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GEOLOGY AND MINERAL RESOURCES OF THE ALBERNI - NANAIMO LAKES SHEET, VANCOUVER ISLAND 92F/1W, 92F/2E AND PART OF 92F/7E

By N.W.D. Massey, P.Geo.

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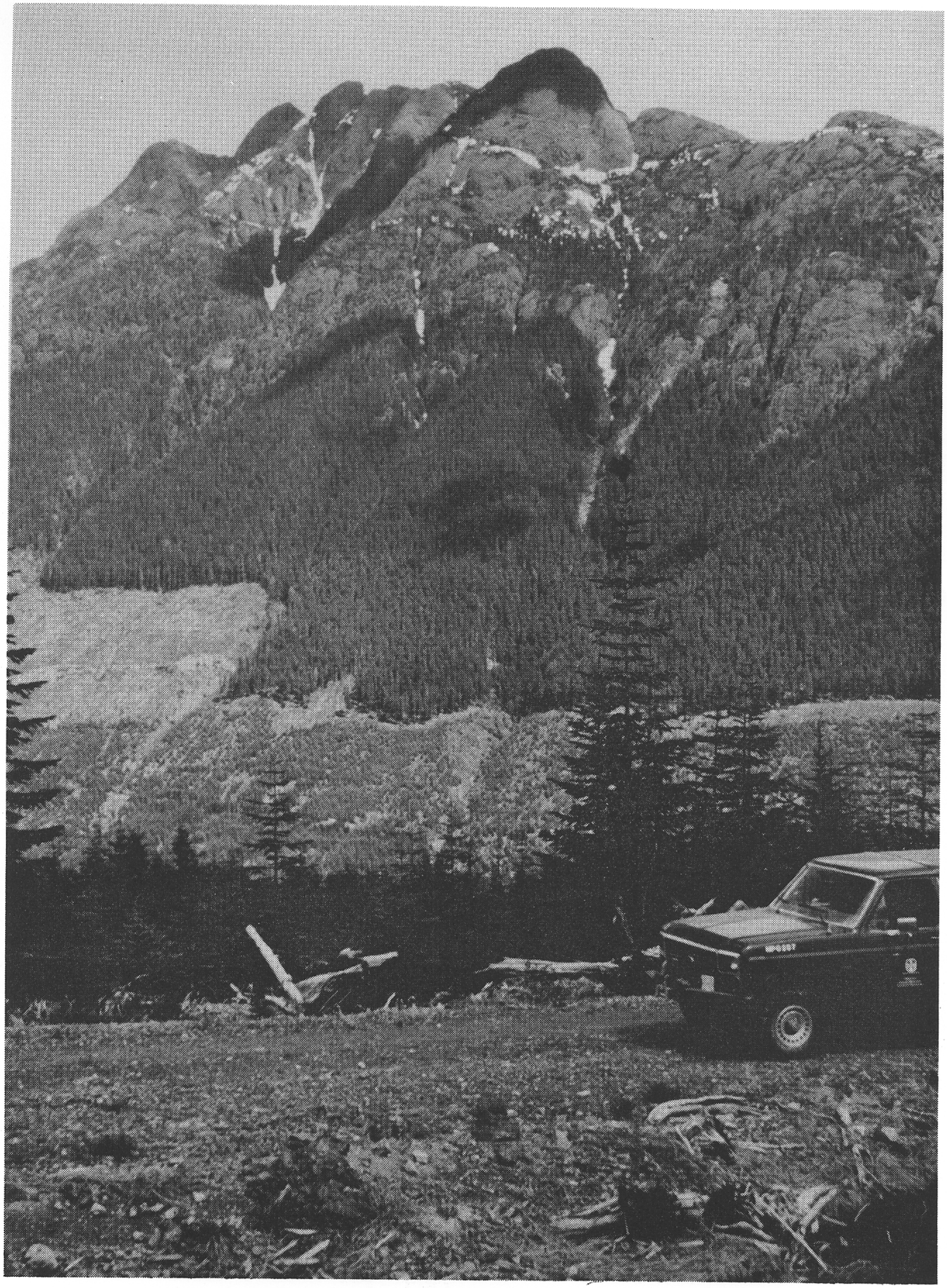
Fieldwork for this project was carried out during the period of 1986 through 1989.



Frontispiece: Mount Arrowsmith viewed from the southeast across the Cameron River Valley.

SUMMARY

The Alberni - Nanaimo Lakes map area is located on Vancouver Island, to the east of Alberni Inlet and to the southeast of Port Alberni. The area lies at the southeastern end of the Vancouver Island Ranges and is characterized by fairly rugged topography with fault-line scarps and fault-controlled valleys, accentuated by glaciation. The area covers the northwestern end of the Cowichan uplift, one of a series of major geanticlinal structures constituting the structural fabric of the Wrangellia terrane of Vancouver Island.

The oldest rocks in the Alberni - Nanaimo Lakes area belong to the Paleozoic Sicker and Buttle Lake groups which contain volcanic and sedimentary units ranging from Middle Devonian to Early Permian age. The Devonian Sicker Group is a thick package of lower greenschist metavolcanic and volcaniclastic rocks that formed in an oceanic island-arc environment. The lowest unit is the Duck Lake Formation which comprises a suite of grey to maroon and green pillowed basalts and basaltic breccias with chert, jasper and cherty tuff interbeds near the top of the sequence. Well-bedded felsic tuffs and lapilli tuffs are associated with the cherts and jaspers. Massive dacite-rhyolite dikes and sills intrude the pillowed basalts. The pillowed basalts can be divided into two subunits on the basis of geochemistry. The apparently lowermost flows are tholeiitic with an affinity to enriched-type mid-ocean ridge basalts and probably represent the oceanic substrate upon which the Sicker arc developed. The uppermost lavas, and dacite intrusions, are of high-potassium calcalkaline chemistry and mark the initiation of the arc construction. These two suites were not recognized nor distinguished in the field.

Overlying the Duck Lake Formation is the Nitinat Formation characterized by pyroxene-feldspar-porphyritic basalts and basaltic andesites. These typically occur as agglomerates, breccias, lapilli tuffs and crystal tuffs that formed as pyroclastic flows, debris flows and lahars. Pyroxene-phyric, amygdaloidal, pillowed and massive flows are also developed.

The Nitinat Formation passes upwards transitionally (over a thickness of about 150 m) into the McLaughlin Ridge Formation, a sequence of volcaniclastic sediments dominated by thickly bedded, massive tuffites and lithic tuffites, interbedded with thinly bedded tuffites and laminated tuffaceous sandstone, siltstone and argillite. The beds tend to form fining-upward cycles from tuffite to argillite, but overall the sequence becomes coarser towards the top with more frequent development of lithic tuffite and coarser pyroclastic horizons. The sequence probably formed as a volcaniclastic apron around a volcanic island and grades eastwards into more proximal volcanic-dominated facies in the Duncan area. The Nitinat and McLaughlin Ridge formations form a coherent suite of medium-potassium calcalkaline chemistry typical of island arcs.

The Buttle Lake Group is made up of a dominantly epiclastic and bioclastic limestone sedimentary sequence ranging from Mississippian to Early Permian in age. This sedimentary package is apparently conformable on the underlying volcanics along the northeastern limb of the Cowichan uplift, for example, in the upper Cameron River valley and St Mary's Lake area, but is unconformable along the southwestern limb and in the Fourth Lake area.

The Fourth Lake Formation comprises mostly thin-bedded, often cherty sediments. These vary from green and red ribbon cherts, black cherty argillites, green and white cherty tuffs, grey and green siltstones and argillites, to thicker bedded green volcanic sandstones. The upper part of the formation is characterized by thinly bedded, turbiditic sandstone-siltstone-argillite intercalations, with some thicker beds of volcanic sandstone. These pass upwards into argillite-calcarenite interbeds at the top of the sequence.

The Mount Mark Formation conformably overlies and laterally interfingers with the Fourth Lake Formation. It consists of well-bedded bioclastic calcarenite and calcirudite with minor argillite and chert interbeds. The overlying St Mary's Lake Formation is sporadically preserved beneath the Triassic unconformity. It comprises clastic sediments varying from polymictic conglomerates to volcanic sandstones and argillites.

Rocks of the Upper Triassic Vancouver Group are exposed throughout the map area, flanking the Paleozoic core of the Cowichan uplift. The group is subdivided into a thick lower basaltic volcanic package (Karmutsen Formation) and a thin upper sedimentary package (Quatsino and Parson Bay formations). The lower Karmutsen Formation basalts rest unconformably on the underlying Paleozoic rocks. The basalts form pillowed flows, pillow breccias and hyaloclastite breccias interbedded with massive flows and sills. There is a tendency for the massive flows to dominate the sequence towards the top and the pillowed flows the lower parts. The Karmutsen Formation basalts show amygdule infillings and alteration assemblages typical of the prehnite-pumpellyite facies. The mafic bodies of the Mount Hall gabbro, intrusive into the Paleozoic rocks, are coeval and consanguinous with the Karmutsen Formation basalts. The basalts formed from an iron-titanium enriched tholeiitic magma, similar to continental tholeiite or enriched mid-ocean ridge basalt, probably in an oceanic flood-basalt province. Succeeding limestones, argillites and tuffaceous

sediments of the Quatsino and Parson Bay formations are poorly developed in the map area.

All of the Paleozoic and Triassic sequences have been intruded by granodioritic stocks of the Early to Middle Jurassic Island Plutonic Suite. These bodies are usually elongate in shape, although the Fourth Lake stock is roughly circular. The intrusions are dominantly equigranular quartz diorite to granodiorite but show considerable lithological variation. The Corrigan pluton in particular is heterogeneous and composite, comprising a mix of diorite, quartz diorite, granodiorite and monzogranite phases with abundant minor intrusive dikes. Most of the large intrusive bodies are rich in inclusions, especially in marginal agmatitic intrusive breccias. Contact metamorphic aureoles are developed around the intrusions causing hornfelsing and skarning in Paleozoic rocks. A variety of dikes and small irregular intrusions, that are probably coeval with the Island Plutonic Suite, occur throughout the area. Lithologically they include intermediate feldspar porphyry, hornblende feldspar porphyry and minor diabase. The Jurassic intrusions form a metaluminous, medium to high-potassium calcalkaline suite typical of a convergent-margin environment.

Clastic sediments of the Upper Cretaceous Nanaimo Group lie unconformably on the older rocks. They are most thickly developed in the Alberni Valley, though only exposed around the margins due to Quaternary cover. The lower Benson Formation comprises basal conglomerates and overlying medium to coarse-grained sandstones. These are succeeded by the black argillites and siltstones of the Haslam Formation. Younger formations of the Nanaimo Group are absent.

Tertiary dacite porphyries of the Mount Washington Intrusive Suite occur throughout the area. Where the magma has penetrated the Nanaimo Group sediments, it has spread out laterally to form thick sills.

