

THE SHAPE OF THE INTERNAL ACOUSTIC PORUS OF SIMA DE LOS HUESOS: A COMPARATIVE STUDY

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Extended data

1. Landmark and semilandmark definitions

The four walls of the internal auditory canal and their maximum measurement points follow Sakashita and Sando (1995). The outline of the *porus acusticus internus* is delimited by five reference landmarks, defined geometrically on the perimeter itself.

Nº	Definition
LM1	Border of the posterior wall; starting point of the outline. Anatomically, the maximum measurement point of the posterior wall.
LM2	Midpoint of the border of the superior wall. Maximum measurement point of the superior wall.
LM3	Junction of the superior and anterior borders, at the lip separating the two walls.
LM4	Anterior wall, diametrically opposite LM1. Maximum measurement point of the anterior wall.
LM5	Inferior wall, equidistant from LM4 and LM1. Maximum measurement point of the inferior wall.
SemiLM	Five curves of fifteen points spanning the perimeter between consecutive landmarks. Since each landmark is registered as the endpoint of two consecutive curves, one of each coincident pair was discarded, giving a configuration of 70 points: five reference landmarks and 65 sliding semilandmarks.

Depth is controlled by orienting the model with the line of sight perpendicular to the aperture of the porus, so that the outline is seen edge-on and any point displaced into or out of the canal can be detected and corrected. In the generalised Procrustes superimposition the five landmarks were fixed and the 65 semilandmarks were slid by minimum bending energy.

2. Composition of the sample

Sample	n	Chronology	Provenance	Specimens
Sima de los Huesos	14	ca. 430 ka	Sierra de Atapuerca, Spain	AT-421, AT-643, Cr.3, Cr.4, Cr.5, Cr.7, Cr.8, Cr.9, Cr.12, Cr.13, Cr.14, Cr.15, Cr.16, Cr.17
Neandertals	10	ca. 130–40 ka	Europe and the Levant	La Chapelle-aux-Saints, La Ferrassie 1, La Quina H5 (France); Krapina 3812, 3821, 3918, 3920 (Croatia); Gibraltar 1 (Gibraltar); CN-46700 (Spain); Tabun C1 (Mount Carmel)
Homo sapiens	20	Holocene	Saint Gregory Priory, Canterbury, UK	SK48, SK72, SK170, SK227, SK287, SK341, SK444, SK563, SK660, SK742, SK749, SK766, SK798, SK830, SK932, SK1053, SK1067, SK1130, SK1212, SK1218

Sample	n	Chronology	Provenance	Specimens
Homo sapiens	10	Holocene	Burgos, Spain	CSJ02, CSJ11, CSJ20, CSJ25, CSJ26, CSJ37, CSJ50, CSJ59, CSP7603, Sep - 622
Total	54			

3. Distances between group mean shapes

Procrustes distances are measured directly in shape space; Mahalanobis distances are measured between group centroids in the canonical space of the discriminant analysis and take the within-group dispersion into account. Both rank the three pairs in the same order. F and p values come from the Procrustes ANOVA with 9999 permutations and Holm correction.

Comparison	Procrustes d	F	p (Holm)	Mahalanobis d
Hs – SH	0.200	16.71	0.0003	3.65
Hs – ND	0.179	11.43	0.0008	3.59
SH – ND	0.135	3.32	0.0242	3.24

4. Software

Segmentation and surface model export were performed in Mimics v.18 (Materialise, Leuven) and semilandmarks were digitised in Avizo 7.1. All statistical analyses were carried out in R 4.5.1 (R Core Team, 2025) with the geomorph package (v. 4.0.10; Baken et al., 2021; Adams et al., 2025). Procrustes ANOVA and pairwise comparisons were tested by residual randomisation (RRPP) with 9999 permutations, and p values were corrected by the Holm method.

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