**92.10**	7	18.40	14	**77.78**	19	55.88	79	**83.16**	35	58.33
Tibia - Metrical												
T8	28	77.80	33	89.20	5	62.50	8	88.89	63	66.32	60	98.36
T3+T7	29	80.60	32	86.50	4	50.00	7	77.78	51	53.68	61	**100.00**
T11	34	94.40	26	70.30	5	83.33	5	55.56	74	77.89	45	73.77
T3	24	66.70	36	97.30	4	44.44	11	**100.00**	58	61.05	61	**100.00**
T10	28	77.80	30	81.10	7	77.78	9	90.00	75	78.95	45	73.77
T1	33	91.70	22	59.50	7	58.33	16	88.89	78	82.11	42	68.85
T7	32	88.90	23	62.20	4	44.44	9	81.82	40	42.11	61	**100.00**
T3+T4+T5+T6+T7	16	44.40	36	97.30	1	12.50	8	88.89	11	11.58	59	96.72
T9	36	**100.00**	25	67.60	9	**100.00**	4	36.36	88	92.63	22	36.07
T12	31	86.10	14	37.80	6	**100.00**	4	50.00	79	83.16	40	65.57
T9*T10	36	100.00	1	2.70	9	**100.00**	0	0.00	95	**100.00**	0	0.00
T11*T12	36	100.00	0	0.00	6	**100.00**	0	0.00	94	98.95	3	4.92
Tibia and Femur - Metrical												
F3+F4+F5+T4+T6+T2+T7	16	48.48	25	73.53	6	**85.71**	7	**87.50**	69	72.63	55	**93.22**
Humerus - Metrical												
H1+H2+H3	35	**100.00**	21	**60.00**	11	**91.67**	13	50.00	50	53.19	59	**98.33**
H4	46	86.79	15	36.59	13	81.25	21	**65.63**	75	**79.79**	42	68.85
Radius - Metrical												
R1+R2+R3	35	92.11	15	**60.00**	11	**78.57**	17	**68.00**	87	**91.58**	37	61.67
R4	47	**97.92**	15	40.54	9	60.00	18	58.06	58	61.05	50	83.33
Ulna - Metrical												
U1+U2+U3	35	**92.11**	16	55.17	12	**92.31**	10	35.71	91	**97.85**	24	40.00
U4	44	89.80	20	**55.56**	19	59.38	7	**46.67**	32	34.41	51	**85.00**
Tibia, Femur, Humerus, Radius - Circumferences												
H4+R4+F8+T1	30	**100.00**	11	39.29	7	77.78	11	78.57	80	**86.96**	35	58.33

Among femur DFs, both univariate and multivariate functions work better for females in Inden series except F1, which has 92.1% accuracy rate for males and females only 18.4%. All those DFs also achieve high accuracy in Lübeck and SA series except for F1 like it was in Inden series. For tibia DFs some univariate functions achieve higher accuracy rates for males than females and some have lower accuracy for males. Some multivariate DFs also achieve higher accuracy for males, and some have higher accuracy for females. One consistent thing in all the series is, that T9*T10 and T11*T12, they have near about 100% accuracy rate for males and near zero accuracy for females. The measurements from both femur and tibia combined, work for Lübeck and SA quite well but not for Inden series. Humerus multivariate DF accuracy for males overpowers female sample in Inden and Lübeck both but works better for females in SA. Radius and ulna multivariate DFs on the other hand, perform better for males in all the three series. The univariate circumference DF for humerus performs better for males in all three series, and for radius and ulna the univariate DFs perform better for males in only Inden and Lübeck and in SA series females accomplish far better accuracy rate.

4.3 Objective 3: Results for Interobserver Error for Data from Metrical Methods

By comparing the recorded measurement data of the first and second observers (Behlert, 2021; Schott, 2021) for the different measurements of an individual, the inter-observer error could be calculated by determining the TEM. The tables with the exact measured values are presented in the appendix section.

4.3.1 Group Statistics: Descriptive and Inferential Statistics between Two Observers

Statistical data analysis and the paired-samples *t*-test were used to test whether the deviations between the measurement results of the two observers in Table 47 and Table 48 were significant. These tables highlight the sample size (N), mean, standard deviation (SD), standard error of mean (SE), *t*-value, degree of freedom and the p value (Sig. 2-tailed). In Crania, the measurements CB2, CF4, and CL6 do not show a significant difference between the mean values obtained from two observers but the rest of the measurements have a significant difference. Among pelvic measurements, except P1, P8 and P9 rest of the measurements have a significant p value (<0.05). Among long bones the significant difference appears for measurements – Humerus (H2, H3), Radius (R2, R3), Ulna (U3), femur (F5, F6), and Tibia (T7, T8, T10, T11). Although most of the tibia measurements have a significant difference but looking at the low SE values of tibia measurements, it can be said that the sample mean values for both observers 1 and 2 are close to the population mean.

Table 47 Descriptive statistics on cranial and pelvic measurements collected by two different observers for the same individuals of Inden series

Bones	Measurements and observers		N	Mean (cm)	Std. Dev. (cm)	Std. Error Mean (cm)	t	df	Sig. (2-tailed)
Crania	CB2	1	44	11.23	1.46	0.22	0.82	43.00	0.42
		2	44	11.38	0.59	0.09			
	CF1	1	40	12.54	0.87	0.14	8.57	39.00	0.00
		2	40	13.22	0.82	0.13			
	CF4	1	44	5.52	0.67	0.10	-2.30	43.00	0.03
		2	44	5.29	0.39	0.06			
	CF5	1	43	2.52	0.20	0.03	-7.94	42.00	0.00
		2	43	2.41	0.18	0.03			
	CL1	1	44	18.29	0.83	0.13	4.58	43.00	0.00
		2	44	18.42	0.83	0.13			
	CL4	1	44	9.84	0.56	0.09	3.00	43.00	0.00
		2	44	9.93	0.52	0.08			
	CL6	1	44	12.93	0.54	0.08	0.89	43.00	0.38
		2	44	12.96	0.49	0.07			
Pelvis	P1	1	33	9.78	0.65	0.11	-1.65	32.00	0.11
		2	33	9.63	0.68	0.12			
	P2	1	39	10.96	0.77	0.12	3.45	38.00	0.00
		2	39	11.09	0.78	0.12			
	P3	1	39	21.14	1.34	0.22	2.86	38.00	0.01
		2	39	21.39	1.17	0.19			
	P4	1	35	15.97	0.68	0.11	7.84	34.00	0.00
		2	35	16.25	0.70	0.12			
	P7	1	40	5.46	0.86	0.14	-7.79	39.00	0.00
		2	40	4.67	0.50	0.08			
	P8	1	38	2.71	0.71	0.12	-1.70	37.00	0.10
		2	38	2.58	0.44	0.07			
	P9	1	33	4.29	0.43	0.08	1.05	32.00	0.30
		2	33	4.32	0.49	0.09			

Note. The data of second observer for crania and pelves has been taken from Behlert (2021)

Table 48 Descriptive statistics on Humerus, Radius, Ulna, Femur and Tibia measurements collected by two different observers for the same individuals of Inden series

Bones	Measurements and observers		N	Mean (cm)	Std. Dev. (cm)	Std. Error Mean (cm)	t	df	Sig. (2-tailed)
Humerus	H1	1	53	31.29	2.42	0.33	0.67	52.00	0.50
		2	53	31.11	2.40	0.33			
	H2	1	53	4.62	0.48	0.07	4.28	52.00	0.00
		2	53	4.34	0.42	0.06			
	H3	1	53	6.03	0.50	0.07	2.30	52.00	0.03
		2	53	5.90	0.59	0.08			
Radius	R1	1	49	23.24	1.67	0.24	0.92	48.00	0.36
		2	49	23.17	1.72	0.25			
	R2	1	49	2.24	0.34	0.05	2.26	48.00	0.03
		2	49	2.15	0.24	0.03			
	R3	1	49	3.15	0.38	0.05	-3.06	48.00	0.00
		2	49	3.32	0.40	0.06			
Ulna	U1	1	53	24.76	1.95	0.27	0.096	52.00	0.92
		2	53	24.75	1.94	0.27			
	U2	1	53	2.73	0.51	0.07	-1.52	52.00	0.14
		2	53	2.81	0.30	0.04			
	U3	1	53	1.80	0.24	0.03	-20.51	52.00	0.00
		2	53	2.77	0.34	0.05			
Femur	F3	1	58	2.80	0.26	0.03	-1.99	57.00	0.05
		2	58	2.82	0.26	0.03			
	F5	1	58	4.56	0.38	0.05	-2.35	57.00	0.02
		2	58	4.60	0.38	0.05			
	F6	1	58	4.54	0.38	0.05	2.08	57.00	0.04
		2	58	4.50	0.36	0.05			
	F7	1	58	14.42	1.32	0.17	-1.79	57.00	0.08
		2	58	14.61	1.17	0.15			
Tibia	T3	1	58	7.24	0.54	0.07	-1.88	57.00	0.07
		2	58	7.30	0.55	0.07			
	T7	1	58	4.89	0.49	0.06	-4.96	57.00	0.00
		2	58	5.08	0.45	0.06			
	T8	1	58	7.26	0.54	0.07	2.57	57.00	0.01
		2	58	7.22	0.55	0.07			
	T10	1	58	4.66	0.39	0.05	3.47	57.00	0.00
		2	58	4.58	0.44	0.06			
	T11	1	58	4.14	0.41	0.05	5.70	57.00	0.00
		2	58	3.99	0.41	0.05			

Note. The data for second observer for long bones has been taken from Schott (2021)

4.3.2 Rate of Interobserver Error

By comparing the recorded measurement data of the first and second observers for the different measurements of particular individuals, the inter-observer error could be calculated by determining the TEM (Technical Error of Measurement). The sample size for the individual measurement can be found in Table 47 and Table 48. The tables with the exact measured values are presented in the appendix section. The resulting TEM values for the measurements on crania and pelvis are shown in Table 49 and on long bones in Table 50

In the presented tables above the relative TEM values for Crania stand to be below the 10% limit. The variability between the measurements of the observers is thus acceptable for all measurement sections. The smallest inter-observer error is found in measurement section CL1. The largest error is found in the measurement section CF4. The TEM values of the pelvic measurements P7 and P8 are above the 10% limit. The largest inter-observer errors are therefore in measurement sections P7 and P8. The smallest error is shown by the measurement section P4. Among long bones humerus, radius, ulna, femur, and tibia only ulna measurements U2 and U2 appear to have TEM above 10%.

Table 49 Results for interobserver error calculated from cranial and pelvic measurements

Bones	Measurements	Minimum difference (mm)	Maximum difference (mm)	Average difference (mm)	Relative TEM-value (%)
Crania	**CF1**	0.50	16.00	6.90	**4.66**
	CF4	0.00	20.00	3.30	**9.07**
	CF5	0.00	3.00	1.20	**4.02**
	CB2	0.00	19.50	2.20	**2.52**
	CL1	0.00	8.00	1.40	**0.83**
	CL4	0.00	11.00	1.10	**1.46**
	CL6	0.00	11.00	0.80	**1.06**
Pelvis	**P1**	0.00	23.00	3.40	**4.11**
	P2	0.00	6.00	2.00	**1.63**
	P3	0.00	18.00	3.40	**1.96**
	P4	0.00	7.00	2.90	**1.50**
	P7	0.00	24.00	8.00	**14.01**
	P8	0.00	9.50	3.70	**12.34**
	P9	0.00	8.50	2.00	**4.31**

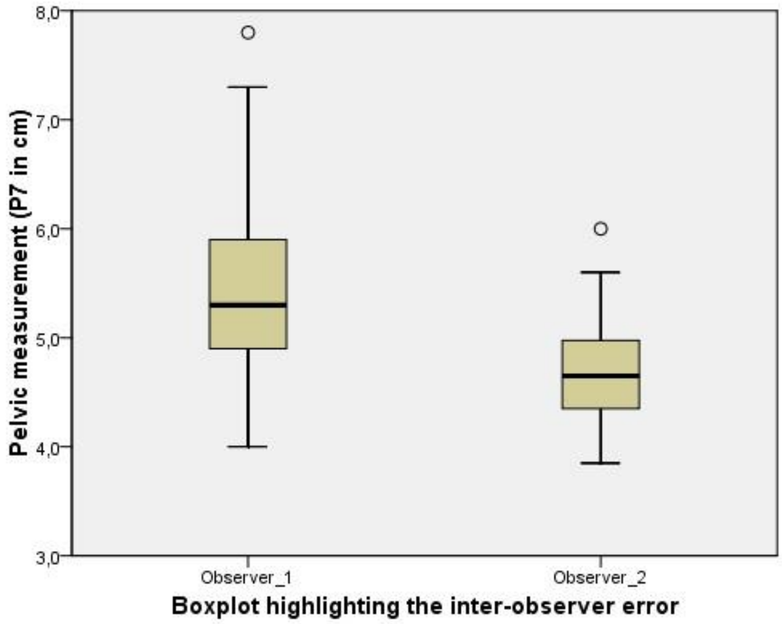


*Figure 21 Box plot highlighting the inter-observer error for the pelvic measurements - **Greater Sciatic Notch Breadth (P7)** which has the highest absolute TEM among all the studied cranial and pelvic measurements*

Table 50 Results for interobserver error calculated from Humerus, Radius, Ulna, Femur and Tibia measurements

Bones	Measurements	Minimum difference (mm)	Maximum difference (mm)	Average difference (mm)	Relative TEM-value (%)
Humerus	**H1**	-1.00	62.00	3.65	**4.30**
	H2	-12.00	14.00	2.89	**8.93**
	H3	-1.00	22.00	1.27	**4.98**
Radius	**R1**	-7.00	39.00	0.76	**1.74**
	R2	-3.00	12.00	0.96	**9.94**
	R3	-20.00	6.00	-1.77	**9.56**
Ulna	**U1**	-26.50	36.50	0.08	**1.82**
	U2	-9.00	9.00	-0.86	**10.65**
	U3	-15.00	-1.00	-9.73	**10.11**
Femur	**F3**	-5.00	2.00	-0.23	**2.30**
	F5	-5.50	6.00	-0.41	**2.15**
	F6	-6.00	4.00	0.37	**2.19**
	F7	-42.00	37.00	-1.83	**3.87**
Tibia	**T3**	-4.50	10.00	-0.57	**2.29**
	T7	-10.00	4.00	-1.95	**5.03**
	T8	-2.00	5.00	0.44	**1.33**
	T10	-7.00	8.00	0.84	**3.09**
	T11	-1.00	8.00	1.53	**4.43**

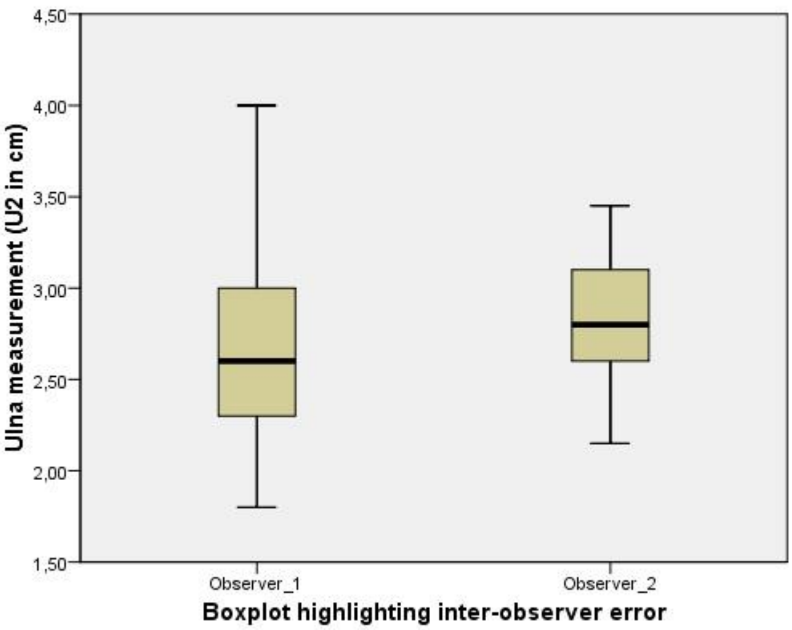


*Figure 22 Box plot highlighting the inter-observer error for the ulnar measurements – **Maximum Ulnar Proximal Width (U2)** which has the highest absolute TEM among the studied long bone measurements.*

Boxplots highlight the distribution of data for both observers. As shown in Table 49 measurement P7 has the highest relative TEM% value which corresponds well with the boxplot. TEM% value reflects the high standard deviation difference between both observers. There are not many outliers, both observers tend to have one outlier which is not far from the maximum range. Since the outlier does not signify an extreme value, it can be said that the measurement for the individual is juts bigger in length or breadth. High TEM% value of U2 (10.65%) resonates with the boxplot illustration of data distribution, although both the observers do not obtain any outliers, but the rate of inter-observer error appears to be high.

4.4 Objective 4: Accuracy Rates Based on Newly Derived Discriminant Functions from the Collected Data on Inden Series Using the Same Set of Measurements as Used for Discriminant Functions in Objective 2

The measurements used in objective 2 have been taken from the literature which made the basis of this dissertation. The discriminant functions associated to those measurements have been derived from data of different population group origins. The objectives 1 and 2 have made their way to understand how accurate and reliable they are, when applied on different population groups. In order to shorten this gap and understand better how classification rates improve or deteriorate, new discriminant functions have been created using the collected data on Inden skeletal series and applied on Lübeck and South African series. The majority of the functions in this study are based on European heritage populations, such as those from the Netherlands, Portugal, Spain, Germany, Greece, and American whites, with a few functions based on American and South African blacks. As a result, this key factor was taken into account while selecting the series from which to generate new discriminant functions.

4.4.1 Discriminant Functions and Accuracy Rates Based on Femur Measurements

The same set of femur measurements as used in objective 2 have been used for every DF to calculate new unstandardised coefficients, constant values to create a new DF as shown in Table 51. The other important components for a DF are the centroid for male sample, centroid for female sample, sectioning point as the average of male and female centroids, along with male, female, sex combined, and leave one out accuracy rates. The leave-one accuracy cross validation represents the analysis done by leaving data for one individual out of the total sample. Wilks' lambda tells that how well a DF discriminates every data point into sex groups. The smaller Wilks' lambda value shows a better a discriminatory capability for a variable used to perform discriminant function analysis. The higher the value of Eigenvalues and Canonical correlation, the better is the DF for the distinction between groups.

*Table 51 Results based on discriminant analysis based on **Femur** measurements. It highlights the components of a discriminant function and also shows the male, female, combined, cross-validated accuracy rates.*

Femur	F1	F2	F3	F4	F5	F3+F4+F5	F6	F7	F3+F7
F1	0.17								
F2		0.03							
F3			0.41			-0.23			-0.04
F4				0.25		0.25			
F5					0.32	0.13			
F6							0.34		
F7								0.10	0.10
F8									
Constant	-14.95	-11.46	-11.61	-19.10	-14.77	-18.26	-15.57	-13.87	-13.32
Centroid male	0.43	0.24	0.30	0.86	0.71	0.97	0.78	0.74	0.74
Centroid female	-0.46	-0.26	-0.31	-0.91	-0.75	-1.02	-0.82	-0.77	-0.78
Sectioning point	-0.01	-0.01	-0.01	-0.02	-0.02	-0.03	-0.02	-0.02	-0.02
Male accuracy (%)	61.50	79.50	71.80	79.50	84.60	84.60	**87.20**	**87.20**	**87.20**
Female accuracy (%)	70.30	54.10	51.40	83.80	86.50	83.80	**89.20**	86.50	83.80
Combined accuracy (%)	65.80	67.10	61.80	81.60	85.50	84.20	**88.20**	86.80	85.50
Leave one out acc. (%)	65.80	67.10	61.80	81.60	85.50	82.90	**88.20**	86.80	85.50

Femur	F1	F2	F3	F4	F5	F3+F4+F5	F6	F7	F3+F7
Wilks' lambda	0.83	0.94	0.91	0.55	0.65	0.50	0.60	0.63	0.63
Eigenvalues	0.20	0.06	0.10	0.81	0.55	1.02	0.66	0.58	0.59
Can. Correlation	0.41	0.24	0.30	0.67	0.60	0.71	0.63	0.61	0.61

Note. The values in **bold** represent the highest accuracy.

4.4.2 Discriminant Functions and Accuracy Rates Based on Tibia Measurements

The same set of tibia measurements as used in objective 2 have been used for every DF to calculate new unstandardised coefficients, constant values to create a new DF as shown in Table 52. The table highlights the centroid for male sample, centroid for female sample, sectioning point as the average of male and female centroids, along with male, female, sex combined, and leave one out accuracy rates.

Table 52 Results based on discriminant analysis based on ***Tibia*** *measurements. It highlights the components of a discriminant function and also shows the male, female, combined, cross-validated accuracy rates.*

Tibia	T1	T3	T7	T3+T7	T3+T4+T5+T6+T7	T8	T9	T10	T9*T10	T11	T12	T11*T12
T1	0.16											
T3		0.29		0.25	0.28							
T4					-0.01							
T5					-0.04							
T6					-0.04							
T7			0.28	0.06	0.09							
T8						0.30						
T9							0.40		0.22			
T10								0.30	0.21			
T11										0.38		0.26
T12											0.45	0.21
Constant	-14.55	-20.96	-13.62	-21.41	-19.99	-21.37	-13.86	-13.55	-17.30	-15.69	-15.66	-18.08
Centroid male	-0.70	1.19	0.77	1.21	1.25	1.17	0.67	0.78	0.93	0.96	0.84	1.05
Centroid female	0.68	-1.22	-0.79	-1.25	-1.29	-1.20	-0.69	-0.81	-0.96	-0.98	-0.86	-1.08
Sectioning point	-0.01	-0.02	-0.01	-0.02	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Male acc. (%)	81.10	**89.20**	81.10	86.50	86.50	78.40	78.40	78.40	78.40	81.10	86.50	83.80
Female acc. (%)	77.80	83.30	72.20	83.30	86.10	**88.90**	80.60	83.30	86.10	80.60	80.60	**88.90**
Combined acc. (%)	79.50	**86.30**	76.70	84.90	86.30	83.60	79.50	80.80	82.20	80.80	83.60	**86.30**
Leave one out acc. (%)	79.50	**86.30**	76.70	82.20	82.20	83.60	79.50	80.80	82.20	80.80	83.60	**86.30**
Wilks' lambda	0.67	0.40	0.61	0.39	0.38	0.41	0.68	0.61	0.52	0.51	0.57	0.46

Tibia	T1	T3	T7	T3+T7	T3+T4+T5+T6+T7	T8	T9	T10	T9*T10	T11	T12	T11*T12
Eigenvalues	0.48	1.49	0.63	1.56	1.65	1.45	0.48	0.65	0.91	0.97	0.74	1.16
Can. Correlation	0.57	0.77	0.62	0.78	0.79	0.77	0.57	0.63	0.69	0.70	0.65	0.73

Note. The values in **bold** represent the highest accuracy.

4.4.3 Discriminant Functions and Accuracy Rates Based on Femur and Tibia Measurements

The same set of femur and tibia measurements as used in objective 2 have been used for every DF to calculate new unstandardised coefficients, constant values to create a new DF as shown in Table 53. The table below also emphasises the centroid for male sample, centroid for female sample, sectioning point as the average of male and female centroids, along with male, female, sex combined, and leave one out accuracy rates.

*Table 53 Results based on discriminant analysis based on **Femur** and **Tibia** measurements. It highlights the components of a discriminant function and also shows the male, female, combined, cross-validated accuracy rates.*

Femur and Tibia	F3+F4+F5+T4+T6+T2+T7
F3	0.27
F4	0.10
F5	0.11
T2	0.00
T4	-0.02
T6	-0.01
T7	-0.10
Constant	-14.56
Centroid male	0.27
Centroid female	-1.67
Sectioning point	-0.70
Male accuracy (%)	**97.80**
Female accuracy (%)	43.80
Combined acc. (%)	**89.60**
Leave one out acc (%)	**86.80**
Wilks' lambda	0.68
Eigenvalues	0.47
Can. Correlation	0.56

Note. The values in **bold** represent the highest accuracy.

4.4.4 Discriminant Functions and Accuracy Rates Based on Humerus, Radius, Ulna, Femur and Tibia Measurements

The same set of humerus, radius, ulna measurements as used in objective 2 have been used for every DF to calculate new unstandardised coefficients, constant values to create a new DF as shown in Table 54. The table below also focuses the DF based on circumferential measurements from multiple long bones, namely femur, tibia, humerus and ulna, along with the centroid for male sample, centroid for female sample, sectioning point as the average of male and female centroids, along with male, female, sex combined, and leave one out accuracy rates.

*Table 54 Results based on discriminant analysis based on **Femur, Tibia, Humerus, Radius, Ulna** measurements. It highlights the components of a discriminant function and also shows the male, female, combined, cross-validated accuracy rates.*

Humerus	**H1+H2+H3**	**H4**	**Radius**	**R1+R2+R3**	**R4**	**Ulna**	**U1+U2+U3**	**U4**	**Multiple long bones**	**F8+H4+R4+T1**
H1	0.03		R1	0.02		U1	0.00		F8	0.01
H2	0.00		R2	0.23		U2	0.15		H4	0.09
H3	0.16		R3	0.18		U3	0.22		R4	0.06
H4		0.21	R4		0.22	U4		0.33	T1	0.08
Constant	-18.60	-13.19	Constant	-16.28	-11.90	Constant	-9.11	-12.24	Constant	-17.78
Centroid male	0.75	0.54		0.67	0.65		0.44	0.42		-1.29
Centroid female	-0.90	-0.62		-1.05	-1.03		-0.63	-0.59		1.01
Sectioning point	-0.08	-0.04		-0.19	-0.19		-0.09	-0.08		-0.14
Male acc. (%)	**84.60**	70.50		89.70	**92.30**		**87.50**	**87.50**		81.80
Female acc. (%)	**73.40**	71.10		76.90	57.70		**69.00**	55.20		86.80
Combined acc. (%)	**79.40**	70.80		**84.60**	78.50		**79.70**	73.90		84.50
Leave one out acc. (%)	**79.10**	70.80		**81.50**	78.50		**78.30**	73.90		77.30
Wilks' lambda	0.59	0.75		0.58	0.59		0.78	.796		0.47
Eigenvalues	0.69	0.34		0.73	0.69		0.29	0.257		1.11
Can. Correlation	0.64	0.50		0.65	0.64		0.47	0.45		0.73

Note. The values in **bold** represent the highest accuracy.

4.4.5 Discriminant Functions and Accuracy Rates Based on Cranial Measurements

The same set of crania and mandible measurements as used in objective 2 have been used for every DF to calculate new unstandardised coefficients, constant values to create a new DF as shown in Table 55. The table below also emphasises the centroid for male sample, centroid for female sample, sectioning point as the average of male and female centroids, along with male, female, sex combined, and leave one out accuracy rates.

Table 55 Results based on discriminant analysis based on ***Crania*** *and* ***Mandible*** *measurements. It highlights the components of a discriminant function and also shows the male, female, combined, cross-validated accuracy rates.*

Crania	CB1	CB2	CF1	CL1+CF1+ CL4+CL6+ CF4+CF5	Mandible	M1+M2+M 3+M4+M5
CB1	0.36				M1	-0.02
CB2		0.18			M2	0.09
CF1			0.12	0.07	M3	0.18
CF4				0.01	M4	0.06
CF5				0.06	M5	-0.04
CL1				0.07		
CL4				0.01		
CL6				-0.01		
Constant	-8.72	-19.90	-14.83	-24.21	Constant	-14.41
Centroid male	0.06	0.08	0.37	0.45		0.30
Centroid female	-0.10	-0.14	-0.65	-0.75		-0.40
Sectioning point	-0.02	-0.03	-0.14	-0.15		-0.05
Male acc. (%)	**100.00**	**100.00**	82.10	85.20		77.40
Female acc. (%)	0.00	0.00	**68.80**	62.50		47.80
Combined acc. (%)	63.60	63.60	**77.30**	76.70		64.80
Leave one out acc. (%)	61.40	59.10	**77.30**	69.80		50.00
Wilks' lambda	0.99	0.99	0.80	0.74		0.89
Eigenvalues	0.01	0.01	0.25	0.35		0.12
Can. Correlation	0.08	0.10	0.45	0.51		0.33

Note. The values in **bold** represent the highest accuracy.

4.4.6 Discriminant Functions and Accuracy Rates Based on Pelvic Measurements

The same set of pelvic measurements as used in objective 2 have been used for every DF to calculate new unstandardised coefficients, constant values to create a new DF as shown in Table 56. The table below also emphasises the centroid for male sample, centroid for female sample, sectioning point as the average of male and female centroids, along with male, female, sex combined, and leave one out accuracy rates.

*Table 56 Results based on discriminant analysis based on **pelvic** measurements. It highlights the components of a discriminant function and also shows the male, female, combined, cross-validated accuracy rates.*

Pelvis	P1+P8	P2	P1+P2	P3+P4	P5+P7	P6	P1+P2+P3+P7+P8+P9
P1	0.01		-0.11				0.08
P2		0.18	0.22				-0.19
P3				0.10			0.00
P4				-0.07			
P5					-0.12		
P6					0.15	0.28	
P7							0.06
P8	0.20						0.10
P9							0.02
Constant	-6.53	-19.91	-13.80	-9.25	-3.82	-16.08	7.14
Centroid male	-0.78	0.64	0.97	0.46	-0.37	0.58	-1.34
Centroid female	1.32	-1.14	-1.65	-0.82	0.65	-1.03	2.26
Sectioning point	0.27	-0.25	-0.34	-0.18	0.14	-0.22	0.46
Male acc. (%)	91.30	87.00	87.00	**95.70**	87.00	91.30	**95.70**
Female acc. (%)	76.90	69.20	84.60	61.50	38.50	69.20	**92.30**
Combined acc. (%)	86.10	80.60	86.10	83.30	69.40	83.30	**94.40**
Leave one out acc. (%)	86.10	80.60	86.10	83.30	69.40	80.60	**91.70**
Wilks' lambda	0.48	0.56	0.37	0.71	0.80	0.61	0.24
Eigenvalues	1.09	0.78	1.70	0.40	0.26	0.64	3.21
Can. Correlation	0.72	0.66	0.79	0.54	0.45	0.62	0.87

Note. The values in **bold** represent the highest accuracy.

4.4.7 Accuracy Rates Based on New Discriminant Functions Derived from Inden Skeletal Series

The metrical data was collected in according to the chosen measurements and discriminant functions as described in literature in objective 2. The DFs used for all the skeletal elements do not have a common origin in terms of the population groups. The accuracy rates achieved for Inden, Lübeck, and South African (SA) series indicate that the classification and reliability of a particular method varies if applied to other population groups. In this objective it intends to understand this phenomenon with new discriminant functions. So, for every univariate and multivariate DF, exactly the same number of measurement variables has been considered. It applies the direct method using discriminant analysis in SPSS. These DFs from Inden series data has been applied on Lübeck and SA samples. The new accuracy rates have been presented in Table 57.

Table 57 Accuracy rates using the new discriminant functions created from Inden series and applied on Lübeck and SA series

Population groups (→) **Discriminant functions (↓)**	**Inden (%)**	**Lübeck (%)**	**South Africa (%)**
Crania - Metrical			
CF1	**76.7**	54.8	69.8
CL1+CF1+CL4+CL6+CF4+CF5	**76.7**	**64.3**	**71.1**
CB2	65.1	28.6	61.6
CB1	65.1	28.6	61
Mandible - Metrical			
M1+M2+M3+M4+M5	64.8	35.5	**71.3**
Pelvis - Metrical			
P1+P2+P3+P7+P8+P9	**94.4**	**72.2**	**92.2**
P1+P2	86.1	70.4	76
P3+P4	83.3	66.7	75.3
P2	80.6	63	53.9
P6	83.3	66.7	70.8
P5+P7	69.4	50	72.1
P1+P8	86.1	64.8	66.9
Femur - Metrical			
F6	**88**	34.6	59.4
F7	86.7	34.6	64.5
F3+F4+F5	86.7	65.4	63.2
F5	85.3	**82.7**	63.9
F3+F7	86.7	53.8	63.2
F4	81.3	67.3	74.2
F2	66.7	65.4	**74.8**
F3	64	34.6	65.2
F1	65.3	34.6	67.1
Tibia - Metrical			
T8	83.3	73.3	78.8
T3+T7	**86.1**	73.3	**84**
T11	80.6	60	67.9
T3	86.1	76.7	83.3
T10	80.6	63.3	76.9
T1	79.2	**80**	79.5
T7	76.4	53.3	56.4
T3+T4+T5+T6+T7	**86.1**	63.3	80.8
T9	79.2	70	76.9
T12	83.3	60	71.8
T9*T10	81.9	73.3	76.9
T11*T12	**86.1**	56.7	70.5
Tibia and Femur - Metrical			
F3+F4+F5+T4+T6+T2+T7	**88.7**	62.7	76.4
Humerus - Metrical			
H1+H2+H3	82.6	68.8	64.3
H4	**82.9**	67.9	63.9
Radius - Metrical			
R1+R2+R3	**84.4**	73.9	**82.6**
R4	78.5	64	65.8
Ulna - Metrical			
U1+U2+U3	**79.4**	**57.4**	**79.1**
U4	73.9	52.9	54.2
Tibia. Femur. Humerus. Radius - Circumferences			
H4+U4+F8+T1	**84.5**	77.3	69.4

Note. The values in **bold** represent the highest accuracy.

In cranium the DFs deteriorate a lot when it is applied on Lübeck series but with SA it decreases and stay comparably close to Inden accuracy rates. For mandible traits it is interesting to see that Lübeck series performs poorly but SA's accuracy rate turns out to be even higher than Inden series, considering the new DFs have been derived from the data collected on Inden series. The univariate DFs in pelvis shows that they perform the best in Inden, decreases in SA series and Lübeck series has the lowest number of accurate individuals. The multivariate pelvic DF achieves the highest accuracy rate in all three series, with Inden and SA securing above 90%. femur DFs present a similar result with a hierarchy of Inden series being the best performing, then SA and lastly Lübeck series. The univariate femur DFs F1, F2, F3 have an improved accuracy for SA series when compared to Inden accuracy rate values. F5 is the only femur DF which performs better in Inden and Lübeck than in SA. Among tibia DFs T1 is the sole measurement that produces better accuracy rate for Lübeck than Inden and SA series. Other that T1, the rest of the DFs have the same hierarchy of Inden being the best performing, seconded by SA and Lübeck series. None of the femur and tibia DFs achieve accuracy above 88% like it does in the case of tibia and femur combined with DF F3+F4+F5+T4+T6+T2+T7, securing 88.7%. With respect to DFs from arm long bones humerus and radius are better performing than ulna.

Chapter 5

5 Discussion

The discussion uses the same order as it has been presented in the previous chapter, divided based on different objectives. Only papers from the literature that used the same landmarks in collecting measurement data, used comparable discriminant functions to document the accuracy rate for correct classifications, and used the same calculations to determine the inter-observer error were chosen to compare the results of this study with findings from other studies. Most of these studies use modern sample and Inskip et al. (2019) is the only study that uses medieval sample as well.

5.1 Discussion on Objective 1: Results on Morphological Methods

An individual's sex can be estimated using either individual traits or a combination of traits, methods, and skeletal regions. Given the accuracy rates of the examined traits in
Table 11 for all three demographic groups, it can be concluded that sex can be accurately determined provided all pelvic qualities are visible, and that it can perform even better if appropriately sexed in association with skull traits. The accuracy rates of morphological traits in an English skeletal collection are greater for both sexes combined (95.6 percent) if skull and os coxae are assessed jointly, according to Inskip et al. (2019), and it exceeds the assessment of os coxae alone, which only obtained 91.8 percent accuracy. When skeletal elements are analysed by forensic anthropologists, "ideally the pelvis should be assessed first, because its evolutionary predisposition to parturition and absence of ancestral traits lead to greater reliability than is possible from assessing the skull, which should be assessed second" pg.263 (Rowbotham, 2016). For the skeletal series of Inden and South Africa, this statement tends to be truer for the subpubic angle than for the other pelvic features. In all three population groups, the difference in accuracies between males and females is fairly small for arc compose, larger sciatic notch, and iliac crest. The slightly greater accuracy rates in males from Inden and South Africa are comparable to those found by (Đurić et al., 2005). Only males on the Balkan group were examined, and they found over 90% accuracy for arc compose.

The classification done solely based on the skull would be significantly lower if pelvic features were shattered or damaged, as combining both skeletal elements increase the accuracy of sex estimation. In the Inden series, there is a slight difference in male and female accuracies for the subpubic angle (male = 93.9 percent, female = 85 percent), as shown in Table 8. However, when skull traits are assessed independently of pelvic traits, the misclassification rate emerges to be high in Lübeck as well as South African females for most of the skull traits. The difference between males and females in the pelvis is related to reproduction, whereas sexual dimorphism in the crania is more related to body size and shape, which emphasizes muscle definition and robusticity. As a result, it has a greater potential for variation among various populations (Inskip et al., 2019). Inden and Lübeck skeletal collections date from distinct periods, Inden is more contemporary and Lübeck series rather from medieval period. Inskip et al. (2019) report that there can be striking difference in the accuracy rates for cranial features in modern and medieval series, as shown in this study in Table 8 and Table 9. The authors gathered traits from modern collection papers and compared them to the results acquired from a medieval English sample. It revealed a higher degree of sexual dimorphism in the medieval sample. When criteria from modern collections (in this case Inden) are applied to archaeological samples (in this case Lübeck), the present study reveals that independent features may not provide an accurate sex assessment.

The three- or five-point scale or qualitative categories of male, probable male, indifferent/indeterminate, probable female, and female are intended to indicate the obsever's confidence in their sex judgment of either male or female, not to depict the variation in sexual difference (Geller, 2005). Discussing the traditional skeleton sexing Wesp (2017) shares that she as a student was taught to throw out the individuals that cannot be confidently estimated for sex. She stands against this practice and adds from a bioarchaeological standpoint that the premise of considering only confidently sexed individuals could lead to analytic bias and may not adequately depict past populations' sex/gender systems. In the present study when indifferent individuals were eliminated, the skull sex estimates and previously determined sex had a significant agreement and an improved accuracy rate. To reduce the biasness though, both accuracy rates have been presented, with indifferent individuals and without. The Inden series, in particular the skull generally, the glabella-supraorbital ridges, and the margo orbitalis, show a dramatic shift. The disparity between raw and correctly sexed accuracies reveals that there are more ambiguous subjects for skull traits than pelvic traits in Inden, as well as more overlapping than in Lübeck and South Africa. It's because the elements in the Inden skeleton collection, for both males and females, have more robust and pronounced features in general. Another reason could be that males and females develop their traits at different ages. Because masculine traits develop over a long length of time, males who die at younger age may appear feminine. As women get older, they may develop more male like robust features (Buikstra & Ubelaker, 1994).

Specially the atrophy of mandibles in old age could contribute to ambiguity and misclassifications in females from series of Inden, Lübeck, and South Africa. Females of old age group are frequently misclassified as men. The morphology of the mandibular bone changes with age, which may alter sexual dimorphism. Understanding how aging affects mandibular shape changes is crucial for accurately assessing a person's sex and forecasting age-related conformational changes (Mendes et al., 2021). Studying age related changes in mandibular shape and sexual dimorphism Mendes et al. (2021) showed that mandibular changes occur between the age of 50 and 70 years and it is different for male and females. Females show age-related shape changes earlier than males. In this study for Inden, Lübeck, and South Africa sample such mandibles have been included which have lost teeth and have got modified alveolar process. In this view, a larger sample size with more females of various age groups might be beneficial. Males in Inden and South Africa series achieve accuracy above 90% with traits – Gonion and Angle. The reason is that males have broader mandibles and rougher muscle attachment surfaces, especially at the coronoid process and gonion, because they generate higher muscular force during mastication (Bejdová et al., 2013). With advancing age the tooth loss increases (Ozturk et al., 2013), affecting the muscle forces during mastication. This could lead to conformational changes particularly in the areas of gonial and coronoid regions (Mendes et al., 2021). The best performing mandible trait could turn out to be the least sexually dimorphic on individuals of older age.

5.2 Discussion on Objective 2: Descriptive and Inferential Statistics for Metrical Data

The outliers of the respective recorded values might be determined using histograms and boxplots. However, the outliers were kept in the analysis because they are credible outliers whose variances can be attributable to natural variability in individual sizes and variances in features. The outliers' measurement data were close to the outlier limits and did not indicate dramatic variances. Furthermore, because of the 1.5-fold interquartile range, the chosen test for outliers is rather sensitive and already flags smaller deviations as outliers. Many individuals in Pelvic measurements P3 and P4 have clearly been identified as an outlier in Lübeck series in particular. However, it is reasonable to suppose that those individuals with outlier values might be just smaller in size and that the variances are minor.

Based on skewness, kurtosis, Shapiro Wilks' test it can be assumed that a distinct normal distribution is difficult, and the histograms (see Appendix) reveal that most of the measurements data in this study are roughly normally distributed. In order to apply inferential statistic, namely parametric *t*-test, one of the assumptions need to be fulfilled that the data be normally distributed. In general, a t distribution is similar to normal distribution, but could differ based on size of the sample. A sample above 30, the distribution is generally normal (L. Williams & Quave, 2019). The reason for the inconsistency regarding normal distribution, despite the suggested minimum sample size of 30 individuals, can be found in the sample size. Different skeletal elements have different sample sizes in every population group. This makes the data slightly positively and negatively skewed and kurtotic and that falls into the category of non-normal data which could be transformed using logarithmic transformation (Krithikadatta, 2014). Although the measurement sections of the pelvis in Lübeck series contain samples from more than 30 individuals and this results in large samples, the sample size of 175 (P3 & P4) may still be insufficient to reflect a clear normal distribution of the data.

With respect to significant results from t-test it is important to understand that p value less than 0.05, does not always identify with having a significant difference. It is difficult to understand how high is type I and type II error. In this case the statistical power analysis helps to understand the probability that t-test has detected the difference between the groups when they exist, reducing the type II error (false positive) and not achieve type I error (false negative) (Dorey, 2011). Cohen's d acts as the index for Effect Size with small, medium, and large effect on the mean difference (Cohen, 1988). With $d = 0.80$ it highlights that how much influence sex has on the dimorphism among the individuals in Inden and South Africa (SA) series. With high statistical power of 0.80, in order to observe an effect or a significant difference between male and female samples, the sample size used in the experiment is appropriate for most of the measurements in Inden and SA series. Femur in Lübeck series do not have the minimum number of individuals required to see an effect on any of its measurements. Humerus measurements appear to have a small effect ($d = 0.20$) among all the population groups. The overlap between the male and female sample measurement values is high. With higher Cohen's d value (0.80), the overlap between the samples decreases and it infers to having higher standard deviation (Cohen, 1988). Thus, making samples' means stand apart with a certain standard deviation and more sexually dimorphic.

5.3 Discussion on Objective 2: Results Highlighting Accuracy of Discriminant Functions

5.3.1 Cranial Discriminant Functions

CB1: For discriminant function (DF) CB1 the accuracy rate in Inden series performs poorly without indifferent individuals being counted (57.7% accurate) and with indifferent individuals being a part of the calculation it achieves only 34.9%, where males (40%) achieve higher accuracy than females (25%). As many as 17 individuals from the sample of 43 individuals have been classified as indifferent. Depth of intertemporal fossa (CB1) has the critical ratio value of 6 between male and female samples in the study done by Keen (1950) on Cape coloured population. Any value above 2.5 for critical ratio indicates increased sexual dimorphism between male and female skulls. Keen (1950) highlights that with sufficient data on a particular population the classification rate could reach 85%. CB1 emerges in Lübeck series as better performing with 77.8% and in SA series only 68.3%. The fact that males in Lübeck perform poor, is because male crania is not robust built like it does in Inden series. The utility of depth of infratemporal fossa has been proved by Williams & Rogers (2006) where the CB1 was assessed as zygomatic extension. It was applied on William B Bass Donated skeletal collection comprising 50 adult skeletons of European white ancestry. Both the observers in this study could achieve 84% and 82% as sex combined accuracy, with males getting 100% accuracy. CB1 does not appear as a reliable measurement that could be applied on different population groups.

CB2: The accuracy rates in Inden (64.5) and SA (16%) are not satisfactory. For classifying individuals in all the three series the mean values from the study of Steyn & İşcan (1998) was used as the cut-off. The mean values are again based on the measurement taken on South Africa whites. Considering the mean cut-off values for CB2 in Steyn & İşcan (1998), it can be said that the male and female sample are not extremely dimorphic and when the focus is brought to the mean values in Inden, Lübeck, and SA, the mean values between sexes did not differ much either. So expectedly it did not perform well in Inden and SA but somehow in Lübeck it does. Lübeck achieves 84% accuracy but the sample size is too small to comment on the efficacy of this method. Steyn & İşcan (1998) included biasterionic breadth (CB2) in their study but it did not enter the discriminant function. SPSS enters variables in stepwise discriminant analysis based on their dimorphic ability. This makes CB2 unreliable to be used on groups of different origin.

CF1: In this study, the discriminant function of the maximum bizygomatic diameter of the facial part of the skull CF1 had a rate of correct classification of 76.5% in Inden, 73.7% in Lübeck, and SA series as 85.4%. Even though the sex combined accuracy without indifferent individuals for SA is satisfactorily high but looking at the individual sex accuracy of males (58.76%) and females (30.65), the reliability on this method decreases since at least 70 individuals out of 159 individuals in South Africa series have been categorized as indifferent. These 70 individuals fall between the male and female mean values calculated by Keen (1950). The male (55.6%) and female (68.8) accuracies in Inden is comparable to sex combined raw accuracy (60.5%). Thus, it is difficult to say if CF1 can be transferred to a different population group. Neither did it work with small samples of Inden and Lübeck series, not with a moderately bigger sample of 159 individuals from South African series. The zygomatic arch width, along with other parameters, achieved an accuracy of 85 % in Keen's (1950) work. The rate of correct classifications for zygomatic arch width as the sole variable was 80% in a study by Steyn and Işcan (1998). For the measurement section CF1, the difference in mean values between sexes was the greatest of all skull measures in this study for Inden and SA series. This suggests that the trait is dimorphic and, as expected, could have resulted in a higher rate of correct classifications. The lower rate can be explained by the fact that the sample sizes used in Keen's (1950) and Steyn and Işcan's (1998) studies were substantially bigger than the sample used here.

CF1+CF4+CF5+CL1+CL4+CL6: In this multivariate DF there are six measurements, three from frontal part and three of the lateral part of the cranium. Inden achieves the highest accuracy rate of 76.7% followed by Lübeck (73.7%) and SA (66.7). This DF produces 86% of correct classification by Steyn & İşcan (1998). Despite the fact that the DF was created from and used on the South African whites, it is interesting to see that it classifies Lübeck female and SA females with 96.15% and 85.48% respectively. Although the white South African population is made up of originally European immigrants and thus appears to fit the Inden series, the diverse origins of the individuals may have had an impact on the male accuracy rates of Lübeck and SA series. The accuracy of males was marginally higher in the study by Steyn and Işcan (1998). This conclusion is supported by the findings of this study at least for Inden series.

5.3.2 Mandible Discriminant Functions

M1+M2+M3+M4+M5: The multivariate DF on mandible produces only 42.6% in Inden and 39.9% accuracy rate in SA series. In Lübeck it produces accuracy above 80% for 21 individuals only. The reliability of this function is difficult to assess. It classifies female samples in all three series with 100% accuracy but does work for males. In the work of Steyn & İşcan (1998) on South African whites this DF concludes 80% accuracy rate with bigonial breadth (M2) as the most sexually dimorphic. In the present study, based on the mean difference for mandible measurements between male and female samples, bigonial breadth appears to be the most dimorphic in SA series. Still, it does not classify individuals of any of the three population groups with a satisfactory accuracy rate. In Loth's, (1996) work on mandibles with six of the seven variables were selected and it produced 92% accuracy rate on South African black sample from the same Dart collection and the same sample has been included in this study as well. During the middle years of life, Shaw Jr et al. (2010) observed a decrease in mandible length, resulting in identical chin projection in men and women. In older people, Avelar et al. (2017) found that the chin becomes more prominent, oblique, and its height lowers. The investigation of shape variations with age for each sex found that mandible shape changes in females begin around 55 years of age, whereas major conformational differences in males appear at 65 years of age (Mendes et al., 2021). Considering the late onset of changes amongst males and the fact that many individuals in Inden sample had no teeth with modified alveolar ridge, it could be assumed that most of the male individuals were of senescent age and thus the accuracy rate for male individuals in this study is so low. Thus, it is recommended that sample size should exclude individuals which show highly atrophic mandibles or belong to the senescent age group.

5.3.3 Pelvic discriminant functions

P1+P2+P3+P7+P8+P9: The efficacy of multivariate DFs over univariate DFs in crania and mandible sometimes work in a population group and in others not. Several research (Patriquin et al., 2005; Steyn & İşcan, 1998; Steyn & Patriquin, 2009) found that combined measures of the entire pelvis yielded superior results than individual pelvic measurements. The multivariate discriminant function at the pelvis with six variables (P1+P2+P3+P7+P8+P9) had the highest determination accuracy of 97.1%, which is equivalent to literature rates. This rate is higher than that of Patriquin et al. (2005), who developed the discriminant function and attained a 95.5% average rate. Females were accurately identified 98% of the time in their work, compared to 93% of the time for males which is lower than 100% for Inden males. In Lübeck it did not work at all, only 20.6% of the individuals were identified rightly and in SA only 90.9%. The individual sexes in SA have performed comparably good, with males reaching 97.92% and females 79.31% accuracy. This suggest that irrespective of the population origin, European or South African African ancestry, this DF was more reliable for male individuals. The discriminant function was constructed on white South Africans by Patriquin et al. (2005). The majority of the South African white population is of European ancestry, hailing primarily from the Netherlands, France, Germany, the United Kingdom, and Portugal. As a result, the discriminant function works well with the European Inden skeletal series as well. It's worth noting that origin should have less of an impact on the outcomes of pelvic investigations, as it's been discovered that using population-specific discriminant functions isn't always necessary in determining pelvic sex (Steyn & Patriquin, 2009).

<u>Bivariate functions of Pelvis (P1+P2, P1+P8, P3+P4, P5+P7 with Greek sample, P5+P7 without Greek sample)</u>: P1+P2 performs better in Inden (82.9%) than in Lübeck (72.2%) and SA (77.9%) series. Steyn & Patriquin, (2009) achieved a higher rate of accuracy rate of 89.8% in their study when DF was created with P1 and P2 on the combined data sets of South African whites, blacks, and Greeks from Crete. This minimum rate of 89% accuracy was maintained when P1 and P2 was used to create DF for individual population group of South African White, Black, and Greek and cross validated with the same data set. P5 and P7 appear to have low accuracy rates across Inden (41.7%), Lübeck (47.2), SA (70.1%) in this study. It performs similarly poor in the study of Steyn & Patriquin (2009) when SA Blacks, SA Whites, and Greeks are combined (72.4%) or assessed individually despite greater sciatic notch depth (P7) having the lowest Wilks' lambda (0.329) in the DF analysis. The lower Wilks' lambda contributes to the more discriminatory power. The authors argue that when it comes to determining sex, population-specific equations may not be necessary because the size of the pelvis is most likely controlled by the need for birthing. Smaller disparities across groups may be smoothed out by a large sample size, making population-specific norms less relevant. These functions may be particularly beneficial if there is any uncertainty about the population of origin of an unknown skeleton that needs to be studied (Steyn & Patriquin, 2009). The same measurements P5 and P7 were entered in the stepwise DF analysis in the study of Patriquin et al. (2005). The authors created the DF based on South African White and Black population groups only and without the Greek sample in their work. They could achieve just 73% accuracy on white males and females. The similar findings were observed

in the present study when P5+P7 DF without Greek sample was applied, Inden (41.7%), Lübeck (66%), and SA (70.1%). Patriquin et al. (2005) underscore the importance of population specific standards. Although the mean difference between sexes in Inden, Lübeck, SA for the measurement of Greater Sciatic Notch Width has been well quantified with t-test significance in this study but Patriquin et al. (2005) suggest that Greater Sciatic Notch in general may be more suitable to morphological assessment. DF P1+P8 from the work of Patriquin et al. (2005) shows improved accuracy in males (79%) among SA white individuals and more in females (75%) among SA black individuals. It is worth noting that it works far better in female samples of Inden (92.31%), Lübeck (100%), and SA (91.38). For the creation of DF P3+P4, the measurements P3 and P4 do not appear to contribute much to the discriminant function, if their high Wilks' lambda value of above 0.650 is to be taken into account. Their high Wilks' lambda shows that they lack classification discriminatory power. Function 4 created from South African white dimensions (Patriquin et al., 2005), described as P3+P4 in this study, gives about 76-81% for males and females in both white and black populations of South Africa. Their results are comparable to the present study where Inden achieves 75%, Lübeck 77.6%, and SA only 61%. So P3+P4 appears to be better suited for population groups of European ancestry.

<u>Univariate functions of Pelvis (P2 and P6)</u>: The function for P2 manages to identify 83% of Inden, 77.6% of Lübeck, and 63% of SA individuals. Patriquin et al. (2005) arrive at an average accuracy rate of 85-87% for SA whites and 81-87% for SA blacks. They found ischial length as the most dimorphic measurement in their work which stands to be valid in the present study as well. Among the three groups, ischial length appears to be the most dimorphic in Inden series. The authors argue that Ischial length includes acetabulum, which is directly connected with the femoral head size (Patriquin et al., 2005). This ultimately translates the robusticity for males as a factor in differentiating males from females whose childbearing trait demonstrates sexual dimorphism. It appears to be the case in Inden and Lübeck samples as well. The femoral head measurement is the best performing DF among all the femur bone DFs securing 80.5% and 87% accuracy rates for Inden and Lübeck series respectively. While this discussion sheds light on the importance of acetabulum in sexual dimorphism, it is to notice that the Acetabular diameter (P6) itself do not identify Inden (69.4%) and Lübeck (70.4%) individuals with high accuracy. But P6 classifies SA individuals in this study with 80.5% accuracy. Steyn & Patriquin (2009) arrive at the classification rates of 84.1% (White South African), 83.5% (Black South African), and 84.1%

(Crete Greeks) when Acetabular diameter was entered in DF analysis based on individual population group data and an 82.5% accuracy for combined group data sets. A plausible reason for P6 to perform better for SA series (154 individuals) in the present study, could be its big sample size which was small in Inden (male: 23, female: 13) and Lübeck (male: 20, female: 34) series. More study is needed, particularly to evaluate the outcomes when data from other population groups is used for the DF analysis for P6. When a function such as P6, acetabular diameter, is utilized, it is to be expected that groups who are unusually robust or gracile will be less successfully classified, as this solely reflects size differences (Steyn & Patriquin, 2009).

5.3.4 Femur Discriminant Functions

Univariate Femur discriminant functions (F1, F2, F3, F4, F5, F6, F7): Transverse head diameter (F6) is the most accurate discriminant function that produces 80.3% accuracy in Inden series and 85.7% in Lübeck, and only 50.3% in SA series (male: 19%, female: 100% accurate). Considering the anatomical relationship between acetabulum and femoral head, F6 in SA series should have resulted in an equally well accuracy rate like it did for P6. The reason for F6 inefficient accuracy rate in SA series lies in the facts – a) the DF for transverse head diameter has been derived from a German skeletal collection where the reported mean value for males is 48.46mm±2.65; b) the DF for P6 has been adopted from a combined discriminant function analysis performed on South African whites, blacks, and Greeks, where the reported mean value for males is 55mm±3.02. This is why the accuracy for male individuals in SA series is lower in F6 than P6, resulting in low combined accuracy of 50.3% only.

Even though F6 performs well in Inden and Lübeck samples, the accuracies still appear lower than Mall et al.'s (2000) 89.6% on a German collection based in Cologne and Tübingen. F6 turns out of be the most discriminatory measurement when entered in the stepwise discriminant function analysis with Wilks' lambda (0.374) to be the lowest of all (Mall et al., 2000). Mall et al. find the mean differences between sexes to be 0.6 cm (6 mm), similar to 6.7 mm in Inden. It is worth noting that in Lübeck series cranial measurements do not show promising classification rates like the post cranial element does. F6 in Lübeck has a mean difference between sexes is 10.6 mm and F5 has 11.3 mm which makes it the most promising measurement and DF. F5 in Lübeck series secures an 87% accuracy. Mall et al. (2000) report 67.7% accuracy rate for Maximum length (F2) which is similar to the poor accuracies of

Inden (65.8) and Lübeck (61%). SA scores much higher for F2 having 76.8%, makes it the best DF of the series in the present study. The present study concurs the finding that width and circumference add more to the sex differences in American whites (İşcan & Miller-Shaivitz, 1984) and for American blacks length is more important (Steyn & İşcan, 1997). The other univariate DFs in SA series achieve accuracies between 42.6-56.8%. Femoral midshaft circumference (F1) has been reported as a relatively dimorphic measurement, the DF of this measurement identifies 82.9% of individuals of Spanish origin (Safont et al., 2000). It performs poorly in Inden and Lübeck series despite the measurement derived from a European sample, and it identifies 77% of SA series individuals. Even though F1 is the second-best performing DF in SA series, it only identifies males (83.16%) better. Lübeck series being an archaeological sample and having less robust features compared to Inden series, it was expected to find that all the male individuals have been identified as females. As a result, it is difficult to conclude if femur measurements identify individuals efficiently with respect to population differences.

<u>Multivariate Femur discriminant functions</u>: Among six measurements, Midshaft diameter (F3) and Head circumference (F7) together identifies 91.7% of German individuals (Mall et al., 2000). F3+F7 DF identifies 72.4% of Inden and 81% of Lübeck individuals accurately but SA series secures only 52.3% where it identifies 96.67% of females and 24.21% of males correctly. Most of the male individuals have been identified as females in SA series. Steyn & İşcan (1997) got 88.6% accuracy for F3+F4+F5 which got 38.7 to 85% accuracy in the present study. Almost all femur measurements show wider variation for males resulting in lower classification rates.

5.3.5 Tibia Discriminant Functions

<u>Univariate Tibia Discriminant Functions (T1, T3, T7, T8, T9, T12)</u>: Garcia (2012) found Circumference at the nutrient foramen of Tibia (T1) to be only 78% accurate for Portuguese individuals and 90% accurate for an archaeological sample also belonging to Portugal from 13th to 16th century. The present study also records the classification rates from 75.3% to 77.4%. For Proximal epiphyseal breadth (T3) and Distal epiphyseal breadth (T7) Steyn & İşcan (1997) found 86.8% and 88.7% accuracies rates. In the present study T3 performs better than T7 among all three population samples. When other sexually dimorphic elements are not preserved, proximal tibia is (Holland, 1991). In his study Holland (1991) found Biarticular breadth (T8) to be most dimorphic, identifying 95% of American white and black

individuals, with Medial condyle articular width (T9) achieving 88% accuracy, and Lateral condyle articular width (T12) getting 89%. In the present study the same hierarchy is seen in Inden, Lübeck, and SA samples, where T8 turns out to be performing better than T9 and T12. In Inden series T8 is the most dimorphic with 83.6% accuracy rate. T8 sounds to be a promising measurement which could be used with population differences. Holland (1991) states that proximal tibia can be used to identify sex without previous knowledge of ancestry.

Multivariate Tibia Discriminant functions: Steyn & İşcan (1997) identify 90.6% of the South African white sample with correct sex using multivariate function (T3+T4+T5+T6+T7) on tibia. This does not resonate with the results of any population groups in the present study. Most of the male individuals have again been identified as female. T3+T7 has been reported with 90.6% accuracy by Steyn & İşcan (1997). Only Inden sample achieves 83.6% accuracy, and the reason could be the same ancestry. Holland (1991) reported above 90% accuracy rates for DFs T9*T10 and T11*T12. These two DFs are found in the present study to be the least dimorphic DFs and do not come across as reliable.

5.3.6 Femur and Tibia Combined Discriminant Functions

Seven measurements from femur and tibia when combined, identify 91.4% of South African individuals correctly for their sex (Steyn & İşcan, 1997). It is worth noting that F3+F4+F5+T2+T4+T6+T7 produces 86.7% accuracy in Lübeck and 79.5% accuracy in SA series. It is interesting to see that even without any proximal tibia measurements the dimorphic ability of this DF seems to have improved a lot and it works on both Inden (white) and SA (black) samples, though the result of this study is lower than the accuracy reported in the literature (Steyn & İşcan, 1997).

5.3.7 Humerus, Radius, Ulna Univariate and Multivariate Discriminant Functions

Charisi et al. (2011) applied multivariate discriminant functions on humerus (H1+H2+H3), radius (R1+R2+R3), ulna (U1+U2+U3) which produced accuracy rates above 90% for every arm long bone. These DFs were applied on Inden, Lübeck, and SA series, resulting in humerus achieving 80% (Inden), 63.2% (Lübeck), and 61% (SA), radius getting 79.4% (Inden), 71.8% (Lübeck), and 61% (SA), and ulna getting 76.1% (Inden), 53.7% (Lübeck), and 62.1% (SA). It is striking that the humeral, radial, and ulna measurements resulted in satisfactory classification results only in Inden series and not for Lübeck and SA series. Charisi et al. (2011) observes the mean values of the German population sample is higher than his Greek samples. It means that not so robust samples of Lübeck and SA series should have shown the same level dimorphism and classification rate in the present study like the multivariate DFs showed for Greek samples in Charisi et al.'s work. Minimum circumference of the humerus (H4), radius (R4), ulna (U4) produce accuracy rate of almost 90% on Spanish sample ((Safont et al., 2000) which is much higher than the classification rates obtained from Inden, Lübeck, and SA series. When the mean differences are closely looked at, the arm long bones measurements appear to be highly significant in the work of Safont et al. (2000) which is not the case for H4, R4, U4 at least in Lübeck and SA series. This explains their low accuracy values. However, the small significant mean difference for humerus in Inden series, still manages to secure a satisfactory accuracy rate of 80%.

5.4 Discussion on Objective 3: Interobserver Error on Measurements

Interobserver error in cranial and pelvic measurements: The TEM values calculated in this investigation were compared to those found in the literature by Langley et al (2016) which has been illustrated in Table 58. In Langley et al., the percentage TEM values of the recorded skull measurements range from 0.07 percent to 1.92 percent (2016). The smallest inaccuracy is in bizygomatic diameter (CF1), whereas the highest is in nasal height (CF4). The range of error in this study is 0.8 percent to 9%, with the smallest mistake being the maximum skull vault length (CL1) which is not in the Table here and the biggest error being the nasal height (CF4). Additionally, the error values of the skull measurements were compared to Utermohle & Zegura's (1982) error values. However, only the absolute TEM value could be compared. Based on the comparison, it is clear that the absolute TEM values in this study are significantly lower than those in Utermohle and Zegura's work (1982). The skull measurements employed by Utermohle and Zegura (1982) have an error range of 0.39-1.09. The bizygomatic diameter (CF1) has the smallest error, whereas the skull base length has the largest error. The absolute error range for the measurements in this study is 0.1-0.49, with the smallest error being the maximum skull length (CL1) and the highest error being the nasal height (CF1).

Table 58 Comparison of the calculated relative TEM (technical error of measurement) values with the values from the literature (Langley et al., 2016).

Measurements*	**Calculated TEM-Wert [%]**	**TEM Value from (Langley et al., 2016) [%]**
CF1	4,6	0,07
CF4	9	1,92
CF5	4	0,4
CB2	2,5	0,4
CF1	0,8	0,3
CF4	1,5	0,5
CF6	1	0,25
P3	2	0,6
P4	1,5	6,3

*Description of measurements could be seen in the chapter 3.1.2

Almost all percentage TEM values are thus much greater in this analysis than in Langley et al. (2016). In the bachelor's thesis, only the P4 measurement portion was able to attain a lower inaccuracy. In this comparison, deviations can also be traced to the sample size. In the context of this study, however, the comparison to Utermohle and Zegura (1982) suggests lesser error levels. In this scenario, it's possible that the definitions have improved over time to locate the landmarks for taking measurement and that the error rates have decreased.

It is also necessary to explain the classification of relative TEM values, what error rate is acceptable and what not. Relative TEM values up to a value of 10% were judged as acceptable in this investigation as suggested by Perini et al. (2005). In general, deviations of roughly 10% might have a substantial magnitude depending on the length of the measurement segment to be investigated. A difference of 10% amounts to only a few millimetres for minor measurement lengths, such as nasal width (CF5). A 10% variance amounts to several centimetres for major measurement distances, such as the total height of the pelvis (P3) or the maximum length of the femur (F2). Several centimetres of difference between two observers' measures, on the other hand, should be taken seriously and even labeled as undesirable. As a result, it is possible to claim that TEM values for small and big measured distances should be classed differently and have different sized limits.

The 10% limit used in this study stems from Perini et al. (2005)'s work on anthropometry, which looked at measurements on living subjects. The measurement techniques in osteometry, on the other hand, differ greatly from those in anthropometry. When measuring human tissue, such as skin folds, like Perini et al. (2005) did, these tissues have a certain compressibility, which might cause variations. In osteometry, the problem of skin tissue compressibility does not exist. Furthermore, persons move to some amount during anthropometric measures, influencing the results. The skeletal part is maintained firmly in place during measurements on bone material, allowing motions to be excluded. Besides, the bone elements can be measured as many times as necessary until the appropriate measurement distance is achieved. In the case of anthropometric measurements, it may not be possible to devote a significant amount of time to data collection. For these reasons, it is self-evident that anthropometry error margins should be set higher than those in osteometry. As a result, the acceptance of the 10% error margin should be reconsidered.

Williams & Rogers (2006) conducted a study on the accuracy and precision of cranial morphological traits in the form of intra-observer study. The same observers study the same characteristics over a period to analyse intra-observer data. In their study Williams & Rogers (2006) support the acceptance of a 10% error rate but their study was on morphological traits and not measurements. Due to the subjective nature of morphological trait assessment, the margin of error in data here could be set greater than obtained by osteometry. It is important to consider if for osteometric methods the error rates should be categorized differently with respect to a much-lowered tolerance limit in future research.

<u>Interobserver error in long bone measurements</u>: Except for Charisi et al. (2015), the literature from which the measurement distances and discriminant functions were derived did not include any consideration of intra- or inter-observer error. In general, it was nearly impossible to discover literature on osteometric measurement that included data on technical measurement error when addressing sex determination. This demonstrates that anthropometric work still pays much too little attention to intra- and inter-observer variability.

Table 59 compares the available arm long bone TEMs to the literature, from which the discriminant functions were derived. In the case of femur TEMs, comparative data from Kanz et al. (2015) has been included.

Table 59 Comparison of the calculated relative TEM (technical error of measurement) values with the values from the literature

Messstrecke	**TEM der vorliegenden Arbeit (%)**	**TEM (%) Literatur**	**Literatur**
H1	4,3	0,11	Charisi et al. (2011)
H2	8,93	1,12	
H3	4,98	0,61	
R1	1,74	0,2	
R2	9,94	4,17	
R3	9,56	1,98	
U1	1,82	1,19	
U3	10,65	4,8	
U4	10,11	2,64	
F3	2,3	2,3	Kanz et al. (2015)
F5	2,15	1,2	
F6	2,19	1,1	
F7	3,87	0,7	

In this study the maximum radial length (R1) has the shortest TEM, but in the literature, the maximum humeral length (H1) has the smallest TEM. In both articles, the Maximum ulnar proximal width (U3) has the highest TEM, indicating that this measurement distance causes the most variations. When looking at the femur data, the TEMs of midshaft diameter (F3) stand out because they have the same TEM of 2.30%. The femoral head's vertical and transverse diameters (F5 and F6) are similarly unusual, with a TEM roughly double that of the literature. With a difference of 3.87 percent above the literature, the TEM of the circumference of the femoral head (F7) is even more noteworthy. With the exception of the diameter of the midshaft diameter (F3), the values of this work are always clearly above those of the literature when comparing the TEMs in general. In the literature, the TEM of maximum humeral length H1 and the humeral epicondylar width (H3) rarely show any inaccuracy, however they are above 4% in this study. The humeral vertical head diameter TEM is over 8% greater than previously reported in the literature. The only TEMs that were significantly elevated in the literature compared to the other data were the maximum width of the proximal radius (R2) and the ulna (U3). This backs with the findings of this study, as the TEMs of R2 and U3 are also higher here than the rest of the TEMs. However, in the literature, the maximal widths of the distal radius (R3) and ulna (U4) do not indicate any anomalies, as they do in this study.

Langley et al. (2018) defined the tendency that maximum lengths and widths have the lowest interobserver error, which is supported by the data, as the longest lengths (R1 and U1) had the lowest TEMs. Because of the increased measurement errors, the maximum humeral length (H1) cannot be included. The midshaft diameter (F3) was also more reliable than the other measured lengths for the femur. This also supports Langley et al. (2018)'s second trend, according to which maximum and minimum diameters near the middle of the shaft are more dependable than their position-dependent counterparts.

It may also be confirmed that smaller measurement distances in the size range of 0 to 200 mm are less reliable and have larger error deviations (Kouchi et al., 1999). The most variable measurement records in this study were for the maximum width of the proximal and distal radius (R2 and R3), and the ulna (U3 and U4), which also had the smallest measurement values of 130 to 400 mm and the biggest TEMs around 10%. Although these are larger than the 200mm limit specified in Kouchi et al. (1999), the second observer’s lack of experience with the procedures must also be considered in this work. Intra-observer error also plays a role, although every measurement was repeated twice by the first observer to see if the first and second readings were similar, and only one result was recorded. Although no two measurement values could be equal even if they were taken by the same observer, intra-observer error was not considered as a scope in this investigation.

The substantial differences between the TEMs of the femur in our study and those in the literature can be attributed to various measuring distance definitions. Unlike Kanz et al. (2015), who employed measurement definition from Martin & Saller (1957), this study used Mall et al. (2000) measurement definition. Identical definitions were employed for the upper postcranial skeletal parts of humerus, radius, and ulna. Sources of mistake such as measurement and locating landmarks play a larger role in this situation. Further factors such as experience, practice, and training, these values might influence the variances of the rates of correct categorization as well as the technical error of measurement.

Thus, sources of high inter-observer error can be identified and rectified before the start of a measurement series by training and consultation, resulting in lesser deviations than before (Kouchi et al. 1999). Vegelin et al. (2003), on the other hand, demonstrated that years of expertise with anthropometric methodologies and knowledge of population-specific norms are ultimately decisive for data reliability. As a result, even brief instruction to untrained assessors prior to anthropometric measures would have no discernible influence on dependability of measurements. Even professionals, according to Dror & Charlton (2006), cannot guarantee error-free performance. Rather, the mistakes' causes must be identified and classified. Competence, method, and technique are the sources of error. The main cause of inaccuracy in this task, however, is errors made by the respective experts when operating the measuring tools. These errors happen regularly, even with a lot of experience or after a lot of instruction (Dror & Charlton, 2006). The assessors can establish their own assessment strategies by finding landmarks and utilizing measurement tools, which leads to inter-observer variability (Kouchi et al. 1999). The challenge of detecting landmarks on the different bones was also validated by Langley et al. (2018).

5.5 Discussion on Objective 4: Reliability of Newly Created Discriminant Functions from Inden Sample.

The debate about population specific standards is an important part of forensic anthropology discipline. Most would agree that population specific data should be used to create new discriminant functions for metrical methods. This means that if the DFs have been derived from a particular sample, these DFs should have the ability to identify most of its individuals with correct sex. Looking at the results in Table 54 from chapter 4.4.6 the cranial DFs do not seem to paint a promising picture. The same set of measurements were taken to create the new equation as presented in the original discriminant functions taken from the literature (Keen, 1950; Steyn & İşcan, 1998). The data from Inden series was used to formulate new functions and the accuracy obtained after applying, for instance the cranial and mandible DFs do not identify even 80% of the Inden individuals. Considering the original aim was to assess the reliability and applicability of DF from one population onto the other, the DFs created from Inden series have been applied on Lübeck and SA series. The accuracy rates for both the population groups dipped even lower. The explanation for this stark change is influenced by different robusticity levels and not uniformed sample size in all the groups.

In the light of results achieved by original DFs in objective 2, it is important to understand that those cranial DFs have a range and not sectioning point. There are raw accuracies (with indifferent individuals) and general accuracies (without indifferent individuals). The original DFs perform better without indifferent individuals. CF1, CB1 and CB2 had mean values for each sex group as presented in the literature. The new DF functions created here in objective 4 have a sectioning point, which do not classify any individual as indifferent. The measurements or variables were added to discriminant function analysis using direct method. Unlike stepwise analysis, direct method in SPSS do not select the variables based on their discriminatory power. So, in the output there are no range produced, rather gives a sectioning point. DFs with a sectioning point should be able to discriminate individuals with more accuracy. Higher accuracy is not the case here though. If the new Wilks' lambda for new DFs is looked at closely, the multivariate function CL1+CF1+CL4+CL6+CF4+CF5 provides the lowest value, indicating the high discriminatory power. This gives the impression that population variability in terms of cranial lengths and widths is high, thus giving low accuracy rates when the cranial functions from Inden are applied on Lübeck and South African samples.

Lübeck and Inden belong to the German ancestry but looking at their mean values, it is clear that Inden skeletal elements are more robust in nature. This reflects in the accuracy results when Inden DF (M1+M2+M3+M4+M5) is applied on Lübeck. The accuracy decreases dramatically. It is noteworthy that the accuracy rate improves when the same DF is applied on SA series. There is at least 7% of improvement which is far better than what was secured for SA series in objective 2 results, i.e., 39.9% accuracy rate only. Looking at the accuracy rates for pelvis, tibia, femur, humerus, and radius in Inden series, it can be added to the argument that creating population specific DFs does improve the accuracy a lot. Focusing on the difference between univariate and multivariate statistics with respect to Eigenvalue and Wilks' lamda on pelvic discriminant functions, it is noteworthy that the multivariate DF P1+P2+P3+P7+P8+P9 has six varying length and widths, which produces the lowest Wilks' lambda and the highest Eigenvalue. These two statistics are better than univariate and bivariate DFs. The fact that the pelvis is a very sexually dimorphic bone could be one explanation for the reported results. We hypothesize that the need for childbirth constrains pelvic dimensions to such a degree that differences in dimensions between populations are minor (Steyn & Patriquin, 2009). Other, less dimorphic bones of the post-cranial skeleton are unlikely to follow the same strategy. Large disparities in long bone robusticity between populations will almost certainly still need the use of population-specific data, much more so than in the case of pelvic data. The multivariate tibia DFs and univariate functions like T1 and T3 work across all population groups with satisfactory accuracy rates. Among the arm bones radius multivariate DF manages to produce a similar accuracy rate when applied on SA series. Although not every DF outperforms published results, it is worth noting that several of the DFs obtained from Inden data could be translated to samples of South African african ancestry because the skeletal elements of Inden and SA exhibit a similar level of sexual dimorphism.

5.6 Limitations: Sources of Error and Influencing Factors

5.6.1 Material and Methods

With respect to objective 3, where it focuses on inter-observer error, it is important to understand that the significant time interval between the observers' observations could have an impact on the collecting of measurement data. This could have impacted the TEM value computations in some way. According to Perini et al. (2005), an incorrect time interval reflects a technical variability that might negatively impact the inaccuracy. While this comment applies to the collection of anthropometric data on living persons, alterations in the skeletal material can also occur as a result of lying, Utermohle and Zegura (1982) imply that the skeletal elements may alter throughout time. Albrecht (1983), in his research, concluded that differences in air humidity have a minor impact on the measurements but increasing humidity causes the skull to expand. Seasonal fluctuations, as well as the warming and chilling of storage locations, are also factors to consider. The skeletons were measured at four-year intervals. It's impossible to know with precision how humid it was four years ago.

Individual skeleton elements from Inden series are also used in teaching activities, thus it's also assumed that the skeletal material has undergone stronger erosion processes within four years. As a result, the bones are moved more frequently and can show more wear, leading to erroneous smaller measurement readings. However, there is no consistent pattern in the data collected by the observers. The second observers (Behlert, 2021; Schott, 2021) recorded higher values than the first observer and sometimes lower values than the first observer. Because no consistent pattern can be identified, it can be assumed that the differences are not related to skeletal material expansion induced by moisture or bone element loss owing to wear. Furthermore, the inaccuracies are bigger than the changes caused by moisture, which results in a maximum discrepancy of 0.5 percent (Albrecht, 1983). As a result, these external influences are unlikely to have skewed the TEM value.

The study by Vegelin et al. (2003) dealt with anthropometric measures on living children with variously qualified observers and discovered that the observer's experience, training, and knowledge have an impact on the measurement's reliability. The most experienced observers had the highest accuracy and the lowest TEM values. Although applying osteometric approaches reduces subjectivity , it is unlikely to be entirely eradicated. However, it is possible that the impacts indicated earlier, particularly the time period, led to discrepancies in the measurements of the observers in the setting of this bachelor's thesis of second observers (Behlert, 2021; Schott, 2021) and this doctorate study. These potential influencing factors are evident in increasing proficiency in handling measuring tools, a better trained eye in recognizing landmarks, more information gained through discussion with other experienced anthropologists, or inattention gained through the establishment of a personal routine. Other factors also have an impact on the measurement error. The error is related to the quality of the skeletal material, the precision of the instruments, and human error in reading the instruments and collecting data (Brůžek et al., 1994). Despite attempts to control these parameters, these factors may have had an impact on the results in the context of objectives 1 and 2 for calculating accuracy rates using morphological and metrical methods. There is also a time gap between the data gathering on the Inden, Lübeck, and South African series.

In case of partly decomposed material, where the particular landmark appears to be slightly eroded or due to handling activity it is broken, those individual skeletons have not been excluded. The measurement has only been recorded for bone sections, where it gives an impression of negligible damage. Behlert (2021) discusses in her bachelor’s dissertation which focused on Inden series to calculate inter-observer error, that for greater sciatic notch measurements at least 24 out of 32 pelves show a stronger deviation, due to a greater measured value recorded by the first observer in the context of this doctoral study. Though for the other pelvic measurements only 7 out of 31 pelves show a strong deviation in the measured values between first and second observer, so the influence of decomposition is low. What effect does the various handling of the slightly damaged bone material have on the individual should be examined in more depth, which was not done within the scope of this study due to time constraints.

5.6.2 Reliability of Osteometric Instruments

In an osteometric board with a right-angled triangle of wood, the possibility of error is so constant that no two observers can get the same reading, and even the same observer cannot get the same reading on two consecutive trials without a lot of careful management because applying the edge of the moveable upright wood triangle to the most noticeable area of the end of a rounded bone like the femur head or distal ends of other long bones, is incredibly difficult (Hepburn, 1899). For the collection of Inden and Lübeck sample data, traditional osteometric board was used but for the collection of South Africa sample data, a modified version of Hepburn osteometric board (Hepburn, 1899) was used which lacks an upright triangle wood and is replaced by an intermediate movable vertical shutter.

When measuring the maximum width of the proximal ulna (U3), the osteometric measuring board and the sliding calliper handled the measurements differently. When osteometric measuring board is used to the joint surface (olecranon fossa) rotates away from the observer, whereas if the sliding calliper allows the joint surface and edges to be seen. Here, the viewing angle and reading methods are significantly different. Furthermore, the separate observers individual handling of the measuring tools plays an important role. As a result, the likelihood of variances between the various measuring instruments is extremely high. So, while measuring the length, osteometric board is suggested to be used and should be avoided to measure the widths. However, in the bachelor's dissertation of Schott (2021) discusses there were no significant differences in the usage of the osteometric measuring board and the sliding calliper, hence both measuring equipment can be considered reliable for the assessment of measurement section U3. The difference of 4% in accuracy rates between the first and second observer and absolute TEM% error of 0.5% confirms her finding.

The circumference of the femoral head was often difficult to measure while utilizing the wide measuring tape for the analysis. The circumference of the femoral head is difficult to measure. The measuring tape was too broad in comparison to the measuring distance, and it was difficult to apply to the bone since it slipped all the time. The sides of the measuring tape, on which the scale is also printed, would bend often, which could result in deviations between the measurement values measured using wide and narrow measuring tapes. Despite the 1 mm difference between both tapes, there were no significant differences in the findings of the osteometric sex determination or the technical measurement error in the bachelor's dissertation work of Schott (2021). As a result, the wide measurement tape may be trusted to accurately measure skeletal material.

5.7 Recommendations

5.7.1 Reliability of Measurements and Discriminant Functions on Sex Estimation

The purpose of this study is to look at the accuracy and reproducibility of osteometric measurements and suitability of osteological traits in estimating sex. The cranial traits revealed that accurate sex estimation with a satisfactory rate of classification is achievable.

The results demonstrate that there are successful cranial and mandible traits like cranium overall and gonion in mandible that identify individuals with the correct sex, but the pelvis is the sole indicator that successfully identifies individuals of both sexes and performs consistently in the Inden, Lübeck, and South African series. Pelvic morphological characteristics are strongly sexually dimorphic due to the childbearing trait.

The skeleton can be analysed equally effectively with the postcranial elements, especially given the typically poor state of preservation of recovered skeletons in which the pelvis and skull are often fragmented. Long bones, or their measurements, should be employed for sex determination in general, especially in the event of uncertain analyses, because they can also outperform the rates of proper osteometric sexing of the pelvis and skull (Spradley & Jantz 2011).

The results, however, cannot be generalised due to the limited sample size, and more research is needed to offer valid patterns and recommendations. The findings are not generalisable to other populations in part, because there can be significant variation between populations (Mall et al. 2000). Because even groups of European descent (Inden and Lübeck) have demonstrated differences, it would be worthwhile to investigate other German populations in order to establish population-specific standards.

Furthermore, the error-proneness of osteometric measurements should be considered in all anthropometric studies. The TEM (Technical Error of Measurement) is a useful starting point for thinking about intra- and inter-observer variability. Standardization of measuring techniques should be extended to the details of practical operations, such as subject education, landmark localization, and measurement equipment handling, to reduce inter-observer variability (Kouchi et al. 1999). Similarly, Ulijaszek & Kerr (1999) claim that anthropometric measurement errors can be reduced by paying attention to other areas of data collecting. Inter-observer variability can be reduced by using appropriate lighting, calibrated measuring devices, personal performance, a standardised process, and good training with many examples and reference points, as well as comparisons amongst observers.

Some measurements can be explored here in terms of comprehensibility and handling. The maximal lengths of the humerus (H1), radius (R1), and ulna (U1) were easy to understand and measure by simply placing them on the osteometric measuring board. Deviations, on the other hand, can be produced by reading errors since the wooden block against the bone and the scale are not exactly in contact with each other, allowing the reader to slip on the glass above the scale while reading the data. The measurement of the humeral epiphyseal width (H2) is difficult. The sliding calliper cannot be applied to the topmost point of the articular surface due to the curvature of the humeral head, hence it must be estimated freehand. The definition of the landmark on the humeral head is not precisely defined and could be interpreted individually by each observer. The proximal radius's maximum width (R2) and the distal ulna's maximum width (U3) both define rounded measurements. The sliding calliper has to be used numerous times in order to find the maximum width. Furthermore, decomposition traces may result in measurement errors. Measuring epicondylar width of humerus could become complicated while aligning the lateral and medial epicondyles on the osteometric board. Considering these measuring aspects about the postcranial upper arm bones and the results from objective 4, radius and ulna bones should be preferable over humerus which could provide better accuracy for both males and females irrespective of the ancestry. The discriminant functions (R1+R2+R3, U1+U2+U3) could achieve a satisfactory accuracy when derived from a population of European descent and applied on sample of South African african ancestry. Although humeurs and ulna multivariate DFs (Discriminant functions) provide promising results for males (>80%) in all three samples of Inden, Lübeck, and South Africa according to the DFs adopted from the literature but it cannot be generalised for other population groups as the sample size for all the groups in this study are different.

Considering the ease of handling instruments and able to locate landmarks while measuring, among femur measurements the circumference of the femoral head (F7) appears to be the most difficult as it requires placing the tape around the femoral head which bends to the side where scaling is present. After a few adjustments to establish the maximum width at the femoral head, measuring the vertical and transverse diameters of the femoral head (F5 and F6) was the simplest. This reflects in the accuracy rates of Inden and Lübeck samples. F5 turns out to be the most reliable even if Inden and Lübeck have different degrees of robusticity. In terms of population variability none of the femoral measurements and DFs seem to be working when applied from European ancestry onto the South African african ancestry. So, femur should be avoided if the demographic information of the skeletal sample is not available.

In terms of measuring tibia, proximal epiphyseal breadth (T3) and biarticular breadth (T8) are the easiest measurements that can be measured by osteometric board and sliding calliper respectively. Because it is easy to locate the landmark, circumference at the nutritive foramen (T1) is another measurement that can be consistently determined. The univariate DFs based on these measurements appear to be highly accurate in terms of correct sex estimation and can be transferable to different population groups because the measurements T1, T3, and T8 are significantly sexually dimorphic. As a result, even if no prior demographic information is provided, these tibial measurements may be preferred. Multivariate functions based on femur and tibia together should be studied further because they do not produce reliable accuracy rates in the current study.

Cranial measurements CB1 and CB2 achieve low accuracies in the present study, which deem to be unreliable and is not recommended to be used on groups other than the South African coloured individuals or similar groups. When cranial sutures play a role in taking measurements (CB2 biasteronic width, CL6 basion bregma height), the degree of suture obliteration can affect the measurement results' reliability. Because a subjective choice must be made regarding where the extensions of each cranial suture meet (in the case of CB2) and where the deepest point in the case of depth of infratemporal fossa (CB1), the presence of changing landmarks could potentially contribute to incorrect results. The multivariate cranial discriminant function CL1+CL4+CL6+CF1+CF4+CF5 do not show a promising result in terms of applying it on other population groups but it proves the point that applying sectioning point is better than a range of mean values from both sexes. If the individuals do not exhibit strong sexual dimorphism, a sectioning point performs better in conjunction with discriminant score calculated based on a discriminant function.

The landmarks on sections P1 (pubic length) and P2 (ischial length) of the measurement were more difficult to locate. This is particularly true of the edge on the acetabulum's margin and the tuber ischiadicum. There may be some uncertainties when recording this measurement segment. Despite the difficulty in measuring, DF P1+P2 appear to perform as the second-best discriminant function in Inden, South Africa samples, and Lübeck sample as well. The ischial height or length is generally measured at the meeting point of ischium, ilium, and pubis bones but in this study the modified measurement for P2 from Steyn & Patriquin (2009) was utilised where they measure from the upper edge of acetabulum. So P2 is not recommended to be used on populations other than of European descent. A second observer (Behlert, 2021) achieved 93.33% accuracy even with a sample size of 30 individuals with P1+P2. Therefore, the DF P1+P2 is highly recommended to apply on population groups of different ancestry but with similar mean values like in this study.

The efficiency of P2 in the multivariate function P1+P2+P3+P7+P8+P9 is higher than its performance in the bivariate discriminant function P1+P2. Similarly, other measurements like P1 (pubic length), P3 (total height), P5 (greater schiatic notch depth), P8 (pubic width) do not conclude with high accuracy but their utility in the multivariate DF P1+P2+P3+P7+P8+P9 attains surprisingly high accuracy without population specificity. In order to apply this function special focus should be given to measuring P5 and P7. With broken posterior inferior spine on ilium bone could result in major errors and deviations, since posterior inferior spine often shows damage in Inden individuals. It can happen that too large a width is measured and ultimately impact the depth of sciatic notch (P5) as well. In his study, Walker (2005) similarly claims that there are no readily identifiable markers at the sciatic notch. Steyn and Işcan (2008) also criticize this measurement length, claiming that it is not as accurate as previously thought.

In general, the osteometric sexing approach has been found to be a very sensitive method that can be altered by a variety of circumstances. The instrument's handling and position, as well as how the instrument is approached to the bone, are all essential influencing aspects in the data collection process. The direction in which the bone is oriented is also crucial. The majority of the measurement sections are clearly defined, but the skeletal elements are rarely entirely preserved, making it difficult to identify these landmarks on the skeletal material. Furthermore, determining whether or not a bone is still sufficiently intact to be measured is a subjective judgement. However, decomposition traces are a series-related problem, as they are related to the individual state in which the series have been stored.

6 Summary and Conclusion

The primary goal of this study is to estimate the sex of human skeletal materials using morphological and metrical methods described in the forensic and anthropological literature with molecular testing performed on Inden and Lübeck skeletal series and with known demographic data on South African series. The data from molecular testing and prior demographic data form the basis of calculating the accuracy. Those approaches have been adopted from published forensic anthropological literature which claim to be able to estimate an individual's sex from single skeleton fragments. The skeletal materials utilized in the publications are from people of various ancestries, primarily European and African. Most advise using sample-specific methods and there are few researchers who proved that their discriminant functions could reproduce similar reliability when metrical methods from one population group are applied on a different population group.

For the first objective in this study, morphological methods were applied on crania, mandibles, and pelves. The evaluation shows that there are successful cranial and mandible traits that identify individuals with correct sex, but pelvis ends up as the only indicator that identifies individuals of both sexes and performs universally in Inden, Lübeck, and South African series. It is due to the childbearing trait that makes pelvic morphological traits highly sexually dimorphic.

In the second objective, measurements were taken on crania, mandible, pelves along with long bones humerus, radius, ulna, femur, and tibia. Discriminant functions based on those measurements were applied on the collected data. The postcranial skeleton measurements on femur and tibia revealed that accurate sex estimation with a high rate of accuracy is achievable better than cranial discriminant functions. In terms of reproducibility of discriminant functions on different population groups tibia performs better than other long bones. Pelvis performs better than every other skeletal element with multivariate discriminant functions on every population group. This puts clarity that population specificity might not be needed if pelvis is being considered. The fact that the pelvis is a very sexually dimorphic bone could be one explanation for the reported results. We hypothesize that the need for childbirth constrains pelvic dimensions to such a degree that differences in dimensions between populations are minor (Steyn & Patriquin, 2009).

Although metric sex estimation might improve objectivity, particularly when compared to morphological assessments, issues can develop in specific situations due to difficult reproducibility. To check the reliability of measurements, error analysis has been performed in the third objective. It was found that pelvic measurements were more sexually dimorphic even though the TEM (Technical Error of Measurement) values were lower for skull measurements. Among long bones, radius and ulna showed the highest error rate. The results of this objective clearly demonstrated that osteometric sex determination is a sensitive examination procedure that is influenced by several factors that must be considered.

In the fourth and last objective new discriminant functions were created based on the collected data from Inden series and applied on Lübeck and South African samples data. Looking at the accuracy rates for pelvis, tibia, femur, and tibia in Inden series, it can be added to the argument that creating population specific DFs does improve the accuracy a lot, but they do not perform equally well when applied on Lübeck and South African samples. These functions were created based on the literature and the accuracy rates from these functions do not outperform the published results. The new discriminant function from German ancestry (Inden series), do not produce the similar accuracy rates when applied on another population group of German ancestry (Lübeck series) itself but some of the functions do reproduce for South African individuals accurately. Thus, this study highlights that multivariate discriminant functions of tibia, radius, ulna, and pelvis along with a couple of univariate tibia functions achieve better accuracy rates, when applied on another population group of different ancestry.

7 References

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Appendix

Table 1 Data collected from Inden series using morphological methods

Morphological - Inden																		Church book	DNA
		Calvarium							Mandible					Pelvis					
S.no.	Individual no.	Cranium overall	Glabella-Supra orbital	Margo orbitalis	Mastoid process	Zygomaticum	Frontal tubercle and Steepness	Eye orbitals	Mandible overall	Condylar process	Corpus height	Mentum	Gonion and angle	Greater schiatic notch	Arc compose	Sub pubic angle	Iliac crest		
1	82	F	F	F	TF	I	TF	TM	TM	TM	TM	TM	M	TM	TF	TM	TF	F	F
2	88	I	I	I	TM	TF	F	TF	-	-	-	-	-	F	F	F	M	-	F
3	91	TM	TM	F	M	I	I	TM	M	M	M	M	M	M	M	-	TM	-	-
4	93	TF	F	F	TF	TF	F	F	-	-	-	-	-	I	TM	-	M	F	F
5	94,1	-	-	-	-	-	-	-	-	-	-	-	-	F	F	-	-	M	-
6	97	-	-	-	-	-	-	-	TM	TM	TM	TM	TM	-	-	-	-	F	-
7	98	I	TF	TF	TM	TM	I	TF	F	TM	-	-	-	F	F	-	TF	F	-
8	99	-	-	-	-	-	-	-	-	-	-	-	-	F	F	-	TF	-	-
9	100	TF	TF	I	TF	I	F	F	F	TM	F	F	TM	F	F	F	F	-	-
10	101	-	-	-	-	-	-	-	-	-	-	-	-	TF	TF	-	TF	F	-
11	102	TF	F	TM	I	I	F	F	TF	F	F	F	TF	F	F	F	F	F	F
12	107	I	TF	I	F	F	F	-	F	F	F	TF	TF	F	F	F	TF	-	F
13	113	M	M	M	M	M	M	M	TM	TM	TM	TM	TM	TM	M	-	TF	M	-
14	114	-	-	-	-	-	-	-	-	-	-	-	-	M	TM	-	TM	M	-
15	115	-	-	-	-	-	-	-	-	-	-	-	-	TF	TF	F	TF	F	-
16	116	-	-	-	-	-	-	-	TF	TF	F	TF	TM	TM	TM	-	-	M	-
17	117	M	M	M	I	I	TM	-	M	M	TM	TM	TM	M	M	M	M	M	-
18	118	I	I	TM	F	F	TM	TM	TF	F	TM	M	F	F	F	F	F	F	F
19	119	M	TM	I	TM	TM	M	M	M	M	M	M	M	M	M	M	M	M	-
20	120	-	-	-	-	-	-	-	TM	F	F	TF	TM	TF	I	M	M	M	-
21	121	-	-	-	-	-	-	-	M	TF	TM	TM	TM	TF	TF	F	F	F	-
22	122	I	TF	TM	I	I	I	TF	TF	F	TM	TM	TM	TM	TF	-	F	F	F
23	123	-	-	-	-	-	-	-	-	-	-	-	-	TM	M	F	F	F	-
24	124	M	M	M	M	M	M	TF	-	-	-	M	M	M	TF	-	I	-	-
25	125	M	M	F	TM	TM	M	M	TM	TF	M	M	M	I	TM	TM	F	M	M
26	126	M	M	M	TF	TM	M	M	M	TM	F	-	-	TM	TM	TF	TM	M	M
27	127	TF	TF	I	M	TF	F	F	F	F	F	TM	TM	F	F	F	F	F	F
28	128	F	F	TF	TF	TF	F	F	TM	TF	TF	TM	TM	M	M	-	TF	M	-
29	129	I	I	I	I	TM	TF	TM	-	-	-	-	-	M	M	M	M	M	-
30	131	TM	TM	I	I	I	TM	TM	M	M	M	M	M	TM	TM	TM	TM	-	-
31	136	-	-	-	-	-	-	-	M	M	-	-	-	M	TM	-	-	M	-
32	145	-	-	-	-	-	-	-	TF	F	F	TF	TM	-	-	-	-	F	-
33	146	TF	TF	TM	TF	TF	I	TM	TM	M	-	-	-	F	F	-	F	M	-
34	161	TM	M	TM	TM	-	I	-	-	-	-	-	-	I	TM	-	-	M	M
35	163	M	M	TM	I	I	TM	I	-	-	-	-	-	-	-	-	-	F	-
36	164	F	F	TF	F	F	TM	-	TF	TF	-	-	-	TF	TM	F	TF	-	-
37	165	-	-	-	-	-	-	-	TF	TF	TF	F	TM	-	-	-	-	F	-
38	166	M	M	TM	I	TM	M	I	TM	TM	TM	TM	TM	TM	TM	TF	TF	-	-
39	169	F	F	I	TF	TF	I	I	-	-	-	-	-	-	-	-	-	F	-
40	170	TF	TF	I	I	TM	TF	TF	M	TM	M	M	TM	-	-	-	-	F	-
41	171	F	F	I	F	F	I	-	-	-	-	-	-	-	-	-	-	F	-
42	174	-	-	-	-	-	-	-	-	-	-	-	-	F	F	I	-	F	-
43	175	M	M	I	TM	TM	TM	TM	TM	M	TM	TM	TM	F	F	TM	TF	M	-
44	176	M	M	M	M	M	M	M	TF	TF	TF	TM	TM	TM	TM	M	M	M	M
45	181	TF	TF	TM	F	I	TM	TM	F	F	F	TF	I	-	-	-	-	-	-
46	182	-	-	-	-	-	-	-	-	-	-	-	-	F	F	-	F	-	-
47	183	F	F	I	F	F	TF	TF	F	TF	F	F	TM	TM	TF	-	TF	-	F

Morphological - Inden																		Church book	DNA
		Calvarium							Mandible					Pelvis					
S.no.	Individual no.	Cranium overall	Glabella-Supra orbital	Margo orbitalis	Mastoid process	Zygomaticum	Frontal tubercle and Steepness	Eye orbitals	Mandible overall	Condylar process	Corpus height	Mentum	Gonion and angle	Greater schiatic notch	Arc compose	Sub pubic angle	Iliac crest		
48	186	TM	M	M	M	M	M	M	TM	-	-	-	-	TM	TM	-	-	M	-
49	195	M	M	TM	M	M	M	M	M	TM	TM	M	M	TM	M	M	M	M	M
50	200	M	M	M	M	M	M	M	M	M	M	M	TM	M	M	M	M	M	M
51	201	I	I	I	TM	TM	I	-	TM	TF	F	F	TF	TM	TM	TM	TF	-	M
52	203	-	-	-	-	-	-	-	TM	TM	TF	TM	TM	TM	TM	TM	TM	M	-
53	236	-	-	-	-	-	-	-	M	TM	-	-	-	-	-	-	-	M	-
54	238	M	M	M	TF	F	TM	TM	TM	M	M	TM	TM	M	M	M	TM	M	-
55	240	M	M	TM	TF	TF	TM	TM	-	-	-	-	-	TM	M	M	M	M	-
56	241	-	-	-	-	-	-	-	M	M	M	M	M	-	-	-	-	F	-
57	242	-	-	-	-	-	-	-	TM	TF	TF	TM	M	-	-	-	-	-	-
58	243	TM	M	M	M	TM	TM	TM	TM	TM	M	M	M	TM	TM	M	TF	M	-
59	244	TF	TF	F	I	I	I	-	M	TM	M	M	-	TM	TM	TM	TF	M	-
60	245	I	I	TM	M	TM	I	-	-	-	-	-	-	M	M	M	-	F	-
61	247	-	-	-	-	-	-	-	TF	TF	F	TM	-	-	-	-	-	-	-
62	252	F	F	F	I	TM	F	F	-	-	-	-	-	-	-	-	-	F	-
63	301	I	TM	TF	I	TM	TM	TM	-	-	-	-	-	TM	TF	TM	I	-	-
64	303	-	-	-	-	-	-	-	F	F	TF	TF	-	-	-	-	-	-	-
65	304	I	I	I	TF	TF	TM	I	M	M	M	M	M	TM	TM	TM	M	M	-
66	306	-	-	-	-	-	-	-	-	-	-	-	-	M	M	-	-	M	-
67	309	F	F	F	I	F	F	F	-	-	-	-	-	-	-	-	-	M	-
68	310	TM	I	TM	TF	TM	I	TM	TM	M	TM	TM	TM	TF	TM	-	TM	F	F
69	311	M	M	M	M	M	M	M	M	M	M	M	M	TM	TM	M	M	M	M
70	313	-	-	-	-	-	-	-	-	-	-	-	-	TF	TF	-	-	F	-
71	314	-	-	-	-	-	-	-	-	-	-	-	-	TF	F	-	-	F	-
72	315	-	-	-	-	-	-	-	F	F	TF	F	M	-	-	-	-	F	-
73	317	F	F	I	F	F	F	TF	-	-	-	-	-	TF	F	F	-	F	-
74	318	M	M	M	M	-	M	-	-	-	-	-	-	-	-	-	-	-	-
75	319	M	M	TM	TM	M	M	M	TM	M	M	TM	M	M	M	M	M	M	M
76	320	-	-	-	-	-	-	-	-	-	-	-	-	TM	TM	-	TF	F	-
77	321	-	-	-	-	-	-	-	F	TF	TF	TF	-	-	-	-	-	M	-
78	322	-	-	-	-	-	-	-	-	-	-	-	-	I	TF	-	F	M	-
79	323	TF	F	F	F	TF	F	TF	TM	TM	TM	TM	M	TM	M	F	TM	F	-
80	324	F	F	TM	F	-	TF	-	-	-	-	-	-	TF	TF	-	-	F	-
81	326	I	TM	TM	TM	-	TM	-	-	-	-	-	-	TF	TF	F	F	F	-
82	327	-	-	-	-	-	-	-	-	-	-	-	-	TM	TM	TM	TM	M	-
83	329,1	M	M	M	M	M	M	TM	M	M	M	M	M	-	-	-	-	-	-
84	329,2	M	M	M	M	M	TM	-	M	M	M	M	TM	-	-	-	-	-	-
85	330	M	M	M	M	M	M	M	M	M	M	TF	M	M	M	M	M	M	-
86	331	I	I	M	TF	TM	M	TM	-	-	-	-	-	-	-	-	-	M	-
87	332	M	M	M	M	M	M	M	TM	M	M	M	M	M	M	M	TM	M	M
88	333	M	M	I	M	M	M	M	M	M	M	M	M	TM	TM	TM	-	M	M
89	335	M	M	F	M	TM	M	TM	M	M	M	M	M	M	M	-	M	M	M
90	337	M	M	I	TM	TM	TM	TM	TM	TM	-	-	-	M	M	M	M	M	-
91	338	F	F	F	F	F	I	TF	-	-	-	-	-	-	-	-	-	M	F
92	339	-	I	M	F	TM	TM	TM	TM	M	M	M	M	TM	TF	F	TM	M	-
93	340	TM	TM	TM	I	I	TM	TF	-	-	-	-	-	TM	TM	M	F	M	-
94	341	-	-	-	-	-	-	-	-	-	-	-	-	TF	M	-	-	M	-
95	342	F	F	F	F	F	F	F	F	F	F	F	I	F	I	-	TM	F	-
96	343	F	F	F	I	I	F	F	-	-	-	-	-	F	F	-	TF	F	-
97	344	M	M	M	M	M	M	M	M	M	M	TM	TM	TF	TF	-	-	M	-
98	345	M	M	TM	M	M	M	TM	M	M	TM	TM	M	TM	TM	TM	TM	M	-

Morphological - Inden																		Church book	DNA
		Calvarium							Mandible					Pelvis					
S.no.	Individual no.	Cranium overall	Glabella-Supra orbital	Margo orbitalis	Mastoid process	Zygomaticum	Frontal tubercle and Steepness	Eye orbitals	Mandible overall	Condylar process	Corpus height	Mentum	Gonion and angle	Greater schiatic notch	Arc compose	Sub pubic angle	Iliac crest		
99	346	-	-	-	-	-	-	-	-	-	-	-	-	TM	TM	TM	TF	-	-
100	347	-	-	-	-	-	-	-	-	-	-	-	-	TF	TF	-	TF	M	-
101	348	-	-	-	-	-	-	-	-	-	-	-	-	I	TF	TM	-	F	-
102	350	F	F	I	F	F	F	F	-	-	-	-	-	-	-	-	-	M	-
103	351	-	-	-	-	-	-	-	-	-	-	-	-	F	F	-	TF	F	-
104	352	F	TF	TM	TF	TF	TF	TF	TF	F	M	M	TM	M	M	M	M	M	-
105	354	TM	TM	I	F	I	I	I	-	-	-	-	-	TM	TF	-	-	M	-
106	355	I	TM	TF	F	I	TM	TM	-	-	-	-	-	F	F	F	-	Not sure	-
107	356	M	M	M	M	TM	M	TM	M	TM	M	TM	TM	TF	I	-	-	M	-
108	357	F	F	F	F	F	F	F	-	-	-	-	-	I	TM	F	TM	F	-
109	358	-	-	-	-	-	-	-	TM	M	M	M	M	TF	TF	-	TF	F	-
110	360,1	TF	TF	TF	I	TF	TF	TM	TF	TF	TF	TF	TM	F	F	-	TF	F	F
111	360,2	-	-	-	-	-	-	-	TF	TF	TM	TM	M	-	-	-	-	-	-
112	363	M	M	F	M	M	M	M	-	-	-	-	-	F	F	F	-	F	F
113	364	F	F	I	F	-	TF	-	-	-	-	-	-	F	M	F	TM	F	-
114	365	M	M	M	M	M	M	M	M	M	M	M	M	TM	TM	-	M	F	-
115	366	-	-	-	-	-	-	-	M	M	M	M	M	-	-	-	-	-	-
116	368	-	-	-	-	-	-	-	-	-	-	-	-	F	F	TF	-	F	-
117	371	-	-	-	-	-	-	-	-	-	-	-	-	M	TM	M	-	M	-
118	373,1	F	F	TF	I	I	TF	M	TM	TM	M	M	TM	TM	TM	TF	-	-	-
119	374	F	F	TF	F	F	F	TF	-	-	-	-	-	-	-	-	-	-	-
120	375	-	-	-	-	-	-	-	-	-	-	-	-	I	I	F	F	-	-
121	378	-	-	-	-	-	-	-	M	-	-	M	M	M	M	I	M	-	-
122	401	I	I	I	TF	-	TF	F	-	-	-	-	-	TM	TM	F	M	F	F
123	405	-	-	-	-	-	-	-	M	TM	TM	TM	TM	M	M	M	TM	-	-
124	406	TF	TF	TF	TM	M	I	-	TF	F	TF	TF	TM	TF	TF	-	F	F	-
125	408	-	-	-	-	-	-	-	M	M	M	M	M	-	-	-	-	M	-
126	409	TF	TF	TF	TM	TM	F	TM	-	-	-	-	-	F	TF	-	F	-	-
127	410	-	-	-	-	-	-	-	F	F	-	-	-	TF	F	-	TM	-	-
128	411	-	-	-	-	-	-	-	-	-	-	-	-	TF	I	-	-	-	-
129	413	-	-	-	-	-	-	-	M	M	M	M	M	M	M	-	-	-	-
130	415	M	M	M	M	M	M	TF	-	-	-	-	-	-	-	-	-	-	-
131	416	M	M	TF	M	M	M	M	M	M	M	M	M	M	TM	M	M	M	-
132	417	M	M	M	M	M	M	M	TM	TM	TM	TM	M	M	M	-	TF	-	-
133	418	TM	TM	I	TM	-	TM	M	-	-	-	-	-	-	-	-	-	-	-
134	419	-	-	-	-	-	-	-	-	-	-	-	-	M	TM	TM	M	-	-
135	420	-	TM	I	TM	-	I	-	-	-	-	-	-	-	-	-	-	-	-
136	422,1	M	M	M	I	M	M	M	-	-	-	-	-	F	F	-	-	-	-
137	422,2	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-
138	423	-	-	-	-	-	-	-	F	F	TM	TM	TM	-	-	-	-	-	-
139	425	TM	TM	TM	M	-	TM	-	M	TM	TM	TM	M	M	TM	-	M	-	-
140	426	-	-	-	-	-	-	-	TF	TF	TM	-	-	M	TM	-	F	M	-
141	428	M	M	M	TF	TM	M	-	TM	M	M	M	M	M	M	M	M	-	M
142	429	TF	F	TF	F	I	I	M	TF	TF	-	-	-	I	TF	F	TM	-	-
143	430	I	I	I	TM	-	I	TM	-	-	-	-	-	-	-	-	-	-	-
144	431	-	-	-	-	-	-	-	M	TF	M	TM	TM	-	-	-	-	-	-
145	436	M	M	M	I	-	TM	-	-	-	-	-	-	-	-	-	-	-	M
146	437	-	-	-	-	-	-	-	-	-	-	-	-	M	M	-	F	-	-
147	438	F	F	F	F	F	TF	-	-	-	-	-	-	M	M	TF	F	-	-
148	439	I	I	M	M	M	M	TF	TF	TM	TM	TM	TM	I	TF	M	TM	M	-
149	440,1	TF	TF	TF	I	TF	TF	TF	-	-	-	-	-	-	-	-	-	-	-

Morphological - Inden																			
		Calvarium							Mandible					Pelvis					
S.no.	Individual no.	Cranium overall	Glabella-Supra orbital	Margo orbitalis	Mastoid process	Zygomaticum	Frontal tubercle and Steepness	Eye orbitals	Mandible overall	Condylar process	Corpus height	Mentum	Gonion and angle	Greater schiatic notch	Arc compose	Sub pubic angle	Iliac crest	Church book	DNA
150	440,2	F	F	I	TF	TF	F	TF	-	-	-	-	-	-	-	-	-	-	-
151	441	-	-	-	-	-	-	-	-	-	-	-	-	TF	F	-	-	-	-
152	442	TF	F	TM	F	F	F	TM	TF	TM	TM	TF	-	F	F	-	F	F	F
153	443	I	TM	TM	F	F	TM	F	F	TF	F	F	TF	-	-	-	-	-	-
154	444	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
155	446	F	I	F	F	F	TF	TM	F	M	F	TF	TF	M	M	F	TF	F	F
156	447	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	-	-
157	448	I	I	I	TF	-	I	TF	M	M	TM	M	M	F	TM	-	-	-	-
158	449	F	F	TF	F	F	TF	-	-	-	-	-	-	I	TF	-	-	-	-
159	452	-	-	-	-	-	-	-	TM	M	M	M	M	M	M	-	-	-	-
160	453	M	M	M	M	M	M	F	TM	TF	TM	M	TM	M	M	M	TF	M	-
161	454	-	-	-	-	-	-	-	-	-	-	-	-	TM	M	-	F	-	-
162	455	I	TM	M	TF	I	TM	M	-	-	-	-	-	-	-	-	-	-	-
163	456	M	M	M	M	M	M	-	M	M	M	M	M	M	M	M	M	-	-
164	611	M	M	M	I	TM	M	M	M	F	M	M	-	-	-	-	-	-	-

Legend: Male – M, Tendency male – TM, Indifferent – I, Tendency female – TF, Female – F, Not available – (-)

Table 2 Data collected from Lübeck series using morphological methods

S.no.	Individual no.	Cranium overall	Glabella-supraorbital	Margo orbitalis	Mastoid process	Zygomaticum	Forehead arch-Frontal tubercle	Orbitals	Greater Schiatic Notch	Arc Compose	Sub-pubic angle	Iliac crest	Molecular sex
1	886	-	-	-	-	-	-	-	TF	TF	I	TM	-
2	887	-	-	-	-	-	-	-	I	F	I	I	F
3	888	-	-	-	-	-	-	-	F	F	I	I	-
4	889	-	-	-	-	-	-	-	TM	M	I	I	-
5	891	M	TM	TM	TM	TM	TM	TM	F	F	I	I	-
6	892	-	-	-	-	-	-	-	I	TM	I	I	-
7	910	I	I	M	I	I	I	I	-	-	-	-	-
8	917	I	TM	TF	TF	TF	TF	TM	I	TM	M	M	-
9	919	I	M	M	M	I	M	I	I	TM	I	TM	-
10	920	TF	I	I	I	I	TF	TF	TF	TF	I	TM	-
11	921	F	F	F	F	F	F	F	-	-	-	-	-
12	922	-	-	-	-	-	-	-	I	TF	I	TM	-
13	923	TM	TM	TM	I	TM	I	TM	TM	TM	M	M	-
14	929	F	TF	TF	F	F	F	F	-	-	-	-	-
15	942	-	-	-	-	-	-	-	TM	I	I	TM	-
16	950	-	-	-	-	-	-	-	M	M	M	I	-
17	958	-	-	-	-	-	-	-	F	F	I	TF	F
18	960	-	-	-	-	-	-	-	TM	TM	I	TM	-
19	962	-	-	-	-	-	-	-	M	M	TM	M	-
20	964	-	-	-	-	-	-	-	TM	M	I	TM	-
21	965	TF	TF	TF	TM	TF	TF	TF	F	F	TM	TM	-
22	966	-	-	-	-	-	-	-	TM	TM	I	TF	-
23	984	-	-	-	-	-	-	-	M	M	I	TF	-
24	988	-	-	-	-	-	-	-	M	M	M	TF	-
25	990	-	-	-	-	-	-	-	TF	TF	TF	TF	-
26	996	-	-	-	-	-	-	-	M	TM	I	TM	-

S.no.	Individual no.	Cranium overall	Glabella-supraorbital	Margo orbitalis	Mastoid process	Zygomaticum	Forehead arch-Frontal tubercle	Orbitals	Greater Schiatic Notch	Arc Compose	Sub-pubic angle	Iliac crest	Molecular sex
27	1003	-	-	-	-	-	-	-	I	I	I	I	M
28	1005	F	F	F	TF	TF	F	F	M	M	I	TM	F
29	1033	-	-	-	-	-	-	-	M	M	I	I	-
30	1037	-	-	-	-	-	-	-	M	M	I	M	-
31	1075	-	-	-	-	-	-	-	I	TF	TM	TM	-
32	1076	-	-	-	-	-	-	-	M	M	M	M	-
33	1084	-	-	-	-	-	-	-	TM	TF	I	TF	-
34	1090	-	-	-	-	-	-	-	F	F	TF	TF	-
35	1095,1	-	-	-	-	-	-	-	F	F	TF	I	-
36	1095,2	-	-	-	-	-	-	-	TM	I	F	F	-
37	1097	TM	TM	TF	TF	TF	M	M	-	-	-	-	-
38	1099	-	-	-	-	-	-	-	M	M	M	M	-
39	1102	-	-	-	-	-	-	-	TM	TM	M	TM	-
40	1105	-	-	-	-	-	-	-	TM	TF	TM	TM	F
41	1106	-	-	-	-	-	-	-	M	TF	TF	TF	-
42	1109	-	-	-	-	-	-	-	M	M	M	M	-
43	1122	-	-	-	-	-	-	-	F	F	F	F	-
44	1123	-	-	-	-	-	-	-	I	TM	I	I	-
45	1126	-	-	-	-	-	-	-	M	M	I	M	-
46	1133	-	-	-	-	-	-	-	TM	M	M	M	M
47	1140	-	-	-	-	-	-	-	M	M	I	TF	-
48	1144	-	-	-	-	-	-	-	TM	M	M	M	-
49	1154	-	-	-	-	-	-	-	TM	TM	M	M	M
50	1156	-	-	-	-	-	-	-	M	M	M	I	M
51	1171	M	M	M	M	M	M	M	I	I	I	TM	-
52	1172	-	-	-	-	-	-	-	M	M	M	M	-
53	1204	-	-	-	-	-	-	-	F	F	F	F	F
54	1207	-	-	-	-	-	-	-	M	M	M	I	-
55	1212	-	-	-	-	-	-	-	F	F	F	TM	-
56	1213	-	-	-	-	-	-	-	M	M	M	M	-
57	1217	-	-	-	-	-	-	-	F	F	I	I	M
58	1218	-	-	-	-	-	-	-	M	M	I	M	-
59	1220	-	-	-	-	-	-	-	TM	TM	F	F	-
60	1221	M	M	M	M	M	M	M	-	-	-	-	-
61	1223	-	-	-	-	-	-	-	TM	F	F	F	F
62	1225	F	TF	F	F	F	F	F	-	-	-	-	F
63	1226	M	TM	M	M	M	M	M	M	M	M	M	-
64	1227	TM	M	TM	TM	TM	TM	TM	TM	TM	M	M	M
65	1228	F	TF	F	TF	F	F	F	TF	TF	TF	I	-
66	1229	I	M	M	M	I	M	I	M	M	M	TM	-
67	1232	-	-	-	-	-	-	-	M	M	M	I	M
68	1233	-	-	-	-	-	-	-	F	F	I	TM	-
69	1234	M	M	TM	I	M	-	M	M	M	M	M	M
70	1245	I	TM	M	M	M	M	I	M	M	M	M	-
71	1249	M	M	TM	TM	TM	M	M	M	M	I	M	-
72	1250	F	TM	TF	TF	F	F	F	TM	I	I	TF	-
73	1252	-	-	-	-	-	-	-	TM	TM	I	TM	-
74	1254	-	-	-	-	-	-	-	I	I	TF	TM	-
75	1257	TM	M	M	TM	M	M	M	-	-	-	-	-
76	1259	-	-	-	-	-	-	-	M	M	M	M	-
77	1261	-	-	-	-	-	-	-	M	-	-	-	-
78	1264	-	-	-	-	-	-	-	TM	TM	I	M	-
79	1269	-	-	-	-	-	-	-	M	M	M	I	-

