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GEOLOGY AND MINERAL DEPOSITS OF NORTHERN TEXADA ISLAND (92F/9, 10, and 15)

By I.C.L. Webster and G.E. Ray

KEYWORDS: Economic geology, Texada Formation, Marble Bay Formation, Jurassic plutonism, Bonanza arc, iron skarn, copper-gold skarn, moss-mat geochemistry.

INTRODUCTION

Texada Island, which is situated approximately 100 kilometres northwest of Vancouver between the Georgia and Malaspina Straits, is 50 kilometres long and averages 6 kilometres in width (Figure 2-4-1). The 1:20 000 mapping of northern Texada Island forms part of a 4-year project by the British Columbia Geological Survey Branch to study the province's important gold, iron and base metal skarn camps. The project was initiated by the work of Ray *et al.* (1987, 1988) and Ettlinger and Ray (1988, 1989) and this study will continue to examine the distribution and metallogeny of skarns in relation to the tectonic belts and geological terranes of the Canadian Cordillera. It will also look at the controls of mineralization and attempt to establish genetic models for skarn formation.

The northern part of Texada Island was selected as an area for detailed mapping because it contains a varied suite of polymetallic skarns that between 1896 and 1976 produced 10 million tonnes of magnetite iron ore, 35 898 tonnes of copper, 39.6 tonnes of silver and 3.3 tonnes of gold. There are also numerous precious and base metal vein deposits and occurrences and an almost inexaustible supply of pure limestone suitable for the manufacture of lime and cement.

PREVIOUS WORK

The discovery of magnetite in the northern part of the island in 1873 marked the beginning of a long history of mining activity. An examination of the shoreline geology was undertaken by Dawson (1885), a comprehensive report and geological map was made by McConnell (1914), and a study of the iron skarns was made by Swanson (1925). More recent work on various aspects of the island's skarn mineralization includes that by Bacon (1952), Muller and Carson (1968), Sangster (1969) and Ettlinger and Ray (1989). Mathews and McCammon (1957) examined the limestones. The 1:20 000 mapping study of northern Texada Island (Webster and Ray, 1990) which forms the basis of this paper, was completed during the summer of 1989.

GEOLOGY

INTRODUCTION

Texada Island lies at the eastern edge of both the Wrangellia Terrane and the Insular physiographic belt. It is mostly underlain by volcanic rocks of the Middle to Late Triassic Texada Formation which, in the northern part of the island, is conformably overlain by massive limestone of the Marble Bay Formation (Figure 2-4-1). These are respectively correlated with the Karmutsen and Quatsino formations of the Vancouver Island Group. Paleozoic Sicker and Buttle Lake Group rocks underlie the Texada Formation and are exposed in a narrow band on the south end of the island. Various stocks and minor intrusions, ranging in composition from gabbro through diorite to quartz monzonite, intrude the volcanics and limestones; many of these are I-type calcalkaline intrusions related to the Middle Jurassic Bonanza magmatic arc (Ettlinger and Ray, 1989), and some are associated with iron and copper-gold skarn mineralization. Poorly exposed Cretaceous sediments of the Nanaimo Group crop out around Gillies Bay; these represent the eastern margin of the Comox basin.

TEXADA FORMATION

Middle to Late Triassic volcanic rocks of the Texada Formation largely comprise pillowed and massive basaltic flows with thick units of pillowed breccias; the flows are often amygdaloidal and spherulitic. Most of the island is underlain by this formation; the most extensive section in the study area is exposed on Surprise Mountain where it reaches 300 metres in thickness.

Although the base of the formation is not seen on northern Texada Island, a stratigraphic succession is recognized. This consists of a lower sequence of predominantly massive basaltic flows with subordinate amounts of pillow lava and pillow breccia. The flows are characterized by amygdules, feldspar phenocrysts and spherulitic "snowflake" textures. Higher in the succession, pillowed flows and pillow breccias predominate. The top of the sequence, immediately underlying the Marble Bay Formation, often comprises thick units of fine hyaloclastite breccia and coarse pillow breccia. The pillow breccias are monomictic with angular to subrounded volcanic clasts up to 30 centimetres across; some breccias display alternating layers of finer and coarser grained material. Particularly well-preserved pillowed flows and pillow breccia outcrop along the west coast between the south end of Crescent Bay and Favada Point (Figure 2-4-1). In this area highly elongate pillows are seen and the layering in the breccias indicates the rocks dip moderately northeast.

The volcanics in the Surprise Mountain area include a 15-metre-thick subhorizontal unit of columnar-jointed basalt that overlies rhythmically layered amygdaloidal, feldspar-porphyritic and spherulitic flows. Columns vary between 1 and 1.5 metres in diameter and up to 15 metres in height; it is uncertain whether this unit represents an intrusive sill or a slow-cooling flow, although the latter is favoured. The discreet zones of pillowed and massive flows and the rare columnar jointed basalts suggest areas of submarine ponding developed during extrusion of the lavas.

