Spences Bridge Bedrock Mapping Project: Preliminary Results from the Merritt Region, South-Central British Columbia (Parts of NTS 092H/14, 15; 092I/02)

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INTRODUCTION

The Spences Bridge Project is a multiyear bedrock mapping – mineral deposits exploration project. It focuses on two major rock successions: island arc rocks of the Late Triassic Nicola Group, specifically the western belt (facies) and a superimposed mid-Cretaceous continent-margin arc succession, the Spences Bridge Group, in selected areas between Princeton in the south and Pavilion in the north (Fig 1). The project objectives are to upgrade the geological understanding and evaluate the economic mineral potential for these contrasting arc regimes.

This brief report presents preliminary geological observations made during the inaugural field season conducted near Merritt in the fall of 2007. No analytical results from the project are yet available. A more in-depth report, incorporating detailed lithological descriptions, stratigraphic relationships and various analyses and age determinations, will be included in future work.

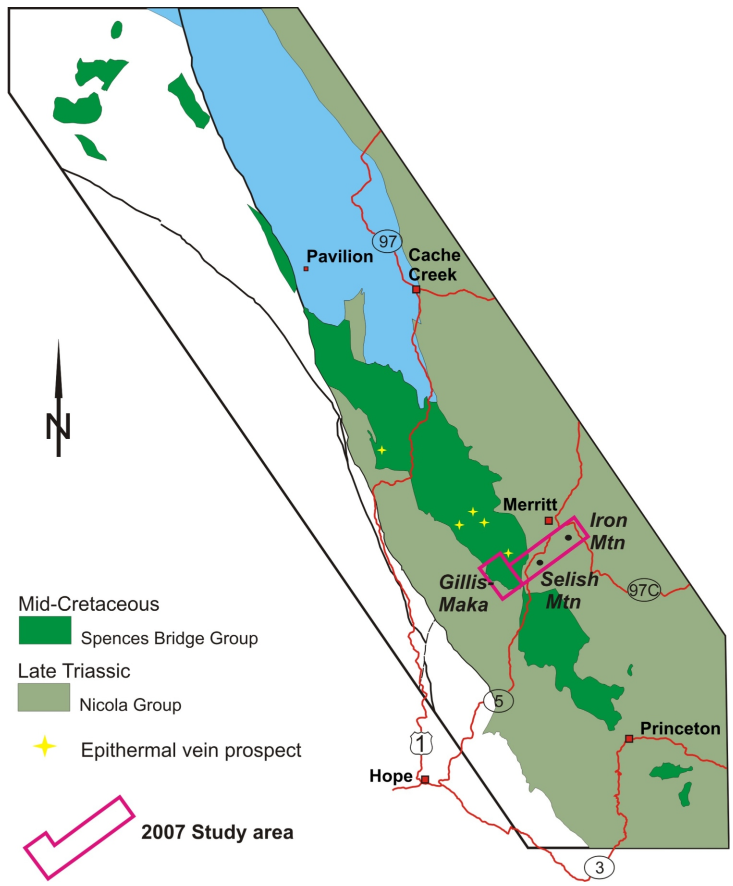

Figure 1. Location of the 1:20 000 scale mapping project covering the Iron Mountain – Selish Mountain and Gillis Lake – Maka Creek transects, and distribution of recently discovered epithermal vein prospects hosted by mid-Cretaceous Spences Bridge Group.

2007 FIELD PROGRAM

During September and October, more than 50 traverses were conducted, providing detailed 1:20 000 scale geological coverage over a 300 km^2 area (Fig 1). The shape of the study area resembles an inverted 'L', the southwest-trending segment informally designated the Iron Mountain – Selish Mountain transect and the shorter, northwest-oriented segment, the Gillis Lake – Maka Creek transect.

This mapping overlaps geographically and, moreover, supplements and refines parts of a solid geological foundation constructed from earlier mapping-based studies. These studies include: Preto's (1979) tripartite time-stratigraphic subdivision of the Nicola Group into lithostratigraphic belts or facies, McMillan's (1981) mapping of the western belt of the Nicola Group at Iron Mountain, and Thorkelson's (1986) mapping of the Spences Bridge Group.

GENERALIZED STRATIGRAPHY

Iron Mountain – Selish Mountain Transect

This area comprises two mountains that make up a north-trending ridge, with the Coquihalla Highway lying at lower elevation along the western margin. Iron Mountain is located at the north end of the ridge, immediately south of Merritt. Situated farther south, Selish Mountain marks a

This publication is also available, free of charge, as colour digital files in Adobe Acrobat® PDF format from the BC Ministry of Energy, Mines and Petroleum Resources website at http://www.em.gov.bc.ca/Mining/Geolsurv/Publications/catalog/cat_fldwk.htm geological division between older layered rocks cropping out to the north and a crosscutting, stock-size granitoid cropping out to the south.