Southern Vancouver Island has a complex structural history with frequent rejuvenation of previous structures. All Paleozoic rocks are affected by a series of southeast-trending, upright to overturned, southwest-verging folds. Associated schistosity and lineation are absent from most of the area, only occurring to the west of the Mineral Creek fault. Regional-scale warping of Vancouver Island occurred during the Early to Middle Jurassic, facilitating the emplacement of the Island Plutonic Suite intrusions and producing the geanticlinal Cowichan uplift. The present map pattern is dominated by the northwestly trending contractional faults of the Tertiary Cowichan fold and thrust system. These are high-angle reverse faults which become listric at mid-crustal levels. They generally place older rocks over younger. The deformation probably took place during the crustal shortening accompanying the formation and emplacement of the Pacific Rim and Crescent terranes outboard of Wrangellia. The north-trending Mineral Creek fault and associated northwest-trending faults, such as the Stokes fault, are subvertical with small, apparently sinistral offsets. They may have formed during minor extension accompanying late-stage post-contractional relaxation.

The Alberni - Nanaimo Lakes area has had a long history of mineral exploration and production, starting with small-scale placer-gold mining on China Creek in 1862. The localization of metal deposits in the area is controlled by the interplay of stratigraphy and spatial association with later intrusions and structures. Three major metallogenic epochs are recognised. Syngenetic mineralization occurred during the building of the Sicker arc. Oxide facies exhalites, such as the 900 zone of the Mineral Creek area, are found in the uppermost Duck Lake Formation. Sulphide facies equivalents are also found, although less commonly. Thin syngenetic manganese oxide beds and sulphidic argillites occur within the radiolarian cherts of the basal Fourth Lake Formation in the upper Shaw Creek area.

The Early to Middle Jurassic arc was characterized by epigenetic mineralization of various types and styles, spatially related to the Island Plutonic Suite intrusions. Copper-molybdenum veins and stockworks occur within intrusions and volcanic country rock. Production has been minor from these deposits but has resulted from the Havilah and WWW mines. Rhodonite forms by contact metamorphism of manganiferous chert. Iron-copper-gold skarns are developed in calcareous tuffs and limestones of the Karmutsen and Quatsino formations, though are rare in Mount Mark lithologies. A stratiform auriferous hematite cap has developed on the top of the skarn on the Villalta property, probably forming by residual weathering during the middle Cretaceous.

Mesothermal gold-bearing quartz-carbonate veins are located along Tertiary structures and have been one of the main exploration targets in the area. Historic production has ensued from the Victoria, Thistle and Black Panther mines. Tertiary epigenetic quartz-arsenic-(antimony) veins are variably developed in dacite porphyry sills and Haslam Formation argillites on the Coal and Grizzly properties.

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INTRODUCTION

A 4-year program of 1:50 000-scale regional mapping was initiated by the British Columbia Geological Survey Branch on southern Vancouver Island in 1986, under the Canada/British Columbia Mineral Development Agreement 1985-89. The program was planned to cover three 1:50 000 NTS sheets centred on the Paleozoic rocks that occur in the core of the Cowichan uplift (Figure 1). These units are the host to several types of mineral deposits including polymetallic Kuroko-style massive sulphides, for example the Mount Sicker camp, and mesothermal gold-bearing quartz-carbonate veins, for example the Victoria mine, Mineral Creek. Preliminary results of mapping have been described by Massey and Friday (1987, 1988, 1989) and released as Open File maps (Massey *et al.*, 1987, 1988, 1989).

LOCATION AND ACCESS

The Alberni - Nanaimo Lakes map area is located to the east of Alberni Inlet and to the southeast of Port Alberni. The area lies at the southeastern end of the Vancouver Island Ranges (Holland, 1976) and is characterized by fairly rugged topography with steep slopes. Fault-line scarps and fault-controlled valleys are common throughout the area, with slopes steepened further by glaciation. Elevations rise from sea level along the shores of Alberni Inlet to over 1250 metres on many of the peaks. Mount Arrowsmith is the highest point in the area, at 1817 metres. The fringes of the coastal flatlands occur along the northeastern edge of the area and part of the Alberni Valley occupies the northwestern corner.

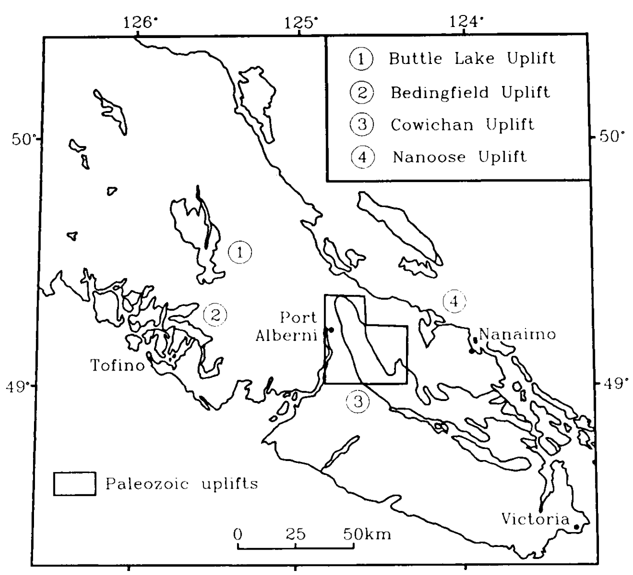

Figure 1. Location of the Sicker Project area, southern Vancouver Island. The four major uplifts cored by Paleozoic rocks are indicated. The Alberni-Nanaimo Lakes map area is shaded.

Port Alberni is the only town within the map area. Road access is good with Highway 4 passing through the northern part of the area and the Bamfield road running along the western margin. An extensive network of logging roads, in varying states of maintenance, provides access along most of the valleys and adjacent slopes.

Rock outcrops are numerous in roadcuts along the logging roads, and are plentiful in creek beds and on hillsides, though the latter may be under thick forest cover.

REGIONAL GEOLOGICAL SETTING

The Alberni - Nanaimo Lakes area covers the northwestern end of the Cowichan uplift, one of a series of major geanticlinal structures constituting the structural fabric of Vancouver Island (Figure 1). It lies within the Wrangellia Terrane, which on Vancouver Island comprises three thick volcano-sedimentary cycles - the Paleozoic Sicker and Buttle Lake groups, the Upper Triassic Vancouver Group and the Lower Jurassic Bonanza Group. These are overlapped by Upper Cretaceous sediments of the Nanaimo Group. All these rocks are involved in the Tertiary Cowichan fold and thrust system (England and Calon, 1991).

PREVIOUS WORK

The first major examination of the rocks of the area was undertaken by Clapp as part of a reconnaissance of southern Vancouver Island (Clapp, 1912). He undertook more detailed mapping to the east (Clapp, 1913, 1914; Clapp and Cooke, 1917) but no further work was done in the Alberni area. MacKenzie's (1923) studies were restricted to the Upper Cretaceous Nanaimo Group in the Alberni Valley. Stevenson (1945) undertook the detailed description of the geology and mineral deposits of the China Creek area. Fyles (1955) reported on detailed mapping in the Cowichan Lake area which overlapped into the southeastern part of the present map sheet. Limestone deposits of the area were briefly described by Mathews and McCammon (1957) and the Permian Mount Mark Formation was studied in detail by Yole (1964). Laanela (1966) mapped the regional geology and described the major mineral showings in the map area. Muller and colleagues mapped large portions of Vancouver Island including the Alberni - Nanaimo Lakes area

(Muller and Carson, 1969). Geological and geophysical studies were undertaken by the Geological Survey of Canada in support of the LITHOPROBE 1 Project along the Alberni-Bamfield corridor (Sutherland Brown and Yorath, 1985; Sutherland Brown *et al.*, 1986: Yorath, in preparation). Biostratigraphic and radiometric dating of the rocks of southern Vancouver Island, including the map area, have been summarized by Muller and Jeletzky (1970), Brandon *et al.* (1986) and Armstrong *et al.* (1986). Regional geochemical data have been released by Matysek *et al.* (1990), and mineral occurrences are described in the B.C. Ministry of Energy, Mines and Petroleum Resources mineral inventory database (MINFILE, 1990).

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LITHOLOGY AND STRATIGRAPHY

The oldest rocks in the Alberni - Nanaimo Lakes area belong to the Paleozoic Sicker and Buttle Lake groups (Figure 2) which contain volcanic and sedimentary units ranging from Middle Devonian to Early Permian age. These are intruded by mafic bodies of the Mount Hall gabbro, and overlain unconformably by basaltic volcanics of the Upper Triassic Karmutsen Formation. Succeeding limestones, argillites and tuffaceous sediments of the Quatsino and Parson Bay formations (which with the Karmutsen Formation make up the Vancouver Group) are conformably to disconformably overlain by marine sediments and marine to subaerial volcanics of the Lower Jurassic Bonanza Group. All of these sequences have been intruded by granodioritic stocks of the Early to Middle Jurassic Island Plutonic Suite. Upper Cretaceous sediments of the Nanaimo Group lie unconformably on the older sequences. Tertiary dacite porphyries intrude the older rocks.

There have been several attempts to formally subdivide the Paleozoic rocks of Vancouver Island. Clapp (Clapp, 1912: Clapp and Cooke, 1917) first mapped these rocks in the Duncan area, naming them the "Mount Sicker Series". However, he incorrectly interpreted them as younger than the Triassic Karmutsen Formation (Vancouver Series). Later workers in the Buttle Lake and Cowichan Lake areas recognized them as indeed Paleozoic in age and referred to them as the Sicker Group (Gunning, 1931; Fyles, 1955; Yole 1964, 1969). In the first major synthesis of data on the Paleozoic rocks of Vancouver Island, Muller (1980) continued the use of the term "Sicker Group" and proposed four subdivisions which, in ascending stratigraphic order, are the Nitinat Formation, the Myra Formation, an informal sediment-sill unit and the Buttle Lake Formation. Recent paleontological and radiochronological studies (Brandon *et al.*, 1986), coupled with newer mapping (Sutherland Brown *et al.*, 1986; Sutherland Brown and Yorath, 1985), have thrown some doubt on these subdivisions and their applicability in the Cowichan uplift. Revised stratigraphic subdivisions have been proposed by Sutherland Brown (in Yorath, *in preparation*) based on work in the Alberni area, and a similar revision has also been made independently by Juras (1987) in the Buttle Lake uplift. The major contribution of these studies has been the formal recognition that the Paleozoic rocks can be separated into an older volcanic-dominated sequence of Devonian age, renamed the Sicker Group *sensu stricto*, and a younger Mississippian to Permian sedimentary sequence renamed the Buttle Lake Group (Figure 3). The revised stratigraphic nomenclature of Sutherland Brown, with some revision by Massey and Friday (1989), has proven to be applicable and useful throughout the entire Cowichan uplift and has been adopted for this project. However, the previously adopted name of "Cameron River Formation" for the lower unit in the Buttle Lake Group (Massey *et al.*, 1987, 1988, 1989; Massey and Friday, 1988, 1989) has been abandoned in favour of "Fourth Lake Formation", introduced to avoid conflict with an already extant Cameron River Formation elsewhere in Canada.