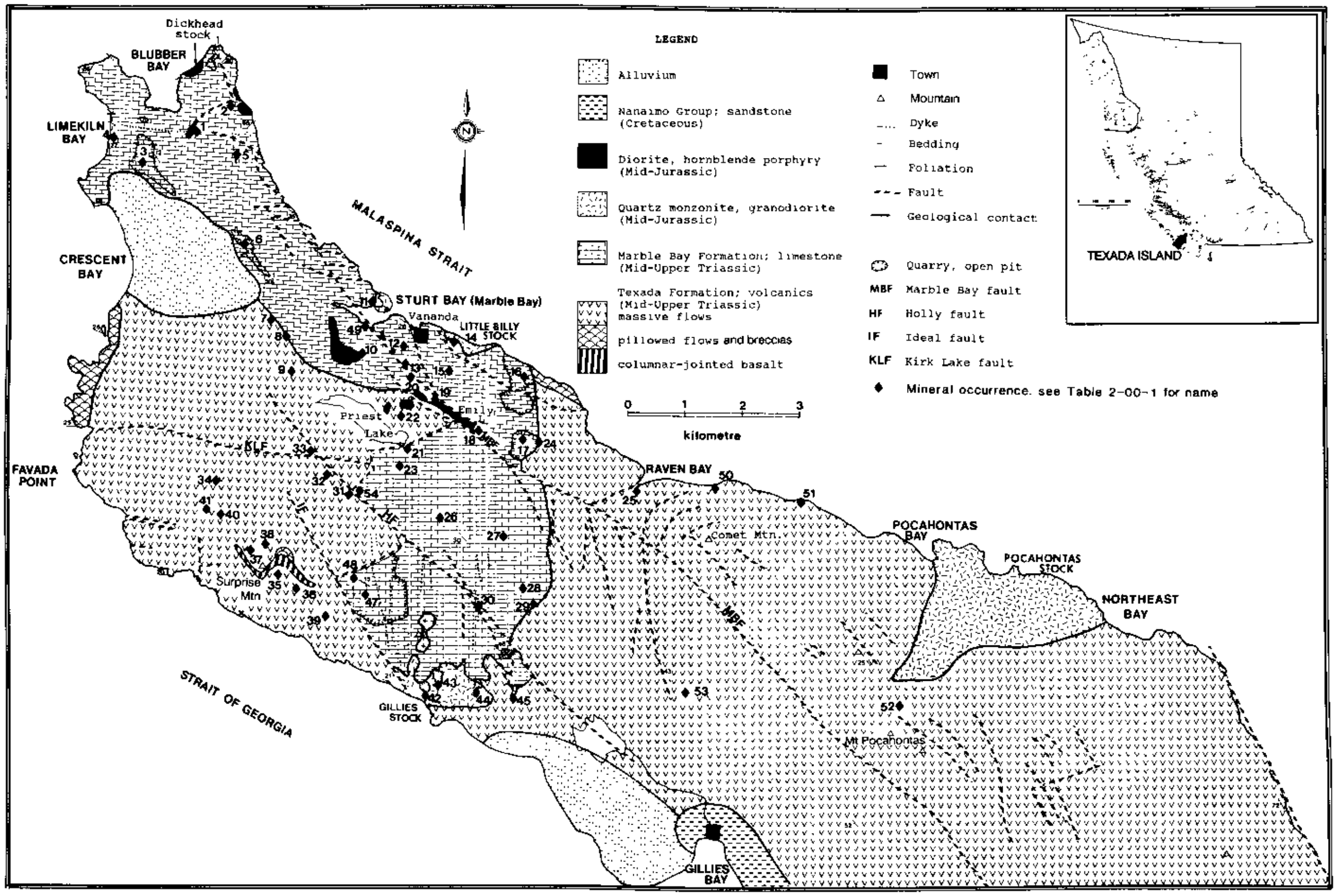

Figure 2-4-1. The geology and location of mineral occurrences on northern Texada Island.

Near the top of the Texada Formation, close to its contact with the overlying Marble Bay Formation, the flows and pillow breccias contain beds of fossiliferous grey limestone up to 3 metres thick, together with with rare, thin beds of dark shale. Crinoid and bivalve fragments are abundant and the tops of the limestone beds often contain irregular and nodular cherty concretions up to 5 centimetres in diameter. These thin beds of fossiliferous limestone are best exposed and least altered on the upper slopes of Surprise Mountain; elsewhere they tend to be recrystallized to marble or overprinted by skarn alteration.

Marble Bay Formation

The Upper Triassic Marble Bay Formation is a limestone sequence 60 to 520 metres thick that occupies a belt 3 kilometres wide extending northwest from Gillies Bay to Vananda and Blubber Bay (Figure 2-4-1). It conformably overlies the Texada Formation and mainly comprises pure, massive to poorly bedded, grey, featureless calcareous and dolomitic limestone. Exposed contacts between the limestone and underlying volcanic rocks are usually marked by steep faults. Recrystallization and bleaching to white marble, together with intense jointing and local shearing make the recognition of primary sedimentary features difficult. The least-altered limestone and best-preserved bedding is exposed along the shoreline of Limekiln Bay and on the east coast north of Vananda, where impure silty interbeds are present.

Mathews and McCammon (1957) divided the limestones of the Marble Bay Formation into three members, based on differences in chemical composition. Calcium-rich limestones, which occupy the lowest part of the succession, are overlain in turn by two members that become increasingly magnesium-rich. These dolomitic units, which contain up to 15 per cent MgO, at first thicken eastward from the Blubber Bay No. 6 quarry and then progessively thin towards the coast; dolomitization appears to be discordant to the limestone stratigraphy. The lower lime-rich member, which at the Blubber Bay No. 6 quarry exceeds 99 per cent $CaCO_3$, is ideal for lime and cement production.

