Dataset

3D models related to the publication:Skull and Inner Ear Morphometrics in Sheep and Goats: Species and Breed Differentiation with Bioarchaeological Applications

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Abstract
This contribution contains the 3D models described and figured in the following publication: *Skull and Inner Ear Morphometrics in Sheep and Goats: Species and Breed Differentiation with Bioarchaeological Applications (Hemelsdael et al. in press)*. The models include the external surface of a complete skull and inner ear of both a sheep (*Ovis aries*) and a goat (*Capra hircus*), generated from micro-CT scans. In the associated paper, we used 3D geometric morphometric data to assess inter and intra (*i.e.* between breeds) discrimination based on complete skulls, skull fragments and the semi-circular canals of the inner ear.

Keywords: Capra hircus, CT-Scan, geometric morphometrics, micro-tomography, *Ovis aries*

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INTRODUCTION

Despite their distinct domestication histories, sheep and goats show marked morphological similarities in the skeleton, which complicates taxonomic identification in archaeological contexts and limits the resolution of within-species analyses. In the associated study, 3D geometric morphometrics was applied to whole skulls, skull bones (frontal, maxilla, occipital), and inner ears of 26 sheep and 15 goats, revealing inter- and intra- species-level size and shape differences. This study combining micro-CT scanning and geometric morphometrics offer a non-destructive tool for both species identification and exploration between populations differences, complementing molecular approaches in bioarchaeological research. The complete collection of 3D geometric morphometric data, along with the 3D models and CT scans of the skull and inner ear of two representative specimens, one sheep (N°UM_RR_2331, University of Montpellier) and one goat (N°Amp_1, ASM UMR 5140) (Fig. **??**, Fig. **??** and Table **??**) are provided here.

The selected sheep specimen belongs to the breed Rouge du Roussillon. **Rouge du Roussillon** is a traditional sheep breed originating from the Roussillon region in southern France, where the specimen has been collected. It is well adapted to the Mediterranean climate (Babo, 2000; Raveneau, 2004). The breed is medium-sized and primarily valued for meat and milk production. The most distinctive feature of the Rouge du Roussillon is its reddish-pink face and limbs, which are free of wool and contrast with its creamy white fleece. Both sexes are polled (hornless).

The selected goat specimen belongs to the breed Blanca de Rasquera and has been collected in 2021 from Amposta (Spain).

M3 nr.	Description
M3#1806	Skull of the goat Amp_1
M3#1807	Inner ear of the goat Amp_1
M3#1808	Skull of the sheep UM_RR_2331
M3#1809	Inner ear of the sheep UM_RR_2331

Table 1. List of models

Blanca de Rasquera is a traditional goat breed native to the mountainous areas of southern Catalonia, particularly around the village of Rasquera in the province of Tarragona, Spain. It belongs to the Iberian group of goat breeds and is well adapted to Mediterranean environments, including steep, rocky terrain and variable forage availability (Fernández Rodríguez et al., 2009). This medium-sized breed is characterized by its white coat, which is typically short and uniform, and by its hardiness and adaptability to extensive and semi-extensive grazing systems. Both males and females often have well-developed, lyre-shaped horns, although some individuals may be polled. The breed is primarily raised for meat, though it can also produce milk for local artisanal cheese production (Babo, 2000; Raveneau, 2004).

METHODS

We acquired high-resolution 3D images of the skulls using a Micro CT EasyTom 150 kV scanner housed at the Institut des Sciences de l'Évolution de Montpellier (ISEM), University of Montpellier (France). Each specimen was placed within a 17 cm diameter scanning tube and imaged using an aluminum filter, yielding voxel sizes between 83 and 102 µm. Volume reconstruction was conducted with Xact-64 software (RX Solutions). Segmentation of the bony labyrinth (inner ear) was carried out using Avizo version 9.7 and Amira version 6.7 (Thermo Fisher