S.no.	Individual no.	Cranium overall	Glabella-supraorbital	Margo orbitalis	Mastoid process	Zygomaticum	Forehead arch-Frontal tubercle	Orbitals	Greater Schiatic Notch	Arc Compose	Sub-pubic angle	Iliac crest	Molecular sex
80	1272	-	-	-	-	-	-	-	M	M	TF	TF	-
81	1273	-	-	-	-	-	-	-	TF	TF	TF	TF	-
82	1274	-	-	-	-	-	-	-	M	-	-	-	-
83	1276	-	-	-	-	-	-	-	F	TM	M	M	-
84	1277	-	-	-	-	-	-	-	I	TM	TM	TM	-
85	1278	-	-	-	-	-	-	-	M	TF	TM	TM	-
86	1282	-	-	-	-	-	-	-	F	I	TM	I	-
87	1284	-	-	-	-	-	-	-	F	F	I	TF	-
88	1286	TM	I	TM	TM	TM	M	M	TF	TF	I	TM	F
89	1290	-	-	-	-	-	-	-	TM	TM	I	TM	-
90	1298	-	-	-	-	-	-	-	I	TF	TM	TM	-
91	1299	M	M	M	M	M	M	M	M	TM	M	TM	-
92	1303	-	-	-	-	-	-	-	TM	M	M	M	-
93	1316	-	-	-	-	-	-	-	F	TF	TM	TM	-
94	1319	M	M	TM	TM	TM	M	M	-	-	-	-	F
95	1327	F	I	TF	M	TF	F	F	TF	TF	I	TF	-
96	1328	-	-	-	-	-	-	-	TF	TF	TF	TM	-
97	1329	TM	TM	TM	TM	TM	TM	TM	-	-	-	-	-
98	1330	-	-	-	-	-	-	-	TM	TM	M	M	-
99	1331	-	-	-	-	-	-	-	TM	TM	M	TM	M
100	1332	-	-	-	-	-	-	-	F	F	TF	I	-
101	1337	-	-	-	-	-	-	-	TM	TM	M	M	-
102	1339	TM	M	TM	TM	TM	TM	TM	I	TM	TF	I	-
103	1340	-	-	-	-	-	-	-	M	M	M	TM	-
104	1341	TM	I	F	TM	F	TM	TM	-	-	-	-	F
105	1347	-	-	-	-	-	-	-	TM	M	M	M	-
106	1348	M	M	TM	M	M	M	M	TF	TF	TF	TF	-
107	1354	-	-	-	-	-	-	-	I	I	TM	I	-
108	1355	I	I	I	I	I	I	TM	-	-	-	-	F
109	1357	-	-	-	-	-	-	-	F	F	F	F	F
110	1358	-	-	-	-	-	-	-	TM	I	I	TM	-
111	1360	-	-	-	-	-	-	-	TM	M	M	I	-
112	1363	-	-	-	-	-	-	-	TM	TF	I	TM	-
113	1366	-	-	-	-	-	-	-	M	TF	I	TM	-
114	1367	-	-	-	-	-	-	-	TM	TF	I	TM	-
115	1374	-	-	-	-	-	-	-	TM	TM	M	M	-
116	1375	-	-	-	-	-	-	-	M	F	F	F	-
117	1378	-	-	-	-	-	-	-	M	TF	TF	TM	-
118	1383	-	-	-	-	-	-	-	TF	F	I	TF	F
119	1390	-	-	-	-	-	-	-	F	F	I	TM	F
120	1391	TM	TM	M	TF	TF	TF	M	TF	TF	TF	TF	F
121	1392	-	-	-	-	-	-	-	TM	TM	M	M	-
122	1394	-	-	-	-	-	-	-	F	F	F	F	-
123	1396	-	-	-	-	-	-	-	F	F	F	F	-
124	1399	-	-	-	-	-	-	-	TF	TF	I	TF	-
125	1401	TM	TM	TM	TM	TM	TM	TM	F	F	I	I	-
126	1403	-	-	-	-	-	-	-	TM	TM	I	M	-
127	1404	-	-	-	-	-	-	-	I	TM	I	TM	-
128	1407	-	-	-	-	-	-	-	M	M	I	TM	-
129	1408	I	TM	M	TM	I	TM	I	F	F	F	F	F
130	1411	-	-	-	-	-	-	-	TM	TF	TM	TM	-
131	1415	-	-	-	-	-	-	-	TM	TM	M	M	M
132	1416	M	M	TM	M	TM	M	M	-	-	-	-	F

S.no.	Individual no.	Cranium overall	Glabella-supraorbital	Margo orbitalis	Mastoid process	Zygomaticum	Forehead arch-Frontal tubercle	Orbitals	Greater Schiatic Notch	Arc Compose	Sub-pubic angle	Iliac crest	Molecular sex
133	1417	I	TM	M	TM	M	I	TM	-	-	-	-	F
134	1422	-	-	-	-	-	-	-	TM	TM	M	M	M
135	1423	-	-	-	-	-	-	-	M	TF	I	TM	-
136	1426	-	-	-	-	-	-	-	F	F	F	TM	-
137	1427	M	M	I	I	I	I	M	I	I	TM	TM	F
138	1428	F	F	F	F	F	F	F	-	-	-	-	-
139	1429	TM	M	M	M	M	M	TM	TM	TM	M	M	-
140	1431	-	-	-	-	-	-	-	TM	TM	F	F	-
141	1432	TF	M	TM	M	M	TF	TF	I	TM	M	I	-
142	1433	-	-	-	-	-	-	-	TM	M	I	TF	-
143	1438	F	F	F	TM	TM	F	F	-	-	-	-	-
144	1440	-	-	-	-	-	-	-	M	M	M	M	M
145	1441	-	-	-	-	-	-	-	TM	M	M	TM	M
146	1443	-	-	-	-	-	-	-	TF	TF	I	TM	F
147	1456	F	TM	TM	TF	TM	F	F	I	TF	TF	I	F
148	1457	M	M	M	TM	TM	TM	M	TF	TF	I	TM	F
149	1458	TF	F	F	TF	TF	TF	TF	-	-	-	-	F
150	1460	-	-	-	-	-	-	-	F	I	TM	M	-
151	1462	-	-	-	-	-	-	-	I	TF	I	TM	M
152	1463	-	-	-	-	-	-	-	TF	TF	TF	TM	F
153	1464	-	-	-	-	-	-	-	I	TF	TF	TF	F
154	1509	M	M	M	M	M	M	M	F	F	TF	M	F
155	1510	TM	TF	TF	M	TM	TM	TM	TF	I	TM	M	F
156	1511	I	TM	TM	F	TM	TM	M	TF	TF	I	TF	F
157	1512	F	I	I	I	I	F	F	F	F	TF	F	F
158	1513	M	M	M	M	TM	-	M	TM	TM	M	M	-
159	1516	TM	M	M	M	M	TF	TM	-	-	-	-	M
160	1519	TF	F	I	I	I	TF	TF	-	-	-	-	-
161	1525	TF	I	I	TM	I	TF	TF	-	-	-	-	F
162	1526	M	M	M	M	M	M	M	-	-	-	-	M
163	1527	-	-	-	-	-	-	-	-	-	-	TM	-
164	1533	F	I	M	TM	M	F	F	-	-	-	-	-
165	1535	M	M	M	F	M	TM	M	-	-	-	-	-
166	1537	M	M	M	I	I	TM	TM	M	M	M	M	-
167	1545	M	M	M	M	M	M	M	-	-	-	-	M
168	1546	-	-	-	-	-	-	-	TM	TM	I	M	-
169	1548	-	-	-	-	-	-	-	F	F	TF	TF	-
170	1550	TF	I	TM	TF	TM	TF	TF	-	-	-	-	-
171	1551	-	-	-	-	-	-	-	TM	TM	M	TM	-
172	1552	TM	M	M	M	M	M	TM	I	TM	TM	M	-
173	1554	TF	I	I	TF	F	TF	TF	F	F	TF	TF	-
174	1555	F	F	I	TF	TF	F	F	-	-	-	-	-
175	1556	F	TF	F	TF	F	F	F	F	F	F	F	F
176	1557	-	-	-	-	-	-	-	M	M	M	M	F
177	1558	TM	TM	TM	TM	TM	TM	TM	TM	TM	M	M	-
178	1559	M	M	M	M	M	M	M	-	-	-	-	F
179	1561	-	-	-	-	-	-	-	F	F	I	TF	F
180	1564	M	M	M	M	M	M	M	M	F	TF	TF	-
181	1567	TF	I	I	I	I	TF	TF	-	-	-	-	-
182	1568	M	M	M	TM	TM	M	TM	TM	-	I	I	-
183	1569	TF	F	F	TM	F	TF	TF	-	-	-	-	-
184	1571	TM	TM	M	M	M	TM	TM	M	M	M	TM	M
185	1572	TF	TM	TM	TM	TM	TM	TM	-	-	-	-	-

S.no.	Individual no.	Cranium overall	Glabella-supraorbital	Margo orbitalis	Mastoid process	Zygomaticum	Forehead arch-Frontal tubercle	Orbitals	Greater Schiatic Notch	Arc Compose	Sub-pubic angle	Iliac crest	Molecular sex
186	1573	M	M	M	M	M	TF	TF	-	TF	TM	TM	-
187	1578	M	M	M	M	M	-	M	M	M	M	M	F
188	1579	F	F	I	F	TM	F	F	-	TM	TF	-	F
189	1580	M	M	M	M	M	M	M	-	-	-	-	M
190	1585	I	I	I	I	I	I	I	-	-	-	-	-
191	1586	-	-	-	-	-	-	-	-	M	-	-	-
192	1588	M	M	M	I	TM	TM	M	-	-	-	-	-
193	1589	TF	TM	TF	TF	F	TF	TF	-	-	-	-	M
194	1592	I	I	I	I	I	I	I	-	-	-	-	-
195	1593	-	-	-	-	-	-	-	-	M	M	M	-
196	1594	M	M	M	M	M	M	TM	M	M	M	F	-
197	1595	F	F	F	F	F	F	F	-	-	-	-	F
198	1597	F	F	F	F	F	F	F	TM	TM	TM	TM	-
199	1599	TM	TM	TM	M	TM	M	TM	F	F	F	F	F
200	1600	TM	I	TM	TM	M	TM	M	M	M	M	M	-
201	1601	M	M	M	M	M	F	TM	M	M	M	M	-
202	1602	F	F	F	F	F	F	F	-	-	-	-	F
203	1605	-	-	-	-	-	-	-	I	I	TM	TM	-
204	1606	F	F	I	TF	I	F	F	-	-	-	-	-
205	1607	-	-	-	-	-	-	-	M	M	M	M	-
206	1608	F	I	I	I	I	F	F	I	TF	TF	TF	F
207	1609	M	M	M	M	M	M	M	TF	TM	TM	M	-
208	1612	TM	I	TM	M	TM	M	M	M	TM	M	M	M
209	1613	TF	F	F	TF	F	TF	TF	-	-	-	-	-
210	1614	M	M	I	M	M	M	M	I	TM	TM	M	-
211	1616	TM	TF	I	TM	I	M	TM	TM	TM	TM	M	-
212	1625	M	M	TM	TM	TM	-	M	-	-	-	-	-
213	1626	TM	M	TM	M	M	TM	TM	TM	TM	M	M	-
214	1627	M	M	I	TM	TM	M	M	TF	TF	TM	-	-
215	1628	M	I	TM	TM	TM	M	M	TF	TM	TF	TF	F
216	1633	-	-	-	-	-	-	-	TF	TF	F	F	F
217	1635	M	M	M	M	M	-	M	M	M	M	M	M
218	1636	M	M	M	M	M	M	M	TF	TF	TF	TF	M
219	1637	TM	M	M	M	M	I	TM	M	M	M	M	-
220	1638	TM	TM	M	M	M	M	M	F	F	F	F	F
221	1639	M	TM	TM	TM	M	TM	M	-	-	-	-	F
222	1644	-	-	-	-	-	-	-	M	M	TM	TM	-
223	1645	-	-	-	-	-	-	-	M	M	M	M	-
224	1646	TF	TF	TF	M	M	TM	TM	-	-	-	-	-
225	1653	M	M	M	M	M	M	TM	M	M	M	M	-
226	1657	-	-	-	-	-	-	-	TM	TM	TM	TM	-
227	1659	TM	TF	TM	I	I	I	M	TF	TF	TF	TM	-
228	1660	TF	TF	TF	TF	TF	TF	TF	F	F	F	F	-
229	1661	M	M	M	M	M	TF	TF	TM	M	M	TF	-
230	1662	M	TM	TM	TM	TM	TM	M	-	M	M	TM	-
231	1664	M	TM	I	M	M	M	M	M	M	M	M	M
232	1665	TF	I	TF	I	TF	TF	TF	F	F	F	F	-
233	1666	M	M	F	TM	TM	I	TM	M	M	M	M	-
234	1667	F	TF	-	I	TF	F	F	-	-	-	-	F
235	1671	TF	F	I	I	I	TF	TF	F	F	F	F	-
236	1673	TM	TM	TM	I	TM	I	TM	-	-	-	-	-
237	1675	I	TM	TM	TM	M	TM	TM	-	-	-	-	-

Legend: Male – M, Tendency male – TM, Indifferent – I, Tendency female – TF, Female – F, Not available – (-)

Table 3 Data collected from Lübeck series using morphological methods

		Mandible					
S.no.	**Individual No.**	**Mandible overall**	**Condylar Process**	**Corpus Height**	**Mentum**	**Gonion and Angle**	**Molecular sex**
1	884	TM	TM	F	TM	F	-
2	884,1	F	F	F	F	F	-
3	891	TF	TM	TF	F	F	-
4	909	M	M	M	M	M	-
5	915	M	-	M	M	M	-
6	916	M	TM	M	M	TM	-
7	919	M	M	M	TM	TM	-
8	921	F	F	F	TF	F	-
9	922	F	TF	F	TM	F	-
10	923	M	TM	M	M	M	-
11	924	TM	-	M	TF	-	-
12	928	TM	TM	TF	F	F	-
13	965	TM	F	TM	F	TM	-
14	971	TM	TF	TM	TM	F	F
15	990	TM	TM	TF	TF	F	-
16	994,1	TM	M	F	M	TF	-
17	1005	TM	TM	TF	M	TF	F
18	1006	TF	-	M	TF	M	M
19	1097	M	TM	M	TF	F	-
20	1171	M	M	M	TM	TM	-
21	1221	M	M	M	M	M	-
22	1225	F	F	F	TF	TM	F
23	1226	M	-	M	M	M	-
24	1228	TF	TF	F	TM	F	-
25	1229	M	TM	M	TM	TF	-
26	1234	M	M	M	M	M	M
27	1245	M	TM	M	TM	TM	-
28	1249	M	M	M	M	M	-
29	1257	F	TF	M	TF	TM	-
30	1271	TF	-	F	TF	F	M
31	1278	M	-	M	M	M	-
32	1292	F	-	TF	F	F	M
33	1319	M	M	M	M	TF	F
34	1351	TF	-	TM	TF	TF	-
35	1362	TM	TM	M	M	M	-
36	1392	M	M	M	M	TM	-
37	1401	F	F	TM	M	F	-
38	1404	F	F	TM	F	TM	-
39	1416	F	M	TF	TM	TM	F
40	1417	TM	TM	TF	TM	TF	F
41	1423	M	M	TM	TM	M	-
42	1428	F	-	F	F	F	-
43	1429	M	TM	M	TF	TM	-
44	1432	F	F	TF	TF	TF	-
45	1441	TF	F	F	TM	F	M
46	1443	F	M	TM	TM	TM	F
47	1449	M	TM	M	TM	M	M
48	1456	TM	TF	TF	M	F	F
49	1458	F	TF	F	TM	TF	F

		Mandible					Molecular sex
S.no.	Individual No.	Mandible overall	Condylar Process	Corpus Height	Mentum	Gonion and Angle	
50	1511	TF	TF	TM	TF	TF	F
51	1512	TF	-	TF	F	F	F
52	1519	F	TF	F	F	F	-
53	1526	M	M	M	M	M	M
54	1550	TM	TM	TF	TF	TM	-
55	1551	TM	-	M	TM	M	-
56	1552	M	TM	M	TM	M	-
57	1554	TF	F	TF	TF	TF	-
58	1556	F	M	TM	M	F	F
59	1558	TM	M	TF	TF	TM	-
60	1559	TM	TF	M	F	TF	F
61	1567	F	F	F	F	F	-
62	1572	F	F	F	F	F	-
63	1573	M	M	TM	TM	M	-
64	1579	TM	I	TM	M	TM	F
65	1580	TM	TM	TM	TM	TM	M
66	1585	I	F	TF	TF	TM	-
67	1588	TM	I	TM	TF	F	-
68	1589	TF	-	TF	F	F	M
69	1595	TF	F	TM	F	F	F
70	1597	F	F	F	TM	TM	-
71	1599	F	TM	F	F	F	F
72	1600	M	I	TM	I	TM	-
73	1601	M	M	M	F	TF	-
74	1602	F	F	F	F	F	F
75	1605	M	M	TM	M	TM	-
76	1607	M	M	M	I	I	-
77	1608	TF	TM	TF	M	F	F
78	1609	M	-	M	TM	M	-
79	1614	M	I	TM	I	TM	-
80	1616	F	TF	F	TF	TM	-
81	1625	M	I	M	TM	TM	-
82	1627	M	M	TM	I	M	-
83	1628	F	TM	TM	TM	TF	F
84	1637	M	TM	TM	TM	M	-
85	1638	TM	M	TM	I	F	F
86	1639	F	TM	TF	TF	TM	F
87	1645	M	M	M	TF	M	-
88	1646	I	TF	TM	TF	M	-
89	1657	TM	M	M	TM	M	-
90	1659	TF	M	TF	F	F	-
91	1667	TF	M	TF	TM	F	F

Legend: Male – M, Tendency male – TM, Indifferent – I, Tendency female – TF, Female – F, Not available – (-)

Table 4 Data collected from Lübeck series using morphological methods

		Morphological Pelvis			
S.no.	Individual no.	Greater Schiatic Notch	Arc Compose	Sub-pubic angle	Iliac crest
1	886	T Female	T Female	Indifferent	T Male
2	887	Indifferent	Female	Indifferent	Indifferent
3	888	Female	Female	Indifferent	Indifferent
4	889	T Male	Male	Indifferent	Indifferent
5	891	Female	Female	Indifferent	Indifferent

		Morphological Pelvis			
S.no.	Individual no.	Greater Schiatic Notch	Arc Compose	Sub-pubic angle	Iliac crest
6	892	Indifferent	T Male	Indifferent	Indifferent
7	917	Indifferent	T Male	Male	Male
8	919	Indifferent	T Male	Indifferent	T Male
9	920	T Female	T Female	Indifferent	T Male
10	922	Indifferent	T Female	Indifferent	T Male
11	923	T Male	T Male	Male	Male
12	942	T Male	Indifferent	Indifferent	T Male
13	950	Male	Male	Male	Indifferent
14	958	Female	Female	Indifferent	T Female
15	960	T Male	T Male	Indifferent	T Male
16	962	Male	Male	T Male	Male
17	964	T Male	Male	Indifferent	T Male
18	965	Female	Female	T Male	T Male
19	966	T Male	T Male	Indifferent	T Female
20	984	Male	Male	Indifferent	T Female
21	988	Male	Male	Male	T Female
22	990	T Female	T Female	T Female	T Female
23	996	Male	T Male	Indifferent	T Male
24	1003	Indifferent	Indifferent	Indifferent	Indifferent
25	1005	Male	Male	Indifferent	T Male
26	1033	Male	Male	Indifferent	Indifferent
27	1037	Male	Male	Indifferent	Male
28	1075	Indifferent	T Female	T Male	T Male
29	1076	Male	Male	Male	Male
30	1084	T Male	T Female	Indifferent	T Female
31	1090	Female	Female	T Female	T Female
32	1095(1)	Female	Female	T Female	Indifferent
33	1095(2)	T Male	Indifferent	Female	Female
34	1099	Male	Male	Male	Male
35	1102	T Male	T Male	Male	T Male
36	1105	T Male	T Female	T Male	T Male
37	1106	Male	T Female	T Female	T Female
38	1109	Male	Male	Male	Male
39	1122	Female	Female	Female	Female
40	1123	Indifferent	T Male	Indifferent	Indifferent
41	1126	Male	Male	Indifferent	Male
42	1133	T Male	Male	Male	Male
43	1140	Male	Male	Indifferent	T Female
44	1144	T Male	Male	Male	Male
45	1154	T Male	T Male	Male	Male
46	1156	Male	Male	Male	Indifferent
47	1171	Indifferent	Indifferent	Indifferent	T Male
48	1172	Male	Male	Male	Male
49	1204	Female	Female	Female	Female
50	1207	Male	Male	Male	Indifferent
51	1212	Female	Female	Female	T Male
52	1213	Male	Male	Male	Male
53	1217	Female	Female	Indifferent	Indifferent
54	1218	Male	Male	Indifferent	Male
55	1220	T Male	T Male	Female	Female
56	1223	T Male	Female	Female	Female
57	1226	Male	Male	Male	Male
58	1227	T Male	T Male	Male	Male
59	1228	T Female	T Female	T Female	Indifferent
60	1229	Male	Male	Male	T Male
61	1232	Male	Male	Male	Indifferent
62	1233	Female	Female	Indifferent	T Male
63	1234	Male	Male	Male	Male
64	1245	Male	Male	Male	Male
65	1249	Male	Male	Indifferent	Male
66	1250	T Male	Indifferent	Indifferent	T Female
67	1252	T Male	T Male	Indifferent	T Male
68	1254	Indifferent	Indifferent	T Female	T Male
69	1259	Male	Male	Male	Male
70	1261	Male	NA	NA	NA
71	1264	T Male	T Male	Indifferent	Male
72	1269	Male	Male	Male	Indifferent
73	1272	Male	Male	T Female	T Female

		Morphological Pelvis			
S.no.	**Individual no.**	**Greater Schiatic Notch**	**Arc Compose**	**Sub-pubic angle**	**Iliac crest**
74	1273	T Female	T Female	T Female	T Female
75	1274	Male	NA	NA	NA
76	1276	Female	T Male	Male	Male
77	1277	Indifferent	T Male	T Male	T Male
78	1278	Male	T Female	T Male	T Male
79	1282	Female	Indifferent	T Male	Indifferent
80	1284	Female	Female	Indifferent	T Female
81	1286	T Female	T Female	Indifferent	T Male
82	1290	T Male	T Male	Indifferent	T Male
83	1298	Indifferent	T Female	T Male	T Male
84	1299	Male	T Male	Male	T Male
85	1303	T Male	Male	Male	Male
86	1316	Female	T Female	T Male	T Male
87	1327	T Female	T Female	Indifferent	T Female
88	1328	T Female	T Female	T Female	T Male
89	1330	T Male	T Male	Male	Male
90	1331	T Male	T Male	Male	T Male
91	1332	Female	Female	T Female	Indifferent
92	1337	T Male	T Male	Male	Male
93	1339	Indifferent	T Male	T Female	Indifferent
94	1340	Male	Male	Male	T Male
95	1347	T Male	Male	Male	Male
96	1348	T Female	T Female	T Female	T Female
97	1354	Indifferent	Indifferent	T Male	Indifferent
98	1357	Female	Female	Female	Female
99	1358	T Male	Indifferent	Indifferent	T Male
100	1360	T Male	Male	Male	Indifferent
101	1363	T Male	T Female	Indifferent	T Male
102	1366	Male	T Female	Indifferent	T Male
103	1367	T Male	T Female	Indifferent	T Male
104	1374	T Male	T Male	Male	Male
105	1375	Male	Female	Female	Female
106	1378	Male	T Female	T Female	T Male
107	1383	T Female	Female	Indifferent	T Female
108	1390	Female	Female	Indifferent	T Male
109	1391	T Female	T Female	T Female	T Female
110	1392	T Male	T Male	Male	Male
111	1394	Female	Female	Female	Female
112	1396	Female	Female	Female	Female
113	1399	T Female	T Female	Indifferent	T Female
114	1401	Female	Female	Indifferent	Indifferent
115	1403	T Male	T Male	Indifferent	Male
116	1404	Indifferent	T Male	Indifferent	T Male
117	1407	Male	Male	Indifferent	T Male
118	1408	Female	Female	Female	Female
119	1411	T Male	T Female	T Male	T Male
120	1415	T Male	T Male	Male	Male
121	1422	T Male	T Male	Male	Male
122	1423	Male	T Female	Indifferent	T Male
123	1426	Female	Female	Female	T Male
124	1427	Indifferent	Indifferent	T Male	T Male
125	1429	T Male	T Male	Male	Male
126	1431	T Male	T Male	Female	Female
127	1432	Indifferent	T Male	Male	Indifferent
128	1433	T Male	Male	Indifferent	T Female
129	1440	Male	Male	Male	Male
130	1441	T Male	Male	Male	T Male
131	1443	T Female	T Female	Indifferent	T Male
132	1456	Indifferent	T Female	T Female	Indifferent
133	1457	T Female	T Female	Indifferent	T Male
134	1460	Female	Indifferent	T Male	Male
135	1462	Indifferent	T Female	Indifferent	T Male
136	1463	T Female	T Female	T Female	T Male
137	1464	Indifferent	T Female	T Female	T Female
138	1509	Female	Female	T Female	Male
139	1510	T Female	Indifferent	T Male	Male
140	1511	T Female	T Female	Indifferent	T Female
141	1512	Female	Female	T Female	Female

		Morphological Pelvis			
S.no.	Individual no.	Greater Schiatic Notch	Arc Compose	Sub-pubic angle	Iliac crest
142	1513	T Male	T Male	Male	Male
143	1527	NA	NA	NA	T Male
144	1537	Male	Male	Male	Male
145	1546	T Male	T Male	Indifferent	Male
146	1548	Female	Female	T Female	T Female
147	1551	T Male	T Male	Male	T Male
148	1552	Indifferent	T Male	T Male	Male
149	1554	Female	Female	T Female	T Female
150	1556	Female	Female	Female	Female
151	1557	Male	Male	Male	Male
152	1558	T Male	T Male	Male	Male
153	1561	Female	Female	Indifferent	T Female
154	1564	Male	Female	T Female	T Female
155	1568	T Male	NA	Indifferent	Indifferent
156	1571	Male	Male	Male	T Male
157	1573	NA	T Female	T Male	T Male
158	1578	Male	Male	Male	Male
159	1579	NA	T Male	T Female	NA
160	1586	NA	Male	NA	NA
161	1593	NA	Male	Male	Male
162	1594	Male	Male	Male	Female
163	1597	T Male	T Male	T Male	T Male
164	1599	Female	Female	Female	Female
165	1600	Male	Male	Male	Male
166	1601	Male	Male	Male	Male
167	1605	Indifferent	Indifferent	T Male	T Male
168	1607	Male	Male	Male	Male
169	1608	Indifferent	T Female	T Female	T Female
170	1609	T Female	T Male	T Male	Male
171	1612	Male	T Male	Male	Male
172	1614	Indifferent	T Male	T Male	Male
173	1616	T Male	T Male	T Male	Male
174	1626	T Male	T Male	Male	Male
175	1627	T Female	T Female	T Male	NA
176	1628	T Female	T Male	T Female	T Female
177	1633	T Female	T Female	Female	Female
178	1635	Male	Male	Male	Male
179	1636	T Female	T Female	T Female	T Female
180	1637	Male	Male	Male	Male
181	1638	Female	Female	Female	Female
182	1644	Male	Male	T Male	T Male
183	1645	Male	Male	Male	Male
184	1653	Male	Male	Male	Male
185	1657	T Male	T Male	T Male	T Male
186	1659	T Female	T Female	T Female	T Male
187	1660	Female	Female	Female	Female
188	1661	T Male	Male	Male	T Female
189	1662	NA	Male	Male	T Male
190	1664	Male	Male	Male	Male
191	1665	Female	Female	Female	Female
192	1666	Male	Male	Male	Male
193	1671	Female	Female	Female	Female

Table 5 Data collected from South Africa series using morphological methods

		Crania							Pelvis				Mandible					
S.no.	Individual no.	Cranium overall	Glabella-supraorbital	Margo orbitalis	Mastoid process	Zygomaticum	Forehead arch-Frontal tubercle	Orbitals	Greater Schiatic	Arc Compose	Sub-pubic angle	Iliac crest	Mandible overall	Condylar process	Corpus height	Mentum	Gonion and angle	Known sex
1	9	M	I	I	M	M	M	F	M	M	M	M	M	M	M	M	M	M
2	15	M	F	M	M	M	I	M	M	M	M	M	M	M	M	M	M	M
3	18	M	M	F	F	M	M	M	M	M	M	M	M	F	F	F	M	M
4	58	M	M	M	F	M	F	M	M	M	M	F	M	M	M	M	F	M

		Crania							Pelvis				Mandible					
S.no.	Individual no.	Cranium overall	Glabella-supraorbital	Margo orbitalis	Mastoid process	Zygomaticum	Forehead arch-Frontal tubercle	Orbitals	Greater Schiatic	Arc Compose	Sub-pubic angle	Iliac crest	Mandible overall	Condylar process	Corpus height	Mentum	Gonion and angle	Known sex
5	81	F	F	M	F	M	F	F	F	F	F	F	M	M	M	M	F	F
6	84	F	F	M	M	F	F	M	M	I	F	M	M	M	F	I	F	F
7	91	F	F	F	F	F	F	M	M	M	M	M	M	F	I	M	M	M
8	177	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	F
9	267	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M
10	309	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
11	514	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M
12	552	F	F	M	F	F	F	M	M	F	F	F	F	F	F	M	M	F
13	579	M	F	M	M	M	M	M	M	M	I	M	M	M	M	M	M	M
14	702	M	M	F	F	F	M	M	M	M	M	F	M	M	M	M	M	M
15	740	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
16	754	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M
17	828	F	F	F	M	F	F	F	M	F	F	F	F	M	M	F	F	F
18	829	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M
19	836	M	M	M	M	F	M	M	F	M	M	F	M	F	F	F	F	M
20	837	M	M	M	F	M	M	M	M	M	M	I	M	F	M	M	M	M
21	873	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
22	883	M	F	F	M	M	F	M	M	M	F	M	F	M	M	F	F	F
23	921	M	M	M	M	I	M	M	F	M	M	F	M	F	M	M	M	M
24	931	M	F	F	M	F	F	F	M	F	F	M	M	F	M	M	F	F
25	939	F	F	M	F	I	F	M	M	M	M	M	M	F	M	F	M	M
26	949	F	F	F	F	F	F	F	F	F	F	M	F	F	F	F	F	F
27	987	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
28	1196	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M
29	1197	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M
30	1202	F	M	F	F	F	F	F	F	F	F	M	M	F	M	M	F	F
31	1274	F	F	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M
32	1284	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	M	M
33	1370	F	F	F	F	F	F	F	F	F	F	F	F	M	F	M	F	F
34	1445	F	F	F	F	M	F	F	M	M	M	M	M	M	M	F	M	M
35	1476	M	M	M	M	M	M	M	F	F	F	F	NA	NA	NA	NA	NA	M
36	1491	F	F	M	F	F	M	F	F	F	M	F	I	I	I	I	I	F
37	1535	M	M	M	M	M	M	M	I	M	F	F	M	M	M	M	M	M
38	1545	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	F	M
39	1557	F	F	F	M	F	F	M	F	F	F	F	M	F	F	M	F	F
40	1576	F	F	F	F	F	F	F	M	M	F	M	F	M	F	F	F	F
41	1653	F	F	F	F	F	F	M	F	M	F	M	F	F	F	M	F	F
42	1668	M	M	F	F	F	F	F	F	F	F	M	M	F	M	M	F	F
43	1671	M	M	F	M	F	M	M	M	M	M	M	F	F	M	F	M	M
44	1673	M	M	M	M	F	M	M	F	F	F	M	M	F	M	M	M	F
45	1674	M	M	M	F	M	M	M	M	M	M	F	M	M	M	M	M	M
46	1685	F	F	F	F	F	F	M	F	F	F	F	F	M	M	F	F	F
47	1693	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F
48	1776	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
49	1801	M	M	M	M	F	F	F	M	M	M	F	M	F	M	M	M	M
50	1811	F	F	M	M	F	F	F	F	F	F	F	M	M	F	M	F	F
51	1890	M	M	M	M	M	M	M	M	M	M	F	M	F	M	M	M	M
52	1891	F	F	M	F	F	F	M	F	F	F	F	M	F	F	F	F	F
53	1892	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	F	M
54	1909	F	F	F	F	F	F	F	F	M	F	M	I	F	F	F	F	F
55	1912	F	F	F	M	F	F	F	F	F	F	F	M	F	M	F	F	F
56	1925	F	F	F	F	F	F	M	M	M	M	M	F	F	F	F	F	F

		Crania							Pelvis				Mandible					
S.no.	Individual no.	Cranium overall	Glabella-supraorbital	Margo orbitalis	Mastoid process	Zygomaticum	Forehead arch-Frontal tubercle	Orbitals	Greater Schiatic	Arc Compose	Sub-pubic angle	Iliac crest	Mandible overall	Condylar process	Corpus height	Mentum	Gonion and angle	Known sex
57	1930	M	M	M	F	M	M	F	F	F	M	F	M	M	M	M	M	M
58	1944	M	M	M	M	M	M	M	F	F	F	F	M	M	M	M	F	F
59	1951	M	M	M	F	M	M	M	F	F	F	F	F	F	F	F	F	F
60	1991	M	M	F	F	M	F	M	F	F	F	F	M	F	F	F	M	F
61	1993	M	M	M	M	F	F	M	M	M	M	M	M	F	M	M	F	M
62	2001	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M
63	2026	F	F	F	F	F	F	F	F	F	F	M	M	M	M	M	M	F
64	2030	M	M	M	M	M	F	M	M	M	M	M	M	M	F	F	M	M
65	2045	M	M	M	M	M	M	I	M	F	M	F	F	F	F	F	M	M
66	2046	F	F	M	M	F	F	M	M	M	M	M	M	M	F	F	M	M
67	2049	M	M	M	M	F	M	M	F	M	M	M	M	M	M	F	M	M
68	2053	M	M	M	M	M	M	F	M	M	M	F	M	M	M	M	M	M
69	2058	M	M	F	M	F	M	M	I	F	M	F	M	M	M	M	M	M
70	2064	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	F	M
71	2099	M	M	M	M	M	M	M	F	F	F	M	M	M	M	M	M	M
72	2132	F	M	F	F	F	M	M	M	M	M	M	M	F	F	M	F	M
73	2140	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	M	M
74	2160	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
75	2167	M	M	M	M	M	M	M	F	F	F	F	M	M	M	M	F	M
76	2199	NA	NA	NA	NA	NA	NA	NA	F	F	F	F	F	F	M	M	F	F
77	2255	M	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M
78	2281	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
79	2303	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	M	M
80	2343	M	F	M	F	F	M	M	F	F	F	F	F	M	F	F	F	F
81	2349	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	F
82	2356	M	M	M	M	M	F	M	M	M	M	M	I	M	M	M	F	M
83	2359	F	F	F	M	F	F	F	F	F	F	F	F	F	F	M	F	F
84	2363	F	M	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M
85	2365	F	F	F	M	M	F	M	M	M	M	M	M	M	F	M	M	M
86	2367	M	F	M	M	M	M	F	F	F	F	F	F	F	F	F	F	F
87	2389	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M
88	2392	M	F	M	F	F	F	M	M	M	M	M	M	M	M	F	M	M
89	2401	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M
90	2402	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
91	2404	F	F	M	F	F	F	F	M	F	F	M	F	F	F	M	F	F
92	2410	M	M	M	F	M	M	M	M	F	F	F	M	F	M	M	M	M
93	2653	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	F	M
94	2662	M	M	F	M	M	M	M	M	M	M	F	M	M	M	M	M	M
95	2735	M	M	M	F	F	F	M	M	F	M	M	M	F	F	F	M	M
96	2764	M	F	M	F	M	M	M	M	M	F	F	F	M	M	M	F	F
97	2863	F	F	M	F	F	F	F	F	M	F	M	F	F	F	F	F	F
98	2867	M	M	M	I	F	M	F	M	M	F	F	F	F	M	M	M	M
99	2892	M	M	M	M	M	F	F	F	F	M	M	M	M	M	F	M	M
100	2935	F	F	M	F	F	F	F	F	F	F	F	F	F	F	M	F	F
101	3057	M	M	M	M	F	F	M	F	F	F	F	F	F	F	F	F	F
102	3090	M	M	M	M	M	M	M	M	F	M	M	M	M	F	M	M	M
103	3091	M	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M
104	3093	M	M	M	M	M	M	M	F	M	M	F	M	F	M	F	M	M
105	3095	M	M	M	M	F	F	F	F	F	F	F	F	F	F	F	M	F
106	3099	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
107	3106	F	M	M	M	I	M	M	M	M	M	F	M	F	M	F	M	M
108	3112	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M

		Crania							Pelvis				Mandible					
S.no.	Individual no.	Cranium overall	Glabella-supraorbital	Margo orbitalis	Mastoid process	Zygomaticum	Forehead arch-Frontal tubercle	Orbitals	Greater Schiatic	Arc Compose	Sub-pubic angle	Iliac crest	Mandible overall	Condylar process	Corpus height	Mentum	Gonion and angle	Known sex
109	3114	M	M	M	F	M	M	M	M	M	M	M	M	M	M	F	F	M
110	3116	F	F	M	F	F	F	F	M	F	F	F	M	F	F	F	F	F
111	3127	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	F
112	3134	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
113	3135	M	M	M	F	M	M	M	M	M	M	M	F	M	F	M	F	M
114	3143	M	M	M	F	M	M	M	M	M	M	M	F	M	M	I	F	M
115	3157	F	F	M	M	F	M	F	F	F	F	F	M	F	M	F	M	F
116	3159	F	F	M	F	M	F	M	M	M	M	M	M	F	M	M	M	M
117	3160	M	M	M	F	I	F	M	M	M	M	M	M	M	I	F	M	M
118	3162	M	M	M	M	M	F	F	F	M	F	M	F	F	M	M	F	F
119	3166	M	M	F	F	F	I	I	M	M	M	M	M	F	M	M	M	M
120	3167	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M
121	3172	M	M	M	M	M	M	M	M	M	M	F	M	M	F	F	F	M
122	3180	F	M	M	M	F	F	M	F	F	F	F	F	F	M	M	F	F
123	3183	F	F	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F
124	3188	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
125	3245	M	F	M	F	M	F	F	M	M	M	M	M	M	F	M	M	M
126	3282	F	F	M	M	M	F	F	M	M	F	M	F	F	M	F	F	F
127	3287	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
128	3290	F	F	M	M	F	F	F	M	M	F	M	I	F	F	F	I	F
129	3314	M	M	M	M	F	M	M	M	M	M	M	M	F	M	F	F	M
130	3315	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M
131	3350	M	M	F	M	M	M	M	M	M	M	F	M	M	M	M	F	M
132	3351	M	M	M	M	M	F	M	M	M	M	F	M	M	M	M	F	M
133	3365	F	F	F	F	F	F	F	F	F	F	F	M	M	F	M	F	F
134	3377	M	M	M	F	M	M	F	M	M	M	M	M	M	M	M	M	M
135	3396	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M
136	3404	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M
137	3415	M	M	F	F	M	F	M	M	M	M	M	M	M	M	F	F	M
138	3419	F	F	F	F	F	M	M	F	F	F	F	F	M	M	F	F	F
139	3450	F	F	F	F	F	F	M	M	M	F	M	M	F	F	F	M	F
140	3453	F	F	F	M	F	M	M	M	M	M	M	F	M	M	F	F	M
141	3480	F	M	F	M	M	F	M	M	M	F	F	F	M	M	F	F	F
142	3485	M	M	M	F	M	M	M	M	M	M	M	M	F	F	I	M	M
143	3490	M	M	F	M	M	M	M	M	M	M	M	M	F	M	F	M	M
144	3491	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M
145	3499	M	F	F	F	F	F	M	M	F	F	F	F	M	F	F	F	F
146	3501	M	M	M	F	F	F	F	M	M	F	F	F	M	M	M	F	F
147	3503	M	F	F	F	F	F	F	M	F	F	F	M	F	M	M	F	F
148	3507	F	F	M	F	F	F	F	M	F	M	M	F	F	F	F	F	F
149	3524	M	M	F	F	F	F	M	M	M	F	M	F	F	I	I	F	F
150	3525	M	M	M	F	F	F	F	F	F	F	F	F	M	F	F	F	F
151	3529	M	M	M	M	M	M	M	F	M	M	M	M	M	M	M	F	M
152	3538	M	M	F	M	F	M	M	M	M	M	M	M	F	M	M	M	M
153	3556	F	M	M	M	M	M	M	F	M	F	F	M	M	F	F	M	F
154	3582	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	F	M
155	3590	F	F	M	F	M	F	F	F	M	F	F	F	M	M	M	F	F
156	3610	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
157	3614	M	M	M	F	F	M	F	M	M	F	M	F	F	F	F	F	F
158	3618	M	M	M	F	M	M	M	M	M	M	M	M	M	F	F	M	M
159	3644	M	M	M	M	M	M	M	NA	NA	NA	NA	M	M	M	F	M	M
160	3653	F	F	F	F	F	M	F	NA	NA	NA	NA	F	F	F	F	F	F

		Crania							Pelvis				Mandible					
S.no.	Individual no.	Cranium overall	Glabella-supraorbital	Margo orbitalis	Mastoid process	Zygomaticum	Forehead arch-Frontal tubercle	Orbitals	Greater Schiatic	Arc Compose	Sub-pubic angle	Iliac crest	Mandible overall	Condylar process	Corpus height	Mentum	Gonion and angle	Known sex
161	3673	F	F	M	F	F	F	F	NA	NA	NA	NA	F	F	F	M	F	F
162	3759	F	F	M	F	F	F	M	NA	NA	NA	NA	F	F	F	F	F	F
163	3763	M	M	M	F	M	M	M	NA	NA	NA	NA	M	M	M	M	M	M

Legend: Male – M, Female – F, Not available – (-)

Table 6 Data collected from Inden series using metrical methods on Femur

S. no.	Box number	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)
1	82	9.9	43.5	2.8	7.5	4.4	4.4	9.7
2	88	9.9	45.1	3.1	8.2	4.8	4.8	15.2
3	91	9	45	3	8.3	4.7	4.7	15
4	93	9.3	40.9	3.1	7.5	4.1	4.1	13.1
5	99	7.6	43.6	2.3	7	4.2	4.2	13.4
6	100	8.5	39.2	2.8	7.4	4.2	4.2	13.5
7	101	8.4	42.1	2.6	7.3	4.1	4.1	13.1
8	102	8.9	43.3	2.8	7.4	4.2	4.2	13.2
9	107	8.2	37.9	2.8	7.2	4.2	4.3	13.5
10	113	8.8	43	2.6	8	4.7	4.7	14.8
11	115	8.5	44.7	3.1	7.1	4.5	4.4	14
12	116	8.8	44.4	2.8	7.7	4.6	4.7	14.8
13	117	9.8	47.3	3.1	8.4	4.6	4.7	14.9
14	118	7.9	41.6	2.6	6.9	4.2	4.2	13.3
15	121	8.6	42.2	2.8	6.6	4	4.1	12.8
16	122	8.5	40.4	2.6	7.1	4	4	12.6
17	124	9.2	45.4	2.8	8.4	4.9	5	15.8
18	125	8.5	44	2.6	8	4.5	4.4	14.1
19	126	9.2	44.1	3.1	7.8	4.7	4.8	15.2
20	127	8.5	38.8	2.9	7.4	3.9	4	12.8
21	131	9.1	47.7	3	8	4.8	4.8	15.5
22	136	9.4	48.1	2.8	7.8	4.7	4.7	15.2
23	145	9	40.2	3	7.4	4.1	4.1	12.9
24	146	9.2	41.1	2.7	8.3	4.7	4.7	15.1
25	161	9.1	47.4	3	8.6	4.9	4.9	15.4
26	163	8.7	45.1	2.6	7.7	4.5	4.4	14
27	164	8.9	41.2	2.8	7.6	4.1	4.1	13.1
28	166	9	44.6	2.8	8.3	4.9	4.9	15.6
29	174	8.9	44	2.8	7.7	4.5	4.5	13.5
30	175	9.3	42.3	3	8.4	4.9	4.9	15.4
31	176	9.2	47.3	3	8	4.7	4.7	14.8
32	180	9.4	49.6	2.9	8.6	4.6	4.6	14.8
33	182	8.7	46.6	2.7	7.7	4.2	4.2	13.4
34	183	8.8	37.6	2.6	7.3	4	4	12.2
35	186	10.2	46.3	3.5	8.4	4.9	4.8	15.3
36	195	9.5	48.2	2.9	8.5	5	5	15.8
37	200	9.8	46.4	2.9	8.9	4.9	4.9	15.7
38	201	8.9	23.9	2.7	8	4.7	4.7	14.9
39	203	8.8	31.4	2.7	7.6	4.8	4.7	15.1
40	217	10	46.8	3.1	8.8	5.3	5	16.6
41	240	9.5	43.9	2.9	8.3	4.9	4.9	15.6
42	242	8.8	44.2	2.9	8.1	4.8	4.7	14.9
43	243	8.8	42	2.8	8.3	4.7	4.7	15.1
44	244	9.4	45.4	2.9	8.6	5.1	5.1	16.1
45	301	8.6	44.3	2.7	7.5	4.8	4.7	15.1

S. no.	Box number	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)
46	304	8.8	46	3	8.2 (avg)	4.9	5	16
47	305	8.8	42	2.8	7.7	4.5	4.5	15.1
48	306	8.9	40.7	2.8	7.8	4.9	4.9	15.5
49	310	8.6	41	2.5	6.9	4.2	4.2	13.4
50	311	10.3	49.2	3.2	8.5	5	5	15.4
51	313	9	43.9	2.9	7.8	4.4	4.3	13.8
52	314	8.2	43.3	2.7	7.1	4.2	4.1	13.1
53	315	7.4	39.2	2.3	7	3.9	3.9	12.4
54	317	7.6	37	2.5	7.3	4.1	4	13
55	319	9.7	46.5	3.1	8.6	5.1	4.9	15.5
56	320	9.7	48.8	3.4	8.2	5.5	5.4	17.3
57	322	9	42.7	2.6	7.2	4.5	4.4	14
58	323	9	43.6	2.9	7.7	4.4	4.4	14
59	324	8.5	42.4	2.7	7.3	4.2	4.2	13.1
60	326	8.5	42.9	2.6	7.4	4.4	4.4	14.1
61	327	7.9	44.7	2.5	7.2	4.3	4.1	13.5
62	330	10.4	47.5	3.2	8.8	5.2	5.2	16.5
63	331	10	47.1	3.4	8.7	5	5	15.7
64	332	8.3	42.9	2.5	7.6	4.3	4.3	13.5
65	333	8.5	42.5	2.6	7.5	4.4	4.4	13.9
66	335	9.7	44.3	2.9	8	4.8	4.8	15.3
67	337	9	44.6	2.8	8	4.7	4.7	14.8
68	338	8.1	41	2.6	7.1	3.9	3.9	12.5
69	340	8.9	45.1	2.9	7.8	4.8	4.8	15.3
70	342	8.5	41.1	2.8	7.4	4.1	4.1	13.3
71	343	8.5	39.2	2.6	7	4.2	4.2	13.5
72	345	8.9	43.4	3	8.3	5	5	15.8
73	348	9.7	48.8	2.8	7.8	5.4	5.3	17
74	353	8.8	41.5	2.7	7	4.2	4.2	13.4
75	355	7.4	36.7	2.15	7	3.8	3.9	12.2
76	356	10.3	48.2	3.3	8.4	4.9	4.9	15.1
77	357	9.5	43.1	2.6	7.5	4.2	4.2	13.6
78	358	9.2	45.3	2.8	7.6	4.4	4.4	14.2
79	360	8.5	44.2	2.7	7.8	4.4	4.4	14
80	363	7.8	41.5	2.4	7.1	4.2	4.2	13.4
81	364	7.75	39.9	2.4	7.1	3.85	3.85	12.4
82	365	9.6	46.1	2.9	8.3	5	5	15.9
83	368	8.8	43.3	2.75	7.5	4.5	4.5	14.3
84	371	9.5	44.2	2.8	8.4	4.6	4.7	14.6
85	373.1	8.2	41	2.6	6.9	4	3.9	12.7
86	374	8.5	43.8	2.7	7.5	4.2	4.2	13.2
87	375	8.4	43.4	2.6	7.1	4.3	4.3	13.8
88	378	9.1	44.2	2.8	9.5	4.6	4.6	14.8
89	401	8.7	44	2.8	7.8	4.5	4.5	14.2
90	405	9.4	46.1	2.8	8.4	5	5	15.5
91	407	9.1	45.2	3	7.9	4.6	4.6	14.5
92	411	9.1	47.6	2.8	7.5	4.4	4.4	13.2
93	413	9.9	50.3	3	8.4	4.7	4.7	14.1
94	415	9.9	44.6	3.3	9.9	4.8	4.8	15.5
95	416	9.8	46.6	3	8.2	5	5	15.9
96	417	9.2	42.7	2.8	7.7	4.6	4.6	14
97	419	8.2	46.9	2.5	7.9	4.9	4.9	15.6
98	420	9.2	23.1	2.7	7.5	4.7	4.7	15
99	426	8.7	43.5	2.3	7.7	4.5	4.6	14.6
100	428	9.4	45.3	2.8	7.8	5	4.9	15.7
101	429	8.5	43.7	2.6	7.1	4.4	4.4	13.82
102	436	8.7	44.5	2.7	7.5	4.7	4.7	15.2

S. no.	Box number	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)
103	438	8.2	39.2	2.5	7	4	3.8	16.5
104	442	8.7	42.7	2.7	7.15	4.9	4.4	14.6
105	443	8.1	40.2	2.4	7.1	4	4	12.56
106	446	8.4	37.8	2.3	6.9	4.1	4.1	13

Legend: Male – M, Female – F, Not available – (-)

Table 7 Data collected from Inden series using metrical methods on Tibia

S. no.	B. no.	Side	T1 (cm)	T2 (cm)	T3 (cm)	T4 (cm)	T5 (cm)	T6 (cm)	T7 (cm)	T8 (cm)	T9 **(cm)**	T10 **(cm)**	T11 **(cm)**	T12 **(cm)**
1	82	L	9.1	35.4	7	3	2.1	8.1	4.2	6.9	3.3	4.7	3.8	3.3
2	88	L	8.5	35.2	7.3	2.6	2.3	7.5	4.4	7.3	3.5	5.1	4.4	3.6
3	91	L	9.3	35.2	7.6	3.2	2.1	7.5	4.9	7.8	3.5	4.9	4.2	3.7
4	93	L	9.1	34	6.6	2.8	2.1	7.9	4	6.9	3.4	4.6	4.3	3.1
5	98	L	8.6	32.8	7.3	2.9	1.9	7.2	4.4	7.2	3.5	5	4.2	3.4
6	99	L	8.6	33.1	6.5	2.7	2.1	7	4.3	6.4	3	4.2	3.9	2.9
7	100	L	9.1	30.3	7	2.6	2.2	7.5	4.2	6.6	3.2	4.5	3.3	3
8	101	L	8	32.4	6.9	2.5	2	7	4.2	6.8	2.9	4.4	3.5	3.3
9	102	L	8.8	34.2	6.9	2.7	2.2	7.7	4.7	6.7	3.3	4	3.6	3
10	107	L	8.1	31.5	6.6	2.6	1.8	6.3	4.4	6.5	3.2	4.4	3.7	3
11	113	L	9.2	33.4	7.7	2.6	2.2	6.7	5	7.7	3.7	5.1	4.5	3.7
12	115	R	9.2	34	6.9	3	2	7.4	4.5	6.8	3.4	4	3.8	3.3
13	117	L	9.8	36.3	7.8	3	2.4	7.7	5.5	7.8	3.8	5	4.2	3.6
14	118	L	7.7	33.1	6.4	2.5	2	6.6	4	6.2	2.9	4.3	4.3	3.5
15	121	L	8.5	33.6	6	2.5	2.1	7.1	4.2	6.3	2.9	3.8	3.8	2.8
16	122	L	8.2	32.8	6.6	2.8	2.2	6.7	4.3	6.8	3.3	4.2	3.9	3.4
17	123	R	8.5	33.1	6.6	2.5	2.2	7.4	4.4	6.7	2.8	3.8	3.9	3.5
18	124	R	8.5	36.4	7.8	2.8	2.1	7.6	5.6	7.8	3.7	4.8	4.7	3.6
19	125	L	9.1	34.5	7.2	2.9	2.1	7.4	4.3	7.2	3.5	4.7	4.4	3.3
20	126	L	9.5	34.4	7.3	3.1	2	7.6	4.4	7.5	3.4	4.8	4.1	3.6
21	127	L	8.8	31.7	6.8	2.7	2.5	7.7	4.3	6.6	2.9	4.2	3.7	3.3
22	129	L	9.2	38.2	7.7	3.1	2.5	8.2	5.1	7.7	3.7	5.1	4.4	3.6
23	131	L	9.4	38.4	7.8	2.6	2.2	7.3	5.2	7.6	3.7	4.7	4.4	3.4
24	136	L	9.6	37.4	7.6	3.2	2.1	7.4	5.2	7.8	3.8	4.9	4.4	4
25	145	L	8.4	33	6.8	2.8	2.1	7.2	4.5	6.8	3.3	4.5	3.8	3.1
26	146	L	9	33	7.6	2.6	2.1	7.2	5	7.6	3.7	4.9	4.6	3.5
27	161	L	9.9	34.3	7.9	3.3	2.1	7.8	5.2	7.7	3.7	5.1	4.3	3.9
28	163	L	9.9	35	7.4	3	2.2	7.7	5	7.5	3.6	4.6	3.8	3.6
29	164	L	8.6	31.3	6.9	2.8	2.2	7	4.8	7	3.3	4.7	4	3.4
30	166	L	9.5	33.4	7.8	3.1	2.1	7.7	5.1	7.7	3.5	5	4.8	3.8
31	174	L	9.2	34.1	7.2	2.9	2.4	7.4	5.2	7.2	3.4	4.4	4.2	3.3
32	175	L	9.6	32.6	7.7	3.2	2.3	7.7	4.6	7.7	3.4	4.7	4.1	3.4
33	176	L	9.3	37.5	7.4	3.3	2.5	7.7	4.6	7.3	3.3	4.9	5.1	3.7
34	180	L	10	37.2	7.5	3	2.4	8	5.6	7.6	3.7	4.3	4.4	3.7
35	182	L	8.4	37	7.2	2.7	2	7.4	4.3	7.3	3.6	4.1	4.1	3.7
36	183	L	8.5	29.1	6.8	2.9	1.8	7	4.6	6.9	3.2	4.3	3.8	3.3
37	186	L	10.7	39.6	8.4	3.2	2.4	8.2	5.4	8.5	4.2	4.9	4.6	4
38	193	L	8.3	33.6	6.7	2.7	2.1	7.1	4.5	6.7	3.2	3.9	4	3.1
39	195	L	9.9	39	7.9	3.1	2.5	7.7	5.4	7.8	3.7	5.3	4.4	3.7
40	200	L	9.7	35.6	8.2	3.1	2.2	7.7	5.6	8.1	3.8	5	4.5	3.9
41	201	L	9.4	33.4	7.5	2.8	2.2	7.5	5.1	7.2	3.4	4.3	4.4	3.5
42	203	L	10.1	33.3	7.6	2.9	2.2	7.5	5	7.5	3.7	4.3	4.5	3.7
43	212	L	9	32.3	7	2.7	2.1	7.1	4.4	7.2	3.5	4.8	4.2	3.7
44	217	L	10.5	35.4	8.4	3	2.5	8	5.7	8.4	3.8	4.9	4.5	4.3
45	240	L	10.2	33.3	7.8	2.9	2.3	7.8	5.5	7.8	3.8	5.2	4.6	3.5
46	242	L	9.6	34.4	7.9	3.1	2.5	7.5	5.1	7.6	3.6	5	4.5	3.6
47	243	L	8.9	31.9	7.9	2.9	2.1	7	5.1	7.8	3.7	4.7	4.3	3.8
48	244	L	9	37.1	7.7	2.7	2.3	7.7	5.5	7.6	3.5	5.4	4.5	3.5
49	245	L	8.1	37.1	6.6	2.6	2.2	6.3	5	6.7	3.3	4.2	4.2	3.3

S. no.	B. no.	Side	T1 (cm)	T2 (cm)	T3 (cm)	T4 (cm)	T5 (cm)	T6 (cm)	T7 (cm)	T8 (cm)	T9 **(cm)**	T10 **(cm)**	T11 **(cm)**	T12 **(cm)**
50	301	L	9.5	34	7.3	3	2.1	7.8	4.8	7.3	3.6	4.7	3.9	3.5
51	304	L	9.3	34.3	7.7	3.3	2.2	7.6	5.2	7.6	3.5	4.5	4.5	3.8
52	304(2)	L	9.2	34.5	7.5	3.3	2.2	7.4	5.2	7.5	3.5	4.4	4.4	3.8
53	305	L	8.3	31.7	7.1	2.6	2.1	6.9	4.9	7	3.2	4.4	4	3.4
54	306	L	9.2	34.5	7.4	2.7	2.2	7.2	5.2	7.2	3.6	4.8	4.4	3.5
55	310	L	8.4	31.8	6	2.6	2.1	7.2	4.8	6.3	3	4.4	3.6	2.9
56	311	L	10.5	39	7.6	3.3	2.4	8.5	5.6	7.8	3.9	5.5	4.6	3.6
57	312	L	9.8	35.4	8.3	3.1	2.4	7.9	5.8	8.3	3.7	4.9	4.5	4.1
58	313	L	9	34.2	7.1	2.6	2.2	7.5	5.1	6.9	3.4	4.3	3.7	3.1
59	315	L	7.9	31.3	6.5	2.5	1.7	6.3	4.4	6.5	3	4.1	3.7	3.3
60	317	R	7.4	29	6.6	2.2	2	5.8	4	6.8	3.2	4.3	4.1	3.3
61	319	L	10.3	36.7	7.8	3	2.6	8.1	5.6	7.9	3.8	4.7	4.5	3.7
62	321	L	7.9	34.2	7.1	2.5	1.7	6.6	5.1	7.1	3.3	4.3	4.2	3.2
63	323	L	8.7	33.5	7.1	2.7	2.1	7	4.7	7.1	3.4	4.3	4	3.3
64	324	L	9.5	33.2	6.5	3	2.1	7.5	4.9	6.6	3.1	4.4	3.7	3.2
65	326	L	8.5	32.5	6.4	2.8	2	7.2	4.7	6.7	3.3	4.3	3.5	3
66	330	L	10.6	39.3	7.8	3.1	2.2	8.3	5.4	8.2	3.9	5.5	4.7	3.9
67	331	L	9.7	36.2	8	3.2	2.2	7.8	5.5	8.1	3.9	4.8	4.6	4
68	332	L	9	33.5	7	2.8	2	7.1	4.8	7	3.6	4.6	4.2	3.2
69	333	R	9.2	32.8	7.2	2.9	2.1	7.1	4.8	7.1	3.4	4.3	3.8	3.6
70	335	L	10.2	36.6	7.4	3	2.1	7.7	5.6	7.7	3.6	5.1	4.6	4
71	337	L	9.3	33.5	7.3	2.9	2	7.2	5.5	7.5	3.5	4.4	4.2	3.7
72	338	L	8.9	31	6.7	2.3	1.9	6.5	4.6	6.7	3.4	4.5	3.8	3.2
73	340	R	9.4	35.2	7.5	2.1	2.8	7.5	5.2	7.5	3.5	5	4.1	3.5
74	342	L	8.7	31.7	6.5	2.2	2.7	7.3	4.8	6.9	3.1	4.3	3.8	3.7
75	343	L	8.5	31.2	6.6	2	2.65	7.2	4.7	6.5	4.2	3.3	3.6	3.1
76	345	L	9.5	33.1	7.4	2.15	3.1	7.8	5.3	7.6	3.5	5	4.5	3.7
77	353	L	8.9	32.6	6.1	2	2.8	7.6	4.3	6.15	3.2	4.2	3.8	2.9
78	355	L	7.2	28.9	6.2	1.7	2.3	6.3	4.2	6.4	2.7	4.1	3.5	3
79	357	L	8.6	33.5	6.6	2.6	2.1	7	4.8	6.7	3.1	4.2	4	3.3
80	360	L	9.4	34.45	6.7	2.45	2.6	7.6	5.1	7	3.2	4.6	3.8	3.4
81	363	L	7.75	31.4	6.6	1.8	2.15	6.85	4.5	6.55	3	4.1	3.8	3.1
82	364	L	7.8	30.8	6.6	1.8	2.4	6.3	3.95	7	3.9	4.3	3.5	3.2
83	365	R	10.1	36.7	7.6	2.8	3	7.9	5.3	7.6	3.5	5.1	4.5	3.8
84	368	L	8.8	34.2	6.6	2.1	2.5	7.5	4.9	6.8	3.2	4.3	4	3.4
85	371	L	8.7	34.1	7.8	2.1	2.8	7.6	5.4	8	3.7	5	4.3	3.6
86	373.1	R	8	31.7	6.5	1.9	2.4	6.3	4.7	6.5	3.2	4	3.7	2.9
87	374	L	8.6	34.3	78.4	2	2.6	6.9	4.8	7.4	3.3	4.9	4.3	4
88	375	L	8.2	33.4	6.6	1.9	2.3	6.6	4.6	6.6	3	4.2	3.9	3.4
89	378	L	9.9	34.2	7.7	2	3.1	7.6	5.4	7.5	3.5	5.2	4.5	3.6
90	401	R	9.2	33.3	7.4	2.2	2.9	7.9	5.3	7.4	3.6	4.2	3.9	3.5
91	405	L	9.8	35.5	7.8	2.3	3	5.3	5.3	7.2	3.7	5	4.5	3.6
92	407	L	8.4	34.7	7.2	2.6	2.1	6.85	4.9	7.2	3.2	4.6	4.15	3.6
93	409	R	8.65	34.1	6.4	2.2	2.7	7.2	4.6	6.3	3.1	3.8	4	3.1
94	410	R	8.1	32.5	6.4	1.9	2.4	4.4	6.4	6.4	3.1	4	3.6	3.2
95	411	L	9.6	37.7	7	3	2.5	4.9	7.1	7.1	3.4	4.7	4.5	3.4
96	413	L	10	40.8	7.9	2.4	3	5.6	7.8	7.8	3.6	5.2	4	4.6
97	416	L	10.2	37.6	7.7	2.3	2.9	8.5	5.4	7.6	3.5	5.1	4.4	3.9
98	417	L	9.2	32.2	7.3	2.1	2.9	4.8	7.25	7.25	3.6	4.6	4	3.2
99	419	L	9	36.3	7.2	2.2	2.9	5.2	7.2	7.2	3.4	4.5	4.1	3.4
100	420	L	9.9	34.4	7.6	2.3	3	7.75	5.2	7.5	3.5	5	4.5	3.7
101	425	R	9.5	33.8	7.5	2	3.2	7.65	5.2	7.4	3.6	4.5	4.4	3.3
102	426	L	9.3	35.1	7	2.2	2.6	7.1	4.8	7	3.4	4.3	4.1	3.2
103	428	L	9.5	33.1	7.6	2.3	3	7.9	5.3	7.6	3.65	4.8	4	3.65
104	429	L	8.3	34.6	6.5	2	2.4	6.7	4.6	6.5	3.1	4.4	3.6	3.1
105	436	L	7.55	32.3	7	1.8	2.5	6.7	4.9	7	3.2	4.5	3.8	3.5
106	437	L	9.6	35.9	7.8	2.1	2.8	7.7	4.7	7.8	3.7	4.5	4.6	3.8

S. no.	B. no.	Side	T1 (cm)	T2 (cm)	T3 (cm)	T4 (cm)	T5 (cm)	T6 (cm)	T7 (cm)	T8 (cm)	T9 **(cm)**	T10 **(cm)**	T11 **(cm)**	T12 **(cm)**
107	438	L	8.2	30	6.4	1.8	2.6	7.1	4.6	6.4	2.9	4.9	3.5	3.3
108	442	L	8.9	33	6.9	2.25	2.6	7.75	5	6.8	3.3	4.1	3.5	3.1
109	443	L	8.1	31.8	6.4	2.1	2.4	6.9	4.8	6.4	3.1	3.9	3.1	3.7
110	446	L	8.65	28	6.5	1.8	2.4	6.75	4.9	6.5	3.1	4.2	3.5	3.1

Legend – L: Left side of the bone, R: Right side of the bone

Table 8 Data collected from Inden series using metrical methods on Humerus

S. no.	Box no.	Side	H1 (cm)	H2 (cm)	H3 (cm)
1	82	L	32.3	4	5.7
2	88	L	30.8	4	6
3	91	L	33.1	4.3	6.6
4	93	L	30.8	4.2	5.3
5	98	L	31.7	4	5.5
6	99	L	30.5	4.2	5
7	100	L	29.4	4.3	6
8	101	L	31.8	4.7	5.7
9	102	L	30.7	4.3	5.6
10	107	L	27.5	3.6	5.4
11	113	L	31.9	4.4	6.4
12	116	L	32.7	4.5	6
13	117	L	32.2	4.5	6.2
14	118	L	29.7	4.1	5
15	122	L	29.2	4.1	5.5
16	123	L	31.4	4.1	5.1
17	125	L	32.5	4.4	6.3
18	126	L	33.2	5.1	6.3
19	127	L	28.1	4.1	5.4
20	129	R	34.8	5.3	7.1
21	131	L	34.9	4.2	6
22	145	L	30.7	4.1	5.6
23	146	R	31.5	4.6	6.1
24	163	L	31.7	4.6	6.3
25	164	L	30.1	4	5.5
26	166	L	31.9	5.1	6.2
27	169	R	32.3	4.6	5.3
28	175	L	31	4.5	6.7
29	176	L	33.2	4.1	6.4
30	180	L	33.8	5.1	6.2
31	182	L	32.5	4.5	5.8
32	183	L	28.1	4.6	5.7
33	186	L	33.6	4.9	6.8
34	195	L	35.7	4.6	6.4
35	200	L	33.3	4.6	6.7
36	201	L	32.4	4.6	5.8
37	203	L	31	4.3	6.2
38	240	L	32.8	4.7	6.1
39	241	R	28.5	4.3	5.5
40	243	L	31.5	4.9	6.3
41	244	R	33.7	4.4	6.4
42	245	R	35.2	4.4	6.3
43	301	L	33.3	5	6.1
44	310	L	29.1	4.3	5.7
45	311	R	35.6	5.3	6.5
46	315	L	28.3	4.1	5.3
47	316	L	30.3	5	6.1
48	317	L	27.4	4.6	5.6
49	319	L	34.6	5.8	6.5

S. no.	Box no.	Side	H1 (cm)	H2 (cm)	H3 (cm)
50	320	L	35.7	5.6	6.7
51	322	L	30.5	4.6	5.7
52	323	L	32.2	4.7	5.6
53	324	L	20.2	4.3	5.4
54	326	L	29.8	4.7	5.6
55	327	R	32.4	4.6	5.7
56	330	L	36.4	5.7	7.1
57	331	L	23.8	5.2	5.7
58	332	L	30.6	4.7	6
59	333	R	31	5.3	6
60	335	L	33.3	5.5	7.1
61	337	L	32.2	6	6.1
62	339	L	32.6	4.8	5.5
63	340	L	32	4.8	6.2
64	342	L	28.3	4.2	5.5
65	345	L	30.7	4.8	6.5
66	351	L	30	4.6	6
67	355	L	26.7	4	5.3
68	356	R	34.6	5.2	6
69	357	L	29.7	4.6	5.6
70	358	R	32.7	4.6	6.4
71	360	L	29.5	4.4	5.4
72	362	R	34.85	5.1	6.65
73	363	L	29.3	4.1	5.35
74	364	L	34.3	5	6.5
75	368	L	30.5	4.5	5.3 (avg)
76	371	L	32.6	4.9	6
77	373.1	L	29.15	4.1	5.3
78	374	L	31	4.2	5.4
79	375	L	30.7	4.3	5.6
80	378	L	33.5	4.9	6.8
81	401	L	31.2	4.8	6.3
82	405	R	33.5	5.2	6.7
83	408	L	32.8	4.9	6.05
84	410	R	32.1	4.1	6
85	417	L	31.9	4.8	5.8
86	417.2	L	37	4.8	6.7
87	418	R	34	4.9	6.6
88	419	L	34.5	4.8	5.9
89	420	L	31	4.6	6.1
90	424	R	28.4	4.3	5.4
91	426	L	35.5	5.1	6.8
92	428	L	32.4	5	6.3
93	429	L	29.9	4.1	5.4
94	434	R	27.8	4.1	5.5
95	437	L	32.7	5.2	6
96	438	R	27.8	4.1	5.2
97	442	R	30.8	4.3	6
98	446	L	27.2	4.2	5.5

Legend – L: Left side of the bone, R: Right side of the bone

Table 9 Data collected from Inden series using metrical methods on Radius

S. no.	Box no.	Side	R1 (cm)	R2 (cm)	R3 (cm)
1	82	L	22.2	1.9	3.2
2	88	L	22.1	2.2	3.2
3	91	L	24	2.2	3.3
4	93	L	21.5	2	2.8

S. no.	Box no.	Side	R1 (cm)	R2 (cm)	R3 (cm)
5	96	L	19.6	1.9	2.7
6	98	L	22.2	2	3.1
7	99	L	21.8	1.8	2.8
8	100	L	20	2	2.9
9	101	L	23	2	3.1
10	107	L	19.5	1.9	2.9
11	113	L	23.7	2.2	3.3
12	115	L	24.7	2	2.9
13	116	R	23.4	2.2	3.2
14	117	L	23.8	2.2	3.2
15	118	L	20.4	1.9	2.8
16	122	L	22.2	1.9	2.8
17	123	R	22.5	2	2.8
18	124	L	24.5	2.4	3.3
19	125	L	24.8	3.3	2.2
20	126	L	23.6	3.4	2.3
21	127	L	21.5	2.9	1.8
22	129	R	26.8	2.5	3.7
23	136	R	24.9	1.8	3.3
24	145	R	23.1	1.9	3
25	146	R	22.8	2.4	3.4
26	161	L	23.9	2.1	3.3
27	163	R	24.3	2.1	3.4
28	164	L	20.6	2	3
29	166	L	23.7	2.5	3.4
30	175	L	23	2.4	3.2
31	176	L	24.5	2.3	3.5
32	180	L	25.1	2.4	3.5
33	182	L	23	2.6	3.4
34	186	L	24.9	2.6	3.5
35	195	L	25	2.6	3.8
36	200	L	24.5	2.4	3.6
37	201	L	22.9	2.2	3
38	203	R	23.2	2.3	3.4
39	240	L	23.6	2.2	3.3
40	241	R	21.2	2.2	2.9
41	243	L	22.1	2.3	3.3
42	244	L	25.5	2.2	3.4
43	245	R	25.8	2.3	3.3
44	301	R	24	2.3	3.5
45	304	R	24.9	2.4	3.8
46	304.2	R	24.9	3.7	2.3
47	306	L	22.7	2.3	3
48	307	L	24.3	2.2	3.3
49	311	L	26.7	2.1	3.5
50	315	R	21.2	1.9	2.8
51	316	L	21.9	2	3.3
52	317	L	20.6	1.9	2.8
53	319	R	25.8	2.5	3.5
54	320	R	26.3	2.2	3.6
55	323	L	22.2	1.8	3.2
56	324	R	N/A	N/A	3.1
57	330	L	26.6	2.5	3.5
58	331	L	25.2	2.3	3.6
59	332	L	23	2.1	2.8
60	333	R	23.1	2.2	3.1
61	335	L	25.3	2.3	3.6

S. no.	Box no.	Side	R1 (cm)	R2 (cm)	R3 (cm)
62	337	L	23.3	2.5	3.3
63	338	L	21.6	1.8	2.5
64	339	R	22.2	1.9	2.8
65	340	L	23.6	2.4	3.4
66	345	L	22.5	2.4	3.3
67	355	L	19.5	1.65	2.5
68	356	R	25.2	2.25	3.2
69	357	L	20.7	2	2.9
70	358	L	23.5	2.4	3.1
71	363	L	20.5	1.9	2.9
72	364	L	20.7	1.6	2.7
73	373.1	L	21.1	1.8	3.1
74	374	L	21.8	1.6	2.8
75	375	L	21.4	2	3
76	378	R	24	2.2	3.4
77	401	L	21.9	2.2	3
78	405	L	25.2	2.3	3.4
79	408	L	24.1	2	3.3
80	409	L	23.15	1.9	2.9
81	410	R	23.5	1.8	3.1
82	411	L	23.7	2.1	3.1
83	416	L	25.8	2.4	3.4
84	417	L	23	2.2	3.2
85	419	L	24.9	2.1	3.4
86	420	L	23.7	2.1	3.4
87	424	L	20.8	1.6	2.6
88	425	R	23.9	2.2	3.5
89	426	L	24.4	2	3
90	428	L	22.5	2.5	3.5
91	436	L	22.8	1.9	3

Legend – L: Left side of the bone, R: Right side of the bone

Table 10 Data collected from Inden series using metrical methods on Ulna

S. no.	Box no.	Side	U1 (cm)	U2 (cm)	U3 (cm)
1	82	L	23.7	2.6	1.6
2	88	L	24.8	2.5	1.8
3	91	L	25.9	2.8	1.9
4	93	L	23.3	2.3	1.4
5	96	L	21.8	2	1.7
6	99	L	22.9	2.5	1.5
8	100	L	21.7	2.4	1.7
7	102	L	23.7	2.3	1.4
9	113	L	25.5	2.5	2
10	115	L	25.4	2.4	1.5
11	116	L	25.7	2.6	2.1
12	117	L	26	3	2.1
13	118	R	22	2.3	1.5
14	122	L	23.6	3.4	2.3
15	123	L	23.7	3.2	1.5
16	124	L	26.5	3.6	1.9
17	125	R	26.8	3.8	1.8
18	126	L	25.8	3.8	1.7
19	127	L	23.2	3.2	1.7
20	128	L	25.9	4	1.6
21	131	L	23.9	4.4	1.7
22	136	L	26.7	3.1	1.7
23	145	L	24.7	2.4	1.6

S. no.	Box no.	Side	U1 (cm)	U2 (cm)	U3 (cm)
26	161	L	25.3	4	1.7
24	163	L	25.9	2.7	2
25	164	L	22	3.6	1.7
27	166	L	25.6	4	1.7
28	174	L	33.5	2	1.9
29	176	L	25.8	2.8	1.9
30	180	L	28	4.1	1.8
31	182	L	24.9	2.6	1.6
32	183	L	21.4	2.1	1.4
33	186	L	26.3	3.2	2
34	195	L	27.8	2.9	2.2
35	200	L	26.2	2.6	2.2
36	201	L	24.5	2.6	2
37	203	L	24.2	2.9	1.7
38	240	L	24.7	2.9	1.9
39	241	R	22.7	2.5	1.7
40	243	L	24	2.5	1.6
41	244	L	27	2.7	2.2
42	245	R	27.5	2.7	2
47	301	L	26.3	2.5	1.7
46	304	L	26.6	2.9	2.2
48	304(2)	L	26.6	3	1.6
45	306	L	24.9	3	2
51	310	L	22.9	2.5	1.7
52	311	L	28.5	2.8	1.8
50	315	R	22.6	2	1.4
49	316	L	23.9	2.5	1.8
44	319	L	27.3	2.1	2.2
43	320	R	38.3	3.2	2.3
53	323	L	23.8	2.3	1.6
54	324	R	N/A	2.1	N/A
55	326	R	23.1	2.2	1.6
56	327	L	24.1	2	1.5
57	330	L	28.3	3.2	2.1
58	331	L	27.3	2.5	2
59	332	L	24.6	2.5	1.7
60	333	L	24.5	2.2	1.4
61	335	R	27.8	3.3	2
62	337	L	25.2	3.1	1.7
63	339	L	23.8	1.8	1.5
64	340	L	25.7	3.1	1.7
65	342	R	20.3	2.4	1.6
66	343	L	21.8	1.8	1.8
67	345	L	24.7	3	1.8
68	347	L	27.4	2.7	1.9
69	354	R	26	3.3	2
71	355	L	21.7	2	1.5
72	356	R	27	2.5	1.9
70	357	L	22.5	2.2	1.3
73	362	R	27.5	3.1	2.1
74	363	R	21.9	2.2	1.9
75	364	L	22.1	1.8	1.7
76	365	R	27.1	2.9	1.9
77	371	L	25.2	2.5	2
78	373.1	L	22.8	2.3	1.7
79	374	L	23.6	1.9	1.6
80	375	L	23.6	2.3	2

S. no.	Box no.	Side	U1 (cm)	U2 (cm)	U3 (cm)
81	378	R	25.6	2.8	2.1
82	379	R	24.4	2.5	1.8
83	401	L	23.9	2.3	2
86	405	R	26.8	3.1	2.3
85	408	L	26.2	2.4	2
84	409	L	25.2	2.3	1.5
88	410	R	25	2.4	1.7
89	411	L	25.4	2.2	1.85
92	413	L	28.7	2.8	2.1
87	415	L	26.8	3.3	2.3
95	416	L	27.1	3.2	2.2
90	417	L	24.7	2.7	2.1
91	418	R	26.8	3	2.1
93	419	L	26.5	2.3	1.9
98	420	L	27	2.5	2
96	422	R	23.8	1.8	1.5
94	424	L	22.7	1.8	1.8
99	426	R	25.5	2.75	1.7
97	428	L	24.8	2.9	1.9
100	429	L	24.1	2.3	1.9
101	438	L	20.8	2.2	1.7
102	442	L	24	2.2	1.75
103	443	L	22.7	2	1.7

Legend – L: Left side of the bone, R: Right side of the bone

Table 11 Data collected from Inden series using metrical methods on circumferences of Femur, Humerus, Radius, Ulna

S.no.	Box no.	F8 (cm)	H4 (cm)	R4 (cm)	U4 (cm)
1	60	-	6.7	-	-
2	82	8.8	6	5.4	3.8
3	88	10.2	6.45	5.2	3.7
4	91	10	7.3	5.3	3.8
5	93	9.8	6.3	5.3	3.6
6	95	-	6.5	-	4
7	96	9.7	5.35	4.6	3.3
8	97	10.4	6.35	5.2	4
9	98	9.85	6.2	5	3.6
10	99	8.6	5.5	4.9	3.3
11	100	9.5	6.35	5.5	3.85
12	101	8.8	5.6	4.5	3.4
13	102	9.4	5.9	4.6	3.3
14	103	9	-	-	3.3
15	107	9.2	5.7	4.5	3.1
16	109	9.7	6.4	4.8	-
17	110	9.1	5.7	-	3.5
18	112	9.35	6.6	5.5	3.8
19	113	9.6	6.5	5.2	3.7
20	114	10.5	6.55	5.8	4.5
21	115	10.6	5.8	4.8	3.3
22	116	-	6.2	5.6	3.7
23	117	10.9	6.9	5.5	3.8
24	118	8.5	5.3	3.9	3.1
25	119	10.9	7.8	6.3	4.35
26	120	10	6.8	-	4.1
27	121	9.9	6.1	5.2	-
28	122	9.3	5.9	4.7	3.45
29	123	9.3	6.3	5.1	3.6
30	124	9.9	6.4	5.9	3.7

S.no.	Box no.	F8 (cm)	H4 (cm)	R4 (cm)	U4 (cm)
31	125	9.4	6.4	5.7	3.9
32	126	10	7.8	5.4	3.65
33	127	9.3	6.1	4.9	3.8
34	128	9.4	5.8	5.4	3.7
35	129	11.9	7.3	6.4	4.35
36	131	10.3	6.2	5.5	3.5
37	136	10.5	6.6	5.5	3.8
38	145	9.7	6.05	4.5	3.4
39	146	10	6.65	5.8	4.1
40	159	10	6.4	-	3.65
41	160	10.5	-	5.8	4
42	161	10.2	7	5.8	3.8
43	163	9.5	6.5	5.3	3.7
44	164	9.3	6.2	5.5	3.4
45	165	-	6	4.65	3.2
46	166	9.5	6.7	6.1	4.1
47	169	10.1	6.2	5	-
48	170	-	6.8	5.8	4.3
49	174	13.4	6	5.2	3.5
50	176	13	6.4	5.4	3.6
51	180	14	7	5.5	4
52	182	13.1	5.5	4.6	3.2
53	183	10.9	5.6	4.6	3
54	186	14.2	7	6.1	4.2
55	195	14.1	6.9	6.2	4.3
56	200	14.4	7.1	6.2	3.6
57	201	13	6.1	5.3	3.9
58	203	13.8	6.9	6.5	3.5
59	211	-	6.1	-	-
60	212	-	6.1	-	-
61	216	12.1	-	-	-
62	217	10.9	-	-	-
63	223	9.1	6	4.9	-
64	225	-	-	5.6	3.9
65	229	-	6.75	-	-
66	234	10.3	6.9	-	-
67	236	-	7	6	3.6
68	237	12.7	6.7	5.1	3.8
69	238	12.4	6.4	5.5	3.6
70	240	14.1	6.4	5.3	3.7
71	241	12.2	5.7	5.3	3.5
72	242	-	6.8	5.8	4
73	243	13.5	6.7	5.4	3.7
74	244	14	7	6	4.7
75	245	-	6.3	5.1	3.3
76	248	13.1	6.5	5	3.7
77	301	11.3	6.3	5.3	3.5
78	304	10.7	-	5.2	3.7
79	306	12.9	6.2	5.6	3.7
80	310	19.5	6.1	5	3.9
81	311	11.2	6.8	6	3.6
82	313	13.1	6.5	5	-
83	315	19.5	5.4	4.5	3.3
84	316	-	6.2	4.9	3.3
85	317	18.6	4.9	4.5	3.2
86	319	14.7	7	6.3	4.3
87	320	13.9	6.8	5.5	4

S.no.	Box no.	F8 (cm)	H4 (cm)	R4 (cm)	U4 (cm)
88	322	19.8	6	-	-
89	323	12.5	6.3	5.1	3.4
90	324	10.1	5.9	-	-
91	326	10.5	6.1	-	3.5
92	327	9.2	5.4	-	3.4
93	330	11.5	7.5	6.6	4.5
94	331	12	6.8	5.9	4.2
95	332	12.7	6.5	4.9	3.65
96	333	13	6.4	5.3	3.6
97	335	14.6	6.8	6	4.1
98	337	14	6.9	5.7	3.9
99	338	9.5	-	4.5	-
100	339	10.3	6.5	5.6	3.4
101	340	11.1	6.6	5.8	3.4
102	341	12.4	6.6	5	3.8
103	342	10.4	6	-	3.3
104	343	10.4	-	-	3.5
105	345	10.4	6.1	5.5	3.6
106	347	-	-	-	4
107	348	10.8	-	-	-
108	351	10	6.25	5	-
109	352	9.9	6.4	5.2	-
110	353	9.7	-	-	-
111	354	-	-	5.5	4.3
112	355	8.5	5.8	5	3.1
113	356	11.7	7.55	5.6	3.9
114	357	10.4	6.6	5.2	3.3
115	360	10.4	6.1	-	-
116	362	-	6.7	-	4.15
117	363	9.2	5.5	5.25	3.3
118	364	8.3	5.3	4.2	1.8
119	365	11	7.3	-	4.3
120	368	10.2	5.9	-	-
121	371	10.9	7	-	-
122	373	9.3	5.6	5	3.6
123	374	9.7	5.7	5	3.1
124	375	9.8	6.2	5.1	3.9
125	378	10.8	6.9	6.35	4
126	379	-	-	-	3.5
127	401	10.2	6.8	6	3.7
128	405	10	7.2	5.9	4
129	407	11.5	-	-	-
130	408	-	6.2	5	3.5
131	409	-	-	4.7	3.5
132	410	9.7	6	4.8	3.8
133	411	9.9	-	5.5	3.7
134	413	10.5	6.7	-	3.8
135	415	11.5	-	-	4.3
136	416	11.2	7.2	6.4	4.4
137	417	9.6	6.8	6.3	4.1
138	418	10.25	6.5	-	3.85
139	419	9.6	5.6	5.1	3.7
140	420	9.9	6.45	5.9	3.95
141	422	-	-	-	3.1
142	424	-	5.5	4.2	2.9
143	425	-	-	5.8	-
144	426	-	-	5.2	3.9

S.no.	Box no.	F8 (cm)	H4 (cm)	R4 (cm)	U4 (cm)
145	428	10.4	6.35	5.8	3.7
146	429	8.7	5.9	5.3	3.6
147	434	-	6	5.3	-
148	436	9.8	-	5.1	-
149	437	10.2	6.5	-	3.7
150	438	8.4	5.85	4.8	3.55
151	439	11	6.8	5.4	4
152	441	-	-	4.9	3.7
153	442	9.5	6.3	4.8	3.6
154	443	8.5	5.5	4.2	3.35
155	444	10.9	7.45	6.5	-
156	446	8.9	5.8	5.5	3.8
157	447	9.6	6	5.2	3.3
158	448	9.4	5.95	-	-
159	449	8.6	5.5	4.5	3.3
160	450	-	6.15	-	3.5
161	451	-	-	-	3.7
162	452	10.5	7.2	6.1	3.8
163	453	10.6	6.9	6.3	3.7
164	454	10.1	6.65	-	3.6
165	456	10.3	6.9	6	3.9
166	611	-	-	4.7	3.8

Legend – (-): Not available

Table 12 Data collected from Inden series using metrical methods on basal view of Crania

S. no.	Box no.	CB1 (cm)	CB2 (cm)
1	88	2.6	11.7
2	91	2.5	10.9
3	93	2.6	10.8
4	98	2.9	11.3
5	100	3	12.9
6	102	2.6	11.3
7	113	2.8	11.5
8	118	2.6	10.5
9	122	2.6	10.8
10	124	2.7	11.8
11	125	2.9	11.7
12	126	2.5	11.9
13	127	2.3	11.7
14	129	2.3	11.1
15	145	2.6	11.3
16	163	2.2	11.8
17	166	2.2	11.2
18	169	2	10.9
19	175	2.6	11.6
20	176	2.4	11.7
21	181	2.5	11
22	183	2.3	11.9
23	186	2.4	11.7
24	195	2.5	11.7
25	200	2.3	11.3
26	240	2.5	11.3
27	243	2.3	10.8
28	244	2.1	10
29	252	2.1	11.6
30	301	1.8	12.1
31	311	2.1	12.4

S. no.	Box no.	CB1 (cm)	CB2 (cm)
32	319	2.4	12.3
33	323	2.3	11.4
34	330	3	11.4
35	331	2.9	11.7
36	332	2.5	12.1
37	333	2.5	11.9
38	335	2.5	10.7
39	339	2.4	11.1
40	340	2.4	11.3
41	344	2.3	11.3
42	345	2.2	11.1
43	350	1.7	9.9
44	356	2.4	11.2
45	365	2.1	12.2
46	366	2.5	11.6
47	373.1	1.8	11.4
48	415	2.7	11.7
49	416	2.3	11.9
50	417	2.4	11.4
51	422	2.9	11.6
52	428	2	12.3
53	429	2.4	11.1
54	438	2.4	10.6
55	442	2.3	11
56	446	1.9	10.6

Table 13 Data collected from Inden series using metrical methods on frontal view of Crania

S. no.	Box no.	CF1 (cm)	CF2 (cm)	CF3 (cm)	CF4 (cm)	CF5 (cm)
1	88	11.8	10.2	14.2	4.9	2.4
2	91	13.7	13.7	14.2	6.1	2.8
3	93	11.7	11.7	14.2	4.9	2.5
4	98	11.7	11.7	13.5	5.8	2.5
5	100	12.5	12.5	14.4	4.8	2.3
6	102	12.5	12.5	14.7	4.6	2.4
7	113	12.6	12.6	14.7	5.7	2.7
8	118	11.3	9.2	12.6	6.7	2.8
9	122	11.7	9.4	12.6	6.8	2.3
10	124	12.4	10.2	14.99	5.4	2.4
11	125	11.6	9.4	13.5	5.5	2.5
12	126	13.5	10.1	14.3	4.8	2.9
13	127	11.4	9.1	14.8	5.3	2.5
14	129	10.9	9.2	14.5	5.4	2.5
15	145	11.4	9.5	12.7	5.1	2.4
16	163	12.9	9.7	14.4	5.6	2.4
17	166	10.9	9	12	5.5	2.8
18	169	11.1	9.5	13	5.3	2.5
19	175	12.1	9.7	13.2	5.2	2.5
20	176	13.1	10.1	14	5.2	2.2
21	181	11.1	9.6	13.7	4.9	4.6
22	183	11.3	9.6	13.6	5	2.4
23	186	12.5	9.7	14.5	6.1	2.7
24	195	12.4	10	14	5.2	2.4
25	200	12	10.1	14.3	5.9	2.6
26	240	12.9	10	14.1	5.2	2.8
27	243	11.3	9.7	13.5	5.5	2.6
28	244	11.7	9.7	13.5	5.1	2.6

S. no.	Box no.	CF1 (cm)	CF2 (cm)	CF3 (cm)	CF4 (cm)	CF5 (cm)
29	252	11	9	14.3	5.1	2.5
30	301	14.7	9.5	11.8	5.2	2.5
31	311	13	9.9	15.5	5.3	2.7
32	319	13.1	10.4	15	6	2.7
33	323	12.5	9.6	15	5.2	2.5
34	330	14.6	10.1	14.5	7.3	2.1
35	331	13.6	9.9	14.4	5.7	2.1
36	332	13	9.5	15	5.7	2.3
37	333	12.9	9.5	15.6	7.3	2.4
38	335	13.2	9.5	14.5	5.2	2.7
39	339	13.4	10.2	15.2	5.2	2.5
40	340	13.5	8.7	14.9	5.6	2.5
41	344	13	10	15.2	6	2.7
42	345	13.7	9.7	15.1	5.6	2.9
43	350	11	9.3	13.5	5.8	2.2
44	356	12.3	9.4	13.9	5.4	2.5
45	365	13.2	10.2	14.7	5.3	2.8
46	366	13.5	10.3	14.2	5.4	2.5
47	373.1	12.4	9.4	14.1	5.1	2.3
48	415	14.1	9.8	14.4	5.7	3.3
49	416	13.6	9.9	14.8	5.4	2.9
50	417	12.5	9.4	13.9	5.3	2.3
51	422	14.2	9.5	14.3	5.7	2.8
52	428	12.8	9.1	14.5	5.4	2.6
53	429	12.8	9.5	14.5	5	2.6
54	438	11.8	8.6	13.7	4.7	2.4
55	442	13.3	9.7	14.5	7.1	2.5
56	446	11.6	8.8	13.5	4.5	2.3

Table 14 Data collected from Inden series using metrical methods on lateral view of Crania

S. no.	Box no.	CL1 (cm)	CL2 (cm)	CL3 (cm)	CL4 (cm)	CL5 (cm)	CL6 (cm)
1	88	18	2.9	8.5	9.6	6.3	12.5
2	91	16.6	3.4	9.8	10.5	7.9	13.3
3	93	17.6	3	9.9	10.1	6.9	13.2
4	98	18.2	3.6	8.6	9.9	7.9	11.8
5	100	18.2	3.2	9.6	9.9	6.4	12.3
6	102	18.3	3	9.1	9.2	6.7	13.6
7	113	18	3.5	8.6	9.9	7.7	13.1
8	118	17.7	2.3	9.1	9.1	6.6	13.1
9	122	16.6	2.7	8.5	8.5	6.9	13
10	124	18.8	3.3	10	10.6	7.2	14
11	125	18.6	2.9	9.1	9.8	7.4	12.7
12	126	17.9	2.8	9	10.2	7.1	13
13	127	18.2	3	8.5	9.3	7	13.7
14	129	18	3.3	8.9	9.6	7.3	13.3
15	145	18.2	2.7	9.7	10.4	8	13.4
16	163	19.2	3.4	8.7	9.9	7.2	13.2
17	166	19.1	3.6	9.5	10.4	7.6	13.5
18	169	16.9	2.9	9.2	9.7	6.6	12.3
19	175	18.7	3.2	10	11	6.9	13
20	176	18.4	3.3	9.9	10.3	7.2	12.1
21	181	17.6	2.8	9.2	9.5	6.4	12.8
22	183	18	3.2	8.7	9.6	6.3	13
23	186	19.7	3.3	9.7	10.2	8	12.5
24	195	18	3.7	8.4	9.3	6.6	13.3
25	200	19.9	3.1	9.9	9.9	7.6	12.5

S. no.	Box no.	CL1 (cm)	CL2 (cm)	CL3 (cm)	CL4 (cm)	CL5 (cm)	CL6 (cm)
26	240	17.2	3.4	8.8	9.8	6.2	13
27	243	18.4	3.2	9.7	9.8	7.8	13
28	244	18.1	2.8	9.6	10.6	7.1	14.1
29	252	18.1	30	8.8	9.7	6.5	13
30	301	19.1	3	8.4	8.3	6.8	12.8
31	311	18.9	3.8	9.4	9.8	7.2	12.9
32	319	19.5	2.9	9.7	10.2	8.3	13.7
33	323	17.9	2.8	9	9.2	6.7	12
34	330	18.6	3.1	8.3	9.8	7.2	12.9
35	331	18.3	3.4	9.5	10.3	6.8	13.5
36	332	19.2	3.5	9.7	10.5	8	11.9
37	333	19.2	3.1	10.2	10.3	7.2	13.9
38	335	18.7	3.5	9.2	9.9	6.5	12.5
39	339	18.3	2.9	9.1	9.8	6.8	12.5
40	340	18.3	3	8.4	9.5	5.5	12.7
41	344	20	3.4	10.4	10.7	8	13.5
42	345	18.8	3.3	10	10.6	6.6	13.5
43	350	16.2	2.4	8.2	8.5	5.7	12.3
44	356	19.5	3.5	10	10.1	7.7	13.3
45	365	18.8	3.4	11	10.9	7.3	13.3
46	366	19.2	3.7	10.2	10.4	7.4	13.4
47	373.1	18.4	3	9.9	9.8	7.1	12
48	415	19.9	3.2	10.7	10.6	7.65	12.2
49	416	18.7	4	9.2	10.4	7.2	13
50	417	18.6	3.2	9.9	10	6.5	13.4
51	422	19	3.4	10	10.5	7.5	13
52	428	18.9	2.9	9.1	9.3	6.9	13.1
53	429	18.1	2.5	8.3	9.2	6.5	12.6
54	438	17.1	2.6	8.3	9.1	6.1	13.1
55	442	17.3	2.9	9.4	9.8	7	13.15
56	446	17.1	2.7	9.3	9.5	5.5	12.4

Table 15 Data collected from Inden series using metrical methods on Mandible

S. no.	Box no.	M1 (cm)	M2 (cm)	M3 (cm)	M4 (cm)	M5 (cm)
1	82	12.1	10.7	3.1	9.1	8.5
2	97	11.6	10.2	2.3	9.1	6.5
3	100	10.8	9	3.1	8.4	7.4
4	102	11.9	9.6	2.8	8.5	7.2
5	107	11	8.3	2.6	8	7.8
6	117	11.7	10.2	3.2	8.5	8
7	118	11.5	8.9	2.7	8.2	6.8
8	122	10.9	9.2	2.4	7.9	6.7
9	125	11.4	10.2	2.9	7.7	6.7
10	126	13	11.3	2.9	9.5	6.9
11	127	11	8.7	3.3	7.8	7.5
12	129	10.8	9.7	2.7	8.6	7.8
13	136	13.4	10	2.8	9.3	7.4
14	145	10.2	8.8	2.7	8.4	7.8
15	163	13.7	9.9	3.5	9.6	8.3
16	164	12.1	9.4	2.8	7.9	6.5
17	170	13.1	10.7	3.2	8.8	6.8
18	183	11.5	9.6	2.9	8.3	7.2
19	186	12.2	10.5	3.4	9.4	7.9
20	195	10.9	10.5	3	9.5	7.9
21	200	12.3	10.6	3.2	10	8.2
22	201	12.1	9.9	2.5	9	7.4

S. no.	Box no.	M1 (cm)	M2 (cm)	M3 (cm)	M4 (cm)	M5 (cm)
23	240	12.5	10.9	2.8	9.5	7.6
24	241	11.5	9.9	2.8	8.8	7.3
25	242	11.4	10	2.8	9	8
26	243	12	10.2	2.9	8.4	7.6
27	244	11.5	10.2	3.4	8.9	7.7
28	304	11.7	9.5	3.2	9.5	7.7
29	309	10.4	8.6	2.5	7.7	5.9
30	310	11.7	9	3.2	8.4	7.6
31	311	12.5	11.1	3.1	9.3	7.4
32	315	10.7	9.6	2.6	8.7	6.6
33	319	11.6	10	3.1	8.7	7.7
34	323	12.6	9.1	3.2	8.1	7.6
35	324	11.7	9.4	2.9	9	7.9
36	326	9.6	8.1	2.9	8.1	8
37	330	13.3	10.6	3.3	9.9	8.1
38	331	12.9	10.7	2.8	8.7	6.9
39	332	11.9	8.9	3.5	8.7	7.9
40	333	12	10.5	3.3	9.3	7.8
41	335	12.1	9.1	2.9	9.2	8.2
42	337	12	9.3	2.9	8.5	7.8
43	339	12.1	9.1	3.4	10.6	7
44	342	11.45	9.7	3.2	9.6	7.5
45	344	11.7	9.1	3.4	9.4	7.7
46	345	13.2	9	3.3	10.4	8.4
47	350	9.5	8	2.7	7.3	6.1
48	351	12.3	10	2.8	9.5	7.7
49	354	12.2	10.1	3.2	9.3	7.8
50	356	11.7	9.3	2.9	9.1	7.6
51	358	11.65	9.6	3.2	9.5	8.1
52	360	11.1	9.2	2.8	8.8	7.2
53	363	11	9.1	2.8	8.5	6.9
54	364	12.75	10.3	3.4	10.1	8
55	373.1	10.5	8.2	3.2	8.7	7.4
56	374	11.3	9.6	2.9	8.8	7.7
57	405	12.8	10	2.8	9.3	7.8
58	407	11	10.7	3	9.2	7.6
59	408	13	9.6	3.6	9.7	8.4
60	410	11.9	10	2.8	8.7	7.1
61	413	12.6	10.6	3.6	10.1	8.8
62	415	12.2	9.2	3.8	10.1	8.3
63	416	11.6	10.8	3	9.3	8.3
64	417	10.9	9.9	2.9	9.1	7.7
65	420	13	10.8	2.7	9.4	7.1
66	424	11	8.2	2.6	8.4	7.1
67	425	11.6	10.2	3.4	9.8	9
68	426	11.5	8.6	3.2	8.8	7.7
69	429	11.6	9	2.8	8.6	7.3
70	430	11.65	9.1	3.2	9.2	7.9
71	443	11.3	9.6	2.8	9.7	7.5
72	446	11	8.9	3.1	8.8	7.2

Table 16 Data collected from Inden series using metrical methods on Pelvis

S. no.	Box no.	Side	P1 (cm)	P2 (cm)	P3 (cm)	P4 (cm)	P5 (cm)	P6 (cm)	P7 (cm)	P8 (cm)	P9 (cm)
1	88	R	11	10.9	22.3	17.2	3.6	5.9	6.4	3.5	5.1
2	100	R	10.1	9.9	19.4	16.5	3.6	5.4	6.6	3.7	4.6

S. no.	Box no.	Side	P1 (cm)	P2 (cm)	P3 (cm)	P4 (cm)	P5 (cm)	P6 (cm)	P7 (cm)	P8 (cm)	P9 (cm)
3	102	R	10.5	10.4	20	16.1	4.4	5.3	7	4.2	3.9
4	107	R	9.6	9.8	17.7	15.8	3.5	5.4	5.3	3.7	4.1
5	115	L	11.4	10.5	19.6	17.1	3.4	6	5.1	3.8	4.6
6	117	L	9.8	11.9	21.8	16.6	3.3	6	5.3	2	4
7	118	L	8.1	10.5	20.7	16.8	3.6	4.9	7.8	4	4.2
8	125	L	8.02	10.9	19.5	15.4	3.8	6	5.6	2.4	4.3
9	126	R	9.8	11.6	20.8	15	3.7	6.3	6.6	2.1	4
10	127	L	9.8	9.9	19.8	15.2	4.1	5	7.3	2.9	3.8
11	131	R	10.7	11.4	21.6	15.9	3	6.2	5	1.5	3.8
12	164	R	7.7	10.6	20.4	15.4	3.6	5.8	6	2	4.6
13	166	L	7.5	10.7	21.9	16.4	4.2	6	6.2	1.6	4.8
14	175	L	10.1	12.1	21.3	15.9	3.6	6	6.9	1.6	4.1
15	176	L	9.3	11.5	20.5	15	4.1	5.7	4.7	1.9	4.5
16	200	L	10.3	11.2	22.1	16	3.5	6.1	5	2.1	4.5
17	201	L	9.4	10.9	20.9	15.5	4	5.8	4.8	1.8	4.1
18	243	L	9.6	11.2	21.5	16.2	3.8	6	5.3	1.6	3.6
19	244	L	10.4	12.1	23.3	16.2	3.8	6.1	5.3	1.7	4.8
20	311	R	10.6	12.3	23.1	17.3	4.5	6.2	6	3	4.9
21	319	L	9.2	11.5	22.6	17	3.7	6.5	5.5	2	5
22	323	L	10.5	10.8	21	15.8	3.5	5.5	5.8	3.5	3.9
23	324	R	9.6	10.4	20	15.7	3	5.4	5	3.1	4
24	326	R	9.6	10.4	20	15.6	3	5.4	5	3.2	3.9
25	327	L	NA	10.3	20.5	14.9	3.3	5	4.6	NA	NA
26	330	L	10.1	12.5	22.9	16	3	6.8	4.4	2.4	4.8
27	332	R	9.4	10.2	21.2	15.1	2.7	5.5	4.1	2.7	4.2
28	337	R	9.4	11.3	22.2	16	2.8	6	4	2.9	4.5
29	340	R	8.8	10.7	21.2	16.2	3.1	5.7	5.2	2.3	3.2
30	345	L	10	11.8	20.8	15.8	3.5	5.9	5.6	2.8	3.7
31	352	L	9.7	10.8	20.9	15.9	2.5	5.6	4.8	2.7	4.3
32	355	R	8.4	9	17.8	14.7	2.75	5	6	2.6	3.6
33	357	L	9.1	10.1	20.4	15.7	3.2	5.3	4.7	3.2	3.8
34	358	R	9.8	11.1	22.2	15.3	3.6	5.7	5.6	2.2	4.3
35	364	L	9.2	9.8	19.3	14.1	2.85	5	5.4	2.8	4
36	371	L	8.9	11	21.2	16.2	3.8	6	4.6	2.3	3.8
37	375	L	10	10.5	19.6	15.9	3.3	5.5	5	3.1	4
38	378	L	9.3	10.9	22.4	15.7	3.3	5.8	5.9	2.6	4.5
39	401	L	10.8	10.8	21.8	16.2	3.2	5.7	6.2	3.6	4.6
40	405	L	9.7	11.8	22.7	15.7	3.7	5.9	3	3.1	4.4
41	416	L	9.9	12.1	23.3	16	3.4	6	5.1	3	4.9
42	419	R	10	11.1	22.4	15.6	3.8	5.8	5.4	3.1	3.8
43	428	L	9.5	11.2	21.6	15.5	3.4	6.5	5	2.6	4.5
44	429	L	9.2	10.2	19.8	15.7	3.2	5.5	4.8	2.5	4.2
45	438	R	9.4	9.5	19.3	14	2.8	4.9	5.1	3.1	3.5
46	439	L	9.9	11.6	22.3	16.1	2.5	6.1	5.4	2.7	4.8
47	448	L	9.5	11	21.1	16.4	3.05	5.3	4	2.6	4.4
48	453	L	9.7	11.6	23.9	15.5	3.3	6.3	5.1	2.8	4.1
49	456	L	10.7	11.6	22.5	15.5	3.3	5.4	5.2	2.2	4.3

Legend – L: Left side of the bone, R: Right side of the bone

Table 17 Data collected from Lübeck series using metrical methods on Femur

S. no.	Individual no.	Box no.	Side	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F8 (cm)
1	886	3	L	8.3	42.4	2.6	7.1	3.9	3.9	12.25	8.6
2	887	4	L	7.9	44.3	2.4	7.1	4	4	12.56	8.8
3	888	4	R	8.6	46.9	2.6	7.6	4.4	4.4	14.1	9.6
4	889	5	L	-	-	3.1	9.4	-	-	-	13.5
5	891	6	R	7.8	43.3	2.4	7	4	4	12.6	8.6
7	915	8	L	9	47.5	3	8	4.5	4.5	13.8	10

S. no.	Individual no.	Box no.	Side	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F8 (cm)
8	917	10	R	8.9	47.75	2.57	7.5	4.53	4.54	14.3	9.8
10	919	11	R	10	45.3	2.98	8.65	5.6	5.1	16.1	11.2
12	920	12	R	7.8	39	2.56	7.3	4.17	4.05	12.9	8.4
14	923	14	R	9.5	48.4	2.8	8.1	4.9	5	-	14
15	942	21	L	8.3	41.9	2.7	7	3.9	3.9	12.5	11.2
16	950	24	L	9.4	45.8	3.1	-	4.8	4.7	15.8	14.4
17	958	25	L	8.1	43.3	2.7	7.6	4.3	4.3	13.5	12.1
18	960	26	L	8.7	-	2.9	-	-	-	-	12.5
19	962	26	L	10	28.8	3.23	8.2	5.07	4.95	15.4	10.2
21	965	28	L	8.4	42.3	2.69	7.1	4.17	4.08	13	9.1
23	966	28	R	-	-	-	-	-	-	-	13.7
24	984	32	L	9.1	48.5	3	7.8	4.77	4.74	14	10.2
26	986	33	R	7.8	43.3	2.41	7	4.06	4.05	12.56	8.5
27	988	33	L	7.9	-	2.2	-	3.9	3.8	12.3	11.4
28	990	34	L	8	42.6	2.5	7	3.95	3.9	12.5	8.5
30	995	37	R	8.8	44.2	2.64	7.4	4.39	4.44	14	9.4
31	996	38	L	9.2	44	2.71	7.4	4.14	4.2	-	-
33	1003	41	R	9.5	47.3	3	8.6	5.2	5.2	16.6	14
34	1075	51	L	7.7	40.9	2.35	7	3.89	3.88	12.5	8.2
36	1076	51	L	10.3	47.6	3.23	8	5	4.9	15.6	11.5
38	1077	51	R	7.7	42.1	2.58	7.2	4.6	4.06	12.9	9
39	1084	53	R	8.9	49.2	2.7	7.7	5.1	5	15.9	13.2
40	1089	54	L	8.6	43.9	2.56	7.1	4.67	4.45	14.1	9.6
41	1090	54	R	8	41	2.4	6.9	3.83	3.81	12	8.8
43	1094	55	R	8.3	42.4	2.43	6.8	3.71	3.57	11.5	8.8
44	1096	55	R	8.7	49.1	2.76	8	4.47	4.37	13.9	9.6
45	1097	56	L	8	-	2.4	-	-	-	-	12.5
46	1099	57	L	9.3	-	3	-	5.4	5.3	17	14.5
47	1102	59	L	7.8	-	2.5	-	4.4	4.4	13.8	12.6
48	1105	60	L	7.9	40.6	2.4	7.1	4.02	4.12	12.9	8.5
50	1106	61	R	8.1	48	2.31	7.2	4.41	4.49	13.65	9.3
52	1109	61	L	8	46.9	2.56	7.8	4.53	4.49	14.2	9.4
54	1122	65	L	7.8	44.6	2.4	7.1	4.3	4.2	13.5	11.4
55	1123	65	R	9.5	45.2	3.1	8.1	4.9	4.8	15	13.1
56	1133	68	L	8.8	46.2	2.7	7.5	4.9	4.7	15.3	13
57	1140	69	R	8.8	-	2.8	-	4.8	4.6	14.9	12.6
58	1144	70	L	9	45.1	2.8	8.6	5	4.9	15.7	13.3
59	1154	72	R	8.75	43.4	3	7.8	4.7	4.6	14.8	12.5
60	1156	73	R	8.9	42.3	2.7	7.8	4.8	4.6	14.8	12.8
61	1171	75	L	9	49.3	3.1	8.6	4.8	4.8	15.4	13.8
62	1172	76	L	9.5	48.1	2.92	8.2	4.78	4.75	14.6	9.9
64	1183	77	R	7.6	43.3	2.37	7.4	4.2	4.1	12.9	9.4
65	1188	78	R	9	45.4	2.88	7.5	4.42	4.31	13.5	9.75
66	1189	78	L	8.5	43.6	2.7	7.4	4.43	4.34	13.65	8.9
67	1195	79	L	7.2	39.5	2.2	6.2	3.29	3.3	10.7	8
68	1203	80	R	8.7	45.6	2.58	7.4	4.22	4.14	12.8	9.1
69	1204	81	L	7.6	41.2	2.4	-	4	4	12.8	11
70	1207	82	L	8.5	-	2.6	-	4.4	4.3	13.7	-
71	1212	83	L	7.1	38.9	2.27	6.9	4.05	3.95	13	9
73	1213	83	L	8.9	-	3	-	4.6	4.5	14.8	12.9
74	1217	84	L	7.7	41.9	2.4	-	-	-	-	-
75	1218	85	L	8.4	45.1	2.6	-	4.7	4.6	14.9	12.9
76	1220	86	R	8.1	-	2.7	7.2	-	-	-	-
77	1223	88	L	7.8	43.5	2.5	7	4	4.1	13	10.8
78	1226	89	L	9.2	45.2	2.7	7.8	4.3	4.3	13.8	12.9
79	1228	90	L	7.6	44	2.5	6.6	3.9	3.9	12.4	10.7
80	1229	91	R	9.4	44	3	8.2	4.5	4.5	14.4	13.1
81	1232	92	L	9.4	-	3.1	-	4.9	4.7	15.3	12.8
82	1233	92	L	8.2	44.6	2.9	7.5	4.3	4.3	13.8	12.2
83	1234	93	L	9	43.9	3	8.4	4.9	4.9	15.4	14.1
84	1249	96	L	9.8	45.7	3.2	8.3	5	4.9	15.6	13.7
85	1250	96	R	7.5	43.3	2.5	7.2	4.2	4.1	12.7	11.2
86	1259	99	L	10.1	43.1	3	-	5.1	4.9	15.8	14.2
87	1264	101	L	8.2	-	2.4	-	4	4	12.4	11.2
88	1269	102	L	9.5	50.5	2.9	8.9	5.2	5.2	16.5	14.1
89	1272	104	R	7.9	44.7	2.5	7.2	4.3	4.3	13.5	11.6
90	1273	104	R	8	44.2	2.6	-	4.2	4	13	11.3
91	1276	105	L	9	46.6	3	7.8	4.9	4.7	15.5	13.4
92	1277	105	L	10.2	46.1	3	8.4	5.2	5	16.2	15.3

