THE ROLE OF TERRESTRIAL IMPACT CRATERS IN FORMATION, IDENTIFICATION, AND PRESERVATION OF ENERGY RESOURCES.

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Introduction: Terrestrial impact craters are circular morphological structures often associated with mass extinctions, formation of large igneous bodies, Earth's Moon, ore deposits among many others. As the world grapples with a potential scarcity of resources with time and the ever-increasing population, it is of great importance that potential regions/structures are well studied. Impact craters form part of the former wherein, 60 (29%) of the 208 terrestrial impact craters are associated with natural resources. The resources across the 60 craters range from hydrocarbons (19), major minerals (10) and materials such as agate, gypsum among others (Fig.1). At the crater, the progenetic, syngenetic and epigenetic mineralization products are witnessed [1,2,3].

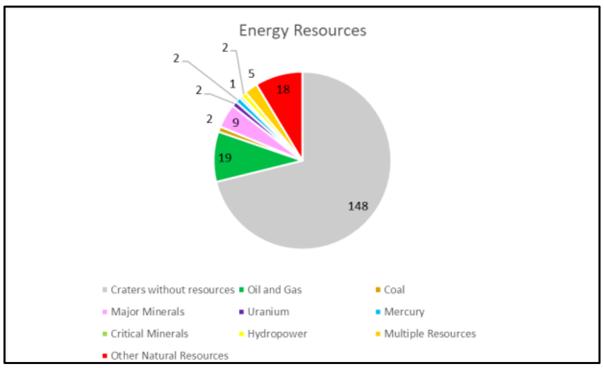

Fig1: Craters related to mineral deposits

Materials and Methods: Remote sensing is the main tool to conduct a widespread reconnaissance survey, as systematic geological survey is a long and complex procedure. The potential images for detecting material properties at Frood and Stobie mines (Sudbury) were procured at four different points at each of the two mining units. For the false color composite and hyperspectral analysis, PlanetLab (3 m resolution) and EO-1 Hyperion satellite images (242 bands) were procured (USGS Earth Explorer). For the Manicouagan reservoir, the Google Earth images were utilized.

Results and Discussions: The crater morphology and resource mineralization are an equally matched function as (1) crater identification aided by mineral deposits, (2) mineral deposition within the crater and (3) mineral identification can be aided by remote sensing techniques. Each of the same are discussed below:

(1) Crater identification aided by mineral deposits. The circular or arcuate or basinal/hemispherical manifestations of mineral deposits, or rather the mineralization itself can be indicative of the crater. The mineralization can be expected along listric or concentric faults of a crater. Furthermore, the spallation patterns of the physical impact derivatives (e.g., melt rock, breccia, shatter cone, ejecta) or regional variations of the shock metamorphic effects can also aid in the crater identification.

(2) Mineral deposition within the crater. The crater accommodates minerals through the different stages of mineralization occurring in correspondence to the crater formation. It is noted that progenetic mineralizations occur in early-excavation stage of crater formation (e.g. expose the originally buried deposits) , while syngenetic mineralization is observed in mid-late excavation stage (e.g., hydrothermal mineralization, melting-induced formation of metallic minerals rich in Pb, Zn, Fe among others) and epigenetic mineralization occur in the modification and post-modification stages (e.g. preservation of the hydrocarbons aided by the structural elements of a crater).

(3) Mineral identification can be aided by remote sensing techniques. The mineral identification can be done via remote sensing techniques, the metal deposits at the Frood and Stobie mines stand out against the vegetation. Additionally, the curves of the hyperspectral images, peak across the absorption band of different minerals namely, chalcopyrite (400 nm), bornite (600 nm) and pyrrhotite (2100 nm) (Fig. 2). At Manicouagan though, the Daniel Johnson Dam is visible, barricading the waters of the Manicouagan reservoir while generating hydropower (Fig. 3).

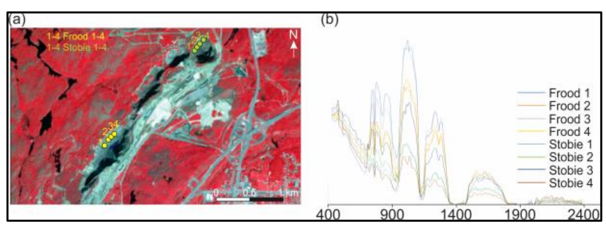

Fig 2: FCC images of Frood and Stobie mines and absorption spectra

Fig 3: Google Earth image of Manicouagan reservoir

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