Layered rocks throughout this transect represent the oldest stratigraphy in the study area. A persistent trend in bedding attitudes, from topographically lowest to highest exposures between Iron and Selish mountains, defines a moderately southeast-inclined homocline that is internally disrupted by steep, mainly west-northwest-striking faults, oriented roughly orthogonal to the general north-northeast strike of beds.

The bottom of the homoclinal succession consists of a largely indivisible, monotonous sequence composed of variably red-oxidized dark green basaltic lava flows. They exhibit a variety of textures, from aphyric and aphanitic to pyroxene plagioclase porphyries, and contain weak to moderately pervasive replacement by secondary chlorite, epidote and calcite.

Based on the absence of features indicative of submarine deposition, these mafic rocks are interpreted to have been deposited in a subaerial environment. An exception, however, occurs at the locally gradational upper contact, as indicated by the presence of relatively thin, massive pyroxene-phyric lavas alternating with marine sedimentary strata.

The mafic unit is replaced upsection by an extensive subaerial volcanic succession that contains locally interspersed fine clastic and carbonate beds. This volcanic succession is dominated by dark maroon and green andesitic tuffs, particularly in the vicinity of Selish Mountain. Felsic eruptives, however, constitute the most distinctive rocks in the succession, Dacitic flows and some associated tuffs make up a relatively small component of the Selish Mountain section, although at Iron Mountain the felsic rocks are volumetrically significant and include lava flows, associated airfall tuffs containing sparse quartz crystals and abundant felsic fragments. Minor beds of epiclastic sandstone derived from volcanic rocks and composed of abundant felsic fragments and quartz grains are interlayered with felsic rocks and, up section, alternate with limestone.

Felsic volcanic units at Iron Mountain grade upwards into limestone beds and intercalated calcareous sandstones and granule conglomerates. These sedimentary rocks have an aggregate thickness in excess of 60 m and provide a local stratigraphic marker. They contain a diverse shallow-marine fossil assemblage including belemnoids, crinoids, corals, bivalves and ammonoids.

Carbonates have also been mapped at several widely spaced localities in the Selish Mountain section, although generally as minor beds. They differ from those at Iron Mountain in the nature of bounding rocks, thickness, appearance and fossil content, thereby making direct correlation impossible. Within the Iron Mountain – Selish Mountain transect it appears that significant carbonate deposition recurred during at least three relatively short-lived, marine transgressive events, each carbonate deposit apparently corresponding in time with hiatuses or at least with substantially diminished subaerial volcanic activity.

AGE OF ROCK UNITS

McMillan (1981) assigned volcanic and sedimentary rocks in the Iron Mountain – Selish Mountain transect to the western belt of the Nicola Group. Despite a number of fossil sites found at Iron Mountain (McMillan, 1981), none of the fossils appear to have been definitively identified and they are hence excluded from a compilation of fossil collections for the Ashcroft map area (Monger, 1989a, b). Based on this compilation, fossil-bearing sedimentary rocks interbedded with volcanic rocks found elsewhere in the western Nicola Belt are late Carnian to early Norian in age. However, the age of the Nicola Group in the Iron Mountain – Selish Mountain transect remains to be determined. Isotopic age and fossil samples collected during this study aim to test the possibility that the felsic volcanic unit and overlying carbonates may represent a younger, perhaps Early Jurassic arc sequence that unconformably overlies the mafic volcanic unit.

Three dacitic-rhyolitic volcanic samples were collected for uranium-lead (U-Pb) dating. The stratigraphically lowest felsic rock collected, west of Selish Mountain, is derived from a 20 cm thick waterlain ash interlayered with siltstone. It sharply overlies pyroxene-bearing lavas that are presumed to mark the top of the mafic volcanic unit. A second sample collected from the summit of Selish Mountain is a flow-laminated dacite. The stratigraphic position of this sample is uncertain; however, it provides an inferred age for a thick assemblage of associated airfall volcanic rocks dominated by oxidized maroon lapilli and finer tuffs that occupy much of the apparent lower and middle parts of the unit. A date from the upper part of the dacitic volcanic succession can be determined from quartz-bearing dacitic tuffs collected from Iron Mountain. The dacite in this location is interbedded with limestone and grades upwards into a sedimentary marker composed of several limestones interbedded with calcareous sandstones. Two fossil collections, containing a diverse bivalve assemblage locally coexisting with ammonoids, were extracted from the sandstone.

Gillis Lake – Maka Creek Transect

Mid-Cretaceous rocks of the Spences Bridge Group form a narrow, northwest-trending belt regionally covering nearly 3200 km^2, and unconformably overlie the Late Triassic Nicola Group and associated intrusions (Fig 1; Monger, 1989a, b; Monger and McMillan, 1989). Cretaceous stratigraphy underlying much of the Gillis Lake – Maka Creek transect forms part of a contiguous mapping project, roughly 250 km^2 in extent, conducted for an MSc thesis (Thorkelson, 1986) that subsequently led to subdivision and formal definition of the Spences Bridge Group (Thorkelson and Rouse, 1989).

