

EROSION AND SEDIMENTARY PROCESSES IN THE METAPONTO OFFSHORE (NORTH IONIAN SEA)

Maria Rosaria Senatore¹, Agostino Meo¹, Modestino Boscaino¹ & Francesco Latino Chiocci²

¹ Dipartimento di Studi Geologici ed Ambientali Università degli Studi del Sannio, Benevento

² Università degli Studi di Roma 'Sapienza', Roma

Corresponding author: M. R. Senatore <senatore@unisannio.it>

ABSTRACT: Senatore M.R. *et al.*, *Erosion and sedimentary processes in the Metaponto offshore (North Ionian Sea)*. (IT ISSN 0394-3356, 2011)

This study is based on surveys carried out to realize the Sheet N° 42 - Metaponto of the MAGIC project and pertain to the analysis of the morpho-dynamic processes acting on the seafloor by means of multibeam data and seismo-stratigraphic interpretation of Chirp and Sparker 1 kJ profiles. The active recognized sedimentary processes have allowed to define morphological units and to distinguish three sectors with different erosional and depositional forms.

RIASSUNTO: Senatore M.R. *et al.*, *Erosione e processi sedimentari nell'offshore di Metaponto (Mare Ionio Settentrionale)*. (IT ISSN 0394-3356, 2011)

Questo studio si basa su indagini svolte per realizzare il foglio n° 42 - Metaponto del progetto MAGIC e riguarda l'analisi dei processi morfo-dinamici che agiscono sul fondale marino utilizzando dati multibeam e l'interpretazione sismo-stratigrafica di profili Chirp e Sparker 1 kJ. I processi attivi sedimentari riconosciuti hanno permesso di definire le unità morfologiche e di distinguere tre settori con differenti forme di erosione e deposizione.

Key words: marine geology, Basilicata offshore, submarine landslide, canyon

Parole chiave: geologia marina, settore marino della Basilicata, frane sottomarine, canyon

This study is based on surveys carried out to realize the Sheet N° 42 - Metaponto. of the MAGIC project (Marine Geohazards along the Italian Coasts). The project, funded by the National Civil Protection Department, aims to define geological hazard features along the Italian coasts through the analysis of seafloor geomorphology.

The Metaponto offshore is part of the Gulf of Taranto, located between the Apennine Thrust Sheets to the west and the Apulia Foreland to the east, representing the Plio-Pleistocene southern extension of the chain foredeep (Bradanic foredeep) (PESCATORE & SENATORE, 1986).

The western sector of the Gulf of Taranto is characterized by the presence of two thrust fronts: the most recent one is the edge of the allochthonous units, while the second, which is deep-seated and older than the previous one, is located in a more internal position and affects the western inner Apulia Platform (SENATORE *et al.*, 1988). Corigliano and Amendolara basins, located in the zone behind the two thrust fronts and unconformably lying on the deformed units, can be interpreted as piggyback basins.

The Gulf of Taranto central sector is occupied by the Taranto Valley, located between the front of the allochthonous units and the Apulia Foreland; it represents the present foredeep of the Southern Apennine chain.

The eastern sector of the Gulf of Taranto represents the present Southern Apennine

Foreland (BELFIORE *et al.*, 1981, ROSSI *et al.*, 1982; TRAMUTOLI *et al.*, 1984; PESCATORE & SENATORE, 1986) mainly affected by normal sub-vertical faults. The analysis of the morpho-dynamic processes acting on the seafloor of the Metaponto offshore, was performed by means of multibeam data and seismo-stratigraphic interpretation of Chirp and Sparker 1 kJ profiles.

The physiographic domains identified are the continental shelf, that, from north to south, shows different morphological features, and the continental slope, with a very uneven morphology. The active sedimentary processes acting in the two recognized domains have been represented through suitable morpho-bathymetric elements allowing to define different morphological units. Thus the study area has been divided into three sectors (Fig. 1) defined by means of erosional and depositional identified forms:

- the north-eastern sector;
- the north-western sector;
- the southern sector.