TABLE 1
COMPARISON OF PILLOW LAVAS IN THE DUCK LAKE AND KARMUTSEN FORMATIONS

		Duck Lake Formation	Karmutsen Formation
Lithology		Green-grey to maroon, mostly aphyric basalt, variolites common, feldspar basalt less abundant.	Black-weathering, orange-brown feldspar basalts (feldspars ragged) dominate, aphyric basalts common. Variolites rare.
Pillows—shape		Tightly packed, rounded.	More loosely packed, rounded to irregular.
—size		30 cm - 2m; uniform within a flow	Average 1 m; some variability within flow units.
—selvages		Thin, 1 cm.	Thick chloritic, 2 - 3 cm.
—intra-pillow		Poorly developed, jasper, chert or quartz infillings, hyaloclastite rare.	Very common, hyaloclastite, "dallasite" chlorite or quartz infillings.
Associated lithologies	i	Monolithic basaltic breccia, pillow breccia common. Hyaloclastite rare.	Pillow breccia, hyaloclastite breccia and isolated pillow breccia common.
	ii	Massive flows, sills common	Massive flows and sills common.
	iii	Well-bedded cherts, jasper, magnetite-hematite chert, cherty tuff, common in upper parts of formation.	Cherty tuffs rare.
	iv	Felsic volcanics sporadic at top of unit; dacite-rhyolite dikes common.	Felsic material absent.

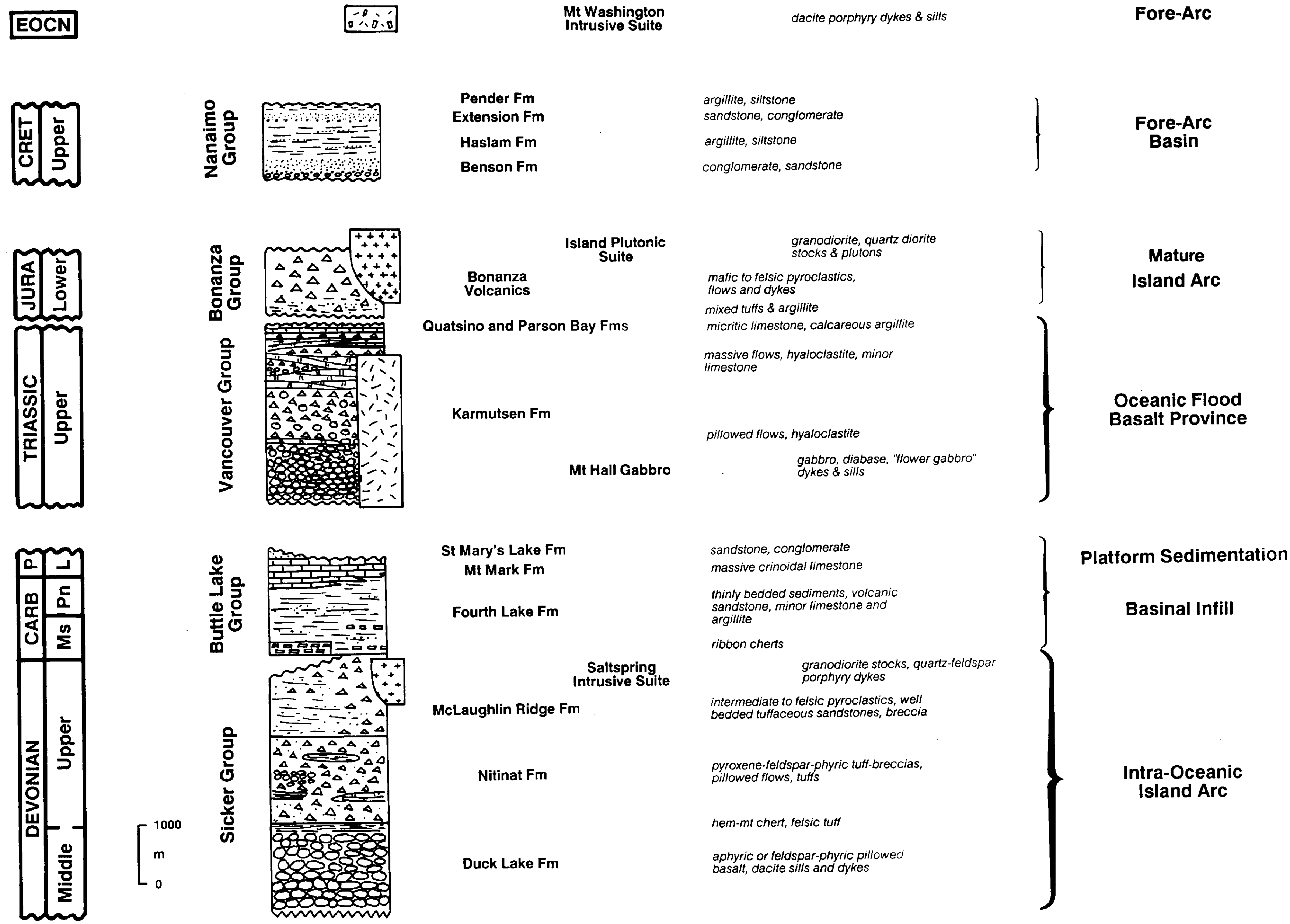

Figure 2. Stratigraphy and tectonic setting of rock units in the Cowichan uplift.

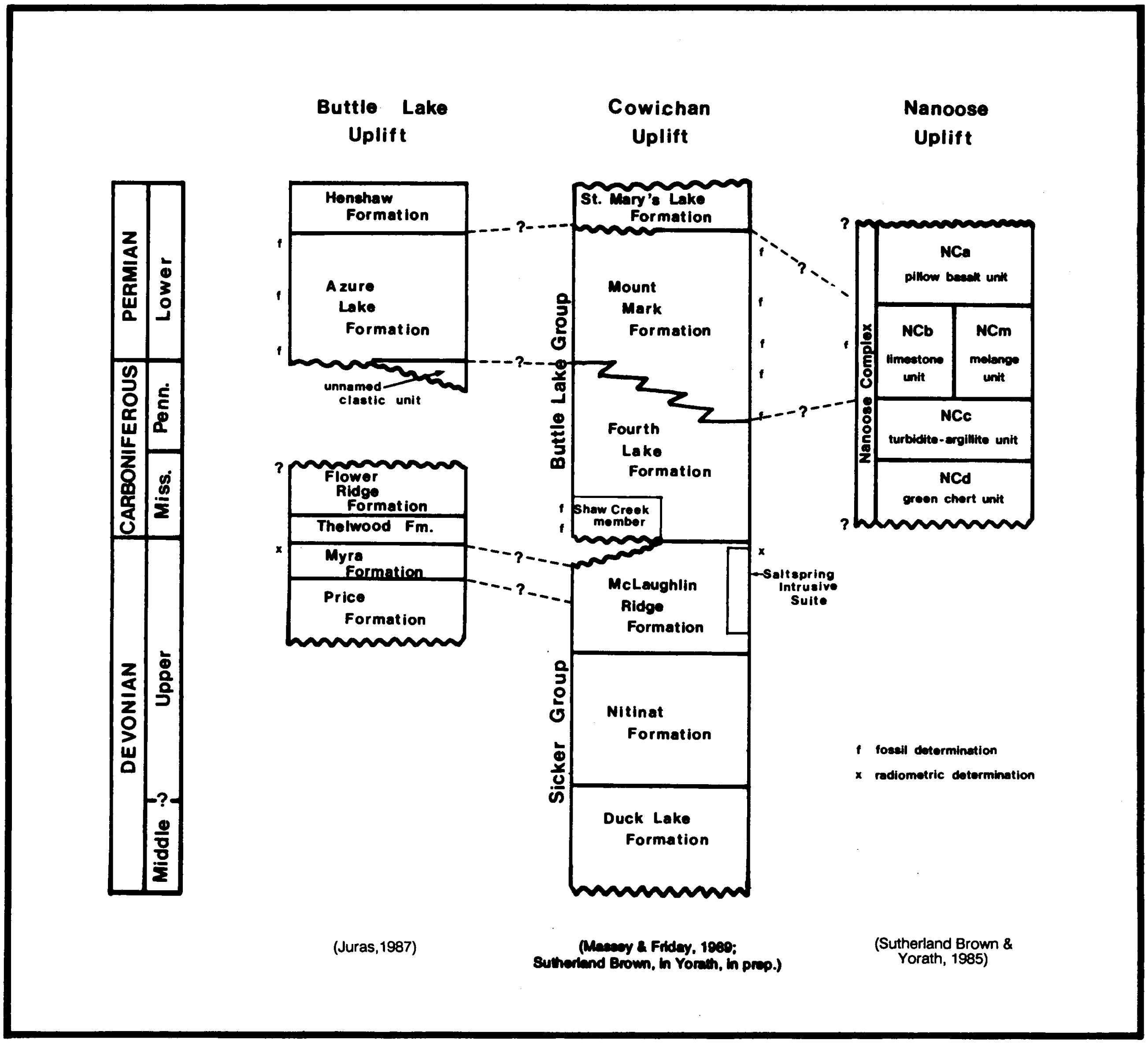

Figure 3. Comparative stratigraphy of the Paleozoic rocks of Vancouver Island. Stratigraphic columns are not drawn to scale. Note that stratigraphic divisions of the Nanoose Complex are informal and have been designated by letter only.

SICKER GROUP

The Sicker Group is a thick package of volcanic and volcaniclastic rocks that forms the exposed basement on Vancouver Island. Biostratigraphic age control is lacking due to the paucity of fossils in the sequence; only scarce, unidentified plant debris and trace fossils have been found in the McLaughlin Ridge Formation. Whole-rock and mineral K-Ar radiometric dating of the volcanics are inconclusive, yielding ages ranging from the Silurian to the Early Jurassic. Zircons from rocks of the Saltspring Intrusive Suite, believed to be cogenetic with the felsic volcanics in the upper part of the McLaughlin Ridge Formation, have yielded concordant U-Pb ages of 362 and 366 Ma (Parrish, 1991). These data point to a Late Devonian age for volcanism, in agreement with correlative rocks in the Buttle Lake uplift (Juras, 1987).

