LUNAR LAVA TUBES AS POTENTIAL SITES FOR HUMAN HABITATION AND RESOURCE EXTRACTION. L. W. Tombrowski[1] and A. A. Mardon[2], [1 2]Antarctic Institute of Canada (Post Office Box 1223, Station Main, Edmonton, Alberta, Canada T5B 2W4, aamardon@yahoo.ca).

Introduction: It has been suggested in the past that potential manned missions to the Moon could make use of lunar lava tubes as habitable shelters and/or storage areas. These tubes could provide protection against cosmic radiation, micrometeriods, meteorites, and other natural hazards while also providing a habitable environment with relatively stable temperatures compared to the wildly fluctuating day/night temperatures on the Moon's surface.

Benefits: Building a manned lunar base inside of a lava tube has many potential benefits. The temperature inside of the tubes is relatively stable, so space suits and base modules would not require as extensive of temperature regulation systems as on the surface of the moon. This would allow astronauts a greater degree of freedom of movement while inside the tube. Eliminating the need for bulky insulation also means a lunar base only requires pressurization, therefore improving the size and portability of base components. This, however, assumes that the risk of debris falling from the roof of the tube is negligible. The protection from cosmic radiation inside the tubes presents the possibility of a long-term manned lunar mission without the need for as extensive of shielding from radiation. Building a base beneath the Moon's surface also provides the opportunity for mining operations and geological study.

Further Study: More information on the exact location, structure, and depth of lunar lava tubes is required. At the present moment, only observational evidence has been found to support the existence of lava tubes on the Moon, such as entrances to tubes on the surface and signs of possible collapsed lava tubes. Unmanned missions using lunar rovers and/or probes must be conducted in advance of a manned mission in order to determine the suitability of a tube for human habitation and resource extraction. Safe and efficient methods of moving supplies, astronauts, other equipment, and any potential resources extracted from the tube in and out of the tube must also be researched. Due to a lower gravity and absence of atmosphere, lunar lava tubes could be significantly larger than lava tubes on Earth.

Seismic Activity: The exact cause and intensity of seismic activity on the moon is currently unknown. Therefore, more study on the seismology of the Moon must be conducted in order to measure the potential risk of a lava tube collapsing or debris falling from the ceiling of a tube. Methods for safely clearing the floor of a tube of debris, boulders, or other potential obstructions must also be looked into.

Power: Considering the scenario where the main base and living quarters are located inside of a lunar lava tube, options for the storage and generation of power must be examined. If the power is generated from outside the tube (i.e. solar panels), an appropriate power transfer system and backup system must be established inside the tube, or vice versa if power is generated inside the tube.

Conclusion: The usage of lunar lava tubes for human habitation, storage, and/or resource extraction in future missions to the Moon is largely theoretical at this point in time. There are unquestionably great potential benefits to the concept, however a considerable amount of study and further unmanned missions to the Moon will be required before any conclusions regarding the viability of the tubes can be reached.

References: [1] G. De Angelis et al. (2002) *LPS XXXIII*, Abstract #1417. [2] Y. Cheryl Lynn et al. (1992), "Lunar lava tube sensing", *Lunar and Planetary Institute, Joint Workshop on New Technologies for Lunar Resource Assessment*, 51–52