Gomez, F., Barazangi, M., and Demnati, A., *Structure and evolution of the Neogene Guercif Basin at the junction of the Middle Atlas Mountains and the Rif thrust belt.* AAPG Bulletin, 84, 1340-1364, 2000.

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Abstract:

The Guercif basin of northern Morocco occupies a 50 x 60 km area where the transpressional Middle Atlas mountains terminate and abut the Rif thrust belt. Analysis of over 800 km of 2-D (two-dimensional) seismic reflection profiles and eight exploratory wells, in combination with existing geological data, suggests a late Miocene episode of extension (4%, or 1.7 km, maximum) and a subsequent episode of contraction since the end of the Miocene. Most of the late Miocene deposition was concentrated in a narrow graben (herein referred to as the Guercif graben), which contrasts with the wider physiographic expression of the basin today. Geohistory analysis indicates that tectonic subsidence persisted until the Messinian, and sediment loading continued to drive subsidence even after extension stopped. Timing constraints demonstrate the contemporaneity of the Guercif graben and west-southwest-vergent thrust tectonics of the Rif thrust belt. Similar timing and proximity with the Rif, as well as the graben geometry, suggest that extension in the Guercif basin, in addition to other smaller extensional basins in the northern Middle Atlas region adjacent to the Rif, may represent the distal effects of a broad lateral shear zone bounding the thrust belt.

The Neogene Guercif basin is superimposed on the Mesozoic Middle Atlas rift, which experienced basin inversion during the Cenozoic, and seismic reflection interpretations in the southern Guercif basin depict old Mesozoic rift faults reactivated as reverse faults. Unconformities illustrate that the uplift of the Middle Atlas appears to be primarily a late Cenozoic phenomenon. The Guercif basin offers a special opportunity for petroleum exploration within an aborted rift basin such as the Middle Atlas. Mesozoic source rocks in the Middle Atlas may have been sufficiently buried beneath Neogene basin sediments to reach maturity, and the late Cenozoic timing of contraction can produce suitable structural traps.