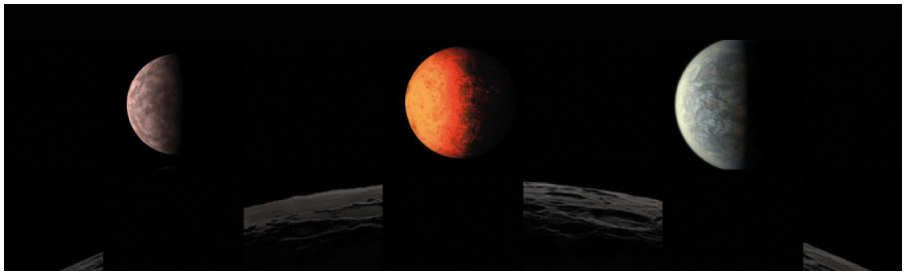

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Estimation of metallic resources of ordinary chondrite parent asteroids

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Although ordinary chondrites are stony meteorites they still contain significant amount of metals (up to 18.6wt%), mainly occurring as FeNi alloy grains. This makes ordinary chondrites and their parent rocks very important in extra-terrestrial metallic resource considerations, crucial for ISRU concept (In Situ Resource Utilization). S-type asteroids both belonging to Near Earth Asteroids (NEAs) and orbiting in main belt are ordinary chondrite parent bodies (e.g. Hebe, Eros, Toutatis, Flora, Itokawa). Due to the fact that their parent asteroids are undifferentiated objects, these metallic grains are homogenously distributed in the whole parent body structure.
Based on microscopic examinations, bulk chemical composition and EMP analysis estimations of Fe, Ni, Co, Cu resources was possible. Our results also consider the distribution of these metals in different mineral phases of FeNi alloy (kamacite and taenite), what is especially important for future mineral processing. Our calculations show potential geological resources of FeNi alloy grains of selected metals (Fe, Ni, Co, Cu, Cr, Au, Pd, Pt) on previously mentioned asteroids and in its regolith layer estimated on the basis of mineral and chemical composition of H, L, and LL chondrite groups.
Our findings demonstrate the richest in metals among ordinary chondrites are H chondrites and their parent bodies –they contain 18.6wt% of ore minerals (FeNi grains). In case of mining Fe and Co can be obtainable mainly (over 90%) from kamacite. Comparable proportions of Ni can be extracted from kamacite (53%) and taenite (47%). Fe0 (metallic, native iron), Ni and Co content in kamacite and taenite was calculated for asteroid 6 Hebe. H chondrite parent bodies are polymetallic (Fe, Ni, Co, Cr, Cu, Au, Pt, Pd) deposits (Łuszczek and Przylibski, 2021).

Łuszczek K., Przylibski T.A., 2021 - Selected metal resources on H chondrite parent bodies, Planetary and Space Science, Vol. 206, https://doi.org/10.1016/j.pss.2021.105309

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