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Indicator mineral abundance data for till samples from the south Core Zone, Quebec and Labrador (NTS 23-P and 23-I): samples collected in 2014

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ABSTRACT

This open file reports results for the first of three field seasons of reconnaissance-scale till sampling in the south part of the Core Zone in NTS sheets 23I and 23P in the summer of 2014 and for till and sand samples collected 10 to 200 km to the north in support of focussed bedrock mapping activities in the north Core Zone. This sampling was carried out as part of the Geological Survey of Canada's (GSC) Geo-mapping for Energy and Minerals 2 (GEM 2) Program, as part of the Core Zone Project (2014-2017).

The report contains unedited indicator mineral weight and abundance data for sediment samples collected in 2014. Samples were processed by the commercial laboratory Overburden Drilling Management Limited, Ottawa, using a combination of tabling, panning, heavy liquids and magnetic separation to recover potential indicator minerals. Sample locations, weights of various fractions produced during sample processing, and indicator mineral grains identified are reported in this open file.

INTRODUCTION

Bedrock mapping and mineral resource exploration in northern Quebec and Labrador faces challenges because the bedrock geology is, in places, poorly documented due to surficial (glacial) sediments cover. The glacial sediments were deposited by a complex sequence of glacial flow related to the migration of the Labrador ice centre of the Laurentide Ice Sheet (Dyke and Prest, 1987). For significant parts of northern Quebec and Labrador, there are neither surficial geology maps nor till geochemical and mineralogical data to aid in the evaluation of mineral potential or support mineral exploration.

To address these knowledge gaps and support resource exploration, the Geological Survey of Canada (GSC) as part of its Geo-mapping for Energy and Minerals 2 (GEM 2) program and in collaboration with the Ministère de l'Énergie et des Ressources Naturelles du Québec (MERNQ) and the Geological Survey of Newfoundland & Labrador (GSNL), are conducting new surficial mapping and surficial geochemical studies as part of an integrated regional mapping program centred on Archean "core zone" rocks between the Torngat Orogen to the east and the New Quebec orogen to the west (Wardle et al., 2002) (Figs. 1 and 2). These surficial activities will produce new regional geoscience data that will increase geological knowledge and support natural resource exploration and responsible resource development.

The 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 (2008-2013), GEM has been renewed until 2020 to continue producing new, publically available, regional-scale geoscience knowledge in Canada's North.

This open file reports preliminary results for 36 till samples and one beach sand sample collected in the south Core Zone in NTS sheets 23I and 23P in the summer of 2014. An additional 17 till and one sand sample were collected 10 to 200 km to the north of the 23I/23P study area, in support of focussed GEM-2 bedrock mapping activities in the north Core Zone (Corrigan et al. 2014). The data for these 18 till samples are also reported here because the samples were analyzed in the same batch as the samples from the south Core Zone (23I/23P) area.

METHODS

Field sampling

All till and sand samples were collected following established GSC protocols (Spirito et al. 2011; McClenaghan et al. 2013). Active mudboils were targeted for till sample collection at a depth between 0.2 and 1.0 m. In the south part of the study area, beyond the limit of discontinuous permafrost, till samples were collected by digging through the naturally developed soil profile, and sampling unoxidized till (C horizon). Cobbles (>64 mm) were removed from the till to maximize the amount of matrix material being collected. At each site, two samples were collected: a large till sample (7 to 13 kg) for recovery of indicator minerals and a ~3 kg sample for geochemical analysis.

Sampling in 2014 was conducted in two areas: 36 till and one beach sand (14-PTA-R055) samples were collected at targeted sites of interest within the south Core Zone and 17 till and one sand sample were collected 10 to 200 km to the north and northeast (NTS 24A, 24H, 14D,14E) in support of GEM 2 bedrock mapping activities by Corrigan et al. (2014). Systematic reconnaissance sampling in the south Core Zone with evenly distributed sampling sites will be completed in follow-up field seasons in 2015 and 2016 (cf., McClenaghan et al., 2015) and will be partially directed from results of this preliminary fieldwork.

