NOTA

PRO-THROMBOLITES FROM LAGUNA SAN IGNACIO, B.C.S., MEXICO

PROTROMBOLITOS EN LAGUNA SAN IGNACIO, B.C.S., MÉXICO

RESUMEN. Se presenta nueva información sobre la presencia de protrombolitos en lagunas costeras de la Península de Baja California. Los registros fotográficos de estructuras protrombolíticas en Laguna San Ignacio, B.C.S. apoyan la hipótesis de que éstas promovieron la formación de las lagunas costeras a lo largo del noroeste mexicano y que las especies de cianofitas involucradas son las mismas.

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Siqueiros Beltrones. D.A., O. U. Hernández Almeida, S. González Carrillo & U. Argumedo Hernández. 2008. Pro-thrombolites from Laguna San Ignacio, B.C.S., Mexico. *CICIMAR Oceánides*, 23 (1,2) :83-86.

Over the course of millions of years cyanophytes have build various rock structures collectively known as microbialites, from which stromatolites are the best known. These have layers that show the vertical growth of filamentous cyanophytes and the concomintant accumulation of sediments that are cemented with carbonates. Microbial structures are common along the Baja California Peninsula, these include: laminated mats, incipient and fossil stromatolites (Horodysky & Von der Haar, 1975; Miranda-Avilés *et al.* 2005), as well as temporal microbial mats placed in a changing environment, *v. gr.*, Laguna Figueroa, B.C. and La Poza, Todos Santos, B.C.S. (Siqueiros-Beltrones, 1988; 1990).

Recently, biosedimentary structures highly associated with cyanophyte mats that cover large intertidal extensions of the La Paz lagoon in the Gulf of California coast were discovered. These structures were produced by entrapment, precipitation and clotting of sediments, as a result of the growth of filamentous cyanophytes (mainly *Microcoleus chthonoplastes* and *Oscillatoria limnetica*/*Lyngbya aestuarii*), and were named pro-thrombolites as precursors of the lithic phase or thrombolites, that require similar conditions to stromatolites for their formation but without the development of a laminated structure (Siqueiros-Beltrones *et al*., 2006).

Observations on these structures had lead to the hypothesis that pro-thrombolitic growths have promoted the formation of lagoons in the Gulf of California, by causing the development of sandbars through the formation of spites that enhance the precipitation and accumulation of sediments.

One question linked to the above was: are these structures and/or processes exclusive to the Gulf of California or do they also occur in the west coast of the Baja peninsula? Thus, our objective was to find new evidences to answer this question. Concomitantly our hypothesis enounces that, since coastal lagoon geomorphology in the west coast is similar to those of the Gulf of California, their development will also show an influence by pro-thrombolitic processes. This considering that favorable environmental characteristics for pro-thrombolitic formation (shallowness, intertidal location, high evaporation, hypersalinity and low weve energy) are not obvious due to differences between the east and west coasts of the penninsula, and since their initial evolution would have occurred in a cove, which would be transformed into a coastal lagoon.

Laguna San Ignacio has a length of 30 km and its located in the mid portion of the west coast of the Baja California peninsula (Figure 1) in a coastal plain surrounded by three mountain chains (26° 43' N and 26° 58' N and 113° 08' W and 113° 16' W), where sand beaches, seashells conglomerates, mangroves, swamps and salted mud plains constitute the landscape (Urbán *et al.* 1996). The weather is semi-warm, very dry, with temperature ranging from 18 °C to 22 °C.