Intrusive Rocks

Numerous sills and dikes, as well as several larger stocks, intrude the Texada and Marble Bay formations. Some mafic sills may represent feeders for the Triassic volcanic rocks, but many are younger as they cut the Marble Bay limestone. The stocks are I-type calcalkaline rocks ranging in composition from quartz monzonite to gabbro, and are locally associated with skarn mineralization (Ettlinger and Ray, 1989). The more mafic stocks are generally smaller than the felsic bodies and tend to be concentrated along the northwest-trending Marble Bay fault (Figure 2-4-1); this fault zone extends from south of Emily Lake, northwards to Sturt Bay and may extend yet farther north to the Canada trench and Paris mine area. The amphibole-rich dioritic stocks and sills in this belt vary from fine to very coarse grained, and are characterized by mafic xenoliths and coarse hornblende megacrysts; numerous skarn occurrences and several past-producing mines are associated with these intrusions. The dioritic Cornell stock, at the south end of the belt, contains up to 35 per cent hornblende and pyroxene phenocrysts set in a fine-grained plagioclase-rich matrix. Similar mafic intrusions, some of which are locally apatite-rich, outcrop near the Florence and Security copper-gold skarns on the north side of Emily Lake. The mafic intrusions outcropping along the northeast coast below the Loyal mine dump contain rounded to angular mafic xenoliths of coarse hornblendite and gabbro up to 30 centimetres across, as well as smaller, rarer xenoliths of massive magnetite. The Dickhead stock (Figure 2-4-1), along the north shore east of Blubber Bay, exhibits compositional layering with abundant xenoliths of magnetite and hornblende-rich material and lesser amounts of paler siliceous material.

The felsic stocks are exposed along the northeast and southwest coasts and include the Gillies, Little Billy and Pocahontas stocks. The Gillies stock, which has yielded a zircon U-Pb radiometric age of 178 Ma (Ettlinger and Ray, 1989), is genetically associated with several magnetite-rich skarn deposits. It mainly comprises a grey, medium-grained equigranular quartz monzonite that contains amphibole, biotite and occasional pyroxene phenocrysts. A late potassium feldspar rich phase is also present. The stock and the surrounding limestones are cut by sets of northerly and easterly trending feldspar-porphyritic dikes that reach 10 metres in thickness and postdate skarn mineralization. The Little Billy stock, on the north coast, is spatially associated with copper-gold skarn mineralization at the Little Billy mine. It comprises a light grey, fine to medium-grained equigranular tonalite (Ettlinger and Ray, 1989) containing up to 10 per cent biotite and hornblende. The Pocahontas stock, farther southeast, is a light grey, equigranular, quartz-rich intrusion that contains approximately 10 per cent biotite and 5 per cent hornblende. Unlike the Gillies and Little Billy stocks, it is not associated with known skarn mineralization.

Other small granodioritic bodies outcrop near the Marble Bay mine, at the head of Marble Bay and at the entrance to Sturt Bay. Like the more mafic intrusions associated with copper-gold skarn mineralization, these felsic bodies sporadically contain subrounded xenoliths of hornblendite up to 5 centimetres in diameter. A distinct, easterly trending quartz porphyry dike that transects the island from Limekiln Bay, through the Paris mine, to the east coast, may be Cretaceous in age. This dike reaches 7 metres in width and appears to postdate the major northwest-trending faults. The margins of the dike contain spherical to oval-shaped cavities up to 5 centimetres in diameter. These probably represent gas bubbles that were concentrated along the edges of the dike during its intrusion. All of the stocks sampled to date give Middle Jurassic radiometric ages (Ettlinger and Ray, 1989).

STRUCTURAL GEOLOGY

Texada Island lies close to the eastern margin of the Insular Belt, and may possibly represent a horst along the eastern edge of the Comox basin (T. Hamilton, personal communication, 1989). Only one major episode of folding (F_1) has been recognized; this resulted in the limestones and, to a lesser extent, the underlying volcanics, being deformed into a series of broad, northwest-trending open folds that plunge northwards. Three subparallel, northwesterly striking lineaments are also recognized, reflecting zones affected by both ductile and brittle movement; from south to north these lineaments coincide with the Ideal, Holly and Marble Bay faults (Figure 2-4-1); These faults cut a set of northeasterly striking faults, one of which forms the northwest boundary of the limestone in the Ideal quarry. Locally the younger northwest-trending structures are represented by a single fault but elsewhere they contain numerous splays of brittle fractures, as seen along the Marble Bay fault zone near Sturt Bay and Blubber Bay. Slickenside measurements and offset of the limestone-volcanic contact along the Marble Bay and Holly faults indicate up to 600 metres of subhorizontal sinistral movement. A noticeable increase in the intensity of F_1 folding occurs within and adjacent to the northwest-trending structural lineaments, particularly toward the Marble Bay fault. In the Limekiln Bay area the limestones are gently folded, but toward the Marble Bay fault the folding becomes tighter, and the development of bleached marble is more common. Localized ductile deformation along the northwest-trending lineaments includes the development of a marked penetrative shear fabric and ductile flow folds in the marbles, as well as the formation of stretched boudin structures in some dikes that intrude the marble.

The Marble Bay fault, and to a lesser extent the Ideal fault, have also apparently controlled the emplacement of some of the Jurassic intrusions and their associated skarn mineralization; this suggests that the plutonism occurred along lines of structural weakness and that the northwesterly trending lineaments are at least Middle Jurassic in age. The Cornell, Copper Queen, Florence-Security, Little Billy, Charles Dickens and Marble Bay copper-gold deposits are all located on or close to the Marble Bay fault, while the Gillies stock and its associated iron-skarn deposits lie close to the Ideal fault. Locally at the iron mines, the volcanic-limestone contact is highly deformed (Figure 2-4-2, 3A, 3B) and these structures have partly controlled the distribution of the magnetite ore. The abundant xenoliths in the mafic plutonic suite associated with the Marble Bay fault, and the morphology of the intrusions associated with the iron-skarn deposits close to the Ideal fault (Figures 2-4-3A and 3B), suggest that diapiric and explosive intrusive activity occurred. It is uncertain, however, whether the intense deformation of the volcanic-limestone contact at the iron mines resulted from localized F_1 regional folding, thrust faulting or forcible diapiric emplacement of the intrusions. This uncertainty is illustrated at the Paxton mine where both the limestones and the relatively competent volcanics are deformed into a series of tight fold-like structures (Figures 2-4-3A and 3B).

