LATE TERTIARY EVOLUTION OF THE ALBORAN SEA AT THE EASTERN ENTRANCE OF THE STRAITS OF GIBRALTAR

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Abstract: Results of a 1975 seismic survey by Shell and the Moroccan government in the western Alboran basin correlated with drill site 121 of "Glomar Challenger" indicate an early Messinian opening of the Straits of Gibraltar. Numerous diapirs (clay or salt) are most probably of pre-Messinian age.

Résumé: Les résultats d'une campagne sismique effectué en 1975 par le gouvernement Marocain et la Shell joints à ceux du forage 121 du Glomar Challenger indiquent que le Détroit de Gibraltar s'est ouvert du debut du Messinien. Les nombreux diapirs (sel ou argile?) de la région sont très probablement antérieurs au Messinien.

The Alboran basin, on the concave innerside of the Gibraltar arc, represents one of the most important accumulations of Neogene and Quaternary sediments in the Western Mediterranean.

Stratigraphic correlations are based on the results of corehole 121 and a comparison with onshore Neogene basins, such as the Murcia and Vera basins in Spain (Montenat, 1973; Montenat and Bizon, 1976) and the Chelif basin in North Africa. Palaeontological re-interpretation of DSDP-121 (Montenat and Bizon, 1975) showed that the lower pelagic marl interval (± 720 m - 867.2 m), which overlies crystalline basement, is of Messinian age. This necessitates a revision of our previous dating (Mulder, 1973), based on Ryan et al. (1972). The unconformity at the top of the

* Shell Int. Petr. Mij., The Hague

Messinian can be recognised as a clear seismic event around the margin of the basin (our horizon 1: "base Pliocene"). A deeper low-frequency reflector band of very distinct character (horizon 2) can be correlated over the whole area, although its continuity is interrupted by diapirs. Its outstanding acoustic contrast probably is caused by evaporites. The reflector onlaps against the basement ridge on which corehole 121 was drilled. It is overlain by Messinian pelagic marls encountered in the basal part of DSDP-121. It is interpreted as lower Messinian, representing a reduced equivalent of the Messinian evaporite interval of the Western Mediterranean.

To the west the strong reflector is terminated abruptly by an approximately E - W trending cliff, the northern edge of a submarine channel. This earliest evidence for strong submarine currents is correlated with the opening of the Straits of Gibraltar in early Messinian. The northern limit of the intra-Messinian erosion channel is less pronounced. The fill probably consists of pelagic sediments as encountered in DSDP-121. Sporadic reflectors suggest that the deeper parts of this channel may contain resedimented evaporites as described by Ricci Lucchi (1973) from the peri-Adriatic basin. Similar submarine erosional patterns are seen at the base of the Plio-Pleistocene and in the present bathymetry of the basin. A deeper seismic event traced through most of the area (horizon 3) locally represents a slight angular unconformity. Elsewhere it onlaps on underlying (older Miocene) sediments. This suggests a tectonic phase, tentatively correlated with the compressive post-Serravallian phase recognised in the Chelif basin and the Murcia and Vera basins. The interval between horizons 2 and 3 consequently could represent the Tortonian. The interval velocities and seismic character of this interval indicate a predominantly shaly or marly compesition away from the basin margin.

The deepest seismic event (horizon 4) is thought to be of Middle Miocene age. Both horizons 3 and 4 are terminated in the west by the intra-Messinian erosional channel.

The diapiric features are widespread in the central parts of the Alboran basin. Study of the seismic sections clearly shows that the diapiric movements were syn-sedimentary, commencing possibly during Middle or Lower Miocene time. In some places their activity was terminated in late Miocene or early Pliocene, in other localities more recent movements cause upheaval of the sea floor. In many places the plastic material pierced the sediments and in one locality the diapiric material reached the sea bed. The plastic material could be either clay or salt. The source is extremely deep and its base is never observed. It is speculated that its origin might be in early Miocene (Burdigalian) or older sediments (c.f. Auzende et al, 1975 and Pastouret et al, 1975).