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A minerochemical cement study of a beachrock slab: The case study of Peristeria, Salamis Island.

G. Saitis[1], N. Evelpidou[1], S. Kawasaki[2], E. Koutsopoulou[3], A. Komi[1]

(1) National and Kapodistrian University of Athens, Panepistimioupoli, Athens, Greece, saitij@geol.uoa.gr
(2) University of Hokkaido, Kita 8, Nishi 5, Sapporo, Hokkaido, Japan
(3) Institute of Geology and Mineral Exploration, Acharnes, Athens, Greece

Introduction

Beachrocks are consolidated sedimentary formations and are composed of coastal sediments, which are cemented through the precipitation of carbonates. The lithification takes place in the intertidal zone and can include various sediments, such as sands and gravels of clastic and biogenic origin. This study deals with the cements' mineralogical and geochemical features of a beachrock outcrop and its aim is the contribution for further understanding on the cementation process of beachrocks. (e.g. Vieira and Ros, 2007; Vousdoukas et al., 2007; Karkani et al., 2017).

Study Area

The site of study is a beachrock outcrop at Peristeria area of Salamis Island which is located at the southeast of the island, 13 km from the city of Salamis. In the coastal area a stream that provides fresh water. The anthropogenic impact is highly evident as there are a number of constructions (basketball court, small piers). The beach has an orientation from East to West and its sediment is characterized as gravely sand. The beachrock slab covers an area of 1.36 Km^2 with a length 453m and maximum width of 50m (Figure 1). The examined beachrock has a mean dip of 13.5^o seawards.The beachrock mean height (from sea level) is 50 cm and it continues at about 1.5m below sea level. The outcrop has no evidence of vertical to shoreline (channels) erosion but a sea intrusion at its Eastern part. There the sea erodes the beachrock from the landward part and Contributes to new sediment accumulation.

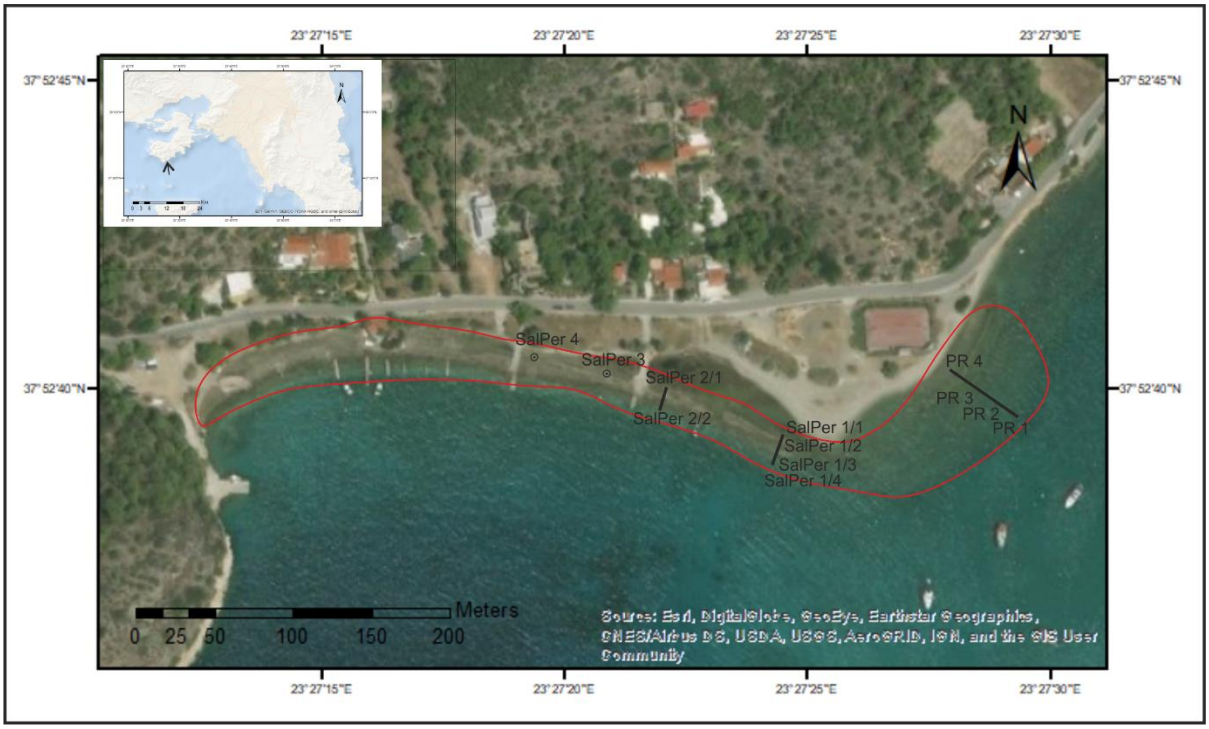

Figure 1. The red circled area indicates the beachrock slab, the lines indicates the morphology transects section and samples (code SalPer and PR) of the beachrocks.

