Title: Calcaneal external shape of *Australopithecus sediba*

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Abstract Text:

Due to its role in weight-bearing, the calcaneus has the potential to reveal important form-function locomotor signals. The *Australopithecus sediba* calcaneus has been particularly scrutinized because of its unique morphology; however, the entire shape of U.W. 88-99 has not yet been analyzed. Here we analyzed the entire calcaneal shape of gorillas (n=86), chimpanzees (n=112), orangutans (n=31), baboons (n=29), hylobatids (n=32) and modern humans (n=130) to put U.W. 88-99 into a phylogenetic/locomotor context.

Calcanei were either surface or micro-CT scanned and external shape analyzed using a three-dimensional geometric morphometric sliding semilandmark analysis. Semilandmarks were slid relative to an updated Procrustes average to minimize the bending energy of the thin plate spline interpolation function. Landmark configurations were aligned using a Generalized Procrustes Analysis and shape variation summarized using principal components (PC) analysis. Procrustes distances between U.W. 88-99 and all (sub)species/populations were calculated.

Humans and non-human primates separate across PC1. U.W. 88-99 demonstrates an intermediate morphology, falling between humans and gorillas, but closer to humans. This separation is driven by a great ape-like posterior talar facet and a human-like anterior/middle talar facet, suggesting unique load transfer through the subtalar joint, but maintenance of the ability to invert/evert the foot for arboreality. Additionally, the calcaneal tuberosity is more supero-inferiorly oriented than in gorillas. Of the gorilla populations, U.W. 88-99 is closest to mountain gorillas, demonstrating an adaptation for terrestriality. The U.W. 88-99 cuboid facet, despite its damage, is unique relative to other groups, likely adapted for both arboreal and terrestrial behaviors.

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