

Assignment 1: Identify the key reference and data resources that you use in your specialism to ensure your work is properly informed, and critically evaluate their accessibility, currency, reliability, and relevance.

Introduction

Whilst many specialisms within archaeology have well-established reference and data resources to inform interpretations of archaeological data, isotope analysis has not yet achieved this level of standardisation within the resources used by specialists. Due to its nature as a methodology adapted relatively recently from hard science disciplines, isotope analysis does not have the same set-up or foundation within archaeology as other fields of study. For example, the specialism does not have physical comparative collections and related reference resources that specialists within pottery analysis (e.g., Tomber and Dore, 1998; Barclay *et al.*, 2016) or zooarchaeology (e.g., Albarella *et al.*, 2017; Baker *et al.*, 2020) can access, nor does it have fully standardised techniques across laboratories to have data resources that could be employed uniformly by every specialist. Indeed, there is no Historic England guidance document (2025) or ClfA toolkit (2025) to advise isotope specialists on resources to use for best practice, emphasising the lack of standardisation within this study area. However, that is not to say that isotope specialists do not use and rely on reference and data resources. Rather, these resources are vital requisites to be able to interpret the raw data produced in the analytical process, which without comparative data would be meaningless. Resources used by isotope specialists are instead more varied than those used in more traditional avenues of archaeological study, and draw on existing research in fields such as geochemistry to provide the context necessary to interpret generated archaeological data. As selection and use of resources within this specialism varies significantly, often depending on where and by who you are taught the theory, practice, and application of isotope analysis, this essay will focus on two types of resources I use in my specialist practice: digital reference datasets and methodological reference publications. By interrogating examples of each resource type, this essay aims to critically evaluate the accessibility, currency, reliability, and relevance of the resources I implement in my work, providing an opportunity to

assess how appropriate they are to ensuring my work is as accurate and properly informed as possible.

Digital Reference Datasets: Biosphere Isotope Domains

In the fast-paced environment of commercial archaeology, where many often-overlapping deadlines restrict specialists' ability to visit physical reference collections or spend significant amounts of time trawling through multiple books to find useful comparative data, digital reference and data resources are becoming increasingly important to researchers. For isotope analysis, the ability to make informed interpretations of isotope values generated from analysis of archaeological materials, such as human enamel and collagen, is dependent on having access to as wide a range of comparative data as possible from various sources including fauna, plants, soil, minerals, and water (Britton, 2020), which is made more achievable using online databases. This is especially true for provenance studies employing this specialist technique. Due to the exclusionary nature of isotope analysis meaning only areas with local environmental values inconsistent with isotope values measured in the human samples can be ruled out as potential places of origin (Montgomery, 2010), researchers must be able to identify and consider all potential origins, exclude all inconsistent ones, and have access to the large amount of data required to do this.

The Biosphere Isotope Domains (BID) dataset for Britain was created by the British Geological Survey (Evans *et al.*, 2023) with the specific aim of aiding archaeological provenance studies employing isotope analysis. This resource compiles and expands existing well-established reference datasets for four isotope systems (strontium, oxygen, lead, and sulphur) in a dedicated website (UKRI, 2025), which also hosts a searchable map created to visually represent the datasets and the variation of these four isotopes across Britain (Evans *et al.*, 2022). The online map viewer is a particularly unique feature, allowing users to input sample data and query it against the isotope datasets to produce a distribution map (Figure 1) highlighting all areas within Britain consistent with the values entered. As this comprehensive digital resource is used frequently within my specialist practice, the content and application of BID will be critically evaluated here to explore its

appropriateness for informing interpretations of childhood origins for analysed individuals.

