

Comparative Lead Isotope Dataset – Metadata Statement Supporting Documentation

This document is associated with the Comparative Lead Isotope Dataset and its file-level metadata statement. The controlled vocabularies and established wordlists used to control data entry for the dataset's "Period", "Tooth Type", "Fédération Dentaire Internationale (FDI) Tooth Notation", "Biological Sex Estimation", and "Age Category" columns are documented here. All future additions to the dataset should adhere to these data classifications. The full bibliographic references for the publications used to compile the lead isotope data and associated contextual information of the 307 samples, are also presented here.

Period

Supporting Documentation Table 1: The period a sample is associated with should be recorded in the dataset using the following vocabulary, which adheres to standardised terminology and dates established by Historic England (2023) and FISH (2023). Periods given in the literature should be transcribed into the dataset where appropriate, so as not to assign new meaning to the published data. *Locational qualifiers should be used before period names where necessary to denote where period date ranges differ considerably between countries (Heritage Data 2023; Young *et al.* 2023)

Period	Date Range
Palaeolithic	1,000,000 BC – 10,000 BC
Lower Palaeolithic	1,000,000 BC – 150,000 BC
Middle Palaeolithic	150,000 BC – 40,000 BC
Upper Palaeolithic	40,000 BC – 10,000 BC
Mesolithic	10,000 BC – 4,000 BC
Early Mesolithic	10,000 BC – 7,000 BC
Late Mesolithic	7,000 BC – 4,000 BC
Neolithic	4,000 BC – 2,200 BC
Early Neolithic	4,000 BC – 3,300 BC
Middle Neolithic	3,300 BC – 2,900 BC
Late Neolithic	2,900 BC – 2,200 BC
Bronze Age	2,600 BC – 700 BC
Early Bronze Age	2,600 BC – 1,600 BC
Middle Bronze Age	1,600 BC – 1,200 BC
Late Bronze Age	1,200 BC – 700 BC
Iron Age	800 BC – 43 AD
Early Iron Age	800 BC – 300 BC
Middle Iron Age	300 BC – 100 BC
Late Iron Age	100 BC – 43 AD
Scottish Iron Age*	700 BC – 400 AD
Irish Iron Age*	500 BC – 400 AD
Roman	43 AD – 410 AD
Early Medieval	410 AD – 1066 AD
Medieval	1066 – 1540 AD
Post-Medieval	1540 – 1901 AD

Tooth Type

Supporting Documentation Table 2: Tooth type is recorded in the dataset using both White and Folkens' (1991) and FDI (Leatherman 1972) notations. The former is more visually identifiable for the dataset user, whilst the latter does not use font formatting so prevents data loss during migration to plain text file format (e.g. .csv file).

Tooth	White and Folkens (1991)	Fédération Dentaire Internationale (FDI)
Permanent Dentition		
First incisor	I1 (I ¹ = upper; I ₁ = lower)	11/21/31/41
Second Incisor	I2 (I ² = upper; I ₂ = lower)	12/22/23/24
Canine	C1 (C ¹ = upper; C ₁ = lower)	13/23/33/43
First premolar	P1 (P ¹ = upper; P ₁ = lower)	14/24/34/44
Second premolar	P2 (P ² = upper; P ₂ = lower)	15/25/35/45
First molar	M1 (M ¹ = upper; M ₁ = lower)	16/26/36/46
Second molar	M2 (M ² = upper; M ₂ = lower)	17/27/37/47
Third molar	M3 (M ³ = upper; M ₃ = lower)	18/28/38/48
Right upper central incisor	RI ¹	11
Right lower central incisor	RI ₁	41
Left upper central incisor	LI ¹	21
Left lower central incisor	LI ₁	31
Right upper lateral incisor	RI ²	12
Right lower lateral incisor	RI ₂	42
Left upper lateral incisor	LI ²	22
Left lower lateral incisor	LI ₂	32
Right upper canine	RC ¹	13
Right lower canine	RC ₁	43
Left upper canine	LC ¹	23
Left lower canine	LC ₁	33
Right upper first premolar	RP ¹	14
Left upper first premolar	LP ¹	24
Right lower first premolar	RP ₁	44
Left lower first premolar	LP ₁	34
Right upper second premolar	RP ²	15
Left upper second premolar	LP ²	25
Right lower second premolar	RP ₂	45
Left lower second premolar	LP ₂	35
Right upper first molar	RM ¹	16
Left upper first molar	LM ¹	26
Right lower first molar	RM ₁	46
Left lower first molar	LM ₁	36
Right upper second molar	RM ²	17
Left upper second molar	LM ²	27
Right lower second molar	RM ₂	47
Left lower second molar	LM ₂	37
Right upper third molar	RM ³	18
Left upper third molar	LM ³	28
Right lower third molar	RM ₃	48
Left lower third molar	LM ₃	38