Location data for all samples collected in 2014 in both areas are reported in Appendix A1. Detailed notes and photos taken at each south Core Zone sample site are included in McClenaghan et al. (in press). Site photo for sample 14-PTA-R055 (beach sand) is included in Appendix A2.

Sample processing and indicator mineral picking

All samples were shipped to Overburden Drilling Management Limited (ODM), Ottawa, for processing and production of heavy mineral concentrates. Laboratory data for these samples are reported in **Appendix B**. In 2014, 37 sediment samples from the south Core Zone, 18 samples from the north Core zone, and three quality control samples for a total of 58 samples were processed. The following three blank samples were inserted into the till batch by GSC prior to processing to monitor carry over contamination in the indicator mineral processing laboratory: 14-PTA-R001, 14-PTA-R012, 14-PTA-B043. They are identified as Bathurst blank in **Appendix A1**. These "blank" samples are weathered Silurian-Devonian granite (grus) of the South Nepisiguit River Plutonic Suite (Wilson, 2007) collected in the Miramichi Highlands approximately 66 km west of Bathurst, New Brunswick (McClenaghan et al., 2012; Plouffe et al., 2013). The material is unconsolidated and has the appearance of moderately sorted, monolithologic sand. It does not contain any precious or base metal indicator minerals except for rare gold grains (Plouffe et al., 2013). Results for these three samples are reported along with the regular till samples.

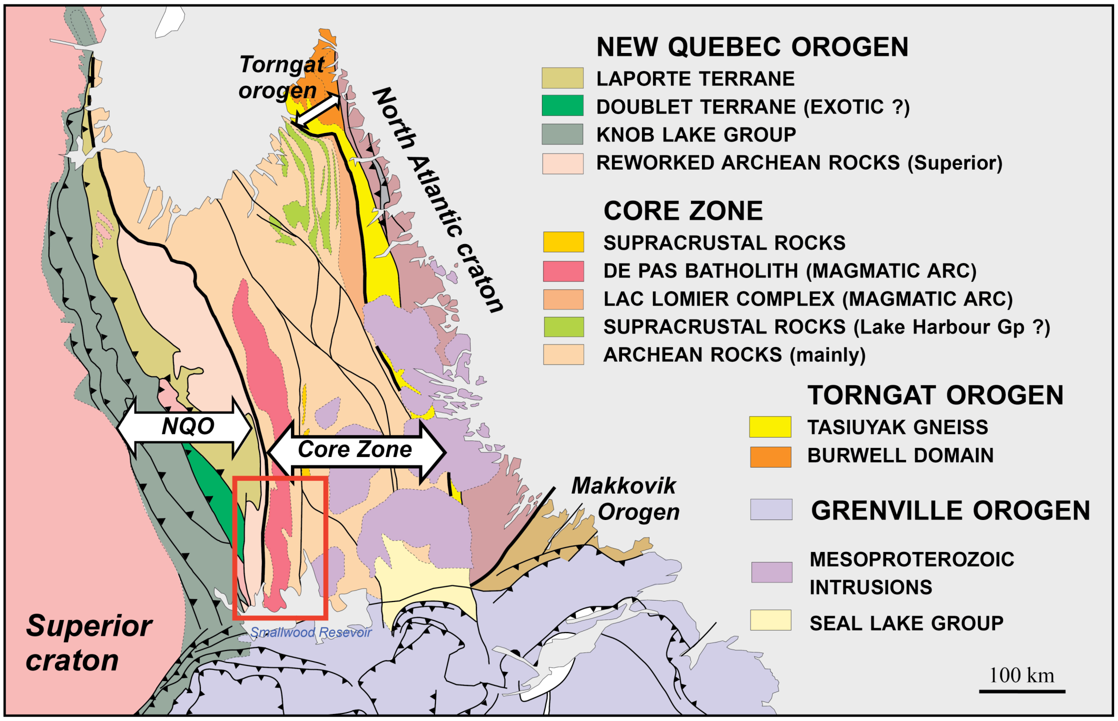


Figure 1. Simplified bedrock geology map of the Core Zone and bounding orogens in Quebec and Labrador. The south Core Zone surficial mapping area (NTS 23P and 23I) is outlined in red. Bedrock geology modified after James et al. (2003).