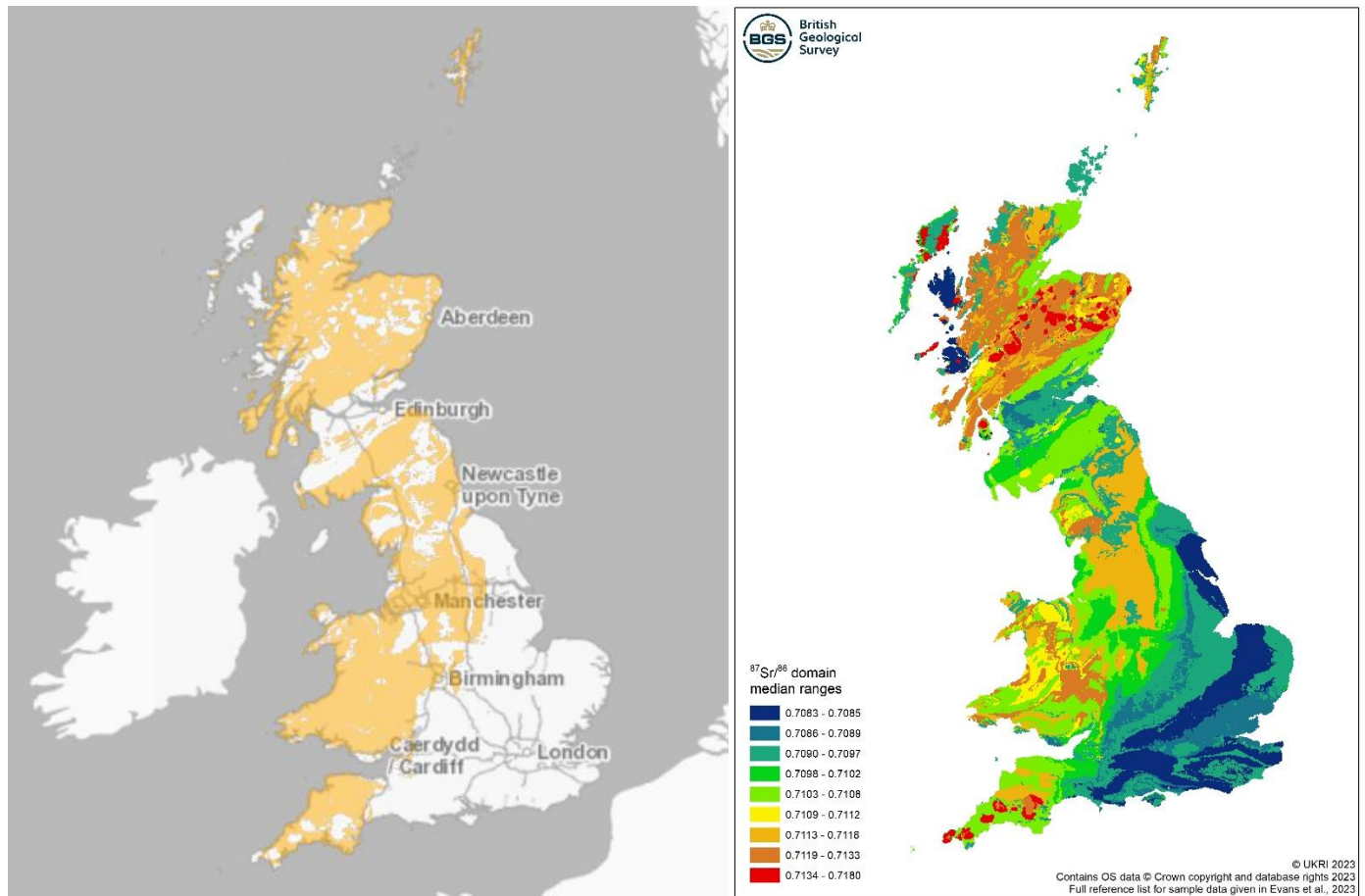


Figure 1: An example distribution map (left) representing areas of Britain consistent with a strontium isotope value of 0.7114 measured in human enamel (example data from Parker, 2022), created using the BID interactive map (Evans et al., 2022), is shown alongside the strontium isotope domain map (right) available through BID's website (UKRI, 2025a). This represents how the two BID resources may be combined in commercial reports to visually represent all potential origins for an individual in Britain based on comparison with environmental data.

Accessibility

BID's creators have made a meaningful attempt at making the dataset as accessible as possible, firstly by providing free access via the dedicated website (UKRI, 2025a) to all the isotope excel data files, the online map viewer, GIS data for the interactive map and an accompanying GeoPackage, as well as JPEG versions of the isotope domain reference maps showing variation across Britain. Not only are these resources freely available in one centralised location, but their use and manipulation are encouraged through their availability under the Open Government Licence which only requires source acknowledgement for any reproduced materials (UKRI, 2025d), highlighting the lengths the creators have gone to ensure other researchers can utilise this reference data in ways that best suit them. This licencing choice is particularly pertinent to commercial laboratories, as it means the easy-to-understand distribution maps for individual samples can be incorporated into specialist reports alongside the reference maps (National Archives, 2014), aiding clients' understanding of the evidence-based process of ruling out potential origins and providing a visual representation of why it is not possible to determine one single provenance (Figure 1). In my own experience of utilising the data this way, the highly accessible nature of this resource and its usability has made my reports more accessible to other researchers and non-specialists, by providing a visual representation of my research process and ensuring comprehension of my interpretations is not solely reliant on understanding specialist jargon.

Yet, for a resource so dependent on visual data representation, it is arguable that not enough has been done to ensure the interactive and reference domain maps are accessible to all viewers. As seen in Figure 2, those with colour blindness, and particularly the most common form of red-green colour blindness (Colour Blind Awareness, 2025), may struggle to use the colour scales on the map legends and consequently may not be able to distinguish between different isotope domains by sight alone, potentially leading to misinterpretations of the BID dataset itself and any research material reproducing it. In comparison, client reports produced by Durham University's commercial isotope laboratory try to ensure all figures (Figure 3) not only have colour combinations appropriate for colour blindness, but also use symbols to differentiate between sample and data types so as not to solely rely on colour to convey meaning (Phillips, 2022). The prevalence of colour blindness in the general

population is actually quite high, particularly in male individuals, so must not be overlooked when creating datasets with visual-based resources, especially when considering free online guidance documents and tools are available to help inform colour use in scientific figures (e.g., Summerbell, 2019; Colblindor, 2021; Katsnelson, 2021; UCL, 2025). Therefore, despite being a large reference dataset with potential to become integrated into archaeological isotope research as a reliable standardised resource, BID falls short of being accessible to many potential users, and should strive to be fully accessible in not only its data availability but also its data presentation.

