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The effects of Late Neogene and Quaternary relative sea level changes on the architecture of the southern Sicily Foreland Basin.

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A sequence stratigraphic study of the peri-shelf and infra-slope basins, located in the frontal region of the southern Apennine-Sicilian Thrust Belt has been carried out, in order to unravel the causal relationship between the Late Neogene – Quaternary depositional systems development, eustasy and tectonic events.

The study area represents a segmented foreland basin, Messinian to Pleistocene in age, where subsidence occurs in response to thrust loading and it is controlled by the rates of deformation in the adjacent folded belt (Catalano *et al.*, 1993).

Detailed interpretation of multi-channel seismic profiles and well logs, demonstrates that the continental margin of southern Sicily (Central Mediterranean Sea), experienced high amplitude (~ 100 m) oscillations in sea level, since Messinian times.

The stratigraphic architecture on the southern Sicily offshore basins is characterized by repeated migrations of the marine onlap, which are interpreted to be associated with third and fourth order cycles of relative sea level changes (Catalano *et al.*, 1998).

Nine 3° order type 1 depositional sequences have been recognized, mapped and described in the study area: 6.01, 4.2, 3.8, 3.05, 2.7, 2.1, 1.4, 0.8 and 0.5 Ma. Furthermore, the 3°order depositional sequences have been subdivided in eleven 4° order sequences

Each sequence comprises both regressive and transgressive parts, but consists primarily of sediments deposited in turbidite systems.

The regressive parts of the sequences have been deposited during phases of fall of relative changes of sea level.

The deep water depositional systems are predominantly composed of mass transport deposits, slump and debris flows and of sand-rich turbidites with laterally extensive, sheet-like geometries.

Slope fans tend to occur in those setting in which tectonic tilting created anomalous gradients and where upper slope failures occurred at the front of quickly prograding sedimentary wedges.

The transgressive parts of the depositional sequences are characterised by backstepping littoral environments, preserved at middle shelf locations, and highly condensed hemipelagites in the upper intra-slope perched basins.

The oldest part of the Late Neogene-Pleistocene stratigraphic successions is the Messinian evaporitic sequence, easily identified on seismic profiles for the peculiar stratigraphic signature.

Biostratigraphic and cyclostratigraphic analysis (Sprovieri *et al.*, 1998) suggest the evaporitic events of the Gela Basin took place within an interval of no more than 500,000 years.

Well log analysis reveals the existence of seven discrete turbiditic layers, which have been detected along the entire margin.

These extensive gypsum turbidites could be formed during eustatic lowering of sea level and they could be tentatively correlated with the heavy Messinian oxygen isotope enrichment, related to the climate cooling intervals at 6,01 Ma, 5,89 Ma, 5,75 Ma, 5,7 Ma, 5,65 Ma, 5,60 Ma and 5,55 Ma (Zhang & Scott, 1996).

Extensional tectonic deformation has occurred throughout the Messinian - Early Pliocene and had a major effect on fan sedimentation, creating a series of topographic highs and lows and controlling the location of submarine canyons along the slope.

Pliocene sequences are characterised by the development of mixed sand-mud submarine fans, dominated by two main architectural elements: channel levee complex and depositional lobes. The channel levee systems form the conduits through which sediments are distributed to the main area of fan; constructional lobes form overlapping, layered sand bodies.

Pliocene mixed sand-mud rich fan systems show a wide range in log response, depending on location. Coarsening upward and cleaning upward gamma or SP profiles reflect progressive stacking and amalgamation of thin-bedded turbidites deposited by overbank flows. Broadly, fining upward trends reflect stacked interbedded channel fill and sandstone turbidites, separated by finer grained turbidites and hemipelagic mudstone.

The sequence stratigraphic study demonstrates how the fan development, in the southern Sicily intraslope basins, shifted generally from NW to SE, throughout all the Pliocene.

Pleistocene sequences were deposited under the influence of high sea level changes, characterised by amplitude up to 130 m and frequency up to 20 ka (4^{th} and 5^{th} order).

Regressive progradational units and transgressive systems tracts couplets dominate each sequence, and little or no highstand deposition is observed in the shelf.

Three sediment dispersal systems operate during Pleistocene: 1) fluvial→delta→delta fed apron; 2) coastal plain →shore zone →shelf → shelf fed apron; 3) delta → submarine fan.

The persistence in time or the dramatic phases of reorganization of sediment dispersal systems are linked to glacioeustasy. Pleistocene upper slope deposition in the study area is characterised by a significant increase in the rate of sedimentation. The intraslope basins active during Early Pleistocene are sited above those established during the late Pliocene and successively reoccupied. However, the propagation of the thrust-and-fold Gela System toward the foreland, increase the rate of denudation in the hinterland and consequently the rate and the amount of sediment supplied to the slope.

The stratigraphic effects on the sedimentary architecture of Pleistocene intraslope southern Sicilian basins is the abundance of chaotic mass transport deposits and the development of a large, complex slide zone located on the central sector of the margin.

This study provides an interesting example of interaction between tectonics and eustasy, emphasizing the role of the local basin factors as sediment flux, increase of the accomodation space from the shelf to the slope and basin physiography. The final architecture of this modern foreland basin represents the complex interaction of different sedimentary variables, modulated according to different magnitude and frequencies, where also the smallest depositional cycle records a pervasive eustatic signature.

References

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