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Oggetto: P.O. Italia-Malta 2007-2013 progetto SIMIT "Costituzione di un sistema integrato di protezione civile transfrontaliere italo-maltese", codice BI-2.19/11 - CUP: G75J13000000006 (Partecipazione 87° Congresso della Società Geologica Italiana, Milano, 10-12 Settembre 2014)

Nell'occasione del Congresso Nazionale della Società Geologica, tenutosi a Milano tra il 10 ed il 12 di Settembre, ho presentato parte dei risultati ottenuti nell'ambito della ricerca che sto portando avanti nel progetto SIMIT "Costituzione di un sistema integrato di protezione civile transfrontaliere italo-maltese".

Nello specifico sono stati presentati i seguenti poster:

- "Foresi L.M., Baldassini N., Lirer F., Verducci M., Mazzei R., Salvatorini G., Ferraro L., Da Prato S., Di Stefano A. – *The St. Peter's Pool section (Malta Island): progress towards the Langhian GSSP.*"
- "Biolchi S., Furlani S., Baldassini N., Antonioli F., Cucchi F., Devoto S., Di Stefano A., Gambin T., Gauci R., Monaco C., Scicchitano G. – *Large boulders along the Maltese coasts.*"

E' stato in questo modo possibile sottolineare sia la rilevanza dei risultati ottenuti, che hanno posto l'interesse della comunità scientifica sull'Arcipelago Maltese, sia mostrare i primi risultati nell'ambito della stima e valutazione del rischio connesso a sismicità nell'area Centro Mediterranea. Nello specifico, particolare attenzione è stata rivolta agli accumuli di massi misurati e studiati lungo l'intera costa settentrionale e nord orientale di Malta. Attraverso recenti datazioni col metodo del radiocarbonio, da noi effettuate presso il centro CEDAD dell'Università del Salento coordinato dal Prof. Calcagnile, tali accumuli, che hanno un'età confrontabile con eventi sismici storici, potrebbero essere connessi all'attività di onda da tsunami. Informazioni di questo tipo consentiranno nell'immediato futuro di poter stilare una mappa della pericolosità da tsunami per le aree riconosciute più a rischio nell'arcipelago.

Niccolò Baldassini





The St. Peter's Pool section (Malta Island): progress towards the Langhian GSSP



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In the last two decades, we have witnessed an intensive chronostratigraphic revision of the Neogene period, carried out by the International Commission on Stratigraphy (Gradstein et al., 2004), which culminated in the ratification of several boundary stratotypes. Concerning the Early and Middle Miocene, the Burdigalian and Langhian reference sections are still missing, whereas the GSSP of the Serravallian Stage has been recently proposed by Abels et al. (2005) and ratified in the section of Ras Il Pellegrin (Malta Island) at 13.82 Ma (Hilgen et al., 2009). The base of the Burdigalian Stage has been provisionally placed by Laurens et al. (2004) in coincidence of the first occurrence of the calcareous nanofossil *Helicosphaera amplipecta*, and the base of the Langhian Stage in coincidence of the top of Subchron C5Cn.1n or of the *Praearbulina* datum (*P. glomerata curva* First Occurrence in the acceptance of Iaccarino et al., 2011). Recently, Foresi et al. (2011) have recognized a suitable section to host the Langhian GSSP in the deposits of the Upper Globigerina Limestone member (Globigerina Limestone formation) outcropping in the Malta Island, namely the St. Peter's Pool section.

Geological Setting

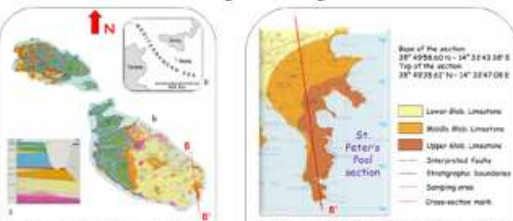


Fig. 1 - a) Location Map of the Maltese Islands b) Geological map and cross-section mark (B-B') from Oil Exploration Directorate (1993). c) Stratigraphic succession of the Maltese Archipelago.

Fig. 2 - Detailed view of the Delimara Peninsula (south-eastern coast of Malta Island) from Oil Exploration Directorate (1993). The violet line highlights the sampling area of the St. Peter's Pool section. The red line represents a portion of the cross-section of the studied area.



Fig. 3 - Cross-section (B-B') from Oil Exploration Directorate (1993)

The St. Peter's Pool section (Fig. 2) was sampled for a stretch of about 500 meters along the southern coast of the Delimara Peninsula (south-eastern part of Malta Island, Figs. 1, 2, 3) in the deposits of the Upper Globigerina Limestone member (Globigerina Limestone formation). The excellent quality of the exposures allowed to correlate layer by layer the sampled outcrops. The base of the section coincides with the brown phosphatic C2 level of Pedley (1975) which lies immediately above the grey marls of the Middle Globigerina Limestone member (Fig. 4a, b). The St. Peter's Pool section is 31 m thick and is composed of rhythmic repetitions of yellowish marly limestones and limestones which sometimes protrudes as hardened limestones brown in color (Figs. 4, 5, 8). About 12 m above the base, 2 meters of gray calcareous marl crop out (Fig. 4c, d). All lithotypes are very bioturbated and show an increase of trace fossils upward, which reaches the highest density in the carbonatic portion.

The St. Peter's Pool section



Fig. 4 - Selected pictures of the St. Peter's Pool exposures. a, b) panoramic view of the uppermost part of the Middle Globigerina Limestone member (MGLm) and Upper Globigerina Limestone member (UGLm). The red arrow indicates the boundary between the two units. c, d) panoramic view of the intermediate layers of the section. The red arrow highlights a well recognizable gray calcareous marl bed, which has been considered a very useful tool for stratigraphic correlations throughout the Delimara Peninsula by Foresi et al. (2011).