S. no.	Individual no.	Box no.	Side	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F8 (cm)
93	1278	106	R	8.8	48.7	2.5	7.7	4.7	4.8	15.2	12.9
94	1282	107	R	9.5	49.3	2.9	8.2	5.1	5	16.1	14
95	1284	108	R	8.5	43.4	2.8	7.8	4.4	4.3	14	12.7
96	1286	109	L	8.1	43.2	2.5	7.2	4.2	4.2	13.4	11.4
97	1290	110	L	10.2	52.3	3.2	9	5.3	5.3	16.9	13.7
98	1298	138	L	8	45.5	2.5	8.2	4.6	4.6	14.7	12.7
99	1299	136	L	8.8	47	2.9	8	4.7	4.6	14.7	13.6
100	1303	135	R	8.5	44.5	2.4	8.3	4.8	4.7	15	11.7
101	1316	137	L	7.25	43.8	2.3	7.2	4.2	4.2	13.2	11.3
102	1328	130	L	8	42.2	2.6	-	4.2	4.2	13.4	11.2
103	1330	132	L	8.5	51.9	2.5	8.4	5.2	5.2	16.5	11.9
104	1331	133	L	8	-	2.5	-	4	4	12.8	12.6
105	1332	131	L	9.3	44.1	2.6	-	4.2	4.2	13.4	12.3
106	1337	124	L	8.7	45.5	2.8	-	4.5	4.3	14.5	12.3
107	1339	129	R		-	2.7	-	4	3.9	12.5	12.2
108	1340	126	L	8.7	47	2.7	8	4.7	4.6	15	12.9
109	1345	95	R	9.6	48.1	3	8.2	5	4.8	15.1	15.5
110	1347	134	L	9.9	43	3	8	4.6	4.6	14.8	13.6
111	1348	129	L	8.1	42	2.6	-	4.2	4.2	13.3	11.9
112	1354	131	L	8.3	33.6	2.9	7.3	4.2	4.1	13.3	11.5
113	1357	132	L	7.7	-	2.3	-	3.8	3.8	12.2	10.8
114	1358	133	L	9.3	-	2.8	-	5.5	5.5	-	12.4
115	1360	134	R	9.6	46.4	2.9	8.7	5.1	4.7	15.7	13.4
116	1366	136	L	8.5	44	2.8	7.7	4.5	4.5	14.2	12.4
117	1367	136	L	8.3	-	2.6	7.3	4.2	4.2	13.3	11.6
118	1374	138	L	9.5	50.3	3	8.3	4.9	4.7	15.3	14.2
119	1378	139	L	7.6	43.5	2.5	6.8	4.3	4.3	13.8	11.3
120	1383	140	R	7.5	-	2.4	-	3.7	3.8	11.8	10.9
121	1390	141	L	7.5	39.9	2.3	6.8	3.8	3.8	12.2	10.3
122	1391	142	L	8.4	41.6	2.5	6.9	3.8	3.8	12.2	11.7
123	1392	143	L	10.2	51.7	3.3	8.2	5.2	5.2	16.6	14.7
124	1394	144	R	8.2	45.7	2.5	7.4	4.3	4.4	13.4	12.3
125	1396	145	L	7.8	43.9	2.5	7.1	4.3	4.3	13.7	11.9
126	1399	146	L	8	42.4	2.6	7.1	4.2	4.1	13.2	12.3
127	1401	147	L	9.8	-	2.7	-	4.5	4.4	14.3	13
128	1403	148	R	9.8	45.1	2.7	8.2	4.5	4.4	14.1	13.2
129	1404	148	L	8.2	-	2.7	-	-	-	-	-
130	1408	150	L	7.5	41.1	2.4	7	4.1	4	12.8	11.8
131	1411	151	L	8	44.7	2.5	7.2	4.5	4.4	14.3	12.5
132	1415	153	L	8.5	44.2	2.9	7.2	4.3	4.3	13.7	12.8
133	1422	154	L	9.7	44.4	3.4	8.5	4.7	4.7	15.3	13.8
134	1423	155	L	8.1	45.6	2.6	7.7	4.5	4.5	14.8	11.8
135	1426	156	L	8.6	43.3	2.7	7.3	4.2	4.2	13.6	11.8
136	1427	156	R	8.2	44.4	2.6	7.2	4.2	4.2	13.3	11.7
138	1429	157	L	9.3	50	2.9	8.5	5	5	16	13.9
139	1431	158	L	8.3	44.5	2.7	7.3	4.1	4.1	13.4	12.1
140	1432	159	L	8.2	-	2.5	-	4.2	4.2	-	-
141	1433	159	L	9	47.4	3.1	-	4.7	4.7	15.1	13.8
142	1441	162	L	9.3	46.6	3.1	7.8	4.5	4.6	14.5	13.2
143	1443	163	L	7.9	-	2.6	-	3.9	3.8	12.3	12.5
144	1456	167	L	8.5	46.3	2.7	7.6	4.6	4.6	14.7	12.6
145	1457	168	L	8.2	43.8	2.7	7.6	4.3	4.3	13.7	12.8
146	1460	169	L	7.3	-	2.1	-	3.9	3.9	12.6	9.7
147	1462	170	L	8.8	-	2.6	-	4.5	4.5	14.3	13.7
148	1463	171	L	7.1	37.2	2.1	6.5	3.7	3.6	11.9	10.9
149	1464	171	L	8.5	-	2.7	-	4.6	4.6	14.8	12.9
150	1509	194	L	8.5	45.8	2.5	7.5	4.1	4.1	13	12.3
151	1510	195	L	8.9	46.7	2.8	7.6	4.3	4.2	13.6	13
152	1511	196	R	7.8	42.3	2.6	7.4	4.3	4.2	13.6	11.6
153	1512	196	R	7.6	-	2.4	-	4.2	4.2	13.4	11.5
154	1513	197	L	9.8	49.2	3.1	8.1	4.8	4.8	15.6	14.4
155	1519	199	L	7.9	40.9	2.5	6.7	3.9	3.9	12.5	11.2
156	1525	201	R	8.2	-	2.6	-	4.5	4.4	14.1	12.6
157	1532	204	R	8.4	44	2.7	7.5	4.2	4.2	13.5	12
158	1533	205	R	8.1	-	2.5	-	4.6	4.7	14.8	12
159	1535	207	R	8.9	46.1	2.7	-	4.4	4.4	13.9	12.7
160	1537	209	L	9.2	-	2.6	-	4.7	4.7	14.7	12.5
161	1545	211	L	7.8	42.7	2.5	7.8	4.4	4.5	14.3	11.7
162	1546	212	L	7.7	40.1	2.5	6.9	4	4	12.8	12

S. no.	Individual no.	Box no.	Side	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F8 (cm)
163	1551	216	L	8.2	46.9	2.8	-	4.6	4.5	14.2	13.2
164	1552	217	L	8.5	44.6	2.6	7.9	4.6	4.6	14.4	12.8
165	1554	218	L	8.1	-	2.5	-	4	4	12.9	11.9
166	1556	219	L	8.9	39.8	2.9	7	4.4	4.3	13.8	12.2
167	1557	220	L	9.2	44	2.9	7.6	4.5	4.5	14.5	13.3
168	1558	221	L	8.9	44.2	2.7	7.6	4.4	4.5	14.2	12.2
169	1561	222	L	9	-	2.8	-	4.7	4.9	15.1	13.7
170	1564	223	L	7.9	43	2.3	7.2	4.2	4.1	13.3	11.7
171	1568	226	L	9.4	50.5	2.9	8.4	5.2	5	16.4	13.5
172	1571	228	L	8.3	42.1	3	7.6	4.6	4.6	14.8	11.9
173	1573	229	R	10.1	47	3.2	8.7	5.1	5.1	16.5	14.7
174	1578	231	L	9.1	45.6	2.8	7.7	4.6	4.5	14.4	11.9
175	1579	232	L	7.4	43.3	2.1	6.9	4	4	12.9	10.4
176	1593	239	L	8.6	46.5	2.8	8	5	4.8	15.7	13.7
177	1594	240	L	9	49.3	2.8	7.9	4.8	4.7	15.1	12.2
178	1599	243	L	6.8	40.5	2	6.5	3.6	3.6	11.2	10.2
179	1600	244	L	8.8	46.3	2.9	8.3	4.9	4.8	15.5	13.6
180	1601	245	L	9.3	-	2.9	-	4.4	4.4	14.1	12.1
181	1605	247	L	8.8	42.7	2.9	7.4	4.3	4.3	3.7	12.7
182	1607	248	R	9.7	45	2.7	7.9	4.6	4.6	14.6	13.5
183	1608	249	L	7.7	41.2	2.5	7	4.2	4.1	13.5	11.5
184	1609	250	L	10	-	3.1	-	5.1	-	-	13.3
185	1612	251	L	8	44.3	2.5	6.8	4	4.1	13.2	11.4
186	1614	253	L	9.4	47	2.9	8	4.8	4.9	15.5	14.1
187	1626	256	L	9.4	46.7	2.8	8	4.9	4.8	15.3	13.5
188	1627	257	L	9.15	37.8	2.9	8.3	4	3.9	13	11.8
189	1628	258	L	8	-	2.8	-	4.1	4.1	13.1	11.8
190	1633	259	L	8.1	42.9	2.6	-	3.9	3.9	12.4	11.8
191	1635	260	L	8.5	44.2	2.9	8.2	4.7	4.6	15.2	12.6
193	1636	261	R	8.4	45.2	2.5	7.6	4.5	4.4	14	12.5
194	1637	261	L	8.5	47.6	2.7	8.2	4.7	4.75	15.3	12.3
195	1638	262	L	8.6	43.6	3	7.6	4.4	4.4	13.9	13.4
196	1644	264	L	9	44.4	2.6	7.5	4.3	4.2	13.6	12.2
197	1653	268	L	9.6	47.4	3.2	9.1	4.9	4.8	15.5	14.9
198	1657	270	L	8.6	47.2	2.5	7.6	4.5	4.5	14.3	12.4
199	1659	271	R	8.8	44.3	2.8	7.2	4.2	4.3	13.6	12.6
200	1660	272	L	7.8	42.5	2.4	6.9	4.1	4.1	13.3	11.6
201	1662	274	L	8.4	45.6	2.6	8.6	4.6	4.5	14.5	11.9
202	1664	275	R	8.5	43.5	2.8	8	4.8	4.7	15.1	12.5
203	1666	277	L	10	49.5	3.2	8.7	5.3	5	16.6	14.5
204	1671	279	L	8	42.5	2.3	6.9	3.8	3.8	12	11.6

Legend – L: Left side of the bone, R: Right side of the bone

Table 18 Data collected from Lübeck series using metrical methods on Tibia

S. no.	Individual no.	Box no.	Side	T1 (cm)	T2 (cm)	T3 (cm)	T4 (cm)	T5 (cm)	T6 (cm)	T7 (cm)	T8 (cm)	T9	T10	T11	T12
1	876	1	L	8.3	32.5	6.3	2	2.7	6.95	4.5	6.4	3.1	4.3	3.9	2.9
2	886	2	L	8.4	32	6.5	1.9	2.7	6.9	4.6	6.5	3.4	4	3.9	2.9
3	888	4	L	8.8	37	6.9	2.1	2.8	7.4	4.5	6.8	3	4.4	3.7	4.2
5	890	5	L	8	35.2	6.5	1.9	2.5	6.3	4.4	6.3	3.4	4.7	3.9	3.1
6	894	6	R	9.9	36.4	7.7	2.3	3.3	7.6	5.1	7.8	3.7	4.7	4.4	3.9
7	900	7	L	8.3	33.7	6.7	1.9	2.65	7	4.9	6.7	3.3	4.3	4	3.1
8	915	9	L	9.4	37.3	7.5	3.2	2.4	7.9	5.1	7.41	3.29	4.74	4.13	3.36
9	917	10	L	9.5			2.9	2.4	7.75	4.6					
10	919	11	L	10.2	34.5	7.9	2.71	2.76	8.3	5.2	7.8	3.96	5.32	3.35	4.46
12	920	12	R	7.8	32.4		2.3	1.7	6.3	4					
13	923	14	L	9.5	37	7.6	2.9	2.1	8	4.6	7.4	3.6	3.6	4.4	3.4
14	942	21	L	8.3	33.8	6.6	2.8	1.9	6.7	3.9	6.7	3.1		3.3	
15	950	24	L	9	37.2	-	3	2.3	7.7	4.7	-	-	-	-	-
16	958	25	L	8.4	-	-	2.9	2	7	-	-	-	-	-	-
17	962	26	L	9.9	39.6	7.92	2.41	2.96	8.1	5.3	8.15	3.92	5.08	4.53	4.12
19	966	28	L	9.6	35.1	7.5	2.19	3.06	7.6	4.8	7.5	3.54	4.7	4.56	3.41
21	986	33	R	8.3	34.4	6.4	2.16	2.42	6.7	4.42	2.92	3.06	4.21	3.8	3.26
22	990	34	R	8.3	-	6.6	2.7	2.2	7	-	6.6	3.4	4.3	3.7	3.3

S. no.	Individual no.	Box no.	Side	T1 (cm)	T2 (cm)	T3 (cm)	T4 (cm)	T5 (cm)	T6 (cm)	T7 (cm)	T8 (cm)	T9	T10	T11	T12
23	996	38	L	9.8	35	6.6	2.83	2.35	7.8	4.7	6.59	2.74	4.27	3.35	3.62
25	1075	51	R	8.1	33.1	6.5	1.86	2.74	6.6	4.5	6.53	3.43	4.13	3.92	3.18
27	1076	51	R	8.5	37.1	7.88	2.85	2.51	7.7	5.4	7.88	3.83	4.96	4.17	3.83
29	1084	53	L	7.5	37.6	7.54	2.86	2.14	7.4	5	7.5	3.99	4.73	4.46	3.46
31	1089	54	R	8.9	33.4	7.05	2.71	2.03	7.1	4.9	7.06	3.29	4.92	3.54	3.51
32	1090	54	R	9.4	36.3	7.85	3.01	2.27	7.8	5.2	7.98	3.91	4.78	4.42	3.78
34	1096	55	R	9.7	39.3	7.4	3	2.2	7.9	5.3	7.32	3.5	4.28	3.59	4.53
35	1102	59	L	8.2	-	-	2.7	2	7	-	-	-	-	-	-
36	1105	60	L	8.5	32	6.6	2.54	1.93	6.6	4.4	6.69	3.28	4.13	3.26	3.66
38	1109	60	L	8.6	38.1	7.1	2.77	1.97	7.5	4.7	7.1	3.46	4.67	3.52	3.84
40	1111	62	L	8.6	33.4	7.2	2.61	1.96	6.9	4.5	7.2	3.43	4.52	3.38	3.91
41	1122	65	L	8.1	34.1	6.6	2.7	2	6.8	4.4	6.6	3.2	4.3	3.7	3.1
42	1123	65	R	10.2	36.2	7.7	3.1	2.5	8.1	4.7	7.5	3.6	5	4.4	3.4
43	1144	70	L	9.6	36.1	7.9	2.7	2.2	7.9	5.4	7.8	4.1	5.1	4.5	3.7
44	1154	72	L	9.4	33.9	7.2	2.8	2.1	7.8	4.7	7.1	3.4	4.9	-	-
45	1156	73	L	9.1	32.6	7.6	2.6	2.1	7.7	5	7.6	3.7	4.9	4.3	3.5
46	1171	75	L	9.9	-	7.8	3.1	2.5	8.4	-	7.7	3.9	4.9	4.6	3.3
47	1172	76	L	9.9	35.8	7.95	2.95	2.33	8	5.6	7.82	3.82	5.24	4.27	3.88
49	1174	76	L	8	31.5	6.9	2.44	1.85	6.6	4.6	7.01	3.06	4.85	4.11	3.33
50	1176	77	R	9.2	34.8	7.2	2.61	2.16	7.5	5.1	7.26	3.49	4.15	4.55	3.6
51	1180	77	R	8.1	32	7.08	2.55	2.01	6.7	5	7.05	3.12	3.99	4.25	3.5
52	1181	77	L	8.9	33.5	7.4	2.74	2.04	7.1	5.1	7.32	3.61	4.91	4.15	3.62
53	1184	77	L	7.9	32.3	6.48	2.4	1.95	6.5	4.4	6.55	3.18	4.21	3.47	2.8
54	1185	78	L	8.5	36	7.5	2.92	1.92	7.2	5.3	7.64	3.87	4.71	3.98	3.72
55	1186	78	L	9	34.4	7.2	2.77	2.08	7.2	4.8	7.31	3.45	4.92	4.11	3.54
56	1188	78	L	9	35.9	7.3	3.01	2.07	7.75	4.9	7.34	3.59	4.7	4.35	3.73
57	1195	79	L	7.85	30.3	5.7	2.47	1.86	6.4	4	5.72	2.76	3.95	3.07	2.78
58	1202	80	L	8.2	36.3	6.9	2.56	1.96	7	4.3	7.03	3.43	4.63	4.09	3.36
59	1205	81	L	8.3	35.5	7.2	2.67	2.03	7.2	4.9	7.22	3.8	4.83	3.43	4.07
60	1207	84	R	8.5	34.1	36.6	2.6	2.2	7	4.3	6.6	3.3	4	3.8	3.2
61	1212	83	R	8.3	30.6	6.5	2.51	1.88	6.7	4.6	6.44	3.12	4.25	3.86	3.01
63	1213	83	L	9	-	7.5	2.6	2.1	7.4	-	7.4	3.7	5	4.2	3.4
64	1217	84	L	7.6	-	-	2.4	1.8	6.6	-	-	-	-	-	-
65	1218	85	L	8.9	35.6		2.8	2.4	7.2	4.8	6.5				
66	1220	86	L	8.4	32.6	7	2.51	1.94	6.9	4.7	6.97	3.47	4.65	3.18	3.87
67	1223	88	L	7.8	34.7	6.5	2.4	2	7	4.1	6.5	3.1	4.4	3.9	3.2
68	1226	89	R	8.9	34.6	7.2	3.1	2.2	7.8	4.7	7.2	3.7	4.3	4.1	3.7
69	1228	90	R	8.5		6.5	2.7	1.9	7		6.5	3.3	3.9	3.7	3.2
70	1229	91	L	8.8	33.7	7.6	2.7	1.9	7.5	5	7.6	3.9	4.9	4.1	3.7
71	1232	92	L	9.5	-	7.6	2.7	2.4	8.1	-	7.7	3.7	5.3	4.1	4
72	1233	92	L	8.1	35.2	7	2.8	2	7.2	4.4	7	3.5	4.6	4	3.2
73	1234	93	L	9.2	34.7	7.8	2.4	2.1	7.5	5.1	7.8	4	5.5	4.5	3.8
74	1245	95	L	7.2	33.6	6.8	2.1	1.7	6.3	4.4	6.7	3.4	6.5	3.4	3.3
75	1249	96	L	9.4	36.6	7.6	2.9	2.3	7.7	5	7.7	3.7	5	4.3	3.6
76	1250	96	R	7	33.5	6.6	2.1	1.7	6.1	4.5	6.7	3.4	4.5	3.9	3.2
77	1254	98	R	9.1	-	-	2.7	2.2	7.7	4.7	-	-	-	-	-
78	1269	102	L	9.9	39.3	8	3.1	2.4	8	5.2	7.9	3.9	4.9	4.5	3.6
79	1272	104	L	8.3	-	-	2.5	1.9	6.7	4.3	-	-	-	-	-
80	1273	104	L	8	-	-	2.9	2.1	6.9	-	-	-	-	-	-
81	1276	105	L	8.9	36.1	7.2	2.4	2	7.1	4.7	7.2	3.5	4.8	4.1	3.5
82	1278	106	R	9.2	-	-	3	2.2	7.7	-	-	-	-	-	-
83	1282	107	R	9.8	39.6	7.9	3	2.2	7.9	5.2	8	4.1	4.5	5	3.8
84	1284	108	L	8.5	34.9	7.1	2.3	2.1	7.2	4.6	7.1	3.4	4.9	4.1	3.5
85	1286	109	L	9	35.8	6	2.9	2	7.5	4.4	-	3.4	4.5	4.1	-
86	1290	110	L	10.2	-	-	2.7	2.4	8.2	5	-	-	-	-	-
87	1299	114	L	9.5	-	-	3.4	2	7.8	-	-	-	-	-	-
88	1303	115	L	8.5	33.1	7.7	2.7	2.2	7.1	4.9	7.8	3.4	5	4.2	3.6

S. no.	Individual no.	Box no.	Side	T1 (cm)	T2 (cm)	T3 (cm)	T4 (cm)	T5 (cm)	T6 (cm)	T7 (cm)	T8 (cm)	T9	T10	T11	T12
89	1316	117	L	8.5	34	6.8	2.7	1.8	7.9	4	6.8	3.2	4.6	3.8	3.3
90	1327	120	R	7.9	-	-	2.6	2.1	6.6	-	-	-	-	-	-
91	1328	121	L	7.8	-	-	2.5	1.8	6.75	-	-	-	-	-	-
92	1330	122	L	8.9	39.5	7.8	2.7	2.1	7.5	5.2	7.8	3.6	5.1	4.8	3.8
93	1331	122	L	8.6	31.3	6.5	2.7	2.2	7.2	4.4	-	3.7	3	-	-
94	1332	123	L	8.4	33.9	-	2.6	2.1	7.3	4.8	-	-	-	4	3.3
95	1337	124	L	9	-	-	2.9	1.9	7.4	4.7	-	-	-	-	-
96	1340	126	L	8.9	37.5	7.7	2.7	2.2	7.3	4.5	7.7	3.7	4.6	4	3.5
97	1347	128	L	9.6	34.3	7.5	3	2.3	7.7	4.9	7.6	3.6	4.2	4.9	3.6
98	1348	129	R	7.9	32.9	6.7	2.6	2	6.9	4.5	6.6	3.2	4.4	4.3	3.4
99	1354	131	L	8	-	6.7	2.7	1.9	6.9	-	-	-	-	-	-
100	1357	132	L	7.7	-	-	2.8	1.5	6	-	-	-	-	-	-
101	1358	133	L	9.6	-	-	3	2.3	7.7	4.7	-	-	-	-	-
102	1360	134	L	9.5	36.1	7.8	2.8	2.3	7.5	5	7.9	3.9	5.6	4.8	3.8
103	1367	136	L	8.4	35.3	6.6	2.5	2.2	7.5	4.8	6.8	3.4	4.4	-	3.2
104	1374	138	R	9.9	40.4	8	3.2	2.3	7.8	5.2	8	3.7	5.5	4.7	3.7
105	1378	139	R	7.9	34.6	6.4	2.6	1.8	6.4	4.3	-	3.2	4.2	-	-
106	1383	140	L	7.7	-	-	2.5	1.9	6.6	-	-	-	-	-	-
107	1390	141	L	7.6	30.8	5.9	4	2.4	1.7	6.2	6.1	3.2	4.3	-	-
108	1391	142	L	8.3	-	6.2	3	2.1	6.9	-	6.5	3.1	-	3.8	2.9
109	1396	145	L	8.4	34	6.6	2.6	2.1	7.2	4.7	6.5	3.2	4.5	3.8	3.2
110	1401	147	L	8.5	-	-	2.7	2.2	7.2	-	-	-	-	-	-
111	1403	148	L	9.3	36.2	7.7	3	2.2	7.7	5.2	7.8	3.8	-	4.5	3.6
112	1404	148	R	8.5	-	-	2.7	2	7	-	-	-	-	-	-
113	1408	150	R	7.9	-	-	2.4	2.1	6.4	-	-	-	-	-	-
114	1411	151	L	7.9	33.8	6.7	2.6	1.9	6.5	4.5	6.8	3.2	4.7	4	3.2
115	1415	153	L	9.2	34.5	6.7	3.1	2.2	8.2	4.6	-	3.6	4.5	-	-
116	1423	155	R	9.2	34.8	7.1	3	2.2	7.8	5	7.2	3.5	4.8	4.1	3.6
117	1427	156	L	8	-	-	2.7	2	6.9	4.3	-	-	-	-	-
119	1432	159	L	9.3	-	-	2.7	2.1	7.4	-	-	-	-	-	-
120	1433	159	L	9	37.9	7.2	2.8	2	7.4	5.2	7.2	-	-	-	-
121	1441	162	L	10	37.8	7	3.2	2.3	7.8	4.4	7.1	3.4	5	3.8	3.4
122	1443	163	R	8.4	-	-	2.7	2	6.9	-	-	-	-	-	-
123	1460	169	R	7.9	-	-	2.5	1.8	6.7	-	-	-	-	-	-
124	1463	171	R	7.8	28.3	-	2.1	2.1	6.5	4.1	-	-	-	-	-
125	1464	171	L	7.4	33	7.4	3.2	2.2	7.9	4.9	7.5	3.3	4.6	4.1	3.5
126	1511	196	L	8	34.4	6.7	2.3	1.9	6.5	4.4	-	3.4	4.5	-	-
127	1512	196	L	7.8	34.1	7	2.3	2	6.6	4.5	7	3.4	4	4	3.6
128	1519	199	R	8.2	32	6.2	2.6	2.1	7.8	-	6.3	3	4.3	3.6	3.1
129	1532	204	R	9	-	6.9	2.6	2.2	7.3	-	6.8	3.3	4.3	4.1	3.6
130	1533	205	L	9.2	35	7.7	2.8	2.2	7.6	4.9	7.7	3.8	5.2	4.3	3.6
131	1535	207	L	9.4	36.6	7.4	3.2	2.5	7.9	4.5	7.4	3.3	4.3	4.3	3.9
132	1537	209	L	9.6	-	-	3	2.4	8.1	-	-	-	-	-	-
133	1545	211	L	7.9	32.7	7.3	2.4	2	7	5	7.3	3.6	4.7	4.1	3.4
134	1546	212	L	7.6	32.2	6.5	2.3	1.9	6.4	4.3	6.5	3.3	4.5	3.9	3.1
135	1551	216	L	10	-	-	2.8	2.3	7.2	-	-	-	-	-	-
136	1552	217	L	8.8	34.8	7.3	2.8	2.2	7.2	4.6	7.3	3.7	4.9	4.2	3.6
137	1554	218	L	8	-	6.6	2.7	1.9	7	-	6.6	3.3	4.2	3.8	3.3
138	1564	223	L	8.2	35.4	6.7	2.8	1.9	7	4.7	-	3.3	4.8	4	-
139	1568	226	L	9.3	39.9	7.4	2.7	2.3	8.1	4.8	7.4	3.5	4.9	4.6	3.5
140	1571	228	L	8.5	-	-	3.1	1.9	-	4.5	6.9	-	-	-	-
141	1573	229	L	10.5	36.6	8.1	3.1	2.3	8.3	5.5	7.8	3.6	4.7	4.8	3.7
142	1593	239	L	8.8	35.6	7.7	2.8	1.9	7.6	4.9	7.6	3.5	5.1	4.4	3.7
143	1597	242	R	7	32.5	6.6	2.1	1.6	5.9	4	6.6	3.3	4.1	4	3.3
144	1599	243	L	7.5	31.2	4.5	2.3	1.9	6.6	4.5	6	2.9	4.1	3.6	2.8
145	1601	245	L	9	35.9	7.5	3	2.1	7.7	5.1	7.4	3.4	5	4.4	3.5
146	1608	249	L	7.6	31.4	6.7	2.3	1.9	6.1	4.4	6.5	3	4.5	3.6	3.1

S. no.	Individual no.	Box no.	Side	T1 (cm)	T2 (cm)	T3 (cm)	T4 (cm)	T5 (cm)	T6 (cm)	T7 (cm)	T8 (cm)	T9	T10	T11	T12
147	1612	251	L	8.1	-	-	2.7	2	6.6	-	-	-	-	-	-
148	1614	253	L	9.3	38.8	7.8	2.9	2.3	7.8	5.5	7.6	3.7	5.2	4.2	3.8
149	1626	256	L	9.6	37.4	7.7	2.7	2.5	8.2	5.2	7.6	3.6	4.9	4.4	3.6
150	1627	257	L	9.3	37.1	9	2.9	2.35	8.8	5.2	7.9	4	5.5	4.4	3.7
151	1644	264	L	8.9	36.7	7.4	3	2.2	7.5	4.4	7.5	3.6	5.3	4.1	3.8
152	1664	275	L	9	34.7	7.5	3	2.2	7.5	6	7.3	3.8	4.7	4.3	3.5
153	1666	277	L	10.1	39.2	8.2	3.2	2.3	8.1	5.1	8.2	4	4.8	5.2	3.9
154	1207.1	82	R	8.5	33.4	6.6	2.65	2.15	7	4.7	6.67	3.45	4.02	3.85	3.35
155	1207.2	82	R	9.1	33.2	7.4	3.02	2.03	7.4	5.3	7.38	3.67	4.36	4.19	3.65

Legend – L: Left side of the bone, R: Right side of the bone, (-): Not available

Table 19 Data collected from Lübeck series using metrical methods on Humerus

S. no.	Individual no.	Box no.	Side	H1 (cm)	H2 (cm)	H3 (cm)	H4 (cm)
1	876	1	R	31.65	4.1	6.1	6.2
2	883	2	R	30.6	4.3	5.4	5.5
3	884	3	L	31.7	4.8	6.3	6.6
4	886	3	R	30.6	4.8	6.3	6.6
5	891	6	L	-	-	5.9	5.7
6	915	9	L	35.3	5.08	6.79	8.4
7	917	10	R	35.7	4.35	6.13	6.5
9	919	11	R	32.4	4.9	7.02	7.2
11	920	12	L	29.3	4.51	5.63	5.7
13	958	25	L	30.9	5.1	6.1	5.8
14	962	26	L	37.3	5.24	6.3	7
16	964	27	L	29.4	4.42	5.5	5.6
18	965	28	R	32.3	4.17	5.84	5.5
20	966	28	L	-	-	6.1	6.6
21	988	33	L	30.8	4.24	5.55	5.2
23	989	34	R	30.9	4.01	5.4	5
24	990	34	L	29.8	3.99	5.64	5.9
26	996	38	R	33.9	4.4	6.16	6.8
28	1005	41	L	28.2	5.2	6.7	5.8
29	1097	56	L	30.8	4.53	5.52	5.6
31	1099	57	R	-	-	6.8	7.2
32	1102	59	L	28.6	4.72	5.53	5.4
34	1122	65	L	30.6	4.6	5.8	6
35	1133	68	L	33	5.9	6.4	6.2
36	1140	69	R	32.3	5.3	6.3	6
37	1154	72	R	31.6	5	6	6
38	1156	73	R	32.7	5.2	6.3	6.5
39	1171	75	L	35.9	5.4	6.5	6.4
40	1172	76	L	34.4	4.94	6.51	6.5
42	1204	81	L	28.1	4.9	5.3	5.5
43	1207	82	L	30.7	4.4	6.3	5.7
45	1212	83	R	27.3	4.12	5.43	5.6
47	1213	83	L	-	-	6.2	7
48	1217	84	R	-	-	-	5.5
49	1218	85	L	31.8	4.95	6.2	6.5
51	1223	88	L	30.6	5	4.9	5.7
52	1226	89	L	-	-	5.9	6.8
53	1228	90	R	31.5	4.5	5	5.4
54	1229	91	L	-	-	6.8	6.4
55	1232	92	R	-	-	-	7.2
56	1233	92	R	33.2	5.4	5.7	6.3
57	1234	93	L	31.5	5.4	6.1	7.3
58	1245	95	R	34.2	6	6.2	6.8
59	1249	96	R	31.3	5.2	5.2	5.2
60	1250	96	L	30.6	4.6	4.6	5.2
61	1254	98	R	29.9	5.6	5.5	6.3
62	1259	99	L	33.4	4.9	6.5	6.6
63	1264	101	R	-	-	6.5	7.4
64	1272	104	L	-	-	6.9	7.4
65	1273	104	L	-	-	-	5.3
66	1276	105	L	34.5	5.3	6.2	6.5
67	1278	106	R	34.6	6.1	6.2	6.4
68	1284	108	L	31.1	4.9	5.8	5.9
69	1286	109	R	31.3	4.5	5.7	5.8

S. no.	Individual no.	Box no.	Side	H1 (cm)	H2 (cm)	H3 (cm)	H4 (cm)
70	1290	110	L	36	5.6	6.5	6.7
71	1299	114	L	-	-	6.7	6.5
72	1303	115	L	30.6	5.5	6.5	6.5
73	1316	117	L	31.6	4.7	5.9	5.5
74	1327	120	R	32.1	5.4	5.8	5.9
75	1328	121	L	31.5	5.1	5.5	5.9
76	1330	122	L	-	-	7	6
77	1332	123	R	-	-	5.4	5.5
78	1337	124	L	-	-	6.3	6
79	1339	125	L	-	-	5.6	5.5
80	1340	126	R	33	5.5	6.4	6.2
81	1347	128	L	30.7	5.4	6.5	6.7
82	1348	129	L	-	-	5.6	5.7
83	1354	131	L	-	-	6	6.2
84	1357	132	R	30.8	4.9	-	5.7
85	1358	133	R	32.5	5.7	6.8	6.6
86	1363	135	L	-	-	6.5	6
87	1366	136	L	30.2	-	5.5	6.3
88	1374	138	L	-	-	6.6	7.2
89	1378	139	L	-	-	5.7	5.5
90	1383	140	L	-	-	5.2	5.4
91	1390	141	L	27.9	6.2	5.2	5.2
92	1391	142	L	30.2	4.5	5.3	5.7
93	1392	143	L	38	6	7.2	7.2
94	1394	144	L	33	5.2	6.7	6
95	1396	145	L	-	-	5.5	5.5
96	1399	146	L	-	-	5.4	5.7
97	1401	147	L	31.2	5.1	5.9	5.8
98	1403	148	L	31.7	5.5	6.4	6.7
99	1404	148	R	-	-	6	6.4
100	1408	150	L	29.5	4.9	6.5	5.65
101	1411	151	L	31.5	5.8	5.5	5.8
102	1415	153	L	31.8	5.2	6.4	6
103	1422	154	L	32.2	5.8	6.4	6.9
104	1423	155	L	-	5.5	6.2	6.2
105	1426	156	L	31.1	4.7	5.8	5.6
106	1427	156	R	31.9	5.2	5.8	5.7
108	1429	157	L	34.5	5	6.8	6.5
109	1432	159	L	-	-	-	6
110	1433	159	L	-	-	6.7	6.1
111	1441	162	R	-	-	6.1	6.6
112	1443	163	R	32.5	4.8	5	5.8
113	1456	167	L	32.3	4.7	5.9	5.7
114	1457	168	L	31.9	4.5	5.6	5.9
115	1460	169	L	-	-	5.3	5.1
116	1462	170	R	-	-	6.1	6
117	1463	171	L	-	-	5.1	5.5
118	1464	171	L	-	-	6	6.1
119	1509	194	L	32.2	5.3	5.3	6.7
120	1510	195	L	32.6	5.1	6	6
121	1511	196	L	30.3	4.8	5.7	5.6
122	1512	196	R	-	-	6	6.1
123	1513	197	R	35.2	5.8	6.6	6.8
124	1519	199	L	28.9	4.6	5.1	5.5
125	1525	201	L	31.4	4.8	5.6	6
126	1532	204	L	30.8	4.5	5.7	6.5
127	1533	205	L	31.2	4.6	5.6	6
128	1535	207	L	31.8	5	6.3	6.2
129	1537	209	R	34.6	5.6	6.3	7.2
130	1545	211	L	31	4.6	6.5	5.9
131	1546	212	L	29.1	4.5	6.6	5.8
132	1551	216	L	-	-	6.6	6.2
133	1552	217	L	31.7	5	6.3	6.6
134	1555	218	L	28.5	4.4	5.6	5.7
135	1556	219	L	28.9	4.2	6.4	6
136	1557	220	L	32	4.9	6.1	6.8
137	1558	221	L	32.1	6.5	6	6.7
138	1561	222	L	-	-	6.1	6.3
139	1564	223	L	31.7	4.5	5.6	6
140	1568	226	L	37.1	5.5	6.7	6.6

S. no.	Individual no.	Box no.	Side	H1 (cm)	H2 (cm)	H3 (cm)	H4 (cm)
141	1571	228	L	30.9	4.6	6.1	6
142	1573	229	L	35.7	5.6	6.2	6.8
143	1578	231	L	33.1	4.5	5.6	6.2
144	1579	232	L	30.6	4.4	5.4	5.4
145	1593	239	L	32.9	5.4	6.5	6.5
146	1594	240	L	34.5	5.3	6.6	6.2
147	1597	242	L	29.5	4.2	6.2	4.8
148	1599	243	L	27.5	3.7	5.1	5.1
149	1600	244	L	33.9	5	6.5	6.3
150	1601	245	L	33	5.2	6.6	6.8
151	1605	247	L	30.7	4.4	5.6	6
152	1607	248	L	31.2	4.8	6.3	6.8
153	1608	249	L	30.1	4.4	6.4	5.4
154	1609	250	L	26.8	5.3	7.2	7.3
155	1612	251	L	32.2	4.2	5.7	5.5
156	1614	253	L	34	4.9	6.9	6.9
157	1626	256	L	33.8	4.7	6.5	6.7
158	1627	257	L	34.5	6.8	5.8	7
159	1628	258	L	27.9	4.6	5.6	5.4
160	1633	259	L	31.6	4.9	5.2	5.8
161	1635	260	L	31.9	5.2	6.2	6
162	1636	261	L	31.5	4.8	6.2	6
163	1637	261	L	33.6	5.2	6.3	6.5
164	1638	262	L	30.5	4.8	5.9	6.1
165	1644	264	L	32	4.5	5.5	5.9
166	1645	265	L	24.8	4.9	5.9	6.7
167	1653	268	L	23.4	5.4	6.6	7
168	1657	270	L	33.6	4.5	6.4	6.4
169	1659	271	L	-	-	5.9	5.9
170	1660	272	L	29.6	4.3	5.7	5.5
171	1661	273	L	36.6	5.2	6.7	7.8
172	1662	274	L	30.4	4.3	6	6.1
173	1664	275	L	32.2	4.6	6.8	6.4
174	1666	277	L	35.7	5.2	6.6	6.9
175	1671	279	L	30.5	4.4	5.5	5.9

Legend – L: Left side of the bone, R: Right side of the bone, (-): Not available

Table 20 Data collected from Lübeck series using metrical methods on Radius

S. no.	Individual no.	Box no.	Side	R1 (cm)	R2 (cm)	R3 (cm)	R4 (cm)
1	876	1	R	21.9	2.1	2.9	5.2
2	884	3	L	22.1	1.9	2.7	5.2
3	891	6	R	22.6	1.9	2.8	5.3
5	915	9	L	26.9	2.32	3.46	5.7
6	916	8	L	23.8	1.9	3	5
7	917	81	L	26.2	2.09	3.12	5.1
9	919	11	L	25	2.27	3.8	6.2
11	920	12	R	-	2.1	-	4.7
12	923	14	L	-	-	-	5.9
13	950	24	R	22.9	2	-	5.8
14	962	26	R	26.6	2.32	3.58	6
16	965	28	R	23.1	2.15	3.2	5.1
18	966	28	L	-	2.2	-	5.4
19	972	30	L	27.1	1.99	3.3	5.8
20	988	33	R	23	2.07	2.87	4.5
22	990	34	L	-	-	2.8	4.7
23	996	38	L	24.7	2	2.8	5
24	1005	41	L	24.7	1.9	3.5	5.8
25	1076	51	L	22.4	20.8	3.01	5.5
27	1097	56	R	23.5	1.98	2.96	5.2
29	1099	57	L	-	2.1	3.2	6.6
30	1105	60	R	22.4	1.9	2.84	5
32	1126	66	L	-	-	3.4	6.5
33	1133	68	L	24.2	2.2	3.2	5
34	1140	69	R	24.1	2.4	3.4	5.3
35	1154	72	L	23.1	2	3	4.8
36	1156	73	R	22.8	2.8	3.2	5.6
37	1171	75	L	26.5	2.4	3.5	5.4
38	1172	76	L	25.5	2.19	3.44	5.8
40	1203	80	L	24.45	1.98	2.75	5.1

S. no.	Individual no.	Box no.	Side	R1 (cm)	R2 (cm)	R3 (cm)	R4 (cm)
41	1204	81	L	19.5	1.9	-	4.5
42	1207	82	L	24.9	2.1	3.1	5
43	1218	85	L	-	-	-	5.4
44	1223	88	L	22.4	2	2.6	4.9
45	1226	89	L	-	-	-	5.9
46	1228	90	L	-	-	2.7	4.7
47	1229	91	R	23.1	2.2	3.3	-
48	1233	92	R	24	2.2	3	5.3
49	1234	93	L	23.3	2.4	3.3	6.5
50	1249	96	R	24.2	2.2	3.3	5.8
51	1250	96	L	22.5	-	2.7	4.5
52	1259	99	L	24.1	2.3	3.3	5.6
53	1264	101	R	25.9	2.3	3.1	5.8
54	1269	102	L	-	2.3	-	6
55	1278	106	R	-	2.2	-	5.1
56	1282	107	L	-	2.5	-	6
57	1284	108	R	22.1	2	3.4	5.3
58	1286	109	R	-	-	2.7	4.5
59	1290	110	L	27	2.2	3.3	5.9
60	1298	113	R	-	2.3	-	5.5
61	1299	114	L	25.3	2.3	3.4	5.4
62	1303	115	L	23.7	2.2	3.3	4.9
63	1316	117	R	-	1.8	-	5.2
64	1327	120	R	22.8	2	3.1	5
65	1328	121	L	-	-	-	4.7
66	1330	122	L	-	2.2	-	5.7
67	1331	122	L	21.4	1.8	2.9	4.9
68	1337	124	L	-	1.8	-	5.1
69	1339	125	R	21.5	2.1	2.9	5.2
70	1340	126	L	24.9	2.2	3.3	5.1
71	1348	129	L	23.2	1.9	2.8	5.1
72	1354	131	L	-	2	-	4.5
73	1357	132	L	-	1.7	-	4.8
74	1358	133	L	24.3	2.2	3.1	5.8
75	1360	134	L	25.5	2.5	3.5	5.9
76	1363	135	L	26.2	2.3	3.2	5.4
77	1366	136	L	22.5	2.1	3.3	5.3
78	1367	136	L	-	-	3	4.8
79	1378	139	L	23.6	2	2.8	4.5
80	1383	140	L	-	2	-	4.5
81	1390	141	R	21	1.9	2.8	4.2
82	1391	142	L	-	2	-	4.5
83	1392	143	L	28.3	2.6	3.5	5.9
84	1394	144	R	-	-	-	4.6
85	1396	145	R	23.3	2.2	3.4	5.3
86	1399	146	L	21.6	2.1	2.9	5.1
87	1401	147	L	-	-	-	4.9
88	1403	148	L	24.1	2.2	3.5	5.4
89	1408	150	L	22.2	1.8	3	5
90	1411	151	L	22.9	2.1	2.7	4.7
91	1415	153	L	-	-	3.2	5.3
92	1422	154	L	24	2.3	3.3	5.9
93	1426	156	L	23.5	2	2.9	5.1
94	1427	156	L	24.2	1.9	2.7	4.9
96	1429	157	L	26.7	2.3	3.4	5.8
97	1431	158	L	-	2	-	4.9
98	1432	159	L	-	2.2	-	4.9
99	1433	159	L	25.3	2.3	3.2	5
100	1441	162	R	23.6	2.2	3.1	5.7
101	1443	163	R	-	1.9	-	4.9
102	1456	167	L	24.5	2.3	3.3	5
103	1457	168	L	24.3	2	3	5
104	1460	169	L	-	1.9	-	4.2
105	1462	170	R	24	2	3	5.5
106	1509	194	L	25	2.1	3	5.9
107	1510	195	L	24.9	2.3	3.1	5.1
108	1511	196	L	23	2	3	4.9
109	1512	196	L	24	1.9	3.1	5.3
110	1513	197	L	25.5	2.2	3.3	6
111	1519	199	L	21.9	1.9	2.8	4.6

S. no.	Individual no.	Box no.	Side	R1 (cm)	R2 (cm)	R3 (cm)	R4 (cm)
112	1525	201	L	22.6	2.2	3.2	5.3
113	1532	204	L	23.3	2	3	4.8
114	1533	205	R	-	2.1	-	5
115	1535	207	R	24.6	2.1	3	4.6
116	1537	209	R	26.2	2.4	3.4	6
117	1545	211	L	24.8	2.1	3.1	4.7
118	1546	212	L	22	2	3	5
119	1551	216	L	-	2	-	5.3
120	1552	216	L	25	2.2	3	5.9
121	1554	218	L	22	2	2.7	5
122	1556	219	L	21	1.9	2.9	4.3
123	1557	220	R	24	2.4	3.1	5.4
124	1558	221	L	23.3	2.2	3.1	5.2
125	1561	222	R	25.5	2	3	5.5
126	1564	223	L	24.3	2	3.1	4.9
127	1568	226	L	26.8	2.4	3.6	6.1
128	1571	228	L	22.9	2.1	3.1	4.9
129	1573	229	L	25.7	2.5	3.65	5.9
130	1578	231	L	24.4	2.1	3.2	5.4
131	1579	232	L	22.4	1.9	2.9	4.7
132	1594	240	L	26.2	2.2	3.2	5.4
133	1597	242	L	-	1.9	-	3.9
134	1599	243	L	21	1.8	2.5	4.1
135	1600	244	L	25.5	2.3	3.5	5.5
136	1601	245	L	25.5	2.5	3.3	6.3
137	1605	247	L	22.4	2.2	2.9	4.9
138	1607	248	L	24.2	2.1	3	5.2
139	1608	249	L	21.3	2	3	4.8
140	1609	250	L	28.5	2.4	3.6	6.3
141	1612	251	L	24.8	2	3	4.6
142	1614	253	L	27.6	2.3	3.5	5.9
143	1626	256	L	27	2.4	3.3	5.9
144	1627	257	L	26	2.7	3.8	6.5
145	1628	258	L	21.1	1.9	2.8	4.4
146	1633	259	L	22.9	1.9	2.7	4.6
147	1635	260	L	24.7	2.3	3.3	5.7
148	1636	261	L	24.6	2.1	3.1	4.7
149	1637	261	L	23.8	2.3	3.3	5.8
150	1638	262	L	23	2.1	3.1	5.4
151	1644	264	L	25	2	3	4.9
152	1645	265	L	24.5	2.3	3.3	5.3
153	1653	268	L	25.7	2.4	3.3	5.5
154	1657	270	L	26.1	2.1	3.2	5.4
155	1660	272	L	21.6	2.1	3	4.8
156	1661	273	L	26.2	2.4	3.5	6.4
157	1662	274	L	24.9	2.2	3	4.8
158	1664	275	L	22.5	2.4	3.4	5.5
159	1665	276	L	23.5	2.2	3.2	4.5
160	1666	277	L	26.5	2.6	3.6	5.6
161	1671	274	L	23.1	1.9	3	5

Legend – L: Left side of the bone, R: Right side of the bone, (-): Not available

Table 21 Data collected from Lübeck series using metrical methods on Ulna

S. no.	Individual no.	Box no.	U1 (cm)	U2 (cm)	U3 (cm)	U4 (cm)
1	887	4	25.8	2.4	2	3.6
2	888	4	-	2.7	-	-
3	891	6	-	2.6	-	3.5
4	915	9	28.9	2.4	2.26	3.9
5	917	11	27.3	2.96	2.33	4.4
7	919	11	27.3	3.2	2.3	4.2
8	920	12	23.8	2.29	2.29	3.2
10	923	14	-	2.8	-	4.1
11	950	24	-	2.9	-	4
12	962	26	28.5	3.18	2.18	4
14	964	27	24.4	2.14	1.85	2.9
15	965	28	25	22.03	1.79	3.2
17	966	28	-	-	-	4.1
18	988	33	24.1	2.27	1.85	3
20	990	34	-	-	1.6	3.4

S. no.	Individual no.	Box no.	U1 (cm)	U2 (cm)	U3 (cm)	U4 (cm)
21	996	38	26.2	2.19	2.19	4
23	1003	41	27.1	3.1	2.1	3.7
24	1037	45	28.2	3	2	4
25	1076	51	24.1	2.45	1.96	3.2
27	1077	51	24.2	2.44	1.81	3.1
28	1084	53	30.3	2.65	2.08	4.1
30	1097	56	25.4	2.28	1.77	3.5
32	1099	57	-	3.2	-	4.4
33	1102	59	-	2.1	-	3.2
34	1105	60	24.1	2.21	2.21	3.4
36	1126	66	29.2	2.9	2.2	3.9
37	1144	70	-	2.9	-	-
38	1154	72	25.5	2.7	1.7	3.3
39	1156	73	-	2.9	-	3.9
40	1172	76	27.9	2.7	1.95	3.85
42	1203	80	27.3	2.39	1.82	3.5
43	1204	81	22.7	2.2	1.6	3
44	1207	82	26.8	2.58	2.15	4.1
46	1213	83	25.5	2.9	2	3.5
47	1217	84	-	-	-	3.1
48	1218	85	-	2.7	-	3.9
49	1223	88	24.7	2.5	1.8	3.6
50	1226	89	-	3	-	4.1
51	1228	90	26.3	2.2	1.7	3
52	1229	91	-	2.8	-	4.1
53	1232	92	27	2.8	2	4.2
54	1233	92	26.5	2.7	2	3.4
55	1234	93	25.5	2.9	2.2	4.1
56	1249	96	26.3	2.9	2.3	3.8
57	1250	96	26.2	2.7	2.1	3.7
58	1259	99	26.2	2.9	2	3.8
59	1272	104	24.6	2.5	1.7	3
60	1273	104	-	2.4	-	3.3
61	1282	107	-	3	-	4.35
62	1284	108	25.1	2.5	1.9	3.7
63	1286	109	-	2.3	-	3.6
64	1290	110	-	3	-	4.8
65	1298	113	28.6	3	2.1	3.7
66	1299	114	27.5	2.9	2.1	3.5
67	1303	115	26	2.8	1.8	3.3
68	1316	117	25.8	2.5	1.9	3.2
69	1327	120	-	-	2	3.3
70	1328	121	24.6	2.3	1.8	3.4
71	1330	122	-	3.1	-	3.5
72	1331	122	23.4	2.5	1.6	3.3
73	1332	123	-	2.5	-	3.3
74	1337	124	-	3.1	-	3.7
75	1339	125	22.3	2.6	1.4	3.3
76	1340	126	26.5	2.8	1.9	4
77	1348	129	26	2.9	2	3.3
78	1354	131	-	2.7	-	3.7
79	1357	132	-	2.2	-	3.1
80	1358	133	26.2	3	2.1	4
81	1360	134	-	2.8	-	-
82	1363	135	-	-	2.3	3.8
83	1366	136	24.5	2.5	2	3.4
84	1374	138	-	3	-	-
85	1378	139	-	2.4	-	3
86	1383	140	-	2.3	-	3.4
87	1390	141	-	2.4	-	3.3
88	1391	142	24.5	2.3	1.6	3.1
89	1392	143	30.6	3.2	2.5	4.2
90	1394	144	24.1	2.2	1.6	3.1
91	1396	145	-	2.5	-	3.6
92	1399	146	-	2.4	-	3.5
93	1401	147	-	2.6	-	3.7
94	1403	148	26.3	2.8	2	3.7
95	1408	150	-	2.5	-	3.9
96	1411	151	24.5	2.5	1.8	3.4
97	1415	153	26.1	2.6	1.9	3.5

S. no.	Individual no.	Box no.	U1 (cm)	U2 (cm)	U3 (cm)	U4 (cm)
98	1426	156	25.6	2.8	1.9	3.4
99	1427	156	26	2.3	1.8	3.3
101	1429	157	28.7	2.8	2.1	3.9
102	1431	158	25	2.2	1.7	3.3
103	1432	159	-	2.5	-	3.6
104	1433	159	-	3	-	3.35
105	1441	162	26	3.1	2.2	4
106	1443	163	25.9	2.3	1.7	3.2
107	1456	167	26.3	2.5	1.8	3.7
108	1457	168	26.6	2.7	2	3.5
109	1460	169	23	2.3	1.5	3.2
110	1463	171	21.8	2.5	1.9	3.6
111	1464	171	24	2.6	2	3.5
112	1509	194	26.6	2.6	1.9	3.7
113	1510	195	26.9	2.6	2	3.8
114	1511	196	25.4	2.5	1.9	3.1
115	1512	196	26	2.6	1.7	3.4
116	1513	197	27.8	2.9	2.1	3.7
117	1519	199	23.9	2.5	1.7	3
118	1525	201	24.5	2.7	1.9	3.6
119	1532	204	25.5	2.8	2	3.6
120	1533	205	-	2.7	1.6	3.5
121	1535	207	27.3	2.8	2	3.5
122	1537	209	27.8	3	2.2	3.9
123	1545	211	26.7	2.5	2	3.3
124	1546	212	23.4	2.3	1.9	3.2
125	1551	216	26.9	2.9	2.1	3.9
126	1552	216	26.5	2.8	2	3.7
127	1555	218	24	2.3	1.6	3.2
128	1556	219	23.2	2.4	1.8	3.4
129	1557	220	25.5	2.7	2	3.9
130	1558	221	25.3	2.7	2	3.7
131	1564	223	26.5	2.7	1.9	3.6
132	1568	226	29.7	3	2.2	4.2
133	1571	228	25.4	2.6	2	3.35
134	1573	229	27.4	3	2.2	4.1
135	1578	231	26.2	2.5	2	3.5
136	1579	232	24.5	2.3	1.8	3.2
137	1594	240	27.8	2.7	1.9	3.5
138	1597	242	-	2.2	-	3
139	1599	243	23	2.3	1.6	3.1
140	1600	244	27.9	2.8	2.4	3.7
141	1601	245	27.2	2.9	1.9	3.9
142	1605	247	24.6	2.6	2	3.4
143	1607	248	26	2.9	2	3.7
144	1608	249	23.2	2.5	1.8	3.3
145	1609	250	30.7	3.4	2.3	4.2
146	1612	251	26.8	2.4	2	3.5
147	1614	253	30.5	3.2	2.5	4.5
148	1626	256	29	3.1	2.3	4
149	1627	257	26.5	2.6	1.9	3.9
150	1628	258	23.3	2.5	1.9	3.25
151	1633	259	24.8	2.4	2	3.7
152	1635	260	26.6	2.8	2.2	3.6
153	1636	261	26.5	2.6	1.9	3.1
154	1637	261	26	2.9	2	3.6
155	1638	262	25.2	2.6	2	3.9
156	1644	264	26.9	2.8	2	3.4
157	1645	265	26.8	2.8	2	4.2
158	1653	268	28.2	3	2.1	4.2
159	1657	270	28.5	2.8	2.1	3.5
160	1660	272	23.2	2.1	1.9	3.3
161	1661	273	28.5	3.2	2	4.7
162	1662	274	26.2	2.5	1.6	3.3
163	1664	275	24.5	2.3	2.1	3.7
164	1665	276	26.2	2.2	1.7	3.4
165	1666	277	28.5	3.3	2.1	3.9
166	1671	279	25	2.2	1.8	3.3

Legend – (-): Not available

Table 22 Data collected from Lübeck series using metrical methods on basal view of Crania

S. no.	Individual no.	CB1 (cm)	CB2 (cm)
1	891	2.5	11
2	910	-	10.25
3	913	1.7	9.7
4	915	2.4	11.39
5	916	2.6	11.4
6	917	2.65	2.05
7	919	-	11.05
8	920	2.72	10.59
9	921	11.15	11.26
10	923	2.4	10.7
11	929	2.1	10.9
12	965	2.37	11.17
13	1005	2.2	10.4
14	1097	1.9	10.7
15	1171	2.3	12.3
16	1221	2.3	11.9
18	1225	1.8	10.1
19	1226	2.6	10.8
20	1227	2	12.5
21	1228	1.9	11.1
22	1229	-	11.6
23	1234	2.4	10.7
24	1245	-	11.6
25	1249	2.6	11.1
27	1257	2.4	10.9
28	1286	2.35	10.5
29	1299	2.7	10.9
30	1319	2.05	11.3
31	1327	1.6	10.5
32	1329	1.7	10.5
33	1339	1.8	11.3
34	1341	1.8	10.9
35	1348	1.9	11.3
36	1355	2.45	11
37	1391	2.1	10.8
38	1401	2.4	11.2
39	1408	-	10.3
40	1416	1.95	11
41	1417	1.95	11
42	1427	2.1	10.4
43	1428	1.9	10.9
44	1429	2.45	11.2
45	1432	2.1	11.3
46	1456	1.8	10.5
47	1457	2.1	11.1
48	1458	2	10.5
49	1509	2.3	11.3
50	1510	1.7	11.2
51	1511	2.1	11
52	1513	2	10.6
53	1516	2.05	11.05
54	1519	1.8	10.1
55	1525	2.1	11.3
56	1526	2.4	12.45
57	1533	2.2	11.2
58	1535	2.5	10.9
59	1537	-	-
60	1545	2.8	11
61	1550	2	10.7
62	1552	2.05	11.2
63	1554	1.9	10.8
64	1555	1.7	10.6
65	1556	2.5	10.8
66	1558	2.6	10.8
67	1559	1.8	10.2
68	1564	2.5	10.7
69	1567	1.6	10.4
70	1568	2.15	10.3

S. no.	Individual no.	CB1 (cm)	CB2 (cm)
71	1569	2.1	11.1
72	1571	2.3	11
73	1572	2.1	10.6
74	1573	2.1	11.5
75	1578	2.4	10.2
76	1579	2.2	10.8
77	1580	2.5	11.2
78	1585	2.35	9.85
79	1588	2.2	11.8
80	1589	1.9	10.7
81	1592	2	10.5
82	1594	2.62	11.3
83	1595	2.9	11
84	1597	1.8	10.4
85	1599	2.1	11
86	1600	2.5	11.5
87	1601	2.3	11.7
88	1602	2	10.6
89	1606	2	11.3
90	1608	2.1	10
91	1609	2.3	12.05
92	1612	2.15	10.4
93	1613	1.9	10.8
94	1614	2.5	11.5
95	1616	2	11.7
96	1625	2.2	11.2
97	1626	1.9	10.3
98	1627	2.8	10.8
99	1628	1.8	10.4
100	1635	2.4	11.2
101	1636	2.3	10.6
102	1637	2.25	11.7
103	1638	2.2	10.75
104	1639	2.3	10.7
105	1646	2.2	11.1
106	1653	2.7	11.9
107	1659	2.1	11
108	1660	1.7	11.1
109	1661	2.1	10.9
110	1662	2.45	9.7
111	1664	2.4	11.25
112	1665	1.9	10.8
113	1666	2.2	10.9
114	1667	2	10.7
115	1671	1.9	10.5
116	1673	1.8	10.75
117	1675	1.9	11.2
118	1965	1.8	11.3

Legend – (-): Not available

Table 23 Data collected from Lübeck series using metrical methods on frontal view of Crania

S. no.	Individual no.	CF1 (cm)	CF2 (cm)	CF3 (cm)	CF4 (cm)	CF5 (cm)
1	891	12.6	9.5	13.5	5.2	2
2	910	NA	9.4	13	NA	NA
3	913	10.7	8.3	13.3	4.1	2
4	915	13.7	9.2	13.7	4.91	2.15
5	916	13.4	1.1	13.8	4.5	2.4
6	917	13.1	9.5	13.6	5.3	2.55
7	919	NA	9.5	15.3	NA	NA
8	920	12.7	9.5	13.1	6.39	2.37
9	921	11.5	8.8	13.5	5.54	2.11
10	923	12.1	9	14.5	4.9	2.5
11	929	12.1	9.7	14	4.8	2.3
12	965	12.4	9.3	14.2	5.15	2.29
13	1005	11.5	9.5	13.4	4.7	2.3
14	1097	11.25	9.1	13.5	4.8	2.3
15	1171	12.9	9.3	14.5	4.9	2.4
16	1221	12.2	9.8	13.9	4.9	2.3
18	1225	12.2	8.8	13.2	4.7	1.9

S. no.	Individual no.	CF1 (cm)	CF2 (cm)	CF3 (cm)	CF4 (cm)	CF5 (cm)
19	1226	11.7	9.2	14.6	4.9	2.7
20	1227	12.3	8.8	14	5.2	2.4
21	1228	12.8	9.3	14.3	4.7	2.2
22	1229	NA	9.7	14.2	NA	NA
23	1234	11.4	9.2	13.3	5.5	2.4
24	1245	NA	9.5	14	NA	NA
25	1249	13	9.5	14.3	4.65	2.4
27	1257	12.2	9.4	13.6	4.8	2.4
28	1286	11.9	9	13.7	5	2.2
29	1299	11.8	9.6	13.4	4.7	2.6
30	1319	12.2	9	14	5.3	2.4
31	1327	11.7	9.4	13.2	4.9	2.4
32	1329	11.55	9	13.4	5.2	2.4
33	1339	11.4	9.3	14.3	4.6	2.2
34	1341	11.4	8.7	13.4	5	2.2
35	1348	11.7	9	14.2	4.8	2.75
36	1355	11.9	9	13.1	4.9	2.3
37	1391	11.5	9.2	13.9	4.8	2.6
38	1401	11	9	13.5	4.5	2.4
39	1408	NA	9	14	5	2.4
40	1416	12	9.15	13.7	4.8	2.5
41	1417	12.4	10.2	14.6	4.8	2.5
42	1427	11.2	9.1	13.5	5.15	2.4
43	1428	11.6	9	13.7	4.5	2.2
44	1429	12.4	9.2	14.2	5.6	2.5
45	1432	12	9.5	14.2	5.1	2.3
46	1456	11.8	9.1	13.5	5.3	2.5
47	1457	11	9.3	13.5	5.6	2.4
48	1458	11.5	9	13.5	4.5	2.4
49	1509	11	9.4	13.9	4.8	2.4
50	1510	11.7	9.8	14	4.9	2.5
51	1511	11.7	9	12.6	4.4	2.2
52	1513	11.9	9.4	14.1	5	2.2
53	1516	12.4	9.6	14.8	5.4	2.3
54	1519	11.35	8.8	13	4.7	2.2
55	1525	12.3	9.7	14.3	5.1	2.6
56	1526	13.1	10.1	14.2	4.7	2.4
57	1533	13.2	10.6	14.3	4.8	2.6
58	1535	10.8	9.1	14.2	4.7	2.2
59	1537	NA	NA	15	5.9	2.7
60	1545	12.2	9.6	13.4	5	2.4
61	1550	11.5	9.2	13	4.5	2.3
62	1552	12.55	9.5	14.5	5.5	2.6
63	1554	11.75	9.7	13.4	5	2.4
64	1555	11.4	8.5	13.2	4.2	1.9
65	1556	NA	9.7	13.8	4.8	2.6
66	1558	12.1	9.4	13.8	5.3	2.5
67	1559	11.5	9.3	13.4	4.6	2.1
68	1564	11.6	9.1	13.6	4.8	2.2
69	1567	10.75	8.4	13.7	4.6	2.2
70	1568	11.6	9.3	13.1	4.8	2.45
71	1569	12.3	9.9	13.8	4.6	2.6
72	1571	12	9.8	14.3	5	2.4
73	1572	11.45	9	13.4	4.7	2.2
74	1573	11.5	10	15.1	5.3	2.6
75	1578	11.4	8.8	14	5.3	2.4
76	1579	13	9.7	14	5.3	2.5
77	1580	11.5	10	14.1	4.5	2.5
78	1585	11.6	8.6	13	5.5	2.1
79	1588	12	9.5	14.7	4.4	2.5
80	1589	11.3	8.7	13.8	5.1	2.2
81	1592	11.5	9	13.2	5.4	2.25
82	1594	12.1	9.2	13.5	4.9	2.45
83	1595	11.7	9.2	13.5	4.5	2.1
84	1597	NA	8.7	13	5	2
85	1599	11.9	8.8	14	4.8	2.3
86	1600	12.6	9.5	15.2	4.4	2.3
87	1601	12.1	10	14.6	5	2.4
88	1602	11.8	9.1	12.9	4.7	2.3
89	1606	11.4	8.5	14	4.4	2

S. no.	Individual no.	CF1 (cm)	CF2 (cm)	CF3 (cm)	CF4 (cm)	CF5 (cm)
90	1608	12.2	9.6	13.4	5.2	2
91	1609	12.5	9.8	14.5	4.9	2.5
92	1612	11.5	8.9	12.9	4.8	2.4
93	1613	11.6	8.8	13.9	4.5	2.15
94	1614	10.7	10.1	13.3	5.6	2.3
95	1616	11.3	9.3	13.4	4.8	2.5
96	1625	12.1	9.1	14	4.6	2.3
97	1626	12.5	9.2	14.5	5	2.5
98	1627	12	9.5	14.2	4.9	2.2
99	1628	11.2	9.1	13.5	4.8	2.3
100	1635	12.8	9.5	14.5	5.2	2.4
101	1636	12	9	13	4.9	2.4
102	1637	12.6	9.5	14.4	4.9	2.4
103	1638	12	9	13.2	4.8	2.3
104	1639	11.9	8.7	13.8	4.9	2.25
105	1646	10.9	9.1	14.2	5.3	2.5
106	1653	12.3	10.2	14	4.8	2.6
107	1659	12.1	9.7	13.8	4.7	2.3
108	1660	11.3	9	13.5	4.75	2.3
109	1661	12.6	9.5	14.5	5.3	2.5
110	1662	11.85	8.9	13	4.8	2.6
111	1664	12.3	9.7	14.3	4.7	2.4
112	1665	11.8	9.5	13.5	4.6	2.3
113	1666	12.4	9.1	14.2	4.9	2.6
114	1667	12.3	9.1	14	4.7	2.1
115	1671	11.7	9.2	14	4.6	2.2
116	1673	11.9	9	14	5	2.2
117	1675	12.35	9.6	13.6	4	2.35
118	1965	11.6	9.4	14.2	5	2.4

Legend – NA: Not available

Table 24 Data collected from Lübeck series using metrical methods on lateral view of Crania

S. no.	Individual no.	CL1 (cm)	CL2 (cm)	CL3 (cm)	CL4 (cm)	CL5 (cm)	CL6 (cm)
1	891	17.8	2.8	8.9	9.4	6.8	12.3
2	913	17	2.5	8	8.9	5.3	12.9
3	916	19	2.8	9.9	10	6.1	12
4	915	17.7	2.75	9.3	9.4	6.32	11.9
5	965	17.6	2.81	8.61	9.3	6.85	12.5
6	917	18.8	3.42	9.71	9.8	7.12	12.9
7	921	17.2	2.55	9.01	9.6	5.52	12.1
8	920	17.6	2.58	9.68	9.7	6.36	11.8
9	1653	18.9	3.6	9.7	10.3	6.7	13.1
10	1545	18.3	3.2	10.7	10.2	6.5	12.6
11	1580	18.3	2.8	8.9	9.9	6.3	13.4
12	1299	18.7	3.3	9.8	10.1	6.8	13.4
13	1614	17.7	3.4	10.1	10.7	7.4	13.1
14	1221	19.3	2.9	9.8	10.2	6.8	13.5
15	1249	19.8	2.6	11.1	11	6.3	13
16	1526	19.2	3	10.6	10.5	7.05	14
17	1537	19.3	-	9.1	10.3	7.65	14
18	1609	19.7	3	10.2	10.5	6.6	13.4
19	1509	19.4	2.7	9.8	10	7.1	12.7
20	1588	18.7	2.7	10.2	10.5	6.45	13.3
21	1535	17.8	2.2	9.2	9.2	6.2	12.3
22	1627	18.4	3.5	9.7	9.9	6.4	13.1
23	1226	19.5	3	10.6	10	6.6	13.2
24	1664	18.3	2.6	9.85	9.9	6.6	12.3
25	1625	18.3	2.6	8.9	9	6.8	12.1
26	1234	18.1	2.3	10.2	10.1	7.1	13
27	1578	18.9	2.9	9.5	10.1	7.2	12.9
28	1666	18.5	2.9	9.2	10.2	6.4	13.4
29	1635	18.7	3.1	9.9	10.2	6.9	13.9
30	1636	18.1	3.1	9.7	9.8	6.6	13
31	1513	18.7	3.1	9.1	9.6	7.2	12.7
32	1171	18	3.1	-	-	6.7	-
33	1348	19.3	2.7	9.5	9.9	6.7	12.5
34	1564	17.9	2.75	8.9	9.8	6.5	13.1
35	1568	19	2.7	9.7	10.2	6.4	13.8
36	1628	18.5	2.3	9.9	10.3	6.7	12.6

S. no.	Individual no.	CL1 (cm)	CL2 (cm)	CL3 (cm)	CL4 (cm)	CL5 (cm)	CL6 (cm)
37	1427	19.05	2.4	9.7	10.1	7.7	12.8
38	1457	18.4	2.3	9.8	9.9	7.6	12.3
39	1416	18.1	3	9.7	10	6.8	12.5
40	1573	19.3	3.6	9.5	10.7	7.1	14.6
41	1319	18.2	3	8.9	9.6	7.5	13.6
42	1661	18.7	2.6	9.5	9.7	7	13.7
43	1601	18.5	3	9.8	10.2	6.9	13.5
44	1594	18.5	3.2	9.15	9.8	6.7	13.2
45	1639	17.5	2.6	9.2	9.5	6.6	12.3
46	1612	16.9	2.65	10.05	9.9	6.9	12.7
47	1559	17.7	2.5	9.2	9.5	6.34	13
48	1662	18	3.1	9.7	9.5	6.6	12.6
49	1558	18.2	3.2	9.8	10.15	6.6	12.9
50	1429	19.2	2.8	9.35	10.5	7.2	13.2
51	1552	19.1	2.9	9.2	10	7.3	13.5
52	1626	19	3.15	9.7	10	7.2	12.5
53	1401	17.2	2.9	-	-	6.8	-
54	1571	18.7	2.5	9.6	9.8	6.9	12.7
55	1673	18.3	2.9	9.1	10	7.05	12.5
56	1329	18.4	3	9.5	9.3	7	12.2
57	1339	17.9	3.1	8.6	9.3	6.5	12.3
58	1616	17.5	2.85	9.8	9.5	6	12.4
59	1659	18.3	2.9	-	-	6.3	-
60	1510	18.3	2.9	9.5	9.4	6.9	12.8
61	1637	18.5	2.8	10.1	10.2	7.1	14
62	923	18.1	2.8	9.5	10.1	7.1	13.9
63	1227	18.5	2.8	9.4	9.8	6.9	12
64	1391	17.8	2.6	9.6	9.4	6.5	12.65
65	1599	17.7	2.75	10.2	9.9	6.4	12.6
66	1257	19.1	2.45	10.2	10.3	6.4	13.2
67	1516	19.2	2.8	9.7	10.1	7.7	13.2
68	1341	17.3	2.7	8.8	9.1	6.7	11.8
69	1097	17.7	2.5	9.5	9.2	7	12.4
70	1638	18.2	2.8	10.2	9.9	6.7	12.2
71	1600	18.1	2.5	9	8.8	6.5	13
72	1286	18.3	2.7	9.8	10.2	7	12.4
73	1417	18	2.8	8.8	9.6	6.7	12.7
74	1355	17.5	2.4	9.3	9.4	6.8	12.5
75	1511	18.2	2.4	9.7	9.8	6.3	12.7
76	1675	17.9	3	9.75	10.2	6.9	12.8
77	1592	18	2.8	9.4	9.5	7.6	12.9
78	1408	18	2.6	9.3	10	7.25	12.3
79	1245	20.2	3.3	-	-	-	-
80	1585	17.5	2.6	9.3	9.5	7.3	12.3
81	919	18.6	2.9	-	-	-	13.8
82	910	18.3	2.6	-	-	-	-
83	1229	19.4	2.6	-	10.6	-	13.4
84	1432	19.1	2.6	9.5	9.6	6.8	13.2
85	1671	17.9	2.7	9.7	9.3	6.6	12.1
86	1567	17.3	2.15	9	8.8	6.4	11.8
87	1519	17.8	2.75	9	9.4	6.7	12.7
88	1569	17.8	2.7	9.6	9.7	6.1	12.8
89	1646	18.6	2.6	10.1	9.8	7.1	12.3
90	1572	17.6	2.35	9	9.5	6.5	12.25
91	1525	18.2	2.8	-	-	6.6	-
92	1589	18.5	1.9	9.5	10	6.9	11.9
93	1554	17.7	2.6	9.75	10.5	7.1	12.9
94	1613	16.6	2.7	8.9	8.7	6.3	11.5
95	1665	18.3	2.75	8.8	9.5	6.3	12.8
96	1965	17.5	2.5	8.7	9.4	6.8	12.5
97	1660	18.3	2.9	9.1	9.9	6.9	13
98	1550	18.7	2.5	9.9	10.2	6.4	12.4
99	1458	18.1	2.3	8.9	9.4	6.8	12.4
100	1606	17.7	2.1	9.3	9.3	5.7	13
101	1456	17.4	2.7	9.2	9.3	6.7	11.7
102	1005	17	2.5	-	-	6.6	-
103	1221	19.7	3.3	9.8	10.3	6.8	13.3
104	1249	20	2.7	10.9	11.1	6.5	13
105	1579	18.5	2.4	9.7	10.2	7.3	12.7
106	1327	18	2.7	9	9.6	6.9	13.1

S. no.	Individual no.	CL1 (cm)	CL2 (cm)	CL3 (cm)	CL4 (cm)	CL5 (cm)	CL6 (cm)
107	1602	18.1	2.4	9	9.4	6.5	12.8
108	1225	17.3	2.5	9.1	9.5	6.4	12.2
109	1555	17.6	2.6	8.9	9.3	6	12.1
110	1597	17.2	2.4	9	9.1	6.9	11.9
111	1428	17	2.5	9.1	9.6	5.9	12.6
112	1667	17.5	3.1	8.9	9.2	6.6	12.7
113	1595	17.9	2.5	9.8	9.8	6.6	13.1
114	1556	18.1	2.3	10.4	9.7	7.2	12.5
115	1533	20.1	2.8	10.3	10.7	6.7	14
116	1608	17.6	2.2	9.1	9.2	6.5	13
117	1228	18.2	2.7	9.9	9.7	6	12.1
118	929	17.8	2.7	9.2	9.4	6.6	12.9

Legend – (-): Not available

Table 25 Data collected from Lübeck series using metrical methods on Mandible

S. no.	Individual no.	M1 (cm)	M2 (cm)	M3 (cm)	M4 (cm)	M5 (cm)
1	884.1	11.4	9.35	3.2	8.6	7.5
2	884.2	11.5	10.2	3.6	9.1	7.4
3	891	11.8	9.1	3	9.5	8.1
4	909	12.1	8.6	3.9	9.2	8.2
5	913	9.2	8.4	3	8	6.5
6	915	11.7	10	34.29	9.83	8.1
7	916	11.1	10.5	3.5	9.4	7.6
8	919	13.37	9.9	3.34	9.52	8.1
10	921	9.83	8.6	3.02	8.33	6.8
11	922	10.82	8.9	2.97	8.88	7.85
12	923	11	9.9	3	9.4	7.6
13	924	NA	NA	NA	NA	NA
14	928	NA	8.8	3.5	9	7.9
15	965	11.12	9.4	2.67	8.45	7
17	971	11.7	9.2	3.19	9.08	7.4
19	990	10.76	9.5	3.29	9.1	7.8
20	994.1	11.2	9.7	3.1	8.6	7.5
21	1005	NA	NA	3.3	9.2	7.4
22	1006	NA	9.4	3.3	9.5	8
23	1097	11.91	9.5	2.88	8.66	7.7
25	1171	12.9	10.8	3.2	9.4	7.9
26	1172	12.37	10.4	3.1	8.88	7.7
27	1221	13	11.4	3.4	9.8	8.1
28	1225	NA	NA	3.1	9.3	NA
29	1226	NA	11.8	3.6	9.3	7.7
30	1228	10.8	8.4	3.3	8.9	7.7
31	1229	NA	NA	3.2	9.1	NA
32	1234	13.1	11.8	3.5	10.2	7.3
33	1245	12.5	11.7	3.4	9.3	7.4
34	1249	NA	NA	3.4	9.2	8.5
35	1257	10.2	9.5	3.7	9.2	7.6
36	1271	NA	9.4	3.2	9.6	8.3
37	1278	NA	9	3.3	9.5	8.4
38	1292	NA	9.6	3.5	9.3	7.9
39	1319	NA	9.5	2.7	9.1	8
40	1351	NA	9.8	3.2	8.6	6.8
41	1362	11.2	9.7	3.8	9	7.8
42	1392	NA	11.5	3.4	9.8	8
43	1401	11.3	9.2	3.2	8.9	7.6
44	1404	11.1	9.6	3.5	9	7.1
45	1416	12.6	9.2	3.3	9.4	8.1
46	1417	NA	10	3	9.3	7.6
47	1423	NA	NA	3.3	9.4	NA
48	1428	NA	9.1	3.2	8.6	7.4
49	1429	11.95	10.5	3.3	9.5	7.7
50	1432	10.1	9.2	3.4	8.6	7.7
51	1441	NA	9.5	3.8	9.6	8
52	1443	10.8	9.5	3.1	9.2	8.1
53	1449	12.1	11.6	3.9	10.3	8.4
54	1456	11.9	8.6	3.2	9	7.4
55	1458	11.7	9.4	3.3	8.4	6.9
56	1511	11	9.5	3	8.7	7.5
57	1512	11.7	9.8	3.3	9.1	7.8

S. no.	Individual no.	M1 (cm)	M2 (cm)	M3 (cm)	M4 (cm)	M5 (cm)
58	1519	10.9	9.3	3.3	8.8	7.3
59	1526	12.6	10.7	3.2	9.9	7.8
60	1550	10.8	8.6	3.7	9.2	7.9
61	1551	NA	9.5	3.8	10.4	9
62	1552	12.3	10.7	4	9.7	8.7
63	1554	11.6	9.9	3.4	9.1	7.7
64	1556	NA	8.5	3.4	9	7.9
65	1558	12.4	10.35	3	9.1	7.7
66	1559	10.7	8.8	3.4	9.1	7.6
67	1567	10.6	8.2	3.1	7.8	6.6
68	1572	10.4	9.1	3	8.8	7.2
69	1573	12.3	11	3.1	9.4	7.6
70	1579	11.4	10.1	3.8	9	7.8
71	1580	11.7	9.2	3.1	9	7.7
72	1585	10.8	9.6	3.2	8.2	6.5
73	1588	11.6	9.6	3.3	9	7.4
74	1589	NA	9.1	2.7	8.6	7
75	1595	11	10.4	3.6	8.9	7.2
76	1597	NA	9.2	3.1	8.7	7
77	1599	11.8	9.3	3.5	9.1	7.8
78	1600	12.3	10.4	2.8	9	7.2
79	1601	12.2	9.8	3	9.1	7.4
80	1602	11.1	9	3.2	9	7.3
81	1605	NA	10.2	2.9	9.2	8
82	1607	11.6	11	3.5	9.1	7.6
83	1608	10.45	9.2	3.2	8.8	7.4
84	1609	NA	10.4	3.2	9.4	7.9
85	1614	11.8	10.2	3.3	9.3	7.9
86	1616	11.1	9	3.3	8.4	7.4
87	1625	11.5	10.5	3.2	9.5	8.1
88	1627	NA	11.7	2.7	9	6.9
89	1628	10.7	9.5	3.3	8.5	7.1
90	1637	11.8	9.9	3.4	8.8	7.9
91	1638	10.8	9.7	3.2	9.2	7.5
92	1639	11	9.5	3.3	9.1	7.9
93	1645	11.7	10.6	3.6	9.4	8.3
94	1646	11.8	10.5	3.2	9.5	7.8
95	1657	11.5	10.3	3.5	9.5	8.1
96	1659	12	9.7	3.1	8.5	7.4
97	1667	11	9.8	3	8.8	7.2

Legend – NA: Not available

Table 26 Data collected from Lübeck series using metrical methods on Pelvis

S. no.	Individual no.	Side	P1 (cm)	P2 (cm)	P3 (cm)	P4 (cm)	P5 (cm)	P6 (cm)	P7 (cm)	P8 (cm)	P9 (cm)
1	886	L	-	9.3	18.7	13.2	3.6	5	5.1	-	-
2	887	L	-	-	-	-	3.6	5	5	-	-
3	888	L	-	-	-	-	-	-	-	-	-
4	889	L	-	-	-	-	2.8	5.4	4.4	-	-
5	891	R	-	9.7	-	-	3.3	4.5	6	-	-
6	892	L	-	11.2	-	-	3.4	5.6	6.2	-	-
7	915	L	9.75	10.99	23.6	17.4	3	5.68	4.78	2.86	4.7
8	917	R	9.49	11.13	21.95	15.7	3.2	5.16	4.83	2.99	4.52
9	919	L	-	-	-	-	-	5.8	5.9	-	-
10	920	L	-	-	19.7	14.5	2.8	5.5	4.9	-	-
11	922	R	-	-	-	14.7	3.4	4.5	6.7	-	-
12	923	L	9.7	11.1	21.3	15.7	3.4	5.8	5.5	2.4	5
13	942	R	-	9.6	19.6	14.8	2.8	4.3	5.3	-	-
14	950	L	10.1	11.5	22.9	16.6	2.7	5.3	6.2	3.1	4.9
15	958	L	-	10.1	21.4	16.6	3.3	4.8	6.4	-	-
16	960	R	-	-	20.6	16.3	3.5	5.4	5.7	-	-
17	962	R	10.85	11.78	23.6	16.8	3.3	6.32	5.99	2.67	4.77
18	964	R	-	9.5	18.9	14.8	2.4	4.6	5.2	-	-
19	965	L	9.01	9.9	20.5	14.9	3.65	5.26	6.29	2.42	4.52
20	966	L	-	11	21.7	-	2.9	5.3	4.9	-	-
21	984	L	-	11.5	22.5	16.8	2.9	5.4	5.1	-	-
22	988	L	9.22	9.85	20.5	15.4	3.2	4.72	4.6	2.81	4.28
24	990	R	9.29	9.53	19.2	14.4	3.7	5.01	6.16	2.84	4.38
25	996	L	-	-	-	16.5	-	5.1	-	-	-

S. no.	Individual no.	Side	P1 (cm)	P2 (cm)	P3 (cm)	P4 (cm)	P5 (cm)	P6 (cm)	P7 (cm)	P8 (cm)	P9 (cm)
27	1003	L	-	11.1	22.5	15.4	3.6	6	6.1	-	-
28	1005	R	-	-	12.5	16.5	3.4	6.3	5.9	-	-
29	1033	L	-	-	-	-	3.8	5.3	3.5	-	-
30	1037	R	-	11.8	13.8	17	4.2	6	4.7	-	-
31	1075	L	9.23	9.88	20.1	15.3	3.9	5.05	5.44	2.76	4.87
33	1076	R	10.21	12.08	23	16.7	2.8	6.31	38.85	2.88	5.5
34	1084	R	-	11.9	12.6	16.3	2.9	5.5	5.3	-	-
35	1090	L	8.91	9.49	19.2	14	3.2	5.2	6.27	1.77	4.63
36	1095.1	R	10	10.7	12.5	17.5	3.7	5.1	6.2	3.6	5.3
37	1095.2	L	11.4	10.9	22.5	16.5	3.2	5.3	5.5	3.6	3.9
38	1097	L	10.22	10.34	21	15.6	3.7	5.14	5.98	3.18	3.62
39	1099	R	10.83	12.75	23.7	18.2	4.2	6.21	5.19	2.75	5.38
40	1102	L	8.7	10.1	20.5	15	-	5.2	5.6	2.5	4.1
41	1105	L	8.4	9.4	18.9	14.6	3.3	5.9	4.8	2.5	5.2
42	1106	R	10.3	10.2	21.6	-	3	5.1	5.8	3.8	5.2
43	1109	L	9.39	10.85	21.1	15.9	3.2	5.05	4.79	2	4.61
45	1122	L	9.6	10	19.8	15.4	3.5	5.1	5.8	2.9	4.3
46	1123	L	-	-	-	16.4	3.5	5.3	5.9	-	-
47	1126	R	-	11.7	23.9	17.3	3.2	5.6	5	-	-
48	1133	L	9.8	11.3	22.8	17.3	-	5.7	-	3.4	4.9
49	1140	R	-	-	21.3	16.1	L	5.3	4.2	-	-
50	1144	L	9.5	11.5	12.2	16.9	3.4	5.6	5	3.3	4.9
51	1154	R	10.1	10.7	21.2	14.4	3.5	5.3	4.4	3	4.2
52	1156	L	9.2	10.6	20.8	14.9	2.6	5.3	3.7	2.5	4.1
53	1171	L	-	-	23.9	18.3	3.9	5.5	5.5	-	-
54	1172	R	9.95	11.72	23	16.8	3.5	5.74	4.36	3.26	4.14
56	1204	L	9.61	9.79	19	15.5	3.2	4.57	5.26	2.66	3.91
58	1207	R	8.8	11.3	-	-	2.9	5.5	4.6	2.4	4.5
59	1212	L	9.39	9.87	19.7	13.9	2.8	4.64	5.52	2.68	3.67
61	1213	L	9.1	10.98	21	16.1	3.2	5.16	4.53	2.28	4.52
62	1217	R	-	-	-	-	3.3	4.6	6.7	-	-
63	1218	L	-	11.1	21.8	14.5	3.5	5.7	5.2	-	-
64	1220	L	10.21	10.1	20.6	15.7	3.3	1.97	1.87	1.39	1.54
66	1223	R	10.3	10.1	20.1	16.6	3.1	4.7	4.6	3.9	3.9
67	1226	L	9.2	10.4	21.2	16	2.6	5	4.6	3.3	5
68	1227	R	9.6	10.5	12.6	17	3.6	5.4	4.5	2.6	4.8
69	1228	R	-	-	-	-	3.5	4.7	6.3	-	-
70	1229	L	9.8	10.6	12	16.1	3.8	5.5	4.8	2.9	5.1
71	1232	R	9.6	11.3	-	-	3	5.5	5.3	2.6	4.7
72	1233	R	-	10.2	13.1	-	3.2	4.6	6.8	-	-
73	1234	L	8.9	11.5	22.1	15.7	2.8	5.7	4.9	2.8	4.4
74	1245	R	9.7	11.2	22.1	15.6	2.9	6.1	5.2	2.9	4.9
75	1249	L	-	11.6	22.3	15.9	2.5	5.2	4	-	-
76	1250	R	-	9.8	20.7	16.1	3.5	4.8	5.1	-	-
77	1252	R	-	-	28.8	13.4	2.8	5	4.6	-	-
78	1254	R	9.3	10.1	20	15.4	3.2	4.7	5.9	3.9	4.3
79	1259	L	9.6	11.2	12.5	17.7	2.4	5.8	5	3	5.2
80	1264	R	-	11.3	12.5	16.3	2.5	5.2	6	-	-
81	1269	L	10.3	12.7	13.3	-	4	6	5.1	3.2	5
82	1272	R	10.8	10.3	20.5	15.9	3.3	5	5.7	3.4	4.2
83	1273	R	8.9	9.8	20.1	14.2	3.8	4.7	6.2	2.9	4.4
84	1276	L	8.7	10.7	21.2	15.7	3.3	5.3	4.6	3.3	4.6
85	1277	L	9.7	11.2	21.8	16.6	3	5.9	5.4	3.1	4.2
86	1278	R	10.1	11.1	12.2	16	3.8	5.6	5	2.7	4.7
87	1282	L	10.1	11.5	-	-	3.8	5.7	6.4	3.1	5
88	1284	L	-	10.6	21.6	16.9	3.1	4.8	6.2	-	-
89	1286	L	-	-	20.4	15.4	3.5	4.9	6.2	-	-
90	1290	L	-	-	24	26.4	3.2	6.2	6.2	-	-
91	1298	L	8.8	10.7	21.9	15.9	3.1	5.5	5.7	2.6	4.5
92	1299	R	10.1	11.3	12.5	16.9	3.8	5.6	4.9	3.6	4.6
93	1303	R	9.3	11	11.9	16.8	3.6	5.3	4.6	3.2	3.9
94	1316	L	8.8	9.3	19.2	15.5	3	5.5	5.1	2.4	4.2
95	1327	R	-	10.5	22.2	17	2.6	5	5	-	-
96	1328	R	10.1	9.9	19.7	15.5	2.8	4.8	5.6	3.7	4.3
97	1330	L	10.3	11.9	23.5	16.4	3	5.8	5.9	3.2	5.5
98	1331	R	-	9.9	19.3	14.3	2.8	4.8	5.3	-	-
99	1332	R	-	10.1	-	-	3.8	4.7	4.4	-	-
100	1337	L	9.7	10.7	-	16.1	2.5	5.3	5.5	2.8	4.2
101	1339	L	9.3	9.8	19.3	15.4	3.4	4.4	4.3	3.2	4.4

S. no.	Individual no.	Side	P1 (cm)	P2 (cm)	P3 (cm)	P4 (cm)	P5 (cm)	P6 (cm)	P7 (cm)	P8 (cm)	P9 (cm)
102	1340	R	9.1	11.6	12	16.5	3.4	5.4	5.4	3.1	4.8
103	1347	R	-	10.6	21	15.1	2.9	5.2	4.7	-	-
104	1348	R	10.6	10	20.8	16.7	3.4	4.8	5.8	3.6	3.7
105	1354	L	-	10.1	-	14	3.4	4.7	5.6	-	-
106	1357	L	9.6	9.9	19.8	15.8	3.5	4.4	5.9	3.3	4.7
107	1358	R	-	-	-	-	3.6	5	5.6	-	-
108	1360	R	9.9	11.3	12.9	-	4.2	5.7	5	3.9	4.3
109	1363	R	-	11.8	23	15.3	3.7	5.6	5.3	-	-
110	1366	R	-	-	19.7	16.3	2.8	5.6	5.5	-	-
111	1367	L	-	-	19.3	14.8	2.6	4.8	4.7	-	-
112	1374	L	9.9	11.7	13.1	17.4	3.4	5.5	5.3	3	5.4
113	1375	R	10.4	10.7	20.7	14.7	3.5	4.9	5.1	4.2	4.3
114	1378	R	9.7	10.1	19.9	15.1	3.3	4.9	5.7	3.4	4.6
115	1383	R	-	9	18.5	14.9	3.8	4.5	5.8	-	-
116	1390	L	-	9.3	18.2	13.7	3	4.2	6.4	-	-
117	1391	L	8.8	9.7	19.8	14.9	3.4	4.5	5	2.7	4.3
118	1392	R	10	11.6	24	17.4	3.3	6.4	6.3	3.6	5.2
119	1394	R	-	10.2	11.7	16.9	3.4	5.2	6.9	3.3	-
120	1396	L	9.8	10.1	20.4	14.1	3.3	4.9	5.5	3	4.3
121	1399	L	-	9.4	20.5	14.9	3.8	5	4.8	-	-
122	1401	L	-	-	-	-	2.9	4.8	5.9	-	-
123	1403	R	-	10.6	21.1	16.3	3.6	5.4	5.2	-	-
124	1404	R	-	-	18.2	14.8	2.1	5.1	4.8	-	-
125	1407	R	-	-	19.8	15.2	3.4	5.4	5.1	-	-
126	1408	R	9.1	-	-	16.6	3.4	4.7	5.8	3.2	3.5
127	1411	R	10.2	10.3	11.9	16.5	3.7	5.4	4.7	3.6	4.7
128	1415	L	9	10.2	19.9	14.1	2.9	5	5.5	2.5	3.8
129	1422	R	9.4	10.8	12.5	17.4	3.2	5.5	5.3	2.9	5
130	1423	L	-	-	21.9	26.7	3.3	5.3	4.7	-	-
131	1426	L	10.1	10.5	21.3	15.9	3.3	4.9	5.7	3.4	4.5
132	1427	L	10.1	10.4	21.4	14.6	4.5	5.5	5.7	3.5	3.9
133	1429	L	9.7	11	13.9	18.6	3.2	5.8	4.8	3.1	5.5
134	1431	L	10.2	10.2	20.2	17.2	3.8	4.8	4.3	3.3	5.1
135	1432	L	9	10.1	-	15.1	3.4	5	5.6	2.9	4.3
136	1433	R	-	11.8	22.7	15.6	3.5	5.6	5.4	-	-
137	1440	L	8.5	10.6	21.5	-	2.5	5	3.6	2.7	4.9
138	1441	L	9.9	11.2	21.9	15.9	3.2	5.3	5.5	2.7	5.1
139	1443	L	-	9.8	20.6	15.9	2.9	4.7	6.1	-	-
140	1456	R	10	11.1	21.2	26.7	3.2	5.4	5.2	3.6	4.8
141	1457	L	-	10.7	20.8	15.3	3.2	5.2	4.3	-	-
142	1460	L	8.3	9.7	28.3	14	2.7	4.6	4.9	2.4	4.6
144	1462	L	-	10.6	11.8	15.7	2.9	5.2	5.4	-	-
145	1463	L	-	8.8	17.6	13.8	3	4.4	4.8	2.6	4.4
146	1464	R	-	10.6	21.2	14.9	3.1	5.4	5.7	3	-
147	1509	L	9	10.2	20.7	16.2	2.9	4.7	4.7	3.2	5
148	1510	L	10	11	21.6	16	3	4.9	5.6	4.6	3.4
149	1511	L	-	10.4	20.6	15.7	3.4	4.8	5.5	-	-
150	1512	L	10	9.8	19.4	13.8	3	4.8	5.1	3.3	4.3
151	1513	L	10.3	11.9	23	16.3	3.4	5.7	6.4	3	5
152	1519	R	9.9	9	20.4	14.5	3.3	4.6	5.2	3.7	3.9
153	1525	L	9.8	10.5	21	16.6	3.3	5.5	5.2	3.4	3.9
154	1532	L	10	10.5	21	16.8	3.6	5.1	5.1	3.6	3.8
155	1533	R	9	10.1	20.5	14.6	4	5.5	4.9	2.8	4.7
156	1535	L	10	9.9	12	16.9	3.7	5.1	4.9	3.7	4.2
157	1537	L	9.9	11.2	23.3	16.1	3.1	5.9	4.6	3.1	5
158	1545	L	9.1	9.8	21.4	15.2	2.7	5	4.6	2.3	4.8
159	1546	R	-	8.9	19.4	14.5	2.5	5.2	5.1	-	-
160	1548	L	-	9.7	18.9	15	3.2	4.6	5.8	-	-
161	1551	L	9.8	10.6	21.6	26.2	4	5.5	4.5	2.8	5
162	1552	L	9.7	10.8	21.8	15.2	2.9	5.2	4.7	2.5	4.5
163	1554	L	9.3	9.8	20.1	14.3	3	4.9	5.4	3	4.5
164	1556	R	10	10	19.9	16.1	3.5	4.9	5.2	3.8	4.1
165	1557	L	9.4	10.7	21.3	15.8	2.8	5.8	5.2	2.6	4.6
166	1558	L	8.8	10.1	20.2	15.4	3.6	5.1	4.3	2.9	4.6
167	1561	L	-	10.8	11.6	16.1	2.8	5.4	7	-	-
168	1564	L	9.5	10	21.2	15.1	3.7	5.2	5	3.2	4.4
169	1568	L	-	11.8	13.2	-	3.2	5.7	5.6	-	-
170	1571	R	-	10.5	20.5	15.8	3	5.6	5	-	5.1
171	1573	R	9.8	11.4	12.5	17.7	3.7	6.1	4.3	2.8	4.3

S. no.	Individual no.	Side	P1 (cm)	P2 (cm)	P3 (cm)	P4 (cm)	P5 (cm)	P6 (cm)	P7 (cm)	P8 (cm)	P9 (cm)
172	1578	L	9.7	10.1	19.8	15.1	2.8	4.9	5.3	3.3	4.1
173	1579	R	8.9	9.7	19	14.5	3.5	4.6	4.3	2.7	4.2
174	1593	L	9.5	11.2	21.9	16	3	6.2	4.9	3.1	4.2
175	1594	L	9.7	11.1	12.6	16.8	3.5	5.5	5.7	2.7	4.4
176	1597	L	7.9	8.8	18.2	13.7	3.3	5.5	5.4	2.1	4.2
177	1599	L	9	8.4	18.4	14.6	3.2	4.3	4.6	2.4	3.5
178	1600	L	9.7	11.1	22.5	16	3.8	6.3	4.9	3.1	4.8
179	1601	L	9	10.4	20.4	16.9	2.6	6	3.8	2.6	4.9
180	1605	L	10.1	10.4	20.7	15.6	3.3	5.2	5.7	3.1	4.7
181	1607	L	8.7	10.8	21.4	16.2	2.8	6.2	4.8	3.2	4.1
182	1608	L	8.7	9.2	20.1	16.3	3.3	4.7	5.4	3.1	4.4
183	1609	L	10.1	11.8	23.3	27	4	5.3	5.4	3.3	4.5
184	1612	L	9	9.9	20.8	15.4	3.6	4.7	4.5	2.4	3.9
185	1614	L	9.6	12.2	23.3	17.2	4.1	6.4	5.4	3	4.4
186	1616	R	8.8	10.1	19.7	14.4	2.9	5.2	5.3	2.8	4.9
187	1626	L	9.8	11.5	22.3	15.7	3	5.5	5.4	2.7	4.6
188	1627	L	10	11.9	23.3	26.9	3.4	5.2	5.6	3.7	5.2
189	1628	R	9.5	9.9	19.6	15.3	2.9	5	5.5	3.3	3.7
190	1633	L	8.8	9.4	19.4	15.1	3.3	4.6	5.8	3.2	3.7
191	1635	L	8.7	10.6	21.4	15.9	3.5	5.3	4.2	2.7	5
192	1636	L	9.3	9.5	21	15.1	3.4	5.2	5.1	2.5	4.3
193	1637	R	9.2	10.9	21.4	16	2.5	6	5.9	3.1	4.7
194	1638	L	10.3	10.3	21.3	16.1	3.8	5.1	5.3	4	4.6
195	1644	R	9.2	9.7	19.6	15.1	3.2	5	4.6	3.3	3.9
196	1645	R	9.5	10.8	22.7	16.7	3.9	6.5	5.3	2.7	4.6
197	1653	L	10	11.7	13.4	16.8	3.7	5.6	5.5	3.1	4.7
198	1657	L	9.4	10.9	21.8	15.2	3.2	5.3	4.7	2.9	4.5
199	1659	L	9.9	10.4	20.1	15.8	2.6	4.8	6	3.3	4.6
200	1660	L	9.3	9.8	19.1	15.4	3.4	4.8	5.1	3.5	4.8
201	1661	L	10.3	11.4	12.8	17.3	3.3	5.1	5.3	3.2	5.4
202	1662	L	8.5	9.7	19.7	15.9	3.2	5.3	3.6	2.3	4.2
203	1664	L	9.1	10.7	21.8	15.4	3.2	5.6	4.7	2.5	4.5
204	1665	L	10.6	10.6	22.5	16.5	3.3	5.2	6.4	3.6	4.5
205	1666	L	11.2	12.2	25.3	18.1	3	5.8	5.8	3.5	4.7
206	1671	L	9.6	9.6	19.9	15.5	3.3	4.4	5	3.1	4.2

Legend – (-): Not available

Table 27 Data collected from South African african series using metrical methods on Femur

S.no.	Box no.	Side	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F8 (cm)
1	9	L	8.4	46.5	2.5	7.9	4.7	4.6	14.8	11.1
2	15	L	8.6	44.5	2.6	8	4.5	4.5	14.2	14.2
3	18	L	9.2	47.5	2.9	8.4	5	4.9	15.7	12.5
4	58	L	8.3	40.9	2.7	7.3	4.2	4.2	13.3	11.5
5	81	L	8.45	44.2	7.5	2.9	2.5	4.1	14.15	13.2
6	84	L	8	41.5	2.4	7.1	4.1	4	12.9	11.2
7	91	L	8.9	43.9	2.9	7.2	4.1	4	12.9	11.7
8	267	L	9.5	47.8	2.9	8.5	5.2	5.25	16.8	12.6
9	514	L	8.3	41.2	2.5	6.8	3.8	3.9	12.3	11
10	552	L	7.5	41.9	2.4	6.6	3.7	3.7	11.9	10
11	579	L	9.1	46.1	3	7.5	4.4	4.3	13.8	13.2
12	702	L	8.4	47.6	2.55	7.6	4.5	4.3	14	12
13	740	L	7.8	41.2	2.5	7.1	4	4	12.7	11.8
14	754	L	9	46	2.8	7.7	4.5	4.5	14.3	13.5
15	828	L	8.6	42.9	2.7	7.5	4.1	4.1	13.1	12.1
16	829	L	8.8	47.6	2.8	8.6	4.4	4.4	14.4	12.3
17	836	L	7.8	42.9	2.3	7.3	4.3	4.4	13.9	10.9
18	837	L	9.1	45.2	2.8	7.5	4.3	4.4	13.7	11.7
19	873	L	10.2	47.2	3	8.5	5	5	15.5	14.5
20	883	L	9	43.6	2.65	7.7	4.2	4.2	13.3	12.1
21	921	L	8	46	2.6	7.5	4.4	4.3	14	11.3
22	931	L	7.9	44.3	2.4	6.8	3.9	3.8	12.4	9.9
23	939	L	7.9	44.6	2.4	7	4	4	12.8	10.7

S.no.	Box no.	Side	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F8 (cm)
24	949	L	8	43.3	2.3	6.8	3.7	3.7	12	10.1
25	987	L	8.7	44.7	2.8	8.2	4.6	4.5	14.5	12.4
26	1196	L	9.5	45.2	2.8	7.6	4.4	4.4	14.2	12.5
27	1197	L	9.1	47.7	2.7	8.1	4.5	4.4	14.4	12.8
28	1202	L	8	38.1	2.4	6.8	3.7	3.8	12	11.6
29	1274	L	7.6	43.4	2.3	7.1	4.1	4.1	13.1	11.6
30	1284	L	7.6	41.4	2.4	7	3.9	4	12.6	11
31	1370	L	8.3	42.9	2.4	7	3.9	3.8	12.2	10.9
32	1445	L	8	47	2.1	7.5	4.2	4.2	13.7	11.3
33	1476	L	9	45.4	2.7	7.8	4.7	4.7	15	13
34	1491	L	8	40.9	2.6	6.8	3.7	3.7	12	11.2
35	1535	L	7.5	43.8	2.4	7.1	4.1	4.2	13.2	11.3
36	1545	L	9	45.3	2.7	8.2	4.7	4.8	15.2	13.6
37	1557	L	7.7	42.8	2.3	6.4	3.5	3.6	11.5	10.1
38	1576	L	7.4	46	2.3	7.2	4.5	4.3	14.3	11.5
39	1653	L	7.5	42.1	2.5	6.8	3.7	3.7	11.9	10.9
40	1668	L	8	40.8	2.5	6.9	3.9	4	12.7	11.7
41	1671	L	8.5	47.3	2.6	7.6	4.35	4.35	13.8	12.3
42	1673	L	8.7	42.4	2.6	7.3	3.8	3.8	12.3	10.9
43	1674	L	8.4	46.1	2.5	7.4	4.4	4.2	13.9	1.5
44	1685	L	8.5	43.1	2.6	7.1	4.1	3.9	12.7	11.6
45	1693	L	8.5	43.9	2.7	7.2	4.15	4.1	13.4	12.4
46	1776	L	8.6	44.7	2.6	7.4	4.4	4.4	14.1	12.1
47	1801	L	8.9	49	2.8	7.9	4.8	4.8	15.2	12.8
48	1811	L	7.9	41.3	2.2	6.7	3.7	3.6	11.7	10.5
49	1890	L	9	46.6	2.6	7.8	4.4	4.4	14	12.1
50	1891	L	7.6	43	2.3	6.6	3.9	3.9	12.5	10.6
51	1892	L	8.1	45.6	2.8	7.5	4.3	4.4	14	12.4
52	1909	L	8.3	44	2.5	7.8	4.3	4.2	13.7	11.8
53	1912	L	8.2	40.5	2.7	7.4	4.2	4.2	13.4	13.5
54	1925	L	8.1	41.1	2.5	6.8	3.9	3.8	12.5	10.7
55	1930	L	8	44.5	2.6	7.9	4.2	4.2	13.5	11.6
56	1944	L	8.3	46.5	2.4	7.3	4.1	4.1	13.1	11.6
57	1951	L	8	40.5	2.5	7	3.9	3.9	12.5	11.2
58	1991	L	7.9	46.4	2.3	7.4	4.1	4.1	13	12.5
59	1993	L	9.2	45.6	2.9	7.8	4.5	4.5	14.2	12.7
60	2001	L	9.4	48.8	2.7	8.1	4.6	4.6	14.7	13.3
61	2026	L	8.2	44.2	2.6	7.3	4.4	4.1	13.4	12.3
62	2030	L	8.4	8.4	2.5	7.5	4.1	4.1	12.5	11.3
63	2045	L	9.9	48.7	3	8	4.6	4.4	14.9	13.5
64	2046	L	9.2	47.4	2.7	7.7	4.3	4.1	13.7	12.4
65	2049	L	8.7	43.5	2.9	7.3	4.4	4.4	13.9	11.8
66	2053	L	9.2	42.8	2.9	7.8	4.6	4.4	14.4	12.9
67	2058	L	9.6	43.6	3	8.2	4.7	4.7	14.9	14.3
68	2064	L	8.5	44	2.6	7.4	4.1	4	12.8	12
69	2099	L	9.9	45.1	2.8	7.7	4.6	4.6	14.6	12.9
70	2132	L	8.9	48	2.6	8	4.6	4.6	14.7	12.5
71	2140	L	7.6	41.5	2.3	7.3	4.3	4.3	13.6	11.9
72	2160	L	9.5	47.7	2.9	7.8	4.4	4.3	13.9	12.4
73	2167	L	8.3	47.1	2.5	7.8	4.3	4.4	13.9	11.9
74	2199	L	7.8	42.4	2.3	7	4.1	3.8	2.8	10.7
75	2255	L	9.5	45.8	2.9	8.2	4.8	4.6	15	13.5
76	2281	L	8.2	47.9	2.6	8	4.5	4.4	14.3	12.5
77	2303	L	9.6	46.7	2.8	8.3	4.8	4.7	15.1	14.1
78	2343	L	8.2	42.2	2.5	7.5	4.2	4	13	11.6
79	2349	L	7.4	37.8	2.3	6.7	3.6	3.6	11.5	10.5
80	2356	L	7.9	39.8	2.5	7.8	4.1	4.3	13.5	11.1

S.no.	Box no.	Side	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F8 (cm)
81	2359	L	7.7	41	2.3	7	3.8	3.8	12.3	10.7
82	2363	L	8.8	47.4	2.7	7.9	4.7	4.6	14.8	12
83	2365	L	8.8	44.7	2.7	7.9	4.4	4.4	14.1	12.1
84	2367	L	8.3	41.1	2.4	6.6	4	4	12.7	13.3
85	2389	L	9.2	41.2	2.8	7.3	4	4	12.9	11.6
86	2392	L	9.4	41.6	2.8	7.8	4.3	4.3	13.8	12.4
87	2401	L	7.9	43.4	2.4	7.2	4.3	4.3	13.7	11.9
88	2402	L	9.3	48.3	2.5	8	4.7	4.6	15	11.8
89	2404	L	8.4	41.7	2.3	7.2	3.9	3.9	12.5	10.8
90	2410	L	9.1	47.3	2.8	7.6	4.5	4.4	14.2	12.8
91	2653	L	10.3	38.6	2.5	7.5	4.45	4.45	14	12.3
92	2662	L	9.3	46.6	2.9	8.1	4.6	4.6	14.7	13.5
93	2735	L	8.8	46.6	2.8	7.7	4.2	4.3	13.6	12
94	2764	L	9.1	43.6	2.7	7	4.3	4.3	3.8	11.4
95	2863	L	8.2	41.5	2.5	6.5	3.8	3.85	12.3	11.5
96	2867	L	9.7	45.2	3	7.9	4.6	4.5	14.4	12.9
97	2892	L	8.8	45.7	2.8	7.8	4.6	4.6	14.8	13.1
98	2935	L	8.4	46.1	2.4	7.2	4	4	2.9	11.4
99	3057	L	8.1	40.4	2.4	6.9	3.7	3.8	11.9	10.5
100	3090	L	8.8	46.9	2.7	7.9	4.8	4.75	15.2	13.7
101	3091	L	10	48.8	3.1	8.4	4.8	4.7	5.2	13.6
102	3093	L	8.9	43.6	2.6	8.1	4.3	4.3	13.8	11.4
103	3095	L	8	43.8	2.4	6.6	3.8	3.8	12.2	10.8
104	3099	L	9.3	48.6	2.7	8.3	4.6	4.5	14.5	12.9
105	3106	L	8.7	44.4	2.4	7.5	4.1	4.1	13.2	11
106	3112	L	10.1	50.1	3	8.2	4.8	4.7	15.7	13.9
107	3114	L	9.3	49.4	2.9	8	4.8	4.7	15.6	13
108	3116	L	8.1	39.5	2.5	6.8	3.6	3.6	11.5	10.5
109	3127	L	7.8	44.6	2.4	7.2	4.1	4.1	13.1	11.9
110	3134	L	9.4	46.5	2.8	8.8	4.8	4.6	15.1	12.8
111	3135	L	8.9	46.1	2.7	9	4.6	4.6	14.8	13.9
112	3143	L	8.7	47.6	2.8	7.7	4.6	4.6	14.8	12.2
113	3157	L	7.3	43	2.4	6.8	4	4	12.7	11.4
114	3159	L	8.3	46.3	2.5	8.1	4.4	4.4	14	11.7
115	3160	L	8.1	43.7	2.6	7.6	4.3	4.3	13.7	11.9
116	3162	L	8.3	46.3	2.5	7.5	4.3	4.4	13.9	11.4
117	3167	L	9.2	48.4	2.6	8.2	4.7	4.6	14.9	13.3
118	3172	L	9.4	43.5	2.8	8.6	4.9	4.8	15.6	12.4
119	3180	L	7.7	44.1	2.7	7	3.8	3.8	12.1	10.5
120	3183	L	8.3	44.1	2.6	7.4	4	4.1	13.1	2.1
121	3188	L	8.1	43.1	2.1	6.5	3.7	3.7	12	10.5
122	3245	L	8.8	44.5	2.8	7.7	4.6	4.5	14.5	12.3
123	3282	L	7.9	41.1	2.4	7.2	4	4	12.7	11.5
124	3287	L	9.3	48.4	2.7	8.3	4.7	4.6	14.9	13
125	3290	L	8.4	41.5	2.5	7.4	4.1	4.1	13	12
126	3314	L	8.5	44.6	2.4	7.4	4.1	4.1	13.2	11.5
127	3315	L	8.2	43	2.45	7.9	4.1	4.2	13.3	10.6
128	3350	L	9.6	50.3	2.8	8	4.6	4.5	14.6	12.6
129	3351	L	9	43.2	2.7	8.1	4.6	4.6	14.8	11.7
130	3365	L	8.5	44	2.6	7.2	4	4	12.8	11.5
131	3377	L	9.3	46.9	2.7	7.8	4.5	4.4	14.1	12.8
132	3396	L	9	47	2.7	8.4	4.9	4.9	15.5	13.1
133	3404	L	10.1	47.4	3.3	8.2	4.7	4.7	15	13.7
134	3415	L	9	46.8	2.9	7.8	4.7	4.7	14.9	13.7
135	3419	L	7.5	42	2.4	7	3.9	3.8	12.5	10.4
136	3450	L	7.8	40.9	2.5	7.1	3.8	3.8	12.2	10.3
137	3453	L	8.5	45.9	2.6	7.9	4.4	4.4	14	11.8

S.no.	Box no.	Side	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F8 (cm)
138	3480	L	7.5	39.1	2.3	6.7	3.6	3.7	11.6	10.7
139	3485	L	8.25	40.2	2.5	7.6	4.3	4.3	13.7	11.6
140	3490	L	8.7	43.1	2.8	8.3	4.4	4.4	14.1	12.5
141	3491	L	9.3	43.9	2.9	7.5	4.4	4.5	14.3	12.1
142	3499	L	7.8	45.2	2.4	7.4	4.4	4.4	14.2	11.1
143	3501	L	7.1	47.4	2.2	6.7	3.7	3.7	12.1	10.4
144	3503	L	8.5	42.3	2.6	7.2	4	4	12.9	10.9
145	3507	L	7.3	37.8	7.5	6.7	3.6	3.6	11.9	10.4
146	3524	L	7.8	40.1	2.3	6.6	3.7	3.6	11.8	11.1
147	3525	L	8	43.9	2.5	7.5	4.1	4.1	13.2	11.8
148	3529	L	9.5	48.5	2.9	8.3	4.4	4.4	14.1	13.4
149	3538	L	8.2	43.9	2.5	7.5	4.3	4.3	13.8	11.5
150	3556	L	8.3	44.4	2.4	7.4	4.1	4.1	13.1	11.9
151	3582	L	9.3	49.2	2.8	7.5	4.3	4.3	13.9	13
152	3590	L	8.3	43.7	2.4	6.9	3.9	3.9	12.5	10.9
153	3610	L	9.5	50.1	2.9	8.1	5	5	16	13.8
154	3614	L	8.7	42.7	2.6	7.7	4.2	4.2	13.3	11.9
155	3618	L	8.3	46.2	2.7	7.9	4.4	4.4	14.2	11.7

Legend – L: Left side of the bone, R: Right side of the bone

Table 28 Data collected from South African african series using metrical methods on Tibia

S.no.	B.no.	Side	T1 (cm)	T2 (cm)	T3 (cm)	T4 (cm)	T5 (cm)	T6 (cm)	T7 (cm)	T8 (cm)	T9	T10	T11	T12
1	9	L	9.1	37.1	7.5	2.9	1.9	7	5.2	7.5	3.2	4.9	4.1	3.3
2	15	L	9.5	35.5	7.8	3.4	2	7.9	5	7.6	3.7	4.9	4.1	3.5
3	18	L	9.5	39.4	8.1	3.2	1.9	7.7	5.6	7.6	3.8	5	4.4	3.6
4	58	L	8.2	34.4	7	2.8	1.95	6.85	5	7	3.35	4.6	3.6	3.2
5	81	L	9.4	36.2	7.4	3.3	2.2	7.5	4.6	7.35	3.7	4.4	4.1	3.3
6	84	L	8.1	32.2	6.9	2.5	1.8	6.7	4.3	6.9	3.3	4.4	3.8	3.2
7	91	L	8.4	35.9	6.9	3.1	1.7	6.9	4.2	6.9	3.2	4.2	3.7	3.6
8	177	L	8.9	38.6	7.2	2.8	2.1	7.4	4.4	6.9	3.4	4.7	4.3	3.2
9	267	L	10.1	40	7.95	3.5	2.9	8.1	5.3	8	4	5.2	4.7	3.9
10	514	L	8.6	34.7	6.4	2.9	1.95	7.2	4.2	6.2	3.1	4.2	3.4	2.7
11	552	L	7.8	33.7	6.1	2.5	2	6.6	4.1	6.2	3	4	3.5	2.8
12	579	L	9.5	39.6	7.3	3.2	2.3	8.1	4.5	7.1	3.5	4.7	4	3.5
13	702	L	9.2	38.2	7.3	3.3	2	7.5	4.8	7.3	3.4	4.5	3.5	4
14	740	L	7.7	32.6	6.6	2.6	2	6.7	4.4	6.6	3	4.3	3.1	3.7
15	754	L	10.3	36.6	7.5	3.5	2.4	8.7	5.2	7.4	3.6	4.8	3.3	4.6
16	828	L	8.9	36.7	6.9	3.1	2.4	7.9	4.6	7	3.25	4.4	4.1	4
17	829	L	10.5	39.5	8.2	3.2	2.3	8.1	5.5	8	4	5.3	4.6	3.6
18	836	L	8.5	35.6	6.3	2.7	2	6.7	4.3	6.7	3.3	4.6	4	3.4
19	837	L	9.7	37.7	7.5	3.2	2.3	7.7	5	7.4	3.5	4.7	4.4	3.5
20	873	L	10.6	39.6	7.9	3.4	2.4	8.4	5.2	8	3.7	5.3	4.1	3.6
21	883	L	9.8	35.6	7.2	2.9	2.3	7.2	4.5	7	3.5	4.7	3.9	3.3
22	921	L	8.6	37.9	7	2.8	2.1	7	4.5	6.9	3.1	4.8	4.1	3.1
23	931	L	8.1	36.5	6.6	2.9	2	7	4.5	6.6	3.3	4.2	4	3.5
24	939	L	8.2	35.8	7.2	2.8	1.9	6.9	4.2	6.9	3.5	4.2	3.6	3.2
25	949	L	8	35.7	6.6	2.7	1.9	6.4	4.4	6.4	3.2	4.3	3.6	3.2
26	987	L	9.7	36.4	7.8	3.2	2.1	8.4	5	7.8	3.9	5.1	4.6	3.5
27	1196	L	9.5	36.5	7.3	2.8	2.4	7.8	4.7	7.2	3.4	5	4.3	3.5
28	1197	L	9.6	38.4	7.8	3.2	2.1	7.5	5	7.7	3.7	5	4	3.6
29	1202	L	7.9	30.7	6.6	2.6	2	6.6	4.2	6.3	3.1	4	3.6	3.1
30	1274	L	8.7	35.1	6.9	2.6	1.7	6.3	4.6	6.8	3	4.5	3.9	3.4
31	1284	L	7.8	35.9	6.7	2.5	2	6.6	4.4	6.5	3.3	4.7	3.5	3.2
32	1370	L	8.8	33.6	6.6	2.8	2.1	7.2	4	6.4	3.1	4.2	3.6	2.9
33	1445	L	8	39.3	7	2.8	1.8	6.4	4.4	6.9	3.4	4.4	3.8	3.3
34	1476	L	9.9	37.3	7.6	3.4	2.6	7.9	4.7	7.6	3.7	4.8	4.2	3.5
35	1491	L	8.5	33.5	6.7	2.9	2.2	7	4.5	6.5	3.1	4	3.2	3.1

