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Evolution of Plio/Pleistocene Sedimentary Processes in Patraikos Gulf, Offshore Western Greece

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Abstract : Patraikos Gulf is located offshore western Greece, and it is limited to the west by the Zante, Cephalonia, and Lefkas islands. The Plio/Pleistocene sequence is characterized by two depocenters, the east and west Patraikos basins separated from each other by a prominent sill. This study is based on the Plio/Pleistocene seismic stratigraphy analysis of a newly acquired 3D PSDM (Pre-Stack depth migration) seismic survey in the west Patraikos Basin and few 2D seismic profiles throughout the entire Patraikos Gulf. The eastern Patraikos Basin, although completely buried today with water depths less than 100 m, it was a deep basin during Pliocene (> 2 km of Pliocene-Pleistocene sediments) and appears to have gathered most of Achelous River discharges. The west Patraikos Gulf was shallower (< 1300 m of Pliocene-Pleistocene sediments) and characterized by a hummocky relief due to thrust-belt tectonics and Miocene to Pleistocene halokinetic processes. The transition from Pliocene to Miocene is expressed by a widespread erosional unconformity with evidence of fluvial drainage patterns. This indicates that west Patraikos Basin was aerially exposed during the Messinian Salinity Crisis. Continuous to semi-continuous, parallel reflections in the lower, early- to mid-Pliocene seismic packet provides evidence that the re-connection of the Mediterranean Sea with the Atlantic Ocean during Zanclean resulted in the flooding of the west Patraikos basin and the domination of hemipelagic sedimentation interrupted by occasional gravity flows. This is evident in amplitude and semblance horizon slices, which clearly show the presence of long-running, meandering submarine channels sourced from the southeast (northwest Peloponnese) and north. The long-running nature of the submarine channels suggests mobile efficient turbidity currents, probably due to the participation of a sufficient amount of clay minerals in their suspended load. The upper seismic section in the study area mainly consists of several successions of clinoforms, interpreted as progradational delta complexes of Achelous River. This sudden change from marine to shallow marine sedimentary processes is attributed to climatic changes and eustatic perturbations since late Pliocene onwards (~ 2.6 Ma) and/or a switch of Achelous River from the east Patraikos Basin to the west Patraikos Basin. The deltaic seismic unit consists of four delta complexes. The first two complexes result in the infill of topographic depressions and smoothing of an initial hummocky bathymetry. The distribution of the upper two delta complexes is controlled by compensational stacking. Amplitude and semblance horizon slices depict the development of several almost straight and short (a few km long) distributary submarine channels at the delta slopes and proximal prodeltaic plains with lobate sand-sheet deposits at their mouths. Such channels are interpreted to result from low-efficiency turbidity currents with low content in clay minerals. Such a differentiation in the nature of the gravity flows is attributed to the switch of the sediment supply from clay-rich sediments derived from the draining of flysch formations of the Ionian and Gavrovo zones, to the draining of poor in clay minerals carbonate formations of Gavrovo zone through the Achelous River.

Keywords : sequence stratigraphy, basin analysis, river deltas, submarine channels
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