

Strike-Slip Nature of the Structure of the Levant Basin offshore Lebanon

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ABSTRACT

New, highly detailed 3-D seismic surveys reveal complex structural features in the Levant Basin offshore Lebanon. The structural system is dominated by left-lateral strike-slip motion of the Dead Sea Fault System and affected by the NE-SW trending restraining bend that produces Mt Lebanon and the Palmyrides. The strike-slip faulting originates in the Miocene or older rocks and is characterized in shallower depths by multiple flower structures resulting in reverse faulting pop-up features, anticlinal structures and occasional small scale extensional basins exhibiting normal faulting. The NE-SW trend of the pop-up anticlinal features is consistent with the expected orientation of transpressive features in a wrench faulting system.

The primary result of the motion along the strike-slip faults is SW translation of the thicker and older continental crust that crops out onshore Lebanon toward the Levant Basin and structurally higher along the margin. Several of the more dominant strike-slip faults merge with the NW–SE trending, so-called ‘Piano Key’ normal fault system in a manner that suggests the two fault sets are related to a single strain field created by the restraining bend in the Dead Sea Fault System. The ‘Piano Key’ faults are accommodation tears that form contemporaneously with the strike slip faulting and both are post-Messinian evaporate deposition. The Messinian Evaporite sequence acts as a buffer and a relative timing horizon between the deeper strike-slip/‘Piano Key’ fault systems and the overlying Pliocene sediments and associated younger normal faulting. The Pliocene sediments are translating NW above the Messinian salt with extensional faulting seen near the margin and compressional folding and faulting observed basinward to the NW. Low angle normal detachment faulting within the lower parts of the Pliocene sediments provide key timing horizons for translation and uplift along lower strike-slip/‘Piano Key’ faults.