Il Quaternario
Italian Journal of Quaternary Sciences
***18**(1), 2005 - Volume Speciale, 137-143*

THE MAIN GEOMORPHOSITES OF THE EGADI ISLANDS (SICILY, ITALY)

Raniero Massoli-Novelli
Via della Mendola, 85
00135 Roma, Email: massoli@tiscali.it

ABSTRACT: R. Massoli-Novelli, *The main geomorphosites of the Egadi Islands (Sicily, Italy)*. (IT ISSN 0394-3356, 2005).
This article describes the main geological and geomorphological features of the three main Egadi Islands: Favignana, Levanzo and Marettimo. These islands, which are essentially made up of Mesozoic carbonate rocks, are considered as the continuation in the sea of the north-western Sicilian chain.
In addition, the main geomorphosites of these three islands are identified for the first time: these are the numerous, significant coastal caves. Particular emphasis is given to natural and anthropogenetic geomorphosites related to the Pleistocene bioclastic calcarenite caves present in Favignana, an ancient site of intense quarrying activities.

RIASSUNTO: R. Massoli-Novelli, I principali geomorfositi delle Isole Egadi (Sicilia, Italia)*. (IT ISSN 0394-3356, 2005).*
Vengono evidenziate le principali caratteristiche geologiche e geomorfologiche delle tre maggiori isole delle Egadi, Favignana, Levanzo e Marettimo, costituite essenzialmente da rocce carbonatiche mesozoiche e considerate la prosecuzione in mare verso ovest della catena nordoccidentale della Sicilia.
Vengono poi individuati per la prima volta i principali geomorfositi delle tre isole, in gran parte costituiti dalle numerose e rilevanti grotte costiere. Particolare risalto viene anche dato ai geomorfositi, naturali ed antropici, relativi alle cave di calcareniti bioclastiche pleistoceniche esistenti a Favignana, luogo di antica ed intensa attività estrattiva.

Keywords: Geomorphosites, Calcarenite, Egadi Islands, Italy.

Parole chiave: Geomorfositi, Calcarenite, Egadi, Italia.

1. INTRODUCTION AND GENERAL GEOLOGICAL SETTING

The Egadi archipelago is formed by three main islands – Favignana, Levanzo and Marettimo – and the islets of Maraone and Formica.

All these islands are geologically linked to the adjacent mainland. In other words, the Egadi are the continuation in the sea of the backbone chain of north-western Sicily (Fig. 1).

The basic geological composition of this archipelago corresponds to calcareous-dolomitic rocks, ranging in age from the Triassic to the Miocene.

Subsequently, layers of sandstones were deposited on top of the carbonate rocks. In particular, bioclastic calcarenites crop out abundantly on the largest island of Favignana. They are typical poorly cemented, easily workable, yellowish calcareous limestones rich in pelecypods, especially the *Pecten genus*. Owing to these characteristics, since the 1700s this stone has been called “tufo” (i.e., tuff; a similar wrong definition has been given to the stones of Matera in Basilicata). These limestones have been intensely quarried through time. No detailed studies have been ever carried out on this interesting stone, although it appears to be quite similar to the proximal bioclastic calcarenite outcrops of the Lower Pleistocene along the coast of Marsala (Ruggieri *et al*., 1975) and in San Vito Lo Capo (Antonioli *et al*., 1994).

The presence of compact calcareous-dolomitic rocks explains the two essential geomorphological characteristics of the Egadi Islands: cliffs and high reliefs in all the islands, especially in the two smaller ones, and many large caves. The highest peak is Mt. Falcone in Marettimo, which reaches a height of 686 m. Not only is this island the furthest from the Sicilian coast but it is also the one most affected by tectonic processes, with numerous overthrusts and transcurrent faults (Abate *et al.*, 1995, 1996).

