

## SEEK Project Update: Stimulating Exploration in the East Kootenays, Southeastern British Columbia (parts of NTS 082F, G, J, K)

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### Introduction

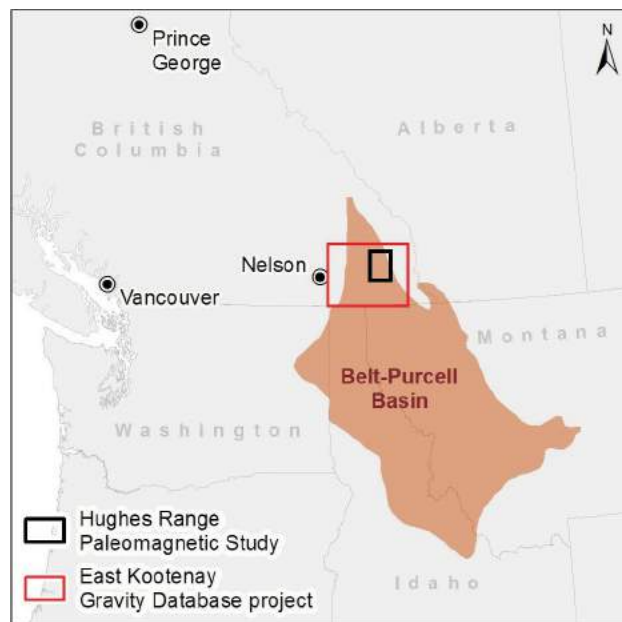
The East Kootenay region has a long successful history of mineral exploration and mining. One of the world's largest Pb-Zn deposits, the former Sullivan mine, sustained the economy of Kimberley and the East Kootenay region for almost 100 years. In November 2011, Geoscience BC, in partnership with the East Kootenay Chamber of Mines, announced the SEEK Project (Stimulating Exploration in the East Kootenays; Geoscience BC, 2011). The SEEK Project was initiated to capitalize on the region's rich exploration history through the compilation of existing mineral prospect and exploration information, primarily by capturing knowledge from local prospectors and exploration geologists. This local knowledge represents invaluable information that the SEEK Project aims to compile and release into the public domain. Hartlaub (2013) presented a review of the geology, metallogeny and mineral potential of the SEEK Project area within the Belt-Purcell Basin (Figure 1).

The SEEK Project recently extended funding to help create the new East Kootenay Chamber of Mines Core Library. This core library collects, restores and catalogues a selection of historically important core from the region, including core from the Sullivan sedimentary exhalative (SEDEX) deposit and surrounding areas. Individuals or companies engaging in mineral exploration in the area are able to examine type sections of both mineralized and nonmineralized strata of the Belt-Purcell Basin. The contents of this library are available to individuals, companies and research institutions.

A second SEEK project, completed in 2012, was a compilation of ground-station gravity data from the region (Sanders, 2012). The majority of gravity data in the database were obtained from data listings in assessment reports on the Assessment Report Indexing System (ARIS) website (BC Ministry of Energy and Mines, 2013).

**Keywords:** *SEEK Project, gravity survey, East Kootenay Gravity Database, paleomagnetic study, Hughes Range*

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**Figure 1.** Outline of Geoscience BC's SEEK Project area in relation to the Belt-Purcell Basin. Data from United States Department of the Interior (2005).

### 2013–2014 SEEK Project Activities

Two separate SEEK projects were granted funding in 2013 and field activities for each project are complete. One project focused on acquiring new ground-station gravity data in the East Kootenay region and updating the East Kootenay Gravity Database (EKGDB) with additional ARIS data that recently became public. The second project will use new paleomagnetic data to help unravel the movement history of faults in the Hughes Range. Understanding fault movement in this mountain range is critical, as the area hosts several Pb-Zn deposits, including the past-producing Kootenay King and Estella mines.