Sampling operations



Fig. 5 - The section was sampled using a hand-core driller system with a spacing of 10 cm taking samples from 172 levels. Up to 4 cores from each level were collected in order to perform biostratigraphic (foraminifera and calcareous nanofossils), cyclostratigraphic, magnetostratigraphic, magnetic susceptibility, reflectance and CaCO₃ analyses.

Paleomagnetic analysis

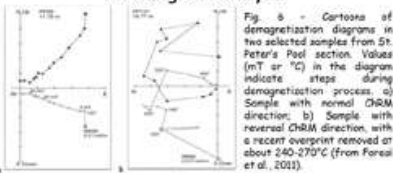


Fig. 6 - Cartoons of demagnetization diagrams in two selected samples from St. Peter's Pool section. Values (mT or °C) in the diagram indicate steps during demagnetization process. a) Sample with normal ChRM direction. b) Sample with reversed ChRM direction, with a recent overprint removed at about 240-270°C (from Foresi et al., 2011).

Fig. 8 - Paleomagnetic results and quantitative distribution patterns of planktonic foraminifera and calcareous nanofossils from St. Peter's Pool section plotted versus the Astronomical Tuned Neogene Time Scale (ATNTS) of Laurens et al. (2004), from Foresi et al. (2011). The numbers (1-25) represent the calcareous plankton bioevents recognized through qualitative and quantitative analysis: 1) *P. acrostoma* LCO; 2) *cf. peripherovindex* base of the continuous presence; 3) *cf. insularis* first appearance; 4) *H. amplipecta* LCO; 5) *cf. zizovae* FO; 6) *cf. almonitae* LCO; 7) *cf. praesicula* first common and continuous presence; 8) *cf. peripherovindex* end of common interval; 9) *P. bella* LCO; 10) *cf. subquadratus* last common and continuous presence; 11) *cf. almonitae* LCO; 12) *P. zizovae* A,B (Acme Base); 13) *H. amplipecta* 1,B (Influx 1 Base); 14) *P. zizovae* A,E; 15) *H. amplipecta* 1,E; 16) *S. heteromorphus* PB (Paracone Begin); 17) *H. waltrani* FO; 18) *H. amplipecta* A,C (Acme Spike); 19) *P. zizovae* A,B; 20) *cf. mariae* mariae FO; 21) *cf. bimaculata* FO; 22) *S. heteromorphus* PE (Paracone End); 23) *cf. insularis* last presence; 24) *P. bella* LO; 25) *P. zizovae* A,E.

Age-Depth Model

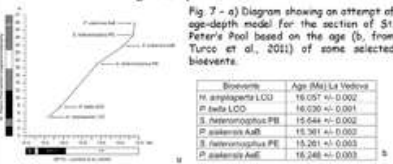
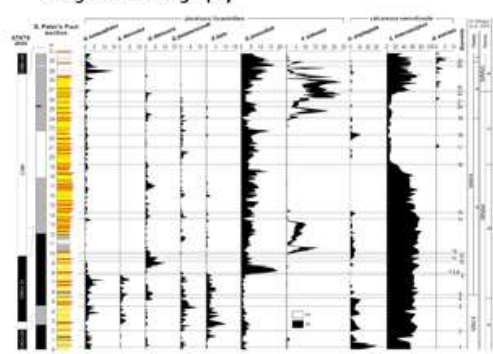


Fig. 7 - a) Diagram showing an attempt of age-depth model for the section of St. Peter's Pool based on the age (b, from Turco et al., 2011) of some selected bioevents.

Integrated stratigraphy



Conclusions

- 1) The bio-magnetostratigraphic results allowed to frame the deposition of the UGLm in the St. Peter's Pool section between the upper Burdigalian (about 16.5 Ma) and the lower-middle Langhian (about 15.2 Ma.), highlighting the oldest deposits of this member in the Maltese Archipelago.
- 2) The St. Peter's Pool section is a potential candidate for the definition of the Langhian GSSP because 1) it is characterized by very easily accessible outcrops, 2) thanks to the rich and well preserved micropaleontological assemblages, several stratigraphic biohorizons useful for worldwide correlation (e.g., the LCOs of the calcareous nanofossil *Helicosphaera amplipecta* and of the planktonic foraminifera *Paraglobobulimina bella*) can be provided, 3) it yields one of the historical criteria considered crucial to define the Langhian GSSP (the C5Cn.1n/C5Br magnetostratigraphic boundary), 4) it is characterized by stratigraphic continuity with the section yielding the Serravallian GSSP (Ras Il Pellegrin, Malta Island), 5) it shows a clear lithological cyclicity.

REFERENCES 1) Abels et al. (2005) - *Paleoceanography*, 20, ppg. 1-11. 2) Foresi et al. (2011) - *Stratigraphy*, 8 (2-3), ppg. 125-143. 3) Gradstein et al. (2004) - *A Geologic Time Scale 2004*. Cambridge. 4) Hilgen et al. (2009) - *Episodes*, 32(2), ppg. 152-166. 5) Iaccarino et al. (2011) - *Stratigraphy*, 8(2-3), ppg. 199-215. 6) Laurens et al. (2004) - *A Geologic Time Scale 2004*, Cambridge, ppg. 409-430. 7) Oil Exploration Directorate (1993) - *Geological map of the Maltese Islands* (Sheets 1 and 2), Malta. 8) Pedley (1975) - Ph.D. Thesis, University of Hull, UK. 9) Turco et al. (2011) - *Stratigraphy*, 8(2-3), ppg. 89-110.



