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The Tsitsikamma coastal shelf, Agulhas Bank, South Africa: example of an isolated Holocene sediment trap

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The Tsitsikamma coastal shelf, which is located on the north-central margin of the Agulhas Bank, South Africa, is a prime example of an isolated sediment compartment that has effectively trapped the bulk of Holocene sediments supplied by local rivers. A rocky headland in the west prevents swell-driven sediment import from the west, while sediment export is prevented by the steep, southeast-oriented rocky coast in the east [1]. The nearshore sediment wedge in this compartment should thus closely correspond to the total terrigenous input supplied by the local rivers in the course of the postglacial transgression, i.e. since the sea recovered to a level of about -70 m some 12 ka BP.

To quantify the sediment input, a comprehensive geophysical survey of the Tsitsikamma coastal shelf was conducted, incorporating precision echo-sounding, side-scan sonography and high-resolution sub-bottom profiling. From this data, the bathymetry, physiography, bedrock structure and sediment thickness (Figure 1) were reconstructed. The seabed slopes seawards with an average gradient of 1:40 until it merges with the Agulhas Bank terrace at a water depth of about 90 m some 5–6 km offshore. The physiography is dominated by a smooth sediment surface which, on the inner shelf, is increasingly replaced by low-relief rock outcrops in the western and central sectors. The seismic data reveal these outcrops to represent the exposed parts of a continuous bedrock terrace that is partially draped by a thin veneer of unconsolidated sediments. The bedrock comprises Ordovician sandstones (Table Mountain Group) in the nearshore and Cretaceous (Coniacian) sandstones and shales in the offshore. The seaward margin of this wave-cut terrace ends in a 10–30 m high cliff or steep scarp, shoaling from a depth of 70 m in the west to 50 m in the east, being completely concealed by the modern sediment wedge along the entire coast. The base of the scarp lies at a depth of 80 m in the west, from where it gradually drops eastwards to 90 m.

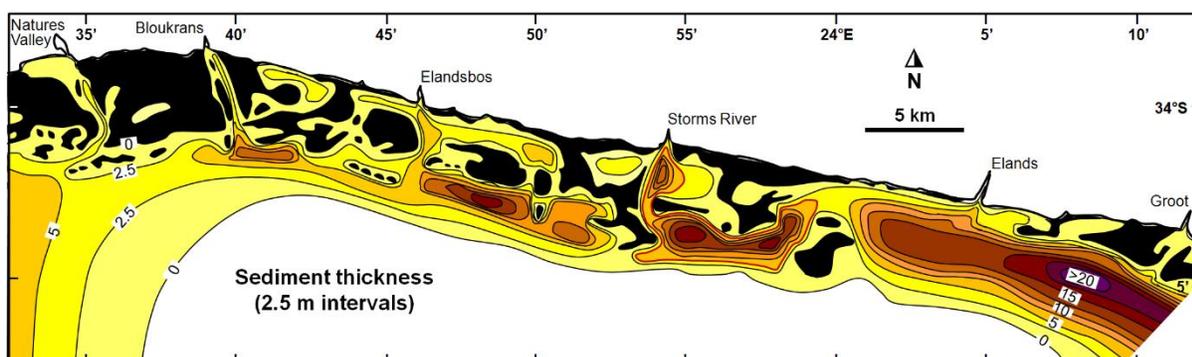


Figure 1: Holocene sediment thickness (2.5 m intervals) on the Tsitsikamma coastal shelf, South Africa

The volume of the sediment wedge has been estimated at $1354 \times 10^6 \text{ m}^3$ of unconsolidated sediment, which includes the sediment filling the river valleys incised into the rock platform. Since most of the sediment supplied over the past 12 ka should have been retained within this isolated sediment

compartment, a mean annual input of $0.1128 \times 10^6 \text{ m}^3$ is calculated. This value is almost identical to the mean annual sediment supply by local rivers estimated on the basis of modern sediment yield data, and which amounts to $0.1 \times 10^6 \text{ m}^3$. Although this close correspondence may be entirely fortuitous, it might, on the other hand, suggest that the average climatic conditions along the Tsitsikamma coast over the last century approximate the Holocene mean climate.

References:

[1] Martin AK and Flemming BW (1986) In: Shelf Sands and Sandstones: Can Soc Petrol Geol Memoir II, 27-44

