Appendix 2: Abbreviations

Table 2.1: Abbreviations and descriptions used in this thesis

Abbreviation	Description
AMH	Anatomically Modern Humans
AH	Archaic Homo Sapiens
EBA	Early Bronze Age
MBA	Middle Bronze Age
LBA	Late Bronze Age
EIA	Early Iron Age
MIA	Middle Iron Age
LIA	Late Iron Age
BP	Before Present
BCE	Before Common Era
CE	Common Era
MFM	Masticatory Functinoal Hypothesis
PME	Probable Mutation Effect
BMU	Bone Multicellular Units
MSM's	Muscular Skeletal Markers
DISH	Diffuse Idiopathic Skeletal Hyperostosis
GMM	Geometric Morphometrics
TMJ	Temporomandibular Joint
CSA	Cross Sectional Area
CVA	Canonical Variate Analysis
PCA	Principal Comonent Analysis
GPA	Generalised Procrustes Analysis
ME	Masticatory Efficiency
MP	Masticatory Performance
MBF	Maximum Bite Force
AMTL	Antemotem Tooth Loss
PC	Principal Components
CV	Canonical Variate
WHR	Waist to Hip Ratio

Abbreviation	Description
Bh	Body Height
Rh	Ramus Height
L1	Length 1
L2	Length 2
ConB	Condylar Breadth
CorB	Coronoid Breadth
N(F/M)	Neolithic females/males
IB(F/M	Bronze and Iron Age females/males
R(F/M)	Roman females/males
AS(F/M)	Anglo-Saxons females/males
M(F/M)	Medieval females/males
PM(F/M)	Post-Medieval females/males

Appendix 3: Skeletal Samples

The skeletal samples employed for this study were accessed from a number of universities, archaeological collections and museums. For the purposes of providing background information on these individuals this section will briefly discuss the excavation reports and relevant previously published research on these sites where they were available.

3.1 Fishergate House, York (Medieval)

Excavation was conducted by the Field Archaeology Specialists Ltd (FAS) on the grounds of Fishergate House in York between August 2000 and March 2001. Excavation by FAS quickly revealed many intercutting densely packed human graves, and 244 individuals were excavated from this site (Holst 2005). Adults and juvenile remains were buried together with no apparent order, and all the skeletons with one exception were buried in a supine extended position west-east. A small number of individuals were interred in coffins as identified by the presence of coffin nails. Only three burials included grave goods, and only one double burial was identified, in which two foetuses were interred in a single grave (Holst 2005). Stratigraphic analysis of the site and dating of the non-human material excavated indicated that the site was dated to the late medieval period. In addition to these late medieval inhumations four Roman cremations were excavated from the Fishergate site, dated between the 1st and early 2nd century, although none of the Roman individuals were sufficiently preserved (Holst 2005).

A study conducted by King and Henderson (2013) found that generally the individuals from Fishergate House in York were consistent with other low status late medieval British sites. Males were taller than females with a mean stature among males being 170cm and females 159cm, 60% of individuals were found to have periostitis with no difference between males and females while males were slightly more likely to have periosteal new growth on the maxillary sinus (34.5% males 31% females) and cribra orbitalia (14% males and 11.3% of females). Previous studies have also analysed weaning practices, with results finding that weaning was complete at 2 years of age which is consistent with previous studies of medieval British assemblages. Weaned children were found to have higher nitrogen levels compared to adult females suggesting a diet high in proteins such as marine fish and pork, an interesting finding considering that during medieval times children were considered to be low-status individuals (Burt, 2013). Other research has focussed on non-specific indicators of 'stress' (Watts 2011) or MSM's (Henderson 2005).

Burt, N., 2013. Stable isotope ratio analysis of breastfeeding and weaning practices of children from medieval Fishergate House York, UK. *American Journal of Physical Anthropology* 152 (3), 407-416.

Henderson, C.Y., 2005. Measuring Rotator Cuff Disease. Conference Paper: Paleopathology Association, 32nd Annual North America Meeting. Milwaukee, Wisconsin.

Holst, M., 2005. Artefacts and Environmental Evidence: Human Bone. Summary of Skeletal Analysis. In: C.A. Spall and N.J. Toop (eds). Blue Bridge Lane and Fishergate House, York. Report on Excavations: July 2000 to July 2002. Archaeological Planning Consultancy Ltd.

King, G., and Henderson, C., 2013. Living cheek by jowl: The pathoecology of medieval York. *Quaternary International* 1-12.

Watts, R., 2011. Non-specific indicators of stress and their association with age at death in Medieval York: Using stature and vertebral neural canal size to examine the effects of stress occurring during different periods of development. *International Journal of Osteoarchaeology* 21 (5), 568-576.

3.2 Coach Lane, North Shields, Tyne and Wear (Post-Medieval)

The Post-medieval Quaker burial ground at Coach Lane in North Shields is dated to between 1711 and 1857 CE. The site was excavated by Pre-construct Archaeology Ltd. During excavation at least 236 inhumations were identified with several additional disarticulated skeletal elements discovered. A full report for this site has not yet been published.

3.3 St Guthlac's Priory, Hereford (Medieval)

The Benedictine Priory of St Guthlac was founded between 1107 and 1122 CE in what is now modern-day Herefordshire. The site remained in use until is dissolution in 1539 CE. Previous excavations at the site exposed a portion of a monastic graveyard which was active between the mid-12th and 16th century. Between 1930 and 1940 during the construction of an extension to the hospital which now inhabits much of the site of St Guthlacs Priory, several inhumations were discovered. Several further excavations were conducted on the site, with 5 inhumations discovered in 1993, and a further 41 individuals between 2002 and 2003 (Herefordshire Council n.d)

Herefordshire Council., n.d. St Guthlac's Priory. Herefordshire Through Time, from World Wide Web: https://htt.herefordshire.gov.uk/her-search/monuments-search/search/Monument?ID=6498 [Accessed 27 February 2019].

3.4 Danebury Hill Fort (Bronze and Iron Age)

Excavations of Danebury Hill Fort took place between 1969 and 1988, during this excavation 73 roundhouses and 500 rectangular buildings were uncovered. It was purposed that the roundhouses were human accommodations and the rectangular buildings were store houses for commodities such as grain. In addition to these buildings, over 180,000 pieces of pottery, 240,000 pieces of animal bone and a number of stone objects such as querns as well as bone objects use for weaving were discovered (Hampshire County Council., 2013).

The remains from at least 58 individuals were excavated at Danebury. Isotopic analysis was conducted on the human remains at Danebury which suggested that the people ate a diet based on terrestrial food items both animal and plant material, and marine or freshwater foods were not regularly consumed. These results also revealed very little variation in isotope levels within the sample, indicating that there was little variation within the Danebury population. These results are similar to the isotopic results of other Iron Age sites in central southern England (Stevens et al. 2010).

The hillfort at Danebury was positioned on an area of chalkland, covered by light soil, located near Stockbridge in Hampshire situated 145 meters above sea level. The area would have been valuable for early settlements, with a wide flood plain ideal for pastures (Stevens et al. 2010). Archaeobotanical remains from Danebury indicate that spelt wheat (*Triticum spelta*) and hulled six-row barley (*Hordeum polystichum*) were the predominant flora species at the site. In addition to these crops wild carrots (*Daucus carota*) emmer (*triticum dicoccum*), bread wheat (*triticum aestivocompactum*) and hazelnuts (*Corylus avellana*) were all found at Danebury. This archaeobotanical evidence indicates that while other crops may have been consumed, extensive cereal processing and consumption occurred at the site, with large quantities of grains stored at the site (Stevens et al. 2010). Zooarchaeological remains at Danebury indicates that cattle, sheep, horses, pig, dog, goat cat, red deer, roe deer, fox, badger, fish and birds were all present at the site. Based on zooarchaeological analysis it is suggested that the predominant animals at the site were sheep, cattle and pig, which were used primarily for their secondary products such as milk, wool and traction (Stevens et al. 2010). These findings support the isotope analysis of the human remains.

Hampshire County Council., 2013. Danebury Iron Age Hill Fort Local Nature Reserve. Enjoy Hamphsire's Countryside, from World Wide Web: https://www.hants.gov.uk/thingstodo/countryside/finder/danebury [Accessed 27 February 2019].

Stevens, R., Lightfoot, E., Hamilton, J., Cunliffe, B., Hedges, R., 2010. Stable isotope investigations of the Danebury hillforts pit burials. *Oxford Journal of Archaeology* 29(4), 407-428.

3.5 Dixon Lane and George Street in York (Medieval)

In 2005 York Archaeological Trust (YAT) carried out an excavation at the junction between Dixon Lane and George Street in York, situated on an area of Bunter Sandstone east of the original course of the River Foss, prior to the development of the area. The discovery of human remains as part of the routine excavation resulted in a full-scale excavation of the site where a total of 118 human remains were discovered. While artefacts from several periods were discovered the majority of the finds were from the cemetery the church of St Stephen dated to the medieval period. The inhumations were generally well preserved, with some damage occurring during the construction of a brewery on the site in the 1800's as well as during early clearance of the site in 2005. Osteological analysis conducted on the inhumations from the site revealed that the population broadly reflected a normal age and sex distribution and with 91 of the individuals recorded as adults and 27 juvenile (McCormish, 2006, Keefe and Holst, 2016).

A pathological analysis of the material was conducted, Dental diseases were most commonly recorded pathology from the inhumations at George Street, from the 118 individuals excavated from the site 73 had surviving dentition which were assessed for dental pathology. 48 individuals had dental caries (66%) which were primarily located on the interproximal dental surfaces. 70 individuals (96% of individuals and 88% of the total number of dentition recorded) had dental calculus present. This report however, did not analyse dental pathology by tooth type and therefore results are highly affected by differential preservation of the dentition and therefore cannot be accurately compare to results from other sites (McCormish, 2006, Keefe and Holst, 2016). Relatively little is known about St Stephen's church, it was first cited in documents dating to between 1093-1094 and in is believed that St Stephen's church was demolished in 1331, which is supported by the fact that St Stephen's is not include in a list of churches complied by the city of York in 1428 (McCormish 2006, Keefe and Holst 2016).

McCormish, J., 2006. Land at the junction of Dixon lane and George Street, York Assessment report for an archaeological excavation. *York Archaeological Trust Reports,* York: York Archaeologcal Trust.

Keefe, K., Holst, M., 2016. Osteological Analysis Dixon Lane and George Street York North Yorkshire. *York Archaeologcal Trust*, York: York Osteology Ltd

3.6 Eggardon (Anglo-Saxon)

Excavations at Eggardon began in 1981, during this excavation a round barrow and an urn dated to the late Bronze Age period was unearthed. In the centre of the barrow three extended Anglo-Saxon inhumations were uncovered, no accompanying grave goods were discovered. The three inhumations were in a reasonable state of preservation although the skulls from all individuals were fragmentary. Age, sex and stature estimations were conducted using standard osteological methods and all individuals were estimated to be male. Stature was only estimated from two of the skeletons and ranged from 168cm and 170cm. two individuals were estimated to be in the age group between 35 and 45 years of age while the third individual was younger and estimated to be between 17 and 20 years. There was a good level of dental preservation from the Eggardon inhumations, and slight dental calculus was recorded among all individuals (Cherryson 2005).

Cherryson, A.K., 2005. Burial practices in the Wessex heartlands c.600-1100 AD. Unpublished PhD Thesis. University of Sheffield.

3.7 Quaker Burial, Kingston upon Thames (Post-Medieval)

Prior to construction on a vacant site at London Road, Kingston-upon-Thames a complete archaeological excavation was conducted by Archaeology South East in 1996. Previous reports from the site indicated its use as a Quaker burial site. As previous literature on nonconformist communities is scares this site provides a valuable information regarding the life and death of these populations. Located at the base of Kingston Hill this site would have been positioned on the outskirts of the medieval town. The earliest reports of the Quaker burial ground at this site date to 1663 when 37 Quakers purchased a plot of land in an orchard, as orchards were favoured areas for Quaker burials and reports from the nearby parish describe the use of this land for burials of the non-conformist population of Kingston. This site was in use for burials from 1664 until 1814 and while records indicate that at least 497 individuals were interned there during this time, although the 316 of these burials had occurred before the end of 1700 (Bashford and Sibun 2007).

During the excavation of the site 364 individuals were recovered; preservation was extremely variable, with only 39 individual beings classed as well preserved, the poor preservation of the burials was influence by the large number of intercut graves, with 200 of the graves being intercut. Pathological analysis of the remains indicated some likely cases of venereal syphilis, DISH, anaemia, rickets and dental and joint disease, although no significant. Analysis of dental pathology revealed that 89% of the individuals had at least one instance of antemortem tooth loss, calculus, caries and periodontal disease was also a common feature among the assemblage (Bashford and Sibun 2007).

Bashford, L., and Sibun, L., 2013. Excavations at the Quaker Burial Ground, Kingston-upon-Thames, London. *Post-Medeival Archaeology* 41(1), 100-154.

3.8 Juniper Green (Bronze and Iron Age)

A crouched individual was discovered from a short cist at Juniper green in Edinburgh Midlothian in 1851. The grave was associated with grave goods dated to the early bronze period. The individual was estimated to be an adult male 40-55 years of age. Dentine was taken in 2004 for C14 dating which estimated the individual was 3797±32 before present (Sheridan n.d, information from uncorroborated written records included with inhumations).

Sheridan, A., n.d. Juniper Green in the Bronze Age. Juniper Green 300. From World Wide Web: http://www.junipergreencc.org.uk/jg300-1/bronzeage.html [Accessed 28th February 2019].

3.9 Boatbridge Quarry (Bronze and Iron Age)

Excavation at Boatbridge quarry, Thankerton South Lancashire led to the discovery of a several cists and human remains. C14 dating was conducted in the 1970's and 1980's the most recent dating conducted by Mike parker Pearson as part of the Beaker peoples project dated skeleton 6 to 3824±32 (information from uncorroborated written records included with inhumations).

3.10 Dryburn Bridge (Bronze and Iron Age)

An Early bronze age cist was discovered at Dryburn bridge, East Lothian, several burials were excavated and a number of grave goods were found in association with these burials. Grave goods included a thumbnail scraper a plano-convex knife. C14 dated the remains to 3755±35 years before present (information from uncorroborated written records included with inhumations).

3.11 Tulloch (Neolithic)

Human skeletal remains were donated to the NMS by Dr Dorothy Lunt, the remains were from Tulloch of Assery at Loch Calder in Caithness. This material was discovered during a excavation of the chamber tombs in 1961 and 1963 (Corcoran and Scot 1964).

Corcoran, J., Scot, F., 1964. Excavation of three chambered cairns at Lock Calder, Caithness. *Proceedings of the Society of Antiquaries of Scotland, 66, 1-75.*

3.12 Gullane Links (Bronze and Iron Age)

In 1968 excavation at Gullane Links, no 3 golf course in east Lothian revealed a of long cist cemetery. The presence of upper rotatory quern stone nearby indicated the site was early historic (information from uncorroborated written records included with inhumations).

3.13 Broxmouth (Bronze and Iron Age)

Material from the site a Broxmouth East Lothian was C14 dated to 2175±30 before present (information from uncorroborated written records included with inhumations)

3.14 Galson (Roman)

The site of Galson Lewis 5 was excavated in 1974 where several human remains were recovered (information from uncorroborated written records included with inhumations)

3.15 Westness (Anglo-Saxon)

Skeletal material excavated from the Westness cemetery at Rousay Orkney was C14 dated to 1400±60 before present. The individuals from this site was also used in an isotope analysis conducted by James Barrett, results from this analysis have not yet been published (Sellevold 1999).

Sellvold, B.J., 1999. Picts and Vikings at Westness: Anthropological Investigations of the Skeletal Material from the Cemetery at Westness, Rousay, Orkney Islands. Oslo: NIKU (Scientific Report, 10, 1-62).

3.16 Cnip

In 1979 the grave of an adult females estimated to be 40+ years of age was excavated from Cnip, (information from uncorroborated written records included with inhumations).

3.17 East Hill (Roman)

The Romano-British site of East hill farm at Houghton Regis near Dunstable Bedfordshire was excavated by Dr Osman Hill in 1954 who subsequently donated the skeletal remains (information from uncorroborated written records included with inhumations).

3.18 Isle of May (Anglo-Saxon)

St Ethernan's Monastery also known as St Adrian's priory on the Isle of May in Fife (information from uncorroborated written records included with inhumations)

3.19 Colonsay (Anglo-Saxon)

Human remains excavated from a probable Viking grave from Colonsay Galloway (information from uncorroborated written records included with inhumations).

3.20 Brunton's Wireworks (Bronze and Iron Age)

In 1985 excavation conducted by Anne Clarke and Mary Kemp at Brunton's Wireworks, Inveress, Musselburgh in East Lothian led to the discovery of approximately 5 graves. Non-skeletal material found in association with the skeletal remains was dated to the second century CE, indicating the individuals excavated were probably Roman Iron Age (information from uncorroborated written records included with inhumations).

3.21 Longniddry (Bronze and Iron Age)

Skeleton excavated from Longniddry in east Lothian were C14 dated although these dates have been subsequently withdrawn with no explanation, the site however, is considered to be a possible middle bronze age (Baker 2003).

Baker, L., 2003. A Bronze Age burial ground at Longniddry, East Lothian. *Proceedings of the Society of Antiquaries of Scotland* 133, 125-136.

3.22 Near Meikle Kenny (Bronze and Iron Age)

A short cist was discovered as a result of quarrying near Meikle Keeny in Angus North West of the fairy hillock. No grave goods were uncovered and the skeletons were C14 date to 3634± 30 BCE (information from uncorroborated written records included with inhumations).

3.23 Near Seacliff House (Bronze and Iron Age)

A large communal cist thought to be Iron Age between 1-500CE was discovered in 1865 Near Seacliff House, North Berwick, East Lothian no further information can be found concerning the excavation and human burials (information from uncorroborated written records included with inhumations).

3.24 Eyemouth (Unknown)

Excavation conducted in 1896 led to the discovery of several human remains no further information can be found concerning the excavation and human burials (information from uncorroborated written records included with inhumations).

3.25 Dunbar (Bronze and Iron Age)

Human remains excavated from a long cist discovered in Dunbar Clyde villa, East Links were donated by Dorothy Lunt in 2005. No further information can be found concerning the excavation and human burials (information from uncorroborated written records included with inhumations).

3.26 Dounreay (Neolithic)

Excavation of the site was conducted in 1956, no further information is available (information from uncorroborated written records included with inhumations).

3.27 Skara Brae (Neolithic)

A long cist at Skara Brae Orkney was excavated by Vere Gordon Childe in 1930, no further information can be found concerning the excavation and human burials (information from uncorroborated written records included with inhumations).

3.28 Kingoodie (Bronze and Iron Age)

These skeletal remains were excavated from a long cist at Kingoodie, Longforgan, no further information is available (information from uncorroborated written records included with inhumations).

3.29 Keiss (Bronze and Iron Age)

A long cist burial mound site A Keiss in Caithness was dated to the first millennium CE, no further information can be found concerning the excavation and human burials (information from uncorroborated written records included with inhumations).

3.30 Penywyrlod: Llanigon (Neolithic)

An excavation conducted in 1921 led to the discovery of a chambered cairn and 20 individuals were exhumed. The chambers were made out of sandstone, and the largest chamber measured 18 by 9 meters. No further information concerning this site or the inhumations is available (information from uncorroborated written records included with inhumations).

3.31 Dinorben (Iron Age)

Dinorben Iron age hillfort was located near Abergele in North Wales, positioned on the northern edge of limestone hills which extend from Denbigh to Llanddulas. This site was mostly destroyed by quarrying activity between 1950 and 1980 run by Hanson Aggregates. Between 2005 and 2008 the NAA conducted a series of excavations on the site prior to extension of the quarry (Guilbert 2016, Pollock 2006).

Previous excavations conducted on the site from as early as 1912 suggested that the site had been occupied during the Mesolithic and remained occupied until the Iron Age. The site was then later reuse by Roman and medieval populations. Excavation by NAA revealed a large number of Neolithic features including pits and wells and well as a circular enclosed settlement dated to the Iron or Roman periods. Three male skeletons, one female and one juvenile skeleton were excavated from the site, these remains could not be precisely dates, but based on other material from the site are believed to date to between the Late Bronze and middle Iron Age (Guilbert 2016, Pollock 2006).

Pollock, K., 2006. *The Evolution and Role of Burial Practices in Roman Wales*. Unpublished PhD thesis Bangor University.

Guilbert, G., 2016. Dinorben - Illusion of a 'Bronze Age hillfort'? *Internet Archaeology*, 43.

3.32 Pipton (Neolithic)

No information could be found regarding the Pipton site and instead the notes from the NMW detailing this site as Neolithic had to be relied upon (information from uncorroborated written records included with inhumations).

3.33 Llantwit Major (Roman)

Llantwit major was a Roman villa which was excavated several times from 1887 until 1971. These excavations revealed the foundations of several fourth century buildings and courtyards. A number of human skeletons were exhumed from the site, are no radiocarbon dates are available, instead dating is based on the buildings and non-skeletal material associated with these burials (Rutherfood and Robinson 2014). Unfortunately, the excavation report for this site is not available

Rutherfoord, J., and Robinson, D., 2014. Llancarfan and Llantwit Major: Vale of Glamorgan, Wales. British Archaeological Association. From World Wide Web: https://thebaa.org/event/study-day-llancarfan-and-llantwit-major-vale-of-glamorgan/ [Accessed 27th February 2019]

3.34 Bulmore New Farm (Roman)

A Roman settlement at Great Bulmore was discovered in 1815, further excavations, revealed an extensive Roman settlement either side of the Roman road which linked Caerleon to Usk. Coins and pottery discovered at the site were dated to around 90CE, and the site is believed to have been abandoned at approximately 300CE. No further information concerning the site and human burials exhumed has been found (Boon 1975, Zienkiewicz 1934).

Boon, G.C., 1975. 'Three Caerleon sculptures', *Bulletin of the Board of Celtic Studies* 26**,** 227–30. Zienkiewicz, J.D., 1984. 'Great Bulmore', *Archaeology in Wales* 24, 57–8.

3.35 Culver Hole Cave (Neolithic)

The site is known to have been occupied during the Bronze Age, and human remains have been excavated from the site and were dated to this period. No further site information could be found, regarding the excavations or analysis of human remains (information from uncorroborated written records included with inhumations).

3.36 Tyddyn Bleiddyn Burial Chamber (Neolithic)

Two cairns dated to the Neolithic were excavated in the mid-19th century, during the excavation several inhumations were exhumed. The site is described as a long cairn with two side chamber, this is the only identified tomb in the Elwy valley. No further information can be found concerning the excavation and human burials at Tyddyn Bleiddyn (Gibson 1996, Prevett 2004).

Gibson, A.M., 1996. Cerfn Meiriadog Water Mains Refurbishment: archaeological watching brief. CPAT Reprot 207. Powys, Wales: The Clwyd-Powys Archaeological Trust.

Prevett, T., 2004. Tyddyn Leiddyn. The Megalithic portal. From World Wide Web: https://www.megalithic.co.uk/article.php?sid=10321 [Accessed 27th February 2019].

3.37 Barry Island (Bronze and Iron Age)

Evidence of flint tools indicates that Barry Island was occupied from the Mesolithic and Neolithic period, and the excavation of roundhouses and further structures indicates that the Island was inhabited throughout the Bronze Age. The specific Bronze Age skeleton included in this study cannot be identified among the numerous excavations and burials unearthed at Barry (Statton 2008).

Statton, M., 2008. Barry Island Pleasure Park, Bary. Archaeological desk-based assessment. Swansea, Wales: The Glamorgan-Gwent Archaeological Trust Ltd.

3.38 Ely Racecourse (Roman)

The remains of a Roman villa thought to be 1800 years old was excavated near at the centre of Trelai Park, near Ely racecourse. Several excavations were conducted on this side since the 1890's, and in 1920 a human burial, along with numerous iron workings and roman pottery. No further information concerning this burial could be found (RCAHMW 2014).

RCAHMW., 2014.Ely Roman Villa. Peoples Collection Wales, from World Wide Web: https://www.peoplescollection.wales/items/382921 [Accessed 28th February 2019].

3.39 Pwll Swil (Bronze and Iron Age)

Pwll Swil cist is located at the foot of the high part of Merthyr Mawr Warren and is positioned near a natural spring and two early Iron Age sites. Examination of the site led to the suggestion that it may have been a round barrow formed from wind-blown sand. While there is no direct evidence of dating for the barrow, the location and formation of the barrow has led to the suggestion that it was late Bronze to early Iron Age. No further information concerning the remains could be found and the records and NMW state that they represent an early Bronze Age individual (information from uncorroborated written records included with inhumations).

3.40 Orchid Cave (Bronze and Iron Age)

Orchid cave was first excavated in 1981 by Tony King and the North Wales Caving club. Details concerning this excavation were either not recorded or were subsequently lost. Artefacts excavated from this site includes three human burials, and a decorated bone toggle. Radiocarbon dating was conducted on the human bone excavated from the site, which dated the burials to approximately 4830 BP.

Davies, M., 1981. Identification of bones from Orchid Cave, Maeshafn, Clwyd. Unpublished report.

Guilbert, G., 1982. Orchid Cave. Archaeology in Wales 22, 15.

3.41 Ogof-yr-esgyrn

Little information could be found regarding the archaeological excavations at Ogof-yr-esgyrn, the only report that could be found detailed the finding of one set of human remains which are referenced to by male pronouns throughout the article, although it cannot be assumed this relate to osteological determination of sex and certainly no methods are discussed. In addition to the human remains, shards of pottery dated to the twelfth century were found in close physical proximity to the human remains. Decorative bronze copper and gold items are also mentioned, although no description concerning the quantity or form of this material is included. The report mentions that the cave has been extensively and repeatedly explored from the beginning of the twentieth century and as such this report may related to a different burial excavated from the site. As the material at NMW does not include further information concerning the date of excavation, individuals involved, or other non-skeletal material recovered it is not possible to say if this report details the same individual from Ogof-yr-esgyrn. The remains at the NMW describes that the remains could be dated between prehistoric to the Roman period and therefore do not shed any further light regarding the dating of this individual.

Mason, E. J., 1977. The archaeology of Ogof yr Esgyrn. *Brit Cave Res Ass Trans* 4 (1-2). Vol 4, pp. 343-344.

3.42 Castle Ditches (Bronze and Iron Age)

A small excavation was conducted on the ditch and rampart defences of a multivallate hillfort thought to date to around the 2nd century BCE. During the excavation a single inhumation was recovered, the remains are described as female although no osteological report is available (Hogg 1976).

Hogg, A.H.A. 1976 'Castle Ditches, Llancarfan, Glamorgan', *Archaeologia Cambrensis* 125, 13–39.

3.43 Cowbridge (Roman)

No information concerning the Cowbridge site could be found, instead only the notes from the NMW which described the site of being dated to the Roman period (information from uncorroborated written records included with inhumations).

3.44 Caerwent (Bronze and Iron Age)

A number of excavations in the 1930's were conducted on the site of Llanmelin hillfort, a larger scale excavation was conducted in 2012 by Archaeology Wales. The excavations in the 1930's led to the exhumation of two human skeletons. Currently a report is not yet available from the 2012 study although the aim of this study is to more accurately date the site and exhumed material which is currently believed to date to the Iron Age (Barker and Driver 2015).

Barker, L., Driver, T., 2015. A new archaeological survey of Llanmelin Wood Hillfort, Caerwent. Heritage of Wales News. From World Wide Web: http://heritageofwalesnews.blogspot.com/2015/03/a-new-archaeological-survey-of.html [Accessed 28th February 2019].

3.45 Llanbergoch (Anglo-Saxon)

In 1989-199 five skeletons were uncovered at Llanbedrgoch in Anglesey. The skeletons were identified as two adolescents of unknown sex, two adult males and one female. Stable Isotope analysis suggested that the male individuals were not local to the area, but may have travelled from North Scotland or Scandinavia. Anglo Saxon coins from the site are dated to between 787 and 810CE. In 2012 a further burial was excavated from the site and silver and bronze items dated to the 7th century were found (National Museum Wales, 2012).

National Museum of Wales., 2012. New skeleton discovery at Llanbedrgoch, Anglesey sheds further light on the Vikings in Wales. Press Office. From World Wide Web: https://museum.wales/news/?article_id=777 [Accessed 28th February 2019].

3.46 Llandow (Bronze and Iron Age)

No information concerning the Llandow site could be found, instead only the notes from the NMW which described the site of being dated to the early Bronze Age (information from uncorroborated written records included with inhumations).

3.47 New House Farm St Fagans (Bronze and Iron Age)

No information concerning the New House St Fagans site could be found, instead only the notes from the NMW which described the site of being dated to the Iron or Bronze age (information from uncorroborated written records included with inhumations).

3.48 Llandough (Medieval)

Excavation was conducted in 1990 at the village of Llandough located 3.5km from Cardiff. The site was excavated by Glamorgan-Gwent Archaeological trust. Numerous burials were excavated from the site during further excavations, in total 814 individuals were exhumed. Dating of the non-skeletal material found in association with the burials led to the conclusion that the majority these individuals were from the early medieval period. Radiocarbon dating however indicated that burial at this site starting the mid 7th century and that the cemetery continued to be in use until the 11th century (Holbrook and Thomas 2005).

Holbrook, N., and Thomas, A., 2005. An Early-medieval Monastic Cemetery at Llandough, Glamorgan: Excavations in 1994. *Journal of Medieval Archaeology* 49(1), 1-92.

3.49 Kempton (Roman)

The Roman settlement of Kempton located at the modern-day village by the same name was excavated during construction work at the site as part of the Bedford Southern Orbital Sewer. Prior to the Norman Conquest Kempton formed part of the estate of the earl of Tostig. The site was dated by typological dating and the dating of coins excavated from the site. The majority of the site dated to the Roman and spanned this period. Although there were a small number of Saxon inhumations dated by the presence of grave goods from this period. Charred plant and seed remains from the graves were identified which revealed that the majority of the plant material were weed seeds, cereal grain and cereal chaff. *Triticum spelta* was the most commonly occurring cereal at the site, but *Triticum. Cf. dicoccum* and *triticum aestivum* type (free threshing bread wheat), avena sp. And bromus/avena type were also present in small quantities. The dominance of spelt what in Iron and roman sites in Bedfordshire is consistent with other sites and historical data which indicates a preferences for this grain during these periods. Analysis of the faunal material from the site indicates that the most commonly occurring animal species were cattle (17.4) followed by sheep and goat (15.5%), horses, pig, chicken and other non-specified small mammals were present at the site although in small quantities. Dental pathology was analysed from the inhumations excavated from this site, which revealed that dental calculus was the most frequently occurring dental pathology with 75% of dentition from adult individuals being affected by dental calculus, while only 6.3% of adult dentition affected by dental caries (Dawson, 2004).

Dawson, M., 2004. Archaeology in the Bedford Region. Bedford Archaeology Monograph Series, 4.

3.50 Wetwang Slack, East Yorkshire (Bronze and Iron Age)

Between 1975 and 1979 the bronze and Iron Age site of Wetwang slack was excavated prior to commercial gravel extraction. Wetwang slack is located in the parish of Wetwang in the central section of the Yorkshire Wolds. The cemetery lay on the southern side of the valley 50m O.D. There is a shortage of surface water and the soil quality is poor which likely had an impact on the agricultural development at Wetwang Slack. The cemetery was only discovered after 5 years of excavation on the site, was discovered a large number of inhumations were excavated. In total a minimum of 450 individuals were excavated from the site (Dent, 1984).

Dent, J.S., 1984. Wetwang Slack : an Iron Age cemetery on the Yorkshire Wolds. MPhil thesis, University of Sheffield.

3.51 Baldock, Hertfordshire (Roman)

Between 1980 and 1985 the north Hertfordshire district council. Excavation revealed the California cemetery of Baldock, which was also known as the Upper Walls Common Cemetery, which was occupied between c200 and 550 CE (Applebaun 1932, Fitzpatrick-Matthews 2016).

Applebaum, E. S., 1932. Excavations at Baldock in 1932. Trans St Albans Architect Archaeol Soc , 244-58

Fitzpatrick-Matthews, K.J., 2016. The Cemeteries of Roman Baldock. Fragments Interdisciplinary Approaches to the Study of Ancient and Medieval Pasts, 5 from World Wide Web: http://hdl.handle.net/2027/spo.9772151.0005.002 [Accessed 28th February 2019].

3.52 Kingsholm, Gloucester (Roman)

The Roman fortress of Kingsholm is thought to have been established 49CE as part of a military campaign to supress the Silures tribe in South Wales. Skeletal remains were dated to between 240 and 386 CE (information from uncorroborated written records included with inhumations).

3.53 Eccles, Kent (Anglo-Saxon)

During the excavation of Eccles Roman Villa in Kent an earlier Iron Age farmstead and an Anglo-Saxon cemetery were discovered. A minimum of 200 graves were identified to form the Anglo-Saxon cemetery, with graves aligned from east-west (Historic England, 2016).

Historic England., 2016. Romano-British villa, Anglo-Saxon cemetery and associated remains at Eccles, from World Wide Web: https://historicengland.org.uk/listing/the-list/list-entry/1011770 [Accessed 28th February 2019].

3.54 Raunds, Northamptonshire (Anglo-Saxon)

The Anglo-Saxon church and churchyard at Raunds was continuously occupied from the sixth to the late fifteenth century (information from uncorroborated written records included with inhumations)..

3.55 Blackfriars, Gloucester (Medieval)

The site of Blackfriars cemetery was excavated in 1991 by Gloucester city council excavation unit. A Dominican friary was in use at the site from between 1246 and 1539. While the site was principally used for the burial of mendicant friars, the cemetery also contained a varied population. A later medieval cemetery in use during the twelfth and sixteenth century (Historic England 2017).

Historic England., 2017. Gloucester Greater Blackfriars Publication Project Gloucester. Gloucester: Gloucester City Council.

3.56 St James and St Mary Magdalene, Chichester (Medieval)

The site of St James and St Mary Magdalene was excavated between 1986 and 1992 by Chichester District Archaeological Unit. The leprosarium was founded in 1118 CE and was in use until at least 1418 (Lee and Magilton 2010).

Lee, F., and Magilton, J., 1989. The cemetery of the hospital of St James and St Mary Magdalene, Chichester - a case study. *Journal of World Archaeology*21 (2), 273-282.

3.57 Hereford Cathedral (Medieval)

During building construction the site of Hereford Cathedral was discovered and subsequently excavated between 2009 and 2011. A minimum number of 6200 individuals were excavated from the site which included a charnel pit and a medieval cemetery. It is considered that approximately 200 of the 1200 individuals discovered from the cemetery came from a Black Grave mass grave. The burials excavated were determined to range between the 12th century and the early 19th century (Headland Archaeology, n.d).

Headland Archaeology, n.d. Hereford Cathedral. From World Wide Web: https://headlandarchaeology.com/project/hereford-cathedral/ [Accessed 28th February 2019].

3.58 Box Lane, Pontefract (Medieval)

No further information could be found

3.59 Towton (Medieval)

In 1996 as part of building construction in Towton a mass grave containing 37 individuals was discovered and subsequently excavated. The individuals from the mass grave are believed to have been casualties in the battle of Towton part of the war of the roses, during which 28,000 individuals died (Fiorato et al. 2007, University of Bradford n.d).

Fiorato, V., Boylston, A. and Knüsel C. 2007 Blood Red Roses. Oxford: Oxbow Books. (2nd edn.)

University of Bradford,. n.d. Towton Mass Graves Project. Biological Anthropology Research Centre. From World Wide Web: https://www.bradford.ac.uk/life-sciences/arch-sci/research/biological-anthropology-research-centre/projects/towton-mass-grave-project/ [Accessed 28th February 2019].

3.60 St Peter's Wolverhampton (Post-Medieval)

St Peter's church in Wolverhampton has been a place of prominence in the area since Anglo-Saxon times and the Christian church present at the site dates to the late 13th century. Despite the early founding of the church, the human remains excavated from the site were dated to the 19th century. The gravestones recorded during groundwork were dated to between the mid-18th century and the early 19th century (Adams and Colls 2007).

Adams, J., Colls, K.., 2007. Out of Darkness, Cometh Light: Life and Death in NineteenthCentury Wolverhampton: Excavation of the Overflow Burial Ground of St Peter's Collegiate Church, Wolverhampton 2001-2002. BAR British Series 442. Archeopress, Oxford, pp. 79-91.

3.61 Hickleton, South Yorkshire (Post-Medieval)

No further information could be found

3.62 E. Smithfield Black Death (Medeival)

Excavated between 1986 and 1988 the East Smithfield Black Death cemetery was used between 1348 and 1350 and was the first Black Death cemetery established in London and covered nearly 2 hectres of land. A total of 636 individuals were exhumed from the cemetery. The preservation of the material was good for adult individuals and poor for the sub-adults, in total 66.7% of the inhumations had a good level of preservation. Although completeness of the remains was poor preventing age estimations for 24.8% of the assemblage. Age estimation revealed that 27.8% were sub-adults and 72.2% were adults with the majority of the adults dying before the age of 35. This age profile does not reflect a typical medieval cemetery populations and instead reflects the death curve of a catastrophe cemetery consistent with the records that this was a Black Death cemetery. Pathological analysis revealed that only a small number of individuals exhibited skeletal evidence of pathology, this may be related to the young age profile of the assemblage. High rates of dental pathology such as dental caries and dental calculus was recorded, which is consistent with other medieval populations (Bekvalac et al., 2007).