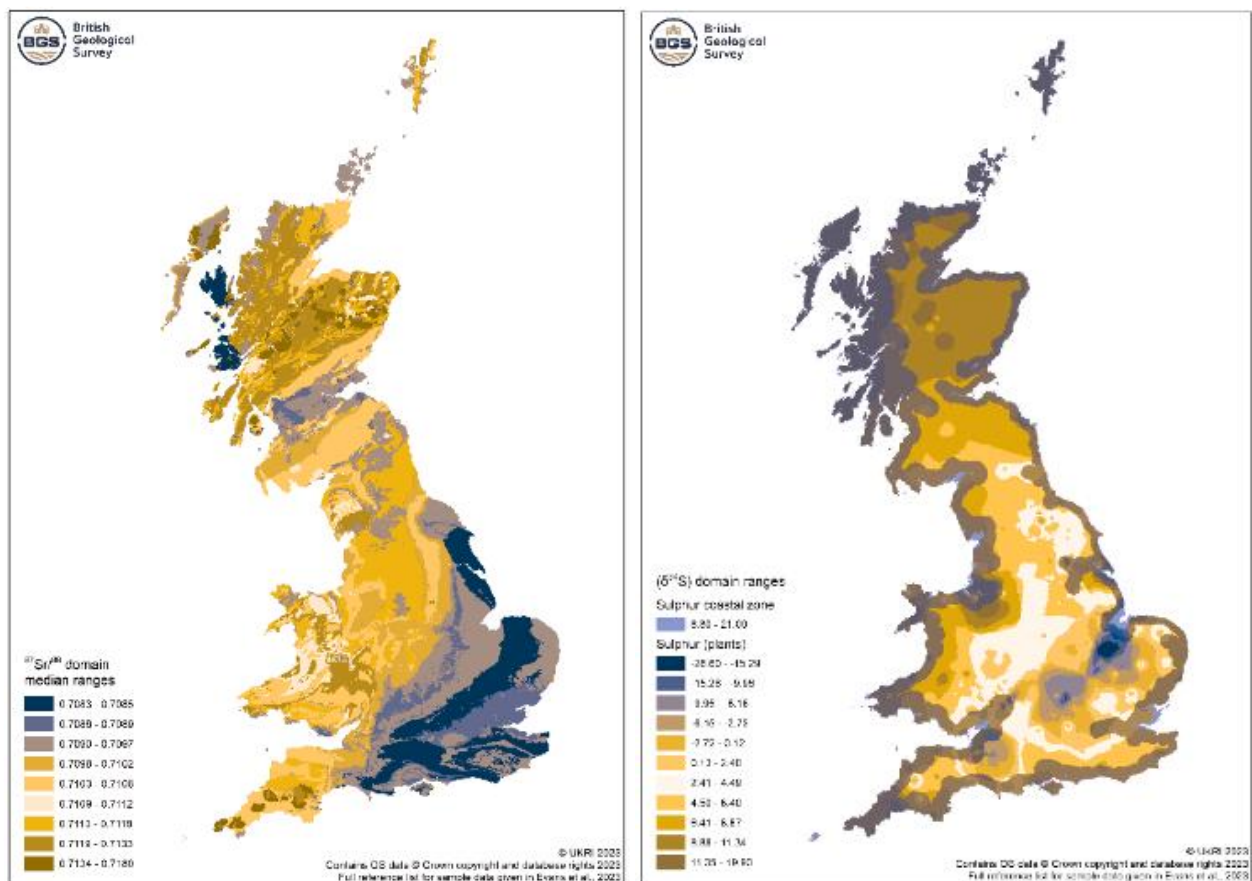


Figure 2: The reference domain maps (UKRI, 2025a) for strontium (left) and sulphur (right) are shown as they may appear to someone with colour blindness (simulated for deuteranopia: Colblindor, 2021). As can be seen, some colours used to represent the domains may appear very similar to others, potentially impacting the reliability of the map's use and restricting accessibility of the resource.

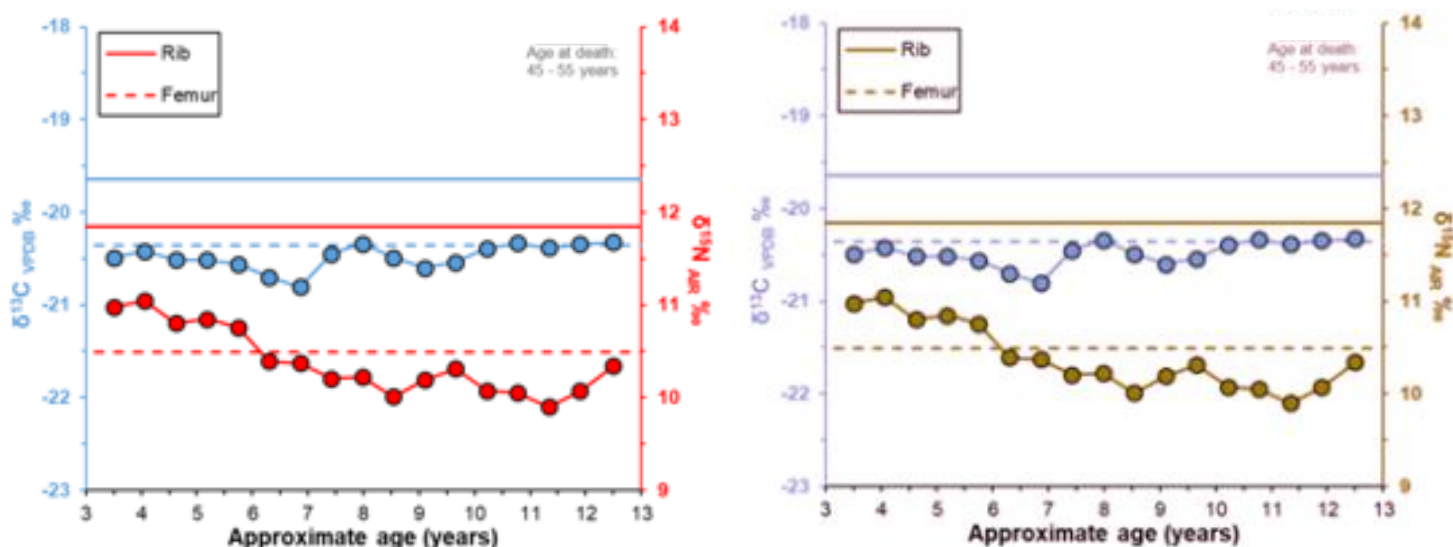


Figure 3: An example incremental profile (left) from Durham’s commercial isotope laboratory, showing carbon and nitrogen isotope changes across tooth development measured in dentine collagen increments, is shown as it may appear to someone with colour blindness (right) (simulated for deuteranopia: Colblindor, 2021). As is shown, the colour choices for the data points and axis, as well as the use of different symbols and line-types facilitate the figure’s readability and do not cause significant changes that would limit accessibility. Example figure anonymised from a commercial report (Moore and Montgomery, 2021).

Nevertheless, this design oversight does not significantly undermine other steps taken to improve BID’s accessibility, especially for first time users. The supporting information provided on the website, including the comprehensive yet concise user guide (Evans *et al.*, 2023) and the informative video guide (BGS Training and Resources, 2024), demonstrates a purposeful choice to go beyond the provision of a unique and engaging reference resource, and put additional effort into ensuring users get the best use out of it by understanding not only how to use it, but also how it was developed and decisions made during its creation. In comparison to similar reference resources used in my practice, such as the collaborative IsoArch database (Salesse *et al.*, 2018; 2020) and worldwide geology viewer Macrostrat (2025), BID has the most intuitive interface (Figure 4), as well as the clearest and best-signposted guidance information. Overall, it is clear BID’s creators have shown a commitment to accessibility in the set-up and layout of this resource, and whilst certain aspects could be improved, it stands as a great example of the level of accessibility other isotope reference datasets should strive to achieve.

