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Mineral Potential of the Southern Coast Belt, Cape Caution Area, British Columbia (092L, 092M)

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INTRODUCTION

This report discusses the geology and mineral potential of a segment of the southern Coast Mountains, near Cape Caution (straddling NTS areas 092L, 092M). The information presented is based on field visits, public domain reports and old staking records. The area was covered by a Ministry of Energy and Mine's lake sediment survey in 1999. The program is discussed in Jackaman *et al*. (1999), this volume. The project was funded under the Provincial Government's Corporate Resource Inventory Initiative (CRII) as part of the Ministry's contribution to the Central Coast Land and Coastal Resource Management (CCLCRMP) planning process.

The Cape Caution area covers approximately 1200 square kilometres of Hecate Lowland on the northeast side of Queen Charlotte Strait, 20 kilometres northeast of the northern-most tip of Vancouver Island (Figure 1). It is low-lying (less than 700 metres elevation) but highly irregular in topography and, locally, extremely rugged. The terrain is glaciated and over-deepened valleys have been flooded to create a patchwork of steep-sided marine sounds, inlets, peninsulas and islands.

The area is readily accessible by boat, float plane or helicopter from Port Hardy or Port McNeill; however, the bush is thick over much of the area and there are few helicopter landing sites. There has been a considerable amount of logging in the Mount Bullock area, at the north end of Drury Inlet and in the Bamford Lagoon area. These areas are readily accessible by road from ocean-based forestry load-out sites. Road construction has, exposed a considerable amount of rock.

PREVIOUS WORK

Ministry records, including Annual Reports, indicate that there was a considerable amount of exploration interest in the southern coastal region in the late 1800s and early 1900s. This is best exemplified by the work carried out on the Doratha Morton, Alexandria and other Crown Granted mineral claims in the Loughborough Inlet area, approximately 150 kilometres to the southeast of Cape Caution.

Much of the early exploration in the area was carried out without the benefit of geological maps. The Geological Survey of Canada carried out reconnaissance surveys along the coast in the early 1900s and produced a brief description of the geology of the Cape Caution area in 1909 (Graham, 1909). It did not map the area in any detail until the 1960s, when it was covered by the Coast Mountain Project (Roddick and Hutchison, 1967). The geology of the southern part of the area (Alert Bay Map Sheet 092L) is described at 1:125 000-scale by Roddick (1980) and the northern part (Rivers Inlet Map Sheet 092M), is described at 1:250 000-scale by Roddick (1996). Access to the inland portion of the map area was exceedingly difficult in the 1960s and Roddick (1980) notes that individual map units commonly include a variety of other rock types. Despite their common provenance, there are significant inconsistencies in nomenclature between the two maps covering the northern and southern parts of the area.

GEOLOGY

A simplified geological map of the Cape Caution area and adjacent parts of Vancouver Island taken from government and industry mapping (Bellefontaine and Alldrick, 1994) is shown in Figure 1. The mainland portion is underlain by stratabound rock pendants, diorite complexes and cross-cutting plutonic rocks.

The Cape Caution area is underlain by subparallel belts of pendant rocks, diorite complex material and massive to foliated intermediate plutonic rocks. Together, they define a broad regional fabric with a well-defined northwesterly trend. The rocks display both tectonic and intrusive contacts.

A major northeasterly dipping thrust fault that extends from Drury Inlet in the south to Belize Inlet in the north, a distance of approximately 50 kilometres, is shown in Figure 1. The Nenahlmai thrust has juxtaposed a five-kilometre wide package of interleaved pendant, diorite complex and younger plutonic rock against a large body of locally schistose footwall granodiorite and quartz diorite of the Burnett Bay Pluton (Roddick, 1996).