Favignana is the largest of the Egadi Islands. Owing to its shape, it is compared to a butterfly: at the centre of the island, a north-south ridge of Mesozoic calcareous-dolomitic rocks stands out, reminiscent of a butterfly’s body. At the sides, calcareous marine sediments to the west and arenaceous marine sediments to the east were subsequently deposited on these hard and compact carbonate rocks, forming two small plains: the butterfly’s wings.

In the plain to the east, abundant strata of Pleistocene bioclastic calcarenites crop out (the “tufo” or Favignana stone previously mentioned). These rocks, between a few centimetres to about 30 cm thick, show a generally sub-horizontal bedding. The calcarenite is a marine, very rich in fossils (pelecypods, corals, remains of fish, etc.) calcareous sandstone.

The isle of Levanzo, which is the smallest of the three main Egadi Islands, is famous for its rugged land-

scape and absence of beaches.

Also Marettimo, the most mountainous of the Egadi Islands, has practically no beaches. From the geological standpoint, it is older than the other two islands, since it is mostly composed of Triassic-Lias limestones and dolostones (Incandela, 1996). Because of its position in the open sea, surrounded by a deep sea floor, Marettimo is often windswept and pounded by westerly and northerly breakers. As a consequence, this island has a much more jagged coastline than Levanzo and Favignana.

2. THE MAIN GEOMORPHOSITES OF THE EGADI ISLANDS

The main geomorphosites identified on each island are here below illustrated with progressive numbers, with reference to the map in Fig. 1.

2.1 Isle of Favignana

The excursion starts from the south, from the "Scindo Passo" cliff, where a long vertical rock wall of tectonic origin is found. This area is characterised by

