

FIRST RECOVERY OF MARINE QUATERNARY DEPOSITS FROM GEOGNOSTIC BOREHOLES OF THE COASTAL PLAIN OF MARINA DI CAMPO (ELBA ISLAND): PRELIMINARY RESULTS

Maurizio D'Orefice¹, Luca Foresi² & Roberto Graciotti¹

¹ISPRA – Servizio Geologico d'Italia, Roma

²Dipartimento di Scienze Geologiche, Università di Siena, Siena

Corresponding author: M. D'Orefice <maurizio.dorefice@isprambiente.it>

ABSTRACT: D'Orefice M. *et al.*, *First recovery of marine quaternary deposits from geognostic boreholes of the coastal plain of Marina di Campo (Elba Island): preliminary results.* (IT ISSN 0394-3356, 2011).

Here we describe the preliminary results deriving from the analysis of the S2 geognostic borehole, which was drilled near the town of Marina di Campo (Elba Island). Starting from a ground level at 1.29 m above the sea level, 25 m of Quaternary deposits have been cored. These deposits are probably related to the last glacial-eustatic cycle. In particular, the lower part of the borehole is characterized by gravel and sandy-silt sediments typical of a fluvial environment. They settled during a low-stand phase of the Last Glacial Maximum. These deposits are unconformably covered by coastal marine sands, sandy-silts and biocalcarenes (between -11.90 m and -5.20 m from the ground level) that were ascribed to the last sea level rise. The upper part of the geognostic survey is characterized by dark and plastic organic clays (from -5.20 m to the top). The basal clays are still marine (an age of 4.36 ± 3.81 ky cal BP has been obtained by radiocarbon dating), whereas those of the intermediate part are brackish (3.97 ± 3.45 ky cal BP). In the upper part we found clays that settled in a freshwater environment.

RIASSUNTO: D'Orefice M. *et al.*, *Primi depositi quaternari marini rinvenuti nei sondaggi geognostici effettuati nella piana costiera di Marina di Campo (Isola d'Elba): risultati preliminari.* (IT ISSN 0394-3356, 2011).

Nella presente nota vengono descritti i risultati preliminari delle analisi condotte sulle carote prelevate nel sondaggio S2, realizzato alle spalle del centro abitato di Marina di Campo (Isola d'Elba). Il sondaggio, spintosi sino alla profondità di -25,00 m dal piano campagna (p.c.), ha attraversato terreni quaternari in gran parte riferibili all'ultimo ciclo glacio-eustatico. In particolare, la metà inferiore del sondaggio ha intercettato depositi ghiaiosi e sabbioso-limosi d'ambiente fluviale depositisi nel corso di una fase di basso stazionamento del livello marino attribuibile all'ultimo massimo glaciale. Questi depositi passano superiormente (tra -11,90 e -5,20 m dal p.c.), con contatto netto erosivo, a sabbie, limi sabbiosi e biocalcarenes di chiara origine marina, attribuibili all'ultima risalita eustatica del livello del mare. La porzione superiore del sondaggio (da -5,20 m sino al p.c.) è composta da argille scure organiche plastiche. Tali argille sono d'ambiente ancora marino nella loro parte basale (età radiometrica intorno ai $4,36 \pm 3,81$ ky cal BP), poi lagunare salmastro nel tratto intermedio ($3,97 \pm 3,45$ ky cal BP) ed infine d'acqua dolce nella parte superiore.

Key words: Quaternary geology, geognostic boreholes, marine deposits, Marina di Campo (Elba Island).

Parole chiave: geologia del Quaternario, sondaggi geognostici, depositi marini, Marina di Campo (Isola d'Elba).

In the small area of the Elba Island, the presence of a considerable variety of lithotypes, ranging from Paleozoic to Miocene, contrasts with the almost total absence of marine Neogene and Quaternary deposits (BARBERI *et al.*, 1969). Only few outcrops of uncertain marine origin are reported by MAZZANTI (1983) and CENTAMORE *et al.* (1988). Yet, Neogene and Quaternary marine units extensively outcrop in the nearby island of Pianosa (FORESI *et al.*, 2000; GRACIOTTI *et al.* 2002-2003) and along the Tuscan coast (MAZZANTI, 1983).

As a part of the geomorphological survey of the Elba Island (one project at a scale 1:50.000), six shallow continuous-core boreholes (< 30 m) were drilled in order to characterize the deposits of the main coastal plains. Among them, four boreholes were drilled in the plain of Marina di Campo (central-southern Elba), one near Magazzini (central-northern Elba) and the last one close to the locality of S. Giovanni (central-northern Elba).

The sedimentological, micropaleontological (foraminifers and ostracods) and palynological analysis of many samples is ongoing. Currently, 20 radiometric dating analyses were carried out using the technique of mass spectrometry (AMS). Other dating analyses are planned for the near future.

