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Isolated Platforms of the Iles Eparses: A Complete Source-to-Sink Carbonate System

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Core, bathymetric, and seismic data from the southwestern Indian Ocean reveal a comprehensive picture of the source-to-sink deposition of carbonate sediments originating from the Iles Eparses, a series of isolated, volcano-cored, atoll-like carbonate platforms near Madagascar. Carbonate sediments are produced on shallow platform tops and redeposited onto the platform slopes through various processes, leading to MTDs, turbiditic channel-levee complexes with terminal lobes, and thick (up to 250 m) sedimentary bodies composed of bundled sandy calciturbidites and neritic material. This study focuses on these slope and basin-floor deposits, and describes their internal character, geometry, and distribution, providing new insights into the depositional systems surrounding atoll-like carbonate platforms and a new analogue for similar deposits in the geologic record. In addition, comparison of the seafloor sedimentary record with past sea level (as determined through the δ18O isotope record) has enabled the reconstruction of the sedimentary response to past climate change over the past 1 million years, in a region where very little data exists. Results show that aragonite export from the platform top increases significantly during sea-level highs (interglacial intervals) and decreases during sea level lows (glacial intervals), a phenomenon known as highstand shedding. This process has not previously been documented in the area, and has implications for both the global ocean chemistry budget and the prediction of hydrocarbon reservoir properties. Sea level-induced variations in the thickness and frequency of calciturbidites can also be observed; these occur during both highstand and lowstand intervals, but are more common during highstands. Calciturbidites are composed primarily of planktonic foraminifera and the skeletal fragments of shallow-water organisms. Turbidite composition can be seen to vary both downdip and stratigraphically as beds fine-upward. The well-developed calciturbidite systems seen here have not often been described from modern deepwater environments; they therefore provide an important point of comparison with their more common ancient counterparts.

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