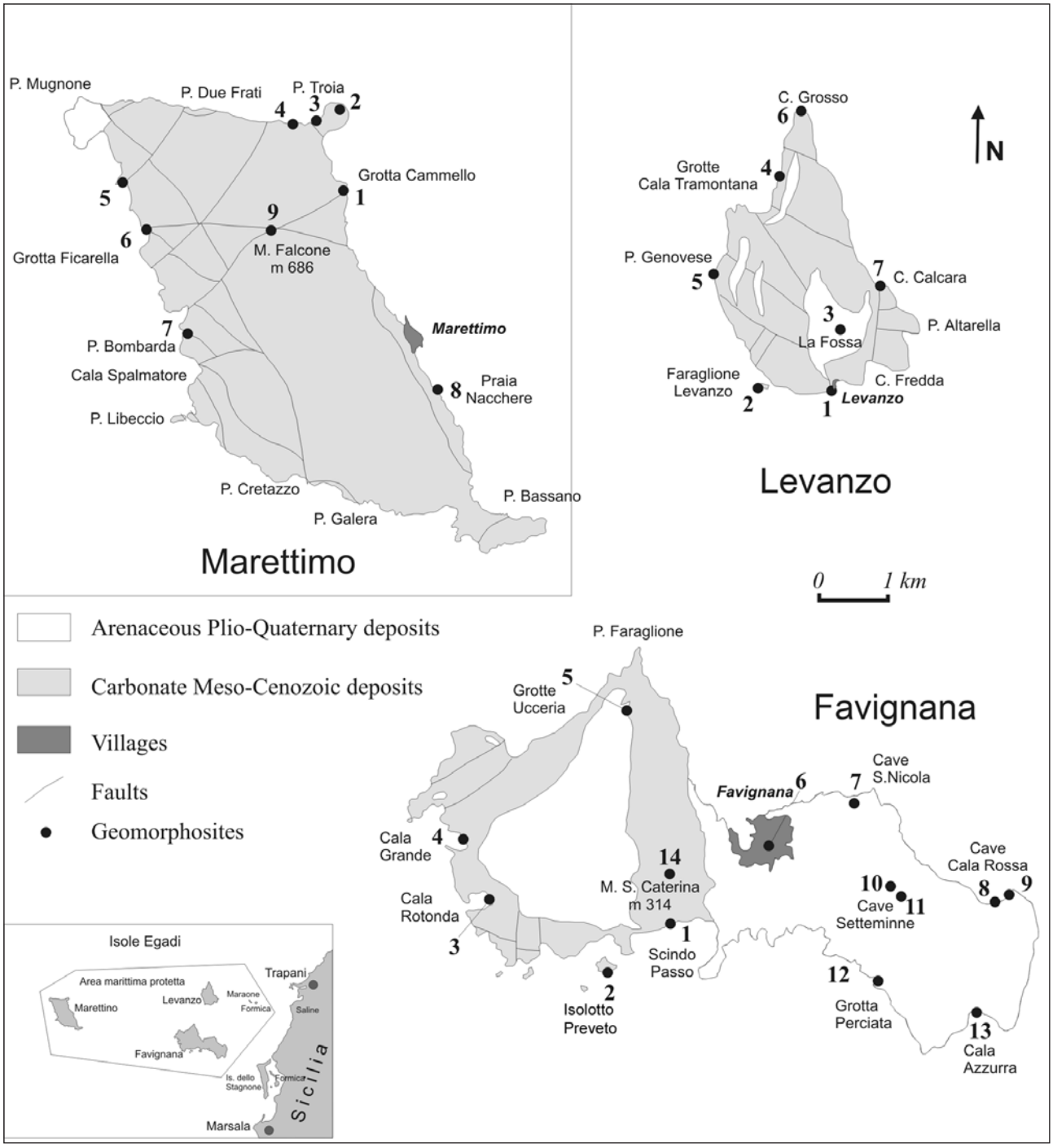

Fig. 1 – Schematic geological map of the Egadi Islands. Numbers refer to the geomorphosites listed in the text.
Cartina geologico-schematica delle isole Egadi: i numeri si riferiscono ai geomorfositi elencati nel testo.

the presence of large, unstable limestone boulders which have caused several rock falls. This cliff and the rock fall materials make up an interesting geomorphosite (1), easily observable from the asphalt road.

To the south, another geomorphosite is found: the "Preveto Islet" (2), which is made up of Mesozoic limestones. This geosite is the obvious continuation into the sea of the Favignana ridge.

To the west, the perfectly circular natural inlet of Cala Rotonda is found. Inside it, a small geomorphosite named the "Arch of Ulysses" (3) is located. This is a remarkable, thin natural arch rising from the sea. All the western coast is made up of vast sub-horizontal outcrops of limestones and calcareous breccias and is an important example of an ancient sub-aerial plain which was later reworked by the sea. It contains innumerable microforms of the *Karren* and pot-hole types, which are particularly visible in the Cala Grande area. It is therefore possible to identify a karst coastal plain of the Cala Grande geomorphosite (4).

To the north, high on a cliff towards Punta Faraglione, there are two large karst caves very close to each other. The one known as "Grotte dell'Ucceria" has two entrances and important prehistoric artefacts were found inside it. This two-cave complex makes up an important karst-type geomorphosite (5).

We shall now describe the eastern side of Favignana, with its calcarenite sandstones and the previously mentioned "tufo" quarries.

For many centuries this "tufo" rock was exploited as the most important economic activity of this island, together with fishing and farming. The quarrying of this material goes back to very ancient times – certainly Roman times – but the peak of quarrying activities dates back to the period between the 17th and 19th centuries. Many palaces in Tunis were built with Favignana "tufo". The same rock was used for the reconstruction of Messina after it had been destroyed by the earthquake of 1908.

Indeed "tufo" has always typified the isle of Favignana. Apart from making up most of the geological landscape, it can be observed everywhere as building material: numerous houses and stone walls dividing land properties are made of it.

