

### Rib histomorphometry: Testing sampling and population errors on existing formulae

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Bone histomorphometry is often the only available ageing method for highly fragmented human remains, thus it is vital to test and revise existing techniques particularly for use in legal cases. This study tested Stout & Paine (1992) and Stout et al.'s (1994) histological methods on a Greek population using 3 sampling sites (vertebral, middle and sternal part).

The sample consists of 6 left 4th ribs of known age from a modern Greek collection. The ribs were cut into three equal segments. A thin section was acquired from each segment. Four variables were calculated (cortical area, intact and fragmented osteon density and osteon population density) and age was estimated for each section according to Stout & Paine (1992) and Stout et al. (1994).

Stout & Paine (1992) underestimated age in all samples (-1.14 years to -33.78 years) while Stout et al. (1994) produced average ages within the reported error for all individuals with the exception of the two oldest individuals (46 and 58 years old). Comparison of the different sampling sites showed no specific pattern, suggesting that a larger sample should be used to further test sampling error.

The Stout et al. (1994) formula performed better for the Greek sample; this can be attributed to the fact that the Stout & Paine (1992) formula was developed for the 6<sup>th</sup> rib. These results contradict previous research reporting no significant differences between 3<sup>rd</sup>-8<sup>th</sup> ribs. There is a scope for expanding the number of individuals sampled to verify findings and further explore sampling error.

### Landmark-free 3D method for comparison of fossil hominins and hominids based on endocranium and EDJ shapes

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This research focuses on an *Australopithecus* versus *Paranthropus* comparison using a promising landmark-free morphometric method,

which analyzes the shape of two anatomical structures: the endocranium and the enamel-dentine junction (EDJ) on complete dental arcades.

Landmark-based approach is often used in morphometry to statistically study shape differences but it involves pointing manually some specific points, which could implicate arbitrary assumptions. We present a method for the generation of 3D anatomical atlases based on landmark-free deformation maps. These statistical atlases are composed not only of an average template but also quantify local morphological variation. They are then used to classify anatomical 3D data. More precisely, an average shape and deformation maps describing how each individual surface differs from the average shape are estimated using "currents", a mathematical model for surfaces, curves, point sets and volume. New specimen can then be classified with deformation comparisons, and the approach permits also to highlight the local variability for each species.

Atlases were built with EDJs as well as endocrania from extant human, bonobo and chimpanzee. A linear discriminant analysis using the deformations was significant for identification of extant species both based on endocranium or EDJ. We also determined the taxonomic usefulness of endocrania versus EDJs, and we used the variability of these samples to compare *Australopithecus africanus* (Sts 5, Sts 52) with *Paranthropus robustus* (Sk 48, Skw 5). This study gives visual and quantitative tools to study inter and intra-species variability, providing a better model for the comparison and the classification of new fossils.

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### Taphonomic study of the fossil fauna from the Mursi Formation and Member A of the Shungura Formation, Ethiopia

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The Mursi Formation has an age estimated at more than 4 million years, which corresponds to the time of emergence of the australopithecines, the first indisputably bipedal hominins. In this study, the Mursi faunal collection (N=201 fossil vertebrates) is compared taphonomically to that of another Pliocene locality of the Omo Valley, Member A of the Shungura Formation (N=300 fossil vertebrates). This research describes the main taphonomic differences and similarities between these two collections and makes paleoenvironmental inferences based on the fossil evidence. For each taphonomical agent (weathering, trampling, etc.), fossils are graded using previously established stages. It was found that in spite of a few significant differences (carnivore action, weathering), the two collections are taphonomically similar and their link with water, as predicted by paleoenvironmental reconstructions, is supported (Voorhies groups, abrasion). This new evidence provides key information for our understanding of the range of East African environments during

the time of emergence of the genus *Australopithecus*.

### Comparative forelimb use during foraging in three cercopithecids from Côte d'Ivoire's Taï Forest

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Interspecific differences in primate limb anatomy are frequently related to variation in locomotion. Much less is known about how limb morphology co-varies with activities that occur when an individual is stationary, such as behaviors employed during manual acquisition of food. Several early studies suggested black and white colobus monkeys (*Colobus* spp.) were distinct from other cercopithecids in the high frequency with which they used forelimb elevation and abduction to gather food. We test this hypothesis by comparing data on forelimb activities during feeding in two colobines (*Colobus polykomos* and *Procolobus badius*) and one guenon (*Cercopithecus diana*) collected over three months in the Taï Forest, Côte d'Ivoire. Focal animal sampling was used to quantify rates of four forelimb activities: retrieval of foods (1) inferior, (2) parallel, or (3) superior to the trunk of the body and (4) transmission of food items from hand to mouth. We used Mann-Whitney *U*-tests to compare average frequencies of activities per five minute focal.

The three taxa differ markedly in their forelimb use: *C. polykomos* foraging involves significantly more parallel retrieval ( $p < 0.001$ ), *P. badius* uses more superior retrieval ( $p = 0.005$ ), and *C. diana* uses more inferior retrieval ( $p < 0.001$ ). Based on these results, we conclude that the *P. badius* glenohumeral joint is capable of greater abduction, lateral rotation, and forelimb elevation relative to *C. polykomos* and that these kinematic differences are reflected in the extent of humeral head expansion, height of the greater tuberosity, and geometry of the scapular glenoid.

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### Primate postcrania from the early Eocene of India, and implications for the initial diversification of strepsirhines and haplorhines

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The oldest fossil primates from India come from the Cambay Formation at Vastan Mine in Gujarat and date from approximately 54.5 Ma. The Vastan primate fauna comprises both adapoids and omomyids, with the asiadapine