The north-eastern sector corresponds to very northern part of the Apulia Ionian continental slope. The sea-floor shows the typical concave-convex form linked to widespread gravitational instability probably extending beyond the study area. The headscarps are identified from a depth of 300 m and have a maximum width of 4 km. The deposit area occurs from a depth of 550 m and reaches

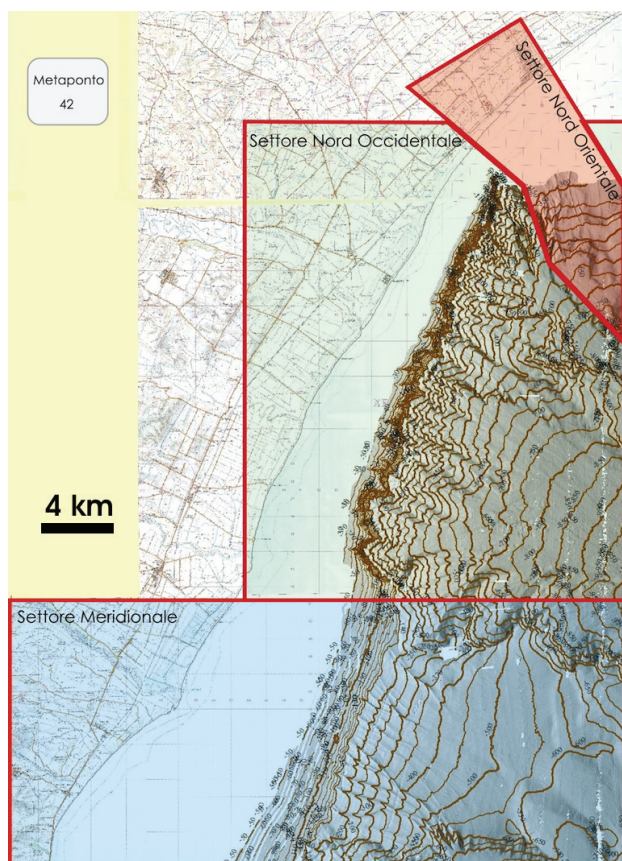


Fig. 1, Study area; the different indicated sectors are described in the text.

Area di studio; i diversi settori indicati, sono descritti nel testo.

the eastern edge of the Taranto Valley, where shows a width ranging from 3.5 km to 1.7 km. The total area occupied by this gravitational process is of about 25 km², with an average length of about 6 km and an estimated volume of mobilized sediment approximately of 245 km³, assessed by means of seismic reflection profiles.

The north-western sector comprises both the continental shelf and slope and extends from Marina di Ginosa to the mouth of the River Agri. The shelf from north to south shows a progressive increase in width, from 2 km off Metaponto Lido, 5 km near the town of Scanzano Ionico, up to 6 km off the mouth of the River Agri.

The identified morpho-bathimetric elements are erosional furrows carving increasingly toward the shelf margin the bottom sediments. They achieve their maximum development in the offshore of the rivers mouths of Bradano, Basento, Cavone and Agri.

The continental slope extends from a depth of 30 m to 600 m. Its upper part, up to an average depth of 450 m, is characterized by the presence of two Canyon systems, which cover a total area of about

50 km². The heads carve the edge of the shelf very deeply, shaping it in a morphology defined as "cauliflower". Many linear incisions have been identified where the average sloping is of 7 - 8%. They in part disappear down dip where the sloping decreases significantly reaching values of about 4%.

At greater depths, between 500 m and 800 m, the northern canyon system reaches the depressed area of the Valley of Taranto, stretching along the toe of the continental slope. The valley, that represents the main sediments collector of this canyon system, is both a bypass and depositional zone of sediment.

The southern canyon system, is located from the mouths of the Basento River and Agri River. At depth of 550 m, the canyon has width about 8 km; in this area the phenomena of transport and temporary deposition of sediments coming from the head occur. At the end of the canyon a strip parallel to the slope develops, sloping less than 4%, in which depositional bodies have been identified, stretched according to the axis of the canyon, probably linked to the last lowstand of the sea level and covered by a sediment drape .

The southern sector comprises both the continental shelf and slope and extends from the mouth of the Agri River up to the Rocca Imperiale Marina offshore.

The continental shelf is well developed, has an average width of 8 km with an almost flat trend up to the edge, located at a depth of 130 m. The shelf marginal zone, for a length of 17 km and an width of 2 km, presents at the bottom undulations almost parallel to the margin itself. They have heights ranging from 3 to 6 m and wavelengths between 250 m and 500 m. The undulations greatest development occur between the offshore of Lido di Policoro and Agri River. According to REBESCO *et al.*, (2009), which identified the same forms, in the southern part of Gulf of Taranto, both on the shelf and at greater depths, these undulations could represent either deposition of sediments from hyperpicnal flows or deformations due to slow sediment movements (creep). According to PETRUCCIONE *et al.* (2010) IORIO *et al.* (2010); SENATORE *et al.* (2010), the undulations, very common on continental shelves, are linked to slow sediment deformation triggered by the combined effect of high sedimentation rate, typical of the pro-delta areas, and gas trapped in the sediment, which weakening the cohesion trigger the sliding process.

