7th International Conference on Mars Polar Science and Exploration

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Report

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Polar caps on Mars are the only other known climate record preserved in the Solar System analogous to how ice sheets on Earth record our climatic past. The Mars community is interested in the upper North Polar Layered Deposits (NPLD), estimated to be 5 Myr old, which may provide a snapshot of recent martian climate. The 2011 NRC Planetary Science Decadal Survey identifies the NPLD as a high priority target and recommends a robotic mission to sample ice core for climatic records. The Seventh International Conference for Mars Polar Science and Exploration (ICMPSE) held in January of 2020 at Ushuaia, Argentina aimed to capture the advancements made in characterizing the nature of the polar deposits as steps in preparations for a putative rover mission to study the climate records.

This conference was most important for me as it is very relevant to my dissertation which aims to determine the geologic history of ice-rich sedimentary layers in the polar caps of Mars. My academic training under my advisor Professor Briony Horgan at Purdue University has been in the specialty of visible and near-infrared spectroscopy from orbit and Earth-analog field study to understand the nature of planetary surface processes on Mars, especially in the polar region. My talk at the conference made a unique contribution to the field by characterizing the mineralogy of sediments in the polar caps and confirms detection of mafic minerals likely sourced from recent volcanism/impact cratering on Mars. Since, these minerals can be radiometrically age-dated, a future rover mission can constrain the age of climate records in ice.

However, it is not well understood how geologic processes influence physical fractionation and aqueous alteration of mafic sediments within the ice-rich polar deposits. Terrestrial analog study Semi-Autonomous Navigation for Detrital Environments (SAND-E), a NASA supported Planetary Science and Technology Research (PSTAR) project, aims to bridge this knowledge gap through research in the glacio-fluvial-eolian landscapes of Iceland. Additionally, unmanned aerial systems and semi-autonomous terrain analysis were integrated to develop science framework and operation protocols for conducting science using a rover within a mafic sedimentary environment. At the conference, I had the opportunity to present my experience as a ground and field scientist in simulating rover operations. Moreover, insights from this study could be useful in preparations for addressing challenges associated with rover traverse and target detection on icy-surfaces.

Finally, I gained hands-on experience studying geological processes of glacial origin during the field trips organized by the conference to glacial landscapes of southern Patagonia and southern Tierra Del Fuego in Argentina. Catamaran cruise ride over the Beagle Channel provided a unique perspective to study roche moutonnee, flutes, and drumlin fields. It was illuminating to observe ice flow features, ice towers called “seracs”, and the process of ice damming at the Perito Moreno Glacier. It was enlightening to visit Lake Argentino, Lake Viedma, and Lake Torre which preserved glacial features from the Last Glacial Maximum as well as its recessional phases. All the sites visited are potential planetary analogs for studying cryosphere on other planetary bodies.

Attending ICMPSE-2020 was timely for me to participate in meetings that will provide inputs to larger NASA mission strategies. As an aspiring planetary scientist, this conference was an ideal opportunity for me to promote my work and gather community feedback. Therefore, this conference has been of immense significance to me as a graduate student and I express my heartfelt gratitude towards the International Association of Geomorphologists for encouraging and supporting my participation in a scientifically enriching experience.