SEDIMENTOLOGICAL AND GEOCHEMICAL CHARACTERISTICS OF MODERN ARAGONITE-RICH SEDIMENTS IN MEDITERRANEAN KARSTIC MARINE LAKES (MLJET ISLAND, ADRIATIC SEA)

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Abstract
Sedimentological and geochemical characteristics of aragonite-rich sediments in semi-enclosed, karstic, marine lakes on the island of Mljet (Adriatic Sea), have been investigated. The lakes and their sediments are a unique sedimentological environment characterized by authigenic formation of aragonite mud in a restricted Mediterranean environment [1,2]. The results have shown that distribution, diagenesis, and the historical record of the presence of trace metals are mostly dependent on sedimentological processes associated with the inorganic formation of aragonite, and prevailing physico-chemical conditions.
Keywords: Geochemistry, Trace Elements, Adriatic Sea

Study Area
Veliko and Malo Jezero (the Mljet Lakes) are located in the western part of the island of Mljet (42º 47′ N, 17º 21′ E; Adriatic Sea) (Fig.1A). These are two typical semi-enclosed karst depressions (*doline* or sinkholes) which were formed under subaerial exposures, and are today submerged due to the Holocene sea-level rise [3]. Being connected with the sea, they contain sea water and therefore, can be termed marine lakes. Due to their depth of 47 and 29 meters, respectively, they can not be termed lagoons, because these are usually defined as shallow semi-enclosed water bodies having depths that seldom exceed a couple of meters.

Materials and Methods
Undisturbed sediment cores were collected at three sampling stations (Fig. 1A) by an Uwitec gravity corer, and immediately frozen and kept at -20ºC until further analyses were performed. Cores were cut into 2 cm segments and analyzed by X-ray diffraction, scanning electron microscopy, laser diffraction particle size analysis, high resolution inductively coupled plasma mass spectrometry, and gamma spectrometry.

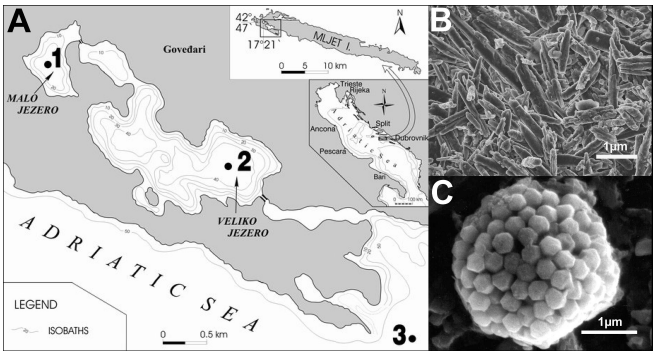

Fig. 1. The investigated area of the Mljet Lakes with: (A) sampling stations; (B), SEM microphotographs of needle-like aragonite particles; and (C) framboidal pyrite in sediments from Malo Jezero (Station 1).

Results and Discussion
The results have shown that sediment cores consist of muddy sediments which, according to Folk & Ward [4] can be classified as slightly gravely mud (Stations 1 and 2) and gravely mud (Station 2). There were no changes in the granulometric characteristics in core sediment samples with depth. Samples were mainly composed of aragonite, calcite, Mg-calcite, and dolomite. However, the ratio of carbonate polymorphs in surface sediments varied. Aragonite, in the form of needle-like particles (Fig. 1B), was the most abundant mineral phase in sediments at Station 1, with approximately 70% in total carbonate content. The vertical distribution patterns for redox sensitive trace elements, particularly Mo (Fig. 2), together with the presence, morphological characteristics and size of framboidal pyrite at the deeper part of core sediments (Fig. 1C), suggest the existence of euxinic conditions in the sedimentary system in lake history of the Malo Jezero (Station 1) [5]. Higher concentration of Cu, Cd, Zn, Sn, and Pb in surface sediments, taken from the sediment core from Station 2, indicates a substantial increase in their loads in the last 50 years. The only cause for this enrichment could be anthropogenic activities. However, the measured concentrations still reflect a relatively low level of anthropogenic metal pollution. The observed high concentration of Sr, and its distribution in sediments, is directly influenced by authigenic formation, deposition pattern and the content of aragonite. The obtained results should help to understand the processes involved in distribution of trace metals, governed and accompanied by early diagenetic processes and physico-chemical conditions, in aragonite-rich sediments in the Mediterranean marine environments.

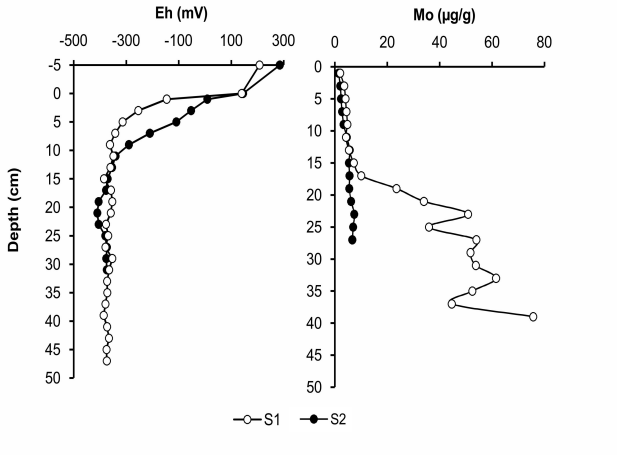

Fig. 2. Vertical distribution of redox potential (Eh) and concentration of Mo in the sediment cores from sampling Sations 1 and 2.

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