DUCK LAKE FORMATION

The Duck Lake Formation is the oldest known exposed unit on Vancouver Island. It consists dominantly of grey to maroon and green pillowed and massive basaltic flows. The flows have been confused with the younger Karmutsen Formation pillow lavas in the past, but show significant lithological differences (Table 1). Typically the Duck Lake flows are aphyric and amygdaloidal, although variolitic (Plates 1 and 2) and feldspar-phyric varieties are common. Pillows, although usually uniform in size within a particular flow, range from 30 centimetres to 3 metres

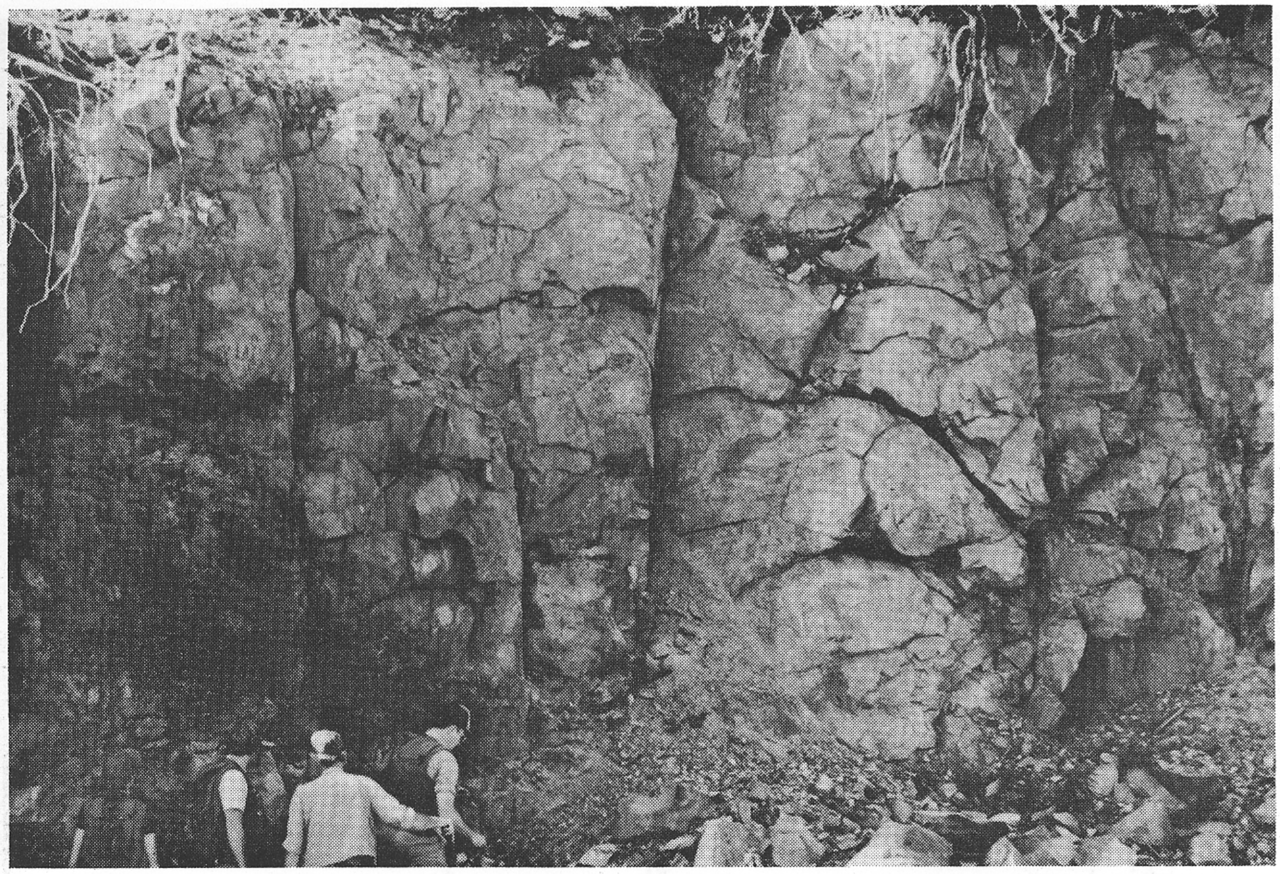

Plate 1. Variolitic pillow lavas of the Duck Lake Formation (Duck Main; NMA88-19-17: 5439527N; 399638E).

Plate 2. Close-up of margins of variolitic pillow lava, Duck Lake Formation (Duck Main; NMA88-19-17: 5439527N; 399638E).

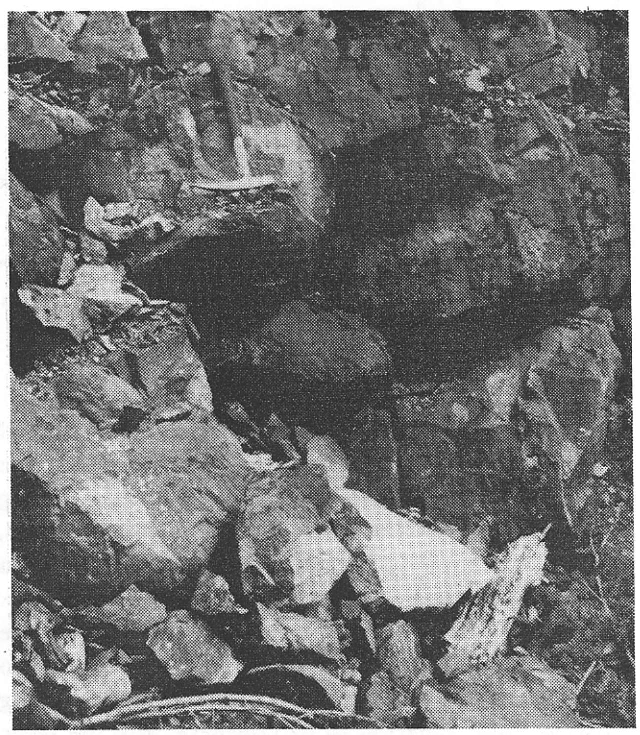

Plate 3. Aphyric pillowed basalt showing characteristic maroon-coloured hematitic rims and chills and light green epidote-rich cores, Duck Lake Formation (Summit area; NMA88-27-08: 5454617N; 378799E).

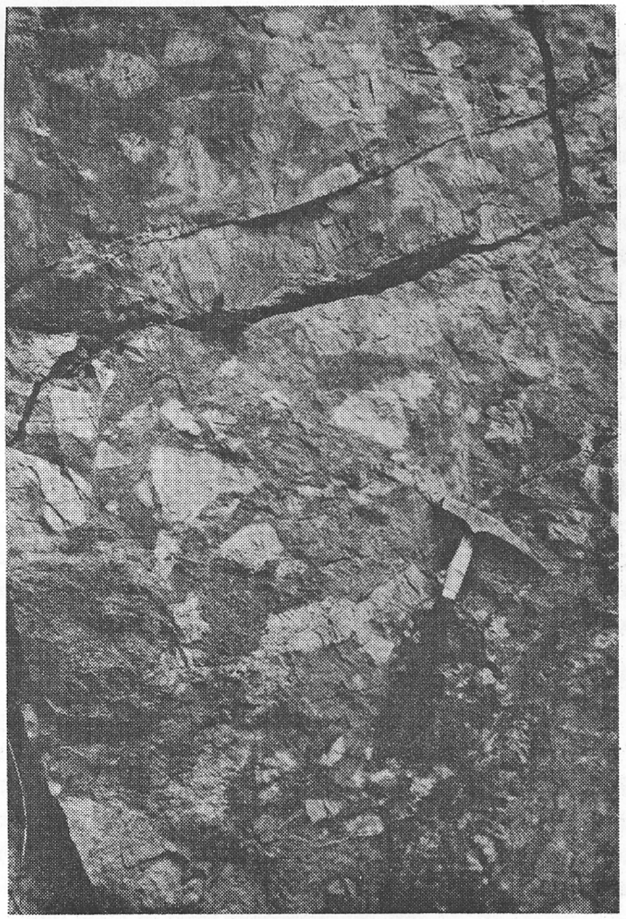

Plate 4. Pillow breccia, Duck Lake Formation (Rift Creek area; SFR88-12-10: 5434290N; 382920E).

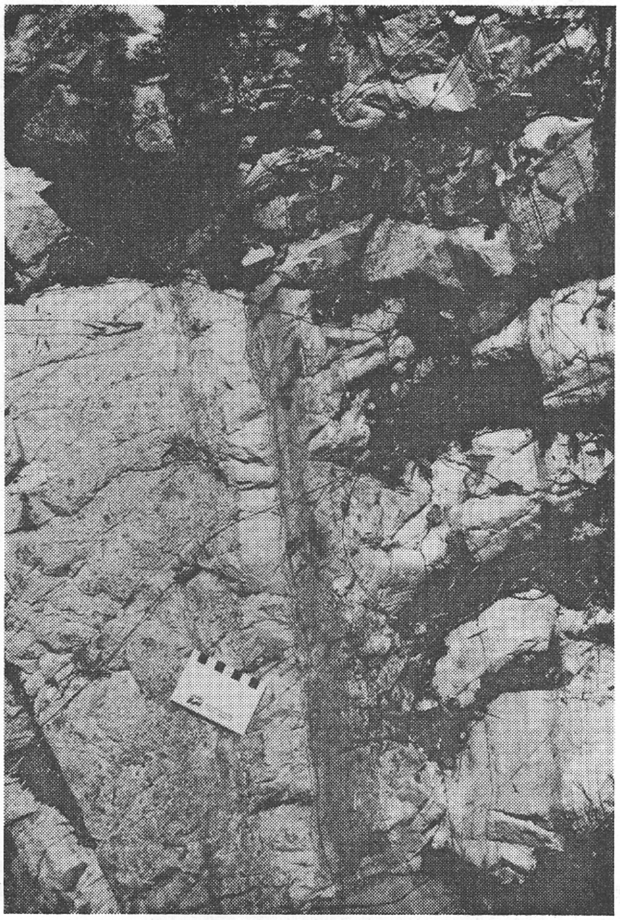

Plate 5. Well-bedded felsic tuffs, Duck Lake Formation (microwave tower; NMA88-33-06; 5460828N; 376245E).

in diameter. Shapes vary from spherical to ellipsoidal and elongate. Amygdules often form concentric zones which are thicker in the curved tops of pillows and are infilled with calcite, chlorite, epidote and quartz. Veins of quartz and epidote are also common. Green epidote alteration patches occurs within the cores of some pillows, contrasting with the maroon hematitic rims and selvages (Plate 3). Variolitic zones are coincident with, or inside, the amygdaloidal zones (Plate 2). Pillow selvages are thin, 50 to 100 millimetres, and chloritic. The pillows are usually tightly packed with very little space between them. Where present, the space is infilled with chert, jasper, tuff, or rarely hyaloclastite.

The pillowed basalts can be divided into two subunits on the basis of geochemistry. The apparently lowermost flows are tholeiitic, whereas the uppermost lavas are calcalkaline. These two suites were not recognized nor distinguished in the field. Petrographic differences are minor and somewhat obscured by the affects of prehnite-pumpellyite to lower greenschist grade metamorphism. Subophitic textures appear to be limited to tholeiitic flows and hornblende phenocrysts to calcalkaline basaltic andesites. More detailed mapping is needed to confirm these two subdivisions and determine their mutual relationships.

Monolithic basaltic breccias and pillow breccias occur as interbeds within the flows (Plate 4). Like the flows, clasts in the breccias are aphyric, amygdaloidal basalt. The matrix is usually chloritic and tuffaceous, but occasional hyaloclastite is present. Chert, jasper and cherty tuff interbeds are also found, particularly near the top of the sequence. These are usually well bedded and laminated with occasional magnetite and hematite laminae.

Well-bedded felsic tuffs and lapilli tuffs are sometimes seen associated with cherts and jaspers at the top of the Duck Lake Formation, for example, at the 900 zone on Mineral Creek and the microwave tower north of Summit Lake (Plate 5). This horizon is potentially of major significance for gold and base metal exploration in the area. Massive dacite-rhyolite bodies are found associated with the pillow lavas in several places. They appear, in the most part, to be dikes and sills. The dacite is fine grained, aphyric and cherty in appearance. It is dark to medium grey in colour, weathering white with some red stains on fracture surfaces. The dacites and felsic tuffs have a similar calcalkaline chemistry to the upper basalts.

