Vancouver Island North Regional Project: Airborne Magnetic and Radiometric Survey, British Columbia (Parts of NTS 092E, F, K, L)

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Introduction

The Vancouver Island North Regional Project (VIN) is designed to provide high-quality airborne geophysical data over 6127 km^2 of northern Vancouver Island, British Columbia (BC; Figure 1), an area with a long history of mining and mineral exploration. The project falls within the Wrangellia terrane—a mixture of Triassic through Jurassic volcanic and sedimentary sequences, including the Karmutsen Formation and Bonanza Group (Nixon et al., 2011a–c). The VIN project covers prospective trends for Jurassic and Miocene porphyry copper deposits, Eocene gold vein deposits, Jurassic iron and copper skarn deposits, and Paleozoic volcanogenic massive sulphide deposits (J. Houle, pers. comm., 2014).

Following in the Geoscience BC tradition of regional geophysical surveys such as Targeting Resources through Exploration and Knowledge (TREK) and Search, these new geophysical data will assist the mineral exploration community in identifying regional geological and structural mineral exploration targets, thereby providing new economic stimulation to the region. Geoscience BC is committed to engaging with communities in the region to share information during and after the project is completed.

Previous Work

The VIN covers an area that had not been surveyed as part of a regional geophysical program since the 1980s (Natural Resources Canada, 2019). Survey lines at that time were flown 1500 m apart. The project builds on the 2012 Northern Vancouver Island Exploration Geoscience Project, which was a partnership between Geoscience BC and the Island Coastal Economic Trust (ICET; Simpson et al., 2013). The 2012 airborne magnetic survey was conducted using a predefined drape surface with a nominal ground clearance of 80 m at 250 m line-spacing over the northwestern extent of Vancouver Island (Figure 1). The work carried out in 2012 included the collection of new regional geochemical data for northern Vancouver Island (Geo Data Solutions GDS Inc., 2013; Jackaman and Lett, 2013; Simpson et al., 2013). The geochemical survey covered a much larger area than the magnetic survey, which overlapped the northern part of the new VIN project area. Geological mapping in the region has been recently updated by the BC Geological Survey (Nixon et al., 2011a–c).

Vancouver Island North Regional Project

Covering approximately 20% of Vancouver Island, the airborne survey carried out under the VIN project collected horizontal gradient magnetic data as well as radiometric data. The survey was flown by Precision GeoSurveys Inc. of Langley, BC, between August and October 2019. The survey area is located between the communities of Port Alice and Zeballos on the west, Sayward on the east, Gold River on the south and Port McNeill on the north (Figure 1). In total, data were collected over 26 973.4 line-km at a constant height of 80 m above ground level. The sensors used were attached to an Airbus AS350 helicopter flying along lines 250 m apart and oriented at 56.5°, with tie lines flown every 2500 m, perpendicular to the main flight lines. Within the project area there are three large provincial parks, which were excluded from the survey, and communities within the survey area were flown at a minimum of 300 m above ground level. The survey overlaps slightly with the 2012 Northern Vancouver Island Exploration Geoscience Project magnetic survey so that the two surveys can be levelled.

The VIN 2019 survey height was maintained at a constant 80 m above ground surface, following the contours of the terrain as much as possible, within the limitations of pilot safety. In contrast, the 2012 Northern Vancouver Island Exploration Geoscience Project survey was flown using a pre-

