

New geological and paleontological data from the Dikika hominin site, Ethiopia

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Our understanding of the causes for pivotal events in human evolution is intricately linked to our knowledge about key events in paleoclimatic changes. In order to appreciate how our long past has been shaped by external factors such as climate, it is crucial to investigate how those changes affected environmental contexts in which our ancestors lived first. In this regard, documenting local and regional paleoenvironments, and faunal content of specific hominin sites are prerequisites for exploring the effect of climatic factors on speciation, extinction and other evolutionary events. However the effects of climate on paleoenvironments and their change through time need to be understood in a dynamic fashion in order to account for the complex nature of environmental evolution both in time and space beyond just static reconstruction of habitats, and this requires well documented fossil data. Field activities in the Afar of Ethiopia have contributed, among many sites in Africa, considerably to the improvement of the fossil database in the African Mio-Plio-Pleistocene that are pertinent to these issues in addition to the recovery of several hominin species from the sites of Middle Awash, Hadar, Gona, Middle Ledi and Dikika.

In this short presentation we will present the geological and paleontological context of the Dikika Research Project (DRP) area, and discuss its potential for contributing to paleoenvironmental records of the Afar. The composite stratigraphy of the DRP area encompasses what has classically been attributed to the Hadar Formation (Basal, Sidi Hakoma, Denen Dora and Kada Hadar Members), as well as disconformably overlying sediments of the Busidima Formation, which extends to at least 0.6 Ma. New sections of the Basal Member in the eastern DRP area extend the range of the Hadar Formation to the age of the Ikini Tuff, a correlate of the Wargolo Tuff from the Turkana Basin (3.8 Ma), and provide a definitive lower boundary on deeply weathered paleosols developed on basalts of the lower Afar Stratoid Series (4 Ma). Structural and stratigraphic relationships show that this area provides an opportunity to examine basin-scale depositional patterns during two distinct tectonic episodes during the past 4 Ma: deposition in the Hadar Basin and the Busidima Half-graben.

A high resolution record of stable isotopic composition of pedogenic carbonate is developing from several projects in lower Awash Valley, demonstrating changing lateral variability of habitats. A general trend towards more C₄-dominated habitats is observed over the entire sequence. A significant shift in the mean between 3 and 2 Ma occurs when deposition shifted from a NE-extending Hadar Basin consistent with tectonics of the Red Sea Rift, and where Dikika occupied the southern delta of a lake, to the NW extending Ethiopian Rift System, where Dikika occupied a marginal basin (the Busidima Half-graben), in which lateral migration of the Awash River was the dominant depositional process. In many sites freshwater gastropods, fishes, hippopotamids, crocodiles and giant tortoises are abundant pointing to a mesic deltaic environment, with nearby permanent

water. The terrestrial fauna includes many species from mesic bush and tree loving genera. Impalas are the most common antelopes showing the prevalence of C3 vegetation. However, the commonness of Alcelaphini and *Ceratotherium*, elephants, suggests the presence of open grasslands were an important part of the paleolandscape. Future work will analyze spatial and temporal patterns of fauna, stable isotope records of mammalian tooth enamel, fossil molluscs and diatoms, as well as continuing records of paleosol carbonate through the Busidima Formation, where the strata are much more laterally variable, and where age constraints are being worked out by tephrostratigraphy and tephrochronology.