SEDIMENTARY PROCESSES AND OUTCROP GEOLOGY OF THE WESTERN STRAIT GIBRALTAR SILL, NORTHERN SECTOR.

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The western sill of the Strait of Gibraltar has a prominent arcuate ridge that extends across the axis of the strait between Spain and Morocco. The physiography of this area is very complex with shelves, shallow banks, ridges, slope platforms and small, deep basins. The slopes bordering the broad shelves are dissected by numerous ravines, some of which locally produce a gully-like morphology. Terraces and platforms are also observed in the upper slope and outer shelf. This area is important because its setting in the sector connecting the alpine belts of southern Europe with northern Africa and the Mediterranean Sea with the Atlantic Ocean. The geology of this area, however, is very incomplete due to the general poor resolution of most seismic records and the difficulties for sampling in an area of strong currents, rocky bottoms and dense maritime traffic.

In order to investigate the rock outcrops and distribution of recent sediments, we have recently conducted a detailed survey of the northern sector of this area with side scan sonar (100 kHz), high resolution seismic reflection (3.5 kHz) and bottom sampling (rock cores). Four major bottom types were recognized in the seismic records, complemented with the bottom samples (Fig. 1). The smooth, flat bottom is characterized in

the sonographs by featureless surface, with median to low reflectivity and little bottom relief. Frecuently this bottom shows prominent bedforms fields, that have been identified as megaripples and sand waves. This smooth bottom arises in areas where a mantle of sand and graved cover the sea floor. The smooth, undulating bottom is defined by a flat surface, occasionally modified by bottom relief of high reflectivity. This bottom reveals areas with a thin layer of sediment that is interrupted by rock outcrops.

About half of the study area is occupied by rocky bottoms of two different types. The well bedded, rocky bottom shows a very irregular surface and alternances of long parallel, lineations with 2-5 m bottom relief. This physiography is produced by outcrops of sandstone beds, alternating with marl layers. There is a large outcrop of these units oriented WNW-ESE in the southwestern sector, while the other two main sectors whith this bottom type have a NE-SW trend. The ledged, rocky bottom may merge with the bedded rocky bottom and both have similar characteristics. The main differences observed in the ledged bottom are the predominance of marls over sandstones and a discontinuous, thin sediment veneer.

The surface distribution of these bottom types reveals some meaningful patterns. Smooth, flat bottom is best developed in a nearshore clastic wedge between Punta Paloma and Tarifa, an area of large sediment supply from local streams. This wedge extents into the continental shelf and the sediment is transported offshore and parallel to the coast by the strong bottom currents active in this area. The local physiography has a large

influence in the flow regime and sediment dispersal patterns. Thus, the megaripples fields and sand dunes are preferentialy distributed in shelf areas affected by promontories, such as west of Tarifa and off Punta Camarinal. During the course of our investigation (June-July, 1984) net sediment transport revealed by the bedforms was predominantly westward oriented.

Shallow bank areas, with hard rocky bottom as the southwest trending ridge in the central sector, are depleted of sedimentary cover because the morphological restrictions impose to the flow and sediment transport. In these areas, only bioclastic, calcareous sediment filling depressions are observed. Sediment that in its journey reaches the outer shelf is trapped by the ravines and transported into deeper water.

The rocky bottoms are Late Cretaceous and Early Tertiary outcrops, that can be correlated with several flysch units of the "Campo de Gibraltar" by the lithology and bedding characteristics. Off Punta Camarinal, a thin-bedded turbiditic unit, with slumps and synsedimentary faults crops out. This unit has been truncated by erosion and the bedding is detailed observed in the side scan sonar records. A blue, calcareous, laminated marly turbiditic unit occupies most of the inner-middle continental shelf off Punta Paloma. This unit is attributed to the inland Armachal Unit. Turbiditic units with thick, coarse-grained beds, locally massive, are observed in the outer shelf and slopes near the central ridge. Two main independent units separated by a fault contact, crop out in this sector. One of these units has similar characteristics that the Numidian sandstones of the Rift and Betic chains. Off Tarifa,

We finally conclude that rather conventional techniques of Marine Geology can be the most useful ones to resolve sedimentological and geological problems in complex areas such as the Strait of Gibraltar.

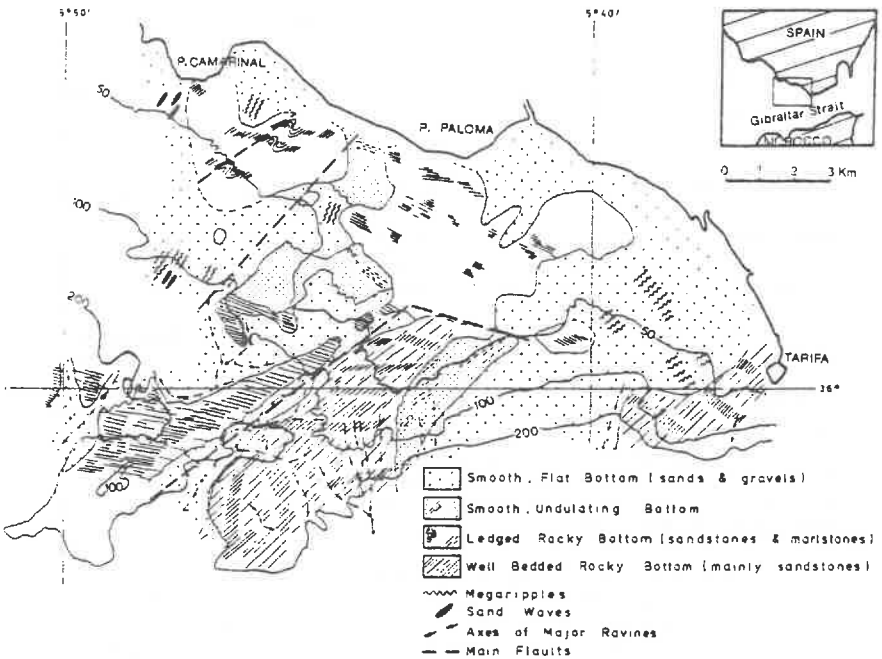

Fig. 1.- Interpretative chart showing the distribution of bottom types and bedforms in the study area. Contours in meters.