There are about 150 existing quarries, of which most are open cast quarries or pit-like ones. On the other hand, other quarries have been dug out underground. Four groups of caves, which are the most interesting and representative of several types are here proposed as geomorphosites:

- "ancient quarries in the village of Favignana" (6), in particular those next to the security prison. Although there is no certainty about their age, it is assumed that most of them were excavated between the 17th and the end of the 19th century. These sites are now utilised as gardens and small orchards;
- "ancient coastal quarries of San Nicola" (7), whose floors have now been covered by sea advancement for a depth of about 20 cm, and where the ancient submerged excavation frames are still perfectly visible (Fig. 2). The calcarenites are very rich in fossils here, especially in *Pecten* specimens. It is assumed that they were exploited between the Middle Ages and the last century, in analogy with the nearby coastal quarries of bioclastic calcarenites of San Vito Lo Capo, which are also submerged (Antonioli *et al*., 1994). Recently, in the area of San Nicola, the skeleton of a cetacean in a horizontal position, embedded in calcarenite, was found, together with layers of pelecypod shells. This large marine mammal was probably grounded on the beach (Massoli-Novelli, in press);
- "ancient/modern quarries of Cala Rossa" (Fig. 3), here different types of quarries are found: coastal open cast quarries (8) and underground excavated quarries (9), with the presence of numerous, considerable sedimentation structures, in particular cross-bedding, which were exploited manually in the past centuries;
- "recent quarries of Setteminne-Torretta" (10), these are often large pit-type quarries, up to 30 m deep, which have been worked by means of cutting machines. Many of them were recently abandoned, although some are still active in order to guarantee the required material for restoring the many old houses built of calcarenite stones.

As has been suggested by many authoritative sources, the Favignana "tufo" quarries should be reclaimed for cultural and geotourism purposes, as, for example, a Quarry Museum or an Earth Museum. Furthermore, in Setteminne there are two large contiguous quarries which together make up an interesting geomorphosite (11). They are both pit-type quarries; the first one is abandoned but it still has a typical residual

Fig. 2 – Aerial view of the Cala Rossa ancient "tufo" quarries (Pleistocene bioclastic calcarenite), isle of Favignana: the resulting landscape is similar to that of an abandoned city (photo by Tamagnini).

Le antiche cave di "tufo" (calcarenite bioclastica pleistocenica) di Cala Rossa, isola di Favignana, osservate dal cielo: il paesaggio che ne deriva risulta simile a quello di una città abbandonata (Foto Tamagnini).

Fig. 3 – The spectacular Pilastro calcarenite quarry, in Setteminne of Favignana. This is a recently opened quarry, as witnessed by the marks of the digging machines. It has now been abandoned and, hopefully, should be reclaimed and appraised (photo by Massoli-Novelli).

La spettacolare cava di calcarenite del Pilastro, in località Setteminne di Favignana, una cava recente come mostrano i segni delle macchine tagliatrici, abbandonata da poco ed in attesa di una auspicabile valorizzazione (Foto Massoli-Novelli).

Fig. 4 – Ancient calcarenite coastal quarry in San Nicola, isle of Favignana. It probably goes back to Medieval times and its floor is at present under 20-30 cm of sea water (photo by Massoli-Novelli).

Antica cava costiera di calcarenite a San Nicola, isola di Favignana, di età probabilmente medioevale, dove il pavimento è oggi ricoperto da 20-30 cm di acqua di mare (Foto Massoli-Novelli).

pillar of the excavation activities (Fig. 4), whereas the second one has a regular square shape which would be very suitable as a stage for open-air summer shows by night.

Along the south-eastern coast another natural geomorphosite is found: the "Grotta Perciata" (12). Here the sea hollowed out a cave which has partially collapsed, leaving only an interesting arch and a little shelter for two or three fishing boats. Further to the south-east, the "Cala Azzurra" is found, which is another coastal geomorphosite (13) of great scenic value, with the only sandy beach of the island, which is divided into two parts by an outcrop of compact calcarenite.

Finally, after this series of prevalently coastal geomorphosites, an outstanding internal site is found on top of the Mesozoic carbonate ridge at the centre of the island: Mount Santa Caterina (14), at an altitude of 314 m a.s.l., where the Fort bearing the same name rises and from which a spectacular view over the village, the harbour and the calcarenite quarries can be enjoyed.

