Ridge and swale morphology on the North Adriatic epicontinental shelf

A. CORREGGIARI*, M. E. FIELD**, G. BORTOLUZZI*, M. LIGI* and D. PENITENTI*

*Istituto per la Geologia Marina CNR, BOLOGNA **(Italy)**
US Geological Survey, MENLO PARK, CA **(USA)

The Adriatic sea is an elongate and narrow (800x200 km) epicontinental basin. The basin is characterized by a wide gently sloping shelf to the north, the Meso-Adriatic Depression below the shelf-break (140m), and a more complex area to the south. Sediment ridges are well known from the north Adriatic shelf trough the studies of BRAMBATI & VENZO 1967; COLANTONI *et al.* 1979, 1991 ; CAVALERI & STEFANON 1980.

During the late Quaternary lowstand of sea level, subaerial erosion and alluvial deposition dominated the north Adriatic shallow shelf and deposition of a coastal lowstand wedge occured on the northern shelf edge of the Mesoadriatic Depression. These coastal and fluvial surfaces were drowned and reworked by marine processes during the most recent (post 18ky) eustatic rise of sea level. Barrier island complexes and delta front bars formed during the transgression and present highstand have a patchy distribution reflecting shift in sediment sources. This study examines a small field of ridges previously examined by COLANTONI *et al.* (1979).

The data base comprises approximatly 480 km of 3.5 kHz high resolution seismic reflection profiles and 250 km of UNIBOOM profiles collected in 180 km2 during 1990 and 1991 cruises by IGM-CNR. Navigation was based on GPS integrated with hyperbolic LORAN C. Absolute positioning errors are less than 50 m.

The rhythmic ridge swale morphology of the shelf area lying 20 km SE of Venice is best identified through a detailed bathymetric map contoured at 1m intervals (fig . 1). The spacing between the ridges varies from 300 to 900m ; their height varies from 1 to 4.5 m. Ridges crests have NW-SE (320°) orientation. The ridges are relatively wide and clearly asymmetric with the steep side facing SW and with slopes of 0.4° to 4.2°. Fifteen samples from two troughs and one crest show the grain size to vary from fine to medium sand. The crest population is moderately well-sorted, while the trough population is poorly sorted.

The main ridge field rests on a sediment mound that parallels the regional bathymetric contour and is bounded landward by an elongated trough. Most of the subbottom reflectors identified in the 3.5 kHz records are sufficiently persistent and nearly horizontal ; others dip gently to the south. The shallowest one lies just beneath the ridges and is exposed in some of the troughs and may be related to the peat horizon found at 80 cm below the surface in a trough.

Possible interpretation for the ridges formation include origin as: erosional remnants of subaerial dunes or depositional bodies formed in a submarine setting. The latter interpretation appears more supportable from our data. Based on a ratio of subaerial dune high to width of 1:15, the ridges, as they exist today, would have to have been 24m high as subaerial dune. For them to be reformed to their present shape would have required extensive erosion. The lack of evidence of such erosion, including an absence of eroded sand and a consistent crest height, argue against such an origin.

More likely, the ridges formed by submarine processes. The ridges are strikingly similar in length, shape, and crest height and have consistent orientation and consistent asymmetry to the southwest. The depth-average velocity required to produce sand waves of this type is about 40 to 80 cm/sec (from RUBIN & McCALLOCH, 1980) and such a peak could be reached during exceptional storms or by high tides combined storm surge (MOSETTI, 1985) in the north Adriatic sea. Unfortunately little data on currents are available in the study area. The sediment composing the ridges was probably derived from a relict body (delta lobe, littoral bar) as it was reworked in the first stage of the transgression. The marine origin of the sediment is also attested to by the presence of shell fragments and marine foraminifera.

The next step to a better knowledge of the origin of these bottom features is a regional detailed bathymetric map followed by long cores sampling and bottom current measurements, in order to understand the relationship with other bottom features and the erosional processes related to the subbottom main surfaces.

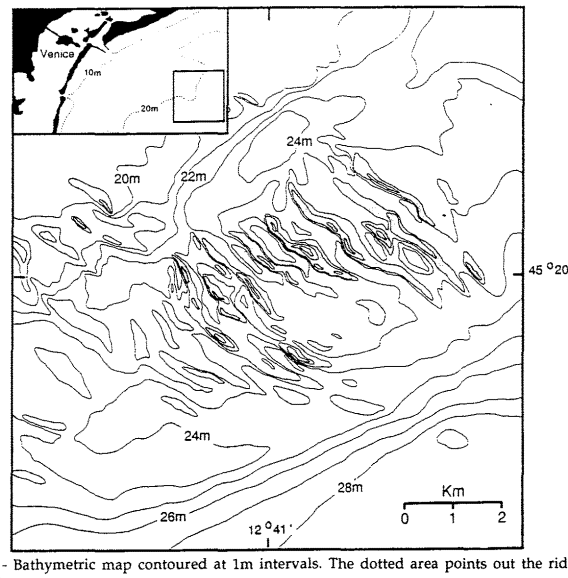

Fig. 1 - Bathymetric map contoured at 1m intervals. The dotted area points out the ridge morphology.

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