

Spicules of the Freshwater Sponge *Ephydatia facunda* Indicate Lagoonal Paleoenvironment at the Pampas of Buenos Aires Province, Argentina

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ABSTRACT

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Sediments dredged at the site Puente de la Tropa by the banks along the middle reach of River Luján (34°34'40"S-59°08'14"W), northeastern Pampas of Buenos Aires Province, Argentina, were ¹⁴C dated as 4,000 (80 cm) and 11,000 (222cm) yr B.P. Abundant gemmular spicules of the freshwater sponge *Ephydatia facunda* (Weltner, 1895), were seen in the samples dated 11,060 and 10,420 yr B.P. The spicules were associated with diatoms together with a rich gastropod and ostracod fauna, silicophytoliths and fish bones. *Hyalodiscus subtilis* (Bailey) a brackish, benthic diatom dominated the diatom flora. The detected taxocene indicates the existence of a lagoonal environment in this area during the Pleistocene. The remarkable presence of *E. facunda* lends weight to this interpretation as the species has been proven to presently thrive in coastal lagoonal brackish to fresh water rivers and swampy areas along the Brazilian and Argentinean ocean border. A strong relationship was seen between the species and the enrichment by floating meadows that occurs in such areas, the corresponding organic enrichment of the waters and sediments and the reduction of the free water column.

ADDITIONAL INDEX WORDS: Luján River, sponge spicules, diatoms, coastal water bodies.

INTRODUCTION

Freshwater sponges have been used with success in paleo-environmental reconstruction studies (HALL AND HERRMANN, 1980; HARRISON 1988; SIFFEDINE et al. 2001, VOLKMER-RIBEIRO et al. 2006, among others). Paleoenvironmental reconstruction studies were carried out by PRIETO et al. (2004), in the locality of Puente de La Tropa (Ciudad de Luján/Provincia de Buenos Aires), based on sedimentary sequences with the interpretation of pollens, gastropod mollusk shells, diatoms and fish bones. The age detected was from the start of the Holocene (10,420 and 11,160 ¹⁴C yr BP).

The study, PRIETO et al, op. cit., concluded that at that time the region consisted of a shallow, alkaline, eutrophized, marshy freshwater environment. Though sponge spicules were found they were not identified and hence were not used in the paleoenvironmental interpretation offered. The aim of this study was to identify the freshwater sponge species upon the spicules present in the sediments and see if the paleointerpretation offered by PRIETO et al. (2004) agreed with the habitat characteristics known for these sponges. The present study now offers new interpretations based on sponge identification allied to that of the Diatoms.

The study area is situated to the west of the city of Luján (Buenos Aires Province), the analysed outcrop is located at Puente de La Tropa (34°34'40"S; 59°08'14"W – Figure 1), a distance of 63 km from the capital, Buenos Aires. The River Luján has a permanent flow, is moderately sinuous in its upper reach oriented SW-NE, though in its middle and lower course it

assumes a southeasterly direction following the Delta of the River Paraná (FUCKS AND DE FRANCESCO, 2000). From the geomorphological point of view the area is part of the Undulating Pampa (CAPPANNINI and DOMINGUEZ 1961). The evaluated stratified sequences are contained in the Membro Rio Salado of the Luján Formation, situated at the end of the Pleistocene and the beginning of the Holocene and are composed of fluvial-lacustrine sediments (FIDALGO, 1979) (Figure 2).

METHODS

The study is based on the collection and dating carried out by PRIETO et al. (2004). This first author furnished the present authors with samples from the sequences 85, 105, 120, 180, 220 and 230 cm from the Puente de La Tropa outcrop (34°34'40"S-59°08'14"W), in order to identify the sponge spicules and contribute towards the paleoenvironmental interpretation of the sequences. The siliceous material suspended in water was next dropped onto microscope slides, left to dry under a common lamp, Etellan mounted and permanently sealed with cover slides. Four such slides were prepared from each sediment sample for microscopic examination and photography. The slide collection is archived at the Museu de Ciências Naturais (Museum of Natural Sciences) in Porto Alegre/RS under the catalogue number MCN-POR 7.382 (180 cm) and 7.383 (220 cm).