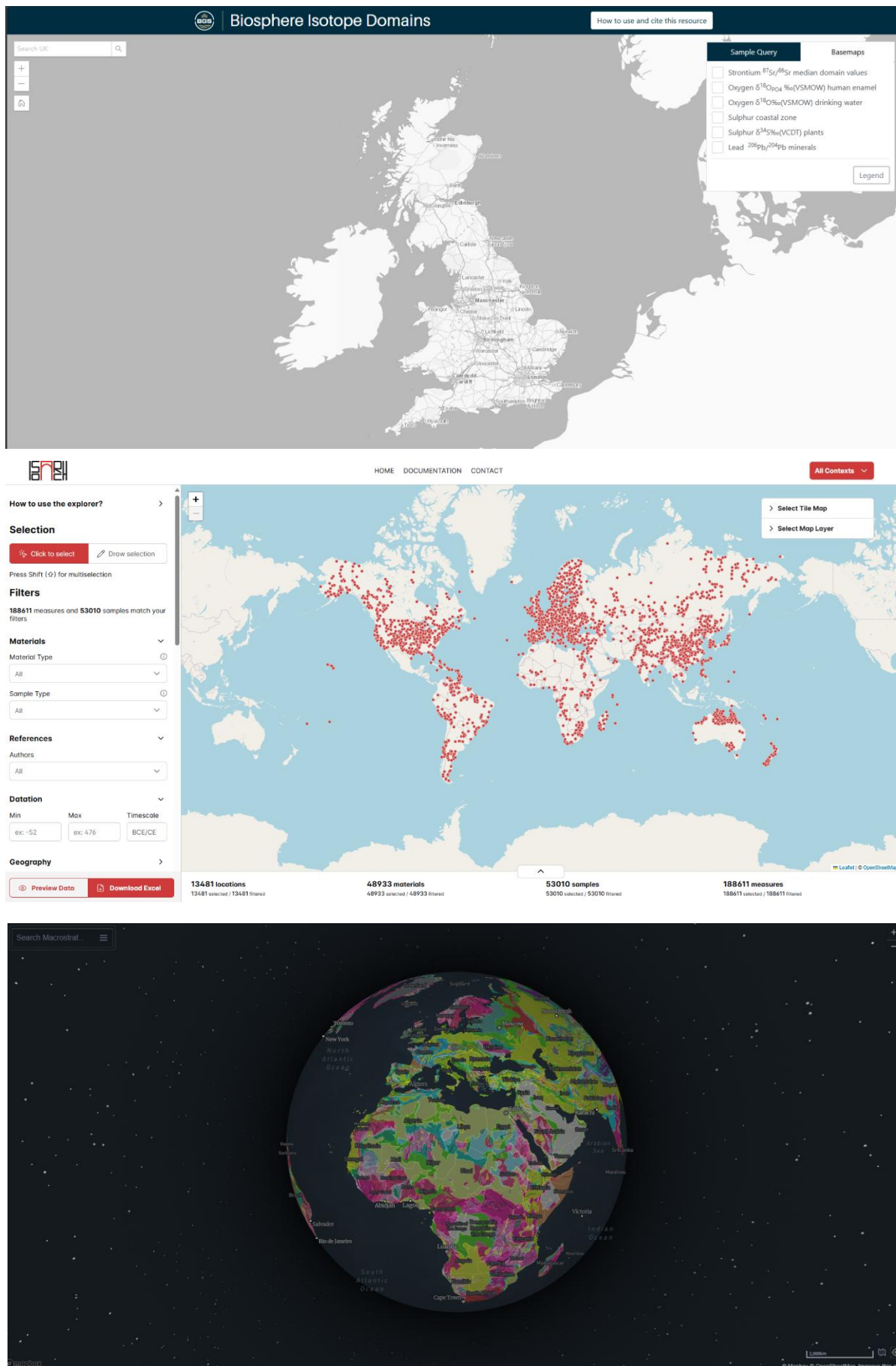


Figure 4: A comparison of the interactive resource interfaces for BID (top: Evans *et al.*, 2022), IsoArch (middle: Salesse *et al.*, 2018; 2020) and Macrostrat (bottom: 2025). BID’s interface is clear, concise and easy to navigate with links to user help information. In comparison, IsoArch’s interface is complicated and cluttered with too many data entry options, and Macrostrat’s interface is too simple with no links to user help information.

Currency

As stated in the user guide (Evans *et al.*, 2023), BID is designed with the aim of maintaining its currency over time by expanding the dataset and adding new samples as results are received or published. Version 2 has built upon the foundations of the initial dataset by incorporating published data from external laboratories and collaborating with the National Environmental Isotope Facility to generate new data, which has significantly increased the amount of strontium data that initially predominantly derived from a single publication (Evans *et al.*, 2018). Continuous review and growth of this dataset through inclusion of more varied data published by researchers outside of the team behind BID demonstrates a proactive approach to ensuring the dataset remains current, not only by keeping up to date with new publications but also by expanding the dataset's scope beyond the creators' research interests and reach. Advantages of this approach are exemplified by version 2's addition of a staggering 34 data sources (including 7 completely new ones) to the 13 sources originally included in BID (Evans *et al.*, 2018; 2023), highlighting that in the five years between the two versions, considerable work was put in to both creating and curating data to ensure BID represents the most informed and up-to-date understanding of isotope variation across Britain. Furthermore, this data expansion not only enabled significant improvement of the sulphur isotope dataset and accompanying domain maps by increasing data resolution and combatting previous large data gaps for Scotland (Figure 5), but also resulted in an entirely new dataset and resources for lead isotope variation (Evans *et al.*, 2018; 2023) that has been useful for inferring potential origins for populations with non-anthropogenic lead exposure. The continued use of BID in my specialist practice is encouraged by the clear focus on currency and continued improvement, particularly when considering the level of detail and resolution provided is not available from other resources.

