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Long-distance multistep sediment transfer at convergent plate margins (Barbados, Lesser Antilles)

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We present a regional provenance study of the compositional variability and long distance multicyclic transport of terrigenous sediments along the convergent and transform plate boundaries of Central America, from the northern termination of the Andes to the Lesser Antilles arc-trench system. We focus on high-resolution bulk-petrography and heavy-mineral analyses of modern beach and fluvial sediments and Cenozoic sandstones of Barbados island, one of the places in the world where an active accretionary prism is subaerially exposed (Speed et al., 2012).
The main source of siliciclastic sediment in the Barbados accretionary prism is off-scraped quartzose to feldspatho-litho-quartzose metasedimentaclastic turbidites, ultimately supplied from South America chiefly via the Orinoco fluvio-deltaic system. Modern sand on Barbados island is either quartzose with depleted heavy-mineral suites recycled from Cenozoic turbidites and including epidote, zircon, tourmaline, andalusite, garnet, staurolite and chloritoid, or calcareous and derived from Pleistocene coral reefs. The ubiquitous occurrence of clinopyroxene and hypersthene, associated with green-brown kaersutitic hornblende in the north or olivine in the south, points to reworking of ash-fall tephra erupted from andesitic (St. Lucia) and basaltic (St. Vincent) volcanic centers in the Lesser Antilles arc transported by the prevailing anti-trade winds in the upper troposphere.
Modern sediments on Barbados island and those shed by other accretionary prisms such as the Indo- Burman Ranges and Andaman-Nicobar Ridge (Garzanti et al., 2013) define the distinctive mineralogical signature of Subduction Complex Provenance, which is invariably composite. Detritus recycled dominantly from accreted turbidites and oceanic mudrocks is mixed in various proportions with detritus from the adjacent volcanic arc or carbonate reefs widely developed at tropical latitudes. Ophiolitic detritus may be locally prominent.
Quantitative provenance analysis is a basic tool in paleogeographic reconstructions when multicyclic sediment dispersal along and across convergent plate margins occur. Such analysis provides the link between faraway factories of detritus and depositional sinks, as well as clues on subduction geometry and the nature of associated growing orogenic belts, and even information on climate, atmospheric circulation and weathering intensity in source regions.

REFERENCES

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