NEW SPLITSTONE AND OPAL OCCURRENCES, NIPPLE MOUNTAIN, BEAVERDELL AREA (82E/11E)

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INTRODUCTION

Nipple Mountain is located 35 kilometres southeast of Kelowna at latitude 49°36.2' north, longitude 119°07.8' west (Figure 1). Access is from the Dale Creek road, about 16 kilometres south of the main forest access road that connects Idabel Lake to Highway 33.

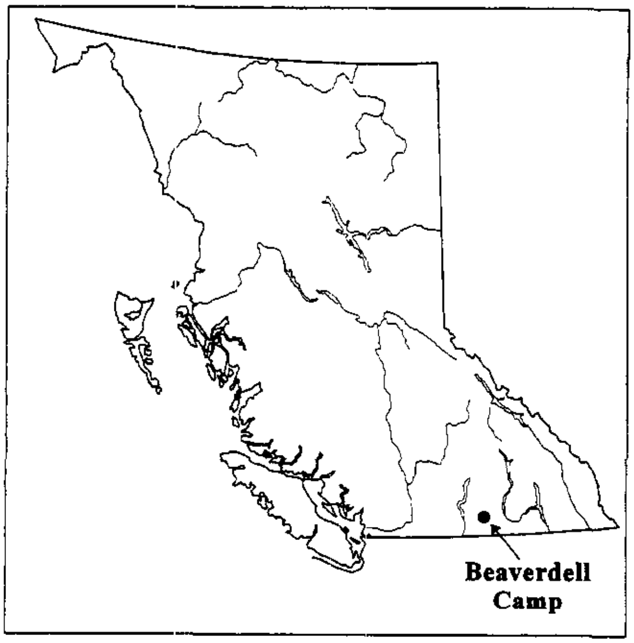

Figure 1. Location map of the Nipple Mountain area in the Beaverdell Mining Camp

This report describes new opal and splitstone localities on Nipple Mountain in the northwest part of the Beaverdell mining camp. The area was first mapped in detail by Reinecke (1915) and visited by the author in September, 1996.

The Beaverdell camp is centred on a number of silver, gold and copper prospects discovered in 1897 and a few rich veins of silver-lead ore mined from 1913 to 1991. Most of this mineralization is associated with the Westkettle quartz diorite that is believed to be related to the Nelson plutonic complex of Jurassic age. Until recently no mineral localities were identified in the surrounding Tertiary rocks.

In 1995, Don Sandberg of Kelowna discovered opal on the upper slopes of Nipple Mountain and splitstone outcrops in the Tertiary rocks on the flanks of Nipple Mountain underlying the Queen and Glory claims.

Interest in opal occurrences in British Columbia has increased significantly since 1993 when the Klinker deposit was discovered near McGregor Creek, northwest of Vernon. Other opal occurrences are known in the Kamloops, Salmon Arm, Spences Bridge, Keremeos and Kelowna areas (Read, 1995, and Church, 1996).

Flagstone and ashlar (splitstone) products are a significant part of the provincial dimension stone industry. Annually, 500 to 1000 tonnes of flagstone are produced in British Columbia and sold throughout western Canada. In the Kootenay area of British Columbia, the Hamill micaeous quartzite (Cambrian) is quarried for flagstone on Porcupine Creek, 17.5 kilometres northeast of Salmo. The quartzite is sold locally and used in building facings and for various other decorative and architectural purposes (Bowels, 1960). Also, granite is split into 'ashlar' blocks and slabs by several producers in the Vancouver area and used locally for masonary and facings on residential and commerical buildings.

The term 'splitstone', as used in this report, is a general term for rocks that manifest a platy habit resulting from primary or secondary structures, such as bedding, flow banding or cleavage. Unlike the Hamill quartzite, the characteristic banding and fabric of the Nipple Mountain volcanic rocks is non-sedimentary in origin. Volcanic splitstone is lighter weight and less dense than quartzite, however, quartzite flagstone tends to have greater strength because of recrystallization due to metamorphism.

