"A RARE NATURAL FRESHWATER BLISTER"

By The GIT-Gems and Precious Metal Testing Laboratory

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Figure 1: *A baroque of natural freshwater blister (223 ct., 45.7 x 38.7 x 21.6 mm size) submitted for identification. Photo by C. Kamemaganon*

INTRODUCTION

A nacreous blister refers to an internal protuberance on a shell, which may be low or high domed, resulting from the intrusion and entrapment of foreign objects between the mantle and the inner surface of the shell. These objects may enter through the live opened shell or penetrate through the shell from the exterior. The interior of the blister may or may not contain the remnants of various skeletal, plant or mineral forms, indeed they are often hollow following the decomposition of organic intrusions. These blisters are naturally secreted and typically exhibit round or irregular shapes without human intervention.

In contrast, a natural blister pearl is a cyst (whole) pearl that breaks through a pearl sac and get in between the mantle tissue and the inner side of the shell. Eventually this pearl is covered with nacreous layers that attach it to the shell. A cross section through a blister pearl reveals concentric (spherical) rings of calcium carbonate (e.g. nacre) in the inner part, wrapped around by a part of later formed nacreous layers of the shell (Krzemnicki, 2017 and CIBJO, 2020). The GIT-Gems and Precious Metal Testing Laboratory (GIT-GPTL) has received an unusual piece of organic gem material for identification as shown in Figure 1.

MATERIALS AND METHODS

General properties, e.g., color, weight, size, were measured using standard gemological equipment. Fluorescence reaction was observed by using a gemological ultraviolet lamp in both long-wave (365 nm) and short-wave (254 nm) ultraviolet light. Photomicrographs were taken using a gem microscope attached with Canon EOS 7D camera. External features were observed under a gemological microscope.

For advanced testing, a Ranishaw inVia Raman spectroscopy with a green laser 532 nm excitation was used to verify this sample. X-radiography was performed with a Softex SFX-100 instrument. The chemical trace analysis was carried out by an Energy-dispersive X-ray Fluorescence (EDXRF) Eagle III spectrometer.

RESULTS

- ***Gemological properties***

This unusual blister showed the following basic properties: light brown in color with slightly pink and purple overtone, baroque shape of approximately 45.7 x 38.7 x 21.6 mm in size, weight 223.89 ct, and florescence moderately white to long-wave UV and weak white to short-wave UV radiation.

Microscopic examination of the sample revealed thick layer-like structure (Figure 2a and b), with terrace-like feature and orient effect on the exterior surface (Figure 2c and d), commonly found in pearls and blisters from bivalves' mollusk.

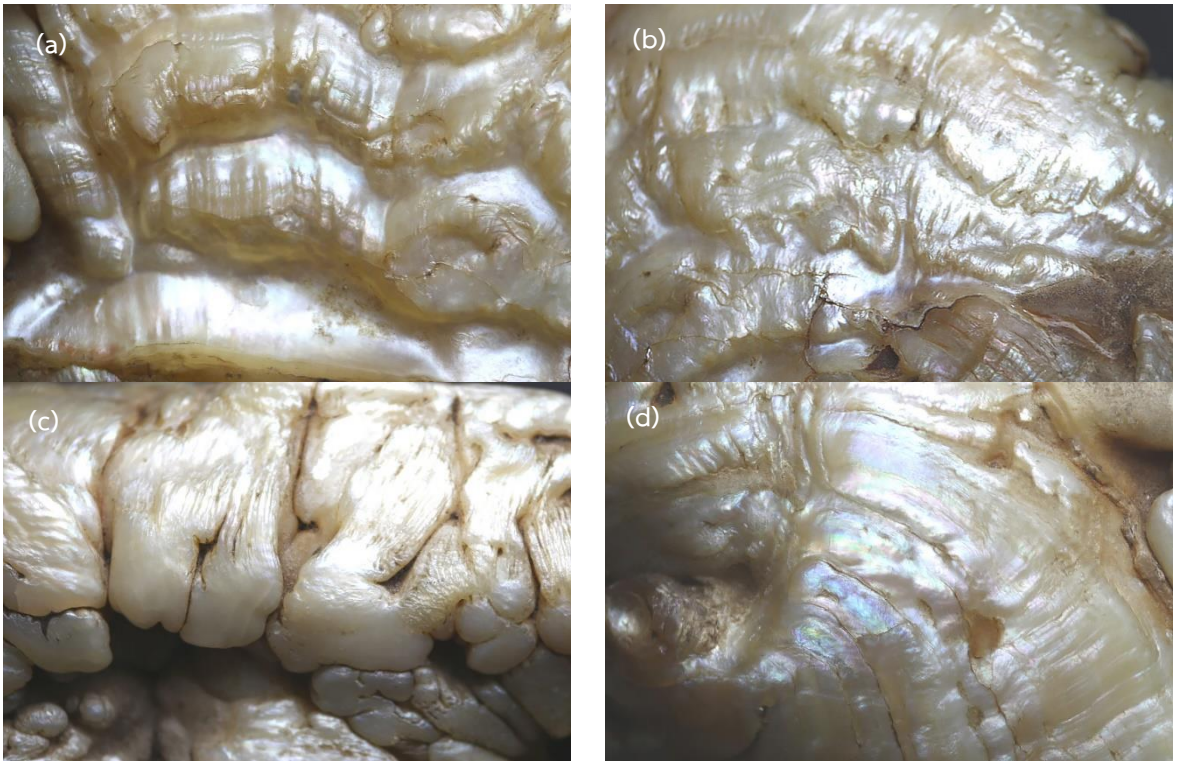

Figure 2*: Magnification of the blister showing thick layer-like structure (a and b, 12.5X), highly irregular to some extent (c, 12.5X), with orient effect and weakly terrace-like pattern on the exterior surface (d,12.5X). Photos by P.Ounorn*

- **Raman spectroscopy**

Raman spectra of the blister showed dominant peaks (Raman shifts) at 1086 cm^{-1} and other smaller peaks at 472 and 703 cm^{-1} (Figure 3). The pattern perfectly matched with the spectrum of aragonite (RRUFF), indicating the sample is composed essentially of aragonite.