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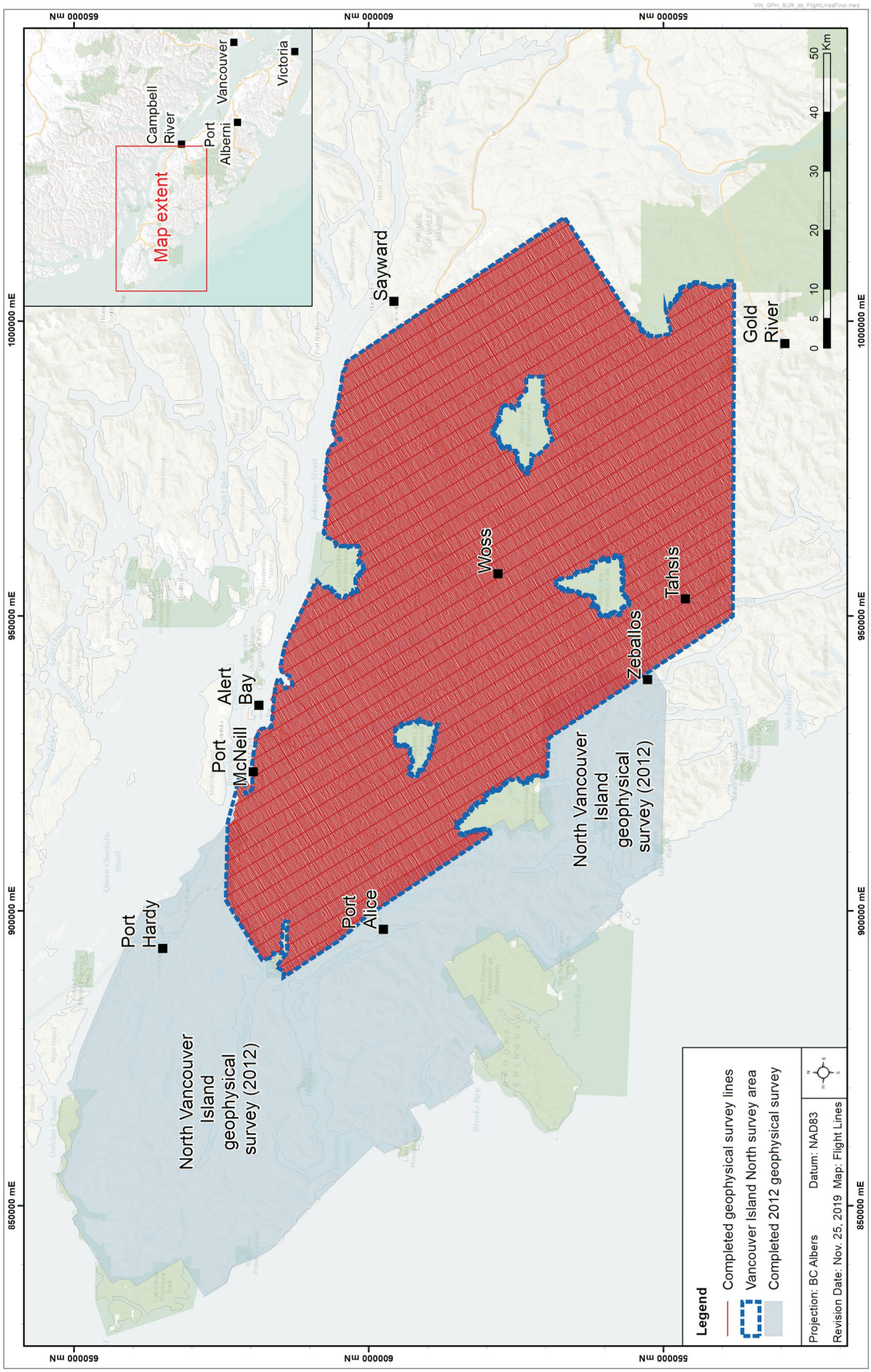

Figure 1. Vancouver Island North (VIN) Regional Project area, British Columbia. Geophysical survey lines (oriented at 56.5° and spaced 250 m apart) and tie lines (spaced 2500 m apart) are shown in red. The area covered by the geophysical survey undertaken by Geoscience BC in 2012 as part of the Northern Vancouver Island Exploration Geoscience Project is shown in blue. Background map created using ArcGIS® software by Esri. ArcGIS® and ArcMap™ are the intellectual property of Esri and are used herein under license. Copyright © Esri. All rights reserved. For more information about Esri software, please visit www.esri.com.