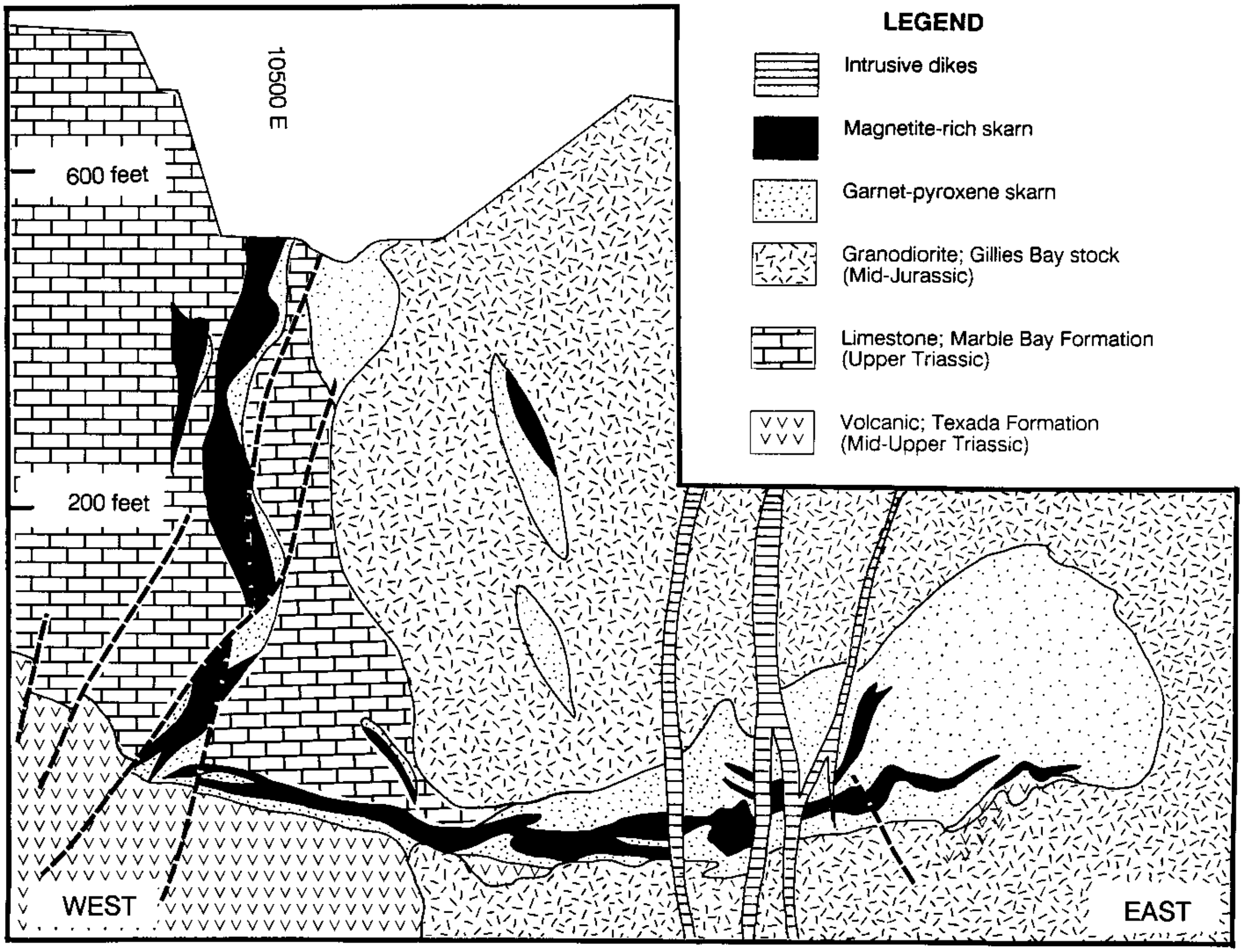

Figure 2-4-2. East-west geological cross-section through the Prescott pit at 11135 north, Texada Iron mine. Data courtesy of Ideal Cement Company.

MINERALIZATION

The mineral deposits and occurrences on northern Texada Island are listed in Table 2-4-1. Mineralization mainly comprises skarns and veins, both of which carry base and precious metals. Ten million tonnes of iron ore and substantial amounts of copper, gold and silver have been produced from the skarns but the quartz and carbonate veins, which received considerable attention during the early mining history of the island, have so far been relatively unproductive.

SKARNS

Skarn mineralization can be broadly divided into iron-rich, which is associated with the felsic Gillies stock, and copper-gold-rich, which is mostly related to a suite of mafic intrusions. All skarns on the island are associated with high-level calcalkaline plutonism and were formed under oxidizing to intermediate conditions (Ray *et al.*, 1990, this volume). Small occurrences of skarn alteration are common throughout the Marble Bay Formation; in some cases the hornblende porphyry dike suite intruding the limestone exhibits varying degrees of endoskarn alteration but exoskarn halos are generally less than 1 metre thick and, in many cases, are totally lacking. In numerous localities the limestones have been intensely bleached as in the Imperial and White Rock quarries. Bleaching often follows subvertical joints and gently dipping bedding planes, and was probably caused by the movement of fluids and gases produced by skarn development at depth.