S.no.	B.no.	Side	T1 (cm)	T2 (cm)	T3 (cm)	T4 (cm)	T5 (cm)	T6 (cm)	T7 (cm)	T8 (cm)	T9	T10	T11	T12
36	1535	L	8.3	36.9	7	2.8	1.9	6.9	4	6.7	3	4.5	4	3
37	1545	L	9.9	37	8	2.9	2.4	8	5	7.9	3.1	5.1	4.4	3.7
38	1557	L	8.3	35.9	6	2.5	1.9	6.4	3.9	6	3	4.1	3.3	2.3
39	1576	L	7.7	35.9	6.8	2.5	1.9	6.3	4.1	6.8	3.1	4.1	3.6	3.2
40	1653	L	7.2	34.3	6.4	2.3	1.7	5.7	3.9	6.3	3.1	4.3	3.8	2.7
41	1668	L	8	32.6	6.4	2.7	1.9	6.8	4.1	6.3	3.2	4.3	3.6	2.9
42	1671	L	9	38	7.3	2.7	2.3	7.3	4.2	7.3	3.5	4.7	4.2	3.2
43	1673	L	9	35.1	6.5	3	2.2	7.9	4.2	6.6	3.3	4.9	4	3.3
44	1674	L	9.2	40.1	7.2	3.1	2.2	8.2	4.4	7.2	3.4	4.7	4	3.4
45	1685	L	8.9	34.3	6.7	2.8	2.1	7	4.1	6.5	3.1	3.9	4.1	3.1
46	1693	L	9.3	35.6	7.1	2.9	2	7.2	4.4	7.1	3.4	4.6	3.9	3.3
47	1801	L	9.8	40.8	7.7	3.3	2.3	7.65	4.7	7.5	3.7	5.2	5	3.7
48	1811	L	8	34.1	6.4	2.8	1.9	6.6	4.1	6.5	3.1	4.2	3.7	3.1
49	1890	L	9.6	37.8	7.5	3.2	2.2	7.6	4.5	7.2	3.5	4.8	3.9	2.9
50	1891	L	7.9	34.8	6.5	2.6	1.9	6.4	4	6.4	3	4.2	4	3.2
51	1892	L	8.7	36	7.2	2.8	2	7.1	4.8	7.1	3.5	4.8	4	3.1
52	1909	L	9	34.5	7.2	3	2.2	7.3	4.5	7.1	3.2	4.7	4.3	3.4
53	1912	L	8.9	32.5	7	2.8	2.2	7.3	4.5	6.8	3.3	4.5	3.6	3.2
54	1925	L	8.4	34.9	6.5	2.8	1.9	6.6	4.2	6.3	3.2	4	3.8	2.8
55	1930	L	8.6	36.6	7.5	2.9	2	7.1	4.7	7.5	3.5	4.6	4.2	3.4
56	1944	L	8.9	39.3	7	2.8	2	6.9	4.2	6.9	3.4	4.6	4.1	3.4
57	1951	L	8.3	32.5	6.5	2.5	1.8	6.6	4.4	6.5	3.2	4.2	3.6	2.8
58	1991	L	9.5	38.6	7	3	2.2	7.8	4.5	6.7	3.3	4.6	4	3.45
59	1993	L	9.3	37.9	7.2	3	2.3	7.6	4.5	7.2	3.5	4.7	4.3	3.6
60	2001	L	9.3	40.1	7.8	3.1	2	7.4	5.1	7.7	3.6	5.2	4.5	3.6
61	2026	L	9	35.7	6.8	2.9	2	7.2	4.3	6.8	3.2	4.4	4	3.3
62	2030	L	8.9	36.9	7	3	2.2	7.2	4.4	7	3.2	4.3	3.9	3.3
63	2045	L	10.9	39.4	7.8	3.4	2.3	7.9	5	7.6	3.5	5	4.3	3.5
64	2046	L	10.4	38.8	7.3	3.7	2.7	9	4.5	7.2	3.4	4.4	4.2	3.6
65	2049	L	9.1	36.1	7.1	3	2	7.2	4.7	6.9	3.2	4.7	4	3.2
66	2053	L	9.3	36	7.7	3	2.4	9.1	4.5	7.5	3.7	4.3	4.1	3.3
67	2058	L	10.5	37.5	7.6	3.2	2.3	8.7	4.3	7.5	9.5	4.8	4.1	3.4
68	2064	L	9.2	35.9	7	3	2.2	7.1	4.8	6.9	3.4	4.5	3.9	3.1
69	2099	L	12	39	7.6	3.5	2.5	8.4	4.5	7.5	3.5	5.1	4.1	3.7
70	2132	L	9.7	39.1	7.7	3	2.1	7.1	4.5	7.5	3.7	4.4	4.3	3.4
71	2140	L	9.1	33.9	7.2	2.9	2	7.3	4.2	7.2	3.2	4.5	4.2	3.2
72	2160	L	9.9	39.8	7.7	3.2	2.4	8	4.7	7.5	3.6	4.9	4.1	3.4
73	2167	L	8.9	39.9	7.7	3	2	7	4.7	7.5	3.8	4.75	4.2	3.5
74	2199	L	8.3	33.5	6.7	2.6	2	6.7	4.1	6.4	3.1	4	3.7	3.2
75	2255	L	9.9	39	7.9	3.3	2.3	8.6	5	7.7	3.6	5.2	4.1	3.7
76	2281	L	8.9	39.1	7.7	3	2.2	7.1	5.3	7.4	3.4	4.8	4.2	3.5
77	2303	L	9.5	37.1	8	3.3	2.2	8.2	4.6	7.7	3.6	5.5	4.3	3.6
78	2343	L	8.3	32.8	7.2	2.9	2	7.4	4.4	6.9	3.5	4.8	3.9	3.7
79	2349	L	8	31.6	6.3	2.7	2.1	6.7	3.9	6	2.9	4	3.4	2.7
80	2356	L	8.7	31.1	7.6	2.8	1.9	6.9	4.8	7.3	3.3	4.6	4	3.3
81	2359	L	8.4	32.8	6.7	2.75	2	6.6	4.1	6.6	3.3	4.2	3.7	3.1
82	2363	L	9	38.3	7.6	2.8	2.2	7.3	4.6	7.4	3.5	5	4.3	3.5
83	2365	L	9.2	35.5	7.7	3	2	7.2	4.8	7.6	3.5	4.9	4.1	3.5
84	2367	L	8.5	32.6	6.3	2.7	2.4	6.9	4.1	6.3	3.2	4.1	3.7	2.7
85	2389	L	8.8	34.7	6.9	3.1	1.9	7.2	4.2	6.8	3.2	4.4	3.8	3.1
86	2392	L	8.5	34.7	7.2	2.9	2.1	7	4.5	7.1	3.5	4.5	3.8	3.5
87	2401	L	8.5	34.1	7	2.9	1.9	6.7	4.2	6.9	3.1	4.4	3.9	3.3
88	2402	L	9.1	37.2	7.4	3	2	7.3	4.8	7.4	3.6	4.6	4	3.6
89	2404	L	9.1	34.6	6.6	2.8	2	7.2	4.2	6.6	3.3	4.3	3.9	3.2
90	2410	L	10.1	41.2	7.2	3.3	2.4	8	4.8	7.2	3.4	4.6	4	3.3
91	2653	L	10	32.6	7.1	3.2	2.2	8.8	4.8	7.1	3.4	4.5	4.2	3.4
92	2662	L	9.9	38.3	7.8	2.9	2.6	8	5	7.5	3.7	5.4	4.3	3.6

S.no.	B.no.	Side	T1 (cm)	T2 (cm)	T3 (cm)	T4 (cm)	T5 (cm)	T6 (cm)	T7 (cm)	T8 (cm)	T9	T10	T11	T12
93	2735	L	9.9	39.7	7.3	3.1	2.2	7.7	4.5	7.1	3.5	4.8	3.9	3.3
94	2764	L	9.9	37.1	6.8	2.9	2.8	7.1	4.1	6.8	3.4	4.7	3.8	3.3
95	2863	L	9	34.4	6.4	2.8	2.3	7.4	4.1	6.4	3.4	4.3	3.5	2.9
96	2867	L	10.7	37.3	7.5	3.3	2.5	8.2	5	7.1	3.4	4.6	4.3	3.5
97	2892	L	9.6	36.9	7.4	3.1	2.1	7.6	4.5	7.4	3.5	4.9	4.3	3.8
98	2935	L	8.6	38.9	6.7	2.6	2	6.6	4	6.7	3.2	4.8	4.1	3.5
99	3057	L	8.4	31.9	6.5	2.9	2.1	7.4	4	6.4	3.2	4	3.6	3.1
100	3090	L	9.9	36.1	7.7	3.1	2.3	7.7	4.5	7.5	3.8	5.2	4.2	3.5
101	3091	L	11	41.4	8	3.2	2.6	8.7	5	7.7	3.8	5.3	6.7	4
102	3093	L	9.5	34.6	7.8	3.1	2.2	7.8	4.6	7.8	3.9	4.8	4.4	3.8
103	3095	L	8.5	34.5	6.3	2.9	2.4	7.3	4	6.1	3.1	4.2	3.7	3.1
104	3099	L	10.5	39.7	7.8	3.4	2.3	7.8	4.6	7.8	3.6	4.7	4.4	3.7
105	3106	L	9.1	36.5	7.4	2.8	2	7.1	4.5	7.4	3.4	4.4	4	3.6
106	3112	L	10.7	42.9	7.7	3.4	2.4	8.4	4.7	7.7	3.7	5.1	4.5	3.6
107	3114	L	10.3	41.3	7.7	3.4	2.5	8.4	4.5	7.6	3.7	5	4.6	3.6
108	3116	L	8.1	31.8	6.5	2.6	1.8	6.6	4.2	6.3	3.2	4.2	3.8	31
109	3127	L	8.5	35.4	6.8	2.6	1.9	6.5	4.2	6.7	3.2	4.35	3.9	3
110	3134	L	10.5	38.9	8.2	3.3	2.3	8	4.9	8	3.9	4.9	4.5	3.9
111	3135	L	10	38.5	8.5	3.1	2	7.6	5.2	8.2	3.9	5.6	4.4	4.1
112	3143	L	9.9	36.6	7.8	3.1	2.3	7.8	4.6	7.6	3.6	4.7	4.2	3.5
113	3157	L	8.6	34.6	6.7	2.7	1.9	6.5	4.2	6.6	3.4	4.5	3.7	3.1
114	3159	L	8.5	35.9	7.6	3.2	1.7	6.9	4.9	7.5	3.6	4.9	9.1	3.4
115	3160	L	9.3	37.7	7.3	2.7	2.2	7.3	4.6	7	3.7	4.6	3.7	3.1
116	3162	L	9	38.2	7.2	2.9	2.2	7.4	4.4	6.9	3.3	4.6	4.1	3.5
117	3166	L	9.1	35.7	7.5	3	2.1	7.5	4.8	7.4	3.6	4.9	4.1	3.7
118	3167	L	10.1	39.8	7.7	3	2.7	8.6	4.9	7.5	3.7	4.7	5	3.7
119	3172	L	9.9	34.4	7.7	2.9	2.4	8.1	5.1	7.7	3.8	4.7	4.5	3.4
120	3180	L	8.2	35.1	6.6	2.6	1.9	6.4	4.1	6.6	3.1	4.3	3.6	3.1
121	3183	L	8.8	36.6	7.1	3	1.9	7.3	4.1	6.8	3.5	4.8	3.8	3.1
122	3188	L	8.3	33.4	6.4	2.7	1.95	6.4	3.8	6.3	2.9	4.2	3.6	3
123	3245	L	9	38	7.5	2.9	2.4	7.8	4.7	7.3	3.6	4.9	4.4	3.6
124	3282	L	7.8	34	6.8	2.7	1.7	6.8	3.8	6.6	3.2	4.4	3.6	3.3
125	3287	L	10	40.5	7.8	3	2.5	7.8	4.8	7.7	3.7	5	4.3	3.6
126	3290	L	8.4	36	7	2.6	2.1	7.2	4.4	7	3	4.6	3.6	3.2
127	3314	L	9.1	35.8	7	3	2.2	7	4.2	6.8	3.3	4.4	4.2	3.4
128	3315	L	9	35.1	7.3	3	2.3	7.4	5	7.3	3.4	4.1	4.1	3.9
129	3350	L	10.5	40.8	7.5	3.2	2.4	8	4.8	7.4	3.6	5.1	4.4	3.6
130	3351	L	9.2	34.5	7.8	2.9	2.1	7.6	4.6	7.6	3.8	5	4	3.6
131	3365	L	8.4	36.5	6.8	2.9	1.9	7	4.1	6.5	3.2	4.5	3.9	3.3
132	3377	L	9.4	39.1	7.5	3.2	2.2	8	4.6	7.5	3.6	4.9	4.2	3.3
133	3396	L	9.2	38.7	8	2.8	2.3	7.6	4.8	7.8	3.6	5.1	4.6	4
134	3404	L	10.9	40.1	8	3.6	2.4	8.4	4.7	7.9	4.1	5.7	4.6	3.7
135	3415	L	10.2	38.3	7.5	2.9	2.7	7.8	4.7	7.3	3.6	5	4.4	3.6
136	3419	L	7.7	33.6	6.8	2.4	2	6.3	4.2	6.8	3.1	4.4	3.8	3.3
137	3450	L	8.2	33	6.7	2.4	1.9	6.3	4	6.5	3.2	4.2	3.5	3
138	3453	L	9.3	36.1	7.8	3.1	2.2	7.5	4.4	7.6	3.9	4.9	4.3	3.7
139	3480	L	8.1	34	6.2	2.5	2	6.8	4.1	6.2	3.1	4	3.8	2.8
140	3485	L	8.2	32.2	7.1	2.8	1.9	6.8	4.1	7.1	3.8	4.9	3.7	3.2
141	3490	L	9.4	34.2	7.8	3.2	2.1	7.5	4.5	7.8	3.8	4.9	4	3.7
142	3491	L	9.5	35.6	7.5	3.2	2.4	8	4.9	7.3	3	4.9	3.9	3.6
143	3499	L	8.3	35.9	7.2	26	2	6.4	4.2	7.1	3.2	4.6	4	3.3
144	3501	L	8.2	31.9	6.2	2.7	1.8	7.8	4	6.1	3.2	4.2	3.4	3.1
145	3503	L	8.7	35.5	7	3	2.9	7.3	4.3	6.8	3.4	4.7	3.7	2.9
146	3507	L	7.8	31.7	6.3	2.5	6.2	1.8	4	6.1	2.9	4	3.2	2.9
147	3524	L	7.8	31.9	6.2	2.6	1.9	6.6	3.8	6.2	3	4	3.3	3
148	3525	L	8.6	34.9	7.1	2.6	2	7	4.3	6.9	3.5	4.5	4	3.1
149	3529	L	10.6	40.8	8	3.3	2.5	8.2	4.7	7.7	3.9	5.2	3.9	3.7

S.no.	B.no.	Side	T1 (cm)	T2 (cm)	T3 (cm)	T4 (cm)	T5 (cm)	T6 (cm)	T7 (cm)	T8 (cm)	T9	T10	T11	T12
150	3538	L	9	35.4	7	3.1	2.1	7.3	4.4	6.9	3.3	4.8	3.7	2.8
151	3556	L	8.9	37.1	7.1	3	2.3	8.3	4.2	7.1	3.3	4.3	3.8	3.4
152	3582	L	10.8	40.5	7.4	3.4	2.3	8.1	4.8	7.3	3.5	4.9	4.4	3.5
153	3590	L	8.6	36.1	6.5	2.6	2.1	6.8	4.1	6.3	3.1	4.2	3.6	3.2
154	3610	L	10.3	40.1	7.7	3.1	2.4	8.3	5	7.7	3.8	5.2	4.6	3.6
155	3614	L	8.7	35.5	7.3	2.8	2	7	4.2	7.1	3.3	4.7	4.2	3.1
156	3618	L	9.2	36.5	7.6	2.8	2.1	6.8	4.5	7.4	3.5	4.7	4.1	3.4

Legend – L: Left side of the bone, R: Right side of the bone

Table 29 Data collected from South African african series using metrical methods on Humerus

S.no.	B.no.	Side	H1 (cm)	H2 (cm)	H3 (cm)	H4 (cm)
1	9	L	32.9	4.1	6.4	6.5
2	15	L	33.1	4.3	6	5.9
3	18	L	33.6	4.3	6.3	6.2
4	58	L	30.4	4.5	5.9	6
5	81	L	29.7	3.8	5.6	6.3
6	84	L	28.7	4.3	5.5	6
7	91	L	29.4	3.8	5.7	5.3
8	267	L	34.2	5	6.5	7.5
9	514	L	30.4	3.7	5.1	5.7
10	552	L	28.5	3.6	5.3	5.1
11	579	L	32.15	3.95	6	6.7
12	702	L	3.1	4.1	6	5.9
13	740	L	28.1	3.6	5	6.4
14	754	L	32.8	4.3	6	5.9
15	828	L	31.2	4.1	5.7	6.5
16	829	L	33.5	4.5	6.4	6.8
17	836	L	30.6	4	5.6	5.5
18	837	L	32.1	4.2	5.6	6.1
19	873	L	33.5	4.9	6	7.2
20	883	L	30.4	3.8	5.6	6.5
21	921	L	31.8	4.3	5.6	5.7
22	931	L	31	3.8	5.2	5.5
23	939	L	30.2	4.1	5.6	5.4
24	949	L	30.6	3.8	5.3	5.3
25	1196	L	31	4.1	6.2	6.5
26	1197	L	32	4.5	5.9	6.6
27	1202	L	27.5	3.5	5.1	5.2
28	1274	L	30.5	3.9	5.7	5.4
29	1284	L	29.2	3.9	5.5	5.9
30	1370	L	29.9	3.8	5.2	5.8
31	1445	L	32.5	4.4	5.4	5.7
32	1476	L	33.5	4.7	6.3	6.8
33	1491	L	28.7	3.8	5.2	5.7
34	1535	L	30.9	4.4	5.6	6
35	1545	L	33.6	4.5	6.4	7
36	1557	L	28.7	3.7	5.1	5.7
37	1576	L	30.6	3.4	5.6	5.7
38	1653	L	28.4	3.7	5.3	5.7
39	1668	L	27.8	3.7	5.1	5.6
40	1671	L	32.4	4.3	6.1	5.9
41	1673	L	28.1	3.8	5.6	6.1
42	1674	L	32.9	4.2	5.7	5.8
43	1685	L	29.1	4.1	5.5	6
44	1693	L	30.7	4.4	5.6	5.9
45	1776	L	33.2	4.5	5.8	6.3
46	1801	L	34.6	4.6	6.1	6.5

S.no.	B.no.	Side	H1 (cm)	H2 (cm)	H3 (cm)	H4 (cm)
47	1811	L	28.5	3.7	5.6	5.5
48	1890	L	33.9	4.5	5.9	6
49	1891	L	30.2	4.1	5.2	5.8
50	1892	L	31.7	4.3	5.8	6
51	1909	L	30.8	4.4	6	6.4
52	1912	L	29	4.1	5.9	6
53	1925	L	27.8	3.7	5	6
54	1930	L	30.9	4.2	5.8	5.4
55	1944	L	32.7	4.1	5.8	6.5
56	1951	L	28.6	4.3	5.2	5.8
57	1991	L	30.6	4.3	6	5.8
58	1993	L	31.9	4.7	5.9	6.4
59	2001	L	34.7	4.7	5.8	6.2
60	2026	L	29.5	4.2	6	5.8
61	2030	L	30.8	4.4	5.7	6.1
62	2045	L	32.7	4.1	6.4	7.3
63	2046	L	33.5	3.9	6.6	6.4
64	2049	L	31.7	4.2	6	6
65	2053	L	30.8	4.2	6	7.2
66	2058	L	31.9	4.4	6.6	6.8
67	2064	L	30.6	4	5.6	5.9
68	2099	L	33.5	4.3	6	7
69	2132	L	34.5	4.3	5.6	6
70	2140	L	29.3	4.1	5.5	6.5
71	2160	L	33.8	4.8	5.8	6.5
72	2167	L	32.9	4.6	6.1	6.1
73	2199	L	27.6	4.2	5.2	5.9
74	2255	L	32.3	4.4	6.2	6.8
75	2281	L	32.2	4.3	6.2	6.2
76	2303	L	32.7	4.3	6.5	6.7
77	2343	L	29	4.2	5.4	5.9
78	2349	L	26.5	3.6	5.2	5.5
79	2356	L	28.8	4.5	5.9	6
80	2359	L	27.4	3.8	5.1	5.9
81	2363	L	31.7	4.3	6.4	6.4
82	2365	L	31.3	4.5	5.9	6
83	2367	L	28.1	3.8	5.5	6.2
84	2389	L	30.8	4.4	5.8	6
85	2392	L	30.8	4.2	6.2	6.3
86	2401	L	31.9	4.6	5.6	6
87	2402	L	32.3	4.5	6.2	6.3
88	2404	L	28.8	3.9	5.1	5.5
89	2410	L	35	4.3	6.1	7.1
90	2653	L	29.3	4.5	6.6	6.4
91	2662	L	32.3	4.2	6.1	6.8
92	2735	L	33	4.5	6.1	6.4
93	2764	L	32.3	4.3	5.6	6.4
94	2863	L	28.1	4.1	5.2	5.6
95	2867	L	33.7	4.3	6	6.2
96	2892	L	32.6	4.4	6	6.8
97	2935	L	32.7	4.7	5.8	5.6
98	3057	L	28.4	3.9	5	5.9
99	3090	L	32	4.7	6.4	6.3
100	3091	L	33.5	4.8	6.5	7
101	3093	L	29.7	4.1	5.8	6.6
102	3095	L	29.4	4	5.4	5.7
103	3099	L	33.3	5.8	6.3	6.6

S.no.	B.no.	Side	H1 (cm)	H2 (cm)	H3 (cm)	H4 (cm)
104	3106	L	30.7	4.4	5.7	6.7
105	3112	L	35	5	6.5	7.4
106	3114	L	35	4.3	6	6.4
107	3116	L	28.3	3.8	5	5.1
108	3127	L	30.4	4	5.4	5.9
109	3134	L	32.3	4.6	6.6	7.1
110	3135	L	32.3	4.8	6.9	6.7
111	3143	L	34.1	4.5	6.3	6.2
112	3157	L	29.4	5.5	4	5.9
113	3159	L	32.6	4	6.3	6
114	3160	L	30.4	4.4	6.2	5.9
115	3162	L	32.6	4.1	5.5	5.8
116	3166	L	33.9	4.4	6	6.1
117	3167	L	34.8	4.7	6.3	6.4
118	3172	L	30.1	4.4	6.6	7.2
119	3180	L	28.9	5.4	3.5	5.3
120	3183	L	30.2	4.1	5.1	5.7
121	3188	L	27.6	3.9	5	6
122	3245	L	31.3	4.2	6.3	6.3
123	3282	L	28.1	3.9	5.6	5.5
124	3287	L	36	4.5	6.1	6.7
125	3290	L	31	4.2	5.6	6
126	3314	L	31	4.5	6	5.8
127	3315	L	30.5	4.3	5.6	6.1
128	3350	L	34.9	4.4	6.6	6.5
129	3351	L	30.5	4.5	5.9	6.2
130	3365	L	31.2	4.2	5.4	5.8
131	3377	L	32.8	4.5	5.8	6.4
132	3396	L	33.5	4.8	6.4	5.9
133	3404	L	35.5	4.8	6.1	6.9
134	3415	L	31.3	4.2	5.5	6.3
135	3419	L	28.5	3.9	5.3	5.4
136	3450	L	29.4	4.1	5.7	6.3
137	3453	L	30.6	4.3	6.2	6.3
138	3480	L	29.4	4	5	5.8
139	3485	L	27.6	4.1	5.8	5.8
140	3490	L	30.2	4.8	6.4	6.9
141	3491	L	30.9	4.3	6	7.3
142	3499	L	32.4	4.2	5.4	5.5
143	3501	L	28.5	4	5.2	5.2
144	3503	L	28.3	4.2	5.4	5.8
145	3507	L	27.2	3.6	5.1	5.4
146	3524	L	28.5	3.6	5.4	5.9
147	3525	L	31.4	3.9	5.7	5.6
148	3529	L	35	4.7	6.3	6.5
149	3556	L	30.8	3.9	5.5	5.9
150	3582	L	34.4	4.3	6.5	6.7
151	3590	L	29.6	3.7	5.5	6.4
152	3610	L	34.8	5.1	6.3	7
153	3614	L	29.2	4.6	5.8	6
154	3618	L	31.6	4.5	5.9	6

Legend – L: Left side of the bone, R: Right side of the bone

Table 30 Data collected from South African african series using metrical methods on Radius

S.no.	B.no.	Side	R 1	R 2	R 3	R 4
1	9	L	26.6	2.2	3.2	4.5
2	15	L	24.5	2.3	3.2	4.3

S.no.	B.no.	Side	R 1	R 2	R 3	R 4
3	18	L	27.5	2.2	3.5	5.6
4	58	L	23.9	2.1	2.9	4.9
5	81	L	24.5	2.2	3.1	4.8
6	84	L	21.8	2	2.8	5.6
7	91	L	23.4	2	2.8	4.1
8	267	L	27	2.6	3.6	5.9
9	514	L	24.6	1.9	2.6	4.7
10	552	L	21.4	1.8	2.7	4.2
11	579	L	27.7	2.2	3.15	5.2
12	702	L	25.2	2.1	3.1	5
13	740	L	21	1.8	2.8	4.5
14	754	L	25	2.3	3.1	5.3
15	828	L	23.8	2.2	2.8	5.2
16	829	L	26	2.5	3.4	5.3
17	836	L	24.1	2.1	3	4.2
18	837	L	25.8	2.1	3	5.2
19	873	L	26.7	2.3	3.4	6.2
20	883	L	23.9	2.3	3.2	5.4
21	921	L	24.5	2.3	3	4.2
22	931	L	23.2	2.1	2.9	4.4
23	939	L	24	2	3	4.5
24	949	L	24.1	2	2.8	4.2
25	1196	L	25	2.3	3.2	5.2
26	1197	L	27.2	2.3	3.4	5
27	1202	L	21.2	1.9	2.9	4.4
28	1274	L	24.5	2.1	2.9	4.4
29	1284	L	23.7	2	2.9	5.8
30	1370	L	22.8	1.9	2.8	4.8
31	1445	L	27.8	2.1	3.1	4.4
32	1476	L	26.2	2.4	3.1	5.2
33	1491	L	22	2	31	4.2
34	1535	L	24.3	2.1	2.7	4.4
35	1545	L	25.5	2.5	3.6	5.7
36	1557	L	23.8	1.9	2.6	4
37	1576	L	23.2	2	2.7	4.5
38	1653	L	23	1.9	2.6	4.2
39	1668	L	22	1.9	2.8	4.6
40	1671	L	26.1	2.2	2.8	4.7
41	1673	L	23.3	2	2.9	4.8
42	1674	L	27	2.3	2.7	4.7
43	1685	L	23.5	2	2.7	4.9
44	1693	L	23.7	2.1	3	5.1
45	1776	L	26.4	2.3	3	5
46	1801	L	27.4	2.3	3.3	4.9
47	1811	L	22.5	2	2.6	4.5
48	1890	L	26.2	2.1	2.8	4.7
49	1891	L	23.7	2	2.6	4.3
50	1892	L	25.6	2.2	3.1	5.2
51	1909	L	23.7	2	3.2	5.6
52	1912	L	21.1	2.1	2.9	4.8
53	1925	L	23.2	2	2.8	4.8
54	1930	L	24.9	2.2	3	4.4
55	1944	L	25.5	2.1	3	4.5
56	1951	L	22.2	2	2.6	5
57	1991	L	24.3	2.1	2.9	4.4
58	1993	L	25.4	2.2	2.9	4.9
59	2001	L	27.5	2.4	3.3	5

S.no.	B.no.	Side	R 1	R 2	R 3	R 4
60	2026	L	23.8	2.1	2.8	4.8
61	2030	L	25.8	2.2	3.1	4.5
62	2045	L	26.8	2.2	3.3	5.8
63	2046	L	26.6	2	3	5.6
64	2049	L	26	2.3	3.1	5.2
65	2053	L	25.9	2.4	3.3	5.3
66	2058	L	24.4	2.3	3.2	5.3
67	2064	L	24.6	2	2.8	4.8
68	2099	L	25.8	2.3	3.2	5.5
69	2132	L	28.4	2.3	3	4.5
70	2140	L	22.5	2.2	2.8	5.1
71	2160	L	26.5	2.1	3	4.9
72	2167	L	27.1	2.3	3	4.9
73	2199	L	22.1	2	22.9	4.5
74	2255	L	26.6	2.3	3.2	5.5
75	2281	L	25.4	2.3	3.2	5
76	2303	L	26.2	2.2	3.3	4.8
77	2343	L	22	2.2	3.5	4.8
78	2349	L	21.4	1.8	2.5	4.5
79	2356	L	22.5	2.1	3.1	4.5
80	2359	L	21.6	2	2.7	4.4
81	2363	L	26.1	2.3	3	4.7
82	2365	L	25.3	2.3	3.3	4.9
83	2367	L	22.3	1.9	2.7	5
84	2389	L	25.3	2.1	2.9	4.7
85	2392	L	24.2	2.2	3	5.1
86	2401	L	24	2.3	2.9	4.8
87	2402	L	26.5	2.2	3.1	5.7
88	2404	L	23	1.8	2.7	4.7
89	2410	L	28.3	2.3	3	5
90	2653	R	22.8	2.2	3.2	5.8
91	2662	L	25.5	2.2	3.4	5.4
92	2735	L	26.5	2.3	3	5.3
93	2764	L	26.2	2.1	3	4.8
94	2863	L	22.5	1.8	2.6	4.2
95	2867	L	26.7	2.4	3.3	5
96	2892	L	26.3	2.4	3.2	5.5
97	2935	L	26.1	2.1	2.9	5.1
98	3057	L	21.7	2.1	2.7	5.2
99	3090	R	24.9	2.4	3.7	5.8
100	3091	R	26.5	2.4	3.3	5.9
101	3093	R	21.7	2.1	3	5.3
102	3095	R	21.6	1.8	2.8	4.9
103	3099	R	26.6	2.2	2.9	5.8
104	3106	R	25.9	2.2	3.3	4.8
105	3112	L	28.6	2.7	3.1	5.9
106	3114	R	29.6	2.1	3.5	4.9
107	3116	R	21.6	1.8	2.6	4.4
108	3127	R	22.6	2	2.9	4.8
109	3134	R	25.7	2.3	3.2	5.7
110	3135	R	26.7	2.5	3.2	5.4
111	3143	R	26.4	2.3	3.1	5.2
112	3157	R	23	2.1	2.8	4.6
113	3159	R	24.5	2.2	3.1	4.9
114	3160	R	23.9	2.2	3.1	5.3
115	3162	R	24.2	2.1	2.9	4.6
116	3166	R	25.6	2.3	3.2	5

S.no.	B.no.	Side	R 1	R 2	R 3	R 4
117	3167	R	26.2	2.5	3.5	5.5
118	3172	R	25	2.4	3.2	6.3
119	3180	R	23.7	1.8	2.7	4
120	3183	R	24.4	2.1	2.7	4.5
121	3188	R	21.9	2	2.6	4.3
122	3245	R	26	2.2	3.2	5.5
123	3282	R	21.7	2	2.8	4.5
124	3287	L	27.8	2.4	3.4	5.4
125	3290	R	24	2.2	3	4.8
126	3314	R	24	2.1	3	4.9
127	3315	R	24.5	2.3	3.5	4.8
128	3350	L	27.1	2.5	3.2	5.5
129	3351	R	23.5	2.4	3.1	4.8
130	3365	R	23.4	2.3	2.9	4.6
131	3377	R	26.1	2.2	3	4.9
132	3396	R	25.8	2.4	3.4	5.3
133	3404	R	26.8	2.4	3.4	5.9
134	3415	R	25.4	2.2	3.1	5.2
135	3419	R	23	2	3	4.5
136	3450	R	22.9	2.2	2.9	5
137	3453	R	23.8	2.2	3.1	5
138	3480	R	22.6	2	2.7	4.9
139	3485	R	20.7	2	3	5.4
140	3490	R	25.5	2.2	3.4	5.2
141	3491	R	24.5	2.3	3	5.4
142	3499	R	25	2.1	3	4.5
143	3501	R	21.7	2.1	2.8	4.2
144	3503	R	22.9	2	2.7	4.4
145	3507	R	21	1.9	2.6	4.1
146	3524	R	22.2	2	1.8	4.6
147	3525	R	22.6	2.7	3	4.8
148	3529	R	26.2	2.3	3.5	5.3
149	3538	R	24.8	2	2.9	4.7
150	3556	R	23.8	2.4	2.8	4.9
151	3582	L	26.5	2.1	3.1	5.6
152	3590	R	23.2	2	2.7	4.7
153	3610	R	28.1	2.5	3.5	5.7
154	3614	R	23.8	2.1	3	4.7
155	3618	R	24.9	2.3	2.9	4.6

Legend – L: Left side of the bone, R: Right side of the bone

Table 31 Data collected from South African african series using metrical methods on Ulna

S.no.	B.no.	Side	U1 (cm)	U2 (cm)	U3 (cm)	U4 (cm)
1	9	L	28.3	2.7	2.2	3.4
2	15	L	26.1	2.5	1.8	3.3
3	18	L	29.5	2.9	2	3.4
4	58	L	25.9	2.9	1.9	3.3
5	81	L	26.7	2.5	1.8	3.4
6	84	L	23.8	2.7	1.8	3.3
7	91	L	24.3	2.4	1.8	2.9
8	267	L	29	3	2.3	4
9	309	L	28.2	2.7	1.8	3.4
10	514	L	26.6	2.3	2	3.1
11	552	L	23	2.4	1.8	3.1
12	579	L	30	2.7	2	3.8
13	702	L	27.1	2.4	1.9	3.1
14	740	L	23	2.3	1.6	3.25

15	754	L	26.65	2.7	2	3.7
16	828	L	25.6	2.3	1.9	3.7
17	829	L	27.5	2.7	2	3.5
18	836	L	26.5	2.6	1.8	3.1
19	837	L	27.5	2.3	1.9	3.7
20	873	L	28.6	2.8	2	4
21	883	L	25.6	2.7	1.9	3.6
22	921	L	25	3	1.6	3
23	931	L	24.9	2.5	1.8	3.6
24	939	L	25.6	2.5	1.6	2.8
25	949	L	25.5	2.2	1.7	3
26	1196	L	26.1	3	1.9	3.6
27	1197	L	29	2.8	1.8	3.4
28	1202	L	23.1	2.6	1.7	2.9
29	1274	L	26.1	2.7	1.8	2.9
30	1284	L	26.2	2.6	1.8	3.1
31	1370	L	24.3	2.3	1.7	3.1
32	1445	L	29.2	2.2	1.7	3
33	1476	L	28.2	2.8	1.8	3.6
34	1491	L	23.7	2.5	1.8	3.3
35	1535	L	26.6	2.7	1.8	3.5
36	1545	L	27.2	2.9	2.1	3.8
37	1557	L	25.9	2.3	1.6	2.85
38	1576	L	25.4	2.6	1.5	3.2
39	1653	L	24.8	2.3	1.7	2.9
40	1668	L	24.2	2.4	1.6	3.1
41	1671	L	27.7	2.7	1.9	3.2
42	1673	L	25.4	2.5	1.9	3.7
43	1674	L	29.5	2.6	1.8	3.6
44	1685	L	25.1	2.6	1.8	3.5
45	1693	L	25.2	2.8	1.8	3.7
46	1776	L	28.4	2.6	1.9	3.5
47	1801	L	28.7	2.9	1.9	3.3
48	1811	L	24.5	2.2	1.6	2.8
49	1890	L	28.1	2.9	1.8	3.5
50	1891	L	25.8	2.5	1.6	3.2
51	1892	L	27.4	2.7	2	3.1
52	1909	L	25.5	2.7	1.9	3.3
53	1912	L	23.4	2.8	2	3.1
54	1925	L	24.5	2.4	1.7	3
55	1930	L	26.1	2.5	1.7	3.2
56	1944	L	27.4	2.5	1.7	3.2
57	1951	L	23.8	2.5	1.8	3
58	1991	L	26.2	2.5	1.8	3.2
59	1993	L	26.6	2.4	1.7	3.25
60	2001	L	29.7	2.9	2	3.1
61	2026	L	25.8	2.8	1.8	4.1
62	2030	L	27.7	2.7	1.9	3.2
63	2045	L	28.8	3	2	4
64	2046	L	28.4	2.6	1.7	3.2
65	2049	L	27.6	2.6	1.7	2.85
66	2053	L	28	3	2	3.8
67	2058	L	26.6	2.7	2.6	3.6
68	2064	L	26	2.4	1.8	2.9
69	2099	L	27.9	2.9	2	3.6
70	2140	L	24.4	2.8	1.8	3.3
71	2160	L	28.3	2.6	1.9	3.5
72	2167	L	29	2.7	1.9	3.3

73	2199	L	23.85	2.3	1.5	3.4
74	2255	L	28.8	3	1.7	3.6
75	2281	L	26.6	2.8	1.9	3.3
76	2303	L	28	2.8	2	3.6
77	2343	L	23.9	2.5	1.8	4
78	2349	L	23.1	2.3	1.5	3
79	2356	L	23.4	2.8	2	3.1
80	2359	L	23.4	2.4	1.7	3.1
81	2363	L	28	2.7	2	3.7
82	2365	L	27	2.7	1.8	3.1
83	2367	L	23.8	2.3	1.6	3.3
84	2389	L	26.9	2.7	1.9	3.2
85	2392	L	25.6	2.5	1.9	3.7
86	2401	L	25.8	2.5	1.8	3.2
87	2402	L	28.1	2.5	1.9	3.5
88	2404	L	24.9	2.4	1.8	3.2
89	2410	L	30.3	2.8	2	3.5
90	2653	L	25.5	2.8	1.9	4.2
91	2662	L	27.1	2.7	2.1	3.7
92	2735	L	27.9	2.4	1.9	3
93	2764	L	28.1	2.5	1.6	3.6
94	2863	L	24.2	2.4	1.6	3.7
95	2867	L	28.8	2.6	2	3.5
96	2892	L	28.1	2.7	2	3.7
97	2935	L	27.5	2.6	1.7	3.1
98	3057	L	23.5	2.5	1.6	3
99	3090	L	27.5	2.9	2	4.4
100	3091	L	28.9	3	2	3.7
101	3093	L	23.9	2.6	2.1	3.5
102	3095	L	23.2	2.6	1.4	2.7
103	3106	L	27	2.9	1.8	3.6
104	3112	L	31.1	3.1	2.1	4.2
105	3114	L	31.1	2.7	1.6	3.5
106	3116	L	23	2.3	1.4	2.7
107	3127	L	24.6	2.7	1.67	3.4
108	3134	L	27.4	2.8	1.9	3.8
109	3135	L	28.4	3	2	3.3
110	3143	L	28	2.8	1.8	3.5
111	3157	L	23.6	2.6	1.6	3.4
112	3159	L	26.2	2.6	1.8	3.2
113	3160	L	25.1	2.7	1.9	3.5
114	3162	L	26.5	2.6	1.7	3.2
115	3166	L	26.8	2.6	2	3.4
116	3167	L	27.2	2.7	2	3.8
117	3172	L	26.8	2.8	1.8	4
118	3180	L	25.5	2.3	1.7	2.8
119	3183	L	25.9	2.5	1.8	3.3
120	3188	L	23.6	2.4	1.4	3
121	3245	L	27.8	2.8	1.8	4.2
122	3282	L	23.5	2.4	1.8	3.4
123	3287	L	29.5	2.8	2.3	3.6
124	3290	L	25.9	2.5	1.6	3.3
125	3314	L	26.25	3	1.6	3.3
126	3315	L	26.7	2.6	1.7	3.4
127	3350	L	29.2	2.8	1.8	3.5
128	3351	L	24.9	2.6	1.8	3.4
129	3365	L	24.7	2.8	1.9	3.5
130	3377	L	28.2	2.9	1.8	3.5

131	3396	L	27.6	2.9	2.1	3.5
132	3404	L	29.7	2.9	2.3	4.1
133	3415	L	26.9	2.7	1.7	3.4
134	3419	L	25.3	2.6	1.7	3.2
135	3450	L	24.3	2.5	1.6	3.1
136	3453	L	24.8	2.6	1.7	3.4
137	3480	L	24.1	2.3	1.6	3
138	3485	L	22.4	2.5	1.8	3.3
139	3490	L	27	3	1.8	3.5
140	3491	R	25.8	2.9	1.7	3.5
141	3499	R	26.4	2.5	1.5	3.3
142	3501	R	23.5	2.3	1.8	3.5
143	3503	R	24.5	2.6	1.6	3.2
144	3507	R	23	2.4	1.6	2.7
145	3524	R	24.2	2.6	1.7	3.3
146	3525	L	25.1	2.8	1.8	3.1
147	3529	R	27.3	3	2	3.7
148	3538	R	26.4	2.5	1.7	3.6
149	3556	R	26.3	2.6	1.8	3.2
150	3582	L	28.4	2.8	1.9	3.4
151	3590	R	25.1	2.6	1.6	3.3
152	3610	R	29.9	3	2	3.4
153	3614	R	25.3	2.6	2	3.3
154	3618	R	26.8	2.8	1.9	3.4

Legend – L: Left side of the bone, R: Right side of the bone

Table 32 Data collected from South African african series using metrical methods on basal view of Crania

S.no.	B.no.	CB1 (cm)	CB2 (cm)
1	9	2.3	11.3
2	15	2.1	10
3	18	2.2	10.7
4	58	2.4	10.5
5	81	2.1	11
6	84	2	11.1
7	91	2.4	10.2
8	267	2.6	10.7
9	514	2.6	10.7
10	552	2	10.1
11	579	3	11.3
12	702	2.2	11.2
13	740	1.9	10.6
14	754	1.9	10.9
15	828	2.3	10.2
16	829	2.3	10
17	836	2	9.5
18	837	2.2	10.7
19	873	2.2	10.6
20	883	2.55	10.8
21	921	1.7	10.5
22	931	1.8	11
23	939	1.9	10.1
24	949	1.8	10
25	987	2.1	10.7
26	1196	1.7	10.7
27	1197	2.5	10
28	1202	2	10.7
29	1274	1.95	10.2
30	1284	2.2	10.7

S.no.	B.no.	CB1 (cm)	CB2 (cm)
31	1370	1.9	10.7
32	1445	1.9	10.9
33	1476	2.6	10.7
34	1491	1.9	10.65
35	1535	2.3	11.1
36	1545	2.1	10.5
37	1557	2	10.6
38	1576	2.3	9.7
39	1653	2.3	10.6
40	1668	2.2	10.2
41	1671	2.4	9.8
42	1673	2.4	10.3
43	1674	1.9	10.5
44	1685	2.1	10.7
45	1693	2	10.2
46	1776	2.2	11
47	1801	2.7	10.6
48	1811	2.2	10.4
49	1890	2.2	10.2
50	1891	1.9	9.3
51	1892	2.1	11.3
52	1909	2.1	11.5
53	1912	1.6	11.8
54	1925	1.85	10
55	1930	2.4	9.9
56	1944	2.1	11
57	1951	2.1	10
58	1991	2.1	10.2
59	1993	2.2	11.1
60	2001	2.5	11.1
61	2026	2.4	10.5
62	2030	2.3	10.6
63	2045	2.6	11.3
64	2046	2.1	10.6
65	2049	2.9	10.7
66	2053	2.4	10
67	2058	2.6	11
68	2064	2.4	10.7
69	2099	2.7	10.6
70	2132	2.6	9.9
71	2140	2.1	10.1
72	2167	2.4	10.7
73	2255	2.6	10.3
74	2281	2.1	10.2
75	2303	2.4	10.5
76	2343	1.6	10.6
77	2349	2.3	11.6
78	2356	2.4	10.2
79	2359	2.2	10.1
80	2363	2.5	10.5
81	2365	2.5	10.4
82	2367	2	10.7
83	2389	2.3	11
84	2392	2.3	10.7
85	2401	1.8	10.4
86	2402	2.4	10.8
87	2404	2.1	10.9

S.no.	B.no.	CB1 (cm)	CB2 (cm)
88	2410	2.5	10.5
89	2653	1.8	10.9
90	2662	2.4	11.2
91	2735	2.9	11.7
92	2764	2.3	10.3
93	2863	1.9	11.3
94	2867	1.8	10.8
95	2892	2.8	10
96	2935	1.9	11
97	3057	2	11.3
98	3090	2.7	10.4
99	3091	2.6	10.5
100	3093	2	11
101	3095	2.1	10.5
102	3099	2.5	10.1
103	3106	1.9	10.8
104	3112	2.3	10.7
105	3114	1.8	10.2
106	3116	1.8	10.5
107	3127	2.2	10.5
108	3134	2.7	10.9
109	3135	2.6	10.3
110	3143	2.3	10.3
111	3157	2	9.7
112	3159	2.1	10.6
113	3160	2	10.7
114	3162	2.3	10.5
115	3166	2.4	10.3
116	3167	2.5	10.4
117	3172	2.4	10.6
118	3180	2.1	9.8
119	3183	1.9	11.1
120	3188	1.9	10.4
121	3245	2.4	10.3
122	3282	2	10.4
123	3287	2.1	10.1
124	3290	2.2	11.3
125	3314	2.2	10.3
126	3315	2.5	10.1
127	3350	2.6	11.3
128	3351	2.5	11.1
129	3365	2.6	10.6
130	3377	2.3	10.1
131	3396	2.1	10.8
132	3404	2.3	11
133	3415	2	10.4
134	3419	2	9.9
135	3450	2.1	10.7
136	3453	2.4	11.4
137	3480	2	11
138	3485	2	10.8
139	3490	2.4	10.7
140	3491	2.3	11.1
141	3499	2	10.2
142	3501	2.3	10.7
143	3503	2.1	9.9
144	3507	2.1	10.1

S.no.	B.no.	CB1 (cm)	CB2 (cm)
145	3524	2.2	10.2
146	3525	2.2	10.3
147	3529	2.2	10.6
148	3538	2	10.4
149	3556	2.2	11.1
150	3582	2.5	11.8
151	3590	2.2	11
152	3610	2.4	11
153	3614	1.9	10.8
154	3618	2.4	10.5
155	3644	2	11.4
156	3653	2.1	10.5
157	3673	2.1	10.2
158	3759	1.8	10.4
159	3763	2.4	11.5

Table 33 Data collected from South African african series using metrical methods on frontal view of Crania

S.no.	B.no.	CF1 (cm)	CF2 (cm)	CF3 (cm)	CF4 (cm)	CF5 (cm)
1	9	13.4	9.6	13.7	4.6	2.6
2	15	13	9	13.2	4.6	2.5
3	18	13.2	9	13.2	4.4	2.4
4	58	13.2	9.2	13.1	5.1	2.9
5	81	12.3	9.7	14	4.1	2.7
6	84	12.5	9	13.1	4.5	2.7
7	91	12	9.3	13.4	4.6	2.8
8	267	13.5	9.3	13.1	5.3	2.7
9	514	12.7	9.7	12.9	4.6	2.8
10	552	12.1	9.5	12.9	3.7	2.2
11	579	14.3	10	14.4	5.6	2.5
12	702	12.9	9.7	13.5	4.4	2.5
13	740	11.7	8.1	12.3	4.6	2.4
14	754	13.3	10.1	13.2	5	3
15	828	12.2	9	13.4	4.5	2.7
16	829	12.6	9.2	12.6	5.4	2.6
17	836	11.9	8.2	12.2	4.2	2.4
18	837	12.8	9.1	12.6	4.6	2.5
19	873	13.7	9.5	13.1	4.8	2.9
20	883	12.9	9.8	13.5	4.9	3
21	921	12.8	9.5	14	4.7	2.6
22	931	11.9	9.1	13.7	4.4	2.6
23	939	11.9	8.7	12.6	4.4	2.3
24	949	11.5	9.2	12.8	4.6	2.6
25	987	13	9.4	14.2	4.7	2.5
26	1196	13.2	10.1	14.1	4.6	2.5
27	1197	13.7	10	13.5	5.25	2.6
28	1202	11.5	8.3	13	4.4	2.7
29	1274	12.2	8.8	12.5	4.7	2.2
30	1284	12.2	9.3	12.4	4.3	2.6
31	1370	12	9.1	13	4.3	2.5
32	1445	12.8	9.1	12.5	5.4	2.7
33	1476	15.5	10.2	13.7	4.8	2.7
34	1491	10.9	9.1	12.6	4.5	2.7
35	1535	12.6	9.3	12	4.9	2.5
36	1545	13	9.5	14.3	5	2.5
37	1557	11.7	8.8	12.6	4.5	2.6
38	1576	12.3	9.4	13.4	4.7	2.5

39	1653	12	9.1	12.5	4.5	2.4
40	1668	13	9.8	13.1	4.8	2.6
41	1671	12.6	9.4	12.9	4.7	2.5
42	1673	12.8	9.3	12.5	4.1	2.8
43	1674	12.7	9.1	12.6	4.7	2.5
44	1685	12.9	9.5	13.5	4.5	2.6
45	1693	12.1	8.8	12	4.8	2.7
46	1776	12.5	9.3	13.8	5	2.9
47	1801	12.9	9.2	12.2	5.4	2.5
48	1811	12.3	9.3	13.1	5.1	2.6
49	1890	12.2	8.7	12.9	4.7	2.5
50	1891	11.3	8.9	12	4.2	2.3
51	1892	13	9.3	13.2	4.9	2.8
52	1909	12.2	9.2	13	4.4	2.4
53	1912	12.7	9.1	13.6	4.7	2.6
54	1925	11.7	9.1	12.7	4	2.4
55	1930	13	9.3	12.9	4.8	2.5
56	1944	13	9.5	14.3	4.5	2.4
57	1951	12.3	9.3	13	4.6	2.6
58	1991	12.3	9.1	12.8	4.5	2.9
59	1993	12.6	9.1	12.7	4.7	2.7
60	2001	13.6	9.8	13.7	5.5	3
61	2026	12.5	9.3	12.9	4.2	2.6
62	2030	12.9	9.1	13	4.8	2.7
63	2045	13.8	9.6	13.6	4.7	3.1
64	2046	12.4	9.3	13	5.1	3.3
65	2049	13.7	8.9	12.9	4.2	2.8
66	2053	12.9	9	13.6	5.3	2.9
67	2058	13.4	9.1	13.2	5	3
68	2064	12.4	9.4	13.1	4.5	2.7
69	2099	13	9.4	2.8	5.1	2.9
70	2132	12.8	9.3	12.6	4.7	2.7
71	2140	11.9	9.1	12.1	4.3	2.6
72	2167	13.4	9.8	13.1	5	2.5
73	2255	13.5	9.8	13.7	5.1	2.4
74	2281	12.8	9.4	12.8	4.9	2.9
75	2303	13.4	9.8	13.6	5.2	2.9
76	2343	11.5	9.4	13.7	4.5	2.4
77	2349	12.6	9.3	13.2	4.6	2.7
78	2356	12.6	9.4	13.5	5.1	2.7
79	2359	12.4	8.7	12.8	4.7	2.8
80	2363	13.4	9.2	12.8	4.8	2.9
81	2365	13.1	9.1	12.1	5	2.8
82	2367	12.2	8.9	13.1	4.5	2.8
83	2389	12.7	9.7	13	4.6	2.5
84	2392	12.9	9.2	13.4	4.8	2.8
85	2401	13.3	9.4	12.9	4.7	4.7
86	2402	13.3	9.3	13	5.2	2.5
87	2404	12.1	9.3	13.5	5.2	2.8
88	2410	12.8	8.9	12.6	5.6	2.9
89	2653	12.7	9.5	13.5	4.2	3
90	2662	13.2	9.9	13.4	5.1	2.7
91	2735	13.5	9.7	13.5	4.8	2.7
92	2764	13.5	10.2	12.9	4.9	2.6
93	2863	11.4	9.2	13	5	2.4
94	2867	13	9.3	13	4.1	2.9
95	2892	13.3	9.7	12.9	5.7	2.9
96	2935	12	8.8	13.3	4.8	2.6

97	3057	12.5	9.5	14.1	5.1	2.2
98	3090	13.2	9	12.7	4.5	2.2
99	3091	13.5	9.8	13.3	4.5	2.8
100	3093	12.5	10	13.7	4.2	2.4
101	3095	11.8	8.3	12.3	4.7	2.5
102	3099	13	9.5	12.8	4.4	2.6
103	3106	15.5	9	13	4.7	2.6
104	3112	13.4	9.7	12.9	4.9	2.7
105	3114	12.7	9.6	12.6	5.1	2.6
106	3116	11.9	8.7	12.5	4.3	2.2
107	3127	13	9.8	13.5	3.5	2.4
108	3134	14	10	13	5.4	2.9
109	3135	13	9.6	13.2	5.3	3.1
110	3143	13	9.8	13.5	5.1	2.5
111	3157	11.4	9.3	12	4.7	2.6
112	3159	12.7	9	12.8	5.1	3
113	3160	11.8	8.7	12	4.9	2.5
114	3162	12.7	9.4	13.4	4.9	2.5
115	3166	12.7	9.3	13.4	4.8	2.5
116	3167	13.5	9.1	14.1	4.7	2.4
117	3172	13	9.5	12.5	4.8	2.6
118	3180	11.8	9	13	5	2.6
119	3183	12.5	9.3	13.7	4.5	2.8
120	3188	11.8	9.3	12.5	4.3	2.1
121	3245	12.5	8.8	12.6	4.9	2.9
122	3282	12.1	9.1	13	4.7	2.5
123	3287	12.4	9.1	13.2	4.9	2.5
124	3290	12.3	9	12.6	4.1	2.4
125	3314	12.6	9.1	13.4	4.6	2.5
126	3315	13.3	9.4	12.8	4.9	3
127	3350	13.7	9.5	13.6	4.8	3
128	3351	12.6	9.3	13.7	4.5	2.5
129	3365	12.7	9.2	13.6	5.2	3.2
130	3377	11.9	8.7	11.7	4.9	2.4
131	3396	12.2	9.3	12.8	4.7	2.7
132	3404	13.1	9.9	13.8	4.5	2.8
133	3415	13.3	9	13.8	4.9	2.7
134	3419	11.6	8.9	12.2	4.3	2.5
135	3450	12.5	9.5	13	4.8	2.8
136	3453	13	9.3	13.7	4.8	2.4
137	3480	12.3	9.6	13.8	4.5	2.6
138	3485	12.2	9.1	13.2	4	2.5
139	3490	13	9.3	12.6	4.5	3
140	3491	16	9.6	15	4.4	2.9
141	3499	11.9	9	12.2	4.7	2.7
142	3501	12.2	9.4	12.8	4.4	2.3
143	3503	12.1	9	12.3	4.8	2.7
144	3507	11.8	8.6	13	4.6	2.3
145	3524	12	8.7	12.4	4.2	2.5
146	3525	12.3	8.8	12.6	4.2	2.6
147	3529	13	9.4	14.2	4.8	2.3
148	3538	12.1	9	12.8	4.7	2.4
149	3556	13.3	9.8	13.1	4.5	2.9
150	3582	13.4	9.8	13.5	4.9	3.1
151	3590	12.2	9.1	13.3	4.9	2.7
152	3610	13.3	9.2	13.3	4.4	2.7
153	3614	12	8.7	12	4.6	2.3
154	3618	12.9	8.9	12.5	4.8	2.6

155	3644	13.1	10.4	13.4	4.7	2.6
156	3653	12.3	9.2	13.2	4.3	2.5
157	3673	12	9.4	12.5	4.6	2.4
158	3759	11.9	9	13	4.6	2.5
159	3763	12.8	9.7	13.3	4.9	2.9

Table 34 Data collected from South African african series using metrical methods on lateral view of Crania

S.no.	B.no.	CL1 (cm)	CL2 (cm)	CL3 (cm)	CL4 (cm)	CL5 (cm)	CL6 (cm)
1	9	19	3.1	9.8	10	6.7	13.5
2	15	17.7	3.1	10	10.1	6.8	14
3	18	19.1	2.4	9.3	10.1	5.9	13.8
4	58	18.4	2.5	11.2	10.8	7.3	13.5
5	81	19	2.4	9.9	9.5	6.2	13.5
6	84	17.9	2.4	9.6	9.5	6.1	12.1
7	91	19.1	2.5	9.3	9.7	6	12.8
8	267	18.7	3.1	10.6	9.8	7.3	13.4
9	514	18.7	2.9	10.6	10	6.6	11.9
10	552	17.1	2.4	9.5	9.3	5.3	12.3
11	579	19.3	3.1	10.4	10.7	8	12.7
12	702	19	2.9	9.7	10	6.9	13.5
13	740	17	2.9	9.6	9.5	6.7	12.6
14	754	19	3	10.6	10.3	6.7	12.9
15	828	18.7	2.8	10.5	9.5	7.8	12.7
16	829	19	3	10.5	10.3	10.5	13.5
17	836	18.6	2.6	9.9	9.5	5.7	13.5
18	837	17.2	3	9.8	9.6	6.1	13.3
19	873	18.8	3	10.8	10.4	10.7	13.4
20	883	18.5	2.2	10.3	10.3	7.5	13.1
21	921	17.9	2.8	9.8	9.5	6.2	12.4
22	931	18.6	3	10.4	9.8	6.3	12.2
23	939	17.5	2.7	9	9.3	5.7	12.1
24	949	18	2.6	9.9	9.8	6.3	12.4
25	987	17.7	4.1	9.7	9.5	7.5	13.7
26	1196	19.8	3.1	10.2	10.4	6.5	13.7
27	1197	19.3	3.2	10.3	10.3	7.5	14.4
28	1202	18	2.5	10	9.2	6.5	12.4
29	1274	17.2	2.8	9.4	9.3	6.3	12.9
30	1284	19.4	2.7	10	10.5	6.3	14.1
31	1370	17.8	2.7	9.6	9.1	6.3	12
32	1445	17.8	2.7	9.5	9.5	7.3	12.1
33	1476	18.3	3.3	10.5	10.6	6.6	14.6
34	1491	18.5	2.3	9.1	9.3	5.9	13.2
35	1535	18.5	3	10.2	10	7.5	13.5
36	1545	19.6	3.4	10.4	10.2	7	13.1
37	1557	18.2	2.4	10.2	9.5	6.6	12.3
38	1576	17.5	2.7	9.1	9.5	6.7	12.9
39	1653	17.3	2.5	9.8	9.4	6	13
40	1668	18.7	2.5	9.7	9.4	6.6	11.9
41	1671	17.7	2.9	9.1	9.5	9.1	12.5
42	1673	18.5	2.7	9.9	9.8	5.7	13
43	1674	18.1	2.5	11.3	10.3	6.8	12.8
44	1685	18.7	2.8	10.3	10.5	6	14
45	1693	17.2	2	10.3	9.8	7	12.5
46	1776	19.2	2.9	10.4	10.4	6.3	14.2
47	1801	19	2.3	10.1	10.5	7.3	13.3
48	1811	17.5	2.9	9.4	9.9	6.6	13.5
49	1890	19	3.1	9.8	10	6.1	14.1

S.no.	B.no.	CL1 (cm)	CL2 (cm)	CL3 (cm)	CL4 (cm)	CL5 (cm)	CL6 (cm)
50	1891	17.8	2.4	9.8	9.8	6.4	13.3
51	1892	19.2	2.9	9.4	10.2	6.4	13.9
52	1909	17.5	2.5	8.7	9.2	6.3	13.2
53	1912	19.1	2.6	10.4	10.1	7.1	13.5
54	1925	17.5	2.5	8.8	8.9	5.4	12.1
55	1930	18.3	2.4	10.6	9.8	9.7	13.5
56	1944	18.4	3	9.8	9.7	6.5	13.7
57	1951	18.3	2.3	9.7	9.7	6.5	13
58	1991	17	2.4	9.8	9.1	6.7	12.9
59	1993	18.6	3.3	10.1	10	6.5	12.5
60	2001	19.3	3	10.4	10.2	7.4	14
61	2026	17.3	2.6	9.6	9.4	6.1	12.3
62	2030	18.1	3	10.4	10.1	6.3	13
63	2045	18.6	3.6	10.6	10.5	5.9	13.3
64	2046	18.1	2.4	9.5	9.9	6.5	14
65	2049	17.6	2.8	9.8	10	5.9	12.3
66	2053	18.3	2.9	10.4	10.3	7.8	14.3
67	2058	19.1	3.4	10.6	10.8	7.3	14
68	2064	18.3	2.5	9.1	9.6	6.5	13
69	2099	18.3	2.5	10.2	10.5	6.2	13.5
70	2132	17.8	2.8	10.2	10.3	6.6	13.3
71	2140	17.3	2.7	10.3	9.9	6.7	13.6
72	2167	18.3	2.6	10.4	10.1	6.5	13.2
73	2255	20	2.6	10.2	10.5	7	15
74	2281	18.5	3.2	9.8	10.2	6.5	13.3
75	2303	18.7	3.8	10.5	10.6	7.9	13.5
76	2343	18	2.6	10.2	9.6	6.6	13.6
77	2349	18.4	2.5	9.4	9.9	6	13.4
78	2356	17.7	2.9	9.2	9.7	6.6	13.4
79	2359	17.2	2.6	9.2	9.3	6.4	12.4
80	2363	18.4	3.2	10.6	10.7	6.9	13.2
81	2365	18.3	2.8	10.7	10.2	6.9	12.7
82	2367	17.7	3.1	10.6	9.3	6.7	12.4
83	2389	18.5	2.9	9.7	9.9	6.6	13.6
84	2392	17.9	2.8	10	9.7	6.3	13
85	2401	17.5	2.8	10.5	10	6.7	12.9
86	2402	18.3	3	10.1	10.5	7.5	13.6
87	2404	18.4	2.7	9.9	10	6.4	13
88	2410	18.5	2.8	10.2	10.4	7.6	12.7
89	2653	18	2.9	9.9	9.4	6.8	12.7
90	2662	19.5	3.7	10.5	10.3	7.1	13.3
91	2735	18.6	2.8	9.7	9.5	6.6	12.7
92	2764	18.6	2.9	10.8	10.9	7.4	13.9
93	2863	17.6	2.8	9.8	10.3	6.5	14
94	2867	19.1	2.8	11.1	10.7	5.9	13.6
95	2892	18.8	2.9	9.3	10.5	6.6	14.2
96	2935	18	2.6	9.8	9.7	6.5	12.8
97	3057	20.1	2.7	9.6	10	9.7	12.5
98	3090	18.8	3.4	10.5	10.3	6.7	13.1
99	3091	17.3	3.2	9.7	9.4	6.1	13.1
100	3093	19	2.4	9.1	9.7	5.6	13.3
101	3095	17.6	2.5	9.4	9.3	6.6	12
102	3099	18.9	3.1	10.4	9.9	6.8	13.6
103	3106	17.9	2.6	9.6	9.6	6.1	13.7
104	3112	18.9	2.9	10.8	10.9	7	13.4
105	3114	18.5	2.5	11	10.8	6.6	13.1
106	3116	16.9	2.1	8.3	8.5	6	11.5

S.no.	B.no.	CL1 (cm)	CL2 (cm)	CL3 (cm)	CL4 (cm)	CL5 (cm)	CL6 (cm)
107	3127	17.7	2.5	9	9.1	6.2	13.5
108	3134	19.7	3.2	10.6	10.6	7.8	13.5
109	3135	18.7	2.7	11	10.5	6.8	13.2
110	3143	18.6	2.5	9.7	9.1	7.2	11.8
111	3157	17.8	2.4	10.5	9.7	6.8	13
112	3159	19.3	2.8	10	9.9	6.8	13.9
113	3160	18.3	2.7	8.7	9.6	6.1	12.5
114	3162	18.4	2.9	10.3	10.2	7	13.5
115	3166	19	2.7	10.1	10.2	6.5	11.9
116	3167	18.5	3.2	9.1	9.6	6.4	13.5
117	3172	19	2.5	10.5	10.5	6.5	13
118	3180	18.1	2.7	9.5	9.6	7.3	12.1
119	3183	18	1.9	9.3	9.8	6	13.2
120	3188	17.3	2.3	9.5	9.5	5.9	12.3
121	3245	18.2	2.4	9.3	9.8	7.3	13
122	3282	17.9	2.7	9.3	9.6	6.7	13.1
123	3287	19.2	3.3	11	10.5	7.6	13
124	3290	18.8	2.7	9.3	10	5.9	13.5
125	3314	18	2.9	10.4	9.8	7.2	12.1
126	3315	19	3	10.5	10.2	7	12.7
127	3350	18.5	3.1	10.6	10.3	7	14.2
128	3351	18.6	3.2	9.6	10	6	13.5
129	3365	18.2	2.3	10.1	9.9	6.9	12.8
130	3377	18.5	2	10	10.3	6.8	13.5
131	3396	19	3.2	11.1	10.5	6.7	12.2
132	3404	19.7	3.4	10.4	10.4	6.6	13.9
133	3415	19.1	2.8	10.2	9.8	7.3	13
134	3419	18.3	2.5	10.2	9.7	6.8	13.2
135	3450	18.5	2.4	9.3	9.7	6.4	12.9
136	3453	17.9	2.9	10.4	10.1	6.8	13.5
137	3480	17.9	3.1	10.2	9.6	6.5	13.2
138	3485	17.8	2.6	9.2	9	6	12.5
139	3490	18.6	3.6	9.8	9.3	6.5	12.8
140	3491	18.8	2.7	11.2	10.5	6.2	13.2
141	3499	18.3	2.2	10	10.2	6.4	13
142	3501	18.5	2.1	9.6	9.3	6.4	12.7
143	3503	17.5	2.3	9.4	9.4	6.9	12.2
144	3507	17.3	3.1	9.1	9.3	6.2	12.6
145	3524	16.7	2.3	8.8	9.3	4.9	12.4
146	3525	17.2	2.4	9.3	9.2	5.8	12.7
147	3529	18.4	2.7	9.4	9.3	6.1	13.1
148	3538	19.2	3.2	10.6	10.2	7.1	13.3
149	3556	18.5	3.2	10.1	9.9	6.1	13
150	3582	18.4	3.1	10.4	10.3	6.4	12.6
151	3590	18.8	2.8	10.5	9.7	7.7	13
152	3610	19.7	2.8	10.1	10	7.1	13.8
153	3614	17.2	2.6	10.1	9.8	6.4	13.2
154	3618	18.2	2.7	9.8	10.5	6.4	13.9
155	3644	19.9	3	10.1	10.4	6.9	13.7
156	3653	18.1	2.9	9.2	9.4	6.3	13
157	3673	17.8	2.2	9.9	9.7	6.4	12.6
158	3759	18.4	2.4	9.8	9.7	6.7	12.8
159	3763	19.9	2.7	10.7	10.8	7.2	13.6

Table 35 Data collected from South African african series using metrical methods on Mandible

S.no.	B.no.	M1 (cm)	M2 (cm)	M3 (cm)	M4 (cm)	M5 (cm)
1	9	12.5	10.6	3.4	9.2	8
2	15	12	9.9	3.2	9	8.2
3	18	12.2	10.7	3.5	8.8	7.1
4	58	11.7	9.9	3.7	9.5	7.8
5	81	-	9.3	3.6	8.8	7.9
6	84	10.6	8.3	3.5	9.1	8
7	91	10.7	7.6	3.5	8.5	8.1
8	267	11.8	9.9	3.3	9.9	8.5
9	514	10.7	8.8	3.95	9.3	8.8
10	552	10.6	8.3	3.6	8.2	7.4
11	579	12.5	10.1	4.1	9.5	8.5
12	702	11.3	10.3	3.25	8.9	7.6
13	740	10.7	8.3	2.9	8.8	7.3
14	754	12.2	9.5	3.7	10.1	8.9
15	828	10.9	9	3.7	8.6	7.8
16	829	10.8	9.3	3.3	9.7	8.6
17	836	10.2	9	3.5	9.4	8.6
18	837	11.6	9.4	3.5	9.3	8.6
19	873	12.1	9.7	3.7	9.5	9
20	883	12	9.5	3.6	9.1	8.2
21	921	11.6	9.8	3.3	9.5	8.2
22	931	11.2	8.9	3	8.9	8.1
23	939	10.1	8.3	2.5	7.7	6.9
24	949	10.7	8	3.3	8.4	7.6
25	987	11	10	3.7	9.8	8.7
26	1196	11.9	9.5	3.6	8.6	8.1
27	1197	12.9	10.4	3.7	10	8.5
28	1202	10.7	8.4	3	8	7.4
29	1274	10.35	9.4	3	8.1	7.2
30	1284	11.3	9.9	3.8	9.7	8.5
31	1370	11.1	9	3.2	9	8.1
32	1445	11.4	9.5	3.7	8.8	7.9
33	1491	10.2	8.5	2.8	8.7	7.6
34	1535	11.5	10.5	3.9	10.1	8.9
35	1545	11.7	9.4	9.3	9.4	8.4
36	1557	10.6	8.8	3.3	9.2	8
37	1576	10.8	8.6	3.2	8.2	7.6
38	1653	10.9	8.2	3.6	9.3	8.4
39	1668	11.7	8.7	3.4	8.7	8.2
40	1671	10.8	9.3	3.6	9.3	8.1
41	1673	11.2	10.2	3.5	9.2	8.1
42	1674	11.5	9.5	3.3	8.8	8.3
43	1685	11.7	8.9	3.7	9.1	8
44	1693	11.3	8.4	3.6	8.6	8.4
45	1776	11.6	9.2	3.8	9.5	8.8
46	1801	12	10.2	2.8	9.3	7.6
47	1811	11.3	8.7	3.4	8.9	8
48	1890	11.1	9.7	3.4	10.2	9
49	1891	10.5	9	3.3	8.6	8.1
50	1892	11.5	9.6	3.5	9.2	8.3
51	1909	10.2	8.2	3	9	8.2
52	1912	12.2	8.6	3.6	9.1	8.1
53	1925	10.7	8.9	2.9	7.9	7.4
54	1930	11.3	9.2	3.7	9.8	8.7
55	1944	11.4	8.8	3.2	9.4	8.2
56	1951	11.3	9.3	3.8	9.2	7.7

S.no.	B.no.	M1 (cm)	M2 (cm)	M3 (cm)	M4 (cm)	M5 (cm)
57	1991	11.5	9.2	3.5	9.6	8.2
58	1993	11.9	9.4	3	9.3	8.1
59	2001	12.3	10.6	3.1	9.4	8.1
60	2026	11.4	9.3	3.4	9.4	8.2
61	2030	11.7	9.6	3.7	9.3	8
62	2045	12.8	10.6	3.8	9.4	7.9
63	2046	11.4	9.9	2.6	8.9	7
64	2049	12	9.9	3.5	9.2	8
65	2053	12	10	3.5	10	8.8
66	2058	12	10.7	3.7	10.3	8.9
67	2064	-	8.8	3.8	9.7	8.5
68	2099	10.5	9	4	9.7	9.2
69	2132	11.4	8.7	3.2	8.7	7.6
70	2140	10.6	8.9	3	9.3	8.3
71	2160	11.6	10	3.4	9.5	7.7
72	2167	12.4	9.9	2.8	8.9	7.3
73	2199	11	9	3.5	9.7	8.3
74	2255	12	10.1	3.8	10.2	9
75	2281	11.5	9.6	3.3	9.1	7.9
76	2303	11.8	10.3	3.3	9.8	8.2
77	2343	10.2	9.4	3	9.6	7.6
78	2349	10.7	8.4	3.2	8.7	7.4
79	2356	11.3	8.8	3.3	9.1	8.4
80	2359	11.3	8.7	3.9	9.3	8.5
81	2363	11.7	9.4	3.7	9.4	8.4
82	2365	12	9.4	3.6	9.4	8.2
83	2367	11.3	8.9	4	9.2	8.2
84	2389	10.8	9.2	3.5	8.5	7.5
85	2392	11.7	10	3.6	9	8.1
86	2401	11.6	9.7	3.5	8.7	8.1
87	2402	11.2	9.7	3.7	10.5	8.9
88	2404	11	9.2	3.2	8.6	7.6
89	2410	12.3	9.9	3.5	9.9	8.1
90	2653	11	8.6	3.3	9.3	8.5
91	2662	11.7	9.7	3.9	9.6	8.6
92	2735	12	9.3	4	9.1	8.7
93	2764	12.5	10.1	4.1	9.8	8.7
94	2863	10.8	8.8	3.1	8.2	7.2
95	2867	11.9	9.3	3.5	9.2	8.5
96	2892	11.7	9.7	3.9	9.4	8.9
97	2935	11.1	9.4	3.5	8.7	7.7
98	3057	11.2	9.4	3.5	9	8
99	3090	11.8	10.5	3.8	10.7	9.5
100	3091	12.4	9.7	3.4	9.8	8.4
101	3093	10.2	8.9	3.5	9.3	8.3
102	3095	10.5	10.1	3.5	8.6	7.6
103	3099	12.3	10.7	3.5	9.5	8
104	3106	11.5	10	3.4	8.8	7.7
105	3112	11.8	11.6	3.6	10.3	8.5
106	3114	11.6	9.7	3.9	10.4	8.7
107	3116	10.5	9.3	2.6	8.2	6.7
108	3127	12.1	9.8	2.9	8.5	7.5
109	3134	12.3	10.3	3.5	9.2	8
110	3135	11.5	10	3.6	9.5	8.6
111	3143	11.7	9.7	3	9.6	8.4
112	3157	10.4	9.3	3.4	8.3	7.4
113	3159	10.8	9.2	3.3	9.2	8.1

S.no.	B.no.	M1 (cm)	M2 (cm)	M3 (cm)	M4 (cm)	M5 (cm)
114	3160	10.5	9.1	3	7.6	7.3
115	3162	11.2	9.2	3.6	9	7.9
116	3166	11.4	9.5	3.6	9.2	8.6
117	3167	11.4	9.4	3.3	9.1	8.6
118	3172	11.7	9.5	3.7	9.4	8
119	3180	10.2	8.5	3	9	8.1
120	3183	11	9.2	3.1	8.7	7.4
121	3188	10.3	8.3	3.5	9	8.1
122	3245	11	9.6	3.6	9.1	7.9
123	3282	11.3	9	3.2	9	7.8
124	3287	11.3	9	3.8	9.4	8.7
125	3290	10.7	8.3	3	8	7
126	3314	10.5	9.2	3.5	9.2	7.9
127	3315	11.8	9.4	3.9	9.4	8.6
128	3350	11.3	9.6	3.9	9.5	9.4
129	3351	11	8.9	3.1	9.2	8.5
130	3365	10.3	8.1	3.1	9.5	8.9
131	3377	10	9.4	3.8	9.6	8.4
132	3396	11.4	9.3	3.8	9.1	8.5
133	3404	11.4	10.3	3.4	9.5	8
134	3415	11.9	10.2	3.1	9.5	8.1
135	3419	10.6	8.8	2.9	8.6	8.1
136	3450	11.6	9.7	2.6	8.3	7.1
137	3453	12	9.3	3.5	9.3	8.2
138	3480	11.2	8.2	3.5	8.7	8
139	3485	10.6	9.5	3.2	9	7.5
140	3490	11.2	9.5	3.8	9.8	8.7
141	3491	12.3	9.5	3.6	9.5	9.2
142	3499	11.3	9.1	3.3	9.4	8.3
143	3501	11.3	8.8	3.7	9	8
144	3503	11.1	9	3.5	9.5	8.6
145	3507	10.9	8.6	3	8.5	7.9
146	3524	10.3	8.6	3	9	7.5
147	3525	11.5	8.2	3.5	9.3	8.4
148	3529	11.6	9.4	3.2	10	9.2
149	3538	10.9	9.7	3.4	9.5	8.7
150	3556	12.5	10	3.8	9.8	8.6
151	3582	11.6	9.4	3.6	9.8	8.6
152	3590	11.2	9	3.5	9.8	8.5
153	3610	11.8	10.7	3.9	9.8	8.4
154	3614	11.3	9.1	3.5	9.3	8
155	3618	10.9	8.8	3.7	9.4	8.5
156	3644	11.7	10.5	3.4	9.9	8.5
157	3653	11	8.3	3.7	9	8.1
158	3673	10.3	8.5	3.7	9.5	8.5
159	3759	11.1	8.6	2.9	8.9	8
160	3763	12.1	8.8	3.7	9.3	8.5

Table 36 Data collected from South African african series using metrical methods on Pelvis

S.no.	B.no.	P1 (cm)	P2 (cm)	P3 (cm)	P4 (cm)	P5 (cm)	P6 (cm)	P7 (cm)	P8 (cm)	P9 (cm)
1	9	8.4	10.2	20.2	13.75	3.3	5.6	4.85	2.1	4.3
2	15	8.6	10.1	20.7	15.3	3.2	5.4	5	1.9	4
3	18	9.3	11.5	21.7	14.9	4.8	5.6	4.8	2.6	4
4	58	8.1	9.7	18.5	13.2	3	6.5	5	1.8	3.6
5	81	9.5	9.8	19.4	15	3.3	5.3	6.6	3.2	3.7
6	84	8.7	9.3	18.2	14.1	2.9	5.3	4.7	2.8	3.6

7	91	9.1	9.5	18.6	14	2.1	4.7	4.9	2.3	4
8	267	9.1	11.1	20.8	15.3	3.7	6.2	3.7	2.5	4.4
9	514	7.5	9	17.6	12	2.2	5.1	4.1	1.9	3.1
10	552	8.5	9	17.25	12.9	2.7	4.6	5.8	2.8	3.3
11	579	8.8	10.3	21.1	15	3.9	5.4	3.4	2.8	3.4
12	702	8.6	10.7	20.7	15	3.4	5.4	5.1	2	3.8
13	740	9.1	9.2	18.3	13.7	2.4	5.1	5.6	2.5	3.4
14	754	9.1	10.5	20	13.8	2.7	5.6	5	2.6	4.4
15	828	9.4	10.15	19.9	14.5	3	5.3	5.7	2.6	3.8
16	829	9	10	20.8	14.3	2.9	5.6	6.2	2	4.4
17	836	8.3	9.9	18.5	14.4	2.8	5.4	4.1	1.85	3.6
18	837	9	10.4	19.5	13.2	2.8	5.4	4.3	1.9	3.8
19	873	9.4	11.4	21.2	15.5	2.7	6.2	5.6	2.8	3.8
20	883	9.1	10.2	20	14.5	2.6	5.3	5.2	3.4	3.7
21	921	8.9	10.2	18.3	13.1	2.8	5.5	5	2.3	3.3
22	931	8.7	9.6	18.2	13.1	2.2	4.9	4.9	2.6	3.8
23	939	8.1	9.5	18.5	12.9	2.3	4.8	4	2.2	3.1
24	949	8.3	9.4	18.3	14.3	2.5	4.7	5	2.6	3
25	987	8.9	10.9	20.3	14.9	2.4	5.5	4.6	2.7	3.8
26	1196	8.4	10.6	20.3	13.4	3.2	5.8	4	2	3.5
27	1197	8	9.5	19.5	14.8	2.7	5.6	3.8	2.2	4.7
28	1202	9.1	7.9	16.8	13.3	1.8	4.7	5.3	2.5	3.1
29	1274	7.9	9.4	18.7	13.1	2.5	5.2	4	2.2	3.1
30	1284	7.9	9.4	17.9	12.6	2.4	4.8	4.2	1.9	3.8
31	1370	8.5	9	18.2	13.6	1.8	4.8	5.1	2.1	3.7
32	1445	8.3	9.7	19.3	12.9	2.8	5.6	3.7	2.5	3.9
33	1476	8.4	10.5	20.5	15.5	2.6	6	5.3	3.3	3.8
34	1491	8.5	9.1	18	13.4	1.9	4.8	4.2	2.5	3.6
35	1535	8.2	9.8	18.6	13.6	2.8	5.1	3.5	2.1	4
36	1545	8.3	10.6	20.3	14.2	2.9	6.1	4.5	2.8	3.8
37	1557	8.1	9.3	17.9	12.3	2.4	4.6	4.4	2.8	3.7
38	1576	9.1	9.9	18	13.8	2.3	5.7	4.5	2.8	3
39	1653	8.4	8.6	17.5	13.1	1.8	4.8	4.8	2.5	3.3
40	1668	9	9.2	17.7	12.7	1.9	5.1	5.2	2.8	3.4
41	1671	8.7	10.5	19.3	14.3	2.4	5.4	3.4	2.8	3.8
42	1673	8.3	9.2	18.3	14.3	2.9	4.5	5.1	2.6	3.8
43	1674	8.8	9.5	18.5	13.3	3	5.4	4.1	2.8	3.3
44	1685	8.2	9.6	19.3	13.9	2.4	4.9	4.7	3	3.5
45	1693	8.4	10.1	19.3	14.4	2.1	5.1	5.4	2.3	4.3
46	1776	9	10.5	19.8	13.6	3.2	5.7	4.2	2.4	3.5
47	1801	9.3	10.9	21.5	15.3	3.3	5.9	4.5	2.5	3.6
48	1811	7.2	8.7	17.8	12.6	2.3	4.7	4.2	2.1	3
49	1890	8.3	10.1	20	13.5	2.8	5.6	5	2.3	3.8
50	1891	8.5	9.7	18.9	14.1	2.3	5.3	5.9	2.4	3.8
51	1892	8.3	9.9	19.6	13.9	2.7	5.2	4.1	2.5	4.4
52	1909	8.5	9.5	19.4	14	2.5	5.2	4.2	2	3.6
53	1912	9	9.9	19.3	14.9	2.5	5.3	5.4	2.8	3.7
54	1925	8.9	8.9	18.2	13.6	2.8	4.9	4.5	2.4	3.3
55	1930	8.2	9.6	19.8	14.8	2.9	5.3	4.3	2.2	4.3
56	1944	9.8	10	19.8	15.6	2.1	5.1	6.1	3.1	3.8
57	1951	8.7	9.1	18.6	14.3	2.6	5.1	5.5	3.2	3.2
58	1991	8.6	9.9	18.7	15.1	2.6	5.1	5.2	2.6	4.1
59	1993	9	10.7	20.4	14.1	2.7	5.5	4.3	2.5	4.2
60	2001	9.2	10.7	21.1	14.9	2.8	5.7	4.3	2.3	4.1
61	2030	7.7	9.4	18.3	13.8	2.2	5	4	2.2	3.2
62	2045	9.3	10.7	20.7	15.6	3.1	5.6	5.7	2.8	4.7
63	2046	8	10.5	20.1	15.1	3	5.4	4.7	2.5	3.7
64	2049	8	10.3	19.7	14.5	2.5	5.2	4.4	2.4	4.4

65	2053	8	10.5	19.8	15.1	3.1	5.8	4.3	2	4
66	2058	9	11.1	21.9	15.9	2.6	5.7	5	2.4	4.1
67	2064	7.7	9.5	17.9	13	2.3	5.2	4.5	2.3	3.9
68	2099	8.6	10.9	21.7	15.9	3	5.4	4.2	2.6	3.9
69	2132	8.4	9.5	20.1	14.5	3.3	6	4.2	2.3	4.1
70	2140	8.1	10.1	19.1	14	2.8	5.6	4.6	2.2	3.4
71	2160	8.1	10	19.8	14.3	2.8	5.4	4.3	2	3.7
72	2167	8.2	10.4	19	14.6	2.9	5.8	4.6	2.2	3.8
73	2199	9.5	9	19	14.1	2.6	4.8	4.7	2.8	4
74	2255	8.5	10.5	20.5	15.3	2.6	5.9	4.1	2.2	3
75	2281	8.4	10.3	19.4	13.8	2.8	5.6	3.9	2.1	3.5
76	2303	8.5	10.6	20.5	15.5	3.4	6	3.7	2.3	3.6
77	2343	8.6	9.9	1.1	14.6	2.4	5.1	5.1	2.5	3.6
78	2349	7.7	8.6	16.3	12.9	2.5	4.7	4.1	2.6	2.8
79	2356	7.4	9.4	18.4	14.8	1.8	5.4	3.1	2	4
80	2359	8.2	9.1	18.3	13.7	2.3	4.8	5.7	2.6	3.3
81	2363	9.1	10.8	20.9	14.7	3	5.8	5.6	2.5	4.8
82	2365	8.3	9.8	19.4	14.1	3.3	5.5	4.5	2.5	3.5
83	2367	8.4	9.6	18.2	13.1	2.3	5.1	4.8	2.9	3.2
84	2389	7.3	8.8	17.2	14	5.4	5	3.8	2.3	2.7
85	2392	8.1	9.8	19	14	2.9	5.9	4.4	2.1	3.6
86	2401	8.1	9.6	18.1	13.3	2.5	5.4	3.3	2	3.6
87	2402	8.5	10.8	20.4	14.9	3.4	5.6	4.4	2.2	3.9
88	2404	8.3	9.4	16.7	13.2	2.6	5.1	4.2	2.7	3.5
89	2410	8.8	10.6	24.5	17.2	2.7	5.3	4.8	2.8	4
90	2653	8.4	9.8	18.3	13.1	2.5	5.4	3.5	2.5	3.6
91	2662	8.6	11.1	20.1	15.5	2.4	5.8	4.2	2.3	3.4
92	2735	9	10.7	20.3	14.5	2.6	5.6	4.6	2.6	4
93	2764	8.7	10.3	19	14.9	2.4	5.4	4.3	2.4	4.3
94	2863	8.6	9.5	18.1	13.6	2.7	5.1	4.2	2.6	3.3
95	2867	8.8	10.8	20.4	15.1	3	5.8	4.6	2.2	4.3
96	2892	8.5	10.2	20.3	14.9	2.8	5.8	4.7	2.5	3.5
97	2935	8.3	9.9	19.2	14	2.5	5.3	5.3	2.6	3.8
98	3057	18.1	9.6	18.2	13.8	2.2	4.9	5.1	2.4	3.2
99	3090	8.9	10.9	20.3	14.8	3.1	6	4.2	2.2	3.9
100	3091	8.5	11.2	20.8	15.6	2.8	5.7	5.3	3	4.1
101	3093	8.1	10.3	18.8	14.3	2.7	5.4	4.1	2.2	3.8
102	3095	8.7	9.7	18.4	14	2.2	4.7	4.8	2.7	3.3
103	3099	8.8	10.8	20.4	13.5	2.7	5.7	5	2.6	3.9
104	3106	8.5	10.1	18.9	14.5	2.7	5.3	4.2	2.5	3.8
105	3112	8.5	11.2	21.9	15.4	2.8	6.2	4.4	2.6	4.2
106	3114	9	10.7	21.5	15.2	2.9	5.9	4.7	2.4	3.9
107	3116	8.8	9.3	17.7	13.3	2.2	4.7	3.6	3	3.6
108	3127	8.8	9.7	18.9	14	2.7	5.3	4.3	3	3.5
109	3134	8.4	10.7	19.7	15.3	3.2	5.4	4	2.6	4.4
110	3135	8.1	10.6	21	16.7	2.9	6.1	4.4	3	4.4
111	3143	9.2	10.8	21.3	15.4	2.7	5.8	4.8	2.6	3.9
112	3157	9.3	10.4	19.3	14.5	2.8	5.4	5.6	3.3	3.8
113	3159	8.7	10.1	19.5	13.8	3.2	5.7	3.7	2.1	4.3
114	3160	8.4	10.3	19.3	14.1	3	4.9	4.4	2.5	3.2
115	3162	9.1	10.5	19.3	15.3	2.8	5.5	5.2	2.6	4
116	3166	8.4	10.1	19.7	14.3	2.6	5.4	3.7	2.2	3.8
117	3167	8.4	11.1	20.6	16.1	3.5	5.7	4.8	2.4	4.4
118	3172	8.6	11.1	20.3	15.7	3.5	5.9	3.3	2.7	4.4
119	3180	8.6	9.2	17.6	13.4	2.3	4.9	5.1	2.2	3.4
120	3183	8.5	9.6	19.4	14.6	2.9	5.2	5.7	2.6	3.8
121	3188	7.6	9.2	17.6	13.5	2.5	4.7	4.5	2.6	3.3
122	3245	8.3	10.4	20.6	15.2	2.8	5.7	4.3	2.8	4.1

123	3282	8.4	9.6	18	14.9	3	5	4	2.5	4.2
124	3287	8.2	11.1	22.1	15.5	3.1	5.8	4.2	2.4	4
125	3290	9	10.1	19.7	14.3	2.7	4.7	4.1	3.3	3.4
126	3314	7.3	9.8	18.1	13.6	2.6	5	4.5	2.3	3.7
127	3315	8	9.8	18.6	14.5	2.9	5.3	3.7	2.2	3.4
128	3350	9	10.5	20.8	15	3.2	5.9	3.6	2.5	4
129	3351	7.7	10.4	19.5	14	2.9	5.8	3.6	2.4	4.3
130	3365	9.7	9.8	20.3	16.4	3.1	5.2	5.6	3.2	3.3
131	3377	8.4	10.8	20.7	14.7	3	5.4	4.5	2.6	4.2
132	3396	8.7	10.8	21.2	14.5	3.2	5.9	4.3	2.8	3.8
133	3404	8.9	10.8	21.2	14.9	3	5.6	4.5	2.7	4.1
134	3415	9	10.7	20	14.8	2.7	5.8	4.4	2.6	4.2
135	3419	8.2	9.1	18	14	2.3	4.5	4.6	2.6	3.7
136	3450	8.5	8.9	18.8	13.5	2.6	4.8	4.1	2.9	3.6
137	3453	8.3	10.3	19.6	14.2	2.9	5.7	3.7	2.6	3.5
138	3480	8.4	8.8	18.6	14.5	2.8	4.8	4.3	2.8	3.9
139	3485	7.4	9.7	17.6	12.8	2.9	5.4	3.8	2.1	3.1
140	3490	8.1	10.6	19.4	14.7	2.8	5.4	3.7	2.1	4.1
141	3491	7.8	10	19.2	13.7	2.7	5.4	3.6	2.5	3.8
142	3499	8.7	10.3	20.5	14.8	3.1	5.4	4.1	2.8	3.7
143	3501	8.2	8.6	17.3	12.3	2.6	4.5	4.2	2	3.3
144	3503	9	10	19	14.4	1.9	4.9	4.2	2.6	3.7
145	3524	8.2	8.7	17.4	13.1	2	4.3	4	2.3	3.7
146	3525	9.6	10.1	20.2	14.4	2.5	5.4	5.2	2.9	3.8
147	3529	9.6	11.1	21.5	15.6	2.5	4.8	5	2.6	3.8
148	3538	8.9	10	19.1	13.6	2.8	5.1	4.3	2.5	3.7
149	3556	8.6	9.7	19.1	14.5	2.9	4.7	4	3.2	3.9
150	3582	9.4	11.3	21.5	15.3	3	5.6	4.6	2.7	3.8
151	3590	8.5	9.5	18.4	13.5	2.3	4.6	3.6	2.6	3.4
152	3610	8.9	11.5	22	16.6	3.2	5.7	4.7	2.1	4.4
153	3614	8.7	9.7	18.4	13.9	3	4.8	4.6	2.4	4.1
154	3618	8.5	10	20.4	14.5	3.3	5.1	4.3	2.4	3.3

Table 37 Extended comparison among different population groups on femur data analysed using Tukey HSD post-hoc test

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
F1	Inden	Lübeck	3,7962*	,9608	,000	1,535	6,057
		South Africa	3,8149*	,9315	,000	1,623	6,007
	Lübeck	Inden	-3,7962*	,9608	,000	-6,057	-1,535
		South Africa	,0187	,8531	1,000	-1,988	2,026
	South Africa	Inden	-3,8149*	,9315	,000	-6,007	-1,623
		Lübeck	-,0187	,8531	1,000	-2,026	1,988
F2	Inden	Lübeck	-12,7905*	4,5745	,015	-23,554	-2,027
		South Africa	-12,3999*	4,4346	,015	-22,834	-1,966
	Lübeck	Inden	12,7905*	4,5745	,015	2,027	23,554
		South Africa	,3906	4,0614	,995	-9,165	9,947
	South Africa	Inden	12,3999*	4,4346	,015	1,966	22,834
		Lübeck	-,3906	4,0614	,995	-9,947	9,165
F3	Inden	Lübeck	1,0257*	,3332	,006	,242	1,810
		South Africa	1,8748*	,3230	,000	1,115	2,635

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
	Lübeck	Inden	-1,0257*	,3332	,006	-1,810	-,242
		South Africa	,8491*	,2958	,012	,153	1,545
	South Africa	Inden	-1,8748*	,3230	,000	-2,635	-1,115
		Lübeck	-,8491*	,2958	,012	-1,545	-,153
F4	Inden	Lübeck	2,0830*	,7637	,018	,286	3,880
		South Africa	2,5494*	,7404	,002	,807	4,291
	Lübeck	Inden	-2,0830*	,7637	,018	-3,880	-,286
		South Africa	,4664	,6781	,771	-1,129	2,062
	South Africa	Inden	-2,5494*	,7404	,002	-4,291	-,807
		Lübeck	-,4664	,6781	,771	-2,062	1,129
F5	Inden	Lübeck	,9755	,5323	,160	-,277	2,228
		South Africa	2,8407*	,5161	,000	1,626	4,055
	Lübeck	Inden	-,9755	,5323	,160	-2,228	,277
		South Africa	1,8652*	,4726	,000	,753	2,977
	South Africa	Inden	-2,8407*	,5161	,000	-4,055	-1,626
		Lübeck	-1,8652*	,4726	,000	-2,977	-,753
F6	Inden	Lübeck	1,2719*	,4928	,028	,112	2,431
		South Africa	2,8156*	,4777	,000	1,691	3,940
	Lübeck	Inden	-1,2719*	,4928	,028	-2,431	-,112
		South Africa	1,5437*	,4375	,001	,514	2,573
	South Africa	Inden	-2,8156*	,4777	,000	-3,940	-1,691
		Lübeck	-1,5437*	,4375	,001	-2,573	-,514
F7	Inden	Lübeck	3,3337	1,6184	,100	-,474	7,142
		South Africa	7,3515*	1,5690	,000	3,660	11,043
	Lübeck	Inden	-3,3337	1,6184	,100	-7,142	,474
		South Africa	4,0178*	1,4369	,015	,637	7,399
	South Africa	Inden	-7,3515*	1,5690	,000	-11,043	-3,660
		Lübeck	-4,0178*	1,4369	,015	-7,399	-,637
F8	Inden	Lübeck	-4,0075	2,4575	,234	-9,790	1,775
		South Africa	-6,0152*	2,3823	,032	-11,620	-,410
	Lübeck	Inden	4,0075	2,4575	,234	-1,775	9,790
		South Africa	-2,0077	2,1818	,628	-7,141	3,126
	South Africa	Inden	6,0152*	2,3823	,032	,410	11,620
		Lübeck	2,0077	2,1818	,628	-3,126	7,141

*. The mean difference is significant at the 0.05 level.

Table 38 Extended comparison among different population groups on tibia data analysed using Tukey HSD post-hoc test

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
T1	Inden	Lübeck	3,3049*	1,0143	,003	,919	5,691

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
		South Africa	-,6273	,9912	,802	-2,959	1,704
	Lübeck	Inden	-3,3049*	1,0143	,003	-5,691	-,919
		South Africa	-3,9321*	,9268	,000	-6,112	-1,752
	South Africa	Inden	,6273	,9912	,802	-1,704	2,959
		Lübeck	3,9321*	,9268	,000	1,752	6,112
T2	Inden	Lübeck	-8,6311*	3,3542	,028	-16,524	-,738
		South Africa	-23,1055*	3,0533	,000	-30,291	-15,920
	Lübeck	Inden	8,6311*	3,3542	,028	,738	16,524
		South Africa	-14,4744*	3,1045	,000	-21,780	-7,169
	South Africa	Inden	23,1055*	3,0533	,000	15,920	30,291
		Lübeck	14,4744*	3,1045	,000	7,169	21,780
T3	Inden	Lübeck	,5155	,7766	,785	-1,312	2,343
		South Africa	-,1060	,7121	,988	-1,782	1,570
	Lübeck	Inden	-,5155	,7766	,785	-2,343	1,312
		South Africa	-,6215	,7179	,662	-2,311	1,068
	South Africa	Inden	,1060	,7121	,988	-1,570	1,782
		Lübeck	,6215	,7179	,662	-1,068	2,311
T4	Inden	Lübeck	-,8717	,4346	,112	-1,894	,151
		South Africa	-3,3501*	,4246	,000	-4,349	-2,351
	Lübeck	Inden	,8717	,4346	,112	-,151	1,894
		South Africa	-2,4784*	,3971	,000	-3,412	-1,544
	South Africa	Inden	3,3501*	,4246	,000	2,351	4,349
		Lübeck	2,4784*	,3971	,000	1,544	3,412
T5	Inden	Lübeck	1,8753*	,3565	,000	1,037	2,714
		South Africa	1,9154*	,3484	,000	1,096	2,735
	Lübeck	Inden	-1,8753*	,3565	,000	-2,714	-1,037
		South Africa	,0402	,3258	,992	-,726	,807
	South Africa	Inden	-1,9154*	,3484	,000	-2,735	-1,096
		Lübeck	-,0402	,3258	,992	-,807	,726
T6	Inden	Lübeck	,7304	,8572	,671	-1,286	2,747
		South Africa	-,5044	,8363	,818	-2,472	1,463
	Lübeck	Inden	-,7304	,8572	,671	-2,747	1,286
		South Africa	-1,2349	,7834	,257	-3,078	,608
	South Africa	Inden	,5044	,8363	,818	-1,463	2,472
		Lübeck	1,2349	,7834	,257	-,608	3,078
T7	Inden	Lübeck	1,4181*	,5822	,040	,048	2,788
		South Africa	4,1265*	,5387	,000	2,859	5,394
	Lübeck	Inden	-1,4181*	,5822	,040	-2,788	-,048
		South Africa	2,7083*	,5373	,000	1,444	3,973
	South Africa	Inden	-4,1265*	,5387	,000	-5,394	-2,859
		Lübeck	-2,7083*	,5373	,000	-3,973	-1,444
T8	Inden	Lübeck	,1203	,7273	,985	-1,591	1,832
		South Africa	1,1780	,6604	,176	-,376	2,732

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
	Lübeck	Inden	-,1203	,7273	,985	-1,832	1,591
		South Africa	1,0577	,6735	,260	-,527	2,643
	South Africa	Inden	-1,1780	,6604	,176	-2,732	,376
		Lübeck	-1,0577	,6735	,260	-2,643	,527
T9	Inden	Lübeck	-,5955	,3845	,269	-1,500	,309
		South Africa	,1293	,3517	,928	-,698	,957
	Lübeck	Inden	,5955	,3845	,269	-,309	1,500
		South Africa	,7248	,3556	,105	-,112	1,562
	South Africa	Inden	-,1293	,3517	,928	-,957	,698
		Lübeck	-,7248	,3556	,105	-1,562	,112
T10	Inden	Lübeck	-,7262	,5682	,408	-2,063	,611
		South Africa	-,5821	,5159	,497	-1,796	,632
	Lübeck	Inden	,7262	,5682	,408	-,611	2,063
		South Africa	,1442	,5261	,959	-1,094	1,382
	South Africa	Inden	,5821	,5159	,497	-,632	1,796
		Lübeck	-,1442	,5261	,959	-1,382	1,094
T11	Inden	Lübeck	,3605	,5608	,796	-,959	1,680
		South Africa	1,0725	,5053	,087	-,117	2,262
	Lübeck	Inden	-,3605	,5608	,796	-1,680	,959
		South Africa	,7119	,5199	,358	-,512	1,935
	South Africa	Inden	-1,0725	,5053	,087	-2,262	,117
		Lübeck	-,7119	,5199	,358	-1,935	,512
T12	Inden	Lübeck	-,3761	,4538	,685	-1,444	,692
		South Africa	1,1052*	,4067	,019	,148	2,062
	Lübeck	Inden	,3761	,4538	,685	-,692	1,444
		South Africa	1,4813*	,4211	,001	,490	2,472
	South Africa	Inden	-1,1052*	,4067	,019	-2,062	-,148
		Lübeck	-1,4813*	,4211	,001	-2,472	-,490

*. The mean difference is significant at the 0.05 level.

Table 39 Extended comparison among different population groups on humerus data analysed using Tukey HSD post-hoc test

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
H1	Inden	Lübeck	-1,3962	3,0989	,894	-8,688	5,896
		South Africa	4,2092	2,9520	,329	-2,737	11,156
	Lübeck	Inden	1,3962	3,0989	,894	-5,896	8,688
		South Africa	5,6054	2,7688	,108	-,910	12,121
	South Africa	Inden	-4,2092	2,9520	,329	-11,156	2,737
		Lübeck	-5,6054	2,7688	,108	-12,121	,910

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
H2	Inden	Lübeck	-3,4383*	,6266	,000	-4,913	-1,964
		South Africa	3,5478*	,5969	,000	2,143	4,952
	Lübeck	Inden	3,4383*	,6266	,000	1,964	4,913
		South Africa	6,9861*	,5599	,000	5,669	8,304
	South Africa	Inden	-3,5478*	,5969	,000	-4,952	-2,143
		Lübeck	-6,9861*	,5599	,000	-8,304	-5,669
H3	Inden	Lübeck	-,6412	,6622	,597	-2,199	,917
		South Africa	1,9659*	,6622	,009	,408	3,524
	Lübeck	Inden	,6412	,6622	,597	-,917	2,199
		South Africa	2,6071*	,5822	,000	1,238	3,977
	South Africa	Inden	-1,9659*	,6622	,009	-3,524	-,408
		Lübeck	-2,6071*	,5822	,000	-3,977	-1,238
H4	Inden	Lübeck	1,6064	,7330	,074	-,118	3,331
		South Africa	1,7596*	,7374	,046	,025	3,494
	Lübeck	Inden	-1,6064	,7330	,074	-3,331	,118
		South Africa	,1532	,6348	,968	-1,340	1,647
	South Africa	Inden	-1,7596*	,7374	,046	-3,494	-,025
		Lübeck	-,1532	,6348	,968	-1,647	1,340

*. The mean difference is significant at the 0.05 level.

Table 40 Extended comparison among different population groups on radius data analysed using Tukey HSD post-hoc test

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
R1	Inden	Lübeck	-8,5457*	2,5452	,003	-14,536	-2,556
		South Africa	-13,9156*	2,4057	,000	-19,577	-8,254
	Lübeck	Inden	8,5457*	2,5452	,003	2,556	14,536
		South Africa	-5,3699*	2,2231	,043	-10,602	-,138
	South Africa	Inden	13,9156*	2,4057	,000	8,254	19,577
		Lübeck	5,3699*	2,2231	,043	,138	10,602
R2	Inden	Lübeck	,4758	,3270	,314	-,294	1,245
		South Africa	,2373	,3194	,738	-,514	,989
	Lübeck	Inden	-,4758	,3270	,314	-1,245	,294
		South Africa	-,2385	,2826	,676	-,903	,426
	South Africa	Inden	-,2373	,3194	,738	-,989	,514
		Lübeck	,2385	,2826	,676	-,426	,903
R3	Inden	Lübeck	,0472	,4085	,993	-,914	1,008
		South Africa	1,2600*	,3894	,004	,344	2,176
	Lübeck	Inden	-,0472	,4085	,993	-1,008	,914
		South Africa	1,2128*	,3569	,002	,373	2,053
	South Africa	Inden	-1,2600*	,3894	,004	-2,176	-,344

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
		Lübeck	-1,2128*	,3569	,002	-2,053	-,373
R4	Inden	Lübeck	1,3116	,7245	,168	-,393	3,016
		South Africa	4,3476*	,7194	,000	2,655	6,040
	Lübeck	Inden	-1,3116	,7245	,168	-3,016	,393
		South Africa	3,0360*	,6115	,000	1,597	4,475
	South Africa	Inden	-4,3476*	,7194	,000	-6,040	-2,655
		Lübeck	-3,0360*	,6115	,000	-4,475	-1,597

*. The mean difference is significant at the 0.05 level.

Table 41 Extended comparison among different population groups on ulna data analysed using Tukey HSD post-hoc test

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
U1	Inden	Lübeck	-9,4598*	2,8123	,002	-16,078	-2,842
		South Africa	-12,5064*	2,6396	,000	-18,718	-6,295
	Lübeck	Inden	9,4598*	2,8123	,002	2,842	16,078
		South Africa	-3,0467	2,5483	,457	-9,043	2,950
	South Africa	Inden	12,5064*	2,6396	,000	6,295	18,718
		Lübeck	3,0467	2,5483	,457	-2,950	9,043
U2	Inden	Lübeck	,3075	,4597	,782	-,774	1,389
		South Africa	,4276	,4560	,617	-,645	1,500
	Lübeck	Inden	-,3075	,4597	,782	-1,389	,774
		South Africa	,1201	,4124	,954	-,850	1,090
	South Africa	Inden	-,4276	,4560	,617	-1,500	,645
		Lübeck	-,1201	,4124	,954	-1,090	,850
U3	Inden	Lübeck	-1,4585*	,2817	,000	-2,121	-,796
		South Africa	-,0621	,2665	,971	-,689	,565
	Lübeck	Inden	1,4585*	,2817	,000	,796	2,121
		South Africa	1,3964*	,2548	,000	,797	1,996
	South Africa	Inden	,0621	,2665	,971	-,565	,689
		Lübeck	-1,3964*	,2548	,000	-1,996	-,797
U4	Inden	Lübeck	,7965	,4583	,192	-,282	1,875
		South Africa	3,1003*	,4554	,000	2,029	4,172
	Lübeck	Inden	-,7965	,4583	,192	-1,875	,282
		South Africa	2,3038*	,4062	,000	1,348	3,259
	South Africa	Inden	-3,1003*	,4554	,000	-4,172	-2,029
		Lübeck	-2,3038*	,4062	,000	-3,259	-1,348

*. The mean difference is significant at the 0.05 level.

Table 42 Extended comparison among different population groups on cranium basal data analysed using Tukey HSD post-hoc test

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
CB1	Inden	Lübeck	2,4290*	,4662	,000	1,331	3,527
		South Africa	1,9719*	,4413	,000	,933	3,011
	Lübeck	Inden	-2,4290*	,4662	,000	-3,527	-1,331
		South Africa	-,4570	,3522	,398	-1,286	,372
	South Africa	Inden	-1,9719*	,4413	,000	-3,011	-,933
		Lübeck	,4570	,3522	,398	-,372	1,286
CB2	Inden	Lübeck	4,6715*	,8171	,000	2,748	6,595
		South Africa	8,1543*	,7792	,000	6,320	9,989
	Lübeck	Inden	-4,6715*	,8171	,000	-6,595	-2,748
		South Africa	3,4828*	,6138	,000	2,038	4,928
	South Africa	Inden	-8,1543*	,7792	,000	-9,989	-6,320
		Lübeck	-3,4828*	,6138	,000	-4,928	-2,038

*. The mean difference is significant at the 0.05 level.

Table 43 Extended comparison among different population groups on cranium frontal data analysed using Tukey HSD post-hoc test

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
CF1	Inden	Lübeck	5,8360*	1,2031	,000	3,003	8,669
		South Africa	-1,6571	1,1353	,312	-4,330	1,016
	Lübeck	Inden	-5,8360*	1,2031	,000	-8,669	-3,003
		South Africa	-7,4931*	,9110	,000	-9,638	-5,348
	South Africa	Inden	1,6571	1,1353	,312	-1,016	4,330
		Lübeck	7,4931*	,9110	,000	5,348	9,638
CF2	Inden	Lübeck	4,1340*	,9845	,000	1,816	6,452
		South Africa	3,4419*	,9388	,001	1,232	5,652
	Lübeck	Inden	-4,1340*	,9845	,000	-6,452	-1,816
		South Africa	-,6921	,7396	,618	-2,433	1,049
	South Africa	Inden	-3,4419*	,9388	,001	-5,652	-1,232
		Lübeck	,6921	,7396	,618	-1,049	2,433
CF3	Inden	Lübeck	3,2297*	,9876	,003	,904	5,555
		South Africa	10,7455*	,9432	,000	8,525	12,966
	Lübeck	Inden	-3,2297*	,9876	,003	-5,555	-,904
		South Africa	7,5158*	,7411	,000	5,771	9,261
	South Africa	Inden	-10,7455*	,9432	,000	-12,966	-8,525
		Lübeck	-7,5158*	,7411	,000	-9,261	-5,771
CF4	Inden	Lübeck	5,8536*	,6793	,000	4,254	7,453
		South Africa	7,8615*	,6449	,000	6,343	9,380

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
	Lübeck	Inden	-5,8536*	,6793	,000	-7,453	-4,254
		South Africa	2,0080*	,5120	,000	,802	3,213
	South Africa	Inden	-7,8615*	,6449	,000	-9,380	-6,343
		Lübeck	-2,0080*	,5120	,000	-3,213	-,802
CF5	Inden	Lübeck	2,2304*	,4295	,000	1,219	3,242
		South Africa	-,7521	,4078	,157	-1,712	,208
	Lübeck	Inden	-2,2304*	,4295	,000	-3,242	-1,219
		South Africa	-2,9825*	,3238	,000	-3,745	-2,220
	South Africa	Inden	,7521	,4078	,157	-,208	1,712
		Lübeck	2,9825*	,3238	,000	2,220	3,745

*. The mean difference is significant at the 0.05 level.

Table 44 Extended comparison among different population groups on cranium lateral data analysed using Tukey HSD post-hoc test

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
CL1	Inden	Lübeck	1,1176	1,1910	,616	-1,686	3,922
		South Africa	-,0743	1,1374	,998	-2,752	2,603
	Lübeck	Inden	-1,1176	1,1910	,616	-3,922	1,686
		South Africa	-1,1920	,8937	,378	-3,296	,912
	South Africa	Inden	,0743	1,1374	,998	-2,603	2,752
		Lübeck	1,1920	,8937	,378	-,912	3,296
CL2	Inden	Lübeck	3,9302*	,5606	,000	2,610	5,250
		South Africa	3,6150*	,5346	,000	2,356	4,874
	Lübeck	Inden	-3,9302*	,5606	,000	-5,250	-2,610
		South Africa	-,3152	,4212	,735	-1,307	,676
	South Africa	Inden	-3,6150*	,5346	,000	-4,874	-2,356
		Lübeck	,3152	,4212	,735	-,676	1,307
CL3	Inden	Lübeck	-1,7943	,9485	,143	-4,028	,439
		South Africa	-6,4944*	,8936	,000	-8,599	-4,390
	Lübeck	Inden	1,7943	,9485	,143	-,439	4,028
		South Africa	-4,7001*	,7191	,000	-6,393	-3,007
	South Africa	Inden	6,4944*	,8936	,000	4,390	8,599
		Lübeck	4,7001*	,7191	,000	3,007	6,393
CL4	Inden	Lübeck	,9193	,8090	,492	-,986	2,824
		South Africa	-,2719	,7634	,932	-2,069	1,526
	Lübeck	Inden	-,9193	,8090	,492	-2,824	,986
		South Africa	-1,1912	,6126	,128	-2,634	,251
	South Africa	Inden	,2719	,7634	,932	-1,526	2,069
		Lübeck	1,1912	,6126	,128	-,251	2,634

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
CL5	Inden	Lübeck	2,9589*	1,0934	,020	,384	5,533
		South Africa	3,0879*	1,0381	,009	,644	5,532
	Lübeck	Inden	-2,9589*	1,0934	,020	-5,533	-,384
		South Africa	,1290	,8241	,987	-1,812	2,069
	South Africa	Inden	-3,0879*	1,0381	,009	-5,532	-,644
		Lübeck	-,1290	,8241	,987	-2,069	1,812
CL6	Inden	Lübeck	1,7904	,9890	,168	-,538	4,119
		South Africa	-1,4720	,9347	,258	-3,673	,729
	Lübeck	Inden	-1,7904	,9890	,168	-4,119	,538
		South Africa	-3,2624*	,7480	,000	-5,024	-1,501
	South Africa	Inden	1,4720	,9347	,258	-,729	3,673
		Lübeck	3,2624*	,7480	,000	1,501	5,024

*. The mean difference is significant at the 0.05 level.