Bekvalac, J., Cowal, L., Mikilski, R., Kausmally, T., 2007. East Smithfield Black Death cemetery summary. Archaeology at the Museum of London. From the World Wide Web: http://archive.museumoflondon.org.uk/Centre-for-Human-Bioarchaeology/Database/Medieval+cemeteries/ESmithfieldBlackDeath.htm [Accessed 28th February 2019].

3.63 Guildhall (Medieval)

The Guildhall Yard East site located on Basinghall Street was excavated by the Museum of London Archaeological Service between 1992 and 1997. This site is considered to have been the location of a medieval churchyard associated with St Lawrence Jewry with burials dating to the late 11th century. 68 individuals from this site were excavated and analysed by the Museum of London. While preservation of the remains was high, skeletal completeness was poor, preventing age and sex estimations for several individuals. Osteological analysis determined that 47 of the exhumed individuals were adults and there was no significant difference in sex estimation. Pathological analysis of the remains revealed that metabolic disease was the most frequently occurring pathology and trauma was more common among males (17%) compared to females (7%). Prevalence of dental pathology was low when compared to other medieval assemblages (Cowal 2007).

Cowal, L., 2007. Guildhall Yard cemetery summary. Archaeology at the Museum of London. From the World Wide Web: https://www.museumoflondon.org.uk/collections/other-collection-databases-and-libraries/centre-human-bioarchaeology/osteological-database/medieval-cemeteries/guildhall-yard-medieval [Accessed 28th February 2019].

3.64 St Brides Lower (Post-Medieval)

606 individuals were excavated from St Bride's lower cemetery at Farringdon Street. This cemetery was an overflow cemetery linked to St Brides church on Fleet Street and is believed to be dating to the 18th and 19th century (1770-1849). The cemetery is believed to have contained individuals from the nearby Fleet prison and the Bridewell workhouse, with the majority of the individuals at St Brides Lower of a low socioeconomic status. Detailed parish records include information concerning the individual information of each burial including cause of death, however, the lack of burial plates due to the socioeconomic status of the individuals makes matching records to skeletal remains impossible (Kausmally 2008).

Of the 606 individuals exhumed 544 were analysed, the preservation of this material was very good with 94.8% of individuals being in good condition and excellent completeness of the skeletal remains. 369 of the individuals analysed were adults. The average stature was estimated to be 160.5cm for females and 169cm for males. 65.6% of the individuals analysed had skeletal evidence of more than one pathological condition. The most frequently occurring pathological conditions were metabolic diseases, while trauma was also a frequent occurrence, with rib and nasal fractures being the most common. Dental pathology was a frequent occurrence among the analysed skeletons, with high rates of dental caries, calculus and antemortem tooth loss (Kausmally 2008).

Kausmally, T., 2008. St. Bride's lower churchyard cemetery summary. From World Wide Web: http://archive.museumoflondon.org.uk/Centre-for-Human-Bioarchaeology/Database/Post-medieval+cemeteries/St+Brides+lower.htm [Accessed 28th February 2019].

3.65 Chelsea Old Church (Post-Medieval)

In 2000 excavations were conducted out by the Museum of London Archaeological Services prior to development work on the site of Chelsea old church, destroyed during the Second World War a rebuilt in 1950. Historical data indicates that that the cemetery was used principally by high status individuals living in Chelsea during the 18th and 19th century.

In total 290 inhumations were recovered from the site, although only 198 individuals were analysed. The majority of the graves were earth cut stacked graves and the coffins were typically wooden, although there were some cases of lead lined coffins at the site. The preservation of coffin plates in association with 25 individuals allowed at least partial identification of these remains. The dates of these coffin plates ranged between 1712 and 1842 (Cowie et al., 2008).

The exhumed material was well preserved with 88.9% of the material having a good level of preservation and only 2% being poorly preserved. Of the 198 individuals analysed, 168 were adults. Both the biographical and osteological data indicates that the majority of the individuals excavated from Chelsea old church lived into old age with 36.4% of individuals estimated to be over 46 years of age. The average stature was 163.4cm for females and 168.4cm for males. Pathological analysis of the remains indicates the presence of diseases typical among post medieval populations, residual rickets and osteomalacia among adults and metabolic disease among sub adults were some of the most prevalent pathology present. Among the exhumed individuals dental pathology was also typical compared to other post medieval populations, with high rates of antemortem tooth loss and dental caries.

Cowie, R., Bekvalac, J. and Kausmally, T. 2008. Late 17th to 19th century burial and earlier occupation at All Saints, Chelsea Old Church, Royal Borough of Kensington and Chelsea. London: MoLAS Archaeology Studies Series 18.

Bekvalac, J., Kausmally, T., 2009. Chelsea Old Church (post-medieval) cemetery summary. From World wide Web: https://www.museumoflondon.org.uk/collections/other-collection-databases-and-libraries/centre-human-bioarchaeology/osteological-database/post-medieval-cemeteries/chelsea-old-church-post-medieval [Accessed 28th February 2019]

3.66 Bow Baptist Church (Post-Medieval)

Between 2007 and 2010 265 human burials were excavated from the site, preservation of this material was high with 65% of the assemblage being over 50% complete. Preservation of adult material was better compared to subadult, with 86% of adults and 39.6% of subadults being at least 50% complete. 254 individuals from this site were examined as part of an osteological report for the site, all further information refers to these 254 individuals (Henderson et al. 2013, Miles and Powers 2007).

Located on the western side of the river Lea, the Baptist church was established in 1785 bow was a village situated between the parish church of St Mary and the River Lea, population of Bow remained small with approximately 2000 inheritance recorded at the start of the 19th century. Towards the second half of the 19th century population boomed following the opening of multiple factories in the area, with populations in Bow more than doubling between 1861 and 1871 (Henderson et al. 2013, Miles and Powers 2007).

Henderson, M., Miles, A., Walker, D., Connell, B.,Wroe-Brown, R., 2013. *'He being dead yet speaketh': excavations at three post-medieval burial grounds in Tower Hamlets, east London, 2004–10*. London: Museum of London Archaeology.

Miles, A. and Powers, N., 2007. *Bow Baptist Church Burial Ground, 2-25 Payne Road, London, E3. London Borough of Tower Hamlets. A Post-Excavation Assessment and Updated Project Design*. London: Museum of London Archaeology.

3.67 All Saints, Fishergate, York (Medieval)

There is little historical information regarding All Saints church, the earliest mention of the church dates to between 1091 and 1095 where it was noted to be part of the Whitby Abbey cell. In 1539 as part of Henry VIII's dissolution of the monasteries, All Saint's church was lost. While city maps from the late 17th and 18th century show no indication of the church and instead only indicate the agricultural land at Fishergate. And early ordinance survey maps published in 1852 an approximation of the church's location was included within the site covered by the cattle market (McIntyre and Bruce 2010).

The All Saints church was excavated as part of a routine rescue excavation conducted in 2007 by On Site Archaeology, on a plot of land between Kent Street and Fawcett Street in York. The site was due for major redevelopment as part of the construction of residential housing, prior to this a cattle market built in 1820's had occupied the site. Documentation from previous construction described the disturbance of human remains, as such it was known before excavation began that human remains were present on the site (McIntyre and Bruce 2010).

The earliest material excavated from the site was dated to the Roman period and included 7 inhumations, these were identified as roman based on the orientation and position of the grave and the accompanying grave goods, which included bronze, ring, broaches and anklets. In addition to the inhumations, there was also fragments of cremated human bone (McIntyre and Bruce 2010).

The foundations of a three celled masonry church the cobble and rubble foundations measured approximately 19m with a minimum width of 5m, the full width of the church cannot be estimated as this part of the church was partially covered by the adjacent pavement. The churches foundation had cut through an early timber structure which is believed predate the church. Approximately 550 medieval burials were excavated in association with the church. The church and associated graveyard were in use for over 400 years and as such the earlier burials had been cut through by later burials (McIntyre and Bruce 2010).

Due to high rate of the graves being cut through only a small number of inhumations were intact, although preservation in general was good. The majority of graves were single inhumations with only a small number of double burials, suggested to represent family or community members who died at the same time. While the presence of grave goods was scarce, broaches and belts were present in some graves. The osteological analysis of age and sex profiles consistent with other medieval burial sites in the area (McIntyre and Bruce 2010).

During excavation of the medieval church and graveyard, 10 mass graves comprising of over a hundred skeletons were uncovered. These mass graves cut through the medieval cemetery graves, indicating that they were dug after the cemetery was in use. The mass graves varied in size, with the smallest grave containing 4 individuals and the largest 18. The skeletons were arranged in tightly packed parallel rows and the majority were in a prone position. The parallel organised position of the individuals is unusual for mass graves of this period. The positioning of the burials and the lack of non-skeletal objects in the grave, suggests that the individuals were stripped of clothing and belongings before burial. Osteological analysis revealed that of approximately 113 burials, 87 were estimated as male, 20 individuals were of indeterminate sex and only 6 were estimated to be female. Age estimation showed that age of the mass grave burials ranged from teenagers to 50 years of age, with the mean age group being between 35 and 49 years old. The demographic profiles of these mass grave burial in addition to the high prevalence of pathology associated the high levels of excessive physical activity, led to the suggestion that these individuals represented a military group. The lack of evidence of trauma on the mass grave individuals, however, contrasts with this theory. It is, however, possible that the individuals in this grave were casualties of infectious disease, which were documented among the sieging parliamentary forces in the siege of York in 1644 (McIntyre and Bruce 2010).

McIntyre, L., and Bruce, G. 2010. Excavating All Saint's: A Medieval Church Rediscovered. *Current Archaeology* 245: 30-7.

3.68 Black Gate Cemetery (Anglo-Saxon)

The Black Gate site was used over several periods and a number of buildings, burial and non-skeletal evidence have been found on the site. A Roman fort, An Anglo-Saxon motte and bailey castle and accompanying cemetery and a tower keep castle from medieval and postmediaeval periods have all been excavated from the site. The earliest finds from the site are prehistoric flint tools and a stone axe indicating that the site has been occupied frequently since the Neolithic period (Historic England 2002, Nolan 2010).

Overlaying and extending beyond the Roman fort the remains of an Anglo-Saxon cemetery was discovered during construction on the site as part of railway development in the 19th century. The site was then partially excavated between 1977 and 1992. The cemetery appears to have been in used from the eighth century until the middle of the 12th century and in total approximately 660 inhumations were exhumed. These burials were dated based on coins found with the burials and. In addition to the burials the foundation of a stone building near the cemetery was excavated which is believed to have been the remains of a church or chapel that would have been associated with the graveyard. Historical documentation details a motte and bailey castle constructed in 1080 on the site of the Roman fort was built by Robert Duke of Normandy, the eldest son of William the Conqueror (Historic England 2002, Nolan 2010).

Historic England., 2002. Roman fort, Anglo-Saxon cemetery, motte and bailey castle and tower keep castle. From World Wide Web: https://historicengland.org.uk/listing/the-list/list-entry/1020126 [Accessed 28th February 2019].

Nolan, J., 2010. The early medieval cemetery at the Castle, Newcastle-upon-Tyne. *Archaeologia Aeliana* 39 147-287.

3.69 The Church of St Hilda, Coronation Street (Post-Medieval)

Excavation conducted by Oxford Archelogy North in 2006 unearthed a partial churchyard which was determined to be part of St Hilda's church built in the 18th century. This 18th century church replaced the previous medieval chapel on the grounds by the same name. This graveyard had been in use from the 1600's to 1855 when the church yard was closed. The site of the original churchyard had been cut through in the 1970's when Coronation Street was built, as such only a small area on the south side of the original graveyard could be excavated (The University of Sheffield n.d).

In total 124 burials were excavated, 117 of these were adult individual with 87 sub adult burials, it was estimated that 50 individuals were disarticulate Charnel burials. Pathological analysis indicated low levels of nutritional deficiency disease, while a high prevalence of dental disease such as caries, calculus and ante mortem tooth loss were recorded (Newman 2016, Raynor et al. 2001, The University of Sheffield n.d).

Raynor. C., McCarthy, R., and Clough, S. 2011. Coronation Street, South Shields, Tyne and Wear. Lancaster: Oxford Archaeology North.

Newman, S.L. 2016. The Growth of a Nation: Child health and development in the Industrial Revolution in England, c. AD 1750-1850, Durham theses, Durham University. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/11508/

The University of Sheffield., n.d. Osteology Lab: Human Skeletal Collection. From world Wide Web: https://www.sheffield.ac.uk/archaeology/research/osteology-lab/skeletal-collection [Accessed 28th February 2019]

3.70 Carver Street (Post-Medieval)

The Carver Street Methodist chapel was constructed in 1805 at which time it was the largest chapel of its kind in Sheffield. The associate graveyard is the only known major burial ground for nonconformist individuals in Sheffield during the early 19th century (McIntyre and Willmott 2003, The University of Sheffield n.d). Burial records from the Carver street chapel indicate that is was in use between 1806 and 1855 during which time approximately 1,600 individuals were interned (Witkin and Belford, 2000). There was evidence that the graves at Carver Street were frequently reused over time, with several cases of multiple stacked burials occurring. The burials at Carver Street are considered to represent a "good cross section of Sheffield's 19th century population" with members of different social classes and status's being represented (McIntyre and Willmott 2003, The University of Sheffield n.d).

McIntyre, L. and Willmott, H. 2003. Excavations at the Methodist Chapel, Carver Street, Sheffield. ARCUS 507

The University of Sheffield., n.d. Osteology Lab: Human Skeletal Collection. From world Wide Web: https://www.sheffield.ac.uk/archaeology/research/osteology-lab/skeletal-collection [Accessed 28th February 2019]

Witkin, A., and Belford, P., 2000. Skeletal Assessment of Carver Street Methodist Chapel, Sheffield, unpublished ARCUS report 507, 1.

3.71 Grimthorpe, E.R. York Iron Age (Bronze and Iron Age)

No information concerning this site beyond what was written on the box could be found, therefore only the location and Iron Age date is known about this individual.

3.72 Cherry Hinton War Ditches Cambridge (Bronze and Iron Age)

In 2008 Oxford archaeology east and the Cambridge antiquarian society subsequently conducted a excavation at the site. During this and subsequent excavations a number of Iron Age individuals were exhumed from a ditch to the east of the site, in addition to the human remains, pottery, fired clay, animal bones and flints were excavated. Radiocarbon dating was used to date human and animal bone as well as charcoal from this assemblage, which indicated that the ditch was dug between 575 and 385 BCE. Analysis of the faunal remains from the site, is consistent with other Iron Age sites witch cattle making up 42% of all faunal remains. Pig (28%) and sheep/goat (17%) where the next most frequently occurring animal remains. Earlier excavation reports did not always specify the number of remains excavated or the sex and age estimations of this material, more than 13 human remains were excavated from the site between 1893 and 2009 (Pickstone and Mortimer 2012).

Pickstone, A., Mortimer, R., 2012. War Ditches, Cherry Hinton: Revisiting an Iron Age hillfort. *Proceedings of the Cambridge Antiquarian Society.* 101, 31-60.

3.73 Northton, Isle of Harris (Bronze and Iron Age)

There was insufficient information was present to identify the site referenced on the box, as such no further information could be found.

3.74 Brewery Field, Baldock (Bronze and Iron Age)

Between the Neolithic and Iron Age the area of Baldock was extensively occupied by humans, and a number of Bronze Age cemeteries have been identified. No further information concerning the specific site these remains are from could be found.

Archaeological data service., n.d. Baldock. From World Wide Web: http://archaeologydataservice.ac.uk/archiveDS/archiveDownload?t=arch-436-1/dissemination/pdf/baldock.pdf [Accessed 28th February 2019].

3.75 Tallington (Bronze and Iron Age)

There was insufficient information was present to identify the site referenced on the box, as such no further information could be found.

3.76 Aldwincle, Northhants (Bronze and Iron Age)

There was insufficient information was present to identify the site referenced on the box, as such no further information could be found.

3.77 Amesbury Barrow (Bronze and Iron Age)

There was insufficient information present to identify the site referenced on the box, as such no further information could be found.

3.78 Pin Farm, Gazeley Suffolk (Bronze and Iron Age)

An early Bronze Age cemetery was excavated in the south end of Breckland, at Pin Farm in Gazeley. A minimum of six individuals were excavated from the barrow centre and a further nine individuals from the periphery (Petersen n.d).

Petersen, F., n.d. The excavation of an Early Bronze Age cemetery at Pin Farm, Gazeley. Sufflok Institute of Archaeology, 19-41.

3.79 Waterhill Farm Chippenham (Bronze and Iron Age)

No further information beyond what was written on the box could be found.

3.80 Winterbourne Stoke, Barrow (Bronze and Iron Age)

A round barrow cemetery comprised of 19 later Neolithic to early Bronze Age round barrows was excavated by Sir Richard Colt Hoare in the early 19th century. During this excavation several burials dating to the Bronze age were identified, in addition to these inhumations other finds including cremations, food vessels, flints, bronze daggers and beads (Historic England n.d, Winterbourne Stoke Group, n.d).

Historic England., n.d. Winterbourne Stoke Crossroads Barrow Cemetery. PastScape. From World Wide Web: http://www.pastscape.org.uk/hob.aspx?hob_id=219525 [Accessed 28th February 2019].

Winterbourne Stoke Group., n.d. Stone Circle. From World Wide Web: http://www.stone-circles.org.uk/stone/winterstoke.htm [Accessed 28th February 2019].

3.81 Tooth Cave, Gower Pen, Wales (Bronze and Iron Age)

The Ancient Monument of tooth cave is the longest cave in Gower and was occupied during the Bronze Age, at least 8 individuals have been excavated from the site. Evidence of human activity during the Bronze Age has been discovered at Tooth cave, this included funeral urns, pottery and human remains (Explore Gower, n.d)

Explore Gower., n.d. Tooth Cave- SS 5317 9092. Gower Caves. From World Wide Web: http://www.explore-gower.co.uk/gower-caves [Accessed 28th February 2019].

3.82 Burwell Fen (Bronze and Iron Age)

A human mandible was excavated as a stray find at Burwell Fen, Cambridgeshire England in 1992. Radiocarbon dating was conducted and the remains were dated to the late Bronze Age (OxA -4286 to -4291).

Archaeology data service., n.d. Radiocarbon date, Sample number OxA-4289. From World Wide Web: http://archaeologydataservice.ac.uk/archsearch/record.jsf?titleId=919262 [Accessed 28th February 2019]

3.83 Crichel Down Dorsetshire (Bronze and Iron Age)

A roman inhumation was excavated at Long Crichel in Dorset, no further information could be found regarding this individual.

3.84 Staxton East Riding, Yorkshire (Bronze and Iron Age)

There was insufficient information present to identify the site referenced on the box, as such no further information could be found.

3.85 Normanton Wilts (Bronze and Iron Age)

The barrows at Normanton down near Stonehenge are part of a series of Neolithic and Bronze Age barrows, although the majority are Bronze Age. There are several barrows which have been excavated at this site and it is not possible to determine the specific barrow or excavation.

3.86 LondAsh Lane Frampton Dorchester

There was insufficient information present to identify the site referenced on the box, as such no further information could be found.

3.87 St Neots (Bronze/Iron Age)

An Archaeological evaluation was conducted in 2005 by the Cambridge County Council Archaeological Field Unit at St Neots Community College (Cooper 2005).

Cooper, S., 2005. Prehistoric and Roman remains at St Neots Community College, Cambridgeshire: An Archaeological Evaluation. Archaeological Field Unit.

3.88 Shepherd Shore Wansdyke N wilts(Bronze and Iron Age)

There was insufficient information present to identify the site referenced on the box, as such no further information could be found.

3.89 Kennet Hill Wilts (Bronze/Iron Age)

The longest long barrow in southern England, west Kennet long barrows is over 100 meters long and is located along a ridge near River Kennet. Several excavations have been conducted on the site and six burials were excavated in 1859 and a further 40 burials were excavated in 1955-1956. The majority of these burials were disarticulated, and incomplete, radio-carbon dating was conducted on the human remains which indicated they were deposited around 3500BCE.

Darvill, T., 2013. West Kennet Long Barrow, Avebury, Wiltshire. From World Wide Web: http://digitaldigging.net/west-kennet-long-barrow-avebury-wiltshire/ [Accessed 28th February 2019].

3.90 Morgan Hill Wilts (Bronze/Iron Age)

There was insufficient information present to identify the site referenced on the box, as such no further information could be found.

3.91 Barrow Burials, Radley (Bronze/Iron Age)

The Barrow Hills site in Radley is a large archaeological site dated to the Bronze age period, the site was by Oxfordshire archaeological unit. Finds excavated from the site includes a number of flints and iron fragments, as well as animal skeletal remains and mollusc shells. The human skeleton was excavated from Section 3 of the barrows, age was estimated between seventeen and nineteen years based on epiphyseal fusion and eruption of the third molars (Parrington 1976).

Parrington, M., 1976. Excavations in Barrow Hills Field, Radley, Oxon, from World Wide Web: https://oxoniensia.org/volumes/1948/williams.pdf

3.92 Barrow Burials Cassington(Bronze/Iron Age)

An emergency excavation was conducted in 1943 on behalf of the Ashmolean Museum, during which two inhumations were recovered. This site is believed to date to the middle Bronze Age based on material finds and the treatment of the human remains (Parkinson et al. n.d)

Parkinson, A., Barclay, A., McKeague, P., n.d. The Excavations of two Bronze Age Barrows, Oxford. Oxford: Oxford Archaeology.

3.93 Barrow Burials Snailwell (Bronze/Iron Age)

There was insufficient information present to identify the site referenced on the box, as such no further information could be found.

3.94 Littleport Cambs (Bronze/Iron Age)

There was insufficient information present to identify the site referenced on the box, as such no further information could be found.

3.95 W. Monkton Wilts (Neolithic)

Excavations were conducted at the Neolithic chambered tomb in Winterbourne Monkton Wiltshire, further details concerning the excavation of human remains from this site could not be found.

3.96 Little Drew Lugbury N Wilts 1854 (Neolithic)

Several excavations had previously been conducted at the Lugbury site in Wiltshire. In 1854 a further excavation was carried out after ploughing revealed a four stone chamber where 26 inhumations were excavated from.

Andy, B., 2016. Lugbury- Chambered Tomb in Angland in Wiltshire. The Megolithic Portal. From World Wide Web: https://www.megalithic.co.uk/article.php?sid=1904481563 [Accessed 28th February 2019].

3.97 Lanhill (Neolithic)

There was insufficient information present to identify the site referenced on the box, as such no further information could be found.

3.98 Whitehorse Hill Berkshire (Roman)

There was insufficient information present to identify the excavation referenced on the box, as such no further information could be found.

3.99 Spittisbury Dorset (Roman)

There was insufficient information present to identify the site referenced on the box, as such no further information could be found.

3.100 Arbury Road (Roman)

In the 1950's a Roman building was discovered during construction of a water main. Excavation was conducted by Dr Alexander and Dr Trump from the University of Cambridge. During this excavation six skeletons buried in wooden and stone coffins (University of Cambridge 2007).

University of Cambridge., 2007. Arbury's Roman past revisited. https://www.cam.ac.uk/news/arburys-roman-past-revisited

3.101 Maxey Northamptonshire (Roman)

There was insufficient information present to identify the site referenced on the box, as such no further information could be found.

3.102 Great Casterton (Roman)

There was insufficient information present to identify the site referenced on the box, as such no further information could be found.

3.103 Sinnington Nr Rotherham Yorks

There was insufficient information present to identify the site referenced on the box, as such no further information could be found.

3.104 Ashwell Guilden Modern (Roman)

Ashwell has been occupied since Neolithic times, and during the Roman period a number of Roman farmsteads were present in the Ashwell parish. Roman finds in the area include a hoard of Roman silver coins, and near Ruddery Spring a Roman cemetery was excavated. A number of other Roman inhumations have been excavated from the Ashwell parish and it is not possible to determine which excavation the remains at the Duckworth were from (Ranson, 2012).

Ranson, C., 2012. Archaeological Test Pit Excavations in Ashwell, Hertfordshire, 2011 and 2012. Cambridge: Access Cambridge Archaeology.

3.105 Godmanchester (Roman)

There was insufficient information present to identify the site referenced on the box, as such no further information could be found.

3.106 Norton East Riding Yorkshire (Roman)

No further information beyond what was written on the box could be found.

3.107 Melbourn War Ditches (Roman)

There was insufficient information present to identify the site referenced on the box, as such no further information could be found.

3.108 Poundbury Dorset (Roman)

A Roman stone coffin dating to the 3rd or 4th century CE was excavated from Poundbury farm, Poundbury, Dorset (Wessex Archaeology n.d)

Wessex Archaeology., n.d. *Roman stone coffin form Poundbury Farm,* from World Wide Web: http://www.wessexarch.co.uk/projects/dorset/poundbury [Accessed 28th February 2019]

3.109 Isleham Fen (Roman)

There was insufficient information present to identify the site referenced on the box, as such no further information could be found.

3.110 Combe Down (Roman)

There was insufficient information present to identify the site referenced on the box, as such no further information could be found.

3.111 York (Roman)

No information concerning this site beyond what was written on the box could be found, therefore only the location and Iron Age date is known about this individual.

3.112 Bletsoe (Roman)

No information concerning this site beyond what was written on the box could be found, therefore only the location and Iron Age date is known about this individual.

3.113 Zoological Collection, Royal College of Surgeons

All of the non-human material included in this study was sourced from the Odonatological collection at the RCS, species and sex and age group were provided in the museum catalogue, sub species and further information is not required for the purposes of this study.

3.114 Breedon-on-the-hill, Leicestershire (Anglo-Saxon)

Breedon-on-the-hill is located to the north-west of Leicestershire, as a result of large amounts of quarrying archaeological remains were uncovered. The site is positioned on a 400ft hill with access to the Soar and Trent River valleys making the location ideal for early British populations. While material uncovered at Breedon dates to as early as 3,000 BCE the majority of the material from the site is dated to the Iron Age approximately 300BCE when the hill fort is thought to have been constructed (Kenyon 1946).

23 graves were excavated at the site, they were very shallow and were positions in three parallel lines funning north to south with. The skeletons were in an extended supine positioned and were orientated east to west. The graves were for the most part well spread apart, with on average 1 foot between each grave, and there was only one case of a grave being cut through by a later burial. Only one grave had evidence of a possible coffin, with three iron nails recovered. There was potter present in the grave which was dated to the Iron Age and as no other grave goods from different periods were present it was concluded that these skeletons were Iron Age individuals. However, the proximity of these burial to an early Saxon church creating speculations that these may have been Saxon individuals (Kenyon 1946).

Osteological analysis was conducted on 14 of the inhumations excavated from the site, this included age and sex estimations. All of the individuals analysed were adults ranging between 17 to 50+ years of age. Stature varied between the individuals although specific statures estimates were not included and only descriptions such as "short stature" and "tall, muscular build" were provided. While dental wear and presence were described, this was not sufficiently detailed or standardised to allow analysis (Kenyon 1946).

Kenyon, K., 1946. Excavations at Breedon-on-the-Hill: Leicestershire Archaeological Society. Archaeologia, ixxvii, 18- 82.

3.115 Guildford Friary (Medieval)

Excavations were conducted on a Dominican Friary in Guildford in 1974 and 1978, the site was first discovered during the demolition of the Friary Meux brewery. Based on historical evidence the friary is believed to have been founded in 1275 by Eleanor Provence. During the later excavation in 1978 human burials were discovered at the site, and a total of 113 were exhumed (Poulton and Woods 1984).

Poulton, R., and Woods, H., 1984. Excavations on the site of the Dominican Friary at Guildford in 1974 and 1978, Res Vol Surrey Archaeological Society 9, 83.

3.116 GW85 (Anglo-Saxon)

No information or matching site records could be found concerning the GW85 site at the Surrey Archaeological Trust, only an uncorroborated time period of Saxon is provided, as such this data shall be used tentatively.

3.117 Hurstbourne Priors Manor Farm

During construction of a latrine pit by a girl guides camp in 1988 a human femur was excavated. Upon further excavation of the site more human remains were excavated, along with Roman pottery and other material dated to the Roman period. At this point Andover Museum was contacted and a full excavation of the site was conducted. The human burial was determined to be that of an adult mail between 35 and 50 years of age and about 1.6 meters in height. The presence of over 50 iron nails indicates that this individual may have been buried in a coffin, which may account for the high preservation of the skeleton. This site was dated to between 200-280 based on analysis of the Roman pottery associated with the human remains (Allen 1992).

Allen, D., 1992. A Third Century Roman Burial from Manor Farm, Hurstbourne Priors. Proc Hants Field Club and Arch Soc, 47, 253-257.

3.118 United Reform (Anglo-Saxon)

This site is recorded as being dated to the Anglo-Saxon period, unfortunately there is no further information currently published for this site.

3.119 Westham Playing Fields (Roman)

This site is recorded as being dated to the Roman Age, unfortunately there is no further information currently published for this site.

3.120 Owslebury (Roman)

The site of Owslebury which was excavated between 1961 and 1972 is dated to the Roman period. A total of 50 inhumations were excavated from this site, 30 of which were juvenile. Of the adult remains sex was estimated from 17 individuals of which 14 were male. Unfortunately there is no further information currently published for this site.

Collis, J., 1968. Excavations at Owslebury, Hants: a first interim report, *Antiq. J.* 48, 18-31

3.121 Nutbane (Neolithic)

Nutbane longbarrow in Andover was excavated in 1957 after being discovered two years prior to excavation. Nutbane longbarrow was built and used about 3,500 BCE. The site had been worked for agricultural purposes prior to excavation, frequent ploughing reduced the height of the longbarrow structures to 0.75 meters in height. There were four human inhumations excavated from the east end of the site where a mortuary structure was identified. Of the burials three were estimated to be male adults ranging in age from 30-50 years old, while the fourth burial was a child between 12 and 13 years of age. There were no grave goods excavated from this site, although it is possible that these materials decomposed. This site has been included in this study because it is one of very few Neolithic sites that have been fully excavated in Hampshire (de Mallett Morgan 1959)

de Mallett Morgan, F., 1959. The excavation of a Long Barrow at Nutbane, Hant. Proceedings of the Prehistoric Society 25, 15-51.

3.122 Droxford (Anglo-Saxon)

The Anglo-Saxon cemetery at Droxford was first discovered in 1900 during routine archaeological excavations as part of a railway line construction. After the excavation of several human bones and Iron Age objects the site was not fully excavated though until 1973 when it was rediscovered as a result of soil erosion near the railway lines. During this excavation a total of 41 graves were identified along with their accompanying grave goods(Aldsworth 1979).

Aldsworth, F.R. 1979. The Droxford Anglo-Saxon cemetery, Soberton, Hampshire. *Proc Hampshire Field Club Archaeol So*c 35, 93-182.

3.123 Suddern Farm (Roman)

This site is recorded as being dated to the Roman period, unfortunately there is no further information currently published for this site.

3.124 Walworth Barrows (Bronze and Iron Age)

The Bronze Age site of Walworth Barrows in Andover dated to between 2000-1000BCE consists of two round barrows which were excavated in 1987 prior to scheduled development of the site. These round barrows were built very close together so that in an aerial view they form a figure eight. The barrows were built on land which was since extensively ploughed as farmland, until only the outer ditches remained. The site was constructed during the early Bronze Age and was in use until the late Bronze Age, after which the ditches were filled with silt. Several burial were excavated from the site, these burials included both inhumations and cremations (King 2015).

King, J., 2015. The excavations of two Bronze Age barrows on Walworth industrial estate, Andover in 1987. *Proc Hampshire Field Club Archaeological So*ciety 70, 1-33.

3.125 Micheldelver Wood (Bronze and Iron Age)

This site is recorded as being dated to the Iron Age, unfortunately there is no further information currently published for this site.

3.126 Brighton Hill South (Medieval)

In 1984 and 1985 trial excavations were conducted at the site of an Iron Age enclosure at Brighton Hill South in Basingstoke, led to the unexpected discovery of a medieval church and the partial discovery of an associated settlement. Dating of the medieval settlement was conducted based on analysis of pottery material which ranged from the mid-11th century to the late 15th century. Of the graves excavated 6 human skeletons were retrieved and analysed from within the church building. Of these remains two were infants, one was juvenile and one was a mature adult male. Information concerning the other 2 skeletons were not available. Within the churchyard 258 graves were recorded although only 37 of these were excavated, due to a number of double burials at least 46 human skeletons were excavated as a result of this. It is not known from the published material why only such a small fraction of the graves were excavated. A high proportion of the burials were juvenile, with over half of the individuals being immature (Fasham et al. 1995).

Evidence of the nearby settlement shows that the accompanying timber buildings made up the ancient manor and church of Hatch, which is considered to have been quite a high status settlement during the 12th and 13th century's (Fasham et al. 1995).

Fasham, P.J., Keevill, G., and Coe, D., 1995. Brighton Hill South (Hatch Warren): an Iron Age farmstead and deserted medieval village in Hampshire. Wessex Archaeology Report No. 7.

3.127 Twyford Farm (Bronze and Iron Age)

Excavations were conducted at Twyford Down prior to construction of the M3, this work revealed a number of archaeological features ranging from Early Bronze Age to Early Roman period. In addition to numerous material and animal remains several human cremations and inhumations were excavated from the site, with over 6000 human bone fragments identified. From these remains 20 human inhumations were recorded and dated to the Bronze Age, preservation of these remains was for the majority good. Dating was conducting using radiocarbon testing from 6 samples of human bone (Anon 1993).

Anon., 1993. M3 Twyford Down, Winchester, Hampshire: Assessment Report and Updated Project Design Specification. Wessex Archaeology.

3.128 Shavards Lane (Anglo-Saxon)

This site is recorded as being dated to the Anglo-Saxon period, unfortunately there is no further information currently published for this site.

3.129 Winchester Street (Roman)

During the mid-1980's excavation took place at a site on the east side of Winchester street in Andover. During this excavation a number of medieval and post-medieval pits and cellars were discovered. In addition to the medieval and post medieval finds at the site a late roman cemetery was also uncovered. A total of nine human skeletons were excavated from the Roman cemetery between 1984 and 1987. The site of this Roman cemetery is 0.5 km from the Winchester to Cirencester Roman road, although there are no conferment Romano-British settlements within the nearby vicinity of the Winchester street cemetery (Jennings 2000 and Clarke 1979).

Jennings, K., 2000. The excavation of nine Romano-British burials at Andover, Hampshire Studies 55, 114 -132.

Clarke, G., 1979.The Roman Cemetery at Lankhills, Winchester Studies 3.

3.130 Kempshott Park (Iron and Bronze Age)

This site is recorded as being dated to the Bronze Age, unfortunately there is no further information currently published for this site.

3.131 Easton Lane (Iron and Bronze Age)

This site is recorded as being dated to the Bronze Age, unfortunately there is no further information currently published for this site.

3.132 Selborne Priory (Medieval)

Selborne priory was founded in 1233 by Peter des Roches the Bishop of Winchester and was in use until 1486 when it was dissolved by William Waynflete. The site was excavated between 1953 and 1971, early excavations were conducted by armatures, while later excavations and publications was by David Baker. During the excavations 13 human burials were discovered as well as numerous material finds (Baker n.d). This site is recorded as being dated to the Medieval, unfortunately there is no further information currently published for this site.

Baker, D., n.d. Selborne Priory: Excavations 1953-1971. Hampshire Field Club Monograph 12.

3.133 Breamore (Anglo-Saxon)

The Anglo-Saxon cemetery site at Breamore in Hampshire was first identified though a Geophysical Survey conducted in August 2000 which indicated the presence of at least three human burials (Hinton and Worrell 2017). Unfortunately, there is no further information currently published for this site.

Hinton, D.A., and Worrell, S., 2017. An Early Anglo-Saxon Cemetery and Archaeological Survey at Breamore, Hampshire, 1999–2006. Archaeological Journal 174(1), 68-145.

3.134 Easton Down (Bronze and Iron Age)

This site is recorded as being dated to the Bronze Age, unfortunately there is no further information currently published for this site.

3.135 Church Close Andover (Medieval)

In 1990 during the construction of a new church hall at Church Close in Andover led to the discovery of a peg-tile hearth and several other deposits. Later in 1990 a further site at Church Close was excavated during the construction of St Mary's medical centre led to the discovery of a number of human remains were discovered. While currently this excavation report has not been published the site is conserved to date to the King John (Allen et al. 2015, Stoodley 2013).

Allen, D., Gould, S., Johnson, L., King, J., Stone, P., 2015. Buried in time – Church Close and Newbury Street, Andover. *Hampshire Archaeology*. From World Wide Web: https://hampshirearchaeology.wordpress.com/2015/06/15/buried-in-time-church-close-and-newbury-street-andover/

Stoodley, N., 2013. The Archaeology of Andover: The Excavations of Andover Archaeological Society 1964-89. *AHAS*.

3.136 Portway East, Andover (Anglo-Saxon)

The 6th century Saxon cemetery at Portway east was excavated between 1973 and 1975 by the Andover Archaeological Society. The site contained 69 inhumations and 57 cremations, however the preservation of many of these remains was very poor due to damage caused by ploughing. A high prevalence of grave goods were excavated from the site, site reports also indicates a higher number of female burials compared to male burials. The cemetery was dated to the late 6th century based on the decorations of the grave goods excavated from the site (Cook and Dacre 1985).