IRON SKARNS

Iron-skarn mineralization is seen at the Prescott, Yellow Kid, Paxton and Lake mines where it is generally developed close to or along the margin of the Gillies stock (Figure 2-4-1). Mineralization is concentrated along either the Marble Bay–Texada Formation contact, the margins of the Gillies stock or within limestone and volcanic rocks some distance from the stock where the skarn-forming fluids were controlled by subvertical brittle fractures (Figure 2-4-2). Magnetite

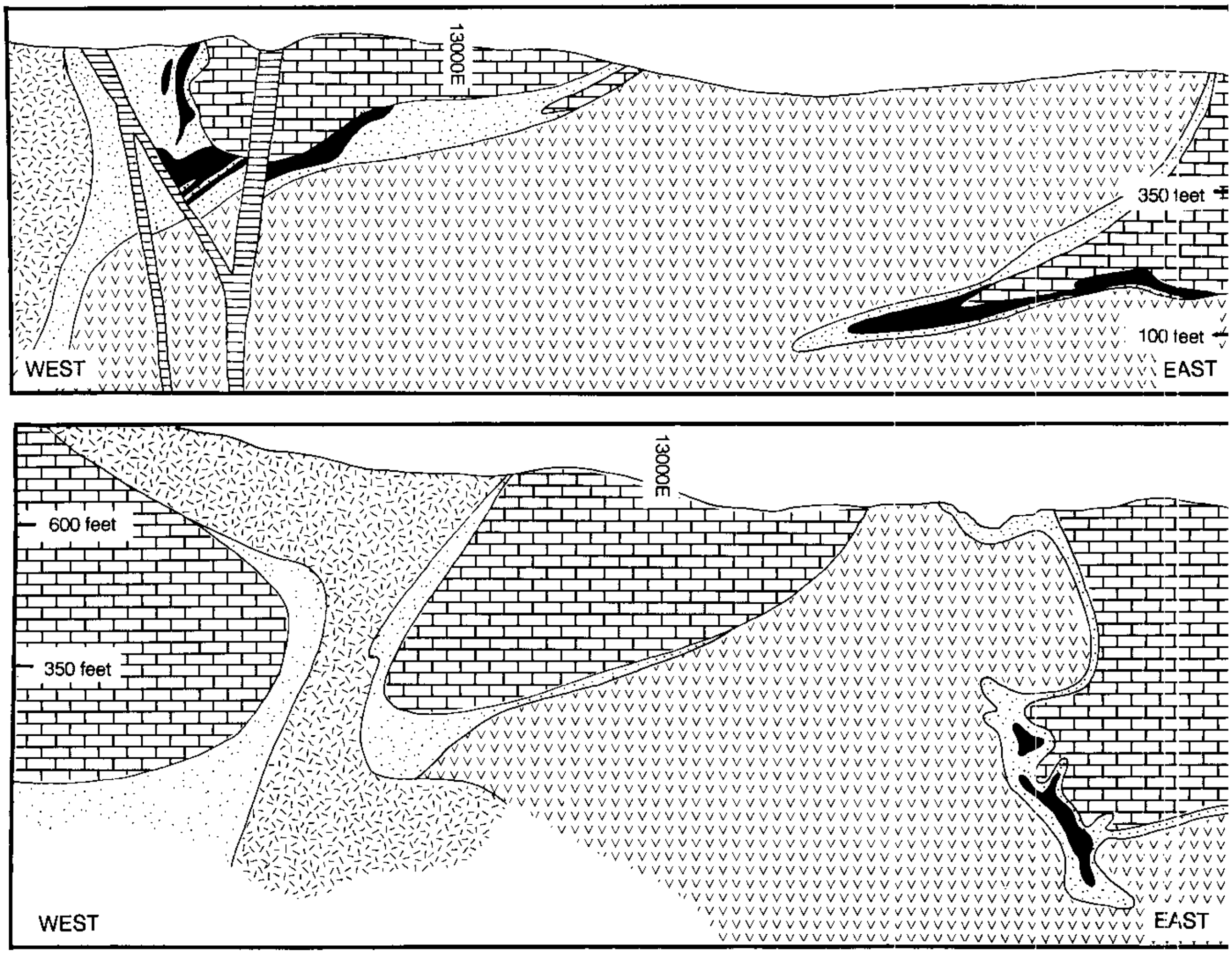

Figure 2-4-3A and 3B. East-west geological cross-sections at 11300 north and 11900 north, Texada Iron mine. Legend as in Figure 2-4-2.

orebodies adjacent to the stock are generally associated with abundant garnet-pyroxene-amphibole skarn, while the more distal, structurally controlled, subvertical deposits have less extensive skarn envelopes. The massive magnetite occurs with reddish brown garnet, pyroxene, epidote, actinolite and sporadic chalcopyrite, pyrite and pyrrhotite. No arsenic or bismuth enrichment is reported (Ettlinger and Ray, 1989) and gold values are generally less than 0.5 gram per tonne. The skarn alteration and mineralization overprints all phases of the Gillies stock and, to a lesser degree, the limestone and volcanic rocks, although it is often difficult to distinguish between exoskarn and endoskarn. Contacts between the skarn and unaltered rocks are generally sharp. Mineralogical zoning is recognized and, where fully developed, comprises barren skarn close to the intrusion, grading outwards to magnetite-rich skarn and then into marble. Locally, chalcopyrite and pyrite occur close to the outer margins of the skarn envelope, adjacent to limestone or marble. Magnetite veinlets commonly cut garnet-pyroxene skarn (Sangster 1969) and in the Yellow Kid mine, veinlets of pyrite and chalcopyrite crosscut the magnetite. Thus, early garnet-pyroxene assemblages were followed, in turn, by the introduction of magnetite and late sulphide mineralization.

Minor iron skarn also occurs farther north, near the Imperial Limestone quarry and at the Raven Bay showings (Figure 2-4-1; Table 2-4-1). These showings, which lie close to the contact between the Marble Bay and Texada formations, comprise magnetite and chalcopyrite with high (0.17 per cent) cobalt ; some erythrite-bearing float is seen in this area.