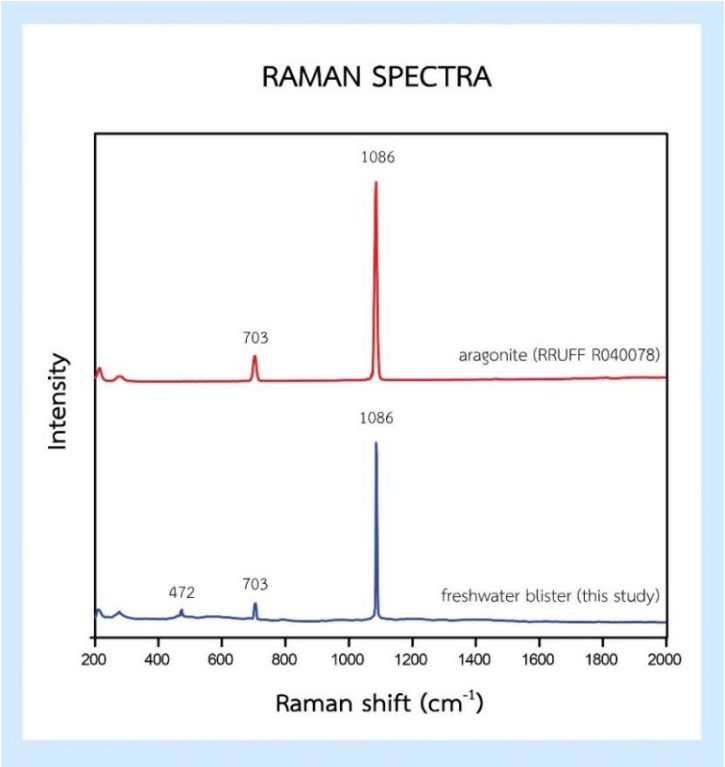

Figure 3: *Raman spectra of the blister (blue line) as compared with aragonite from RRUFF #R0440078 database (red line).*

- **X-radiography image**

The X-radiograph of the sample revealed quite unusual internal growth structures. The image showed thick layer-like structure, lacking a radial pattern and onion-like spherical ring structures commonly seen in blister pearls. However, only curved and accumulated layers of nacre were observed. Notably, no bead or tissue was present at the center of the sample (Figure 4). These features suggest that this sample is a natural blister.

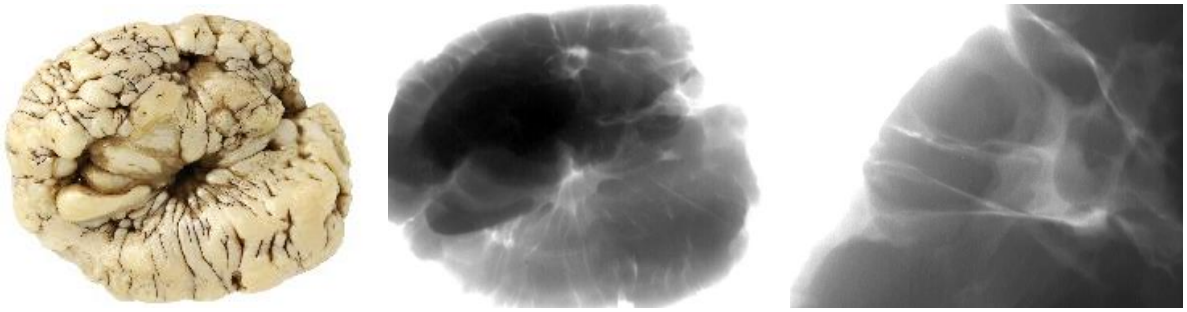

Figure 4: *(Left) photo of the blister, (Center) X-radiography image at the same magnification of the left photo, (Right) a high magnification image at the middle upper rim of the center image.*

- **EDXRF Analyses**

The semi-qualitative chemical analysis of the blister revealed a high content of calcium, and traces of phosphorus, sulfur, manganese, strontium (Table 1). As seen in the table, a relatively higher Mn content as compared to the Sr (i.e., MnO/SrO mole ratio = 3.49) suggests a freshwater origin of this blister (Abduriyim, 2018).

Table 1: *Semi-quantitative EDXRF analysis of the blister (normalized based on 44% CO_2)*

Element Oxide (wt.%)	CaO	P_2O_5	SO_3	MnO	SrO
The blister sample	54.17	1.15	0.33	0.24	0.10

CONCLUSIONS

In summary, this baroque blister displayed a thick layer-like structure with orient effect and weakly terrace-like pattern on the exterior surface, fluorescence moderately white under LWUV and weak white under SWUV radiation. The Raman spectrum indicated the sample was made up essentially of aragonite. The X-radiograph revealed a non-beaded-and-non-tissue natural blister with a layer-like structure. This sample was able to distinguish from typical cultured and blister pearls by the absence of bead, radial pattern and onion-like spherical ring structures in the inner part. Moreover, the sample contained a relatively higher concentration of manganese (Mn) as compared to strontium (Sr), which indicated a freshwater origin.

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