Table 45 Extended comparison among different population groups on mandible data analysed using Tukey HSD post-hoc test

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
M1	Inden	Lübeck	2,8739	1,2316	,053	-,027	5,775
		South Africa	4,2972*	1,0371	,000	1,854	6,740
	Lübeck	Inden	-2,8739	1,2316	,053	-5,775	,027
		South Africa	1,4233	1,0527	,368	-1,056	3,903
	South Africa	Inden	-4,2972*	1,0371	,000	-6,740	-1,854
		Lübeck	-1,4233	1,0527	,368	-3,903	1,056
M2	Inden	Lübeck	-1,0206	1,1904	,668	-3,824	1,783
		South Africa	3,2556*	1,0604	,007	,759	5,753
	Lübeck	Inden	1,0206	1,1904	,668	-1,783	3,824
		South Africa	4,2761*	,9953	,000	1,932	6,620
	South Africa	Inden	-3,2556*	1,0604	,007	-5,753	-,759
		Lübeck	-4,2761*	,9953	,000	-6,620	-1,932
M3	Inden	Lübeck	-2,6949*	,4864	,000	-3,840	-1,550
		South Africa	-4,3479*	,4387	,000	-5,381	-3,315
	Lübeck	Inden	2,6949*	,4864	,000	1,550	3,840
		South Africa	-1,6530*	,4044	,000	-2,605	-,701
	South Africa	Inden	4,3479*	,4387	,000	3,315	5,381
		Lübeck	1,6530*	,4044	,000	,701	2,605
M4	Inden	Lübeck	-1,3771	,8767	,260	-3,441	,687
		South Africa	-2,3694*	,7907	,008	-4,231	-,508
	Lübeck	Inden	1,3771	,8767	,260	-,687	3,441
		South Africa	-,9924	,7290	,363	-2,709	,724

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
	South Africa	Inden	2,3694*	,7907	,008	,508	4,231
		Lübeck	,9924	,7290	,363	-,724	2,709
M5	Inden	Lübeck	-,8552	,8288	,557	-2,807	1,097
		South Africa	-6,0076*	,7420	,000	-7,755	-4,260
	Lübeck	Inden	,8552	,8288	,557	-1,097	2,807
		South Africa	-5,1525*	,6914	,000	-6,781	-3,524
	South Africa	Inden	6,0076*	,7420	,000	4,260	7,755
		Lübeck	5,1525*	,6914	,000	3,524	6,781

*. The mean difference is significant at the 0.05 level.

Table 46 Extended comparison among different population groups on pelvis data analysed using Tukey HSD post-hoc test

Multiple Comparisons

Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
P1	Inden	Lübeck	,5427	1,0091	,853	-1,833	2,918
		South Africa	10,9885*	,9887	,000	8,661	13,316
	Lübeck	Inden	-,5427	1,0091	,853	-2,918	1,833
		South Africa	10,4458*	,7109	,000	8,772	12,119
	South Africa	Inden	-10,9885*	,9887	,000	-13,316	-8,661
		Lübeck	-10,4458*	,7109	,000	-12,119	-8,772
P2	Inden	Lübeck	3,8334*	1,2450	,006	,904	6,763
		South Africa	9,2018*	1,2602	,000	6,236	12,167
	Lübeck	Inden	-3,8334*	1,2450	,006	-6,763	-,904
		South Africa	5,3683*	,8536	,000	3,360	7,377
	South Africa	Inden	-9,2018*	1,2602	,000	-12,167	-6,236
		Lübeck	-5,3683*	,8536	,000	-7,377	-3,360
P3	Inden	Lübeck	14,6592*	4,2017	,002	4,772	24,546
		South Africa	17,0728*	4,2639	,000	7,040	27,106
	Lübeck	Inden	-14,6592*	4,2017	,002	-24,546	-4,772
		South Africa	2,4136	2,8724	,678	-4,345	9,172
	South Africa	Inden	-17,0728*	4,2639	,000	-27,106	-7,040
		Lübeck	-2,4136	2,8724	,678	-9,172	4,345
P4	Inden	Lübeck	-3,1641	2,6766	,465	-9,462	3,134
		South Africa	15,2472*	2,7163	,000	8,856	21,639
	Lübeck	Inden	3,1641	2,6766	,465	-3,134	9,462
		South Africa	18,4113*	1,8298	,000	14,106	22,717
	South Africa	Inden	-15,2472*	2,7163	,000	-21,639	-8,856
		Lübeck	-18,4113*	1,8298	,000	-22,717	-14,106

P5	Inden	Lübeck	1,7377	,7566	,057	-,042	3,518
		South Africa	6,7143*	,7754	,000	4,890	8,538
	Lübeck	Inden	-1,7377	,7566	,057	-3,518	,042
		South Africa	4,9766*	,5114	,000	3,773	6,180
	South Africa	Inden	-6,7143*	,7754	,000	-8,538	-4,890
		Lübeck	-4,9766*	,5114	,000	-6,180	-3,773
P6	Inden	Lübeck	4,9071*	,7328	,000	3,183	6,631
		South Africa	4,0102*	,7525	,000	2,240	5,780
	Lübeck	Inden	-4,9071*	,7328	,000	-6,631	-3,183
		South Africa	-,8969	,4940	,166	-2,059	,265
	South Africa	Inden	-4,0102*	,7525	,000	-5,780	-2,240
		Lübeck	,8969	,4940	,166	-,265	2,059
P7	Inden	Lübeck	1,1648	1,1036	,542	-1,432	3,761
		South Africa	8,5598*	1,1321	,000	5,896	11,223
	Lübeck	Inden	-1,1648	1,1036	,542	-3,761	1,432
		South Africa	7,3951*	,7450	,000	5,642	9,148
	South Africa	Inden	-8,5598*	1,1321	,000	-11,223	-5,896
		Lübeck	-7,3951*	,7450	,000	-9,148	-5,642
P8	Inden	Lübeck	-3,5928*	,7590	,000	-5,380	-1,806
		South Africa	1,8820*	,7459	,032	,126	3,638
	Lübeck	Inden	3,5928*	,7590	,000	1,806	5,380
		South Africa	5,4748*	,5330	,000	4,220	6,730
	South Africa	Inden	-1,8820*	,7459	,032	-3,638	-,126
		Lübeck	-5,4748*	,5330	,000	-6,730	-4,220
P9	Inden	Lübeck	-2,8278*	,7266	,000	-4,538	-1,117
		South Africa	4,8477*	,7134	,000	3,168	6,527
	Lübeck	Inden	2,8278*	,7266	,000	1,117	4,538
		South Africa	7,6755*	,5108	,000	6,473	8,878
	South Africa	Inden	-4,8477*	,7134	,000	-6,527	-3,168
		Lübeck	-7,6755*	,5108	,000	-8,878	-6,473

*. The mean difference is significant at the 0.05 level.

Table 47 Data on Inden series individuals for long bones (humerus, radius, ulna, femur, and tibia) measurements collected by a second observer (Schott, 2021)

Individual no.	H1 (cm)	H2 (cm)	H3 (cm)	R1 (cm)	R2(cm)	R3 (cm)	U1 (cm)	U2 (cm)	U3 (cm)	F3 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	T3 (cm)	T7 (cm)	T8 (cm)	T10 (cm)	T11 (cm)
82	32,3	4,2	5,8	22,15	1,8	3,3	23,6	2,8	2,7	2,8	4,4	4,35	13,9	7	4,9	7	4,7	3,75
88	30,8	4,2	6,1	22,1	1,9	3,35	24,75	2,65	2,7	3,1	4,8	4,7	15,4	7,3	5,4	7,3	5	4
93	30,8	3,95	5,3	21,5	2	2,9	23,25	2,7	2,5	3,1	4,1	4,1	12,9	6,95	4,9	6,8	4,7	4,1
100	29,35	4,2	5,85	20	2	3	21,95	2,6	2,6	2,75	4,25	4,2	13,8	7	4,5	6,65	4,4	3,2
101	30,8	4,1	5,6	22,95	2,1	3,2	-	-	-	2,6	4,1	4,1	13,4	6,9	4,5	6,8	4,3	3,5
102	30,6	3,7	5,45	-	-	-	23,6	2,4	2,3	2,8	4,25	4,2	13,5	6,8	4,75	6,7	4	3,5
113	31,8	4,4	6,3	23,6	2,2	3,3	25,5	2,7	2,6	2,55	4,7	4,65	14,9	7,7	5,4	7,7	5,05	4,5
117	32,1	4,9	6,3	23,7	2,2	3,4	25,95	2,9	2,75	3	4,7	4,7	15,1	7,85	5,4	7,75	4,95	4,05
118	29,6	4	4,9	20,35	1,85	2,7	22	2,4	2,3	2,6	4,2	4,2	13,6	6,4	4,6	6,1	4	3,7
122	29,15	3,9	5,6	21,85	1,9	2,8	23,6	2,6	2,4	2,6	4	3,9	12,8	6,75	4,6	6,6	4	3,9
125	32,45	4,2	6,2	24,8	2,1	3,35	26,8	2,95	3	2,6	4,5	4,35	14,2	7,2	5,15	7,2	4,75	4,15
126	33,2	4,2	6,1	23,65	2,3	3,5	25,8	2,95	3,1	3,15	4,75	4,8	15,4	7,5	5,3	7,4	4,6	4
127	28,1	4	5,4	21,4	1,7	3	23,1	2,4	2,5	2,9	4	4	12,9	6,8	4,7	6,4	4	3,3
136	-	-	-	24,9	1,5	5,3	26,65	3,1	3,2	2,75	4,8	4,7	15,2	7,7	5,3	7,7	4,5	4,45
145	30,7	4,2	5,5	22,95	1,8	2,8	24,1	2,7	2,6	3,1	4,1	4,05	13,1	7	4,8	6,85	4,45	3,2
146	31,5	4,6	6,2	22,7	2,3	2,8	-	-	-	2,7	4,75	4,7	15,3	7,8	5,2	7,6	5	4,6
161	-	-	-	24,6	2,4	3,3	26	3,1	3,2	3	5	4,9	15,9	7,8	5,2	7,7	5,1	4,1
163	31,7	4,6	6,3	24,2	2,2	3,6	25,8	3,1	3	2,6	4,6	4,3	14,1	7,5	5,1	7,5	4,6	3,85
166	31,95	4,4	6,25	23,8	2,3	3,5	25,8	3,1	3	2,6	4,8	4,8	15,5	7,7	5,3	7,65	4,95	4,75
175	30,95	4,4	6,65	23	2,3	3,45	-	-	-	3	4,9	4,85	15,7	7,6	5,2	7,55	4,6	4,2
176	33,2	4,3	6,35	24,4	2,2	3,6	25,8	3,1	3	2,95	4,65	4,45	14,5	7,4	5,1	7,3	4,85	4,3
183	28,1	4,2	5,1	-	-	-	21,3	2,5	2,45	2,6	4	3,95	12,5	6,8	4,7	6,8	4,3	3,8
186	33,15	5,1	6,9	25	2,4	3,6	26,4	3,45	3,4	3,45	4,95	4,75	15,5	8,45	5,8	8,45	4,8	4,5
195	35,7	4,6	6,5	24,9	2,5	3,6	27,8	2,8	2,7	2,9	5,1	5	16,1	7,7	5,8	7,7	5,2	4,2
200	33,4	4,3	6,6	24,6	2,3	3,65	26,3	2,7	2,6	3	5,1	4,9	15,8	8,2	5,6	8	4,85	4,35
201	32,4	5,8	4,7	22,9	2,2	3,2	24,5	2,9	2,7	2,75	4,75	4,65	15	7,4	5,15	7,2	4,3	4,3
203	31	4,3	6,2	23,2	2,3	3,5	24,2	3,1	3,1	2,7	4,8	4,6	15	7,3	4,6	7,3	4,2	3,8
240	32,8	5,1	6,1	23,7	2,2	3,35	24,7	3,2	3,25	2,95	5	4,9	15,8	6,8	5,6	7,4	5	3,9
243	31,55	4,4	6,2	22,2	2,35	3,4	24	2,8	2,8	2,7	4,8	4,65	15,4	7,9	5,2	7,7	4,35	4,2
244	33,7	4,3	6,4	25,6	2,2	3,3	27	2,9	3	2,95	5,1	5,05	16,3	7,7	5,5	7,5	5,2	4,2
306	-	-	-	22,75	2,2	3,3	24,9	2,9	2,8	2,9	4,9	4,6	15,7	7,3	4,95	7,3	4,45	4,1
310	29,1	4	5,65	-	-	-	22,9	2,6	2,6	2,5	4,25	4,2	13,7	6,3	4,65	6,3	4,4	3,4
311	35,6	4,4	6,55	26,75	2,4	3,6	28,7	3,2	3,2	3,3	5	4,8	15,7	8,05	5,6	7,9	5,6	4,6
315	28,3	3,6	5,3	21,2	1,85	2,95	22,55	2,6	2,4	2,4	3,95	3,9	12,7	6,4	4,4	6,4	3,8	3,5
317	22,4	4,2	5,6	20,65	2	3,05	-	-	-	2,4	4,35	4,3	13,8	6,3	4,4	6,3	3,95	3,8

Individual no.	H1 (cm)	H2 (cm)	H3 (cm)	R1 (cm)	R2(cm)	R3 (cm)	U1 (cm)	U2 (cm)	U3 (cm)	F3 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	T3 (cm)	T7 (cm)	T8 (cm)	T10 (cm)	T11 (cm)
319	34,6	4,6	6,5	25,8	2,5	3,45	27,25	3	3,05	3,1	5,05	4,8	15,7	8,1	5,8	7,85	4,5	4,3
323	32,25	4,4	5,6	22,2	1,8	3,3	23,8	2,45	2,5	2,9	4,45	4,35	14,2	7,2	4,75	6,85	4,4	3,8
330	36,3	4,5	7,2	26,45	2,5	3,55	28,4	3,1	3,2	3,3	5,25	5,2	16,7	8,2	5,6	8,05	5,45	4,7
331	33,8	4,9	5,4	25,2	2,2	3,8	27,3	3,1	2,9	3,5	5,15	4,65	16	8,2	5,8	8,2	4,7	4,5
332	30,65	3,8	5,95	23	2,1	3	24,7	2,6	2,65	3	4,3	4,25	13,7	7,1	4,7	7,1	4,6	4
333	31	4,7	6,1	23,15	2,2	3,3	24,45	2,6	2,6	2,6	4,5	4,5	14,5	7,2	5,1	7,1	4,15	3,6
335	33,15	5,1	7,15	25,3	2,2	3,7	27,8	3,3	3,5	2,9	4,85	4,8	15,5	7,8	5,6	7,8	5,8	4,6
337	32,2	4,7	5,85	23,4	2,45	3,3	25,2	3,3	3,1	2,85	4,85	4,65	15,2	7,6	5,3	7,5	4,3	4,3
340	31,9	4,9	6,15	23,65	2,4	3,45	25,8	2,65	2,55	3	4,85	4,75	15,55	7,75	5,4	7,6	5	4,1
342	28,3	4,2	5,6	-	-	-	22,95	2,8	2,7	2,8	4,2	4,1	13,2	6,8	5	6,8	4,35	3,65
345	30,7	4,6	6,5	22,5	2,4	3,4	25	2,8	3,2	3	5	4,95	15,9	7,8	5,4	7,5	4,9	4,45
357	28,75	4,3	5,6	20,7	2	3,1	22,6	2,7	2,8	2,65	4,75	4,8	13,5	6,8	5,05	6,7	4,25	4,1
363	29,3	4	5,2	20,55	1,9	3	21,9	2,4	2,3	2,45	4,2	4,2	13,6	6,75	4,5	6,7	4,05	3,75
364	29,3	3,7	4,3	20,65	1,65	2,7	21,85	2,3	2,1	2,45	3,95	3,85	12,6	7	3,9	7	4,4	3,4
365	-	-	-	-	-	-	27,05	3,2	3,3	2,95	5	5	16	7,8	5,8	7,8	5,1	4,5
401	31,1	4	6,25	21,9	2,2	3,1	23,9	2,7	2,6	2,85	4,6	4,5	14,7	7,4	5,4	7,4	4,1	4
416	-	-	-	25,8	2,4	3,5	27,15	3,25	3,2	3	5,1	5	16,2	7,7	5,6	7,6	5,05	4,4
426	29,3	3,7	5,25	20,5	2	3	21,85	2,5	2,3	2,5	4,2	4,2	13,6	6,6	4,5	6,6	4,1	3,7
428	32,4	4,4	6,05	22,5	2,45	3,55	24,8	2,95	2,9	2,85	5,15	4,95	16,2	7,8	5,5	7,6	4,7	3,95
429	29,9	4	5,4	-	-	-	24,1	2,45	2,4	2,6	4,35	4,35	14,1	6,5	4,7	6,5	4,4	3,5
438	27,8	3,8	5,25	-	-	-	20,8	2,15	2,1	2,5	4,1	3,85	12,8	6,45	4,5	6,45	4,1	3,4
442	30,8	4,35	6	-	-	-	24	2,8	2,6	2,75	4,3	4,1	14,5	6,9	4,95	6,8	4,1	3,35
446	27,2	4,4	5,45	-	-	-	-	-	-	2,3	4,2	4,05	13,2	6,6	4,75	6,6	4,1	3,5

Legend – Not available: (-)

Table 48 Data on Inden series individuals for cranial and pelvic measurements collected by a second observer (Behlert, 2021)

Individual no.	CB2	CF1	CF4	CF5	CL1	CL4	CL6	P1	P2	P3	P4	P7	P8	P9
82	-	-	-	-	-	-	-	-	-	-	-	-	-	-
88	11,6	13,2	4,85	2,35	18,7	9,6	12,55	11	11,15	22,4	17	6	3,2	4,7
93	11,05	12,95	4,75	2,35	18,4	10,05	13,2	-	-	-	-	-	-	-
98	11,35	12,55	5,7	2,4	18,4	9,85	11,8	-	-	-	-	-	-	-
100	12,1	12,65	4,8	2,25	18,5	9,9	12,25	9,5	10,45	20,5	16,4	5,55	2,9	4,2
101	-	-	-	-	-	-	-	-	-	-	-	-	-	-
102	11,45	13,05	5,05	2,35	18,3	9,65	13,55	-	10,6	20,7	16,15	5,6	3,35	-
107	-	-	-	-	-	-	-	9,45	9,8	19,1	15,8	4,65	2,75	3,7
113	11,5	14,05	5,65	2,55	17,95	9,8	13,05	-	-	-	-	-	-	-

115	-	-	-	-	-	-	-	10,85	10,9	21,25	17,45	4	2,9	4,6
117	-	-	-	-	-	-	-	9,9	11,8	22,5	16,7	3,85	2,55	4,85
118	10,65	12,1	4,7	2,6	17,75	9,2	13	10,4	10,35	21	16,85	5,4	3,3	3,8
122	10,9	12,2	4,8	2,05	16,6	9,6	13	-	-	-	-	-	-	-
125	11,95	12,65	5,6	2,4	18,6	9,9	12,9	-	11	21,3	15,4	5,1	2,2	-
126	11,6	14,6	4,75	-	17,8	10,3	13	9,6	11,6	21,65	-	5,2	2,1	4,05
127	11,7	12,55	5,2	2,4	18,3	9,3	13,8	9,7	9,9	19,7	15,4	4,95	2,6	3,6
136	-	-	-	-	-	-	-	-	-	-	-	-	-	-
145	-	-	-	-	-	-	-	-	-	-	-	-	-	-
146	-	-	-	-	-	-	-	-	-	-	-	-	-	-
161	-	-	-	-	-	-	-	-	-	-	-	-	-	-
163	11,75	14,15	5,7	2,3	19,2	10	13,2	-	-	-	-	-	-	-
166	10,8	-	5,65	2,5	19,2	10,6	13,4	-	10,7	21,85	16,65	4,4	2,45	-
169	10,9	12,3	5,5	2,45	17,2	9,75	12,3	-	-	-	-	-	-	-
175	11,65	-	5,15	2,4	18,75	11,05	13,15	9,4	12,1	21,4	16,5	5,2	2,2	4,45
176	11,75	13,7	5,2	2,3	18,3	10,1	12,15	8,95	11,3	21,2	15,5	4,8	2,6	4,45
183	12,05	-	5	2,35	18	9,75	13,05	-	-	-	-	-	-	-
186	11,75	14	5,8	2,55	20	10,3	12,5	-	-	-	-	-	-	-
195	11,5	13,3	5,15	2,15	18	9,4	13,4	-	-	-	-	-	-	-
200	11,3	13,6	5,85	2,45	20	9,9	12,6	9,8	11,15	22,85	16,3	4,35	2,6	4,65
201	-	-	-	-	-	-	-	8,75	11,3	20,9	15,7	4,45	2,25	4,05
203	-	-	-	-	-	-	-	-	-	-	-	-	-	-
240	11,3	14,3	5,2	2,6	17,6	9,8	13	-	-	-	-	-	-	-
243	10,7	-	5,45	2,4	18,5	9,9	13,1	9,6	11,3	21,8	16,5	4,85	2,1	3,5
244	9,9	12,5	5,15	2,5	18,1	10,5	13,8	10,2	12,05	23,3	16,65	4,6	1,75	5,1
252	11,65	12,3	5,2	2,35	18,4	9,8	13	-	-	-	-	-	-	-
306	-	-	-	-	-	-	-	-	-	-	-	-	-	-
310	-	-	-	-	-	-	-	-	-	-	-	-	-	-
311	12,5	14	5,45	2,45	18,9	9,8	12,95	10,9	12,85	23,25	18	4,8	2,7	5
315	-	-	-	-	-	-	-	-	-	-	-	-	-	-
317	-	-	-	-	-	-	-	-	-	-	-	-	-	-
319	12,35	14,05	5,95	2,5	19,7	10,3	13,7	9,4	12,1	22,6	17,3	4,25	2,35	5,3
323	11,6	13,5	5,2	2,45	18	9,25	12,1	10,55	10,9	21	16,3	4,85	3,35	4
324	-	-	-	-	-	-	-	-	-	-	-	5,2	-	-
326	-	-	-	-	-	-	-	9,5	10,25	20	16	4,8	2,95	4,25
327	-	-	-	-	-	-	-	-	10,55	20,45	15,4	4,55	-	-
330	11,3	15	5,3	2,1	18,7	10,05	12,9	10,2	12,4	23	16,4	4,4	2,2	4,65
331	10,6	13,5	5,7	2,05	18,35	10,45	13,5	-	-	-	-	-	-	-

332	11,85	13,2	5,7	2,25	19,5	10,6	13	9,15	10,25	21,2	15,4	4	2,15	4,25
333	11,4	13,2	5,4	2,3	19,3	10,3	13,95	-	-	-	-	-	-	-
335	10,8	13,6	5,35	2,55	18,75	10	12,5	-	-	-	-	-	-	-
337	-	-	-	-	-	-	-	9	11,45	22,3	16,55	3,9	2,55	4,4
339	11,1	13,6	5,3	2,55	18,5	9,9	12,5	-	-	-	-	-	-	-
340	11,35	13,7	5,6	2,4	18,4	9,5	12,7	-	11,1	21,1	16,5	5	2,1	-
342	-	-	-	-	-	-	-	-	-	-	-	-	-	-
344	11,85	13,2	5,95	2,6	20,1	10,85	13,05	-	-	-	-	-	-	-
345	11,05	13,8	5,6	2,8	18,75	10,6	13,5	9,9	11,85	20,9	16	4,4	2,6	3,65
350	9,8	11,05	4,25	2,1	16,35	8,5	12,3	-	-	-	-	-	-	-
352	-	-	-	-	-	-	-	9,6	11,15	20,85	16,4	3,85	2,55	4,5
357	-	-	-	-	-	-	-	8,95	10,1	20,3	15,9	4,1	3,15	3,7
358	-	-	-	-	-	-	-	8,3	11,6	22,2	-	4,65	2,1	4,45
363	-	-	-	-	-	-	-	-	-	-	-	-	-	-
364	-	-	-	-	-	-	-	9	9,85	19,25	14,2	5,1	2,35	4,2
365	11,95	13,9	5,3	2,55	18,9	11	13,35	-	-	-	-	-	-	-
371	-	-	-	-	-	-	-	8,6	10,7	21,1	16,5	4,5	1,95	3,9
401	-	-	-	-	-	-	-	10,7	11,15	21,7	16,45	4,8	3,4	4,7
416	11,95	13,7	5,35	2,8	18,8	10,45	13	9,8	12,15	23,45	16,1	4,5	2,6	4,7
426	-	-	-	-	-	-	-	-	-	-	-	-	-	-
428	12,3	13,1	5,5	2,65	19	9,5	13,1	9,05	11,35	21,55	15,85	4,25	2,05	4,4
429	11,5	12,9	5,2	2,5	18,1	9,25	12,6	9,1	10,15	19,8	15,8	4,65	2,55	4
438	10,6	12	4,9	2,44	17,1	9,2	13,1	9,15	9,75	19,3	-	4,1	3,15	3,55
439	-	-	-	-	-	-	-	9,7	11,85	22,7	16,6	4,95	2,6	5,15
442	11,1	13,4	5,5	2,5	17,4	9,8	13,1	-	-	-	-	-	-	-
446	11	11,75	4,55	2,1	17,2	9,45	12,45	-	-	-	-	-	-	-
453	-	-	-	-	-	-	-	-	11,5	22,85	-	4,35	2,8	-

Table 49 Results of sex estimation from discriminant functions on Inden series

		Metrical																																						
		Crania				Pelvis								Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna		
S.no.	Individual no.	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P3 (cm)+P4 (cm)	P1 (cm)+P8 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	Church book	DNA
1	82	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	F	F	M	M	F	F	F	M	F	F
2	88	M	M	F	F	F	F	F	M	F	M	F	M	M	M	M	M	M	M	M	M	M	F	F	F	F	F	M	M	M	M	M	M	M	M	F	M	M	-	F
3	91	M	F	M	M	-	-	-	-	-	-	-	-	M	M	F	M	M	M	M	M	M	M	F	M	M	M	M	M	M	M	F	M	M	F	M	M	M	-	-
4	93	M	F	F	F	-	-	-	-	-	-	-	-	M	F	M	F	F	F	F	F	F	M	F	F	F	F	F	M	M	M	F	M	M	F	F	F	F	F	F
5	96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	-	-
6	98	M	I	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	M	M	M	M	M	M	-	F	F	-	F	-
7	99	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	F	F	-	-
8	100	M	M	I	F	F	F	F	F	F	M	F	F	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	F	F	F	M	M	F	M	F	F	-	-
9	101	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	M	F	M	M	-	F	-
10	102	M	I	I	F	F	F	F	F	F	M	F	F	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	F	F	M	M	M	F	F	-	F	F	F
11	107	-	-	-	-	F	F	M	F	F	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	M	M	M	M	F	F	-	-	F
12	113	M	M	I	M	-	-	-	-	-	-	-	-	M	F	F	F	M	M	M	F	M	M	F	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	-
13	115	-	-	-	-	F	F	M	F	F	M	F	F	M	M	M	F	F	F	F	M	F	M	F	F	F	F	F	M	F	F	F	M	M	M	-	M	M	F	-
14	116	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	M	M	M	F	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	-
15	117	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	-
16	118	M	F	F	M	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	M	M	F	F	F	F	F	F
17	121	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	M	F	-	-	-	F	-
18	122	M	F	F	F	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	M	M	M	F	F	F	M	F	F
19	123	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	F	F	F	M	F	M	-	F	F	M	F	-
20	124	M	M	I	M	-	-	-	-	-	-	-	-	M	M	F	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	F	-	M	M	-	-
21	125	M	M	F	F	M	F	M	F	F	M	M	M	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M	M
22	126	M	M	M	M	M	F	F	M	M	M	M	M	M	F	M	F	M	M	M	M	M	M	F	F	F	F	M	M	M	M	M	M	M	F	M	M	M	M	M
23	127	I	M	F	F	F	F	F	F	F	F	F	F	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	F	F	F	M	M	M	F	F	M	M	F	F
24	128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	-

		Metrical																																						
		Crania				Pelvis								Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna		
S.no.	Individual no.	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P3 (cm)+P4 (cm)	P1 (cm)+P8 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	Church book	DNA
25	129	I	I	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	F	M	M	M	M	M	M	M	F	M	M	-	M	M	-	M	-
26	131	-	-	-	-	M	F	M	F	M	M	F	M	M	M	F	F	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	-	M	-	-
27	136	-	-	-	-	-	-	-	-	-	-	-	-	M	M	F	F	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	F	-	F	M	M	-
28	145	M	I	F	F	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	M	M	M	M	F	F	M	F	-
29	146	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	M	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	F	M	M	-	M	-
30	161	-	-	-	-	-	-	-	-	-	-	-	-	M	M	F	F	F	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	-	M	M	M	M
31	163	I	M	M	M	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	M	F	F	M	M	M	M	M	F	M	M	M	F	M	M	M	F	-
32	164	-	-	-	-	M	F	F	F	M	M	M	M	M	M	F	M	M	M	M	M	M	F	F	F	M	F	F	M	M	M	M	M	M	M	F	F	M	-	-
33	166	I	I	F	M	M	F	M	M	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	-	-
34	169	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	F	-
35	174	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	M	F	F	M	M	F	M	F	M	M	M	M	M	-	-	M	F	-
36	175	M	M	I	M	M	F	F	M	M	M	M	M	M	F	F	M	M	M	M	M	M	M	F	M	F	M	M	M	M	M	M	M	M	F	M	M	-	M	-
37	176	I	M	M	M	M	M	M	F	M	M	M	M	M	M	F	F	M	M	M	M	M	M	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M
38	180	-	-	-	-	-	-	-	-	-	-	-	-	M	M	F	M	F	F	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	F	M	M	M	-	-
39	181	M	I	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	182	-	-	-	-	-	-	-	-	-	-	-	-	M	M	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	M	F	M	M	F	M	M	M	-	-
41	183	I	M	F	F	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	M	M	M	F	M	-	F	-	F
42	186	I	M	I	M	-	-	-	-	-	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	-
43	193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	M	F	M	M	M	M	-	-	-	-	-	-
44	195	M	M	I	F	-	-	-	-	-	-	-	-	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
45	200	I	I	I	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	M
46	201	-	-	-	-	M	M	M	M	M	M	M	M	M	F	F	F	M	M	M	F	M	M	F	M	M	M	F	M	F	M	M	M	M	M	M	M	M	-	M
47	203	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	M	M	M	M	F	M	F	M	M	M	M	M	F	M	M	M	M	F	M	M	M	M	-
48	212	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	M	M	M	M	M	M	-	-	-	-	-	-
49	217	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	-	-	-	-	-
50	240	M	I	M	F	-	-	-	-	-	-	-	-	M	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	-
51	241	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	M	F	F	-

		Metrical																																					Church book	DNA
		Crania				Pelvis								Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna		
S.no.	Individual no.	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P3 (cm)+P4 (cm)	P1 (cm)+P8 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)		
52	242	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	-	-	-	-	-
53	243	I	F	F	F	M	F	M	M	M	M	M	M	M	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	-
54	244	F	F	F	M	M	F	M	M	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	-
55	245	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	M	F	F	M	F	M	M	M	M	-	M	M	M	F	-
56	252	F	M	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-
57	301	F	M	M	M	-	-	-	-	-	-	-	-	F	F	F	F	F	F	F	F	F	M	F	F	M	M	M	M	M	F	M	M	M	F	M	M	M	-	-
58	304	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	-	-	M	M	M	-
59	304,2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	M	M	M	F	M	F	M	M	-	-	M	M	-	-
60	305	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	F	F	F	M	F	F	M	F	M	M	M	M	M	-	-	-	-	-
61	306	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	M	M	M	M	M	M	F	F	M	M	F	M	M	M	M	M	M	F	-	M	M	M	-
62	307	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	-
63	310	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	M	M	F	F	F	F	M	F	F	F	F	F	F	M	M	F	F	-	F	F	F
64	311	F	M	M	M	M	F	M	M	F	M	M	M	M	F	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	M
65	312	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	-	-	-	-	-	-
66	313	-	-	-	-	-	-	-	-	-	-	-	-	M	M	F	M	M	M	M	M	M	M	F	F	M	M	F	M	F	F	M	M	M	F	-	-	-	F	-
67	314	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	M	M	M	M	F	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-	F	-
68	315	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	-	F	F	F	F	-
69	316	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	F	M	-	-
70	317	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	M	M	M	M	F	M	F	-	F	-
71	319	I	M	M	M	M	F	M	M	M	M	M	M	F	F	F	F	F	F	F	F	F	M	M	M	M	M	M	M	M	M	F	M	M	F	M	M	M	M	M
72	320	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	F	-
73	321	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	M	M	F	M	F	M	F	M	M	-	-	-	-	M	-
74	322	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	M	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	M	-
75	323	I	M	I	F	M	F	F	F	F	M	F	M	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	M	M	M	M	F	M	F	F	F	-
76	324	-	-	-	-	M	F	M	F	F	M	F	F	M	F	F	F	F	F	F	F	F	M	F	F	M	F	F	F	F	F	M	M	M	M	F	-	-	F	-
77	326	-	-	-	-	M	F	M	F	F	M	F	F	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	M	-	F	F	-
78	327	-	-	-	-	-	M	M	M	-	F	-	F	F	M	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	F	M	-

		Metrical																																						
		Crania				Pelvis								Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna		
S.no.	Individual no.	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P3 (cm)+P4 (cm)	P1 (cm)+P8 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	Church book	DNA
79	330	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	-
80	331	M	M	M	M	-	-	-	-	-	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	-
81	332	M	M	M	M	M	M	M	M	F	M	M	F	F	F	F	F	F	F	F	F	F	M	F	F	M	F	F	M	M	M	M	M	M	F	M	M	M	M	M
82	333	M	M	M	M	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	M	F	F	M	F	F	M	F	F	F	M	M	M	M	M	F	M	M
83	335	M	F	M	M	-	-	-	-	-	-	-	-	M	F	F	F	M	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	F	M	M	M	M	M
84	337	-	-	-	-	M	M	M	M	F	M	M	M	M	M	F	F	M	M	M	M	M	M	M	F	M	M	M	M	F	M	M	M	M	M	M	M	M	M	-
85	338	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	F	F	F	M	M	F	-	F	-	M	F
86	339	I	I	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	M	-
87	340	I	I	M	M	M	F	F	F	F	M	M	M	M	M	F	F	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	-
88	342	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	F	F	F	M	M	F	F	-	F	F	-
89	343	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	-	-	F	F	-
90	344	I	I	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-
91	345	I	I	M	M	M	F	M	F	F	M	M	M	M	F	F	M	M	M	M	M	M	M	F	F	M	M	M	M	M	M	M	M	M	F	M	M	M	M	-
92	347	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	-
93	348	-	-	-	-	-	-	-	-	-	-	-	-	M	M	F	F	M	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-
94	350	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-
95	351	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	M	F	-
96	352	-	-	-	-	M	F	F	F	F	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-
97	353	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	F	F	M	M	M	F	-	-	-	-	-
98	355	-	-	-	-	F	F	F	F	F	F	F	F	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	F	F	Not sure	-
99	356	I	I	I	M	-	-	-	-	-	-	-	-	M	M	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	-
100	357	-	-	-	-	M	M	M	F	F	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	F	M	F	M	M	M	M	F	F	F	-
101	358	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	-	F	-
102	360,1	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	M	F	F	M	F	F	M	M	F	M	M	M	M	F	-	-	F	F
103	362	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	M	-	-
104	363	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	M	F	F	F	F	F	F

		Metrical																																						
		Crania				Pelvis								Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna		
S.no.	Individual no.	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P3 (cm)+P4 (cm)	P1 (cm)+P8 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	Church book	DNA
105	364	-	-	-	-	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	M	M	M	F	M	F	F	F	-
106	365	F	M	M	M	-	-	-	-	-	-	-	-	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	F	-	-	M	F	-
107	366	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
108	368	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	M	F	F	M	F	F	M	F	M	M	M	M	F	F	-	-	F	-
109	371	-	-	-	-	M	M	M	F	F	M	M	M	M	F	F	M	F	M	F	F	M	F	F	M	M	M	M	M	M	M	M	M	M	F	M	-	M	M	-
110	373,1	F	M	I	F	-	-	-	-	-	-	-	-	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	M	M	M	F	F	F	F	-	-
111	374	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M	F	F	F	F	-	-
112	375	-	-	-	-	M	F	M	F	F	M	F	F	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	M	F	F	F	F	-	-
113	378	-	-	-	-	M	F	F	M	F	M	M	M	M	F	F	M	F	F	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	F	M	M	M	-	-
114	379	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-
115	401	-	-	-	-	F	F	F	M	F	M	F	M	M	F	F	F	F	F	F	F	F	M	F	F	M	M	M	M	F	F	F	M	M	M	M	M	F	F	F
116	405	-	-	-	-	M	M	M	M	F	M	M	M	M	M	F	F	F	F	F	M	M	M	M	M	M	M	F	M	M	M	F	M	M	F	M	M	M	-	-
117	407	-	-	-	-	-	-	-	-	-	-	-	-	M	M	F	M	M	M	M	M	M	F	F	F	M	M	F	M	M	M	M	M	M	M	-	-	-	-	-
118	408	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	-
119	409	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	F	F	M	M	M	M	-	-	F	M	-	-
120	410	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	M	F	M	M	F	F	F	F	M	M	M	-	F	F	M	-	-
121	411	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	M	M	M	M	M	M	M	F	M	M	F	M	M	M	F	M	M	F	-	M	M	-	-
122	413	-	-	-	-	-	-	-	-	-	-	-	-	M	M	F	F	F	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	-	-	M	-	-
123	415	M	M	M	M	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-
124	416	I	M	M	M	M	F	M	M	F	M	M	M	M	M	F	M	M	M	F	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	-	M	M	M	-
125	417	I	M	I	M	-	-	-	-	-	-	-	-	F	M	F	F	M	M	M	F	M	M	M	F	M	M	M	M	M	M	M	M	M	F	M	M	M	-	-
126	417,2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	-	-
127	418	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	M	-	-
128	419	-	-	-	-	M	F	M	M	F	M	M	M	M	M	F	M	M	M	M	M	M	M	M	F	M	M	F	M	F	M	F	M	M	M	M	M	M	-	-
129	420	-	-	-	-	-	-	-	-	-	-	-	-	M	M	F	F	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	F	M	M	M	-	-
130	422,1	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-
131	424	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	-	-

		Metrical																																						
		Crania				Pelvis								Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna		
S.no.	Individual no.	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P3 (cm)+P4 (cm)	P1 (cm)+P8 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	Church book	DNA
132	425	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	F	M	M	M	M	M	F	M	F	M	M	-	-	M	-	-	-
133	426	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	M	M	M	F	F	M	F	F	M	F	F	M	F	M	M	M	M	F	M	M	M	M	-
134	428	F	M	I	M	M	F	M	M	F	M	M	M	M	F	F	F	F	F	F	F	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	-	M
135	429	I	I	I	F	M	M	M	F	F	M	F	F	M	M	F	F	M	M	M	M	F	F	F	F	F	F	F	F	F	F	M	M	M	F	F	-	F	-	-
136	434	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-	-
137	436	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	F	F	F	M	F	F	M	F	F	F	M	M	M	-	F	-	-	M
138	437	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	F	M	F	M	M	M	F	M	M	M	M	-	M	-	-	-	-
139	438	I	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	F	F	F	F	F	F	M	F	F	M	M	F	F	-	M	-	-
140	439	-	-	-	-	M	F	F	M	F	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-
141	442	I	I	M	M	-	-	-	-	-	-	-	-	M	F	F	F	M	F	F	F	F	M	F	F	M	F	F	M	F	F	F	M	M	F	M	-	F	F	F
142	443	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	F	F	F	M	M	F	-	-	F	-	-
143	446	F	F	F	F	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	F	F	F	M	M	F	F	-	-	F	F
144	448	-	-	-	-	M	M	M	F	F	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
145	453	-	-	-	-	M	F	M	M	F	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-
146	456	-	-	-	-	M	F	M	M	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Legend – M: Male, F: Female, (-): Not available

Table 50 Results of sex estimation from discriminant functions on Lübeck series

Metrical - Lübeck																																								
		Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna	Pelvis								Crania				Mandible	
S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	Molecular sex
1	876	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	F	F	F	F	M	M	-	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	883	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	884	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	884,1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-
5	884,2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-
6	886	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	M	-	-	-	F	M	F	-	F	-	F	-	-	-	-	-	-
7	887	F	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	M	M	-	-	F	-	-	-	-	-	-	-	F
8	888	M	M	-	-	-	-	-	-	-	M	-	-	F	-	F	F	F	F	M	M	M	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	889	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	-	-	M	-	-	-	-	-	-	-	-
10	890	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	M	M	F	F	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	891	F	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	-	F	F	-	-	F	-	F	M	I	I	F	F	-
12	892	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	-	-	M	-	M	-	-	-	-	-	-
13	894	-	-	-	-	-	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	900	-	-	-	-	-	-	-	-	-	F	F	F	M	F	F	M	F	M	F	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	909	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-
16	910	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-	-
17	913	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	-
18	915	M	M	-	-	-	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	F	M	F	M	I	M	M	F	M	-
19	916	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	-	M	M	M	F	F	-
20	917	M	M	-	-	-	-	-	-	-	M	F	F	F	F	F	F	F	F	F	F	F	-	M	M	M	M	F	M	M	F	F	F	M	M	F	M	M	-	-

Metrical - Lübeck																																								
		Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna	Pelvis								Crania				Mandible	
S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	Molecular sex
21	919	M	M	-	-	-	-	-	-	-	M	F	M	M	M	M	M	M	F	M	M	M	M	M	M	M	-	-	-	-	-	M	-	-	-	I	-	-	F	-
22	920	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	-	F	-	F	-	F	F	F	-	M	-	-	M	F	I	M	-	-
23	921	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	I	F	F	F	-
24	922	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	-	-	F	-	-	-	-	-	-	F	-
25	923	M	M	-	-	-	-	-	-	-	M	F	M	F	F	M	M	F	M	M	M	M	M	-	-	-	M	F	M	M	M	M	F	M	I	F	I	F	F	-
26	929	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	I	F	-	-
27	942	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	-	-	-	-	F	F	F	-	F	-	F	-	-	-	-	-	-
28	950	M	M	-	-	-	-	-	-	-	M	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	M	F	M	M	M	-	-	-	-	-	-
29	958	F	F	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	-	F	F	F	-	F	-	F	-	-	-	-	-	F
30	960	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	-	M	-	-	-	-	-	-	-	-
31	962	M	F	M	-	-	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	M	M	F	M	-	-	-	-	-	-
32	964	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	F	-	F	F	F	-	F	-	F	-	-	-	-	-	-
33	965	M	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	F	M	M	M	F	F	M	F	M	M	F	I	I	I	F	F	-
34	966	-	-	-	-	-	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	-	-	-	-	-	F	M	-	-	M	-	M	-	-	-	-	-	-
35	971	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F
36	972	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
37	984	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	M	-	M	-	M	-	-	-	-	-	-
38	986	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	M	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
39	988	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	M	M	F	F	F	M	F	-	-	-	-	-	-
40	989	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41	990	F	F	F	F	F	F	F	F	F	F	-	F	-	-	F	M	F	F	M	M	M	-	F	-	-	F	F	F	F	F	F	M	F	-	-	-	-	F	-
42	994,1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-

Metrical - Lübeck																																								
		Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna	Pelvis								Crania				Mandible	
S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	Molecular sex
43	995	M	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44	996	M	F	F	F	F	F	-	-	-	M	F	F	F	F	F	F	F	F	M	M	M	F	M	F	M	-	-	-	-	-	F	-	-	-	-	-	-	-	-
45	1003	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	F	F	M	-	M	-	M	-	-	-	-	-	M
46	1005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	F	-	-	F	F	F	-	M	-	-	I	F	F	-	-	F
47	1033	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	-	-	M	-	-	-	-	-	-	-	-
48	1037	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	M	M	F	-	M	-	M	-	-	-	-	-	-
49	1075	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	-	-	-	F	F	M	F	F	F	M	F	-	-	-	-	-	-
50	1076	M	M	-	-	-	-	-	-	-	F	M	M	M	M	M	M	M	M	M	M	M	M	-	M	M	M	F	F	M	F	M	M	M	-	-	-	-	-	-
51	1077	F	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
52	1084	M	M	-	-	-	-	-	-	-	F	F	M	M	M	M	M	M	M	M	M	M	M	-	-	M	-	F	F	F	-	M	-	M	-	-	-	-	-	-
53	1089	M	F	F	F	M	-	-	-	-	M	F	F	M	F	F	M	M	F	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
54	1090	F	F	F	F	F	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M	M	F	-	-	-	F	F	F	F	M	F	M	F	-	-	-	-	-	-
55	1094	M	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
56	1095,1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	M	M	-	-	-	-	-	-
57	1095,2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	M	F	M	M	M	-	-	-	-	-	-
58	1096	M	M	-	-	-	-	-	-	-	M	F	F	M	M	M	M	F	F	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
59	1097	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	M	F	F	F	M	F	F	M	F	F	F	F	F	F	-
60	1099	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	M	F	M	-	-	-	-	-	-
61	1102	F	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	M	-	-	F	F	F	M	F	-	-	-	-	-	-
62	1105	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	M	M	M	F	-	F	F	M	M	M	F	F	M	M	F	-	-	-	-	-	F
63	1106	F	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	-	F	F	M	F	-	-	-	-	-	-
64	1109	F	M	-	-	-	-	-	-	-	F	F	F	F	F	F	M	M	F	M	M	M	M	-	-	-	M	M	M	F	M	F	F	M	-	-	-	-	-	-

Metrical - Lübeck																																								
		Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna	Pelvis								Crania				Mandible	
S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	Molecular sex
65	1111	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	M	F	F	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
66	1122	F	M	-	-	-	-	-	-	-	F	F	F	F	F	F	M	F	F	F	M	M	F	M	-	-	F	F	F	F	F	F	M	F	-	-	-	-	-	-
67	1123	M	M	-	-	-	-	-	-	-	M	F	M	F	M	M	M	M	M	M	M	M	M	-	-	-	-	F	F	-	-	M	-	-	-	-	-	-	-	-
68	1126	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	F	M	M	-	M	-	M	-	-	-	-	-	-
69	1133	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	-	M	-	-	M	F	M	-	M	-	-	-	-	-	M
70	1140	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	-	-	F	F	F	-	M	-	-	-	-	-	-	-	-
71	1144	M	M	-	-	-	-	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M	-	-	-	M	F	M	F	F	M	M	M	-	-	-	-	-	-
72	1154	M	F	M	-	-	-	-	-	-	M	F	F	F	F	F	M	M	-	-	M	-	M	M	F	M	M	M	M	M	F	M	M	M	-	-	-	-	-	M
73	1156	M	F	F	F	M	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	-	M	M	M	M	F	M	F	M	-	-	-	-	-	M
74	1171	M	M	-	-	-	-	-	-	-	M	-	M	-	-	M	M	M	M	M	M	M	-	M	M	-	-	F	M	M	-	M	-	-	I	M	M	-	F	-
75	1172	M	M	-	-	-	-	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	F	M	-	-	-	-	F	-
76	1174	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	F	M	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
77	1176	-	-	-	-	-	-	-	-	-	M	F	F	M	M	M	M	F	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
78	1180	-	-	-	-	-	-	-	-	-	F	F	F	M	M	F	M	F	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
79	1181	-	-	-	-	-	-	-	-	-	M	F	F	M	M	M	M	M	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80	1183	F	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
81	1184	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	M	F	F	F	M	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
82	1185	-	-	-	-	-	-	-	-	-	F	M	M	M	M	M	M	M	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
83	1186	-	-	-	-	-	-	-	-	-	M	F	F	M	F	M	M	M	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
84	1188	M	M	-	-	-	-	-	-	-	M	F	F	M	M	M	M	M	M	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
85	1189	M	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
86	1195	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Metrical - Lübeck																																								
		Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna	Pelvis								Crania				Mandible	
S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	Molecular sex
87	1202	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	M	M	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
88	1203	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	M	-	-	-	-	-	-	-	-	-	-	-	-	-	F
89	1204	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	F	F	F	M	F	F	F	M	F	-	-	-	-	-	F
90	1205	-	-	-	-	-	-	-	-	-	F	F	F	M	M	F	M	M	F	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
91	1207	M	-	-	-	-	-	-	-	-	F	M	M	F	M	F	M	F	F	F	M	M	-	M	M	M	M	M	M	-	F	M	-	M	-	-	-	-	-	-
92	1207,1	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	M	F	F	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
93	1207,2	-	-	-	-	-	-	-	-	-	M	M	F	M	M	M	M	F	M	M	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
94	1212	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	F	-	-	F	F	F	F	F	F	M	F	-	-	-	-	-	-
95	1213	M	-	-	-	-	-	-	-	-	M	-	M	-	-	M	M	M	M	M	M	M	-	-	-	M	M	M	M	F	M	F	F	M	-	-	-	-	-	-
96	1217	F	F	F	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	-	-	F	-	-	-	-	-	-	-	M
97	1218	M	M	-	-	-	-	-	-	-	M	F	F	M	F	F	F	F	F	F	F	F	-	M	-	-	-	F	M	M	-	M	-	M	-	-	-	-	-	-
98	1220	F	-	-	-	-	-	-	-	-	F	F	F	F	F	F	M	M	F	M	M	M	-	-	-	-	F	M	M	F	M	F	F	F	-	-	-	-	-	-
99	1221	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I	M	I	M	F	-
100	1223	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	F	M	F	M	M	F	F	F	M	F	-	-	-	-	-	F
101	1225	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	I	F	-	F
102	1226	M	M	-	-	-	-	-	-	-	M	F	F	F	F	F	M	F	M	M	M	M	M	-	-	-	M	F	M	F	F	F	M	F	M	F	F	F	-	-
103	1227	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	F	F	M	M	F	F	M	I	F	-	M
104	1228	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	-	F	-	M	-	F	F	-	-	F	-	-	F	I	I	F	F	-
105	1229	M	F	M	-	-	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	M	-	M	-	M	M	M	F	F	M	M	M	-	M	-	-	-	-
106	1232	M	-	-	-	-	-	-	-	-	M	-	M	-	-	M	M	M	M	M	M	M	-	-	-	M	M	F	F	-	F	M	-	M	-	-	-	-	-	M
107	1233	M	M	-	-	-	-	-	-	-	F	F	F	F	F	F	M	M	M	F	M	M	M	M	M	M	-	F	F	-	-	F	-	F	-	-	-	-	-	-
108	1234	M	F	M	-	-	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	F	M	F	M	I	F	F	F	F	M

Metrical - Lübeck																																								
		Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna	Pelvis								Crania				Mandible	
S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	Molecular sex
109	1245	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	M	M	F	M	M	M	-	M	-	-	M	F	F	M	F	M	F	M	-	M	-	-	F	-
110	1249	M	M	-	-	-	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	-	M	M	M	-	F	-	M	M	I	M	M	-	-
111	1250	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	F	-	M	-	F	M	F	-	F	-	F	-	-	-	-	-	-
112	1252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	M	M	-	F	-	-	-	-	-	-	-	-
113	1254	-	-	-	-	-	-	-	-	-	M	-	-	F	-	-	-	-	-	-	-	-	-	M	-	-	M	F	F	F	F	F	M	F	-	-	-	-	-	-
114	1257	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I	F	I	F	F	-
115	1259	M	F	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	F	F	F	M	M	M	-	-	-	-	-	-
116	1264	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	F	F	F	-	F	-	M	-	-	-	-	-	-
117	1269	M	M	-	-	-	-	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M	-	-	-	M	M	M	-	F	M	M	M	-	-	-	-	-	-
118	1272	F	M	-	-	-	-	-	-	-	F	-	-	F	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	F	M	F	-	-	-	-	-	-
119	1273	F	F	F	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	M	F	F	M	F	-	-	-	-	-	-
120	1276	M	M	-	-	-	-	-	-	-	M	F	F	F	F	F	M	M	M	M	M	M	M	M	-	-	M	M	M	M	F	M	M	M	-	-	-	-	-	-
121	1277	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	M	F	M	F	M	-	-	-	-	-	-
122	1278	M	M	-	-	-	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	M	M	M	F	F	M	M	M	-	-	-	-	-	-
123	1282	M	M	-	-	-	-	-	-	-	M	M	M	M	M	M	M	F	M	M	M	M	M	-	-	-	M	F	F	-	F	M	-	M	-	-	-	-	-	-
124	1284	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	M	M	M	M	M	M	F	M	-	F	F	F	-	F	-	M	-	-	-	-	-	-
125	1286	F	F	F	F	F	F	F	F	F	M	F	F	F	F	-	M	F	M	-	M	-	F	F	-	-	-	F	F	F	-	F	-	-	I	F	F	F	-	F
126	1290	M	M	-	-	-	-	-	-	-	M	-	-	M	-	-	-	-	-	-	-	-	-	M	M	-	-	F	F	F	-	M	-	-	-	-	-	-	-	-
127	1298	F	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	F	F	M	F	M	F	M	-	-	-	-	-	-
128	1299	M	M	-	-	-	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	M	F	F	M	M	M	M	F	F	F	-	-
129	1303	M	M	-	-	-	-	-	-	-	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	M	M	-	-	-	-	-	-
130	1316	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	M	M	M	F	M	-	M	F	F	F	F	F	M	M	F	-	-	-	-	-	-

Metrical - Lübeck																																								
		Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna	Pelvis								Crania				Mandible	
S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	Molecular sex
131	1319	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	I	I	F	-	F
132	1327	-	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	M	F	-	-	F	F	M	-	F	-	F	F	F	F	F	-	-
133	1328	F	F	F	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	M	-	F	F	F	F	F	F	F	M	F	-	-	-	-	-	-
134	1329	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	-	-
135	1330	M	M	-	-	-	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	M	-	-	-	M	F	F	M	F	M	F	M	-	-	-	-	-	-
136	1331	F	-	-	-	-	-	-	-	-	F	F	F	F	F	-	M	F	-	-	M	-	-	-	F	F	-	F	F	F	-	F	-	F	-	-	-	-	-	M
137	1332	M	F	F	-	-	-	-	-	-	F	-	-	M	-	-	-	-	M	M	-	M	-	-	-	-	-	M	M	-	-	F	-	F	-	-	-	-	-	-
138	1337	M	M	-	-	-	-	-	-	-	M	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	-	F	M	-	M	-	-	-	-	-	-
139	1339	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	M	M	F	F	F	M	F	F	I	F	F	-	-
140	1340	M	M	-	-	-	-	-	-	-	M	F	M	F	F	M	M	M	M	M	M	M	M	M	M	M	M	F	M	F	F	M	M	M	-	-	-	-	-	-
141	1341	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	-	F
142	1345	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
143	1347	M	F	M	-	-	-	-	-	-	M	F	M	M	M	M	M	F	M	M	M	M	M	M	-	-	-	F	M	M	-	F	-	M	-	-	-	-	-	-
144	1348	F	F	F	-	-	-	-	-	-	F	F	F	F	F	F	M	F	M	M	M	M	-	-	F	M	F	F	F	F	F	F	M	F	F	I	F	F	-	-
145	1354	M	F	F	F	F	F	F	F	F	F	-	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	-	-	F	-	F	-	-	-	-	-	-
146	1355	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	I	F	F	-	F
147	1357	F	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	M	F	-	-	-	-	-	F
148	1358	M	-	-	-	-	-	-	-	-	M	-	-	F	-	-	-	-	-	-	-	-	-	M	M	M	-	F	M	-	-	F	-	-	-	-	-	-	-	-
149	1360	M	M	-	-	-	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	M	-	M	-	M	M	M	-	F	M	M	M	-	-	-	-	-	-
150	1362	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-
151	1363	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	F	M	M	-	M	-	M	-	-	-	-	-	-
152	1366	M	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	-	F	F	F	-	M	-	-	-	-	-	-	-	-

Metrical - Lübeck

		Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna	Pelvis								Crania				Mandible	
S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	Molecular sex
153	1367	M	-	-	-	-	-	-	-	-	F	F	F	M	F	F	M	F	-	F	M	-	F	-	-	-	-	F	F	F	-	F	-	-	-	-	-	-	-	-
154	1374	M	M	-	-	-	-	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M	-	-	-	M	F	M	F	F	M	M	M	-	-	-	-	-	-
155	1375	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	F	M	M	F	F	M	M	-	-	-	-	-	-
156	1378	F	F	F	F	F	F	F	F	F	F	F	F	F	F	-	M	F	-	-	M	-	F	-	F	-	F	F	F	F	F	F	M	F	-	-	-	-	-	-
157	1383	F	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	M	F	-	F	-	F	-	-	-	-	-	F
158	1390	F	F	F	F	F	F	F	F	F	F	M	F	M	M	F	M	F	-	-	M	-	M	M	F	-	-	F	F	F	-	F	-	F	-	-	-	-	-	F
159	1391	M	F	F	F	F	F	F	F	F	F	-	F	-	-	F	F	-	F	F	-	M	-	F	-	F	M	F	M	F	F	F	M	F	F	F	F	F	-	F
160	1392	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	F	M	F	M	M	M	-	-	-	-	-	-
161	1394	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	F	-	F	F	F	-	F	-	F	-	-	-	-	-	-
162	1396	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	-	M	-	F	F	F	M	F	F	M	F	-	-	-	-	-	-
163	1399	F	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	M	M	M	-	F	-	F	-	-	-	-	-	-
164	1401	M	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	-	F	F	-	-	F	-	-	I	I	F	-	F	-
165	1403	M	M	-	-	-	-	-	-	-	M	M	M	M	M	M	M	-	M	M	-	M	M	M	M	M	-	F	M	F	-	M	-	M	-	-	-	-	-	-
166	1404	M	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	-	F	-	-	-	-	-	-	F	-
167	1407	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	M	F	-	M	-	-	-	-	-	-	-	-
168	1408	F	F	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	-	F	F	-	F	F	-	-	-	F	-	-	-	F
169	1411	F	M	-	-	-	-	-	-	-	F	F	F	F	F	F	M	M	M	F	M	M	M	M	F	M	F	M	M	F	F	M	M	F	-	-	-	-	-	-
170	1415	M	F	F	F	F	F	F	F	F	M	F	F	F	F	-	M	F	-	-	M	-	F	M	-	M	M	F	F	M	F	F	M	F	-	-	-	-	-	M
171	1416	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	I	I	F	F	F
172	1417	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	I	I	F	-	F
173	1422	M	F	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	-	M	F	F	F	F	M	M	M	-	-	-	-	-	M
174	1423	F	M	-	-	-	-	-	-	-	M	F	F	M	M	F	M	M	M	M	M	M	M	-	-	-	-	M	M	F	-	M	-	-	-	-	-	-	-	-

Metrical - Lübeck																																								
		Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna	Pelvis								Crania				Mandible	
S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	Molecular sex
175	1426	M	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	M	F	M	M	F	F	M	F	F	M	F	-	-	-	-	-	-
176	1427	M	F	F	F	F	F	F	F	F	F	-	-	F	-	-	-	-	-	-	-	-	-	M	F	M	F	F	M	M	F	M	M	F	F	F	F	F	-	F
177	1428	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	-	-
178	1429	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	M	M	F	F	M	M	M	M	I	I	M	F	-
179	1431	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	M	M	F	F	F	M	F	-	-	-	-	-	-
180	1432	M	-	-	-	-	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	-	F	F	-	F	F	I	I	F	F	-
181	1433	M	M	-	-	-	-	-	-	-	M	F	F	M	M	F	-	-	-	-	-	-	-	-	M	-	-	F	M	M	-	M	-	M	-	-	-	-	-	-
182	1440	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	-	F	F	F	M	-	-	-	-	-	M
183	1441	M	M	-	-	-	-	-	-	-	M	F	F	F	F	F	M	M	F	M	M	M	M	-	M	M	M	F	F	M	F	M	F	M	-	-	-	-	-	M
184	1443	F	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	F	-	M	-	F	F	F	-	F	-	F	-	-	-	-	F	F
185	1449	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	M
186	1456	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	M	F	F	M	M	M	F	F	F	F	F	F
187	1457	M	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	M	-	M	M	M	-	F	-	M	F	I	F	F	-	F
188	1458	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F
189	1460	F	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	M	F	F	M	F	F	F	F	-	-	-	-	-	-
190	1462	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	F	F	F	-	F	-	M	-	-	-	-	-	M
191	1463	F	F	F	F	F	F	F	F	F	F	-	-	F	-	-	-	-	-	-	-	-	F	-	-	F	-	F	M	F	-	F	-	F	-	-	-	-	-	F
192	1464	M	-	-	-	-	-	-	-	-	F	F	F	M	M	M	M	M	M	M	M	M	-	-	-	M	-	F	F	M	-	M	-	M	-	-	-	-	-	F
193	1509	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	M	F	F	F	M	F	I	I	F	F	-	F
194	1510	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	F	M	F	F	M	M	F	I	F	F	-	F
195	1511	F	F	F	F	F	F	F	F	F	F	F	F	F	F	-	M	F	-	-	M	-	F	M	F	M	-	F	M	F	-	F	-	F	F	I	F	F	F	F
196	1512	F	-	-	-	-	-	-	-	-	F	F	F	F	F	F	M	F	M	M	M	M	-	-	F	M	F	F	F	F	F	F	M	F	-	-	-	-	F	F

Metrical - Lübeck																																								
		Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna	Pelvis								Crania				Mandible	
S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	Molecular sex
197	1513	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	F	M	F	M	F	M	F	F	F	F	-	-
198	1516	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	I	I	M	-	M
199	1519	F	F	F	F	F	F	F	F	F	F	-	F	-	-	F	F	F	F	F	M	M	-	F	F	F	F	F	M	M	F	F	M	F	F	F	F	F	F	-
200	1525	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	M	F	F	M	M	F	F	I	I	-	-	F
201	1526	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I	M	M	M	F	M
202	1532	M	F	F	F	F	F	F	F	F	M	-	F	-	-	F	M	F	M	M	M	M	-	F	F	M	M	F	M	F	F	F	M	F	-	-	-	-	-	F
203	1533	F	-	-	-	-	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	-	F	-	-	M	M	M	M	F	M	M	F	I	I	M	M	-	-
204	1535	M	M	-	-	-	-	-	-	-	M	F	F	F	F	M	M	F	M	M	M	M	-	M	M	M	F	M	M	F	F	F	M	F	M	F	F	F	-	-
205	1537	M	-	-	-	-	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	M	M	M	F	M	F	M	-	-	-	-	-	-
206	1545	F	F	F	F	F	F	F	F	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	M	M	F	M	F	M	I	I	F	-	M
207	1546	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	M	F	F	-	F	F	F	-	F	-	F	-	-	-	-	-	-
208	1548	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	-	F	-	F	-	-	-	-	-	-
209	1550	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	-
210	1551	M	M	-	-	-	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	F	M	M	M	-	-	-	-	-	-
211	1552	M	M	-	-	-	-	-	-	-	M	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	F	F	F	M	F	I	I	M	F	-
212	1554	F	-	-	-	-	-	-	-	-	F	-	F	-	-	F	M	F	F	M	M	M	-	-	F	-	F	F	F	M	F	F	M	F	F	F	F	F	F	-
213	1555	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	F	-	-	-	-	-	-	-	-	F	F	F	F	-	-
214	1556	M	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	M	F	F	F	M	F	M	F	-	-	-	F
215	1557	M	F	F	F	F	F	F	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	F	M	F	M	F	M	-	-	-	-	-	F
216	1558	M	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	M	M	F	F	F	M	F	M	F	I	F	F	-
217	1559	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F
218	1561	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	F	F	F	-	M	-	M	-	-	-	-	-	F

Metrical - Lübeck																																								
		Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna	Pelvis								Crania				Mandible	
S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	Molecular sex
219	1564	F	F	F	F	F	F	F	F	F	F	F	F	F	F	-	M	M	M	-	M	-	F	F	M	M	F	M	M	M	F	F	M	F	M	F	F	F	-	-
220	1567	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	-
221	1568	M	M	-	-	-	-	-	-	-	M	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	-	F	F	-	-	M	-	M	I	F	F	F	-	-
222	1569	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	I	I	F	-	-
223	1571	M	F	M	-	-	-	-	-	-	F	-	-	F	-	F	-	-	-	-	-	-	-	M	M	M	-	F	M	F	-	M	-	F	I	I	I	F	-	M
224	1572	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	-
225	1573	M	M	-	-	-	-	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	M	M	F	M	F	M	F	-
226	1578	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	M	M	F	F	F	F	F	F	M	F	I	F	F	F	-	F
227	1579	F	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	M	M	F	F	F	M	F	I	F	M	M	F	F
228	1580	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	I	F	F	F	M
229	1585	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I	F	F	F	F	-
230	1588	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I	M	I	F	F	-
231	1589	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	-	M
232	1592	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	-	-
233	1593	M	M	-	-	-	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	M	M	-	-	M	F	M	M	F	M	F	M	-	-	-	-	-	-
234	1594	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	F	F	F	M	M	M	M	I	I	F	-	-
235	1595	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	I	F	F	F	F
236	1597	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	M	F	M	M	M	M	-	F	-	-	F	F	M	F	F	M	M	F	F	F	-	-	-	-
237	1599	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	F	F	F	M	M	F	F	F	M	F	F	I	F	F	F	F
238	1600	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	M	M	M	F	M	F	M	M	M	I	F	F	-
239	1601	M	-	-	-	-	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	-	M	M	M	M	M	M	F	F	M	F	F	I	M	I	F	F	-
240	1602	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F

Metrical - Lübeck

		Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna	Pelvis								Crania				Mandible	
S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	Molecular sex
241	1605	M	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	F	M	M	F	F	F	F	F	F	M	F	-	-	-	-	-	-
242	1606	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	I	F	F	-	-
243	1607	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	M	M	F	M	F	M	-	-	-	-	F	-
244	1608	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	M	F	F	F	F	M	F	F	F	M	F	F	F	I	F	F	F
245	1609	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	M	F	F	M	F	M	I	M	I	M	-	-
246	1612	F	F	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	F	M	M	M	M	M	F	F	F	F	F	I	F	F	F	-	M
247	1613	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	-	-
248	1614	M	M	-	-	-	-	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	F	M	F	M	M	M	F	F	F	-
249	1616	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	M	F	F	M	F	F	F	-
250	1625	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I	I	I	F	F	-
251	1626	M	M	-	-	-	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	F	M	F	M	F	F	I	F	-	-
252	1627	M	F	F	M	-	-	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	F	F	F	M	M	M	F	I	F	-	-
253	1628	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	F	F	F	F	M	F	F	F	F	F	F	F
254	1633	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	M	F	F	F	F	F	F	M	F	-	-	-	-	-	F
255	1635	M	F	F	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	M	M	M	F	M	F	M	I	I	I	M	-	M
256	1636	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	F	F	M	M	F	F	M	F	I	F	I	F	-	M
257	1637	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	F	M	F	M	M	M	I	M	I	M	F	-
258	1638	M	F	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	F	F	M	F	F	F	M	F	I	F	I	F	F	F
259	1639	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I	F	F	F	F	F
260	1644	M	F	F	F	F	F	F	F	F	M	F	F	F	F	M	M	M	M	M	M	M	F	F	M	M	F	M	M	F	F	F	M	F	-	-	-	-	-	-
261	1645	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	M	M	F	M	F	M	-	-	-	-	F	-
262	1646	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	I	I	F	F	F	-

Metrical - Lübeck

		Femur									Tibia												Femur+Tibia	Humerus	Radius	Ulna	Pelvis								Crania				Mandible	
S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	Molecular sex
263	1653	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	M	F	F	M	M	M	M	M	I	F	-	-
264	1657	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	M	M	M	F	M	F	M	-	-	-	-	F	-
265	1659	M	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	M	F	F	I	I	-	F	-
266	1660	F	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	M	F	F	F	M	F	F	I	F	F	-	-
267	1661	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	M	F	M	F	F	F	M	M	F	F	I	M	-	-
268	1662	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	M	M	M	M	M	F	F	M	F	F	M	F	F	F	-	-
269	1664	M	F	F	F	M	-	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	F	M	I	I	I	F	-	M
270	1665	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	F	F	F	M	F	F	M	M	F	F	F	F	-	-
271	1666	M	M	-	-	-	-	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	F	M	F	M	I	F	I	M	-	-
272	1667	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	I	F	F	F
273	1671	F	F	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	F	M	F	F	F	M	F	F	F	F	F	-	-
274	1673	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	F	F	-	-
275	1675	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	I	I	F	-	-
276	1965	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	I	F	F	-	-

Legend – M: Male, F: Female, (-): Not available

Table 51 Results of sex estimation from discriminant functions on South Africa series

S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	Known sex
1	9	M	M	F	F	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	F	M	M	M	F	F	I	I	F	M	M
2	15	M	M	F	F	F	F	F	F	F	M	F	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	F	M	F	M	M	M	F	F	F	I	M	F	M
3	18	M	M	F	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	F	I	I	M	M	M
4	58	M	F	F	F	F	F	F	F	F	F	F	F	M	M	F	M	M	F	F	M	M	M	F	M	M	M	F	M	F	M	M	M	F	F	I	I	M	M	M
5	81	M	F	M	F	F	F	F	M	F	M	F	F	F	F	M	M	F	M	M	M	M	F	F	M	M	F	F	F	F	F	M	F	F	-	F	I	I	F	F
6	84	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	F	F	M	F	F	M	F	F	M	F	F	F	F	I	I	F	F
7	91	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	M	M	M	F	F	F	F	F	F	F	F	M	F	F	F	F	I	I	I	F	M
8	177	-	-	-	-	-	-	-	-	-	M	F	F	F	F	F	M	M	M	F	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F
9	267	M	M	F	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	F	M	F	M	M	M
10	309	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	#N/A
11	514	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	F	M	M	M	M	F	M	F	M	F	F	M	F	I	F	M
12	552	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	I	F	F	F	F	F	F	F	F	F	F	F	F	F	F	I	I	F	F
13	579	M	M	M	F	F	F	F	F	F	M	F	F	F	F	F	M	M	M	M	M	M	F	F	M	M	M	M	M	M	F	M	M	F	F	M	I	M	M	M
14	702	M	M	F	F	F	F	F	F	F	M	F	F	M	M	M	M	F	F	M	M	M	M	F	M	M	M	F	M	M	M	M	M	M	F	I	I	M	F	M
15	740	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	I	F	F	F
16	754	M	M	F	F	F	F	F	F	F	M	F	M	M	M	M	M	M	F	M	M	M	M	F	M	M	M	F	F	M	F	M	M	F	F	F	I	M	M	M
17	828	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	F	M	M	M	M	F	F	M	M	M	F	F	F	F	M	F	F	F	I	I	I	F	F
18	829	M	M	F	M	F	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	M	M	F	F	F	I	I	I	M	M
19	836	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	M	M	M	M	F	F	M	M	M	M	M	F	M	M	M	F	F	F	I	F	F	M
20	837	M	M	F	F	F	F	F	F	F	M	F	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	F	F	I	I	I	F	M
21	873	M	M	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	F	M	M	M	F	I	I	M	M	M
22	883	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	F	M	M	M	M	F	M	M	M	F	F	F	F	M	M	F	F	M	F	M	M	F
23	921	F	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	M	M	F	F	M	M	M	F	F	F	F	M	M	F	F	F	I	I	F	M
24	931	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	M	M	M	M	F	F	M	M	M	F	F	F	F	F	F	F	F	F	I	F	F	F

S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	Known sex
25	939	F	M	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	F	F	M	M	M	M	F	F	F	M	F	F	F	I	F	F	M
26	949	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	F	F	F	M	F	F	F	F	F	F	F	F	F	I	F	F	F
27	987	M	M	F	M	F	F	F	F	F	M	F	M	M	M	M	M	M	M	M	M	M	M	-	-	-	M	F	F	F	F	M	M	M	F	F	I	M	F	M
28	1196	M	M	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	M	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	F	F	I	M	M	M
29	1197	M	M	F	M	F	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	M	F	F	M	F	M	M	M
30	1202	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	I	F	F	F
31	1274	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	M	F	F	M	M	M	M	M	F	F	F	M	F	F	F	I	I	F	M
32	1284	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	M	M	F	F	F	M	M	M	M	F	M	F	M	F	F	I	I	I	F	M
33	1370	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	F	F	F	F	M	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	I	I	F	F
34	1445	F	M	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	M	M	M	F	F	M	M	M	M	M	M	F	M	M	F	F	F	I	I	F	M
35	1476	M	M	F	F	M	M	M	F	F	M	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	F	F	M	M	F	-	M	F	M	M	M
36	1491	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	M	F	F	F	F	F	F	F	F	F	F	M	I	F	M	F
37	1535	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	M	M	F	F	M	M	M	M	M	F	M	F	M	F	F	I	I	I	F	M
38	1545	M	M	F	M	M	M	M	M	F	M	F	M	M	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	F	I	M	M	M
39	1557	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	F	M	M	F	F	F	F	F	F	F	F	F	I	F	F	F
40	1576	F	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	F	M	M	F	F	F	F	M	F	F	F	I	I	I	F	F
41	1653	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	F	F	F	F	F	F	F	F	F	F	F	I	I	I	F	F
42	1668	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	F	F	F	F	F	F	F	F	F	F	F	F	I	I	M	F	F
43	1671	M	M	F	F	F	F	F	F	F	M	F	F	F	F	M	M	M	M	F	M	M	F	F	M	M	M	M	M	F	F	M	M	F	F	I	I	I	F	M
44	1673	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	M	M	M	M	F	F	F	M	F	F	F	F	F	F	F	F	F	I	I	I	F	F
45	1674	M	M	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	M	M	M	M	F	F	M	M	F	M	M	F	F	M	M	F	F	F	I	I	F	M
46	1685	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	F	F	M	F	M	M	F	F	F	M	M	F	F	F	F	F	M	F	F	F	I	M	M	F
47	1693	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	F	M	M	M	-	F	M	M	M	F	F	F	F	F	F	F	F	F	I	I	F	F
48	1776	M	M	F	F	F	F	F	F	F	-	-	-	-	-	-	-	-	-	-	-	-	F	M	M	M	M	M	M	M	F	M	M	F	F	I	I	I	M	M
49	1801	M	M	F	F	M	M	M	M	F	M	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	F	M	F	M	M	M
50	1811	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	F	F	M	M	M	F	F	F	M	F	F	I	I	I	F	F
51	1890	M	M	F	F	F	F	F	F	F	M	F	M	F	F	F	M	M	F	F	M	M	M	M	M	M	M	F	F	M	F	M	M	F	F	I	I	I	F	M

S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	Known sex
52	1891	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	M	M	F	F	F	M	M	F	F	F	F	M	F	F	F	F	I	F	F	F
53	1892	F	M	F	F	F	F	F	F	F	F	F	F	M	F	F	M	M	M	F	M	M	M	F	M	M	M	M	M	F	F	F	M	F	F	F	I	M	M	M
54	1909	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	M	M	M	M	M	F	F	M	M	M	M	F	M	F	M	F	F	F	I	I	F	F
55	1912	I	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	F	F	F	M	M	F	F	F	M	M	F	F	F	F	M	F	F	F	F	I	I	M	F
56	1925	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	F	F	F	F	M	M	F	F	F	F	F	F	F	I	F	F	F
57	1930	F	M	F	F	F	F	F	F	F	F	F	M	F	M	M	M	M	M	M	M	M	M	F	M	M	M	M	M	F	F	M	M	F	F	I	I	M	F	M
58	1944	M	M	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	M	M	M	M	F	F	M	M	F	F	F	F	F	F	F	F	F	F	I	M	F	F
59	1951	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	F	F	M	F	F	F	F	F	F	F	F	F	F	I	I	F	F
60	1991	F	M	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	M	M	M	M	F	F	M	M	M	F	F	F	F	F	F	F	F	F	I	I	F	F
61	1993	M	M	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	F	I	I	I	F	M
62	2001	M	M	F	M	F	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	I	M	M	M
63	2026	I	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	F	M	M	M	M	F	F	M	M	-	-	-	-	-	-	-	-	F	I	I	I	F	F
64	2030	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	F	F	M	M	M	F	F	M	M	M	M	M	F	F	F	M	F	F	I	I	M	F	M
65	2045	M	M	M	F	F	F	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	F	F	M	M	M	F	M	I	M	M	M
66	2046	M	M	F	F	F	F	F	F	F	M	F	F	F	F	F	M	F	M	M	M	M	F	F	M	M	M	F	M	F	F	M	M	F	F	F	I	I	M	M
67	2049	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	M	F	M	M	M	F	M	M	M	F	M	F	F	F	M	F	F	M	F	M	F	M
68	2053	M	F	F	F	F	F	F	M	F	M	F	M	F	F	M	M	F	M	M	M	M	F	F	M	M	M	M	M	F	M	M	M	F	F	I	I	M	M	M
69	2058	M	F	M	M	M	M	M	M	F	M	F	M	F	F	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	F	M	M	M	F	M	I	M	M	M
70	2064	M	F	F	F	F	F	F	F	F	M	F	F	M	F	F	M	F	F	F	M	M	M	F	F	M	M	F	F	F	F	F	M	F	-	I	I	I	F	M
71	2099	M	M	F	F	F	F	F	F	F	M	F	M	F	F	M	M	M	M	M	M	M	M	F	M	M	M	M	M	M	F	M	M	M	F	M	F	M	M	M
72	2132	M	M	F	F	F	F	F	F	F	M	F	M	F	F	M	M	F	M	M	M	M	M	F	M	-	M	M	M	F	F	M	M	F	F	M	F	I	F	M
73	2140	F	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	F	M	F	M	M	F	F	M	M	M	F	M	F	F	M	M	F	F	F	I	F	F	M
74	2160	M	M	F	F	F	F	F	F	F	M	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	F	F	-	-	-	-	M
75	2167	M	M	F	F	F	F	F	F	F	M	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	M	F	F	I	I	M	M	M
76	2199	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	M	F	F	F	F	F	F	F	F	F	F	-	-	-	-	F
77	2255	M	M	F	M	M	F	M	M	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	M	F	F	M	F	M	M	M
78	2281	I	M	F	F	F	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	F	F	F	I	I	M	M

S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	Known sex
79	2303	M	M	F	M	M	M	M	M	F	M	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	M	M	F	I	I	M	M	M
80	2343	I	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	M	M	M	F	F	M	M	M	F	F	F	F	F	F	F	F	F	I	F	F	F
81	2349	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	F	F	F	M	M	F	F	F	F	F	F	I	I	I	F	F
82	2356	F	F	F	F	F	F	F	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	M	F	F	M	M	F	F	I	I	I	F	M
83	2359	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	F	F	F	F	F	F	F	F	F	F	F	F	I	I	I	F	F
84	2363	M	M	F	F	M	F	M	F	F	M	F	M	F	F	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	F	M	M	M	F	M	F	M	M	M
85	2365	M	M	F	F	F	F	F	F	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	M	F	F	M	F	M	M	M
86	2367	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	F	F	F	M	F	F	F	F	F	F	F	F	F	I	I	F	F
87	2389	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	F	F	F	M	M	F	F	M	M	M	M	M	F	F	F	M	F	F	I	I	I	F	M
88	2392	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	M	M	M	M	F	M	M	M	M	M	F	F	M	M	F	F	I	I	M	F	M
89	2401	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	M	F	F	M	M	M	M	M	F	M	M	M	F	F	F	I	M	M	M
90	2402	M	M	F	F	M	F	M	F	F	M	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	M	M	F	I	I	M	M	M
91	2404	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	F	F	F	M	M	F	F	F	M	M	M	M	F	F	F	F	F	F	F	I	I	F	F
92	2410	M	M	F	F	F	F	F	F	F	M	F	F	M	F	F	M	M	M	M	M	M	M	M	M	M	M	F	F	M	F	M	M	M	F	M	F	I	M	M
93	2653	M	F	F	F	F	F	F	F	F	M	F	F	M	F	F	M	F	M	M	M	M	F	M	M	M	M	M	M	F	F	M	M	F	F	F	I	I	F	M
94	2662	M	M	F	M	F	F	F	M	F	M	F	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	M	F	F	M	M	M	F	I	I	M	M	M
95	2735	M	M	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	F	M	M	M	F	M	M	M	M	F	M	M	F	M	M	M	F	M	M	M	M	M
96	2764	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	F	M	M	M	F	F	M	M	M	M	M	F	F	M	M	F	F	I	I	M	M	F
97	2863	I	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	F	F	F	M	M	F	F	F	F	F	M	M	F	F	F	F	F	F	F	I	F	F	F
98	2867	M	M	M	F	F	F	F	M	F	M	F	M	M	M	F	M	M	M	M	M	M	M	F	M	M	M	M	M	F	M	M	M	M	F	F	I	M	M	M
99	2892	M	M	F	F	F	F	M	M	F	M	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M	M	F	M	F	F	M	M	F	F	M	F	M	M	M
100	2935	M	M	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	M	M	M	M	F	M	M	M	M	F	F	F	F	M	M	F	F	F	I	I	F	F
101	3057	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	I	I	M	F
102	3090	M	M	F	F	M	M	M	M	F	M	F	M	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	F	M	F	M	F	M
103	3091	M	M	M	M	M	M	F	F	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	F	F	M	M	M	F	M	F	M	F	M
104	3093	M	F	F	M	F	F	F	F	F	M	F	M	F	M	M	M	M	M	M	M	M	M	F	F	M	M	M	M	F	F	M	M	F	F	F	I	I	F	M
105	3095	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	F	F	M	F	F	F	F	F	F	F	F	F	I	F	F	F

S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	Known sex
106	3099	M	M	F	M	F	F	F	F	F	M	F	M	F	M	M	M	M	M	M	M	M	M	M	M	-	M	F	F	M	F	M	M	M	F	M	F	M	F	M
107	3106	M	F	F	F	F	F	F	F	F	M	F	F	F	F	M	M	F	M	M	M	M	F	F	M	M	M	M	M	F	F	M	M	F	F	F	I	M	M	M
108	3112	M	M	M	M	M	M	M	M	F	M	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	F	I	I	M	M	M
109	3114	M	M	F	F	M	M	M	M	F	M	F	M	F	F	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	F	M	M	M	F	F	I	I	M	M
110	3116	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	M	M	M	F	F	F	F	F	M	M	F	F	F	F	F	F	F	I	F	F	F
111	3127	F	M	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	F	F	M	M	M	M	F	F	M	M	F	F	I	I	M	F	F
112	3134	M	M	F	M	M	F	M	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	M	M	F	M	F	M	M	M
113	3135	M	M	F	M	F	F	M	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	M	M	F	M	F	M	M	M
114	3143	M	M	F	F	F	F	M	M	F	M	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	F	M	M	M	F	I	I	M	F	M
115	3157	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	F	M	F	M	F	F	F	F	M	F	F	F	F	I	F	F	F
116	3159	M	M	F	M	F	F	F	F	F	F	F	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	M	M	F	M	M	M	F	F	F	I	I	M	M
117	3160	F	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	F	F	M	M	F	M	M	M	M	M	M	F	F	F	M	F	F	F	I	F	F	M
118	3162	M	M	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	M	M	M	M	F	F	M	M	M	F	F	F	F	M	M	F	F	I	I	I	M	F
119	3166	-	-	-	-	-	-	-	-	-	M	F	M	M	M	M	M	M	M	M	M	M	-	M	M	M	M	M	M	F	F	M	M	F	F	I	I	I	F	M
120	3167	M	M	F	M	M	F	M	F	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	M	M	F	M	F	M	M	M
121	3172	M	F	F	M	M	M	M	M	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	M	M	F	I	I	M	M	M
122	3180	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	F	M	F	F	F	F	M	F	F	F	F	F	I	F	F	F
123	3183	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	F	F	M	M	F	F	M	M	M	F	F	F	F	F	F	F	F	F	I	I	F	F
124	3188	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	F	F	M	F	M	F	F	F	F	F	F	F	I	F	F	F
125	3245	M	M	F	F	F	F	F	F	F	M	F	M	F	M	M	M	M	M	M	M	M	M	F	M	M	M	M	M	F	F	M	M	F	F	I	I	I	F	M
126	3282	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	M	M	M	F	F	F	F	M	M	M	F	F	F	F	F	F	F	I	I	F	F
127	3287	M	M	F	M	M	F	M	F	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	F	F	I	I	M	M
128	3290	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	M	M	F	F	M	M	M	M	M	F	F	F	M	F	F	I	I	I	F	F
129	3314	M	M	F	F	F	F	F	F	F	M	F	F	F	F	F	M	F	M	M	M	M	F	M	M	M	M	F	M	F	F	F	M	F	F	I	I	I	F	M
130	3315	I	F	F	F	F	F	F	F	F	M	F	F	M	M	M	M	F	M	M	M	M	M	F	M	M	M	M	M	F	F	M	M	F	F	M	F	M	M	M
131	3350	M	M	F	F	F	F	F	F	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	F	F	M	I	M	M	M
132	3351	M	F	F	M	F	F	M	F	F	M	F	M	F	M	M	M	M	M	M	M	M	M	F	M	M	M	M	M	F	F	M	M	F	F	M	I	I	F	M

S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	Known sex
133	3365	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	M	M	M	F	F	M	M	F	F	F	F	F	F	F	F	F	M	F	I	M	F
134	3377	M	M	F	F	F	F	F	F	F	M	F	M	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	F	I	I	F	F	M
135	3396	M	M	F	M	M	M	M	M	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	F	F	I	I	F	M
136	3404	M	M	M	M	M	M	M	M	F	M	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	F	I	I	M	M	M
137	3415	M	M	F	F	M	M	M	M	F	M	F	M	F	M	M	M	M	M	M	M	M	M	F	M	M	M	M	M	F	F	M	M	M	F	F	I	M	M	M
138	3419	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	M	F	F	F	M	F	F	F	F	F	F	F	F	F	F	I	F	F	F
139	3450	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	F	M	M	F	M	M	F	F	F	F	F	F	F	I	I	F	F
140	3453	M	M	F	F	F	F	F	F	F	M	F	M	F	F	M	M	M	M	M	M	M	M	F	M	M	M	M	M	F	F	M	M	F	F	I	I	M	F	M
141	3480	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	F	F	F	M	M	F	F	F	F	F	F	F	I	I	F	F
142	3485	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	M	M	F	F	F	F	M	M	M	F	F	M	M	F	F	F	I	I	F	M
143	3490	M	F	F	M	F	F	F	F	F	M	F	M	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	M	M	F	I	I	M	F	M
144	3491	M	F	F	F	F	F	F	F	F	M	F	M	M	M	M	F	M	F	M	M	M	M	F	M	M	M	M	M	F	F	M	M	F	F	I	I	M	M	M
145	3499	F	M	F	F	F	F	F	F	F	F	M	F	F	F	F	M	M	M	M	M	M	M	F	M	M	M	M	M	M	F	M	M	F	F	F	I	F	F	F
146	3501	F	M	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	F	F	M	M	F	F	F	F	F	M	M	F	M	F	F	F	F	I	I	I	F	F
147	3503	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	M	M	F	F	F	M	M	F	F	F	F	F	F	F	F	F	I	I	F	F
148	3507	F	F	M	F	F	F	F	M	M	F	M	F	F	F	F	F	F	F	F	M	F	M	F	F	F	-	-	-	-	-	-	-	-	F	F	I	F	F	F
149	3524	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	F	M	F	M	F	F	F	F	F	F	F	I	I	I	F	F
150	3525	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	F	M	F	M	M	F	F	M	M	F	F	F	M	F	M	F	F	F	I	I	I	F	F
151	3529	M	M	F	M	F	F	F	F	F	M	F	M	F	M	M	M	M	F	M	M	M	M	M	M	M	M	F	F	M	F	F	M	M	F	I	I	M	F	M
152	3538	I	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	M	F	F	M	M	F	-	F	M	M	M	M	F	F	F	M	F	F	F	I	I	F	M
153	3556	M	F	F	F	F	F	F	F	F	M	F	F	F	F	F	M	F	F	M	M	M	F	F	M	M	M	M	M	F	F	F	M	F	F	I	I	M	M	F
154	3582	M	M	F	F	F	F	F	F	F	M	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	M	M	M	F	M	M	M	M	M
155	3590	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	F	F	F	M	M	M	M	F	F	F	M	F	F	I	I	I	F	F
156	3610	M	M	F	M	M	M	M	M	F	M	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	I	I	M	M	M
157	3614	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	M	M	M	F	M	M	F	F	M	M	M	M	M	F	F	F	F	F	F	F	I	I	F	F
158	3618	M	M	F	F	F	F	F	F	F	M	F	M	F	F	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	F	F	M	F	F	I	I	M	M	M
159	3644	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	I	M	M	M

S.no.	Individual no.	F1 (cm)	F2 (cm)	F3 (cm)	F4 (cm)	F5 (cm)	F6 (cm)	F7 (cm)	F3 (cm)+F7 (cm)	F3 (cm)+F4 (cm)+F5 (cm)	T1 (cm)	T3 (cm)+T4 (cm)+T5 (cm)+T6 (cm)+T7 (cm)	T3 (cm)	T7 (cm)	T3 (cm)+T7 (cm)	T8 (cm)	T9	T10	T11	T12	T9*T10	T11*T12	F3 (cm)+F4 (cm)+F5 (cm)+T4 (cm)+T6 (cm)+T2 (cm)+T7 (cm)	H1 (cm)+H2 (cm)+H3 (cm)	R1 (cm)+R2 (cm)+R3 (cm)	U1 (cm)+U2 (cm)+U3 (cm)	P1 (cm)+P2 (cm)	P5 (cm)+P7 (cm) (greek)	P5 (cm)+P7 (cm)	P4 (cm)+P3 (cm)	P8 (cm)+P1 (cm)	P6 (cm)	P2 (cm)+P8 (cm)+P7 (cm)+P9 (cm)+P1 (cm)+P3 (cm)	P2 (cm)	M1 (cm)+M2 (cm)+M3 (cm)+M4 (cm)+M5 (cm)	CB1 (cm)	CB2 (cm)	CF1 (cm)	CL1 (cm)+CF1 (cm)+CL4 (cm)+CL6 (cm)+CF4 (cm)+CF5 (cm)	Known sex
160	3653	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	I	I	F	F
161	3673	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	I	I	F	F
162	3759	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F	I	F	F	F
163	3763	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	I	I	I	M	M

Table 52 Results of genetic sexing on selected individuals of Inden series

S.no.	Sample Name	PCR	Amelogenin		DYS392	GATA172D05	DYS438	DXS9898	DYS439	DXS6789
1	Inden 118	1a	X	-	-/-	9/11	-/-	12/13	-/-	20/21
		1b	X	-	-/-	9/11	-/-	12/13	-/-	20/21
	Konsensus 118		**X**	**X**	**-/-**	**9/11**	**-/-**	**12/13**	**-/-**	**20/21**
2	Inden 161	1a	X	Y	11/-	5/-	11/-	11/-	11/-	22/-
		1b	X	Y	11/-	5/-	11/-	11/-	11/-	22/-
	Rerun	5	X	Y	11/-	5/-	11/-	11/-	11/-	22/-
	Konsensus 161		**X**	**Y**	**11/-**	**5/-**	**11/-**	**11/-**	**11/-**	**22/-**
3	Inden 183	1a	-	-	-	-	-	-	-	-
		1b	X	-	-	-	-	11/-	-	(20)/-
		4a	-	-	-/-	-/-	-/-	-/-	-/-	-/-
		4b	X	-	-/-	-/-	-/-	-/-	-/-	-/-
		5a	X	-	-/-	(5)/(9)	-/-	11/-	-/-	(19)/(20)
		5b	X	-	-/-	-/-	-/-	-/-	-/-	-/-
	Konsensus 183		**X**	**X**	**-/-**	**(5)/(9)**	**-/-**	**11/11**	**-/-**	**(19)/20**
4	Inden 195	1a	X	Y	13/-	11/-	12/-	12/-	12/-	20/-
		1b	X	Y	13/-	11/-	12/-	12/-	12/-	20/-
	Rerun	1b	X	Y	13/-	11/-	12/-	12/-	12/-	20/-
	Konsensus 195		**X**	**Y**	**13/-**	**11/-**	**12/-**	**12/-**	**12/-**	**20/-**
5	Inden 310	1a	X	-	-/-	7/9	-/-	8.3/11	-/-	20/22
		1b	X	-	-/-	7/9	-/-	8.3/11	-/-	20/22
	Konsensus 310		**X**	**X**	**-/-**	**7/9**	**-/-**	**8.3/11**	**-/-**	**20/22**
6	Inden 319	1a	X	Y	(10)/11	(9)/-	9/-	11/-	13/-	21/-

S.no.	Sample Name	PCR	Amelogenin		DYS392	GATA172D05	DYS438	DXS9898	DYS439	DXS6789
		1b	X	Y	11/-	9/-	(9)/-	11/-	13/-	21/-
	Rerun	1a	X	Y	11/-	9/-	9/-	11/-	13/-	21/-
	Rerun	1b	X	Y	11/-	9/-	9/-	11/-	13/-	21/-
	Konsensus 319		**X**	**Y**	**11/-**	**9/-**	**9/-**	**11/-**	**13/-**	**21/-**
7	Inden 335	1a	X	-	-/-	-/-	(12)/-	8.3/-	(12)/-	22/-
		1b	X	Y	13/-	(5)/-	12/-	8.3/-	(12)/-	-/-
		4a	X	Y	(13)/-	5/-	12/-	8.3/-	(12)/-	22/-
		4b	X	Y	(13)/-	5/-	12/-	8.3/-	12/-	22/-
	Konsensus 335		**X**	**Y**	**13/-**	**5/-**	**12/-**	**8.3/-**	**12/-**	**22/-**
8	Inden 338	1a	X	-	-/-	-/-	-/-	11/-	-/-	15/-
		1b	X	-	-/-	5/9	-/-	11/12	-/-	15/21
		4a	X	-	-/-	5/9	-/-	11/12	-/-	15/21
		4b	X	-	-/-	5/9	-/-	11/12	-/-	15/21
	Konsensus 338		**X**	**X**	**-/-**	**5/9**	**-/-**	**11/12**	**-/-**	**15/21**
9	Inden 436	1a	X	Y	13/-	(10)/-	12/-	8.3/-	(12)/-	-/-
		1b	X	Y	13/-	10/-	12/-	8.3/-	12/-	21/-
		4a	X	Y	(13)/-	10/-	12/-	8.3/-	12/-	21/-
		4b	X	Y	13/-	10/-	12/-	8.3/-	12/-	21/-
	Konsensus 436		**X**	**Y**	**13/-**	**10/-**	**12/-**	**8.3/-**	**12/-**	**21/-**
10	Inden 442	1a	X	-	-/-	8/9	-/-	11/12	-/-	20/-
		1b	X	-	-/-	8/9	-/-	11/12	-/-	20/-
	Konsensus 442		**X**	**X**	**-/-**	**8/9**	**-/-**	**11/12**	**-/-**	**20/20**
11	Inden 446	1a	X	-	-/-	7/-	-/-	8.3/11	-/-	(20)/21
		1b	X	-	-/-	7/10	-/-	8.3/11	-/-	21/-
		4a	X	-	-/-	-/-	-/-	8.3/11	-/-	21/-
		4b	X	-	-/-	7/10	-/-	8.3/11	-/-	21/-
	Konsensus 446		**X**	**X**	**-/-**	**7/10**	**-/-**	**8.3/11**	**-/-**	**21/21**
12	Inden 82	2a	X	-	-/-	9/-	-/-	10/14	-/-	20/22
		2b	X	-	-/-	9/-	-/-	10/14	-/-	20/22
	Konsensus 82		**X**	**X**	**-/-**	**9/9**	**-/-**	**10/14**	**-/-**	**20/22**
13	Inden 88	2a	X	-	-/-	5/7	-/-	13/-	-/-	23/-
		2b	X	-	-/-	5/7	-/-	12/13	-/-	21/23
		4a	X	-	-/-	5/7	-/-	12/13	((8))/-	(21)/(23)
		4b	X	-	-/-	5/7	-/-	12/13	-/-	21/23
	Konsensus 88		**X**	**X**	**-/-**	**5/7**	**-/-**	**12/13**	**-/-**	**21/23**
14	Inden 100	2a	X	-	-/-	5/10	-/-	12/13	-/-	20/-
		2b	X	-	-/-	5/10	-/-	12/13	-/-	20/-
	Konsensus 100		**X**	**X**	**-/-**	**5/10**	**-/-**	**12/13**	**-/-**	**20/20**
15	Inden 107	2a	X	-	-/-	5/-	-/-	8.3/-	-/-	20/-
		2b	X	-	-/-	5/9	-/-	8.3/12	-/-	20/21
		4a	X	-	-/-	-/-	-/-	-/-	-/-	20/21
		4b	X	-	-/-	5/-	-/-	8.3/12	-/-	20/-
	Konsensus 107		**X**	**X**	**-/-**	**5/9**	**-/-**	**8.3/12**	**-/-**	**20/21**

S.no.	Sample Name	PCR	Amelogenin		DYS392	GATA172D05	DYS438	DXS9898	DYS439	DXS6789
16	Inden 176	2a	-	Y	12/-	7/-	10/-	-/-	11/-	20/(21)
		2b	X	Y	12/-	7/-	10/-	13/-	11/-	20/-
		4a	X	Y	12/-	(7)/-	10/-	13/-	11/-	20/-
		4b	X	-	12/-	-/-	-/-	-/-	11/-	-/-
	Konsensus 176		**X**	**Y**	**12/-**	**7/-**	**10/-**	**13/-**	**11/-**	**20/-**
17	Inden 200	2a	X	Y	13/-	9/-	12/-	13/-	13/-	23/-
		2b	X	Y	13/-	9/-	12/-	13/-	13/-	23/-
	Konsensus 200		**X**	**Y**	**13/-**	**9/-**	**12/-**	**13/-**	**13/-**	**23/-**
18	Inden 311	2a	X	Y	13/-	((6))/((8))	12/-	11/-	(12)/-	20/-
		2b	X	Y	13/-	8/-	12/-	11/-	12/-	20/-
		4a	X	Y	13/-	(8)/-	(12)/-	(11)/-	(12)/-	(20)/-
		4b	X	Y	13/-	8/-	12/-	11/-	12/-	20/-
	Konsensus 311		**X**	**Y**	**13/-**	**8/-**	**12/-**	**11/-**	**12/-**	**20/-**
19	Inden 323	2a	X	-	-/-	9/11	-/-	8.3/10	-/-	19/21
		2b	X	-	-/-	9/11	-/-	8.3/10	-/-	19/21
	Konsensus 311		**X**	**X**	**-/-**	**9/11**	**-/-**	**8.3/10**	**-/-**	**19/21**
20	Inden 332	2a	X	-	-/-	-/-	-/-	8.3/-	-/-	-/-
		2b	X	Y	13/-	-/-	12/-	-/-	11/-	23/-
		4a	X	Y	13/-	(5)/-	12/-	8.3/-	-/-	21/-
		4b	X	Y	13/-	5/-	12/-	8.3/14	((11))/((13))	?/21
	Konsensus 332		**X**	**Y**	**13/-**	**5/-**	**12/-**	**8.3/-**	**(11)/-**	**21/23**
21	Inden 333	2a	X	Y	13/-	9/-	12/-	12/-	12/-	23/-
		2b	X	Y	13/-	9/-	12/-	12/-	12/-	23/-
	Konsensus 333		**X**	**Y**	**13/-**	**9/-**	**12/-**	**12/-**	**12/-**	**23/-**
22	Inden 428	2a	X	Y	13/-	9/-	12/-	12/-	(12)/-	21/-
		2b	X	Y	13/-	9/-	12/-	12/-	12/-	21/-
	Konsensus 428		**X**	**Y**	**13/-**	**9/-**	**12/-**	**12/-**	**12/-**	**21/-**
23	Inden 93	3a	X	-	-/-	5/8	-/-	11/12	((15))/-	15/-
		3b	X	-	-/-	5/8	-/-	11/12	-/-	15/20
		4a	X	-	-/-	5/8	-/-	11/12	-/-	15/20
		4b	X	-	-/-	5/8	-/-	11/12	-/-	15/20
	Konsensus 93		**X**	**X**	**-/-**	**5/8**	**-/-**	**11/12**	**-/-**	**15/20**
24	Inden 102	3a	X	-	-/-	9/-	-/-	11/12	-/-	22/-
		3b	X	-	-/-	9/-	-/-	11/12	-/-	22/-
	Konsensus 102		**X**	**X**	**-/-**	**9/9**	**-/-**	**11/12**	**-/-**	**22/22**
25	Inden 122	3a	X	-	-/-	9/11	-/-	11/13	-/-	22/-
		3b	X	-	-/-	9/11	-/-	11/13	-/-	22/-
	Konsensus 122		**X**	**X**	**-/-**	**9/11**	**-/-**	**11/13**	**-/-**	**22/22**
26	Inden 125	3a	X	Y	13/-	9/-	12/-	12/-	13/-	21/-
		3b	X	Y	(12)/13	9/-	12/-	12/-	13/-	21/-
	Rerun	3b	X	Y	13/-	9/-	12/-	12/-	13/-	21/-
	Konsensus 125		**X**	**Y**	**13/-**	**9/-**	**12/-**	**12/-**	**13/-**	**21/-**
27	Inden 126	3a	X	Y	13/-	5/-	12/-	12/-	12/-	22/-

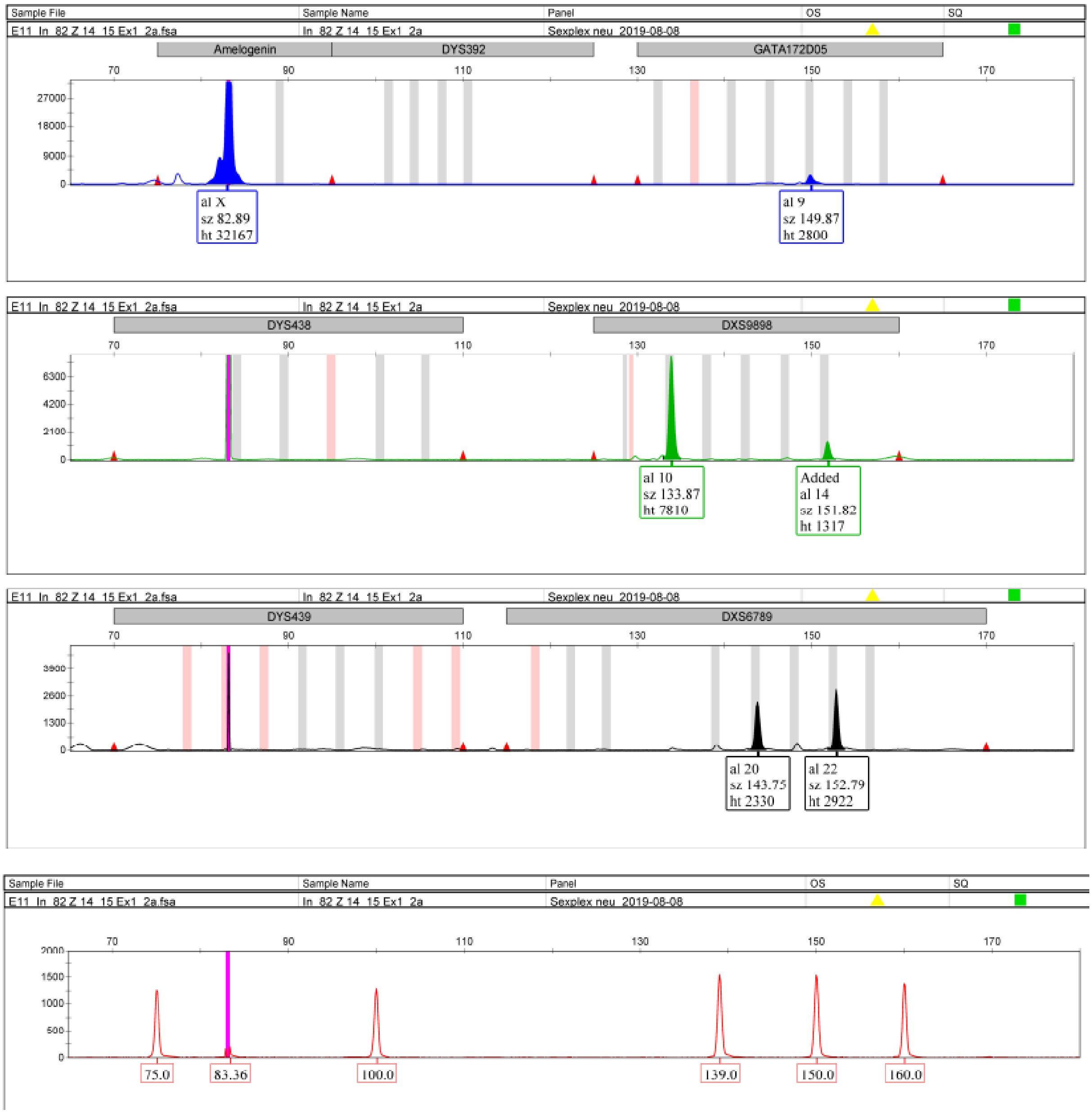
S.no.	Sample Name	PCR	Amelogenin		DYS392	GATA172D05	DYS438	DXS9898	DYS439	DXS6789
		3b	X	Y	(12)/13	5/-	12/-	12/-	12/-	22/-
	Rerun	3b	X	Y	13/-	5/-	12/-	12/-	12/-	22/-
	Konsensus 126		**X**	**Y**	**13/-**	**5/-**	**12/-**	**12/-**	**12/-**	**22/-**
28	Inden 127	3a	X	-	-/-	-/-	-/-	((8.3))/((13))	-/-	((23))/-
		3b	X	-	-/-	9/10	-/-	8.3/13	-/-	19/23
		4a	X	-	-/-	9/10	-/-	8.3/13	-/-	19/23
		4b	X	-	-/-	9/10	-/-	8.3/13	-/-	19/23
	Konsensus 127		**X**	**X**	**-/-**	**9/10**	**-/-**	**8.3/13**	**-/-**	**19/23**
29	Inden 201	3a	X	Y	11/-	5/-	10/-	13/-	11/-	22/-
		3b	X	Y	11/-	5/-	10/-	13/-	11/-	22/-
	Konsensus 201		**X**	**Y**	**11/-**	**5/-**	**10/-**	**13/-**	**11/-**	**22/-**
30	Inden 360	3a	X	-	-/-	9/11	((10))/-	12/-	-/-	20/-
		3b	X	-	-/-	9/11	-/-	12/-	-/-	20/-
	Konsensus 360		**X**	**X**	**-/-**	**9/11**	**-/-**	**12/12**	**-/-**	**20/20**
31	Inden 363	3a	X	-	-/-	7/9	-/-	8.3/11	-/-	20/21
		3b	X	-	-/-	7/9	-/-	8.3/11	-/-	20/21
	Konsensus 363		**X**	**X**	**-/-**	**7/9**	**-/-**	**8.3/11**	**-/-**	**20/21**
32	Inden 401	3a	X	-	-/-	5/-	-/-	11/12	-/-	(20)/21
		3b	X	-	-/-	5/11	-/-	11/12	-/-	20/(21)
		4a	X	-	-/-	5/-	-/-	11/12	-/-	20/21
		4b	X	-	-/-	5/11	-/-	11/12	-/-	20/21
	Konsensus 401		**X**	**X**	**-/-**	**5/11**	**-/-**	**11/12**	**-/-**	**20/21**

Alleles in round brackets () had a low peak height.

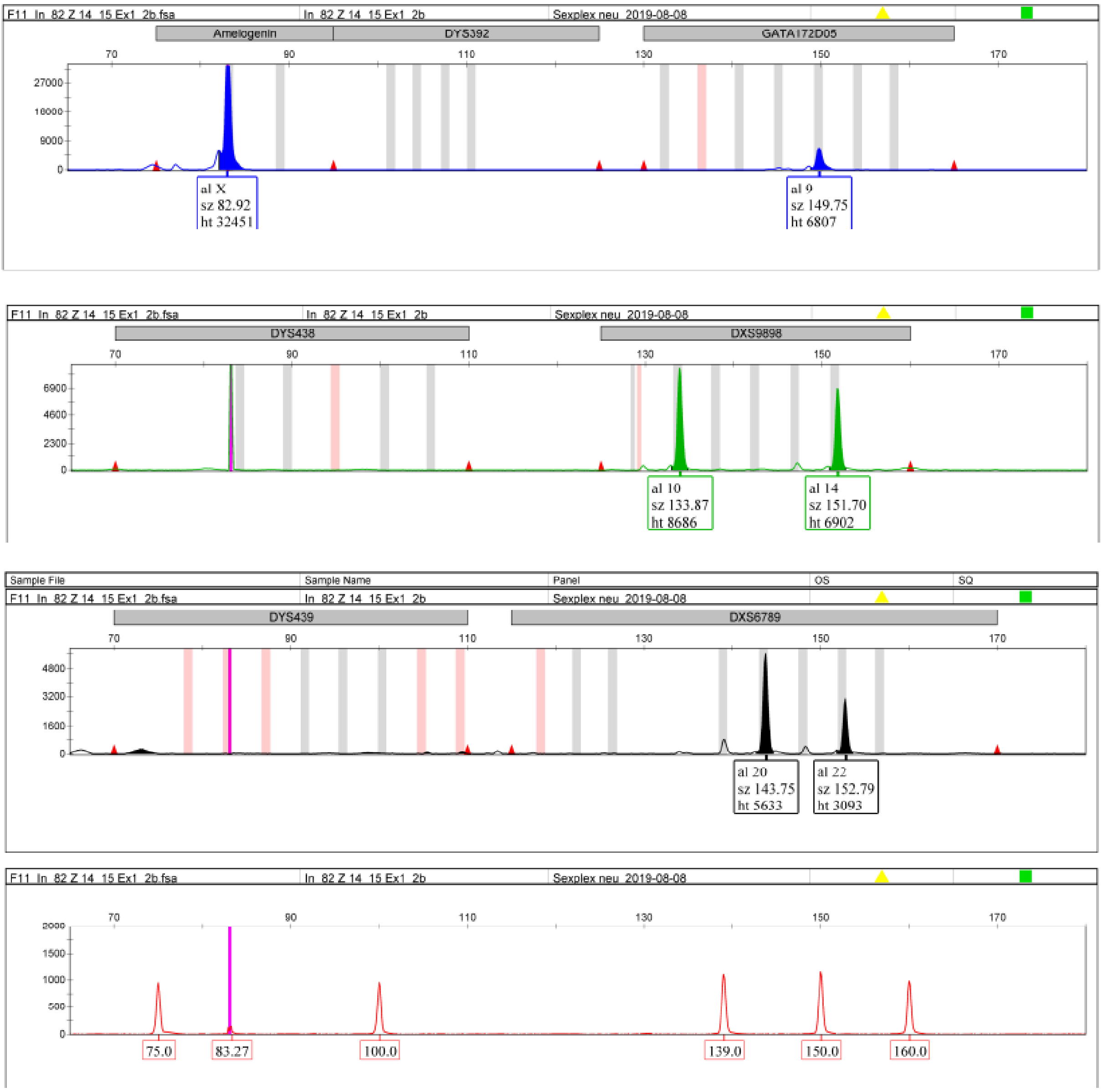
Dashes (- or -/-) were entered if no allele could be determined.