Cook, A., and Dacre, W., 1985. *Excavations at Portway, Andover, 1973–1975*. Oxford : Oxford University Committee for Archaeology

3.137 St Andrews (Medieval)

Included from the collections at Chichester were four medieval individuals excavated from the Church of St. Andrew- in-the-Oxmarket. St Andrews church in Chichester is generally assigned to the 13th century based on architectural features. Although during excavation it was realised that the footings of the church may be earlier, although a date for these features is not provided (Down 1981, Salzman 1935).

In 1976 the Trustees of the Chichester Arts Centre gave permission for a limited excavation funded by the Department of the Environment, prior to scheduled building works in the church. The aim of this investigation was to determine if a Saxon church lay in the foundations of St Andrews. Excavation of the site later revealed no evidence to indicate the presence of any such Saxon church, however, features of a Roman house were identified. In addition to the Roman material discovered during the excavation further features of St. Andrews church were revealed, including human remains dated to the medieval period. The burials, however, were not discussed further in the published material (Down 1981, McCann 1978, Salzman 1935).

Salzman, L.F., 1935. 'Chichester: Advowsons', in A History of the County of Sussex: Volume 3, 164-166. British History, from World Wide Web: http://www.british-history.ac.uk/vch/sussex/vol3/pp164-166 [Accessed 28 February 2019].

Down, A., 1981. Excavations in St Andrew, Oxmarket, in Chichester Excavations V, Chichester.
McCann, A., 1978. The History of the Church and Parish of St Andrew Oxmarket, Chichester.

3.138 Eastgate Needlemaker (Roman)

During an archaeological assessment conducted prior to the commencement of planned construction across the River Levant in Chichester in 1976 at a site, known as the Eastgate Needlemakers Site. During excavation 14 human burials and roman pottery were discovered and dated to the 4th-5th century (Lyne 2015).

Very little is included in the archaeological report regarding the skeletal remains excavated, with only general descriptions of the preservation included. The cemetery itself is thought to be late in the Roman period, and based on the presence of Roman coins and pottery has been dated to between the 4th and 5th century. These dates are further supported by the carbon 14 dating of burial 13 to the mid-4th century. Quicklime was discovered in two of the graves may indicate that these individuals were plague victims (Lyne 2015).

Lyne, M., 2015. The end of Roman Pottery Production in Southern Britain. *Internet Archaeology* 41 http://intarch.ac.uk/journal/issue41/index.html

3.139 Stocklund (Medieval)

No published reports concerning the excavation of the skeletal material from Stocklund were available, it was known based on informal written records accompanying the remains the remains were discovered in 1966 during the construction of Stocklund house in Chichester and the site was dated to the Medieval period.

3.140 Theological College (Roman)

Excavation were conducted in Chichester in 1985 and 1987 at the former site of the Theological College. At the north of this site 43 Roman skeletons were uncovered from a Roman inhumation cemetery, these burials are thought to represent only a small portion of a much larger cemetery beyond the North and East Gates. In addition to the cemetery the remains of two timber buildings were also discovered south of the cemetery (Hicks 2016).

Hicks, C., 2016. The Romans and Westgate. From the World Wide Web: http://www.westgatera.org.uk/2016/01/01/theromans/ [Accessed 28th February 2019].

3.141 Appledown Cemetery (AngloSaon)

The majority of the material analysed at Chichester was excavated from the Anglo-Saxon cemeteries of Appledown, Compton, West Sussex which was in use between the 5th and late 7th century. The site was discovered in 19822 through the activity of a metal detectorist, which led to the discovery of a number of Anglo-Saxon artefacts. This led to the subsequent excavation of the site by the Chichester excavation committee between 1982 and 1987. As part of these excavations two Anglo-Saxon cemeteries were uncovered (Lyne 2015, Tremless and Paine n.d).

Appledown is an elongated hill on the dipslope of the South Downs between the parishes of Compton and East, the hill top of Appledown was previously occupied by four Bronze Age barrows. The landscape of the Appledown site is typical downland, with landscape conditions which provides a variety of land uses including: pasture, arable and woodland. Chichester are believed to have been central to Aethelweaths kingdom, and several Anglo-Saxon sites have previously been excavated in Chichester. It was hoped that the excavation of this site would provide valuable information concerning the major gap in the archaeological record between the Roman occupation of Chichester and the late Anglo-Saxon period (Lyne 2015, Tremless and Paine n.d).

In addition to the human remains excavated from Apple down 33 timber structures were also identified, which are believed to have functioned as "houses for the dead". Of the human remains excavated from the site very young children were underrepresented. It was suggested that very young children may have been buried in shallower graves resulting in their comparatively poor preservation. Over 25% of the individuals from Appledown died before the age of 15, and 75% of men and 50% of women died before the age of 45 (Lyne 2015, Tremless and Paine n.d).

Lyne, M., 2015. The end of Roman Pottery Production in Southern Britain. *Internet Archaeology* 41 http://intarch.ac.uk/journal/issue41/index.html

Tremless, P., Paine, C., n.d. Apple Down Cemetery. The Novium museum. From World Wide Web: http://www.thenovium.org/article/28824/Apple-Down-Cemetery

3.142 St Gregory's Priory and Cemetery (Medieval)

Skeletal collections curated by the University of Kent, Canterbury were included in this study, with access granted by the collections curator Dr Patrick Mahoney. This skeletal collection includes over 1342 medieval individuals, with 91 burials excavated from St Gregory's cemetery and 45 from the priory. This collection was chosen due to it being known from previous research that the preservation of the material was high as well as the socio-economical division between the cemetery and priory collections being of specific interest for further analysis in this study.

The site of St. Gregory's Priory is located on the north side of Canterbury, outside of the medieval city walls. Excavation of the site was conducted by the Canterbury Archaeological Trust between 1988 and 1991, which uncovered two extensive ecclesiastical establishments identified as St Gregory's priory and to the south a cemetery. St Gregory's priory and cemetery was established during the 11th century by Lanfranc the Archbishop of Canterbury and remained open until the 16th century. The dates are further confirmed by 12 inhumations which were dated to this period as well as the analysis of non-human material excavated from the site. In addition the medieval material, Prehistoric, Roman and Anglo-Saxon material was also discovered, although this material was not discussed further in the archaeological report written by Hicks and Hicks (2001).

Animal remains from St Gregory's cemetery and priory were analysed as a means of evaluating the diet of medieval Canterbury populations. Of the animal remains excavated the majority were identified as sheep/goat, followed by pig and cattle remains were the least frequently identified domestic animal excavated. The rates of domestic animals finds, were not recorded to vary significant over time at the site. Other domesticated food species, wild species and domestic non-food species were also identified from the material which included several fish and bird species.

A total of 1342 skeletal remains between the priory and the cemetery. Overall the preservation of the skeletal remains excavated from both the cemetery and the prior was very good, with 40% of inhumations estimated at over 75% complete (Hicks and Hicks, 2001, pg.338). Analysis of the skeletal material determined that 80% of the individuals from the priory were estimated to be male, while the cemetery had a more equal divide (Hicks and Hicks, 2001). Unfortunately material from St Gregory's cemetery is not analysed further in the published material, as due to a lack of funding instead only the remains from the priory were analysed in the archaeological report.

Archaeological and historical records indicate that there was a distinct socioeconomic divide between the cemetery and the priory (Hicks and Hicks, 2001). Previous studies which have analysed the effect of this socio-economic difference have found that there may have been dietary difference between these two groups. Although analysis of dental wear conducted by Dawson and Brown (2013) determined that there was not a significant difference in dental wear between the cemetery and the priory populations.

Hicks, M., and Hicks, A., 2001. St Gregory's Priory, Northgate, Canterbury Excavations 1988–1991. Canterbury: Canterbury Archaeological Trust.

Dawson, H., Brown, K., 2013. Exploring the relationship between dental wear and status in late medieval subadults from England. American Journal of Physical Anthropology 150, 433–441.

3.143 GOP Wales (Iron and Bronze Age)

One individual from the Manchester collection was from the Bronze Age Gop Caves which are located close to Hill Cairn site in Wales, the largest prehistoric monument in Wales. Located near Trelawnyd, Flitshire. Gop cave is a limestone cave with evidence of burning indicates the cave was in use during the Neolithic. The site was discovered during the primary excavation of the nearby cairn by Boyd Dawkins in 1886. During this early excavation 14 human skeletons dated to the Late Neolithic were excavated. In addition to the human remains many zooarchaeological skeletal remains were excavated and identified beneath the Neolithic deposits and dated to the Pleistocene period, these skeletal elements were identified as: hyaena, woolly rhinoceros, bison, horse and reindeer.

A later excavation conducted Moris, J and Glenn, A resulted in the discovery of a further 6 skeletons in the North West passage of the cave. In addition to the human remains several stone tools were discovered including a hand-axe made from Graid Lwyd rock from Penmaenmawr. Further excavations were conducted by Glenn, A and funded by the National museum of Wales, led to the discovery of further, human and animal remains as well as stone tools.

Walker, E., 1993. History of excavations at GOP cave, Clwyd archaeological news 3.

3.144 Wandlebury Hill-fort (Iron and Bronze Age)

Five individuals were excavated from Wandlebury Iron age hillfort after the remains were exposed during a storm in January 1976 which felled a tree. Five adult individuals were excavated three male, one probable female and one unsexed individual. No associated grave goods were found with the burials. One individual had evidence of sharp force trauma thought to be from a sword to the mandible (Historic England 1995).

Historic England., 1995. Wandlebury Camp: a multivallate hillfort, earlier univallate hillfort, Iron Age cemetery and 17th century formal garden remains. From World Wide Web: https://historicengland.org.uk/listing/the-list/list-entry/1009395 [Accessed 28th February 2019].

3.145 Craig-Y-nos (Bronze Age)

No further information could be found

3.146 Birsay, Orkney (Neolithic)

There are a number of Neolithic sites in the borough of Birsay in Orkney and unfortunately with not further information provided it was not possible to narrow down which site these remains are from

3.147 Bratton Camp, Bratton Down (Bronze Age)

The Bronze age Long Barrow at Bratton downs was first excavated in the 18th century , later excavations revealed three skeletons, pottery animals bones and beads unfortunately no more information could be found regarding these individuals (information from uncorroborated written records included with inhumations).

3.148 Chippenham (Iron/Bronze Age)

No further information could be found

3.149 Grange Road (Roman)

No further information could be found

Appendix 4: Results – Measurements

Appendix 4 details the results produced in SPSS when analysing the eman mandible measurements detailed in section 6.1 of the results.

4.1 Mansible measurements - males and females

Table 4.1.1: Results from a Shapiro-Wilk test for normality illustrating which mandible measurmenst are normally distributed among males and females. For the measurements where the results of a Shapiro-Wilk test indicate data were not normally distributed a Q-Q plot was created to further investigate this.

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	MF	Statistic	df	Sig.	Statistic	df	Sig.
CorB	Female	.090	103	.037	.963	103	.005
	Male	.064	112	.200*	.951	112	.000
ConB	Female	.152	103	.000	.943	103	.000
	Male	.145	112	.000	.929	112	.000
L1	Female	.141	103	.000	.894	103	.000
	Male	.171	112	.000	.939	112	.000
Bl	Female	.087	103	.052	.911	103	.000
	Male	.091	112	.023	.941	112	.000
Bh	Female	.055	103	.200*	.988	103	.490
	Male	.051	112	.200*	.987	112	.348
Rh	Female	.096	103	.021	.979	103	.107
	Male	.055	112	.200*	.990	112	.613
L2	Female	.060	103	.200*	.977	103	.075
	Male	.058	112	.200*	.987	112	.388

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

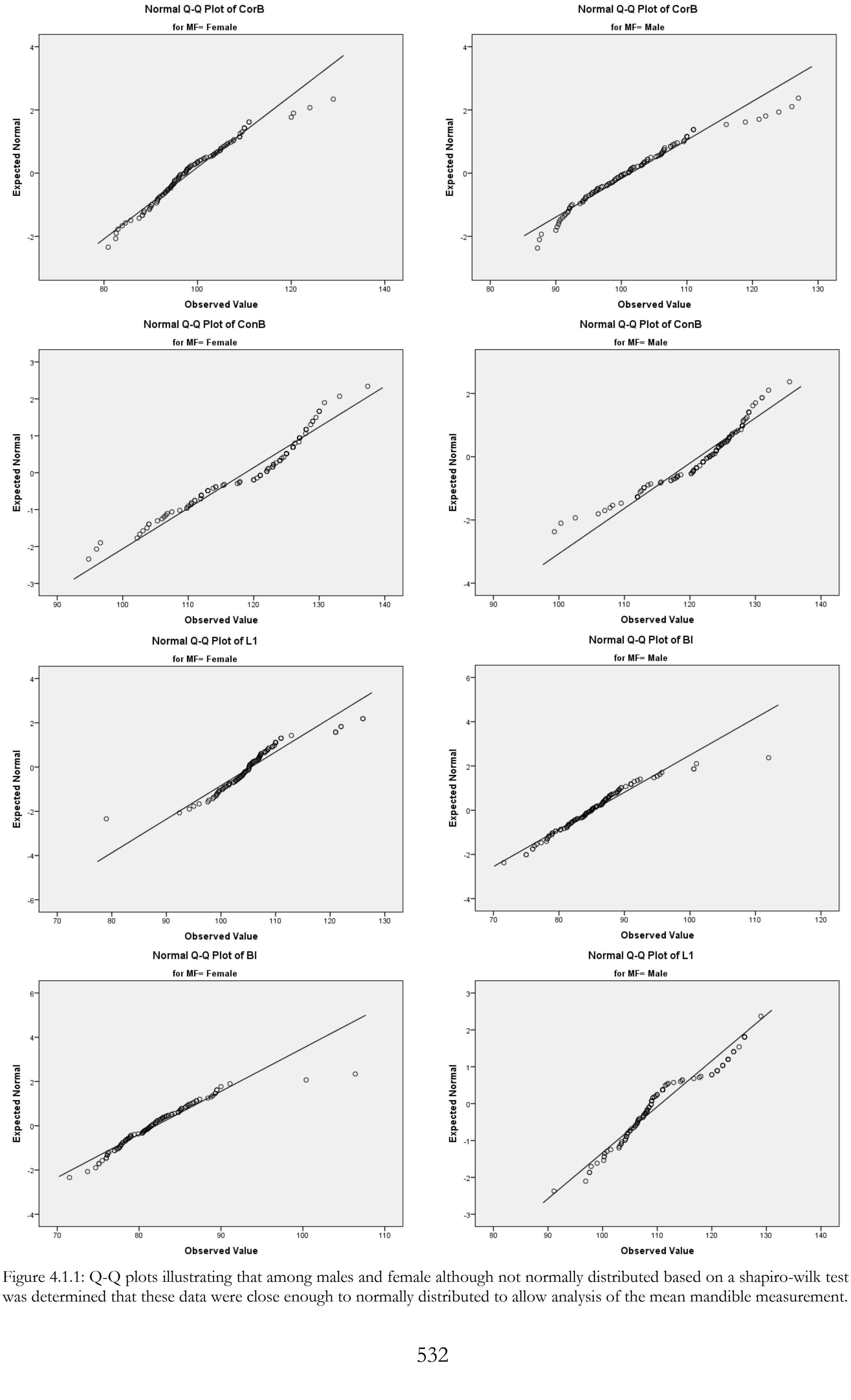

Figure 4.1.1: Q-Q plots illustrating that among males and female although not normally distributed based on a shapiro-wilk test it was determined that these data were close enough to normally distributed to allow analysis of the mean mandible measurement.

Table 4.1.2: Mean mandible measurements for females and males among all time periods

Report

MF		CorB	ConB	L1	Bl	Bh	Rh	L2
Female	Mean	98.34	118.18	105.71	81.71	30.27	62.60	79.53
	N	158	130	250	253	261	249	250
	Std. Deviation	8.108	9.223	7.343	5.455	3.165	5.602	5.892
Male	Mean	101.69	121.23	111.42	86.11	32.51	67.08	83.49
	N	163	154	312	319	325	319	312
	Std. Deviation	8.476	7.729	8.862	5.535	3.487	5.730	6.357
Total	Mean	100.04	119.83	108.88	84.16	31.51	65.12	81.73
	N	321	284	562	572	586	568	562
	Std. Deviation	8.452	8.566	8.692	5.914	3.526	6.089	6.456

Table 4.1.3: Indenpendant samples t-test comparing mean mandible measurements for males and females among all time periods.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
CorB	Equal variances assumed	.180	.672	-3.614	319	.000	-3.348	.926	-5.170	-1.525
	Equal variances not assumed			-3.617	318.945	.000	-3.348	.926	-5.169	-1.527
ConB	Equal variances assumed	11.372	.001	-3.028	282	.003	-3.046	1.006	-5.026	-1.066
	Equal variances not assumed			-2.984	252.461	.003	-3.046	1.021	-5.057	-1.035
L1	Equal variances assumed	23.897	.000	-8.191	560	.000	-5.716	.698	-7.086	-4.345
	Equal variances not assumed			-8.361	559.360	.000	-5.716	.684	-7.059	-4.373
BI	Equal variances assumed	.004	.952	-9.502	570	.000	-4.400	.463	-5.309	-3.490
	Equal variances not assumed			-9.518	544.089	.000	-4.400	.462	-5.308	-3.492
Bh	Equal variances assumed	1.839	.176	-8.067	584	.000	-2.245	.278	-2.791	-1.698
	Equal variances not assumed			-8.153	575.271	.000	-2.245	.275	-2.786	-1.704

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Rh	Equal variances assumed	.012	.912	-9.330	566	.000	-4.477	.480	-5.419	-3.534
	Equal variances not assumed			-9.356	538.415	.000	-4.477	.478	-5.416	-3.537
L2	Equal variances assumed	.317	.574	-7.569	560	.000	-3.954	.522	-4.980	-2.928
	Equal variances not assumed			-7.632	548.257	.000	-3.954	.518	-4.972	-2.936

4.2 Mandible measurements – sex differences over time

Table 4.2.1: Results from a Shapiro-Wilk test for normality mandible measurements are normally distributed among males and females within each time period. As with previous cases the Q-Q plots were analysed and it was determined that data were close enough to normally distributed to allow analysis of the mean.

Tests of Normality

			Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Period		MF	Statistic	df	Sig.	Statistic	df	Sig.
AS	CorB	Female	.149	15	.200*	.955	15	.604
		Male	.176	16	.200	.894	16	.063
	ConB	Female	.188	15	.161	.891	15	.069
		Male	.140	16	.200*	.903	16	.089
	L1	Female	.168	15	.200*	.908	15	.125
		Male	.258	16	.005	.816	16	.005
	BI	Female	.121	15	.200*	.953	15	.571

Tests of Normality

Period		MF	Kolmogorov-Smirnov[a] Statistic	df	Sig.	Shapiro-Wilk Statistic	df	Sig.
		Male	.152	16	.200*	.948	16	.455
	Bh	Female	.192	15	.144	.897	15	.085
		Male	.155	16	.200*	.954	16	.551
	Rh	Female	.197	15	.123	.925	15	.229
		Male	.148	16	.200*	.919	16	.161
	L2	Female	.183	15	.191	.944	15	.430
		Male	.140	16	.200*	.939	16	.333
IB	CorB	Female	.253	8	.142	.815	8	.042
		Male	.194	10	.200*	.914	10	.306
	ConB	Female	.224	8	.200*	.912	8	.368
		Male	.200	10	.200*	.865	10	.087
	L1	Female	.357	8	.003	.738	8	.006
		Male	.246	10	.086	.829	10	.032
	Bl	Female	.204	8	.200*	.887	8	.221
		Male	.243	10	.097	.749	10	.003
	Bh	Female	.201	8	.200*	.893	8	.248
		Male	.194	10	.200*	.956	10	.736
	Rh	Female	.263	8	.111	.923	8	.452
		Male	.269	10	.039	.848	10	.056
	L2	Female	.159	8	.200*	.977	8	.946
		Male	.201	10	.200*	.937	10	.519
M	CorB	Female	.200	23	.018	.909	23	.040
		Male	.190	26	.016	.894	26	.012
	ConB	Female	.205	23	.013	.920	23	.065
		Male	.245	26	.000	.891	26	.010
	L1	Female	.155	23	.157	.918	23	.059
		Male	.236	26	.001	.892	26	.010
	Bl	Female	.133	23	.200*	.947	23	.253
		Male	.148	26	.151	.959	26	.378
	Bh	Female	.139	23	.200*	.942	23	.197
		Male	.106	26	.200*	.943	26	.161
	Rh	Female	.142	23	.200*	.905	23	.032
		Male	.140	26	.200*	.969	26	.596
	L2	Female	.162	23	.119	.957	23	.410
		Male	.108	26	.200*	.978	26	.826
N	CorB	Female	.260	2	.			
		Male	.362	3	.	.804	3	.124
	ConB	Female	.260	2	.			

Tests of Normality

Period		MF	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
			Statistic	df	Sig.	Statistic	df	Sig.
		Male	.245	3	.	.971	3	.672
	L1	Female	.260	2	.			
		Male	.385	3	.	.750	3	.000
	Bl	Female	.260	2	.			
		Male	.356	3	.	.818	3	.157
	Bh	Female	.260	2	.			
		Male	.351	3	.	.828	3	.183
	Rh	Female	.260	2	.			
		Male	.245	3	.	.971	3	.672
	L2	Female	.260	2	.			
		Male	.186	3	.	.998	3	.921
PM	CorB	Female	.171	37	.008	.862	37	.000
		Male	.189	38	.001	.854	38	.000
	ConB	Female	.144	37	.052	.933	37	.029
		Male	.211	38	.000	.851	38	.000
	L1	Female	.144	37	.051	.889	37	.001
		Male	.208	38	.000	.913	38	.006
	Bl	Female	.115	37	.200*	.972	37	.463
		Male	.092	38	.200*	.968	38	.339
	Bh	Female	.057	37	.200*	.983	37	.826
		Male	.083	38	.200*	.962	38	.219
	Rh	Female	.069	37	.200*	.988	37	.950
		Male	.094	38	.200*	.983	38	.817
	L2	Female	.075	37	.200*	.959	37	.182
		Male	.099	38	.200*	.969	38	.376
R	CorB	Female	.134	17	.200*	.918	17	.137
		Male	.232	10	.134	.913	10	.299
	ConB	Female	.268	17	.002	.855	17	.013
		Male	.180	10	.200*	.897	10	.202
	L1	Female	.245	17	.008	.859	17	.015
		Male	.195	10	.200*	.898	10	.209
	Bl	Female	.168	17	.200*	.840	17	.008
		Male	.137	10	.200*	.970	10	.894
	Bh	Female	.109	17	.200*	.953	17	.497
		Male	.237	10	.116	.807	10	.018
	Rh	Female	.166	17	.200*	.942	17	.337
		Male	.239	10	.111	.910	10	.282
	L2	Female	.162	17	.200*	.935	17	.262

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Period	MF	Statistic	df	Sig.	Statistic	df	Sig.
	Male	.205	10	.200*	.930	10	.446

*. This is a lower bound of the true significance.

Table 4.2.2: Mean mandible measurements for males and females comparinog all time periods

Report

Period		CorB	ConB	L1	Bl	Bh	Rh	L2
AS	Mean	98.78	120.96	109.71	85.29	31.67	65.92	81.90
	N	73	69	133	138	138	138	132
	Std. Deviation	7.736	7.380	8.834	5.120	3.695	5.894	6.019
IB	Mean	97.34	120.34	108.76	85.37	31.91	63.94	81.03
	N	41	36	80	80	81	78	80
	Std. Deviation	8.114	10.630	10.056	6.612	3.449	6.896	5.131
M	Mean	102.92	116.45	108.77	83.48	30.58	64.79	81.07
	N	104	100	194	199	203	196	197
	Std. Deviation	8.365	7.937	7.211	5.147	3.337	6.878	5.967
N	Mean	100.05	121.23	106.49	85.30	32.11	63.49	81.26
	N	6	7	14	15	15	17	13
	Std. Deviation	7.038	4.854	10.813	4.586	3.949	5.529	5.198
P	Mean	96.37	121.93	114.68	87.04	30.87	66.36	83.42
	N	12	9	13	14	14	14	13
	Std. Deviation	5.824	7.518	9.459	6.650	3.607	5.648	4.767
PM	Mean	99.17	118.30	106.77	82.23	31.12	64.78	81.47
	N	123	106	197	196	197	199	190
	Std. Deviation	8.626	8.736	7.464	6.073	3.421	6.074	6.566
R	Mean	101.17	122.77	109.84	84.74	31.95	64.95	81.34
	N	55	38	94	96	104	92	98
	Std. Deviation	10.146	7.790	8.568	6.220	3.379	6.504	8.575
U	Mean	99.22	121.36	108.54	89.81	32.99	64.64	86.20
	N	6	5	9	9	9	9	9
	Std. Deviation	6.095	8.871	13.455	5.967	3.398	5.396	4.678

Table 4.2.3: Independent samples t-test showing significant differences in mean mandible measurements among time peroids between males and females

Independent Samples Test[a]

Period			Levene's Test for Equality of Variances F	Levene's Test for Equality of Variances Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper
AS	CorB	Equal variances assumed	1.655	.205	-1.680	42	.100	-3.924	2.336	-8.638	.790
		Equal variances not assumed			-1.650	34.404	.108	-3.924	2.378	-8.754	.907
	ConB	Equal variances assumed	4.277	.045	-.715	39	.479	-1.684	2.356	-6.450	3.083
		Equal variances not assumed			-.691	29.185	.495	-1.684	2.436	-6.665	3.298
	L1	Equal variances assumed	.291	.591	-3.229	79	.002	-6.758	2.093	-10.925	-2.592
		Equal variances not assumed			-3.168	68.553	.002	-6.758	2.133	-11.014	-2.502
	Bl	Equal variances assumed	.306	.582	-3.168	83	.002	-3.178	1.003	-5.173	-1.182
		Equal variances not assumed			-3.169	77.733	.002	-3.178	1.003	-5.174	-1.181
	Bh	Equal variances assumed	.474	.493	-3.613	83	.001	-2.733	.756	-4.237	-1.228
		Equal variances not assumed			-3.564	73.194	.001	-2.733	.767	-4.261	-1.205

Independent Samples Test[a]

Period			Levene's Test for Equality of Variances: F	Sig.	t-test for Equality of Means: t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference: Lower	Upper
	Rh	Equal variances assumed	.542	.464	-4.385	83	.000	-4.859	1.108	-7.063	-2.655
		Equal variances not assumed			-4.327	69.755	.000	-4.859	1.123	-7.098	-2.619
	L2	Equal variances assumed	.132	.717	-2.351	78	.021	-3.222	1.370	-5.950	-.494
		Equal variances not assumed			-2.348	72.833	.022	-3.222	1.372	-5.957	-.487
IB	CorB	Equal variances assumed	.045	.833	.269	32	.790	.792	2.946	-5.210	6.793
		Equal variances not assumed			.265	28.160	.793	.792	2.992	-5.335	6.918
	ConB	Equal variances assumed	3.059	.092	-2.223	27	.035	-9.077	4.084	-17.456	-.698
		Equal variances not assumed			-2.086	17.269	.052	-9.077	4.351	-18.247	.093
	L1	Equal variances assumed	4.580	.036	-1.715	60	.092	-4.486	2.616	-9.718	.747
		Equal variances not assumed			-1.838	59.949	.071	-4.486	2.440	-9.367	.396
	BI	Equal variances assumed	.399	.530	-3.773	61	.000	-5.822	1.543	-8.908	-2.736

Independent Samples Test[a]

Period			Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
		Equal variances not assumed			-3.962	58.913	.000	-5.822	1.469	-8.762	-2.882
	Bh	Equal variances assumed	1.666	.202	-2.676	61	.010	-2.230	.833	-3.896	-.564
		Equal variances not assumed			-2.826	59.474	.006	-2.230	.789	-3.808	-.651
	Rh	Equal variances assumed	.298	.587	-3.532	60	.001	-5.893	1.668	-9.230	-2.556
		Equal variances not assumed			-3.606	57.553	.001	-5.893	1.634	-9.165	-2.621
	L2	Equal variances assumed	3.616	.062	-1.967	60	.054	-2.590	1.316	-5.222	.043
		Equal variances not assumed			-2.113	59.982	.039	-2.590	1.225	-5.040	-.139
M	CorB	Equal variances assumed	.087	.768	-1.467	69	.147	-2.785	1.898	-6.572	1.002
		Equal variances not assumed			-1.469	68.749	.146	-2.785	1.896	-6.567	.998
	ConB	Equal variances assumed	.272	.603	-.672	68	.504	-1.328	1.976	-5.271	2.615
		Equal variances not assumed			-.678	67.561	.500	-1.328	1.960	-5.239	2.583

Independent Samples Test[a]

Period			Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
	L1	Equal variances assumed	6.367	.013	-3.498	141	.001	-4.510	1.289	-7.059	-1.961
		Equal variances not assumed			-3.702	140.936	.000	-4.510	1.218	-6.918	-2.102
	Bl	Equal variances assumed	.111	.739	-3.486	146	.001	-2.856	.819	-4.476	-1.237
		Equal variances not assumed			-3.517	133.220	.001	-2.856	.812	-4.463	-1.250
	Bh	Equal variances assumed	2.240	.137	-2.681	150	.008	-1.451	.541	-2.521	-.382
		Equal variances not assumed			-2.766	141.326	.006	-1.451	.525	-2.488	-.414
	Rh	Equal variances assumed	.455	.501	-3.304	143	.001	-3.218	.974	-5.143	-1.293
		Equal variances not assumed			-3.295	121.081	.001	-3.218	.977	-5.151	-1.284
	L2	Equal variances assumed	.797	.374	-3.660	144	.000	-3.488	.953	-5.371	-1.604
		Equal variances not assumed			-3.805	142.709	.000	-3.488	.917	-5.299	-1.676
N	CorB	Equal variances assumed	.839	.411	-.386	4	.719	-2.433	6.308	-19.948	15.082

Independent Samples Test[a]

Period		Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
	Equal variances not assumed			-.386	3.175	.724	-2.433	6.308	-21.898	17.031
ConB	Equal variances assumed	6.110	.056	-1.103	5	.320	-4.017	3.643	-13.381	5.347
	Equal variances not assumed			-.959	2.353	.426	-4.017	4.189	-19.684	11.650
L1	Equal variances assumed	.563	.472	-1.587	9	.147	-10.390	6.549	-25.204	4.424
	Equal variances not assumed			-1.531	6.931	.170	-10.390	6.789	-26.475	5.695
Bl	Equal variances assumed	11.737	.008	-2.501	9	.034	-5.850	2.339	-11.142	-.558
	Equal variances not assumed			-2.311	4.858	.070	-5.850	2.531	-12.414	.714
Bh	Equal variances assumed	1.226	.294	-2.218	10	.051	-4.833	2.179	-9.689	.022
	Equal variances not assumed			-2.218	9.534	.052	-4.833	2.179	-9.721	.055
Rh	Equal variances assumed	1.650	.228	-3.239	10	.009	-6.850	2.115	-11.562	-2.138
	Equal variances not assumed			-3.239	7.199	.014	-6.850	2.115	-11.823	-1.877

Independent Samples Test[a]

Period			Levene's Test for Equality of Variances		t-test for Equality of Means						
										95% Confidence Interval of the Difference	
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
	L2	Equal variances assumed	.056	.818	-.032	9	.975	-.060	1.863	-4.273	4.153
		Equal variances not assumed			-.032	8.737	.975	-.060	1.857	-4.280	4.160
PM	CorB	Equal variances assumed	.005	.943	-2.461	103	.016	-3.876	1.575	-7.001	-.752
		Equal variances not assumed			-2.460	101.987	.016	-3.876	1.576	-7.001	-.751
	ConB	Equal variances assumed	4.447	.038	-1.760	92	.082	-3.081	1.750	-6.557	.395
		Equal variances not assumed			-1.746	85.409	.084	-3.081	1.765	-6.589	.428
	L1	Equal variances assumed	6.524	.012	-5.006	169	.000	-5.353	1.069	-7.464	-3.242
		Equal variances not assumed			-5.027	162.855	.000	-5.353	1.065	-7.456	-3.250
	BI	Equal variances assumed	1.288	.258	-7.080	168	.000	-5.929	.837	-7.582	-4.276
		Equal variances not assumed			-7.111	164.893	.000	-5.929	.834	-7.575	-4.283
	Bh	Equal variances assumed	2.674	.104	-5.996	169	.000	-2.904	.484	-3.860	-1.948

Independent Samples Test[a]

Period			Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
		Equal variances not assumed			-6.015	165.804	.000	-2.904	.483	-3.857	-1.951
	Rh	Equal variances assumed	.465	.496	-5.923	171	.000	-5.031	.850	-6.708	-3.355
		Equal variances not assumed			-5.945	170.177	.000	-5.031	.846	-6.702	-3.361
	L2	Equal variances assumed	.060	.806	-4.693	164	.000	-4.609	.982	-6.548	-2.670
		Equal variances not assumed			-4.711	163.836	.000	-4.609	.978	-6.540	-2.677
R	CorB	Equal variances assumed	.097	.757	-3.148	47	.003	-8.467	2.689	-13.877	-3.056
		Equal variances not assumed			-3.078	39.234	.004	-8.467	2.751	-14.030	-2.904
	ConB	Equal variances assumed	2.940	.096	-1.409	31	.169	-3.857	2.737	-9.440	1.725
		Equal variances not assumed			-1.541	28.411	.134	-3.857	2.503	-8.982	1.267
	L1	Equal variances assumed	7.604	.007	-3.139	78	.002	-5.783	1.843	-9.451	-2.115
		Equal variances not assumed			-3.157	75.546	.002	-5.783	1.832	-9.432	-2.134

Independent Samples Test[a]

Period		Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Bl	Equal variances assumed	2.079	.153	-2.311	79	.023	-3.131	1.354	-5.827	-.435
	Equal variances not assumed			-2.303	71.913	.024	-3.131	1.359	-5.841	-.421
Bh	Equal variances assumed	.208	.649	-2.329	87	.022	-1.648	.708	-3.054	-.242
	Equal variances not assumed			-2.334	86.996	.022	-1.648	.706	-3.051	-.245
Rh	Equal variances assumed	.332	.566	-2.504	75	.014	-3.527	1.408	-6.333	-.721
	Equal variances not assumed			-2.500	73.234	.015	-3.527	1.411	-6.339	-.715
L2	Equal variances assumed	.076	.783	-3.079	82	.003	-5.288	1.718	-8.705	-1.871
	Equal variances not assumed			-3.079	81.816	.003	-5.288	1.718	-8.705	-1.871

Table 4.2.4: ANOVA showing significant differences in mean mandible measurements among males and females between each time period.