#### Updated East Kootenay Gravity Database and St. Mary Gravity Survey

The EKGDB was first compiled by SEEK project proponent T. Sanders and released through Geoscience BC's website in December 2012 (Sanders, 2012; Figure 2). The data release consists of the EKGDB in Excel format and a report that describes the collection of the ground-station gravity data, the majority of which were obtained from data listings

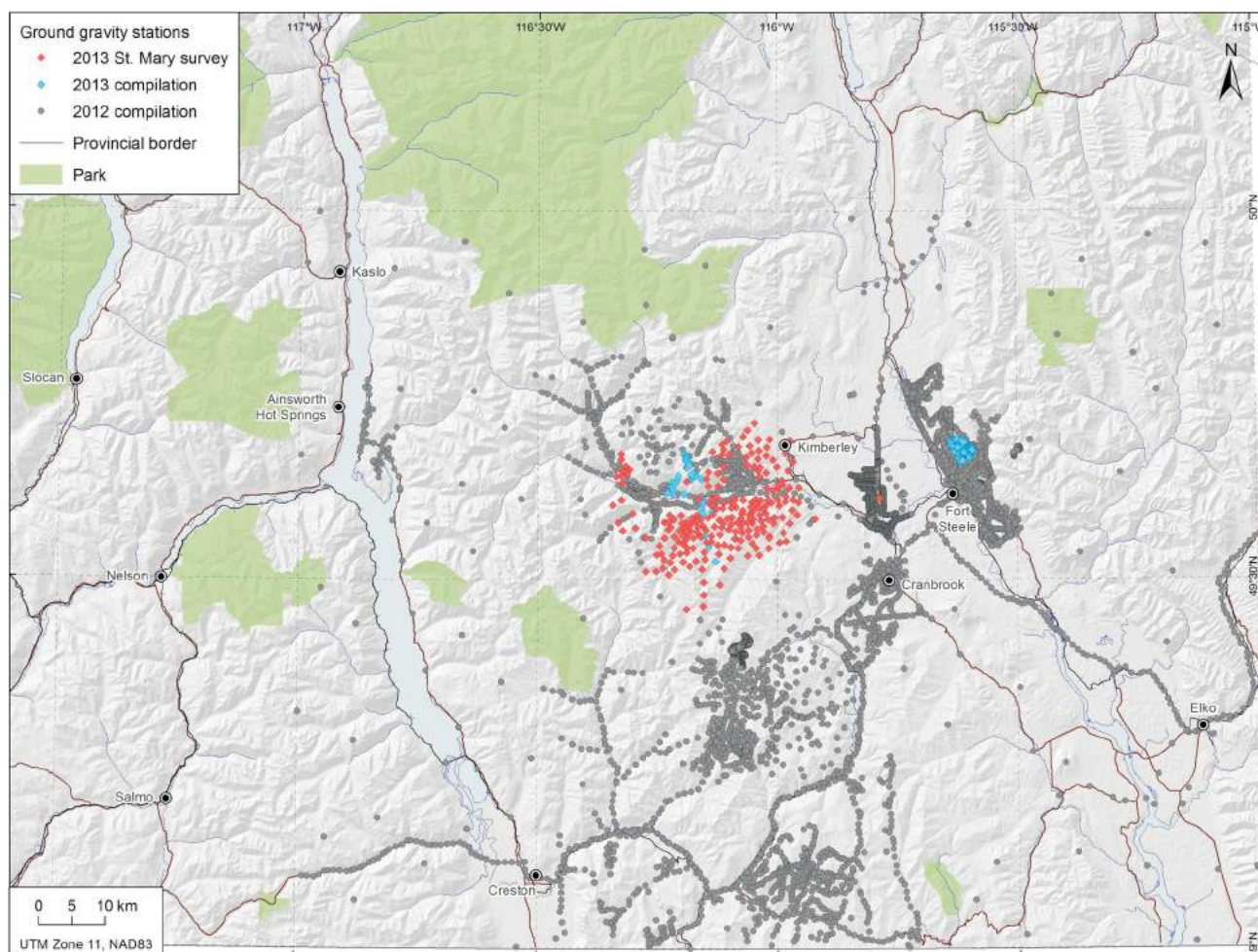
in assessment reports on the Assessment Report Indexing System (ARIS) website (BC Ministry of Energy and Mines, 2013). Other sources included 1) contributed data from gravity surveys not available on the ARIS website, 2) a subset of the Geological Survey of Canada (GSC) database, and 3) a digitized Bouguer gravity anomaly map (obtained from an ARIS file that did not contain raw data). The EKGDB contains 27 fields of levelled and reprocessed gravity data, and includes raw and reduced Bouguer gravity anomaly values for all stations using three rock densities.

