INHOMOGENEITY OF THE PUŁTUSK H CHONDRITE REGOLITH BRECCIA AS A RECORD OF DYNAMIC EVOLUTION OF PARENT BODY.

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Introduction: The regolith forms on airless bodies, due to repeated impact events leading to disruption and re-agglomeration of the bodies [1,2]. Thus, as principle, meteoritic regolith breccias record the dynamical evolution of their parent bodies, the shock and annealing history. Impact history is, however difficult to be read because of small size of regolith particles and inhomogeneity of material. Nonetheless, deciphering of the history is one of the fundamental aspects in planetary research, as the process broadly affects mineralogical, petrological, geochemical and isotopic features [1,2].

The Pułtusk meteorite represents H chondrite regolith breccia [3]. The textural observation of 23 specimens (1–20 g) by μCT, SEM as well as EPMA and Raman analyses enabled to reconstruct at least three impact events in history of the parent body of chondrite.

Lithologies and impact history: The Pułtusk reveals high lithological inhomogeneity of material. Well lithified, down to tens μm-sized clasts of petrologic types 3.8–6 build up the breccia. Many specimens of meteorite are cut by vein-like metallic structures, formed by amoeboid metal grains with plenty of tendrils and protrusions. The metal grains are accompanied by large plagioclase, merrillite and Cl,F-apatite crystals. The composition and structure of metal grains suggest they were formed due to early impact event, unmixing of FeNi-metallic melt, its incorporation into the crater basement and slow cooling. Late metamorphic minerals in the vicinity of metal confirm local increase in temperature and annealing as well as reveal action of fluids.

Minor but important specimens represent impact melt. They consist of microcrystalline groundmass embedding metal-troilite eutectic globules. Calculated cooling rate for melt suggests its rapid quenching on the parent body surface, typical for many H chondritic breccias impacted ~3.7 Ga [4].

The most prominent in Pułtusk are microfaults and microcataclasis. Shear strain is well recorded in grain scale, its influence on metal grains is manifested by metal fabric rebuilding [5]. In samples large enough, it is visible that shear fractures cut all the products of former impacts – they are related to the youngest collision, the Pułtusk rock suffered on parent body. The impact affected regolith, probably finally lithifing it. In dark, regolith matrix of chondrite, CM2.6 microxenoliths occur, that are weakly shocked but deformed along with the rock hosting them [6].

Conclusion: Textural observations of Pułtusk fragments sampling regolith provide us with information on evolution of their parent body. It confirms high inhomogeneity of regolith, but reveals, on the other hand, that dynamic evolution of parent body is recorded in both sample and grain scales.

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