Electropherogram shows that every individual has been analysed twice with two different extracts: (a) 1 µl, (b) 5 µl

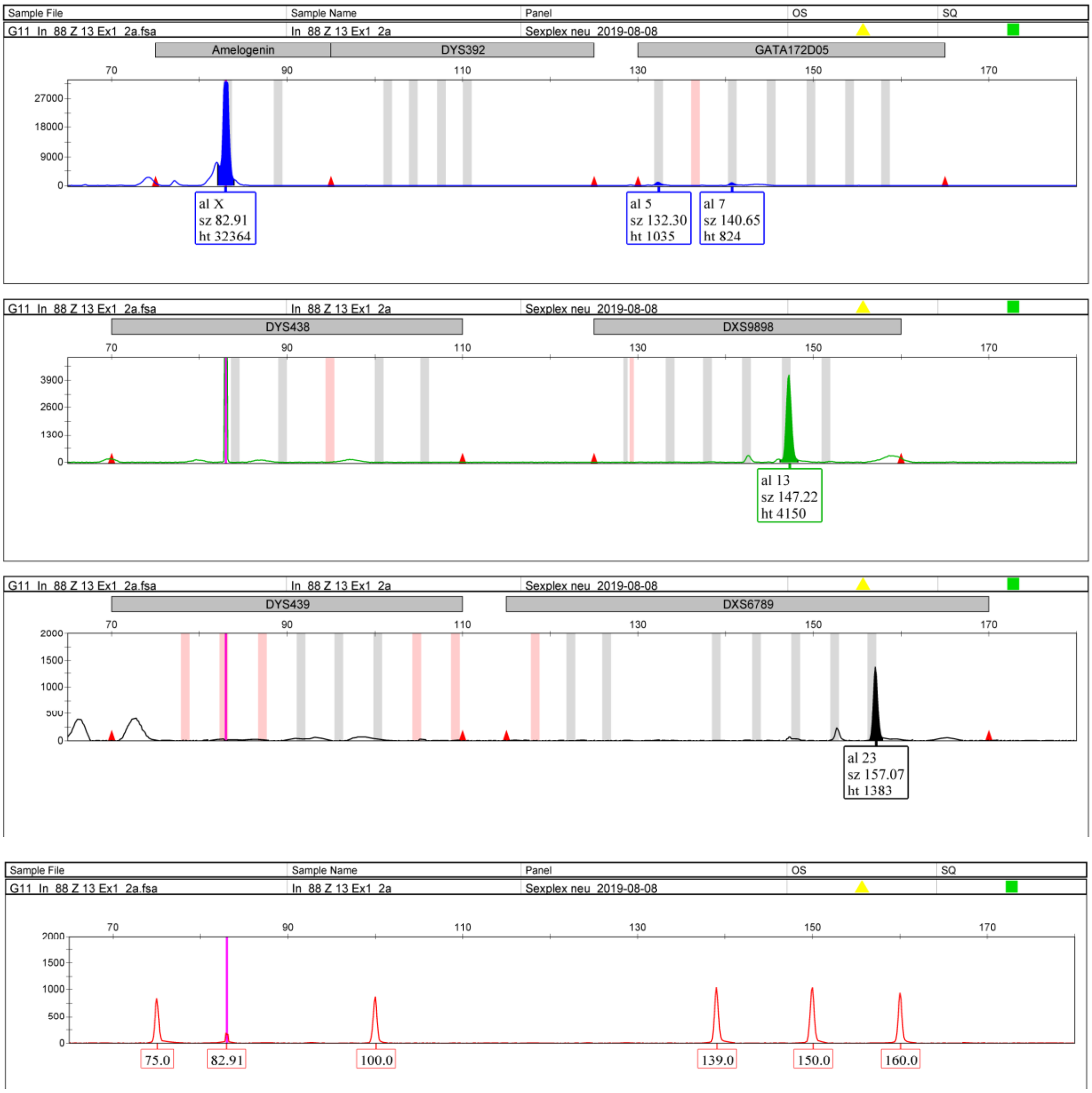
Inden 82



Inden 82

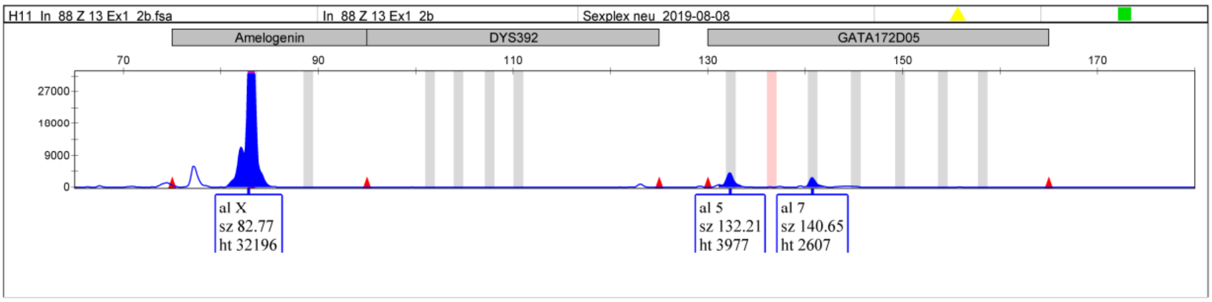

F11_In_82 Z 14_15 Ex1_2b.fsa
In_82 Z 14_15 Ex1_2b
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
70
90
110
130
150
170
27000
18000
9000
0
al X
sz 82.92
ht 32451
al 9
sz 149.75
ht 6807
F11_In_82 Z 14_15 Ex1_2b.fsa
In_82 Z 14_15 Ex1_2b
Sexplex neu_2019-08-08
DYS438
DXS9898
6900
4600
2300
al 10
sz 133.87
ht 8686
al 14
sz 151.70
ht 6902
Sample File
Sample Name
Panel
OS
SQ
F11_In_82 Z 14_15 Ex1_2b.fsa
In_82 Z 14_15 Ex1_2b
Sexplex neu_2019-08-08
DYS439
DXS6789
4800
3200
1600
al 20
sz 143.75
ht 5633
al 22
sz 152.79
ht 3093
F11_In_82 Z 14_15 Ex1_2b.fsa
In_82 Z 14_15 Ex1_2b
Sexplex neu_2019-08-08
2000
1500
1000
500
75.0
83.27
100.0
139.0
150.0
160.0

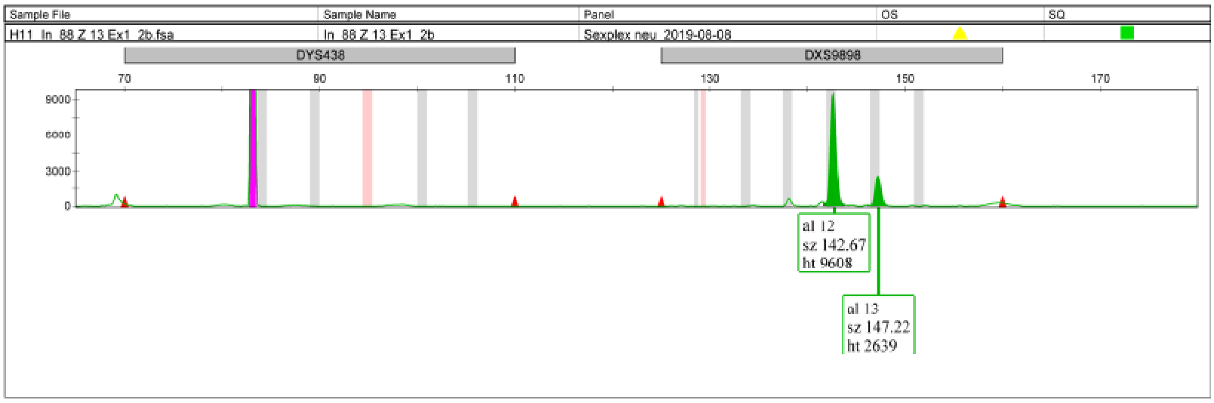
Inden 88

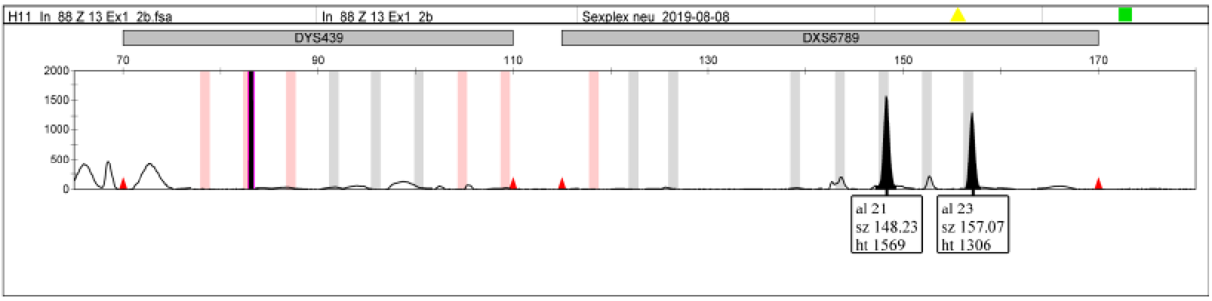


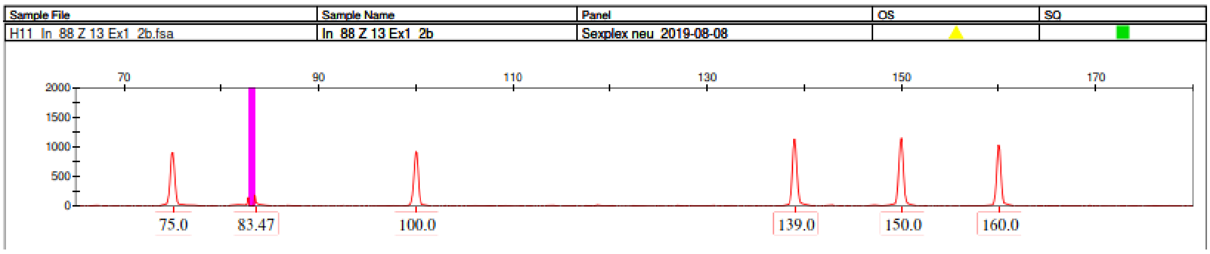
Sample File
Sample Name
Panel
OS
SQ
G11_In_88 Z 13 Ex1_2a.fsa
In_88 Z 13 Ex1_2a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
al X
sz 82.91
ht 32364
al 5
sz 132.30
ht 1035
al 7
sz 140.65
ht 824
DYS438
DXS9898
al 13
sz 147.22
ht 4150
DYS439
DXS6789
al 23
sz 157.07
ht 1383
75.0
82.91
100.0
139.0
150.0
160.0

Inden 88

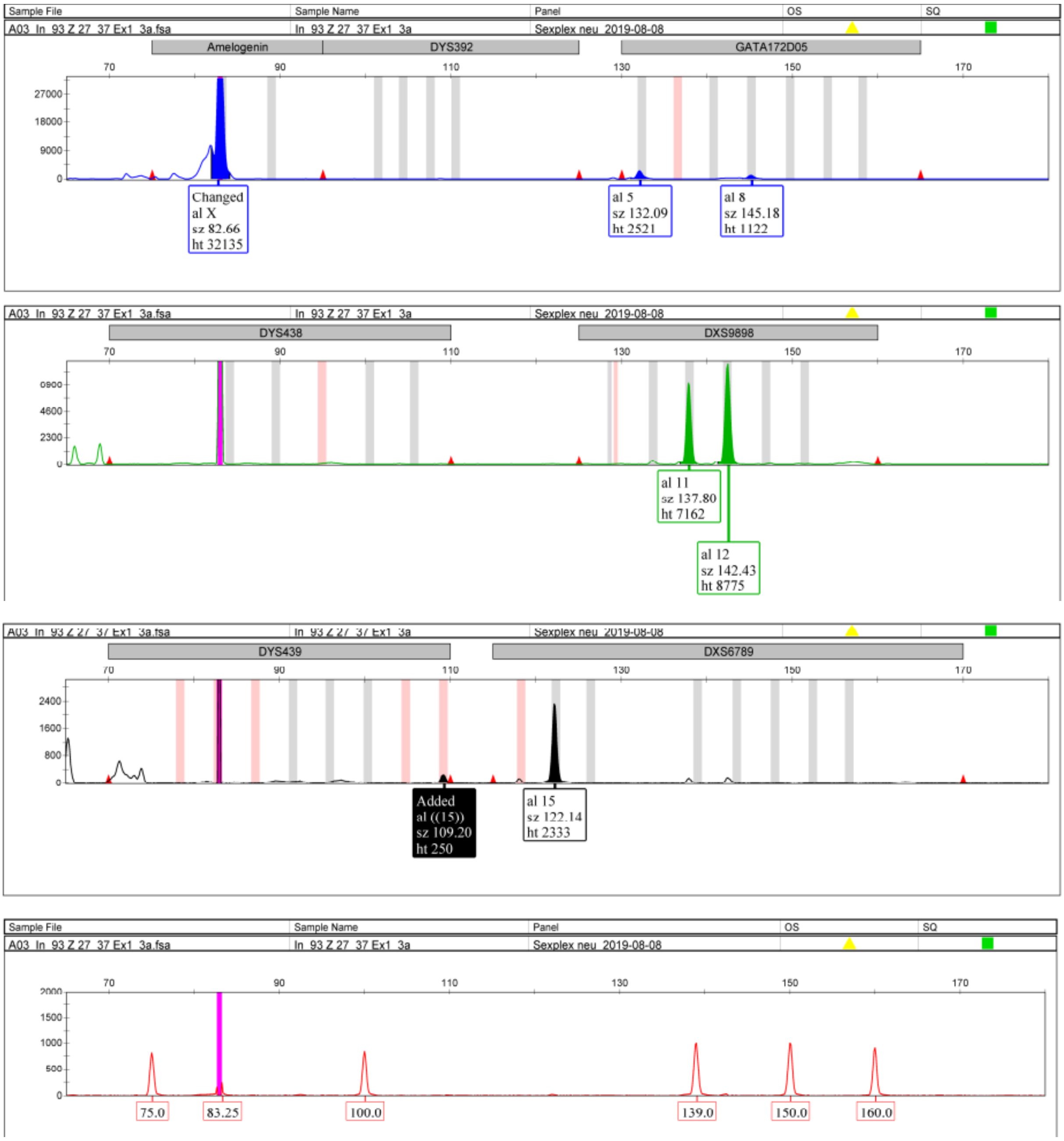

H11 In 88 Z 13 Ex1 2b.fsa
In 88 Z 13 Ex1 2b
Sexplex neu 2019-08-08
Amelogenin
DYS392
GATA172D05
70
90
110
130
150
170
27000
18000
9000
0
al X
sz 82.77
ht 32196
al 5
sz 132.21
ht 3977
al 7
sz 140.65
ht 2607


Sample File
Sample Name
Panel
OS
SQ
H11 In 88 Z 13 Ex1 2b.fsa
In 88 Z 13 Ex1 2b
Sexplex neu 2019-08-08
DYS438
DXS9898
70
90
110
130
150
170
9000
6000
3000
0
al 12
sz 142.67
ht 9608
al 13
sz 147.22
ht 2639

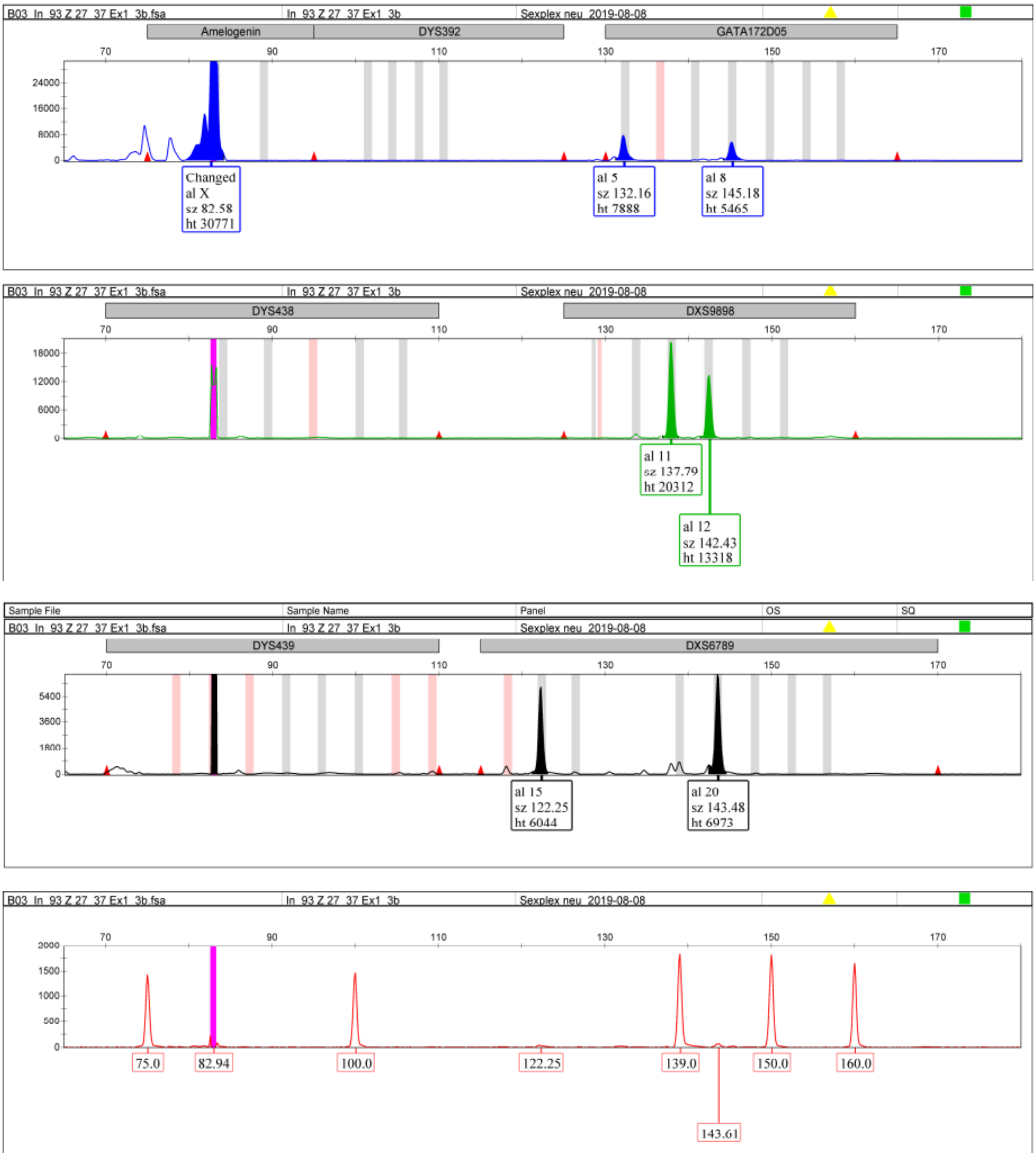

H11 In 88 Z 13 Ex1 2b.fsa
In 88 Z 13 Ex1 2b
Sexplex neu 2019-08-08
DYS439
DXS6789
70
90
110
130
150
170
2000
1500
1000
500
0
al 21
sz 148.23
ht 1569
al 23
sz 157.07
ht 1306


Sample File
Sample Name
Panel
OS
SQ
H11 In 88 Z 13 Ex1 2b.fsa
In 88 Z 13 Ex1 2b
Sexplex neu 2019-08-08
70
90
110
130
150
170
2000
1500
1000
500
0
75.0
83.47
100.0
139.0
150.0
160.0

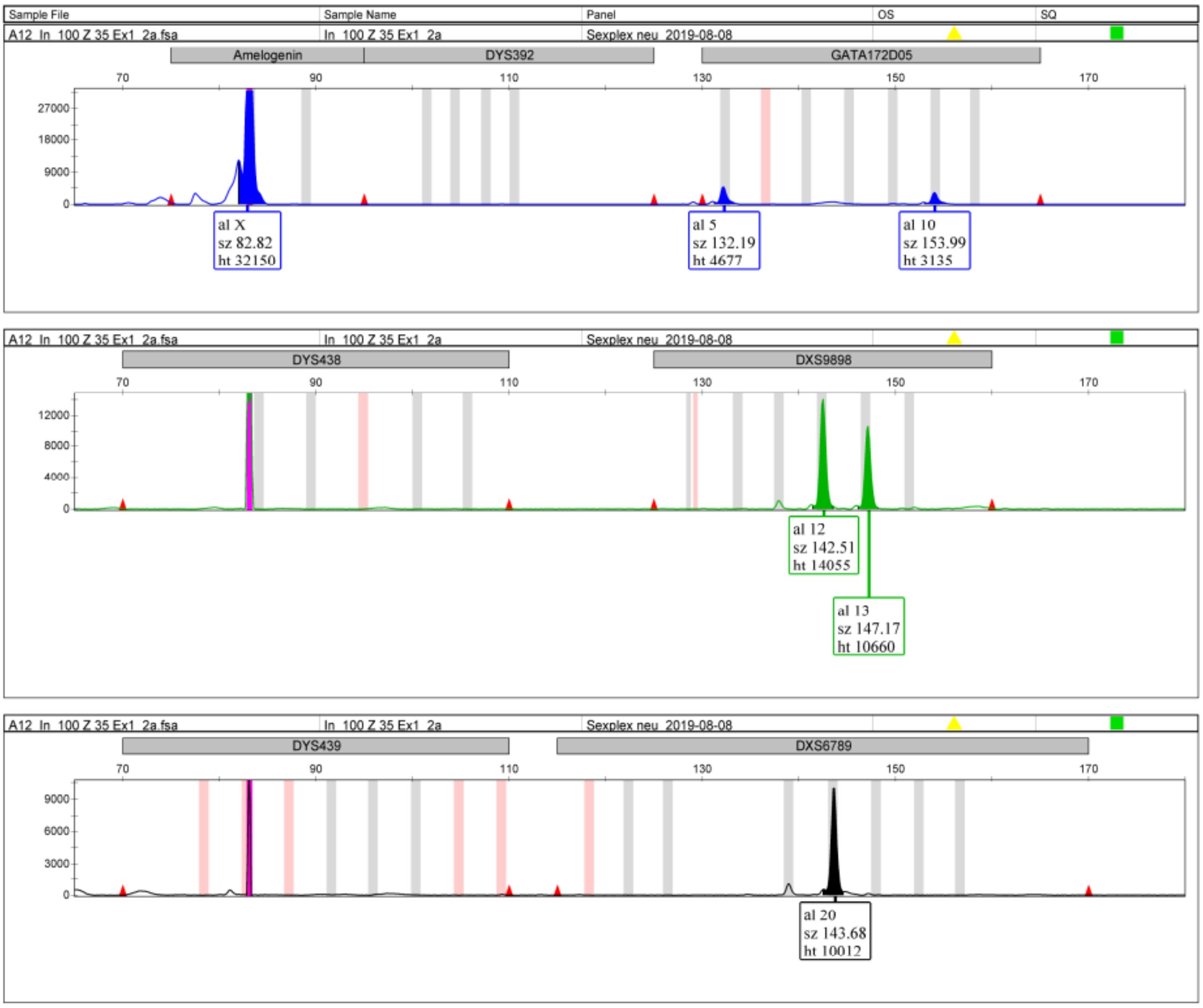
Inden 93

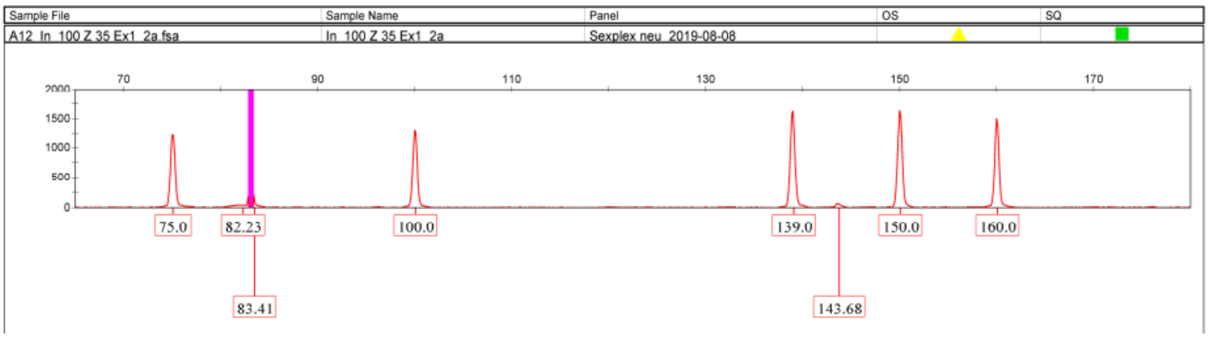

Sample File
Sample Name
Panel
OS
SQ
A03_In_93 Z 27_37 Ex1_3a.fsa
In_93 Z 27_37 Ex1_3a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
Changed
al X
sz 82.66
ht 32135
al 5
sz 132.09
ht 2521
al 8
sz 145.18
ht 1122
DYS438
DXS9898
al 11
sz 137.80
ht 7162
al 12
sz 142.43
ht 8775
DYS439
DXS6789
Added
al ((15))
sz 109.20
ht 250
al 15
sz 122.14
ht 2333
75.0
83.25
100.0
139.0
150.0
160.0

Inden 93

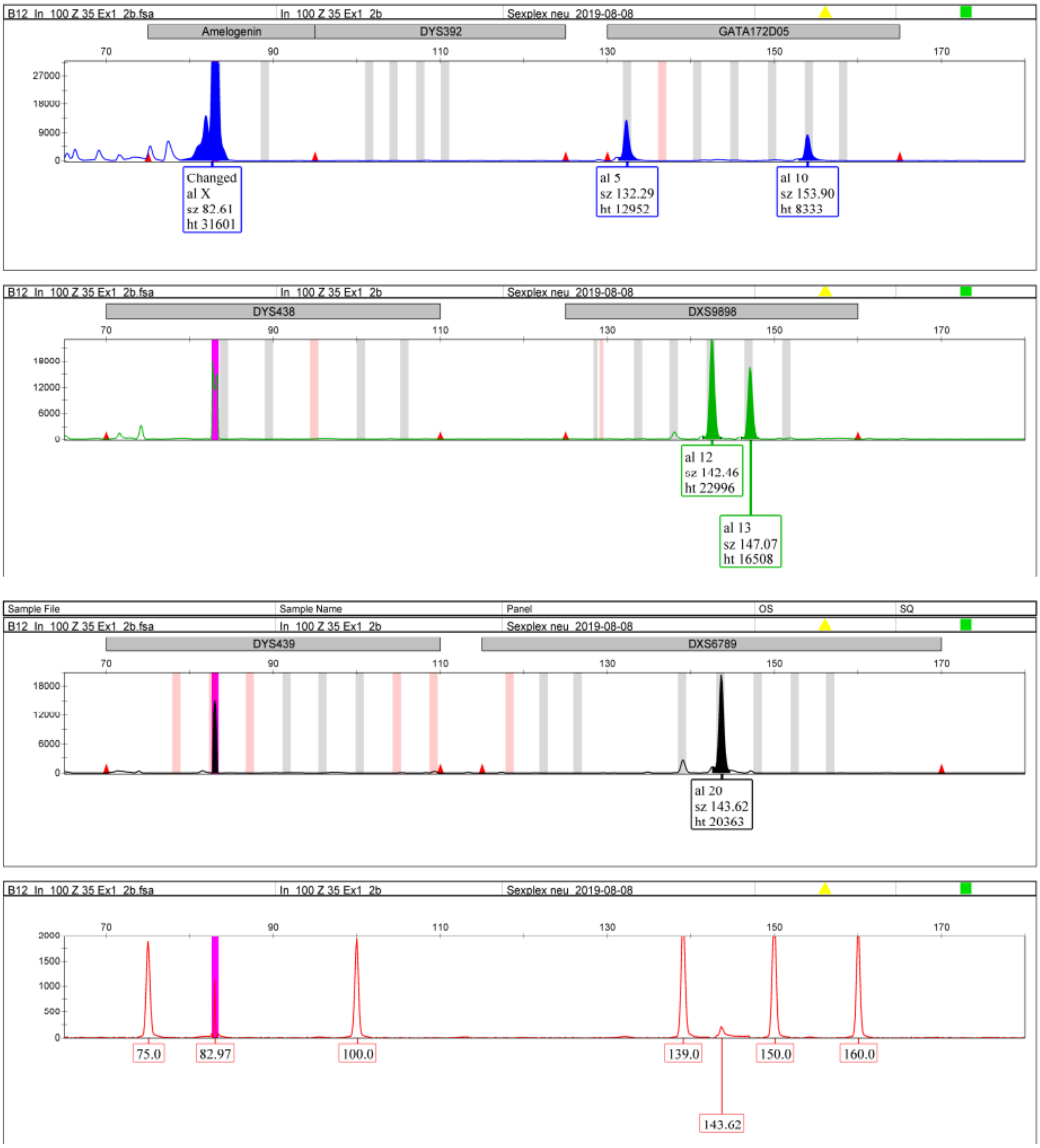

B03_In_93 Z 27_37 Ex1_3b.fsa
In_93 Z 27_37 Ex1_3b
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
Changed
al X
sz 82.58
ht 30771
al 5
sz 132.16
ht 7888
al 8
sz 145.18
ht 5465
DYS438
DXS9898
al 11
sz 137.79
ht 20312
al 12
sz 142.43
ht 13318
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 15
sz 122.25
ht 6044
al 20
sz 143.48
ht 6973
75.0
82.94
100.0
122.25
139.0
150.0
160.0
143.61

Inden 100

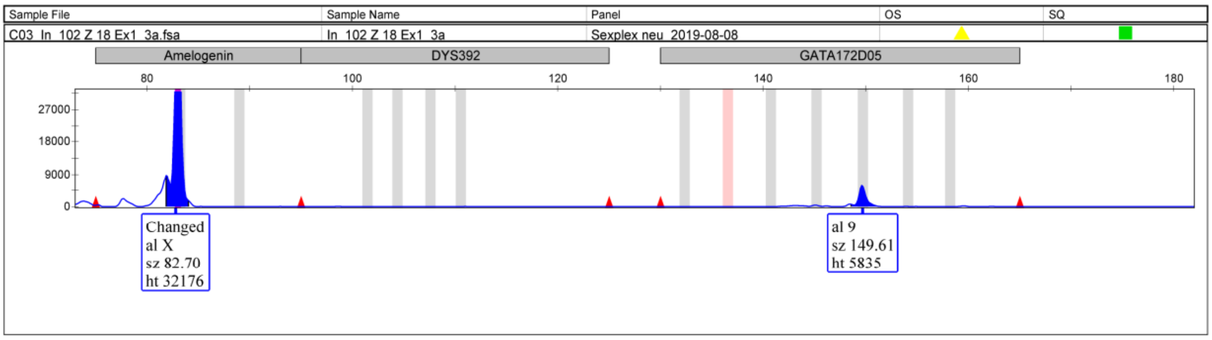

Sample File
Sample Name
Panel
OS
SQ
A12 In 100 Z 35 Ex1 2a.fsa
In 100 Z 35 Ex1 2a
Sexplex neu 2019-08-08
Amelogenin
DYS392
GATA172D05
al X
sz 82.82
ht 32150
al 5
sz 132.19
ht 4677
al 10
sz 153.99
ht 3135
DYS438
DXS9898
al 12
sz 142.51
ht 14055
al 13
sz 147.17
ht 10660
DYS439
DXS6789
al 20
sz 143.68
ht 10012

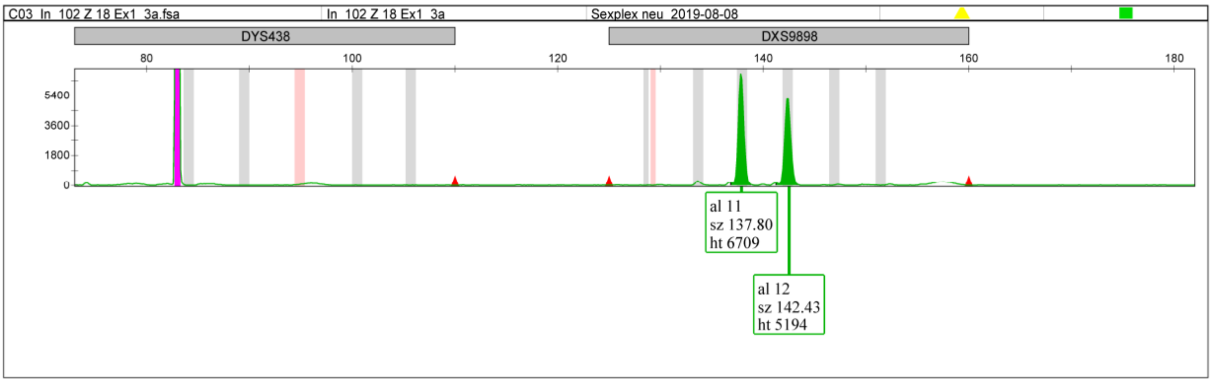

Sample File
Sample Name
Panel
OS
SQ
A12 In 100 Z 35 Ex1 2a.fsa
In 100 Z 35 Ex1 2a
Sexplex neu 2019-08-08
75.0
82.23
100.0
139.0
150.0
160.0
83.41
143.68

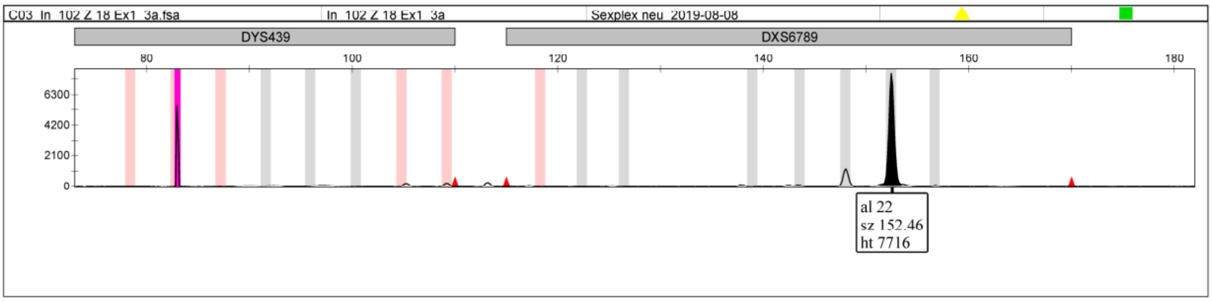
Inden 100

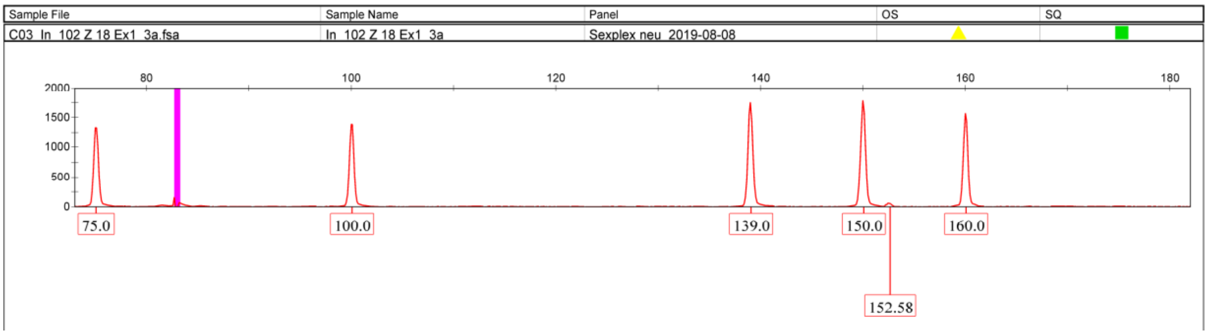

B12_In_100 Z 35 Ex1_2b.fsa
In_100 Z 35 Ex1_2b
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
Changed
al X
sz 82.61
ht 31601
al 5
sz 132.29
ht 12952
al 10
sz 153.90
ht 8333
DYS438
DXS9898
al 12
sz 142.46
ht 22996
al 13
sz 147.07
ht 16508
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 20
sz 143.62
ht 20363
75.0
82.97
100.0
139.0
150.0
160.0
143.62

Inden 102

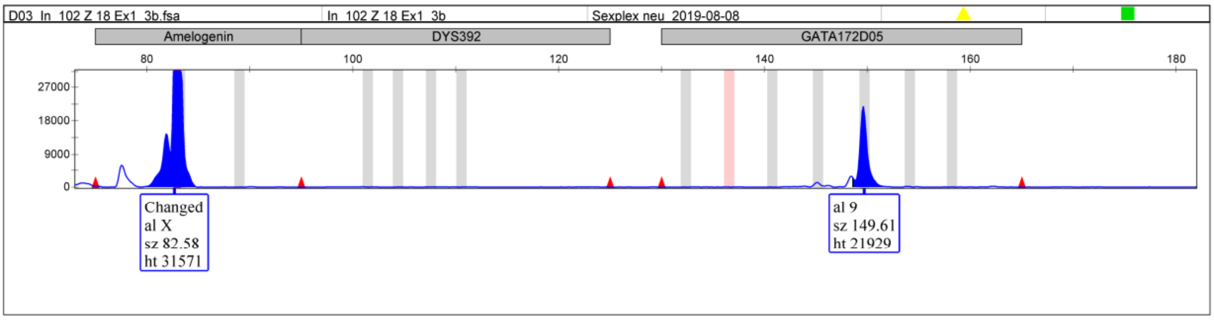

Sample File
Sample Name
Panel
OS
SQ
C03_In_102 Z 18 Ex1_3a.fsa
In_102 Z 18 Ex1_3a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
80
100
120
140
160
180
27000
18000
9000
0
Changed
al X
sz 82.70
ht 32176
al 9
sz 149.61
ht 5835

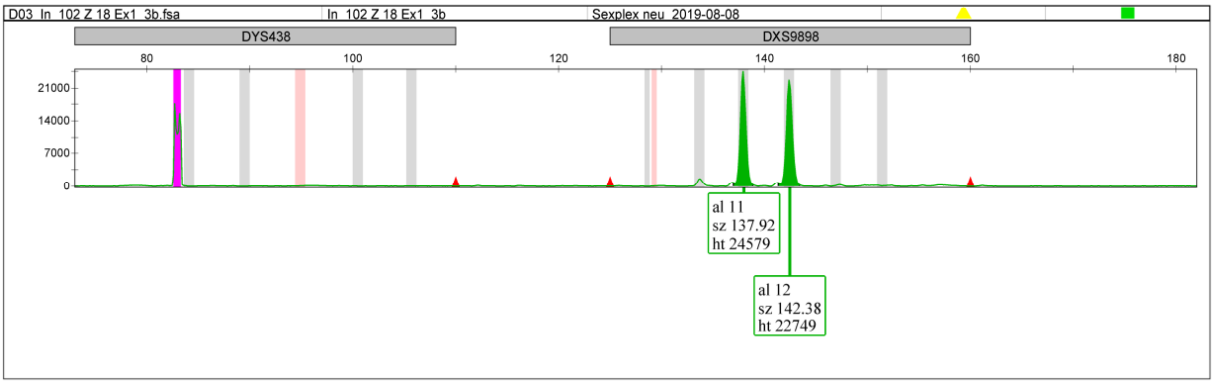

C03_In_102 Z 18 Ex1_3a.fsa
In_102 Z 18 Ex1_3a
Sexplex neu_2019-08-08
DYS438
DXS9898
80
100
120
140
160
180
5400
3600
1800
0
al 11
sz 137.80
ht 6709
al 12
sz 142.43
ht 5194

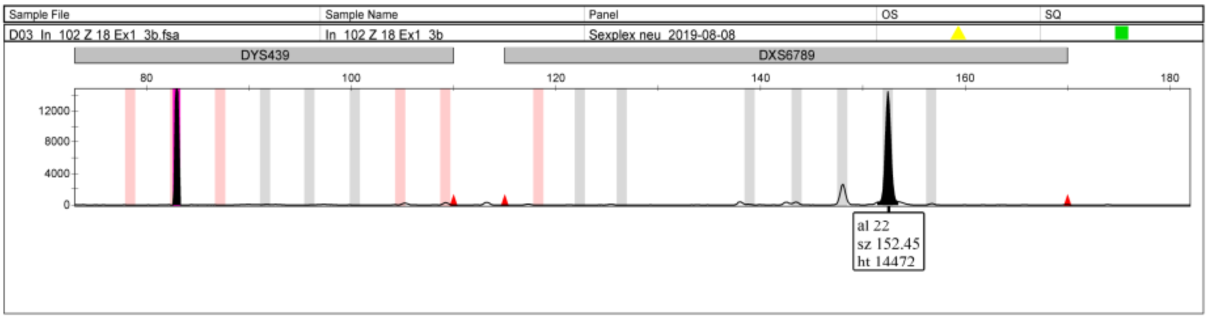

C03_In_102 Z 18 Ex1_3a.fsa
In_102 Z 18 Ex1_3a
Sexplex neu_2019-08-08
DYS439
DXS6789
80
100
120
140
160
180
6300
4200
2100
0
al 22
sz 152.46
ht 7716

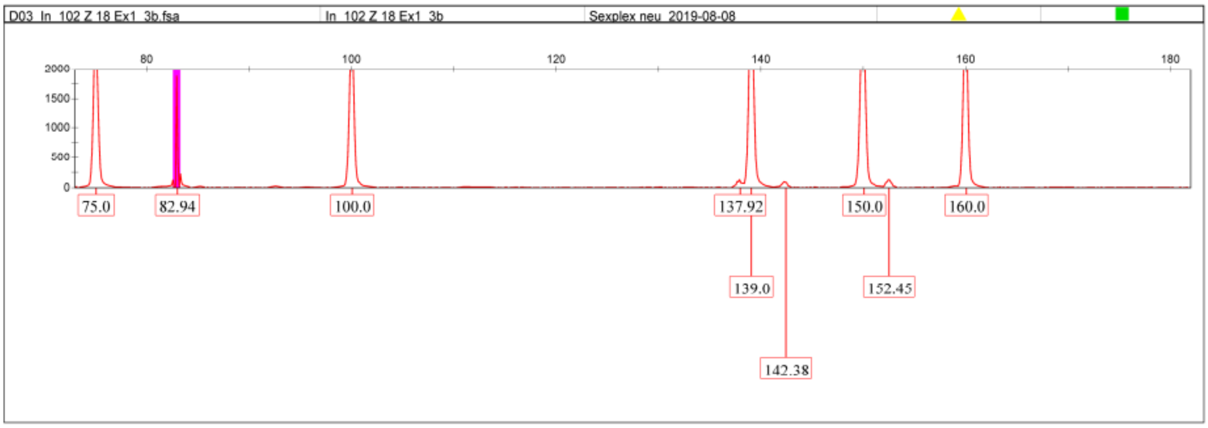

Sample File
Sample Name
Panel
OS
SQ
C03_In_102 Z 18 Ex1_3a.fsa
In_102 Z 18 Ex1_3a
Sexplex neu_2019-08-08
80
100
120
140
160
180
2000
1500
1000
500
0
75.0
100.0
139.0
150.0
160.0
152.58

Inden 102

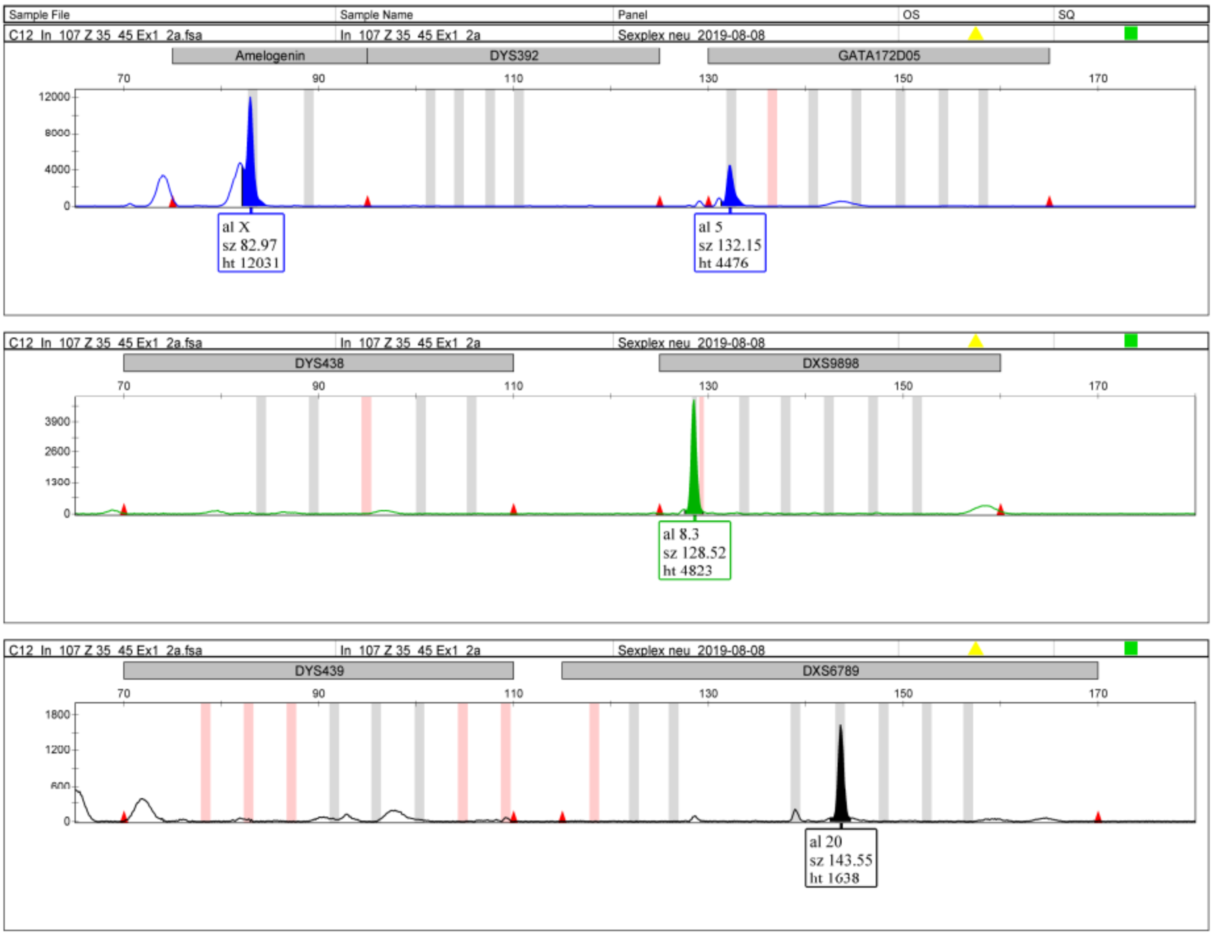

D03_In_102 Z 18 Ex1_3b.fsa
In_102 Z 18 Ex1_3b
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
80
100
120
140
160
180
27000
18000
9000
0
Changed
al X
sz 82.58
ht 31571
al 9
sz 149.61
ht 21929

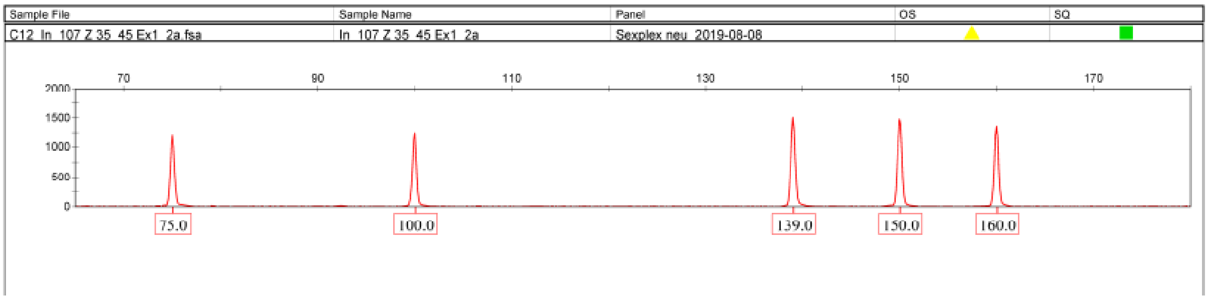

D03_In_102 Z 18 Ex1_3b.fsa
In_102 Z 18 Ex1_3b
Sexplex neu_2019-08-08
DYS438
DXS9898
80
100
120
140
160
180
21000
14000
7000
0
al 11
sz 137.92
ht 24579
al 12
sz 142.38
ht 22749


Sample File
Sample Name
Panel
OS
SQ
D03_In_102 Z 18 Ex1_3b.fsa
In_102 Z 18 Ex1_3b
Sexplex neu_2019-08-08
DYS439
DXS6789
80
100
120
140
160
180
12000
8000
4000
0
al 22
sz 152.45
ht 14472

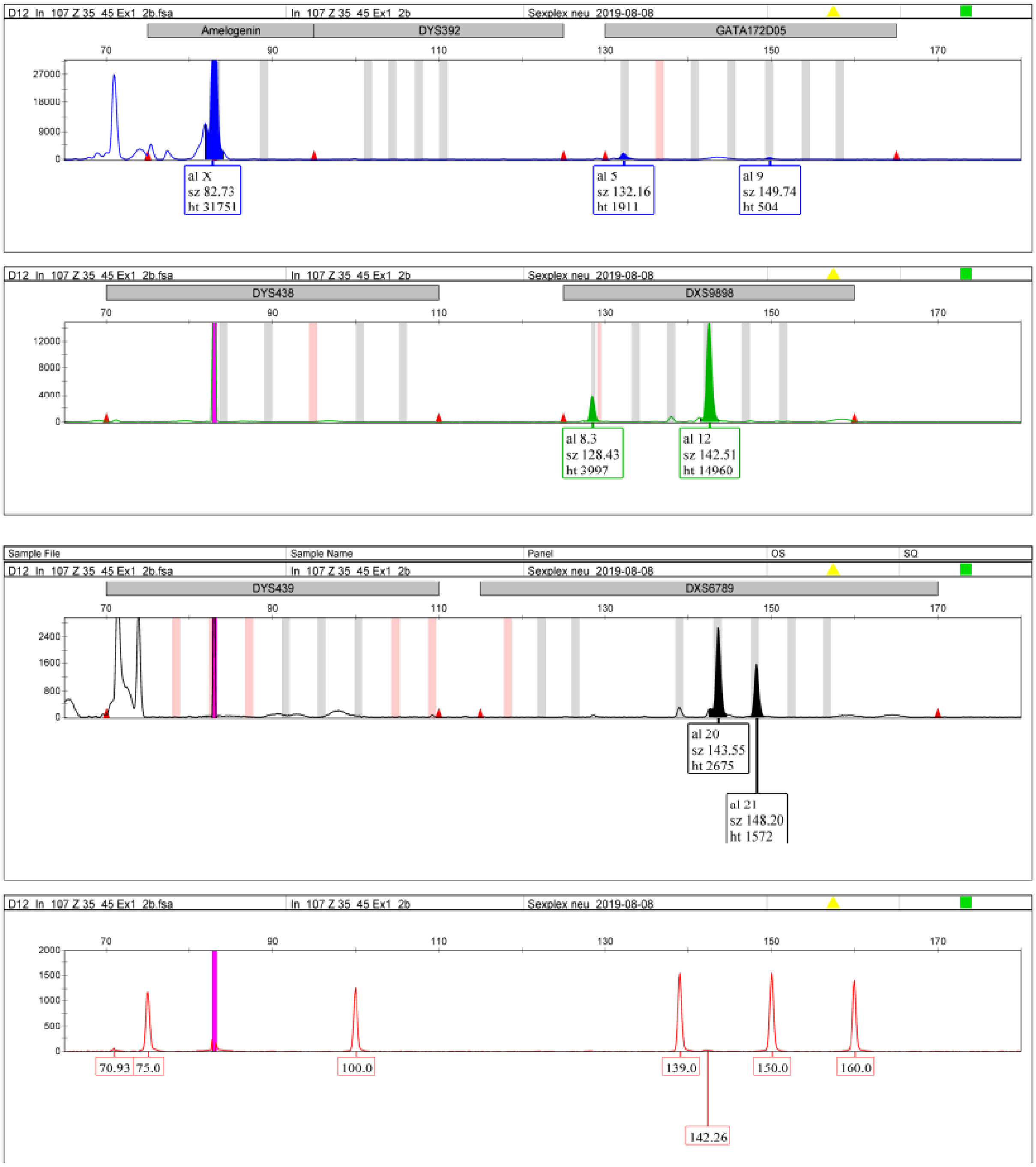

D03_In_102 Z 18 Ex1_3b.fsa
In_102 Z 18 Ex1_3b
Sexplex neu_2019-08-08
80
100
120
140
160
180
2000
1500
1000
500
0
75.0
82.94
100.0
137.92
150.0
160.0
139.0
152.45
142.38

Inden 107

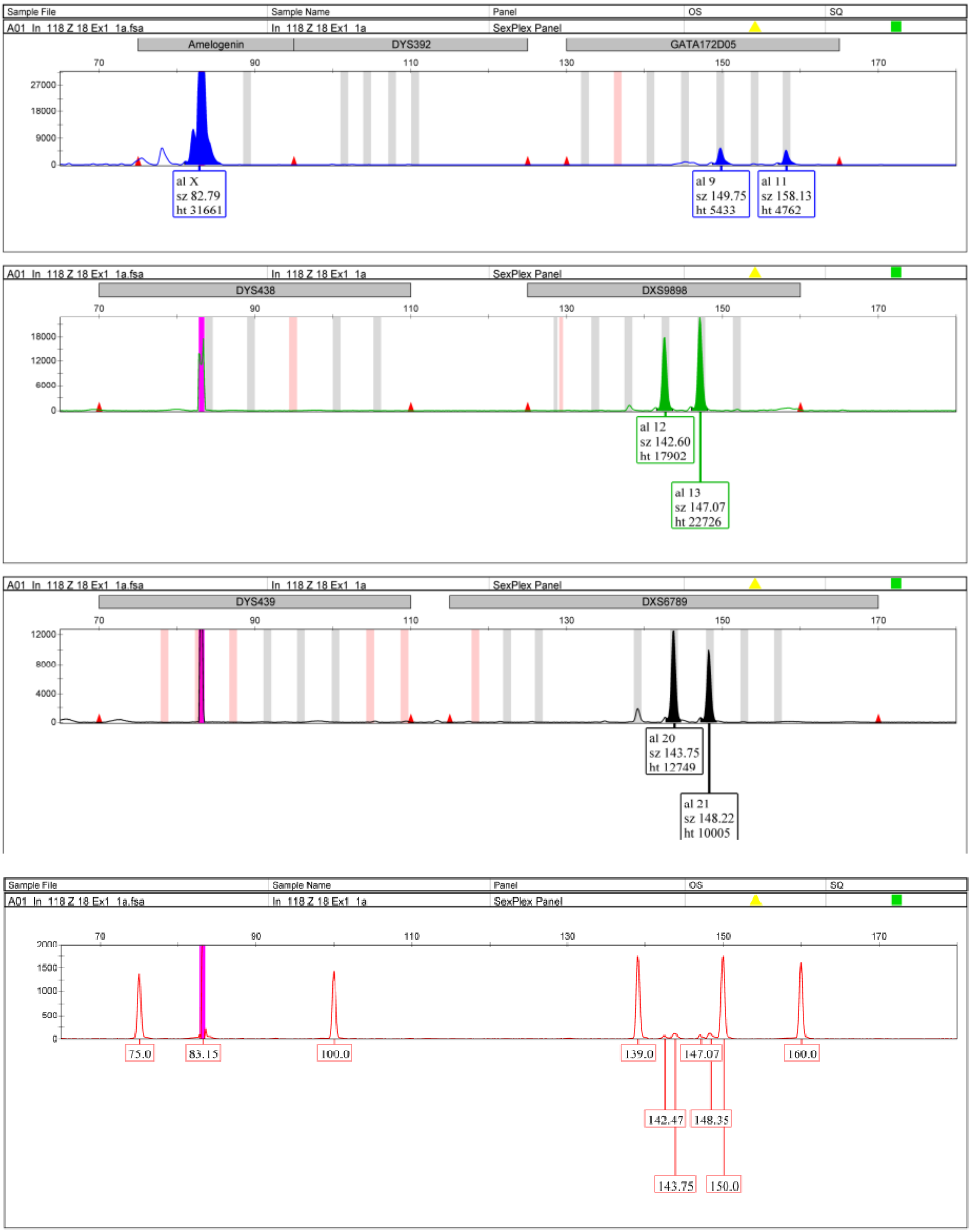

Sample File
Sample Name
Panel
OS
SQ
C12_In_107_Z_35_45_Ex1_2a.fsa
In_107_Z_35_45_Ex1_2a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
al X
sz 82.97
ht 12031
al 5
sz 132.15
ht 4476
DYS438
DXS9898
al 8.3
sz 128.52
ht 4823
DYS439
DXS6789
al 20
sz 143.55
ht 1638


Sample File
Sample Name
Panel
OS
SQ
C12_In_107_Z_35_45_Ex1_2a.fsa
In_107_Z_35_45_Ex1_2a
Sexplex neu_2019-08-08
75.0
100.0
139.0
150.0
160.0

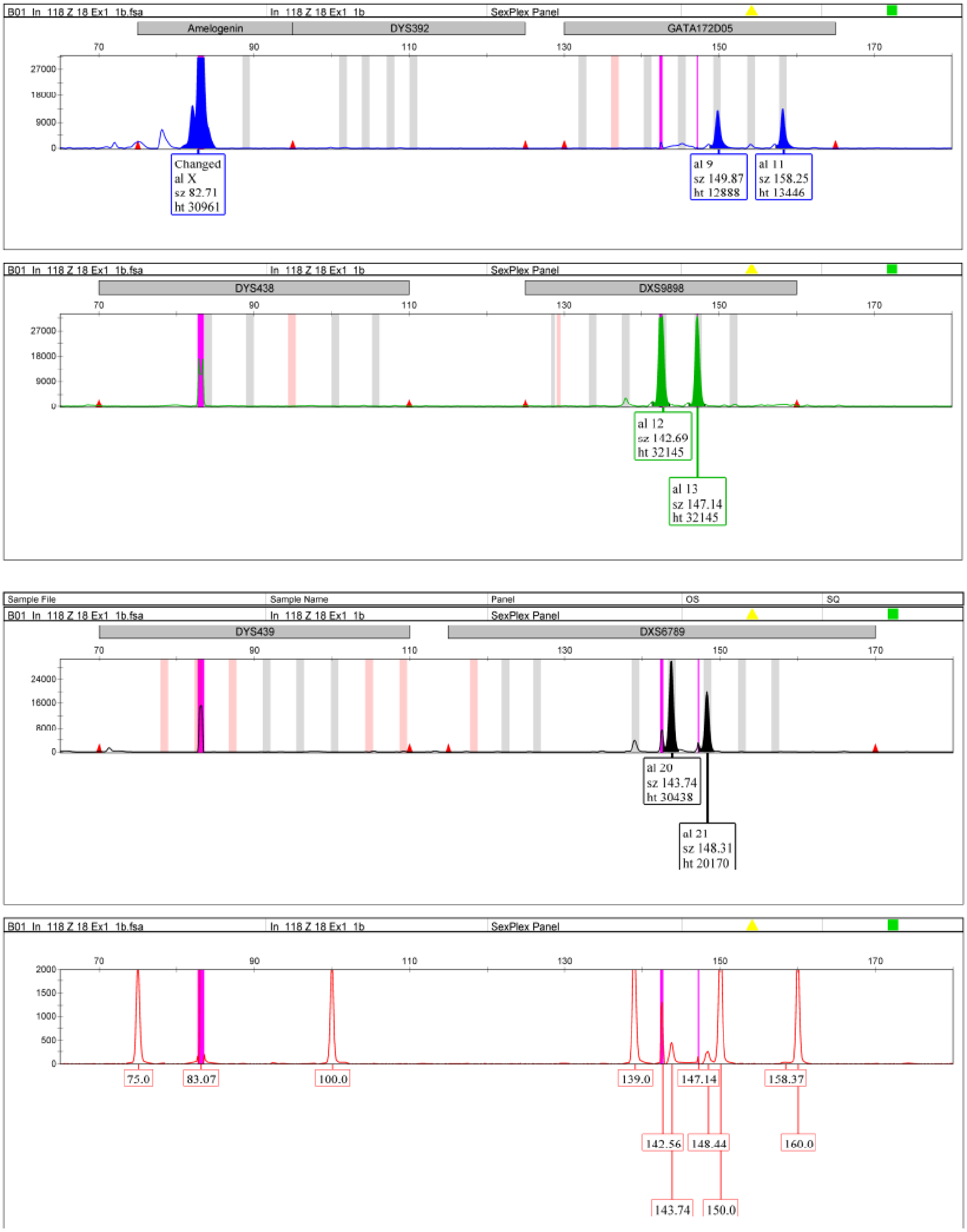
Inden 107


D12_In_107 Z 35_45 Ex1_2b.fsa
In_107 Z 35_45 Ex1_2b
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
al X
sz 82.73
ht 31751
al 5
sz 132.16
ht 1911
al 9
sz 149.74
ht 504
DYS438
DXS9898
al 8.3
sz 128.43
ht 3997
al 12
sz 142.51
ht 14960
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 20
sz 143.55
ht 2675
al 21
sz 148.20
ht 1572
70.93
75.0
100.0
139.0
142.26
150.0
160.0

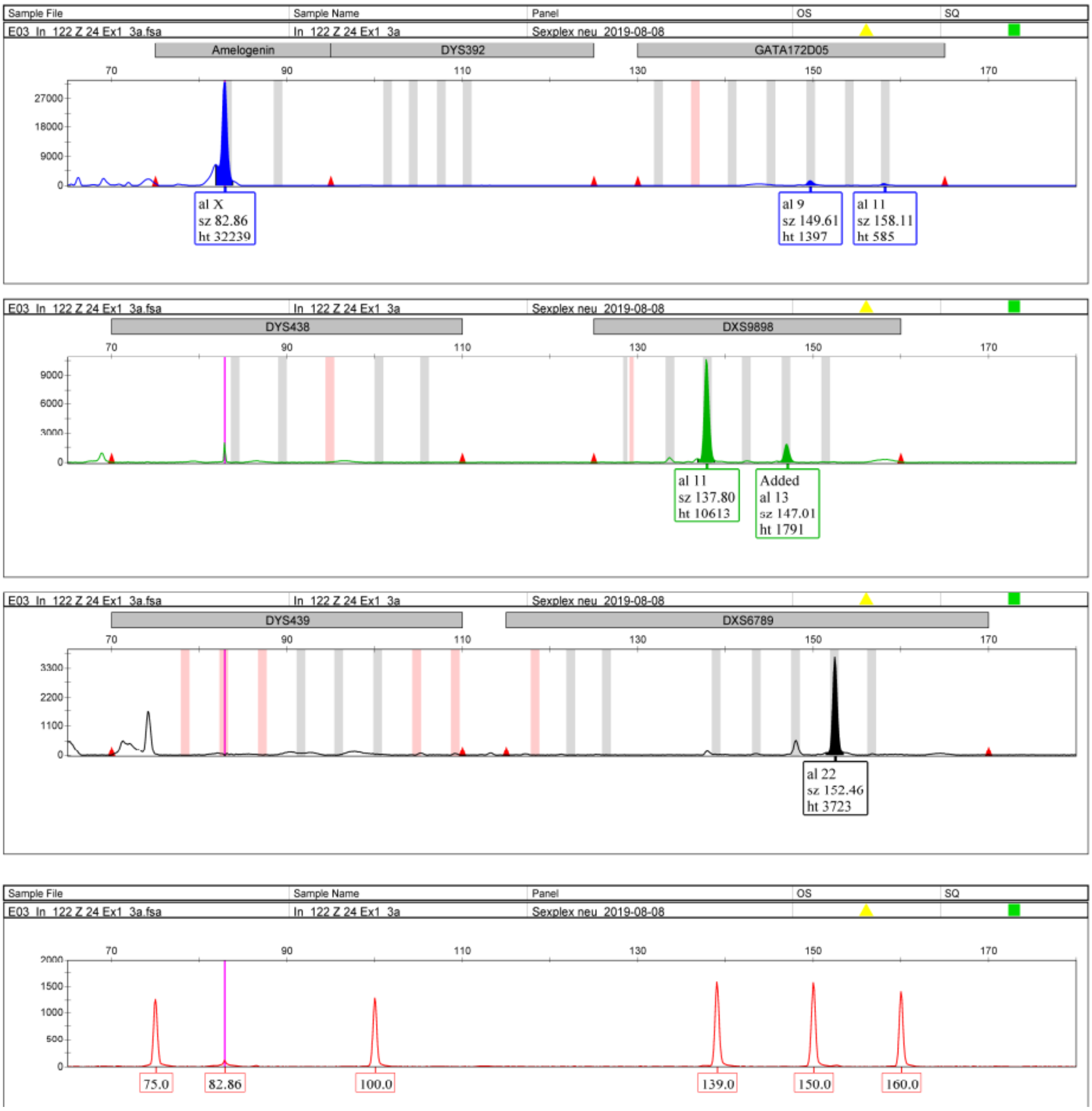
Inden 118


Sample File
Sample Name
Panel
OS
SQ
A01 In 118 Z 18 Ex1 1a.fsa
In 118 Z 18 Ex1 1a
SexPlex Panel
Amelogenin
DYS392
GATA172D05
al X
sz 82.79
ht 31661
al 9
sz 149.75
ht 5433
al 11
sz 158.13
ht 4762
DYS438
DXS9898
al 12
sz 142.60
ht 17902
al 13
sz 147.07
ht 22726
DYS439
DXS6789
al 20
sz 143.75
ht 12749
al 21
sz 148.22
ht 10005
75.0
83.15
100.0
139.0
147.07
160.0
142.47
148.35
143.75
150.0

Inden 118

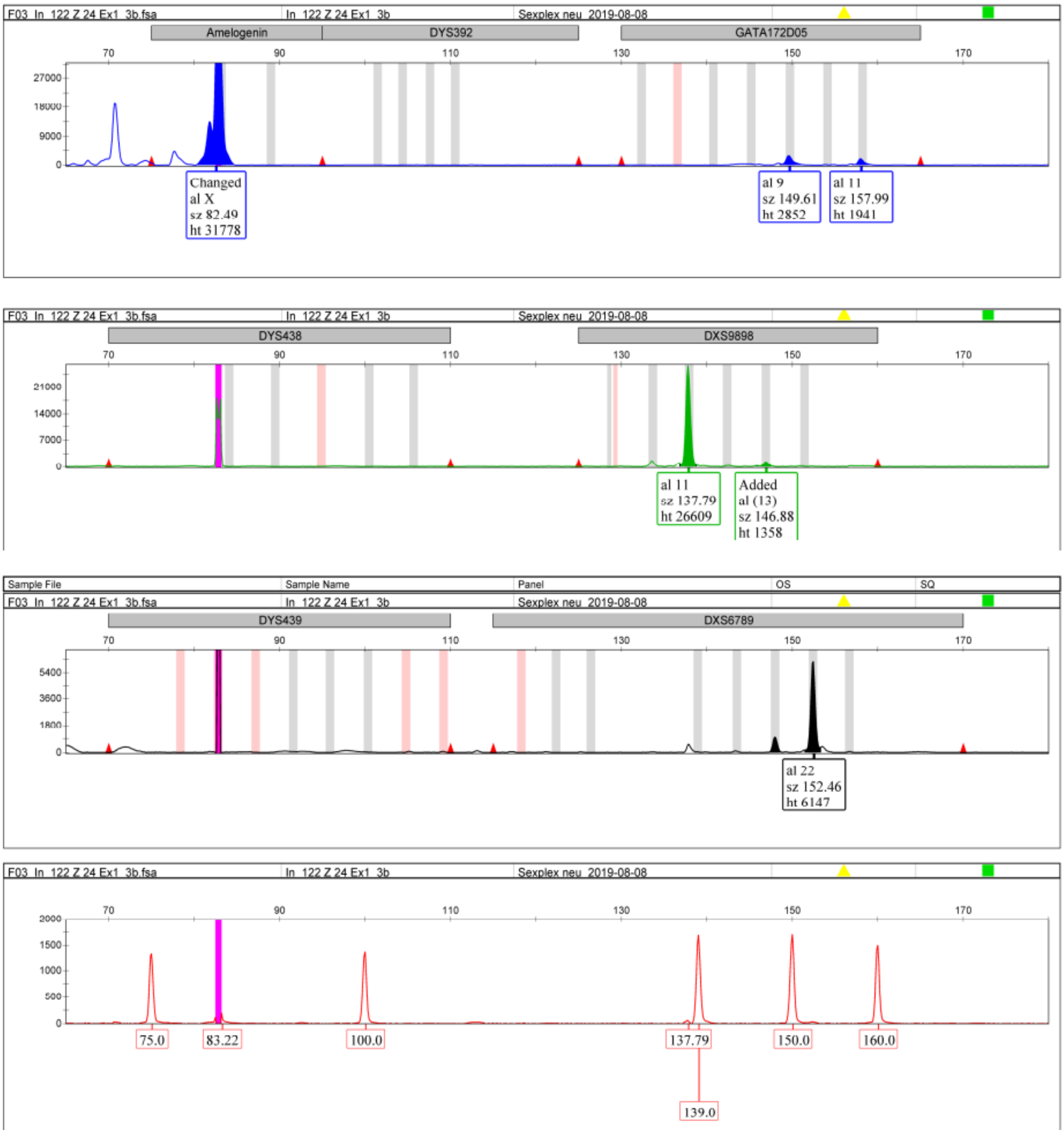

B01_In_118 Z 18 Ex1_1b.fsa
In_118 Z 18 Ex1_1b
SexPlex Panel
Amelogenin
DYS392
GATA172D05
Changed
al X
sz 82.71
ht 30961
al 9
sz 149.87
ht 12888
al 11
sz 158.25
ht 13446
DYS438
DXS9898
al 12
sz 142.69
ht 32145
al 13
sz 147.14
ht 32145
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 20
sz 143.74
ht 30438
al 21
sz 148.31
ht 20170
75.0
83.07
100.0
139.0
147.14
158.37
142.56
148.44
160.0
143.74
150.0

Inden 122



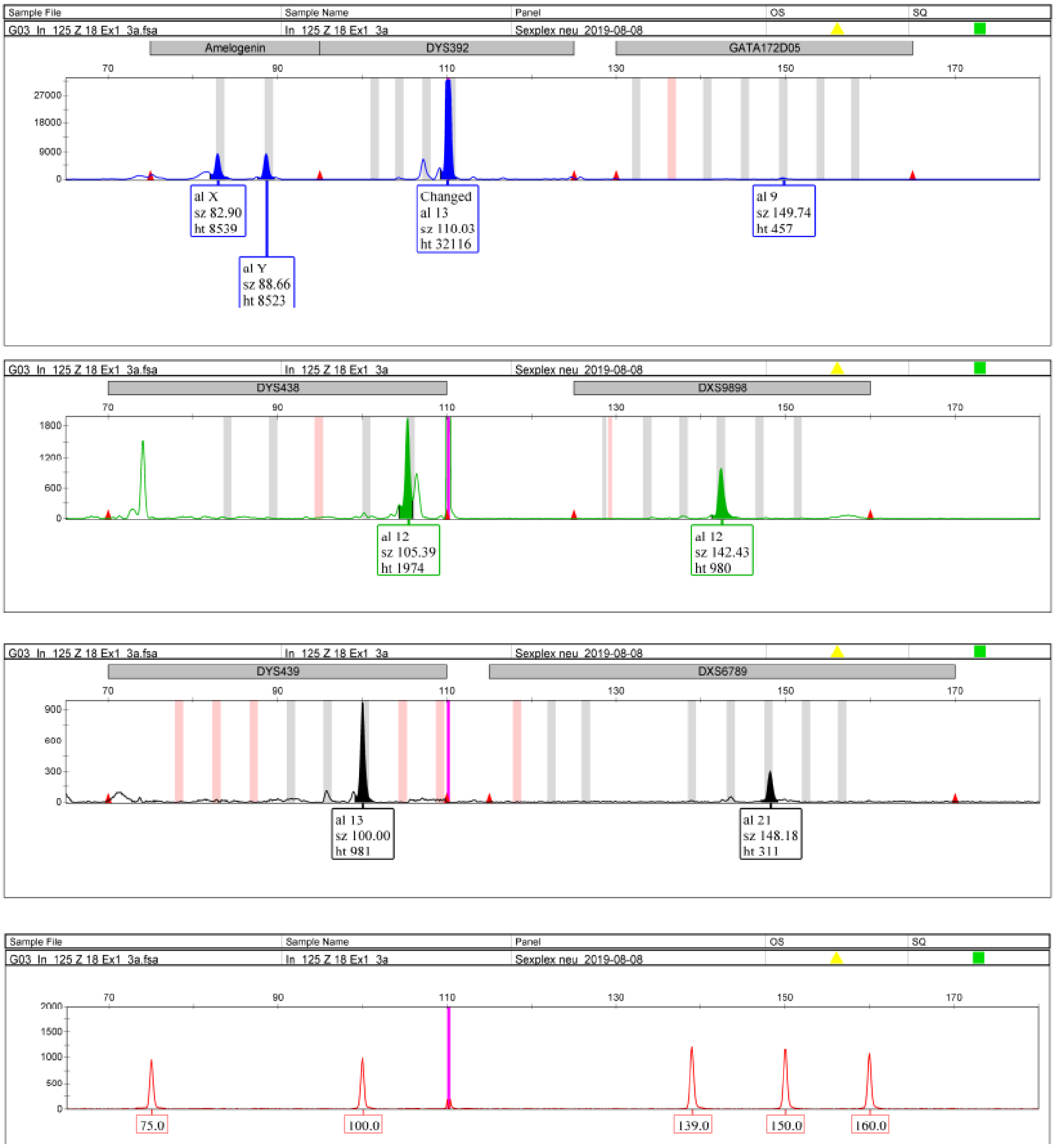
Sample File
Sample Name
Panel
OS
SQ
E03_In_122 Z 24 Ex1_3a.fsa
In_122 Z 24 Ex1_3a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
70
90
110
130
150
170
27000
18000
9000
0
al X
sz 82.86
ht 32239
al 9
sz 149.61
ht 1397
al 11
sz 158.11
ht 585
DYS438
DXS9898
9000
6000
3000
al 11
sz 137.80
ht 10613
Added
al 13
sz 147.01
ht 1791
DYS439
DXS6789
3300
2200
1100
al 22
sz 152.46
ht 3723
2000
1500
1000
500
75.0
82.86
100.0
139.0
150.0
160.0

Inden 122

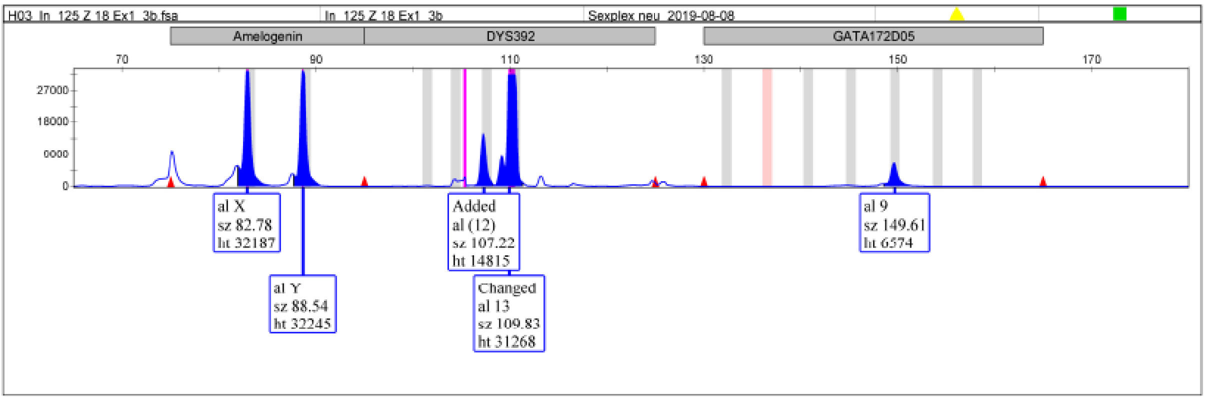


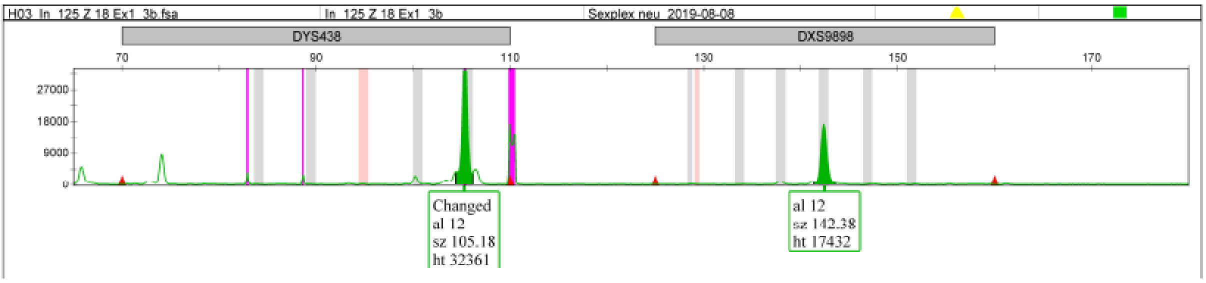
F03 In 122 Z 24 Ex1 3b.fsa
In 122 Z 24 Ex1 3b
Sexplex neu 2019-08-08
Amelogenin
DYS392
GATA172D05
Changed al X sz 82.49 ht 31778
al 9 sz 149.61 ht 2852
al 11 sz 157.99 ht 1941
DYS438
DXS9898
al 11 sz 137.79 ht 26609
Added al (13) sz 146.88 ht 1358
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 22 sz 152.46 ht 6147
75.0
83.22
100.0
137.79
139.0
150.0
160.0

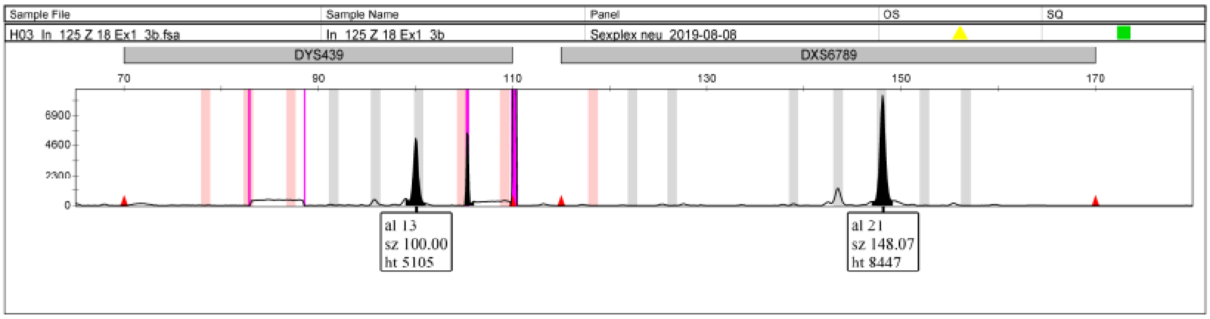
Inden 125

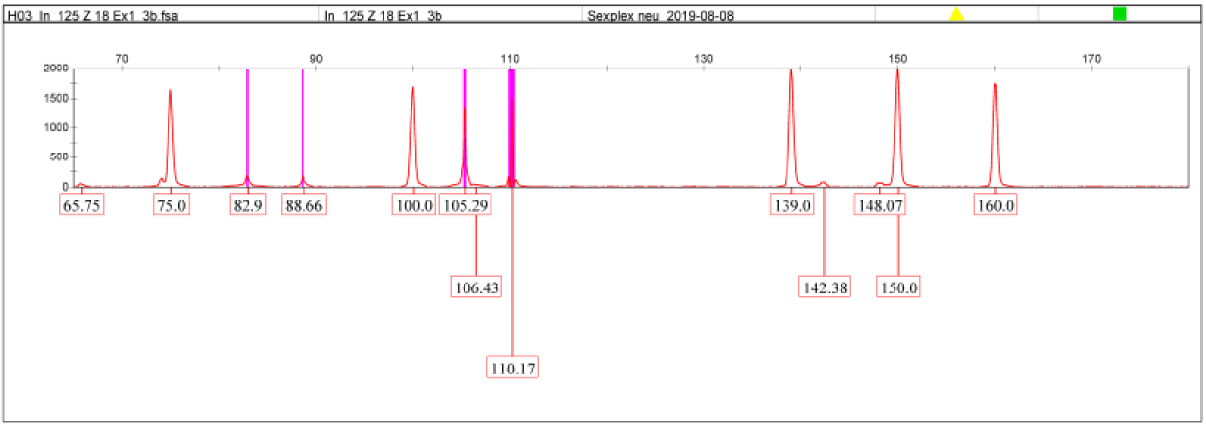

Sample File
Sample Name
Panel
OS
SQ
G03_In_125 Z 18 Ex1_3a.fsa
In_125 Z 18 Ex1_3a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
al X
sz 82.90
ht 8539
al Y
sz 88.66
ht 8523
Changed
al 13
sz 110.03
ht 32116
al 9
sz 149.74
ht 457
DYS438
DXS9898
al 12
sz 105.39
ht 1974
al 12
sz 142.43
ht 980
DYS439
DXS6789
al 13
sz 100.00
ht 981
al 21
sz 148.18
ht 311
75.0
100.0
139.0
150.0
160.0

Inden 125

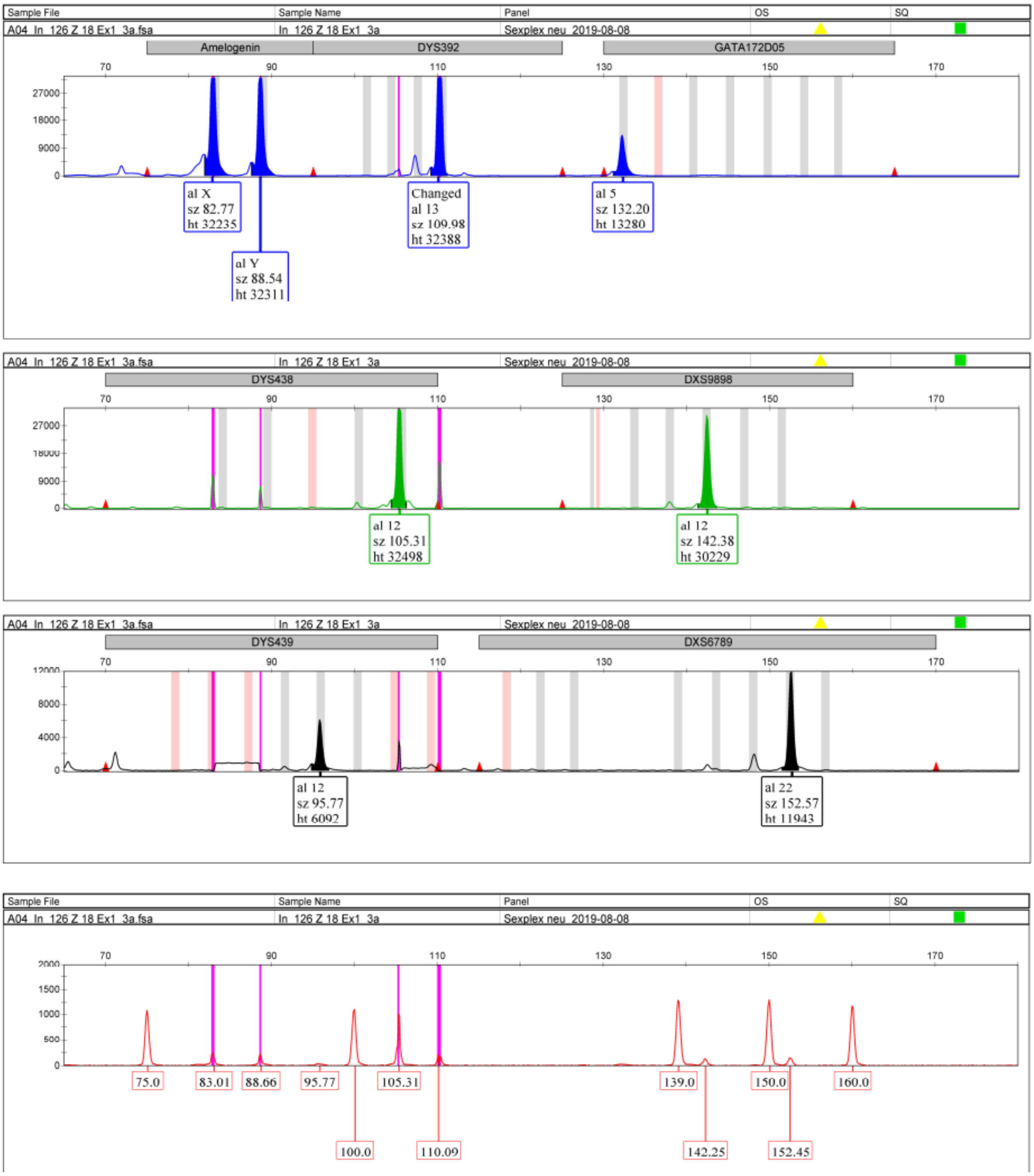

H03_In_125 Z 18 Ex1_3b.fsa
In_125 Z 18 Ex1_3b
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
70
90
110
130
150
170
27000
18000
9000
0
al X
sz 82.78
ht 32187
al Y
sz 88.54
ht 32245
Added
al (12)
sz 107.22
ht 14815
Changed
al 13
sz 109.83
ht 31268
al 9
sz 149.61
ht 6574


H03_In_125 Z 18 Ex1_3b.fsa
In_125 Z 18 Ex1_3b
Sexplex neu_2019-08-08
DYS438
DXS9898
70
90
110
130
150
170
27000
18000
9000
0
Changed
al 12
sz 105.18
ht 32361
al 12
sz 142.38
ht 17432


Sample File
Sample Name
Panel
OS
SQ
H03_In_125 Z 18 Ex1_3b.fsa
In_125 Z 18 Ex1_3b
Sexplex neu_2019-08-08
DYS439
DXS6789
70
90
110
130
150
170
6900
4600
2300
0
al 13
sz 100.00
ht 5105
al 21
sz 148.07
ht 8447

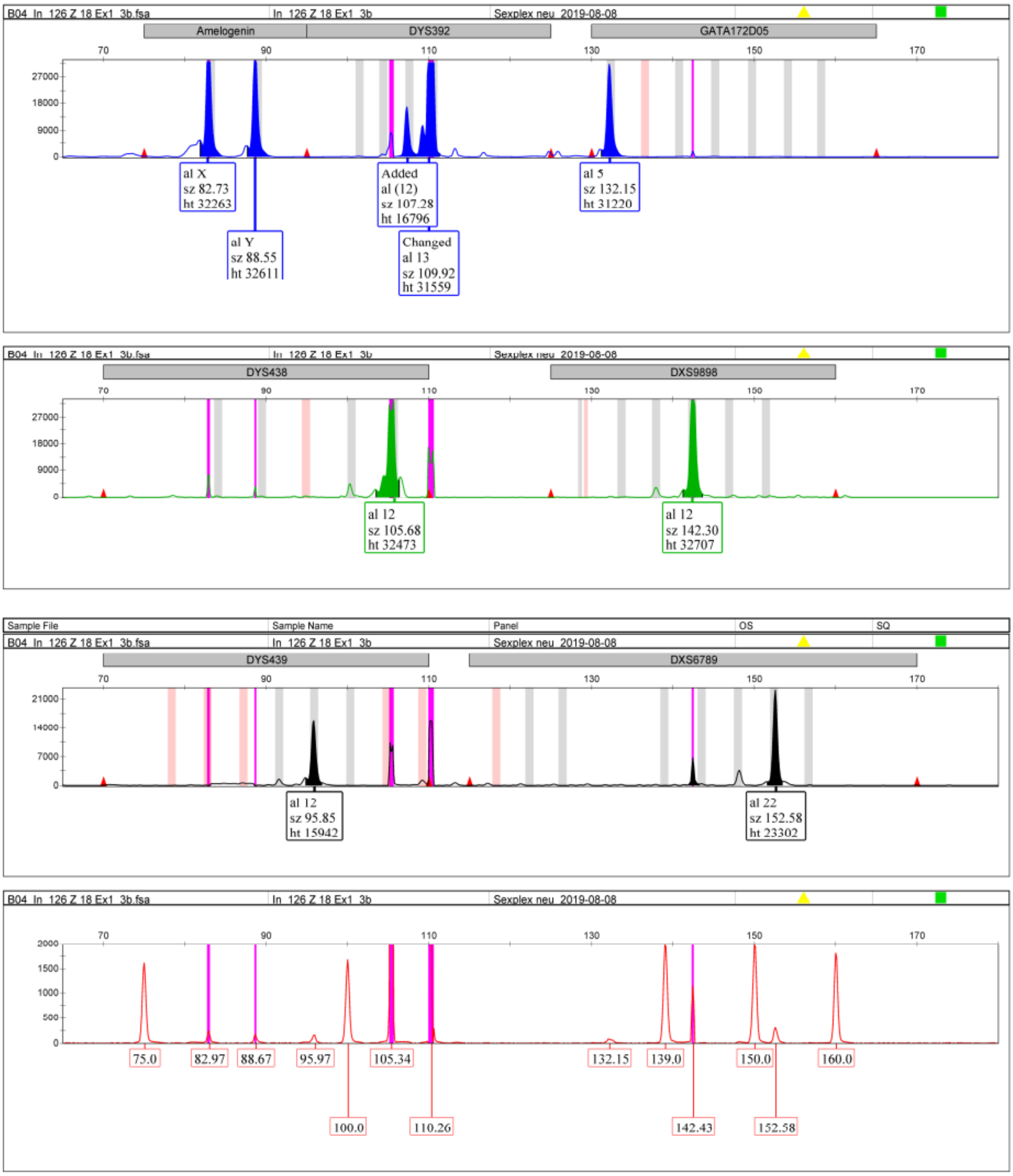

H03_In_125 Z 18 Ex1_3b.fsa
In_125 Z 18 Ex1_3b
Sexplex neu_2019-08-08
70
90
110
130
150
170
2000
1500
1000
500
0
65.75
75.0
82.9
88.66
100.0
105.29
139.0
148.07
160.0
106.43
142.38
150.0
110.17

Inden 126

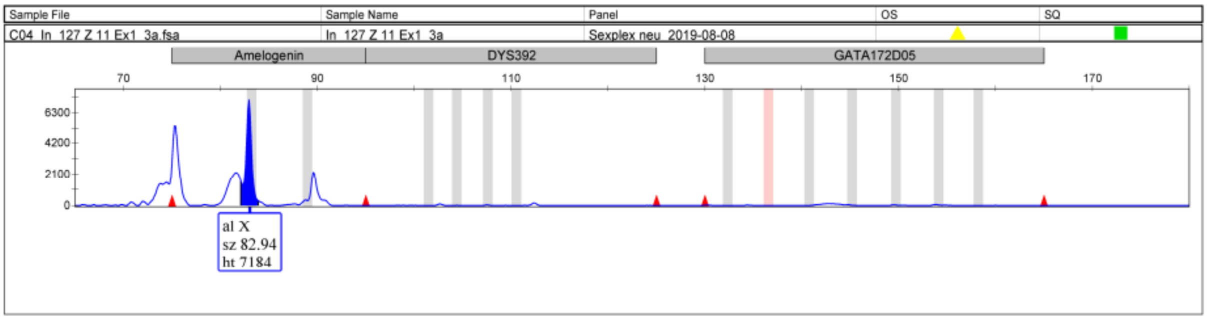


Sample File
Sample Name
Panel
OS
SQ
A04_In_126 Z 18 Ex1_3a.fsa
In_126 Z 18 Ex1_3a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
al X
sz 82.77
ht 32235
al Y
sz 88.54
ht 32311
Changed
al 13
sz 109.98
ht 32388
al 5
sz 132.20
ht 13280
DYS438
DXS9898
al 12
sz 105.31
ht 32498
al 12
sz 142.38
ht 30229
DYS439
DXS6789
al 12
sz 95.77
ht 6092
al 22
sz 152.57
ht 11943
75.0
83.01
88.66
95.77
100.0
105.31
110.09
139.0
142.25
150.0
152.45
160.0

Inden 126

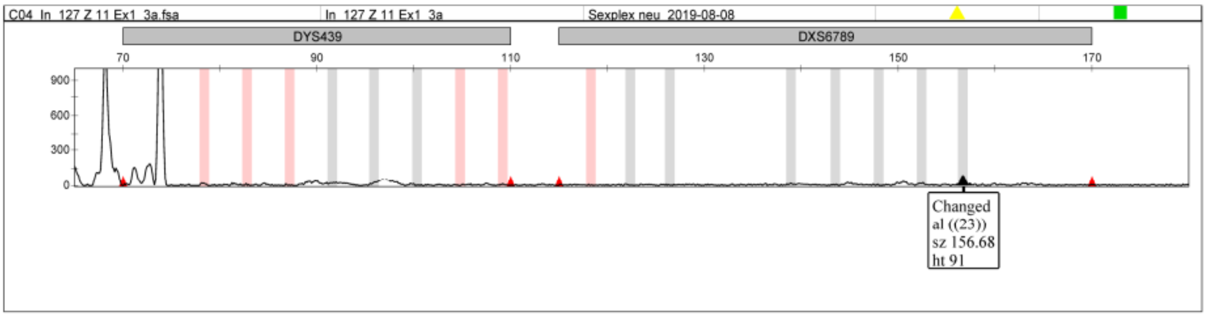

B04_In_126 Z 18 Ex1_3b.fsa
In_126 Z 18 Ex1_3b
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
al X
sz 82.73
ht 32263
al Y
sz 88.55
ht 32611
Added
al (12)
sz 107.28
ht 16796
Changed
al 13
sz 109.92
ht 31559
al 5
sz 132.15
ht 31220
DYS438
DXS9898
al 12
sz 105.68
ht 32473
al 12
sz 142.30
ht 32707
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 12
sz 95.85
ht 15942
al 22
sz 152.58
ht 23302
75.0
82.97
88.67
95.97
100.0
105.34
110.26
132.15
139.0
142.43
150.0
152.58
160.0

Inden 127

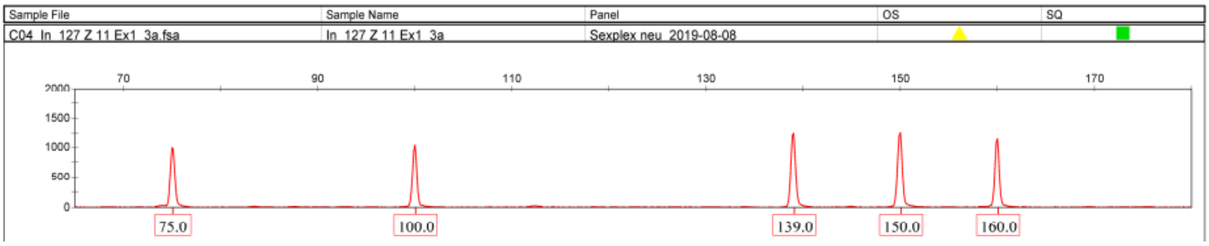


Sample File
Sample Name
Panel
OS
SQ
C04_In_127 Z 11 Ex1_3a.fsa
In_127 Z 11 Ex1_3a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
70
90
110
130
150
170
6300
4200
2100
0
al X
sz 82.94
ht 7184

C04_In_127 Z 11 Ex1_3a.fsa
In_127 Z 11 Ex1_3a
Sexplex neu_2019-08-08
DYS438
DXS9898
70
90
110
130
150
170
1800
1200
600
0
Changed
al ?
sz 87.89
ht 1594
Changed
al ((8.3))
sz 128.36
ht 186
Changed
al ((13))
sz 146.88
ht 167

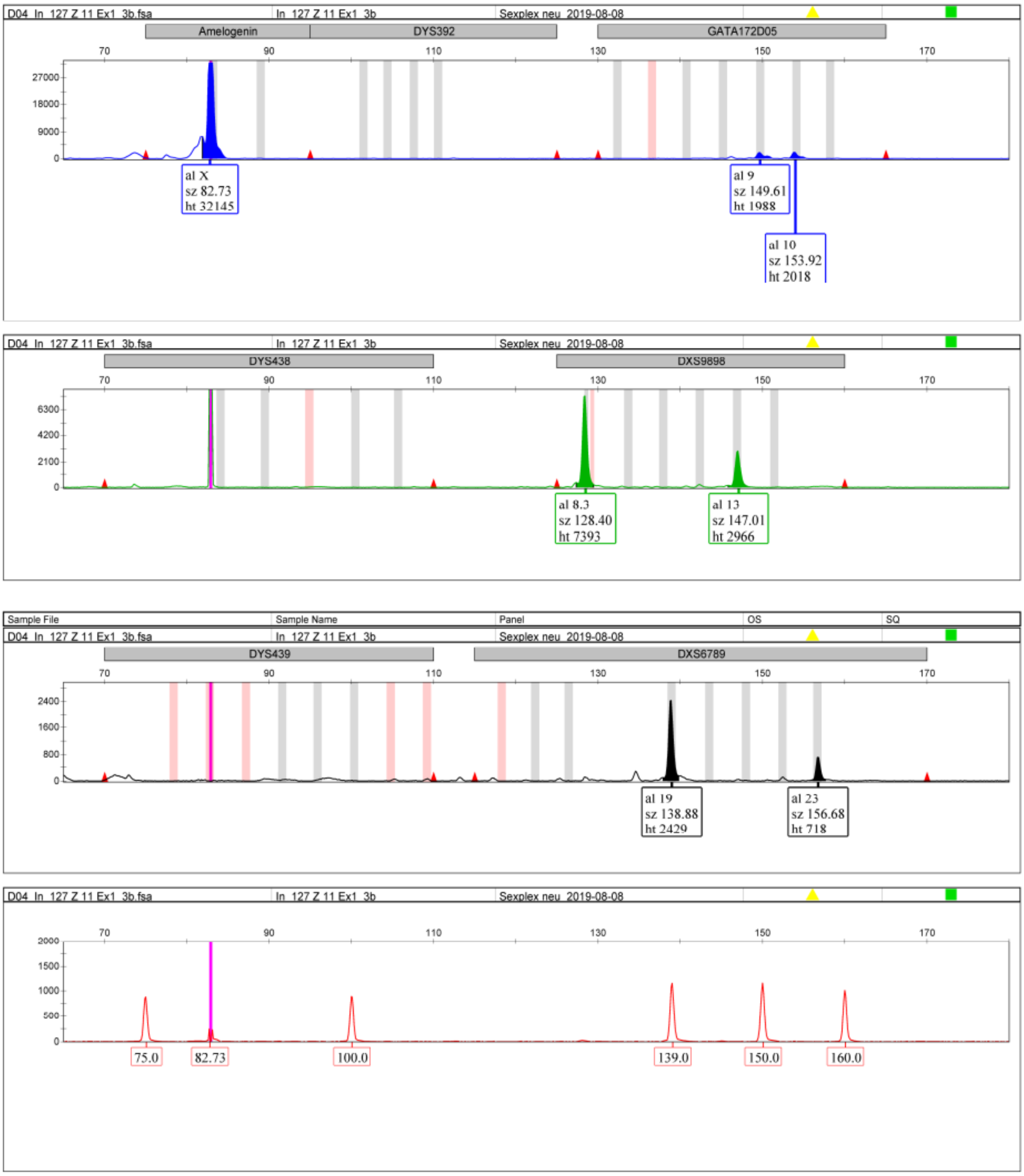


C04_In_127 Z 11 Ex1_3a.fsa
In_127 Z 11 Ex1_3a
Sexplex neu_2019-08-08
DYS439
DXS6789
70
90
110
130
150
170
900
600
300
0
Changed
al ((23))
sz 156.68
ht 91

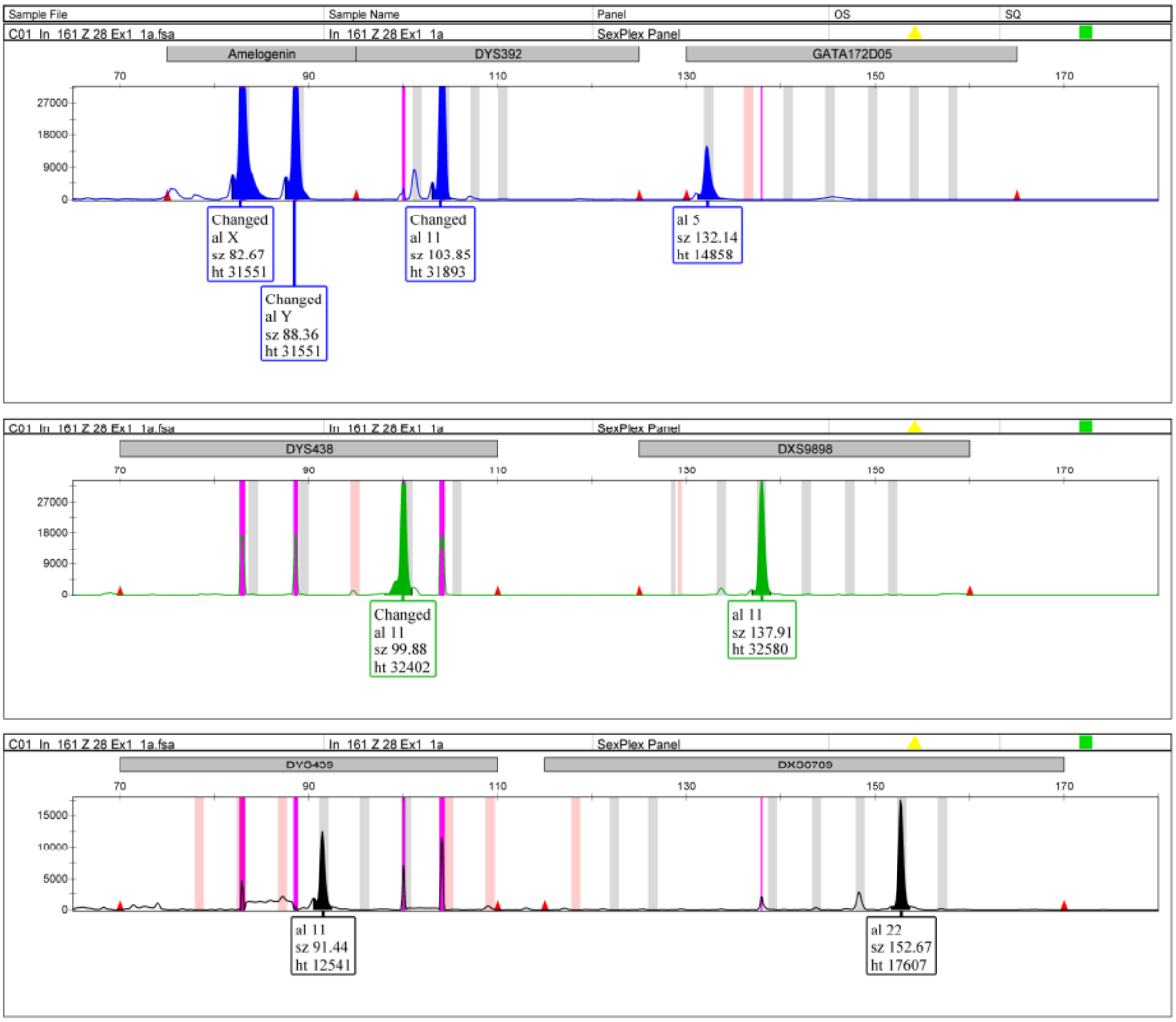


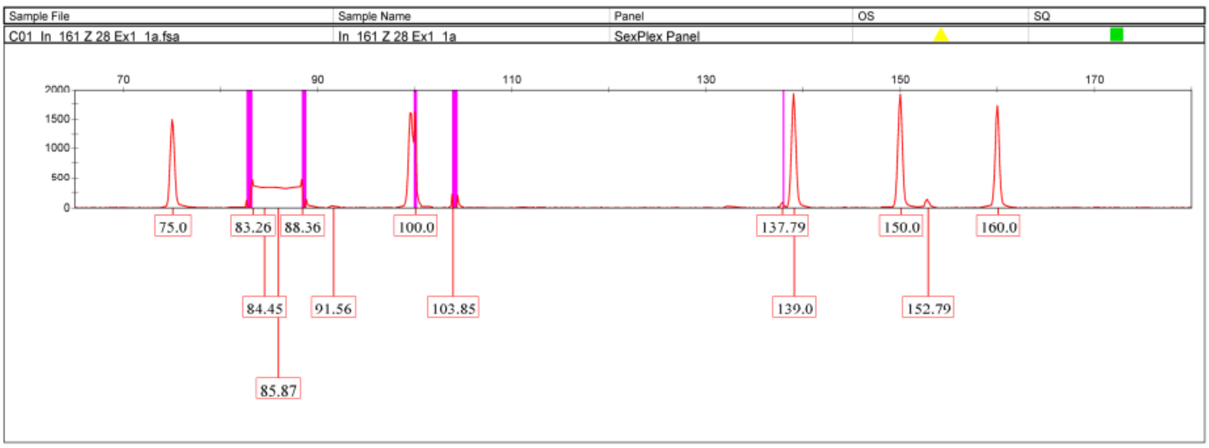
Sample File
Sample Name
Panel
OS
SQ
C04_In_127 Z 11 Ex1_3a.fsa
In_127 Z 11 Ex1_3a
Sexplex neu_2019-08-08
70
90
110
130
150
170
2000
1500
1000
500
0
75.0
100.0
139.0
150.0
160.0

Inden 127

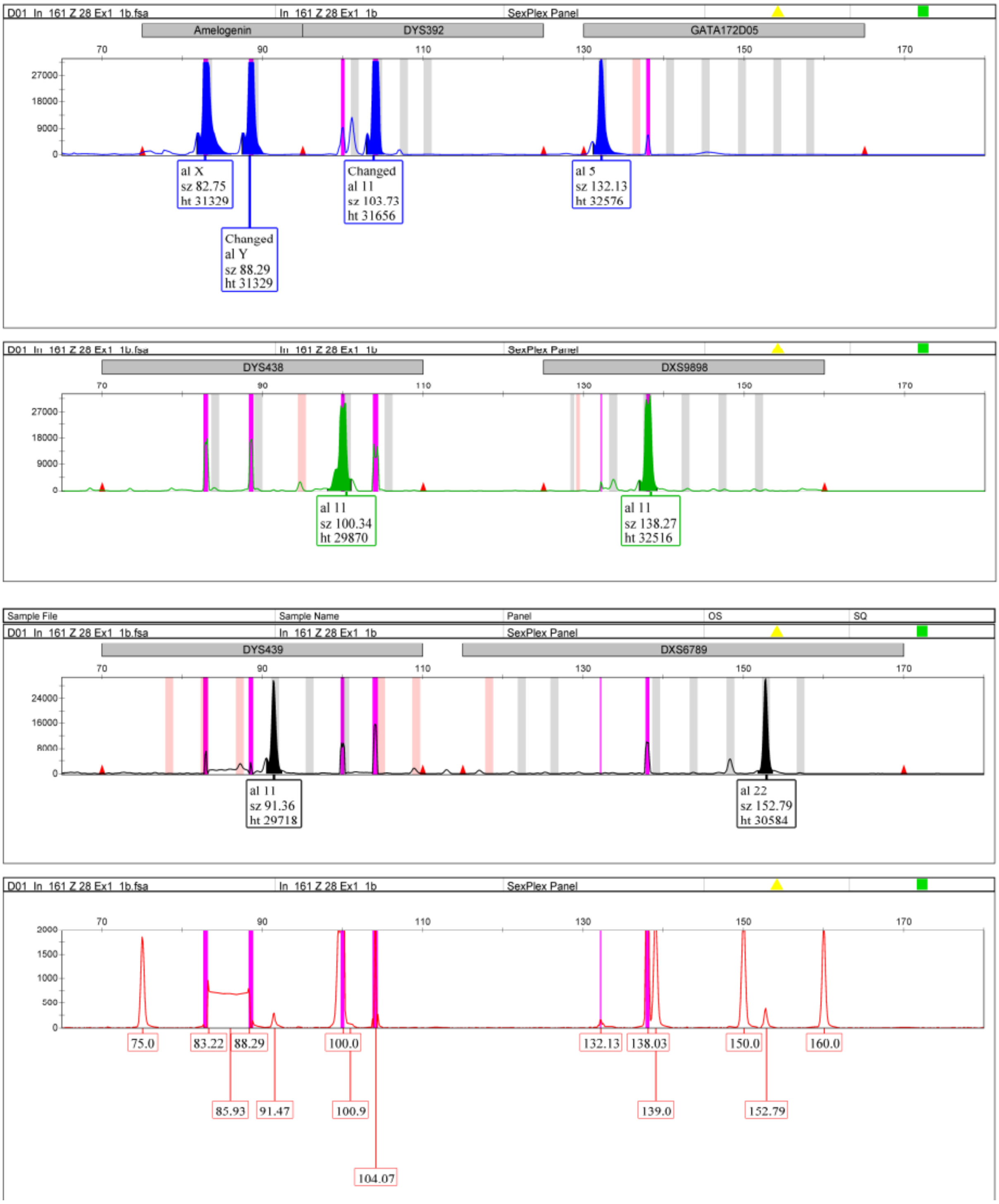

D04_In_127 Z 11 Ex1_3b.fsa
In_127 Z 11 Ex1_3b
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
al X
sz 82.73
ht 32145
al 9
sz 149.61
ht 1988
al 10
sz 153.92
ht 2018
DYS438
DXS9898
al 8.3
sz 128.40
ht 7393
al 13
sz 147.01
ht 2966
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 19
sz 138.88
ht 2429
al 23
sz 156.68
ht 718
75.0
82.73
100.0
139.0
150.0
160.0

Inden 161

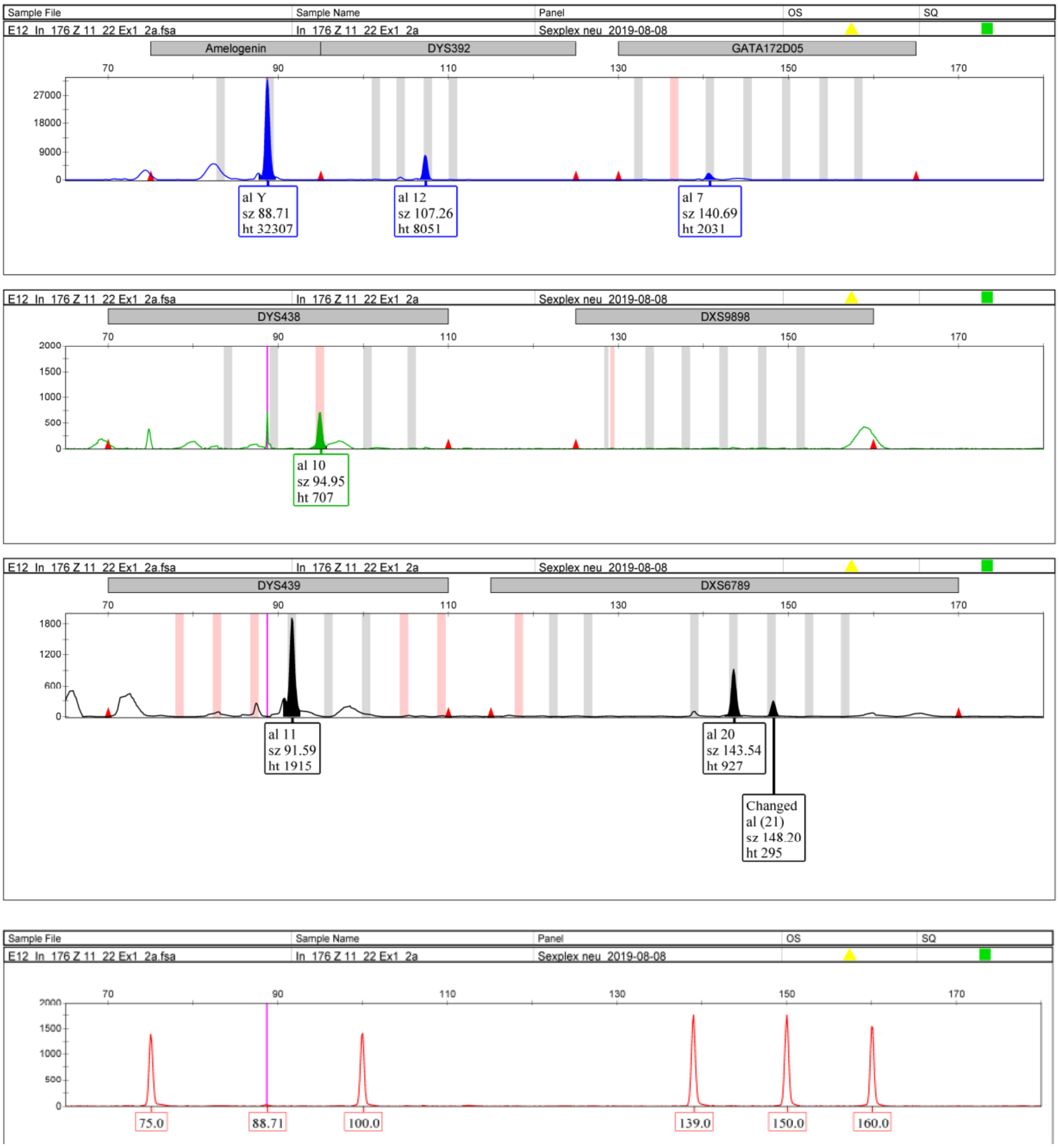

Sample File
Sample Name
Panel
OS
SQ
C01 In 161 Z 28 Ex1 1a.fsa
In 161 Z 28 Ex1 1a
SexPlex Panel
Amelogenin
DYS392
GATA172D05
Changed
al X
sz 82.67
ht 31551
Changed
al Y
sz 88.36
ht 31551
Changed
al 11
sz 103.85
ht 31893
al 5
sz 132.14
ht 14858
DYS438
DXS9898
Changed
al 11
sz 99.88
ht 32402
al 11
sz 137.91
ht 32580
DYS439
DXS0709
al 11
sz 91.44
ht 12541
al 22
sz 152.67
ht 17607


Sample File
Sample Name
Panel
OS
SQ
C01 In 161 Z 28 Ex1 1a.fsa
In 161 Z 28 Ex1 1a
SexPlex Panel
75.0
83.26
88.36
100.0
137.79
150.0
160.0
84.45
91.56
103.85
139.0
152.79
85.87

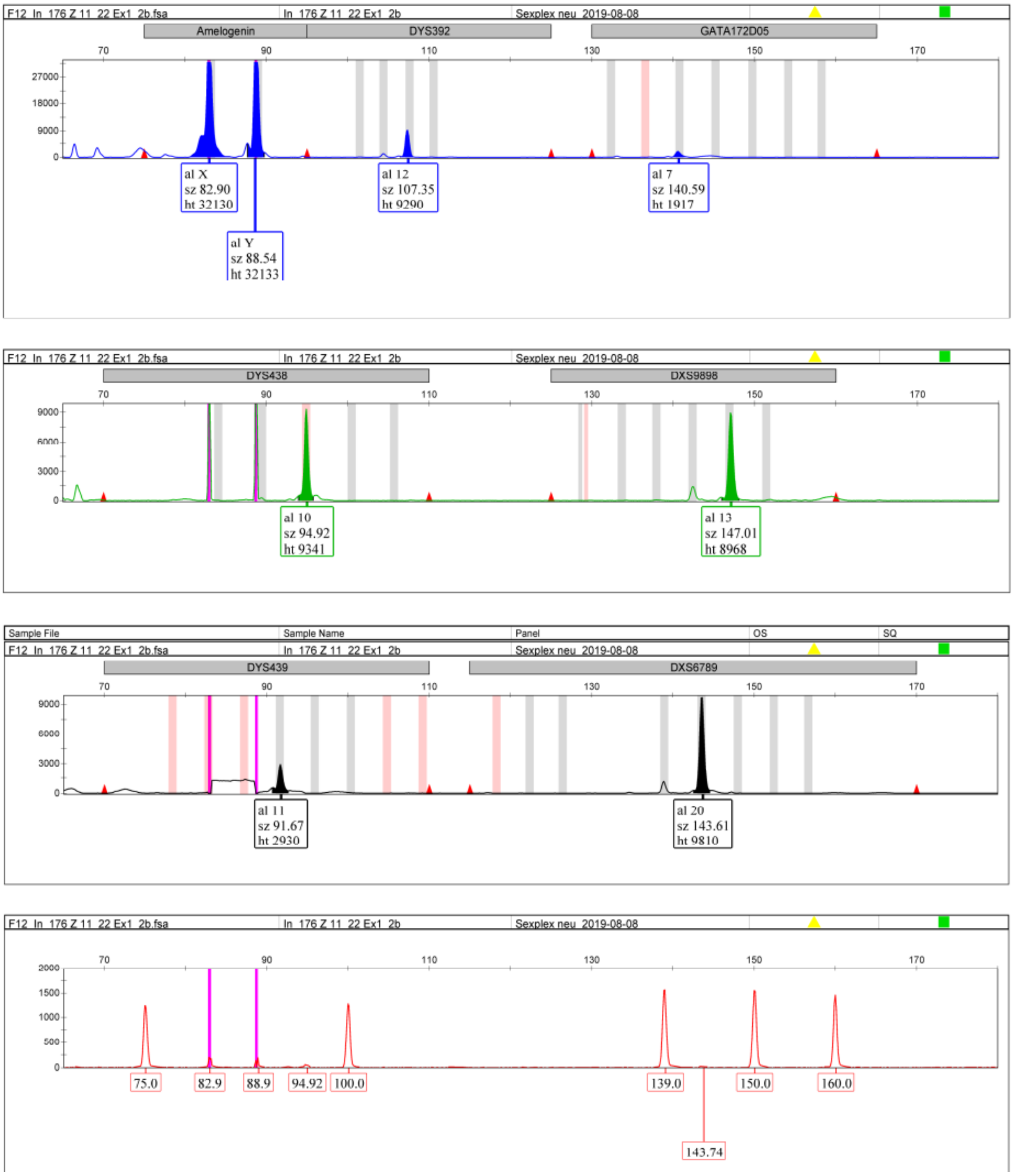
Inden 161


D01_In_161 Z 28 Ex1_1b.fsa
In_161 Z 28 Ex1_1b
SexPlex Panel
Amelogenin
DYS392
GATA172D05
al X sz 82.75 ht 31329
Changed al Y sz 88.29 ht 31329
Changed al 11 sz 103.73 ht 31656
al 5 sz 132.13 ht 32576
DYS438
DXS9898
al 11 sz 100.34 ht 29870
al 11 sz 138.27 ht 32516
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 11 sz 91.36 ht 29718
al 22 sz 152.79 ht 30584
75.0
83.22
88.29
100.0
132.13
138.03
150.0
160.0
85.93
91.47
100.9
139.0
152.79
104.07