Scientific), and further refined with the Biomedisa online tool (Lösel et al., 2020). Final 3D surface models of the skulls and inner ears were exported in PLY format. Geometric morphometrics data were acquired on both skulls and the semi-circular canals of the inner ear. Skull morphology was captured using 41 anatomically homologous 3D landmarks. Missing landmarks were reconstructed using mirroring techniques (Claude, 2008) and regression-based estimation (Baken et al., 2021; Adams et al., 2024). The morphometrics of the bony labyrinth of the inner ear was captured by 6 3D landmarks and 60 sliding semi-landmarks on the three semicircular canals (anterior, posterior, lateral) and the common crus. All landmarking was performed by a single operator (AH) using MorphoDig software (Lebrun, 2018). The list of the sheep and goats for which both skull and inner ear were scanned/segmented and measured, as well as landmark and semi-landmark coordinates are available in Supplementary data.

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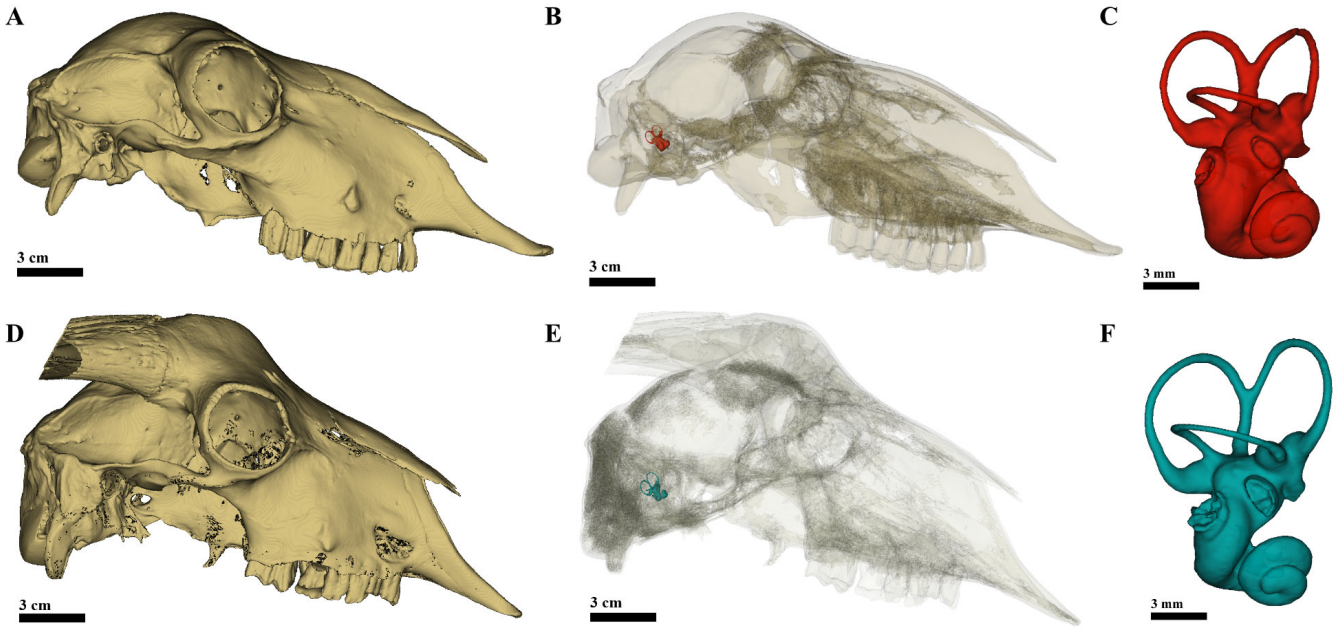

Figure 1. Visualisations of the skull (A, D) with the right inner ear *in situ* (B, E) of a sheep (top row, specimen UM_RR_2331) and a goat (bottom row, specimen Amp_1). Panels C and F display the right inner ear.