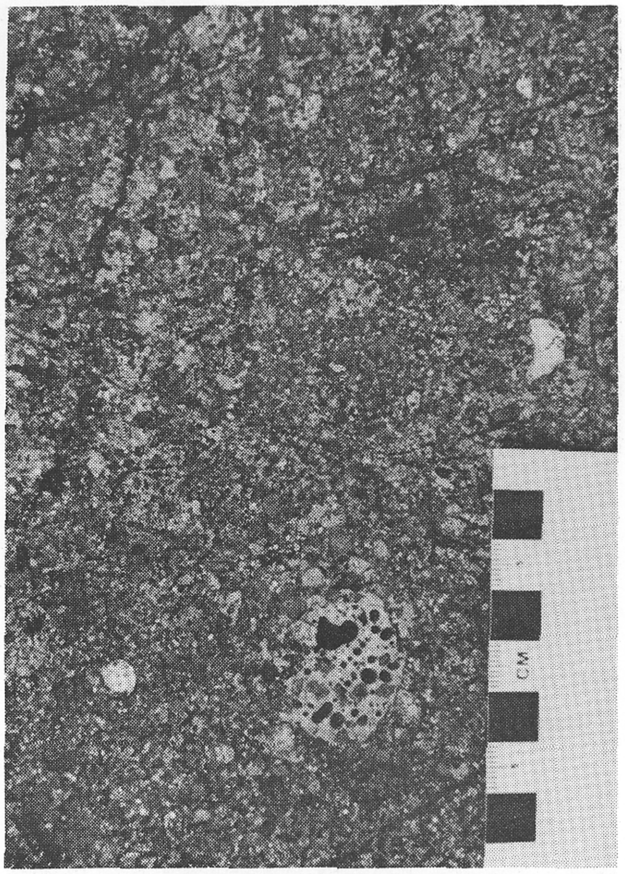

Plate 6. Monolithic pyroxene crystal lapilli tuff, Nitinat Formation. Clasts are amygdaloidal pyroxene-feldspar basalt (Peak Lake; SFR88-02-03: 5446031N; 386211E).

Nitinat Formation

Overlying the Duck Lake Formation is the Nitinat Formation, a volcanic package characterized by pyroxene-feldspar-porphyritic basalts and basaltic andesites. These typically occur as agglomerates, breccias, lapilli tuffs and crystal tuffs (Plates 6 and 7) that formed as pyroclastic flows, debris flows and lahars. Pyroxene-phyric, amygdaloidal, pillowed and massive flows are also developed in several areas, for example Nitinat Pass (Plate 8) and the West Fork of the Nitinat River. Pyroxenes may be large, up to 1 centimetre in diameter, euhedral to subhedral, and comprise 5 to 20 per cent of the rock. They are variably uralitized. Plagioclase is often as abundant as pyroxene, but phenocrysts are usually smaller, ranging up to 5 millimetres in diameter. Amygdules present in flows and clasts in coarser pyroclastics are infilled with chlorite, quartz, epidote or calcite. Non-pyroxene-phyric breccia, tuffaceous sandstone and laminated tuff are also found locally, interbedded with the pyroxene-phyric rocks.

McLaughlin Ridge Formation

The Nitinat Formation passes upwards transitionally (over a thickness of about 150 m) into the McLaughlin Ridge Formation, a sequence of volcaniclastic sediments dominated by thickly bedded, massive tuffites and lithic tuffites, interbedded with thinly bedded tuffites (Plate 9) and laminated tuffaceous sandstone, siltstone and argillite (Plates 10, 11 and 12). The beds tend to form fining-

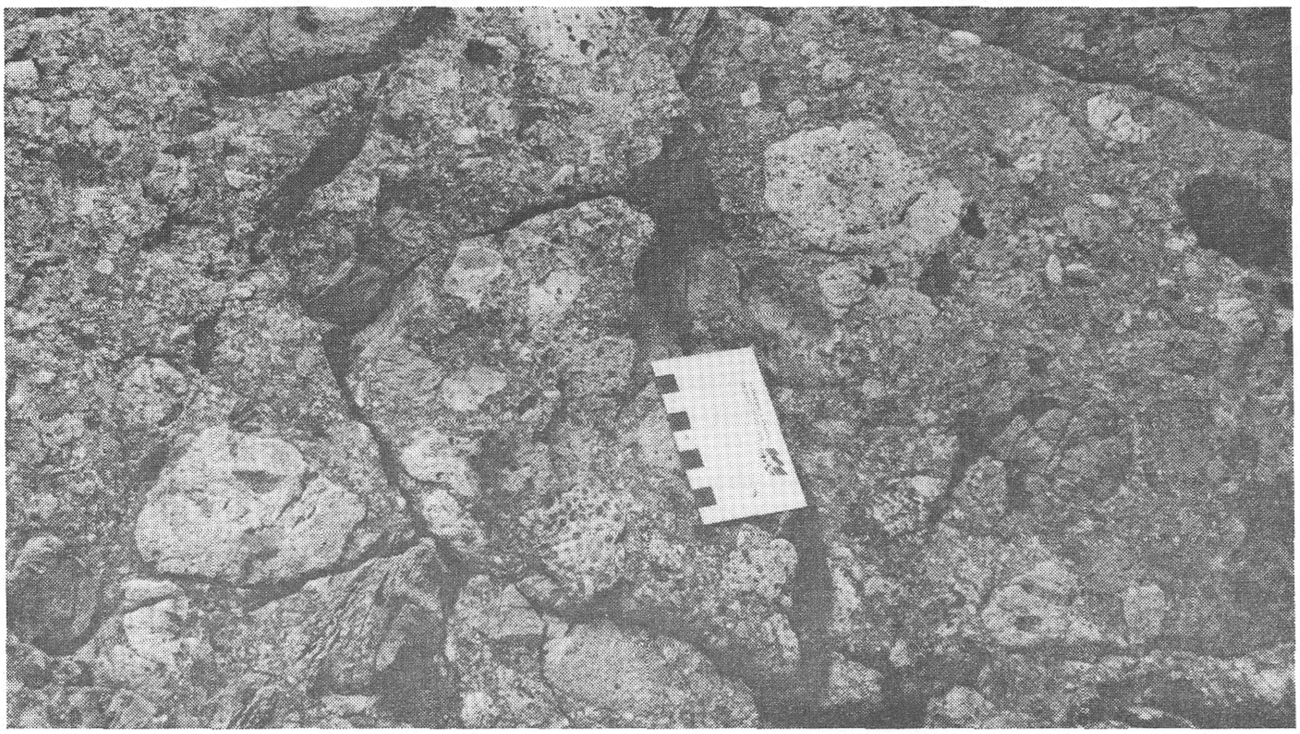

Plate 7. Matrix-supported, heterolithic agglomeratic tuff-breccia, Nitinat Formation (Nitinat River valley; SDU88-12-14: 5436847N; 388937E).

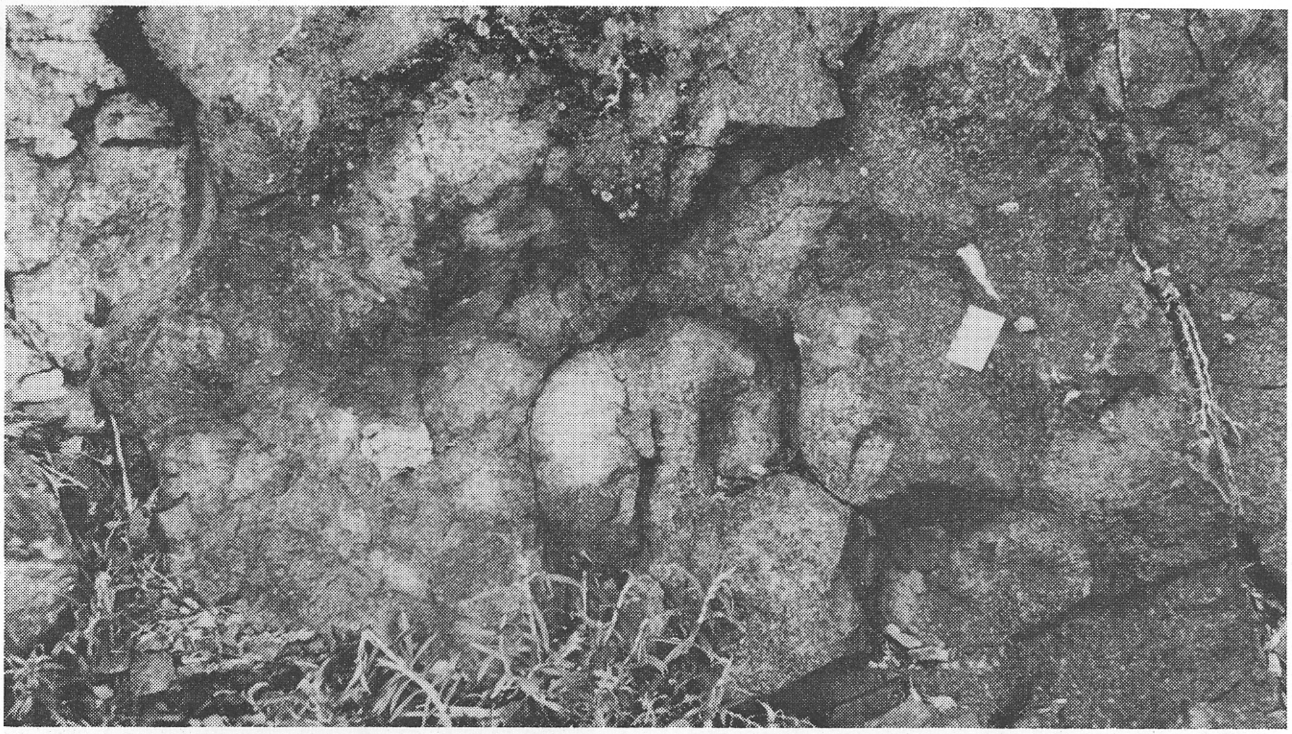

Plate 8. Pyroxene basalt, pillowed lava, Nitinat Formation. Note the abundant coarse pyroxene crystals (Nitinat Pass; NMA88-20-16-2: 5435079N; 388895E).

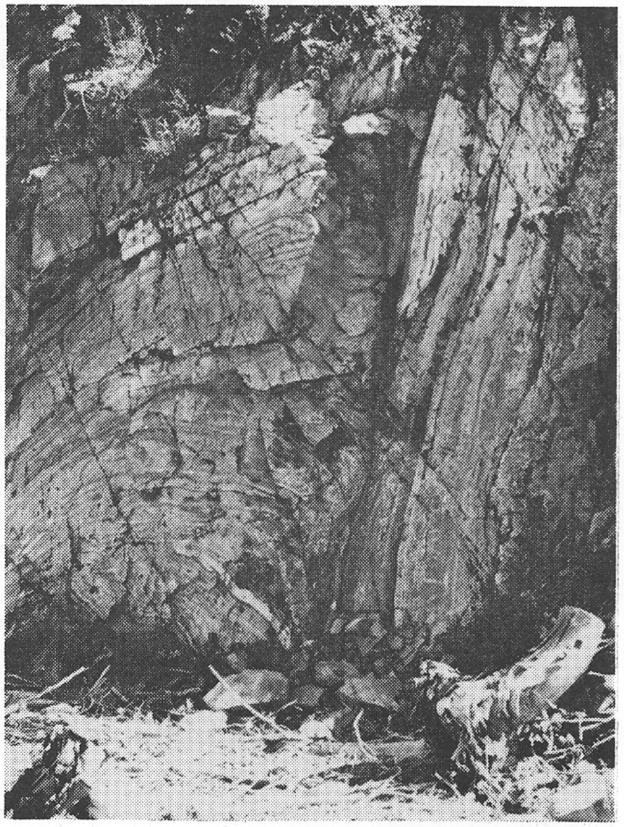

Plate 9. Thinly bedded tuffs and tuffites, McLaughlin Ridge Formation, folded into upright Z-folds on the limb of an antiform (North Nitnat River; NMA88-30-09: 5442473N; 386827E).

