WEATHERING OF ANTARCTIC EUCRITES

A. Losiak[1], [1]Planetary Geology Lab, Institute of Geological Sciences, Polish Academy of Sciences, Poland (anna.losiak@twarda.pan.pl)

Introduction: Antarctica is the most abundant source of meteorites, including valuable samples from Mars or Moon [1]. On this continent, the rate of weathering is much lower than in other natural terrestrial environments, because of very cold and dry conditions [2,3]. However, even in this setting, weathering may significantly alter primary properties of the extraterrestrial materials [4]. Because of that, understanding the processes of meteorite weathering is important for a proper interpretation of any analysis performed on meteorites that are "finds". Additionally, Antarctica is considered to be one of the best Mars analog sites, and pre-terrestrial weathering assemblages present within nakhlites found in Miller Range are very similar to those developed on the terrestrial polar cap [4,5, 6,7]. Studying weathering on Antarctica can lead to better understanding low-temperature and low-water-contents alteration on Mars, especially in respect to recently proposed weathering on and within Martian North Polar Residual Cap [8, 9,10,11,12].

Aim: The aim of the study is to compare secondary phases resulting from aqueous processes (e.g., formation of poorly crystalline iddingsite-like material, precipitation of evaporites including Mg- and Ca-, K-, Fe-carbonates and sulfates) and aqueous corrosion features (e.g., etch-pits and weathering rims) developed in a set of eucritic meteorites from different ANSMET meteorite fields. All meteorites are basalts which have not been engaged in aqueous processes before landing on Earth.

Samples and Methods: Nine thick sections of eucrites [13] has been allocated by the US Antarctic Meteorite Program. All of the thick sections came from the outermost parts of the meteorite, with a visible fusion crust preserved. All samples came from meteorites that were: 1) at least 35 g in mass (preferably >100g); 2) had fusion crust preserved; 3) had weathering category A, A/B or B; five samples had evaporites visible in hand samples and four did not; 4) represented a wide range of geographical locations in respect to distance from the sea, and local conditions influencing evaportie formation [1]; 5) years of collection with abnormally high evaporites abundances were omitted [1]. Thick sections were prepared without use of water in order to not disturb evaporitic minerals. The selected samples are: ALHA81001.53, EET92003.28, PCA91007.32, PCA91081.16, BTN00300.41, GRA98098.66, QUE97014.39, QUE99006.12 and LEW86001.25. Thick sections were analyzed with SEM and microprobe.

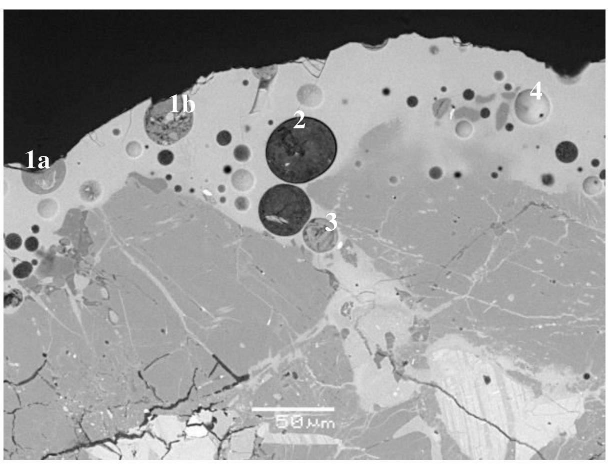

Figure 1. Terrestrial (Antarctic) aqueous alteration products within the fusion crust (light grey colored material with multiple vesicles) of the LEW 86001.25. Vesicles that are opened to the surface are filled with the desert varnish that is often layered (1a) and sometimes includes crushed fragments of fusion crust glass (1b). Desert varnish rarely is present outside the vesicles, even if other protective pockets or cracks are available. Vesicles located deeper within fusion crust, that are not in the direct contact with the surface, are filled with two main types of material: (2) low z-contrast phase rich in Si, Fe, Mg and Ca; and (3) euhedral crystals composed of Ca and S. Some vesicles appear to be devoid of any alteration products, but in most cases it is probably caused by sample preparation.

Preliminary results: All analysed eucrites had aquaeous weathering phases in the outhermost layer – including meteorites that were classified as not-evaporite bearing. The amount of preserved evaporites seem to be correlated the most with the level of vessicularity and preservation of the fusion crust. Not all meteorites are covered by desert varnish.

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