Locally, the rocks in the Cape Caution area display a pronounced northeasterly to easterly fracture set that is subparallel to a dominant set of local lineations. The

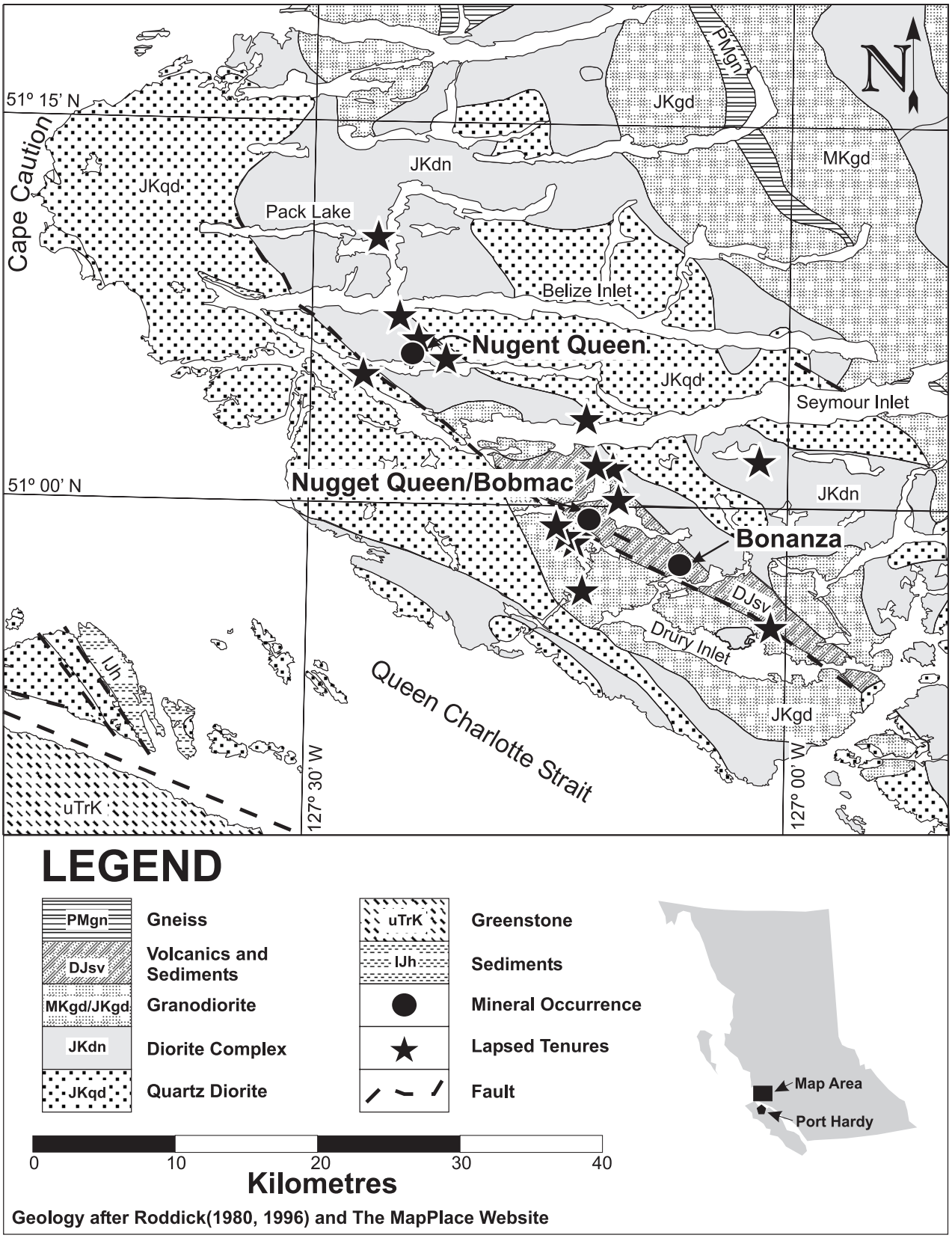

Figure 1. Generalized geology map of the Cape Caution area showing precious metal occurrences and lapsed tenure sites.