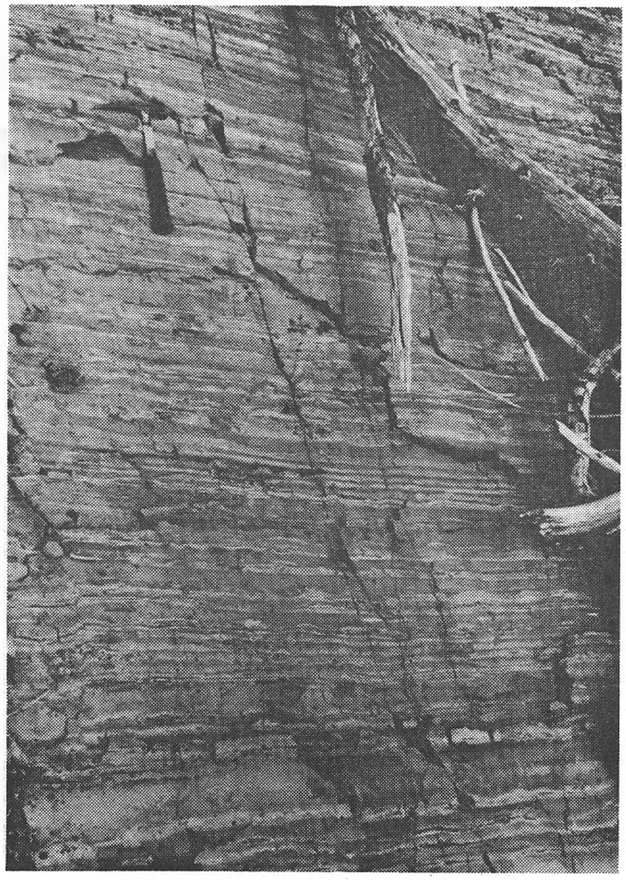

Plate 10. Thinly bedded tuffaceous sediments, McLaughlin Ridge Formation (east slope of McKinlay Peak; SFR88-48-05: 5444990N; 384821E).

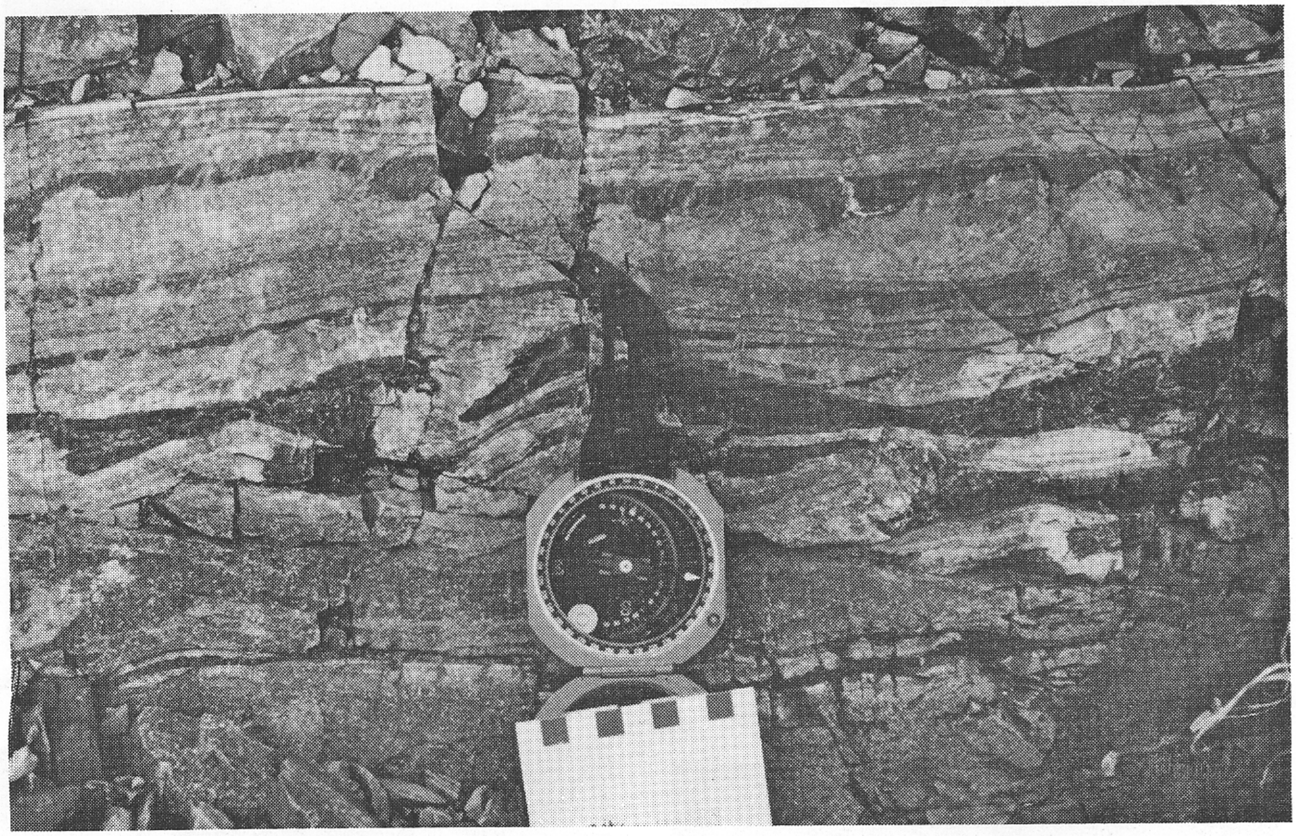

Plate 11. Inverted, thinly bedded and laminated tuffaceous sandstone-siltstone-argillite, McLaughlin Ridge Formation. Note the flame structures at the base of the beds which indicate way-up (east slope of McKinlay Peak; NMA88-50-08: 5444038N; 385171E).

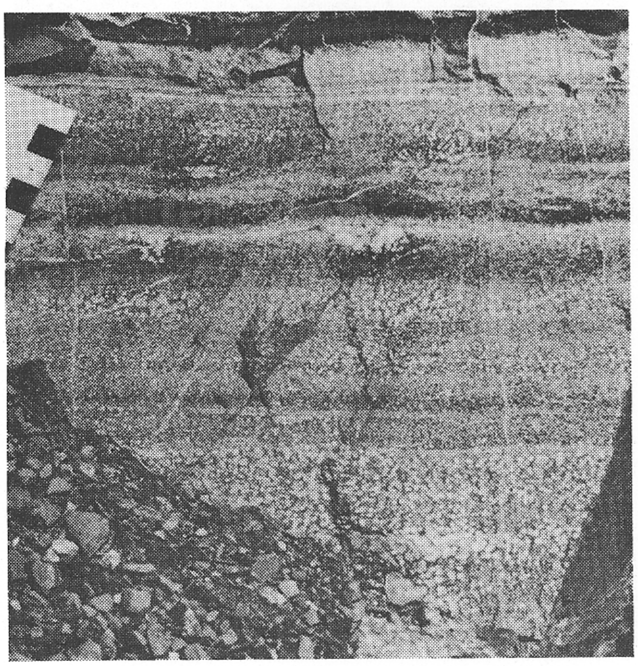

Plate 12. Well-bedded and laminated spherulitic tuff, McLaughlin Ridge Formation (North Nitinat River; NMA88-30-03: 5441996N; 386984E).

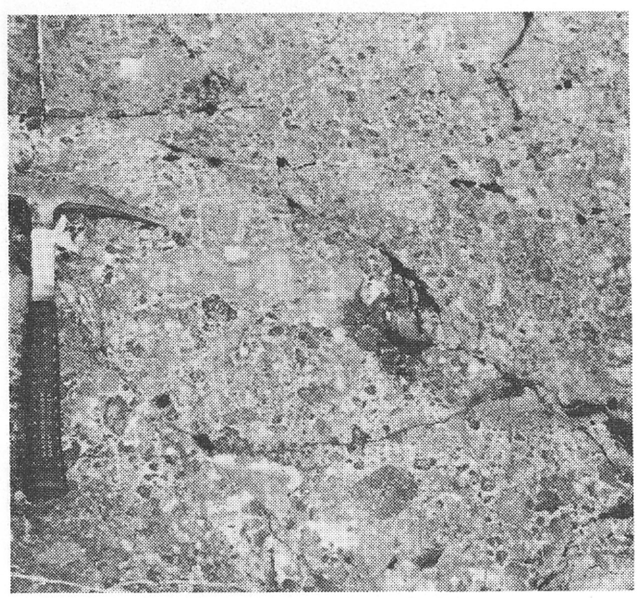

Plate 13. Lithic lapilli tuff, McLaughlin Ridge Formation (east slope, McKinlay Peak; SFR88-48-05: 5444990N; 384821E).

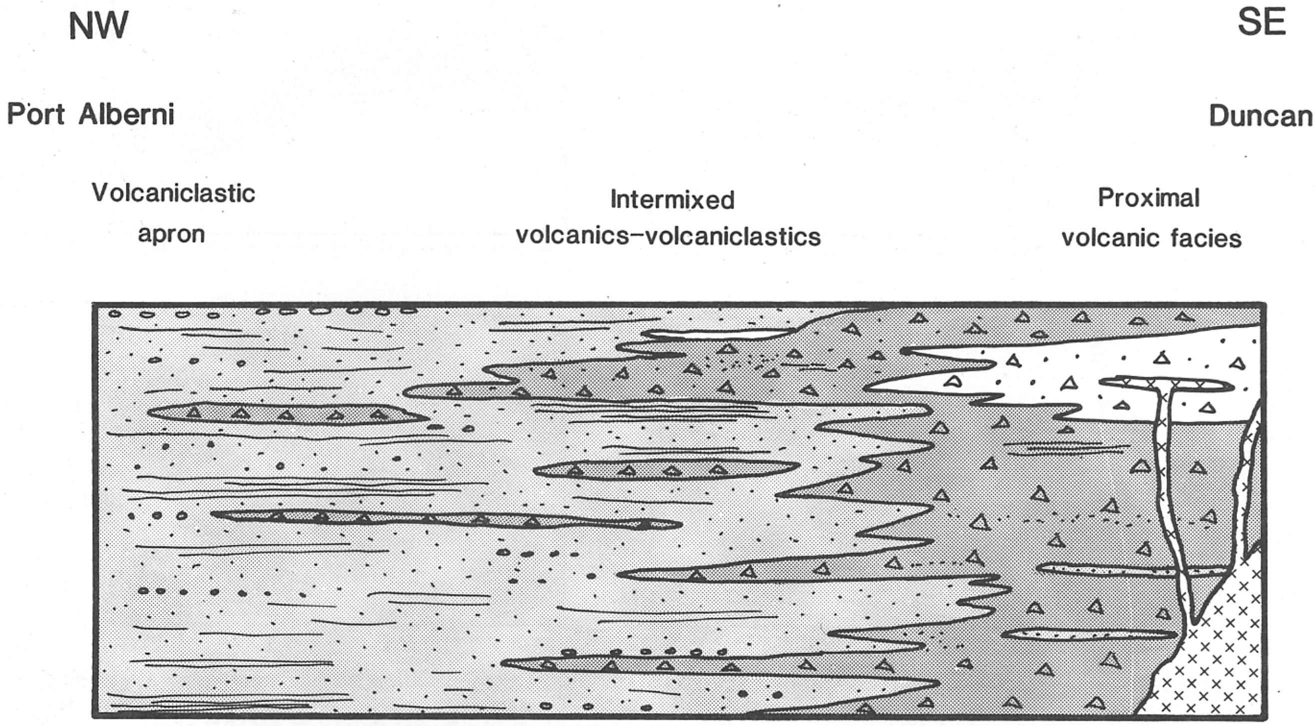

Figure 4. Lithofacies variations in the McLaughlin Ridge Formation along the length of the Cowichan uplift. Section is diagrammatic and not to scale. Volcaniclastic rocks are shown in the light shading, intermediate to mafic volcanics in the darker shading, felsic volcanics unshaded and felsic intrusions with the cross pattern.