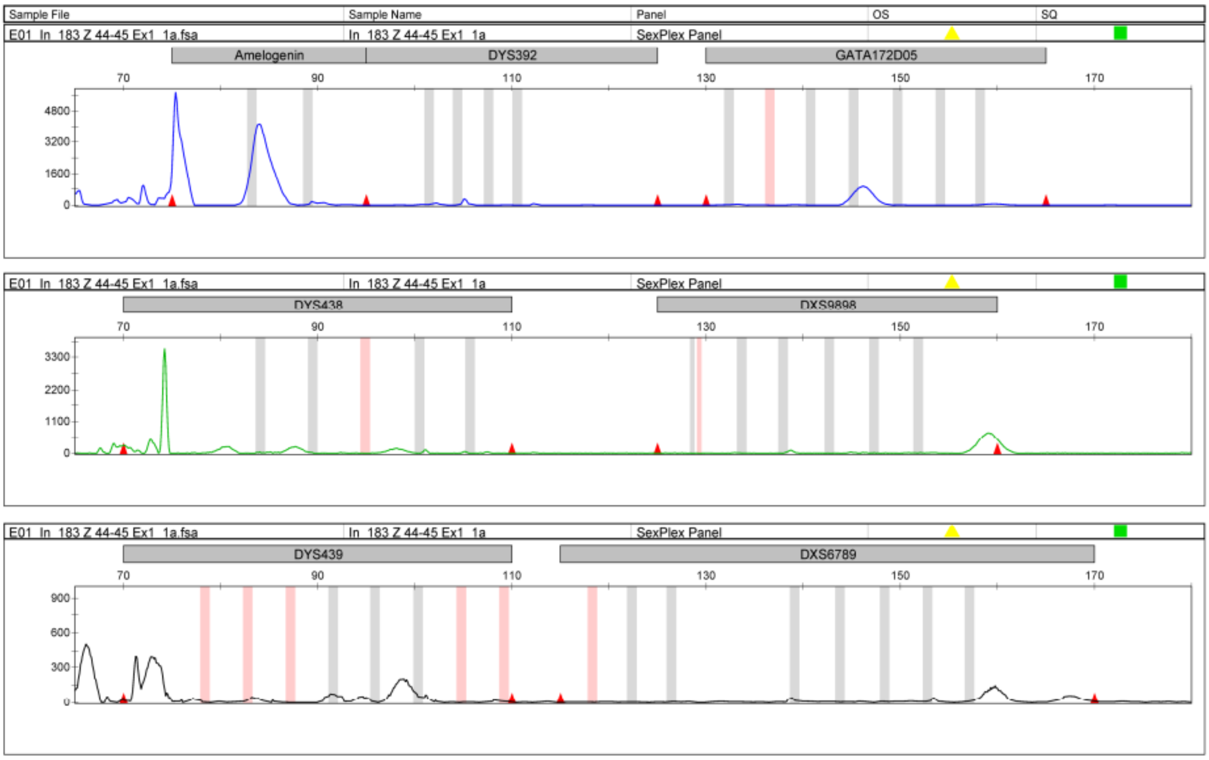
Inden 176


Sample File
Sample Name
Panel
OS
SQ
E12_In_176 Z 11_22 Ex1_2a.fsa
In_176 Z 11_22 Ex1_2a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
al Y
sz 88.71
ht 32307
al 12
sz 107.26
ht 8051
al 7
sz 140.69
ht 2031
DYS438
DXS9898
al 10
sz 94.95
ht 707
DYS439
DXS6789
al 11
sz 91.59
ht 1915
al 20
sz 143.54
ht 927
Changed
al (21)
sz 148.20
ht 295
75.0
88.71
100.0
139.0
150.0
160.0

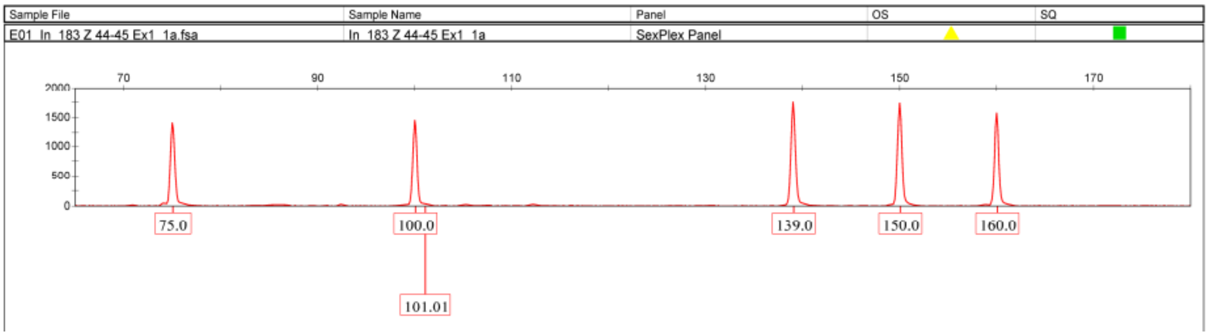
Inden 176


F12_In_176 Z 11_22 Ex1_2b.fsa
In_176 Z 11_22 Ex1_2b
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
al X
sz 82.90
ht 32130
al Y
sz 88.54
ht 32133
al 12
sz 107.35
ht 9290
al 7
sz 140.59
ht 1917
DYS438
DXS9898
al 10
sz 94.92
ht 9341
al 13
sz 147.01
ht 8968
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 11
sz 91.67
ht 2930
al 20
sz 143.61
ht 9810
75.0
82.9
88.9
94.92
100.0
139.0
150.0
160.0
143.74

Inden 183

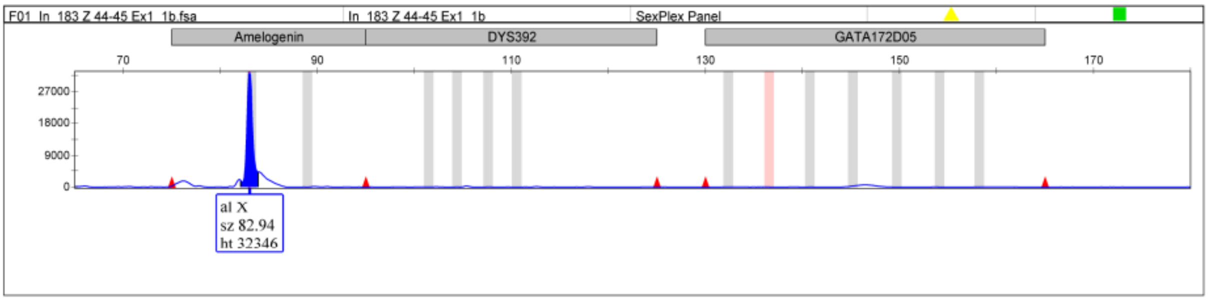


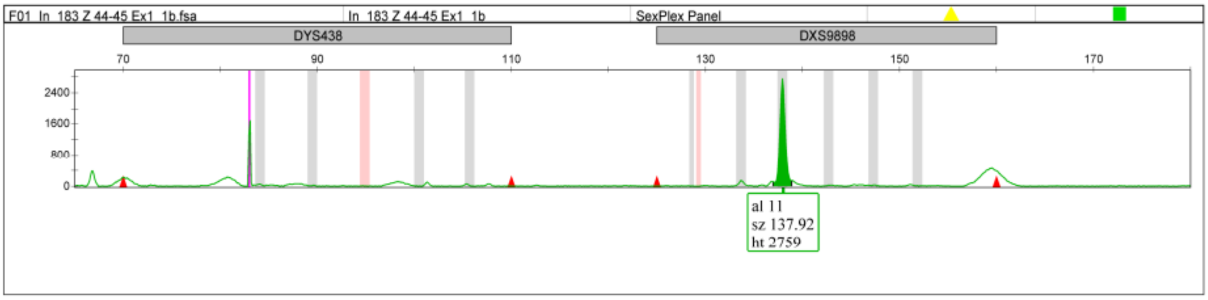
Sample File
Sample Name
Panel
OS
SQ
E01_In_183 Z 44-45 Ex1_1a.fsa
In_183 Z 44-45 Ex1_1a
SexPlex Panel
Amelogenin
DYS392
GATA172D05
DYS438
DXS9898
DYS439
DXS6789

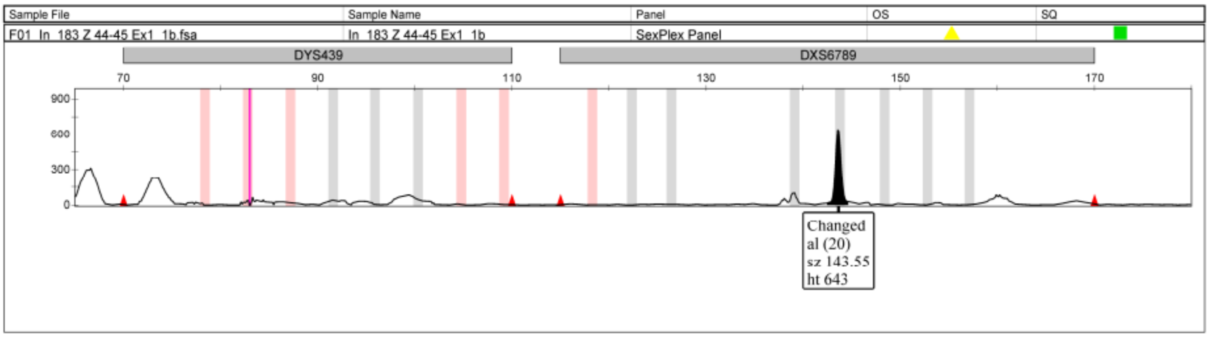


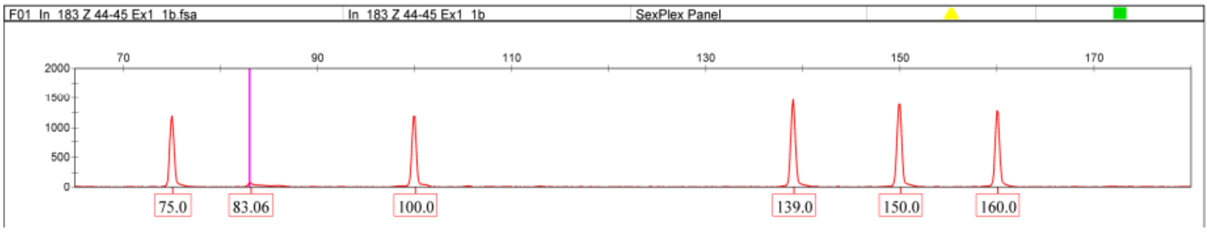
Sample File
Sample Name
Panel
OS
SQ
E01_In_183 Z 44-45 Ex1_1a.fsa
In_183 Z 44-45 Ex1_1a
SexPlex Panel
75.0
100.0
139.0
150.0
160.0
101.01

Inden 183

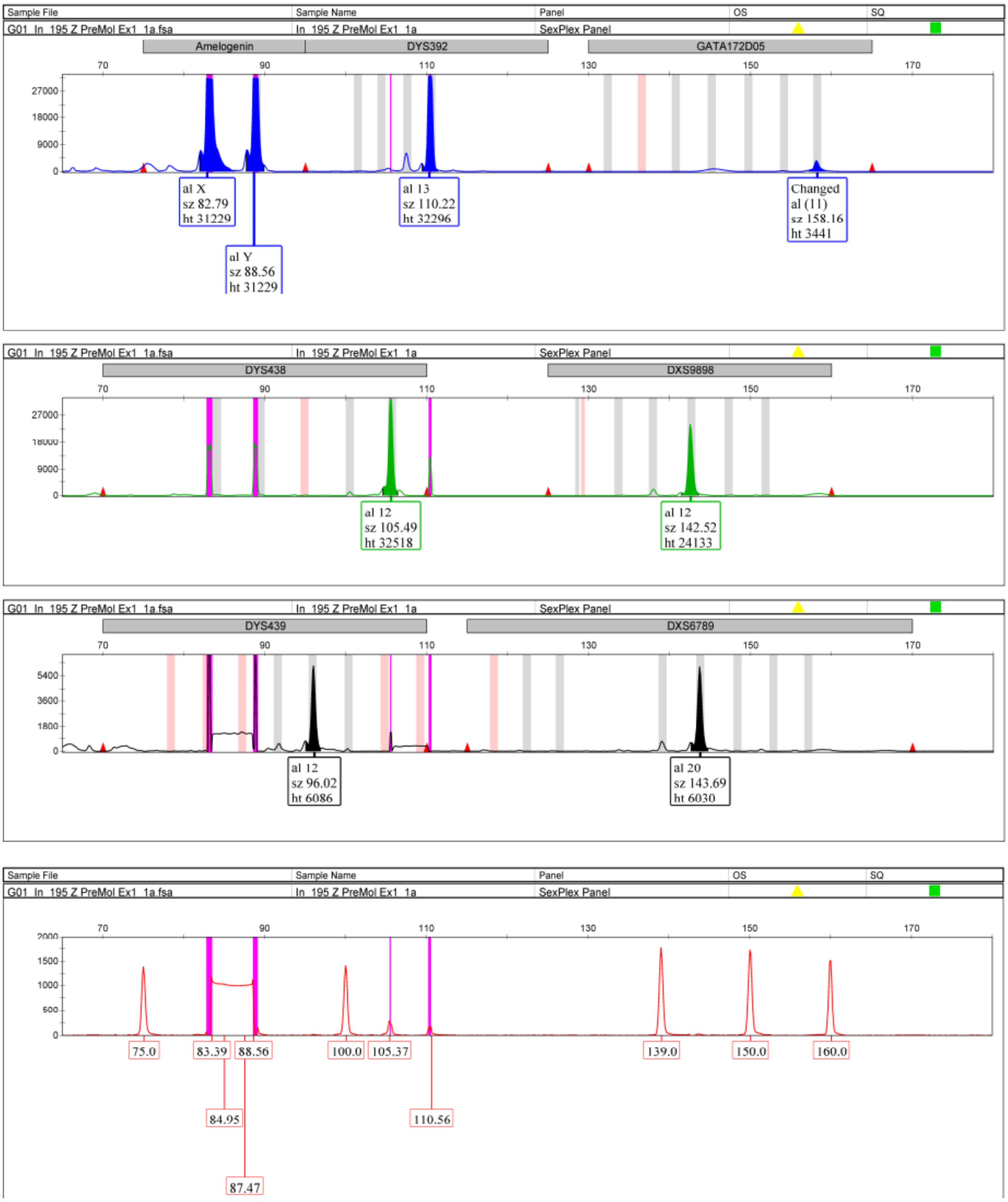

F01_In_183 Z 44-45 Ex1_1b.fsa
In_183 Z 44-45 Ex1_1b
SexPlex Panel
Amelogenin
DYS392
GATA172D05
70
90
110
130
150
170
27000
18000
9000
0
al X
sz 82.94
ht 32346


F01_In_183 Z 44-45 Ex1_1b.fsa
In_183 Z 44-45 Ex1_1b
SexPlex Panel
DYS438
DXS9898
70
90
110
130
150
170
2400
1600
800
0
al 11
sz 137.92
ht 2759

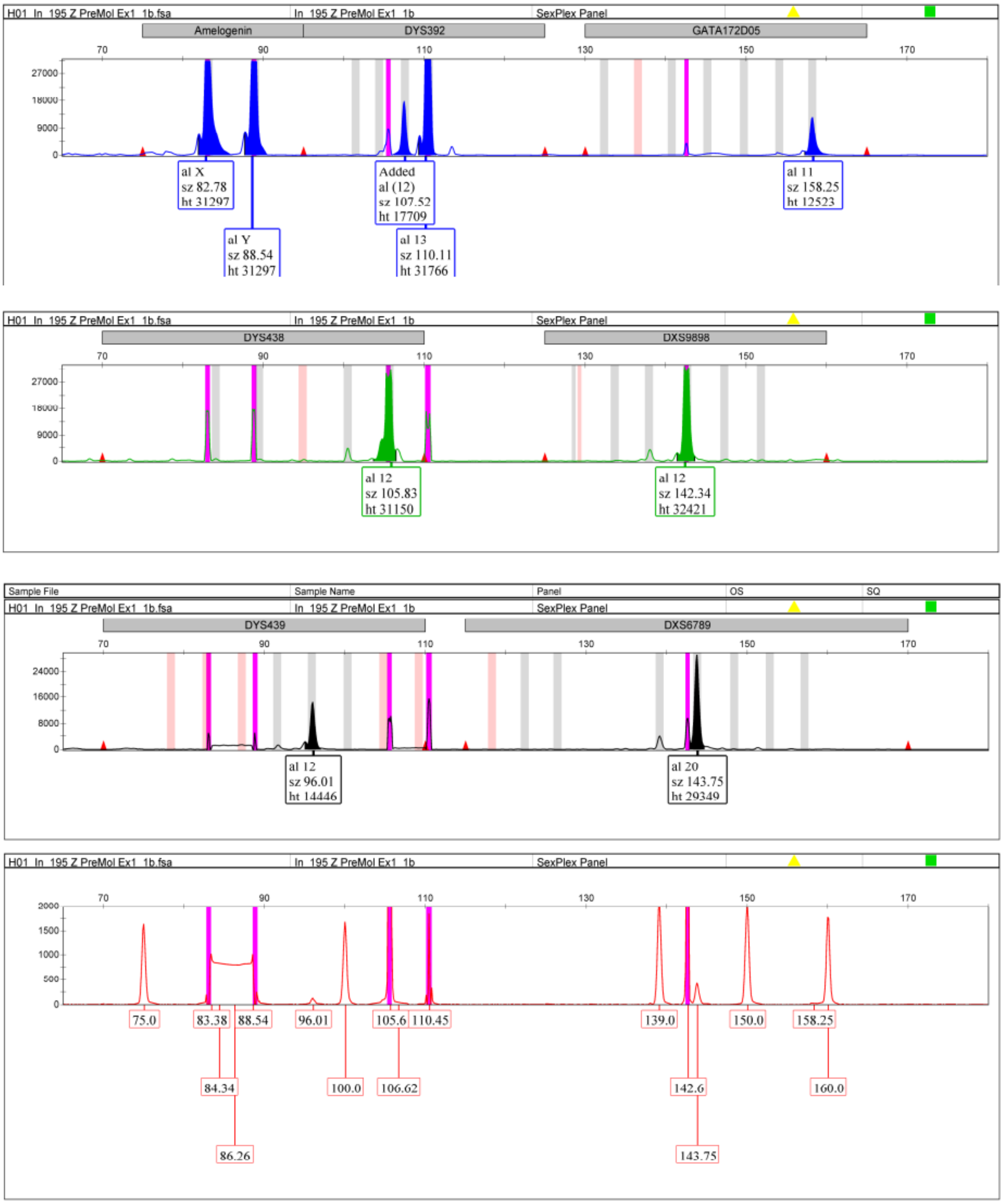

Sample File
Sample Name
Panel
OS
SQ
F01_In_183 Z 44-45 Ex1_1b.fsa
In_183 Z 44-45 Ex1_1b
SexPlex Panel
DYS439
DXS6789
70
90
110
130
150
170
900
600
300
0
Changed
al (20)
sz 143.55
ht 643


F01_In_183 Z 44-45 Ex1_1b.fsa
In_183 Z 44-45 Ex1_1b
SexPlex Panel
70
90
110
130
150
170
2000
1500
1000
500
0
75.0
83.06
100.0
139.0
150.0
160.0

Inden 195

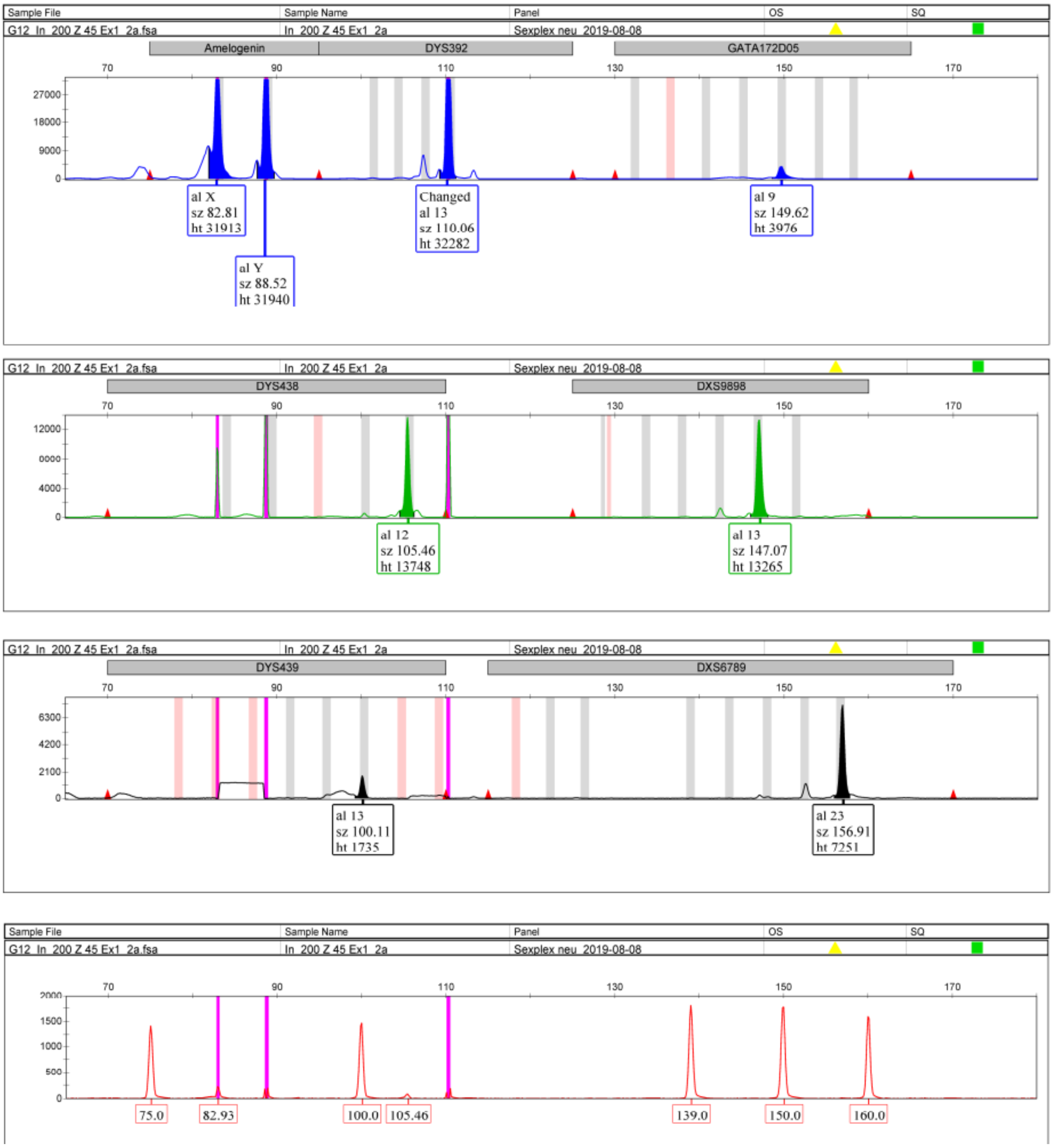

Sample File
Sample Name
Panel
OS
SQ
G01 In 195 Z PreMol Ex1 1a.fsa
In 195 Z PreMol Ex1 1a
SexPlex Panel
Amelogenin
DYS392
GATA172D05
al X sz 82.79 ht 31229
al Y sz 88.56 ht 31229
al 13 sz 110.22 ht 32296
Changed al (11) sz 158.16 ht 3441
DYS438
DXS9898
al 12 sz 105.49 ht 32518
al 12 sz 142.52 ht 24133
DYS439
DXS6789
al 12 sz 96.02 ht 6086
al 20 sz 143.69 ht 6030
75.0
83.39
88.56
100.0
105.37
139.0
150.0
160.0
84.95
110.56
87.47

Inden 195

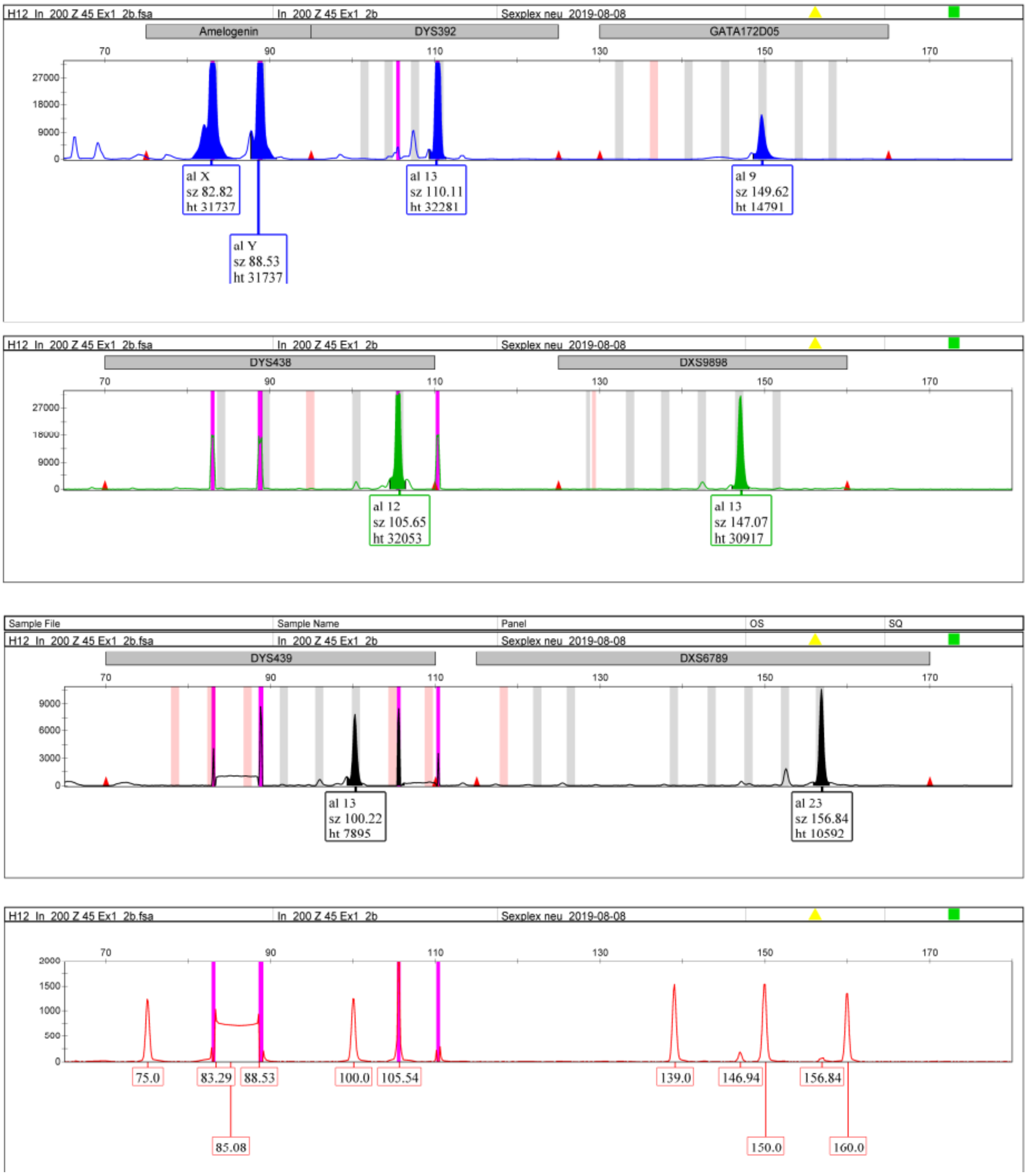


H01_In_195 Z PreMol Ex1_1b.fsa
In_195 Z PreMol Ex1_1b
SexPlex Panel
Amelogenin
DYS392
GATA172D05
al X sz 82.78 ht 31297
al Y sz 88.54 ht 31297
Added al (12) sz 107.52 ht 17709
al 13 sz 110.11 ht 31766
al 11 sz 158.25 ht 12523
DYS438
DXS9898
al 12 sz 105.83 ht 31150
al 12 sz 142.34 ht 32421
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 12 sz 96.01 ht 14446
al 20 sz 143.75 ht 29349
75.0
83.38
88.54
96.01
105.6
110.45
139.0
150.0
158.25
84.34
100.0
106.62
142.6
160.0
86.26
143.75

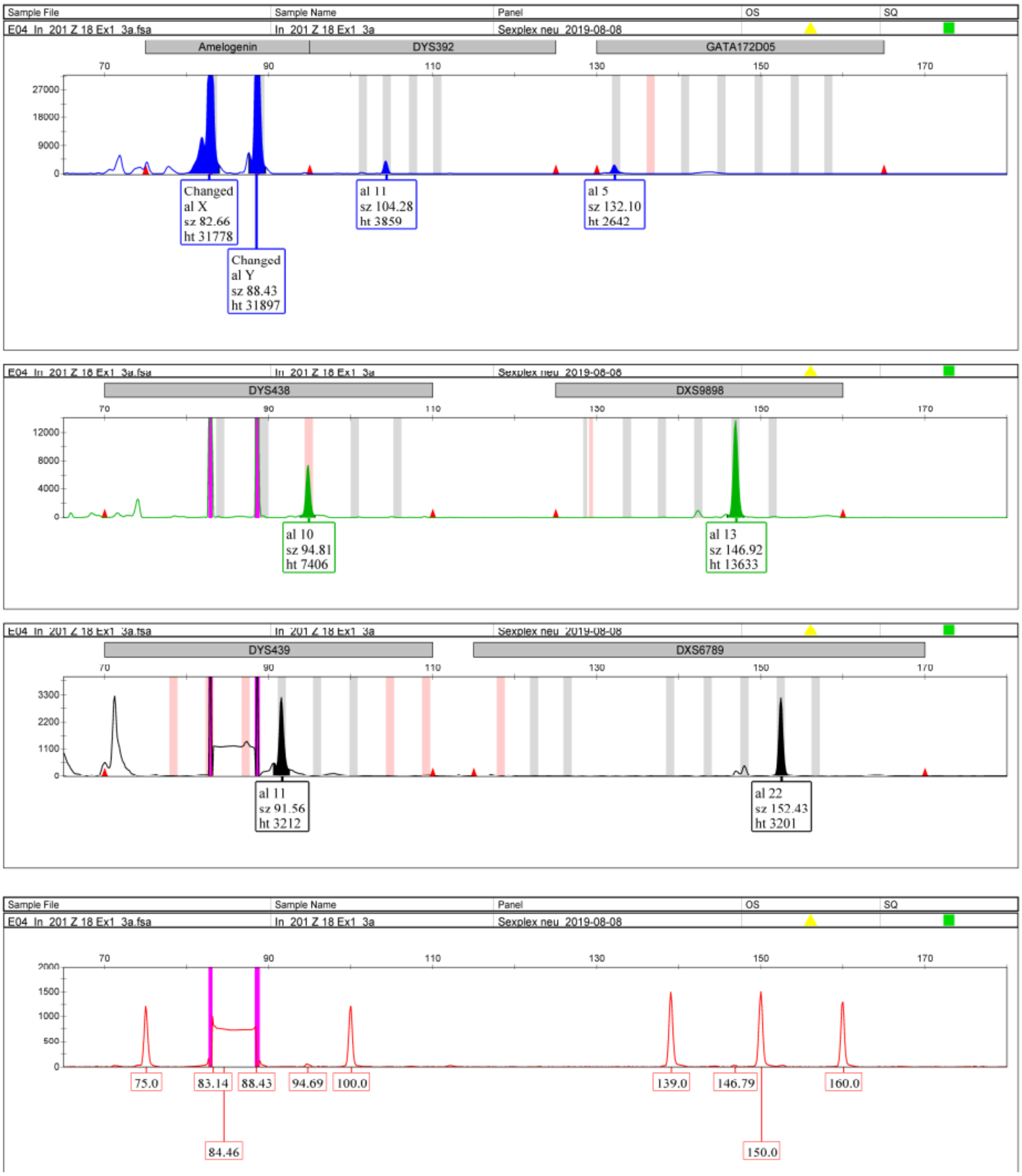
Inden 200


Sample File
Sample Name
Panel
OS
SQ
G12_In_200 Z 45 Ex1_2a.fsa
In_200 Z 45 Ex1_2a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
al X
sz 82.81
ht 31913
al Y
sz 88.52
ht 31940
Changed
al 13
sz 110.06
ht 32282
al 9
sz 149.62
ht 3976
DYS438
DXS9898
al 12
sz 105.46
ht 13748
al 13
sz 147.07
ht 13265
DYS439
DXS6789
al 13
sz 100.11
ht 1735
al 23
sz 156.91
ht 7251
75.0
82.93
100.0
105.46
139.0
150.0
160.0

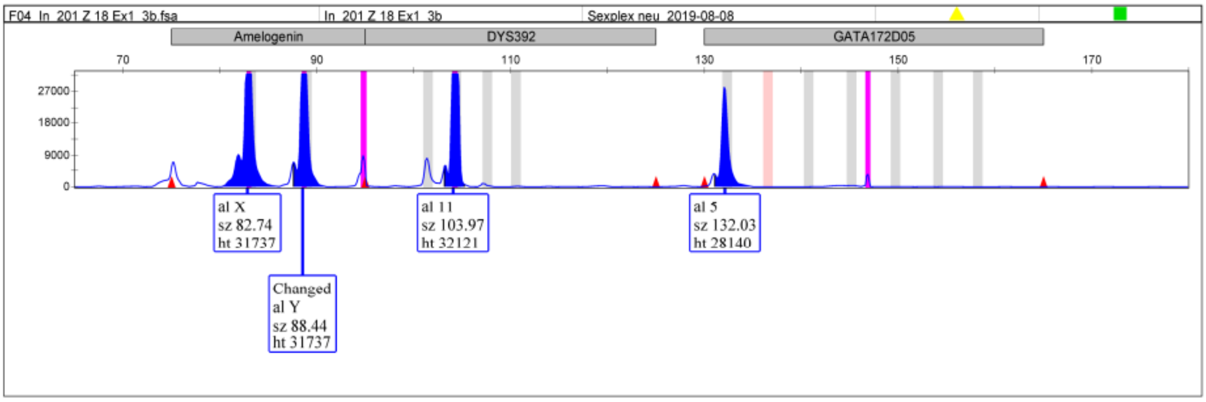
Inden 200

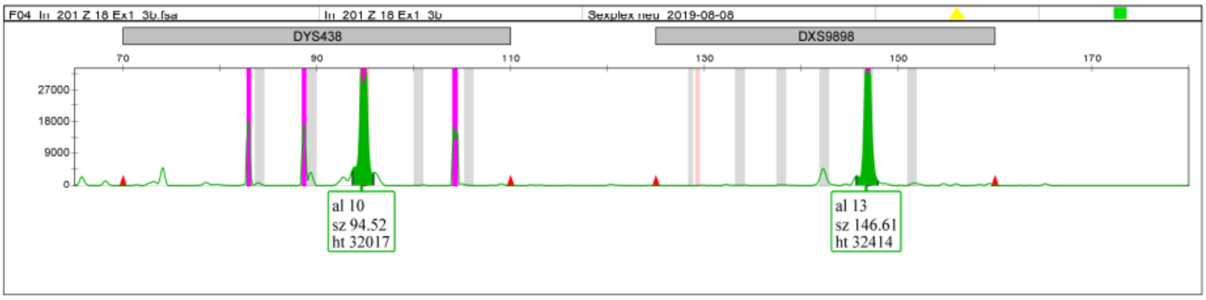

H12_In_200 Z 45 Ex1_2b.fsa
In_200 Z 45 Ex1_2b
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
al X
sz 82.82
ht 31737
al Y
sz 88.53
ht 31737
al 13
sz 110.11
ht 32281
al 9
sz 149.62
ht 14791
DYS438
DXS9898
al 12
sz 105.65
ht 32053
al 13
sz 147.07
ht 30917
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 13
sz 100.22
ht 7895
al 23
sz 156.84
ht 10592
75.0
83.29
88.53
100.0
105.54
139.0
146.94
156.84
85.08
150.0
160.0

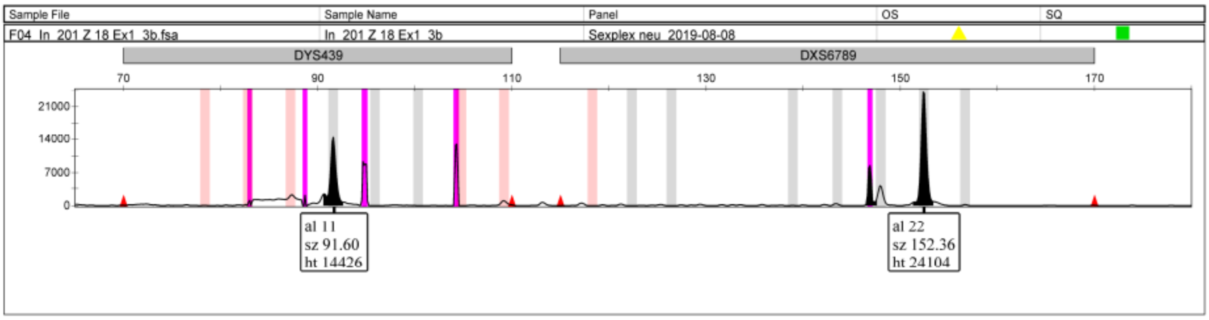
Inden 201

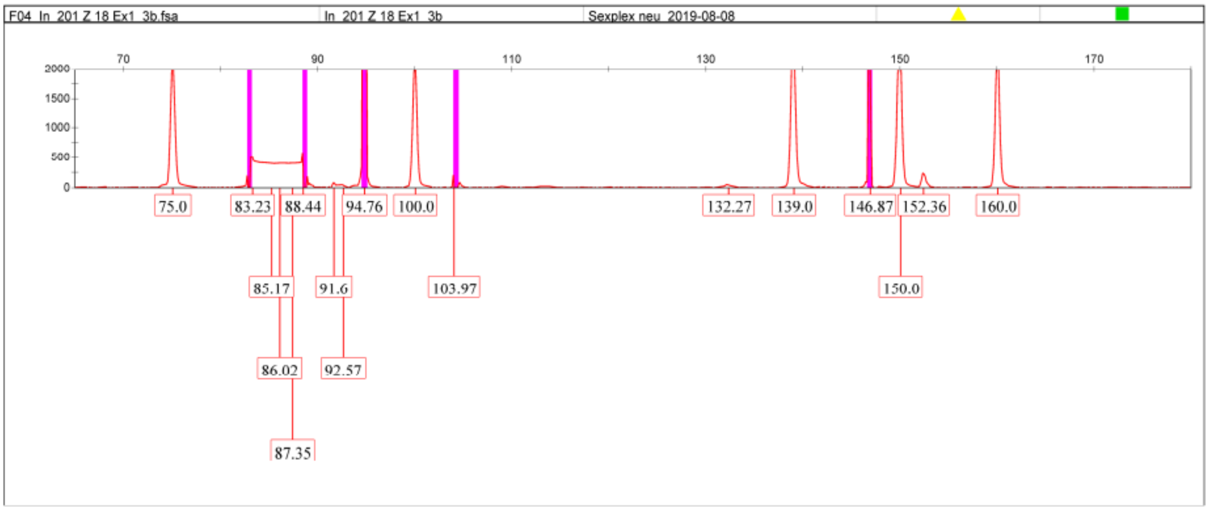

Sample File
Sample Name
Panel
OS
SQ
E04 In 201 Z 18 Ex1 3a.fsa
In 201 Z 18 Ex1 3a
Sexplex neu 2019-08-08
Amelogenin
DYS392
GATA172D05
Changed
al X
sz 82.66
ht 31778
Changed
al Y
sz 88.43
ht 31897
al 11
sz 104.28
ht 3859
al 5
sz 132.10
ht 2642
DYS438
DXS9898
al 10
sz 94.81
ht 7406
al 13
sz 146.92
ht 13633
DYS439
DXS6789
al 11
sz 91.56
ht 3212
al 22
sz 152.43
ht 3201
75.0
83.14
88.43
94.69
100.0
139.0
146.79
160.0
84.46
150.0

Inden 201

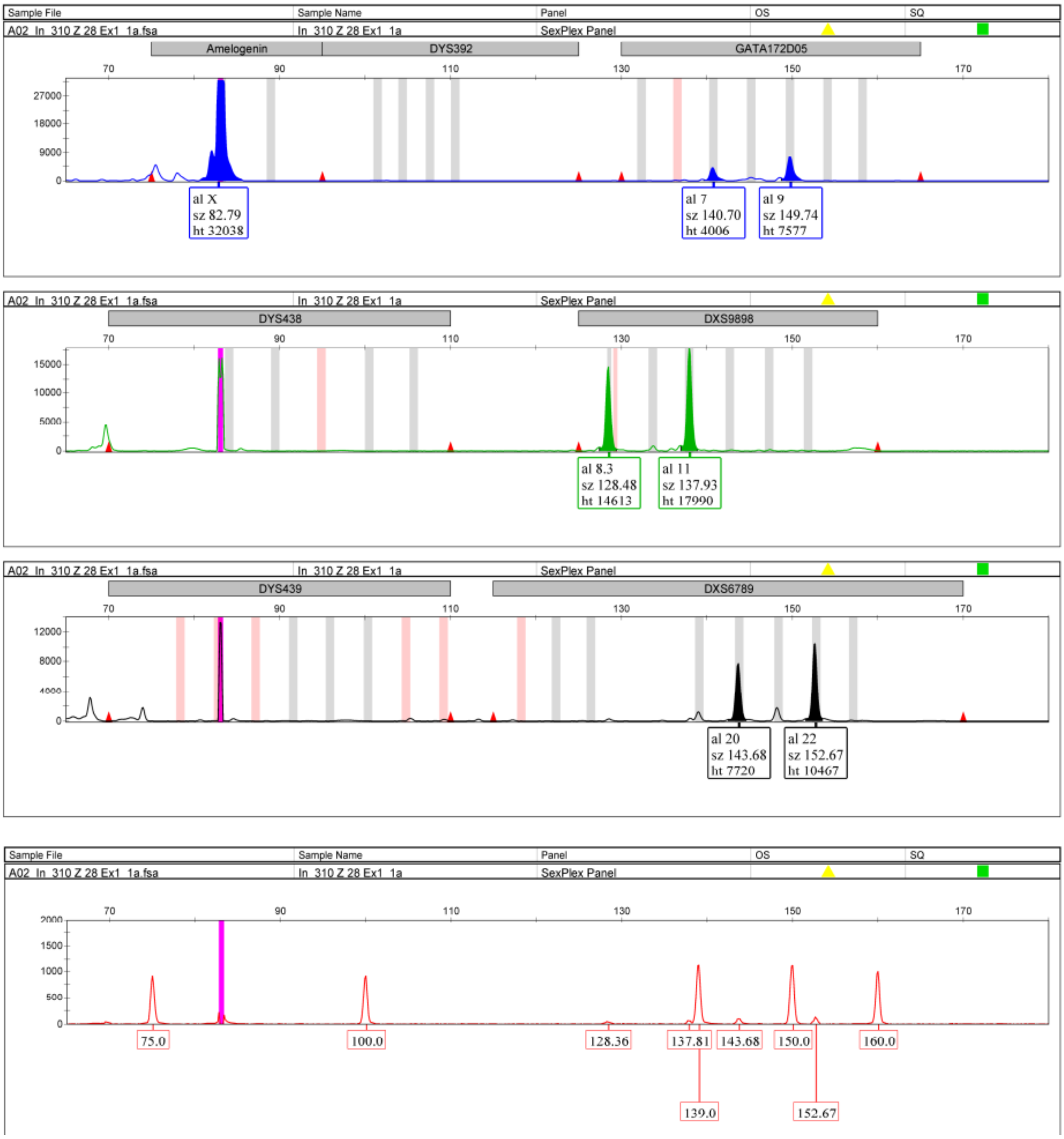

F04_In_201 Z 18 Ex1_3b.fsa
In_201 Z 18 Ex1_3b
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
70
90
110
130
150
170
27000
18000
9000
0
al X
sz 82.74
ht 31737
al 11
sz 103.97
ht 32121
al 5
sz 132.03
ht 28140
Changed
al Y
sz 88.44
ht 31737


F04_In_201 Z 18 Ex1_3b.fsa
In_201 Z 18 Ex1_3b
Sexplex neu_2019-08-08
DYS438
DXS9898
70
90
110
130
150
170
27000
18000
9000
0
al 10
sz 94.52
ht 32017
al 13
sz 146.61
ht 32414

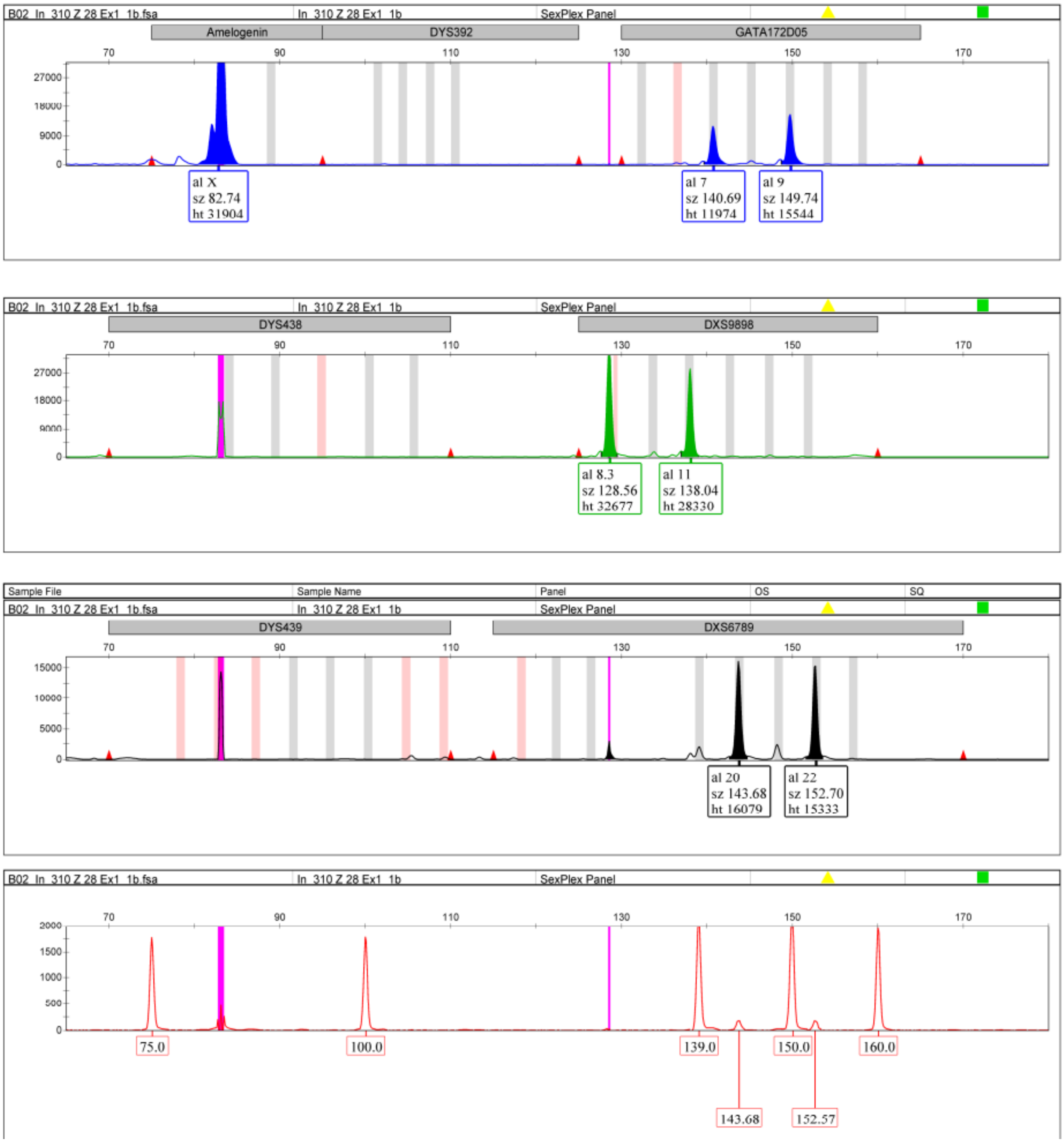

Sample File
Sample Name
Panel
OS
SQ
F04_In_201 Z 18 Ex1_3b.fsa
In_201 Z 18 Ex1_3b
Sexplex neu_2019-08-08
DYS439
DXS6789
70
90
110
130
150
170
21000
14000
7000
0
al 11
sz 91.60
ht 14426
al 22
sz 152.36
ht 24104


F04_In_201 Z 18 Ex1_3b.fsa
In_201 Z 18 Ex1_3b
Sexplex neu_2019-08-08
70
90
110
130
150
170
2000
1500
1000
500
0
75.0
83.23
88.44
94.76
100.0
132.27
139.0
146.87
152.36
160.0
85.17
91.6
103.97
150.0
86.02
92.57
87.35

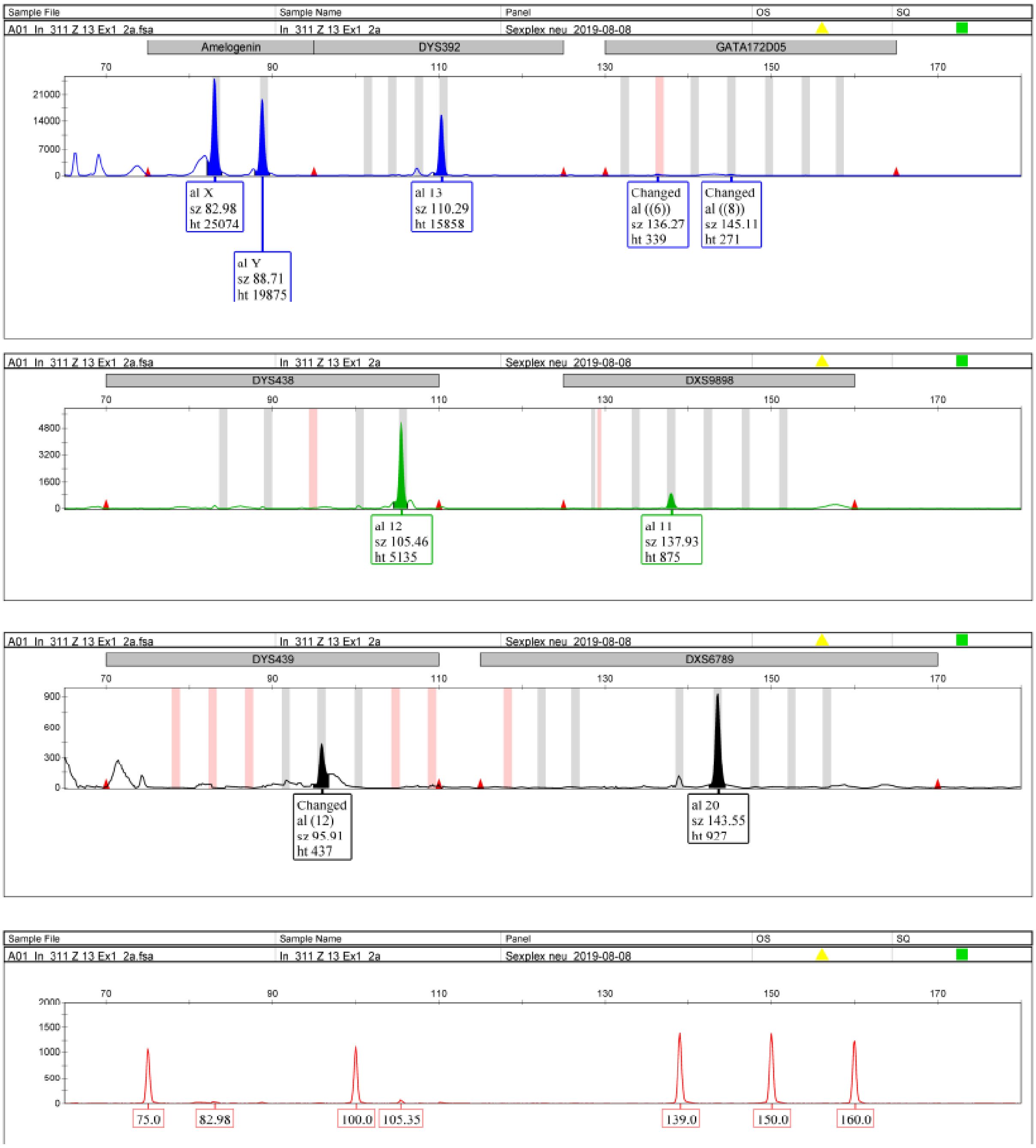
Inden 310


Sample File
Sample Name
Panel
OS
SQ
A02_In_310 Z 28 Ex1_1a.fsa
In_310 Z 28 Ex1_1a
SexPlex Panel
Amelogenin
DYS392
GATA172D05
al X
sz 82.79
ht 32038
al 7
sz 140.70
ht 4006
al 9
sz 149.74
ht 7577
DYS438
DXS9898
al 8.3
sz 128.48
ht 14613
al 11
sz 137.93
ht 17990
DYS439
DXS6789
al 20
sz 143.68
ht 7720
al 22
sz 152.67
ht 10467
75.0
100.0
128.36
137.81
143.68
150.0
160.0
139.0
152.67

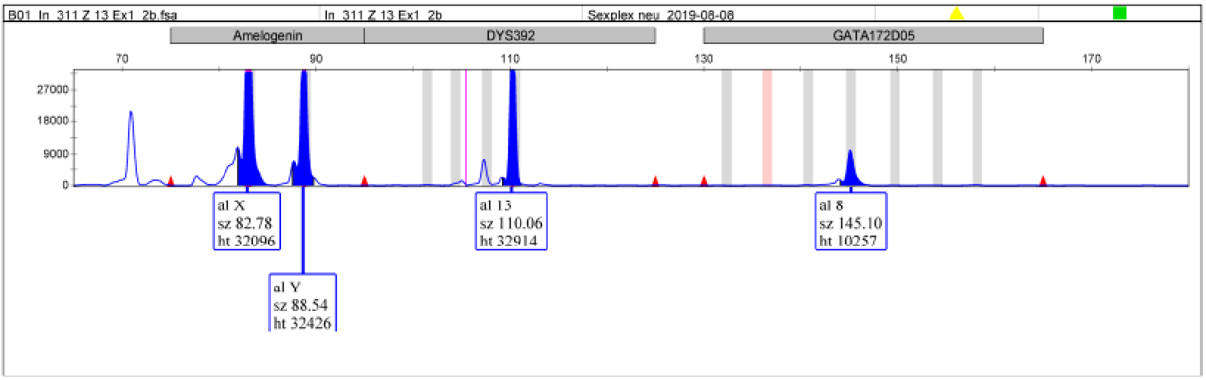
Inden 310

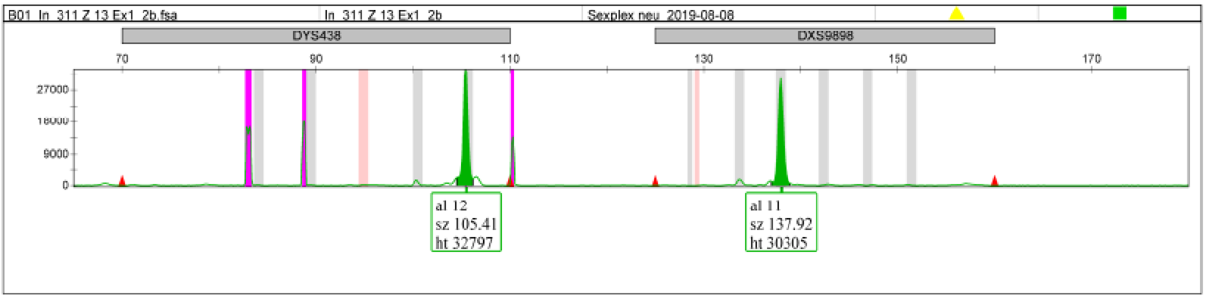

B02_In_310 Z 28 Ex1_1b.fsa
In_310 Z 28 Ex1_1b
SexPlex Panel
Amelogenin
DYS392
GATA172D05
al X
sz 82.74
ht 31904
al 7
sz 140.69
ht 11974
al 9
sz 149.74
ht 15544
DYS438
DXS9898
al 8.3
sz 128.56
ht 32677
al 11
sz 138.04
ht 28330
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 20
sz 143.68
ht 16079
al 22
sz 152.70
ht 15333
75.0
100.0
139.0
150.0
160.0
143.68
152.57

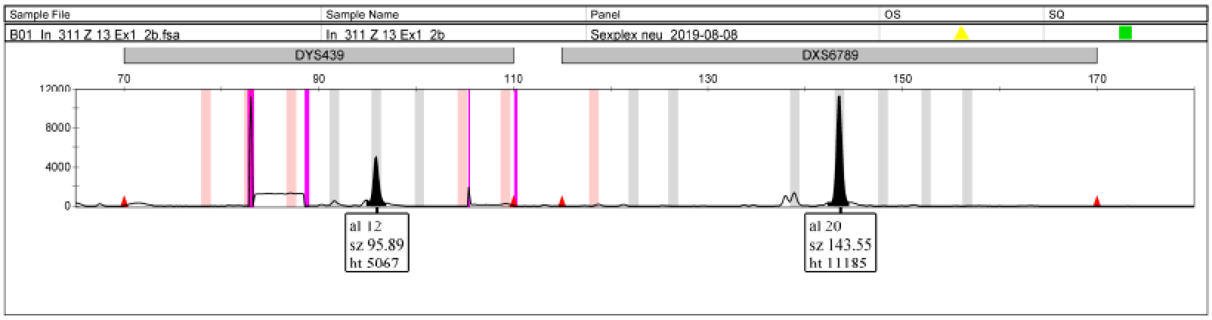
Inden 311

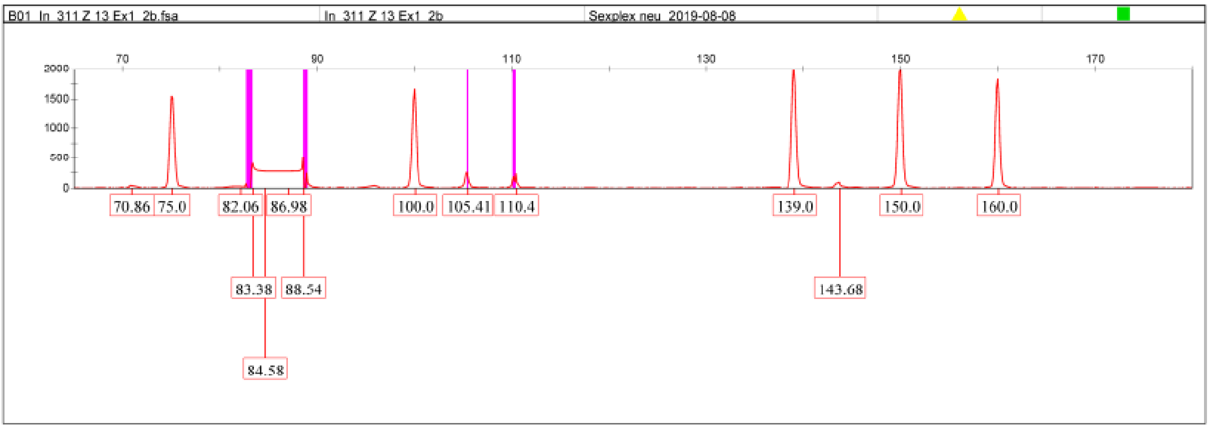

Sample File
Sample Name
Panel
OS
SQ
A01_In_311 Z 13 Ex1_2a.fsa
In_311 Z 13 Ex1_2a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
al X
sz 82.98
ht 25074
al Y
sz 88.71
ht 19875
al 13
sz 110.29
ht 15858
Changed
al ((6))
sz 136.27
ht 339
Changed
al ((8))
sz 145.11
ht 271
DYS438
DXS9898
al 12
sz 105.46
ht 5135
al 11
sz 137.93
ht 875
DYS439
DXS6789
Changed
al (12)
sz 95.91
ht 437
al 20
sz 143.55
ht 927
75.0
82.98
100.0
105.35
139.0
150.0
160.0

Inden 311

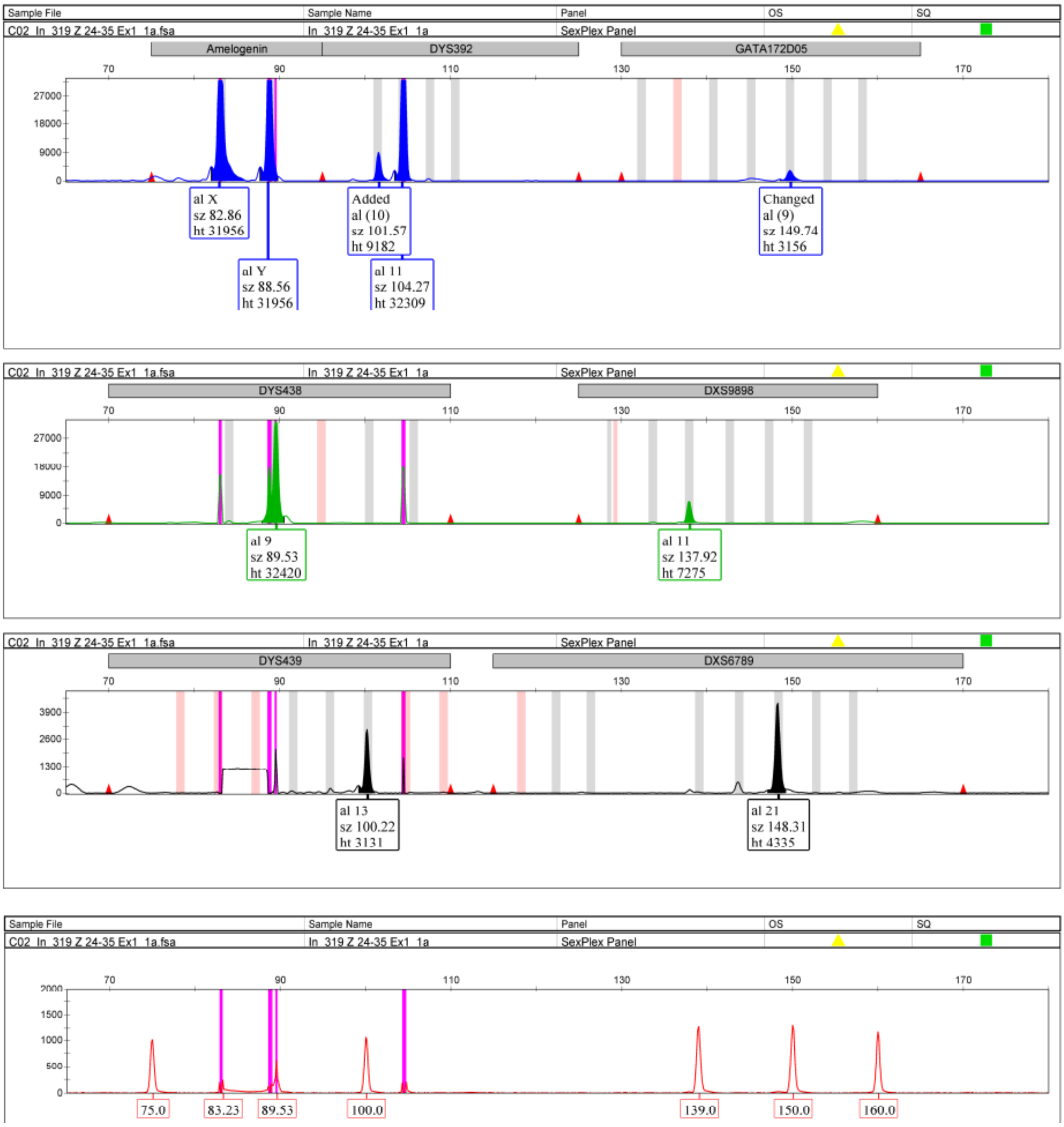

B01 In 311 Z 13 Ex1 2b.fsa
In 311 Z 13 Ex1 2b
Sexplex neu 2019-08-08
Amelogenin
DYS392
GATA172D05
70
90
110
130
150
170
27000
18000
9000
0
al X
sz 82.78
ht 32096
al Y
sz 88.54
ht 32426
al 13
sz 110.06
ht 32914
al 8
sz 145.10
ht 10257


B01 In 311 Z 13 Ex1 2b.fsa
In 311 Z 13 Ex1 2b
Sexplex neu 2019-08-08
DYS438
DXS9898
70
90
110
130
150
170
27000
18000
9000
0
al 12
sz 105.41
ht 32797
al 11
sz 137.92
ht 30305


Sample File
Sample Name
Panel
OS
SQ
B01 In 311 Z 13 Ex1 2b.fsa
In 311 Z 13 Ex1 2b
Sexplex neu 2019-08-08
DYS439
DXS6789
70
90
110
130
150
170
12000
8000
4000
0
al 12
sz 95.89
ht 5067
al 20
sz 143.55
ht 11185

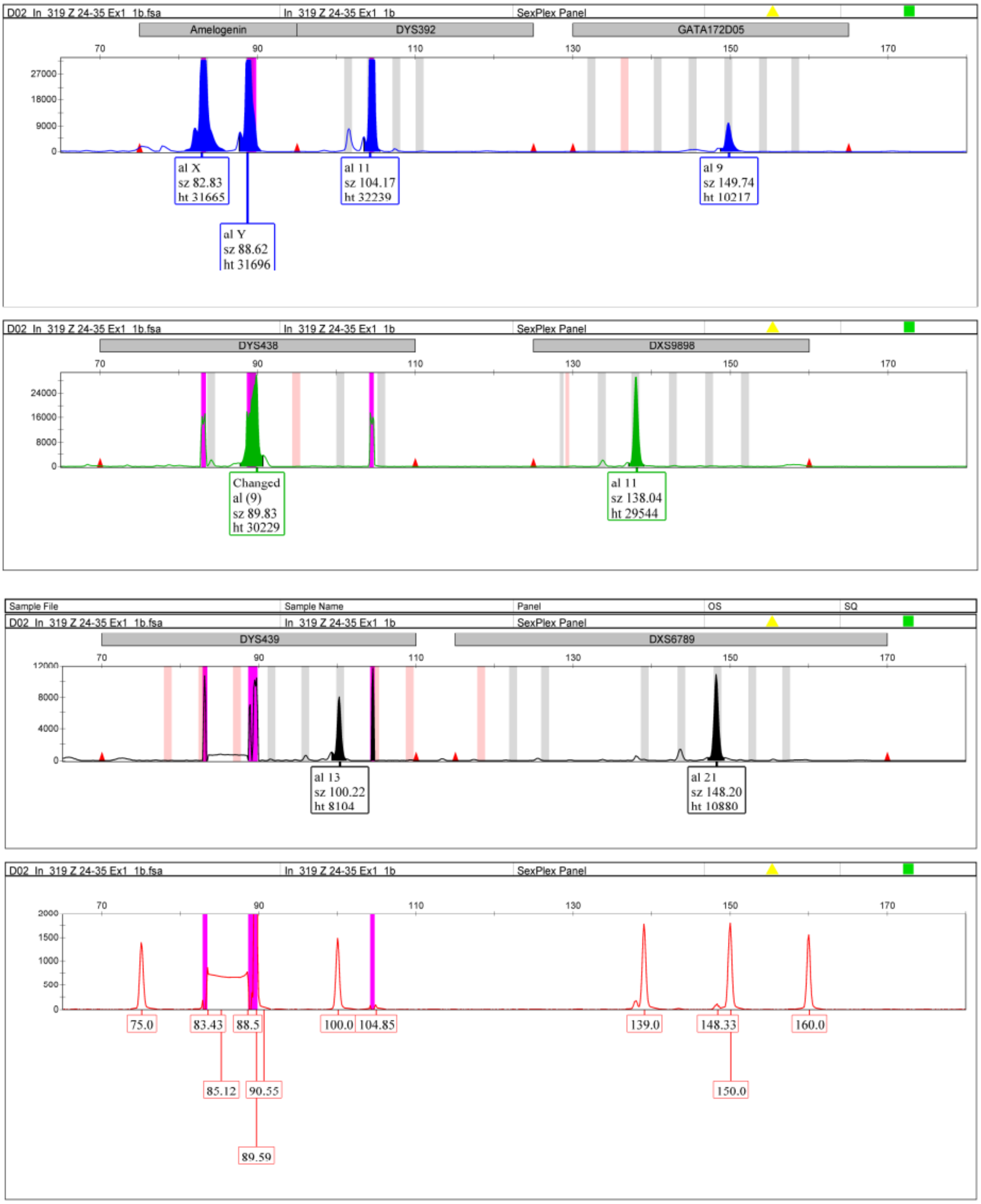

B01 In 311 Z 13 Ex1 2b.fsa
In 311 Z 13 Ex1 2b
Sexplex neu 2019-08-08
70
90
110
130
150
170
2000
1500
1000
500
0
70.86
75.0
82.06
86.98
100.0
105.41
110.4
139.0
150.0
160.0
83.38
88.54
143.68
84.58

Inden 319

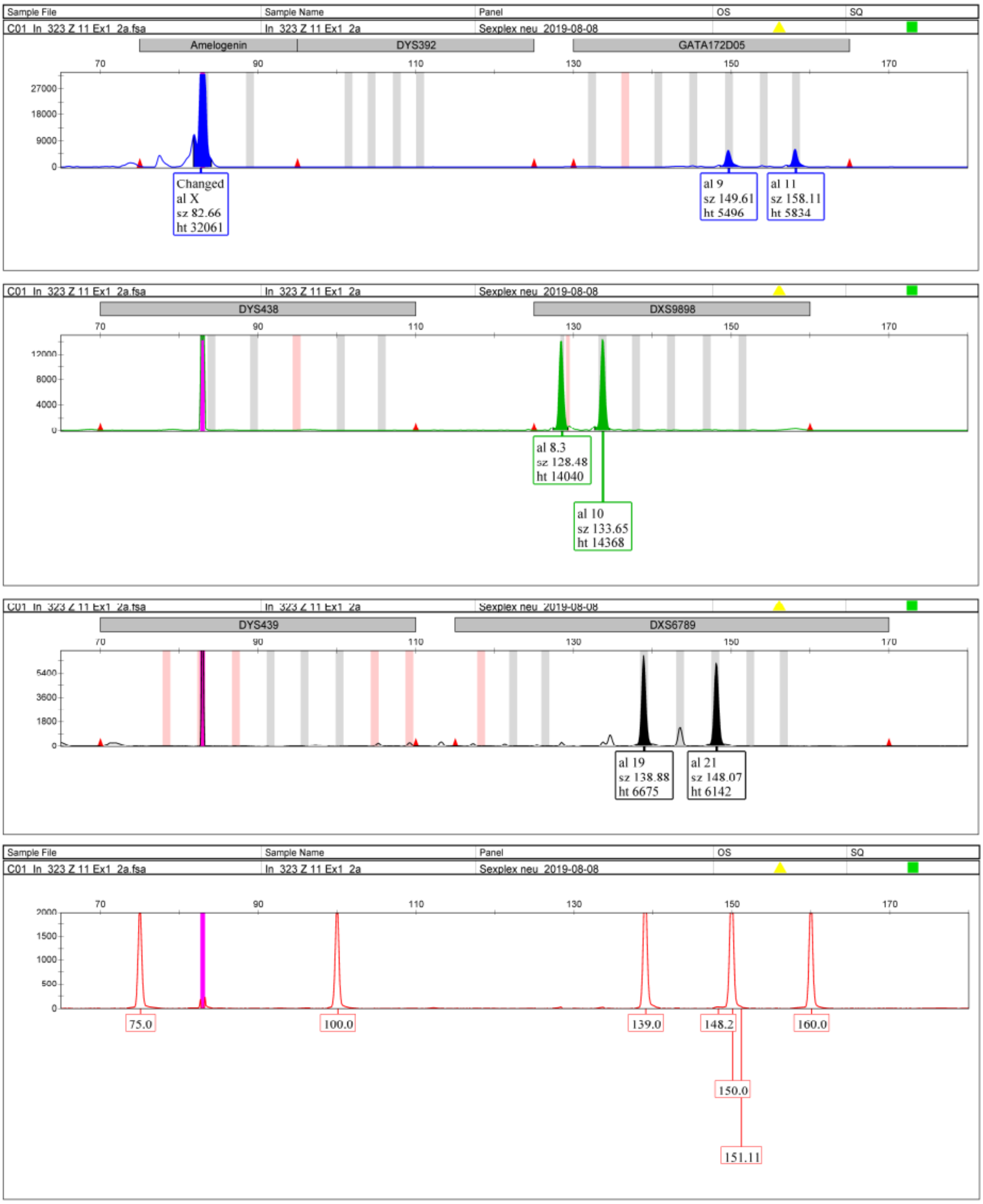


Sample File
Sample Name
Panel
OS
SQ
C02 In 319 Z 24-35 Ex1 1a.fsa
In 319 Z 24-35 Ex1 1a
SexPlex Panel
Amelogenin
DYS392
GATA172D05
al X
sz 82.86
ht 31956
al Y
sz 88.56
ht 31956
Added
al (10)
sz 101.57
ht 9182
al 11
sz 104.27
ht 32309
Changed
al (9)
sz 149.74
ht 3156
DYS438
DXS9898
al 9
sz 89.53
ht 32420
al 11
sz 137.92
ht 7275
DYS439
DXS6789
al 13
sz 100.22
ht 3131
al 21
sz 148.31
ht 4335
75.0
83.23
89.53
100.0
139.0
150.0
160.0

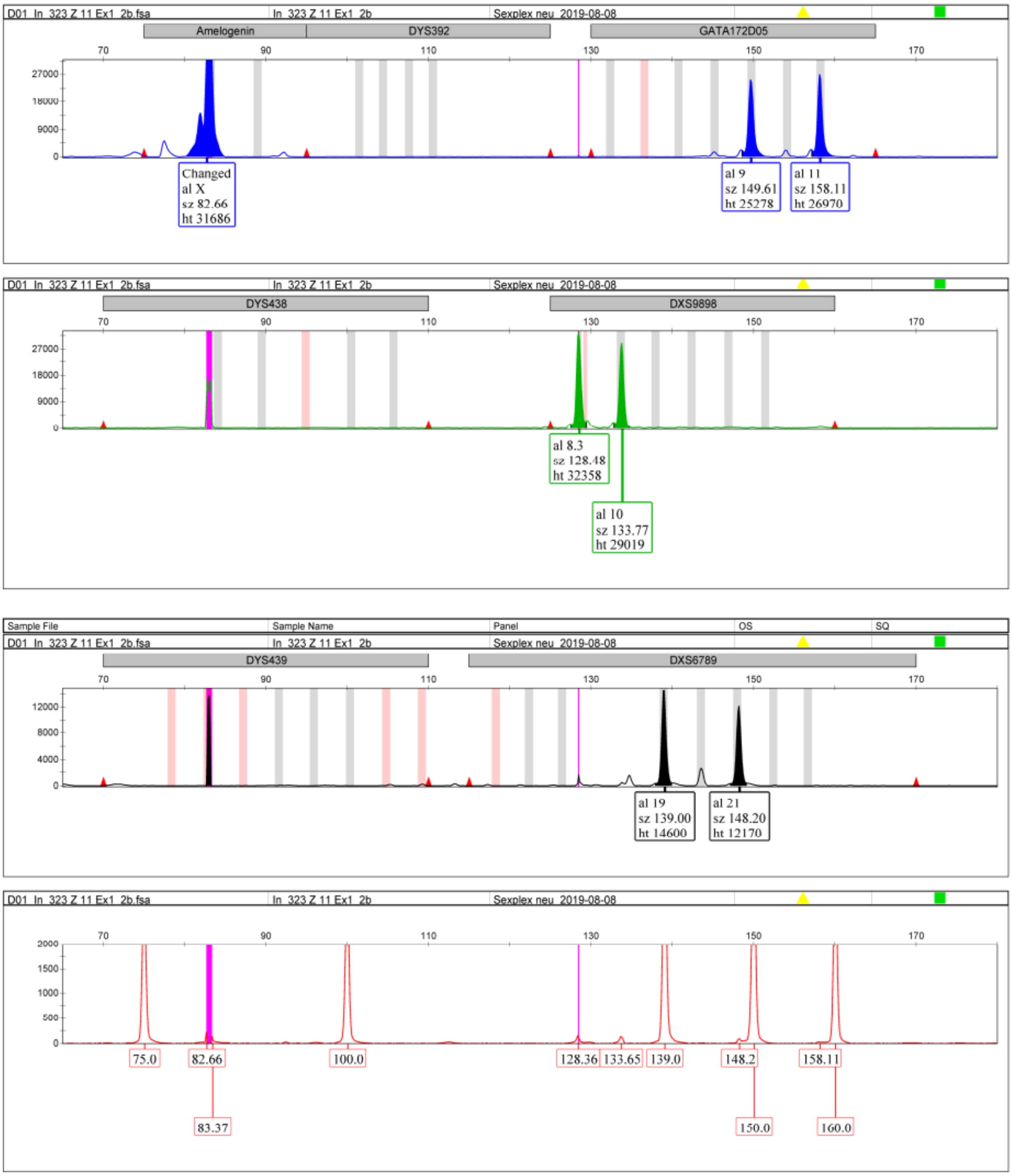
Inden 319


D02 In 319 Z 24-35 Ex1 1b.fsa
In 319 Z 24-35 Ex1 1b
SexPlex Panel
Amelogenin
DYS392
GATA172D05
al X
sz 82.83
ht 31665
al Y
sz 88.62
ht 31696
al 11
sz 104.17
ht 32239
al 9
sz 149.74
ht 10217
DYS438
DXS9898
Changed
al (9)
sz 89.83
ht 30229
al 11
sz 138.04
ht 29544
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 13
sz 100.22
ht 8104
al 21
sz 148.20
ht 10880
75.0
83.43
88.5
100.0
104.85
139.0
148.33
160.0
85.12
90.55
150.0
89.59

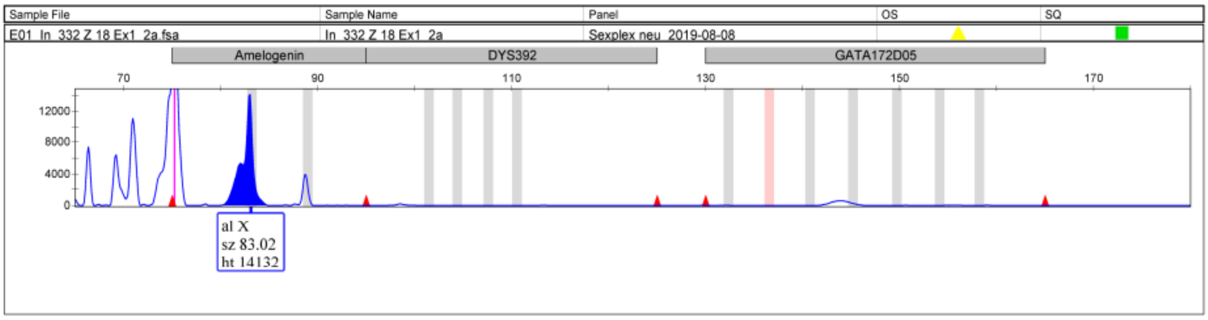
Inden 323

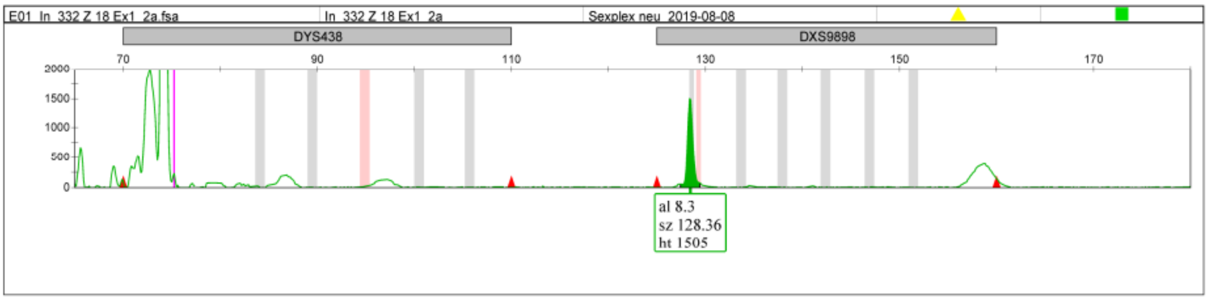

Sample File
Sample Name
Panel
OS
SQ
C01_In_323 Z 11 Ex1_2a.fsa
In_323 Z 11 Ex1_2a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
Changed
al X
sz 82.66
ht 32061
al 9
sz 149.61
ht 5496
al 11
sz 158.11
ht 5834
DYS438
DXS9898
al 8.3
sz 128.48
ht 14040
al 10
sz 133.65
ht 14368
DYS439
DXS6789
al 19
sz 138.88
ht 6675
al 21
sz 148.07
ht 6142
75.0
100.0
139.0
148.2
150.0
151.11
160.0

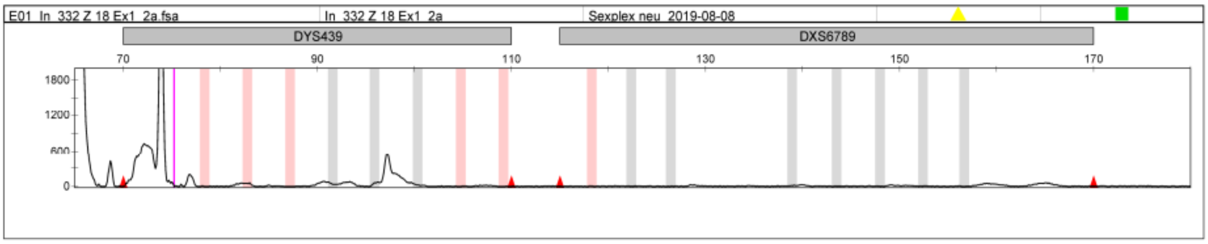
Inden 323

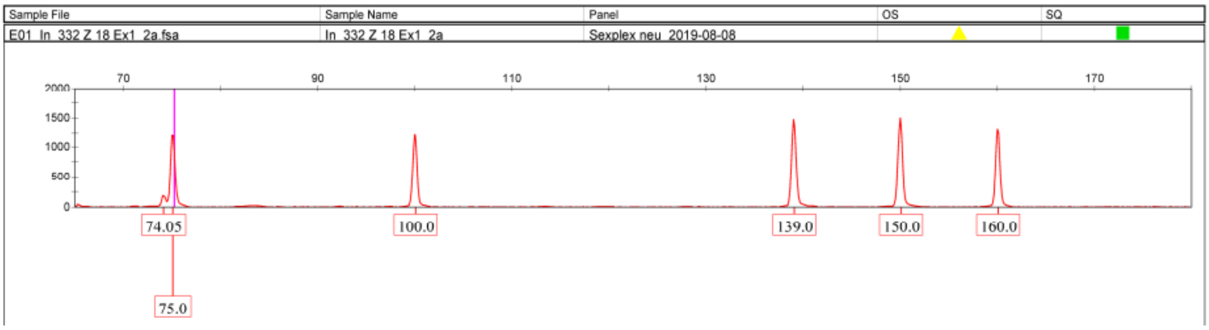

D01_In_323 Z 11 Ex1_2b.fsa
In_323 Z 11 Ex1_2b
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
Changed
al X
sz 82.66
ht 31686
al 9
sz 149.61
ht 25278
al 11
sz 158.11
ht 26970
DYS438
DXS9898
al 8.3
sz 128.48
ht 32358
al 10
sz 133.77
ht 29019
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 19
sz 139.00
ht 14600
al 21
sz 148.20
ht 12170
75.0
82.66
83.37
100.0
128.36
133.65
139.0
148.2
150.0
158.11
160.0

Inden 332

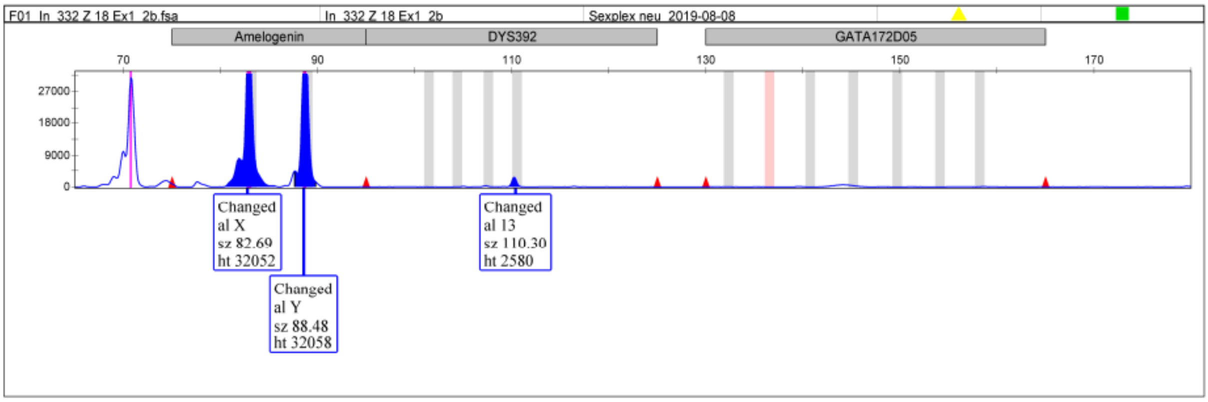

Sample File
Sample Name
Panel
OS
SQ
E01 In 332 Z 18 Ex1 2a.fsa
In 332 Z 18 Ex1 2a
Sexplex neu 2019-08-08
Amelogenin
DYS392
GATA172D05
70
90
110
130
150
170
12000
8000
4000
0
al X
sz 83.02
ht 14132

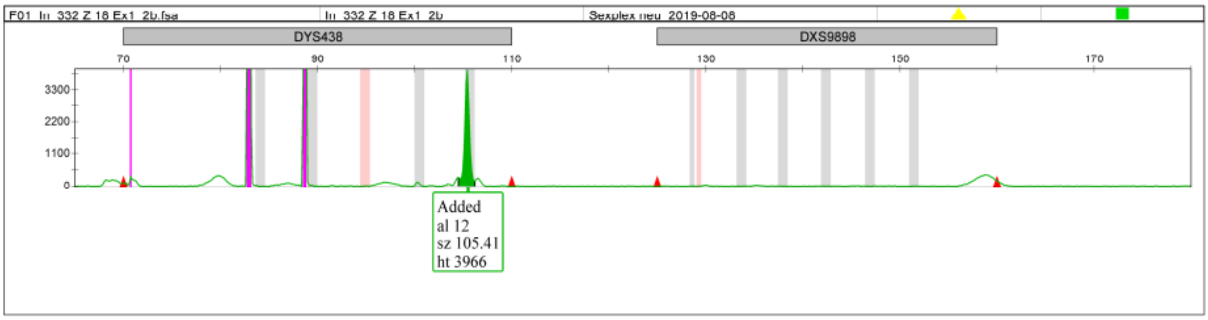

E01 In 332 Z 18 Ex1 2a.fsa
In 332 Z 18 Ex1 2a
Sexplex neu 2019-08-08
DYS438
DXS9898
70
90
110
130
150
170
2000
1500
1000
500
0
al 8.3
sz 128.36
ht 1505

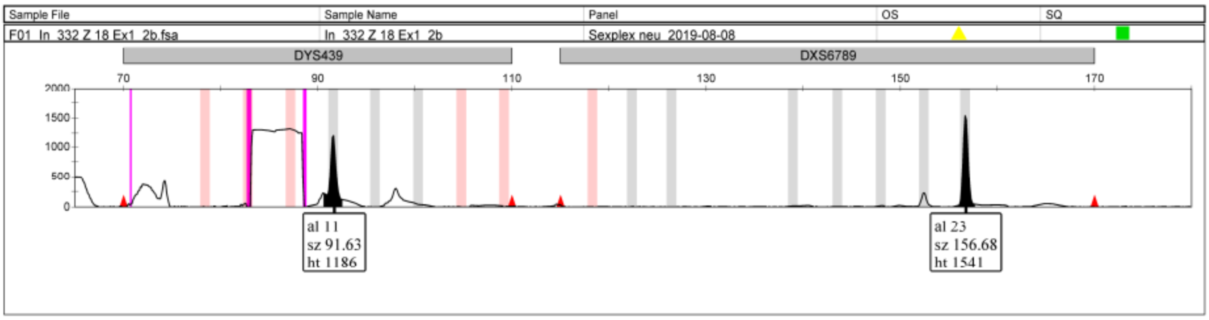

E01 In 332 Z 18 Ex1 2a.fsa
In 332 Z 18 Ex1 2a
Sexplex neu 2019-08-08
DYS439
DXS6789
70
90
110
130
150
170
1800
1200
600
0

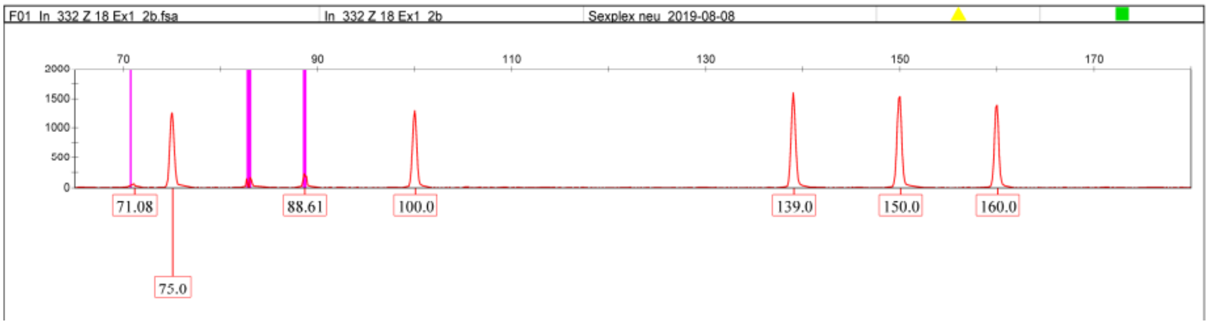

Sample File
Sample Name
Panel
OS
SQ
E01 In 332 Z 18 Ex1 2a.fsa
In 332 Z 18 Ex1 2a
Sexplex neu 2019-08-08
70
90
110
130
150
170
2000
1500
1000
500
0
74.05
100.0
139.0
150.0
160.0
75.0

Inden 332

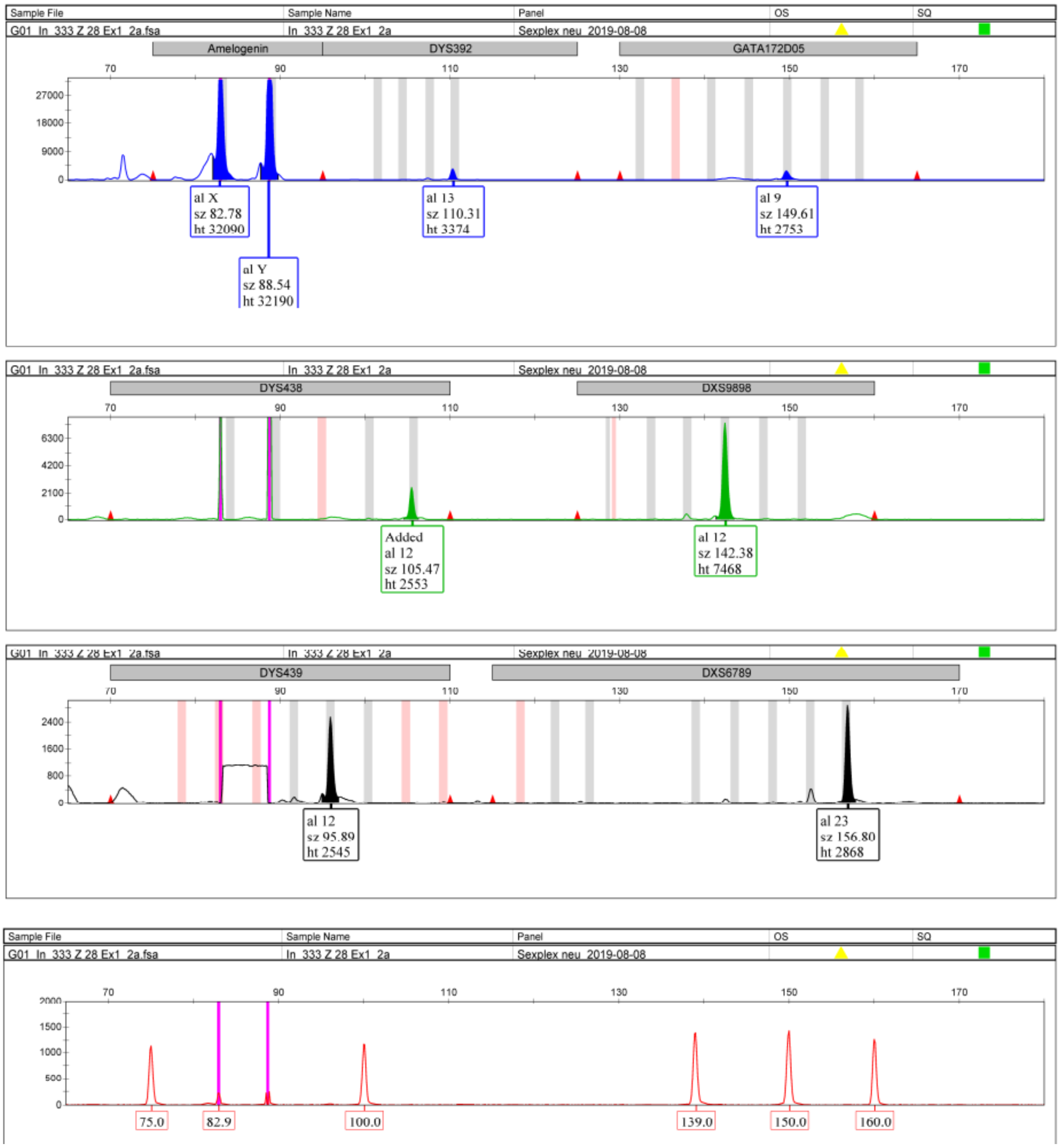

F01 In 332 Z 18 Ex1 2b.fsa
In 332 Z 18 Ex1 2b
Sexplex neu 2019-08-08
Amelogenin
DYS392
GATA172D05
70
90
110
130
150
170
27000
18000
9000
0
Changed
al X
sz 82.69
ht 32052
Changed
al 13
sz 110.30
ht 2580
Changed
al Y
sz 88.48
ht 32058


F01 In 332 Z 18 Ex1 2b.fsa
In 332 Z 18 Ex1 2b
Sexplex neu 2019-08-08
DYS438
DXS9898
70
90
110
130
150
170
3300
2200
1100
0
Added
al 12
sz 105.41
ht 3966

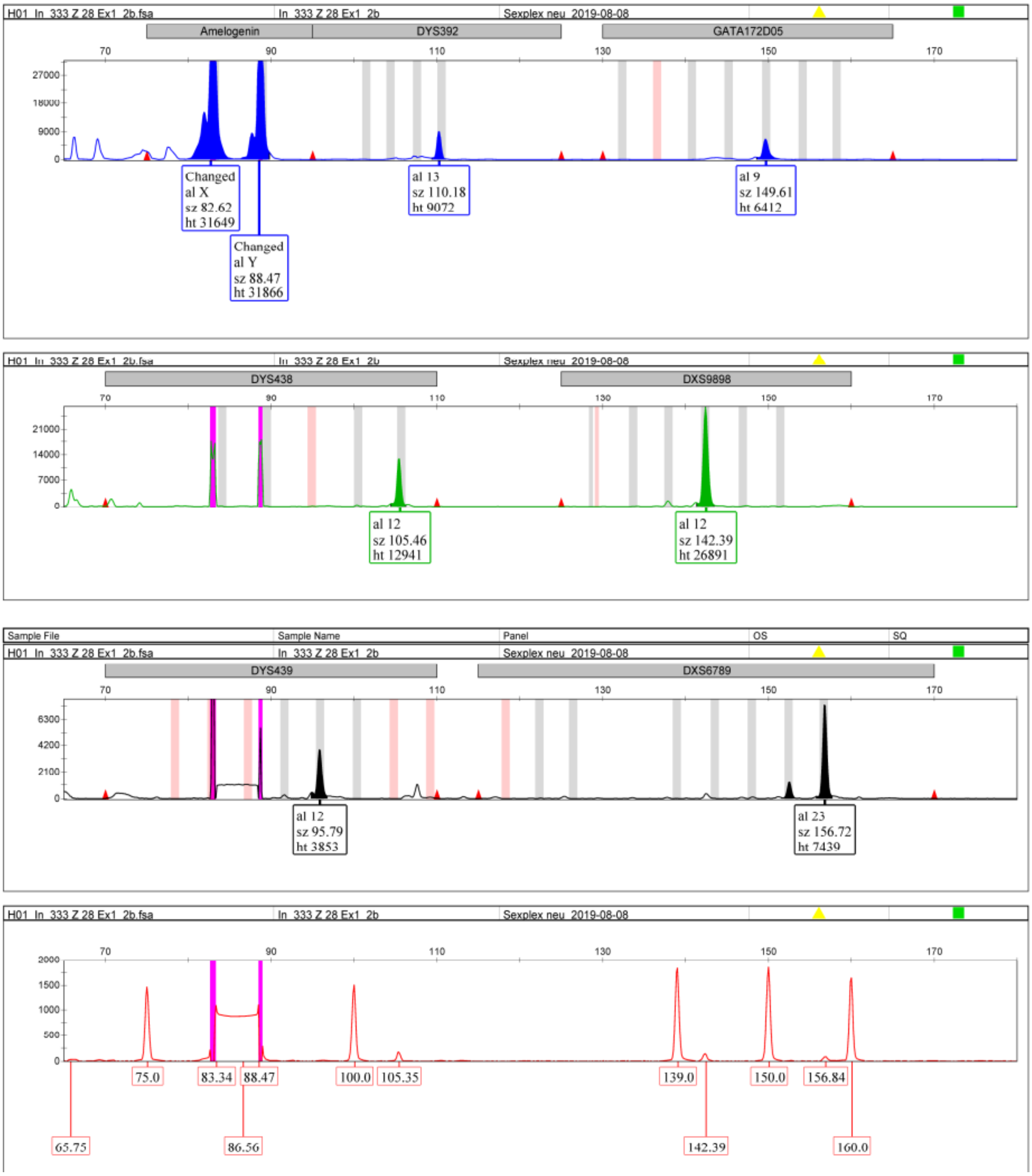

Sample File
Sample Name
Panel
OS
SQ
F01 In 332 Z 18 Ex1 2b.fsa
In 332 Z 18 Ex1 2b
Sexplex neu 2019-08-08
DYS439
DXS6789
70
90
110
130
150
170
2000
1500
1000
500
0
al 11
sz 91.63
ht 1186
al 23
sz 156.68
ht 1541


F01 In 332 Z 18 Ex1 2b.fsa
In 332 Z 18 Ex1 2b
Sexplex neu 2019-08-08
70
90
110
130
150
170
2000
1500
1000
500
0
71.08
88.61
100.0
139.0
150.0
160.0
75.0

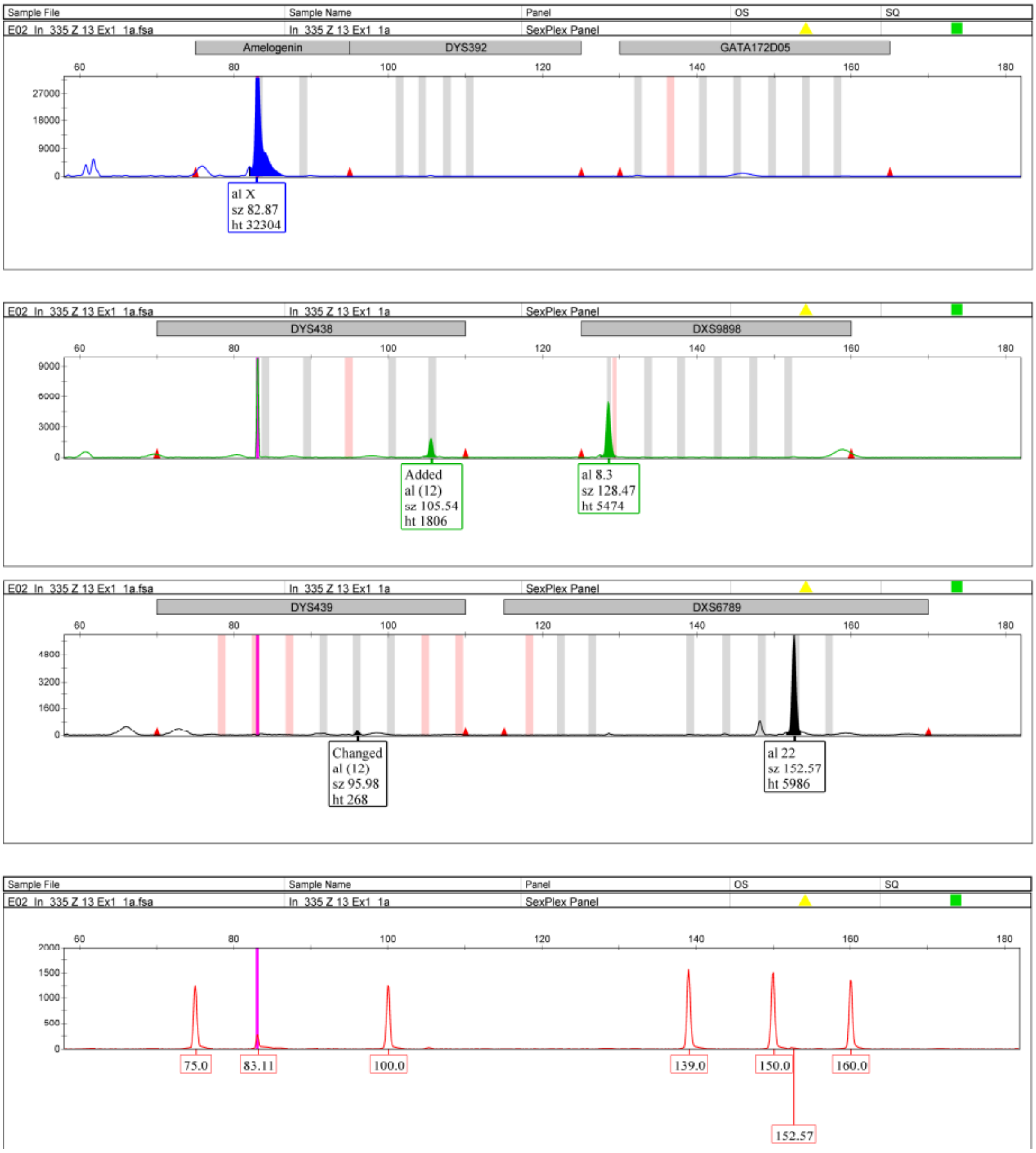
Inden 333


Sample File
Sample Name
Panel
OS
SQ
G01 In 333 Z 28 Ex1 2a.fsa
In 333 Z 28 Ex1 2a
Sexplex neu 2019-08-08
Amelogenin
DYS392
GATA172D05
al X
sz 82.78
ht 32090
al Y
sz 88.54
ht 32190
al 13
sz 110.31
ht 3374
al 9
sz 149.61
ht 2753
DYS438
DXS9898
Added
al 12
sz 105.47
ht 2553
al 12
sz 142.38
ht 7468
DYS439
DXS6789
al 12
sz 95.89
ht 2545
al 23
sz 156.80
ht 2868
75.0
82.9
100.0
139.0
150.0
160.0

Inden 333

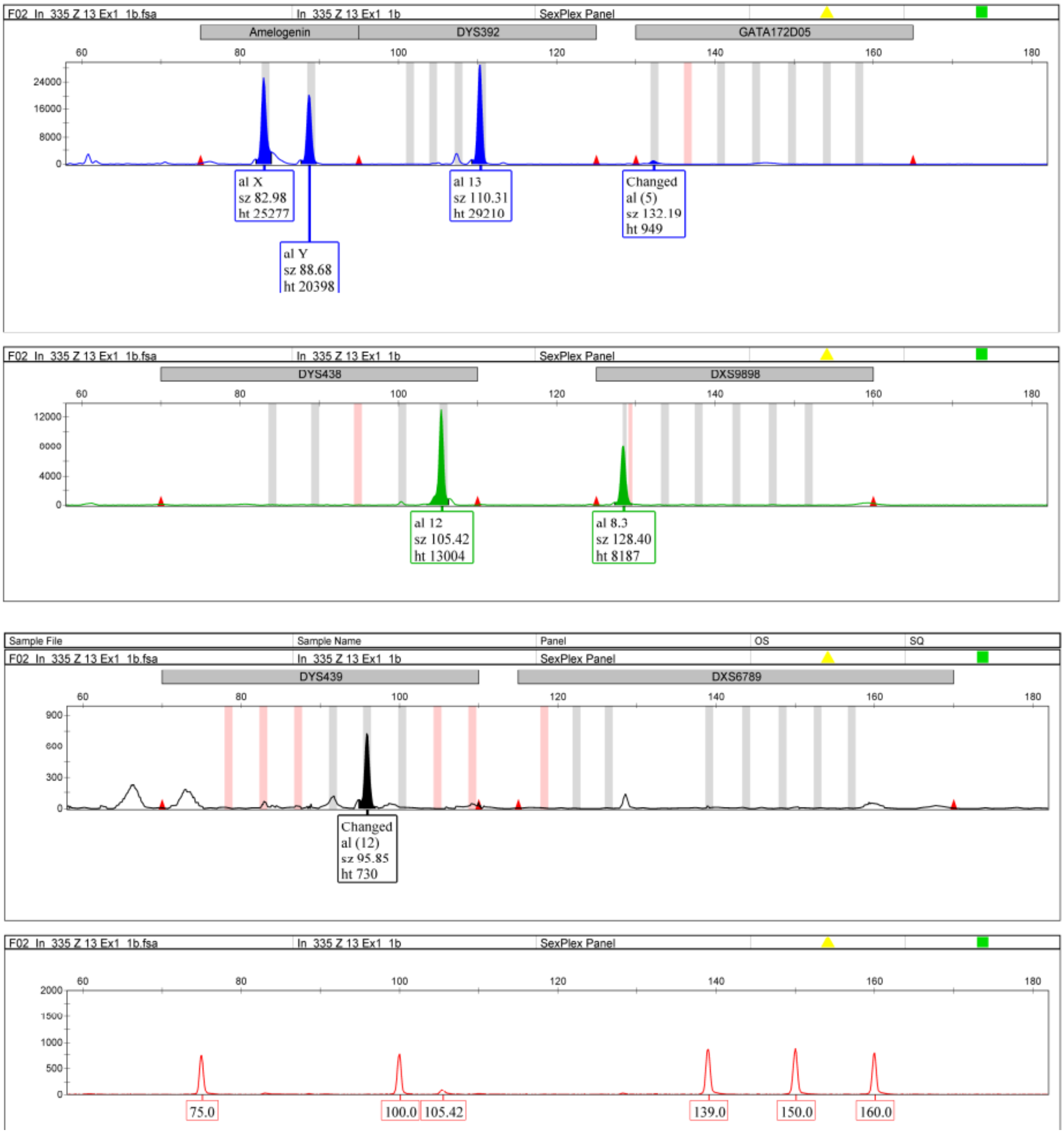

H01_In_333 Z 28 Ex1_2b.fsa
In_333 Z 28 Ex1_2b
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
Changed
al X
sz 82.62
ht 31649
Changed
al Y
sz 88.47
ht 31866
al 13
sz 110.18
ht 9072
al 9
sz 149.61
ht 6412
DYS438
DXS9898
al 12
sz 105.46
ht 12941
al 12
sz 142.39
ht 26891
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 12
sz 95.79
ht 3853
al 23
sz 156.72
ht 7439
75.0
83.34
88.47
100.0
105.35
139.0
150.0
156.84
65.75
86.56
142.39
160.0

Inden 335

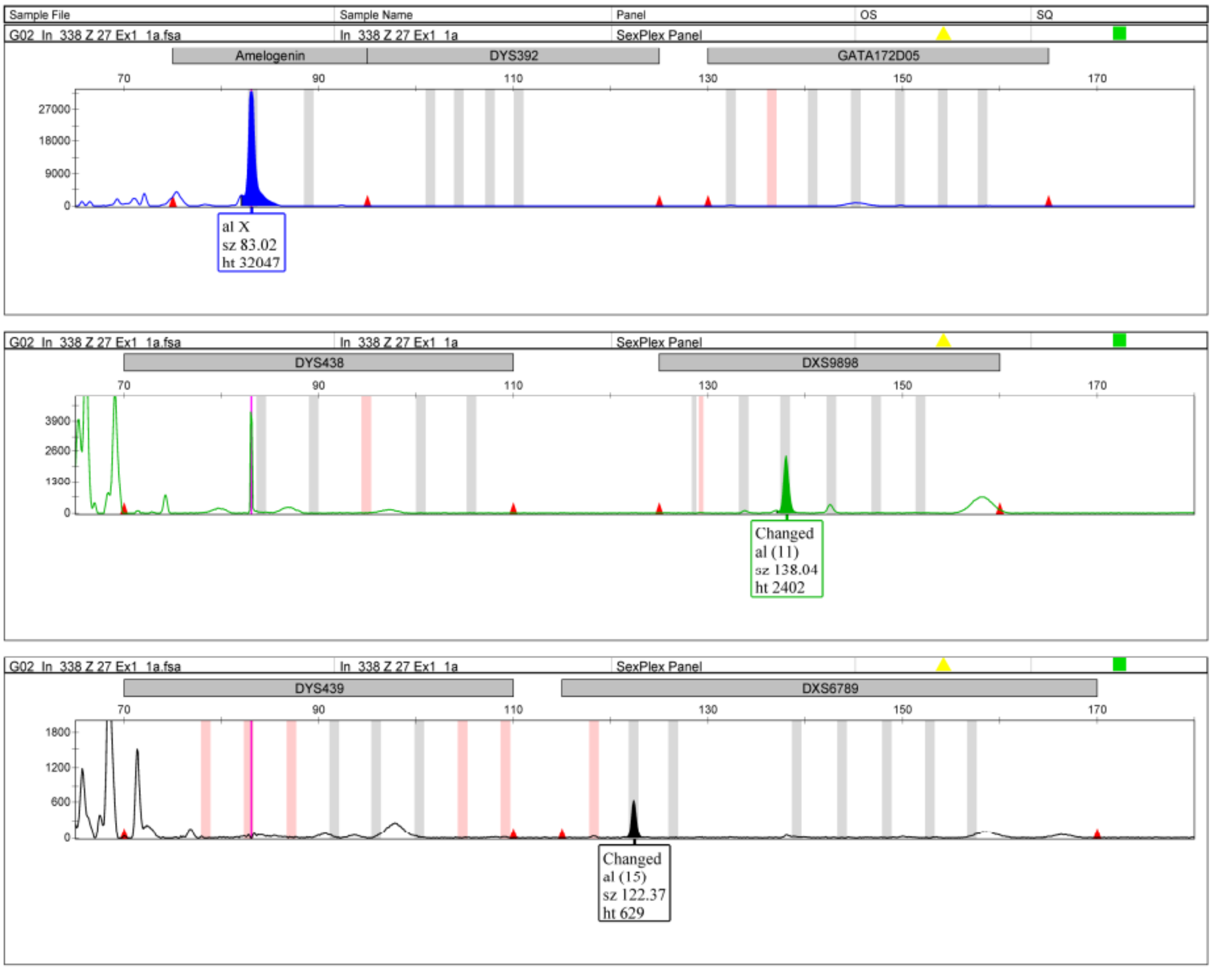


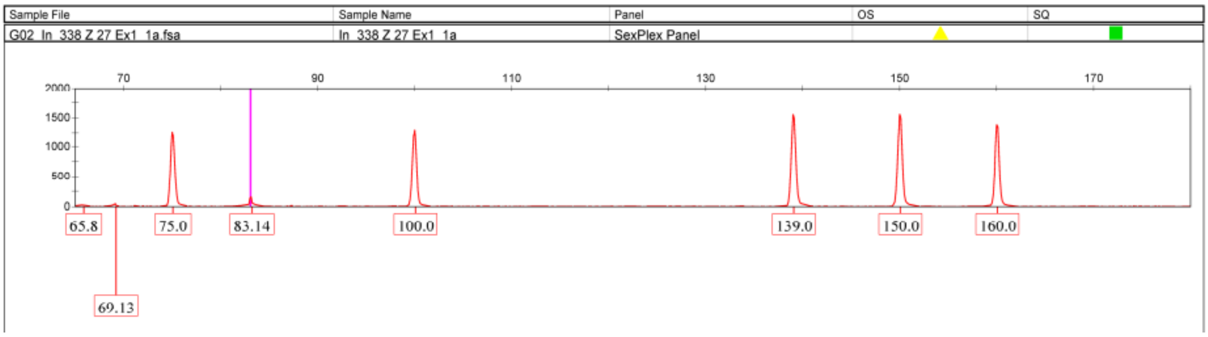
Sample File
Sample Name
Panel
OS
SQ
E02_In_335 Z 13 Ex1_1a.fsa
In_335 Z 13 Ex1_1a
SexPlex Panel
Amelogenin
DYS392
GATA172D05
al X
sz 82.87
ht 32304
DYS438
DXS9898
Added
al (12)
sz 105.54
ht 1806
al 8.3
sz 128.47
ht 5474
DYS439
DXS6789
Changed
al (12)
sz 95.98
ht 268
al 22
sz 152.57
ht 5986
75.0
83.11
100.0
139.0
150.0
160.0
152.57

