

## **Geomorphic evolution of drainage basins in the Marrakech High Atlas: marker of tectonic activity**

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We examine the tectonic geomorphology of the Ouzzelarh massif, located in the inner part of Marrakech High Atlas (MHA). The Ouzzelarh massif is bounded on the north by the Tizi N'Test Fault (TTFZ) and on the south by the Sour Fault Zone (SFZ). These faults bound a positive flower of the pop-up structure. New insights into geomorphological changes in drainage patterns and related landforms are based on geological fieldwork in conjunction with DEM analysis. This implies that fluvial response is mainly controlled by drainage growth, interaction with restraining bends along strike-slip faults and thrusts.

The aim of this work is to evaluate the relationship between the geometry of the drainage network and the main fault systems in this region. The quantitative measurement of landscape is based on geomorphic indices. The E–W and NE–SW trending transfer faults are consistent with an NW–SE compression, which accommodated the strike-slip motion and created tectonically uplifted blocks. The spacing ratio (R) for the range, expressing the drainage organization on a mountain belt scale, is of 1.73 (northern flank) to 2 (southern flank: narrow flank and linear sections of the mountain belt). Calculated curves for the southern part of the TTFZ have a slightly convex shape and a higher hypsometric integral values (HI >0.55). The drainage, topography and fault pattern show a rhomboidal zone of uplift that is bounded on the north by the TTFZ, and on the south by the SFZ. The drainage network that displays contorted and a radial pattern, high stream frequency drainage and show uplift in separate tectonically-uplifted blocks in particular the Jebel Toubkal characterized by asymmetric drainage basins. The highest values of Stream Length-Gradient (SL) are located along the northern side of the MHA. Many of the rivers and streams, which cross faults, show breaks in their longitudinal profiles. Knickpoints along channels that cut mostly the southwest correspond to the TTFZ activity. By using these above geomorphic parameters, the MHA is affected by a high spatial variability of uplift and a sensitivity of the fluvial system.

**Keywords:** Drainage basins; Tectonic geomorphology, geomorphic indices; Tizi N'Test fault Zone; Marrakech High Atlas; Morocco