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USING AIRBORNE MAGNETOMETRY TO DISCOVER, LOCALIZE, AND MAP LAVA TUBES FOR FUTURE LUNAR AND MARTIAN RESEARCH AND HABITATION

Abstract

This presentation at the IAC 2024 in Milan will describe the magnetometric research done during several analogue astronaut campaigns; EMMIHS, in 2019/2020, at the HI-SEAS facility on Mauna Loa, Hawai'i, CHILL-ICE II, in 2022 in Hallmundarhraun, Iceland, and the final continuation of this project during CHILL-ICE III, happening in August 2024 in Vesturland, Iceland. The purpose of this research is to investigate the possibilities of discovering, localizing, and mapping subsurface cavities using magnetometry for future extraterrestrial research.

Initial results were obtained using the MagArrow airborne magnetometer from Geometrics, when a total of 125 measurements were taken, of which 118 profiles, 2 point-measurements, and 5 corrupted or incomplete acquisitions, during the EMMIHS-III campaign in February 2020. The presence of a lava tube could be clearly indicated by a negative anomaly in the local magnetic field strength, with higher accuracy and similar precision, at a lower intensive load in both time and (human) energy, than manual mapping in the field. A relative magnetic deviation between 1.8

A replication of this field study was done using Hall sensors from mobile phones in Iceland during CHILL-ICE II, which showed that using longer duration point measurements in a profile, are also able to detect the presence of a subsurface cavity in tholeiitic basalts in Iceland, at a fraction of the price.

The latest iteration of this field study will be done as part of the CHILL-ICE Analogue Astronaut campaign, where a crew of 4 will live and survive for fourteen days in the subsurface of an Icelandic lava tube, to simulate the lunar night. Using an array of Hall sensors and an over-the-counter drone programmed to fly grids, the goal of this third fieldwork will yield results on predicting the number and size of "hidden" lava tubes; those without any skylights or openings to the surface. Results will be presented and published.