FINESSE: Field Investigations to Enable Solar System Science and Exploration

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The FINESSE (Field Investigations to Enable Solar System Science and Exploration) team is focused on a science and exploration field-based research program aimed at generating strategic knowledge in preparation for the human and robotic exploration of the Moon, near-Earth asteroids (NEAs) and Phobos & Deimos. We follow the philosophy that "science enables exploration and exploration enables science."

1) FINESSE Science: Understand the effects of volcanism and impacts as dominant planetary processes on the Moon, NEAs, and Phobos & Deimos.
2) FINESSE Exploration: Understand which exploration concepts of operations (ConOps) and capabilities enable and enhance scientific return.

To accomplish these objectives, we are conducting an integrated research program focused on scientifically-driven field exploration at Craters of the Moon National Monument and Preserve in Idaho and at the West Clearwater Lake Impact Structure in northern Canada.

Field deployments aimed at reconnaissance geology and data acquisition were conducted in 2014 at Craters of the Moon National Monument and Preserve. Targets for data acquisition included selected sites at Kings Bowl eruptive fissure, lava field and blowout crater, Inferno Chasm vent and outflow channel, North Crater lava flow and Highway lava flow. Field investigation included (1) differential GPS (dGPS) measurements of lava flows, channels (and ejecta block at Kings Bowl); (2) LiDAR imaging of lava flow margins, surfaces and other selected features; (3) digital photographic documentation; (4) sampling for geochemical and petrographic analysis; (5) UAV aerial imagery of Kings Bowl and Inferno Chasm features; and (6) geologic assessment of targets and potential new targets.

Over the course of the 5-week field FINESSE campaign to the West Clearwater Impact Structure (WCIS) in 2014, the team focused on several WCIS research topics, including impactites, central uplift formation, the impact-generated hydrothermal system, multichronometer dating of impact products, and using WCIS as an analog test site for crew studies of sampling protocols.

The FINESSE team visited and mapped all of the major islands within West Clearwater Lake. Excellent cliff exposures around the coasts of many of the islands allowed a general stratigraphy of impactites to be defined. Notable differences to previous work includes the discovery of a monomict lithic breccia and a medium to coarse grained impact melt rock.

In addition, ample rock samples were returned from West Clearwater for geochronology study. Geochronology work centers around laboratory analyses of these samples (and samples collected in the future or obtained from archives housed at the

Canadian Geological Survey). Samples returned from the FINESSE field season have been evaluated for suitability for geochronologic analysis, and selected samples have been crushed for mineral separation and/or sawed for the preparation of polished petrologic thin sections. Heavy minerals (e.g., zircon, titanite, and apatite) will be separated from the crushed material for (U-Th)/He geochronology. The sections will be used for laser ablation $^{40}Ar/^{39}Ar$ research after neutron irradiation.

This presentation will highlight the exciting science and exploration work conducted by FINESSE, as well as future plans for continued research.