SURFACE TEXTURAL ANALYSIS OF MARS RELEVANT FLUVIAL AND AEOLIAN BASALTIC GRAINS BY SCANNING ELECTRON MICROSCOPY. Zs. Kapui[1], A. Kereszturi[2], S. Józsa[3], Cs. Király[4], Z. Szalai[4], G. Újvári[1], [1] MTA Research Centre for Astronomy and Earth Sciences, Institute for Geological and Geochemical Research (kapui.zsuzsanna@csfk.mta.hu), [2]MTA Research Centre for Astronomy and Earth Sciences, Konkoly Observatory [3]Eötvös Loránd University, Department of Petrology and Geochemistry, [4]MTA Research Centre for Astronomy and Earth Sciences, Geographical Institute.

Introduction: This work aims to provide some preliminary information on the surface microtextures on basaltic grains to support in-situ missions on Mars, especially the ExoMars 2020 rover [1]. The microtextures of the quartz sand grains in the different transport modes got well known in the last couple of years, however little information is available on basaltic grains in this aspect. Certain microtextures on the grain surfaces can be formed in the given environment, and as long as significant changes are not happened in the system, these forms are retained. Thus the transport environments can be reconstructed using surface analysis [2].

This information could be also important to reconstruct Martian surface environments. The aim of this study is to identify different microtextures on basaltic aeolian and fluvial sands, and compared them to the known micromorphological features on quartz. These features were examined with optical and electron microscope, while the outlines of the grains were analyzed with the Morphology 3G instrument.

Geological background: Among the analyzed samples Icelandic basaltic sands from the ISAR collection [3] and fluvial sand from Azores Islands [4] were used. The tholleiitic aeolian sand was collected from Lambahraun volcanic plateau [5, 6], while the fluvial sand came from near Hekla. The composition of this area is mainly basaltic-andesite. The third sample was derived from São Miguel (Azores), the composition of this volcanic area is non-primitive basaltic magma [7].

Analytical methods: The analysis started with optical microscope (NICON Eclipse E600 POL) using 4, 10, 20 and 40x magnifications to identify the general and specific features of these samples. Then the grains were sticked to glass plates, which were made high-resolution photos with Tm4000 Plus Tabletop electron microscope in Eötvös Loránd University, Budapest.

The micromorphology features of fluvial and aeolian grains: The fluvial sand from Azores (d <1mm) and the aeolian sand from Icelandic (d<1mm) showed few typical “quartz-type” micromorphology forms using optical microscope.

Using SEM the identified microtextures on the fluvial grain are: angular shape, medium relief surface, V-shaped percussion cracks, abrasion features and uncertain precipitation features. In contrast, more microtextures were found on the aeolian grains: subangular-angular shape, low or medium relief surface, flat cleavage surface, conchoidal fracture, upturned plates, crescentic gouge, adhering particles and precipitation features. Characteristic images are visible in Figure 1.

Summary: Analyzing the microtextures of grains helps to determine the grains' transport medium. This work focused on basaltic sands from aeolian and fluvial environments (Iceland, Azores Islands), opposite to most works that focus on quartz a the most abundant mineral in such environments on the Earth. By optical microscopy some microtextures could be identified: upturned plates, meandering ridges and chemical precipitation – however the morphology is much more diverse and exotic than that of quartz. Several microtextures could be found using SEM pictures: conchoidal fractures, different steps or marks (fluvial); upturned plates, bulbous edges and chemical precipitation (in aeolian regime). The difference between the quartz and basaltic microtxtures could be caused by the shorter transport time and that the basaltic minerals (olivine, pyroxene) are less resistant to the external influence. The aim of this study is to collect many examples of basaltic microtextures, because these information could help to identify the settling environments of grains on Mars as well. It seems, the microtextures analyzing will be also used to determine the transport medium in case of basaltic grains.