MF			Sum of Squares	df	Mean Square	F	Sig.
Female	CorB	Between Groups	181.641	5	36.328	.545	.742
		Within Groups	10139.536	152	66.707		
		Total	10321.177	157			
	ConB	Between Groups	523.718	5	104.744	1.243	.293
		Within Groups	10450.536	124	84.279		
		Total	10974.254	129			
	L1	Between Groups	397.979	5	79.596	1.491	.193
		Within Groups	13027.096	244	53.390		
		Total	13425.076	249			
	Bl	Between Groups	756.011	5	151.202	5.539	.000
		Within Groups	6743.090	247	27.300		
		Total	7499.101	252			
	Bh	Between Groups	108.941	5	21.788	2.226	.052
		Within Groups	2496.359	255	9.790		
		Total	2605.300	260			
	Rh	Between Groups	150.280	5	30.056	.957	.445
		Within Groups	7631.270	243	31.404		
		Total	7781.550	248			
	L2	Between Groups	46.284	5	9.257	.263	.933
		Within Groups	8597.091	244	35.234		
		Total	8643.374	249			
Male	CorB	Between Groups	1093.691	5	218.738	3.248	.008
		Within Groups	10437.088	155	67.336		
		Total	11530.779	160			
	ConB	Between Groups	712.822	5	142.564	2.538	.031
		Within Groups	8199.843	146	56.163		
		Total	8912.665	151			
	L1	Between Groups	407.955	5	81.591	1.041	.394
		Within Groups	23834.354	304	78.402		
		Total	24242.310	309			
	Bl	Between Groups	401.017	5	80.203	2.671	.022
		Within Groups	9338.313	311	30.027		
		Total	9739.330	316			
	Bh	Between Groups	208.783	5	41.757	3.612	.003
		Within Groups	3664.637	317	11.560		
		Total	3873.419	322			

MF			Sum of Squares	df	Mean Square	F	Sig.
	Rh	Between Groups	164.517	5	32.903	.997	.420
		Within Groups	10264.616	311	33.005		
		Total	10429.133	316			
	L2	Between Groups	124.757	5	24.951	.613	.690
		Within Groups	12366.959	304	40.681		
		Total	12491.715	309			

Table 4.2.5: Boneferroni test showing significant differences in mean mandible measurements aamong males and females and between each time period

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
.	L1	Neolithic	IronBronze Age	-4.861	4.294	1	-17.66	7.93
			Roman	-6.471	4.38	1	-19.52	6.58
			AngloSaxon	-6.165	4.084	1	-18.34	6.01
			Medieval	-4.675	4.09	1	-16.86	7.51
			Postmedieval	-2.938	4.198	1	-15.45	9.57
		IronBronze Age	Neolithic	4.861	4.294	1	-7.93	17.66
			Roman	-1.61	2.454	1	-8.92	5.7
			AngloSaxon	-1.304	1.874	1	-6.89	4.28
			Medieval	0.187	1.888	1	-5.44	5.81
			Postmedieval	1.923	2.111	1	-4.37	8.21
		Roman	Neolithic	6.471	4.38	1	-6.58	19.52
			IronBronze Age	1.61	2.454	1	-5.7	8.92
			AngloSaxon	0.307	2.065	1	-5.85	6.46
			Medieval	1.797	2.077	1	-4.39	7.99
			Postmedieval	3.533	2.282	1	-3.27	10.33
		AngloSaxon	Neolithic	6.165	4.084	1	-6.01	18.34
			IronBronze Age	1.304	1.874	1	-4.28	6.89
			Roman	-0.307	2.065	1	-6.46	5.85
			Medieval	1.49	1.344	1	-2.52	5.5
			Postmedieval	3.226	1.644	0.771	-1.67	8.12
		Medieval	Neolithic	4.675	4.09	1	-7.51	16.86
			IronBronze Age	-0.187	1.888	1	-5.81	5.44
			Roman	-1.797	2.077	1	-7.99	4.39
			AngloSaxon	-1.49	1.344	1	-5.5	2.52
			Postmedieval	1.736	1.659	1	-3.21	6.68
		Postmedieval	Neolithic	2.938	4.198	1	-9.57	15.45
			IronBronze Age	-1.923	2.111	1	-8.21	4.37
			Roman	-3.533	2.282	1	-10.33	3.27

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-3.226	1.644	0.771	-8.12	1.67
			Medieval	-1.736	1.659	1	-6.68	3.21
	BI	Neolithic	IronBronze Age	0.465	3.038	1	-8.59	9.52
			Roman	1.287	3.077	1	-7.88	10.45
			AngloSaxon	-1.748	2.83	1	-10.18	6.68
			Medieval	0.61	2.839	1	-7.85	9.07
			Postmedieval	2.238	2.936	1	-6.51	10.99
		IronBronze Age	Neolithic	-0.465	3.038	1	-9.52	8.59
			Roman	0.822	1.937	1	-4.95	6.59
			AngloSaxon	-2.213	1.514	1	-6.72	2.3
			Medieval	0.145	1.531	1	-4.42	4.71
			Postmedieval	1.774	1.705	1	-3.31	6.85
		Roman	Neolithic	-1.287	3.077	1	-10.45	7.88
			IronBronze Age	-0.822	1.937	1	-6.59	4.95
			AngloSaxon	-3.035	1.59	0.87	-7.77	1.7
			Medieval	-0.677	1.606	1	-5.46	4.11
			Postmedieval	0.952	1.773	1	-4.33	6.23
		AngloSaxon	Neolithic	1.748	2.83	1	-6.68	10.18
			IronBronze Age	2.213	1.514	1	-2.3	6.72
			Roman	3.035	1.59	0.87	-1.7	7.77
			Medieval	2.358	1.058	0.409	-0.79	5.51
			Postmedieval	3.987*	1.297	0.037	0.12	7.85
		Medieval	Neolithic	-0.61	2.839	1	-9.07	7.85
			IronBronze Age	-0.145	1.531	1	-4.71	4.42
			Roman	0.677	1.606	1	-4.11	5.46
			AngloSaxon	-2.358	1.058	0.409	-5.51	0.79
			Postmedieval	1.629	1.318	1	-2.3	5.55
		Postmedieval	Neolithic	-2.238	2.936	1	-10.99	6.51
			IronBronze Age	-1.774	1.705	1	-6.85	3.31
			Roman	-0.952	1.773	1	-6.23	4.33

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-3.987*	1.297	0.037	-7.85	-0.12
			Medieval	-1.629	1.318	1	-5.55	2.3
	Bh	Neolithic	IronBronze Age	1.178	2.076	1	-5.01	7.36
			Roman	0.033	2.105	1	-6.24	6.3
			AngloSaxon	0.632	1.972	1	-5.24	6.51
			Medieval	1.418	1.977	1	-4.47	7.31
			Postmedieval	0.392	2.029	1	-5.65	6.44
		IronBronze Age	Neolithic	-1.178	2.076	1	-7.36	5.01
			Roman	-1.144	1.164	1	-4.61	2.32
			AngloSaxon	-0.546	0.902	1	-3.23	2.14
			Medieval	0.24	0.912	1	-2.48	2.96
			Postmedieval	-0.785	1.021	1	-3.83	2.25
		Roman	Neolithic	-0.033	2.105	1	-6.3	6.24
			IronBronze Age	1.144	1.164	1	-2.32	4.61
			AngloSaxon	0.599	0.968	1	-2.28	3.48
			Medieval	1.384	0.978	1	-1.53	4.3
			Postmedieval	0.359	1.079	1	-2.86	3.57
		AngloSaxon	Neolithic	-0.632	1.972	1	-6.51	5.24
			IronBronze Age	0.546	0.902	1	-2.14	3.23
			Roman	-0.599	0.968	1	-3.48	2.28
			Medieval	0.786	0.644	1	-1.13	2.7
			Postmedieval	-0.24	0.79	1	-2.59	2.11
		Medieval	Neolithic	-1.418	1.977	1	-7.31	4.47
			IronBronze Age	-0.24	0.912	1	-2.96	2.48
			Roman	-1.384	0.978	1	-4.3	1.53
			AngloSaxon	-0.786	0.644	1	-2.7	1.13
			Postmedieval	-1.025	0.802	1	-3.41	1.36
		Postmedieval	Neolithic	-0.392	2.029	1	-6.44	5.65
			IronBronze Age	0.785	1.021	1	-2.25	3.83
			Roman	-0.359	1.079	1	-3.57	2.86

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	0.24	0.79	1	-2.11	2.59
			Medieval	1.025	0.802	1	-1.36	3.41
	Rh	Neolithic	IronBronze Age	0.544	3.716	1	-10.53	11.61
			Roman	-3.193	3.745	1	-14.35	7.96
			AngloSaxon	-2.123	3.385	1	-12.21	7.96
			Medieval	-0.804	3.399	1	-10.93	9.32
			Postmedieval	1.627	3.542	1	-8.92	12.18
		IronBronze Age	Neolithic	-0.544	3.716	1	-11.61	10.53
			Roman	-3.737	2.606	1	-11.5	4.03
			AngloSaxon	-2.667	2.056	1	-8.79	3.46
			Medieval	-1.348	2.078	1	-7.54	4.84
			Postmedieval	1.083	2.304	1	-5.78	7.95
		Roman	Neolithic	3.193	3.745	1	-7.96	14.35
			IronBronze Age	3.737	2.606	1	-4.03	11.5
			AngloSaxon	1.07	2.108	1	-5.21	7.35
			Medieval	2.389	2.13	1	-3.96	8.74
			Postmedieval	4.82	2.351	0.63	-2.18	11.83
		AngloSaxon	Neolithic	2.123	3.385	1	-7.96	12.21
			IronBronze Age	2.667	2.056	1	-3.46	8.79
			Roman	-1.07	2.108	1	-7.35	5.21
			Medieval	1.319	1.404	1	-2.86	5.5
			Postmedieval	3.75	1.721	0.462	-1.38	8.88
		Medieval	Neolithic	0.804	3.399	1	-9.32	10.93
			IronBronze Age	1.348	2.078	1	-4.84	7.54
			Roman	-2.389	2.13	1	-8.74	3.96
			AngloSaxon	-1.319	1.404	1	-5.5	2.86
			Postmedieval	2.431	1.748	1	-2.78	7.64
		Postmedieval	Neolithic	-1.627	3.542	1	-12.18	8.92
			IronBronze Age	-1.083	2.304	1	-7.95	5.78
			Roman	-4.82	2.351	0.63	-11.83	2.18

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-3.75	1.721	0.462	-8.88	1.38
			Medieval	-2.431	1.748	1	-7.64	2.78
	L2	Neolithic	IronBronze Age	-3.422	4.586	1	-17.09	10.25
			Roman	-1.686	4.651	1	-15.55	12.18
			AngloSaxon	-5.435	4.429	1	-18.64	7.77
			Medieval	-2.563	4.435	1	-15.78	10.66
			Postmedieval	-2.988	4.528	1	-16.48	10.51
		IronBronze Age	Neolithic	3.422	4.586	1	-10.25	17.09
			Roman	1.737	2.193	1	-4.8	8.27
			AngloSaxon	-2.012	1.671	1	-6.99	2.97
			Medieval	0.859	1.687	1	-4.17	5.89
			Postmedieval	0.435	1.918	1	-5.28	6.15
		Roman	Neolithic	1.686	4.651	1	-12.18	15.55
			IronBronze Age	-1.737	2.193	1	-8.27	4.8
			AngloSaxon	-3.749	1.842	0.652	-9.24	1.74
			Medieval	-0.877	1.856	1	-6.41	4.66
			Postmedieval	-1.302	2.069	1	-7.47	4.87
		AngloSaxon	Neolithic	5.435	4.429	1	-7.77	18.64
			IronBronze Age	2.012	1.671	1	-2.97	6.99
			Roman	3.749	1.842	0.652	-1.74	9.24
			Medieval	2.872	1.196	0.263	-0.69	6.44
			Postmedieval	2.447	1.505	1	-2.04	6.93
		Medieval	Neolithic	2.563	4.435	1	-10.66	15.78
			IronBronze Age	-0.859	1.687	1	-5.89	4.17
			Roman	0.877	1.856	1	-4.66	6.41
			AngloSaxon	-2.872	1.196	0.263	-6.44	0.69
			Postmedieval	-0.425	1.523	1	-4.96	4.11
		Postmedieval	Neolithic	2.988	4.528	1	-10.51	16.48
			IronBronze Age	-0.435	1.918	1	-6.15	5.28
			Roman	1.302	2.069	1	-4.87	7.47

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-2.447	1.505	1	-6.93	2.04
			Medieval	0.425	1.523	1	-4.11	4.96
Female	L1	Neolithic	IronBronze Age	-4.568	3.58	1	-15.18	6.04
			Roman	-5.137	3.471	1	-15.43	5.15
			AngloSaxon	-4.426	3.487	1	-14.76	5.91
			Medieval	-4.745	3.399	1	-14.82	5.33
			Postmedieval	-2.364	3.364	1	-12.33	7.61
		IronBronze Age	Neolithic	4.568	3.58	1	-6.04	15.18
			Roman	-0.569	1.872	1	-6.12	4.98
			AngloSaxon	0.142	1.902	1	-5.5	5.78
			Medieval	-0.177	1.735	1	-5.32	4.97
			Postmedieval	2.204	1.665	1	-2.73	7.14
		Roman	Neolithic	5.137	3.471	1	-5.15	15.43
			IronBronze Age	0.569	1.872	1	-4.98	6.12
			AngloSaxon	0.711	1.689	1	-4.29	5.72
			Medieval	0.393	1.498	1	-4.05	4.83
			Postmedieval	2.774	1.416	0.769	-1.42	6.97
		AngloSaxon	Neolithic	4.426	3.487	1	-5.91	14.76
			IronBronze Age	-0.142	1.902	1	-5.78	5.5
			Roman	-0.711	1.689	1	-5.72	4.29
			Medieval	-0.319	1.536	1	-4.87	4.23
			Postmedieval	2.062	1.456	1	-2.25	6.38
		Medieval	Neolithic	4.745	3.399	1	-5.33	14.82
			IronBronze Age	0.177	1.735	1	-4.97	5.32
			Roman	-0.393	1.498	1	-4.83	4.05
			AngloSaxon	0.319	1.536	1	-4.23	4.87
			Postmedieval	2.381	1.229	0.808	-1.26	6.02
		Postmedieval	Neolithic	2.364	3.364	1	-7.61	12.33
			IronBronze Age	-2.204	1.665	1	-7.14	2.73
			Roman	-2.774	1.416	0.769	-6.97	1.42

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-2.062	1.456	1	-6.38	2.25
			Medieval	-2.381	1.229	0.808	-6.02	1.26
	BI	Neolithic	IronBronze Age	0.28	2.56	1	-7.31	7.87
			Roman	-0.843	2.478	1	-8.19	6.5
			AngloSaxon	-0.643	2.49	1	-8.02	6.74
			Medieval	0.644	2.428	1	-6.55	7.84
			Postmedieval	3.446	2.406	1	-3.69	10.58
		IronBronze Age	Neolithic	-0.28	2.56	1	-7.87	7.31
			Roman	-1.123	1.332	1	-5.07	2.83
			AngloSaxon	-0.923	1.353	1	-4.93	3.09
			Medieval	0.364	1.235	1	-3.3	4.03
			Postmedieval	3.166	1.192	0.126	-0.37	6.7
		Roman	Neolithic	0.843	2.478	1	-6.5	8.19
			IronBronze Age	1.123	1.332	1	-2.83	5.07
			AngloSaxon	0.199	1.192	1	-3.33	3.73
			Medieval	1.487	1.056	1	-1.64	4.62
			Postmedieval	4.288*	1.006	0	1.31	7.27
		AngloSaxon	Neolithic	0.643	2.49	1	-6.74	8.02
			IronBronze Age	0.923	1.353	1	-3.09	4.93
			Roman	-0.199	1.192	1	-3.73	3.33
			Medieval	1.288	1.082	1	-1.92	4.5
			Postmedieval	4.089*	1.033	0.001	1.03	7.15
		Medieval	Neolithic	-0.644	2.428	1	-7.84	6.55
			IronBronze Age	-0.364	1.235	1	-4.03	3.3
			Roman	-1.487	1.056	1	-4.62	1.64
			AngloSaxon	-1.288	1.082	1	-4.5	1.92
			Postmedieval	2.801*	0.873	0.023	0.21	5.39
		Postmedieval	Neolithic	-3.446	2.406	1	-10.58	3.69
			IronBronze Age	-3.166	1.192	0.126	-6.7	0.37
			Roman	-4.288*	1.006	0	-7.27	-1.31

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-4.089*	1.033	0.001	-7.15	-1.03
			Medieval	-2.801*	0.873	0.023	-5.39	-0.21
	Bh	Neolithic	IronBronze Age	-1.185	1.422	1	-5.4	3.03
			Roman	-1.39	1.358	1	-5.41	2.63
			AngloSaxon	-0.79	1.377	1	-4.87	3.29
			Medieval	0.016	1.337	1	-3.95	3.98
			Postmedieval	0.207	1.322	1	-3.71	4.12
		IronBronze Age	Neolithic	1.185	1.422	1	-3.03	5.4
			Roman	-0.205	0.777	1	-2.51	2.1
			AngloSaxon	0.395	0.81	1	-2.01	2.8
			Medieval	1.201	0.74	1	-0.99	3.39
			Postmedieval	1.392	0.713	0.778	-0.72	3.5
		Roman	Neolithic	1.39	1.358	1	-2.63	5.41
			IronBronze Age	0.205	0.777	1	-2.1	2.51
			AngloSaxon	0.6	0.691	1	-1.45	2.65
			Medieval	1.406	0.607	0.32	-0.39	3.2
			Postmedieval	1.597	0.574	0.087	-0.1	3.3
		AngloSaxon	Neolithic	0.79	1.377	1	-3.29	4.87
			IronBronze Age	-0.395	0.81	1	-2.8	2.01
			Roman	-0.6	0.691	1	-2.65	1.45
			Medieval	0.806	0.648	1	-1.11	2.73
			Postmedieval	0.997	0.617	1	-0.83	2.83
		Medieval	Neolithic	-0.016	1.337	1	-3.98	3.95
			IronBronze Age	-1.201	0.74	1	-3.39	0.99
			Roman	-1.406	0.607	0.32	-3.2	0.39
			AngloSaxon	-0.806	0.648	1	-2.73	1.11
			Postmedieval	0.191	0.521	1	-1.35	1.74
		Postmedieval	Neolithic	-0.207	1.322	1	-4.12	3.71
			IronBronze Age	-1.392	0.713	0.778	-3.5	0.72
			Roman	-1.597	0.574	0.087	-3.3	0.1

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-0.997	0.617	1	-2.83	0.83
			Medieval	-0.191	0.521	1	-1.74	1.35
	Rh	Neolithic	IronBronze Age	-0.696	2.538	1	-8.22	6.83
			Roman	-2.747	2.462	1	-10.05	4.55
			AngloSaxon	-2.997	2.476	1	-10.34	4.34
			Medieval	-3.033	2.399	1	-10.15	4.08
			Postmedieval	-2.54	2.368	1	-9.56	4.48
		IronBronze Age	Neolithic	0.696	2.538	1	-6.83	8.22
			Roman	-2.051	1.426	1	-6.28	2.18
			AngloSaxon	-2.301	1.451	1	-6.6	2
			Medieval	-2.337	1.316	1	-6.24	1.56
			Postmedieval	-1.844	1.258	1	-5.57	1.88
		Roman	Neolithic	2.747	2.462	1	-4.55	10.05
			IronBronze Age	2.051	1.426	1	-2.18	6.28
			AngloSaxon	-0.25	1.313	1	-4.14	3.64
			Medieval	-0.286	1.162	1	-3.73	3.16
			Postmedieval	0.207	1.096	1	-3.04	3.45
		AngloSaxon	Neolithic	2.997	2.476	1	-4.34	10.34
			IronBronze Age	2.301	1.451	1	-2	6.6
			Roman	0.25	1.313	1	-3.64	4.14
			Medieval	-0.036	1.192	1	-3.57	3.5
			Postmedieval	0.457	1.127	1	-2.89	3.8
		Medieval	Neolithic	3.033	2.399	1	-4.08	10.15
			IronBronze Age	2.337	1.316	1	-1.56	6.24
			Roman	0.286	1.162	1	-3.16	3.73
			AngloSaxon	0.036	1.192	1	-3.5	3.57
			Postmedieval	0.493	0.947	1	-2.32	3.3
		Postmedieval	Neolithic	2.54	2.368	1	-4.48	9.56
			IronBronze Age	1.844	1.258	1	-1.88	5.57
			Roman	-0.207	1.096	1	-3.45	3.04

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-0.457	1.127	1	-3.8	2.89
			Medieval	-0.493	0.947	1	-3.3	2.32
	L2	Neolithic	IronBronze Age	2.316	2.908	1	-6.3	10.94
			Roman	2.869	2.808	1	-5.46	11.19
			AngloSaxon	2.129	2.838	1	-6.28	10.54
			Medieval	2.488	2.758	1	-5.69	10.66
			Postmedieval	2.714	2.736	1	-5.4	10.83
		IronBronze Age	Neolithic	-2.316	2.908	1	-10.94	6.3
			Roman	0.553	1.499	1	-3.89	5
			AngloSaxon	-0.187	1.554	1	-4.8	4.42
			Medieval	0.172	1.403	1	-3.99	4.33
			Postmedieval	0.398	1.36	1	-3.63	4.43
		Roman	Neolithic	-2.869	2.808	1	-11.19	5.46
			IronBronze Age	-0.553	1.499	1	-5	3.89
			AngloSaxon	-0.74	1.359	1	-4.77	3.29
			Medieval	-0.381	1.182	1	-3.89	3.12
			Postmedieval	-0.155	1.131	1	-3.51	3.2
		AngloSaxon	Neolithic	-2.129	2.838	1	-10.54	6.28
			IronBronze Age	0.187	1.554	1	-4.42	4.8
			Roman	0.74	1.359	1	-3.29	4.77
			Medieval	0.359	1.251	1	-3.35	4.07
			Postmedieval	0.585	1.203	1	-2.98	4.15
		Medieval	Neolithic	-2.488	2.758	1	-10.66	5.69
			IronBronze Age	-0.172	1.403	1	-4.33	3.99
			Roman	0.381	1.182	1	-3.12	3.89
			AngloSaxon	-0.359	1.251	1	-4.07	3.35
			Postmedieval	0.226	1	1	-2.74	3.19
		Postmedieval	Neolithic	-2.714	2.736	1	-10.83	5.4
			IronBronze Age	-0.398	1.36	1	-4.43	3.63
			Roman	0.155	1.131	1	-3.2	3.51

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-0.585	1.203	1	-4.15	2.98
			Medieval	-0.226	1	1	-3.19	2.74
	CorB	Neolithic	IronBronze Age	1.008	5.139	1	-14.32	16.33
			Roman	0.39	4.962	1	-14.41	15.19
			AngloSaxon	0.533	5.014	1	-14.42	15.49
			Medieval	-1.182	4.898	1	-15.79	13.43
			Postmedieval	1.673	4.855	1	-12.81	16.15
		IronBronze Age	Neolithic	-1.008	5.139	1	-16.33	14.32
			Roman	-0.618	2.56	1	-8.25	7.02
			AngloSaxon	-0.475	2.659	1	-8.4	7.45
			Medieval	-2.191	2.434	1	-9.45	5.07
			Postmedieval	0.665	2.346	1	-6.33	7.66
		Roman	Neolithic	-0.39	4.962	1	-15.19	14.41
			IronBronze Age	0.618	2.56	1	-7.02	8.25
			AngloSaxon	0.143	2.298	1	-6.71	7
			Medieval	-1.573	2.034	1	-7.64	4.49
			Postmedieval	1.283	1.928	1	-4.47	7.03
		AngloSaxon	Neolithic	-0.533	5.014	1	-15.49	14.42
			IronBronze Age	0.475	2.659	1	-7.45	8.4
			Roman	-0.143	2.298	1	-7	6.71
			Medieval	-1.716	2.158	1	-8.15	4.72
			Postmedieval	1.14	2.058	1	-5	7.28
		Medieval	Neolithic	1.182	4.898	1	-13.43	15.79
			IronBronze Age	2.191	2.434	1	-5.07	9.45
			Roman	1.573	2.034	1	-4.49	7.64
			AngloSaxon	1.716	2.158	1	-4.72	8.15
			Postmedieval	2.856	1.758	1	-2.39	8.1
		Postmedieval	Neolithic	-1.673	4.855	1	-16.15	12.81
			IronBronze Age	-0.665	2.346	1	-7.66	6.33
			Roman	-1.283	1.928	1	-7.03	4.47

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-1.14	2.058	1	-7.28	5
			Medieval	-2.856	1.758	1	-8.1	2.39
	ConB	Neolithic	IronBronze Age	4.188	5.98	1	-13.71	22.09
			Roman	-2.167	5.703	1	-19.24	14.9
			AngloSaxon	-2.119	5.703	1	-19.19	14.95
			Medieval	1.521	5.536	1	-15.05	18.09
			Postmedieval	1.849	5.474	1	-14.54	18.23
		IronBronze Age	Neolithic	-4.188	5.98	1	-22.09	13.71
			Roman	-6.355	3.478	1	-16.77	4.06
			AngloSaxon	-6.307	3.478	1	-16.72	4.1
			Medieval	-2.667	3.196	1	-12.23	6.9
			Postmedieval	-2.339	3.088	1	-11.58	6.9
		Roman	Neolithic	2.167	5.703	1	-14.9	19.24
			IronBronze Age	6.355	3.478	1	-4.06	16.77
			AngloSaxon	0.047	2.978	1	-8.87	8.96
			Medieval	3.688	2.644	1	-4.23	11.6
			Postmedieval	4.016	2.512	1	-3.5	11.53
		AngloSaxon	Neolithic	2.119	5.703	1	-14.95	19.19
			IronBronze Age	6.307	3.478	1	-4.1	16.72
			Roman	-0.047	2.978	1	-8.96	8.87
			Medieval	3.641	2.644	1	-4.27	11.55
			Postmedieval	3.968	2.512	1	-3.55	11.49
		Medieval	Neolithic	-1.521	5.536	1	-18.09	15.05
			IronBronze Age	2.667	3.196	1	-6.9	12.23
			Roman	-3.688	2.644	1	-11.6	4.23
			AngloSaxon	-3.641	2.644	1	-11.55	4.27
			Postmedieval	0.328	2.104	1	-5.97	6.63
		Postmedieval	Neolithic	-1.849	5.474	1	-18.23	14.54
			IronBronze Age	2.339	3.088	1	-6.9	11.58
			Roman	-4.016	2.512	1	-11.53	3.5

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-3.968	2.512	1	-11.49	3.55
			Medieval	-0.328	2.104	1	-6.63	5.97
Male	L1	Neolithic	IronBronze Age	1.336	3.897	1	-10.19	12.87
			Roman	-0.53	3.87	1	-11.98	10.92
			AngloSaxon	-0.917	3.83	1	-12.25	10.41
			Medieval	0.911	3.74	1	-10.15	11.98
			Postmedieval	2.183	3.731	1	-8.86	13.22
		IronBronze Age	Neolithic	-1.336	3.897	1	-12.87	10.19
			Roman	-1.867	2.008	1	-7.81	4.07
			AngloSaxon	-2.254	1.928	1	-7.96	3.45
			Medieval	-0.425	1.744	1	-5.58	4.73
			Postmedieval	0.846	1.724	1	-4.25	5.95
		Roman	Neolithic	0.53	3.87	1	-10.92	11.98
			IronBronze Age	1.867	2.008	1	-4.07	7.81
			AngloSaxon	-0.387	1.874	1	-5.93	5.16
			Medieval	1.442	1.684	1	-3.54	6.42
			Postmedieval	2.713	1.663	1	-2.21	7.63
		AngloSaxon	Neolithic	0.917	3.83	1	-10.41	12.25
			IronBronze Age	2.254	1.928	1	-3.45	7.96
			Roman	0.387	1.874	1	-5.16	5.93
			Medieval	1.829	1.588	1	-2.87	6.53
			Postmedieval	3.1	1.566	0.73	-1.53	7.73
		Medieval	Neolithic	-0.911	3.74	1	-11.98	10.15
			IronBronze Age	0.425	1.744	1	-4.73	5.58
			Roman	-1.442	1.684	1	-6.42	3.54
			AngloSaxon	-1.829	1.588	1	-6.53	2.87
			Postmedieval	1.271	1.332	1	-2.67	5.21
		Postmedieval	Neolithic	-2.183	3.731	1	-13.22	8.86
			IronBronze Age	-0.846	1.724	1	-5.95	4.25
			Roman	-2.713	1.663	1	-7.63	2.21

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-3.1	1.566	0.73	-7.73	1.53
			Medieval	-1.271	1.332	1	-5.21	2.67
	BI	Neolithic	IronBronze Age	0.308	2.407	1	-6.81	7.43
			Roman	1.877	2.395	1	-5.21	8.96
			AngloSaxon	2.104	2.363	1	-4.88	9.09
			Medieval	3.722	2.312	1	-3.12	10.56
			Postmedieval	3.031	2.309	1	-3.8	9.86
		IronBronze Age	Neolithic	-0.308	2.407	1	-7.43	6.81
			Roman	1.569	1.234	1	-2.08	5.22
			AngloSaxon	1.796	1.169	1	-1.66	5.26
			Medieval	3.414*	1.064	0.022	0.27	6.56
			Postmedieval	2.723	1.057	0.156	-0.4	5.85
		Roman	Neolithic	-1.877	2.395	1	-8.96	5.21
			IronBronze Age	-1.569	1.234	1	-5.22	2.08
			AngloSaxon	0.227	1.144	1	-3.16	3.61
			Medieval	1.845	1.036	1	-1.22	4.91
			Postmedieval	1.154	1.029	1	-1.89	4.2
		AngloSaxon	Neolithic	-2.104	2.363	1	-9.09	4.88
			IronBronze Age	-1.796	1.169	1	-5.26	1.66
			Roman	-0.227	1.144	1	-3.61	3.16
			Medieval	1.618	0.958	1	-1.22	4.45
			Postmedieval	0.927	0.951	1	-1.88	3.74
		Medieval	Neolithic	-3.722	2.312	1	-10.56	3.12
			IronBronze Age	-3.414*	1.064	0.022	-6.56	-0.27
			Roman	-1.845	1.036	1	-4.91	1.22
			AngloSaxon	-1.618	0.958	1	-4.45	1.22
			Postmedieval	-0.69	0.817	1	-3.11	1.73
		Postmedieval	Neolithic	-3.031	2.309	1	-9.86	3.8
			IronBronze Age	-2.723	1.057	0.156	-5.85	0.4
			Roman	-1.154	1.029	1	-4.2	1.89

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-0.927	0.951	1	-3.74	1.88
			Medieval	0.69	0.817	1	-1.73	3.11
	Bh	Neolithic	IronBronze Age	1.418	1.494	1	-3	5.84
			Roman	1.795	1.482	1	-2.59	6.18
			AngloSaxon	1.512	1.466	1	-2.82	5.85
			Medieval	3.357	1.433	0.296	-0.88	7.59
			Postmedieval	2.06	1.433	1	-2.18	6.3
		IronBronze Age	Neolithic	-1.418	1.494	1	-5.84	3
			Roman	0.377	0.757	1	-1.86	2.62
			AngloSaxon	0.093	0.726	1	-2.05	2.24
			Medieval	1.938	0.656	0.05	0	3.88
			Postmedieval	0.641	0.656	1	-1.3	2.58
		Roman	Neolithic	-1.795	1.482	1	-6.18	2.59
			IronBronze Age	-0.377	0.757	1	-2.62	1.86
			AngloSaxon	-0.284	0.701	1	-2.36	1.79
			Medieval	1.561	0.628	0.202	-0.3	3.42
			Postmedieval	0.264	0.628	1	-1.59	2.12
		AngloSaxon	Neolithic	-1.512	1.466	1	-5.85	2.82
			IronBronze Age	-0.093	0.726	1	-2.24	2.05
			Roman	0.284	0.701	1	-1.79	2.36
			Medieval	1.845*	0.59	0.029	0.1	3.59
			Postmedieval	0.548	0.59	1	-1.2	2.29
		Medieval	Neolithic	-3.357	1.433	0.296	-7.59	0.88
			IronBronze Age	-1.938	0.656	0.05	-3.88	0
			Roman	-1.561	0.628	0.202	-3.42	0.3
			AngloSaxon	-1.845*	0.59	0.029	-3.59	-0.1
			Postmedieval	-1.297	0.501	0.152	-2.78	0.19
		Postmedieval	Neolithic	-2.06	1.433	1	-6.3	2.18
			IronBronze Age	-0.641	0.656	1	-2.58	1.3
			Roman	-0.264	0.628	1	-2.12	1.59

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-0.548	0.59	1	-2.29	1.2
			Medieval	1.297	0.501	0.152	-0.19	2.78
	Rh	Neolithic	IronBronze Age	0.261	2.533	1	-7.23	7.75
			Roman	0.576	2.519	1	-6.88	8.03
			AngloSaxon	-1.031	2.472	1	-8.34	6.28
			Medieval	0.68	2.424	1	-6.49	7.85
			Postmedieval	-0.766	2.419	1	-7.92	6.39
		IronBronze Age	Neolithic	-0.261	2.533	1	-7.75	7.23
			Roman	0.315	1.328	1	-3.61	4.24
			AngloSaxon	-1.293	1.236	1	-4.95	2.36
			Medieval	0.418	1.137	1	-2.94	3.78
			Postmedieval	-1.027	1.126	1	-4.36	2.3
		Roman	Neolithic	-0.576	2.519	1	-8.03	6.88
			IronBronze Age	-0.315	1.328	1	-4.24	3.61
			AngloSaxon	-1.607	1.207	1	-5.18	1.96
			Medieval	0.104	1.105	1	-3.17	3.37
			Postmedieval	-1.342	1.094	1	-4.58	1.9
		AngloSaxon	Neolithic	1.031	2.472	1	-6.28	8.34
			IronBronze Age	1.293	1.236	1	-2.36	4.95
			Roman	1.607	1.207	1	-1.96	5.18
			Medieval	1.711	0.993	1	-1.23	4.65
			Postmedieval	0.266	0.981	1	-2.64	3.17
		Medieval	Neolithic	-0.68	2.424	1	-7.85	6.49
			IronBronze Age	-0.418	1.137	1	-3.78	2.94
			Roman	-0.104	1.105	1	-3.37	3.17
			AngloSaxon	-1.711	0.993	1	-4.65	1.23
			Postmedieval	-1.446	0.852	1	-3.97	1.08
		Postmedieval	Neolithic	0.766	2.419	1	-6.39	7.92
			IronBronze Age	1.027	1.126	1	-2.3	4.36
			Roman	1.342	1.094	1	-1.9	4.58

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-0.266	0.981	1	-3.17	2.64
			Medieval	1.446	0.852	1	-1.08	3.97
	L2	Neolithic	IronBronze Age	-0.214	2.807	1	-8.52	8.09
			Roman	-2.36	2.784	1	-10.6	5.88
			AngloSaxon	-1.437	2.759	1	-9.6	6.73
			Medieval	-1.019	2.694	1	-8.99	6.95
			Postmedieval	-1.736	2.688	1	-9.69	6.22
		IronBronze Age	Neolithic	0.214	2.807	1	-8.09	8.52
			Roman	-2.146	1.438	1	-6.4	2.11
			AngloSaxon	-1.223	1.389	1	-5.33	2.89
			Medieval	-0.805	1.256	1	-4.52	2.91
			Postmedieval	-1.523	1.244	1	-5.2	2.16
		Roman	Neolithic	2.36	2.784	1	-5.88	10.6
			IronBronze Age	2.146	1.438	1	-2.11	6.4
			AngloSaxon	0.923	1.341	1	-3.05	4.89
			Medieval	1.341	1.203	1	-2.22	4.9
			Postmedieval	0.623	1.19	1	-2.9	4.14
		AngloSaxon	Neolithic	1.437	2.759	1	-6.73	9.6
			IronBronze Age	1.223	1.389	1	-2.89	5.33
			Roman	-0.923	1.341	1	-4.89	3.05
			Medieval	0.418	1.144	1	-2.97	3.8
			Postmedieval	-0.3	1.13	1	-3.64	3.04
		Medieval	Neolithic	1.019	2.694	1	-6.95	8.99
			IronBronze Age	0.805	1.256	1	-2.91	4.52
			Roman	-1.341	1.203	1	-4.9	2.22
			AngloSaxon	-0.418	1.144	1	-3.8	2.97
			Postmedieval	-0.717	0.962	1	-3.56	2.13
		Postmedieval	Neolithic	1.736	2.688	1	-6.22	9.69
			IronBronze Age	1.523	1.244	1	-2.16	5.2
			Roman	-0.623	1.19	1	-4.14	2.9

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	0.3	1.13	1	-3.04	3.64
			Medieval	0.717	0.962	1	-2.13	3.56
	CorB	Neolithic	IronBronze Age	4.233	5.117	1	-11.02	19.49
			Roman	-5.643	5.065	1	-20.74	9.46
			AngloSaxon	-0.813	5.025	1	-15.79	14.17
			Medieval	-1.585	4.937	1	-16.3	13.13
			Postmedieval	0.732	4.855	1	-13.74	15.21
		IronBronze Age	Neolithic	-4.233	5.117	1	-19.49	11.02
			Roman	-9.876*	2.636	0.004	-17.73	-2.02
			AngloSaxon	-5.046	2.559	0.756	-12.67	2.58
			Medieval	-5.818	2.38	0.234	-12.91	1.28
			Postmedieval	-3.502	2.205	1	-10.08	3.07
		Roman	Neolithic	5.643	5.065	1	-9.46	20.74
			IronBronze Age	9.876*	2.636	0.004	2.02	17.73
			AngloSaxon	4.83	2.452	0.759	-2.48	12.14
			Medieval	4.058	2.265	1	-2.69	10.81
			Postmedieval	6.375*	2.081	0.039	0.17	12.58
		AngloSaxon	Neolithic	0.813	5.025	1	-14.17	15.79
			IronBronze Age	5.046	2.559	0.756	-2.58	12.67
			Roman	-4.83	2.452	0.759	-12.14	2.48
			Medieval	-0.772	2.175	1	-7.26	5.71
			Postmedieval	1.544	1.982	1	-4.36	7.45
		Medieval	Neolithic	1.585	4.937	1	-13.13	16.3
			IronBronze Age	5.818	2.38	0.234	-1.28	12.91
			Roman	-4.058	2.265	1	-10.81	2.69
			AngloSaxon	0.772	2.175	1	-5.71	7.26
			Postmedieval	2.316	1.745	1	-2.89	7.52
		Postmedieval	Neolithic	-0.732	4.855	1	-15.21	13.74
			IronBronze Age	3.502	2.205	1	-3.07	10.08
			Roman	-6.375*	2.081	0.039	-12.58	-0.17

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-1.544	1.982	1	-7.45	4.36
			Medieval	-2.316	1.745	1	-7.52	2.89
	ConB	Neolithic	IronBronze Age	-0.872	4.143	1	-13.23	11.49
			Roman	-2.007	4.249	1	-14.69	10.67
			AngloSaxon	-0.092	4.047	1	-12.17	11.99
			Medieval	4.416	3.939	1	-7.34	16.17
			Postmedieval	2.476	3.883	1	-9.11	14.07
		IronBronze Age	Neolithic	0.872	4.143	1	-11.49	13.23
			Roman	-1.135	2.671	1	-9.1	6.83
			AngloSaxon	0.781	2.337	1	-6.19	7.75
			Medieval	5.288	2.144	0.222	-1.11	11.69
			Postmedieval	3.348	2.04	1	-2.74	9.44
		Roman	Neolithic	2.007	4.249	1	-10.67	14.69
			IronBronze Age	1.135	2.671	1	-6.83	9.1
			AngloSaxon	1.915	2.52	1	-5.61	9.44
			Medieval	6.423	2.343	0.103	-0.57	13.42
			Postmedieval	4.483	2.248	0.719	-2.22	11.19
		AngloSaxon	Neolithic	0.092	4.047	1	-11.99	12.17
			IronBronze Age	-0.781	2.337	1	-7.75	6.19
			Roman	-1.915	2.52	1	-9.44	5.61
			Medieval	4.507	1.954	0.337	-1.32	10.34
			Postmedieval	2.568	1.839	1	-2.92	8.05
		Medieval	Neolithic	-4.416	3.939	1	-16.17	7.34
			IronBronze Age	-5.288	2.144	0.222	-11.69	1.11
			Roman	-6.423	2.343	0.103	-13.42	0.57
			AngloSaxon	-4.507	1.954	0.337	-10.34	1.32
			Postmedieval	-1.94	1.587	1	-6.68	2.8
		Postmedieval	Neolithic	-2.476	3.883	1	-14.07	9.11
			IronBronze Age	-3.348	2.04	1	-9.44	2.74
			Roman	-4.483	2.248	0.719	-11.19	2.22

MF	Dependent Variable	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
			AngloSaxon	-2.568	1.839	1	-8.05	2.92
			Medieval	1.94	1.587	1	-2.8	6.68

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

4.3 Mandible measurements – dental wear groups

Table 4.3.1: Results from a Shapiro-Wilk test for normality mandible measurements are normally distributed among females for each dental wear group. As with previous cases the Q-Q plots were analysed and it was determined that data were close enough to normally distributed to allow analysis of the mean.