GEOLOGICAL SETTING

The Tertiary rocks of Beaverdell area occur principally on Nipple Mountain and on several peaks and summits to the east and southeast. These rocks are mostly volcanic in origin and comprise Reinecke's 'Nipple Mountain Series' consisting of dacite, andesite, trachyte and basalt lavas and breccias. The Marron Formation (Eocene), consisting of brown andesites and light coloured trachytic lavas, is best developed on Wallace Mountain, where the volcanics are intruded by Chilcotin basalt dikes, and underlain by Kettle River (Eocene) sandstones and conglomerates. The Chilcotin basalt (Miocene-Pliocene) is uppermost in the stratigraphic sequence and consists of columnar lava flows that form small outliers on China Butte and in the Lassie Lake and Cup Lake area.

The volcanic rocks on Nipple Mountain are mostly light grey coloured, buff, and mauve dacites and dacitic andesites. The unit includes breccias and massive lava flows. In thin section, feldspar is the chief mineral and is accompanied by fine grained matrix and accessory quartz, biotite and/or amphibole. In places the dacite flows split into narrow bands, sometimes only a few centimetres thick. In polished sections, the bands are thin and closely spaced (several per centimetre). Flat vesicles lie with their longer directions parallel to the bands in the direction of flow; dips range from vertical to less than 20 degrees. The rocks are generally fresh, but may be silicified and clay altered along fissures, and rusted at surface.

The Nipple Mountain series is about 1300 m thick and rests directly on the Westkettle quartz diorite and the Anarchist greenstone - metasedimentary complex (Permian / Triassic). According to Reinecke (1915), the lava sequence has been folded into a syncline that pitches southwest. Although there is no direct evidence of major faulting, the north-trending elongation of the Nipple Mountain Tertiary outlier suggests some horst or graben control trending subparallel to the Kettle River extension of the Toroda Creek graben (Tempelman-Kluit, 1989).

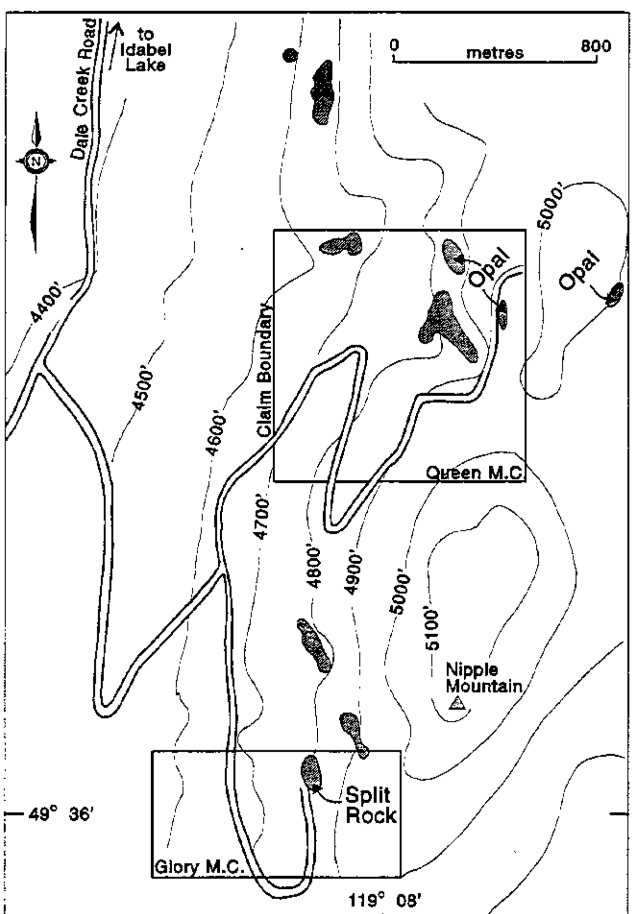

Figure 2. Nipple Mountain map-area; outcrrop areas (dacitic rocks) shown by stippled pattern.

The original lava flows were limited in extent - especially the viscous dacitic lava. Consequently lateral correlation of these rocks across the map area is uncertain. An Eocene age for the Nipple Mountain volcanic suite is indicated by Tempelman-Kluit (1989), although there is no firm correlation with the Marron Formation. Possibly, the Nipple Mountain dacite is source for felsic volcanic clasts in the nearby Kettle River Formation (Church, 1996). This is consistent with evidence suggesting the Nipple Mountain volcanics and the Kettle River Formation are both basal Tertiary units that rest unconformably on older rocks, such as the Anarchist Group.