In 2013, T. Sanders undertook additional work to add to the 2012 version of the EKGDB. A new gravity survey was conducted, called the St. Mary Gravity Survey, and additional gravity data were added from ARIS files that had recently become nonconfidential. The St. Mary Gravity Survey acquired 217 new ground gravity stations during July and September, which were laid out to complement gravity data already compiled within the EKGDB (Sanders, 2013; Figure 2). The entire updated EKGDB now contains re-

cords for more than 5300 individual ground gravity stations from the following sources:

- 217 newly acquired ground gravity stations (2013 St. Mary Gravity Survey)
- 202 gravity stations contributed by B. Kostiuk (collected in October 2011 and recently became nonconfidential)
- 485 stations acquired between 1954 and 1979 that were extracted from the GSC Gravity Database
- 3686 stations from 18 individual ARIS files
- 735 stations from a digitized map of tied Bouguer gravity anomaly values

According to Sanders (2013), the acquisition of new gravity data in the St. Mary River area, in combination with the previously compiled EKGDB, could help revitalize exploration interest in the area. The St. Mary Gravity Survey was conducted primarily over areas underlain by Aldridge Formation that previously had no gravity data. The station spacing was tight enough to highlight information from



**Figure 2.** Ground gravity stations that constitute the East Kootenay Gravity Database (EKGDB). Data from GeoBase® (2004), Natural Resources Canada (2007), DataBC (2008) and Massey et al. (2005).

shallower sources (i.e., potential shallow-sourced density contrasts related to mineralized areas) but not tight enough to provide specific detail. The survey data allowed for interpretation of closure to a gravity anomaly (low) in the same location as the Matthew Creek metamorphic zone (MCMZ) and pegmatite stock. The anomaly infers that a granitic intrusion with a negative density contrast to the surrounding metasedimentary rocks exists beneath the MCMZ and could be the source of the Matthew Creek pegmatite stock and the domed structure. Results from the gravity survey suggest that the Hellroaring Creek pegmatite stock (12 km southwest of the Matthew Creek stock) is larger than previously considered, yet they revealed no deep-sourced gravity anomaly associated with the Hellroaring Creek stock as there is with the Matthew Creek stock. This information will change a few concepts of, yet add to the tectonic story presented by, McFarlane (1997) and McFarlane and Pattison (2000). It will also further the regional geological understanding and thereby potentially promote exploration investment in the search for new SEDEX deposits in the area.

### Hughes Range Paleomagnetic Study

The northern Hughes Range, a subrange of the Rocky Mountains, is directly east of the Rocky Mountain Trench (RMT), approximately 30–40 km east of Kimberley, BC (Figure 3). The Sullivan mine at Kimberley is in the Purcell Mountains and west of the RMT. The Estella and Kootenay King mines, also past Pb-Zn producers, are in the northern Hughes Range. A series of low-angle faults has been mapped and inferred in the northern Hughes Range by Höy (1978), Ransom (1991) and Thompson (2010). Normal faults at the Sullivan mine dip steeply west and are called ‘Sullivan-type’ faults. Similar faults are found in regional mapping extending from east of the Sullivan mine to the limit of outcrop on the west side of the Rocky Mountain Trench. There are no steep Sullivan-type faults known in the Hughes Range.

