



Pleistocene soil development and paleoenvironmental dynamics in East Africa: a multidisciplinary study of the Homo-bearing Aalat succession, Dandiero Basin

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Pleistocene environmental changes in East Africa, largely documented by deep marine or lacustrine records correlated with inland high-resolution, Homo-bearing stratigraphic successions, have been so far interpreted as a major cause of faunal dispersal and human evolution. However, only few studies focused on reconstruction of paleoenvironmental dynamics from continental successions, given the usually poor continuity and extension of stratigraphic records. In this work we report on a multidisciplinary study of the Early to Middle Pleistocene sedimentary fill of the Dandiero Basin (Eritrean Danakil), a morpho-tectonic depression in the East African Rift System, which represents the only continental stratigraphy including human remains of *Homo erectus/ergaster* and abundant fossil vertebrates in the northernmost sector of this region. Sedimentological, pedological, volcanological and paleontological investigations were performed on the Aalat section, located in the northern part of the Dandiero Basin, as tools for an integrated reconstruction of the Early-Middle Pleistocene transition in East Africa. This section is almost 300 m thick and records repeated shifts from fluvial to deltaic and lacustrine depositional environments, as a response to local tectonic activity and climate changes. Sedimentary facies distribution and paleocurrent data show that sedimentation was controlled by a NS-trending axial drainage. Some tephra layers were identified both at the bottom and the top of the section, whereas two main fossiliferous layers were detected in its lower part. Terrestrial vertebrate faunas include a typical Early to Middle Pleistocene East African mammalian assemblage, where taxa characterized by strong water dependence prevail. Also the ichthyofauna is consistent with the shallow water fluvio-lacustrine paleobiotopes. High-quality paleomagnetic analyses, integrated with radiometric dating and vertebrate paleontology, allowed to substantiate the chronological constraints of the Aalat section to a time span approximately bracketed between the Jaramillo event (ca. 1.07-0.99 Ma) and the Matuyama–Brunhes magnetic field reversal (ca. 0.78 Ma). High rates of sedimentary aggradation can be estimated around 1 mm/a, coherently with a poor to moderate degree of soil development and evidence of soil truncation by erosion. Physico-chemical, mineralogical, geochemical and micromorphological analyses were carried out on selected soil samples. Weathering and pedogenetic features mainly consist of pedogenic structure, secondary carbonate accumulations (following carbonate leaching) and iron-oxide/hydroxide segregations, promoted by water infiltration under varying drainage conditions and/or seasonal contrast. The complex patterns of some petrocalcic horizons and rare rubified soils testify for occasionally longer geomorphic stability and non-deposition, which were more prone to pedogenesis. Our multidisciplinary study revealed that the Aalat section in the Dandiero Basin represents a promising continental archive of the main paleoenvironmental changes occurred during the Early-Middle Pleistocene transition in East Africa.