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EXPLORING POTENTIAL ENVIRONMENTAL BENEFITS OF ASTEROID MINING

Abstract

Asteroid mining has been proposed as an approach to complement Earth-based supplies of rare earth metals and supplying resources in space, such as water. Existing research on asteroid mining has mainly looked into its economic viability, technological feasibility, cartography of asteroids, and legal aspects. More recently Hennig (2016) and MacWhorter (2015) have introduced environmental arguments for asteroid mining, in particular with regards to platinum group metals. However, these arguments are not quantified. Hence, the question whether or not asteroid mining could have significant environmental benefits, both for supplementing Earth and providing resources in space has not been answered satisfactorily. This paper attempts to determine if and under which conditions asteroid mining would have environmental benefits compared to either Earth-based mining or launching equipment and resources into space. First, a state-of-the-art of current life cycle assessment results of terrestrial rare Earth metal mining and space launchers is provided. Second, a first order environmental life cycle assessment of an asteroid mining mission is presented, including an inventory of systems and its environmental impact. Finally, a comparison of the environmental impact of terrestrial rare Earth metal mining and in-space rare Earth metal mining and a comparison of launching water to dedicated places in the cis-lunar space is compared to providing water from an asteroid.