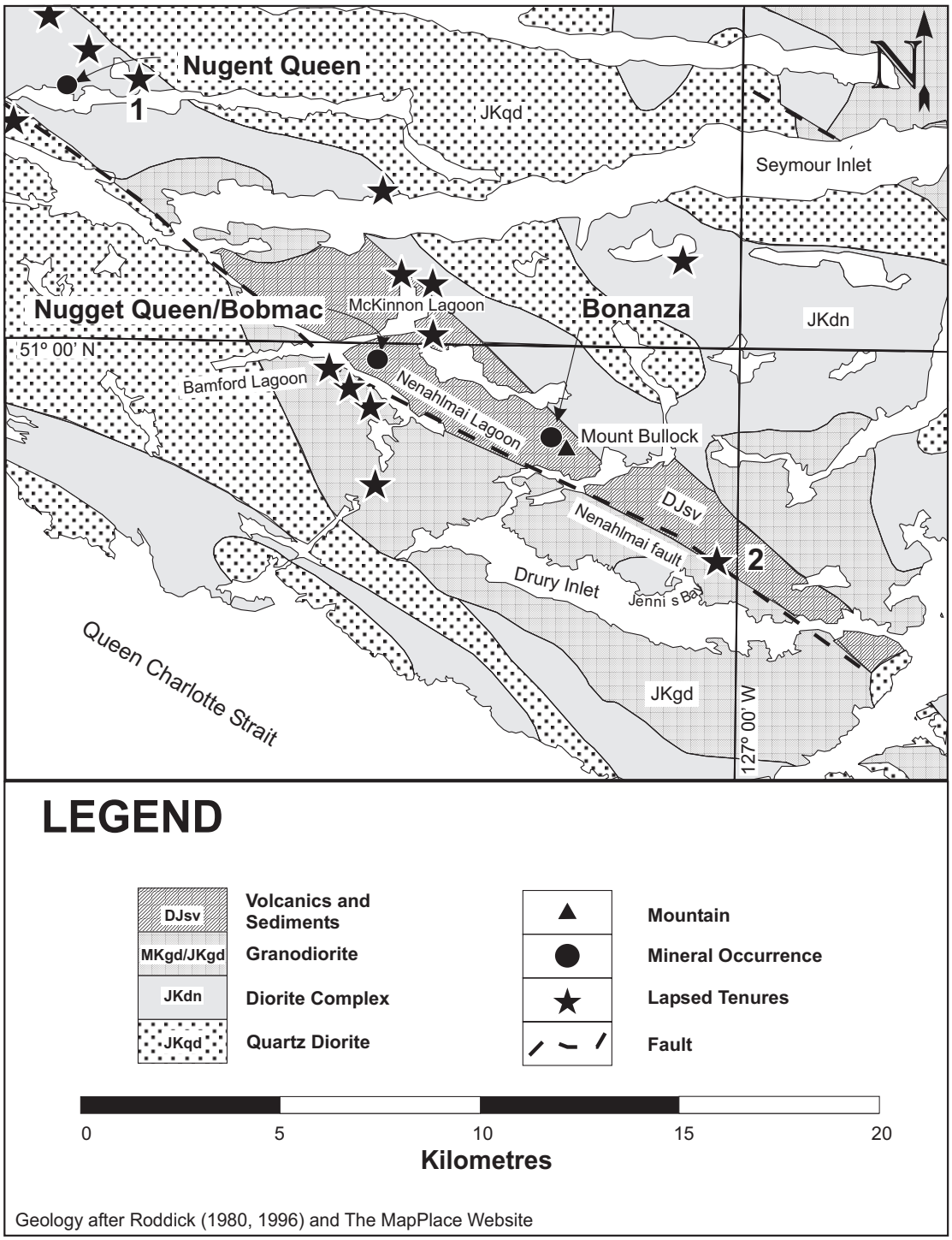

Figure 2. Generalized geology map of the Drury Inlet area showing the location of the Nenahlmai fault and related mineral occurrences.

structures are related to late faults, although there is little evidence of disruption on the Nenahlmai thrust.

The pendants are fragments of weakly to strongly metamorphosed volcanic and sedimentary strata of probable Devonian to Cretaceous age (PMgn, DJsv). They include both relatively undeformed and more schistose and gneissic varieties of greenstone, amphibolite, tuff, argillite, chert and limestone. Many of the pendants are spatially but probably not genetically related to "diorite complexes" (JKdn). These are composed of intermixed agmatite, gneiss and amphibolite of mainly gabbro to diorite composition but which show local gradation to quartz diorite and tonalite. Diorite complexes contain slivers of pendant rock but, according to Roddick (1996),

they are commonly too low in metamorphic grade to be anything other than tectonically interleaved with the diorite. The diorite complexes may be Jurassic and/or Cretaceous in age. They are cut by coeval to younger Jurassic and Early Cretaceous quartz diorite (JKqd) and granodiorite (JKgd) plutons.

