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Alluvial fan response times to tectonic and climatic driven processes: examples from the Khrud mountain belt, central Iran

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It is clear from many modelling studies that sediment flux to depositional basins is a first order control on sequence stratigraphic architecture, acting as a boundary condition for the far-field sediment dispersal. The magnitude of the sediment flux, its calibre and its spacing along a mountain front are primary parameters controlling the gross sedimentary geometries and depositional facies of sedimentary bodies, such as alluvial fans, along the proximal edge of a basin (Frostick & Jones, 2002). Consequently, an improved understanding of how catachment-delivery systems operate, preferably over long (geological) time-scales, in active tectonic settings and differing climates is of fundamental importance to the modelling of basin stratigraphy.

The most obvious setting where sediment flux controls the development of sedimentary geometries and sequences is alluvial fans at mountain fronts. Firstly, in many cases the catchment-fan is a closed system, that will have a well defined tectonic and climatic setting. Second, the progradation distance of fans, is a length control readily identifiable in the stratigraphic record which can be directly attributed to fault activity, subsidence rates and climate forcing of sediment supply.

The Plio-Pleistocene to Recent alluvial fans of the Khrud Mountain belt of central Iran are located along a tectonically active mountain front with regular seismic activity focused along major fault systems (e.g. Qom-Zefreh fault, Abbas Abad fault, Deh Shir fault). Associated with the active faults and throughout the proximal alluvial fan stratigraphy intercalated travertine deposits mark episodes of renewed fault movement. Through careful field observations, walking along the fault systems and

age dating of the travertine sediments (e.g. C^{14} and Ur series analysis) an accurate temporal framework of fault activity has been constructed and how the alluvial fans have responded to such tectonism. In comparison, at the distal portion of the fans, intercalated playa lake sediments from the Ghavkhoni lake record the rise and fall of the lake level that has had an important impact on both the erosional modification and progradation of the alluvial fans. The Ghavkhoni lake level has fluctuated considerably over the last 4 Myrs and was at least c. 220 m higher than at the present day. It is well documented for the Dead Sea, Israel that it only requires small increases in annual rainfall to cause the lake level to rise several tens of metres and that this can be accomplished within a short time span as a few hundreds of years. The climatic setting of Central Iran has changed considerably from the Pliocene to Recent and has significantly influenced the flood events on the alluvial fans and corresponding lake levels.

This contribution will therefore present a detailed temporal and spatial framework for alluvial fans along a mountain front and identify the key response times within fan sediments to tectonic and climatic forcing. The analysis sheds further light on the importance of tectonically active faults controlling the gross geometry of alluvial fans and offers new insights into their interpretation along tectonically active mountain fronts in the geological record.

Frostick, L.E. & Jones, S.J. 2002. Impact of periodicity on sediment flux in alluvial systems; grain to basin scale. *In:* Jones, S.J. and Frostick, L.E. (eds) Sediment supply to basins: causes, controls and consequences, Geological Society Special Publication, **191**, 81-95.