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A new open-access 3D database of crania from prehistoric and historic Sardinia

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This paper introduces to the scientific community a newly developed open-access database featuring high-resolution 3D models of crania titled "Prehistoric and historic crania from Sardinia hosted at the Museo Sardo di Antropologia ed Etnografia (MuSAE), University of Cagliari, Italy". With the growing importance of digital repositories for research in bioarchaeology, physical anthropology, forensic sciences, and digital heritage, we believe this database represents a significant contribution to multidisciplinary research.

Over the past decade, digital osteological collections have gained increasing recognition as essential tools for research, communication, and education. Notable examples include the New Mexico Decedent Image Database (https://nmdid.unm.edu/; Daneshvari and Edgar, 2021), which supports forensic and bioanthropological studies by providing CT scan data of modern human remains, and The Human Fossil Record (https://human-fossil-record.org), which offers digitized hominin fossils for phylogenetic and morphometric research. Several museums and universities have developed databases focused on specific collections. Examples include the Smithsonian Institution (https://3d.si.edu/collections/hominin-fossils), the Turkana Basin Institute, in collaboration with the National Museums of Kenya and Stony Brook University (https://africanfossils.org/), and the National Museum of Health and Medicine (https://skfb.ly/owTGv). Similarly, the Department of Archaeology at Durham University (UK) hosts its virtual osteological and archaeological collections on the commercial repository Sketchfab (listed in https://www.durham.ac.uk/departments/academic/archaeology/lab-commercial-services-home/digital-visualisation-laboratory/). Other research institutions and universities have also created their own repositories, freely hosting surface models and CT scans derived from academic studies in paleontology, biological anthropology, and comparative anatomy. Two prominent examples are MorphoMuseuM (CNRS, UMR 5554 Montpellier, France; Lebrun and Orliac 2016)) and MorphoSource (Duke University, USA; Boyer et al. 2016). Another open-access repository providing 3D models of skeletal materials is Zenodo (CERN; https://zenodo.org), a general-purpose platform for research outputs created within the European Union OpenAIRE initiative.

Our database is hosted on MorphoSource (https://www.morphosource.org/projects/000500961/) and includes 416 crania spanning various periods, from the Neolithic to the 20th century (Summary Table in Supplementary Material). Much of the skeletal material is curated at MuSAE and is primarily the result of excavation activities led by Carlo Maxia (who established the museum in) and Enrico Atzeni in the mid-20th century (Sarigu et al. 2016). The specimens originate from different parts of Sardinia (Fig. 1). Detailed information on the correspondence between each MuSAE catalog number and skeletal series is available in the

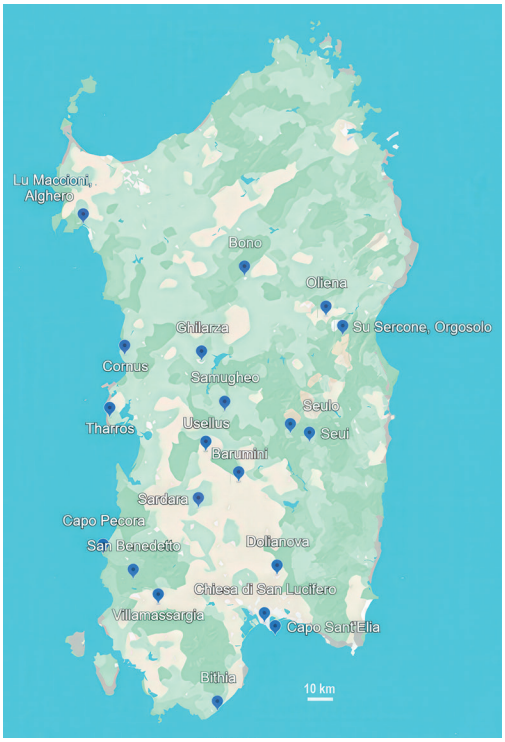

***Fig. 1** – Map of Sardinia showing the locations of the sites from which the crania were digitalized. Created with Google Earth.*

Supplementary Information attached to this letter.

The digitalization and sharing of the 3D models have been authorized and endorsed by the SABAP (Soprintendenza Archeologia, Belle Arti e Paesaggio) of the city of Cagliari and the provinces of Oristano and Sud Sardegna (http://www.sabapca.beniculturali.it/), and of the same office of the provinces of Sassari and Nuoro (http://sabap_ssnu.beniculturali.it/). According to the Italian law (*Codice dei beni culturali e del paesaggio*, D.Lgs. 42/2004), the prehistoric/historic specimens, including both archaeological artifacts and human remains, are held by the state as part of the public cultural heritage. However, access to these cultural heritage objects - as well as the right to handle them to make copies - is strictly regulated due to conservation and protection laws. Human remains in particular cannot be owned by any individual or entity, but their custody, conservation and protection are a duty of the state, exercised through the Superintendency (for a discussion of the concept of "property" and protection, see the guidelines of the Ministry of Culture on the state management of human remains, MiC). According to EU/790 on copyright and related rights in the Digital Single Market, faithful reproductions of public commons, such as those made on archaeological artifacts and human remains, do not create new copyright protection. Therefore, the publication of digital reproductions under a Creative Commons license is not appropriate, as also indicated by the Italian guidelines for the acquisition, dissemination, and reuse of reproductions of cultural property in a digital environment (https://docs.italia.it/italia/icdp/icdp-pnd-circolazione-riuso-docs/it/v1.0-giugno-2022/index.html). Nevertheless, under Italian cultural heritage law (D.Lgs. 42/2004), the state retains exclusive control over the reproduction and distribution of archaeological materials and human remains. Thus, while the original prehistoric specimens are public cultural heritage, the digital scans are subject to the Superintendency's regulation via permitting and licensing conditions. In particular, a recent Italian Ministerial Decree D.M. 108/2024 revised guidelines on the fees for the use and reproduction of cultural assets managed by state institutions. While it simplifies procedures and maintains exemptions for non-commercial uses such as academic publishing and educational materials, it continues to impose fees for commercial re-use of publicly own cultural heritage. We note that the decree risks undermining goals of openness, innovation, and equitable cultural dissemination (Caso 2024). Recent legal disputes, including the Vitruvian Man and Michelangelo's David cases, highlight growing tensions between Italy's restrictive national policies and EU principles of public domain access.