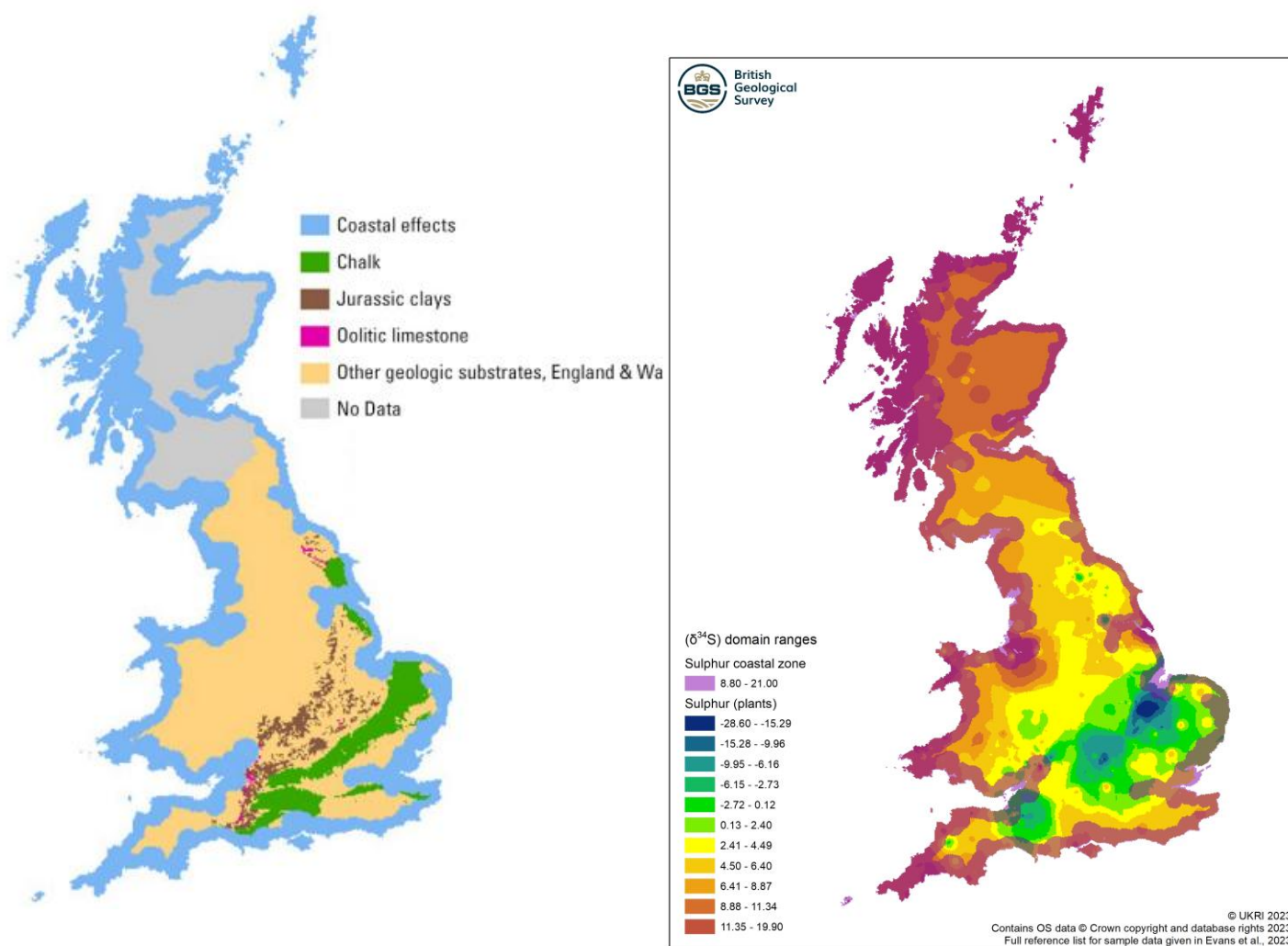


Figure 5: Comparing the sulphur isotope domain maps from version 1 (left: Evans *et al.*, 2018) and version 2 (right: Evans *et al.*, 2023) of BID highlight the significant improvement in data coverage and resolution provided by the increase in data sources used to construct the datasets.

Reliability

Like with all datasets, especially those compiling data from various sources, employing BID within isotope provenance studies comes with limitations users must consider. Most notably, despite the resource's extensive bibliography, data distribution maps provided in the user guide (Evans *et al.*, 2023) show many areas within Britain still have considerable gaps across the isotope datasets, meaning generalised and theoretical interpolated values have had to be applied to these areas on the domain maps. Whilst this may be standard for many datasets and the domains with interpolated values have been justified within the user guide, general interactive map users may not realise that when attempting to investigate expected isotope values for specific areas, values shown may not be entirely accurate at high

resolutions. This is particularly evidenced by the strontium isotope domains map, where some domains are represented by over 100 samples and others, such as the Scottish Ordovician igneous and granite domain, have been created based on as few as 2 samples (Evans *et al.*, 2022; 2023). Admittedly, when I started using the interactive map I didn't realise reliability of the domains differed so significantly, and often took the value range provided for a site as dependable proxy data with which to estimate local bioavailable strontium ratios used to infer an individual's locality to their burial environment, not considering the potential caveat of small sample datasets being applied to large geographical areas and therefore potentially diminishing the reliability of any interpretations formed.