2.2 Isle of Levanzo

Levanzo is a small hamlet located in a very beautiful inlet on the island's southern coast. As soon as one arrives there, an interesting geomorphosite (1) is immediately noticeable: it is made up of a large, steep, tectonic pinnacle of Mesozoic carbonate rock, subsequently modelled by erosion, which hangs over the sea and the hamlet.

Following the path to the west, another similar geomorphosite (2) is immediately visible: the well-known "Faraglione di Levanzo", an imposing block of Mesozoic dolomitic limestone, which was first isolated by tectonics and then by sea erosion.

Proceeding uphill towards the "Grotta dei Genovesi", one crosses an area named "La Fossa", which is another geomorphosite (3) corresponding to a karst depression, the only one on the island. This site was cultivated up to a few years ago

and the residual soil, with its typical reddish colour, has been subject to fertilisation. The site is surmounted by an ancient homestead of the Florio family.

The "Grotta dei Genovesi", which is located on the island's western coast, is the main attraction of Levanzo. Owing to its artistic Palaeolithic engravings and Neolithic paintings, this cave is to be considered an important geomorphosite (4). Another peculiarity of this cave is given by the strange scarcity of stalactite/stalagmite concretions, probably due not only to the scarce rainfall of this island but also to the presence of overlying clayey beds. This cave was formed at the foot of a rock wall made up of monoclinal, seaward-dipping thick beds of Mesozoic limestone. These strata show a westward dip-downstream attitude. In proximity of this cave, both on the rock wall overhanging the entrance to the cave and along the underlying coast, the strata crop out extremely well and with considerable regularity.

The land journey along Levanzo's western coast is quite difficult but eventually one reaches Cala Tramontana, which is characterised by a steep calcareous-dolomitic falaise and where a geomorphosite (5) made up of a series of caves named "Grotte di Cala Tramontana" is found. These other caves are all located at nearly the same altitude as the Grotta dei Genovesi, some 10-20 m above the present sea level (Fig. 5). The Cala Tramontana Caves are larger than the more popular Grotta dei Genovesi and they too contain prehistoric and historic remains.

Geomorphosite no. 6 is Capo Grosso, the island's northern point. This site is particularly interesting because tectonic and erosional processes have shaped it as if it had been cut through, giving origin to a magnificent falaise where thick strata of dolomitic limestone are particularly well exposed. This beautiful outcrop shows west-dipping layers at an angle of about 45°.

All the eastern coastline of Levanzo is of the falaise type. Here, another geomorphosite (7), which is interesting not only from a scenic standpoint, can be admired at Capo Calcara, where the strata of Mesozoic dolomitic limestone were cut by a visible N-S oriented fault which has created this little bay.

2.3 Isle of Marettimo

By sailing from the harbour of Marettimo and moving counter-clockwise, it is possible to circumnavigate the whole island and have a good view of the numerous geomorphosites located along the coast. Most of these, are coastal caves, whose origin is mainly to be ascribed to the numerous faults which characterise this island (Abate *et al.* 1996).

Soon after the small beach of Bagno di Fimmine, the interesting "Cave of the Camel" (1) appears, whose name is derived from an adjacent rock similar in appearance to the head of this animal. This cave was affected by the collapse of part of its vault, and the sea water inside it is crystal-clear.

To the north, one of the most prominent geomorphosites of Marettimo is found: the small promontory of "Punta Troia" (2), well-known for the ancient castle that rises on top of it. This site is also important due to particular geological features, such as the perfect semi-arch which links the promontory to the island, thus creating a particularly striking landscape.

Behind Punta Troia, the "Cave of Thunder" (3) is found, so called after the roar created by the waves that after breaking on the outer wall of the cave, are sucked out through a sort of siphon.

Adjacent to the Cave of Thunder, another interesting geomorphosite (4) is found: a gigantic "Talus Fan", indeed the largest fan present on the island. This landform stretches from a canyon high on the cliff as far as the sea-shore, with considerable scenic effect.

