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Nota Breve
Short communication

ANTONINO IETTO (*), CARMINE ALTOMARE (*), FRANCESCO FERDINANDO DONATO (*), MATTEO FEDERICO (*), FABIO IETTO (*) & FRANCESCO TETI (**)

THE MIOCENIC CLIFF AT THE NW EDGE OF THE MESIMA SEDIMENTARY BASIN (CALABRIA, SOUTHERN ITALY)

ABSTRACT: IETTO A., ALTOMARE C., DONATO F.F., FEDERICO M., IETTO F. & TETI F., *The miocenic cliff at the NW edge of the Mesima sedimentary basin (Calabria, Southern Italy).* (IT ISSN 1724-4757, 2003).

In Calabria (near the town of Vibo Valentia) marine deposits at a cliff toe made up of granulitic gneiss, describe the beginning of a transgression with carbonate sediments (upper Miocene) and, in the mean time, they suggest the geomorphic evolution of a high rocky coast that experiences a strong seismo-tectonic activity. Landslides and megabreccias characterize the deposit as well as many large sedimentary veins, made up of fossils, that cross cut both the basement gneiss and cliff gneiss (KEY WORDS: Coastal Geomorphology, Tectonic and Sedimentation, Sedimentary Veins, Calabrian Arc, Italy).

RIASSUNTO: IETTO A., ALTOMARE C., DONATO F.F., FEDERICO M., IETTO F. & TETI F., *La falesia miocenica al bordo NO del bacino sedimentario del Mesima (Calabria, Sud Italia).* (IT ISSN 1724-4757, 2003).

In Calabria (Vibo Valentia), i depositi al piede di una falesia, formata da gneiss granulitici, descrivono l'inizio di una trasgressione con sedimenti carbonatici (Miocene superiore) e al contempo indicano le modalità di evoluzione geomorfologica di una costa alta rocciosa soggetta a forte attività sismo-tettonica. Frane e megabrecce caratterizzano il corpo deposizionale e al contempo grandi filoni sedimentari, formati da veri e propri accumuli fossiliferi, attraversano sia gli gneiss del basamento che di scarpata (TERMINI CHIAVE: Geomorfologia Costiera, Tettonica e sedimentazione, Filoni sedimentari, Arco Calabro, Italia).

Recent road work excavations on the eastern sides of the Vibo Valentia-Pizzo ridge (Calabria), have brought to light spectacular outcrops of marine deposits at the foot of an ancient cliff of Upper Miocene age (Tortonian). Along the road cut, exposed for almost 1 km, and for a height from 10 to 30 m it is possible to clearly see both the metamorphic rocks of the coastal paleoslope and sedimentary substratum, and also on top of these or laterally, breccias and megabreccias wedges. The latter records clastic sedimentation without either wave-induced motion or subaerial transport.

The morphoevolutionary and sedimentary context is that of a transgression on a high coast made up of high grade metamorphites: the well known «dioritico-kinzingitic formation» Autoch. (Cortese, 1895). These are gneiss with a banded structure and evident phenomena of anatexis (banding gneiss). The cliff is very probably situated in an active fault zone (fig. 1), as suggested by outcrop evidence such as:

- sedimentary veins along open lesions in the kinzingites, which follow in sequence up to more than 20 m in height and which have openings of up to 1-1.5 m;
- debris avalanches (megabreccias) with blocks up to 2.5-3 m in diameter, made up exclusively of gray or blackish metamorphites;
- paleo-landslides of thicknesses up to 10-15 m and front widths of up to 70-80 m.

The intra-basin sedimentary component is represented exclusively by carbonates: tawny-coloured waxy calcareous shelly rocks; zoned gray micritic calcareous deposits, only in the veins; breccias and megabreccias with carbonatic cement; calci-rudites and calcarenites with various cementing. At a first assessment, the thickness of this basal sedimentary interval can be estimated at around 70-80 m. Above, and sometimes laterally, the rock falls from the cliff and landslips are gradually substituted by monogenic calcirudites (gneiss) with a carbonate matrix and by poorly stratified coarse calcarenites, which include lenticular coquinas.