NIPPLE MOUNTAIN SPLITSTONE (MINFILE 082ENW109)

Splitstone outcrops on the Glory claims 1500 m east of the Dale Creek road on the west slope of Nipple Mountain (Fig. 2). At this locality, broadly jointed dacite is exposed in a 150 metre long, northerly-trending cut on a logging road. The dacite is flow banded, dips gently westerly, and is intersected by two sets of widely divergent, steeply-dipping cross joints. Blocks of dacite up to 0.5 metres across can be readily levered from the cut face, rotated, then split with a mason's chisel into slabs 3 to 5 cm thick (Photo 1). The splits occur on clay

Photo 1. Don Sandberg splitting flow banded dacite, Nipple Mountain.

partings and planar concentrations of gas cavities. Surfaces of the slabs range from finely rippled and flat to grooved with gas cavities. Some slabs are hacky and somewhat undular. The weathered surface colour ranges from pale mauve to buff; less commonly, the rock is light rusty colour with minor manganese oxide stain. The natural outcrops and road cuts have fresh-looking surfaces which appear to be resistant to weathering.

Several truck loads of this splitstone have been shipped to Kelowna by Don Sandberg for personal use and test marketing with building supply stores as slabs for garden walkways and patio construction. The advantages of the product are durability, pleasant pastel colours and good surface traction for outdoor use. The large potential resource of the rock on Nipple Mountain could supply the major population centres in the Okanagan Valley.

NIPPLE MOUNTAIN OPAL (MINFILE 082ENW110)

Opal was first discovered by Don Sandberg in a logging road cut in the area now covered by the Queen claims on the ridge extending north from Nipple Mountain, 1500 metres east of the Dale Creek road (Figure 2). Subsequently other localities were located, on a rock bluff 150 metres to the northwest of the road on the west slope of the ridge, and another locality 400 metres to the east on the east side of ridge.

At the three localities opal occurs in flow banded dacite filling cavities in the bands, in breccia pods and on cross joints. The opal occurrences associated with banding are commonly almond-shaped lenses 1 to 3 cm in diameter, roughly elongated in the direction of flow (Photo 2). The opal on cross-fractures includes translucent coatings a few millimetres thick, covering areas up to 0.5 m^2 on the walls of the fissures.

The largest opals occur on the east side of the ridge. These weigh as much as 23 kg (opal plus some rock inclusions) and fill breccia cavities several centimetres thick. The opal is commonly waxy and amber coloured but it can be flesh, peach, honey-hues; less commonly grey and rarely green in colour. Fire opal, containing a rainbow of colours, such as described at the famous African, Mexican and Australian localites (Downing, 1996) has not been found. However, some of the watery fissure-lining opal displays a weak play of colours.

In some instances white plume opal is associated with quartz and chalcedony that forms variegated horizontal or concentric bands on cavity floors or walls. Chalcedony is believed to form within gas cavities of volcanic host rocks when microcrystalline chalcedony fibres nucleate on vug walls and grow inward (O'Donoghue, 1983). Oscillatory zoning and iris banding, as seen in thin section, are the result of variations in silica concentrations in solutions at the tips of the growing chalcedonic fibers. This can result in smooth and regular or botryoidal surfaces parallel to the banding (Heaney and Davis, 1995; Church, 1996).

A possible source of the silica-rich solutions is the host Nipple Mountain volcanics. Analyses of these rocks shows marked excess silica based on norm calculations. For example, a fresh dacite sample from the Glory claims contains 74.06% SiO_2, 0.24% TiO_2, 14.13% Al_2O_3, 2.00% Fe_2O_3, 0.02% MnO, 0.49% MgO 1.76% CaO, 3.65% Na_2O and 3.65% K_2O (major oxides recast to 100) that yields 34.3% free silica/quartz (CIPW norm). Thin sections reveal an estimated 7% plagioclase phenocrysts, 1% amphibole microlites and 1% opaque minerals in a glassy and devitrified fine grained matrix, leaving a large amount of unaccounted (excess) silica. It is concluded that part of the excess silica, accompanied by fluids and gases, moved from the dacite lava to gas cavities and fracture openings, during the original magma cooling process, to form the opal, quartz and chalcedonic fillings.

Photo 2. Opal lenses parallel to flow banding, Nipple Mountain dacite.

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