Remapping the geology in the Gillis Lake – Maka Creek transect during this study revealed a crudely layered, subaerial volcano-sedimentary stratigraphy. This bedded succession forms a northeast-inclined homocline and rests nonconformably on granitic rocks of probable Late Triassic to Early Jurassic age. The homocline is made up of a number of distinctive volcanic and intervolcanic sedimentary units that are readily traceable along strike. The continuity of rock units, however, is disrupted by numerous steep faults trending north to northeast, which probably developed during regional Eocene extensional tectonic episodes.

A representative stratigraphic section for the Spences Bridge Group in the Gillis Lake – Maka Creek transect, in which all mappable units are stacked successively and no faults were recognized, is at least 1600 m thick. The underlying basement consists of an intrusive complex composed of pyroxene diorite that, in many places, is intruded by younger dikes and small apophysis composed generally of granodiorite and quartz monzonite. White aphanitic felsite dikes, in turn, crosscut the older phases.

Initial deposits of the Spences Bridge Group consist of pyroxene-phyric andesite. Nearly identical lava flows recur in at least two intervals well above this basal flow member. Resistant, lithic-rich, dacitic ash-flow tuff occurs immediately above the lowest andesite, and a similar deposit is found near the top of the section. Differentiating sequentially younger volcanic strata from lithologically similar older strata is facilitated by three distinctive conglomeratic beds dispersed at successively higher levels in the stratigraphy. The lowest, enclosed as a thick bulbous-shaped body within the lowest andesite unit, is distinguished by the preponderance of intrusive clasts derived from nearby plutonic basement rocks. The next highest conglomerate occurs at the interface marking the top of the lowest pyroxene andesite with overlying dacitic ash-flow tuff. This conglomerate is thinner than the lower conglomerate and composed exclusively of metavolcanic, metaplutonic and vein quartz clasts, which indicates it is derived from a metamorphosed terrain. The stratigraphically highest conglomerate crops out close to the top of the section and contains a variety of clasts that resemble underlying volcanic units of the Spences Bridge Group. It is the thickest of the three conglomerate units and also contains significant interbedded sandstone units, some of which display large-scale planar crossbeds. The uppermost conglomeratic unit passes into a thick, mixed unit composed of reworked and primary fragmental rocks that constitute the top of the stratigraphic section.

In addition to the three distinctive conglomerates, sedimentary rocks, including finer granule conglomerate and sandstone, are interspersed at several other levels, consistently at the contact of several specific volcanic units. These finer clastic beds commonly contain rock clasts and crystals derived locally from underlying volcanic or plutonic units, such as pyroxene, quartz or sometimes biotite. Without exception, sandstone units encountered throughout the section all contain plant debris, which indicates that the volcano-sedimentary sequence was deposited in a terrestrial setting.

Thorkelson and Rouse (1989) reported a U-Pb date of 104.5 ±0.3 Ma on rhyolite from the lower part of the Spences Bridge Group. This Early Cretaceous, Albian date is corroborated by identification of fossil leaves and palynomorphs that extends deposition of the Spences Bridge Group into the Cenomanian stage of the Late Cretaceous (Thorkelson and Rouse, 1989). Ash-flow tuff forming the lower of two lithologically similar pyroclastic flows recognized in the Gillis Lake – Maka Creek section was sampled to determine when felsic volcanism began.

MINERALIZATION

The study area contains relatively few recorded MINFILE (2007) prospects, consisting mainly of small copper and lead-zinc-barite prospects hosted by mafic and felsic volcanic rocks of the Nicola Group. Mining exploration in the Merritt region currently focuses on precious-metal-bearing epithermal quartz veins hosted in subaerial volcanic rocks of the Spences Bridge Group. Epithermal vein deposits constitute an important new exploration target throughout the belt of Spences Bridge Group rocks. They became evident after 2001, during follow-up of geochemical anomalies detected in selected stream sediments samples, coupled with diligent prospecting by E. Balon, all of which subsequently led to a number of significant vein discoveries.

In this first year of bedrock mapping, field efforts focussed on determining stratigraphy and structure, with only minor work conducted on the mineral deposits. As mapping expands north and south next season, epithermal prospects, including those at Prospect Valley, Sullivan Ridge and Ponderosa, shown in Figure 1, will be incorporated into the developing geological framework. The character of epithermal mineralization, geological controls and time-space relationship with major magmatic events are integral components of the regional mapping project focussing on the Spences Bridge Group.

During the course of fieldwork, zones of rusty altered rocks were routinely sampled for assay. Of the 28 samples collected from 12 widely separated sites exhibiting varying intensities of hydrothermal alteration, 10 sites can be categorized as epithermal-type, one as porphyry-type and one as a base-metal-bearing vein. Interestingly, all but one of these alteration sites occur within rocks mapped as part of the western belt of the Nicola Group. Since the assay results were not available when this report was written, they will be presented in a table accompanying the open file map scheduled for release in spring 2008.

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