Inden 335

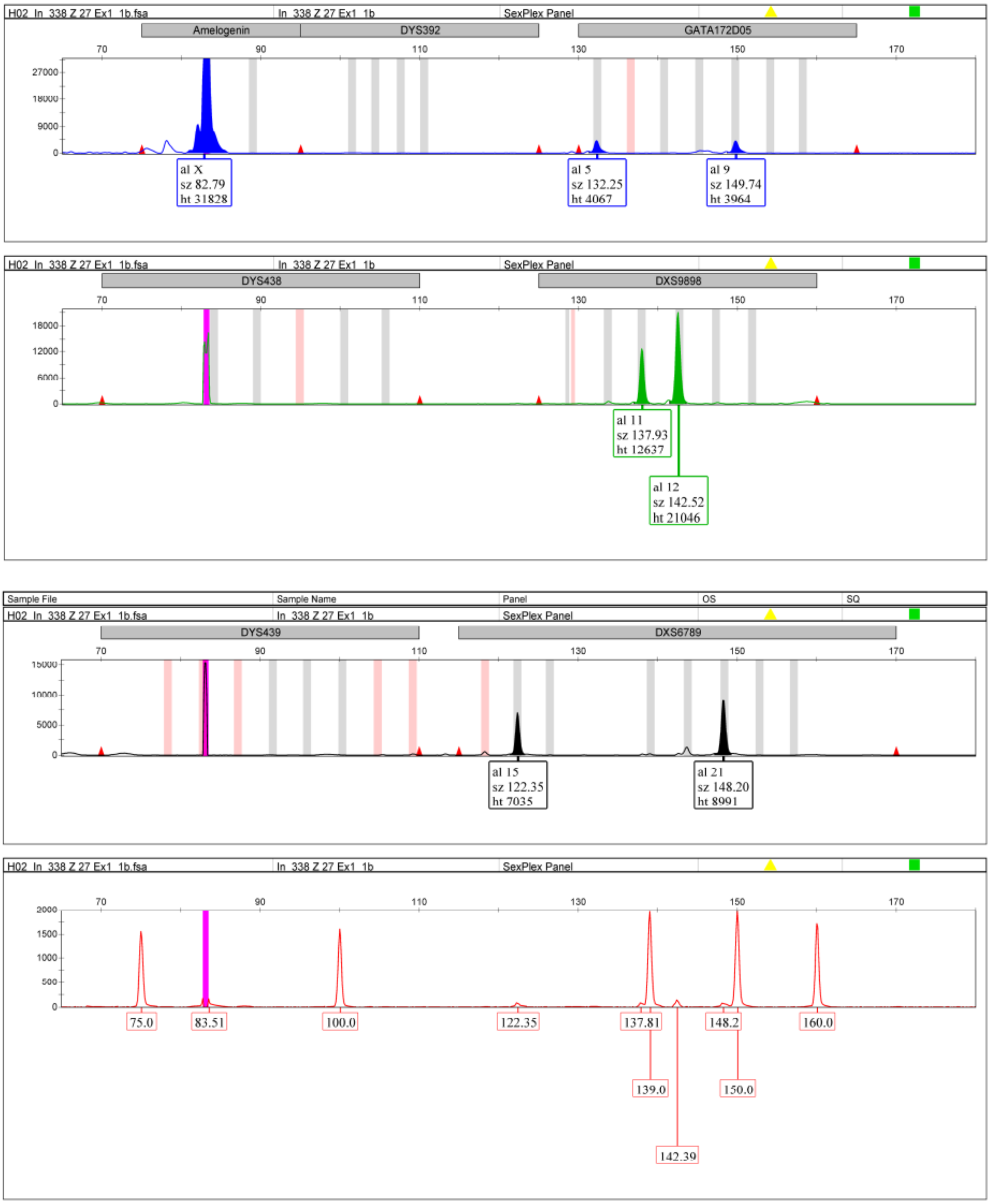

F02_In_335 Z 13 Ex1_1b.fsa
In_335 Z 13 Ex1_1b
SexPlex Panel
Amelogenin
DYS392
GATA172D05
al X
sz 82.98
ht 25277
al Y
sz 88.68
ht 20398
al 13
sz 110.31
ht 29210
Changed
al (5)
sz 132.19
ht 949
DYS438
DXS9898
al 12
sz 105.42
ht 13004
al 8.3
sz 128.40
ht 8187
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
Changed
al (12)
sz 95.85
ht 730
75.0
100.0
105.42
139.0
150.0
160.0

Inden 338

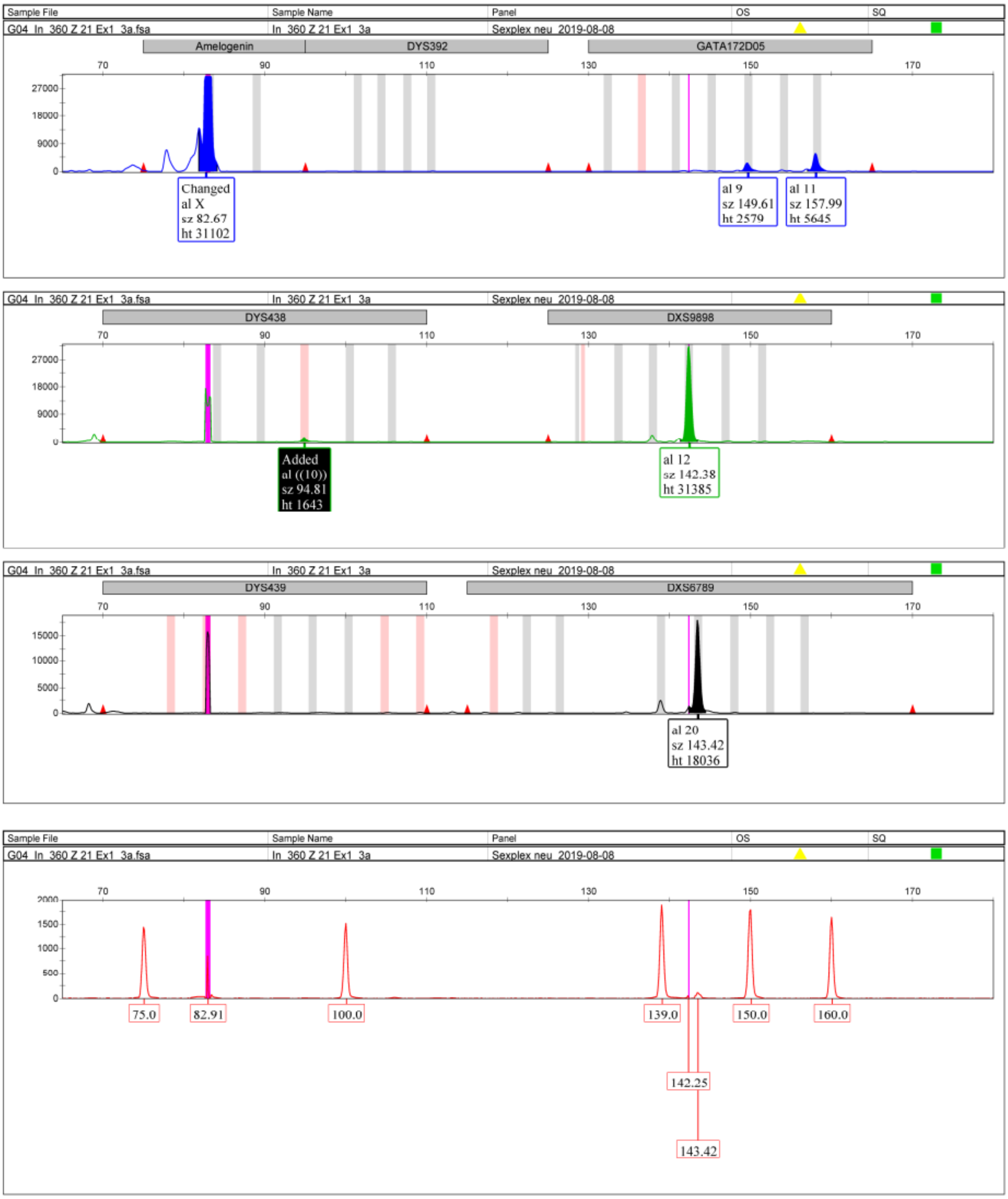

Sample File
Sample Name
Panel
OS
SQ
G02_In_338 Z 27 Ex1_1a.fsa
In_338 Z 27 Ex1_1a
SexPlex Panel
Amelogenin
DYS392
GATA172D05
70
90
110
130
150
170
27000
18000
9000
0
al X
sz 83.02
ht 32047
DYS438
DXS9898
3900
2600
1300
Changed
al (11)
sz 138.04
ht 2402
DYS439
DXS6789
1800
1200
600
Changed
al (15)
sz 122.37
ht 629


Sample File
Sample Name
Panel
OS
SQ
G02_In_338 Z 27 Ex1_1a.fsa
In_338 Z 27 Ex1_1a
SexPlex Panel
70
90
110
130
150
170
2000
1500
1000
500
0
65.8
75.0
83.14
100.0
139.0
150.0
160.0
69.13

Inden 338

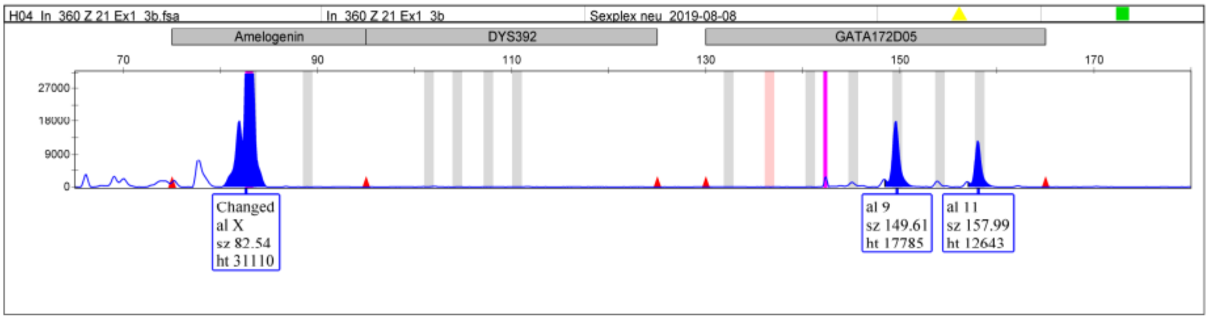

H02_In_338 Z 27 Ex1_1b.fsa
In_338 Z 27 Ex1_1b
SexPlex Panel
Amelogenin
DYS392
GATA172D05
al X
sz 82.79
ht 31828
al 5
sz 132.25
ht 4067
al 9
sz 149.74
ht 3964
DYS438
DXS9898
al 11
sz 137.93
ht 12637
al 12
sz 142.52
ht 21046
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 15
sz 122.35
ht 7035
al 21
sz 148.20
ht 8991
75.0
83.51
100.0
122.35
137.81
148.2
160.0
139.0
150.0
142.39

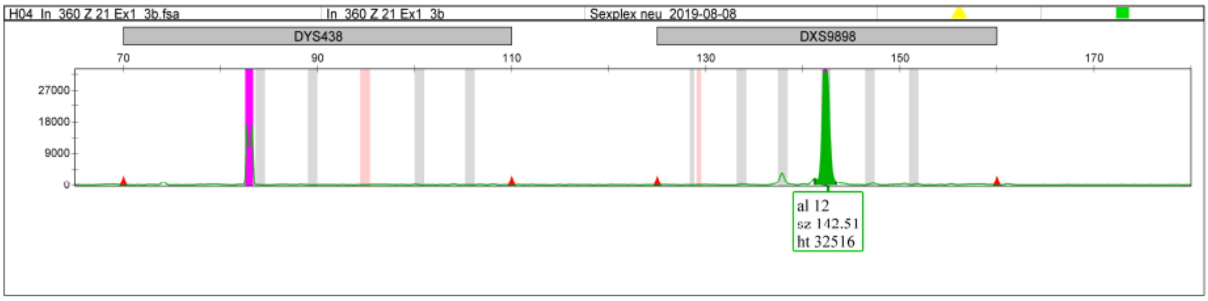
Inden 360

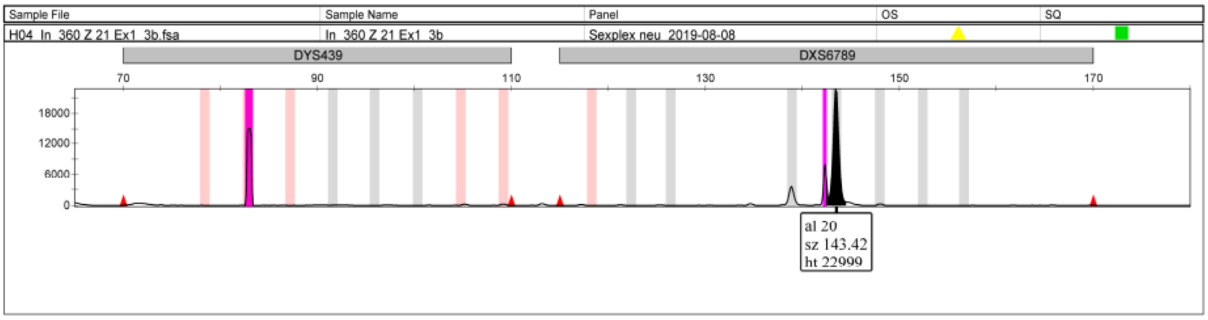


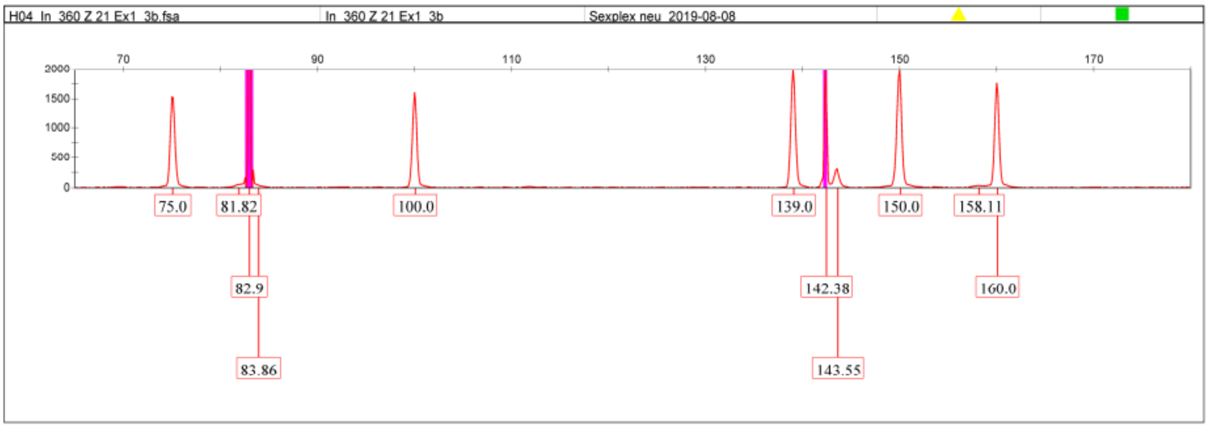
Sample File
Sample Name
Panel
OS
SQ
G04_In_360 Z 21 Ex1_3a.fsa
In_360 Z 21 Ex1_3a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
Changed
al X
sz 82.67
ht 31102
al 9
sz 149.61
ht 2579
al 11
sz 157.99
ht 5645
DYS438
DXS9898
Added
al ((10))
sz 94.81
ht 1643
al 12
sz 142.38
ht 31385
DYS439
DXS6789
al 20
sz 143.42
ht 18036
75.0
82.91
100.0
139.0
150.0
160.0
142.25
143.42

Inden 360

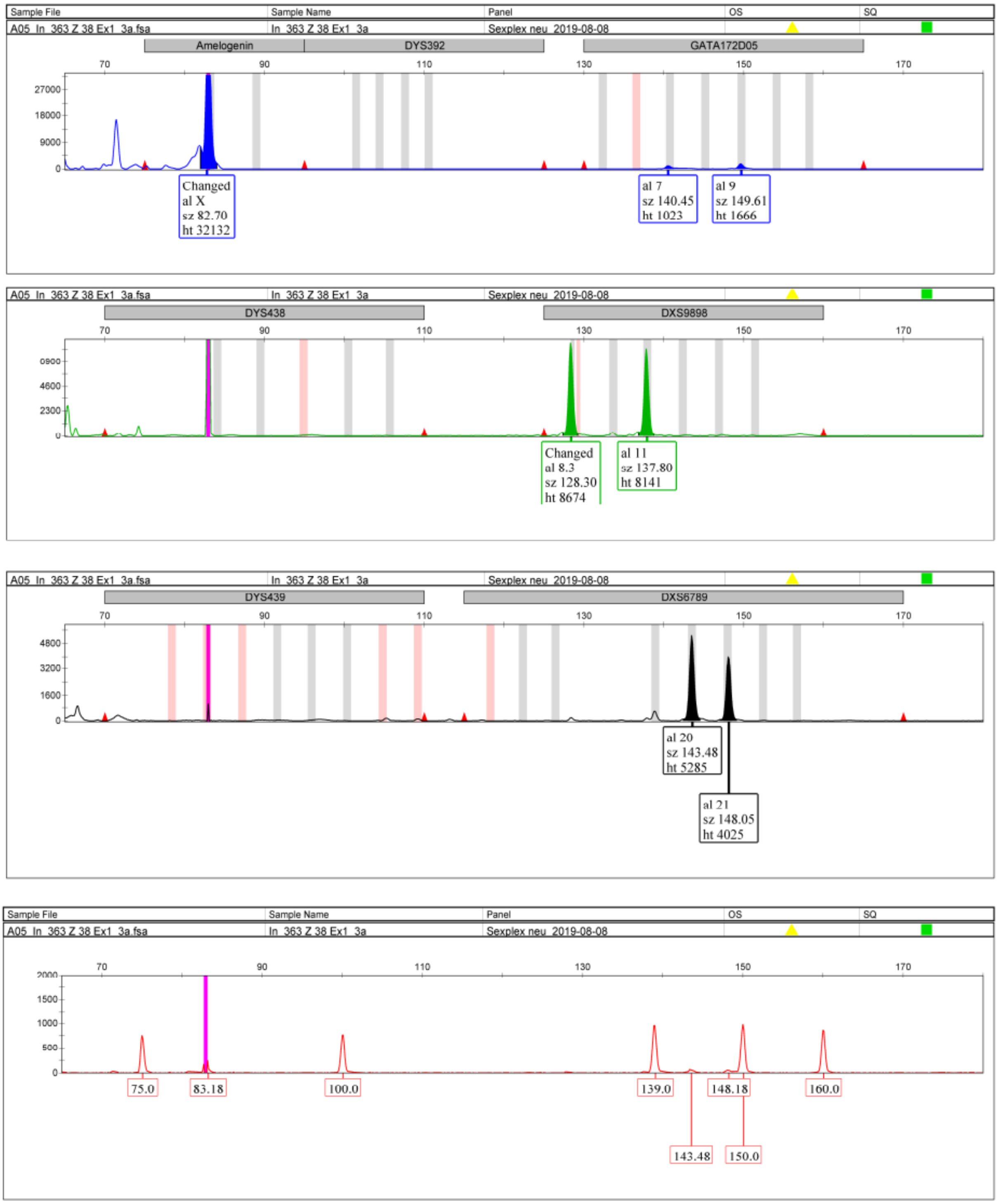

H04_In_360 Z 21 Ex1_3b.fsa
In_360 Z 21 Ex1_3b
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
70
90
110
130
150
170
27000
18000
9000
0
Changed
al X
sz 82.54
ht 31110
al 9
sz 149.61
ht 17785
al 11
sz 157.99
ht 12643


H04_In_360 Z 21 Ex1_3b.fsa
In_360 Z 21 Ex1_3b
Sexplex neu_2019-08-08
DYS438
DXS9898
70
90
110
130
150
170
27000
18000
9000
0
al 12
sz 142.51
ht 32516

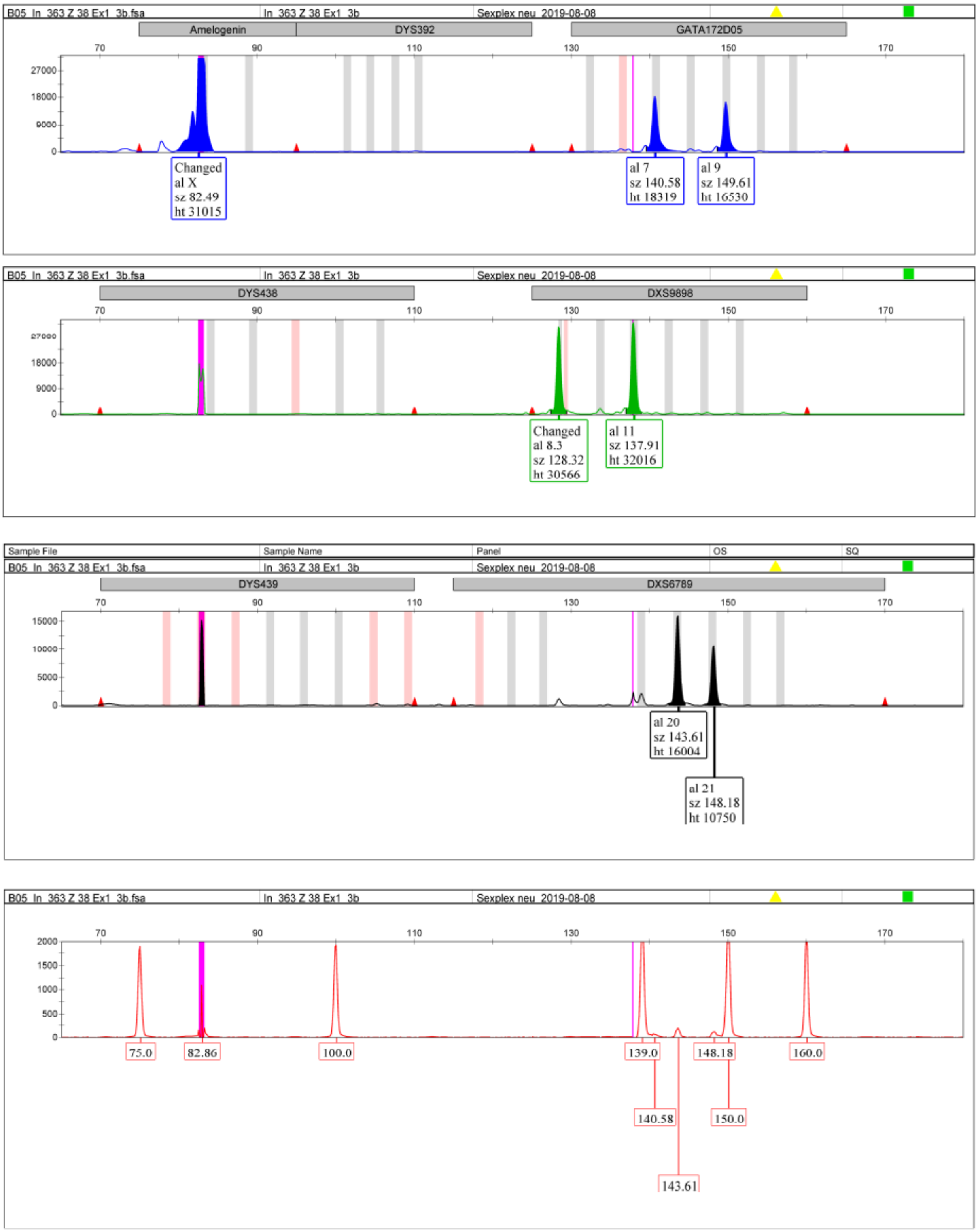

Sample File
Sample Name
Panel
OS
SQ
H04_In_360 Z 21 Ex1_3b.fsa
In_360 Z 21 Ex1_3b
Sexplex neu_2019-08-08
DYS439
DXS6789
70
90
110
130
150
170
18000
12000
6000
0
al 20
sz 143.42
ht 22999


H04_In_360 Z 21 Ex1_3b.fsa
In_360 Z 21 Ex1_3b
Sexplex neu_2019-08-08
70
90
110
130
150
170
2000
1500
1000
500
0
75.0
81.82
100.0
139.0
150.0
158.11
82.9
142.38
160.0
83.86
143.55

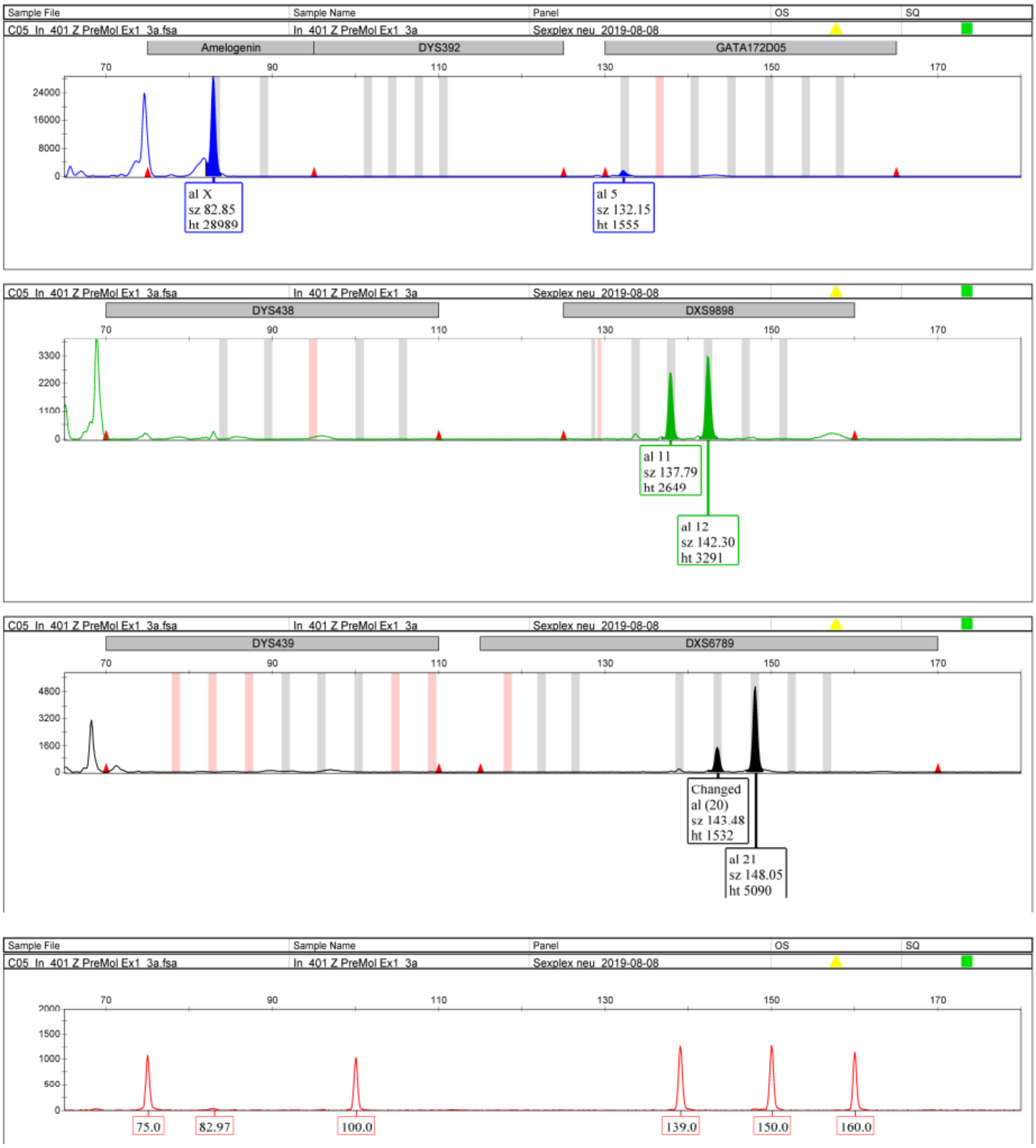
Inden 363


Sample File
Sample Name
Panel
OS
SQ
A05_In_363 Z 38 Ex1_3a.fsa
In_363 Z 38 Ex1_3a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
Changed
al X
sz 82.70
ht 32132
al 7
sz 140.45
ht 1023
al 9
sz 149.61
ht 1666
DYS438
DXS9898
Changed
al 8.3
sz 128.30
ht 8674
al 11
sz 137.80
ht 8141
DYS439
DXS6789
al 20
sz 143.48
ht 5285
al 21
sz 148.05
ht 4025
75.0
83.18
100.0
139.0
148.18
160.0
143.48
150.0

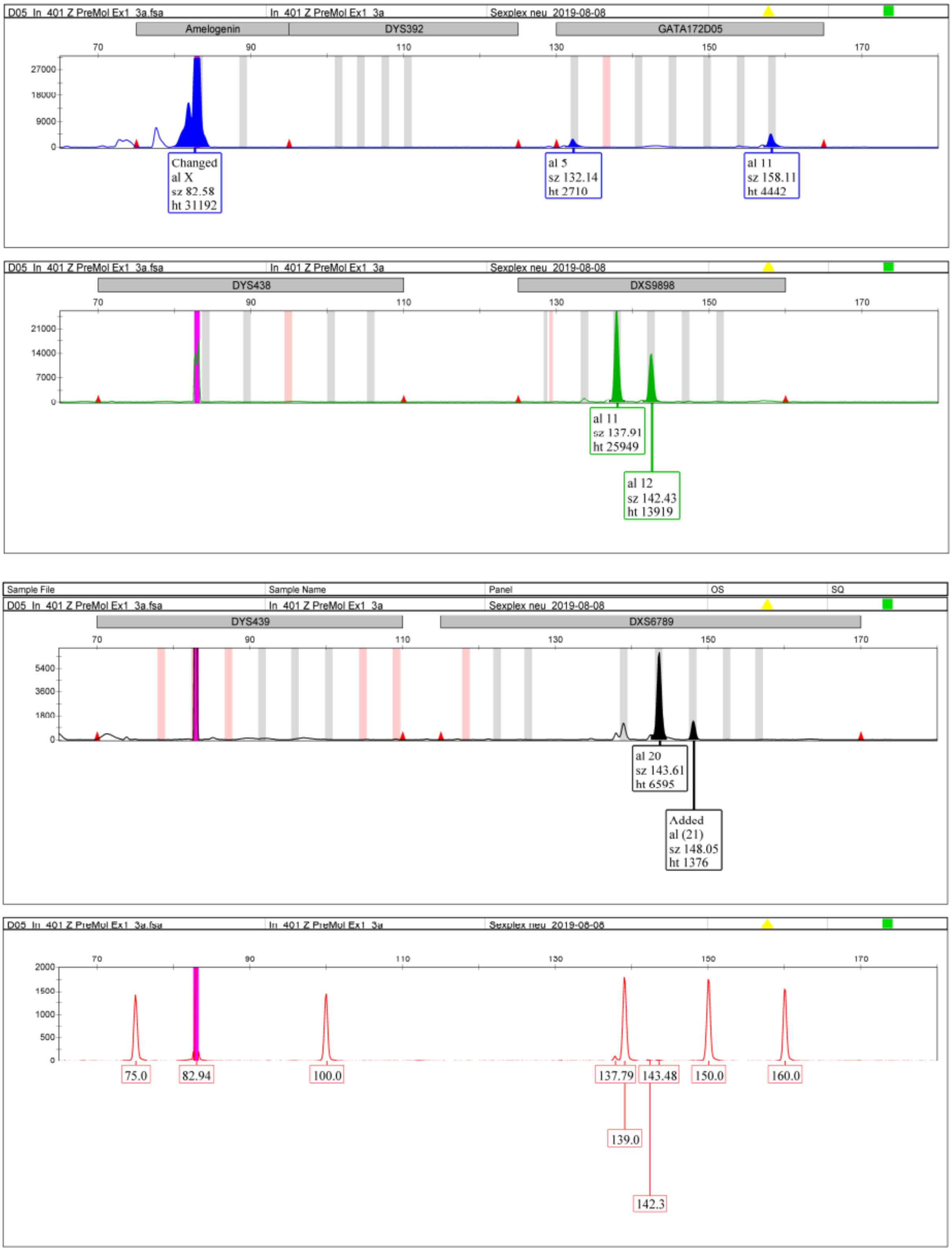
Inden 363


B05_In_363 Z 38 Ex1_3b.fsa
In_363 Z 38 Ex1_3b
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
Changed
al X
sz 82.49
ht 31015
al 7
sz 140.58
ht 18319
al 9
sz 149.61
ht 16530
DYS438
DXS9898
Changed
al 8.3
sz 128.32
ht 30566
al 11
sz 137.91
ht 32016
Sample File
Sample Name
Panel
OS
SQ
DYS439
DXS6789
al 20
sz 143.61
ht 16004
al 21
sz 148.18
ht 10750
75.0
82.86
100.0
139.0
148.18
160.0
140.58
150.0
143.61

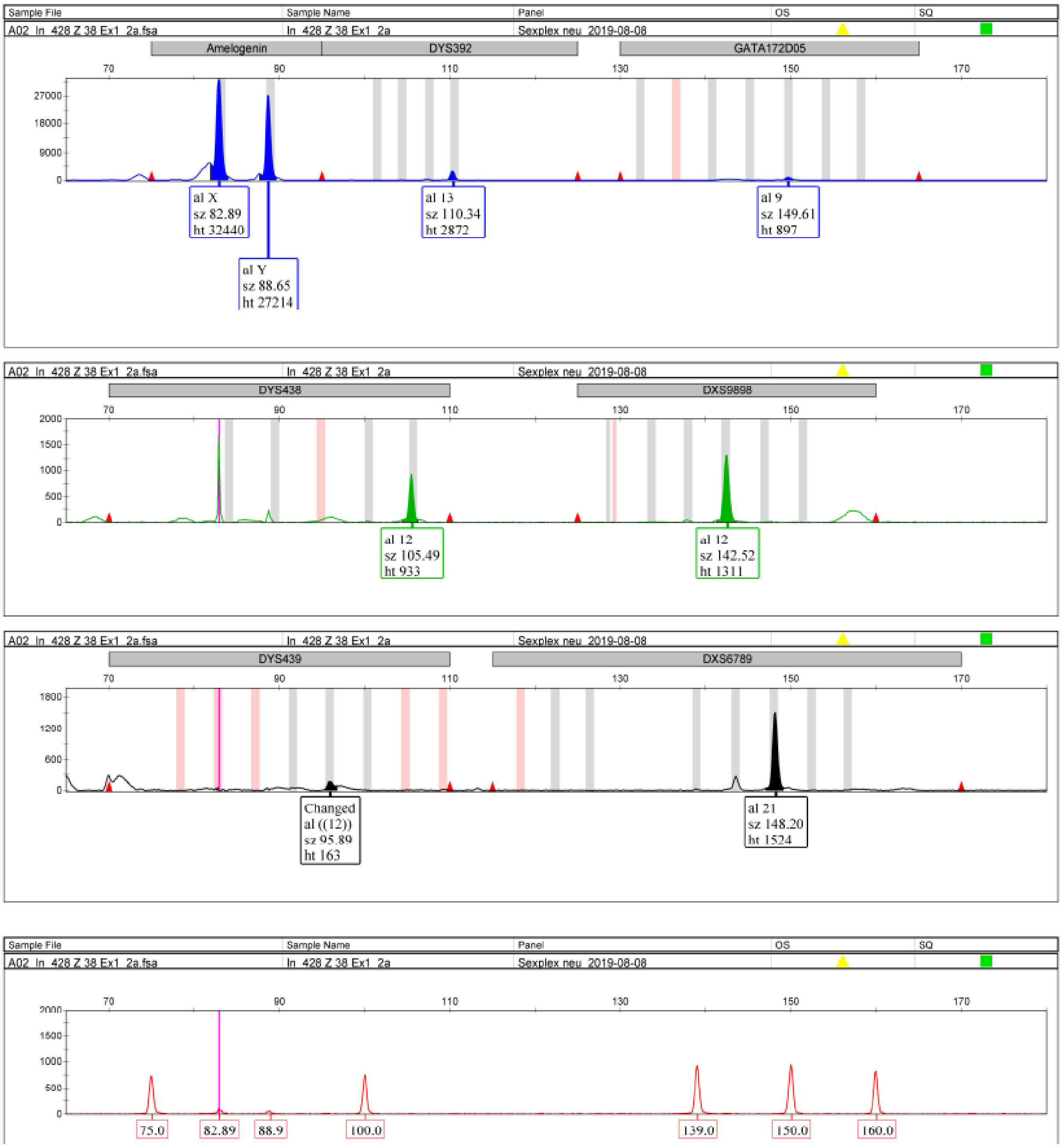
Inden 401


Sample File
Sample Name
Panel
OS
SQ
C05_In_401 Z PreMol Ex1_3a.fsa
In_401 Z PreMol Ex1_3a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
al X
sz 82.85
ht 28989
al 5
sz 132.15
ht 1555
DYS438
DXS9898
al 11
sz 137.79
ht 2649
al 12
sz 142.30
ht 3291
DYS439
DXS6789
Changed
al (20)
sz 143.48
ht 1532
al 21
sz 148.05
ht 5090
75.0
82.97
100.0
139.0
150.0
160.0

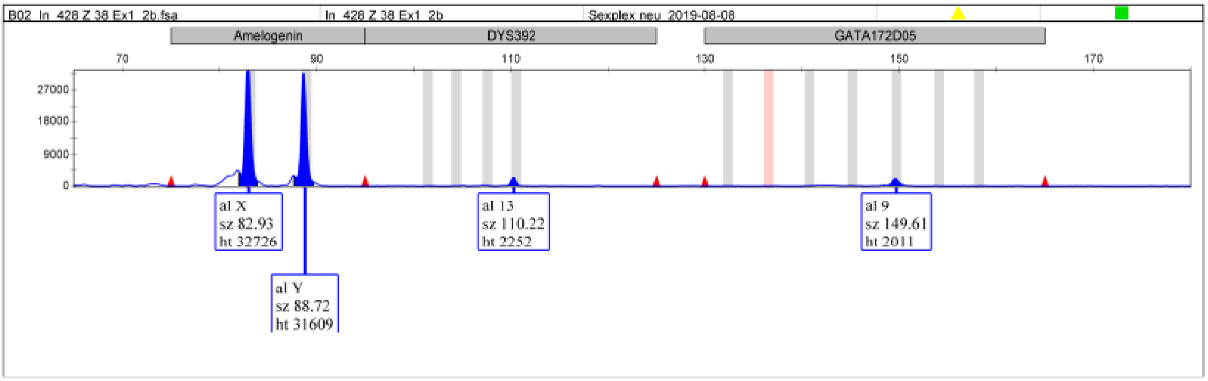
Inden 401

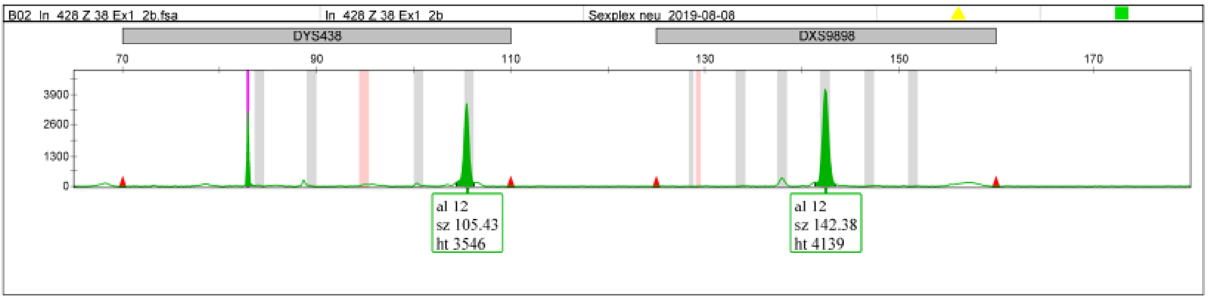

D05_In_401 Z PreMol Ex1_3a.fsa
In_401 Z PreMol Ex1_3a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
70
90
110
130
150
170
27000
18000
9000
0
Changed
al X
sz 82.58
ht 31192
al 5
sz 132.14
ht 2710
al 11
sz 158.11
ht 4442
D05_In_401 Z PreMol Ex1_3a.fsa
In_401 Z PreMol Ex1_3a
Sexplex neu_2019-08-08
DYS438
DXS9898
21000
14000
7000
al 11
sz 137.91
ht 25949
al 12
sz 142.43
ht 13919
Sample File
Sample Name
Panel
OS
SQ
D05_In_401 Z PreMol Ex1_3a.fsa
In_401 Z PreMol Ex1_3a
Sexplex neu_2019-08-08
DYS439
DXS6789
5400
3600
1800
al 20
sz 143.61
ht 6595
Added
al (21)
sz 148.05
ht 1376
D05_In_401 Z PreMol Ex1_3a.fsa
In_401 Z PreMol Ex1_3a
Sexplex neu_2019-08-08
2000
1500
1000
500
75.0
82.94
100.0
137.79
143.48
150.0
160.0
139.0
142.3

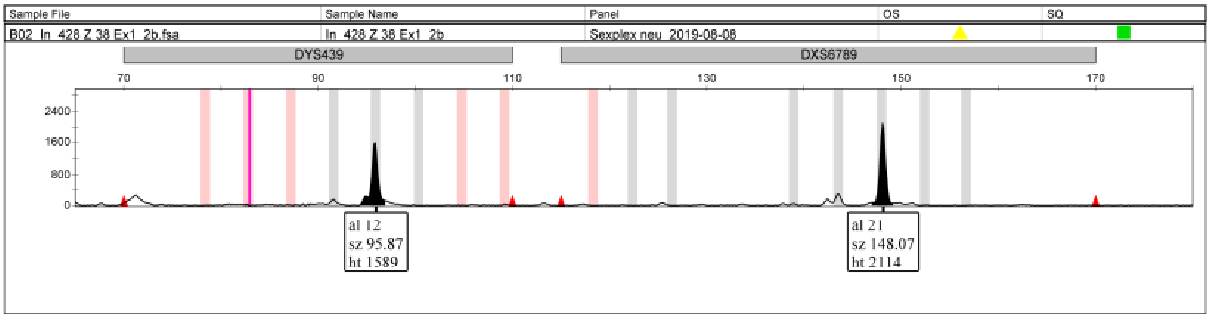
Inden 428

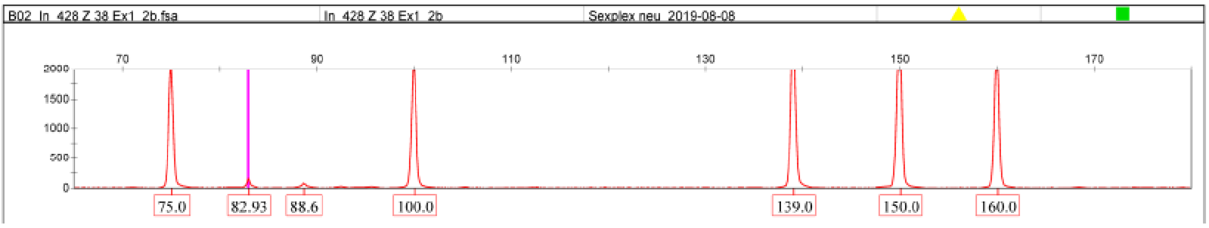

Sample File
Sample Name
Panel
OS
SQ
A02_In_428 Z 38 Ex1_2a.fsa
In_428 Z 38 Ex1_2a
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
al X
sz 82.89
ht 32440
al Y
sz 88.65
ht 27214
al 13
sz 110.34
ht 2872
al 9
sz 149.61
ht 897
DYS438
DXS9898
al 12
sz 105.49
ht 933
al 12
sz 142.52
ht 1311
DYS439
DXS6789
Changed
al ((12))
sz 95.89
ht 163
al 21
sz 148.20
ht 1524
75.0
82.89
88.9
100.0
139.0
150.0
160.0

Inden 428

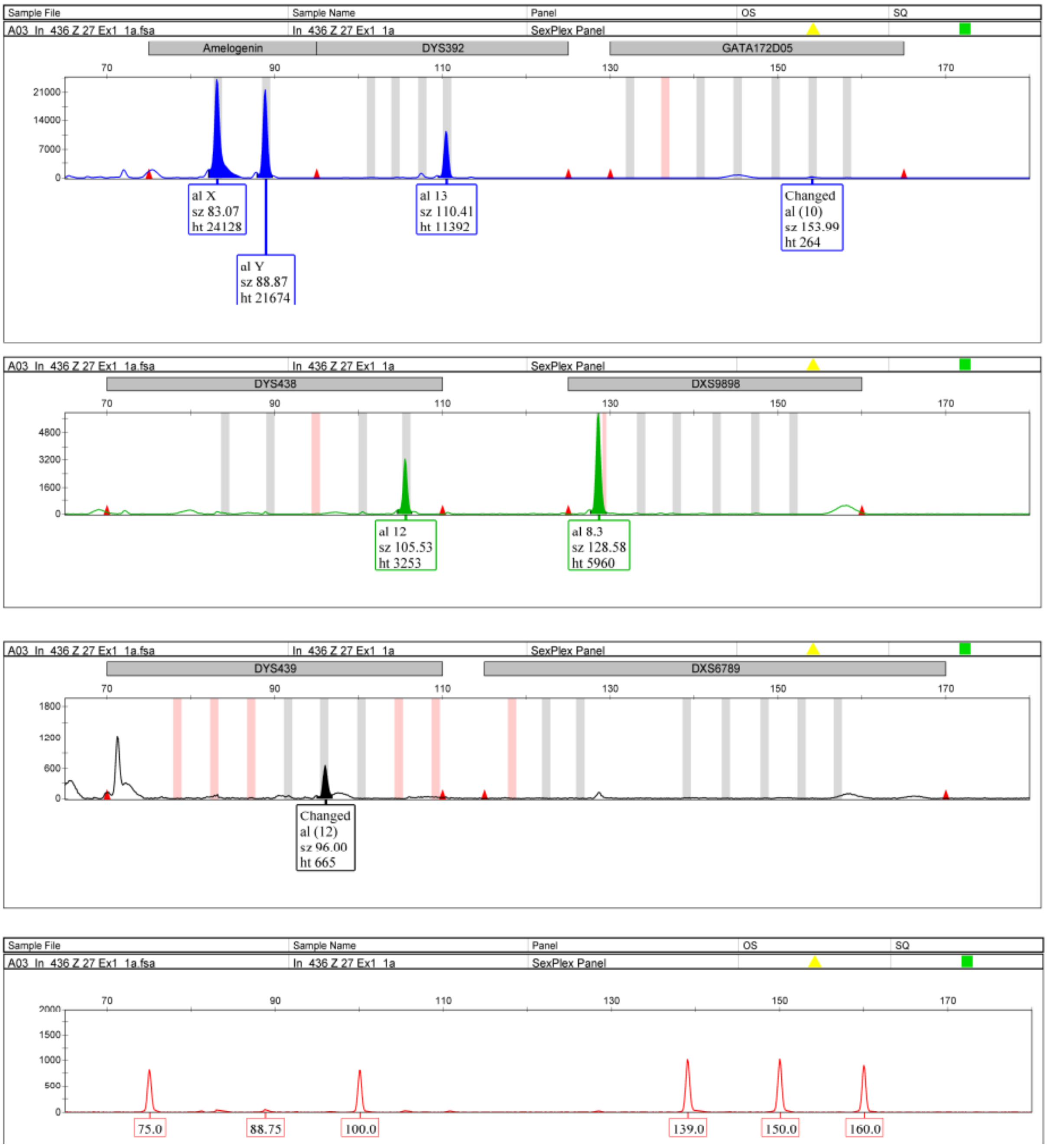

B02_In_428 Z 38 Ex1_2b.fsa
In_428 Z 38 Ex1_2b
Sexplex neu_2019-08-08
Amelogenin
DYS392
GATA172D05
al X
sz 82.93
ht 32726
al Y
sz 88.72
ht 31609
al 13
sz 110.22
ht 2252
al 9
sz 149.61
ht 2011


B02_In_428 Z 38 Ex1_2b.fsa
In_428 Z 38 Ex1_2b
Sexplex neu_2019-08-08
DYS438
DXS9898
al 12
sz 105.43
ht 3546
al 12
sz 142.38
ht 4139

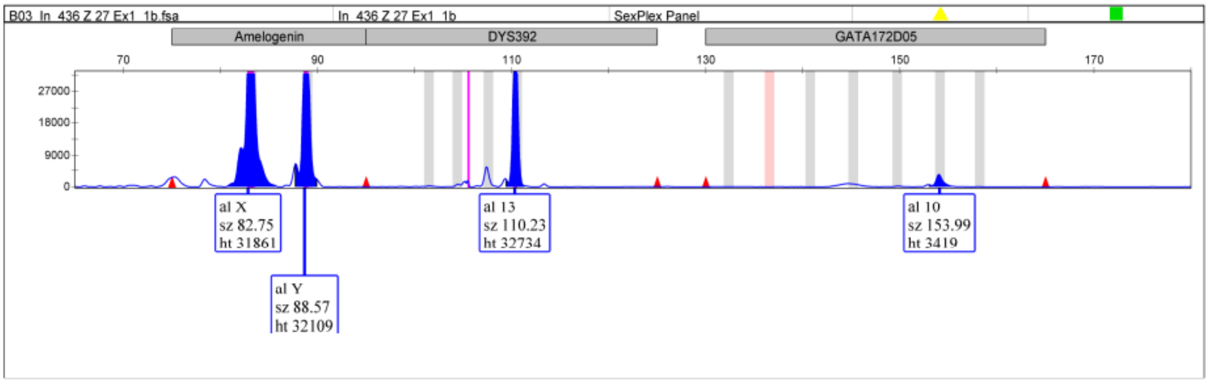

Sample File
Sample Name
Panel
OS
SQ
B02_In_428 Z 38 Ex1_2b.fsa
In_428 Z 38 Ex1_2b
Sexplex neu_2019-08-08
DYS439
DXS6789
al 12
sz 95.87
ht 1589
al 21
sz 148.07
ht 2114

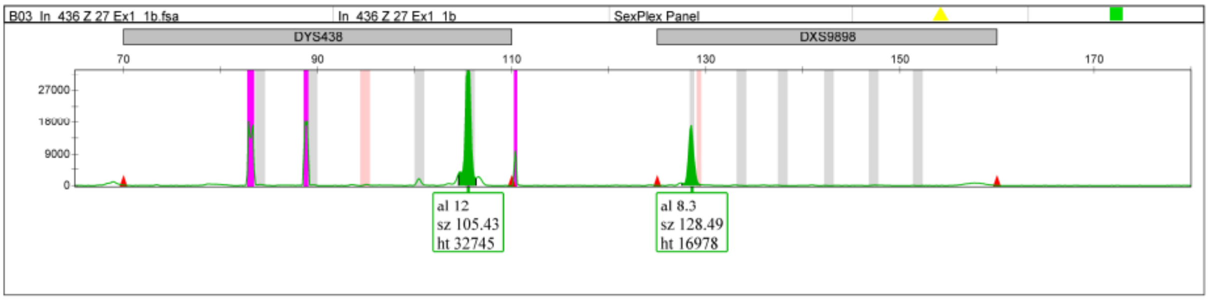

B02_In_428 Z 38 Ex1_2b.fsa
In_428 Z 38 Ex1_2b
Sexplex neu_2019-08-08
75.0
82.93
88.6
100.0
139.0
150.0
160.0

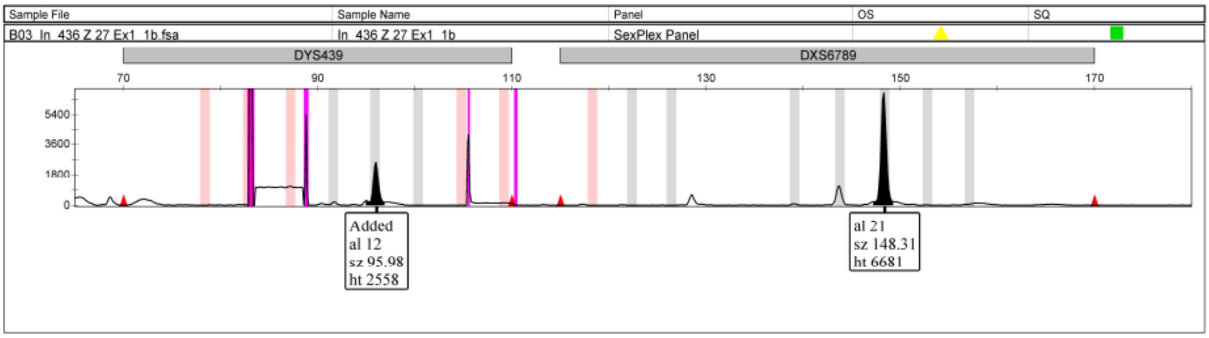
Inden 436

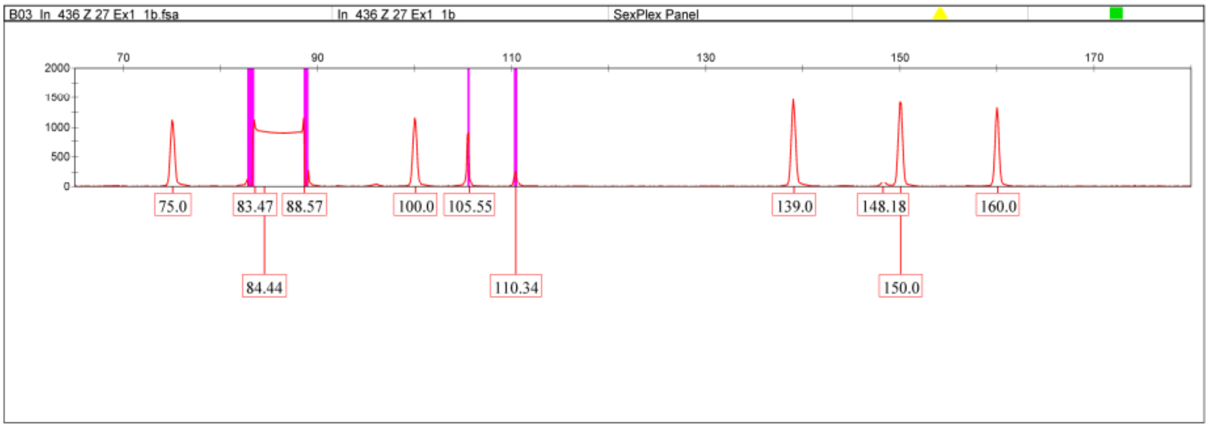

Sample File
Sample Name
Panel
OS
SQ
A03_In_436 Z 27 Ex1_1a.fsa
In_436 Z 27 Ex1_1a
SexPlex Panel
Amelogenin
DYS392
GATA172D05
al X
sz 83.07
ht 24128
al Y
sz 88.87
ht 21674
al 13
sz 110.41
ht 11392
Changed
al (10)
sz 153.99
ht 264
DYS438
DXS9898
al 12
sz 105.53
ht 3253
al 8.3
sz 128.58
ht 5960
DYS439
DXS6789
Changed
al (12)
sz 96.00
ht 665
75.0
88.75
100.0
139.0
150.0
160.0

Inden 436

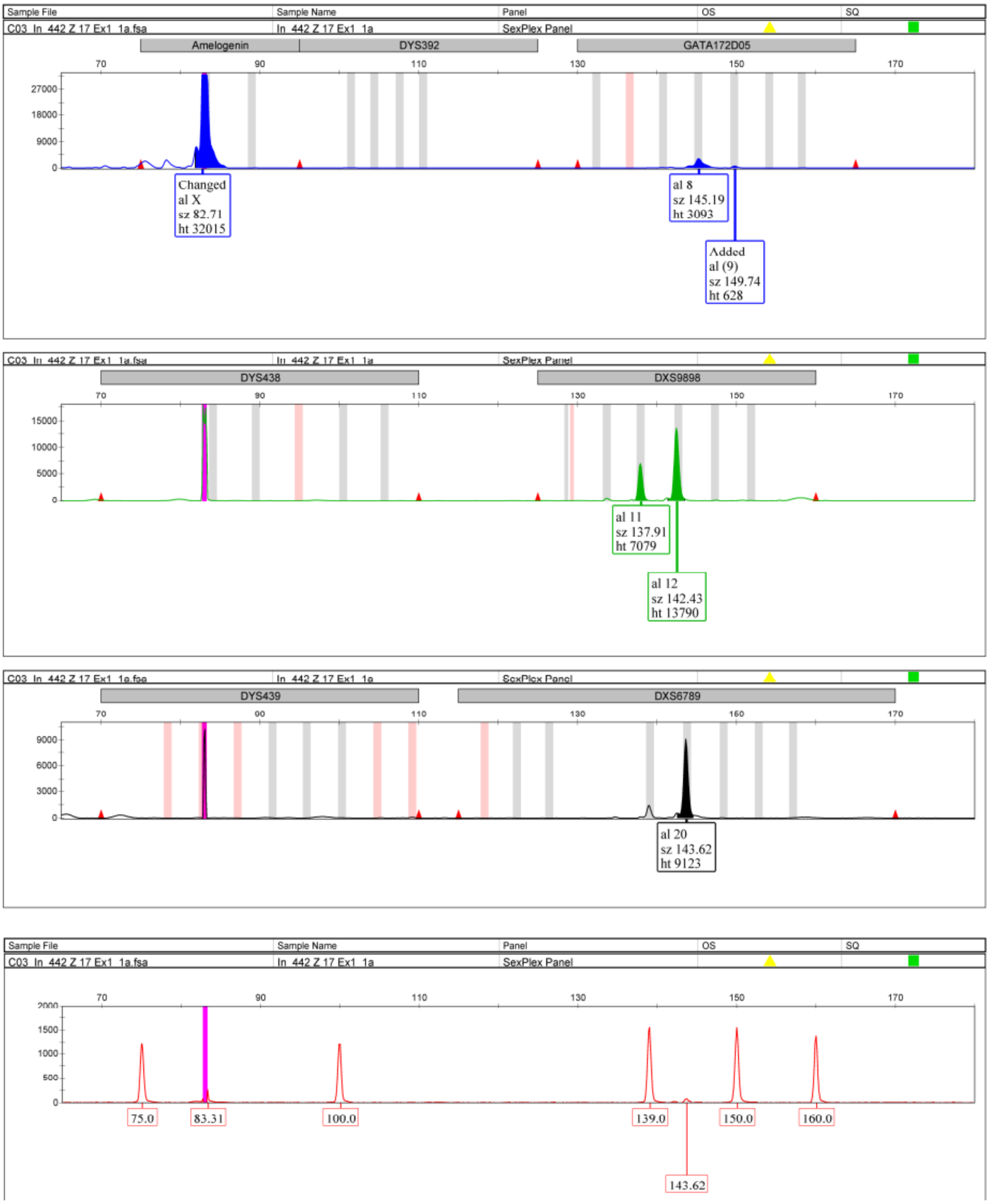

B03_In_436 Z 27 Ex1_1b.fsa
In_436 Z 27 Ex1_1b
SexPlex Panel
Amelogenin
DYS392
GATA172D05
70
90
110
130
150
170
27000
18000
9000
0
al X
sz 82.75
ht 31861
al 13
sz 110.23
ht 32734
al 10
sz 153.99
ht 3419
al Y
sz 88.57
ht 32109


B03_In_436 Z 27 Ex1_1b.fsa
In_436 Z 27 Ex1_1b
SexPlex Panel
DYS438
DXS9898
70
90
110
130
150
170
27000
18000
9000
0
al 12
sz 105.43
ht 32745
al 8.3
sz 128.49
ht 16978

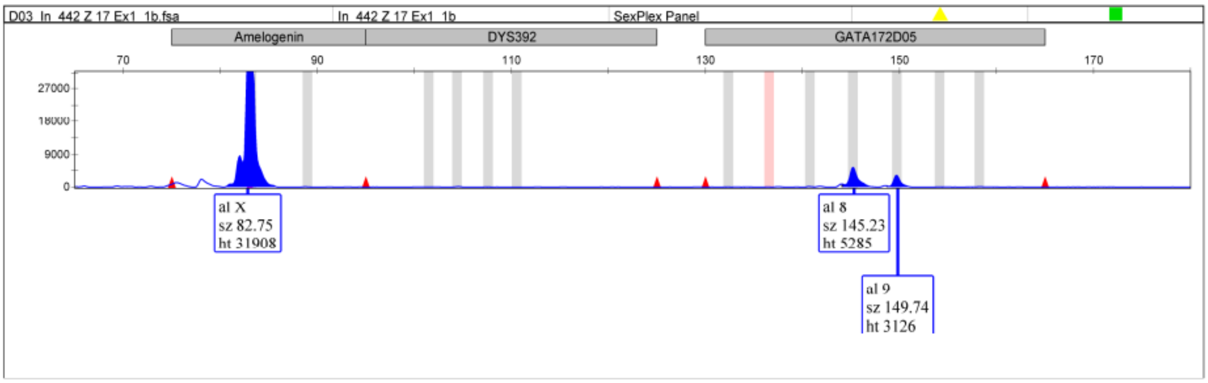

Sample File
Sample Name
Panel
OS
SQ
B03_In_436 Z 27 Ex1_1b.fsa
In_436 Z 27 Ex1_1b
SexPlex Panel
DYS439
DXS6789
70
90
110
130
150
170
5400
3600
1800
0
Added
al 12
sz 95.98
ht 2558
al 21
sz 148.31
ht 6681

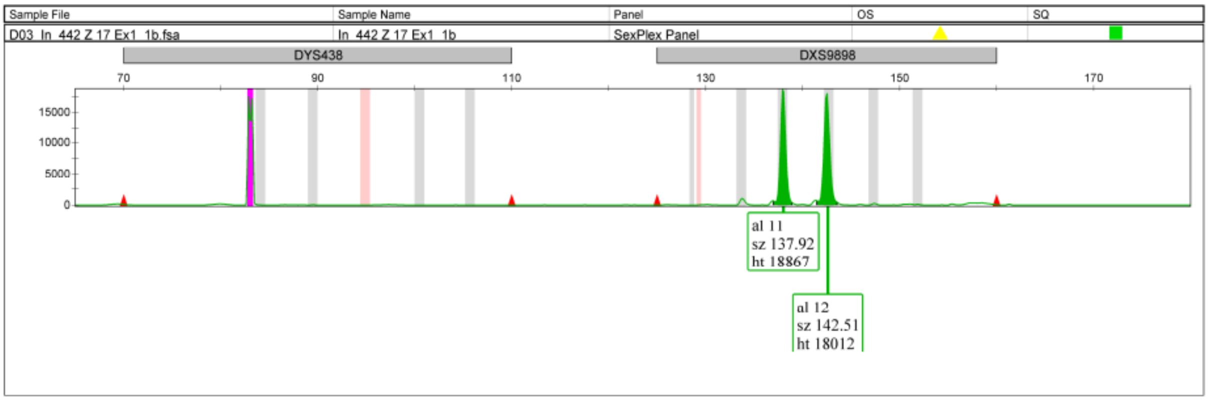

B03_In_436 Z 27 Ex1_1b.fsa
In_436 Z 27 Ex1_1b
SexPlex Panel
70
90
110
130
150
170
2000
1500
1000
500
0
75.0
83.47
88.57
100.0
105.55
139.0
148.18
160.0
84.44
110.34
150.0

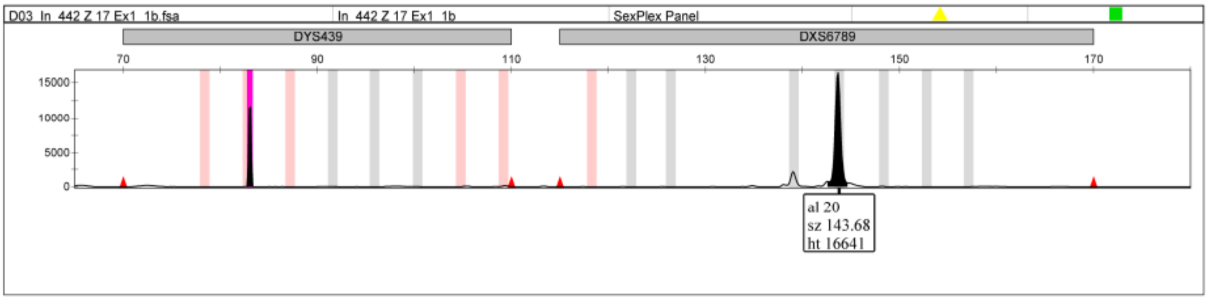
Inden 442

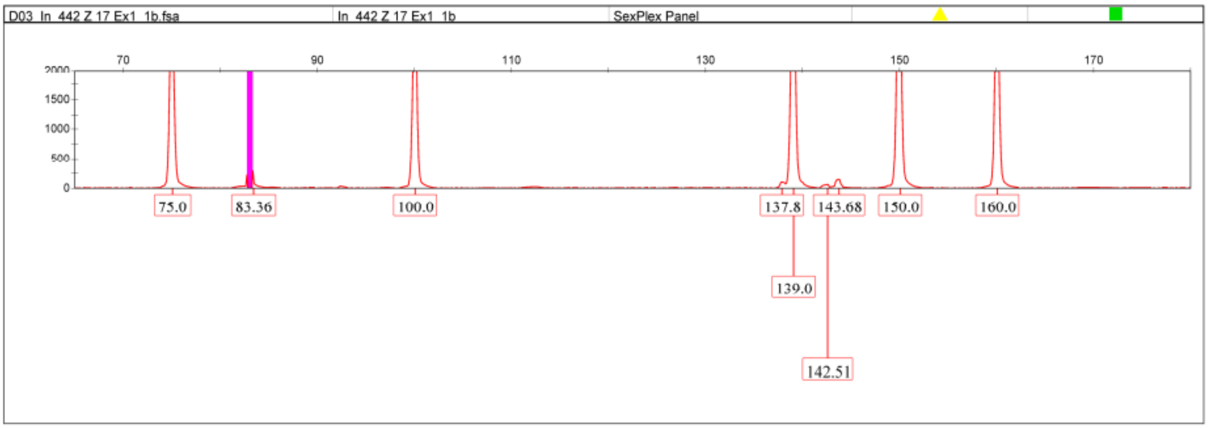

Sample File
Sample Name
Panel
OS
SQ
C03_In_442 Z 17 Ex1_1a.fsa
In_442 Z 17 Ex1_1a
SexPlex Panel
Amelogenin
DYS392
GATA172D05
Changed
al X
sz 82.71
ht 32015
al 8
sz 145.19
ht 3093
Added
al (9)
sz 149.74
ht 628
DYS438
DXS9898
al 11
sz 137.91
ht 7079
al 12
sz 142.43
ht 13790
DYS439
DXS6789
al 20
sz 143.62
ht 9123
75.0
83.31
100.0
139.0
150.0
160.0
143.62

Inden 442

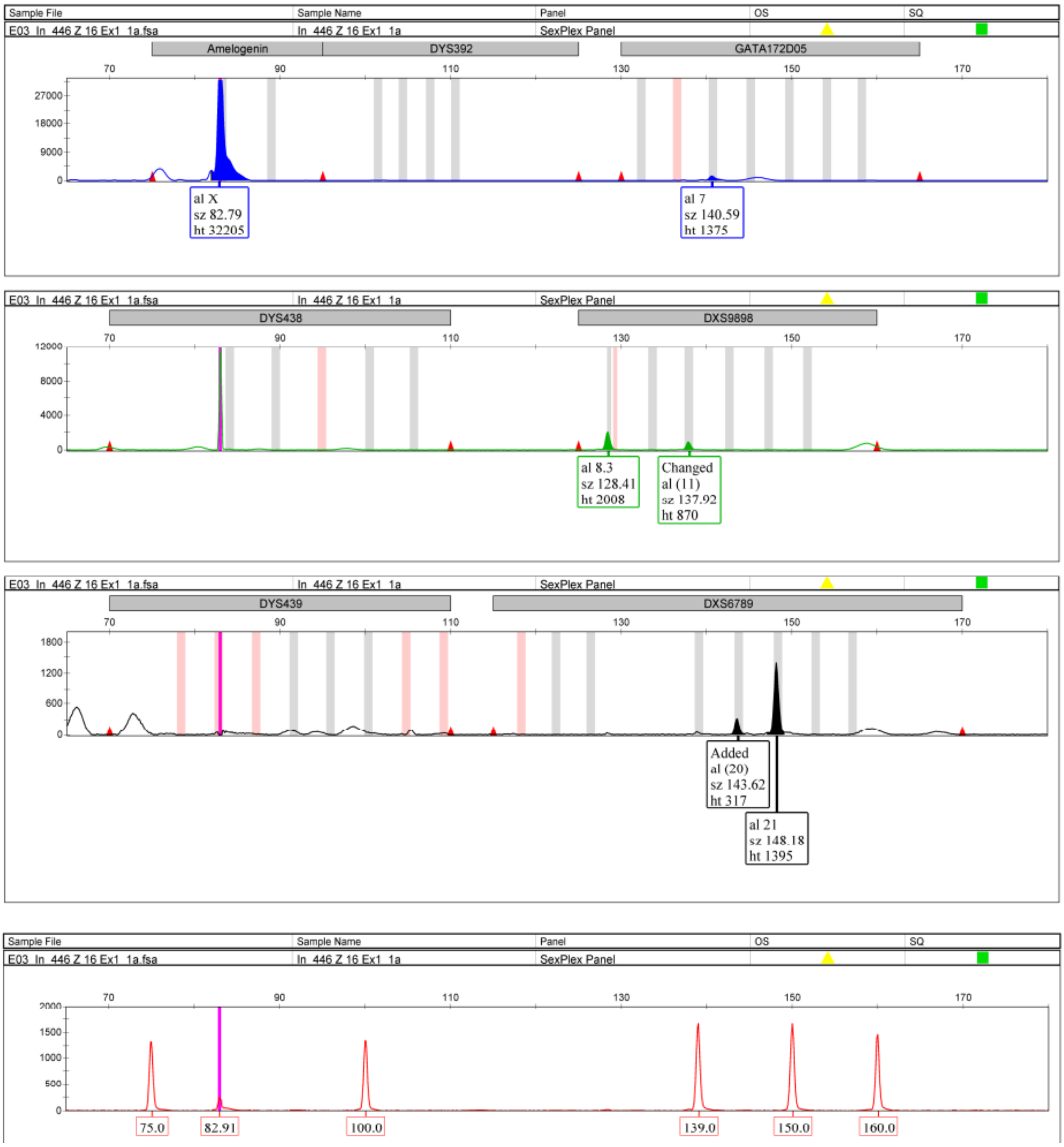

D03_In_442 Z 17 Ex1_1b.fsa
In_442 Z 17 Ex1_1b
SexPlex Panel
Amelogenin
DYS392
GATA172D05
al X
sz 82.75
ht 31908
al 8
sz 145.23
ht 5285
al 9
sz 149.74
ht 3126


Sample File
Sample Name
Panel
OS
SQ
D03_In_442 Z 17 Ex1_1b.fsa
In_442 Z 17 Ex1_1b
SexPlex Panel
DYS438
DXS9898
al 11
sz 137.92
ht 18867
al 12
sz 142.51
ht 18012


D03_In_442 Z 17 Ex1_1b.fsa
In_442 Z 17 Ex1_1b
SexPlex Panel
DYS439
DXS6789
al 20
sz 143.68
ht 16641


D03_In_442 Z 17 Ex1_1b.fsa
In_442 Z 17 Ex1_1b
SexPlex Panel
75.0
83.36
100.0
137.8
143.68
150.0
160.0
139.0
142.51

Inden 446


Sample File
Sample Name
Panel
OS
SQ
E03_In_446 Z 16 Ex1_1a.fsa
In_446 Z 16 Ex1_1a
SexPlex Panel
Amelogenin
DYS392
GATA172D05
al X
sz 82.79
ht 32205
al 7
sz 140.59
ht 1375
DYS438
DXS9898
al 8.3
sz 128.41
ht 2008
Changed
al (11)
sz 137.92
ht 870
DYS439
DXS6789
Added
al (20)
sz 143.62
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al 21
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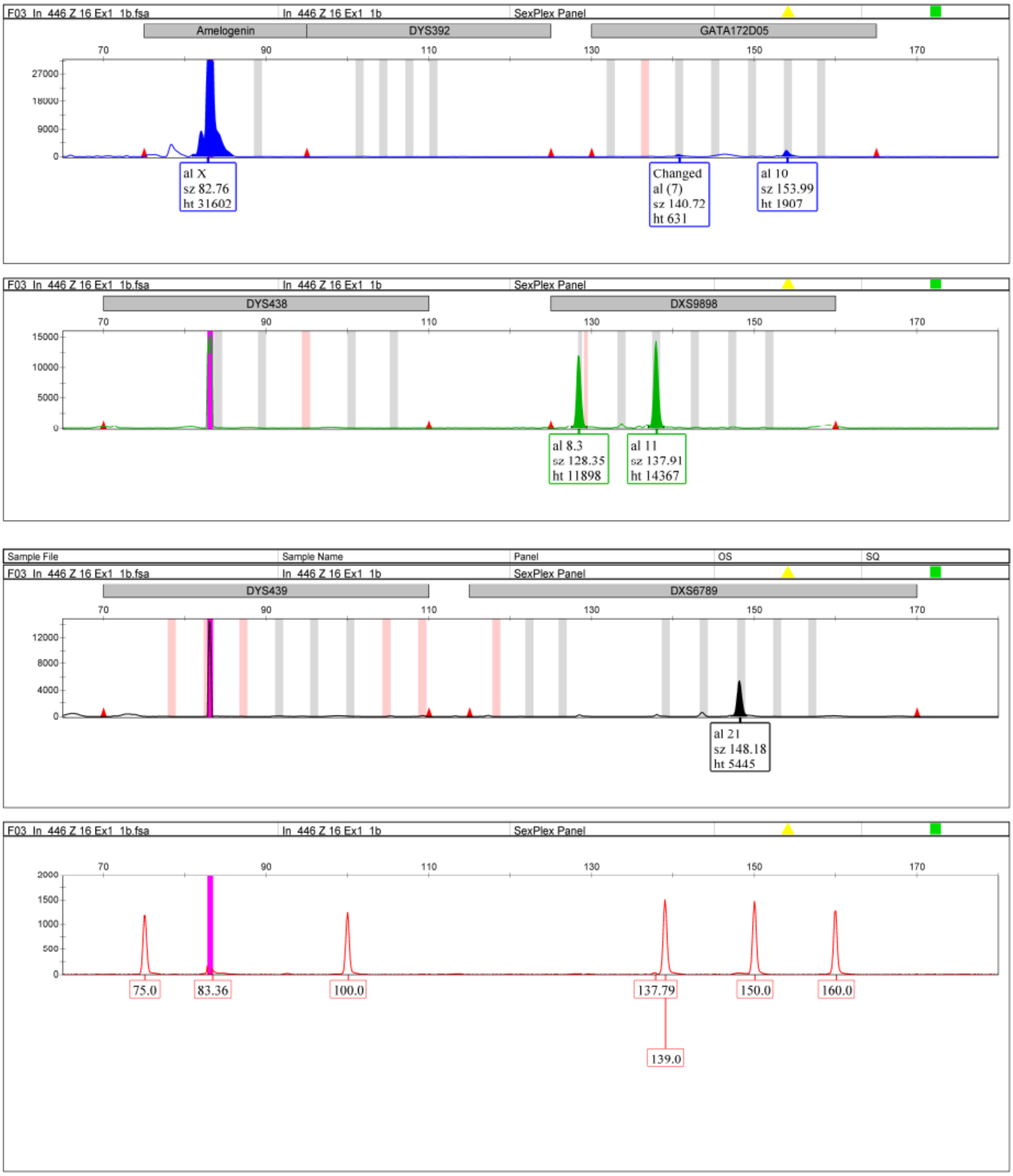
ht 1395
75.0
82.91
100.0
139.0
150.0
160.0

Inden 446



F03_In_446 Z 16 Ex1_1b.fsa
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Amelogenin
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al X
sz 82.76
ht 31602
Changed
al (7)
sz 140.72
ht 631
al 10
sz 153.99
ht 1907
DYS438
DXS9898
al 8.3
sz 128.35
ht 11898
al 11
sz 137.91
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Sample File
Sample Name
Panel
OS
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DYS439
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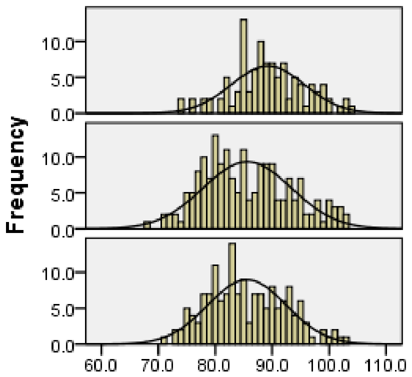
Femur



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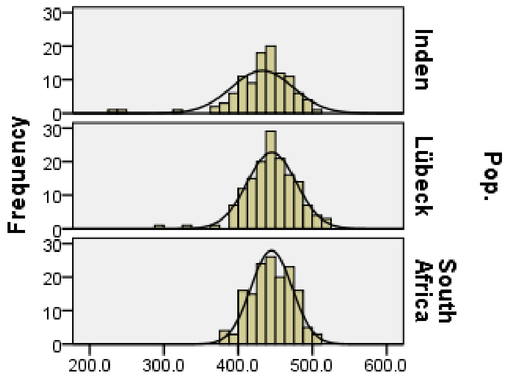

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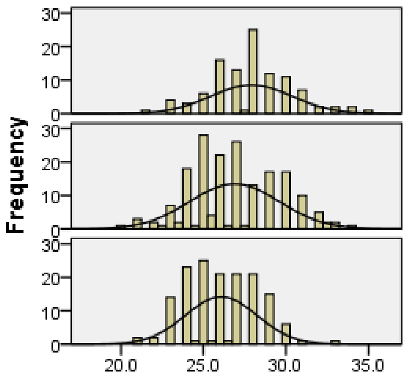

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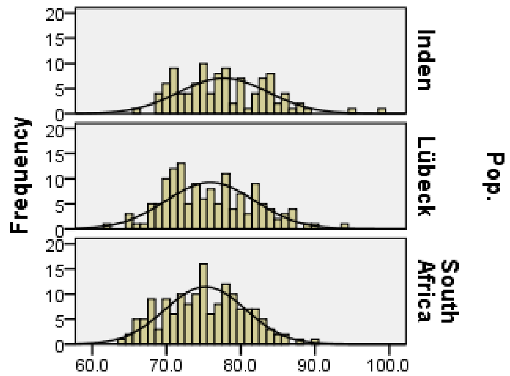

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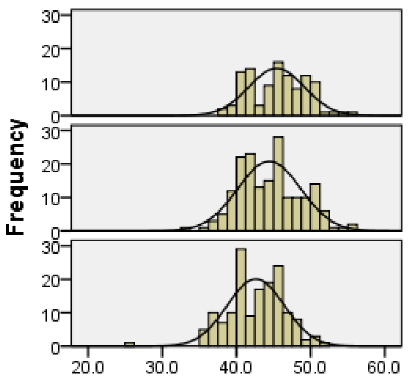

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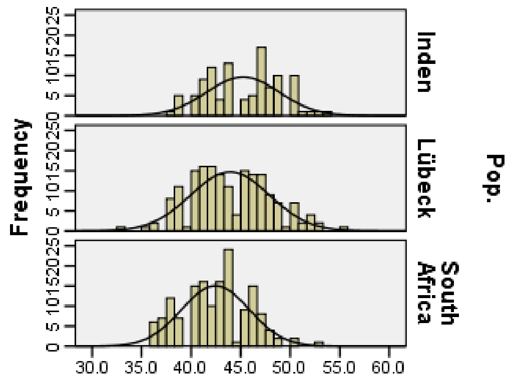

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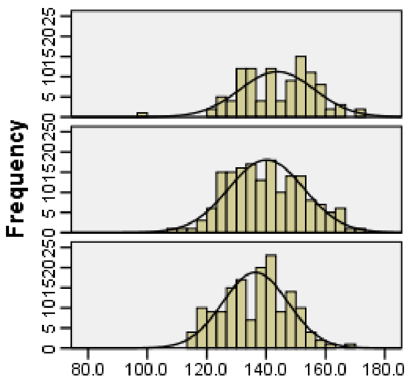

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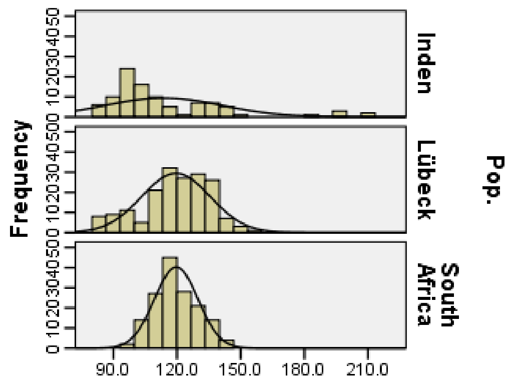
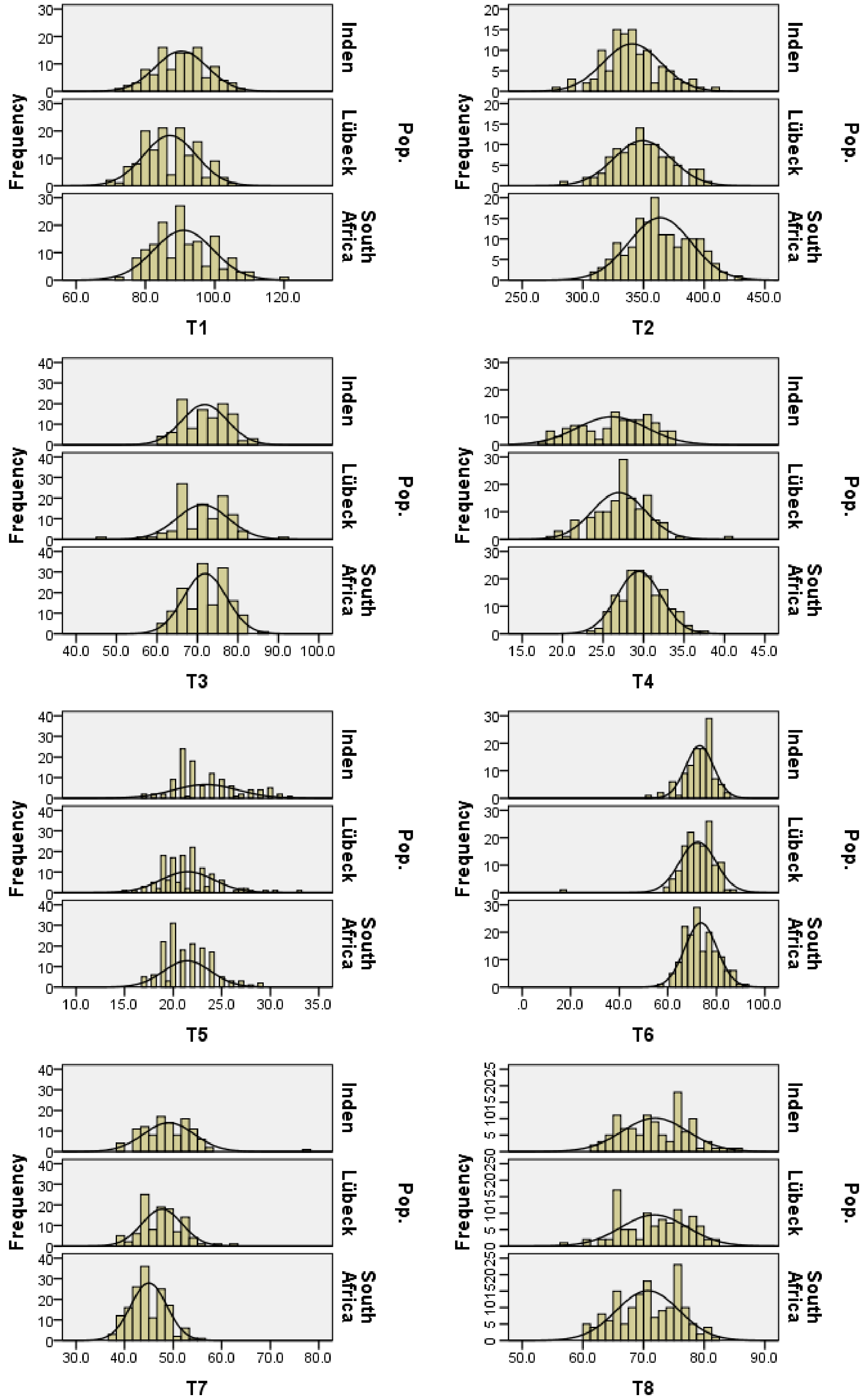
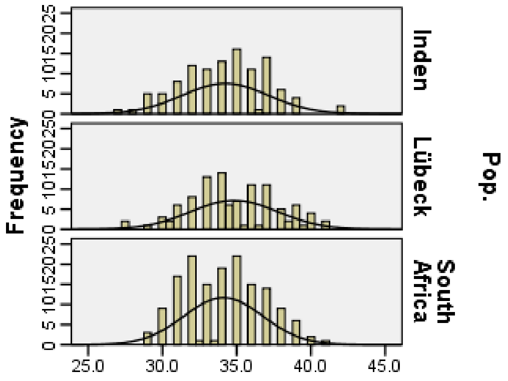


F8

Tibia


Frequency
Inden
Lübeck
South Africa
Pop.
T1
T2
T3
T4
T5
T6
T7
T8



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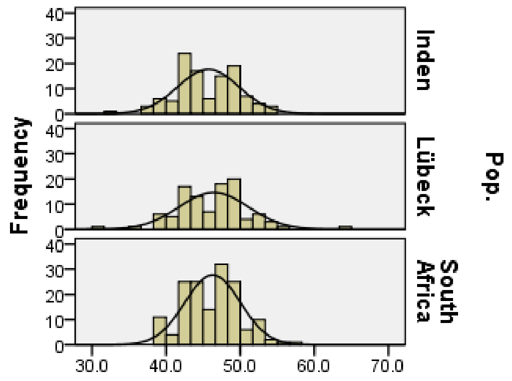

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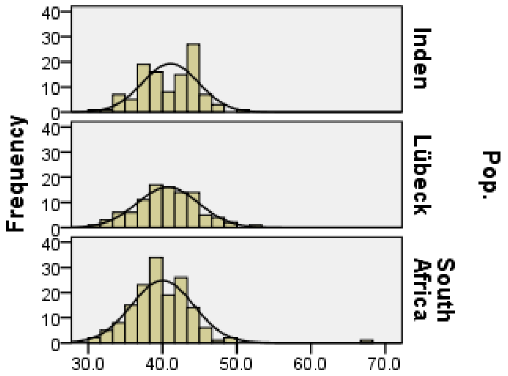

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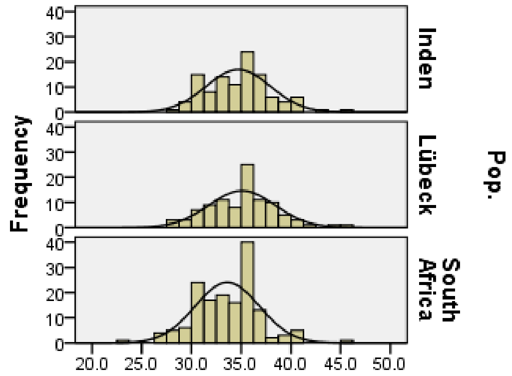
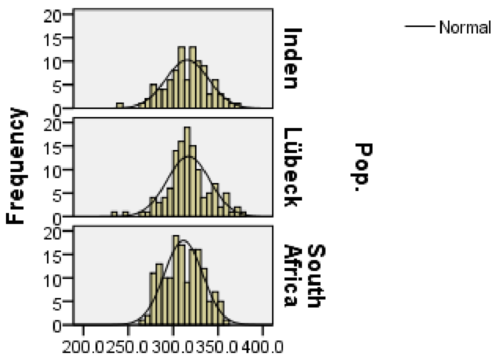


T12

Humerus



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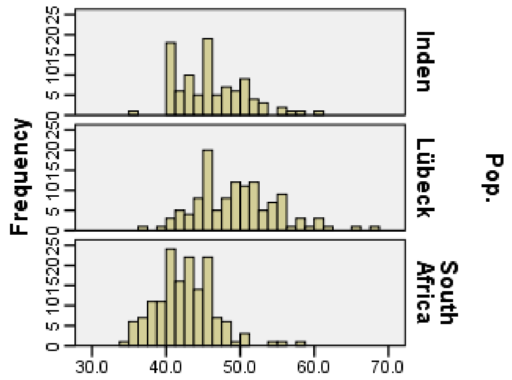
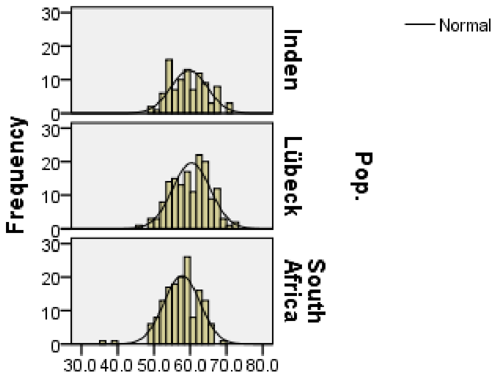
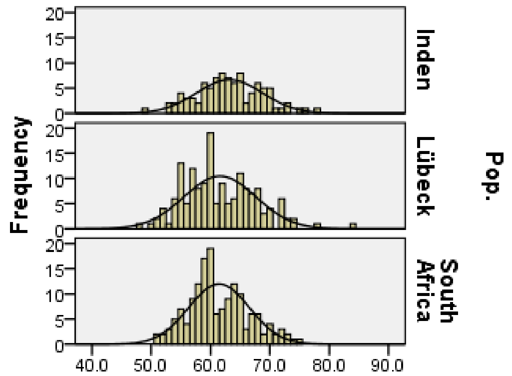


H2

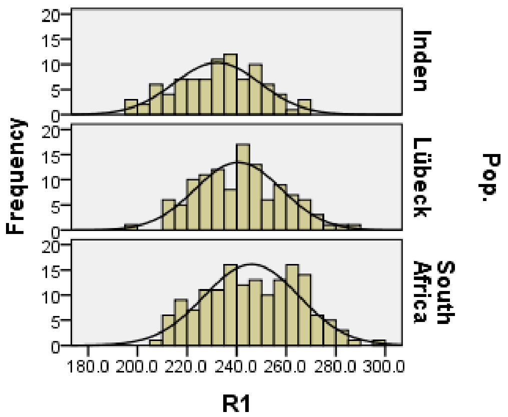


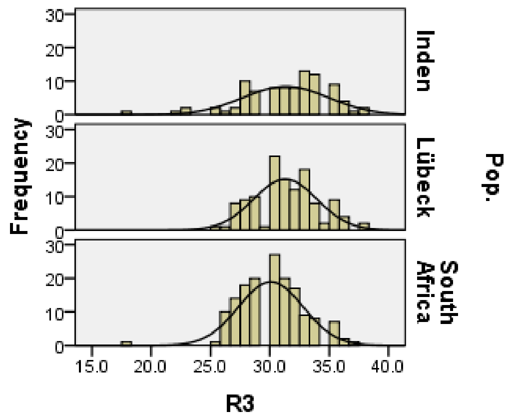
H3

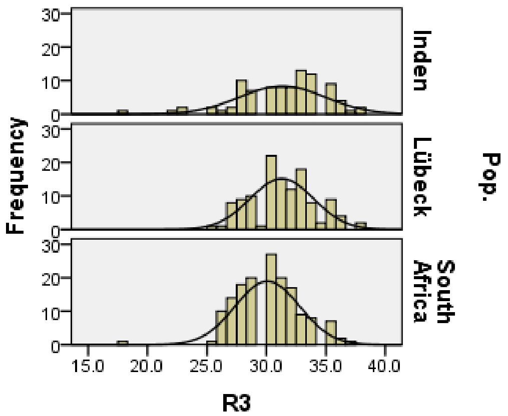


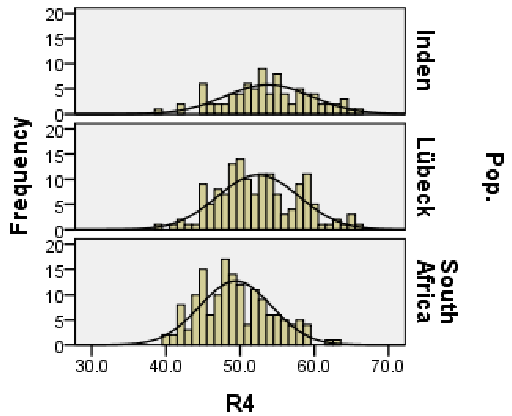
H4

Radius

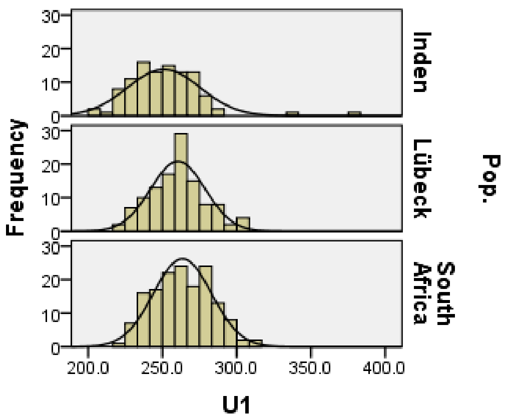

Frequency
Inden
Lübeck
South Africa
Pop.
180.0 200.0 220.0 240.0 260.0 280.0 300.0
R1


Frequency
Inden
Lübeck
South Africa
Pop.
15.0 20.0 25.0 30.0 35.0 40.0
R3


Frequency
Inden
Lübeck
South Africa
Pop.
15.0 20.0 25.0 30.0 35.0 40.0
R3


Frequency
Inden
Lübeck
South Africa
Pop.
30.0 40.0 50.0 60.0 70.0
R4

Ulna


Frequency
Inden
Lübeck
South Africa
Pop.
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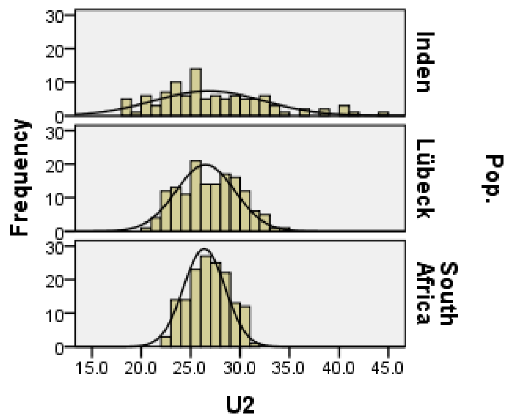
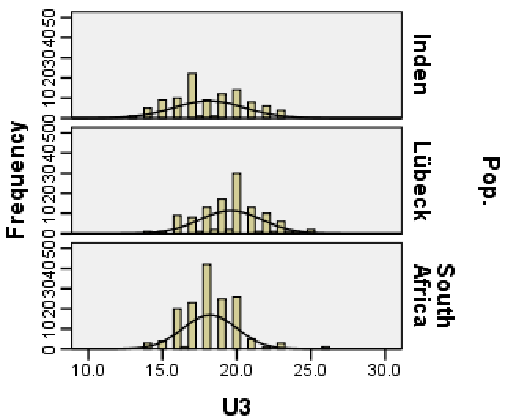
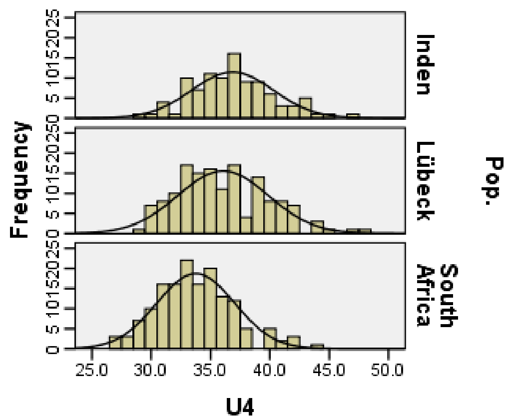
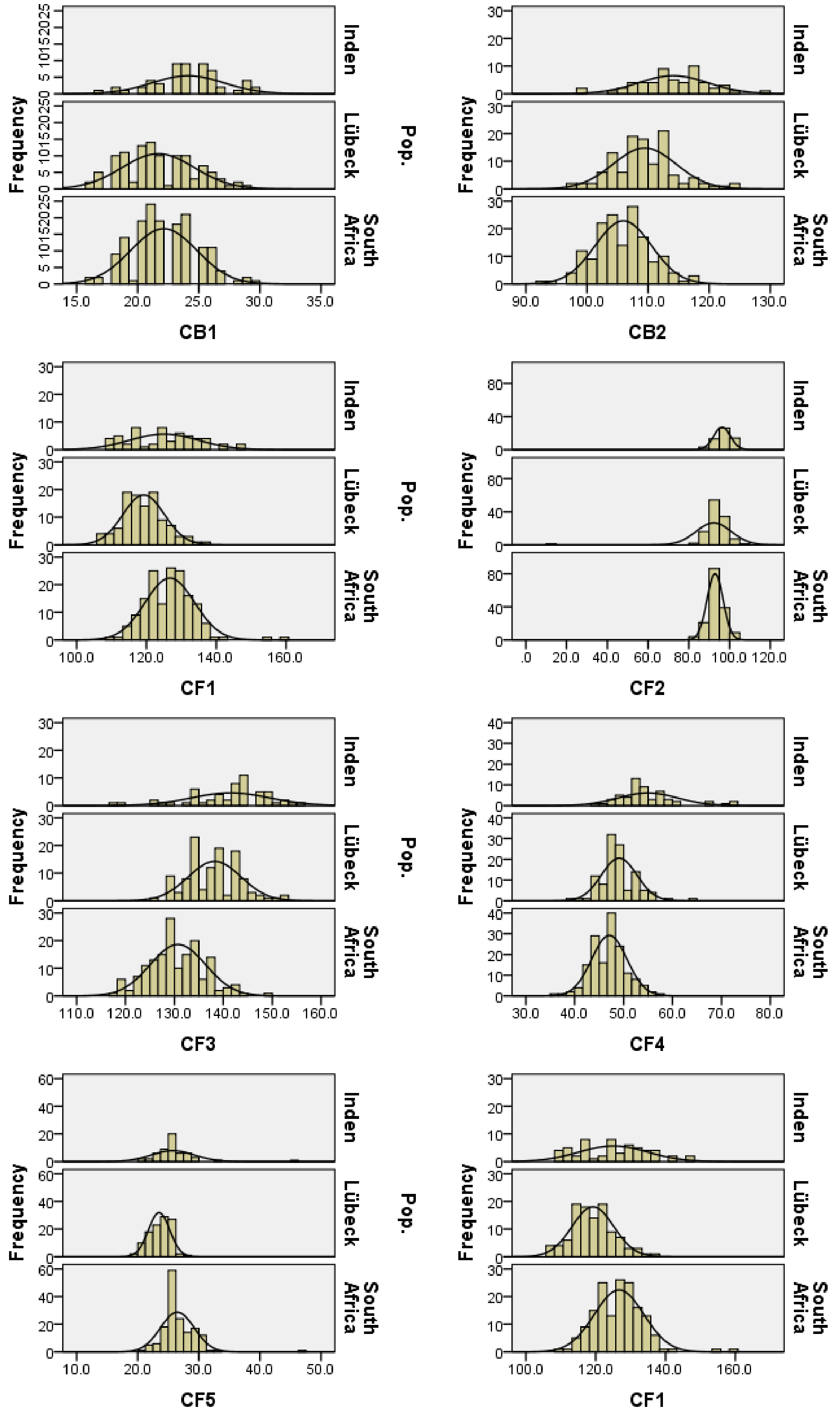
U1

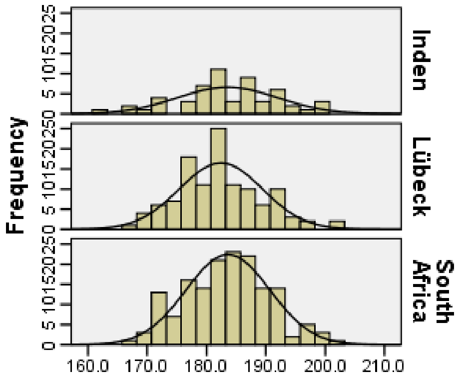

Frequency
Inden
Lübeck
South Africa
Pop.
15.0 20.0 25.0 30.0 35.0 40.0 45.0
U2


Frequency
Inden
Lübeck
South Africa
Pop.
10.0 15.0 20.0 25.0 30.0
U3


Frequency
Inden
Lübeck
South Africa
Pop.
25.0 30.0 35.0 40.0 45.0 50.0
U4

Crania


Frequency
Inden
Lübeck
South Africa
Pop.
CB1
CB2
CF1
CF2
CF3
CF4
CF5
CF1



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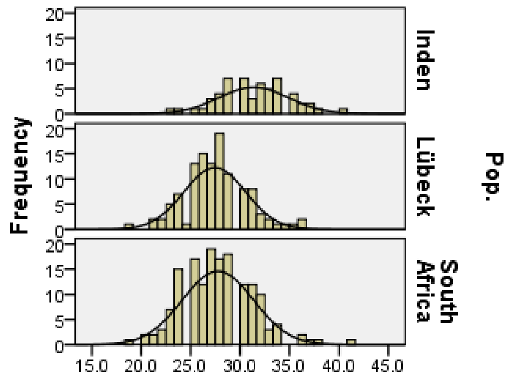
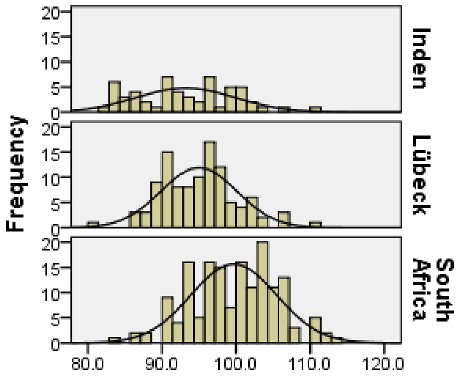


CL2



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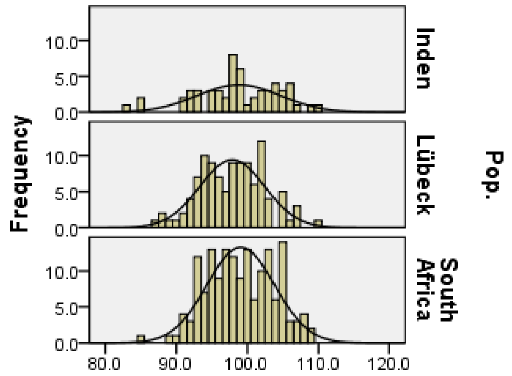

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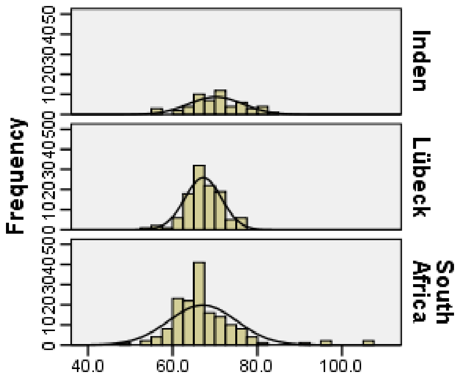
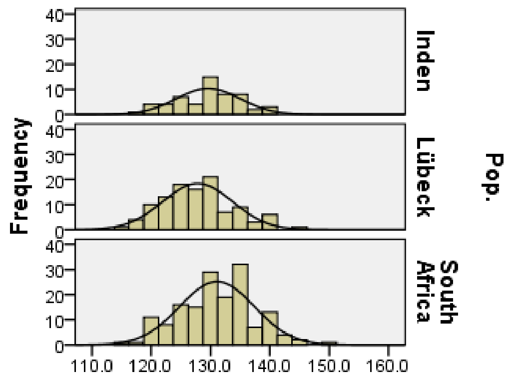
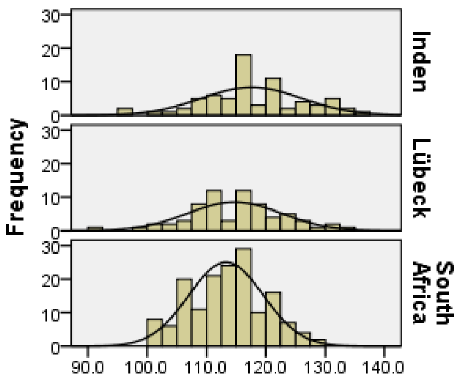


CL5

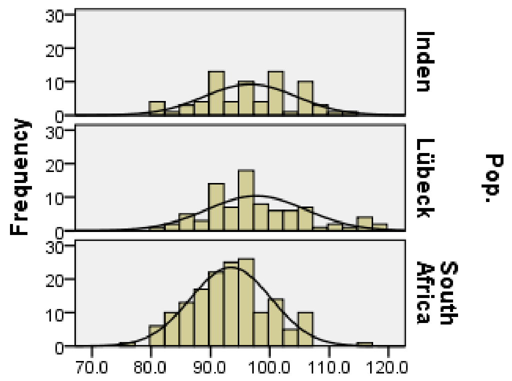


CL6

Mandible



M1



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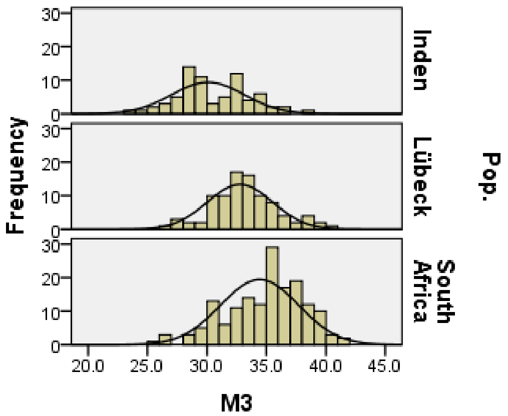
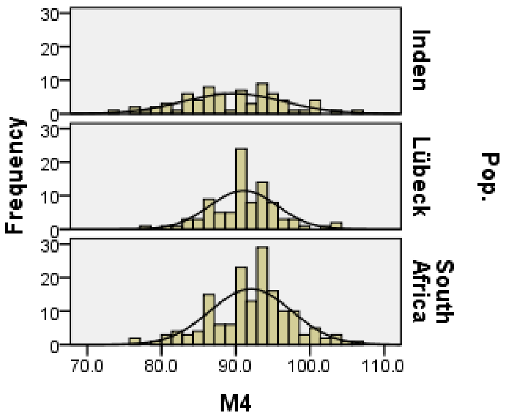
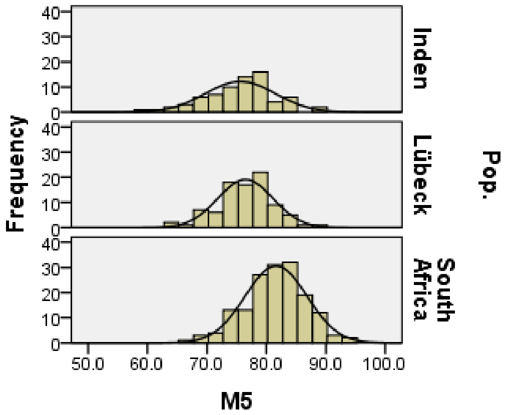
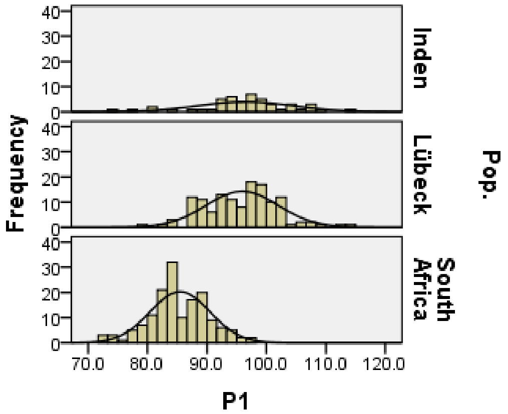
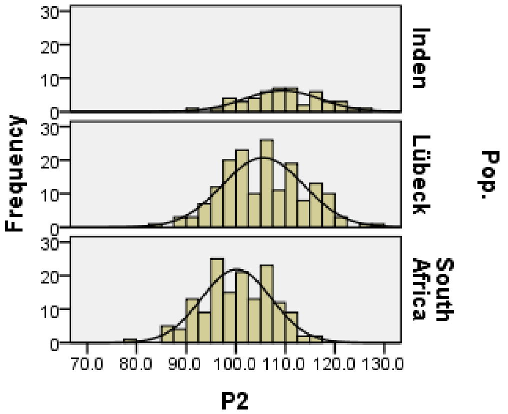

Frequency
Inden
Lübeck
South Africa
Pop.
M3

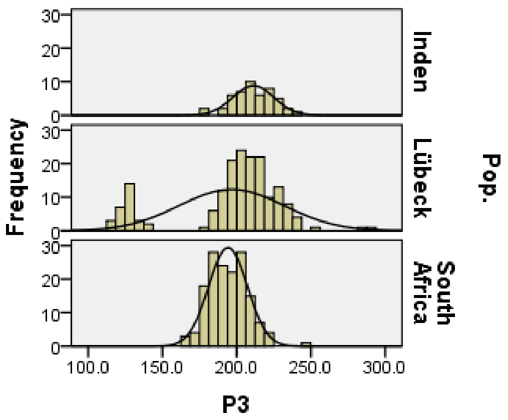

Frequency
Inden
Lübeck
South Africa
Pop.
M4

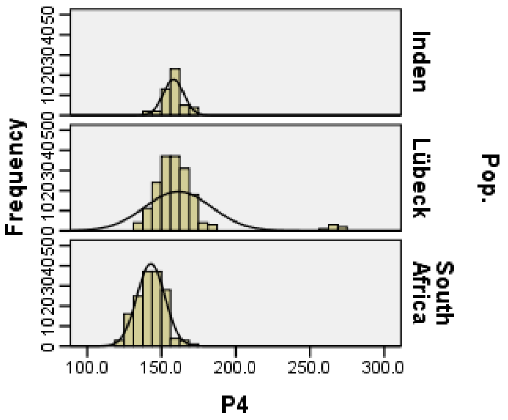

Frequency
Inden
Lübeck
South Africa
Pop.
M5

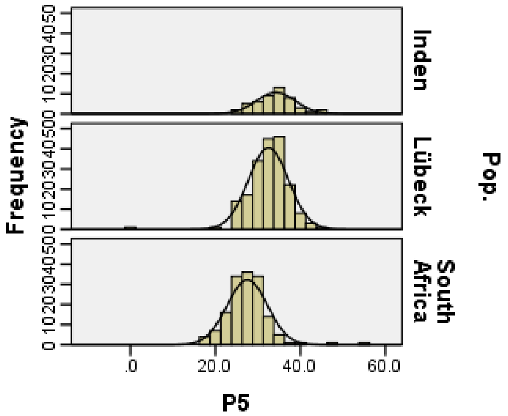
Pelvis

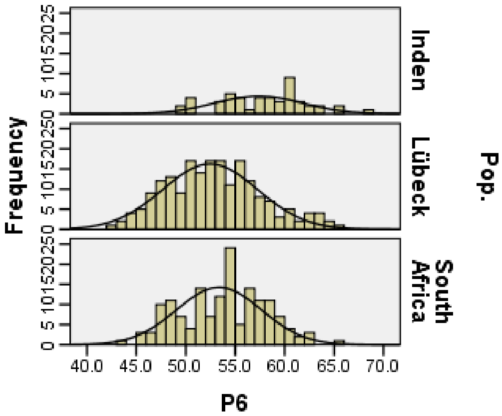

Frequency
Inden
Lübeck
South Africa
Pop.
P1


Frequency
Inden
Lübeck
South Africa
Pop.
P2


Frequency
Inden
Lübeck
South Africa
Pop.
P3


Frequency
Inden
Lübeck
South Africa
Pop.
P4


Frequency
Inden
Lübeck
South Africa
Pop.
.0
20.0
40.0
60.0
P5


Frequency
Inden
Lübeck
South Africa
Pop.
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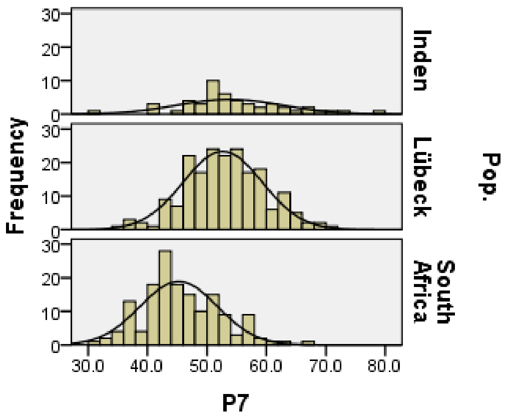
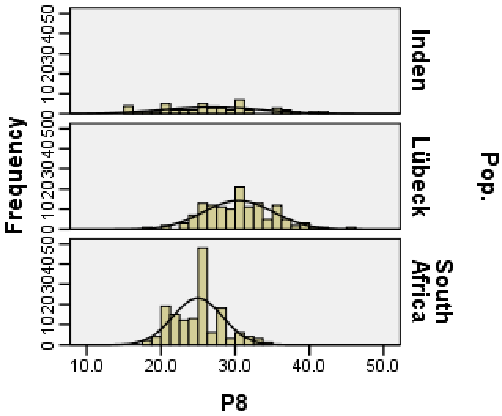
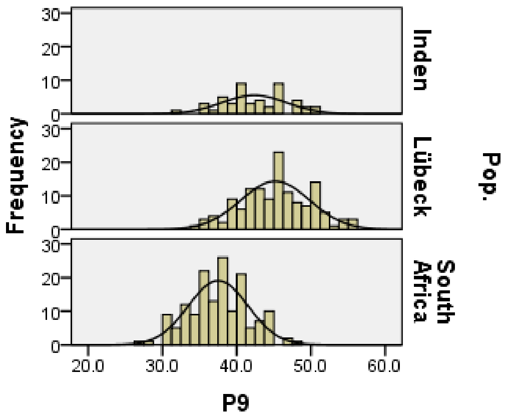
45.0
50.0
55.0
60.0
65.0
70.0
P6


Frequency
Inden
Lübeck
South Africa
Pop.
30.0
40.0
50.0
60.0
70.0
80.0
P7


Frequency
Inden
Lübeck
South Africa
Pop.
10.0
20.0
30.0
40.0
50.0
P8


Frequency
Inden
Lübeck
South Africa
Pop.
20.0
30.0
40.0
50.0
60.0
P9

Acknowledgement

I would like to start with thanking my thesis committee members Prof. Dr. Peter Kappeler, Prof. Dr. Julia Ostner, and Dr. Susanne Hummel for their immense support during the development of my doctoral work. I am also indebted to Prof. Dr. Lorenz Rahmstorf and Dr. Brendon Billings for their participation in my PhD examination.

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CONFERENCE CONTRIBUTION

Gupta A, Grosskopf B, Hummel S (2018): Evaluating morphological and metrical methods for sex determination on human skeletal materials by molecular testing. British Association for Biological Anthropology and Osteoarchaeology.