While nothing this conflict, we complied with all applicable regulations in the context of making the 3D model publicly available by releasing it under a Rights Statement NoC-OKLR (No

Copyright – Other Known Legal Restrictions; https://rightsstatements.org/en/) accompanied by metadata detailing the restrictions that limit re-use. This statement permits non-commercial sharing with attribution while prohibiting the distribution of derivative works, thereby preserving the integrity of a faithful representation (within the technical limits of the hardware and software used) of the original specimen. Derivative modifications for internal research purposes, such as format conversion, cropping, or simplification, are permitted but may not be re-uploaded or publicly distributed without explicit permission. On the MorphoSource platform, users must declare the intended use before being authorized to download the model. This approach enables controlled dissemination, safeguards the integrity of these digital assets, and promotes their appropriate application in scientific research.

The 3D models were produced using cloud-based ultra close-range digital photogrammetry (UCR-DP) (Lussu 2020; Lussu and Marini 2020; Lai et al. 2023). Photographs were taken with a Canon EOS 1200D and an EF 50 mm f/1.8 STM lens, and processed through the Autodesk ReCap Photo cloud platform (https://www.autodesk.com/products/recap/overview). For scaling, a 10 cm distance - approximately parallel to the sagittal plane - was defined between two arbitrary landmarks per specimen, measured three times, and averaged. The mean value was applied using ReCap Photo's "Scale by Value" tool. Full methodological details are available in Lussu (2020) and Lai et al. (2023).

The acquisition of the 3D models was conducted primarily by a diverse group of students, including undergraduate and doctoral candidates, as part of their traineeships and thesis research activities. This hands-on experience not only provided valuable methodological training but also contributed to the advancement of the field, as evidenced by methodological publications (Lussu 2020; Lussu and Marini 2020; Lai et al. 2023). A subsample of 10 crania was previously published in Morphomuseum (https://doi.org/10.18563/journal.m3.112) and made available for educational purposes through the MuSAE website (https://web.unica.it/unica/it/musae_didattica.page). The extensive process of uploading the datasets and completing the associated metadata forms on Morphosource was undertaken by one of our team members (MC) during his traineeship. The dataset has already supported scholarly research, with the first publication utilizing the collection as a comparative sample appearing recently (Oxilia et al. 2025). We anticipate that this resource - which adds to similar collections developed in Morphosource by one of us (VSS; eg. "The Arene Candide 3D Database" https://www.morphosource.org/projects/00000C206) - will foster a rich series of future studies by the international scientific community, further underscoring the training and scientific value of this project. Future work will include the expansion of the collection via the digitalization of further crania, and the implementation of new technologies to improve the model accuracy and texture fidelity.

References

Boyer DM, Gunnell GF, Kaufman S, *et al* (2016) Morphosource: Archiving and sharing 3-d digital specimen data. Paleobiology 22:157-181.

Caso R (2024) Patrimonio culturale di pubblico dominio (riproduzione del). AISA, Dizionario della scienza aperta, Zenodo. https://doi.org/10.5281/zenodo.10643938

Daneshvari Berry S, Edgar HJH (2021) Announcement: The New Mexico decedent image database. Forensic Imaging 2021: 24. https://doi.org/10.1016/j.fri.2021.200436

European Parliament & Council (2019) Directive (EU) 2019/790 of the European Parliament and of the Council of 17on copyright and related rights in the Digital Single Market and amending Directives 96/9/EC and/29/EC. Official Journal of the European Union, L130, 92–124. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019L0790

Lai G, Casula M, Sparacello V, et al (2023) Antropologia scheletrica virtuale. Guida multimediale sulle tecniche fotogrammetriche

per la realizzazione di modelli 3D, Cagliari, UNICA press. https://doi.org/10.13125/unicapress.978-88-3312-097-3

Lebrun R, Orliac M J (2016) MorphoMuseuM: an online platform for publication and storage of virtual specimens. The Paleontological Society Papers 22:183-195. https://doi.org/10.1017/scs.2017.14

Lussu P (2020) Ultra close-range digital photogrammetry as a tool to preserve, study, and share skeletal remains, PhD Thesis, Università degli Studi di Cagliari. https://hdl.handle.net/11584/294813

Lussu P, Marini E (2020) Ultra closerange digital photogrammetry in skeletal anthropology: A systematic review. PLoS One 15:e0230948. https://doi.org/10.1371/journal.pone.0230948

Ministero della Cultura (2022) I resti scheletrici umani: dallo scavo, al laboratorio, al museo. Ministero della Cultura. https://ica.cultura.gov.it/wp-content/uploads/2022/06/d97b61bd3d687c20b29e8836bb5fdfbf_I-resti-scheletrici-umani_28giugno.pdf

Ministero della Cultura (2024) Decreto Ministeriale n. 108 del 21 marzo. https://cultura.gov.it/comunicato/26075

Oxilia G, Mussi M, Chiriu D, et al (2025) virtual analysis of a concretioned skullcap from S'Omu e S'Orku, an Early Holocene Mesolithic site of Sardinia. Am J Biol Anthropol 187:e70065. https://doi.org/10.1002/ajpa.70065

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