



The 17 Ma old Turkana beaked whale fossil: new paleoaltimetry constraints for uplift and environmental change in East Africa

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Timing and magnitude of vertical motions of the Earth's crust is key to evaluate the impact of tectonic processes on changes in atmospheric circulation patterns, rainfall, and environmental conditions. The East African Plateau (EAP) is a major topographic feature that fundamentally impacts the patterns of the Indian-African Monsoon and the eastward transport of air masses from the Congo Basin. Uplift of the EAP in Kenya has been linked to mantle processes, but due to the lack of reliable palaeoaltimetric data it has been challenging to unambiguously constrain plateau evolution, vertical motions associated with late Cenozoic rifting of the East African Rift System, and ensuing environmental change. We explored the fossil remains of a beaked whale (Ziphiidae) from the Turkana region in the northern Kenya Rift, 700 km inland from the present-day coastline of the Indian Ocean. The whale fossil, preserved near sea level, was discovered at an elevation of 620 m and thus constrains the uplift of the northeastern flanks of the EAP. The Kenyan ziphiid was discovered in fluvio-lacustrine sediments of the extensional Oligo-Miocene Lokichar basin (Mead, 1975) along with terrestrial mammals and freshwater molluscs below a basalt dated at 17.1 ± 1.0 Ma (Boschetto et al., 1992). The unifying characteristics of riverine occurrences of modern marine mammals include sufficient discharge in low-gradient rivers to maintain pathways deep enough to facilitate migration, and the absence of shallow bedrock, rapids, and waterfalls. The most likely route, which may have had these characteristics is a fluvial corridor controlled by protracted thermal subsidence of the Cretaceous Anza Rift, which once linked extensional processes in Central and East Africa with the continental margin of northeastern Africa. The fossil locality and analogies with present-day occurrences of marine mammals in terrestrial realms suggest that the ziphiid stranded slightly above sea level. In combination with Miocene lava flows that utilized eastward-directed drainages away from the EAP the fossil find thus provides the older of only two empirical palaeoelevation points that constrain the onset of uplift of the EAP to the interval between approximately 17 and 13 Ma. Our results show that topographic uplift of the EAP is a viable mechanism that induced palaeoclimatic change from a low-elevation humid environment to highly variable, much drier conditions, which altered biotic communities and drove evolution in East Africa, including that of primates.