The <2.0 mm fraction of each sample was processed to produce a non-ferromagnetic heavy mineral concentrate for selection of indicator minerals as outlined in Figure 3. Weights for all fractions produced are reported in **Appendix B**. First, the <2.0 mm material was passed over a shaking table and the heavy table concentrate was recovered and micropanned to recover any gold, sulphide, and other minerals in the <0.25 mm fraction. The minerals in the panned concentrates were counted and their size and shape characteristics recorded and then returned to the sample. Concentrates were then sieved at 0.25 mm. The 0.25 to 2.0 mm pre-concentrate was then further refined using heavy liquid separation in methylene iodide diluted to a specific gravity (SG) of 3.2. After panning and heavy liquid separation, the 0.25-2.0 mm ferromagnetic fraction was then removed and the non-ferromagnetic heavy mineral fraction was sieved into three size fractions: 0.25-0.5, 0.5-1.0, and 1.0-2.0 mm. The <0.25 mm fraction of each sample was processed to recover the non-ferromagnetic fraction and then archived. The 0.25-0.5 mm fraction was further subjected to paramagnetic separations using a Carpco® magnetic separator to produce <0.6 amp (strongly paramagnetic), 0.6 to 0.8 amp (moderately paramagnetic), 0.8 to 1.0 amp (weakly paramagnetic) and >1.0 amp (non-paramagnetic fractions) to assist counting and picking indicator minerals in this fine-grained fraction. The 0.25-0.5 mm fraction was cleaned with oxalic acid to remove oxidation stains (tarnish) from the grains and restore their natural colour, most importantly for sulphide minerals, which facilitates optical mineral identification. Clasts >2 mm were washed with oxalic acid for lithological identification, the results of which are reported in McClenaghan et al. (in press).