Deciduous Dentition		
Deciduous central incisor	di1 (di ¹ = upper; di ₁ = lower)	51/61/71/81
Deciduous lateral incisor	di2 (di ² = upper; di ₂ = lower)	52/62/72/82
Deciduous canine	dc1 (dc ¹ = upper; dc ₁ = lower)	53/63/73/83
Deciduous first molar	dm1 (dm ¹ = upper; dm ₁ = lower)	54/64/74/84
Deciduous second molar	dm2 (dm ² = upper; dm ₂ = lower)	55/65/75/85
Deciduous right upper central incisor	Rdi ¹	51
Deciduous right upper later incisor	Rdi ²	52
Deciduous right upper canine	Rdc ¹	53
Deciduous right upper first molar	Rdm ¹	54
Deciduous right upper second molar	Rdm ²	55
Deciduous left upper central incisor	Ldi ¹	61
Deciduous left upper later incisor	Ldi ²	62
Deciduous left upper canine	Ldc ¹	63
Deciduous left upper first molar	Ldm ¹	64
Deciduous left upper second molar	Ldm ²	65
Deciduous right lower central incisor	Rdi ₁	81
Deciduous right lower later incisor	Rdi ₂	82
Deciduous right lower canine	Rdc ₁	83
Deciduous right lower first molar	Rdm ₁	84
Deciduous right lower second molar	Rdm ₂	85
Deciduous left lower central incisor	Ldi ₁	71
Deciduous left lower later incisor	Ldi ₂	72
Deciduous left lower canine	Ldc ₁	73
Deciduous left lower first molar	Ldm ₁	74
Deciduous left lower second molar	Ldm ₂	75

Biological Sex Estimation

Supporting Documentation Table 3: The standardised vocabulary used to document biological sex estimation follows Buikstra and Ubelaker (1994). In the dataset, the full-word terminology (e.g. Male or Female) is preferred over the abbreviated notation for user clarity. Both formats are shown here to facilitate data entry, as many publications use the notation format. *The undetermined classification includes both individuals with an intermediate sex estimation and those whose sex could not be assessed.

Biological Sex Estimation	Common Notation
Male	M
Probable Male	M?
Probable Female	F?
Female	F
Undetermined*	U

Age-at-Death Estimation

Supporting Documentation Table 4: The age category of adult individuals should be recorded in the dataset using Buikstra and Ubelaker's (1994) standard terminology and established age ranges. For non-adults, the controlled vocabulary follows Scheuer and Black's (2000) age ranges. If an individual's estimated age range overlaps two categories, both should be expressed (e.g. Young Adult/Middle Adult).

Age Category	Age Range
Adults	
Young Adult	20 – 35 years
Middle Adult	35 – 50 years
Old Adult	50+ years
Non-Adults	
Neonate	Birth – 28 days
Infant	Birth – 1 year
Child	1 – 12 years
Adolescent	13 – 18 years
Juvenile	0-18 years

Resource References

Supporting Documentation Table 5: The full bibliographic references of the publications used to compile the lead isotope data and contextual information for the 307 human enamel samples are documented here. The site(s) discussed in each publication are listed to allow dataset users to look up references for relevant comparative data. Any publications linked to data added in the future should also be recorded in this table.

Publication Reference	Site(s) Discussed
Budd, P., Montgomery, J., Evans, J., Barreiro, B., 2000. Human Tooth Enamel as a Record of the Comparative Lead Exposure of Prehistoric and Modern People. <i>The Science of the Total Environment</i> , 263(1-3), pp. 1-10	Monkton-up-Wimbourne
Budd, P., Millard, A., Chenery, C., Lucy, S., Roberts, C., 2004a. Investigating Population Movement by Stable Isotope Analysis: A Report from Britain. <i>Antiquity</i> , 78(299), pp. 127-141	West Heslerton Mangotsfield Repton Monkton-up-Wimbourne Eagle Hotel Blackfriars
Budd, P., Montgomery, J., Evans, J., Trickett, M., 2004b. Human Lead Exposure in England from Approximately 5500 BP to the 16 th Century AD. <i>The Science of the Total Environment</i> , 318(1-3), pp. 45-58	Shepperton Monkton-up-Wimbourne West Heslerton Southwark Mangotsfield Winchester Stonehenge Bamburgh Repton Riccall Lihou Rivenhall

