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SatValMod Application - Churchill Tectonic Province - Nunavut, Canada

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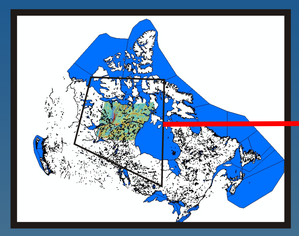
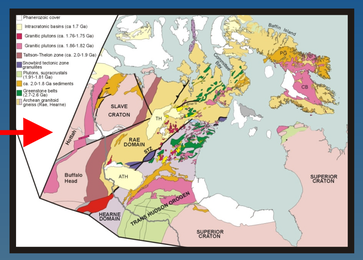
INTRODUCTION



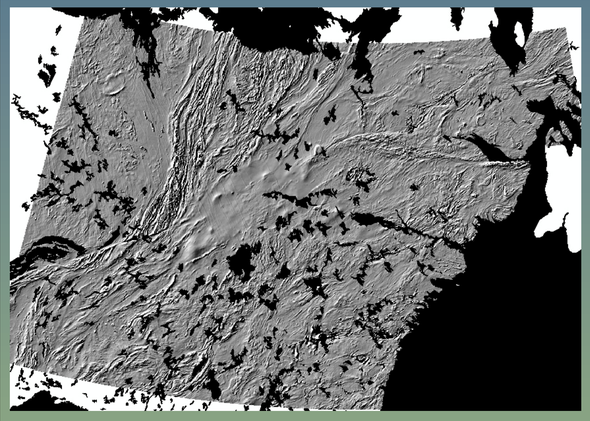
Study Area Western Churchill Province (WCP), Nuavut, Canada



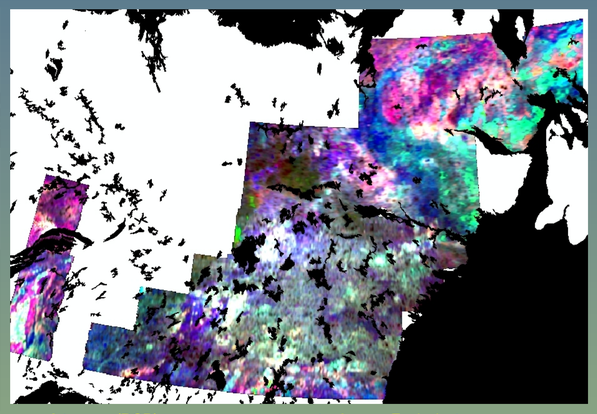
Generalized geology of the WCP

The Geological Survey of Canada is presently is finishing a three year multidisciplinary and multi-agency initiative to understand the nature, distribution and context of mineral resources in the Western Churchill Province (shown on the above maps). A component of this project involved re-mapping this large area using remote predictive mapping techniques (RPM). RPM involves the regional interpretation of enhanced and fused geophysical data, primarily airborne magnetics and gamma ray spectrometer data. Both data types provide complimentary information on regional lithology and structure. When combined using **SatValMod** striking imagery is produced which offers " the best of both data types" ; that is the regional structural and tectonic patterns provided by the magnetic data and the surficial (both bedrock and surface cover) and metamorphic patterns provided by the gamma ray data.

DATA

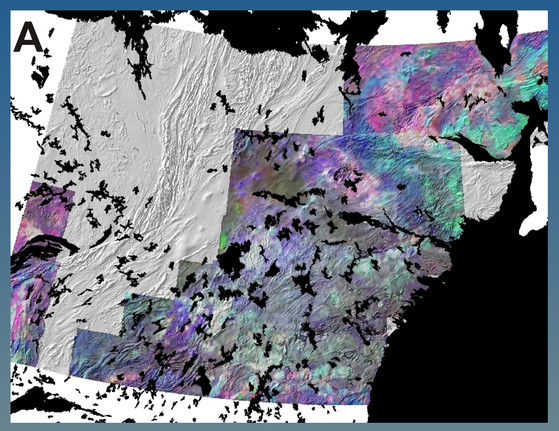


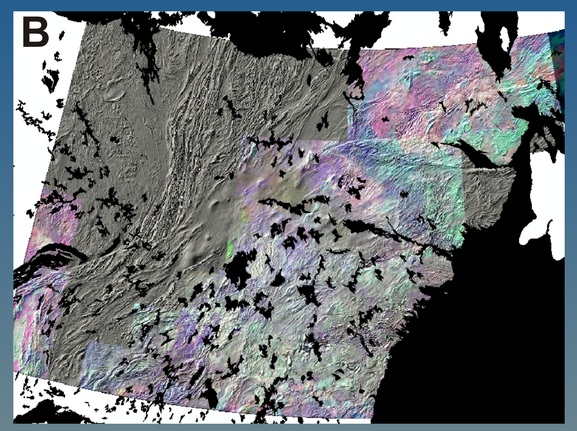
A shaded airborne magentic image. This is used to modulate value or intensity in the fusion process



A ternary (RGB) gamma ray spectrometer image. Equivalent uranium is red, equivalent thorium is green and % potassium is blue. This is used to modulate hue in the fusion process

