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Nd ISOTOPES IN NILE SEDIMENTS (ETHIOPIA, SUDAN)

M. Padoan (1), I.M. Villa (1,2), E. Garzanti (1), M. Galbusera (), S. Quistini (1), L. Peruta (1), and A. El Kammar (3)

(1) Dip. Sci. Geol. Geotec., Università Milano-Bicocca, 20216 Milano, Italy, (2) Institut für Geologie, Universität Bern, 3012 Bern, Switzerland, (3) Geol.Dept., Cairo University, Giza (Egypt)

The Nile is the most important river of the Eastern Mediterranean. Its water and sediment fluxes have greatly influenced marine circulation throughout the Quaternary, and are widely considered as possible causes for stagnation and formation of sapropel (Krom et al., 1999a; 2002; Talbot et al., 2000; Freydier et al., 2001; Weldeab et al., 2002; Scrivner et al., 2004). Variations in annual flooding and baseflow of the river Nile, controlled by climate changes, had major impact on the rise and demise of Egyptian dynasties (Stanley et al., 2003).

In order to better define sedimentary sources of the Nile system and to obtain more robust results, we have analyzed Nd isotopes in sediments of all its major Sudanese and Ethiopian tributaries (Atbara, Gash, Abay, Didesa, Dabus, White Nile, Bahr Ez Zeraf) in several replicate samples. Analyses were carried out on distinct mud and sand fractions (<40 microns and 125-180 microns) of 30 samples, and systematic changes related to grain size and hydraulic-sorting processes could thus be investigated. On the same samples, companion studies are being carried out on Sr isotopes (Padoan et al., 2007) and on Pb isotopes at the Geological Survey of Israel (Harlavan et al., in preparation). Overall, isotopic signals are markedly different between the White Nile system, derived from largely Archean to Paleoproterozoic basement rocks, and Ethiopian tributaries, derived in diverse proportions from largely Neoproterozoic rift-shoulder basements and overlying Oligocene flood basalts. Isotopic signals of Main Nile sediments downstream of the Atbara confluence are close to those of Blue Nile sediments, indicating that detritus is mainly provided by the latter (Garzanti et al., 2006).

In the White Nile branch, the 143Nd/144Nd ratio of the mud fraction is lower in the Bahr Ez Zeraf (0.51167) than in the White Nile downstrean of the Sobat confluence (0.51219), revealing significant sediment influx from the latter. In Blue Nile and Atbara branches, values vary from 0.51240-0.51242 for tributaries draining basement rocks only (e.g., Gash, wadi Guba) to 0.51275-0.51280 for tributaries draining mostly basaltic rocks (Atbara); tributaries draining both record mixed signals (e.g., 0.51259; Beles). Nd ratios for Atbara sediments correspond closely with signatures of volcanic source rocks (0.51271-0.51298; Pik et al., 1999), revealing involvement of various mantle and crustal components in petrogenesis of flood basalts. Corresponding Nd model ages (tDM) cluster around 0.84 Ga for the mostly volcanic-derived Blue Nile, Atbara, and Main Nile muds, range 1.2 – 1.5 Ga for tributaries draining Ethiopian basement rocks, and reach as high as 2.4 Ga for the Bahr Ez Zeraf. The different Nd isotopic signal between mud and sand samples is closely controlled by mineralogical composition, Nd and other REE being chiefly contributed by ultradense minerals (e.g., monazite), and consequently concentrated in the finest size fractions of each sample (Garzanti et al., 2008).

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