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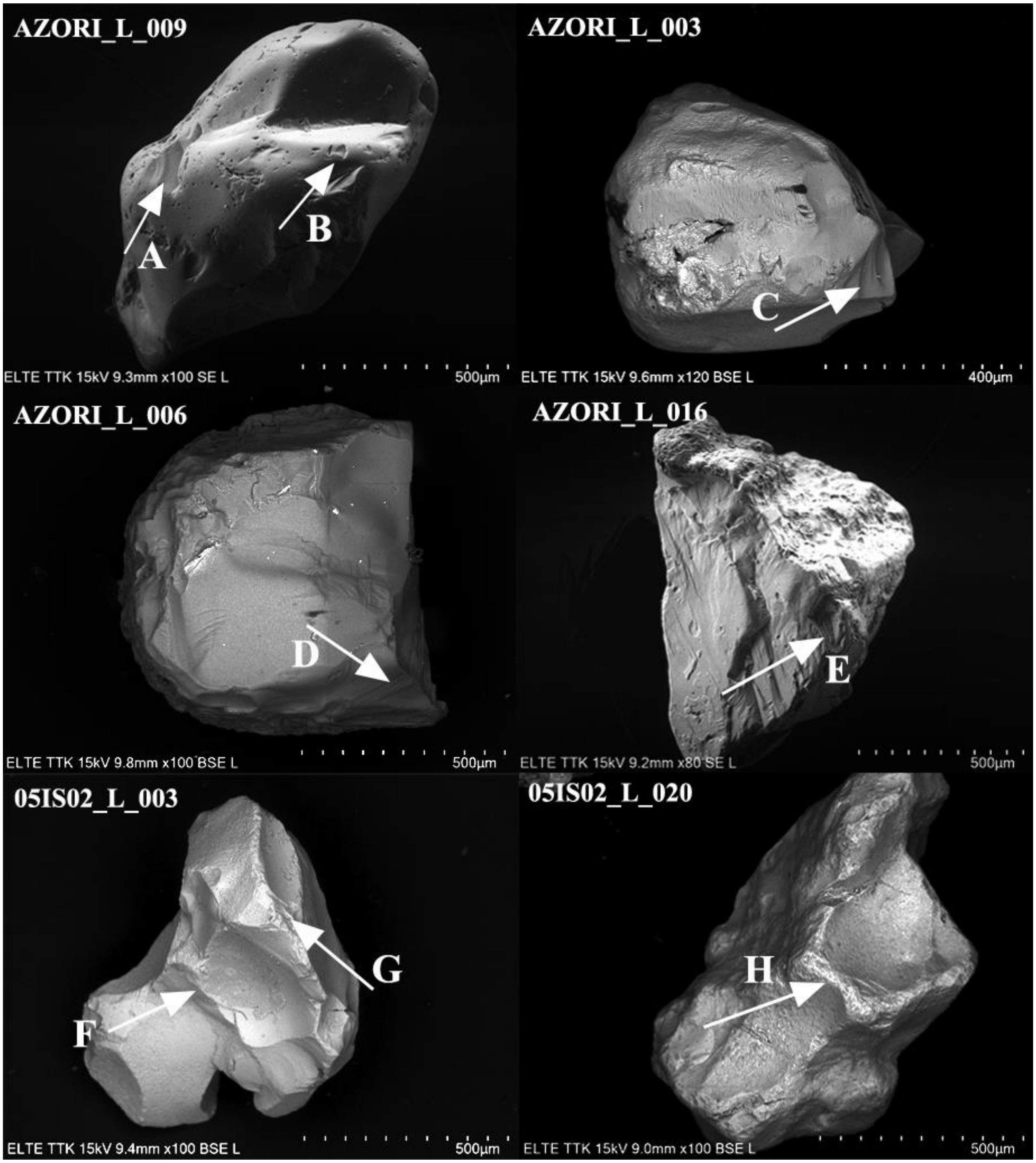

Figure 1.: Fluvial basaltic grains from Azores-island (AZORI_L_009-016). The conchoidal fractures (A, D), percussion marks/cracks and grooves (B, C) arcuate or straight steps (E) are related to the fluvial transport. Aeolian grains from Iceland (05IS02_L_003, 020) show bulbous edges (G, H) and precipitation features (H) are related to aeolian environments.