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Report of 2014 Activities for the Geologic and Metallogenic Framework of the South Rae Craton, Southeast Northwest Territories: Reconnaissance Surficial and Bedrock Fieldwork in the GEM 2 South Rae Project Area

J.E Campbell and S. Eagles

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Abstract

A six day field reconnaissance was completed in summer of 2014 to obtain an overview of the South Rae study area, southeast Northwest Territories. The goal of this reconnaissance was to ascertain the optimum surficial and bedrock mapping strategies and assess logistics for 2015 and later field seasons. A general perspective of the region's Quaternary geology, the amount of bedrock exposure, access to key mapping areas and possible camp locations for the area was achieved. Air-photo interpretation of the surficial geology of 75B map sheet is underway.

KEYWORDS: Geo-Mapping for Energy and Minerals (GEM) Program, Geologic and Metallogenic Framework of the South Rae Craton Activity, reconnaissance field work, surficial geology

FORWARD

The Geo-mapping for Energy and Minerals (GEM) program is laying the foundation for sustainable economic development in the North. The Program provides modern public geoscience that will set the stage for long-term decision making related to investment in responsible resource development. Geoscience knowledge produced by GEM supports evidence-based exploration for new energy and mineral resources and enables northern communities to make informed decisions about their land, economy and society. Building upon the success of its first five-years, GEM has been renewed until 2020 to continue producing new, publically available, regional-scale geoscience knowledge in Canada's North.

During the summer 2014, GEM's new research program has been launched with 14 field activities that include geological, geochemical and geophysical surveying. These activities have been undertaken in collaboration with provincial and territorial governments, northerners and their institutions, academia and the private sector. GEM will continue to work with these key collaborators as the program advances.

INTRODUCTION

A reconnaissance, 6 day helicopter-based field visit to the southern Rae Province, Northwest Territories, was completed during the summer of 2014 as part of the Geologic and Metallogenic Framework of the South Rae Craton Activity, a component of the GEM-2 Rae Project (Figure 1). The main objective of this activity is to improve the geoscience knowledge and to evaluate the economic mineral potential of this remote and poorly mapped region of the Rae Province (e.g. Taylor, 1959; Craig, 1964; Prest et al., 1968; Taylor et al., 1970; Fulton, 1995; Harris et al., 2014; Henderson and Thompson, 1982; Pehrsson et al., 2014a and b).

While the general region of interest for this activity is defined by 60 and 62˚ latitude and 104 to 110˚ longitude and covers 7 NTS map sheets, 65E, 75 A to C, and 75F to H, the field component of this project will concentrate on 5 map sheets (65E, 75A, B, G and H) where there has been little to no field-based bedrock or surficial geological mapping. The focus of this summer's reconnaissance trip was to obtain an overview of the field study area to assist with the planning of mapping approaches and field logistics for upcoming field seasons.