(*) *Dipartimento Scienze della Terra, Università della Calabria (UNICAL) Rende, Italy.*
(**) *Amministrazione Provinciale Vibo Valentia, Settore Viabilità, Italy.*

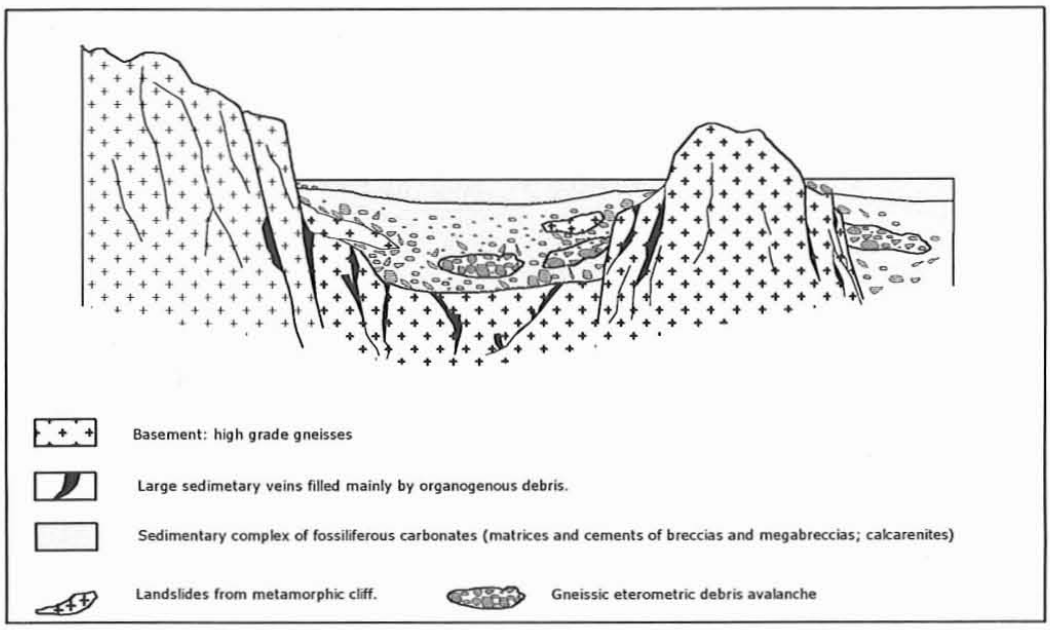

FIG. 1 - Qualitative reconstruction of the cliff depositional system.

The fossil component is very rich and among the species represented we have:
- echinoderms, often with entire shells, from 1 to over 10 cm; many fragments of larger forms and single spines from 3-4 mm in diameter and more than 6 cm in length (often cidaroids);
- brachiopods, with sizes from 1 to 10-12 cm (mostly Terebratula);
- lamellibranchs with smooth or ribbed shell from 0,5 cm to more than 10 cm (mostly Pecten and large Ostrea);
- crustacea, among which so far the entire segments of a chela of 6 cm in diameter and some almost complete carapaces;
- numerous bryozoa of various shapes (with planar zoari both branched and laminar);
- polychaetes and vermetids in centimeter-sized fragments;
- encrusted fragments of various shapes and sizes;
- individual and arborescent corals with corallites less than a centimeter in thickness (rare).

The overall sedimentary thickness, which can be reconstructed on the entire exposed scarp, is 130-140 m maximum.

