Geologic Origin of the Mari Mound Complex From Sediment Injection, Deep-Water Levant Basin, Eastern Mediterranean Sea

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ABSTRACT

The lower Pliocene Mari Mound Complex, located in the deepwater Levant Basin of the eastern Mediterranean Sea, consists of seven mounds that formed from the injection of sediment into the regional deep-water Yafo Sand Member. Interpretation of 113 km2 3D seismic data, borehole logs from 9 wells (8 from the Mari-B field), biostratigraphy, and core photos from one well helped to determine the timing and origin of these unique mounds. The Yafo sand is a regionally extensive, base-of-slope, sand-rich turbidite system, approximately 100 m thick. Within the mound complex, individual mounds vary from 220 to 390 m in thickness, and 0.10 to 2.8 to km2 in area. The Mari-B gas field produces from the largest of the mounds. All seven mounds have a prominent seismic flat spot due to a gas-water contact. Two distinct facies are present within each mound. The Reservoir Facies comprises gas-charged Yafo sands, with low gamma-ray, high resistivity, low velocity, and low density values. Reflections are slightly layered, and vary from low to high amplitude with low to moderate continuity. Cores recovered highly fluidized sands, injected into turbidite sands. This facies is present around the mounds' margins, and terminate against the Chaotic Facies in the core of each mound. This chaotic facies has a pillar-like geometry, and vary from 0 to 300 m in height above the flat spot, and 0.02 to 0.93 km2 in area. The reflections are chaotic with moderate to high amplitude. The facies has alternating high to low gamma-ray low resistivity, high velocity, and high density. Cores recovered a mixture of deformed sands, muds, and anhydrites, comprising both brittle and ductile deformation. The Chaotic Facies formed as the result of sediment from deeper in the subsurface that was remobilized and injected upward into the Yafo Sand Member, creating the mounds. The formation of the Mari Mound Complex involved several components: (a) partially filled channels in the underlying Afiq Canyon during the early Messinian; (b) deposition of the Messinian Evaporites in these channels; (c) deposition of the early Pliocene Yafo Sand Member on the top of the Messinian evaporites; (d) significant seismic event(s) that triggered the release of overpressured fluids upward from below the Afiq Canyon; (e) these fluids remobilized unlithified sands, muds, and anhydrites upward into the base of the Yafo Sand Member, pushing it upward and creating the mounds.