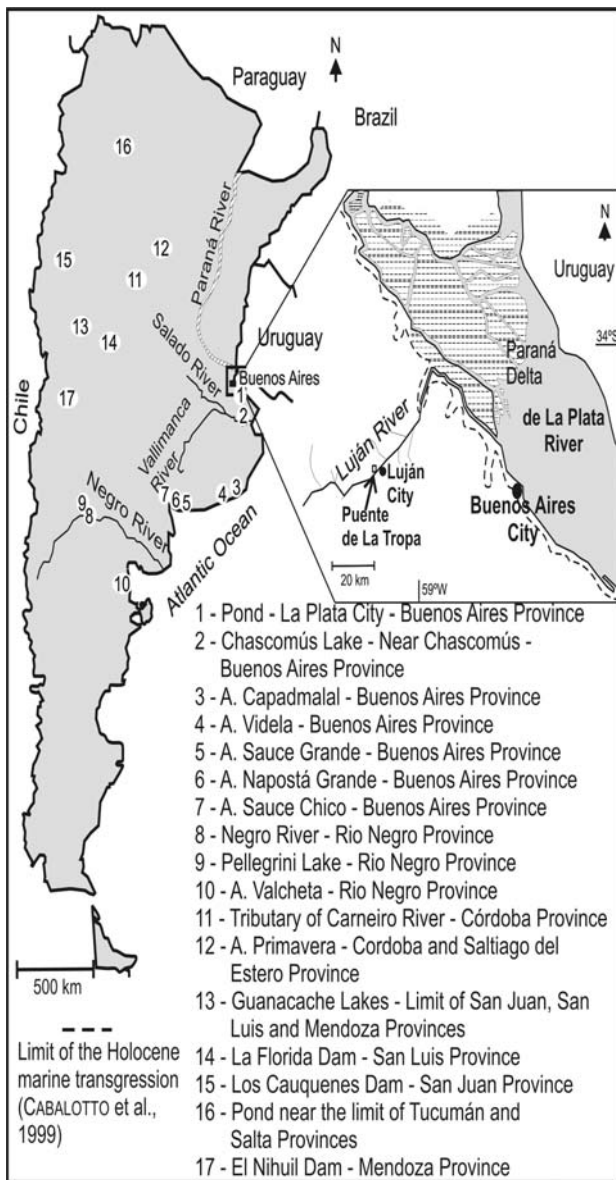


Figure 1 – Map showing the distribution of *E. facunda* in the Argentinean territory and map showing the location of Puente de La Tropa adapted from PRIETO et al. (2004).

RESULTS

Only one species of continental sponge was found to be present, *Ephydatia facunda* Weltner, 1895, represented by both skeletal and gemmular spicules (Figure 3). The species was found in the samples dated between $10,420 \pm 50$ and $11,160 \pm 60$ yr BP. At 180 cm, there were complete megascleres and gemmoscleres while at 220 cm there were fragments of gemmoscleres (Figure 2). According to PRIETO et al. 2004, these sequences, besides containing spicules, are rich in gastropods, ostracods, diatoms, silicophytoliths and fish bones. The presence of the diatom *Hyalodiscus subtilis* (Bailey) was also detected in the sequences evaluated at 230 (rare), 220 (abundant) and 180 cm (present), confirming the data from FRENGUELLI. (1945).

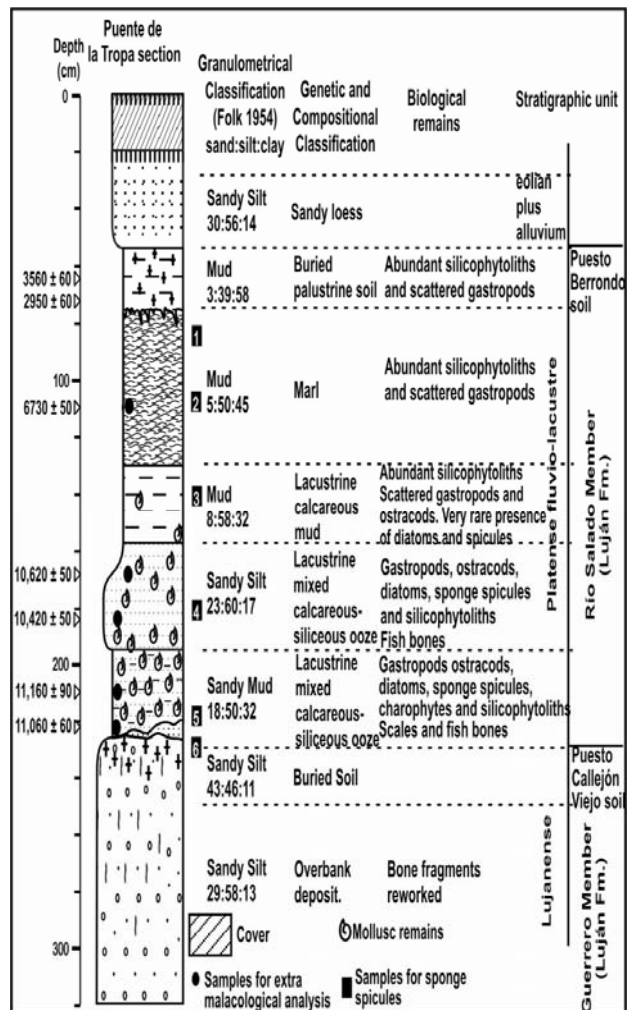


Figure 2 – Dating, sedimentary profile and descriptions made by PRIETO et al. (2004) showing the points where the sediments used in the sponge study were collected.

DISCUSSION

VOLKMER-RIBEIRO et al. (2006) have demonstrated that, in Rio Grande do Sul, *E. facunda* occurs in coastal lakes, in eutrophic, slightly alkaline (pH between 7.57 and 8.39) freshwater to mesohaline environments, with the presence of macrophytes which result from the closing and gradual desalinisation of lagoons. The species has been characterised by its occurrence in environments along the coast of Brazil that pass from mesohaline (lagoons) to oligohaline, thus constituting an indicator of such environments (VOLKMER-RIBEIRO and MACHADO, in press). Bonetto and EZCURRA DE DRAGO (1967) and EZCURRA DE DRAGO (1975) registered, respectively, *Ephydatia fluviatilis* Linné 1758 and *Ephydatia fluviatilis ramsayi* Haswell, 1882, for Argentina.