COPPER-GOLD SKARNS

Copper-gold skarns are more widely distributed on the island than the iron skarns, and are also more variable in their mineralogy and chemistry. Copper and gold were won from a number of deposits including the Marble Bay, Little Billy, Copper Queen and Cornell mines southeast of Vananda (Figure 2-4-1). Mineralization often forms irregular pipe-like bodies that plunge moderately, subparallel to the contacts

TABLE 2-4-1
LIST OF MINERAL DEPOSITS AND OCCURRENCES

Map Number	Occurrence and Commodity	92 F MINFILE Number	Type
1	Paris, Fe, Cu, Zn	266	skarn
2	Loyal, Cu, Ag, Pb, Zn	265	skarn
3	Blubber Bay No. 6, lst	397	quarry
4	Limekiln Bay, lst	407	quarry
5	Canada, Fe, Cu	267	skarn
6	Hiesholt, lst	*	quarry
7	Bolivar, Au	364	u
8	Marjory, Ag, Au	109	vein
9	Saga	*	vein
10	Volunteer, Fe	268	skarn
11	Oke, Cu, Zn, Ag	374	vein
12	Marble Bay, Au, Ag, Cu	270	skarn
13	Charles Dickens, Cu, Zn	295	u
14	Little Billy, Cu, Au, Ag	105	skarn
15	Copper Queen, Cu, Ag, Au	271	skarn
16	LaFarge-Beale, lst	396	quarry
17	Imperial, lst	394	quarry
18	Cornell, Cu, Au, Ag	112	skarn
19	Florence, Cu	210	skarn
20	Security, Fe, Cu	269	skarn
21	Wolfe	*	u
22	Yew, Cu, Au, Fe	*	skarn
23	Belle, Au	*	u
24	Midas, Fe, Co	*	u
25	Raven, Cu, Fe, lst	111	u
26	Lucky Jack	*	u
27	Vauxhall, Au, Ag, Cd	*	u
28	Sentinel, Cu, Pb, Zn	113	vein
29	Aladdin	*	vein
30	Sandy, Zn, Pb, Ag, Au, Cu	373	u
31	Holly	321	vein
32	Gem, Au	*	vein
33	Victoria, Au	264	vein
34	Iron Horse	*	vein
35	Surprise, Au, Ag, Cu, Zn	262	vein
36	Copper King, Au, Ag, Cu	263	vein
37	Silver Tip, Au, Ag, Cu, Zn	261	vein
38	Nancy Bell	*	vein
39	Retriever, Cu, Ag, Au	357	vein
40	Tyee	*	vein
41	Lion, Cu	*	vein
42	Prescott, Fe, Cu	106	skarn
43	Yellow Kid, Fe, Cu, Au, Ag	258	skarn
44	Paxton, Fe, Cu	107	skarn
45	Lake, Fe, Cu	259	skarn
46	White Rock, lst	*	quarry
47	Ideal, lst	395	quarry
48	Manto, Au, Zn, Pb, Cu	*	u
49	Marble Bay, lst	095	quarry
50	Malaspina, Fe	273	u
51	Lucky Lead	*	u
52	Black Prince, Au, Cu, Ag	108	skarn
53	Cap Sheaf, Cu, Fe	274	skarn
54	Maude Adams	*	u

* = no MINFILE number.
u = unknown type of mineralization.

between limestone and intrusive rocks. Compared to the iron-skarn deposits, which developed close to the base of the Marble Bay Formation, the copper-gold skarns southeast of Vananda occur throughout the thick limestone succession. The composition of the intrusion genetically related to the Little Billy skarn is uncertain. The main Little Billy stock is tonalitic (Ettlinger and Ray, 1989); this is atypical of most gold-copper skarns on the island which are generally associated with more mafic dioritic plutonism. Recent drilling by Freeport-McMoRan Gold Company indicates some of the skarn is spatially associated with a suite of amphibole-rich mafic dikes that may postdate the tonalitic Little Billie stock. The Little Billy skarn comprises coarse, light tan grossularite and light green and dark brown andradite garnet that varies compositionally from Ad_{35} to Ad_{70} mole per cent (Ettlinger and Ray, 1989), as well as wollastonite, clinopyroxene, tremolite, quartz and feldspar. The main ore minerals are chalcopyrite and bornite with variable but minor amounts of molybdenite, pyrite, magnetite and sphalerite. Compared to the other copper-gold skarns, the Little Billy mineralization is locally pyrite-poor. Bornite sometimes occurs as coarse euhedral crystals intergrown with garnet, and the higher gold values are commonly found with the higher copper concentrations (C.N. Forster, personal communication, 1989). Ettlinger and Ray, (1989) report the gold occurs as minute 20 to 50 micron blebs that are attached to grains of bornite. Chalcopyrite and bornite are interstitial to bladed wollastonite. Other minerals at the Little Billy include galena, scheelite and native silver as well as the tellurides hessite, petzite and wehrlite (A. Panteleyev, personal communication, 1989).

The Marble Bay orebody is reported to have carried chalcopyrite, bornite and native silver within extensive, steeply dipping, skarn-altered fracture zones that cut brecciated limestone (McConnell, 1914). The sulphides, gold and silver tend to be concentrated along one margin of these zones at the contact between skarn and marble or skarn and unaltered limestone; the other margin is commonly occuppied by barren garnet-pyroxene-epidote-tremolite-calcite skarn.

The ore at the Cornell and Copper Queen mines is dominated by chalcopyrite and bornite. However, the copper-gold skarn mineralization in the Florence and Security area, north of Emily Lake, is locally more magnetite rich. This mineralization, like the iron-skarns, lies close to the faulted and unconformable contact between the Marble Bay limestones and the underlying Texada Formation, although it is related to small mafic, amphibole-phenocrystic sills and stocks that are locally apatite rich and epidotized. Mineralization, which may be massive, is commonly developed in the basal gritty limestones; it consists primarily of magnetite with some chalcopyrite, pyrite and chalcocite in a garnet-pyroxene gangue.