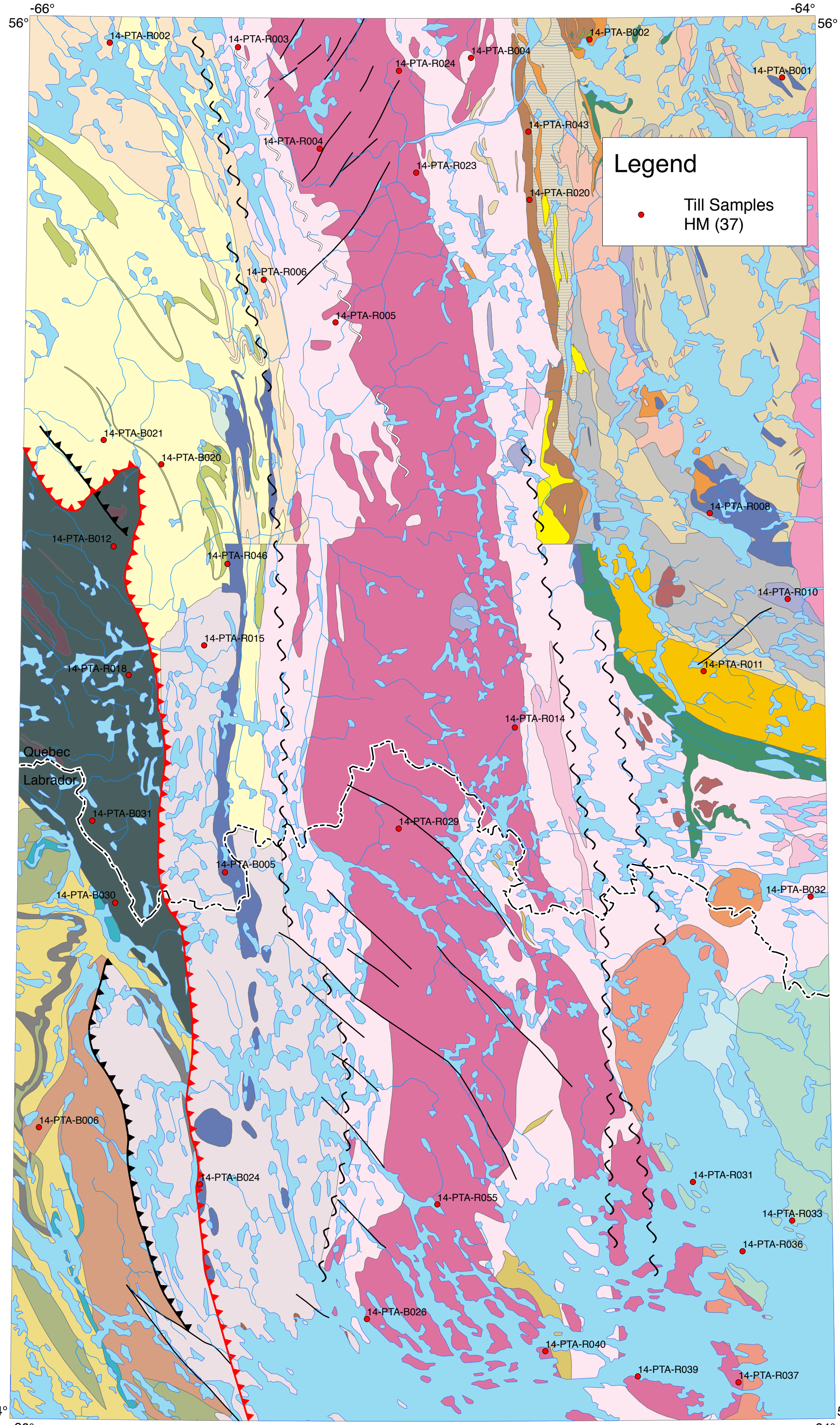
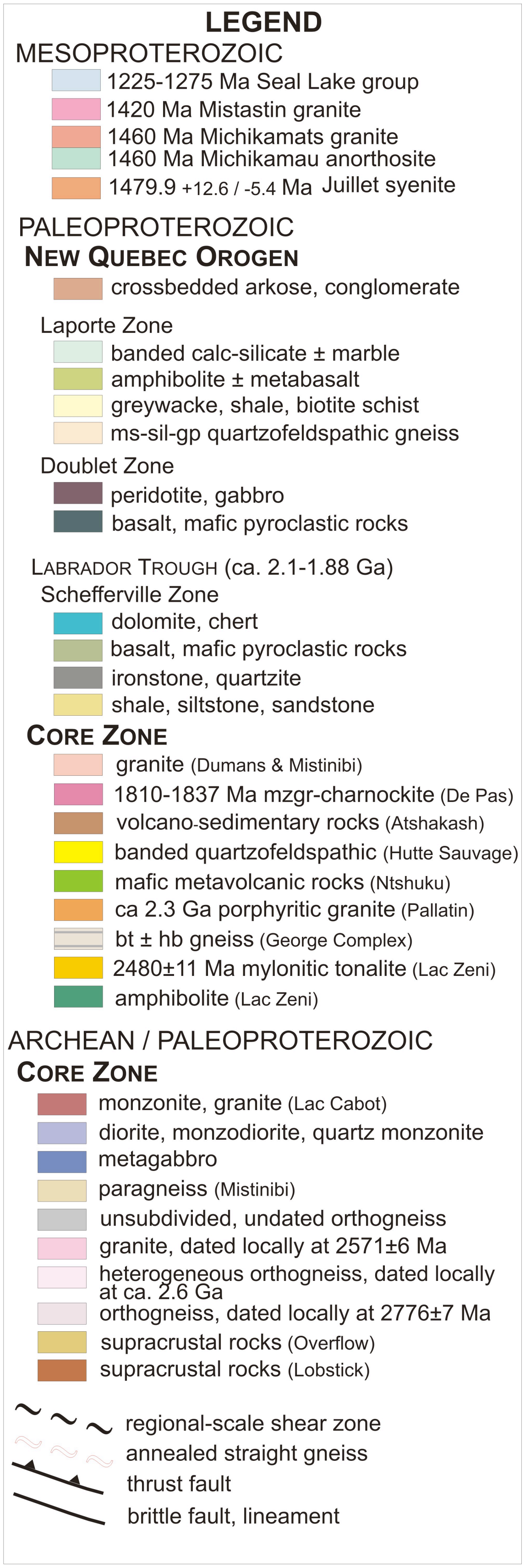