All the island's north-western coast, with its jagged coastline and spectacular cliffs rising towards the top of Mt. Falcone (659 m a.s.l.), forms an extremely beautiful and rugged landscape. The "Cave of the Pipe" (5) is the first to be found. This has a high educational value since, more than any other cave, it clearly shows that the origin of the coastal caves is often due to tectonics. In this case, the cavity was developed along a long, partly collapsed, vertical fault. Also "Ficarella Cave " (6) was formed at the foot of a long fault: its rock walls also show evident marks of sea breakers at about 5 m a.s.l.

Shortly afterwards, one arrives at what is considered the most interesting cave, the geomorphosite (7) named "Bombarda Cave" (Fig. 6), near the headland bearing the same name. The cave's peculiarity is not so much given by the fault stretching across its vault but rather by its geological structure, with thick layers of Mesozoic dolomitic limestone in sub-horizontal attitude. Practically, the cave shows long, horizontally striated walls, slightly changing in colour. Owing to an optical effect the horizontal striae seem to enhance the already considerable depth of this cave.

After Bassano Point – the southernmost tip of the island – and before returning to Marettimo, a coastal geomorphosite (8) is found along the regular eastern coast. It consists of one of the very few small beaches of the island, the so-called "Praia Nacchere". Here, a considerable fault can be observed just at the

Fig. 5 – The steep Cala Tramontana coastline of the isle of Levanzo. It is made up of Mesozoic dolomitic limestones and located north of the well-known Grotta dei Genovesi. The "Grotte di Cala Tramontana" geomorphosite, made up of three main karst caves containing prehistoric finds, is also visible (photo by Tamagnini).

La ripida costa di Cala Tramontana, isola di Levanzo, composta di calcari dolomitici mesozoici ed ubicata a nord della nota Grotta dei Genovesi; si nota il gemorfosito "Grotte di Cala Tramontana" dato da tre cavità carsiche principali, anch'esse con reperti preistorici (Foto Tamagnini).