The S2 borehole [25 m coring interval, from 1.29 m asl (above sea level) to 23.71 m bsl (below sea level)] is the most interesting. It is located just west of the coastal dune on which stands the Marina di Campo town, and records Quaternary sediments of marine environment between 3.31 m bsl and 10.61 m bsl. For the first time, the presence of marine deposits of Quaternary age is documented for certain on the Elba Island.

The lower part of the borehole, from 25 m to 11.90 m bgl (below ground level) is mainly characterized by coarse gravel beds alternating with silty-clayey sands (Fig. 1). The gravels are sub-angular, heterometric (ranging from some millimeters to a

maximum of 8 cm), heterogeneous (they derived from monzogranitic, porphyric and arenitic rocks), and are supported by a silty-sandy matrix. The gravel beds have an average thickness of about 150 cm, while the silty-clayey sands beds are 20÷230 cm thick. The finer levels are sometimes characterized by oxidized sandy laminae. No fossils were recovered in the lower interval of the borehole.

Starting from 11.90 m bgl, the coarse deposits of the lower part are unconformably covered by fine sands (80 cm thick). The contact is sharp and erosive. The sands pass up to matrix supported gravel beds (20 cm thick), rich of siliceous and poorly elaborate centimetric clasts. Laminated silty sands with ochreous levels and clayey silty fine sands (120 cm total thickness) lay above the gravels. Small fragments of mollusk, Foraminifera and rare rests of others marine organism were found in the intervals 11.90 m ÷ 11.10 m and 10.50 m ÷ 9.70 m bgl.

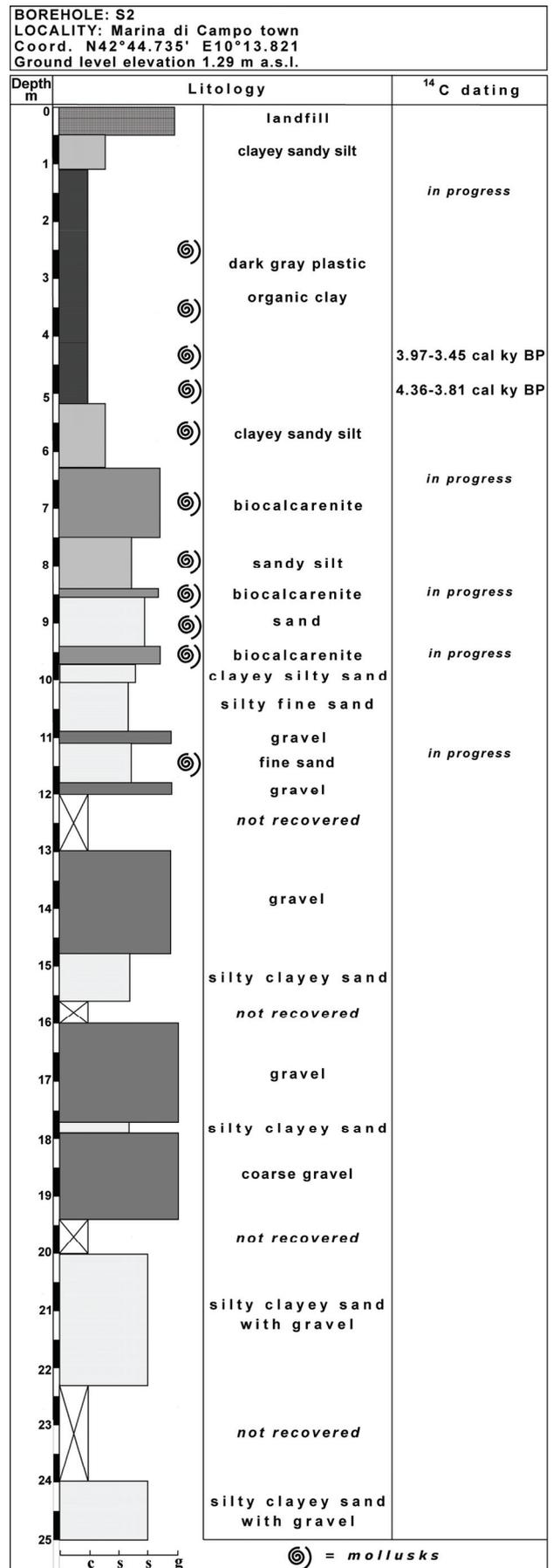
The interval between 9.70 m and 5.20 m bgl is composed of a sequence of highly fossiliferous sands, sandy silts and clayey sandy silts, alternating with three levels of biocalcarenites: the first between 9.70 m and 9.40 m, the second between 8.50 and 8.40 m and the third between 7.50 m and 6.30 m bgl. The micropaleontological analysis allowed to identify an abundant organic fraction consisting of mollusks, calcareous algae, foraminifers, ostracods, echinoids, sponge spicules, bryozoans and other minor components.