The carbonatic sediment, always highly fossiliferous, fills all the gaps between the elements of the debris cones; it provides a matrix for the breccias and the heterometric conglomerates (at least 20% of the exposed outcrops) and mainly fills up, with more than 50% of fossiliferous contribution, the sedimentary conduits opened in the metamophites of the scarp or substrate. Furthermore, calcareous micrites fill the frequent centimeter-sized fissures that dissect the kinzingites in place or at the base of the landslip body (see fig. 2, fig. 3 and fig. 4). In these cases, where the routes of penetration are reduced to only 2-3 cm, the fossiliferous content lacks macroforms. Particularly evident is the filling of the veins (see table) in which white zoned micrites, often finely stratified and with geopetal position for thicknesses of 10-20 cm, are overlapped by organogenetic debris often thicker than a meter in which the fossiliferous contribution is around 90% out of the total sediment. Evidence of storm and/or tsunami pulses seem evident here.

An origin from traumatic events, in this case seismic, can also be evoked as a controlling factor of the strong frequency of landslides and falls of large blocks from the metamorphites that made up the emerged portion of the cliff. There is particular evidence from the landslides which slide on the sediments like «corestone», conserved by a relatively brief transport, of a mass gravitational event in which the most disorganized portion is made up of a crown of heterometric boulders (megabreccias) which accompany, in the fall and also in the sediment, the central more compact portions.

The evidence from the outcrop, which is illustrated here due to its scientific and didactic importance and on which various detailed studies have been activated in the various fields of the Earth Sciences, therefore clearly point to a transgressive phase on the high coast influenced by a rapid geomorphological evolution and intense seismic-tectonic activity. On the other hand, we have a carbonatic sedimentation extremely rich in marine life in which different forms, and each one well developed, express a high energy marine environment, with well oxygenated waters and tropical-type temperatures. The Miocenic age of the cliff is estimated by the neogenic series cropping out at the SW edge of the road cutting, where the breccias and conglomerates with kinzingitic clasts fade upwards into delicate whiteish calcarenites with lenticolari accumulations of shells of brachiopods, pettinids and ostreids. The calcarenites, in turn and in absolute stratigraphic continuity, within

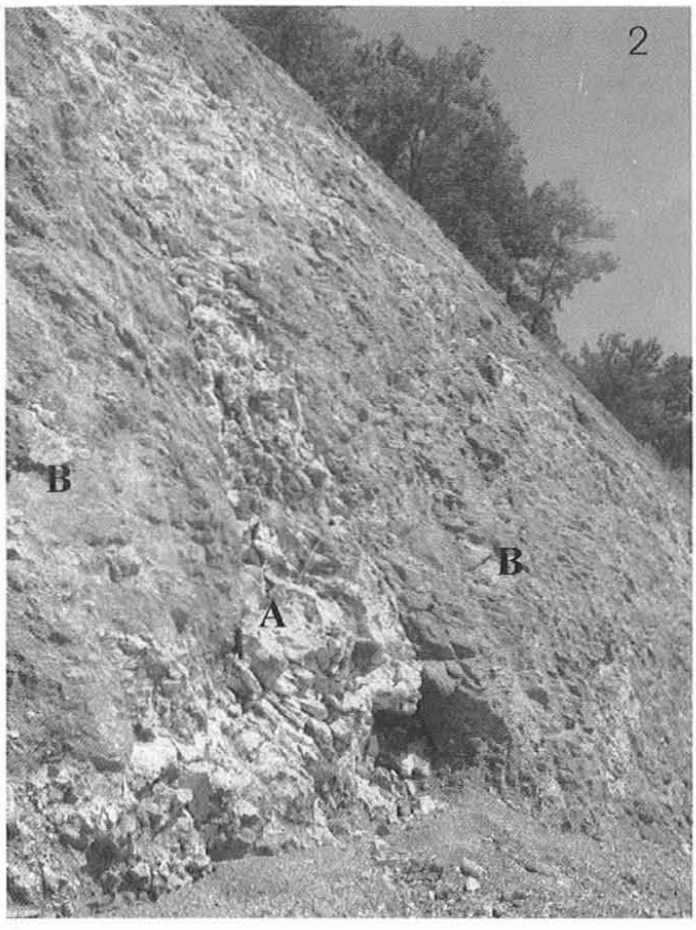

FIG. 2-3: **A** - Carbonate sedimentary veins.
B - Kinzingites (banding gneisses).

