

RAMAN SPECTROSCOPIC ASSESSMENT OF HYDROMAGNESITE FROM SALDA LAKE. B. Yilmaz¹ and O. Unsalan², ¹Department of Biotechnology, Graduate School of Natural and Applied Science, Ege University, Izmir, Turkey (brgzzr@outlook.com), ²Department of Physics, Faculty of Science, Ege University, Izmir, Turkey (physicistozan@gmail.com)

Introduction: The only known place with carbonate detections near to Fluvio-lake structures is the Noachian-aged Jezero crater, however it's uncertain if the carbonates at Jezero are linked to lake activity. Carbonate traces are greatest on the northwest inner rim of the crater and between the west delta and the crater rim [1]. Hydrated Mg-carbonate minerals are formed in abundance in Mg containing mafic terrains by the evaporation of Mg rich waters have high Mg:Ca ratio [2]. Hydromagnesite (HMG) is a common mineral along the evaporate rims of Mg rich alkaline lakes [2]–[5] and also with other hydrated magnesites in playafed by Mg rich groundwater [6]–[8]. Hydrated Mg-carbonate minerals are transformed into magnesite by high temperatures, dehydration, and diagenesis [2], [9]–[11]. As a result, HMG is unlikely to exist throughout geological time periods. One possible source of concentrated hydrated magnesite or magnesite-HMG mixtures in Jezero carbonates is dehydration or diagenesis of pre-existing HMG. If carbonates in Jezero is lake shoreline sediments have high biosignature conservation potential. Particularly, lacustrine carbonates can contain morphological and textural biosignatures at scales that can be detected by a land mission. Mineralogically, the presence of hydrated magnesite is compatible with a lake origin [12]. In the past decade, Balci and co-workers also discussed the importance of Salda lake and its microbial habitat in terms of formation mechanism of Mg-rich carbonates and discussed the importance of comparison of possible paleolake deposits at Jezero crater on Mars with terrestrial analogs at Salda Lake [13] and they also published present-day stromalite formation by means of ICP-MS, XRF, XRD and petrographic methods [14]. Due to the similar geologic/mineralogic structure of Jezero crater and Lake Salda, this research was performed to observe certain possible minerals, particularly, HMG, by Raman spectroscopy. of the HMG mineral experimentally to aid future investigations on the Mars-Jezero crater.

Methods: Renishaw Raman spectrometer was used to perform measurements on the Salda lake samples. The laser power is adjusted to 5% (~1 mW) to avoid harming the sample. Spectra were recorded in 200-2000 cm^{-1} region. 532 nm excitation laser was used. Samples were collected on the 17.July.2014 and was kept in plastic bottles before the experiments. Samples were extracted with a plastic dropper among the three layers (mud, white&grey, water).

Results and discussion: Salda lake samples and their corresponding Raman spectra were given in Figs. 1 and

2. It was previously concluded that cyanobacteria colonies prefer Ca ions instead of Mg ions in the presence of calcium ions in the environment and aragonite mineral is formed around the cyanobacteria colony in HMG [15]. Considering the microbial diversity of the lake it can be concluded that the bands at 1153.68 and 1511.07 cm^{-1} belong to β -carotene in addition C=C, C–C stretching modes can be assigned respectively. The bands (Figure 2), especially the band seen at 690.19 cm^{-1} , differed from the results of other studies. In other studies on HMG, a band of CO_3^{2-} ion with in-plane bending motion was observed at approximately 727 cm^{-1} [15]–[17]. The reason for this difference in the data may be due to the artinite mineral, because HMG ($\text{Mg}_5(\text{OH})_2(\text{CO}_3)_4 \cdot 4\text{H}_2\text{O}$) and artinite ($\text{Mg}_2\text{CO}_3(\text{OH})_2 \cdot 3\text{H}_2\text{O}$) minerals are the hydrated variants of magnesite and are often found together [16]. The 1168.24 cm^{-1} band can be assigned as the C=C stretching mode for β -carotene, and the 1604.50 cm^{-1} band can be assigned to scytonemin, the UV protective molecule found in cyanobacterial sheaths in stressful environments [15] also 1604.50 cm^{-1} value can be assigned as water bending peak [17]. The value at 1117.17 cm^{-1} is the symmetrical stretching peak of the CO_3^{2-} ion [15]–[17]. The broad band at 1310.06 cm^{-1} can be attributed to chlorophyll α , and the band at 1590.18 cm^{-1} might be assigned to scytonemin again [15].

Conclusion: Our findings suggested that no direct evidence of pure HMG was observed. The CO_3^{2-} in-plane bending motion of HMG was detected at 727 cm^{-1} in prior research, but the value of this typical bending motion could not be determined in this work. The disparity in the obtained values might be due to artinite minerals because HMG and artinite minerals are usually found together. In the presence of Ca^{2+} ions in the environment, cyanobacteria in Salda Lake preferred Ca^{2+} ions over Mg^{2+} ions, may resulting in the formation of aragonite mineral. Similarly, the band at 1604.501 cm^{-1} can be attributed to scytonemin, a UV-protective molecule. Finally, it can be concluded that if the carbonates in Jezero are hydrated magnesite compounds, these carbonates might have formed by lake activity. The presence of HMG, aragonite, and artinite minerals in Jezero will increase the possibility that the crater may have microbial origin.

Acknowledgments: This work was supported by Ege University Scientific Research Projects Coordination Unit. Project Number: 22523. (Part of a M.Sc. thesis project of Berguzar Yilmaz). Salda lake samples were

collected within the framework of the support by the project coded: MFAG/113F035 by The Scientific and Technological Research Council of Turkey (TUBITAK). Ozan Unsalan further acknowledges to the project (MFAG/113F035) team members (Mehmet Emin Ozel, Ersin Kaygisiz, Tugba Temel, Zahide Terzioglu) who participated in sample collecting campaign and student Ahmet Karadag as a volunteer.

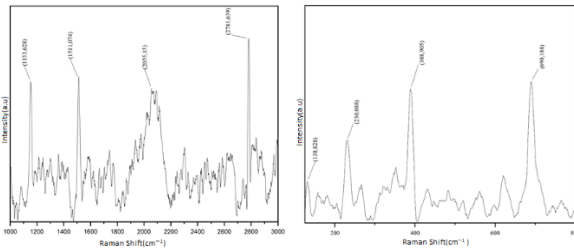


Fig. 1. Left: Raman spectrum of Salda beach sample (white sand-gray particles) and right: white sand-yellow).

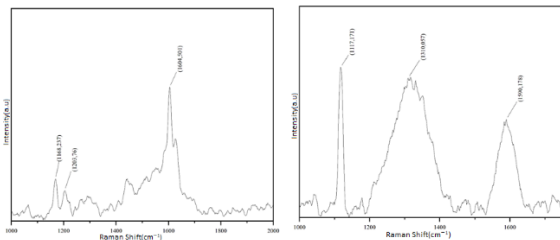


Fig. 2. Left: Raman spectrum of Salda beach water sample and right: pebbles from beach.

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