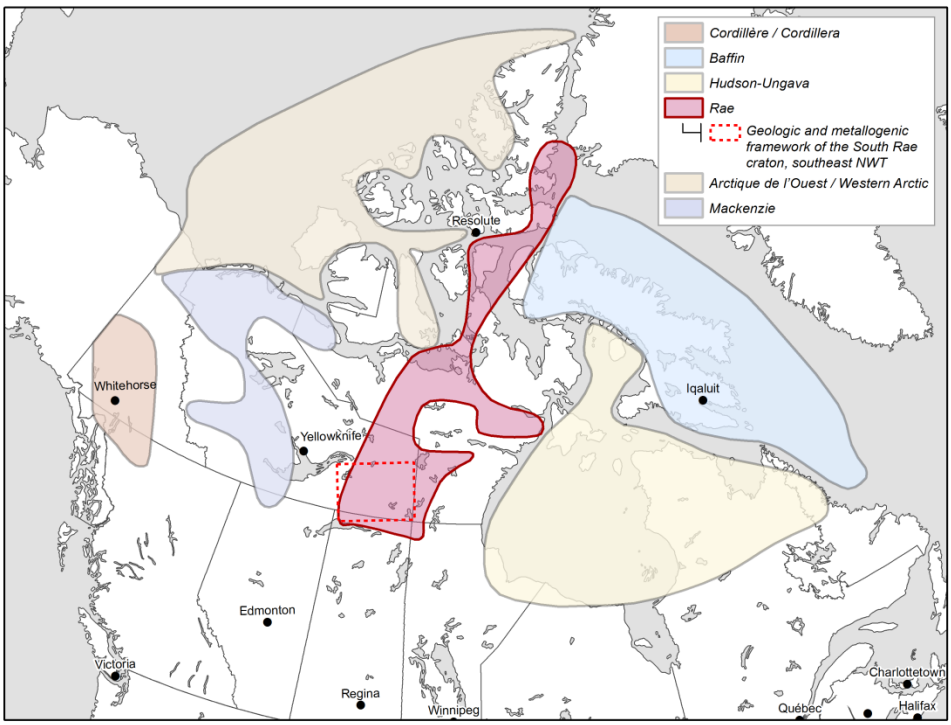

Figure 1. Location of the GEM 2 South Rae Activity (dashed red box) of the Rae project.

FIELDWORK

Figure 2 outlines the region covered by this summer's reconnaissance field trip. Six days were spent surveying the area by helicopter based out of Selwyn Lake. While the focus was primarily the 2015 field area, NTS 75A and B, the intent was made to see as much of the project field area as possible to assist with the overall planning for the bedrock and surficial mapping sub activities for the next 3 years. The area covered was restricted by the location of the fuel caches. In addition to the assessment of overall field conditions, logistics and possible camp locations, attention was paid to specific regions of geologic interest, namely the Howards Lake and Black Bay shear zones, Hoidas extension and the Firedrake-Selwyn lakes region (Figure 2) with respect to the amount of bedrock exposure and the ease of access by foot, boat, plane and/or helicopter.

Another focus of this field trip was to obtain a regional perspective of the surficial geology with respect to the geomorphology (landforms), the distribution of materials and deposits types, and direction(s) of ice flow. The spectral signatures of the various surface materials were noted to assist with the interpretation of satellite imagery in aid of targeting future fieldwork and mapping of the surficial materials. Locations on route were also compared against LANDSAT spectral and SPOT panchromatic imagery to interpret anomalies or spectral differences between material types.

Remote and/or ground observations were recorded at 110 sites (Figure 2). Five till samples were taken from 5 sites for compositional (textural, geochemical and lithological) and indicator mineral analyses. Multiple small scale erosional ice -flow indicators (e.g. striations, grooves, roche moutonnée) were measured at 5 locations.

The Nickel King Ni-Cu-Co deposit on Thye Lake, in the southeast corner of the study area (Figure 2), was visited to assess its suitability for an orientation study with respect to the applicability of drift prospecting for Ni-Cu ± PGEs in this region.

