AAPG Annual Convention
Salt Lake City, Utah
May 11-14, 2003

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Role of Basement Architecture During Salt Tectonics in the Northwest and Southeast Mediterranean: Comparison Between the Rhone and Nile Deep-Sea Fans

Plio-Pleistocene tectonics in the Mediterranean results from combined crustal tectonics and gravity-driven deformation associated with thick evaporites deposited above preexisting subsalt relief during the Messinian salinity crisis. Loading of Messinian evaporites triggered gravity gliding-spreading, which caused proximal extension, midslope translation, and distal contraction. Although deformation was mostly thin skinned, the structural topography of the base salt greatly influenced the pattern of salt structures. In the Rhone deep-sea fan (NW Mediterranean), the distal, contractional region comprises numerous circular or elongate diapirs whose rise was driven mostly by shortening, rather than density inversion. Diapir distribution closely matches that of dormant, crustal-scale faults in the sub-Messinian basement. Seismic and experimental data suggest that such a correlation results from differential compaction of the pre-Messinian sediments above the basement steps during gravity spreading of the overlying salt and overburden. In the Nile deep-sea fan (SE Mediterranean), the preexisting basement architecture influenced the style of salt tectonics differently. First, polygonal minibasins formed during progradation across the steep, NW-SE-trending Messinian continental slope. The minibasins were initially bounded by NE-SW and NW-SW grabens underlain by reactive salt ridges. Northeastward spreading of the minibasins was subsequently blocked by the Eratosthenes seamount, which acted as a distal buttress, causing shortening of NW-SE salt ridges. Spreading became restricted toward the northeast, NE-SW salt ridges further widened, whereas NW-SE ridges were reactivated in strike slip. The overall result is a linear NW-SE structural corridor bounded by the paleo-Messinian slope and the Eratosthenes seamount.