Figure 2. Bedrock geology of the GEM 2 southern Core Zone project area (NTS 23P and 23I) highlighting crustal domains within the New Quebec Orogen and southern Core Zone. Red dots indicate localities where till samples were collected in 2014. Geology from Wardle et al. (1997) and Ministère de l'Énergie et des Ressources naturelles (2010).

Figure 2 continued….



Mineral picking
The 0.25-0.5, 0.5-1.0, and 1.0-2.0 mm non-ferromagnetic fractions of each sample was examined under a binocular microscope by ODM. Indicator minerals, including sulphides and selected oxide and silicate minerals, were counted including ODM's suite of magmatic or metamorphosed massive sulphide indicator mineral (MMSIM®) (Averill, 2001). The visual identification of a number of limited mineral grains was verified with a scanning electron microscope (SEM). The abundance of various mineral species in a random 100 grain point count of the 0.25-0.5 mm non-ferromagnetic fraction of five till samples and one beach sand sample was carried out to document their mineralogy.

Digital data files
ODM produced a digital data file to report the processing weights and indicator mineral grain counts. The weights of the fractions produced during sample processing are reported in four worksheets: "Tabling Data"; "KIM Data"; "HM Processing" (<0.25 mm table concentrate weights); and "Paramag" (weights for the paramagnetic fractions). The weight of the 2.0 to 5.6 mm pebbles and the >5.6 mm pebbles are reported in the worksheet "Pebbles".

Gold grain data generated from panning each table concentrate are reported in two worksheets: "Gold summary" and "Detailed VG", which describe the abundance, size, and shape of the visible gold grains as well as size of any other indicator mineral grains observed during panning (e.g., pyrite, sperrylite, uraninite, thorianite, and cerianite).

The abundance of indicator minerals including those indicative of metamorphosed massive sulphide deposits (MMSIM®) is listed in the worksheet entitled "MMSIM". The abundance of various mineral species in a random 100 grain point count of the 0.25-0.5 mm non-ferromagnetic fraction of five till samples and one beach sand sample is listed in the worksheet entitled "100 count".

RESULTS

The abundance of selected indicator minerals in the South Core Zone samples is presented in Appendix C. The distribution of gold and sperrylite grains in the pan concentrate of samples normalized to 10 kg of <2.0 mm table feed is shown on maps 1 and 2. Maps 3 to 8 show the distribution for pyrite, chalcopyrite, olivine, Mn epidote, red rutile, and blue-green spinel in the 0.25 to 0.5 mm non ferromagnetic HMC normalized to 10 kg of <2.0 mm table feed.

