48th IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – The Next Steps (A4)
Interactive Presentations - 48th IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – The Next Steps (IP)

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THE SEARCH FOR RESOURCE EXTRACTION TECHNOSIGNATURES IN THE SOLAR SYSTEM

Abstract

A search for evidence of ETI resource extraction technosignatures in our solar system is informed by a good understanding of mineral deposit formation combined with advances in terrestrial exploration and mining processing technology. The assumption is that space-faring advanced technological civilizations, whether biological or robotic, require metals, minerals, and rock for construction of space travel infrastructure. Evidence of ETI mining and processing activity in our solar system may be ancient and obscured by millions of years of geological processes and natural catastrophic events. A review of current and near-future mining practices on earth provides clues as to what far-future resource extraction technologies could possibly resemble. Near-future mining throughout the solar system will generate conventional physical manifestations of resource extraction activity (mining and processing infrastructure, tailings piles, open pits). Activities may include recovering elemental hydrogen and oxygen from water, using rock as a construction material on the Moon and Mars, mining metals from asteroids and atmospheric mining of helium 3 and hydrogen from the atmospheres of Uranus and Neptune. Far-future large-scale resource extraction activities may generate planetary or solar system scale geochemical depletion halos, unusual biosignatures and geochemical anomalies. For example large-scale chemical leaching in-situ or in leach piles over thousands of years to extract uranium or gold could generate metal depletion anomalies on a planetary scale. Certain microbes used to facilitate metal extraction from ore could generate unexpected biosignatures. Exotic natural geological environments may mimic resource extraction technosignatures. As shown in Gabon, Africa, the presence of plutonium and unusual isotopic ratios in the geological record may be due to natural nuclear fission processes as opposed to nuclear industrial technology.