MINERALIZATION

There are four hard-rock MINFILE occurrences in the survey area (Nugget Queen, 092L 178; Bobmac #6, 092L 179; Bonanza, 092L 292 and Nugent Queen, 092M 005) as shown in Figure 1. They appear to be shear-hosted, gold-bearing quartz vein prospects, although there is very little data available on the Nugent Queen occurrence and, as noted below, some of that may be suspect. In addition, the figure shows numerous "lapsed tenures". These are small sites that are known from old staking records to have been staked at some point over the past 70 years but for which there is insufficient information to warrant inclusion as a mineral occurrence in the Ministry's MINFILE database. The rationale behind the staking isn't known but, in most cases, the locator is likely to have been a prospector who found traces of mineralization.

The distribution of MINFILE showings and "lapsed tenures" suggests considerable potential for gold mineralization in the hanging wall of the Nenahlmai thrust.

Nugget Queen (MINFILE 092L 178) and Bobmac (MINFILE 092L 179)

The Nugget Queen and Bobmac gold prospects (latitude 50º 59' N and longitude 127º 12' W) are separate occurrences in MINFILE but they cover a single cluster of quartz veins near a pendant contact on the east side of Nenahlmai Lagoon (Figure 2) approximately 36 km northeast of Port Hardy.

Between them, the two prospects include eight veins, seven of which were known in the 1930s. According to information in the Ministry's Property File, they were extensively explored and trenched by the Mining Company of Canada Limited, in 1938. The eighth vein was located by Solaia Ventures Inc. in 1996.

Most of the veins are in a narrow, 200-metre wide band of slaty, pyritic argillite that is intercalated with basalt near the western margin of a pendant which is bounded by weakly foliated granodiorite and quartz diorite. Some of the veins are subparallel to bedding and display a northwesterly strike and a steep to vertical northeasterly dip. Others are markedly discordant and fill east-southeasterly trending structures in the argillite and adjacent meta-basalt. The discordant veins are also either vertical or they dip steeply to the northeast. Most of the exploration to date has been focused on six of the veins. However, there are two lesser known outliers, an occurrence in basalt close to the pendant contact near the shore of McKinnon Lagoon and a showing in granodiorite a short distance to the south.

The veins are contained in silicified shear zones. They are discontinuous, pinch and swell and reach a maximum width of approximately 2.0 metres. They are comprised of milky white, partially strained and recrystallized breccia-type, quartz with a trace amount of sericite, carbonate and, locally, angular fragments of country rock argillite. They also contain variable amounts of disseminated to semi-massive, blebby and stringer sulphide, principally galena, sphalerite, chalcopyrite and lesser bornite intermixed with pyrrhotite and pyrite. In most of the veins, there is a positive correlation between sulphide and gold content. Sulphide-rich samples commonly contain in excess of thirty grams per tonne of gold (Grove, 1996; Yacoub and Young, 1997).

The Mining Company of Canada stripped, trenched and sampled several of the veins. One of the east-southeasterly trending veins was exposed over a strike length of approximately 76 metres. The company sampled the vein at 1.5 metres intervals and, based on 43 samples, calculated a weighted grade of 5.69 grams per tonne gold over an average width of 0.7 metre (Yacoub and Young, 1997).

There was no recorded production from 1938 but ministry records indicate that a private individual shipped 604 tonnes of "higher-grade" material, taken from a 15-metre long, 5-metre deep surface cut along one of the northwesterly trending veins, to the Tacoma smelter in 1940/1941. A further 5 tonnes were shipped from the "main" vein in 1949. According to MINFILE, the samples yielded 20 869 grams of gold, 44 758 grams of silver, 1755 kilograms of copper, 10 188 kilograms of lead and 234 kilograms of zinc.

In 1972, Q.C. Explorations Ltd. conducted a limited VLF-EM geophysical survey in the vicinity of the producing vein (Allen, 1972) and in 1980, Frank Beban Logging Limited undertook additional geophysical and regional mapping programs (Brownlee *et al.*, 1980). Three years later, it drilled five short winkie drill holes for a total depth of 157 metres to test the previously sampled vein immediately to the west of the old sample site. The results were disappointing as the holes encountered argillite and quartz but returned low gold values (Soltermann, 1983).

