INFRARED SPECTROSCOPIC ANALYSIS OF THE AIOUN EL ATROUSS DIOGENITE. I.Ayvaz[1], O. Unsalan[2], C. Altunayar-Unsalan[3], M. E. Zolensky[4], [1]Ege University, Faculty of Natural and Applied Sciences, Department of Biotechnology, 35100, Bornova, Izmir, Turkey, [2]Ege University, Faculty of Science, Department of Physics, 35100, Bornova, Izmir, Turkey. [3]Ege University, Central Research Testing and Analysis Laboratory Research and Application Center, 35100 Bornova, Izmir, Turkey, [4]Astromaterials Research and Exploration Science, NASA Johnson Space Center, 2101 NASA Parkway, Houston, TX 77058, USA.

Introduction: Aioun El Atrouss is a meteorite that fell in 1974 in Mauritania. Following the previous classifications as achondrite-hypersthene in 1979 and diogenite in 2000, Aioun El Atrouss was classified as diogenite-pm in 2006, which belongs to the group called howardite-eucrite-diogenite (HED). There is clear evidence that (4) Vesta is the parent body of HED group meteorites [1]. In the light of this information, the HED group meteorites offer a unique view of the differentiation processes that occurred in asteroid-sized bodies early in the solar system's history. Spectroscopic analysis of meteorite samples provide data on their chemical composition. Information about composition and structure helps to remove the question marks about the outer solar system as well as provide information about the history of the solar system as a whole. In this study, Fourier-Transform Infrared (FT-IR) spectrometry was used to detect the organic and inorganic substances in the provided meteorite. FT-IR spectrometry is a well-known technique to determine the composition as well as possible biomarkers by detecting the molecular interactions. Thanks to the detection of biomarkers, the probability of finding life on planets that have the potential to contain life such as Mars has increased. Here we report the first IR spectroscopic analysis of the Aioun El Atrouss diogenite.

Material and methods. A total 75.9 mg of Aioun El Atrouss sample AAT-01 was ground in an agate mortar to prepare separate powder aliquots with various sizes (Fig. 1). The average sizes of the particles in the powdered sample are ~199 µm for the first sample (Fig. 1A), ~50 µm for the second sample (Figure 1B) and ~21 µm for the third sample (Fig. 1C). A Leica MZ16 stereo microscope was used to determine the grain size of the meteorite sample. 3.2x magnification was used to capture the images of powder samples. Images were measured and analysed by ImageJ [2]. Approximately 17.9 mg of sample was re-ground after each record and placed on the diamond crystal of the Attenuated Total Reflection (ATR) unit of the Perkin Elmer Spectrum Two infrared spectrometer equipped with a deuterium triglycide sulphide (DTGS). All spectra were recorded in 4000-400 cm^{-1} region at ambient temperature with a resolution of 4 cm^{-1} with 64 scans. Before starting the experiment, the Polystyrene Reference Card supplied by Perkin Elmer was used for calibration purposes. Recorded spectra were analysed with Spectragryph v1.2.15 [3].

Results and discussion: Optical microscope images of the three different sized ground samples are shown in Figure 1 whereas FT-IR spectra of three samples are presented in Fig. 2. Diogenites mainly contain plagioclase, pyroxene, olivine, chromite and troilite [4]. Our study reveals that Aioun El Atrouss AAT-01 shows clear evidence of pyroxene and plagioclase. Diopside, enstatite, and hypersthene has also been observed and a successful match was found. In previously published data [5] the authors analysed and determined the diopside (639, 678, 720, 870, 917, 1002, 1025 cm^{-1}), enstatite (910, 930, 975, 1010, 1050, 1100, and 1120 cm^{-1}) and feldspar (639, 687, 723, 742, 924, 1000, 1045, and 1120 cm^{-1}). As demonstrated in Figure 2, IR spectra of hypersthene, diopside, and enstatite reference spectra fit well to our results.

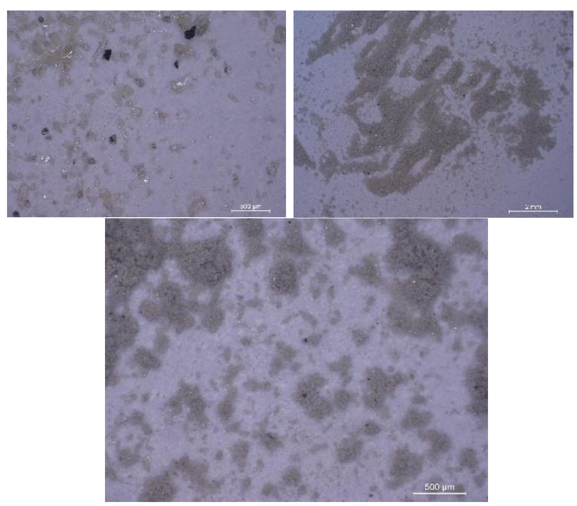

Figure 1. Ground samples in various sizes captured by stereo microscope. A) Top left: First crushing, average size is 199 µm, B) Top right: Second crushing, average size is 50 µm, C) Bottom: Third crushing, average size is 21 µm.

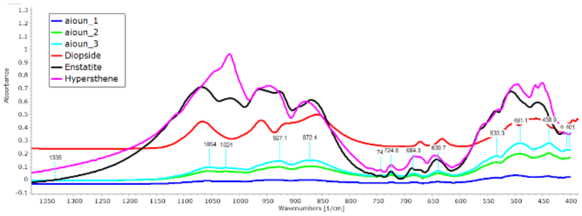

Figure 2. FT-IR spectra of Aioun El Atrouss and representative pyroxene minerals (diopside, hypersthene, enstatite).

Conclusion: Our preliminary work's results are in line with the previously reported studies that indicate diogenites consist mainly of pyroxene, plagioclase, chromite, and olivine [3]. Strong evidence of hypersthene, enstatite, diopside and plagioclase in our sample of Aioun El Atrouss were observed. This might be due to the analysed chips of not being truly representative of the meteorite. This sample is apparently representative of an olivine-poor and pyroxene-rich assemblage among diogenites. Further investigation is thus required for this puzzling rare diogenite.

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