Moreover, as there is no indication within the resource as to why certain publications were chosen as data sources and others weren't, BID's reliability is limited by this lack of acknowledgement and the inability of users to understand potential selection biases in the datasets. In comparison, other related resources such as Lightfoot and O'Connell's (2016) compilation of European human oxygen isotope data, declare datasets as being non-exhaustive and biased towards publications available in certain languages and via specific academic search engines, thus making users aware of where data has been sourced from and why. Ultimately, whilst data interpolation, sample size variations, and data source bias do hinder BID's reliability, no reference dataset is perfect and will inevitably contain restrictions and some level of bias. The discussion of reliability and application limitations within the BID user guide (Evans *et al.*, 2023) does however imply the desire to ensure users are informed about its constraints.

Relevance

The use of BID is entirely relevant to isotope provenance studies, as without access to comparative environmental isotope data, human data is meaningless and cannot be contextualised to infer potential mobility and origins. Previously, this data was only available in data tables within separate publications and on isoscape maps with large generalisations and low resolution (E.g., Darling *et al.*, 2003; Evans *et al.*, 2010). As BID combines, integrates and improves all these aspects, and provides additional resources like the GIS dataset allowing users to query data independently

(UKRI, 2025b; 2025c), its suitability for commercial and academic isotope research is undeniable. One drawback, however, is the dataset's coverage, excluding Northern Ireland and the Isle of Man despite data being available for these regions (Darling *et al.*, 2003; Evans *et al.*, 2010; Snoeck *et al.*, 2020). As there are areas of shared geology between these regions and Britain, this choice in data scope may lead users to fail to consider that potential origins for analysed individuals may also exist in these geographically close regions. Nevertheless, BID's scope is justified by modern political boundaries, and the centralised and holistic nature of the dataset makes it, in my opinion, the most appropriate digital reference resource for isotope variation data across Britain.

Methodological Reference Publications: Tooth Development

Occasionally, isotope specialists aren't provided with skeletal reports for the individuals they sample, and consequently do not have information about dental development and age estimation. This is essential for investigating diet through incremental dentine analysis, which identifies changes in carbon and nitrogen isotopes across a tooth's development at high temporal resolution to infer childhood dietary changes and physiological events such as puberty and stress (Beaumont *et al.*, 2013; 2014; Beaumont and Montgomery, 2015). For non-adults, tooth development information is particularly important when employing this technique, as if development is incomplete, the full developmental age range cannot be used to estimate the formation period of each increment required to construct an accurate profile of the isotope values (Beaumont *et al.*, 2013; Beaumont and Montgomery, 2015). Where this information is unavailable, myself and other researchers may use established methodologies, such as the Atlas of Tooth Development and Eruption (AlQahtani, 2008) briefly considered here, to ensure incremental age ranges are properly informed.

Accessibility

As this resource is usually accessed within the laboratory at the time of sampling, typically a printed pdf of the Atlas (Appendix 1: AlQahtani, 2008), and not the accompanying publication (AlQahtani *et al.*, 2010), is consulted. The pdf is freely

available via the Queen Mary University of London website (QMUL, 2025) in 22 different languages, emphasising the effort made to combat language barriers that frequently restrict resource access. However, unlike BID, using the Atlas is restricted to educational and individual learning purposes (QMUL, 2025), so cannot be reproduced in commercial reports to visually support interpretations. Additionally, design and font choices impact the Atlas' readability, especially if printed in A4, as the spiral-type design used to show chronological development combined with the small floating text indicating the age each diagram represents can make it difficult for some people to follow. Thus, despite being available to international audiences, the Atlas' accessibility is restricted by its design.

Currency

Despite being over a decade old, the Atlas remains the go-to resource for isotope specialists when faced with a tooth of unknown age. This is because its currency as the most accurate age estimation method using tooth development (AlQahtani *et al.*, 2014) has been maintained over time, as highlighted by its continued adoption internationally to aid victim identification, teach the next generation of osteological, dental, and forensic specialists, and age recovered archaeological remains (QMUL, 2014). This reputation as an accepted internationally-applicable method stems from the substantial and geographically diverse sample set used to inform the resource's creation, which showed little variation in tooth development timing between ethnic groups (QMUL, 2014), and was recently supported further by a meta-analysis that concluded the method remains an accurate age estimation method for worldwide application (Jacometti *et al.*, 2023). Therefore, the Atlas' application within isotope analysis is justified by its continued far-reaching applicability to current research requiring dental development information.

Reliability

Being such a widely accepted and well-established method, the Atlas' reliability arguably depends more on the way it is used than the resource itself. As discussed, its application within isotope analysis is passive and uncritical, often utilising only the

diagram (AlQahtani, 2008) as a visual reference for tooth development, without being aware of the limitations of the data underpinning it. For instance, the publication (AlQahtani *et al.*, 2010) acknowledges various limitations such as uneven sex profiles within age groups, natural variation, and issues with using fragmentary remains with incomplete dentition as references, and how these constraints impact diagram accuracy and resolution. Moreover, as slight differences exist in tooth development between males and females (represented in the Atlas app: Audsley and Khan, 2024), using the diagram alone, which uses combined sex data, may compromise age estimations and thus the reliability of constructed incremental profiles. Overall, whilst the Atlas is a reliable source itself, the casual nature of its use by isotope specialists may constrain the level of credibility achievable.

Relevance

Incremental analysis is a destructive method, requiring sectioning of the tooth from crown to root (Beaumont *et al.*, 2013). Full documentation of the tooth prior to sampling is essential, with the Atlas used to infer age estimations for studied individuals from their tooth development, which cannot be deduced after destruction. This documented information supports record photographs in preserving the tooth's appearance, and is especially relevant to non-adult teeth with incomplete dentition, for which the degree of root apex closure inferred using the Atlas' incorporation of Moorrees *et al.*'s (1993) tooth development stages, can be used to estimate individuals' age-at-death. Unlike for adult individuals who survived beyond tooth formation, carbon and nitrogen values measured in the last root increments in non-adults were incorporated around the time of death, and can be used to infer dietary behaviour and physiological changes in the final months of life (Beaumont *et al.*, 2013). Accurate age-at-death estimations for non-adults are critical to construct incremental profiles with reliable increment age ranges, and to interpret whether isotope changes across the profile may be linked to weaning, physiological events, or dietary change (Beaumont *et al.*, 2015; Beaumont and Montgomery, 2015). Therefore, the well-established use and accuracy of the Atlas' age estimation method make it completely relevant for informing creation of reliable incremental profiles to infer past dietary behaviour.

