DISTRIBUTION OF MESSINIAN SALT, EVAPORITES AND EROSIONAL SURFACES BENEATH THE TYRRHENIAN SEA

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We interpreted sediment horizons belonging to Messinian time-interval on about 6500 km seismic reflection profiles obtained by Laboratorio di Geologia Marina of Consiglio Nazionale delle Ricerche, Bologna, using a 24 kilojoules Sparker sound source, about 2900 km multichannel (12 and 24 fold) lines obtained by Osservatorio Geofisico Sperimentale, Trieste, with a Flexotir explosive sound source, and about 1000 km single channel profiles obtained by the U.S.A. research vessels Robert D. Conrad and Glomar Challenger using a 400 cm^3 Airgun sound source.

We have subdivided the acoustic expression of the Messinian into four acoustic facies: (1) Messinian seismic sequence previously described in the Western Mediterranean (Montadert et al., 1978), composed by, from top to bottom: (1a) well stratified interval previously described as M-horizons (Ryan et al., 1971), calibrated by drilling (Ryan, Hsü et al., 1973) and interpreted as interbedded sulphates, dolomitic muds and some clastics; (1b) a transparent unit associated with diapirism, and interpreted as halite; (2) a non-coherent, irregular group of reflectors, interpreted as clastic alluvial deposits; (3) a horizontally bedded reflector with extensive lateral continuity, interpreted as subaqueous, maybe lacustrine sediments; (4) a very rough reflector dissected by several channels possessing a dendritic basin-directed drainage pattern, interpreted as a Messinian erosional surface.

Space distribution of the four mentioned Messinian acoustic facies is depicted in Fig. 1. Acoustic facies 1 is confined to the western part of the Tyrrhenian Sea, where the M-horizons (unit 1a) conformably overlay the inferred halite layer (unit 1b). Thickness of the latter (assuming a sound velocity of 4.2 km/sec) reaches 800-1000 m. The subaqueous deposits (facies 3) are confined to the subsurface of the deeper southeastern bathyal plain. The alluvial deposits (facies 2) form a transition between the subaqueous deposits and the erosional surfaces (facies 4), which surround all the former acoustic units.

Morphology of the four Messinian acoustic facies is consistent with their interpretation. Facies 1 and 3 lie more or less flat at depths of 3000 m and 4000 m respectively. Surface of facies 2 slightly dips towards the deepest troughs where facies 3 is developed. An analogous but stronger dip (about 5°) is displayed by the erosional surface.

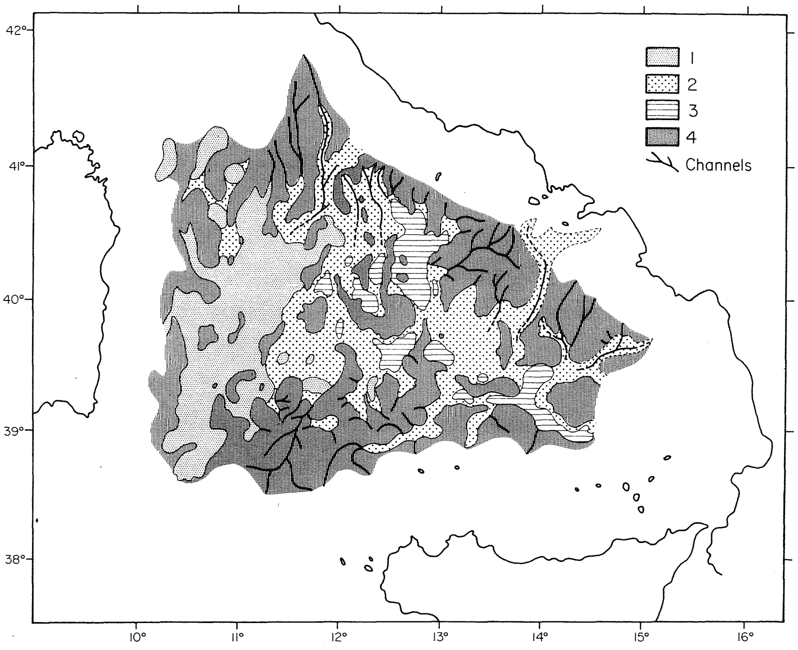

Fig. 1 - The four Messinian acoustic facies.

The Tyrrhenian Sea in Messinian time can therefore be subdivided into a western part, where evaporites deposited, and a southeastern part, where evaporites are not recognized and clastic supply seems to predominate over chemical sedimentation. This was maybe also prevented by fresh water input from the wide surrounding water shed.

A pre-Messinian age for the creation of the Tyrrhenian Sea is supported by (a) widespread occurrence of Messinian-age sediments throughout the whole basin, (b) existence of Messinian erosional surfaces, which point to a substantial relief between the basin and its margins, (c) age and nature of basalts recovered in DSDP Site 373 (southeastern Tyrrhenian), which show that spreading was already active in Messinian time (Barberi et al., 1978).

Further evidence is provided by geophysical models. Quantitative estimates of basement depth and heat flux in stretched continental crust (Mc

Kenzie, 1978) and oceanic crust (Parsons and Sclater, 1977) for different times since the extension episode and since the creation of new crust respectively have been carried out (Malinverno, in press; Malinverno et al., in press). Both models point to an overall pre-Messinian age for the creation of the Tyrrhenian basin. A 10-14 My (Tortonian-Serravallian) age is suggested. The calculations point to about 1900 m depth in Messinian time for the western Tyrrhenian evaporitic basin.

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