

Constructing the provenance of siliciclastic sediments using their clay fraction

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Establishing sedimentary rocks' provenance is imperative for understanding the continental-scale processes from formation to deposition. In contrast with heavy minerals and feldspars, which are primary minerals, clays are weathering products. Hence no straightforward link to rock type at the origin. In the current presentation, three siliciclastics sequences from Israel are analyzed. The first is the Cambro-Ordovician sandstones of Northern Gondwana (Yam-Suf Gr.) exposed at the northern edge of the Arabian Nubian Shield (ANS), Elat. The other two sequences are Miocene sequences, exposed west, and east of the current Dead Sea Transform (DST); the Hazeva and Hordus Fms., deposited some 100 km apart during Miocene time.

The clay fractions separated from the above sequences were analyzed for clay mineralogy, elemental compositions, and isotope compositions of Pb, Sr, and Nd.

The Pb, ⁸⁷Sr/⁸⁶Sr ratios and εNd values of clays separated from the Yam-Suf Gr. indicate a significant contribution of remote ancient terranes outside the Arabian Nubian Shield (ANS) (Ben-Dor et al., 2018). Similarly, the oldest member of the Miocene Hazeva Fm. primarily consists of recycled clays from the Yam-Suf Gr. suggesting a fluvial system traversing the current DST. The younger members of this formation indicate an additional contribution from the ANS erosional products. The other Miocene Fm. (Hordus Fm.) indicate contribution from the ANS weathering products, similarly to the upper sample of the Hazeva Fm.; however, no indications for recycled clays from the Yam-Suf Gr.

During the deposition of Hazeva Fm. in the early Miocene, the Yam-Suf Gr. covers the Arabian Nubian Shield (ANS), was eroded and removed, which exposed parts of the ANS basement rocks to weathering and erosion. The differences between the sources of clays for the two Miocene formations may indicate a different fluvial system for the two sequences. Alternatively, during the Early Miocene, the Hordus Fm. was probably not deposited as the early Hazeva members. Only later, this area rose from the Neo Tethys ocean and accumulated siliciclastic sediments. The use of clays to shed light on provenances is promising.