Methodology

During the fieldwork detailed mapping of the beachrock slab was performed measuring width, height/depth with respect of the sea level. Additionaly, 12 samples were collected derived by the front and the end of the slabs and sediment bedding. Thin sections were prepared from the beachrocks and samples were studied for their mineralogical and morphological features with a petrographic polarized microscope and confirmed with Scanning Electron Microscope (SEM). Additionally, bulk material was examined for the mineralogical and geochemical composition with X-Ray diffraction (XRD) and Energy Dispersive X-ray Florescence Spectroscopy (XRF).

Results and Discussion

From the analysis of the beachrock samples, High Magnesium Calcite [$(Ca,Mg)CO_3$] cement in micritic form is most common (7% wt of MgO in samples) with microfossils. Sparitic formation of cement indicated a well grown crystallization or cement precipitation in the meniscus of sediment by mixing sea water and fresh ground water with higher influence by the marine phase. During the polarized and scanning electron microscopy needles of aragonite have been also observed which reveals a low energy coastal environment. Peristeria beachrock mineralogy is evenly distributed between Mg-calcite, Quartz and Calcite. SEM and XRD analysis also revealed the participation of clay minerals in the matrix cement in full accordance with the mineralogical results that showed the presence of clay minerals in the beachrocks (Figure 2).

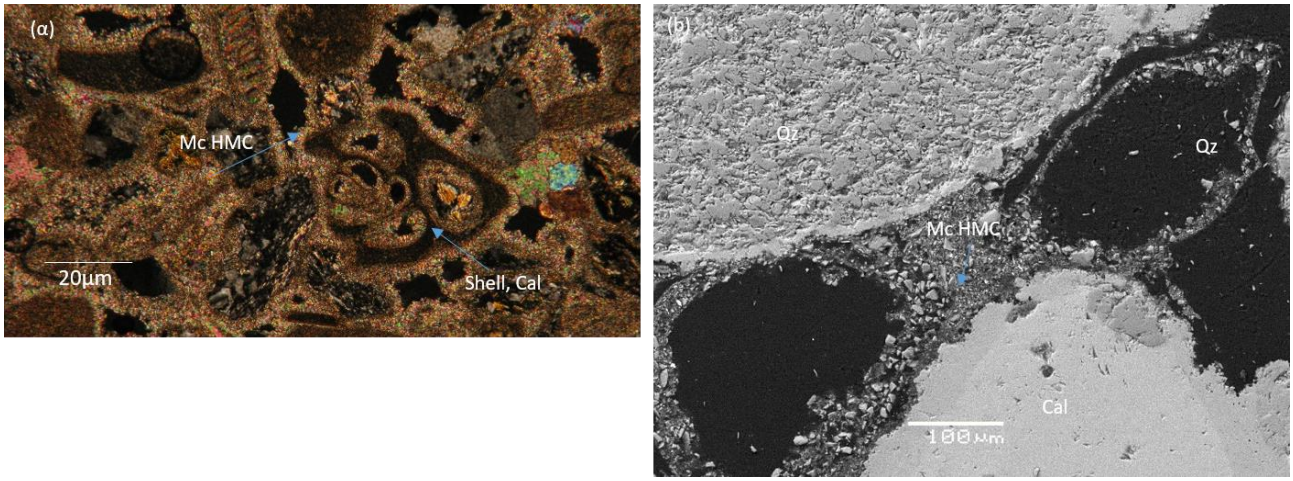

Figure 2. (a) Polarized microscopy, the samples are characterized by micritic and sparitic HMC cement that coat Quartz and shell fragment. (b) SEM analysis, micritic cement coat Calcite and Quartz grains and matrix of HMC and fine particles (e.g. clay minerals) cement, is observed.

Conclusion

The Peristeria beachrock outcrop has a very compact and thick morphology with a variety of sediment particles. An alternation in precipitation events seems to have taken place which initiates with a mixed environment of sea water and fresh ground water, was later succeeded with a period of saturation from sea water and lastly with a mixed sea/fresh water environment. The prevalence of the sea water influence in the precipitation of the cement could be due to a sea level rise, for a time period, and then followed by a sea level retreat.

References

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