Sedimentary and Stratigraphic Expression of Fluvial-Aeolian Interactions: Examples from the Skeleton Coast of Namibia and the Triassic Helsby Sandstone Formation, UK, With Implications for Reservoir Heterogeneity*

Mahmud Alkathery1 and Nigel P. Mountney1

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1School of Earth and Environment, University of Leeds, Leeds, United Kingdom (mahmud.katheri@hotmail.com)

Abstract

Fluvial drainage networks are common at the margins of desert basins. Some penetrate 101–102 km into the inner parts of eolian dune fields; others are dammed and ponded at outer margins. Some systems occupy long-lived fluvial corridors that partition dune fields; others occupy transient interdune corridors that open and close as desert dunes migrate. Thus, a range of styles of fluvial-eolian interaction arise. Results from two case studies are presented here: the presently active Skeleton Coast Erg, Namibia and the Triassic Helsby Sandstone Formation, UK. This study documents the effects of temporal and spatial variability on preserved stratigraphic architecture of mixed fluvial-eolian systems arising from: (i) changes in the dune and interdune morphology; (ii) variability in sediment transport processes across desert basins for both settings; (iii) variability in the preservation mechanism for sediments of mixed systems. Fluvial incursions into desert basins are controlled by precipitation-event frequency and magnitude, fluvial runoff distance from catchment to receiving basin, sediment yield, changes to regional water-table level in response to flood events, paleotopography of the accumulation surface, and long-term climate change. These factors conspire to determine fluvial discharge to the receiving basin in the form of confined floods within channelized networks or as widespread unconfined sheet flows in dune-field margins. Presently 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 eolian 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 eolian dune fields. The preserved stratigraphic expression of ancient fluvial-eolian interactions include: (i) relationships indicative of systematic temporal change from an eolian 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 center settings; (ii) evidence for fluvial reworking of eolian dune deposits by erosive flows that resulted in temporary cessation in dune migration in the immediate aftermath of flood events.
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Types of Present-Day Interaction Between Fluvial & Aeolian Systems: Skeleton Coast Erg, Northern Namib Desert
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Introduction

Data & Methods

Location

Summary Facies Models

Conclusions