Jurassic Rift Basin and Sedimentation

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The Northwestern edge of the African continent is composed of three main platforms or microplates: The Saharan Shield (or African Craton), The Moroccan Meseta and the Oran Meseta. Today these plateaus are separated by the Central and Eastern High Atlas (CEHA) and Middle Atlas Orogenic Belts. Both the CEHA and Middle Atlas mountains contain major fault- and fracture-zones that have two major trends: one is NE/SW, parallel to the Atlantic and the other is ENE/WSW, parallel to the Mediterranean. These ancient fracture zones are related to short-lived Mesozoic rifts.

Rifting in the Late Triassic to Early Jurassic formed troughs along the linear trends we see today. Red bed sedimentation, evaporites and basalts characteristic of the Upper Triassic and Lowest Jurassic rift zone, change abruptly into a dominantly carbonate regime, signifying rapid flooding of the marine trough. The CEHA trough consists of two main basins, the Western High Atlas basin, which was flooded by the embryonic Atlantic, and the CEHA basin to the east which was inundated by waters from the Neo-Tethys Sea. Subsidence began in the Middle Liassic and continued through the Early Dogger. Subsidence rates exceeded rates of sedimentation until subsidence slowed in the Early Dogger, and by Middle Dogger marine carbonate sediments filled the rift-graben system.

Excess accommodation in the early Liassic resulted in very deep waters within the troughs and allowed deep-water basinal sedimentation characterized by thick, rhythmic sequences of micrites and marls, distal turbidites, and pelagic limestones. Slope deposits of shelf debris, slump blocks and turbidites flank the basin and grade into shallow-shelf environments, marking the shelf/trough boundary. The shelf environments in the CEHA trough were bounded by the Saharan Plateau to the south and the Oran Meseta to the north, with these two foreland areas supplying the bulk of detrital sedimentation. Extensive mudflat deposits with marine-vadose structures overlain by intertidal-subtidal lime muds characterize the shelf-slope deposits, and sponge mud-mound formation occurs on the foreslope. Upper Liassic deposits are primarily shallow lagoonal. Rhythmic deposits in both shallow and deep water sediments interpreted as fluctuating sediment supply are common throughout the Liassic.

In the Middle Jurassic, marlier sediments with abundant brachiopod faunas and shallow water pinnacle reefs formed over deep water deposits and are indicative of a shallowing sea. Platform facies which began to form earlier with the shallowing of the sea, gradually stepped into the basin as it was infilled. Upper Jurassic supratidal deposits overlie Lower Jurassic open marine sediments on the southern shelf, however uplift and erosion have removed much of the Upper Jurassic and some of the Middle Jurassic rocks. Widespread slump block and turbidite deposits indicate tectonic activity simultaneous with deposition, suggesting activity on the South Atlas Fault during the Lower and Middle Jurassic. Activity in this region is also reflected by extensive tectonic disruption of the platform.

Continuing into the Cretaceous and Cenozoic, the convergence of Africa and Europe along with the occurrence of the Alpine Orogeny and the closing of the Tethys sea compositely increased compressional stresses causing tectonic inversion of the CEHA and Middle Atlas troughs. This produced the highly faulted and folded CEHA and Middle Atlas Mountains that are prominent on the Morocco landscape today.

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