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Recognition of strike-slip faulting on the supra-detachment basin of Messara (central Crete Island) with remote sensing image interpretation techniques

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Abstract: The role of recently identified NNE-SSW trending strike slip fault zones on the development of the E-W trending Messara basin in Central Crete is examined in this paper. The examination of several tectonic and mophotectonic criteria along with high and medium resolution remote sensing image interpretation are leading to the conclusion that this quite recently formed basin on the top of the hanging wall of the Southern Crete extensional detachment fault is still evolving and the lateral slip of faults trending oblique to the Hellenic trench are very significant. The history of this supra-detachment basin starts during Middle Miocene only after the compressional phase of the alpine units' nappe pile stacking has been accomplished at the southern part of the Hellenic Arc system. The Iraklion basin, delimitated by two nearly N-S trending fault zones, which is located to the north of Messara and also including the area at the easternmost part of it, begins to get filled with lacustrine sediments, during Serravallian. The eastern marginal fault zone is almost vertical with some fault surfaces dipping to the west and has a strong left lateral component which is active at least since Tortonian, as this has been proved by tectonic analysis of syn-sedimentary faults found on marine sediments, along the faulted area. During Messinian time, left-slip displacement was relocated to the fault system bounding the western margin of the Heraklion-Messara basin. These oblique fault activations are causing the segmentation of the south dipping detachment fault and the variation of the slip rates of each of the –at least– three segments that were identified. The westernmost segment of the detachment seems to have the highest slip rate as the largest structural omission related to the alpine units has been detected along its trace. The continuous subsidence of the hanging wall is boosting Messara to be formed as an individual basin trending E-W differentiated by the Iraklion basin, the area of which is reduced and finally remained on the foot wall of the Southern Crete detachment fault. The new independent supra-detachment basin is stabilizing whilst internal deformation takes place and becoming homogenous during the Holocene as the modern topography shows. Remote sensing image interpretation based on spectral analysis led us to a high detail and accuracy geological mapping of these major and in many cases blind structures and eventually build the evolution model of a very complicated area at the edge of the Hellenic trench.