Tests of Normality

MF		AgeGroup	Kolmogorov-Smirnov[a] Statistic	df	Sig.	Shapiro-Wilk Statistic	df	Sig.
.	CorB	1.00	.162	23	.121	.935	23	.141
		2.00	.164	31	.032	.916	31	.019
		3.00	.286	5	.200*	.813	5	.103
	ConB	1.00	.239	23	.001	.942	23	.199
		2.00	.140	31	.126	.939	31	.076
		3.00	.348	5	.048	.770	5	.045
	L1	1.00	.171	23	.078	.934	23	.130
		2.00	.186	31	.008	.776	31	.000
		3.00	.395	5	.010	.708	5	.012
	Bl	1.00	.138	23	.200*	.960	23	.455
		2.00	.081	31	.200*	.960	31	.285
		3.00	.261	5	.200*	.846	5	.181
	Bh	1.00	.118	23	.200*	.954	23	.347
		2.00	.116	31	.200*	.951	31	.166
		3.00	.207	5	.200*	.971	5	.880
	Rh	1.00	.120	23	.200*	.947	23	.258
		2.00	.144	31	.100	.942	31	.096
		3.00	.293	5	.185	.829	5	.137
	L2	1.00	.133	23	.200*	.954	23	.353
		2.00	.115	31	.200*	.972	31	.588
		3.00	.348	5	.047	.812	5	.100
Female	CorB	1.00	.100	35	.200*	.963	35	.283
		2.00	.096	41	.200*	.972	41	.398
		3.00	.223	9	.200*	.903	9	.270
	ConB	1.00	.150	35	.045	.913	35	.009
		2.00	.145	41	.031	.923	41	.008
		3.00	.314	9	.011	.663	9	.001
	L1	1.00	.152	35	.039	.865	35	.001
		2.00	.180	41	.002	.865	41	.000
		3.00	.152	9	.200*	.953	9	.724
	Bl	1.00	.122	35	.200*	.902	35	.004
		2.00	.109	41	.200*	.900	41	.002
		3.00	.175	9	.200*	.936	9	.536

Tests of Normality

MF		AgeGroup	Kolmogorov-Smirnov[a] Statistic	df	Sig.	Shapiro-Wilk Statistic	df	Sig.
	Bh	1.00	.119	35	.200*	.959	35	.219
		2.00	.091	41	.200*	.979	41	.623
		3.00	.227	9	.200*	.917	9	.364
	Rh	1.00	.108	35	.200*	.984	35	.872
		2.00	.116	41	.182	.959	41	.150
		3.00	.271	9	.056	.889	9	.193
	L2	1.00	.108	35	.200*	.967	35	.362
		2.00	.138	41	.048	.931	41	.015
		3.00	.202	9	.200*	.885	9	.175
Male	CorB	1.00	.145	36	.052	.907	36	.005
		2.00	.098	56	.200*	.951	56	.023
		3.00	.236	5	.200*	.835	5	.151
	ConB	1.00	.188	36	.002	.885	36	.001
		2.00	.126	56	.027	.908	56	.000
		3.00	.400	5	.009	.698	5	.009
	L1	1.00	.190	36	.002	.921	36	.014
		2.00	.198	56	.000	.900	56	.000
		3.00	.252	5	.200*	.865	5	.248
	Bl	1.00	.148	36	.044	.943	36	.061
		2.00	.168	56	.000	.861	56	.000
		3.00	.345	5	.053	.722	5	.016
	Bh	1.00	.120	36	.200*	.943	36	.064
		2.00	.081	56	.200*	.981	56	.539
		3.00	.275	5	.200*	.839	5	.161
	Rh	1.00	.146	36	.051	.966	36	.325
		2.00	.093	56	.200*	.984	56	.670
		3.00	.286	5	.200*	.760	5	.037
	L2	1.00	.110	36	.200*	.971	36	.448
		2.00	.068	56	.200*	.989	56	.873
		3.00	.255	5	.200*	.832	5	.143

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 4.3.2: Mean mandible measurements among males and females for each dental wear group

Report

MF	AgeGroup		CorB	ConB	L1	Bl	Bh	Rh	L2
.	1.00	Mean	100.18	114.15	105.78	83.16	29.45	61.41	79.31
		N	29	25	47	49	49	49	47
		Std. Deviation	11.072	8.650	7.012	6.327	2.843	7.357	6.860
	2.00	Mean	99.80	118.36	108.06	83.79	31.44	65.78	80.56
		N	46	41	80	81	82	80	80
		Std. Deviation	8.116	7.270	7.583	5.260	3.379	7.060	6.164
	3.00	Mean	108.60	116.13	109.59	85.71	30.72	66.49	82.30
		N	5	6	10	10	10	11	10
		Std. Deviation	2.881	6.563	5.150	4.953	3.360	4.331	4.435
	Total	Mean	100.49	116.71	107.39	83.71	30.70	64.30	80.26
		N	80	72	137	140	141	140	137
		Std. Deviation	9.266	7.874	7.301	5.634	3.313	7.277	6.321
Female	1.00	Mean	95.10	114.38	104.45	81.14	30.20	61.35	79.52
		N	55	39	83	85	88	84	84
		Std. Deviation	6.688	8.199	6.494	5.499	2.903	5.625	5.523
	2.00	Mean	101.28	118.51	106.79	83.27	30.55	63.97	79.90
		N	57	52	90	89	95	90	91
		Std. Deviation	9.624	10.034	7.250	5.527	3.316	5.460	5.878
	3.00	Mean	98.52	124.01	106.52	81.60	30.15	62.76	78.92
		N	14	10	20	20	20	19	20
		Std. Deviation	5.344	7.502	5.048	3.755	2.309	5.006	4.897
	Total	Mean	98.28	117.46	105.75	82.17	30.36	62.71	79.64
		N	126	101	193	194	203	193	195
		Std. Deviation	8.506	9.514	6.797	5.434	3.046	5.603	5.614
Male	1.00	Mean	99.16	118.76	109.07	84.69	32.10	66.70	83.15
		N	51	42	80	80	83	81	79
		Std. Deviation	8.267	7.076	8.231	5.405	3.368	6.363	6.188
	2.00	Mean	102.74	122.44	111.61	86.48	32.98	67.41	83.48
		N	76	71	132	136	137	137	132
		Std. Deviation	8.149	6.583	8.329	5.654	3.730	5.586	5.540
	3.00	Mean	104.82	124.42	114.49	87.42	32.84	68.14	84.16
		N	12	12	35	37	38	34	37
		Std. Deviation	9.743	8.670	10.717	4.523	3.280	6.113	7.699
	Total	Mean	101.60	121.39	111.19	86.05	32.68	67.28	83.48
		N	139	125	247	253	258	252	248
		Std. Deviation	8.499	7.179	8.813	5.493	3.562	5.911	6.092

Table 4.3.3: ANOVA showing significant differences in mean mandible measurements among dental wear groups for males and females

ANOVA

MF			Sum of Squares	df	Mean Square	F	Sig.
.	CorB	Between Groups	353.348	2	176.674	2.116	.127
		Within Groups	6429.532	77	83.500		
		Total	6782.880	79			
	ConB	Between Groups	277.186	2	138.593	2.318	.106
		Within Groups	4124.897	69	59.781		
		Total	4402.083	71			
	L1	Between Groups	206.790	2	103.395	1.967	.144
		Within Groups	7042.803	134	52.558		
		Total	7249.594	136			
	Bl	Between Groups	55.528	2	27.764	.873	.420
		Within Groups	4355.825	137	31.794		
		Total	4411.353	139			
	Bh	Between Groups	121.475	2	60.737	5.924	.003
		Within Groups	1414.774	138	10.252		
		Total	1536.248	140			
	Rh	Between Groups	637.791	2	318.896	6.499	.002
		Within Groups	6722.777	137	49.071		
		Total	7360.568	139			
	L2	Between Groups	90.558	2	45.279	1.136	.324
		Within Groups	5343.258	134	39.875		
		Total	5433.816	136			
Female	CorB	Between Groups	1070.803	2	535.401	8.259	.000
		Within Groups	7973.749	123	64.827		
		Total	9044.552	125			
	ConB	Between Groups	855.986	2	427.993	5.118	.008
		Within Groups	8195.561	98	83.628		
		Total	9051.547	100			
	L1	Between Groups	249.759	2	124.880	2.753	.066
		Within Groups	8619.642	190	45.367		
		Total	8869.401	192			
	Bl	Between Groups	203.367	2	101.684	3.533	.031
		Within Groups	5496.472	191	28.777		
		Total	5699.839	193			
	Bh	Between Groups	6.614	2	3.307	.354	.702
		Within Groups	1868.064	200	9.340		
		Total	1874.678	202			

ANOVA

MF			Sum of Squares	df	Mean Square	F	Sig.
	Rh	Between Groups	296.734	2	148.367	4.919	.008
		Within Groups	5730.673	190	30.161		
		Total	6027.407	192			
	L2	Between Groups	17.810	2	8.905	.280	.756
		Within Groups	6096.853	192	31.754		
		Total	6114.664	194			
Male	CorB	Between Groups	526.574	2	263.287	3.793	.025
		Within Groups	9441.416	136	69.422		
		Total	9967.989	138			
	ConB	Between Groups	477.057	2	238.528	4.921	.009
		Within Groups	5913.175	122	48.469		
		Total	6390.232	124			
	L1	Between Groups	762.136	2	381.068	5.068	.007
		Within Groups	18345.602	244	75.187		
		Total	19107.738	246			
	Bl	Between Groups	243.669	2	121.835	4.138	.017
		Within Groups	7360.195	250	29.441		
		Total	7603.864	252			
	Bh	Between Groups	40.986	2	20.493	1.623	.199
		Within Groups	3219.892	255	12.627		
		Total	3260.878	257			
	Rh	Between Groups	54.713	2	27.357	.782	.459
		Within Groups	8716.288	249	35.005		
		Total	8771.001	251			
	L2	Between Groups	25.517	2	12.758	.342	.711
		Within Groups	9141.868	245	37.314		
		Total	9167.385	247			

Table 4.3.4: Boneferroni results showing significant differences in mean mandible measurements among among dental wear groups for males and females

Multiple Comparisons

Bonferroni

MF	Dependent Variable	(I) AgeGroup	(J) AgeGroup	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
.	CorB	1.00	2.00	.372	2.167	1.000	-4.93	5.67
			3.00	-8.424	4.425	.182	-19.25	2.41
		2.00	1.00	-.372	2.167	1.000	-5.67	4.93
			3.00	-8.796	4.303	.133	-19.33	1.74
		3.00	1.00	8.424	4.425	.182	-2.41	19.25
			2.00	8.796	4.303	.133	-1.74	19.33
	ConB	1.00	2.00	-4.208	1.962	.106	-9.02	.61
			3.00	-1.985	3.515	1.000	-10.61	6.64
		2.00	1.00	4.208	1.962	.106	-.61	9.02
			3.00	2.223	3.380	1.000	-6.07	10.52
		3.00	1.00	1.985	3.515	1.000	-6.64	10.61
			2.00	-2.223	3.380	1.000	-10.52	6.07
	L1	1.00	2.00	-2.285	1.332	.266	-5.51	.95
			3.00	-3.813	2.525	.400	-9.93	2.31
		2.00	1.00	2.285	1.332	.266	-.95	5.51
			3.00	-1.529	2.432	1.000	-7.42	4.37
		3.00	1.00	3.813	2.525	.400	-2.31	9.93
			2.00	1.529	2.432	1.000	-4.37	7.42
	BI	1.00	2.00	-.635	1.020	1.000	-3.11	1.84
			3.00	-2.553	1.957	.583	-7.30	2.19
		2.00	1.00	.635	1.020	1.000	-1.84	3.11
			3.00	-1.917	1.890	.936	-6.50	2.66
		3.00	1.00	2.553	1.957	.583	-2.19	7.30
			2.00	1.917	1.890	.936	-2.66	6.50
	Bh	1.00	2.00	-1.990*	.578	.002	-3.39	-.59
			3.00	-1.271	1.111	.764	-3.96	1.42
		2.00	1.00	1.990*	.578	.002	.59	3.39
			3.00	.719	1.072	1.000	-1.88	3.32
		3.00	1.00	1.271	1.111	.764	-1.42	3.96
			2.00	-.719	1.072	1.000	-3.32	1.88
	Rh	1.00	2.00	-4.371*	1.271	.002	-7.45	-1.29
			3.00	-5.085	2.337	.094	-10.75	.58
		2.00	1.00	4.371*	1.271	.002	1.29	7.45

Multiple Comparisons

Bonferroni

MF	Dependent Variable	(I) AgeGroup	(J) AgeGroup	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
			3.00	-.713	2.253	1.000	-6.17	4.75
		3.00	1.00	5.085	2.337	.094	-.58	10.75
			2.00	.713	2.253	1.000	-4.75	6.17
	L2	1.00	2.00	-1.240	1.161	.862	-4.05	1.57
			3.00	-2.985	2.199	.531	-8.32	2.35
		2.00	1.00	1.240	1.161	.862	-1.57	4.05
			3.00	-1.745	2.118	1.000	-6.88	3.39
		3.00	1.00	2.985	2.199	.531	-2.35	8.32
			2.00	1.745	2.118	1.000	-3.39	6.88
Female	CorB	1.00	2.00	-6.182*	1.522	.000	-9.88	-2.49
			3.00	-3.420	2.410	.475	-9.27	2.43
		2.00	1.00	6.182*	1.522	.000	2.49	9.88
			3.00	2.763	2.402	.757	-3.07	8.59
		3.00	1.00	3.420	2.410	.475	-2.43	9.27
			2.00	-2.763	2.402	.757	-8.59	3.07
	ConB	1.00	2.00	-4.126	1.937	.107	-8.84	.59
			3.00	-9.631*	3.241	.011	-17.53	-1.74
		2.00	1.00	4.126	1.937	.107	-.59	8.84
			3.00	-5.504	3.158	.253	-13.20	2.19
		3.00	1.00	9.631*	3.241	.011	1.74	17.53
			2.00	5.504	3.158	.253	-2.19	13.20
	L1	1.00	2.00	-2.341	1.025	.070	-4.82	.13
			3.00	-2.074	1.678	.654	-6.13	1.98
		2.00	1.00	2.341	1.025	.070	-.13	4.82
			3.00	.267	1.665	1.000	-3.76	4.29
		3.00	1.00	2.074	1.678	.654	-1.98	6.13
			2.00	-.267	1.665	1.000	-4.29	3.76
	BI	1.00	2.00	-2.124*	.814	.029	-4.09	-.16
			3.00	-.450	1.333	1.000	-3.67	2.77
		2.00	1.00	2.124*	.814	.029	.16	4.09
			3.00	1.674	1.327	.627	-1.53	4.88
		3.00	1.00	.450	1.333	1.000	-2.77	3.67
			2.00	-1.674	1.327	.627	-4.88	1.53
	Bh	1.00	2.00	-.349	.452	1.000	-1.44	.74
			3.00	.060	.757	1.000	-1.77	1.89
		2.00	1.00	.349	.452	1.000	-.74	1.44

Multiple Comparisons

Bonferroni

MF	Dependent Variable	(I) AgeGroup	(J) AgeGroup	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
			3.00	.409	.752	1.000	-1.41	2.22
		3.00	1.00	-.060	.757	1.000	-1.89	1.77
			2.00	-.409	.752	1.000	-2.22	1.41
	Rh	1.00	2.00	-2.613*	.833	.006	-4.63	-.60
			3.00	-1.410	1.395	.941	-4.78	1.96
		2.00	1.00	2.613*	.833	.006	.60	4.63
			3.00	1.204	1.387	1.000	-2.15	4.55
		3.00	1.00	1.410	1.395	.941	-1.96	4.78
			2.00	-1.204	1.387	1.000	-4.55	2.15
	L2	1.00	2.00	-.379	.853	1.000	-2.44	1.68
			3.00	.604	1.402	1.000	-2.78	3.99
		2.00	1.00	.379	.853	1.000	-1.68	2.44
			3.00	.983	1.392	1.000	-2.38	4.34
		3.00	1.00	-.604	1.402	1.000	-3.99	2.78
			2.00	-.983	1.392	1.000	-4.34	2.38
Male	CorB	1.00	2.00	-3.579	1.508	.057	-7.23	.08
			3.00	-5.660	2.673	.108	-12.14	.82
		2.00	1.00	3.579	1.508	.057	-.08	7.23
			3.00	-2.081	2.588	1.000	-8.35	4.19
		3.00	1.00	5.660	2.673	.108	-.82	12.14
			2.00	2.081	2.588	1.000	-4.19	8.35
	ConB	1.00	2.00	-3.671*	1.355	.023	-6.96	-.38
			3.00	-5.652*	2.279	.043	-11.18	-.12
		2.00	1.00	3.671*	1.355	.023	.38	6.96
			3.00	-1.981	2.173	1.000	-7.26	3.29
		3.00	1.00	5.652*	2.279	.043	.12	11.18
			2.00	1.981	2.173	1.000	-3.29	7.26
	L1	1.00	2.00	-2.535	1.229	.120	-5.50	.43
			3.00	-5.414*	1.757	.007	-9.65	-1.18
		2.00	1.00	2.535	1.229	.120	-.43	5.50
			3.00	-2.880	1.649	.246	-6.85	1.09
		3.00	1.00	5.414*	1.757	.007	1.18	9.65
			2.00	2.880	1.649	.246	-1.09	6.85
	BI	1.00	2.00	-1.796	.765	.059	-3.64	.05
			3.00	-2.734*	1.079	.036	-5.33	-.13
		2.00	1.00	1.796	.765	.059	-.05	3.64

Multiple Comparisons

Bonferroni

MF	Dependent Variable	(I) AgeGroup	(J) AgeGroup	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
			3.00	-.938	1.006	1.000	-3.36	1.49
		3.00	1.00	2.734*	1.079	.036	.13	5.33
			2.00	.938	1.006	1.000	-1.49	3.36
	Bh	1.00	2.00	-.877	.494	.231	-2.07	.31
			3.00	-.738	.696	.869	-2.42	.94
		2.00	1.00	.877	.494	.231	-.31	2.07
			3.00	.139	.652	1.000	-1.43	1.71
		3.00	1.00	.738	.696	.869	-.94	2.42
			2.00	-.139	.652	1.000	-1.71	1.43
	Rh	1.00	2.00	-.712	.829	1.000	-2.71	1.29
			3.00	-1.439	1.209	.705	-4.35	1.48
		2.00	1.00	.712	.829	1.000	-1.29	2.71
			3.00	-.727	1.134	1.000	-3.46	2.01
		3.00	1.00	1.439	1.209	.705	-1.48	4.35
			2.00	.727	1.134	1.000	-2.01	3.46
	L2	1.00	2.00	-.323	.869	1.000	-2.42	1.77
			3.00	-1.006	1.217	1.000	-3.94	1.93
		2.00	1.00	.323	.869	1.000	-1.77	2.42
			3.00	-.684	1.136	1.000	-3.42	2.06
		3.00	1.00	1.006	1.217	1.000	-1.93	3.94
			2.00	.684	1.136	1.000	-2.06	3.42

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

Table 4.3.5: Cosstabulation showing wear groups for each time period

Periodc * AgeGroup Crosstabulation

			AgeGroup			
			1.00	2.00	3.00	Total
Periodc	Neolithic	Count	2	8	5	15
		Expected Count	5.3	7.9	1.8	15.0
	IronBronze Age	Count	28	59	11	98
		Expected Count	34.7	51.6	11.7	98.0
	Roman	Count	29	61	5	95
		Expected Count	33.6	50.1	11.3	95.0
	AngloSaxon	Count	32	77	19	128
		Expected Count	45.3	67.5	15.3	128.0
	Medieval	Count	66	89	30	185
		Expected Count	65.4	97.5	22.1	185.0
	Postmedieval	Count	92	77	14	183
		Expected Count	64.7	96.4	21.8	183.0
Total		Count	249	371	84	704
		Expected Count	249.0	371.0	84.0	704.0

Table 4.3.6: Chi-squared results showing that dental wear groups wee significantly different between time periods

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	44.712[a]	10	.000
Likelihood Ratio	43.741	10	.000
Linear-by-Linear Association	13.904	1	.000
N of Valid Cases	704		

a. 1 cells (5.6%) have expected count less than 5. The minimum expected count is 1.79.

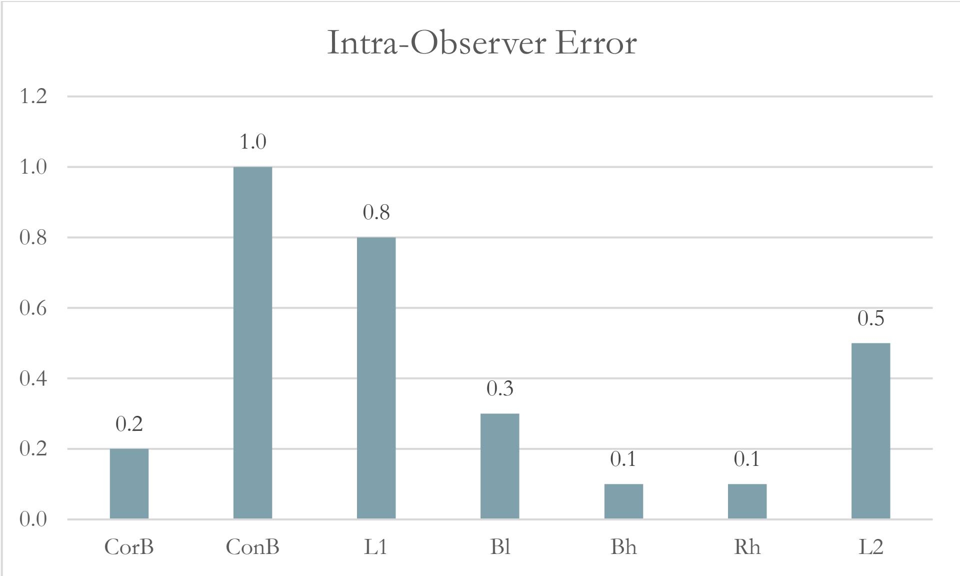

Figure 4.3.1. Bar graph illustrating the mean intra-observer error for each measurement.

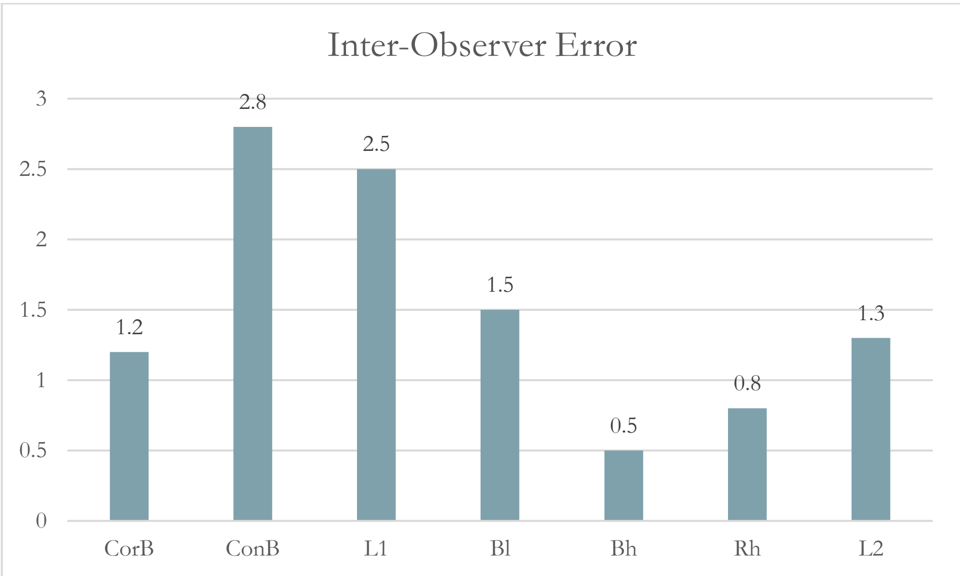

Figure 4.3.2 Bar graph illustrating the mean inter-observer error for each measurement.

Appendix 5: Results – 3D

Appendix 5 details the results produced during 3D geogrtic morphometric analysis that were not included in section 6.2 of the results chapter.

5.1 Centroid size

Table 5.1.1: Results from a Shapiro-Wilk test for normality to determine if centroid size was normally distributed among females for all time periods

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	MF	Statistic	df	Sig.	Statistic	df	Sig.
Centroidsize	Female	.045	269	.200*	.994	269	.390
	Male	.034	328	.200*	.995	328	.336

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 5.1.2**:** Mean centroid size among females for all time periods

Report

Centroidsize

MF	Mean	N	Std. Deviation
Female	335.4622	269	16.18374
Male	350.0895	328	14.91646
Total	343.4986	597	17.11449

Table 5.1.3: Independent samples t-test showing significant differences in centroid size among for males and females for all time periods

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Centroidsize	Equal variances assumed	2.275	.132	-11.472	595	.000	-14.62728	1.27500	-17.13132	-12.12324
	Equal variances not assumed			-11.380	551.947	.000	-14.62728	1.28531	-17.15197	-12.10259

Table 5.1.4: Results from a Shapiro-Wilk test for normality to determine if centroid size was normally distributed among among males and females among each individual time period

Tests of Normality

MF		Periodc	Kolmogorov-Smirnov[a] Statistic	df	Sig.	Shapiro-Wilk Statistic	df	Sig.
.	Centroidsize	Neolithic	.221	5	.200*	.941	5	.673
		IronBronze Age	.091	17	.200*	.970	17	.818
		Roman	.200	16	.086	.963	16	.709
		AngloSaxon	.077	66	.200*	.975	66	.197
		Medieval	.073	56	.200*	.975	56	.306
		Postmedieval	.120	29	.200*	.962	29	.362
Female	Centroidsize	Neolithic	.169	4	.	.996	4	.988
		IronBronze Age	.081	31	.200*	.974	31	.643
		Roman	.091	37	.200*	.954	37	.131
		AngloSaxon	.094	38	.200*	.975	38	.533
		Medieval	.063	64	.200*	.989	64	.850
		Postmedieval	.083	91	.161	.986	91	.424
Male	Centroidsize	Neolithic	.260	5	.200*	.908	5	.456
		IronBronze Age	.119	37	.200*	.944	37	.061
		Roman	.081	40	.200*	.971	40	.393
		AngloSaxon	.094	51	.200*	.979	51	.494
		Medieval	.060	93	.200*	.987	93	.505
		Postmedieval	.044	94	.200*	.991	94	.795

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 5.1.5: Mean centroid size among males and females among males among each individual time period

Report

Centroidsize

MF	Periodc	Mean	N	Std. Deviation
.	Neolithic	337.8016	5	19.15213
	IronBronze Age	349.8149	17	16.59867
	Roman	344.1312	16	16.38277
	AngloSaxon	347.4532	66	15.13297
	Medieval	342.1079	56	19.80941
	Postmedieval	339.4394	29	18.72068
	Total	344.3156	189	17.64327
Female	Neolithic	356.1392	4	12.03406
	IronBronze Age	336.8282	31	16.81677
	Roman	341.0897	37	16.49674
	AngloSaxon	339.6039	38	17.49246
	Medieval	335.2918	64	13.99210
	Postmedieval	330.3018	91	15.32427
	Total	335.5005	265	16.22785
Male	Neolithic	352.1399	5	6.82305
	IronBronze Age	354.3233	37	16.54746
	Roman	349.8812	40	17.16543
	AngloSaxon	350.1506	51	14.77286
	Medieval	351.8876	93	15.42178
	Postmedieval	347.2992	94	12.72166
	Total	350.2977	320	14.92757

Table 5.1.6: ANOVA showing significant differences in centroid size among among males among each individual time period

ANOVA

Centroidsize

MF		Sum of Squares	df	Mean Square	F	Sig.
.	Between Groups	2339.048	5	467.810	1.524	.184
	Within Groups	56182.520	183	307.008		
	Total	58521.567	188			
Female	Between Groups	6016.386	5	1203.277	4.907	.000
	Within Groups	63506.229	259	245.198		
	Total	69522.615	264			
Male	Between Groups	1704.869	5	340.974	1.543	.176
	Within Groups	69378.633	314	220.951		
	Total	71083.502	319			

Table 5.1.7: Boneferroni results showing significant differences in centroid size among among males among each individual time period

Multiple Comparisons

Dependent Variable: Centroidsize

Bonferroni

MF	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
.	Neolithic	IronBronze Age	-12.01331	8.91409	1.000	-38.5258	14.4992
		Roman	-6.32968	8.97718	1.000	-33.0298	20.3705
		AngloSaxon	-9.65162	8.12732	1.000	-33.8241	14.5209
		Medieval	-4.30631	8.17826	1.000	-28.6303	20.0177
		Postmedieval	-1.63782	8.48458	1.000	-26.8729	23.5973
	IronBronze Age	Neolithic	12.01331	8.91409	1.000	-14.4992	38.5258
		Roman	5.68363	6.10306	1.000	-12.4683	23.8355
		AngloSaxon	2.36170	4.76560	1.000	-11.8123	16.5357
		Medieval	7.70701	4.85197	1.000	-6.7239	22.1379
		Postmedieval	10.37549	5.35218	.811	-5.5431	26.2941
	Roman	Neolithic	6.32968	8.97718	1.000	-20.3705	33.0298
		IronBronze Age	-5.68363	6.10306	1.000	-23.8355	12.4683
		AngloSaxon	-3.32194	4.88259	1.000	-17.8439	11.2000
		Medieval	2.02337	4.96692	1.000	-12.7494	16.7961
		Postmedieval	4.69186	5.45660	1.000	-11.5373	20.9210
	AngloSaxon	Neolithic	9.65162	8.12732	1.000	-14.5209	33.8241
		IronBronze Age	-2.36170	4.76560	1.000	-16.5357	11.8123
		Roman	3.32194	4.88259	1.000	-11.2000	17.8439
		Medieval	5.34531	3.18338	1.000	-4.1228	14.8134
		Postmedieval	8.01380	3.90361	.623	-3.5964	19.6240
	Medieval	Neolithic	4.30631	8.17826	1.000	-20.0177	28.6303
		IronBronze Age	-7.70701	4.85197	1.000	-22.1379	6.7239
		Roman	-2.02337	4.96692	1.000	-16.7961	12.7494
		AngloSaxon	-5.34531	3.18338	1.000	-14.8134	4.1228
		Postmedieval	2.66849	4.00859	1.000	-9.2540	14.5909
	Postmedieval	Neolithic	1.63782	8.48458	1.000	-23.5973	26.8729
		IronBronze Age	-10.37549	5.35218	.811	-26.2941	5.5431

Multiple Comparisons

Dependent Variable: Centroidsize

Bonferroni

MF	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
		Roman	-4.69186	5.45660	1.000	-20.9210	11.5373
		AngloSaxon	-8.01380	3.90361	.623	-19.6240	3.5964
		Medieval	-2.66849	4.00859	1.000	-14.5909	9.2540
Female	Neolithic	IronBronze Age	19.31099	8.31920	.316	-5.3361	43.9581
		Roman	15.04952	8.24175	1.000	-9.3681	39.4672
		AngloSaxon	16.53534	8.23116	.684	-7.8509	40.9216
		Medieval	20.84738	8.07036	.155	-3.0625	44.7572
		Postmedieval	25.83745*	7.99962	.021	2.1372	49.5377
	IronBronze Age	Neolithic	-19.31099	8.31920	.316	-43.9581	5.3361
		Roman	-4.26147	3.81269	1.000	-15.5572	7.0343
		AngloSaxon	-2.77564	3.78975	1.000	-14.0034	8.4522
		Medieval	1.53639	3.42649	1.000	-8.6152	11.6880
		Postmedieval	6.52647	3.25639	.691	-3.1212	16.1741
	Roman	Neolithic	-15.04952	8.24175	1.000	-39.4672	9.3681
		IronBronze Age	4.26147	3.81269	1.000	-7.0343	15.5572
		AngloSaxon	1.48583	3.61656	1.000	-9.2289	12.2005
		Medieval	5.79786	3.23391	1.000	-3.7832	15.3789
		Postmedieval	10.78794*	3.05310	.007	1.7426	19.8333
	AngloSaxon	Neolithic	-16.53534	8.23116	.684	-40.9216	7.8509
		IronBronze Age	2.77564	3.78975	1.000	-8.4522	14.0034
		Roman	-1.48583	3.61656	1.000	-12.2005	9.2289
		Medieval	4.31203	3.20683	1.000	-5.1888	13.8128
		Postmedieval	9.30211*	3.02441	.035	.3418	18.2625
	Medieval	Neolithic	-20.84738	8.07036	.155	-44.7572	3.0625
		IronBronze Age	-1.53639	3.42649	1.000	-11.6880	8.6152
		Roman	-5.79786	3.23391	1.000	-15.3789	3.7832
		AngloSaxon	-4.31203	3.20683	1.000	-13.8128	5.1888
		Postmedieval	4.99007	2.55454	.778	-2.5782	12.5584
	Postmedieval	Neolithic	-25.83745*	7.99962	.021	-49.5377	-2.1372
		IronBronze Age	-6.52647	3.25639	.691	-16.1741	3.1212

Multiple Comparisons

Dependent Variable: Centroidsize

Bonferroni

MF	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
		Roman	-10.78794*	3.05310	.007	-19.8333	-1.7426
		AngloSaxon	-9.30211*	3.02441	.035	-18.2625	-.3418
		Medieval	-4.99007	2.55454	.778	-12.5584	2.5782
Male	Neolithic	IronBronze Age	-2.18343	7.08250	1.000	-23.1323	18.7654
		Roman	2.25870	7.05081	1.000	-18.5964	23.1138
		AngloSaxon	1.98930	6.96582	1.000	-18.6144	22.5930
		Medieval	.25224	6.82393	1.000	-19.9318	20.4363
		Postmedieval	4.84069	6.82208	1.000	-15.3379	25.0192
	IronBronze Age	Neolithic	2.18343	7.08250	1.000	-18.7654	23.1323
		Roman	4.44213	3.39049	1.000	-5.5864	14.4706
		AngloSaxon	4.17273	3.20999	1.000	-5.3219	13.6673
		Medieval	2.43567	2.88920	1.000	-6.1101	10.9814
		Postmedieval	7.02411	2.88482	.232	-1.5087	15.5569
	Roman	Neolithic	-2.25870	7.05081	1.000	-23.1138	18.5964
		IronBronze Age	-4.44213	3.39049	1.000	-14.4706	5.5864
		AngloSaxon	-.26940	3.13945	1.000	-9.5554	9.0166
		Medieval	-2.00647	2.81062	1.000	-10.3198	6.3069
		Postmedieval	2.58198	2.80612	1.000	-5.7180	10.8820
	AngloSaxon	Neolithic	-1.98930	6.96582	1.000	-22.5930	18.6144
		IronBronze Age	-4.17273	3.20999	1.000	-13.6673	5.3219
		Roman	.26940	3.13945	1.000	-9.0166	9.5554
		Medieval	-1.73706	2.59002	1.000	-9.3979	5.9238
		Postmedieval	2.85139	2.58513	1.000	-4.7950	10.4978
	Medieval	Neolithic	-.25224	6.82393	1.000	-20.4363	19.9318
		IronBronze Age	-2.43567	2.88920	1.000	-10.9814	6.1101
		Roman	2.00647	2.81062	1.000	-6.3069	10.3198
		AngloSaxon	1.73706	2.59002	1.000	-5.9238	9.3979
		Postmedieval	4.58845	2.17402	.534	-1.8419	11.0188
	Postmedieval	Neolithic	-4.84069	6.82208	1.000	-25.0192	15.3379
		IronBronze Age	-7.02411	2.88482	.232	-15.5569	1.5087

Multiple Comparisons

Dependent Variable: Centroidsize

Bonferroni

MF	(I) Periodc	(J) Periodc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
		Roman	-2.58198	2.80612	1.000	-10.8820	5.7180
		AngloSaxon	-2.85139	2.58513	1.000	-10.4978	4.7950
		Medieval	-4.58845	2.17402	.534	-11.0188	1.8419

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

5.2 t-tests for canonical variates

An ANOVA was conducted which determined that there was no significant difference in CV1-CV5 between sex estimation groups, with the exception of CV4 and CV5 among the Post-Medieval individuals

Table 5.2.1: Independent samples t-test comparing mean CV score produced during time period analysis among males and females

Independent Samples Test[a]

