

## **Cosmogenic Nuclide Dating of Landscape Evolution in the Ouarzazate Foreland Basin (Morocco)**

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The Atlas Mountains, like other intracontinental orogenic belts, experienced moderate crustal shortening and exhumation. Magnitudes of crustal shortening are defined by cross-section restorations; however, denudation and sediment transfer from the mountains to the forelands have not been previously defined. Such determinations are important to understand the dynamics of earth surface processes and landscape evolution, and for defining and quantifying tectonic and geomorphic models for intracontinental mountain belts.

The Ouarzazate foreland basin lies along the southern margin of the Central High Atlas. Impressive alluvial fans and terraces rising >100 m high present within the basin record a history of sedimentation and denudation that allow rates of denudation and sediment transfer to be determined. Using geomorphic mapping, sedimentology and terrestrial <sup>10</sup>Be cosmogenic nuclide (TCN) dating, the history of sedimentation and erosion within a stretch of the Ouarzazate basin is reconstructed. The alluvial fans and terraces in this region date from the Holocene to >>250 ka. The alluvial fan and terrace incision occurred while thrust loading was still active in the High Atlas margin. In this framework, the incision was induced primarily by a drop in base level as the outlet channel, the Draa River, progressively cut through the Anti-Atlas mountains to the south of the Ouarzazate basin.

The alluvial fan and terrace sediments have abandonment ages that date to at least the past four interglacials (marine isotopes stages 9c, 7e, 5e and 1). The geomorphic analysis and TCN surface exposure ages show that alluvial fan and terrace formation was strongly modulated by climate change on glacial-interglacial timescales as the base level dropped. Incision occurred during interglacial times when the region was wetter and streams more pervasive, albeit still ephemeral, while during the more arid glacial times the sedimentation dominated as sediments were deposited in a flash flood regime and the rivers were less effective transportation agents. The data demonstrate a climatic control on sediment transfer and landscape denudation in this region during the Quaternary. Furthermore, they show that mean rates of fluvial incision range between 0.3 to 1.0 mm/a for the later part of the Quaternary.