Conclusion

By critically evaluating two resource types employed within my specialism, using focused case studies, this essay demonstrates how accessibility, currency, reliability, and relevance vary between and within resources. As a developing reference dataset whose main advantage is the amount of essential information it collates in one location and presents in various forms, BID is a good example of a resource that will result in similar interpretations despite being used in different ways, due to the relevance and accessibility of its data. In comparison, despite the Atlas' credible reputation and documented accuracy, variation in users' method application may cause differing results, which impacts reliability of age-at-death interpretations. Overall, although other resources could be considered for a more holistic overview, the discussed examples emphasise that both the content and design of reference and data resources as well as the way specialists employ them influence their accessibility, currency, reliability, and relevance, and ultimately their appropriateness for informing interpretations.

Bibliography

Albarella, U., Rizzetto, M., Russ, H., Vickers, K. and Viner-Daniels, S (eds.) (2017). *The Oxford Handbook of Zooarchaeology*. Oxford: Oxford University Press.

Audsley, B. and Khan, B. (2024) *Atlas software app*. Available at: <https://www.qmul.ac.uk/dentistry/atlas/software-app/> (Accessed 17th May 2025).

AlQahtani, S.J. (2008) 'Atlas of tooth development and eruption', *Barts and the London School of Medicine and Dentistry*. London: Queen Mary University of London.

AlQahtani, S.J., Liversidge, H.M. and Hector, M.P. (2010) 'Atlas of tooth development and eruption', *Journal of Physical Anthropology*, 142(3), pp. 481-490. Available at: <https://doi.org/10.1002/ajpa.21258>

AlQahtani, S.J., Hector, M.P. and Liversidge, H.M (2014) 'Accuracy of dental age estimation charts: Schour and Massler, Ubelaker and the London Atlas', *American Journal of Physical Anthropology*, 154(1), pp. 70-78. Available at: <https://doi.org/10.1002/ajpa.22473>

Baker, P., Fairnell, E. and Worley, F. (2020) *The historic england zooarchaeology reference collection: description and list*. Portsmouth: Historic England.

Barclay, A., Knight, D., Booth, P., Evans, J., Brown, D.H. and Wood, I. (2016) *A Standard for Pottery Studies in Archaeology*. London: Medieval Pottery Research Group.

Beaumont, J., Lee-Thorp, J. and Montgomery, J. (2013) 'Childhood Diet: A Closer Examination of the Evidence from Dental Tissues Using Stable Isotope Analysis of Incremental Human Dentine', *Archaeometry*, 55(2), pp. 277-295. Available at: <https://doi.org/10.1111/j.1475-4754.2012.00682.x>

Beaumont, J., Gledhill, A. and Montgomery, J. (2014) 'Isotope analysis of incremental human dentine: towards higher temporal resolution', *Bulletin of International Association of Paleodontology*, 8(2), pp. 212-223.

Beaumont, J. and Montgomery, J. (2015) 'Oral Histories: A simple method of assigning chronological age to isotopic values from human dentine collagen', *Annals of Human Biology*, 42(4), pp. 407-414. Available at: <https://doi.org/10.3109/03014460.2015.1045027>

Beaumont, J., Montgomery, J., Buckery, J. and Jay, M. (2015) 'Infant Mortality and Isotopic Complexity: New Approaches to Stress, Maternal Health, and Weaning', *American Journal of Biological Anthropology*, 157(3), pp. 441-457. Available at: <https://doi.org/10.1002/ajpa.22736>

British Geological Survey [BGS] Training and Resources (2024) *Biosphere Isotope Domains: How to use the website*. Available at: <https://www.youtube.com/watch?v=Hb41sMBq9vU> (Accessed 11th May 2025).

Britton, K. (2020) 'Isotope Analysis for Mobility and Climate Studies', in Richards, M.P. and Britton, K. (eds) *Archaeological Science: An Introduction*. Cambridge: Cambridge University Press, pp. 99-124. Available at: <https://doi.org/10.1017/9781139013826.005>

Chartered Institute for Archaeologists [CIfA] (2025) *Toolkits*. Available at: <https://www.archaeologists.net/work/toolkits> (Accessed 11th May 2025).

Colblindor (2021) *Coblis – Color Blindness Simulator*. Available at: <https://www.color-blindness.com/coblis-color-blindness-simulator/> (Accessed 14th May 2025).

Colour Blind Awareness (2025) *About Colour Blindness*. Available at: <https://www.colourblindawareness.org/colour-blindness/> (Accessed 14th May 2025).

Darling, W.G., Bath, A.H. and Talbot, J.C (2003) 'The O and H stable isotope composition of freshwaters in the British Isles. 2. Surface waters and groundwater', *Hydrology and Earth Sciences Discussions, European Geosciences Union*, 2003, 7(2), pp. 183-195.

Evans, J.A., Montgomery, J., Wildman, G. and Boulton, N. (2010) 'Spatial variations in biosphere Sr-87/Sr-86 in Britain', *Journal of the Geological Society*, 167(1), pp. 1-4.

Evans, J.A., Mee, K., Chenery, C.A., Cartwright, C.E., Lee, K.A. and Marchant, A.P. (2018) *User Guide for the Biosphere Isotope Domains GB (Version 1) dataset and web portal*. Nottingham: British Geological Survey.

Evans, J.A., Mee, K., Chenery, C.A. and Marchant, A.P. (2022) *Biosphere Isotope Domains GB (V2): Interactive Website*. Available at: https://mapapps.bgs.ac.uk/biosphereisotopedomains/index.html?_ga=2.253568393.1682161248.1745325829-1313499067.1745325829 (Accessed 11th May 2025).