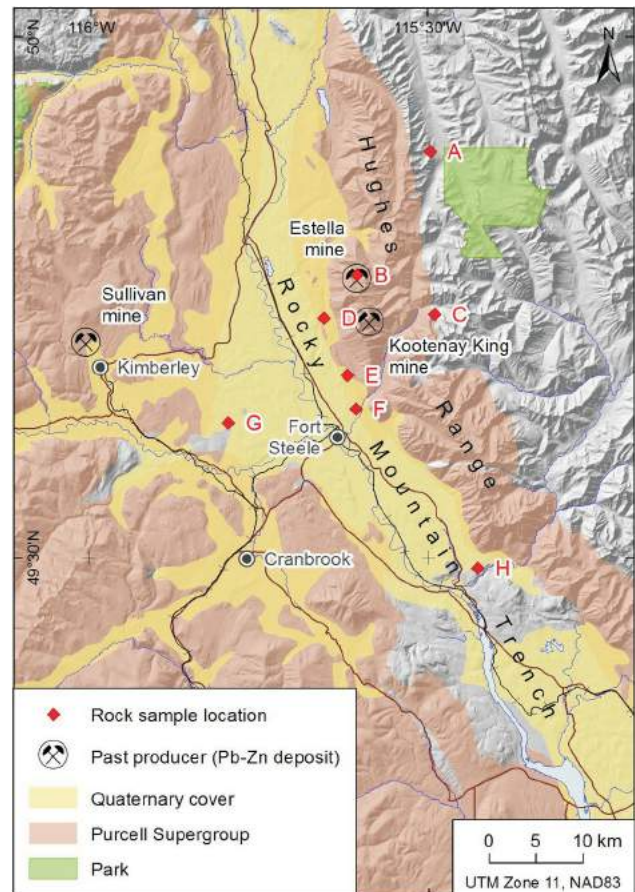
SEEK project proponent P. Ransom proposes that the low-angle faults and steeper bedding dips on the east side of the Hughes Range resulted from significant rotation caused by east-side-down normal faulting on a listric fault. Determination of the paleomagnetic signature of postfolding, 100 Ma intrusions (dikes and stocks) may indicate how much rotation there has been.

Eight sets of 7–12 oriented core samples were collected from different locations in and adjacent to the northern Hughes Range during the 2013 field season (Figure 3). The study will compare paleomagnetic measurements from several of the Cretaceous granitic and monzonitic intrusions, including related dikes, to determine the relative amount of rotation during postmagmatic cooling.

A hand-held gasoline-powered drill, designed for paleomagnetic studies, was used to collect core samples approximately 10 cm long. Orientation of each sample was measured with a hand-held Brunton compass and, on sunny days, solar azimuth was measured and compared to the ‘MrSun’ app (Amber Digital, 2010). A new state-of-the-art paleomagnetic laboratory is presently being established at Okanagan College by T. Day. This lab will be used to analyze the samples collected as part of this study. Project deliverables will include a spreadsheet of raw data, a final report that will contain an expanded account of the geological setting in relation to paleomagnetic results, and graphical representation of the paleomagnetic information that compares the different signatures obtained.

### Summary

Since announcement of the SEEK Project two years ago, Geoscience BC has provided funding for the East Kootenay Chamber of Mines core-storage facility; creation of the



**Figure 3.** Paleomagnetic sample locations in relation to the past-producing Sullivan, Estella and Kootenay King mines: A, Nivlac (originally called Lussier north); B, Estella stock; C, East Wild Horse stock; D, Saugum Canyon dike; E, Sully dike; F, Innis Springs dike; G, Reade Lake stock; H, Bull River stock. Data from MINFILE 082FNE052, 082GNW008, 082GNW009 (BC Geological Survey, 2013); Massey et al., 2005; GeoBase®, 2004; DataBC, 2008.

East Kootenay Gravity Database (EKGDB), plus subsequent updating and data acquisition for the EKGDB by proponent T. Sanders; and a recently commenced paleomagnetic study by proponent P. Ransom. The 2013 paleomagnetic samples will be analyzed in the newly established lab at Okanagan College. Geoscience BC will consider for funding under the SEEK Project umbrella future project proposals that aim to add geoscience information to the East Kootenays and promote economic activity and investment related to mineral exploration in and around the Belt-Purcell Basin by acquiring, compiling and adding value to public- and private-sector mineral exploration information.

## Acknowledgments

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