The continental slope develops from a depth of 130 m, extending toward east for about 15 km, to a depth of 1400 m. The sloping is not constant; values of 7% gradually decrease up to 2% from a

depth of 400 m to 600 m; from 600 m, the slope increases again up to 22% at about 1000 m.

The slope is characterised:

- between 130 and 400 m by a narrow-spaced network of gullies with small incision,
- between 400 m to 600 m by a depositional area which has been interpreted as intraslope basin
- between 600 m to 1400 m, by an area affected by landslides, cutting the sediments of the intraslope basin and carrying them to the Taranto Valley.

The rough morphology of the slope must be linked to the complex structure of the substrate that corresponding to the front of the chain.

REFERENCES

- BELFIORE A., BONADUCE G., GARAVELLE G., MASCELLARO P., MASOLI M., MIRABILE L., MONCHARMONT M., MORETTI M., NUOVO G., PENNETTA M., PESCATORE T., PLACELLA B., PUGLIESE N., RUSSO B., SANSONE E., SANATORE M.R., SGARELLA F., SPEZIE G., THOREZ J., TRAMUTOLI M., & VULTAGGIO M. (1981) – *La sedimentazione recente del Golfo di Taranto (Alto Ionio, Italia)*. Ann. Ist. Navale, Napoli, 49-50, a 3, 1- 196.
- IORIO M., CAPRETTO G., PETRUCCIONE E., MARSELLA E., SENATORE M.R. (2010) - *Defining sedimentary and gravitative processes in highstand prodelta deposits by means of multiproxy analysis: an example from the Phlaegrean offshore, Eastern Tyrrhenian Margin*, sottomesso per la stampa.
- PESCATORE T. & SENATORE M.R. (1986) – *A comparison between a present- day (Taranto Gulf) and a Miocene (Irpinian basin) foredeep of the Southern Apennines (Italy)*. Spec. Publ. Int. Ass. Sediment., **8**, 169- 182.
- PETRUCCIONE E., AIELLO G., CAPRETTO G., SENATORE M.R., MARSELLA E., IORIO M. (2010) – *Late Pleistocene and Holocene geomorphology of a channel and sediment marine deformation process on the Cuma outer shelf (Eastern Tyrrhenian sea, Italy): An integrated approach*. CNR, Rassegna delle attività marine e marittime, accettato per la stampa .
- REBESCO M., NEAGU R.C., CUPPARI A., MUTO F., ACCETTELLA D., DOMINICI R., COVA A., ROMANO C., CABURLOTTO A. (2009) - *Morphobathymetric analysis and evidence of submarine mass movements in the western Gulf of Taranto (Calabria margin, Ionic Sea)*. Int. J. Earth Sci. (Geol. Rundsch), **98**, 791- 805.
- ROSSI S., AUROUX C., & MASCLE J., (1983) – *The Gulf of Taranto (Southern Italy) : Seismic stratigraphy and shallow structure*. Mar. Geol., **51**, 327- 346.
- SENATORE M.R. (1987) – *Caratteri sedimentari e tettonici di un bacino di avanfossa. Il Golfo di Taranto*. Mem. Soc. Geol. It., **38**, 177- 204.
- SENATORE M.R., NORMARK W.R., PESCATORE T. & ROSSI S. (1988) – *Structural framework of the Gulf of Taranto (Ionian Sea)*. Mem. Soc. Geol. It., **41**, 533- 539.
- SENATORE M.R., CHIOCCI F. L., PESCATORE T., DI NOCERA S. et al. (2010) – *Note Illustrative al F. 508 "Policoro" della Carta Geologica d'Italia alla scala 1:50.000*. ISPRA – Servizio Geologico d'Italia.
- TRAMUTOLI M., PESCATORE T., SENATORE M.R. & MIRABILE L. (1984) – *Interpretation of reflection high resolution seismic profiles through the Gulf of Taranto (Ionian Sea, Eastern Mediterranean. The structure of Apennine and Apulia deposits*. Boll. Oceanol. Teor. Appl., **2**, 33- 52