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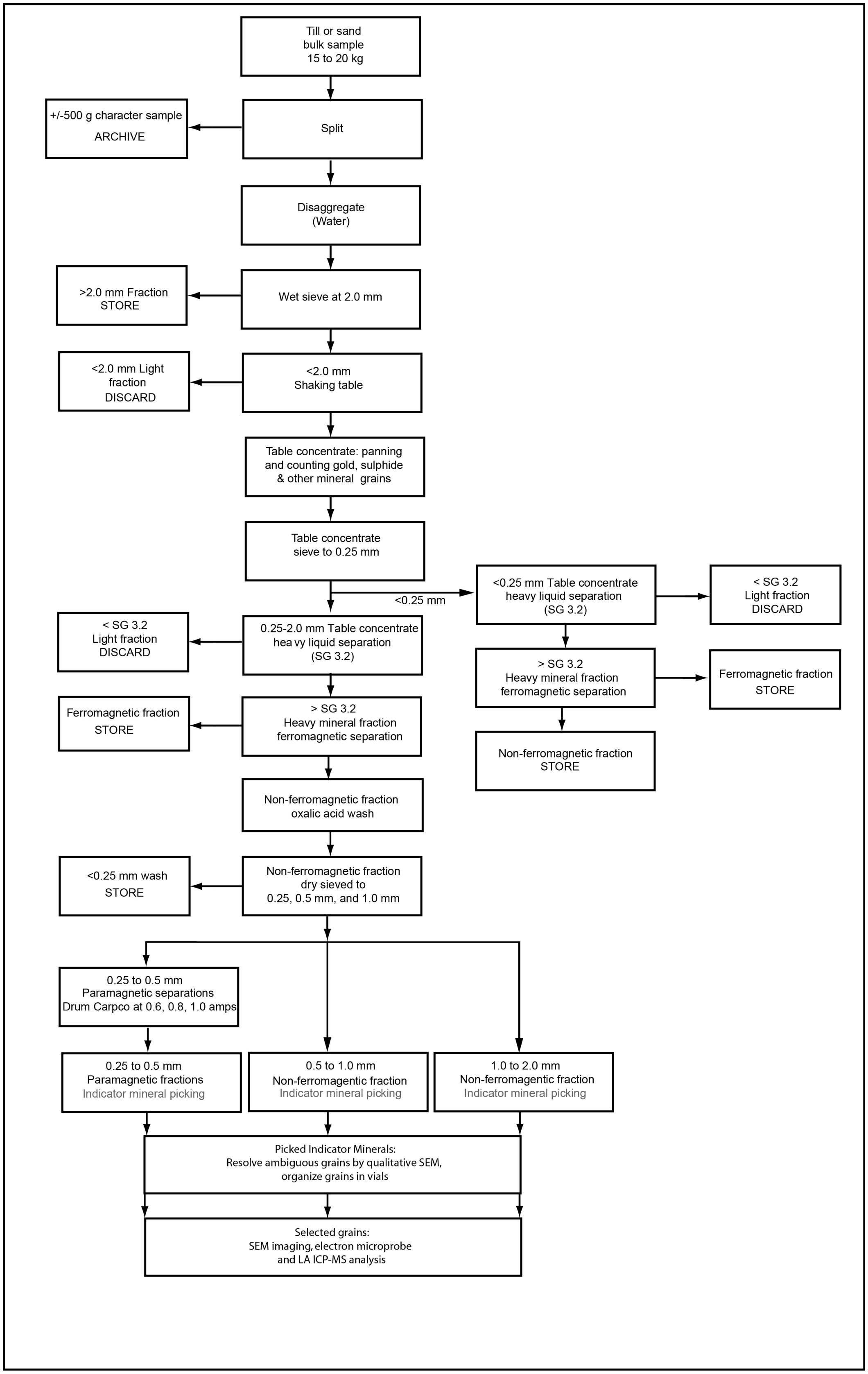

Figure 3. Flow sheet outlining the sample processing and indicator mineral picking procedures used for till and sand samples at Overburden Drilling Management Limited in 2014.

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APPENDIX A.2

Site photo for beach sand site 14-PTA-R055