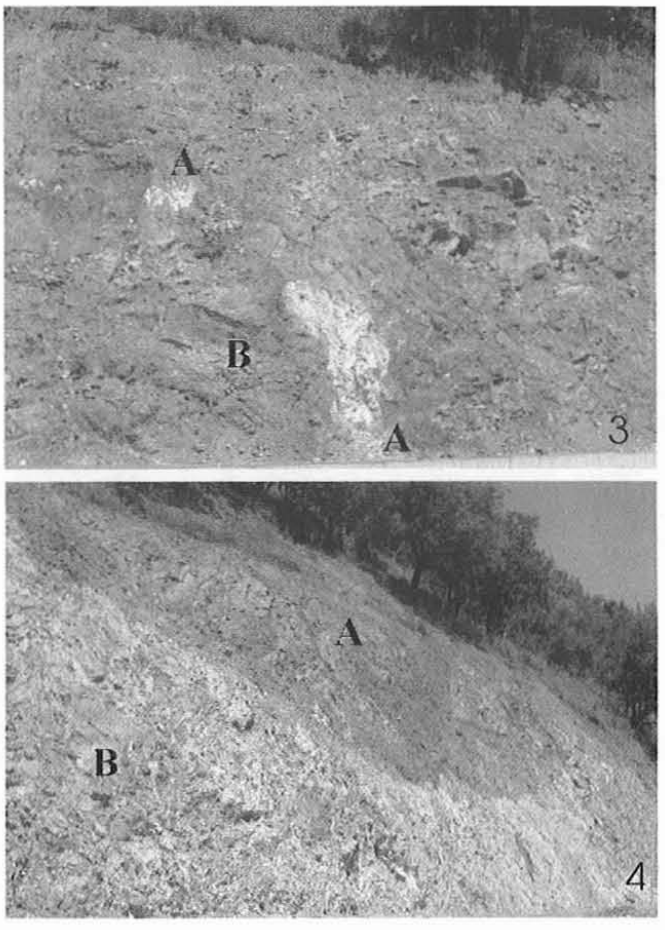

FIG. 4: **A** - Gneissic landslide over carbonate sediments.
B - Breccias and megabreccias cemented by carbonates.

a thickness of about 50 m, pass upwards into white evaporitic calcareous deposits of Messinian age (see Geologic Map of Calabria 1:25.000-F. 241 III SE Vibo Valentia). The dating of this interval, already ascribed to the Tortonian by Nicotera (1959), also in the slightly heteropic facies of the «clypeaster sandstone» near Briatico and Pizzo (clypeasters, also frequent in the sediments studied), is confirmed, not only by the Geologic Map, but also by all the successive literature (Di Nocera & *alii*, 1975).

The cliff described is located, today as in the Miocene, at the north-western border of the neogenic sedimentary basin of Valle Mesima, active from the mid-upper Miocene to the Pleistocene (Ghisetti, 1980; Brogan & *alii*, 1975). The cliff, furthermore, extended at the termination towards the sea of the emerged system of the kinzingites unit, which, in Arco Calabro, forms the geological scaffolding of the ridge running from Vibo Valentia to Pizzo, in turn connected with the granitic batholith which constitutes the promontory of Mt. Poro between Vibo Valentia and Tropea.

Finally, if we wish to draw some comparisons referring to present contexts and geographically close areas, a good example can be the granitoid cliffs of Capo Vaticano and the cliff of Joppolo (in a close Calabrian area). The comparison is particularly appropriate as regards the emerged geomorphological context, neotectonics and seismicity, and also for the type and velocity of sedimentation in the adjacent marine domain. Here, however, the more fragile response of outcropping lithotypes (granitoids) determines a clear prevalence of rock avalanches over landslides in the sedimentary coastal deposits.

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