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Evidence for Slope Instability on the Iberian Mediterranean Margin (Mazarron Scarpment)

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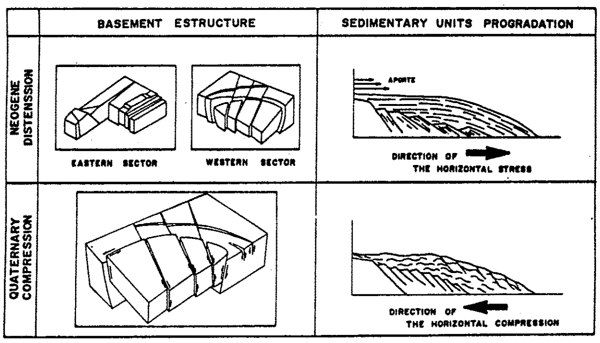
The structural configuration of the acoustic basement infered from seismic-reflection profiles (Sparker 1.500 and 8.000 joules), show the evidence in the existence of a faulted network displaying a special geometry, where the grabens and horsts are alternated in the margin, as a result of the geological evolution that tooke place in the area during Upper Miocene, Pliocene and Quaternary periode (Diaz-del-Rio, 1989).

The detailed morphology and structure of the surveyed area, seems to indicate the development of two combined faulted system, oriented into two main directions: W-E to SW-NE and NW-SE. Tectonic activity during pre-Neogene has exerted an important influence on the relief of the acoustic basement surface. These topographic features have been mantained during later tectonic processes on Neogene-Quaternary times, imposing the depositional axis on the basins, in the places where the grabens was formed (Somoza, 1989).

In the western sector, by the other hand, the main faults are running parallel to the coast line, and this particular phenomena determine a steplike basal geometry. For this reason, the thicknes of the sedimentary bodies are increasing seaward, showing its maximum out of the shelfbreak on the continental slope. As a result of the basement structure, this zone of the margin turn out highly comportmentalised (Vegas, 1986), in a E-W direction, as well as in NNW-SSE direction. The geological processes envolved in the Neogene-Quaternary history, includes two main factors: (1) Tectonic activity (ancient and recent) and, (2) sedimentological imput. There is a third factor inherent in the recent evolution of the Western Mediterranean that is "glacioeustatic factor" being the one that determines the succession of different depositional units in the upper sedimentary bodies composing the margin.

Recent tectonic activity and relative movements of basal blocks (vertical, horizontal and others), have been the origin of certain gravitational slumping observed in the litoseismic serie composing the continental slope and shelfbreak. These morphological irregularities should have been generated under a tectonic distenssion regime, which turns to a compression one.

In this general structural framework, the depositional units could break away along a discontinue surface caused by the heterogeneity of the beds. This is the reason why there is a high variety of submarine relief shapes (uneven bottom, scars, submarine valleys, ...etc), the evolution of which are in relation with the following factors: (1) water depth; (2) hydrodinamic conditions and, (3) sedimentary texture.



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Microtidal Influence in the Ebro River Salt Wedge (Northwestern Mediterranean)

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Introduction

In many of the Mediterranean rivers a salt wedge intrudes up to several kilometers upstream from their mouths, at least during periods of low water discharge. Presence of the salt wedge is controlled basically by the freshwater discharge of the river. The landward limit of the salt wedge changes with the flow variations. In this work we study the tidal influence and the dynamic behavior of the salt wedge in the lower part of the Ebro River.

Tidal range

Tidal data in the Ebro Delta show a microtidal range, with diurnal and semi-diurnal components. Resulting daily tidal oscillations have two very asymmetrical cycles (Fig. 1). The mean tidal range between the higher-high and lower-low tide is 20 cm while the tidal range between the lower-high and the higher-low tide is 7 cm.

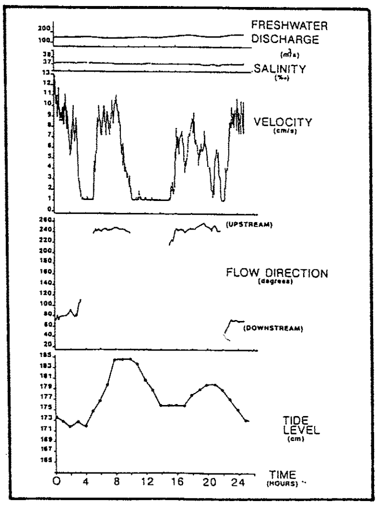

Fig. 1.- Relationships between freshwater discharge, salinity, current velocity of the salt wedge, flow orientation and tide level during the field experiment.

Field Experiment

Five hydrographic cruises were carried out along 30 km upstream from the river mouth in May 88, September 88, January 89, July 89 and October 89. Salinity, temperature and current profiles were recorded systematically in three sections of the river and at the upper limit of the salt wedge. An AANDERAA RCM8 currentmeter was installed 1 meter above the river bed and 3 km upstream from the river mouth on October 4^{th} and 5^{th} of 1989. During these days there were under estuarine conditions and a very steady freshwater discharge controlled by the river dams. Data of current velocity, flow orientation, salinity and temperature were recorded with a sample interval of 2 minutes.

Results

Estuarine conditions in the Ebro River are reached when freshwater discharge is lower than 500 m^3/s. Landward limit of the wedge intrudes more than 30 Km upstream from the river mouth when freshwater flow is lower than 100 m^3/s. The upper limit of the salt wedge in the Ebro River is also controlled by the bed morphology, especially by the topographic high located near Gracia Island, 17 Km upstream from the river mouth. This high stops the upstream salt wedge intrusion until the freshwater discharge is lower than about 150 m^3/s. Velocities in the freshwater layer during estuarine conditions increase downstream from 20 cm/s near the upper limit of the wedge to 80 cm/s in the river mouth, because of the thickness decrease of this layer downstream.

Daily distribution of currents in the salt wedge show two intervals with an upstream orientation (250°N) and one interval with a downstream orientation (70°N) separated by still flow periods. Current velocity ranges from less than 1.1 cm/s (lowest detectable speed by the used currentmeter) to 13 cm/s.

These results are correlated with the daily tidal cycle (Fig. 1): High tide periods correspond to the upstream salt wedge motion. The higher-high tide produces upstream mean flow velocities of 9 cm/s and the lower-high tide generates upstream mean velocities of 5 cm/s in the salt wedge. Downstream salt wedge motion is correlated with the lowest tidal level. Downstream mean velocities are of 9 cm/s, which is similar to the velocities recorded during the high tide level period. Still flow periods correspond to the higher-low tide level and to the intermediate phases between low and high tidal levels.

Conclusions

In microtidal areas, the circulation pattern of salt wedge intrusions in rivers is controlled mainly by tides when freshwater discharge conditions are steady. In the Ebro River, salt wedge motions reflect the diurnal and semi-diurnal components of the mixed tide that affects the Ebro Delta area. Mean upstream-downstream flow velocities in the salt wedge are also related to the tide level.

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