			Levene's Test for Equality of Variances		t-test for Equality of Means						
										95% Confidence Interval of the Difference	
PERIOD			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
A	CV1	Equal variances assumed	.026	.873	-.435	112	.665	-.07624	.17544	-.42386	.27138
		Equal variances not assumed			-.435	99.154	.665	-.07624	.17545	-.42436	.27188
	CV2	Equal variances assumed	.643	.424	.619	112	.537	.10949	.17680	-.24081	.45979
		Equal variances not assumed			.614	96.213	.541	.10949	.17825	-.24433	.46331
	CV3	Equal variances assumed	.542	.463	.706	112	.482	.12690	.17979	-.22933	.48313
		Equal variances not assumed			.702	96.997	.485	.12690	.18088	-.23210	.48590
	CV4	Equal variances assumed	1.196	.276	.990	112	.324	.18349	.18534	-.18373	.55071
		Equal variances not assumed			.968	90.994	.335	.18349	.18949	-.19291	.55989
	CV5	Equal variances assumed	.926	.338	-.659	112	.512	-.12179	.18494	-.48822	.24465
		Equal variances not assumed			-.642	89.884	.522	-.12179	.18964	-.49855	.25497
I	CV1	Equal variances assumed	.104	.749	-.765	53	.448	-.18915	.24725	-.68508	.30678
		Equal variances not assumed			-.761	36.185	.452	-.18915	.24862	-.69330	.31500
	CV2	Equal variances assumed	1.535	.221	.366	53	.716	.10451	.28544	-.46800	.67703

Independent Samples Test[a]

PERIOD			Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
		Equal variances not assumed			.403	47.425	.689	.10451	.25922	-.41686	.62588
	CV3	Equal variances assumed	1.507	.225	-1.582	53	.120	-.55318	.34966	-1.25451	.14814
		Equal variances not assumed			-1.704	44.950	.095	-.55318	.32472	-1.20723	.10086
	CV4	Equal variances assumed	.128	.722	-.831	53	.410	-.21203	.25515	-.72379	.29973
		Equal variances not assumed			-.841	37.988	.406	-.21203	.25214	-.72247	.29841
	CV5	Equal variances assumed	.242	.625	1.187	53	.241	.33971	.28630	-.23454	.91397
		Equal variances not assumed			1.142	33.045	.262	.33971	.29752	-.26556	.94498
M	CV1	Equal variances assumed	1.091	.298	-.740	146	.461	-.13005	.17581	-.47751	.21740
		Equal variances not assumed			-.729	110.891	.468	-.13005	.17840	-.48357	.22346
	CV2	Equal variances assumed	.002	.964	.558	146	.578	.09894	.17736	-.25159	.44947
		Equal variances not assumed			.549	110.360	.584	.09894	.18024	-.25825	.45613
	CV3	Equal variances assumed	2.235	.137	.525	146	.600	.08630	.16424	-.23829	.41089
		Equal variances not assumed			.547	130.859	.585	.08630	.15779	-.22585	.39845
	CV4	Equal variances assumed	.015	.902	-.461	146	.645	-.07786	.16880	-.41147	.25574
		Equal variances not assumed			-.470	123.242	.639	-.07786	.16567	-.40578	.25005
	CV5	Equal variances assumed	1.828	.178	-.306	146	.760	-.05420	.17705	-.40412	.29571

Independent Samples Test[a]

PERIOD			Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
		Equal variances not assumed			-.300	109.086	.765	-.05420	.18056	-.41207	.30366
N	CV1	Equal variances assumed	.072	.795	-1.027	8	.335	-.50681	.49357	-1.64497	.63136
		Equal variances not assumed			-1.027	6.964	.339	-.50681	.49357	-1.67513	.66152
	CV2	Equal variances assumed	20.241	.002	-1.933	8	.089	-1.09960	.56886	-2.41139	.21218
		Equal variances not assumed			-1.933	4.651	.115	-1.09960	.56886	-2.59556	.39635
	CV3	Equal variances assumed	.001	.979	1.230	8	.253	.69414	.56415	-.60680	1.99507
		Equal variances not assumed			1.230	7.869	.254	.69414	.56415	-.61059	1.99887
	CV4	Equal variances assumed	3.325	.106	1.330	8	.220	.89662	.67407	-.65779	2.45103
		Equal variances not assumed			1.330	5.637	.235	.89662	.67407	-.77886	2.57210
	CV5	Equal variances assumed	.079	.786	-.990	8	.351	-.63253	.63886	-2.10573	.84068
		Equal variances not assumed			-.990	7.529	.353	-.63253	.63886	-2.12193	.85688
P	CV1	Equal variances assumed	1.658	.200	.782	127	.436	.19272	.24651	-.29509	.68052
		Equal variances not assumed			.890	60.311	.377	.19272	.21662	-.24054	.62597
	CV2	Equal variances assumed	1.265	.263	-.424	127	.673	-.09168	.21647	-.52004	.33668
		Equal variances not assumed			-.463	55.713	.645	-.09168	.19810	-.48856	.30520
	CV3	Equal variances assumed	1.155	.285	.611	127	.543	.13116	.21478	-.29386	.55618

Independent Samples Test[a]

PERIOD			Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
		Equal variances not assumed			.618	48.786	.540	.13116	.21236	-.29564	.55796
	CV4	Equal variances assumed	.994	.321	3.353	127	.001	.67675	.20183	.27738	1.07613
		Equal variances not assumed			3.588	53.608	.001	.67675	.18863	.29851	1.05500
	CV5	Equal variances assumed	.005	.941	2.608	127	.010	.45305	.17369	.10934	.79676
		Equal variances not assumed			2.628	48.492	.011	.45305	.17240	.10651	.79959
R	CV1	Equal variances assumed	.505	.480	.913	54	.365	.22880	.25066	-.27375	.73135
		Equal variances not assumed			.848	28.071	.404	.22880	.26995	-.32409	.78170
	CV2	Equal variances assumed	.397	.532	1.322	54	.192	.37189	.28127	-.19202	.93581
		Equal variances not assumed			1.309	32.656	.200	.37189	.28406	-.20627	.95005
	CV3	Equal variances assumed	6.430	.014	-.111	54	.912	-.03363	.30258	-.64027	.57300
		Equal variances not assumed			-.131	50.353	.896	-.03363	.25589	-.54752	.48025
	CV4	Equal variances assumed	.012	.911	1.427	54	.159	.38284	.26836	-.15519	.92087
		Equal variances not assumed			1.411	32.547	.168	.38284	.27139	-.16960	.93528
	CV5	Equal variances assumed	6.679	.012	-.479	54	.634	-.15528	.32387	-.80461	.49404
		Equal variances not assumed			-.424	25.327	.675	-.15528	.36613	-.90884	.59827

a. No statistics are computed for one or more split files

No Significant differences were reported in CV1 between sex estimation groups for all period comparisons with the exception of the Medieval and Neolithic

Table 5.2.2: Independent samples t-test comparing difference among males and females in mean CV1 produced in comparison between the Neolithc and Roman indiviudals.

Independent Samples Test

PERIOD			Levene's Test for Equality of Variances: F	Sig.	t-test for Equality of Means: t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference: Lower	Upper
N	CV1	Equal variances assumed	.030	.867	-.779	7	.461	-.37972	.48722	-1.53182	.77239
		Equal variances not assumed			-.757	5.715	.479	-.37972	.50130	-1.62134	.86191
R	CV1	Equal variances assumed	.492	.485	-.182	73	.856	-.04125	.22705	-.49376	.41126
		Equal variances not assumed			-.182	72.993	.856	-.04125	.22700	-.49366	.41116

Table 5.2.3: Independent samples t-test comparing difference among males and females in mean CV1 produced in comparison between the Medieval and Post-Medieval indiviudals.

Independent Samples Test

PERIOD			Levene's Test for Equality of Variances: F	Sig.	t-test for Equality of Means: t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference: Lower	Upper
M	CV1	Equal variances assumed	.736	.392	.227	157	.820	.03466	.15236	-.26627	.33559
		Equal variances not assumed			.232	150.934	.817	.03466	.14951	-.26074	.33006
P	CV1	Equal variances assumed	.048	.827	-.555	185	.579	-.08805	.15852	-.40079	.22469
		Equal variances not assumed			-.558	184.632	.578	-.08805	.15783	-.39944	.22334

Table 5.2.4: Independent samples t-test comparing difference among males and females in mean CV1 produced in comparison between the Anglo-Saxon and Medieval indiviudals.

Independent Samples Test

PERIOD			Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
A	CV1	Equal variances assumed	.163	.687	.081	84	.936	.01883	.23306	-.44463	.48230
		Equal variances not assumed			.079	72.385	.937	.01883	.23786	-.45529	.49296
M	CV1	Equal variances assumed	.239	.626	-1.216	157	.226	-.18911	.15558	-.49641	.11819
		Equal variances not assumed			-1.230	148.078	.221	-.18911	.15374	-.49292	.11470

Table 5.2.5: Independent samples t-test comparing difference among males and females in mean CV1 produced in comparison between the Post-Medieval and Roman indiviudals.

Independent Samples Test[a]

PERIOD			Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
P	CV1	Equal variances assumed	1.184	.278	-.196	185	.845	-.02963	.15143	-.32838	.26911
		Equal variances not assumed			-.197	184.999	.844	-.02963	.15035	-.32626	.26699
R	CV1	Equal variances assumed	1.330	.253	1.577	73	.119	.38470	.24392	-.10142	.87083
		Equal variances not assumed			1.582	69.843	.118	.38470	.24313	-.10023	.86964

a. No statistics are computed for one or more split files

Table 5.2.6: Independent samples t-test comparing difference among males and females in mean CV1 produced in comparison between the Medieval and Roman indiviudals.

Independent Samples Test[a]

PERIOD			Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
M	CV1	Equal variances assumed	2.892	.091	.538	157	.591	.07891	.14669	-.21084	.36866
		Equal variances not assumed			.555	154.889	.580	.07891	.14213	-.20185	.35967
R	CV1	Equal variances assumed	.007	.931	-.602	119	.548	-.23377	.38827	-1.00259	.53504
		Equal variances not assumed			-.600	116.385	.549	-.23377	.38935	-1.00491	.53736

a. No statistics are computed for one or more split files

Table 5.2.7: Independent samples t-test comparing difference among males and females in mean CV1 produced in comparison between the Anglo-Saxon and Roman indiviudals.

Independent Samples Test[a]

PERIOD			Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
A	CV1	Equal variances assumed	.002	.962	1.873	84	.065	.37152	.19836	-.02295	.76598
		Equal variances not assumed			1.852	76.720	.068	.37152	.20063	-.02802	.77105
R	CV1	Equal variances assumed	.017	.895	.747	73	.457	.17956	.24034	-.29944	.65856
		Equal variances not assumed			.748	72.959	.457	.17956	.24018	-.29911	.65824

a. No statistics are computed for one or more split files

Table 5.2.8: Independent samples t-test comparing difference among males and females in mean CV1 produced in comparison between the Iron and Bronze Age and Roman indiviudals.

Independent Samples Test[a]

PERIOD			Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
I	CV1	Equal variances assumed	1.509	.224	-1.773	63	.081	-.45560	.25702	-.96921	.05802
		Equal variances not assumed			-1.755	57.423	.085	-.45560	.25965	-.97545	.06426
R	CV1	Equal variances assumed	.011	.919	1.009	73	.316	.22656	.22450	-.22085	.67398
		Equal variances not assumed			1.008	72.442	.317	.22656	.22468	-.22128	.67441

a. No statistics are computed for one or more split files

Table 5.2.9: Independent samples t-test comparing difference among males and females in mean CV1 produced in comparison between the Post-Medieval and Iron and Bronze Age indiviudals.

Independent Samples Test[a]

PERIOD			Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
I	CV1	Equal variances assumed	1.440	.235	-1.763	63	.083	-.43303	.24558	-.92378	.05771
		Equal variances not assumed			-1.739	56.394	.087	-.43303	.24894	-.93165	.06558
P	CV1	Equal variances assumed	.023	.878	-.882	185	.379	-.13243	.15021	-.42876	.16391
		Equal variances not assumed			-.884	184.106	.378	-.13243	.14977	-.42792	.16306

a. No statistics are computed for one or more split files

Table 5.2.10: Independent samples t-test comparing difference among males and females in mean CV1 produced in comparison between the Post-Medieval and Neolithic indiviudals.

Independent Samples Test[a]

PERIOD			Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
N	CV1	Equal variances assumed	1.330	.287	-.743	7	.482	-.52112	.70145	-2.17979	1.13755
		Equal variances not assumed			-.701	4.738	.516	-.52112	.74377	-2.46531	1.42307
P	CV1	Equal variances assumed	1.722	.191	.148	185	.882	.02149	.14501	-.26461	.30758
		Equal variances not assumed			.147	175.552	.883	.02149	.14600	-.26665	.30963

a. No statistics are computed for one or more split files

Table 5.2.11: Independent samples t-test comparing difference among males and females in mean CV1 produced in comparison between the Anglo-Saxon and Neolithic indiviudals.

Independent Samples Test[a]

PERIOD			Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
A	CV1	Equal variances assumed	.534	.467	-.824	84	.412	-.17885	.21693	-.61024	.25253
		Equal variances not assumed			-.820	79.369	.414	-.17885	.21801	-.61276	.25506
N	CV1	Equal variances assumed	1.272	.297	-1.318	7	.229	-.64974	.49299	-1.81547	.51600
		Equal variances not assumed			-1.376	6.937	.212	-.64974	.47229	-1.76859	.46912

a. No statistics are computed for one or more split files

Table 5.2.12: Independent samples t-test comparing difference among males and females in mean CV1 produced in comparison between the Post-Medieval and Anglo-Saxon indiviudals.

Independent Samples Test

PERIOD			Levene's Test for Equality of Variances F	Levene's Test for Equality of Variances Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper
A	CV1	Equal variances assumed	.638	.427	.279	84	.781	.06088	.21859	-.37380	.49556
		Equal variances not assumed			.281	83.146	.780	.06088	.21679	-.37030	.49207
P	CV1	Equal variances assumed	.029	.865	-.460	185	.646	-.07087	.15397	-.37463	.23288
		Equal variances not assumed			-.463	184.860	.644	-.07087	.15314	-.37301	.23126

Table 5.2.13: Independent samples t-test comparing difference among males and females in mean CV1 produced in comparison between the Anglo-Saxon and Iron/Bronze Age indiviudals.

Independent Samples Test[a]

PERIOD			Levene's Test for Equality of Variances F	Levene's Test for Equality of Variances Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper
A	CV1	Equal variances assumed	3.424	.068	-.970	84	.335	-.21000	.21647	-.64048	.22048
		Equal variances not assumed			-.950	72.124	.345	-.21000	.22105	-.65064	.23064
I	CV1	Equal variances assumed	.118	.733	-1.744	63	.086	-.43262	.24806	-.92832	.06309
		Equal variances not assumed			-1.721	56.570	.091	-.43262	.25131	-.93594	.07071

a. No statistics are computed for one or more split files

Table 5.2.14: Independent samples t-test comparing difference among males and females in mean CV1 produced in comparison between the Iron/Bronze Age and Medieval indiviudals.

Independent Samples Test[a]

PERIOD			Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
I	CV1	Equal variances assumed	2.538	.118	-1.040	43	.304	-.34353	.33034	-1.00974	.32267
		Equal variances not assumed			-1.174	41.737	.247	-.34353	.29263	-.93419	.24712
M	CV1	Equal variances assumed	4.194	.042	-1.157	157	.249	-.18555	.16041	-.50239	.13130
		Equal variances not assumed			-1.189	153.919	.236	-.18555	.15600	-.49372	.12263

a. No statistics are computed for one or more split files

Table 5.2.15: Independent samples t-test comparing difference among males and females in mean CV1 produced in comparison between the Iron/Bronze Age and Neolithic indiviudals.

Independent Samples Test[a]

PERIOD			Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
I	CV1	Equal variances assumed	.418	.520	-.977	63	.332	-.24260	.24840	-.73900	.25380
		Equal variances not assumed			-.993	62.732	.324	-.24260	.24428	-.73080	.24560
N	CV1	Equal variances assumed	.533	.489	-.185	7	.859	-.14841	.80434	-2.05038	1.75356
		Equal variances not assumed			-.199	6.084	.849	-.14841	.74552	-1.96651	1.66970

a. No statistics are computed for one or more split files

Significant differences were reported in CV1 between males and females from the Medieval period, this comparison therefore was not used for any further discussion of results

Table 5.2.16: Independent samples t-test comparing difference among males and females in mean CV1 produced in comparison between the Medieval and Neolithic indiviudals.

Independent Samples Test[a]

PERIOD			Levene's Test for Equality of Variances		t-test for Equality of Means						
										95% Confidence Interval of the Difference	
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
M	CV1	Equal variances assumed	5.773	.017	.959	157	.339	.15896	.16574	-.16841	.48633
		Equal variances not assumed			.917	116.926	.361	.15896	.17325	-.18417	.50208
N	CV1	Equal variances assumed	1.128	.323	-.313	7	.764	-.29737	.95136	-2.54698	1.95225
		Equal variances not assumed			-.330	6.775	.752	-.29737	.90232	-2.44545	1.85071

a. No statistics are computed for one or more split files

Appendix 6: R Scripts

6.1 Time Period: Comparison All

```
#Period differences showing labels

setwd("C:/Users/Cara Hirst/Desktop/Analysis")

require(geomorph)

require(Morpho)

require(abind)

require(xlsx)

A<-read.morphologika("DataNlabel.txt")


#gpa analysis

coords<-A$coords

label<-A$labels

Y.gpa<-gpagen(coords, curves = NULL, surfaces = NULL, PrinAxes = TRUE,max.iter = NULL, ProcD = TRUE,
Proj = TRUE, print.progress = TRUE)


#labels

period<- substr(A$label,1,1)

group <-factor(paste(A$coords))

levels(group)


new.coords<-coords.subset(A= A$coords, group= period)

names(new.coords)


labels.N<-subset(period, period == 'N')

labels.I<-subset(period, period == 'I')

labels.R<-subset(period, period == 'R')

labels.A<-subset(period, period == 'A')

labels.M<-subset(period, period == 'M')

labels.P<-subset(period, period == 'P')

PERIOD<- abind (new.coords$'N', new.coords$'I', new.coords$'R', new.coords$'A', new.coords$'M',
new.coords$'P')

PERIOD.l<- rbind(labels.N, labels.I, labels.R, labels.A, labels.M, labels.P)

PERIOD.gpa<- gpagen(PERIOD)
```

```
#PCA
PERIOD.PCA<-plotTangentSpace(PERIOD.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)
write.xlsx(PERIOD.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/PERIOD.PCA.xlsx")
PERIOD.PCA$pc.summary
PERIOD.PCA$sdev

#LABELS
write.xlsx(PERIOD.l, "C:/Users/Cara Hirst/Desktop/Analysis/PERIOD.PCAlabels.xlsx")

#CVA
PERIOD.PCA<-procSym(PERIOD)
CVA.PERIOD<-CVA(PERIOD.PCA$orpdata, PERIOD.l)
write.xlsx(CVA.PERIOD$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/PERIOD.CVscores.xlsx")
write.xlsx(CVA.PERIOD$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/PERIOD.CVAgroupmeans.xlsx")

#OTHER
CVA.PERIOD
CVA.PERIOD$Dis
CVA.PERIOD$Var

#visulisation cv1
cvvis10 <- 5*matrix(CVA.PERIOD$CVvis[,1],nrow(CVA.PERIOD$Grandm),ncol(CVA.PERIOD$Grandm))+CVA.PERIOD$Grandm
cvvisNeg10 <- -5*matrix(CVA.PERIOD$CVvis[,1],nrow(CVA.PERIOD$Grandm),ncol(CVA.PERIOD$Grandm))+CVA.PERIOD$Grandm

#WRITE.VISULISATION
write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/PERIOD.1cvvis5.xlsx")
write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/PERIOD.1cvvisNeg5.xlsx")

#visulisation cv2
cvvis10 <- 5*matrix(CVA.PERIOD$CVvis[,2],nrow(CVA.PERIOD$Grandm),ncol(CVA.PERIOD$Grandm))+CVA.PERIOD$Grandm
cvvisNeg10 <- -5*matrix(CVA.PERIOD$CVvis[,2],nrow(CVA.PERIOD$Grandm),ncol(CVA.PERIOD$Grandm))+CVA.PERIOD$Grandm
```

```
#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/PERIOD.2cvvis5.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/PERIOD.2cvvisNeg5.xlsx")


#visulisation cv1

cvvis10 <- 5*matrix(CVA.PERIOD$CVvis[,3],nrow(CVA.PERIOD$Grandm),ncol(CVA.PERIOD$Grandm))+CVA.PERIOD$Grandm

cvvisNeg10 <- -5*matrix(CVA.PERIOD$CVvis[,3],nrow(CVA.PERIOD$Grandm),ncol(CVA.PERIOD$Grandm))+CVA.PERIOD$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/PERIOD.3cvvis5.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/PERIOD.3cvvisNeg5.xlsx")


#visulisation cv1

cvvis10 <- 5*matrix(CVA.PERIOD$CVvis[,4],nrow(CVA.PERIOD$Grandm),ncol(CVA.PERIOD$Grandm))+CVA.PERIOD$Grandm

cvvisNeg10 <- -5*matrix(CVA.PERIOD$CVvis[,4],nrow(CVA.PERIOD$Grandm),ncol(CVA.PERIOD$Grandm))+CVA.PERIOD$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/PERIOD.4cvvis5.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/PERIOD.4cvvisNeg5.xlsx")
```

6.2 Sex Estimation: Individual Periods

```
#open data

setwd("C:/Users/Cara Hirst/Desktop/Analysis/DATA")

require(geomorph)

require(Morpho)

require(abind)

require(xlsx)

A<-read.morphologika("DataOLD.txt")


#Newlabels PeriodSex

PeriodSex<- substr(A$label ,1, 3)
```

```
group <-factor(paste(A$coords))
levels(group)

new.coords<-coords.subset(A= A$coords, group= PeriodSex)
names(new.coords)

#Neolithic
labels.NF<-subset(A$labels, A$labels == 'NF')
labels.NM<-subset(A$labels, A$labels == 'NM')
NEO<- abind (new.coords$'NF', new.coords$'NM')
NEO.l<- rbind(labels.NF, labels.NM)
NEO.gpa<- gpagen(NEO)

#PCA and CVA
NEO.PCA <-procSym(NEO)
write.xlsx(NEO.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/ NEO.PCA.PCA.xlsx")
NEO.PCA $pc.summary
NEO.PCA$sdev

CVA.NEO<-CVA(NEO.PCA$orpdata,NEO.l)
write.xlsx(CVA.NEO $groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/ CVA.NEO.CVAgroupmeans.xlsx")
write.xlsx(CVA.NEO$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/NEO.CVscores.xlsx")
CVA.NEO $Var

#labels
write.xlsx(NEO.l, "C:/Users/Cara Hirst/Desktop/Analysis/NEO.PCAlabels.xlsx")

#Iron and Bronze Age
labels.IBF<-subset(A$labels, A$labels == 'IBF')
labels.IBM<-subset(A$labels, A$labels == 'IBM')
IB<- abind (new.coords$'IBF', new.coords$'IBM')
IB.l<- rbind(labels.IBF, labels.IBM)
IB.gpa<- gpagen(IB)


#PCA and CVA
```

IB.PCA <-procSym(IB)

write.xlsx(IB.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/ IB.PCA.PCA.xlsx")

IB.PCA $pc.summary

IB.PCA$sdev

CVA.IB<-CVA(IB.PCA$orpdata,IB.l)

write.xlsx(CVA.IB $groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/ CVA.IB.CVAgroupmeans.xlsx")

write.xlsx(CVA.IB$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/IB.CVscores.xlsx")

CVA.IB $Var

#labels

write.xlsx(IB.l, "C:/Users/Cara Hirst/Desktop/Analysis/IB.PCAlabels.xlsx")

#Roman

labels.RF<-subset(A$labels, A$labels == 'RF')

labels.RM<-subset(A$labels, A$labels == 'RM')

R<- abind (new.coords$'RF', new.coords$'RM')

R.l<- rbind(labels.RF, labels.RM)

R.gpa<- gpagen(R)

#PCA and CVA

R.PCA <-procSym(R)

write.xlsx(R.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/ R.PCA.PCA.xlsx")

R.PCA $pc.summary

R.PCA$sdev

CVA.R<-CVA(R.PCA$orpdata,R.l)

write.xlsx(CVA.R $groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/ CVA.R.CVAgroupmeans.xlsx")

write.xlsx(CVA.R$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/R.CVscores.xlsx")

CVA.R $Var

#Anglo-Saxon

labels.ASF<-subset(A$labels, A$labels == 'ASF')

labels.ASM<-subset(A$labels, A$labels == 'ASM')

AS<- abind (new.coords$'ASF', new.coords$'ASM')

```
AS.l<- rbind(labels.ASF, labels.ASM)
AS.gpa<- gpagen(AS)



#PCA and CVA
AS.PCA <-procSym(AS)
write.xlsx(AS.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/ AS.PCA.PCA.xlsx")
AS.PCA $pc.summary
AS.PCA$sdev

CVA.AS<-CVA(AS.PCA$orpdata,AS.l)
write.xlsx(CVA.AS $groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/ CVA.AS.CVAgroupmeans.xlsx")
write.xlsx(CVA.AS$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/AS.CVscores.xlsx")
CVA.AS $Var
```

#Medieval

```
labels.MF<-subset(A$labels, A$labels == 'MF')
labels.MM<-subset(A$labels, A$labels == 'MM')
M<- abind (new.coords$'MF', new.coords$'MM')
M.l<- rbind(labels.MF, labels.MM)
M.gpa<- gpagen(M)



#PCA and CVA
M.PCA <-procSym(M)
write.xlsx(M.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/ M.PCA.PCA.xlsx")
M.PCA $pc.summary
M.PCA$sdev

CVA.M<-CVA(M.PCA$orpdata,M.l)
write.xlsx(CVA.M $groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/ CVA.M.CVAgroupmeans.xlsx")
write.xlsx(CVA.M$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/M.CVscores.xlsx")
CVA.M $Var
```

#Post-Medieval

```
labels.PMF<-subset(A$labels, A$labels == 'PMF')
```

```
labels.PMM<-subset(A$labels, A$labels == 'PMM')

PM<- abind (new.coords$'PMF', new.coords$'PMM')

PM.l<- rbind(labels.PMF, labels.PMM)

PM.gpa<- gpagen(PM)



#PCA and CVA

PM.PCA <-procSym(PM)

write.xlsx(PM.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/ PM.PCA.PCA.xlsx")

PM.PCA $pc.summary

PM.PCA$sdev


CVA.PM<-CVA(PM.PCA$orpdata,PM.l)

write.xlsx(CVA.PM $groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/ CVA.PM.CVAgroupmeans.xlsx")

write.xlsx(CVA.PM$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/PM.CVscores.xlsx")

CVA.PM $Var
```

6.3 Dental Wear Groups: Comparison

```
#open data

setwd("C:/Users/Cara Hirst/Desktop/Analysis")

require(geomorph)

require(Morpho)

require(abind)

require(xlsx)

A<-read.morphologika("DataNlabel.txt")


#gpa analysis

coords<-A$coords

label<-A$labels

Y.gpa<-gpagen(coords, curves = NULL, surfaces = NULL, PrinAxes = TRUE,max.iter = NULL, ProcD = TRUE,
Proj = TRUE, print.progress = TRUE)


#create subsets

group <-factor(paste(A$coords))

levels(group)

new.coords<-coords.subset(A= A$coords, group= WEAR)
```

```
names(new.coords)


WEAR<- substr(A$label,2,2)
#WEAR
labels.W1<-subset(WEAR, WEAR== '1')
labels.W2<-subset(WEAR, WEAR == '2')
labels.W3<-subset(WEAR, WEAR == '3')

WEARCOM<- abind (new.coords$'1', new.coords$'2', new.coords$'3')
WEARCOM.l<- rbind(labels.W1, labels.W2, labels.W3)
WEARCOM.gpa<- gpagen(WEARCOM)

#PCA
WEARCOM.PCA<-plotTangentSpace(WEARCOM.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)
write.xlsx(WEARCOM.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/WEARCOM.PCA.xlsx")
WEARCOM.PCA$pc.summary
WEARCOM.PCA$sdev

#LABELS
write.xlsx(WEARCOM.l, "C:/Users/Cara Hirst/Desktop/Analysis/WEARCOM.PCAlabels.xlsx")

#CVA
WEARCOM.PCA<-procSym(WEARCOM)
CVA.WEARCOM<-CVA(WEARCOM.PCA$orpdata,WEARCOM.l)
write.xlsx(CVA.WEARCOM$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/WEARCOM.CVscores.xlsx")
write.xlsx(CVA.WEARCOM$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/WEARCOM.CVAgroupmeans.xlsx")
CVA.WEARCOM<-$Var

#visulisation cv1
cvvis10 <- 10*matrix(CVA.WEARCOM$CVvis[,1],nrow(CVA.WEARCOM$Grandm),ncol(CVA.WEARCOM$Grandm))+CVA.WEARCOM$Grandm
cvvisNeg10 <- -10*matrix(CVA.WEARCOM$CVvis[,1],nrow(CVA.WEARCOM$Grandm),ncol(CVA.WEARCOM$Grandm))+CVA.WEARCOM$Grandm
```

```
#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARCOM.1cvvis10.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARCOM.1cvvisNeg10.xlsx")


#visulisation cv2

cvvis210 <-
10*matrix(CVA.WEARCOM$CVvis[,2],nrow(CVA.WEARCOM$Grandm),ncol(CVA.WEARCOM$Grandm))+C
VA.WEARCOM$Grandm

cvvisNeg210 <- -
10*matrix(CVA.WEARCOM$CVvis[,2],nrow(CVA.WEARCOM$Grandm),ncol(CVA.WEARCOM$Grandm))+C
VA.WEARCOM$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARCOM.2cvvis10.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARCOM.2cvvisNeg10.xlsx")
```

6.4 Dental Wear Groups: Sex Estimation

```
A<-read.morphologika("testingdata.txt")


WEAR<- substr(A$label,1,2)

#create subsets

group <-factor(paste(A$coords))

levels(group)

new.coords<-coords.subset(A= A$coords, group= WEAR)

names(new.coords)


#WEAR

labels.F1<-subset(WEAR, WEAR== 'F1')

labels.F2<-subset(WEAR, WEAR == 'F2')

labels.F3<-subset(WEAR, WEAR == 'F3')

labels.M1<-subset(WEAR, WEAR== 'M1')

labels.M2<-subset(WEAR, WEAR == 'M2')

labels.M3<-subset(WEAR, WEAR == 'M3')


WEARSEX<- abind (new.coords$'F1', new.coords$'F2', new.coords$'F3', new.coords$'M1', new.coords$'M2',
new.coords$'M3')
```

```
WEARSEX.l<- rbind(labels.F1, labels.F2, labels.F3, labels.M1, labels.M2, labels.M3)
WEARSEX.gpa<- gpagen(WEARSEX)

#PCA
WEARSEX.PCA<-plotTangentSpace(WEARSEX.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)
write.xlsx(WEARSEX.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/WEARSEX.PCA.xlsx")
WEARSEX.PCA$pc.summary
WEARSEX.PCA$sdev

#LABELS
write.xlsx(WEARSEX.l, "C:/Users/Cara Hirst/Desktop/Analysis/WEARSEX.PCAlabels.xlsx")

#CVA
WEARSEX.PCA<-procSym(WEARSEX)
CVA.WEARSEX<-CVA(WEARSEX.PCA$orpdata,WEARSEX.l)
write.xlsx(CVA.WEARSEX$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/WEARSEX.CVscores.xlsx")
write.xlsx(CVA.WEARSEX$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/WEARSEX.CVAgroupmeans.xlsx")

#OTHER
CVA.WEARSEX
CVA.WEARSEX$Dis
CVA.WEARSEX$Var

#visulisation cv1
cvvis10 <- 10*matrix(CVA.WEARSEX$CVvis[,1],nrow(CVA.WEARSEX$Grandm),ncol(CVA.WEARSEX$Grandm))+CVA.WEARSEX$Grandm
cvvisNeg10 <- -10*matrix(CVA.WEARSEX$CVvis[,1],nrow(CVA.WEARSEX$Grandm),ncol(CVA.WEARSEX$Grandm))+CVA.WEARSEX$Grandm

#WRITE.VISULISATION
write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARSEX.1cvvis10.xlsx")
write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARSEX.1cvvisNeg10.xlsx")

#visulisation cv2
```

```
cvvis10 <- 10*matrix(CVA.WEARSEX$CVvis[,2],nrow(CVA.WEARSEX$Grandm),ncol(CVA.WEARSEX$Grandm))+CVA.WEARSEX$Grandm

cvvisNeg10 <- -10*matrix(CVA.WEARSEX$CVvis[,2],nrow(CVA.WEARSEX$Grandm),ncol(CVA.WEARSEX$Grandm))+CVA.WEARSEX$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARSEX.2cvvis10.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARSEX.2cvvisNeg10.xlsx")


#visulisation cv3

cvvis10 <- 10*matrix(CVA.WEARSEX$CVvis[,3],nrow(CVA.WEARSEX$Grandm),ncol(CVA.WEARSEX$Grandm))+CVA.WEARSEX$Grandm

cvvisNeg10 <- -10*matrix(CVA.WEARSEX$CVvis[,3],nrow(CVA.WEARSEX$Grandm),ncol(CVA.WEARSEX$Grandm))+CVA.WEARSEX$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARSEX.3cvvis10.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARSEX.3cvvisNeg10.xlsx")


#visulisation cv4

cvvis10 <- 10*matrix(CVA.WEARSEX$CVvis[,4],nrow(CVA.WEARSEX$Grandm),ncol(CVA.WEARSEX$Grandm))+CVA.WEARSEX$Grandm

cvvisNeg10 <- -10*matrix(CVA.WEARSEX$CVvis[,4],nrow(CVA.WEARSEX$Grandm),ncol(CVA.WEARSEX$Grandm))+CVA.WEARSEX$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARSEX.4cvvis10.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARSEX.4cvvisNeg10.xlsx")
```

6.5 Dental Wear Groups: Time Period

```
A<-read.morphologika("DataNlabel.txt")


WEARperiod<- substr(A$label,1,2)


#create subsets

group <-factor(paste(A$coords))
```

```
new.coords<-coords.subset(A= A$coords, group= WEARperiod)

names(new.coords)


labels.N1<-subset(WEARperiod, WEARperiod== 'N1')

labels.N2<-subset(WEARperiod, WEARperiod == 'N2')

labels.N3<-subset(WEARperiod, WEARperiod == 'N3')

labels.I1<-subset(WEARperiod, WEARperiod== 'I1')

labels.I2<-subset(WEARperiod, WEARperiod == 'I2')

labels.I3<-subset(WEARperiod, WEARperiod == 'I3')

labels.R1<-subset(WEARperiod, WEARperiod== 'R1')

labels.R2<-subset(WEARperiod, WEARperiod == 'R2')


labels.R3<-subset(WEARperiod, WEARperiod == 'R3')

labels.A1<-subset(WEARperiod, WEARperiod== 'A1')

labels.A2<-subset(WEARperiod, WEARperiod == 'A2')

labels.A3<-subset(WEARperiod, WEARperiod == 'A3')

labels.M1<-subset(WEARperiod, WEARperiod== 'M1')

labels.M2<-subset(WEARperiod, WEARperiod == 'M2')

labels.M3<-subset(WEARperiod, WEARperiod == 'M3')

labels.P1<-subset(WEARperiod, WEARperiod== 'P1')

labels.P2<-subset(WEARperiod, WEARperiod == 'P2')

labels.P3<-subset(WEARperiod, WEARperiod == 'P3')

#allperiods wear1
WEAR1PERIOD<- abind (new.coords$'N1', new.coords$'I1', new.coords$'R1', new.coords$'A1', new.coords$'M1', new.coords$'P1')

WEAR1PERIOD.l<- rbind(labels.N1, labels.I1, labels.R1, labels.A1, labels.M1, labels.P1)

WEAR1PERIOD.gpa<- gpagen(WEAR1PERIOD)


#PCA

WEAR1PERIOD.PCA<-plotTangentSpace(WEAR1PERIOD.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(WEAR1PERIOD.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR1PERIOD.PCA.xlsx")

WEAR1PERIOD.PCA$pc.summary

WEAR1PERIOD.PCA$sdev


#LABELS

write.xlsx(WEAR1PERIOD.l, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR1PERIOD.PCAlabels.xlsx")
```

```
#CVA

WEAR1PERIOD.PCA<-procSym(WEAR1PERIOD)

CVA.WEAR1PERIOD<-CVA(WEAR1PERIOD.PCA$orpdata,WEAR1PERIOD.l)

write.xlsx(CVA.WEAR1PERIOD$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR1PERIOD.CVscores.xlsx")

write.xlsx(CVA.WEAR1PERIOD$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR1PERIOD.CVAgroupmeans.xlsx")


#OTHER

CVA.WEAR1PERIOD

CVA.WEAR1PERIOD$Dis

CVA.WEAR1PERIOD$Var


#visulisation cv1

cvvis10 <- 15*matrix(CVA.WEAR1PERIOD$CVvis[,1],nrow(CVA.WEAR1PERIOD$Grandm),ncol(CVA.WEAR1PERIOD$Grandm))+CVA.WEAR1PERIOD$Grandm

cvvisNeg10 <- -15*matrix(CVA.WEAR1PERIOD$CVvis[,1],nrow(CVA.WEAR1PERIOD$Grandm),ncol(CVA.WEAR1PERIOD$Grandm))+CVA.WEAR1PERIOD$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR1PERIOD.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR1PERIOD.1cvvisNeg15.xlsx")


#visulisation cv2

cvvis10 <- 15*matrix(CVA.WEAR1PERIOD$CVvis[,2],nrow(CVA.WEAR1PERIOD$Grandm),ncol(CVA.WEAR1PERIOD$Grandm))+CVA.WEAR1PERIOD$Grandm

cvvisNeg10 <- -15*matrix(CVA.WEAR1PERIOD$CVvis[,2],nrow(CVA.WEAR1PERIOD$Grandm),ncol(CVA.WEAR1PERIOD$Grandm))+CVA.WEAR1PERIOD$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR1PERIOD.2cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR1PERIOD.2cvvisNeg15.xlsx")


#visulisation cv3
```

```
cvvis10 <- 15*matrix(CVA.WEAR1PERIOD$CVvis[,3],nrow(CVA.WEAR1PERIOD$Grandm),ncol(CVA.WEAR1PERIOD$Grandm))+CVA.WEAR1PERIOD$Grandm

cvvisNeg10 <- -15*matrix(CVA.WEAR1PERIOD$CVvis[,3],nrow(CVA.WEAR1PERIOD$Grandm),ncol(CVA.WEAR1PERIOD$Grandm))+CVA.WEAR1PERIOD$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR1PERIOD.3cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR1PERIOD.3cvvisNeg15.xlsx")


#visulisation cv4

cvvis10 <- 15*matrix(CVA.WEAR1PERIOD$CVvis[,4],nrow(CVA.WEAR1PERIOD$Grandm),ncol(CVA.WEAR1PERIOD$Grandm))+CVA.WEAR1PERIOD$Grandm

cvvisNeg10 <- -15*matrix(CVA.WEAR1PERIOD$CVvis[,4],nrow(CVA.WEAR1PERIOD$Grandm),ncol(CVA.WEAR1PERIOD$Grandm))+CVA.WEAR1PERIOD$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR1PERIOD.4cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR1PERIOD.4cvvisNeg15.xlsx")
```