In the Blubber Bay area, copper-gold skarn containing pyrite, bornite, chalcopyrite, pyrrhotite, sphalerite, galena and variable amounts of magnetite occurs at the Paris and Loyal mines and at the Canada trench. These properties are associated with a suite of elongate hornblende-rich dioritic intrusions that commonly contain mafic xenoliths and occupy major fractures. In the Loyal area, northeasterly trending skarn-altered mafic dikes, more than 250 metres long, carry minor sulphides and a little gold, but the exoskarn halos associated with these intrusions seldom exceed 1 metre in thickness.

With the exception of the Paris mine, where crystalline native arsenic has recently been identified by x-ray diffraction (M. Chaudhry, personal communication, 1989) in marbles adjacent to the outer margins of the skarn, there are no reports of arsenic enrichment or arsenopyrite present in the skarns on Texada Island. Bismuth analyses are generally low except at the Paris skarn, and tellurides have only been identified at the Little Billy mine.

VEIN MINERALIZATION

Numerous quartz and carbonate veins, carrying a varied suite of base and precious metals, were discovered and worked in the early 1900s, particularly in the Surprise Mountain area (Figure 2-4-1). Many of these are described by McConnell (1914) and listed in Table 2-4-1. Most veins are located in or adjacent to north or northwest-trending faults or shear zones that cut the Texada Formation.

At the Lion's trench (Table 2-4-1), drusy quartz veins containing angular fragments of wallrock cut amygdaloidal basalts. These veins carry pyrite, chalcopyrite and anomolous gold values (P. Sargeant, personal communication, 1989). The Silver Tip prospect (Table 2-4-1) is a northwest-trending quartz-carbonate vein, 75 centimetres wide, occupying a shear zone that cuts weakly chloritized feldspar-porphyritic volcanic rocks. Mineralization includes pyrite, chalcopyrite, galena, sphalerite and gold.

At the Nancy Bell showing, on Surprise Mountain, a northwest-trending shear zone 3 to 4 metres wide cuts silicified volcanic rocks and a thin interbed of limestone. A grab sample of pyrite-sphalerite-chalcopyrite-galena-mineralization returned analyses of 32.3 grams per tonne gold, 96 grams per tonne silver, 1.65 per cent copper, 0.2 per cent lead, 6.37 per cent zinc, 47 ppm cobalt, 55 ppm molybdenum, 219 ppm arsenic and 102 ppm bismuth.

MOSS-MAT STREAM GEOCHEMISTRY

Forty-four moss-mat samples were collected from streams throughout the island (Figure 2-4-4) for geochemical analysis of contained silt. The collection and preparation of the samples was conducted using the procedures outlined by Matysek and Day (1988). A 31-element ICP and 6-element hydride ICP analysis was performed and the preliminary results for Au, Ag, Cu, Pb, Zn, Ni, Co, As and Hg are listed in Table 2-4-2. For comparative purposes, the mean, 90th and 95th percentile values for these elements in the Karmutsen Formation, determined from the Regional Geochemical Survey of the Alert Bay/Cape Scott area of northern Vancouver Island (RGS Open File 23) are also listed.

Due to time constraints, only one or two samples were collected from most streams, however two streams were sampled in more detail to provide some orientation data and to detect any changes in element concentration along their courses. The preliminary results show sporadic gold anomalies in streams draining the Priest Lake – Vananda area where the Marble Bay, Little Billy and Florence-Security copper-gold skarn mineralization occurs. Some weak to strong gold and copper anomalies also occur in streams draining the southern half of the island. The highest gold value (Sample 20-1) was obtained from a creek close to the southern tip of the island (Figure 2-4-4); the stream bed at the sample site contains abundant float of quartz-vein material. The complete analytical results together with the conclusions on this moss-mat sampling program will be presented at a later date.

SUMMARY AND CONCLUSIONS

Texada Island, which lies adjacent to the eastern margin of Wrangellia, may contain clues regarding the style and history of tectonism along the contact between the Insular Belt and the Coast plutonic complex. As the island possibly contains the most easterly known equivalents of the Sicker, Buttle Lake and Nanaimo groups and Karmutsen and Quatsino formations, further study of these rocks may reveal facies changes compared to rocks on Vancouver Island and provide additional data concerning both massive sulphide mineralization in the Sicker and Buttle Lake groups and skarn mineralization in the Triassic succession.

TABLE 2-4-2. ANALYTICAL RESULTS OF MOSS-MAT GEOCHEMICAL SAMPLES (for locations *see* Figure 2-4-4).