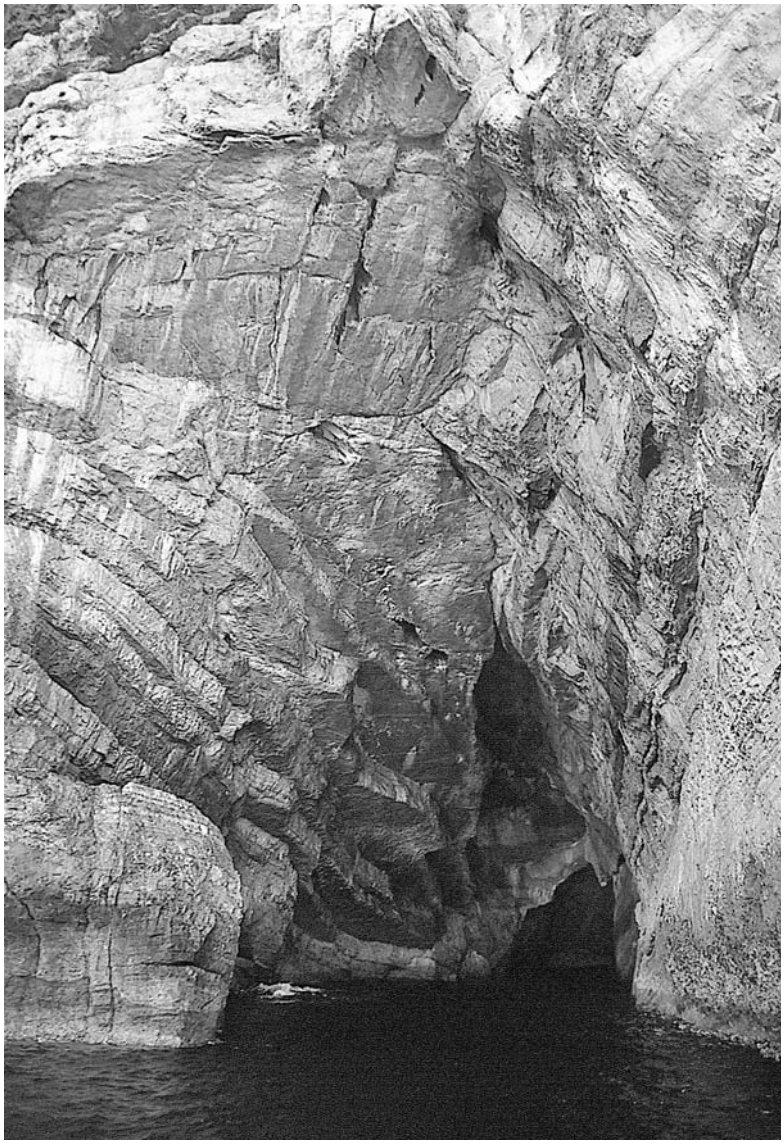

Fig. 6 – La Bombarda cave, located along the western coast of Marettimo, is characterised by thick layers of Mesozoic dolomitic limestones with a sub-horizontal attitude. Along the vault, the fault at the origin of the cave is quite evident. A common tectonic origin characterises most of the numerous karst cavities found on this island (photo by Massoli-Novelli).

La Grotta Bombarda, ubicata lungo la costa occidentale di Marettimo, è caratterizzata da bancate di calcari dolomitici mesozoici in giacitura suborizzontale. Evidente lungo la volta la faglia all'origine della cavità, una origine tettonica comune alla maggior parte delle numerose cavità carsiche dell'isola (Foto Massoli-Novelli).

end of the sandy beach.

Finally, by following a rather demanding trail starting from the village, it is possible to ascend towards geomorphosite (9), which is the island's highest peak: Mt. Falcone, rising to an altitude of 686 m a.s.l.

3. CONCLUSIONS

The geomorphosites of the Egadi Islands are numerous and interesting. They were all formed within two main rock types: i) Mesozoic dolomitic limestones, found in the three main islands, and ii) Pleistocene bioclastic calcarenites present in Favignana.

The geomorphosites resulting from carbonate rocks are mainly coastal caves, stacks, pinnacles and talus fans. On the other hand, the geomorphosites formed within calcarenite rocks are both natural – showing considerable examples of cross-bedding and other sedimentation structures – and anthropogenetic, linked to ancient and intense quarrying activities. On the whole, thirty geomorphosites have been identified as examples of major and immediate interest: 14 in Favignana, 7 in Levanzo and 9 in Marettimo.

Finally it should be noticed that a few years ago the Egadi Islands were declared a Protected Marine Area (AMP) managed at first by the local Harbour-Office and after by the Favignana Municipality. However, at present no educational-divulgative material is yet available on the important and interesting geological-geomorphological features of the Egadi Islands, which should be better understood and appreciated in order to promote sustainable fruition of these natural resources.

Unfortunately, this is not an isolated situation among the eighteen Italian Protected Marine Areas.

ACKNOWLEDGEMENTS

The Author is grateful to Professors Sandra Piacente, from the University of Modena and Reggio Emilia, and Francesco Torre from the University of Trapani, for their critical review of the typescript and useful advice.

REFERENCES

ABATE B., LO CICERO G., & RENDA P. (1982) - *Facies carbonatiche ed evaporitiche del Trias superiore di Marittimo* - Atti Conv. Palermo "Modelli evolutivi delle zone di cerniera nei sistemi piattaforme carbonatiche-bacini", Rend. Soc. Geol. It., 5 (1), pp. 71-76.

ABATE B., FERRUZZA G., INCANDELA A. & RENDA P. (1995) - *Tettonica trascorrente nelle Isole Egadi. In: Geodinamica e Tettonica attiva del sistema Tirreno-Appennino*, Camerino, 9-10 febbraio.

