EOCENE SPONGES FROM CHIAMPO VALLEY (EASTERN LESSINI MOUNTAINS, NORTHERN ITALY): TAXONOMICAL AND PALAEOECOLOGICAL STUDIES

Ph.D. candidate: FRISONE VIVIANA, I course
Tutor: Dr. NEREO PRETO
Co-tutors: Prof. PAOLO MIETTO, Dr. ANDRZEJ PISERA, Prof. WOLFGANG KIESSLING
Cycle: XXVI

Abstract

Fossil sponges are among the oldest fossils known, but their knowledge is very incomplete. This concerns especially Tertiary sponges and includes largely undescribed Eocene sponges of Italy. This Ph.D. project aims at the taxonomic study of Eocene sponges from Chiampo Valley (Eastern Lessini Mountains, Northen Italy), and to the definition of the palaeoecology of the sponge-bearing associations. Expected results are: 1) cataloguing public collections of fossil Eocene sponges of Chiampo Valley, with consequent valorisation and fruition; 2) taxonomic study of Chiampo sponge fauna, with holotypes and paratypes designation; 3) shedding new light on the ecology of Eocene nummulitic carbonate ramp systems, so important, e.g., as potential outcrop analogs for petroleum exploration.

Introduction

Sponges are among the most ancient among extant multicellular animals. First known from the Precambrian and well established by the Cambrian, they were major reef builders during the Paleozoic and Mesozoic Eras (Hooper & van Soest, 2002). Due to the low preservation potential of many taxa, especially those with organic skeleton only, sponge fossil record is rather incomplete. Only those sponges with a rigid skeleton, e.g. *lithistids* (demosponges with desmas), *Hexactinosida* and *Lychniscosida* (*Hexactinellida* class) and sponges with a massive calcareous skeleton (polyphyletic demosponges and Calcarea), have a more or less continuous fossil record that is, however, inadequately studied (Pisera, 2006). This is particularly true for Tertiary sponges and fits perfectly with the scarce knowledge about the sponge fauna object of this project. Until now only 3 publications exist about Chiampo Valley Eocene sponges: Menin (1972), Visentin (1994) and Matteucci & Russo (2005). All these publications refer to siliceous sponge fauna. Matteucci & Russo (2005) made a preliminary illustration and determination of 23 species (many of which are left in open nomenclature) of a private collection. The most abundant are the *Lychniscosida* (class *Hexactinellida*), with ten species, followed by *Hexactinosida* (class *Hexactinellida*), with seven species, and “*lithistids*” (class *Demospongiae*), with six species. No new families, genera or species are designated.

The scarce knowledge on the Chiampo sponge fauna is in contrast with the richness of public collections of Museums of the Vicenza Province, Venice and the University of Padova. These collections are are still not studied and in great part neither catalogued. There is a great potential to describe new genera and new species from these specimens. It would also be the first time that public fossil sponge collections from Chiampo Valley are comprehensively studied.

The fossils object of this study come from Eocene eastern Lessini Montains sites within the “Nummulitic limestone” carbonate complex. The sites are included in a tectonic structure known as Alpone-Agno half-graben with domino-style synsedimentary deformations connected with Eocenic basic volcanic activity (Barbieri & Zampieri, 1992). Recently, Beccaro et al. (2001) interpreted the “Nummulitic limestone” as belonging to a carbonate ramp, of which only the outermost facies are represented. Intercaleted between the “Nummulitic limestone” beds are volcanoclastic debris, tuffites or reworked tuff beds. These beds are included in a classical ramp succession dominated by nummulites, but exhibit a faunal association more complete than usual. Some levels are extremely rich in very well-preserved fossils (e.g. three-dimensional fossil crustacea completed with appendages and ventral parts), to the point that specimens from these localities were used as holotypes of several new species (Beschin et al. 1991, De Angeli & Garassino, 2006). In few sites, sponges constitute the most common macrofaunal element, especially in a horizon of volcanoclastic...
This sponge fauna appears to be extremely diverse and well-preserved (Matteucci & Russo 2005). This Ph.D. project aims at the taxonomic study of Eocene sponges from Chiampo Valley, and to the definition of the palaeoecology of the sponge-bearing association.

Expected results are:

a) taxonomic study of Chiampo sponge fauna, with holotypes and paratypes designation

b) cataloguing public collections of fossil Eocene sponges of Chiampo Valley, with consequent valorisation and fruition

The study of Eocene sponges and their bearing facies would also help the palaeoenvironmental interpretation of the area by:

1. helping a better understanding of an exceptional conservation facies linked to “Nummulitic limestone”

2. helping the bathymetrical characterisation of sponge bearing level and also of “Nummulitic limestone”

3. clarifying if it is an in situ deposit (as suggested by Matteucci & Russo 2005) or redeposited sediments by mass transportation (as suggested by Beccaro et al. 2001)

In a large scale view, the definition of the sponge-bearing assemblage would shed new light on the ecology of Eocene nummulitic carbonate ramp systems, so important, e.g., as potential outcrop analogues for petroleum exploration.

The data obtained could contribute for testing hypotheses on the punctuated distribution of siliceous sponges thru time (Krautter, 2002, Pisera, 2002).

---

**Lithistida and Hexactinellida Diversity**


---

**Genus-level diversity of Lithistida and Hexactinellida during the Phanerozoic**

Material, methods, preliminary results

Field work on the outcrops

The following quarries were visited with the aim of finding the sponge-bearing level and carrying palaeoecological analysis: “Braggi” of Vestenanuova; “Lovara”, “Porto” and “Boschetto” (cited as “del Cengio” in Visentin, 1994 and Matteucci & Russo, 2005) “Zanconato” of Chiampo. “Braggi” is the only quarry which is still active. Access permission was formally asked to the private firm Calcestruzzi S.p.A (Bergamo) and got a positive response. The firm should soon to provide an access date. In “Lovara” and “Porto” quarries the level is in a dangerous position due to collapse hazard. In “Boschetto” and “Zanconato” quarries the sponge-bearing level is covered by tons of debris. We should evaluate the possibility of organizing an official excavation, authorized by the Italian Ministry of Cultural Inheritance.

