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ASTRONOMICAL PROSPECTING: A NECESSARY PRECURSOR TO ASTEROID MINING

Abstract

Extractive resources on Earth are obtained in a multi-step process beginning with the roughest delineation of possible ore bodies and progressing upward in information content until knowledge of the ore body is sufficient to commit the resources of a major mining company to their extraction. A similar series of steps is emerging in the harnessing of asteroid resources. The main asteroid mining companies are at this stage prospecting companies that plan to send large numbers of interplanetary smallsats to assay their value, perhaps then stepping up to sample return from the most promising candidates. However, the limited fraction and numbers of asteroids that are likely ore-bodies argues that a precursor step is necessary: the gathering of astronomical data on thousands of potential asteroid assay targets. Astronomical prospecting is comparable to the area selection step in terrestrial mining exploration, although the "area" is the spectral type of an asteroid, not a location or a family of asteroids with similar composition and orbital parameters, at least for the accessible near-Earth asteroids. This astronomical prospecting project will require the use of significantly large (2m – 4m) ground-based telescopes that are 100% dedicated to this task. Several such telescopes exist that might be re-purposed to asteroid prospecting. Nevertheless this data should be relatively cheap to acquire compared with a few interplanetary smallsats. Orbital mechanics dictates that the collection of a useful sized portfolio of promising near-Earth asteroids will take 3 – 5 years, so an early start is desirable. Astronomical prospecting will make an order of magnitude difference to the odds of finding profitable ore-bearing asteroids. It may thus become a commercial activity in its own right.