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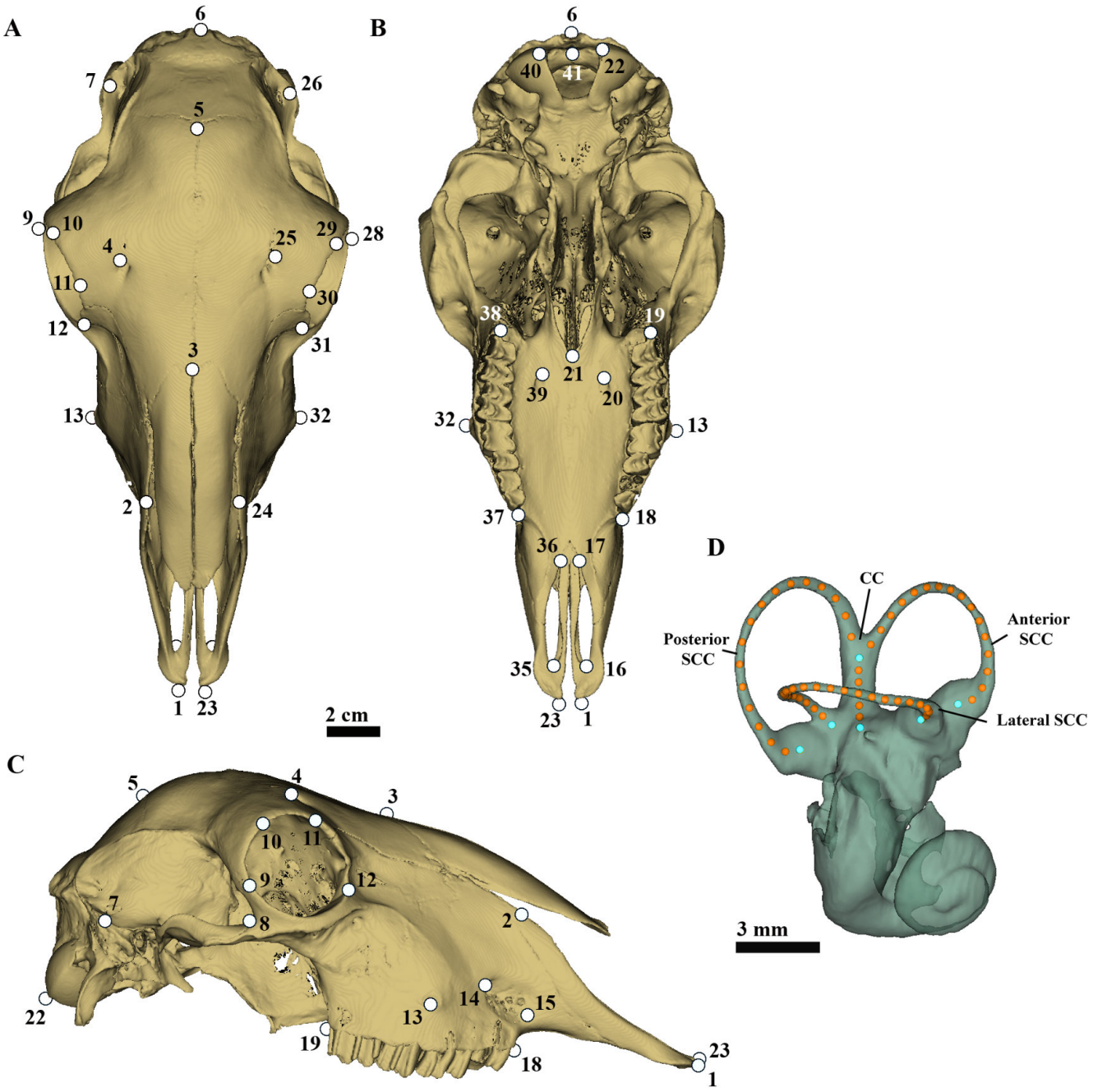

Figure 2. Geometric morphometrics protocol applied to the skull and inner ear. (A) dorsal, (B) ventral and (C) lateral views of the skull (sheep id: UM_BMC_2278), and (D) right inner ear (sheep id: Vendeenne_3070). In skull view, all dots represent homologous landmarks. In the lateral view (C), each landmark is labeled with two numbers: the first refers to the landmark in the visible side, and the second to its symmetric counterpart on the opposite side of the skull. In the inner ear view (D), cyan dots represent the homologous landmarks while orange dots represent sliding semilandmarks. SCC=semicircular canals; CC=common crus.

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