

Fluvial-aeolian interactions in modern and ancient systems: examples from the Skeleton Coast, Namibia, and the Triassic Helsby Sandstone Formation, UK

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ABSTRACT

Fluvial-aeolian interactions are common at the margins of desert regions where drainage networks penetrate into the inner parts of aeolian dune fields over distances of 10¹-10² km. Some fluvial systems occupy long-lived fluvial corridors that partition dune fields; others temporarily exploit transient interdune corridors that open and close as aeolian-dunes migrate. This study documents the effects of temporal and spatial variability on the preserved stratigraphic architecture of mixed fluvial-aeolian systems arising from: (i) morphological changes in aeolian dune configuration; (ii) variability in processes of sediment transport across desert basins for both fluvial and aeolian systems; (iii) variability in mechanisms of sediment preservation. Controls on fluvial incursions into dune-fields include temporal and spatial changes in the frequency and magnitude of precipitation events, fluvial runoff distance from catchment to receiving basin, sediment yield, changes to regional water-table level in response to flood events, subtle variations in palaeotopography of the accumulation surface. These factors conspire to determine whether floods are confined within channelized networks or occur as unconfined sheet flows that inundate large areas of dune-field margins. Results from two case studies are presented: the modern Skeleton Coast Erg, Namibia and the Triassic Helsby Sandstone Formation, UK.

Modern active system interactions include: (i) the establishment of long-lived major through-going open interdune corridors along which well-established rivers pass; (ii) the damming of river courses by active aeolian dunes that form barriers to flow, thereby resulting in the ponding of flood waters and the development of large, slowly draining flood basins; (iii) the passage of flood waters as sheet flows into the outer margins of aeolian dune fields.

The preserved stratigraphic expression of ancient fluvial-aeolian interactions include: (i) relationships indicative of systematic temporal change from an aeolian dune field characterized by small, isolated dry interdunes to one in which interdunes were large and interconnected such that they acted as conduits for fluvial flow whereby fluvial channels were able to penetrate into dune-field centre settings; (ii) evidence for fluvial reworking of aeolian dune deposits by erosive flows that resulted in temporary cessation in dune migration in the immediate aftermath of flood events.