	Blackfriars
Evans, J., Chenery, C., Montgomery, J., 2012. A Summary of Strontium and Oxygen Isotope Variation in Archaeological Human Tooth Enamel Excavated from Britain. <i>Journal of Analytical Atomic Spectrometry</i> , 27(1), pp. 754-764	Aldro Bamburgh Callis Wold Chelsea Old Church Cladh Hallan Cnip St Mary's Cathedral Driffeld Terrace Eagle Hotel Galson Hereford Cathedral High Pasture Cave Kilpheder Mangotsfield Mine Howe Monkton-up-Wimbourne Mull Repton Riccall Stonehenge Towthorpe Wasperton West Heslerton
Jay, M., Richards, M.P., 2006. Diet in the Iron Age Cemetery Population at Wetwang Slack, East Yorkshire, UK: Carbon and Nitrogen Stable Isotope Evidence. <i>Journal of Archaeological Science</i> , 33(5), pp. 653-662	Wetwang
Melton, N., Montgomery, J., Knusel, C., Batt, C., Needham, S., Parker Pearson, M., Sheridan, A., Heron, C., Horsley, T., Schmidt, A., Evans, A., Carter, E., Edwards, H., Hargreaves, M., Janaway, R., Lynnerup, N., Northover, P., O'Connor, S., Ogden, A., Taylor, T., Wastling, V., Wilson, A., 2010. Gristhorpe Man: An Early Bronze Age Log-Coffin Burial Scientifically Defined. <i>Antiquity</i> , 84(1), pp. 796-815	Gristhorpe
Millard, A., Montgomery, J., Trickett, M., Beaumont, J., Evans, J., Chenery, S., 2014. "Childhood Lead Exposure in the British Isles During the Industrial Revolution" In Zuckerman, M.K. (Eds.) <i>Modern Environments and Human Health: Revisiting the Second Epidemiologic Transition</i> (First Edition). Hoboken: John Wiley and Sons, pp. 279-299	St Mary's Cathedral Chelsea Old Church Lukin Street Golden Lane
Montgomery, J., Evans, J., Powlesland, D., Roberts, C., 2005. Continuity or Colonisation in Anglo-Saxon England? Isotope Evidence for Mobility, Subsistence Practice, and	West Heslerton

Status at West Heslerton. <i>American Journal of Physical Anthropology</i> , 126(2), pp. 123-235	
Montgomery, J., 2006. Lead and Strontium Isotope Compositions of Human Dental Tissues as an Indicator of Ancient Exposure and Population Dynamics. PhD Thesis, Bradford: University of Bradford	Cnip West Heslerton
Montgomery, J., Evans, J., Chenery, C., 2009. "Strontium and Oxygen Isotope Analysis of Burials from Wasperton, Warwickshire" In Carver, M., Hills, C., Scheschkewitz, J. (Eds.) <i>Wasperton. A Roman, British and Anglo-Saxon Cemetery in Central England</i> . Specialist Report 4.2. Woodbridge: Boydell and Brewer	Wasperton
Montgomery, J., Evans, J., 2009. "Immigrants on the Isle of Lewis – Combining Traditional Funerary and Modern Isotope Evidence to Investigate Social Differentiation, Migration and Dietary Change in the Outer Hebrides of Scotland" In Gowland, R., Knusel, C. (Eds.) <i>The Social Archaeology of Funerary Remains</i> . Oxford: Oxbow Books, pp. 122-142	Cnip Galson
Montgomery, J., Evans, K., Chenery, S., Pashley, V., Killgrove, K., 2010. "Gleaming White and Deadly": Using Lead to Track Human Exposure and Geographic Origins in the Roman Period in Britain. <i>Journal of Roman Archaeology: Supplementary Series</i> , Suppl. 78(1), pp. 199-226	Gristhorpe Cnip Ratoath Rath Mine Howe High Pasture Galson Kilpheder Driffield Terrace Westness Graemsay Sumburgh Monkton-up-Wimbourne West Heslerton Callis Wold Towthorpe Aldro Cladh Hallan Ardachy Wetwang Eagle Hotel Mangotsfield Poundbury Wasperton Riccal Repton Blackfriars

