High-resolution reflection seismic study of the Southern Aegean Sea

BRAMBATI A.^, BARTOLE R.°, GOT H.^, MASCLE J.+ & MIRABILE L."

^Istituto di Geologia e Paleontologia, Università di Trieste.
°Istituto di Geologia, Università di Urbino.
^Centre de Recherches de Sédimentologie Marine, Université de Perpignan.
+Laboratoire de Géodinamique Sous-Marine, Villefranche sur Mer.
"Istituto Universitario Navale, Napoli.

A high-resolution seismic survey (source: 2 X 4.5 kJ Sparkarray) carried out in the Southern Aegean Sea has confirmed the existence (Jongsma et al., 1977) of tectonically controlled, mainly WNW-ESE trending, elongated depressions filled with transgressive Neogene-Quaternary sediments.

The survey has defined the wide distribution of Messinian evaporites, cored at Site 378 of JOIDES Leg 42 A (Hsü K., Montadert L. et al., 1978), within almost all the basins and has permitted their differentiation into three main seismic facies on the basis of their seismic response (Fig.1):

a - sulphate-bearing evaporites;
b - salt-bearing evaporites;
c - thin or uncertain evaporites.

Type a is the most common evaporitic facies recognized within almost all the basins. Type c is less frequently represented and mainly occurs at basin prolongations. Type b is strictly localized at the center of two basins only: the former north of the western coast of Crete, the latter west of Santorini.

The close resemblance of type b (salt-bearing evaporites) to the tripartition of the Tyrrhenian evaporites (Decima & Wezel, 1971; Fabbri & Curzi, 1979) made up of lower gypsum, salt and upper gypsum, makes it possible to hypothesize a similar genetic model for the Southern Aegean evaporites.

Sub-intrusive and effusive volcanic (?) bodies of sub-circular shape, related to an anomalous magnetic area, have been recognized at the northern flanks of two basins west of Karpathos and south of Kamilonisi (Fig.1). In the same basins a shallow and widespread, relatively thick (up to 80 ms), seismically transparent layer of probable pyroclastic origin has also been observed. Along with the intrusive ridges already recognized by Jongsma et al.(1977) in the western and central parts of the surveyed area, these bodies would prove that extensive tectonic processes took place in the Southern Aegean Sea during Quaternary times.

It seems that extensional movements have also been responsible for tilting and rotational faults very common in the basin east of Andikithira and in that south of Kamilonisi. However seismic profiles indicate that differential vertical movements have played the primary role in the origin and shape of the basins

since before evaporitic deposition occured, their main sinking being of post-Miocene age. In fact, two basins lie in a highly suspende position with respect to the others: the salt bearing evaporitic basin west of Santorini and the sulphate-bearing one east of Dia. In particular within the latter, evaporites lie at -1050 m while within the basin south of Kamilonisi at -3100 m. At least about 2000 m of displacement are therefore attributable to post-evaporitic vertical movements. Non-evaporitic sediments have often been observed between the evaporitic sequence, whose thickness does not exceed 500 ms, and the acoustic basement. The birth of the basins of the Southern Aegean Sea is hence suggested as Tortonian.

As an answer to the differential vertical movements, many sediment slides occured expecially during Quaternary times. This is testified by numerous slumps packed into the Quaternary sequence and by a giant mass flow (350 m thick, about 8 km long) located north-east of Andikithira.

Tectonic activity seems to be still active as demonstrated by the frequent, shallow and superficial slumps and mass flows recovered in the gravity-cores (Brambati, Catani, et al., this volume), expecially well developed at the flanks of the western basins.

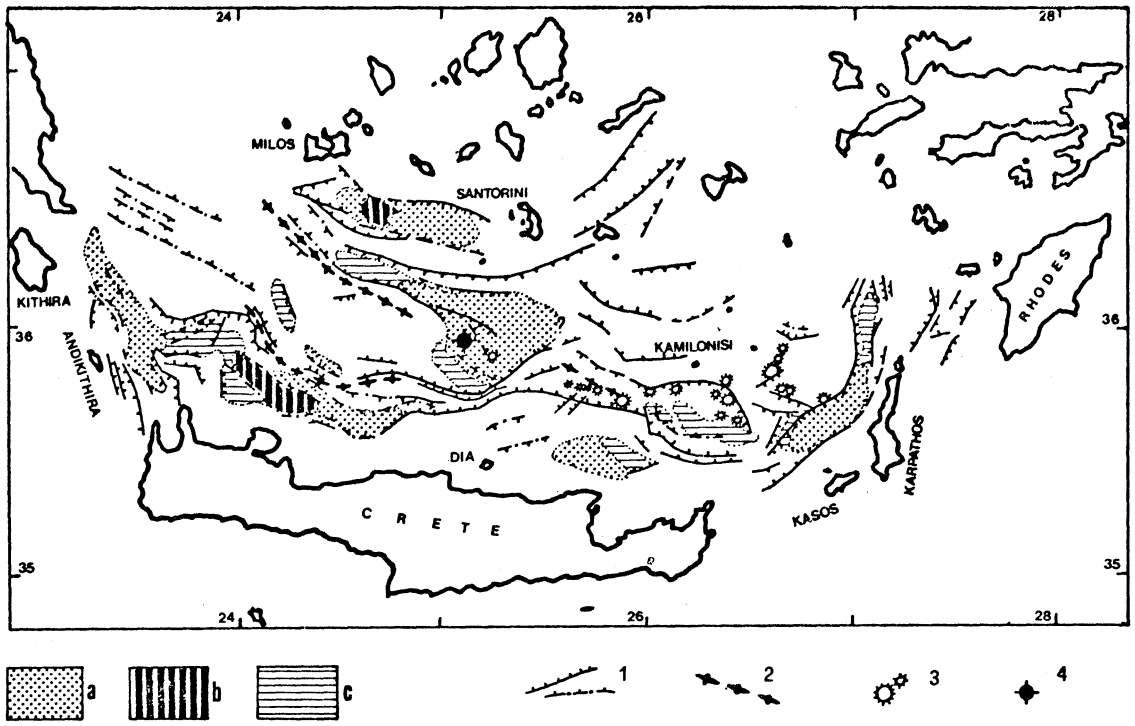

Fig.1: Tectonic scheme and seismic facies of Messinian evaporites in the Southern Aegean Sea. a: sulphate-bearing evaporites; b: salt-bearing evaporites; c: thin or uncertain evaporites. 1: normal faults (dashed and dotted = buried); 2: intrusive ridge; 3: seismic evidence of volcanic bodies; 4: DSDP Site 378.

References cited

BRAMBATI A., CATANI G., et al., this volume.

DECIMA A. & WEZEL F.C.(1971), in: Rivista Mineraria Siciliana, Anno XXII, n.130-132, 172-187.

FABBRI A. & CURZI P.(1979), in: Giornale di Geologia, (2), fasc.1, 215-248, XXI-XXIX, Bologna.

JONGSMA D., WISSMANN G., et al.,(1977), in: Meteor-Forschungs., Reihe C, 3-30.

HSÜ K., MONTADERT L., et al.(1978). Initial Reports of the Deep Sea Drilling Project, Vol.42, Part 1: Washington (U.S. Government Printing Office).