At 5.20 m bgl, very dark gray plastic organic clays cover the fossiliferous sands and silts. The contact between the two units is sharp. The clays contain fossil assemblages which are significantly different from bottom to top. The interval from 5.20 m to 4.60 m bgl contain mollusks, echinoids, foraminifers, ostracods and calcareous algae typical of coastal marine environment. Oligotypical assemblages of brackish environment are recorded from 4.60 m to 2.40 m bgl. They are composed of mollusks, ostracods, foraminifers (*Ammonia tepida* and *Nonion* sp.) and *Characeae oogonia*. The clays in the interval 2.40 m ÷ 1.10 m bgl contain only plant debris and rare *Characeae oogonia*. This denotes a very shallow fresh water environment.

Two radiometric dating analyses carried out on *Cerastoderma* shells from two levels at 4.95 m and 4.30 m bgl have provided calibrated age of 4.36÷3.81 ky BP and 3.97÷3.45 ky BP, respectively.

The upper part of the borehole is characterized by barren clayey-sandy silt in the interval 1.10÷0.50 m

Fig. 1 – Synthetic log of the S2 borehole.
Log sintetico del sondaggio S2.



Depth (m bgl)	Litology and depositional environment	Relative sea level
0.0 ÷ 0.5	landfill	
0.5 ÷ 1.1	sandy clayey silt typical of fresh water environment	sea level high-stand
1.1 ÷ 2.4	very dark gray plastic organic clays deposited in a very shallow brackish or freshwater environment	sea-level high-stand
2.4 ÷ 4.6	very dark gray plastic organic clays deposited around 3.97÷3.45 ky cal BP in a brackish environment	sea-level high-stand
4.6 ÷ 5.2	very dark gray plastic organic clays deposited around 4.36÷3.81 ky cal BP in a shallow marine environment	sea-level high-stand
5.2 ÷ 9.7	sand, silty sands and biocalcarenes of marine infralittoral environment	transgressive phase of post-glacial sea level rise
9.7 ÷ 11.9	sands of very shallow marine environment, with levels of gravels and silty fine sands of fluvial environment	transgressive phase of post-glacial sea level rise
11.9 ÷ 25.0	gravels and sands of fluvial environment	sea level low-stand of the Last Glacial Maximum

Tab. 1 – Main lithotypes and depositional environments recorded by S2 boreholes, associated with relative sea level change. *Principali litotipi e ambienti deposizionali riscontrati nel sondaggio S2, associati alle variazioni relative del livello del mare.*

bgl and by 0.50 m of landfill.

On the basis of sedimentological characteristics and fossil content, eight main depositional intervals can be recognized starting from the stratigraphic top (ground level). They are summarized in Table 1.

In conclusion, preliminary data from the S2 borehole introduces new elements to reconstruct the evolution of the Quaternary plain of Marina di Campo, with particular attention to the last glacial-eustatic cycle. New chronological, paleontological and palynological constrains will be available once the analysis of the entire set of the S2 samples and the careful examination of the stratigraphy of the other five boreholes will be complete.

REFERENCES

BARBERI F., DALLAN L., FRANZINI M., GIGLIA G., INNOCENTI F., MARINELLI G., RAGGI G., SQUARCI P., TAFFI L. & TREVISAN L. (1969) - *Note illustrative della*

Carta Geologica d'Italia alla scala 1:100.000. Foglio 126 Isola d'Elba. Min. Ind. Comm. Art. - Serv. Geol. d'It., 41 pp.

CENTAMORE E., DRAMIS F. & FEDERICI P. R. (1988) - *Superfici di spianamento relitte e vicende morfotettoniche dell'Isola d'Elba.* Suppl. Geogr. Fis. Dinam. Quat., 1, 155-160.

FORESI L. M., CORNAMUSINI G., BOSSIO A., FERRANDINI J., FERRANDINI M., MAZZANTI R., MAZZEI R. & SALVATORINI G. (2000) - *The Miocene sedimentary succession of the Pianosa Island, Northern Tyrrhenian Sea.* "Evoluzione Geologica e Geodinamica dell'Appennino" in memoria del Prof. G. Pialli. Foligno, 16-18 Febbraio 2000, 155-157.

GRACIOTTI R., FORESI L. & PANTALONI M. (2004) - *Lineamenti geomorfologici dell'Isola di Pianosa.* Soc. Tosc. Scien. Nat. Atti serie A.

MAZZANTI R. (1983) - *Il punto sul Quaternario della fascia costiera e dell'Arcipelago di Toscana.* Boll. Soc. Geol. It., 102, 419-556.