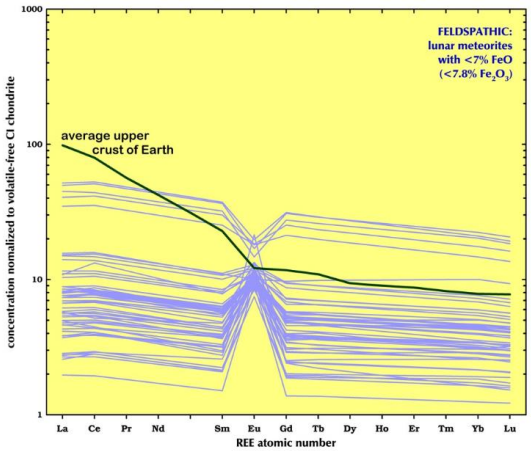
LUNAR RARE EARTH MINERALS FOR COMMERCIALIZATION. A. A. Mardon[1] and G. Zhou[2], R. Witiw[3], [1]University of Alberta (116 St. and 85 Ave. Edmonton, Alberta T6G 2R3, CANADA, aamardon@yahoo.ca), [2]George Washington University (2121 I St NW, Washington, DC 20052, USA, gzhou@gwu.edu), [3]Antarctic Institute of Canada (103 11919 82 ST NW, Edmonton AB, CANADA, riley.w@live.ca)

Introduction: Since the formation of the Moon, collisions of meteorites and comets have impacted the lunar surface creating a great variety of impact craters. Unlike the Earth which has been molded by natural forces through its lifetime, the Moon through its airless and waterless environment has left the lunar surface largely untouched and containing clues of the historical events of the early solar system [1]. With depleting natural resources on Earth, some companies and entrepreneurs have been drawn by the Moon's rough surfaces and investigating feasibility of procuring Rare Earth Elements (REE) from the Moon for terrestrial consumption. One of the many current challenges is that it is currently not economical to lift massive quantities of oxygen, water, structural materials and other vital elements between Earth and the Moon [2]. While technological advancement in this arena continue to develop so that it may one day be more cost-effective for this future business venture, the first of many steps to bringing these ideas to commercialization include producing a well-founded business case to support whether there are enough amounts of REE on the Moon.

Research: Rare earth elements are ultra-rare and previous deposits that can be used in a variety of applications most of which are used on electronics for consumers and defense systems alike. Recent estimates put the global reserves at 140 million tones with the abundance of its deposits located in China (55M) and India (35M) [3].

Based on lunar meteorite samples, lunar samples show different relative concentrations of REE compared to compositions found in the Earth's crust [4]. The graph below for feldspathic lunar meteorites show the varying degrees of concentrations for each element as an example.



Source: http://meteorites.wustl.edu/lunar/chemclass/ree.htm

Most other lunar samples from Apollo, and Luna missions show REE-bearing minerals only as trace phases to include monazite, yttrotitanite and tranquillityite. Given the current information to date, the conclusion shows that there is relatively low REE abundance compared to terrestrial amounts [5].

Conclusion: Beyond the commercial aspect of lunar mining, the seemingly untapped and mineral-rich lunar quarry may also be of strategic and national security importance for the United States and her western allies. Although current studies show that there is not enough REE on the Moon, there may be other minerals that may justify a business case to continue with this investigation on potential lunar mining in the future. With China's growing clout in securing resources around the world and recently blocking exports of rare earth metals from within its boundaries, there may well be another pressing reason for governmental involvement and international collaboration amongst allies to supplement already existing commercial investment for strengthening efforts in lunar geology assessments in relations to lunar mining and full-scale commercialization.

References:

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