#all periods wear2

```
WEAR2PERIOD<- abind (new.coords$'N2', new.coords$'I2', new.coords$'R2', new.coords$'A2', new.coords$'M2', new.coords$'P2')

WEAR2PERIOD.l<- rbind(labels.N2, labels.I2, labels.R2, labels.A2, labels.M2, labels.P2)

WEAR2PERIOD.gpa<- gpagen(WEAR2PERIOD)


#PCA

WEAR2PERIOD.PCA<-plotTangentSpace(WEAR2PERIOD.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(WEAR2PERIOD.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR2PERIOD.PCA.xlsx")

WEAR2PERIOD.PCA$pc.summary

WEAR2PERIOD.PCA$sdev


#LABELS

write.xlsx(WEAR2PERIOD.l, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR2PERIOD.PCAlabels.xlsx")


#CVA
```

```
WEAR2PERIOD.PCA<-procSym(WEAR2PERIOD)

CVA.WEAR2PERIOD<-CVA(WEAR2PERIOD.PCA$orpdata,WEAR2PERIOD.l)

write.xlsx(CVA.WEAR2PERIOD$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR2PERIOD.CVscores.xlsx")

write.xlsx(CVA.WEAR2PERIOD$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR2PERIOD.CVAgroupmeans.xlsx")


#OTHER

CVA.WEAR2PERIOD

CVA.WEAR2PERIOD$Dis

CVA.WEAR2PERIOD$Var


#visulisation cv1

cvvis10 <- 15*matrix(CVA.WEAR2PERIOD$CVvis[,1],nrow(CVA.WEAR2PERIOD$Grandm),ncol(CVA.WEAR2PERIOD$Grandm))+CVA.WEAR2PERIOD$Grandm

cvvisNeg10 <- -15*matrix(CVA.WEAR2PERIOD$CVvis[,1],nrow(CVA.WEAR2PERIOD$Grandm),ncol(CVA.WEAR2PERIOD$Grandm))+CVA.WEAR2PERIOD$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR2PERIOD.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR2PERIOD.1cvvisNeg15.xlsx")


#visulisation cv2

cvvis10 <- 15*matrix(CVA.WEAR2PERIOD$CVvis[,2],nrow(CVA.WEAR2PERIOD$Grandm),ncol(CVA.WEAR2PERIOD$Grandm))+CVA.WEAR2PERIOD$Grandm

cvvisNeg10 <- -15*matrix(CVA.WEAR2PERIOD$CVvis[,2],nrow(CVA.WEAR2PERIOD$Grandm),ncol(CVA.WEAR2PERIOD$Grandm))+CVA.WEAR2PERIOD$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR2PERIOD.2cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR2PERIOD.2cvvisNeg15.xlsx")


#visulisation cv3

cvvis10 <- 15*matrix(CVA.WEAR2PERIOD$CVvis[,3],nrow(CVA.WEAR2PERIOD$Grandm),ncol(CVA.WEAR2PERIOD$Grandm))+CVA.WEAR2PERIOD$Grandm
```

cvvisNeg10 <- -15*matrix(CVA.WEAR2PERIOD$CVvis[,3],nrow(CVA.WEAR2PERIOD$Grandm),ncol(CVA.WEAR2PERIOD$Grandm))+CVA.WEAR2PERIOD$Grandm

#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR2PERIOD.3cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR2PERIOD.3cvvisNeg15.xlsx")

#visulisation cv4

cvvis10 <- 15*matrix(CVA.WEAR2PERIOD$CVvis[,4],nrow(CVA.WEAR2PERIOD$Grandm),ncol(CVA.WEAR2PERIOD$Grandm))+CVA.WEAR2PERIOD$Grandm

cvvisNeg10 <- -15*matrix(CVA.WEAR2PERIOD$CVvis[,4],nrow(CVA.WEAR2PERIOD$Grandm),ncol(CVA.WEAR2PERIOD$Grandm))+CVA.WEAR2PERIOD$Grandm

#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR2PERIOD.4cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR2PERIOD.4cvvisNeg15.xlsx")

#all periods wear3

WEAR3PERIOD<- abind (new.coords$'N3', new.coords$'I3', new.coords$'R3', new.coords$'A3', new.coords$'M3', new.coords$'P3')

WEAR3PERIOD.l<- rbind(labels.N3, labels.I3, labels.R3, labels.A3, labels.M3, labels.P3)

WEAR3PERIOD.gpa<- gpagen(WEAR3PERIOD)

#PCA

WEAR3PERIOD.PCA<-plotTangentSpace(WEAR3PERIOD.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(WEAR3PERIOD.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR3PERIOD.PCA.xlsx")

WEAR3PERIOD.PCA$pc.summary

WEAR3PERIOD.PCA$sdev

#LABELS

write.xlsx(WEAR3PERIOD.l, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR3PERIOD.PCAlabels.xlsx")

#CVA

WEAR3PERIOD.PCA<-procSym(WEAR3PERIOD)

CVA.WEAR3PERIOD<-CVA(WEAR3PERIOD.PCA$orpdata,WEAR3PERIOD.l)

```
write.xlsx(CVA.WEAR3PERIOD$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR3PERIOD.CVscores.xlsx")

write.xlsx(CVA.WEAR3PERIOD$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR3PERIOD.CVAgroupmeans.xlsx")


#OTHER

CVA.WEAR3PERIOD

CVA.WEAR3PERIOD$Dis

CVA.WEAR3PERIOD$Var


#visulisation cv1

cvvis10 <- 15*matrix(CVA.WEAR3PERIOD$CVvis[,1],nrow(CVA.WEAR3PERIOD$Grandm),ncol(CVA.WEAR3PERIOD$Grandm))+CVA.WEAR3PERIOD$Grandm

cvvisNeg10 <- -15*matrix(CVA.WEAR3PERIOD$CVvis[,1],nrow(CVA.WEAR3PERIOD$Grandm),ncol(CVA.WEAR3PERIOD$Grandm))+CVA.WEAR3PERIOD$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR3PERIOD.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR3PERIOD.1cvvisNeg15.xlsx")


#visulisation cv2

cvvis10 <- 15*matrix(CVA.WEAR3PERIOD$CVvis[,2],nrow(CVA.WEAR3PERIOD$Grandm),ncol(CVA.WEAR3PERIOD$Grandm))+CVA.WEAR3PERIOD$Grandm

cvvisNeg10 <- -15*matrix(CVA.WEAR3PERIOD$CVvis[,2],nrow(CVA.WEAR3PERIOD$Grandm),ncol(CVA.WEAR3PERIOD$Grandm))+CVA.WEAR3PERIOD$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR3PERIOD.2cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR3PERIOD.2cvvisNeg15.xlsx")


#visulisation cv3

cvvis10 <- 15*matrix(CVA.WEAR3PERIOD$CVvis[,3],nrow(CVA.WEAR3PERIOD$Grandm),ncol(CVA.WEAR3PERIOD$Grandm))+CVA.WEAR3PERIOD$Grandm

cvvisNeg10 <- -15*matrix(CVA.WEAR3PERIOD$CVvis[,3],nrow(CVA.WEAR3PERIOD$Grandm),ncol(CVA.WEAR3PERIOD$Grandm))+CVA.WEAR3PERIOD$Grandm
```

```
#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR3PERIOD.3cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR3PERIOD.3cvvisNeg15.xlsx")


#visulisation cv4

cvvis10 <- 15*matrix(CVA.WEAR3PERIOD$CVvis[,4],nrow(CVA.WEAR3PERIOD$Grandm),ncol(CVA.WEAR3PERIOD$Grandm))+CVA.WEAR3PERIOD$Grandm

cvvisNeg10 <- -15*matrix(CVA.WEAR3PERIOD$CVvis[,4],nrow(CVA.WEAR3PERIOD$Grandm),ncol(CVA.WEAR3PERIOD$Grandm))+CVA.WEAR3PERIOD$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR3PERIOD.4cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEAR3PERIOD.4cvvisNeg15.xlsx")
```

6.6 Dental Wear Group: Neolithic

```
WEARNEO<- abind (new.coords$'N1', new.coords$'N2', new.coords$'N3')

WEARNEO.l<- rbind(labels.N1, labels.N2, labels.N3)

WEARNEO.gpa<- gpagen(WEARNEO)


#PCA

WEARNEO.PCA<-plotTangentSpace(WEARNEO.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(WEARNEO.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/WEARNEO.PCA.xlsx")

WEARNEO.PCA$pc.summary

WEARNEO.PCA$sdev


#LABELS

write.xlsx(WEARNEO.l, "C:/Users/Cara Hirst/Desktop/Analysis/WEARNEO.PCAlabels.xlsx")


#CVA

WEARNEO.PCA<-procSym(WEARNEO)

CVA.WEARNEO<-CVA(WEARNEO.PCA$orpdata,WEARNEO.l)

write.xlsx(CVA.WEARNEO$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/WEARNEO.CVscores.xlsx")

write.xlsx(CVA.WEARNEO$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/WEARNEO.CVAgroupmeans.xlsx")


#OTHER
```

```
CVA.WEARNEO

CVA.WEARNEO$Dis

CVA.WEARNEO$Var


#visulisation cv1

cvvis10 <- 10*matrix(CVA.WEARIB$CVvis[,1],nrow(CVA.WEARIB$Grandm),ncol(CVA.WEARIB$Grandm))+CVA.WEARIB$Grandm

cvvisNeg10 <- -10*matrix(CVA.WEARIB$CVvis[,1],nrow(CVA.WEARIB$Grandm),ncol(CVA.WEARIB$Grandm))+CVA.WEARIB$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARN.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARN.1cvvisNeg15.xlsx")


#visulisation cv2

cvvis10 <- 10*matrix(CVA.WEARN$CVvis[,2],nrow(CVA.WEARN$Grandm),ncol(CVA.WEARN$Grandm))+CVA.WEARN$Grandm

cvvisNeg10 <- -10*matrix(CVA.WEARN$CVvis[,2],nrow(CVA.WEARN$Grandm),ncol(CVA.WEARN$Grandm))+CVA.WEARN$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARIB.2cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARIB.2cvvisNeg15.xlsx")
```

6.7 Dental Wear Group: Iron and Bronze Age

```
WEARIB<- abind (new.coords$'I1', new.coords$'I2', new.coords$'I3')

WEARIB.l<- rbind(labels.I1, labels.I2, labels.I3)

WEARIB.gpa<- gpagen(WEARIB)
```

PCA

```
WEARIB.PCA<-plotTangentSpace(WEARIB.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(WEARIB.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/WEARIB.PCA.xlsx")

WEARIB.PCA$pc.summary

WEARIB.PCA$sdev


#LABELS

write.xlsx(WEARIB.l, "C:/Users/Cara Hirst/Desktop/Analysis/WEARIB.PCAlabels.xlsx")


#CVA

WEARIB.PCA<-procSym(WEARIB)

CVA.WEARIB<-CVA(WEARIB.PCA$orpdata,WEARIB.l)

write.xlsx(CVA.WEARIB$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/WEARIB.CVscores.xlsx")

write.xlsx(CVA.WEARIB$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/WEARIB.CVAgroupmeans.xlsx")


#OTHER

CVA.WEARIB

CVA.WEARIB$Dis

CVA.WEARIB$Var


#visulisation cv1

cvvis10 <- 10*matrix(CVA.WEARIB$CVvis[,1],nrow(CVA.WEARIB$Grandm),ncol(CVA.WEARIB$Grandm))+CVA.WEARIB$Grandm

cvvisNeg10 <- -10*matrix(CVA.WEARIB$CVvis[,1],nrow(CVA.WEARIB$Grandm),ncol(CVA.WEARIB$Grandm))+CVA.WEARIB$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARIB.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARIB.1cvvisNeg15.xlsx")
```

```
#visulisation cv2

cvvis10 <- 10*matrix(CVA.WEARIB$CVvis[,2],nrow(CVA.WEARIB$Grandm),ncol(CVA.WEARIB$Grandm))+CVA.WEARIB$Grandm

cvvisNeg10 <- -10*matrix(CVA.WEARIB$CVvis[,2],nrow(CVA.WEARIB$Grandm),ncol(CVA.WEARIB$Grandm))+CVA.WEARIB$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARIB.2cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARIB.2cvvisNeg15.xlsx")
```

6.8 Dental Wear Group: Roman

```
WEARROM<- abind (new.coords$'R1', new.coords$'R2', new.coords$'R3')

WEARROM.l<- rbind(labels.R1, labels.R2, labels.R3)

WEARROM.gpa<- gpagen(WEARROM)


#PCA

WEARROM.PCA<-plotTangentSpace(WEARROM.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(WEARROM.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/WEARROM.PCA.xlsx")

WEARROM.PCA$pc.summary

WEARROM.PCA$sdev


#LABELS

write.xlsx(WEARROM.l, "C:/Users/Cara Hirst/Desktop/Analysis/WEARROM.PCAlabels.xlsx")


#CVA

WEARROM.PCA<-procSym(WEARROM)

CVA.WEARROM<-CVA(WEARROM.PCA$orpdata,WEARROM.l)

write.xlsx(CVA.WEARROM$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/WEARROM.CVscores.xlsx")

write.xlsx(CVA.WEARROM$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/WEARROM.CVAgroupmeans.xlsx")
```

```
#OTHER

CVA.WEARROM

CVA.WEARROM$Dis

CVA.WEARROM$Var


#visulisation cv1

cvvis10 <- 10*matrix(CVA.WEARROM$CVvis[,1],nrow(CVA.WEARROM$Grandm),ncol(CVA.WEARROM$Grandm))+CVA.WEARROM$Grandm

cvvisNeg10 <- -10*matrix(CVA.WEARROM$CVvis[,1],nrow(CVA.WEARROM$Grandm),ncol(CVA.WEARROM$Grandm))+CVA.WEARROM$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARROM.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARROM.1cvvisNeg15.xlsx")


#visulisation cv2

cvvis10 <- 10*matrix(CVA.WEARROM$CVvis[,2],nrow(CVA.WEARROM$Grandm),ncol(CVA.WEARROM$Grandm))+CVA.WEARROM$Grandm

cvvisNeg10 <- -10*matrix(CVA.WEARROM$CVvis[,2],nrow(CVA.WEARROM$Grandm),ncol(CVA.WEARROM$Grandm))+CVA.WEARROM$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARROM.2cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARROM.2cvvisNeg15.xlsx")
```

6.9 Dental Wear Group: Anglo-Saxon

```
WEARAS<- abind (new.coords$'A1', new.coords$'A2', new.coords$'A3')

WEARAS.l<- rbind(labels.A1, labels.A2, labels.A3)
```

```
WEARAS.gpa<- gpagen(WEARAS)

#PCA
WEARAS.PCA<-plotTangentSpace(WEARAS.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)
write.xlsx(WEARAS.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/WEARAS.PCA.xlsx")
WEARAS.PCA$pc.summary
WEARAS.PCA$sdev

#LABELS
write.xlsx(WEARAS.l, "C:/Users/Cara Hirst/Desktop/Analysis/WEARAS.PCAlabels.xlsx")

#CVA
WEARAS.PCA<-procSym(WEARAS)
CVA.WEARAS<-CVA(WEARAS.PCA$orpdata,WEARAS.l)
write.xlsx(CVA.WEARAS$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/WEARAS.CVscores.xlsx")
write.xlsx(CVA.WEARAS$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/WEARAS.CVAgroupmeans.xlsx")

#OTHER
CVA.WEARAS
CVA.WEARAS$Dis
CVA.WEARAS$Var

#visulisation cv1
cvvis10 <- 10*matrix(CVA.WEARAS$CVvis[,1],nrow(CVA.WEARAS$Grandm),ncol(CVA.WEARAS$Grandm))+CVA.WEARAS$Grandm
cvvisNeg10 <- -10*matrix(CVA.WEARAS$CVvis[,1],nrow(CVA.WEARAS$Grandm),ncol(CVA.WEARAS$Grandm))+CVA.WEARAS$Grandm
plot(cvvis10,asp=1)
points(cvvisNeg10,col=2)
for (i in 1:nrow(cvvisNeg10))
lines(rbind(cvvis10[i,],cvvisNeg10[i,]))

#WRITE.VISULISATION
write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARAS.1cvvis15.xlsx")
write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARAS.1cvvisNeg15.xlsx")
```

```
#visulisation cv2

cvvis10 <- 10*matrix(CVA.WEARAS$CVvis[,2],nrow(CVA.WEARAS$Grandm),ncol(CVA.WEARAS$Grandm))+CVA.WEARAS$Grandm

cvvisNeg10 <- -10*matrix(CVA.WEARAS$CVvis[,2],nrow(CVA.WEARAS$Grandm),ncol(CVA.WEARAS$Grandm))+CVA.WEARAS$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARAS.2cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARAS.2cvvisNeg15.xlsx")
```

6.10 Dental Wear Group: Medieval

```
WEARMED<- abind (new.coords$'M1', new.coords$'M2', new.coords$'M3')

WEARMED.l<- rbind(labels.M1, labels.M2, labels.M3)

WEARMED.gpa<- gpagen(WEARMED)


#PCA

WEARMED.PCA<-plotTangentSpace(WEARMED.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(WEARMED.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/WEARMED.PCA.xlsx")

WEARMED.PCA$pc.summary

WEARMED.PCA$sdev


#LABELS

write.xlsx(WEARMED.l, "C:/Users/Cara Hirst/Desktop/Analysis/WEARMED.PCAlabels.xlsx")


#CVA

WEARMED.PCA<-procSym(WEARMED)

CVA.WEARMED<-CVA(WEARMED.PCA$orpdata,WEARMED.l)

write.xlsx(CVA.WEARMED$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/WEARMED.CVscores.xlsx")

write.xlsx(CVA.WEARMED$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/WEARMED.CVAgroupmeans.xlsx")
```

```
#OTHER

CVA.WEARMED

CVA.WEARMED$Dis

CVA.WEARMED$Var


#visulisation cv1

cvvis10                                                                                                   <-
10*matrix(CVA.WEARMED$CVvis[,1],nrow(CVA.WEARMED$Grandm),ncol(CVA.WEARMED$Grandm))+C
VA.WEARMED$Grandm

cvvisNeg10                                       <-                                                        -
10*matrix(CVA.WEARMED$CVvis[,1],nrow(CVA.WEARMED$Grandm),ncol(CVA.WEARMED$Grandm))+C
VA.WEARMED$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARMED.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARMED.1cvvisNeg15.xlsx")


#visulisation cv2

cvvis10                                                                                                   <-
10*matrix(CVA.WEARMED$CVvis[,2],nrow(CVA.WEARMED$Grandm),ncol(CVA.WEARMED$Grandm))+C
VA.WEARMED$Grandm

cvvisNeg10                                       <-                                                        -
10*matrix(CVA.WEARMED$CVvis[,2],nrow(CVA.WEARMED$Grandm),ncol(CVA.WEARMED$Grandm))+C
VA.WEARMED$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARMED.2cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARMED.2cvvisNeg15.xlsx")
```

6.11 Dental Wear Group: Post-Medieval

```
WEARPOSTMED<- abind (new.coords$'P1', new.coords$'P2', new.coords$'P3')

WEARPOSTMED.l<- rbind(labels.P1, labels.P2, labels.P3)
```

```
WEARPOSTMED.gpa<- gpagen(WEARPOSTMED)


#PCA

WEARPOSTMED.PCA<-plotTangentSpace(WEARPOSTMED.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(WEARPOSTMED.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/WEARPOSTMED.PCA.xlsx")

WEARPOSTMED.PCA$pc.summary

WEARPOSTMED.PCA$sdev


#LABELS

write.xlsx(WEARPOSTMED.l, "C:/Users/Cara Hirst/Desktop/Analysis/WEARPOSTMED.PCAlabels.xlsx")


#CVA

WEARPOSTMED.PCA<-procSym(WEARPOSTMED)

CVA.WEARPOSTMED<-CVA(WEARPOSTMED.PCA$orpdata,WEARPOSTMED.l)

write.xlsx(CVA.WEARPOSTMED$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/WEARPOSTMED.CVscores.xlsx")

write.xlsx(CVA.WEARPOSTMED$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/WEARPOSTMED.CVAgroupmeans.xlsx")


#OTHER

CVA.WEARPOSTMED

CVA.WEARPOSTMED$Dis

CVA.WEARPOSTMED$Var


#visulisation cv1

cvvis10 <- 10*matrix(CVA.WEARPOSTMED$CVvis[,1],nrow(CVA.WEARPOSTMED$Grandm),ncol(CVA.WEARPOSTMED$Grandm))+CVA.WEARPOSTMED$Grandm

cvvisNeg10 <- -10*matrix(CVA.WEARPOSTMED$CVvis[,1],nrow(CVA.WEARPOSTMED$Grandm),ncol(CVA.WEARPOSTMED$Grandm))+CVA.WEARPOSTMED$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION
```

```
write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARPOSTMED.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARPOSTMED.1cvvisNeg15.xlsx")


#visulisation cv2

cvvis10 <- 10*matrix(CVA.WEARPOSTMED$CVvis[,2],nrow(CVA.WEARPOSTMED$Grandm),ncol(CVA.WEARPOSTMED$Grandm))+CVA.WEARPOSTMED$Grandm

cvvisNeg10 <- -10*matrix(CVA.WEARPOSTMED$CVvis[,2],nrow(CVA.WEARPOSTMED$Grandm),ncol(CVA.WEARPOSTMED$Grandm))+CVA.WEARPOSTMED$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARPOSTMED.2cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/WEARPOSTMED.2cvvisNeg15.xlsx")
```

6.12 Individual Period Comparisons

```
#open data

setwd("C:/Users/Cara Hirst/Desktop/Analysis/DATA")

require(geomorph)

require(Morpho)

require(abind)

require(xlsx)

A<-read.morphologika("Data.txt")


#gpa analysis

coords<-A$coords

label<-A$labels

Y.gpa<-gpagen(coords, curves = NULL, surfaces = NULL, PrinAxes = TRUE,max.iter = NULL, ProcD = TRUE, Proj = TRUE, print.progress = TRUE)


period<- substr(A$label,1,1)


#create subsets

group <-factor(paste(A$coords))
```

```
levels(group)

new.coords<-coords.subset(A= A$coords, group=period)

names(new.coords)
```

#N and IB

```
labels.N<-subset(period, period== 'N')

labels.I<-subset(period, period == 'I')


NEOIRONBRONZ<- abind (new.coords$'N', new.coords$'I')

NEOIRONBRONZ.l<- rbind(labels.N, labels.I)

NEOIRONBRONZ.gpa<- gpagen(NEOIRONBRONZ)


#PCA

NEOIRONBRONZ.PCA<-plotTangentSpace(NEOIRONBRONZ.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(NEOIRONBRONZ.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/NEOIRONBRONZ.PCA.xlsx")

NEOIRONBRONZ.PCA$pc.summary

NEOIRONBRONZ.PCA$sdev


#LABELS

write.xlsx(NEOIRONBRONZ.l, "C:/Users/Cara Hirst/Desktop/Analysis/NEOIRONBRONZ.PCAlabels.xlsx")


#CVA

NEOIRONBRONZ.PCA<-procSym(NEOIRONBRONZ)

CVA.NEOIRONBRONZ<-CVA(NEOIRONBRONZ.PCA$orpdata,NEOIRONBRONZ.l)

write.xlsx(CVA.NEOIRONBRONZ$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/NEOIRONBRONZ.CVscores.xlsx")

write.xlsx(CVA.NEOIRONBRONZ$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/NEOIRONBRONZ.CVAgroupmeans.xlsx")


#OTHER

CVA.NEOIRONBRONZ

CVA.NEOIRONBRONZ$Dis

CVA.NEOIRONBRONZ$Var


#visulisation cv1
```

```
cvvis10 <- 15*matrix(CVA.NEOIRONBRONZ$CVvis[,1],nrow(CVA.NEOIRONBRONZ$Grandm),ncol(CVA.NEOIRONBRONZ$Grandm))+CVA.NEOIRONBRONZ$Grandm

cvvisNeg10 <- -15*matrix(CVA.NEOIRONBRONZ$CVvis[,1],nrow(CVA.NEOIRONBRONZ$Grandm),ncol(CVA.NEOIRONBRONZ$Grandm))+CVA.NEOIRONBRONZ$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/NEOIRONBRONZ.2cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/NEOIRONBRONZ.2cvvisNeg15.xlsx")
```

#N and R

```
labels.N<-subset(period, period == 'N')

labels.R<-subset(period, period == 'R')


NEOROMAN<- abind (new.coords$'N', new.coords$'R')

NEOROMAN.l<- rbind(labels.N, labels.R)

NEOROMAN.gpa<- gpagen(NEOROMAN)


#PCA

NEOROMAN.PCA<-plotTangentSpace(NEOROMAN.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(NEOROMAN.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/NEOROMAN.PCA.xlsx")

NEOROMAN.PCA$pc.summary

NEOROMAN.PCA$sdev


#LABELS

write.xlsx(NEOROMAN.l, "C:/Users/Cara Hirst/Desktop/Analysis/NEOROMAN.PCAlabels.xlsx")


#CVA

NEOROMAN.PCA<-procSym(NEOROMAN)

CVA.NEOROMAN<-CVA(NEOROMAN.PCA$orpdata, NEOROMAN.l)

write.xlsx(CVA.NEOROMAN$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/NEOROMAN.CVscores.xlsx")
```

```
write.xlsx(CVA.NEOROMAN$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/NEOROMAN.CVAgroupmeans.xlsx")


#OTHER

CVA.NEOROMAN

CVA.NEOROMAN$Dis

CVA.NEOROMAN$Var


#visulisation cv1

cvvis10 <- 15*matrix(CVA.NEOROMAN$CVvis[,1],nrow(CVA.NEOROMAN$Grandm),ncol(CVA.NEOROMAN$Grandm))+CVA.NEOROMAN$Grandm

cvvisNeg10 <- -15*matrix(CVA.NEOROMAN$CVvis[,1],nrow(CVA.NEOROMAN$Grandm),ncol(CVA.NEOROMAN$Grandm))+CVA.NEOROMAN$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/NEOROMAN.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/NEOROMAN.1cvvisNeg15.xlsx")
```

#N and AS

```
labels.N<-subset(period, period == 'N')

labels.A<-subset(period, period == 'A')

NEOANGLO<- abind (new.coords$'N', new.coords$'A')

NEOANGLO.l<- rbind(labels.N, labels.A)

NEOANGLO.gpa<- gpagen(NEOANGLO)


#PCA

NEOANGLO.PCA<-plotTangentSpace(NEOANGLO.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(NEOANGLO.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/NEOANGLO.PCA.xlsx")

NEOANGLO.PCA$pc.summary

NEOANGLO.PCA$sdev


#LABELS
```

```
write.xlsx(NEOANGLO.l, "C:/Users/Cara Hirst/Desktop/Analysis/NEOANGLO.PCAlabels.xlsx")


#CVA

NEOANGLO.PCA<-procSym(NEOANGLO)

CVA.NEOANGLO<-CVA(NEOANGLO.PCA$orpdata, NEOANGLO.l)

write.xlsx(CVA.NEOANGLO$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/NEOANGLO.CVscores.xlsx")

write.xlsx(CVA.NEOANGLO$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/NEOANGLO.CVAgroupmeans.xlsx")


#OTHER

CVA.NEOANGLO

CVA.NEOANGLO$Dis

CVA.NEOANGLO$Var


#visulisation cv1

cvvis10 <- 15*matrix(CVA.NEOANGLO$CVvis[,1],nrow(CVA.NEOANGLO$Grandm),ncol(CVA.NEOANGLO$Grandm))+CVA.NEOANGLO$Grandm

cvvisNeg10 <- -15*matrix(CVA.NEOANGLO$CVvis[,1],nrow(CVA.NEOANGLO$Grandm),ncol(CVA.NEOANGLO$Grandm))+CVA.NEOANGLO$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/NEOANGLO.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/NEOANGLO.1cvvisNeg15.xlsx")
```

#N and M

```
labels.N<-subset(period, period == 'N')

labels.M<-subset(period, period == 'M')

NEOMEDIEVAL<- abind (new.coords$'N', new.coords$'M')

NEOMEDIEVAL.l<- rbind(labels.N, labels.M)

NEOMEDIEVAL.gpa<- gpagen(NEOMEDIEVAL)


#PCA
```

```
NEOMEDIEVAL.PCA<-plotTangentSpace(NEOMEDIEVAL.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(NEOMEDIEVAL.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/NEOMEDIEVAL.PCA.xlsx")

NEOMEDIEVAL.PCA$pc.summary

NEOMEDIEVAL.PCA$sdev


#LABELS

write.xlsx(NEOMEDIEVAL.l, "C:/Users/Cara Hirst/Desktop/Analysis/NEOMEDIEVAL.PCAlabels.xlsx")


#CVA

NEOMEDIEVAL.PCA<-procSym(NEOMEDIEVAL)

CVA.NEOMEDIEVAL<-CVA(NEOMEDIEVAL.PCA$orpdata, NEOMEDIEVAL.l)

write.xlsx(CVA.NEOMEDIEVAL$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/NEOMEDIEVAL.CVscores.xlsx")

write.xlsx(CVA.NEOMEDIEVAL$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/NEOMEDIEVAL.CVAgroupmeans.xlsx")


#OTHER

CVA.NEOMEDIEVAL

CVA.NEOMEDIEVAL$Dis

CVA.NEOMEDIEVAL$Var


#visulisation cv1

cvvis10 <- 15*matrix(CVA.NEOMEDIEVAL$CVvis[,1],nrow(CVA.NEOMEDIEVAL$Grandm),ncol(CVA.NEOMEDIEVAL$Grandm))+CVA.NEOMEDIEVAL$Grandm

cvvisNeg10 <- -15*matrix(CVA.NEOMEDIEVAL$CVvis[,1],nrow(CVA.NEOMEDIEVAL$Grandm),ncol(CVA.NEOMEDIEVAL$Grandm))+CVA.NEOMEDIEVAL$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/NEOMEDIEVAL.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/NEOMEDIEVAL.1cvvisNeg15.xlsx")
```

#N and PM

```
labels.N<-subset(period, period == 'N')

labels.P<-subset(period, period == 'P')

NEOPOSTMED<- abind (new.coords$'N', new.coords$'P')

NEOPOSTMED.l<- rbind(labels.N, labels.P)

NEOPOSTMED.gpa<- gpagen(NEOPOSTMED)


#PCA

NEOPOSTMED.PCA<-plotTangentSpace(NEOPOSTMED.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(NEOPOSTMED.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/NEOPOSTMED.PCA.xlsx")

NEOPOSTMED.PCA$pc.summary

NEOPOSTMED.PCA$sdev


#LABELS

write.xlsx(NEOPOSTMED.l, "C:/Users/Cara Hirst/Desktop/Analysis/NEOPOSTMED.PCAlabels.xlsx")


#CVA

NEOPOSTMED.PCA<-procSym(NEOPOSTMED)

CVA.NEOPOSTMED<-CVA(NEOPOSTMED.PCA$orpdata, NEOPOSTMED.l)

write.xlsx(CVA.NEOPOSTMED$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/NEOPOSTMED.CVscores.xlsx")

write.xlsx(CVA.NEOPOSTMED$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/NEOPOSTMED.CVAgroupmeans.xlsx")


#OTHER

CVA.NEOPOSTMED

CVA.NEOPOSTMED$Dis

CVA.NEOPOSTMED$Var


#visulisation cv1

cvvis10 <- 15*matrix(CVA.NEOPOSTMED$CVvis[,1],nrow(CVA.NEOPOSTMED$Grandm),ncol(CVA.NEOPOSTMED$Grandm))+CVA.NEOPOSTMED$Grandm

cvvisNeg10 <- -15*matrix(CVA.NEOPOSTMED$CVvis[,1],nrow(CVA.NEOPOSTMED$Grandm),ncol(CVA.NEOPOSTMED$Grandm))+CVA.NEOPOSTMED$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)
```

```
for (i in 1:nrow(cvvisNeg10))
lines(rbind(cvvis10[i,],cvvisNeg10[i,]))

#WRITE.VISULISATION
write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/NEOPOSTMED.1cvvis15.xlsx")
write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/NEOPOSTMED.1cvvisNeg15.xlsx")
```

#IB and R

```
labels.I<-subset(period, period == 'I')
labels.R<-subset(period, period == 'R')
IRONROMAN<- abind (new.coords$'I', new.coords$'R')
IRONROMAN.l<- rbind(labels.I, labels.R)
IRONROMAN.gpa<- gpagen(IRONROMAN)

#PCA
IRONROMAN.PCA<-plotTangentSpace(IRONROMAN.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)
write.xlsx(IRONROMAN.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/IRONROMAN.PCA.xlsx")
IRONROMAN.PCA$pc.summary
IRONROMAN.PCA$sdev

#LABELS
write.xlsx(IRONROMAN.l, "C:/Users/Cara Hirst/Desktop/Analysis/IRONROMAN.PCAlabels.xlsx")

#CVA
IRONROMAN.PCA<-procSym(IRONROMAN)
CVA.IRONROMAN<-CVA(IRONROMAN.PCA$orpdata, IRONROMAN.l)
write.xlsx(CVA.IRONROMAN$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/IRONROMAN.CVscores.xlsx")
write.xlsx(CVA.IRONROMAN$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/IRONROMAN.CVAgroupmeans.xlsx")

#OTHER
CVA.IRONROMAN
CVA.IRONROMAN$Dis
CVA.IRONROMAN$Var

#visulisation cv1
```

```
cvvis10 <- 15*matrix(CVA.IRONROMAN$CVvis[,1],nrow(CVA.IRONROMAN$Grandm),ncol(CVA.IRONROMAN$Grandm))+CVA.IRONROMAN$Grandm

cvvisNeg10 <- -15*matrix(CVA.IRONROMAN$CVvis[,1],nrow(CVA.IRONROMAN$Grandm),ncol(CVA.IRONROMAN$Grandm))+CVA.IRONROMAN$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/IRONROMAN.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/IRONROMAN.1cvvisNeg15.xlsx")
```

#IB and AS

```
labels.I<-subset(period, period == 'I')

labels.A<-subset(period, period == 'A')

IRONANGLO<- abind (new.coords$'I', new.coords$'A')

IRONANGLO.l<- rbind(labels.I, labels.A)

IRONANGLO.gpa<- gpagen(IRONANGLO)


#PCA

IRONANGLO.PCA<-plotTangentSpace(IRONANGLO.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(IRONANGLO.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/IRONANGLO.PCA.xlsx")

IRONANGLO.PCA$pc.summary

IRONANGLO.PCA$sdev


#LABELS

write.xlsx(IRONANGLO.l, "C:/Users/Cara Hirst/Desktop/Analysis/IRONANGLO.PCAlabels.xlsx")


#CVA

IRONANGLO.PCA<-procSym(IRONANGLO)

CVA.IRONANGLO<-CVA(IRONANGLO.PCA$orpdata, IRONANGLO.l)

write.xlsx(CVA.IRONANGLO$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/IRONANGLO.CVscores.xlsx")

write.xlsx(CVA.IRONANGLO$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/IRONANGLO.CVAgroupmeans.xlsx")
```

```
#OTHER

CVA.IRONANGLO

CVA.IRONANGLO$Dis

CVA.IRONANGLO$Var


#visulisation cv1

cvvis10 <- 15*matrix(CVA.IRONANGLO$CVvis[,1],nrow(CVA.IRONANGLO$Grandm),ncol(CVA.IRONANGLO$Grandm))+CVA.IRONANGLO$Grandm

cvvisNeg10 <- -15*matrix(CVA.IRONANGLO$CVvis[,1],nrow(CVA.IRONANGLO$Grandm),ncol(CVA.IRONANGLO$Grandm))+CVA.IRONANGLO$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/IRONANGLO.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/IRONANGLO.1cvvisNeg15.xlsx")
```

