

# Mathematically Cutting to the Bone: Solving Analytical Problems in ESR Dating the Paleolithic Site at Isimila, Tanzania

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When excavated 1957-1962, the archaeological site at Isimila, Tanzania, was estimated at 60 ka, from its artefacts' similarity to other sites, such as Magubike and Kalambo Falls, none of which were well dated. Since Isimila's age has not been determined absolutely, ESR independently dated seven bovid, suid, and feline tooth subsamples, because ESR can date enamel aged > 2 Ma with 2-10% precision. On the Sands 4/5 boundary at Isimila, Acheulean butchering flake tools surrounded a Hippopotamus skeleton. Due to the teeth's very high U concentrations, some of which exceeded the dating calculation programs' limits, a new iterative protocol was developed to calculate the internal enamel, dentine dose rates, and ages. Most subsamples need more irradiation dose ramping to improve their ages' reliability, before isochron analysis or coupled ESR- $^{238}\text{U}/^{208}\text{Pb}$  dates to measure the U uptake rates. All the teeth's high U concentrations and preliminary age variations necessitated analyses to test the effects from the assumptions for enamel U concentrations, Rn loss, sedimentary water concentrations, and the external dose rates on the calculated ages. The ages depend significantly on the assumed enamel U concentration, and high Rn loss may add age inaccuracy. The sedimentary water concentration and external dose rates do not add inaccuracy to the calculated ages. Nonetheless, provided more sedimentary and teeth samples can be collected during new excavations, this study demonstrates that mammalian teeth from Isimila can be successfully ESR dated, in order to place Isimila's important Acheulean tools in the sequence of human evolutionary and archaeological developments.

## Awards Won:

Second Award of \$2,000

Geological Society of America &

American Geosciences Institute: Second Award of \$1000