

SEISMIC REFLECTION STUDY OF THE MESSINIAN EVAPORITES IN  
THE TYRRHENIAN SEA

Pietro CURZI<sup>x</sup>, Augusto FABBRI<sup>x</sup>, Torquato NANNI<sup>xx</sup>

<sup>x</sup> Laboratorio di Geologia Marina - CNR, Via Zamboni 65, Bologna (Italy)

<sup>xx</sup> Istituto di Geologia Applicata - University, Ancona (Italy)

Abstract. La succession évaporitique MESSINienne typique de la Tyrrhéni-  
enne sud-occidentale est très semblable à celle de la Méditerranée occi-  
dentale et de la Sicile. Il y a une évidente interdépendance parmi la  
morphologie du milieu de déposition et le type et l'épaisseur des évapo-  
rites. Ce milieu a été profondément modifié par la tectonique distensive  
plio-quadernaire.

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A detailed and high-resolution seismic reflection survey  
in the South-Western Tyrrhenian (Sardinia Basin area) points  
out that the typical Messinian evaporitic series corresponds  
well to the Western Mediterranean one and to the basinal zone  
evaporites of Central-South Sicily. It consists of an upper  
and a lower sequence, the former being mainly sulphate  
(upper gypsum beds) and the second including a thick transpa-  
rent layer (salt) and well marked reflectors (lower gypsum  
beds). The upper sequence is unconformable with the lower  
one.

From the variation and the distribution of the evaporitic  
series it emerges that a clear interdependence exists between  
the morphological setting of the depositional environment  
and the type and thickness of the evaporites. The maximum  
thickness and the salt are confined to the depressions (basin-  
al zones); on the marginal zones, the salt pinches out, the  
thickness gradually decreases and only sulphate and/or carbo-  
nate deposits are present. At the rims of the emerged areas,  
in some places, the evaporites are heteropic with clastic se-  
diments. The morphology of the evaporitic depositional envi-  
ronment consisted of depressed basins connected by sills and  
separated by emerged areas.

The results obtained suggest that the basinal zone lower  
sequence was deposited in deep-water basins of some hundreds

of meters, which correspond more or less to those of the pre-evaporitic Miocene sea. Their depth was gradually decreased, mainly as a result of the evaporation of the water and the considerable accumulation of salt. On the marginal zones shallow-water to subaerial environments occurred and the lowering of the sea-level caused large regressions.

In the basins the ending of the deposition of chlorides and the drawing to a close of an all but complete first evaporitic cycle (lower sequence) coincided with the paroxysm of a Messinian extensive tectonic phase. The last one led to a slight differentiated sinking of the whole area.

As a result of the filling of the major depressions by means of the salt and as a result of the Messinian tectonics, the depositional environment became modified, presenting a greater morphological regularity of the sea-bed and a larger extension. The cyclic deposits (gypsum beds alternating with terrigenous sediments) of the upper sequence are linked to this new setting.

From the seismic reflection survey it appears that these deposits extend for hundred of kilometers with identity of acoustic signature and thickness on basinal and marginal zones. This uniformity and continuity of sedimentation is typical of an environment which was principally subaqueous, probably shallow, and which could, cyclically and locally, dry up. The regularity of the sedimentation cycles, spread over such vast areas, leads one to suppose that it was controlled above all by climatic factors.

A differentiated collapse of the area took place at the end of the evaporitic sedimentation, and was followed by a more considerable sinking of Late Pliocene-Quaternary age. Deep faults, with displacements up to 2,000 m, lowered the Tyrrhenian area close to Sardinia by large steps, giving rise to the present-day configuration of the continental margin.

The morphology of the Tyrrhenian sea-bed after the Messinian stage is therefore completely changed; from a series of depressed basins of some hundreds meters, separated by structural highs which rose above the water in places, we arrived at a single large depressed basin of some thousand of meters.