upward cycles from tuffite to argillite, but overall the sequence becomes coarser towards the top with more frequent development of lithic tuffite and coarser pyroclastic horizons (Plate 13). Associated breccias and lapilli tuffs are usually heterolithic and include aphyric and porphyritic (feldspar± pyroxene± hornblende) lithologies, commonly mafic to intermediate in composition. Felsic tuffs are rare. The sequence probably formed as a volcaniclastic apron and grades eastwards into more proximal volcanic-dominated facies in the Duncan map area (Figure 4).

The older dikes, a series of tholeiitic greenstone dikes intruding McLaughlin Ridge volcanics in the Duncan and Chemainus areas (Massey, 1995a, 1995b) are absent in the Alberni - Nanaimo Lakes area.

Geochemistry of the Sicker Group

All samples of Sicker Group rocks analyzed show the effects of variable low-grade alteration. This is reflected in high values for CO_2 (± CaO), loss-on-ignition, ferric/ferrous ratios and variable mobility of alkalis and possibly silica. However, many elements traditionally regarded as immobile during low-grade metamorphism seem to be unaffected in these rocks. They yield smooth patterns on normalized trace-element plots, for example Figures 5 to 7, and give consistent results on petrotectonic discrimination diagrams (Figures 10 to 15).

Basalts of the Duck Lake Formation can be subdivided into two suites which apparently have a stratigraphic basis though no subdivision was recognized in the field. The separation is clearly seen in the normalized trace-element plots (Figure 5), the TiO_2-K_2O-P_2O_5 triangle plot (Figure 11) and the TiO_2-MnO-P_2O_5 triangle plot (Figure 12). The Suite I basalts, which appear to be lowermost stratigraphically, are tholeiitic in character. Extended trace-element plots show much variability in the large-ion lithophile elements (LILE) such as potassium, rubidium and barium due to alteration effects. The immobile rare-earth (REE) and high field-strength (HFS) elements are more uniform and show a moderately dipping pattern from niobium to yttrium. These traceelement characteristics are similar to those seen in enriched tholeiites from the ocean floor or ocean islands. In particular, they lack the negative niobium anomaly seen in the Suite II rocks and typical of arc volcanics. An affinity with E-type mid-ocean ridge basalts is confirmed for the Suite I basalts from the various petrotectonic discriminant diagrams (Figures 11 to 16).

Suite II comprises a bimodal package of basalt and basaltic andesite flows with dacite dikes and felsic tuffs. Rocks of andesitic composition are lacking. The Suite II

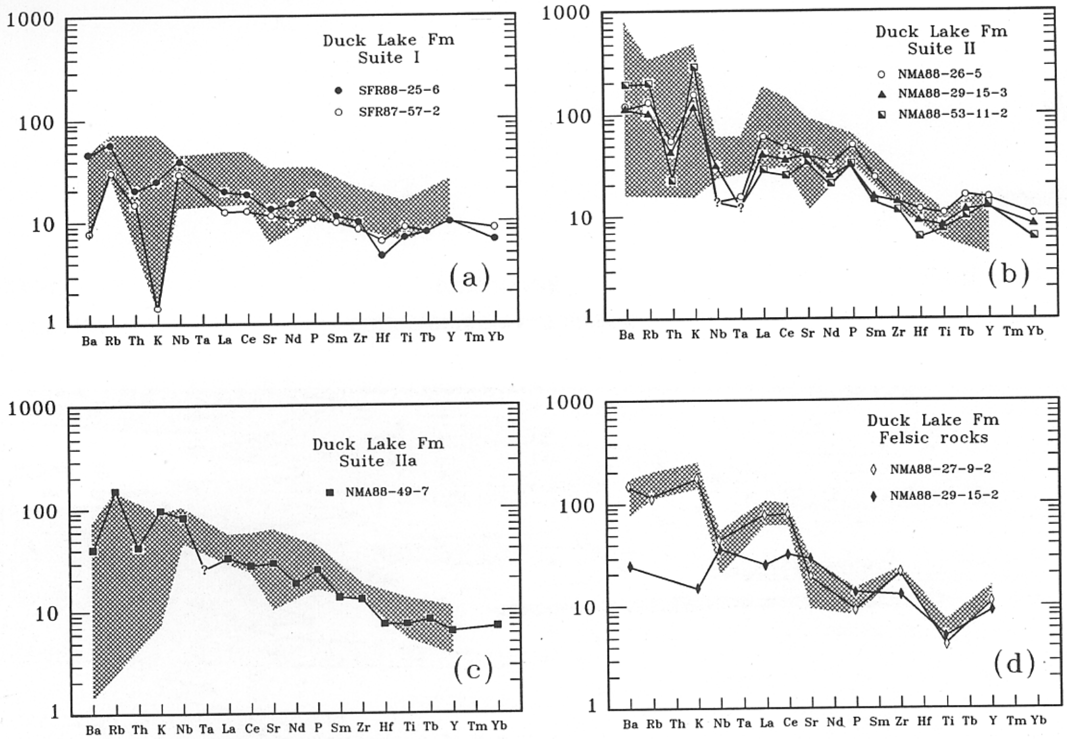

Figure 5. Normalized trace-element plots for volcanic rocks of the Duck Lake Formation. Normalizing values after Thompson *et al.* (1983). Shaded area represents the range of values for all samples of a particular suite in the Sicker Project area. It is based on XRF data only. Samples for which INAA data are available are plotted individually. (a) Suite I: E-MORB basalts; (b) Suite II: High-potassium calcalkaline basalts and basaltic andesites; (c) Suite IIa: High-potassium, high-niobium calcalkaline basalts; (d) Felsic rocks of Suite II (open diamond and shade field) and IIa (closed diamond).

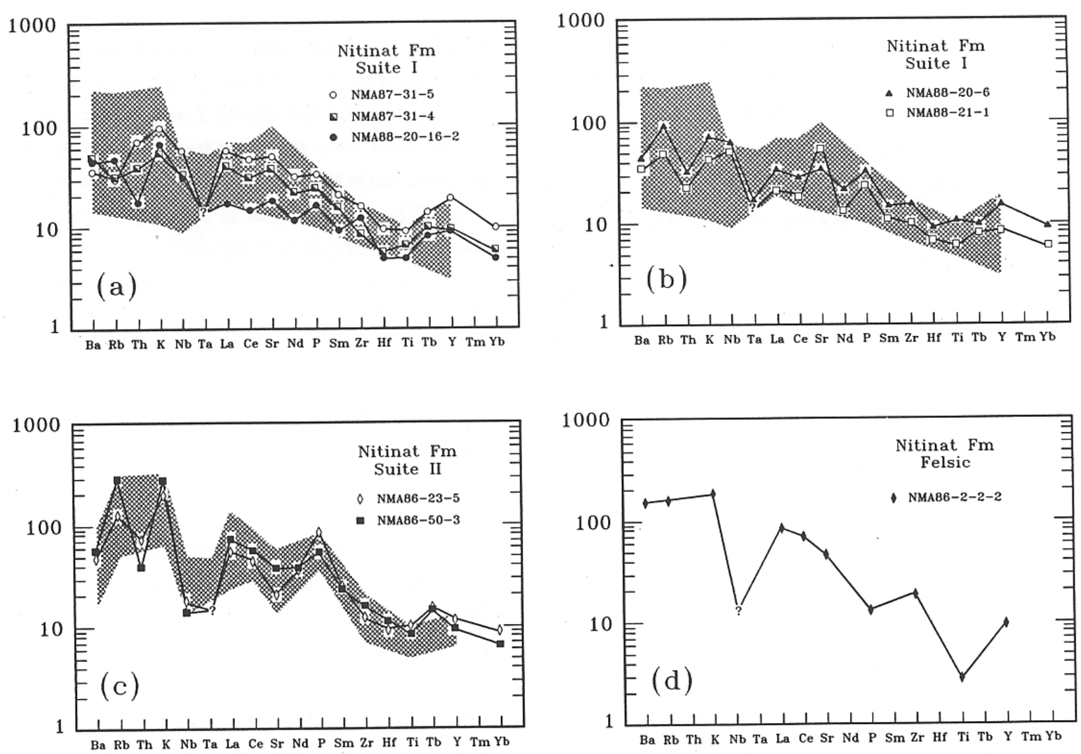

Figure 6. Normalized trace-element plots for volcanic rocks of the Nitinat Formation. Normalizing values after Thompson *et al.* (1983). Shaded area represents the range of values for all samples of a particular suite in the Sicker Project area. It is based on XRF data only. Samples for which INAA data are available are plotted individually. (a) and (b) Suite I: calcalkaline basalts and basaltic andesites; (c) Suite II: low Ti/ P calcalkaline basalts and basaltic andesites; (d) dacite, affinity unknown; compare with felsic rocks from the McLaughlin Ridge Formation, Figure 7.