More recently, in 1995, Solaia Ventures Inc. optioned the property and commissioned Ashworth Explorations Limited to conduct a variety of grid-based and other exploration programs. The next two years, Ashworth re-sampled the old trenches, collected stream sediment samples, conducted magnetometer and VLF-EM geophysical surveys over the main vein cluster, implemented both wide spaced and in-fill soil geochemical surveys and hand trenched and sampled several areas of anomalous soil geochemistry (Grove, 1996; Yacoub and Young, 1997).

The soil survey located a pronounced polymetallic (gold, lead, zinc and arsenic) soil geochemical anomaly coincident with a newly discovered quartz vein, approximately 80 metres to the south of the "main" vein. The anomaly displays an east-southeasterly trend and extends

for a minimum strike length of 225 metres (Yacoub and Young, 1997). It has not been drill tested.

Bonanza (MINFILE 092L 292)

The Bonanza gold prospect (latitude 50º 58' N and longitude 127º 07' W) is located on the north side of Mount Bullock (Figure 2), approximately 38 km northeast of Port Hardy. The area has recently been opened up for forest harvesting and the property is currently accessible by road from tidewater.

The Bonanza deposit is a shear-hosted quartz vein prospect, similar to the Nugget Queen/Bobmac occurrence. It has a similar structural setting within the same sedimentary and volcanic pendant. It is approximately seven kilometres to the southeast. There is very little known about the prospect's early history other than that it was hand trenched in 1945. The trenches were reopened in 1979, and Cominco Limited acquired the area in 1980. The trenches exposed a mineralized quartz vein in a northwesterly trending, steeply, possibly northeasterly, dipping shear zone in a narrow band of deformed graphitic argillite in the pendant. The pendant, at this latitude, is bounded by granodiorite and/or quartz diorite to the southwest of the Nenahlmai fault and by gneissic quartz diorite to the northeast. The sediment band is interbedded with basalt and it is cut by a large number of basalt sills (Dawson, 1987).

The mineralized shear zone is concordant with bedding. It is silica flooded and contains mineralized quartz veinlets, veins and boudins with disseminated to massive sulphides including pyrite, sphalerite, galena and lesser chalcopyrite and bornite. Most of the higher gold values correlate with high levels of lead and zinc and with zones of intense silicification (Dawson, 1987). The trenched section of the vein is between one and two metres wide. It displays an average width of 1.55 metres over a strike length of approximately 280 metres. Surface samples indicated an average grade of 3.39 grams per tonne gold (Wiley, 1981). However, selected sulphide-rich samples are reported to be appreciably higher in grade.

Cominco constructed a small grid and conducted detailed magnetometer and VLF-EM geophysical surveys over the trenched section of the vein (Jackisch, 1981). It also diamond drilled seven angled holes from three sites on the northeast side of the structure, looking for continuity of grade to depth. The results were disappointing. The holes encountered argillite with less quartz than found on surface. Locally the core contained traces of sulphide but the best drill intercept assayed 3.77 grams per tonne gold over 0.3 metre (Wiley, 1981).

American Bullion Minerals Limited examined the property in 1987 and concluded that, given the degree of flexure exhibited by the vein, Cominco's drill holes may not have been deep enough to intersect the main part of the vein system. The company acquired the property, constructed a 32-line kilometre grid and extended the earlier magnetometer and VLF-EM geophysical surveys. It identified a linear magnetic low over the argillite band hosting the vein and a coincident electromagnetic conductor, which was attributed to either graphite in the shear zone or sulphide in the vein. The anomalies were traced for a minimum 1.7 kilometres along strike beyond the trenched section (Dawson, 1987), but they were never drilled.

Nugent Queen (092M 005)

The Nugent Queen gold prospect (latitude 51º 5.39' N and longitude 127º 23.22' W) is described in MINFILE as being on the north shore of Nugent Sound, 5.5 km east of the entrance to Seymour Inlet (Figure 1). However, its precise location is uncertain. It may be marked by the O.K. claims (locality 1, Figure 2) which were staked by Mr. R. D. Smith as an agent for Mr. R.C. McCorkell in July, 1938. If so, it is located between the southeast point of Boydell Lake and Nugent Sound, approximately 45 kilometres north-northeast of Port Hardy.