	Hereford Cathedral Garton Slack Acklam Wold South Great Georges Street
Montgomery, J., Knusel, C., Tucker, K., 2011. "Identifying the Origins of Decapitated Male Skeletons from 3 Driffeld Terrace, York, Through Isotope Analysis" In Bonogofsky (Ed.) <i>The Bioarchaeology of the Human Head: Decapitation, Decoration, and Deformation</i> . Florida: University Press of Florida, pp. 141-178	3 Driffeld Terrace
Montgomery, J., Beaumont, J., Jay, M., Keefe, K., Gledhill, A.R., Cook, G.T., Dockrill, S.J., Melton, N.D., 2013. Strategic and Sporadic Marine Consumption at the Onset of the Neolithic: Increasing Temporal Resolution in the Isotope Evidence. <i>Antiquity</i> , 87(338), pp. 1060-1072	Sumburgh
Montgomery, J., Grimes, V., Buckberry, J., Evans, J., Richards, M., Barrett, J., 2014. Finding Vikings with Isotope Analysis: The View from Wet and Windy Islands. <i>Journal of the North Atlantic (Special Volume)</i> , 7(1), pp. 54-70	South Great Georges Street Westness Cnip Ricall Repton Rath Graemsay
Moore, J., Rose, A., Anderson, S., Evans, J., Nowell, G., Grocke, D.R., Pashley, V., Kirby, M., Montgomery, J., 2020. A Multi-Isotope (C, N, O, Sr, Pb) Study of Iron Age and Roman Period Skeletons from East Edinburgh, Scotland Exploring the Relationship Between Decapitation Burials and Geographical Origins. <i>Journal of Archaeological Science: Reports</i> , 29(1), 102075	Musselburgh
Muldner, G., Chenery, C., Eckardt, H., 2011. The 'Headless Romans': Multi-Isotope Investigations of an Unusual Burial Ground from Roman Britain. <i>Journal of Archaeological Science</i> , 38(2), pp. 280-290	3 Driffeld Terrace 6 Driffeld Terrace
Shaw, H., Montgomery, J., Redfern, R., Gowland, R., Evans, J., 2016. Identifying Migrants in Roman London Using Lead and Strontium Stable Isotopes. <i>Journal of Archaeological Science</i> , 66(1), pp. 57-68	Bishopsgate St Bartholomew's Hospital Cotts House Great Dover Street Hooper Street London Wall Mansell Street Spitalfields Market

	West Smithfield
Trickett, M.A., 2006. A Tale of Two Cities: Diet, Health and Migration in Post-Medieval Coventry and Chelsea Through Biographical Reconstruction, Osteoarchaeology and Isotope Biogeochemistry. PhD Thesis, Durham: University of Durham	Chelsea Old Church St Mary's Cathedral

Bibliography

Buikstra, J.E., Ubelaker, D.H., 1994. Standards for Data Collection from Human Remains. Fayetteville: Arkansas Archaeological Survey

Forum on Information Standards in Heritage, 2023. Chronology. [Online] Available at: <https://www.heritage-standards.org.uk/chronology/> [Access Dated: 19th December 2023]

Heritage Data, 2023. ScAPA: Scottish Archaeological Periods and Ages – Iron Age. [Online] Available at: <https://heritagedata.org/live/schemes/scapa/concepts/IA.html> [Access Dated: 19th December 2023]

Historic England, 2023. England's Historic Periods. [Online] Available at: <https://historicengland.org.uk/listing/the-list/historic-periods/> [Access Dated: 19th December 2023]

Leatherman, G., 1972. Fédération Dentaire Internationale. New Tooth Designation System. *Bulletins and Memoirs of the Society of Anthropology of Paris*, 9(1), pp. 83-85

Scheuer, L., Black, S., 2000. Developmental Juvenile Osteology. London: Academic Press

White, T.D., Folkens, P., 1991. Human Osteology. London: Academic Press

Young, J., Mac Uidhir, D., McDonagh, L., Kelly, A., Crowley, B., Finnegan, N., 2023. Heritage Ireland: Mesolithic – Iron Age (8000BC – 400AD). [Online] Available at: <https://heritageireland.ie/articles/mesolithic-iron-age-8000bc-400ad/> [Access Dated: 19th December 2023]