Following comparisons made with samples from Brazil, these registers are now being synonymised in *E. facunda* (Figure 1). In Argentina also, the species appears to favour the coastal strip (points 1-7 and 10, figure 1), being characterised, in most registers, be they on the coast or inland, as occupying slightly alkaline (pH between 7.6 and 8.5) mesohaline, eutrophized environments encrusting the submerged portions of macrophytes, mosses and bryophytes (Figure 4) (EZCURRA DE DRAGO, 1975, op.cit.). Hence, the status of the species as an indicator of such environments is maintained. Accordingly, its

presence in the sediment samples obtained from the River Lujan site suggests the previous existence of such a lagoonal area in the region. Moreover, the presence of the diatom *H. subtilis*, an indicator of mesohaline environments, (FRENGUELLI, 1945), in the strata below that of the *E. facunda* gemmoscleres lends weight to this interpretation, pointing to a slow progression of a mesohalinic Pleistocene body of water to freshwater one with the evolution of the succession of macrophytic vegetation from the banks to the centre, according to the closing and colmatation of the lagoon.

The hypothesis is put forward that the studied deposit might be related to the transgressive deposits (Querandinense) registered in the estuary of the Rio de La Plata (River Plate) and along the continental coast, that were formed when the level of the sea began to rise at the end of the Pleistocene and beginning of the Holocene (FRENGUELLI 1957, AGUIRRE and WHATLEY 1995). AGUIRRE and WHATLEY, (op cit), report that the deposits related to the Querandinense show a reduced faunal diversity but an abundance of cold and freshwater molluscs. FIDALGO (1979) named these coastal lagoon and marshy deposits (Pleistocene-Holocene) as Destacamento Rio Salado Formation, which would be equivalent to the "Querandinense" of FRENGUELLI, (op cit). In this sense the formation of these lagoons would be related to the drier colder conditions that predominated immediately following the last glacial period. This hypothesis is supported by the work of TRICART (1973), in which the querandinense deposits are related to marine transgressions (10 m. above m.s.l.) relating them to the Lower Pleistocene.

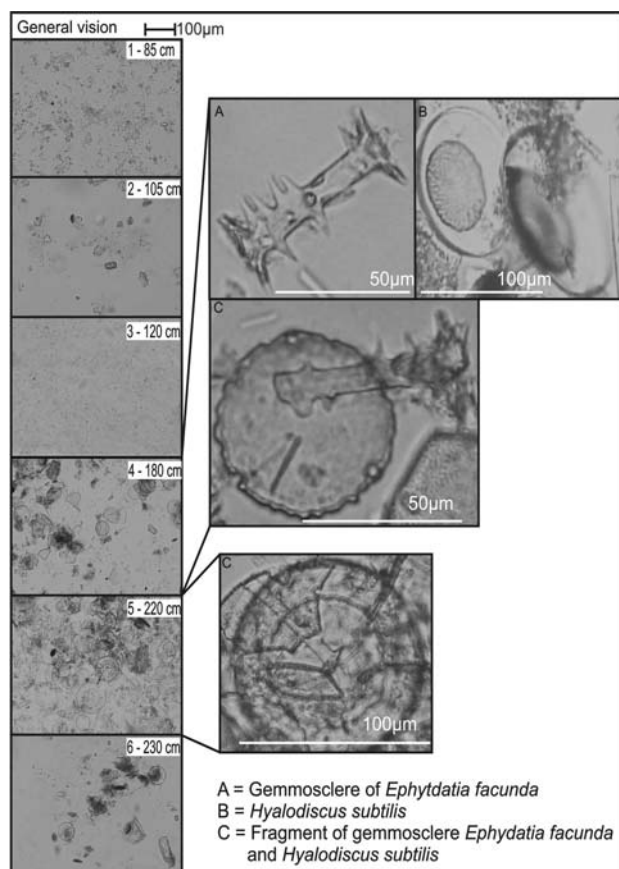


Figure 3 – Photomicrographs, general view of the evaluated sequences and details of the gemmoscleres of *E. facunda* and the diatom *H. subtilis* seen in the studied sediments.



Figure 4 – Photo of a specimen of *Ephydatia facunda* found in one of the tributaries of the Carneiro River in the province of Córdoba, the arrow indicates the gemmules.

CONCLUSION

The present study represents the first description of the species *E. facunda* in Argentina, indicating its presence in the region since the Pleistocene-Holocene boundary ($10,420 \pm 50$ and $11,160 \pm 60$ yr BP) and confirms its use as an indicator of lagoonal/lacustrine environments along the coastal strip of South America. Its occurrence, together with the abundance of the diatom *H. subtilis*, points to the existence of coastal lagoons/lakes in the studied region at the end of the Pleistocene. The presence of such lagoons/lakes could be related to processes resulting from marine transgressions recognised at the end of the Pleistocene.

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