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Determining the palaeodrainage of the Nile river from a provenance study of the Nile delta cone sediments

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This study documents the palaeodrainage history of the Nile River, in particular the time of its transition from a small locally sourced drainage network to the initiation of an extensive catchment. Today, the Nile drains as far south as Lake Victoria, with the White Nile draining largely cratonic rocks of Archean to Proterozoic age and the Blue Nile draining Cenozoic Ethiopian Continental Flood Basalts and Neoproterozoic basement. However, the timing of catchment expansion to the river's current extent is highly debated. Two end member models are:
A) The Blue Nile did not connect with the lower Nile until the Late Messinian, and the White Nile not until 0.5 Ma. In this model, the pre-Messinian Nile delta sediments are locally derived from the Red Sea Hills (RSH) (Issawi and McCauley 1992).
B) The Blue Nile has been connected to the lower Nile since the Oligocene (Burke and Wells 1989).

Onshore fieldwork characterised each possible source area (Ethiopian flood basalts, Archean craton, and Neoproterozoic basement and Phanerozoic cover sequences of the RSH) using petrography, geochemistry and isotope studies. Tertiary-aged Nile delta sediments provide a unique archive of the river's palaeodrainage history, which were analysed from conventional core from exploration and appraisal wells in order to identify the occurrence (if any) of these sources in the delta geological record.

Heavy mineral, petrographic, U/Pb rutile and Lu/Hf zircon analyses indicate Blue Nile and/or RSH input to the Nile delta since at least the Oligocene with very little input from the White Nile. Sr and Nd whole-rock analyses of mud samples allow discrimination between the Blue Nile and RSH sources and may, subject to further analyses, confirm Blue Nile input to the delta since the Oligocene. U-Pb zircon analyses reveal the presence of 20-30 Ma zircons in both the modern river sediments from the Ethiopian Highlands and the Nile Delta core from the early Miocene to present day indicating a connection between the lower Nile and the Blue Nile since at least the early Miocene.