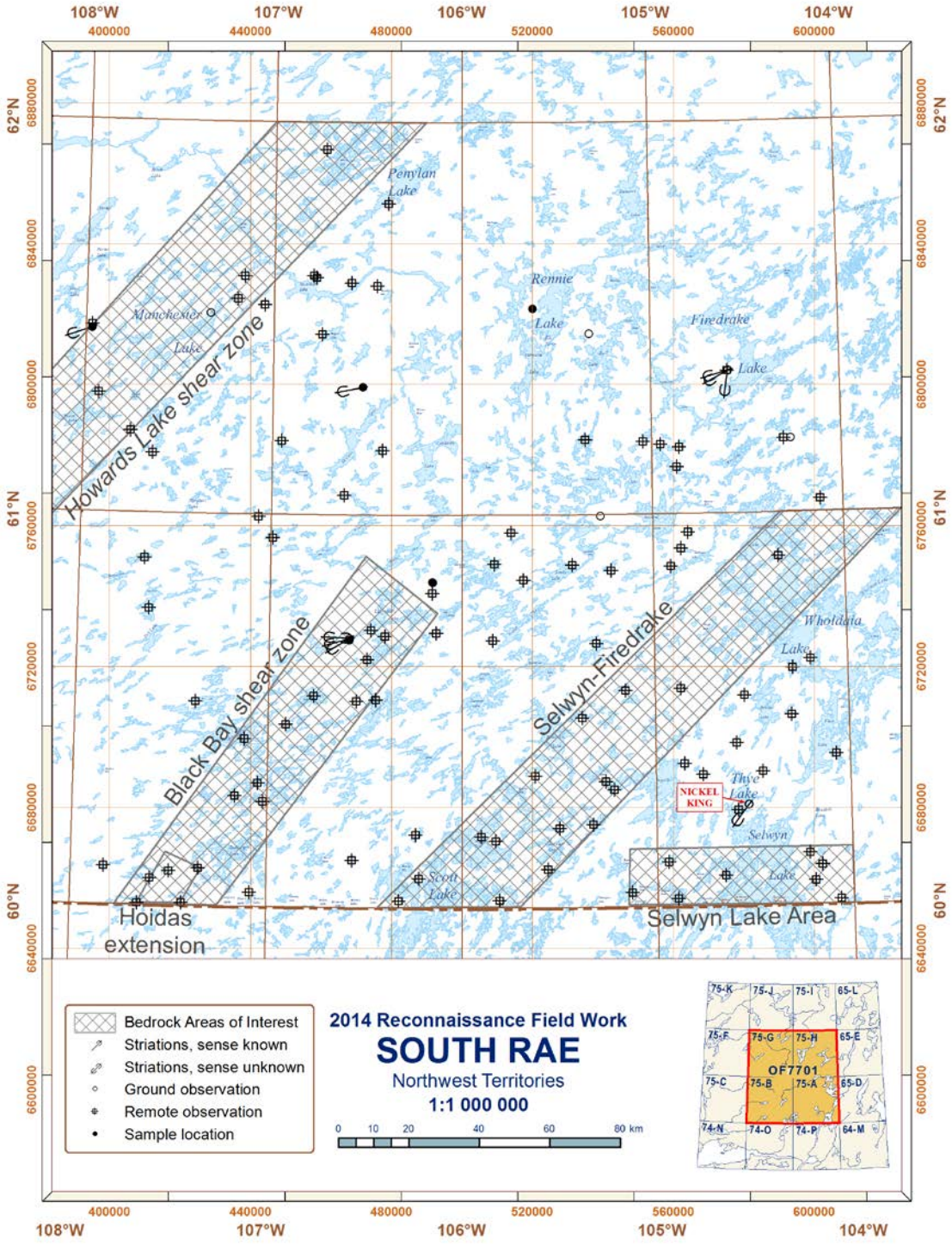

Figure 2. 2014 field reconnaissance area showing the location of field stations, samples and ice-flow indicator measurement.

OBSERVATIONS

The entire South Rae study area is primarily drift covered with bedrock exposure varying from 1 to 40 percent. The thickness of the drift varies from a thin discontinuous cover to thick blankets which mask the underlying bedrock structure. Surficial materials and thickness, landforms, bedrock outcrop locations as well as various terrain and lake characteristics were noted along flight paths.

The project area straddles the tree line therefore the vegetation cover and thickness decreases northward. Thick forested areas are restricted to the extreme south portion of the study area. Much of the area to be mapped has been burned by forest fires over the past several decades and regrowth has been slow. The burns have increased the amount of bedrock exposed. As a result, accessibility and exposure is quite good for mapping in many areas.

Lake shorelines were predominantly boulders; therefore lakes with outcrop were duly noted to help target bedrock and ice flow indicator mapping.

The dominant surficial material is till of varying composition, thickness and genesis. The till occurs as thin veneer, blanket plains, streamlined and ridged moraine, and as hummocky terrain. Large esker systems cross the area from the ENE to the WSW. Evidence, such as beaches, reworked till and glaciofluvial sediments indicate the presence of proglacial lake(s) in the eastern region around Firedrake Lake. Terraced or scarped slopes noted in northern 75B and southern 75G may represent paleo-shorelines or glaciofluvial channel margins.

Calibration of satellite imagery spectral signatures, combined with the geomorphic expression of surficial materials and underlying bedrock structure, will aid in identifying bedrock outcrop and sediment types. This will help target both bedrock and surficial mapping efforts.