FUSED DATA





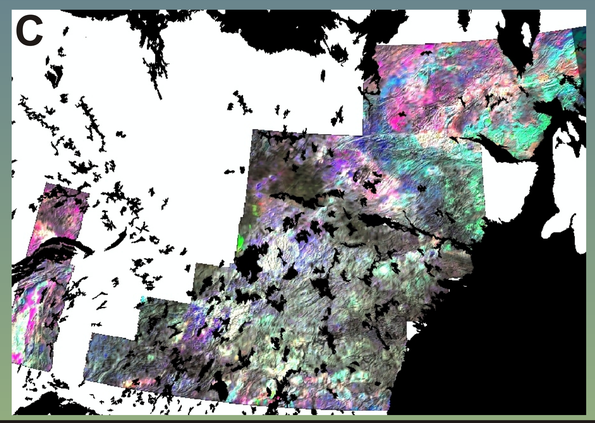
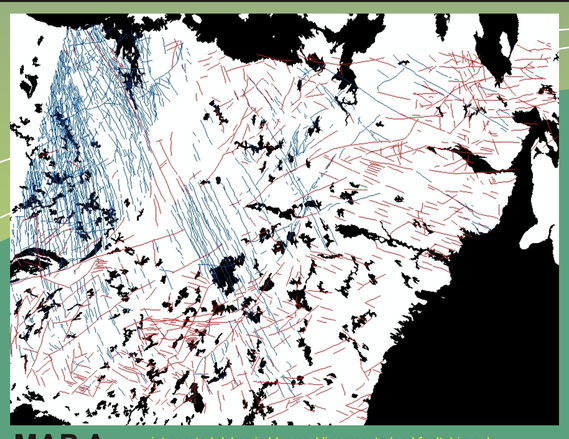
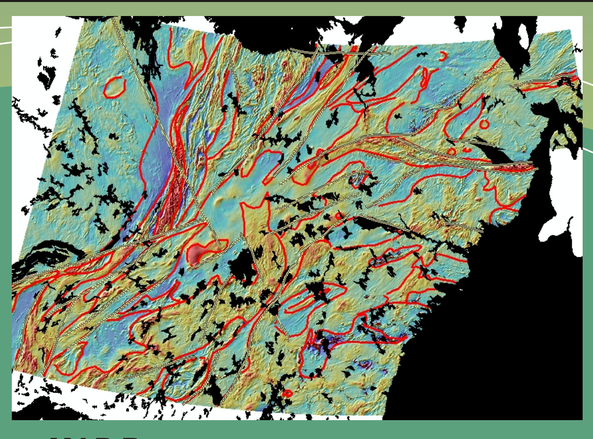


Image A shows the results of fusing the magnetic and gamma data using the transparency function in ArcGIS. The shaded magnetic data was set with a transparency of 50%. Image B shows the results of arithmetically combining the data using a simple additive algorithm. The intensity-hue-saturation (IHS) algorithm is also commonly used to fuse data; however, it can result in colour distortion and loss of information through intensity replacement. Image C shows the results of combining the data using SatValMod. Note how SatValMod preserves the colour balance of the original ternary image providing a superior fusion of the two data types.

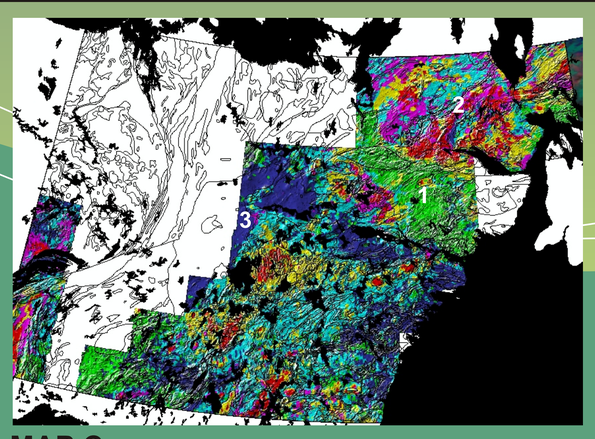
INTERPRETATION



MAP A - interpreted dykes in blue and lineaments (and faults) in red



MAP B - interpreted tectonic domains (in red) and major faults (yellow)



MAP C - radiolelement domains (cool to warm colours) and lithologic contacts

These images separately and in combination (especially fused with SatValMod) provide a good basis for regional geologic interpretation. Map A shows dykes and lineaments (in some cases faults as displacements can be clearly seen) interpreted from the fused imagery. Map B shows interpreted tectonic domains and Map C shows radioelement units derived from clustering the gamma ray data (eU, eth, %K and 3 ratios). This cluster map, in which areas of more intense radiation are shown in warmer colours, has been fused with the shaded magnetic data, again using SatValMod. Lithologic contacts have been overlaid facilitating a comparison between what the gamma ray spectrometer "sees" and what has been mapped in the field. Of particular interest is a large NW-SE trending surficial anomaly (area 1) that truncates bedrock units, Area 2 where radioelement signatures correlate closely with mapped lithology as well as variations in metamorphic grade and Area 3 which represents a sedimentary basin.