Collections study.

Fourteen fossil sponge collections from Chiampo Valley were “mapped”. They are housed in the public museums of: University of Padova, Chiampo, Valdagno, Montecchio Maggiore, Vicenza, Priabona. Some collections were donated from private collectors to public museums in the framework of the present research. The aim of the collections study was either to have a more precise idea of which collections are preserved but also to “hunt” specific specimens on which a taxonomical analysis can be done. A digital database was done consisting in numerous variables: number of specimens, provenance, preparation, place of conservation, deterioration, catalogue numbers, destructive analysis permissions, bibliography, acquisition mode and period etc.

The case of Geology and Paleontology Museum of the University of Padova.

For nearly 30 years the Museum had in its stores a collection of Chiampo fossils sponges, entrusted by the Italian Ministry of Cultural Inheritance for Veneto Region (Soprintendenza Archeologica per il Veneto) as a result of an emergency excavation. With this project, a pre-cataloging of all the material (442 fossils) was carried out by: sequential numbering, measuring, photographing and labeling. Data were entered in a file with ICCD fields (Istituto Centrale per il Catalogo e la Documentazione- Scheda BNP Beni Naturalistici – Paleontologia versione 3.01). The material is now ready to be selected for study. As the specimens are still included in volcanoclastic debris, various preparation techniques have been tested, as suggested by Finks (2003). Best results were obtained with potassium hydroxide.

Taxonomical studies

As methods of study depend on sponge preservation, the petrology of the specimens has to be preliminary investigated. So some specimens were etched (with diluted acetic acid) and revealed strongly calcified spicules. This phenomenon is quite common in fossil sponges as the siliceous sponge spicules of both Hexactinellida and Demospongiae consist of hydrated amorphous silica which is metastable. Biogenic silica dissolves during the lithification process and is replaced and substituted by calcite (Krautter et al., 2006). Consequently, in many cases sponges are preserved as calcite pseudomorphs (Brachert, 1991). As the matrix around the spicules is a carbonate, too, the most suitable study technique in the present study is by cross and thin sections.

Fossil sponges taxonomy relies mainly on megasclechoanosomal spicules, mostly fused (hexactinellids) or articulated (lithistid demosponges) (Pisera, 2006). Morphology (shape), qualitative patterns of skeletal canals on the interior, patterns of skeletal pores on the exterior and cloacal surfaces should be taken into account during the diagnosis, too (Finks, 2003). In the present study, the first step done on the analysed specimens was to look for spicules under a binocular microscope. In some specimens with no evident megascle on the surface, a cross section was done, and in many cases, a fused or articulated skeleton was noticed. A selection of specimens has been chosen for thin sections. All the studied specimens are numbered, photographed, labeled, measured, observed in hand specimen and under the microscope and eventually selected for analytical methods. The resulting data are tracked in a database which is under construction.
Until now (02 November 2011) 43 specimens were observed: 5 belong to “lithistids” (class Demospongiae), 20 to class Hexactinellida (1 to order Lychniscosida) and 18 undetermined (need further analysis).

*Future works*
- focus on taxonomical studies with the laboratory study described above. Holotype and paratype designation following the International Code of Zoological Nomenclature (ICZN).
- begin paleoecological studies and field work: data retrieval (geographical location, mapping and logging of the stratigraphical succession, graphical logs, lithological description, sample attitude, facies association); volumetric sampling of sponge-bearing horizons (as described in Finks, 2003) for determination of sponge population structure, alpha-diversity etc.; biostratigraphic analyses based on planktonic foraminifers and calcareous nannofossils; petrology of the sponge fauna and its bearing sediments.

*References*
**SUMMARY LAST YEAR’S ACTIVITY**

**Courses:**

AGNINI, C. “Paleoecologia e Paleoclimatologia”, Dipartimento di Geoscienze, Università degli Studi di Padova (in progress)
GIUSBERTI, L. “Micropaleontologia”, Dipartimento di Geoscienze, Università degli Studi di Padova (in progress)
MIETTO, P. “Geologia Stratigrafica”, Dipartimento di Geoscienze, Università degli Studi di Padova.
PRETO, N. “Analisi di facies” Dipartimento di Geoscienze, Università degli Studi di Padova.
RIGO, M. “Geologia Regionale”, Dipartimento di Geoscienze, Università degli Studi di Padova.
SALMASO, L. "Statistica Applicata alla Sperimentazione Scientifica", Dipartimento di Tecnica e Gestione dei Sistemi Industriali, Università degli Studi di Padova.

**Posters:**


**Publications:**


**Educational visits:**

Warsaw (Poland), Palaeobiology Department of Polish Academy of Science (PAN), 17-30 July 2001, Dr. Andrzej Pisera, Followed activities: introduction on sponges, methods of study, selected literature, visit to the Warsaw sponge collections, preliminary study of Chiampo fossil specimens

Rio de Janeiro (Brasil), Museu Nacional, Universidade Federal do Rio de Janeiro, Departamento de Invertebrados, 5-15 October 2001, Prof. Eduardo Hajdu. Followed activities: visit to Recent Hexactinellida collections; selected sponge bibliography; preliminary study of Italian spiculite (Ronca, Verona); field trip in Buzios (Rio de Janeiro State) for Recent sponge sampling. Project funded by Servizio Relazioni Internazionali, Università degli Studi di Padova.