Multiple ice flow directions were recorded at 5 sites. The prominent direction, as recorded in the streamline landforms and striations, is the WSW (~ 259˚). An earlier SW direction was recorded at several sites (~240˚).

The suitability of Nickel King deposit for an orientation dispersal study is marginal due to its geographic location. Much of the deposit is underwater and where it does outcrop on land it is on a small peninsula. Further assessment of this deposit, past exploration work and the surficial geology of the area are needed.

FUTURE RESEARCH AND CONCLUSIONS

Information gathered during this trip will aid development of efficient mapping strategies and field logistics for upcoming field initiatives.

Based on field work conducted in the 2014 field season, an approach for surficial mapping is proposed. Preliminary work will include compilation of existing data, a regional geomorphic analysis, and airphoto interpretation of the surficial geology by NTS map sheet. The air photo interpretation of the surficial geology for the 75B sheet is underway. Follow-up surficial investigations in future field seasons will include targeted ground truthing of interpreted map units and surficial materials as well as collection of ice flow indicators and till samples. This information will be crucial for the development of a coherent reconstruction of the paleoglaciology and Quaternary history of the study area.

For the bedrock mapping component of this Activity, this season's reconnaissance fieldwork suggests work focused in areas that have been burned over, even those where the forest fire was over a decade ago,

would be most effective. Correlation of bedrock spectral signature(s) on the satellite imageries will assist in identifying areas of outcrop.

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REFERENCES

Craig, B.G. 1965. Surficial geology of the east-central district of Mackenzie; Geological Survey of Canada Bulletin 99, 41p. 2 maps.

Fulton, R. J. 1995. Surficial materials of Canada; Geological Survey of Canada, "A" Series Map 1880A; 1 sheet, scale 1:5 000 000.

Harris, J.R., Hillary, E.M., Percival, J.A., Buller, G., Buenviaje, R., Bazor, D., Baer, S., Kiessling, G.M., Pehrsson, S.J., Davis, W., Berman, R.G., Wodicka, N., Beauchemin, M., Coyne, M. and Therriault, A.M., 2013. Geo-mapping Frontiers: Updated information on the regions covered by Operations Baker, Bathurst, Keewatin, Northern Keewatin, Thelon and Wager; Nunavut and Northwest Territories**:** GIS Components: Geological Survey of Canada, Open File 7434, 33p.

Henderson, J. B. and Thompson, P. H., 1982. Geology, Healey lake, District of Mackenzie, Geological Survey of Canada Open File 860; map and notes, scale 1:125 000.

Pehrsson, S.J., Currie, M., Ashton, K.E., Harper, C.T., Paul, D., Pana, D., Berman, R.G., Bostock, H., Corkery, T., Jefferson, C.W., and Tella, S., 2014a. Bedrock geology compilation south Rae and western Hearne provinces, Churchill Province, Northwest Territories, Saskatchewan, Nunavut, Manitoba, and Alberta; Geological Survey of Canada, Open File 5744, scale 1:550 000.

Pehrsson, S.J., Percival, J.A., Davis, W.J., McCurdy, M.W., Berman, R.G., Hilary, E.M., Kiss, F., MacKinnon, A. and Jefferson, C.W., 2014b. Operation GEM South Rae: Reconnaissance geology of the most poorly known part of the Churchill Province, Northwest Territories and Nunavut; Geological Survey of Canada, Open File 7410, 25 p.

Prest, V.K., Grant, D.R.. and Rampton, V.N. 1968. Glacial Map of Canada; Geological Survey of Canada, “A” Series Map 1253A; scale 1:5 000 000.

Taylor, F C, 1959. Penlyan Lake-Firedrake Lake, District of Mackenzie, Northwest Territories, Geological Survey of Canada Preliminary Map 8-1959; scale 1:253 440.

Taylor, F. C., Bostock, H. H. and Baer, A. J. 1970. Geology, Wholdaia Lake, District of Mackenzie Geological Survey of Canada, "A" Series Map 1199A; scale 1:250 000.