#IB and M

```
labels.I<-subset(period, period == 'I')

labels.M<-subset(period, period == 'M')

IRONMEDIEVAL<- abind (new.coords$'I', new.coords$'M')

IRONMEDIEVAL.l<- rbind(labels.I, labels.M)

IRONMEDIEVAL.gpa<- gpagen(IRONMEDIEVAL)


#PCA

IRONMEDIEVAL.PCA<-plotTangentSpace(IRONMEDIEVAL.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(IRONMEDIEVAL.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/IRONMEDIEVAL.PCA.xlsx")

IRONMEDIEVAL.PCA$pc.summary

IRONMEDIEVAL.PCA$sdev


#LABELS
```

```
write.xlsx(IRONMEDIEVAL.l, "C:/Users/Cara Hirst/Desktop/Analysis/IRONMEDIEVAL.PCAlabels.xlsx")


#CVA

IRONMEDIEVAL.PCA<-procSym(IRONMEDIEVAL)

CVA.IRONMEDIEVAL<-CVA(IRONMEDIEVAL.PCA$orpdata, IRONMEDIEVAL.l)

write.xlsx(CVA.IRONMEDIEVAL$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/IRONMEDIEVAL.CVscores.xlsx")

write.xlsx(CVA.IRONMEDIEVAL$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/IRONMEDIEVAL.CVAgroupmeans.xlsx")


#OTHER

CVA.IRONMEDIEVAL

CVA.IRONMEDIEVAL$Dis

CVA.IRONMEDIEVAL$Var


#visulisation cv1

cvvis10 <- 15*matrix(CVA.IRONMEDIEVAL$CVvis[,1],nrow(CVA.IRONMEDIEVAL$Grandm),ncol(CVA.IRONMEDIEVAL$Grandm))+CVA.IRONMEDIEVAL$Grandm

cvvisNeg10 <- -15*matrix(CVA.IRONMEDIEVAL$CVvis[,1],nrow(CVA.IRONMEDIEVAL$Grandm),ncol(CVA.IRONMEDIEVAL$Grandm))+CVA.IRONMEDIEVAL$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/IRONMEDIEVAL.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/IRONMEDIEVAL.1cvvisNeg15.xlsx")
```

#IB and PM

```
labels.I<-subset(period, period == 'I')

labels.P<-subset(period, period == 'P')

IRONPOSTMED<- abind (new.coords$'I', new.coords$'P')

IRONPOSTMED.l<- rbind(labels.I, labels.P)

IRONPOSTMED.gpa<- gpagen(IRONPOSTMED)
```

```
#PCA

IRONPOSTMED.PCA<-plotTangentSpace(IRONPOSTMED.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(IRONPOSTMED.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/IRONPOSTMED.PCA.xlsx")

IRONPOSTMED.PCA$pc.summary

IRONPOSTMED.PCA$sdev


#LABELS

write.xlsx(IRONPOSTMED.l, "C:/Users/Cara Hirst/Desktop/Analysis/IRONPOSTMED.PCAlabels.xlsx")


#CVA

IRONPOSTMED.PCA<-procSym(IRONPOSTMED)

CVA.IRONPOSTMED<-CVA(IRONPOSTMED.PCA$orpdata, IRONPOSTMED.l)

write.xlsx(CVA.IRONPOSTMED$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/IRONPOSTMED.CVscores.xlsx")

write.xlsx(CVA.IRONPOSTMED$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/IRONPOSTMED.CVAgroupmeans.xlsx")


#OTHER

CVA.IRONPOSTMED

CVA.IRONPOSTMED$Dis

CVA.IRONPOSTMED$Var


#visulisation cv1

cvvis10 <- 15*matrix(CVA.IRONPOSTMED$CVvis[,1],nrow(CVA.IRONPOSTMED$Grandm),ncol(CVA.IRONPOSTMED$Grandm))+CVA.IRONPOSTMED$Grandm

cvvisNeg10 <- -15*matrix(CVA.IRONPOSTMED$CVvis[,1],nrow(CVA.IRONPOSTMED$Grandm),ncol(CVA.IRONPOSTMED$Grandm))+CVA.IRONPOSTMED$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/IRONPOSTMED.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/IRONPOSTMED.1cvvisNeg15.xlsx")
```

#R and AS

```
labels.RF<-subset(period, period == 'R')

labels.ASM<-subset(period, period == 'A')

ROMANANGLO<- abind (new.coords$'R', new.coords$'A')

ROMANANGLO.l<- rbind(labels.R, labels.A)

ROMANANGLO.gpa<- gpagen(ROMANANGLO)


#PCA

ROMANANGLO.PCA<-plotTangentSpace(ROMANANGLO.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(ROMANANGLO.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANANGLO.PCA.xlsx")

ROMANANGLO.PCA$pc.summary

ROMANANGLO.PCA$sdev


#LABELS

write.xlsx(ROMANANGLO.l, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANANGLO.PCAlabels.xlsx")


#CVA

ROMANANGLO.PCA<-procSym(ROMANANGLO)

CVA.ROMANANGLO<-CVA(ROMANANGLO.PCA$orpdata, ROMANANGLO.l)

write.xlsx(CVA.ROMANANGLO$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANANGLO.CVscores.xlsx")

write.xlsx(CVA.ROMANANGLO$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANANGLO.CVAgroupmeans.xlsx")


#OTHER

CVA.ROMANANGLO

CVA.ROMANANGLO$Dis

CVA.ROMANANGLO$Var


#visulisation cv1

cvvis10 <- 15*matrix(CVA.ROMANANGLO$CVvis[,1],nrow(CVA.ROMANANGLO$Grandm),ncol(CVA.ROMANANGLO$Grandm))+CVA.ROMANANGLO$Grandm

cvvisNeg10 <- -15*matrix(CVA.ROMANANGLO$CVvis[,1],nrow(CVA.ROMANANGLO$Grandm),ncol(CVA.ROMANANGLO$Grandm))+CVA.ROMANANGLO$Grandm
```

```
plot(cvvis10,asp=1)
points(cvvisNeg10,col=2)
for (i in 1:nrow(cvvisNeg10))
lines(rbind(cvvis10[i,],cvvisNeg10[i,]))

#WRITE.VISULISATION
write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANANGLO.1cvvis15.xlsx")
write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANANGLO.1cvvisNeg15.xlsx")
```

#R and M

```
labels.R<-subset(period, period == 'R')
labels.M<-subset(period, period == 'M')
ROMANMED<- abind (new.coords$'R', new.coords$'M')
ROMANMED.l<- rbind(labels.R, labels.M)
ROMANMED.gpa<- gpagen(ROMANMED)

#PCA
ROMANMED.PCA<-plotTangentSpace(ROMANMED.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)
write.xlsx(ROMANMED.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANMED.PCA.xlsx")
ROMANMED.PCA$pc.summary
ROMANMED.PCA$sdev

#LABELS
write.xlsx(ROMANMED.l, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANMED.PCAlabels.xlsx")

#CVA
ROMANMED.PCA<-procSym(ROMANMED)
CVA.ROMANMED<-CVA(ROMANMED.PCA$orpdata, ROMANMED.l)
write.xlsx(CVA.ROMANMED$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANMED.CVscores.xlsx")
write.xlsx(CVA.ROMANMED$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANMED.CVAgroupmeans.xlsx")

#OTHER
CVA.ROMANMED
CVA.ROMANMED$Dis
CVA.ROMANMED$Var
```

```
#visulisation cv1

cvvis10 <- 15*matrix(CVA.ROMANMED$CVvis[,1],nrow(CVA.ROMANMED$Grandm),ncol(CVA.ROMANMED$Grandm))+CVA.ROMANMED$Grandm

cvvisNeg10 <- -15*matrix(CVA.ROMANMED$CVvis[,1],nrow(CVA.ROMANMED$Grandm),ncol(CVA.ROMANMED$Grandm))+CVA.ROMANMED$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANMED.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANMED.1cvvisNeg15.xlsx")
```

#R and PM

```
labels.R<-subset(period, period == 'R')

labels.P<-subset(period, period == 'P')

ROMANPOST<- abind (new.coords$'R', new.coords$'P')

ROMANPOST.l<- rbind(labels.R, labels.P)

ROMANPOST.gpa<- gpagen(ROMANPOST)


#PCA

ROMANPOST.PCA<-plotTangentSpace(ROMANPOST.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(ROMANPOST.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANPOST.PCA.xlsx")

ROMANPOST.PCA$pc.summary

ROMANPOST.PCA$sdev


#LABELS

write.xlsx(ROMANPOST.l, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANPOST.PCAlabels.xlsx")


#CVA

ROMANPOST.PCA<-procSym(ROMANPOST)

CVA.ROMANPOST<-CVA(ROMANPOST.PCA$orpdata, ROMANPOST.l)

write.xlsx(CVA.ROMANPOST$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANPOST.CVscores.xlsx")
```

```
write.xlsx(CVA.ROMANPOST$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANPOST.CVAgroupmeans.xlsx")

#OTHER

CVA.ROMANPOST

CVA.ROMANPOST$Dis

CVA.ROMANPOST$Var

#visulisation cv1

cvvis10 <- 15*matrix(CVA.ROMANPOST$CVvis[,1],nrow(CVA.ROMANPOST$Grandm),ncol(CVA.ROMANPOST$Grandm))+CVA.ROMANPOST$Grandm

cvvisNeg10 <- -15*matrix(CVA.ROMANPOST$CVvis[,1],nrow(CVA.ROMANPOST$Grandm),ncol(CVA.ROMANPOST$Grandm))+CVA.ROMANPOST$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))

#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANPOST.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/ROMANPOST.1cvvisNeg15.xlsx")
```

#AS and M

```
labels.M<-subset(period, period == 'M')

labels.A<-subset(period, period == 'A')

MEDANGLO<- abind (new.coords$'M', new.coords$'A')

MEDANGLO.l<- rbind(labels.M, labels.A)

MEDANGLO.gpa<- gpagen(MEDANGLO)

#PCA

MEDANGLO.PCA<-plotTangentSpace(MEDANGLO.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(MEDANGLO.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/MEDANGLO.PCA.xlsx")

MEDANGLO.PCA$pc.summary

MEDANGLO.PCA$sdev

#LABELS
```

```
write.xlsx(MEDANGLO.l, "C:/Users/Cara Hirst/Desktop/Analysis/MEDANGLO.PCAlabels.xlsx")


#CVA

MEDANGLO.PCA<-procSym(MEDANGLO)

CVA.MEDANGLO<-CVA(MEDANGLO.PCA$orpdata, MEDANGLO.l)

write.xlsx(CVA.MEDANGLO$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/MEDANGLO.CVscores.xlsx")

write.xlsx(CVA.MEDANGLO$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/MEDANGLO.CVAgroupmeans.xlsx")


#OTHER

CVA.MEDANGLO

CVA.MEDANGLO$Dis

CVA.MEDANGLO$Var


#visulisation cv1

cvvis10 <- 15*matrix(CVA.MEDANGLO$CVvis[,1],nrow(CVA.MEDANGLO$Grandm),ncol(CVA.MEDANGLO$Grandm))+CVA.MEDANGLO$Grandm

cvvisNeg10 <- -15*matrix(CVA.MEDANGLO$CVvis[,1],nrow(CVA.MEDANGLO$Grandm),ncol(CVA.MEDANGLO$Grandm))+CVA.MEDANGLO$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/MEDANGLO.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/MEDANGLO.1cvvisNeg15.xlsx")
```

#AS and PM

```
labels.P<-subset(period, period == 'P')

labels.A<-subset(period, period == 'A')

ANGLOPOSTMED<- abind (new.coords$'P', new.coords$'A')

ANGLOPOSTMED.l<- rbind(labels.P, labels.A))

ANGLOPOSTMED.gpa<- gpagen(ANGLOPOSTMED)
```

```
#PCA

ANGLOPOSTMED.PCA<-plotTangentSpace(ANGLOPOSTMED.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(ANGLOPOSTMED.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/ANGLOPOSTMED.PCA.xlsx")

ANGLOPOSTMED.PCA$pc.summary

ANGLOPOSTMED.PCA$sdev


#LABELS

write.xlsx(ANGLOPOSTMED.l, "C:/Users/Cara Hirst/Desktop/Analysis/ANGLOPOSTMED.PCAlabels.xlsx")


#CVA

ANGLOPOSTMED.PCA<-procSym(ANGLOPOSTMED)

CVA.ANGLOPOSTMED<-CVA(ANGLOPOSTMED.PCA$orpdata, ANGLOPOSTMED.l)

write.xlsx(CVA.ANGLOPOSTMED$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/ANGLOPOSTMED.CVscores.xlsx")

write.xlsx(CVA.ANGLOPOSTMED$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/ANGLOPOSTMED.CVAgroupmeans.xlsx")


#OTHER

CVA.ANGLOPOSTMED

CVA.ANGLOPOSTMED$Dis

CVA.ANGLOPOSTMED$Var


#visulisation cv1

cvvis10 <- 15*matrix(CVA.ANGLOPOSTMED$CVvis[,1],nrow(CVA.ANGLOPOSTMED$Grandm),ncol(CVA.ANGLOPOSTMED$Grandm))+CVA.ANGLOPOSTMED$Grandm

cvvisNeg10 <- -15*matrix(CVA.ANGLOPOSTMED$CVvis[,1],nrow(CVA.ANGLOPOSTMED$Grandm),ncol(CVA.ANGLOPOSTMED$Grandm))+CVA.ANGLOPOSTMED$Grandm

plot(cvvis10,asp=1)

points(cvvisNeg10,col=2)

for (i in 1:nrow(cvvisNeg10))

lines(rbind(cvvis10[i,],cvvisNeg10[i,]))


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/ANGLOPOSTMED.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/ANGLOPOSTMED.1cvvisNeg15.xlsx")
```

#M and PM

```
labels.M<-subset(period, period == 'M')

labels.P<-subset(period, period == 'P')

MEDPOSTMED<- abind (new.coords$'M', new.coords$'P')

MEDPOSTMED.l<- rbind(labels.M, labels.P)

MEDPOSTMED.gpa<- gpagen(MEDPOSTMED)


#PCA

MEDPOSTMED.PCA<-plotTangentSpace(MEDPOSTMED.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(MEDPOSTMED.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/MEDPOSTMED.PCA.xlsx")

MEDPOSTMED.PCA$pc.summary

MEDPOSTMED.PCA$sdev


#LABELS

write.xlsx(MEDPOSTMED.l, "C:/Users/Cara Hirst/Desktop/Analysis/MEDPOSTMED.PCAlabels.xlsx")


#CVA

MEDPOSTMED.PCA<-procSym(MEDPOSTMED)

CVA.MEDPOSTMED<-CVA(MEDPOSTMED.PCA$orpdata, MEDPOSTMED.l)

write.xlsx(CVA.MEDPOSTMED$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/MEDPOSTMED.CVscores.xlsx")

write.xlsx(CVA.MEDPOSTMED$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/MEDPOSTMED.CVAgroupmeans.xlsx")


#OTHER

CVA.MEDPOSTMED

CVA.MEDPOSTMED$Dis

CVA.MEDPOSTMED$Var


#visulisation cv1

cvvis10 <- 15*matrix(CVA.MEDPOSTMED$CVvis[,1],nrow(CVA.MEDPOSTMED$Grandm),ncol(CVA.MEDPOSTMED$Grandm))+CVA.MEDPOSTMED$Grandm

cvvisNeg10 <- -15*matrix(CVA.MEDPOSTMED$CVvis[,1],nrow(CVA.MEDPOSTMED$Grandm),ncol(CVA.MEDPOSTMED$Grandm))+CVA.MEDPOSTMED$Grandm

plot(cvvis10,asp=1)
```

```
points(cvvisNeg10,col=2)
for (i in 1:nrow(cvvisNeg10))
lines(rbind(cvvis10[i,],cvvisNeg10[i,]))

#WRITE.VISULISATION
write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/MEDPOSTMED.1cvvis15.xlsx")
write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/MEDPOSTMED.1cvvisNeg15.xlsx")
```

British Time Periods and Geographic Comparison

```
labels.N<-subset(period, period == 'N')
labels.I<-subset(period, period == 'I')
labels.R<-subset(period, period == 'R')
labels.A<-subset(period, period == 'A')
labels.M<-subset(period, period == 'M')
labels.P<-subset(period, period == 'P')
labels.G<-subset(period, period == 'G')
PERIODG<- abind (new.coords$'N', new.coords$'I', new.coords$'R', new.coords$'A', new.coords$'M', new.coords$'P', new.coords$'G')
PERIODG.l<- rbind(labels.N, labels.I, labels.R, labels.A, labels.M, labels.P, labels.G)
PERIODG.gpa<- gpagen(PERIODG)

#PCA
PERIODG.PCA<-plotTangentSpace(PERIODG.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)
write.xlsx(PERIODG.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/PERIODG.PCA.xlsx")
PERIODG.PCA$pc.summary
PERIODG.PCA$sdev

#LABELS
write.xlsx(PERIODG.l, "C:/Users/Cara Hirst/Desktop/Analysis/PERIODG.PCAlabels.xlsx")

#CVA
PERIODG.PCA<-procSym(PERIODG)
CVA.PERIODG<-CVA(PERIODG.PCA$orpdata, PERIODG.l)
write.xlsx(CVA.PERIODG$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/PERIODG.CVscores.xlsx")
write.xlsx(CVA.PERIODG$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/PERIODG.CVAgroupmeans.xlsx")

#OTHER
```

```
CVA.PERIODG

CVA.PERIODG$Dis

CVA.PERIODG$Var


#visulisation cv1

cvvis10 <- 5*matrix(CVA.PERIODG$CVvis[,1],nrow(CVA.PERIODG$Grandm),ncol(CVA.PERIODG$Grandm))+CVA.PERIODG$Grandm

cvvisNeg10 <- -5*matrix(CVA.PERIODG$CVvis[,1],nrow(CVA.PERIODG$Grandm),ncol(CVA.PERIODG$Grandm))+CVA.PERIODG$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/PERIODG.1cvvis5.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/PERIODG.1cvvisNeg5.xlsx")


#visulisation cv2

cvvis10 <- 5*matrix(CVA.PERIODG$CVvis[,2],nrow(CVA.PERIODG$Grandm),ncol(CVA.PERIODG$Grandm))+CVA.PERIODG$Grandm

cvvisNeg10 <- -5*matrix(CVA.PERIODG$CVvis[,2],nrow(CVA.PERIODG$Grandm),ncol(CVA.PERIODG$Grandm))+CVA.PERIODG$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/PERIODG.2cvvis5.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/PERIODG.2cvvisNeg5.xlsx")


#visulisation cv3

cvvis10 <- 5*matrix(CVA.PERIODG$CVvis[,3],nrow(CVA.PERIODG$Grandm),ncol(CVA.PERIODG$Grandm))+CVA.PERIODG$Grandm

cvvisNeg10 <- -5*matrix(CVA.PERIODG$CVvis[,3],nrow(CVA.PERIODG$Grandm),ncol(CVA.PERIODG$Grandm))+CVA.PERIODG$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/PERIODG.3cvvis5.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/PERIODG.3cvvisNeg5.xlsx")


#visulisation cv4
```

```
cvvis10 <-5*matrix(CVA.PERIODG$CVvis[,4],nrow(CVA.PERIODG$Grandm),ncol(CVA.PERIODG$Grandm))+CVA.PERIODG$Grandm

cvvisNeg10 <- -5*matrix(CVA.PERIODG$CVvis[,4],nrow(CVA.PERIODG$Grandm),ncol(CVA.PERIODG$Grandm))+CVA.PERIODG$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/PERIODG.4cvvis5.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/PERIODG.4cvvisNeg5.xlsx")
```

6.12 Time Period: Sex Estimation

```
#open data

setwd("C:/Users/Cara Hirst/Desktop/Analysis/DATA")

require(geomorph)

require(Morpho)

require(abind)

require(xlsx)

A<-read.morphologika("DataOLD.txt")


#gpa analysis

coords<-A$coords

label<-A$labels

Y.gpa<-gpagen(coords, curves = NULL, surfaces = NULL, PrinAxes = TRUE,max.iter = NULL, ProcD = TRUE, Proj = TRUE, print.progress = TRUE)


#create subsets

group <-factor(paste(A$coords))

levels(group)

new.coords<-coords.subset(A= A$coords, group= A$labels)

names(new.coords)
```

#Males all periods

```
labels.NM<-subset(A$labels, A$labels == 'NM')

labels.IBM<-subset(A$labels, A$labels == 'IBM')

labels.RM<-subset(A$labels, A$labels == 'RM')

labels.ASM<-subset(A$labels, A$labels == 'ASM')

labels.MM<-subset(A$labels, A$labels == 'MM')

labels.PMM<-subset(A$labels, A$labels == 'PMM')
```

```
MALES <- abind (new.coords$'NM', new.coords$'IBM', new.coords$'RM' , new.coords$'ASM' ,new.coords$'MM', new.coords$'PMM')

MALES.L <- rbind(labels.NM, labels.IBM, labels.RM, labels.ASM, labels.MM, labels.PMM)

MALES.gpa<- gpagen(MALES)


#PC scores

MALES.PCA<-plotTangentSpace(MALES.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(MALES.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/MALES.PCA.xlsx")

MALES.PCA$pc.summary


#labels

write.xlsx(MALES.L, "C:/Users/Cara Hirst/Desktop/Analysis/PERIODM.labels.xlsx")


#CVA scores

MALES.PCA<-procSym(MALES)

CVA.MALES<-CVA(MALES.PCA$orpdata, MALES.L)

write.xlsx(CVA.MALES$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/MALES.CVscores.xlsx")

write.xlsx(CVA.MALES$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/MALES.CVAgroupmeans.xlsx")


#other data

CVA.MALES

CVA.MALES$Dis

CVA.MALES$Var


#visulisation cv1

cvvis10 <- 15*matrix(CVA.MALES$CVvis[,1],nrow(CVA.MALES$Grandm),ncol(CVA.MALES$Grandm))+CVA.MALES$Grandm

cvvisNeg10 <- -15*matrix(CVA.MALES$CVvis[,1],nrow(CVA.MALES$Grandm),ncol(CVA.MALES$Grandm))+CVA.MALES$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/MALES.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/MALES.1cvvisNeg15.xlsx")


#visulisation cv2
```

```
cvvis10 <-
15*matrix(CVA.MALES$CVvis[,2],nrow(CVA.MALES$Grandm),ncol(CVA.MALES$Grandm))+CVA.MALES$G
randm

cvvisNeg10 <- -
15*matrix(CVA.MALES$CVvis[,2],nrow(CVA.MALES$Grandm),ncol(CVA.MALES$Grandm))+CVA.MALES$G
randm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/MALES.2cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/MALES.2cvvisNeg15.xlsx")


#visulisation cv3

cvvis10 <-
15*matrix(CVA.MALES$CVvis[,3],nrow(CVA.MALES$Grandm),ncol(CVA.MALES$Grandm))+CVA.MALES$G
randm

cvvisNeg10 <- -
15*matrix(CVA.MALES$CVvis[,3],nrow(CVA.MALES$Grandm),ncol(CVA.MALES$Grandm))+CVA.MALES$G
randm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/MALES.3cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/MALES.3cvvisNeg15.xlsx")


#visulisation cv4

cvvis10 <-
15*matrix(CVA.MALES$CVvis[,4],nrow(CVA.MALES$Grandm),ncol(CVA.MALES$Grandm))+CVA.MALES$G
randm

cvvisNeg10 <- -
15*matrix(CVA.MALES$CVvis[,4],nrow(CVA.MALES$Grandm),ncol(CVA.MALES$Grandm))+CVA.MALES$G
randm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/MALES.4cvvis5.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/MALES.4cvvisNeg15.xlsx")

#Females all periods
labels.NF<-subset(A$labels, A$labels == 'NF')

labels.IBF<-subset(A$labels, A$labels == 'IBF')

labels.RF<-subset(A$labels, A$labels == 'RF')

labels.ASF<-subset(A$labels, A$labels == 'ASF')

labels.MF<-subset(A$labels, A$labels == 'MF')

labels.PMF<-subset(A$labels, A$labels == 'PMF')
```

```
FEMALES<- abind (new.coords$'NF', new.coords$'IBF', new.coords$'RF' , new.coords$'ASF' ,new.coords$'MF', new.coords$'PMF')

FEMALESL <- rbind(labels.NF, labels.IBF, labels.RF, labels.ASF, labels.MF, labels.PMF)

FEMALES.gpa<- gpagen(FEMALES)


#PC scores

FEMALES.PCA<-plotTangentSpace(FEMALES.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(FEMALES.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/FEMALES.PCA.xlsx")


#labels

write.xlsx(FEMALESL, "C:/Users/Cara Hirst/Desktop/Analysis/FEMALES.labels.xlsx")


#CVA scores

FEMALES.PCA<-procSym(FEMALES)

CVA.FEMALES<-CVA(FEMALES.PCA$orpdata, FEMALESL)

write.xlsx(CVA.FEMALES$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/FEMALES.CVscores.xlsx")

write.xlsx(CVA.FEMALES$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/FEMALES.CVAgroupmeans.xlsx")


#other data

CVA.FEMALES

CVA.FEMALES$Dis

CVA.FEMALES$Var


#visulisation cv1

cvvis10 <- 15*matrix(CVA.FEMALES$CVvis[,1],nrow(CVA.FEMALES$Grandm),ncol(CVA.FEMALES$Grandm))+CVA.FEMALES$Grandm

cvvisNeg10 <- -15*matrix(CVA.FEMALES$CVvis[,1],nrow(CVA.FEMALES$Grandm),ncol(CVA.FEMALES$Grandm))+CVA.FEMALES$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/FEMALES.1cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/FEMALES.1cvvisNeg15.xlsx")


#visulisation cv2
```

```
cvvis10 <-
15*matrix(CVA.FEMALES$CVvis[,2],nrow(CVA.FEMALES$Grandm),ncol(CVA.FEMALES$Grandm))+CVA.FEMALES$Grandm

cvvisNeg10 <- -
15*matrix(CVA.FEMALES$CVvis[,2],nrow(CVA.FEMALES$Grandm),ncol(CVA.FEMALES$Grandm))+CVA.FEMALES$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/FEMALES.2cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/FEMALES.2cvvisNeg15.xlsx")


#visulisation cv3

cvvis10 <-
15*matrix(CVA.FEMALES$CVvis[,3],nrow(CVA.FEMALES$Grandm),ncol(CVA.FEMALES$Grandm))+CVA.FEMALES$Grandm

cvvisNeg10 <- -
15*matrix(CVA.FEMALES$CVvis[,3],nrow(CVA.FEMALES$Grandm),ncol(CVA.FEMALES$Grandm))+CVA.FEMALES$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/FEMALES.3cvvis15.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/FEMALES.3cvvisNeg15.xlsx")


#visulisation cv4

cvvis10 <-
15*matrix(CVA.FEMALES$CVvis[,4],nrow(CVA.FEMALES$Grandm),ncol(CVA.FEMALES$Grandm))+CVA.FEMALES$Grandm

cvvisNeg10 <- -
15*matrix(CVA.FEMALES$CVvis[,4],nrow(CVA.FEMALES$Grandm),ncol(CVA.FEMALES$Grandm))+CVA.FEMALES$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/FEMALES.4cvvis5.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/FEMALES.4cvvisNeg15.xlsx")
```

6.13 Sex Differences: Total Sample

```
SEX<- substr(A$label, 3,3)


#create subsets

group <-factor(paste(A$coords))
```

```
new.coords<-coords.subset(A= A$coords, group= SEX)
names(new.coords)

#SEX
labels.F<-subset(SEX, SEX== 'F')
labels.M<-subset(SEX, SEX == 'M')

SEXSEX<- abind (new.coords$'F', new.coords$'M')
SEXSEX.l<- rbind(labels.F, labels.M)
SEXSEX.gpa<- gpagen(SEXSEX)

#PCA
SEXSEX.PCA<-plotTangentSpace(SEXSEX.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)
write.xlsx(SEXSEX.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/SEXSEX.PCA.xlsx")
SEXSEX.PCA$pc.summary
SEXSEX.PCA$sdev

#LABELS
write.xlsx(SEXSEX.l, "C:/Users/Cara Hirst/Desktop/Analysis/SEXSEX.PCAlabels.xlsx")

#CVA
SEXSEX.PCA<-procSym(SEXSEX)
CVA.SEXSEX<-CVA(SEXSEX.PCA$orpdata,SEXSEX.l)
write.xlsx(CVA.SEXSEX$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/SEXSEX.CVscores.xlsx")
write.xlsx(CVA.SEXSEX$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/SEXSEX.CVAgroupmeans.xlsx")

#OTHER
CVA.SEXSEX
CVA.SEXSEX$Dis
CVA.SEXSEX$Var

#visulisation cv1
cvvis10 <- 8*matrix(CVA.SEXSEX$CVvis[,1],nrow(CVA.SEXSEX$Grandm),ncol(CVA.SEXSEX$Grandm))+CVA.SEXSEX$Grandm
cvvisNeg10 <- -8*matrix(CVA.SEXSEX$CVvis[,1],nrow(CVA.SEXSEX$Grandm),ncol(CVA.SEXSEX$Grandm))+CVA.SEXSEX$Grandm
```

```
#WRITE.VISULISATION

write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/SEXSEX.1cvvis8.xlsx")

write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/SEXSEX.1cvvisNeg8.xlsx")
```

6.14 Status Comparison

```
#open data

setwd("C:/Users/Cara Hirst/Desktop/Analysis")

require(geomorph)

require(Morpho)

require(abind)

require(xlsx)

A<-read.morphologika("Data.txt")


#gpa analysis

coords<-A$coords

label<-A$labels

Y.gpa<-gpagen(coords, curves = NULL, surfaces = NULL, PrinAxes = TRUE,max.iter = NULL, ProcD = TRUE,
Proj = TRUE, print.progress = TRUE)


STATUS<- substr(A$label,6,6)

group <-factor(paste(A$coords))

new.coords<-coords.subset(A= A$coords, group= STATUS)

names(new.coords)


labels.H<-subset(STATUS, STATUS== 'H')

labels.L<-subset(STATUS, STATUS == 'L')


STATUS<- abind (new.coords$'H', new.coords$'L')

STATUS.l<- rbind(labels.H, labels.L)

STATUS.gpa<- gpagen(STATUS)


#PCA

STATUS.PCA<-plotTangentSpace(STATUS.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(STATUS.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/STATUS.PCA.xlsx")

STATUS.PCA$pc.summary

STATUS.PCA$sdev
```

```
#LABELS
write.xlsx(STATUS.l, "C:/Users/Cara Hirst/Desktop/Analysis/STATUS.PCAlabels.xlsx")

#CVA
STATUS.PCA<-procSym(STATUS)
CVA.STATUS<-CVA(STATUS.PCA$orpdata,STATUS.l)
write.xlsx(CVA.STATUS$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/STATUS.CVscores.xlsx")
write.xlsx(CVA.STATUS$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/STATUS.CVAgroupmeans.xlsx")

#OTHER
CVA.STATUS
CVA.STATUS$Dis
CVA.STATUS$Var

#visulisation cv1
cvvis10 <- 10*matrix(CVA.STATUS$CVvis[,1],nrow(CVA.STATUS$Grandm),ncol(CVA.STATUS$Grandm))+CVA.STATUS$Grandm
cvvisNeg10 <- -10*matrix(CVA.STATUS$CVvis[,1],nrow(CVA.STATUS$Grandm),ncol(CVA.STATUS$Grandm))+CVA.STATUS$Grandm
plot(cvvis10,asp=1)
points(cvvisNeg10,col=2)
for (i in 1:nrow(cvvisNeg10))
lines(rbind(cvvis10[i,],cvvisNeg10[i,]))

#WRITE.VISULISATION
write.xlsx(cvvis10, "C:/Users/Cara Hirst/Desktop/Analysis/STATUS.1cvvis15.xlsx")
write.xlsx(cvvisNeg10, "C:/Users/Cara Hirst/Desktop/Analysis/STATUS.1cvvisNeg15.xlsx")
```

6.15 Status: Sex Comparison

```
#open data
setwd("C:/Users/Cara Hirst/Desktop/Analysis/DATA")
require(geomorph)
require(Morpho)
require(abind)
require(xlsx)
A<-read.morphologika("DatastatusSEX.txt")
```

```
#gpa analysis

coords<-A$coords

label<-A$labels

Y.gpa<-gpagen(coords, curves = NULL, surfaces = NULL, PrinAxes = TRUE,max.iter = NULL, ProcD = TRUE, Proj = TRUE, print.progress = TRUE)


STATUSSEX<- substr(A$label,4,5)

group <-factor(paste(A$coords))

new.coords<-coords.subset(A= A$coords, group= STATUSSEX)

names(new.coords)


labels.FH<-subset(STATUSSEX, STATUSSEX== 'FH')

labels.FL<-subset(STATUSSEX, STATUSSEX == 'FL')

labels.MH<-subset(STATUSSEX, STATUSSEX == 'MH')

labels.ML<-subset(STATUSSEX, STATUSSEX == 'ML')


STATUSSEX<- abind (new.coords$'FH', new.coords$'FL', new.coords$'MH', new.coords$'ML')

STATUSSEX.l<- rbind(labels.FH, labels.FL, labels.MH, labels.ML)

STATUSSEX.gpa<- gpagen(STATUSSEX)


#PCA

STATUSSEX.PCA<-plotTangentSpace(STATUSSEX.gpa$coords, axis1 = 1, axis2 = 2, warpgrids = TRUE)

write.xlsx(STATUSSEX.PCA$pc.scores, "C:/Users/Cara Hirst/Desktop/Analysis/STATUSSEX.PCA.xlsx")

STATUSSEX.PCA$pc.summary

STATUSSEX.PCA$sdev


#LABELS

write.xlsx(STATUSSEX.l, "C:/Users/Cara Hirst/Desktop/Analysis/STATUSSEX.PCAlabels.xlsx")


#CVA

STATUSSEX.PCA<-procSym(STATUSSEX)

CVA.STATUSSEX<-CVA(STATUSSEX.PCA$orpdata,STATUSSEX.l)

write.xlsx(CVA.STATUSSEX$CVscores, "C:/Users/Cara Hirst/Desktop/Analysis/STATUSSEX.CVscores.xlsx")

write.xlsx(CVA.STATUSSEX$groupmeans, "C:/Users/Cara Hirst/Desktop/Analysis/STATUSSEX.CVAgroupmeans.xlsx")
```

```
#OTHER

CVA.STATUSSEX

CVA.STATUSSEX$Dis

CVA.STATUSSEX$Var


#visulisation cv1

cvvis5 <- 5*matrix(CVA.STATUSSEX$CVvis[,1],nrow(CVA.STATUSSEX$Grandm),ncol(CVA.STATUSSEX$Grandm))+CVA.STATUSSEX$Grandm

cvvisNeg5 <- -5*matrix(CVA.STATUSSEX$CVvis[,1],nrow(CVA.STATUSSEX$Grandm),ncol(CVA.STATUSSEX$Grandm))+CVA.STATUSSEX$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis5, "C:/Users/Cara Hirst/Desktop/Analysis/STATUSSEX.1cvvis15.xlsx")

write.xlsx(cvvisNeg5, "C:/Users/Cara Hirst/Desktop/Analysis/STATUSSEX.1cvvisNeg15.xlsx")


#visulisation cv2

cvvis5 <- 5*matrix(CVA.STATUSSEX$CVvis[,2],nrow(CVA.STATUSSEX$Grandm),ncol(CVA.STATUSSEX$Grandm))+CVA.STATUSSEX$Grandm

cvvisNeg5 <- -5*matrix(CVA.STATUSSEX$CVvis[,2],nrow(CVA.STATUSSEX$Grandm),ncol(CVA.STATUSSEX$Grandm))+CVA.STATUSSEX$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis5, "C:/Users/Cara Hirst/Desktop/Analysis/STATUSSEX.2cvvis15.xlsx")

write.xlsx(cvvisNeg5, "C:/Users/Cara Hirst/Desktop/Analysis/STATUSSEX.2cvvisNeg15.xlsx")


#visulisation cv3

cvvis5 <- 5*matrix(CVA.STATUSSEX$CVvis[,3],nrow(CVA.STATUSSEX$Grandm),ncol(CVA.STATUSSEX$Grandm))+CVA.STATUSSEX$Grandm

cvvisNeg5 <- -5*matrix(CVA.STATUSSEX$CVvis[,3],nrow(CVA.STATUSSEX$Grandm),ncol(CVA.STATUSSEX$Grandm))+CVA.STATUSSEX$Grandm


#WRITE.VISULISATION

write.xlsx(cvvis5, "C:/Users/Cara Hirst/Desktop/Analysis/STATUSSEX.3cvvis15.xlsx")

write.xlsx(cvvisNeg5, "C:/Users/Cara Hirst/Desktop/Analysis/STATUSSEX.3cvvisNeg15.xlsx")
```