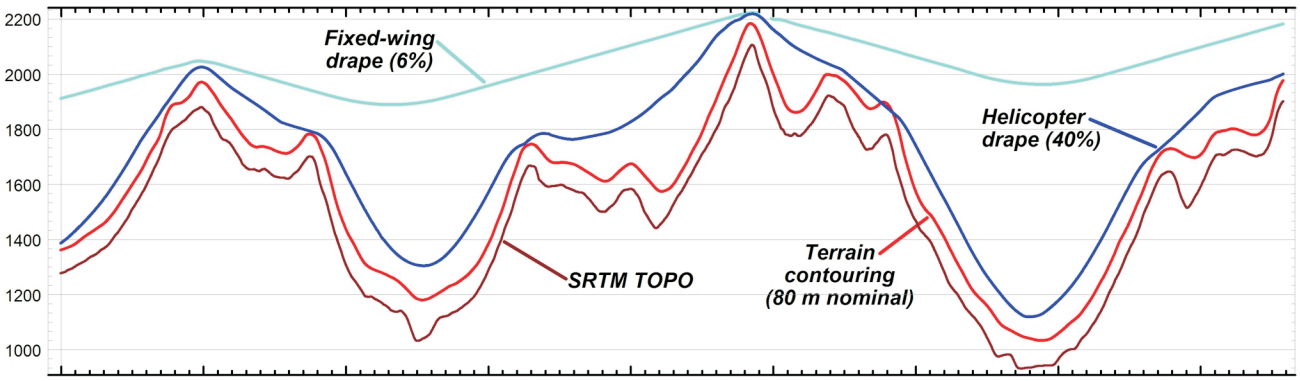

Figure 2. Example of airborne survey height above rugged topography using 'terrain contouring' (red line), which closely follows the contours of the terrain, within the limitations of pilot safety, compared to two examples of 2-D preplanned drape surveys (a fixed-wing drape surface using 6% slope, shown in light blue, and a hypothetical helicopter 40% drape surface, shown in dark blue). The 2-D drape surfaces were calculated using the Geological Survey of Canada's Drape DTM 2.0 software. Note that the vertical axis is exaggerated. All survey heights are relative to Shuttle Radar Topography Mission topography (SRTM TOPO).

defined drape surface (i.e., preplanned terrain clearance) and had a 20% rate of ascent and descent above the surface, resulting in a nominal ground clearance of 80 m. Figure 2 (reproduced from Madu and Ballantyne, 2018) illustrates the benefit of surveys flown at a constant height above ground in mountainous terrain, compared to a common alternative of preplanned flight surface. (Note that in this figure an example of a 40% helicopter drape is shown.)

Magnetic Survey

Three Scintrex CS-3 cesium-vapour airborne magnetometer sensors were arranged into a triple-boom magnetometer configuration on an Airbus AS350 helicopter (Figure 3). Sensor separation was 11.5 m perpendicular to the direction of flight (cross-line) and 7.3 m in the direction of flight (in-line), which allowed for simultaneous collection of magnetic data at three different locations with known and fixed separation. The magnetometers measure total magnetic field, cross-line magnetic gradient (transverse) and in-line gradient (longitudinal).

Figure 3. Precision GeoSurveys Inc.'s Airbus AS350 helicopter, which was used to fly the Vancouver Island North airborne survey. Survey equipment included three Scintrex CS-3 cesium-vapour airborne magnetometer sensors arranged into a triple-boom magnetometer configuration (shown), and 21 L of sodium iodide (NaI) gamma radiation detection crystals. Photo courtesy of Precision GeoSurveys Inc.

Radiometric Survey

Radiometric data, consisting of potassium, thorium and uranium gamma radiation naturally emitted from surface rocks and soils, were measured using an airborne gamma-ray spectrometer with 16.8 L of downward-looking sodium iodide (NaI) crystals. Radiometric data complement magnetic data, representing a different rock property, which contributes to more accurate mapping of lithology, alteration and geological structure.

Summary

The VIN project covers an area that had not been surveyed as part of a regional geophysical program since the 1980s; survey lines at that time were flown 1500 m apart. The VIN survey offers data with a much higher resolution and an exponential increase in the density of sampling. Northern Vancouver Island will now have a modern and highly detailed magnetic and radiometric survey to guide exploration, land use and planning decisions for a significant portion of the island.

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