Fecha de recepción: 12 de mayo , 2008 Fecha de aceptación: 05 de agosto, 2008

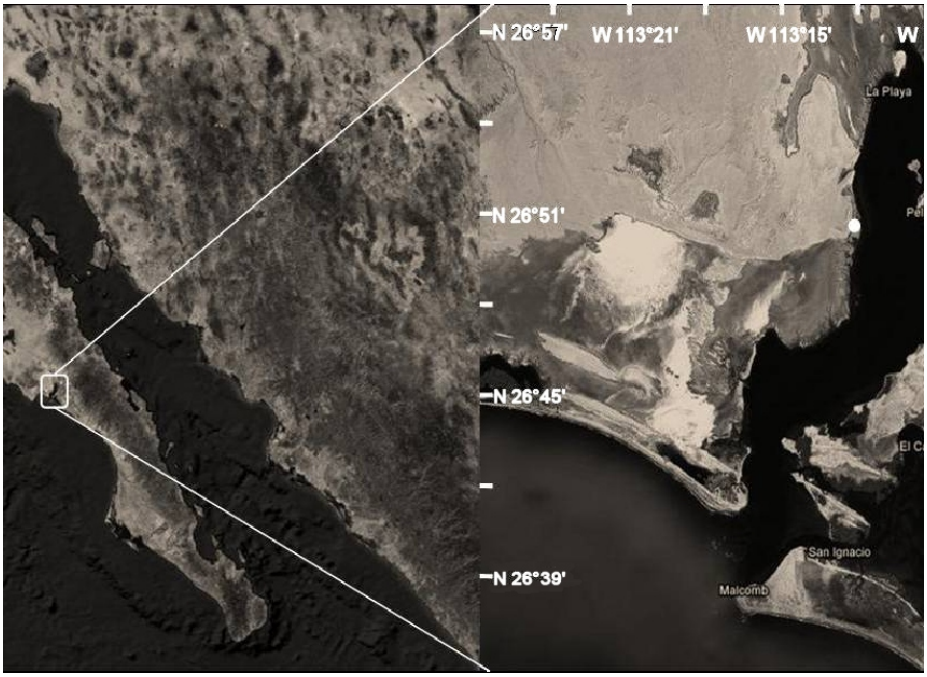

Figure 1. Location of Laguna San Ignacio and Cerritos area.

Laguna San Ignacio is a coastal lagoon located inside Desierto del Vizcaino and belongs to the Reserva de la Biosfera del Vizcaíno. Thus any photographic record gains relevance considering the difficulty to gain access to do any research. The third author, once authorized to carry on observations in another study, noticed structures emerging from the landscape that resemble the pro-thrombolites registered for La Paz lagoon (Siqueiros Beltrones, 2008), and likewise hitherto ignored. The photographic record was taken during the highest tide and was used to confirm the identification.

The observed pro-thrombolitic formations consists of emerged fringes 10 m wide that extend several hundred meters in a discontinuous way along the intertidal of the NW portion of Laguna San Ignacio, in the locality called Cerritos.

Pro-thrombolitic formations reach 20 cm high, their consistence is brittle and somewhat moist. Associated to the pro-thrombolites are dwarf mangroves (*Rhizophora mangle* and *Avicennia germinans*) distributed in patches. Abundant specimens of *Cerithidia* sp., distributed toward the mangroves were also observed, as well abundant specimens of *Uca* sp. A brownish-green coloration of the pro-thrombolites (similar to those found in La Paz lagoon) suggests they are active and regularly submerged by the tides. Trapped seashells were observed trapped inside the conglomerates.

Photographic records (Figures 2, 3, 4) confirm the hypothesis that due to similarities of the coastal lagoons geomorphology in the NW of México, their origin is also influenced by pro-thrombolitic formations. This means that the oceanographic characteristics that affected the primitive cove that served as basin for the present coastal lagoon, around 6000 years ago, would be only secondary. On the other hand, Holser *et al*. (1981) provides evidences that this pro-thrombolitic formations would extend up to Laguna Ojo de Liebre where cyanophyte mats, dominated by *M. chthonoplastes* and *O. limnetica*/*L. aestuarii*, have been registered. This information serves to partially answer another question, *i.e*., is the sheat of the pro-thrombolites in this area formed by the same cyanophyte species?

The observations made by Holser *et al*. (1981) agrees with the observations of several

Figure 2. Pro-thrombolithic extension in Laguna San Ignacio.

Figure 3. Pro-thrombolithic formation showing a fixed xerophytic plant.

Figure 4. Shell accumulations trapped inside the conglomerates.

colleagues who inform noticing these structures (once aware of ther existence) in northern sites of Baja California Sur, in both coasts (Ledesma, J.; Martínez, G., pers. comm.). The lack of interdisciplinary bases for their identification and description, however, have clouded the consequences of their development such as soil formation and the generation of spites that promote the growth of sandbars, all of which could have originated the coastal lagoons of the NW of Mexico, as proposed in this report.

AKNOWLEDGEMENTS

The observations were made during the field work of the project “Monitoreo de la Ballena Gris (*Eschichthius robustus*) en México”, developed by the Programa de Investigación de Mamíferos Marinos (PRIMMA) of the Universidad Autónoma de Baja California Sur (UABCS) and the Cetacean Research Associates, Maryland USA, as a part of Laguna San Ignacio Ecosystem Science Program, under the responsability of Steven Swartz and Jorge

Urban. We also thank Jorge Ledezma (Universidad Autónoma de Baja California) and Genaro Martínez (UABCS) for sharing experiences, as well to Alejandro Arellano and Arturo Carranza Edwards for reviewing the spanish version of the MS. This work was supported by projects SIP-20080010 (IPN) and SIP20050069 (IPN).

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