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# EVALUATING THE SPACE MINING

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**We calculated the number of ore-bearing asteroids according to Elvis equation using current data.**

Since decades ago, the idea of obtaining water and natural resources from planetary bodies different to the Earth has been developing; from science fiction, where the possibility of providing water to Venus colonies transporting objects from the Kuiper belt (Clarke 1998), to proposals about helium extraction from lunar regolith (Schmitt 2006).

In the last decade companies such as Planetary Resources, Asteroid Mining Corporation or Trans Astronautica Corporation have emerged with the objective of developing the technology to mine asteroids and space turism.

In 2014, Elvis published a paper where, he calls to reflect about the feasibility of the space mining, in particular, the mining of Near-Earth Asteroids (NEA's). In that paper, Elvis described what he thought were the key factors to consider a NEA as a mining feasible asteroid. He calculated that 1 in 2,000 asteroids could contain a significant amount of platinum group metals and 1 in 1,100 asteroids an important amount of water for either human consumption or fuel production.

Despite the importance of Elvis' work and the fact that asteroid mining could solve problems such as the high cost transportation of water to space, it is true that the amount of asteroids that bear water has not been precisely estimated yet, neither the amount of water that could be extracted from them, therefore, there is no certainty about their capability to satisfy the human necessities in space. Something similar can be said about the platinum group metals.

The purpose of this work was to make a critical analysis of the probability equation proposed by Elvis, as well as calculate all the factors, considering current information either from asteroid observations along with space mining techniques.

The values we calculated for the platinum-group metals (PGMs) bearing asteroids are 1 in 2,666. In the case of water bearing asteroids we calculated a range of 1 in 3,246 to 1 in 35,714.

After analyzing our results, it was observed that, despite following the same method as Elvis and making many of his considerations, there were meaningful differences with the number of asteroids calculated by him. The reason of this difference in the water calculation is due to a largest characterization of the C complex of asteroids, which significantly affects Elvis $P_{type}$ factor, increasing it in half of the value calculated by him. Moreover, the water content reported in recent literature varies and is not greater than 22%, while Elvis uses a value of 25%, which corresponds to a high value only present in CI chondrites.

The difference between the number of PGMs calculated by us and Elvis was not as drastic as the water.

We concluded that the most important factor in Elvis equation is $P_{type}$, the reason of this is that if no asteroid of the type that contains PGMs or water is found, it is impossible to think about estimating the amount of resources that it has. The $P_{rich}$ factor gains importance in the case of water due to its variability in the C complex asteroids. Direct relations between taxonomies of meteorites and asteroids, such as CM chondrites and Ch asteroids, could help to narrow down this factor.

## REFERENCES

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