ID No.	Au	Hg	Ag	Cu	Pb	Zn	Ni	Co	As
	– ppb –		ppm						
2-1	4	60	0.1	51	9	71	12	9	3
2-2	136	40	.1	34	10	53	11	7	4
2-3	11	50	.1	37	11	67	13	8	3
2-4	1	40	.1	36	11	56	11	7	4
2-5	3	50	.1	32	5	83	15	9	5
2-6	1	20	.1	20	5	37	11	6	2
2-7	2	70	.1	60	16	159	29	15	[illegible]
2-8	2	110	.1	39	10	131	17	11	[illegible]
3-1	33	30	.1	23	10	72	6	4	[illegible]
3-2	1	20	.1	8	5	57	3	3	[illegible]
3-3	1	40	.1	10	10	68	3	3	[illegible]
3-4	2	60	.1	19	17	86	6	4	[illegible]
3-5	1	20	.1	13	7	38	3	2	[illegible]
3-6	80	30	.1	59	9	42	5	4	[illegible]
3-7	1	50	.1	11	6	46	4	3	[illegible]
3-8	9	150	.1	33	21	217	6	5	108
4-1	4	80	.1	42	8	41	11	7	[illegible]
4-2	1	30	.1	26	4	28	7	5	[illegible]
5-1	4	70	.1	47	15	43	12	11	[illegible]
6-1	1	20	.1	45	7	43	20	10	[illegible]
7-1	1	50	.1	29	10	51	12	7	[illegible]
7-2	1	40	.1	33	2	40	9	7	[illegible]
8-1	1	50	.1	37	11	38	11	6	[illegible]
9-1	2	30	.1	37	6	32	11	6	[illegible]
10-1	1	100	.2	80	11	40	18	7	7
10-2	71	30	.1	28	2	41	14	8	3
11-1	55	40	.1	88	9	87	51	25	8
12-1	4	100	.1	131	31	101	36	17	6
13-1	3	80	.1	143	15	68	42	18	2
14-1	4	60	.1	177	10	71	45	18	7
15-1	21	90	.1	153	14	98	46	23	5
16-1	27	40	.1	102	5	55	33	16	6
17-1	6	50	.2	118	7	57	33	17	2
18-1	4	130	.3	79	43	152	33	67	10
19-1	5	80	.2	54	3	54	25	11	7
20-1	320	140	.1	113	28	135	60	30	8
21-1	13	60	.1	126	29	166	64	33	9
22-1	23	80	.3	129	41	85	40	22	6
25-1	7	60	.1	23	21	41	9	8	2
26-1	126	50	.1	42	26	50	20	10	3
27-1	38	180	.7	94	88	188	20	19	17
27-2	8	100	.4	93	44	188	38	21	22
28-1	8	80	.3	59	70	74	13	10	13
29-1	1	170	.8	91	157	79	17	17	16

	Au ppb	Cu ppm
90th percentile	34	149
95th percentile	80	166
Mean	18.2	90.0
(MEMPR BC RGS 23 1988)		

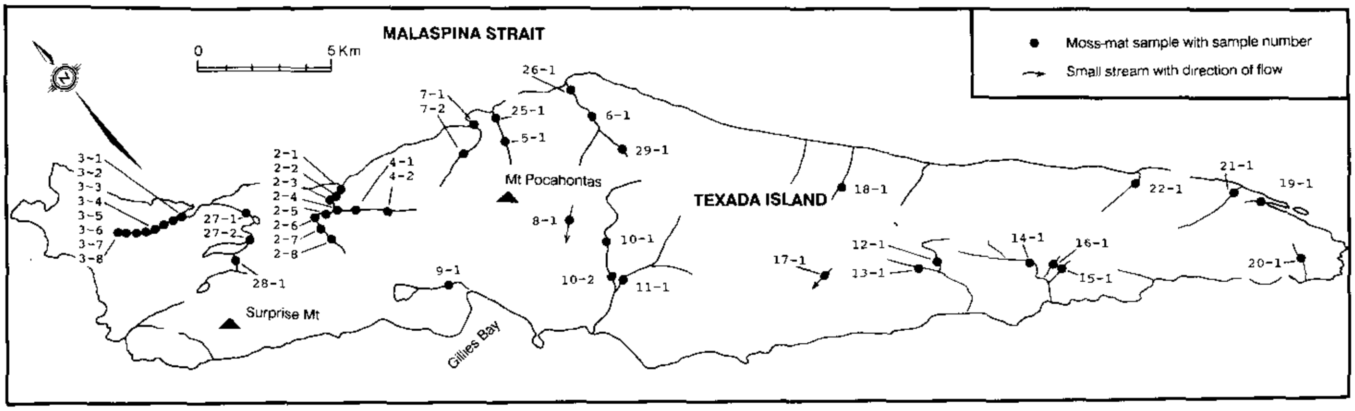

Figure 2-4-4. Location of moss-mat geochemical samples (*see* Table 2-4-2 for analytical results).

The northern part of Texada Island was affected by an episode of deformation that generally produced broad open, northwesterly striking folds in the volcanics and limestones. However, the island geology has been influenced by at least three northwesterly trending, subparallel structural zones that have undergone both ductile and brittle deformation. Evidence for ductile movement includes the development of stretched boudins in some dikes, and the presence of flow folds and a penetrative shear fabric in some marbles. These narrow belts coincide with brittle transcurrent fault zones with sinistral offset atypical of the mostly dextral faults present elsewhere in the province. Many copper-gold and iron-skarn occurrences, and their related intrusions, are associated with these belts. Thus, on a district scale, the intensity of deformation, emplacement of the intrusions, and skarn formation were controlled by mid-Jurassic zones of structural weakness. However, it is possible that the intense deformation in these zones was not entirely due to folding but partly resulted from the forcible diapiric intrusion of the stocks into the limestones.

The iron and copper-gold skarns are stratigraphically and structurally controlled, and are genetically related to a varied suite of I-type intrusions that formed part of the mid-Jurassic Bonanza magmatic arc. Intrusions of similar age farther west, at Nanaimo Lakes and Zeballos on Vancouver Island, are also associated with skarns (Ettlinger and Ray, 1989). All of the iron and some of the copper-gold skarn mineralization on Texada Island lies close to the base of the Marble Bay Formation. However, copper-gold skarns, including the Marble Bay and Little Billy deposits, occur throughout the limestone succession.

The iron and copper-gold skarns are believed to be coeval and related, and both formed within a similar high-level, oxidized to intermediate environment (Ray *et al.*, 1990, this volume). The gold-bearing skarns are unusual in only containing sporadic arsenic, bismuth or tellurium enrichment. The massive, impermeable nature of most Marble Bay limestone on the island, and its pure composition, are unfavorable for skarn formation, and this has inhibited the development of wide exoskarn halos. The presence of extensive bleaching in the limestones may indicate skarn mineralization at depth and this feature can possibly be used as an exploration guide. Moss-mat sediment sampling indicates sporadic precious and base metal anomalies that warrant follow-up investigation in several streams on the island.

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