ABATE B., BUCCHIERI G., INCANDELA A. & RENDA P. (1996) - *Le sezioni tirreniane delle località La Conca e Punta Libeccio (Isola di Marettimo, Egadi, Sicilia N-O): indagine stratigrafica e paleoecologica* - Boll. Soc. Geol. It., 115, pp. 145-158.

ANTONIOLI F., PUGLISI C., REITANO G. & TUSA S. (1996) - *Evoluzione geomorfologica pleistocenica del settore costiero di S. Vito Lo Capo (Sicilia): rapporti tra neotettonica, eustatismo e comunità preistoriche* - GEOSUB '94, Conv. Intern. di Geologia Subacquea, Palinuro, 1994, Mem. Descr. Carta Geol. It., 52, pp. 337-360.

ANTONIOLI F., CREMONA G., IMMORDINO F., PUGLISI C., ROMAGNOLI C., SILENZI S., VALPREDA E. & VERRUBBI V. (2002) - *New data on the Holocenic sea-level rise in NW Sicily (Central Mediterranean Sea)* - Global and Planetary Change, Elsevier, 34 (1-2), pp. 121-140.

COLANTONI P., LEMBO P., PANTALEONE N. A., SACCHI L. & SPANIO F., (1993) - *Morpho-lithological map (1:50.000 scale) of the Egadi Islands shelf (western Sicily)* - Proceedings Conf. Geological Development of the Sicilian-Tunisian Platform, Urbino, Italy, November 4-6, 1992, UNESCO Reports in Marine Science, 58, pp. 87-92.

D'ANGELO S., LEMBO P., MARRAS G., SACCHI L. & VENTURA G. (1996) - *Aspetti geologici ed ambientali dei fondali al largo dell'isola di Marittimo* - GEOSUB '94, Conv. Intern. di Geologia Subacquea, Palinuro, 1994, Mem. Descr. Carta Geol. It., 52, pp. 41-52.

GEREMIA F. & MASSOLI-NOVELLI R. (2004) - *Il periplo dell'isola di Lipari (Isole Eolie): alla scoperta dei geomorfositi costieri di origine vulcanica* (in press).

INCANDELA A. (1996) - *Deformazioni neogeniche nelle isole di Favignana e Levanzo* - Mem. Soc. Geol. It., 51, pp. 129-135.

MALATESTA A. (1957) - *Terreni, faune e industrie quaternarie nell'arcipelago delle Egadi* - Quaternaria, vol. 4, pp. 165-190.

MASSOLI-NOVELLI R. (2003) - *Geositi, Geoturismo e Sviluppo sostenibile* - Conv. Naz. SIGEA "La Geologia Ambientale: strategie per il nuovo millennio", in Geologia dell'Ambiente, 1, SIGEA, Roma.

PANIZZA M. & PIACENTE S. (2002) - *Geositi nel paesaggio italiano: ricerca, valutazione e valorizzazione. Un progetto di ricerca per una nuova cultura geologica* - Geologia dell'Ambiente, 2, SIGEA, Roma.

RUGGIERI G., UNTI A., UNTI M. & MORONI M.A. (1975) - *La calcarenite di Marsala (Pleistocene inferiore) e i terreni contermini* - Boll. Soc. Geol. It., 94, pp. 1623-1657.

TORRE F. (1980) - *Levanzo - La Grotta del Genovese* - Comune di Favignana - Assessorato Regionale Beni Cultuali e Pubblica Istruzione.

TORRE F., (1988) - *Notazione a proposito delle oscillazioni del livello del mare nel trapanese durante il Pleistocene medio-superiore* - Sicilia Archeologica, Anno XXIII, no. 74 , Trapani.

ULZEGA A. & ORRU P. (1989) - *Piattaforma continentale delle Egadi* - In: V. Agnesi, T. Macaluso, A. Ulzega, Guida alle escursioni, Gruppo Nazionale Geografia Fisica e Geomorfologia, C.N.R., Trapani, 27-30 giugno 1989, Università di Palermo.