Evans, J.A., Mee, K., Chenery, C.A. and Marchant, A.P. (2023) *User Guide for the Biosphere Isotope Domains GB dataset and web portal*. Nottingham: British Geological Survey.

Historic England (2025) *Current Guidance and Advice*. Available at: <https://historicengland.org.uk/advice/find/a-z-publications/#ptocl> (Accessed 11th May 2025).

Jacometti, V., Sato, C.M., Meireles, D.A. and Alves da Silva, R.H. (2023) 'Age estimation using London Atlas methodology: A systematic review and meta-analysis', *Forensic Science International*, 342(2023), pp. 1-11. Available at: <https://doi.org/10.1016/j.forsciint.2022.111532>

Katsnelson, A. (2021) 'Colour me better: fixing figures for colour blindness', *Nature*, 598(1), pp. 224-225. Available at: <https://doi.org/10.1038/d41586-021-02696-z>

Lightfoot, E. and O'Connell, T.C. (2016) 'One the Use of Biomineral Isotope Data to Identify Human Migrants in the Archaeological Record: Intra-Sample Variation, Statistical Methods and Geographical Considerations', *PLoS ONE*, 11(4), pp. 1-29. Available at: <https://doi.org/10.1371/journal.pone.0153850>

Macrostrat (2025) *Macrostrat: A platform for geological data exploration, integration, and analysis*. Available at: <https://macrostrat.org/> (Accessed 15th May 2025).

Montgomery, J. (2010) 'Passports from the past: investigating human dispersals using strontium isotope analysis of tooth enamel', *Annals of Human Biology*, 27(3), pp. 325-246. Available at: <https://doi.org/10.3109/03014461003649297>

Moore, J. and Montgomery, J. *Specialist Report: Multi isotope study of nine individuals from mid-late 19th century [site redacted]*. Unpublished commercial report. Archaeological Isotope and Peptide Research Laboratory.

Moorrees, C.F.A., Fanning, E.A. and Hunt, E.E. (1993) 'Age Variation of Formation Stages for Ten Permanent Teeth', *Journal of Dental Research*, 42(1), pp. 1490-1502.

National Archives (2014) *Open Government Licence for public sector information: version 3*. Available at: <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/> (Accessed 14th May 2025).

Parker, A. (2022) *The "Furry Beaker Man": An isotopic investigation of a Bronze Age cist burial found at Oakslaw, near Rock, Northumberland*. Unpublished undergraduate BSc dissertation. Durham University.

Phillips, A. (2022) 'Colourblind Safe Color Schemes', *NCEAS Science Communication Resource Corner*, 29 June. Available at: <https://www.nceas.ucsb.edu/sites/default/files/2022-06/Colorblind%20Safe%20Color%20Schemes.pdf> (Accessed 14th May 2025).

Queen Mary University of London [QMUL] (2014) *REF 2014 impact case studies: the London atlas of dental development and eruption*. Available at: <https://impact.ref.ac.uk/casestudies/CaseStudy.aspx?Id=18142> (Accessed 17th May 2025).

Queen Mary University of London [QMUL] (2025) *Atlas of tooth development and eruption*. Available at: <https://www.qmul.ac.uk/dentistry/atlas/> (Accessed 17th May 2025).

Salesse, K., Fernandes, R., de Rochefort, X., Brůžek, J., Castex, D. and Dufour, É. (2018) 'IsoArch.eu: An open-access and collaborative isotope database for bioarchaeological samples from Graeco-Roman World and its margins', *Journal of Archaeological Science: Reports*, 19(1), pp. 1050-1055. Available at: <https://doi.org/10.1016/j.jasrep.2017.07.030>

Salesse, K., Fernandes, R., de Rochefort, X., Brůžek, J., Castex, D. and Dufour, É. (2020) *IsoArch (v.1.1)*. Available at: <https://isoarch.org/> (Accessed 15th May 2025).

Snoeck, C., Ryan, S., Pouncett, J., Pellegrini, M., Claeys, P., Wainwright, A.N., Mattioli, N., Lee-Thorp, J.A. and Schulting, R.J. (2020) 'Towards a biologically available strontium isotope baseline for Ireland', *Science of the Total Environment*, 710(2010), pp. 1-10. Available at: <https://doi.org/10.1016/j.scitotenv.2019.136248>

Summerbell, E. (2019) 'How to make scientific figures accessible to readers with color-blindness', *American Society for Cell Biology*, 15 January. Available at:

<https://www.ascb.org/diversity-equity-and-inclusion/how-to-make-scientific-figures-accessible-to-readers-with-color-blindness/> (Accessed 14th May 2025).

Tomber, D. and Dore, J. (1998) *The National Roman Fabric Reference Collection: A Handbook*. London: Museum of London Archaeology Service.

UK Research and Innovation [UKRI] (2025a) *Biosphere isotope domains (Great Britain): BGS Datasets*. Available at: <https://www.bgs.ac.uk/datasets/biosphere-isotope-domains-gb/> (Accessed 11th May 2025).

UK Research and Innovation [UKRI] (2025b) *Biosphere isotope GIS data (shapefile format)*. Available at: <https://www.bgs.ac.uk/download/biosphere-isotope-domains/> (Accessed 11th May 2025).

UK Research and Innovation [UKRI] (2025c) *Biosphere isotope (OGC GeoPackage)*. Available at: <https://www.bgs.ac.uk/download/biosphere-isotope-domains-ogc-geopackage-zip/> (Accessed 11th May 2025).

UK Research and Innovation [UKRI] (2025d) *Open Government Licence*. Available at: <https://www.bgs.ac.uk/bgs-intellectual-property-rights/open-government-licence/> (Accessed 14th May 2025).

University College London [UCL] (2025) *Guidelines for Colour-Blind Friendly Data*. Available at: https://www.ucl.ac.uk/mathematical-physical-sciences/sites/mathematical_physical_sciences/files/guidelines_for_colour_blindness.pdf (Accessed 14th May 2025).

Appendix

Appendix 1 has been uploaded as supporting documentation.