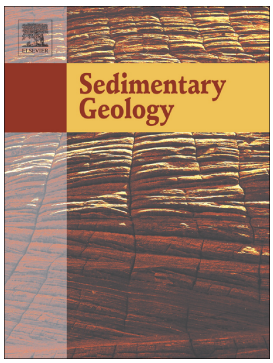

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Long-term controls on continental-scale bedrock river terrace deposition from integrated clast and heavy mineral assemblage analysis: an example from the lower Orange River, Namibia

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Abstract

Establishing relationships between the long-term landscape evolution of drainage basins and the fill of sedimentary basins benefits from analysis of bedrock river terrace deposits. These fragmented detrital archives help to constrain changes in river system character and provenance during sediment transfer from continents (source) to oceans (sink). Thick diamondiferous gravel terrace deposits along the lower Orange River, southern Namibia, provide a rare opportunity to investigate controls on the incision history of a continental-scale bedrock river. Clast assemblage and heavy mineral data from seven localities permit detailed characterisation of the lower Orange River gravel terrace deposits. Two distinct fining-upward gravel terrace deposits are recognised, primarily based on mapped stratigraphic relationships (cross-cutting relationships) and strath and terrace top elevations, and secondarily on the proportion of exotic clasts, referred to as Proto Orange River deposits and Meso Orange River deposits. The older early to middle Miocene Proto Orange River gravels are thick (up to 50 m) and characterised by a dominance of Karoo Supergroup shale and sandstone clasts, whereas the younger Plio-Pleistocene Meso Orange River gravels (6-23 m thick) are characterised by more banded iron formation clasts. Mapping of the downstepping terraces indicates that the Proto gravels were deposited by a higher sinuosity river, and are strongly discordant to the modern Orange River course, whereas the Meso deposits were deposited by a lower sinuosity river. The heavy minerals present in both units comprise magnetite, garnet, amphibole, epidote and ilmenite, with rare titanite and zircon grains. The concentration of amphibole-epidote in the heavy minerals fraction