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Tectono-sedimentary history of the Early Liassic basins of the Central High Atlas (Morocco)

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The timing of the opening of the Central High Atlas basins (Morocco) is still debated. Previous works have proposed that the tectonics which started in the Triassic was polyphased and that the Early Liassic was characterized by thermal subsidence before a new phase of extension at the beginning of the Toarcian. In order to precise the timing during the Early Liassic, we have documented a syn-rift succession, in the hanging wall of normal fault segment along a 75 km-long transect (Tizi n' Firest fault). Deposits are composed of massive limestones alternating with marl and gravity-flow related deposits. Field observations have been performed on six sections, 5 to 40 km apart. They include both the description of large-scale architecture from satellite image analysis, the identification of carbonate facies from thin sections, the measurements of sediment transport direction, and also the determination of nine time-lines dated by biochronological markers, from the Sinemurian to the Domerian. This fine chronostratigraphic framework has permitted to delineate and correlate 9 stratigraphical units in 6 sites from the Sinemurian to the Domerian.

The reconstructions of detailed temporal and spatial sedimentary patterns along the fault have highlighted a high variability of the syn-rift stratigraphy along the normal fault segments. Two main sub-basins have been defined along this transect. The geometry provided by the time-lines showed that the depocenter were located firstly in the west sub-basin, up to the Carixian, and later in the east sub-basin. The central area remained a low preservation domain during the Early Liassic.

Most of the transport directions measured is oriented toward the north, indicating the existence of an active topography on the southern limit of the basin at that time. However, some measurements are oriented toward the east, and this mainly during Domerian, possibly indicating slopes orientated in that direction, suggesting asymmetric fault geometry. The sedimentary data described thus indicates that the tectonic pattern of the Tizi n'Firest fault cannot be considered as cylindrical as had been inferred by previous studies which focused only on the Midelt - Errachidia transect. It also shows that the Central High Atlas basin was bounded by an active extensional fault during the Early Liassic operating diachronously from the West to the East.