The property is poorly documented and there are no detailed geological descriptions. However, the O.K. claims can be shown to have straddled a contact between diorite complex rocks and quartz diorite.

The Minister of Mines Annual Report for 1939 documents that a bulk sample, comprised of three small test lots from the Nugent Queen property, was processed in Prince Rupert. The samples had an aggregate dry weight of 0.867 tonne and an average grade of 48.7 grams per tonne gold, 121 grams per tonne silver, 0.46 percent copper, 3.2 percent lead and 0.9 percent zinc.

It is worth noting that the metal ratios are similar to those obtained from bulk samples taken from the Nugget Queen/Bobmac property a few years later, and there is a possibility that the samples came from the latter property. Mr. McCorkell had interests in both properties and data in the Ministry's Property File suggests that there may have been confusion between the two properties as early as the early 1940s.

Lapsed Tenures

With the exception of one site, the lapsed tenures shown in Figures 1 and 2 are known only from staking records. The ministry has old claim records which document where the claims were staked, when and by whom but not why. Nevertheless, their distribution is informative.

The known site was staked by Mr. L. L. King to the north of Jennis Bay on Drury Inlet in 1967 (locality 2, Figure 2). He staked ten, two-post, (Jay Bee) claims along a section of the Nenahlmai fault covering similar rocks to those found on the Bonanza property, approximately eight kilometres to the northwest. The site was covered by an expanded claim group in the 1970s; however, the tenures had lapsed by 1976.

Two lines of evidence suggest the presence of gold-bearing quartz vein mineralization on the property. American Bullion Minerals Limited indicates the presence of a gold occurrence in the area on a regional map

(Dawson, 1987), and a regional geochemical silt sample collected from a stream cutting the property and listed in MEMPR BC RGS 23, 1988 (Sample # 887133) contains 12 parts per million lead and 32 part per billion gold.

Most of the remaining lapsed tenures cover pendant or diorite complex rocks in the hanging wall of the Nenahlmai fault. They include several sites that were staked in the 1930s in the same geological environment as the O. K. tenures mentioned previously. They cover a contact between diorite complex rocks and quartz diorite (Figure 1). There are also four sites covering granodiorite on the footwall side of Nenahlmai fault. Most of these are close to the fault and may reflect prospector interest in splays emanating from it.

LAKE GEOCHEMISTRY

In June, 1999, the Geological Survey Branch collected 157 lake sediment and lake water samples over an area of approximately 1200 square kilometres, between Pack Lake and the south end of Drury Inlet (see Figure 1). The samples were collected to test for mineralization along the trace of the Nenahlmai fault and elsewhere in the Cape Caution region. The program is discussed in Jackaman *et al*. (1999), this volume.

Preliminary data indicate that a few of the sediment samples are weakly to strongly anomalous in one or more element, including molybdenum, lead, arsenic and zinc. Some lake water samples are enriched in flourine and/or sulphate. Although most of these samples are isolated, spot occurrences, many are located close to the Nenahlmai fault.

SUMMARY AND CONCLUSIONS

Two of the three known mineral occurrences in the Cape Caution area, the Nugget Queen/Bobmac and Bonanza prospects are polymetallic, gold-bearing, mesothermal quartz veins that have a common setting. They are located in sheared argillite in a large pendant in the hanging wall of the Nenahlmai fault. The third occurrence, the Nugent Queen prospect may be similar in type but it is poorly described and may be spurious.

Assessment report and other data suggest the presence of another mineralized site, near Jennis Bay, on Drury Inlet. The data indicates intermittent mineralization within the pendant over a minimum distance of approximately 15 kilometres.

The mineralization appears to be related to the Nenahlmai fault, a major, deep-rooted, structure that can be traced for approximately 50 kilometres. The known showings are restricted to the southern part of the structure, but the same style of mineralization may continue to the north. This concept was recently tested by means of a lake geochemical survey. Although the results are far from conclusive, spot anomalies are consistent with local mineralization along the fault.

The results suggest potential for mesothermal vein-type gold deposits in pendant rocks in the hanging wall of the Nenahlmai fault, and possibly also for similar deposits in the hanging wall of other deeply rooted thrusts in the southern Coast Mountains.

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