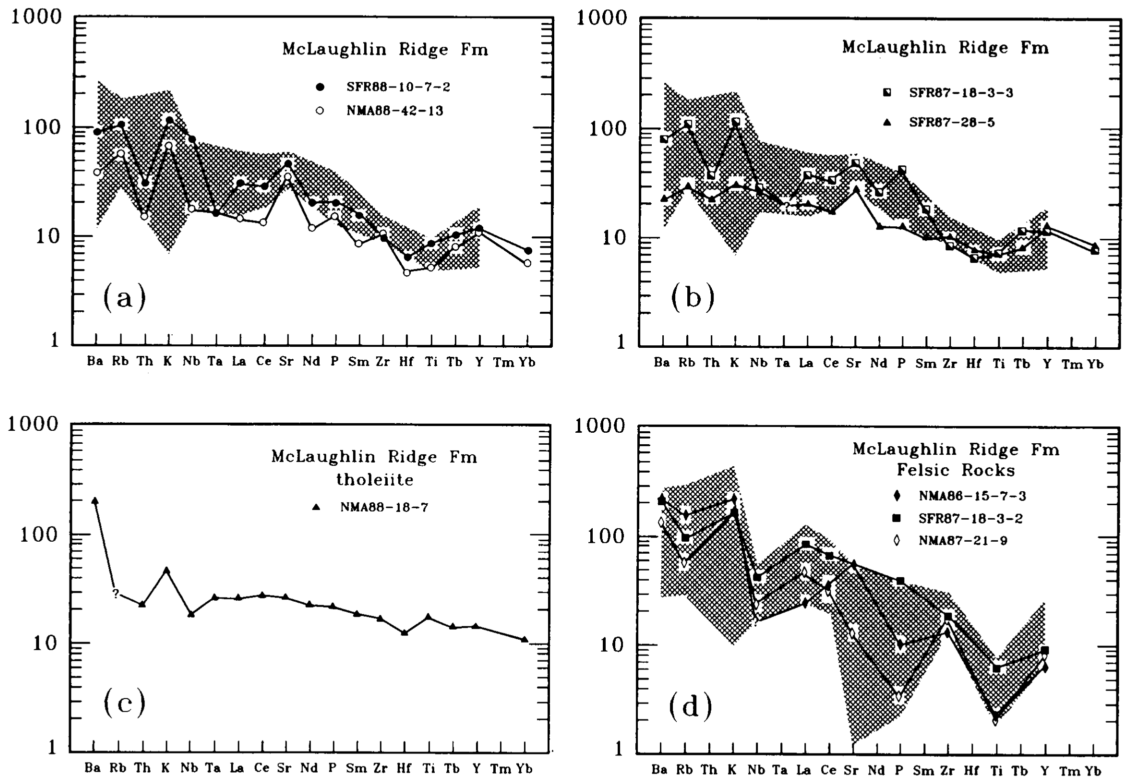

Figure 7. Normalized trace-element plots for volcanic rocks of the McLaughlin Ridge Formation. Normalizing values after Thompson *et al.* (1983). Shaded area represents the range of values for all samples of a particular suite in the Sicker Project area. It is based on XRF data only. Samples for which INAA data are available are plotted individually. (a) and (b) calcalkaline basalts and basaltic andesites; (c) tholeiite from the Nitinat River area; (d) felsic rocks.

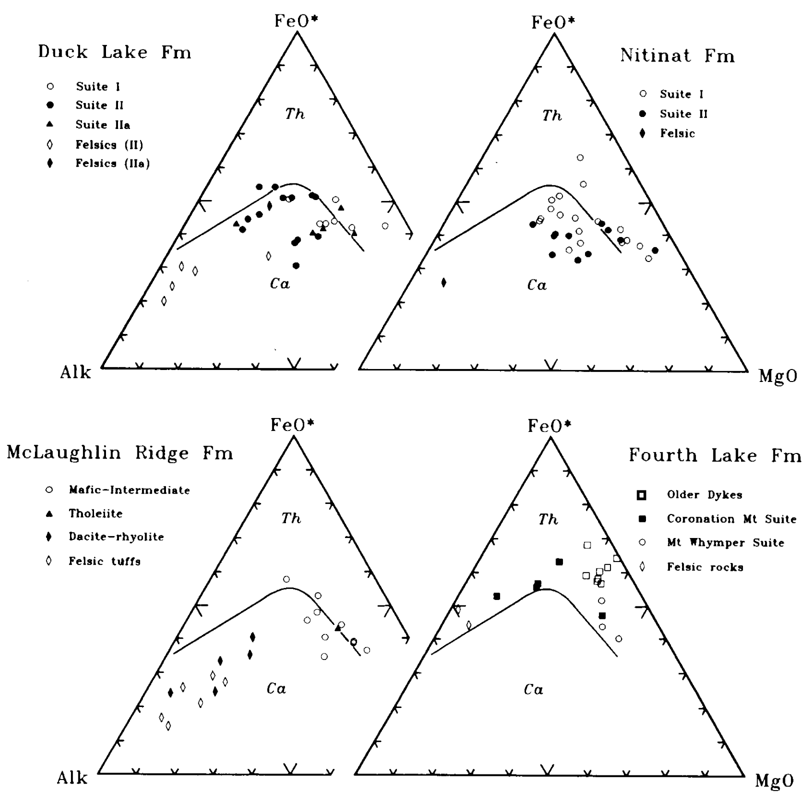

Figure 8. AFM triangle diagrams for volcanic rocks of the Sicker Group and Fourth Lake Formation. Tholeiite (Th) - calcalkaline (Ca) dividing line after Irvine and Baragar (1971). Alk = Na_2O + K_2O; FeO* = total iron as FeO.

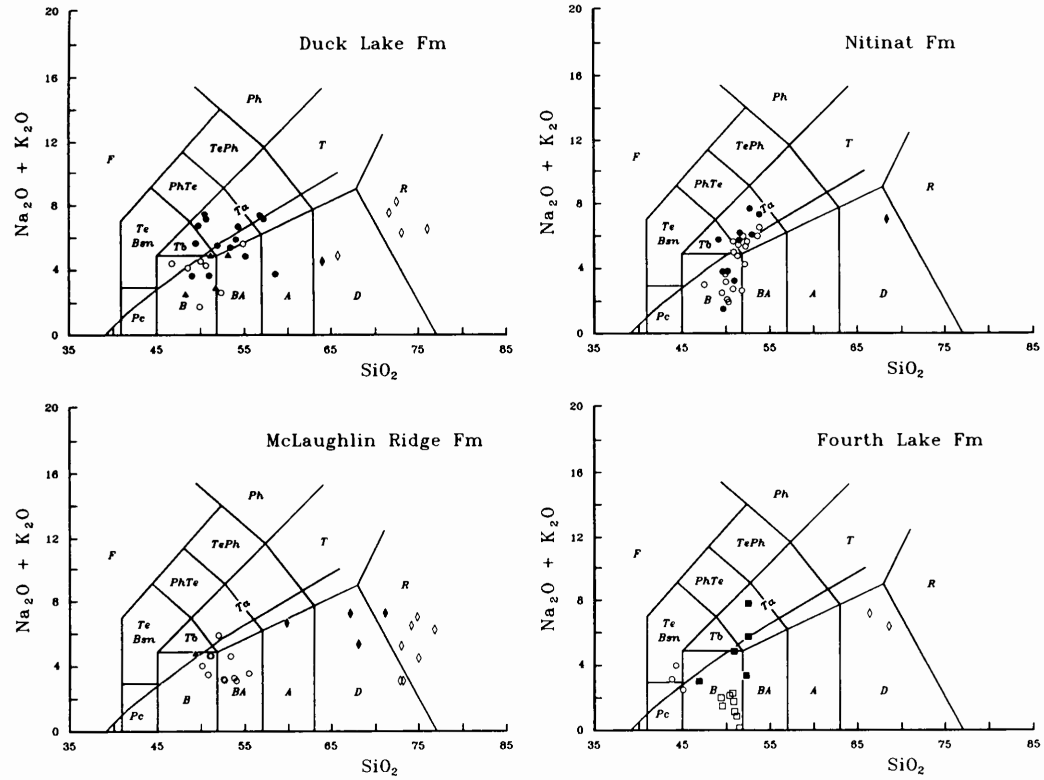

Figure 9. Alkali-silica diagrams for volcanic rocks of the Sicker Group and Fourth Lake Formation. Fields after Le Maitre (1984); F= foidites; Pc= picrobasalt; Bsn= basanite; Te= tephrite; PhTe= phonotephrite; TePh= tephriphonolite; Ph= phonolite; Tb= trachybasalt; Ta= trachyandesite; T= trachyte and alkali trachyte; B= basalt; BA= basaltic andesite; A= andesite; D= dacite; R= rhyolite and alkali rhyolite. Sloping solid line divides alakaline rocks (above line) from subalkaline rocks (below line), after Irvine and Baragar (1971). Symbols as in Figure 8.

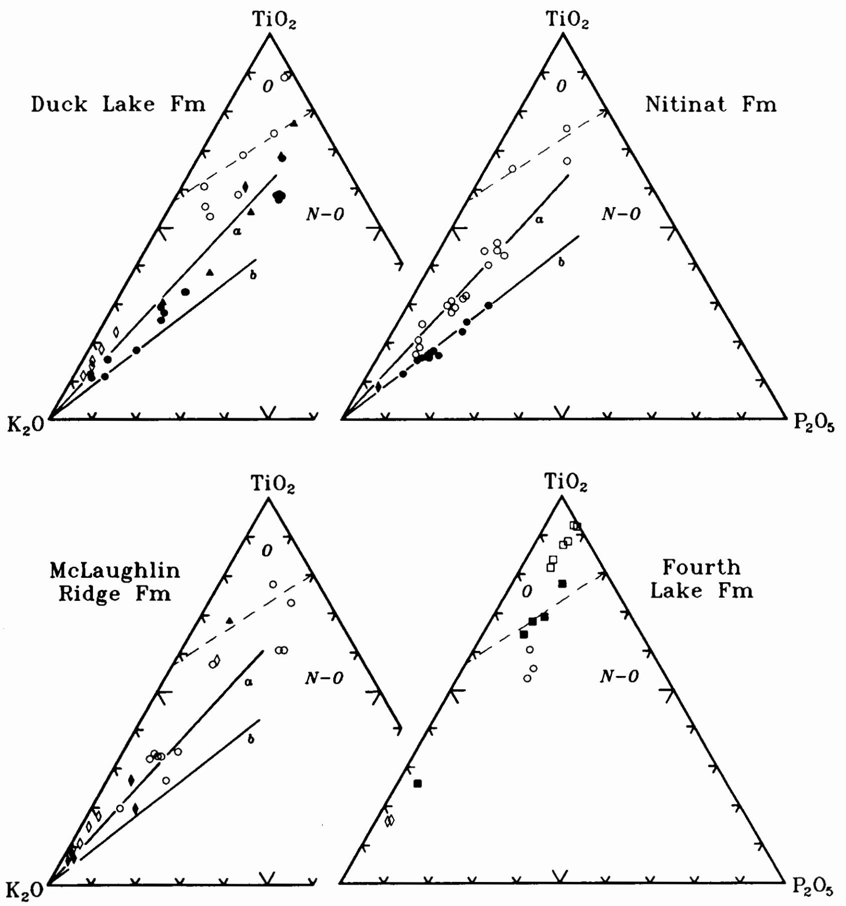

Figure 10. TiO_2-K_2O-P_2O_5 diagrams for volcanic rocks of the Sicker Group and Fourth Lake Formation. Fields after Pearce *et al.* (1975) are shown for reference; O= oceanic basalts; N-O = continental basalts. Lines *a* and *b* are of differing TiO_2/P_2O_5 ratio and distinguish Suites I and II of the Nitinat Formation. They are included for reference in the plots of the Duck Lake and McLaughlin Ridge formations. Symbols as in Figure 8.

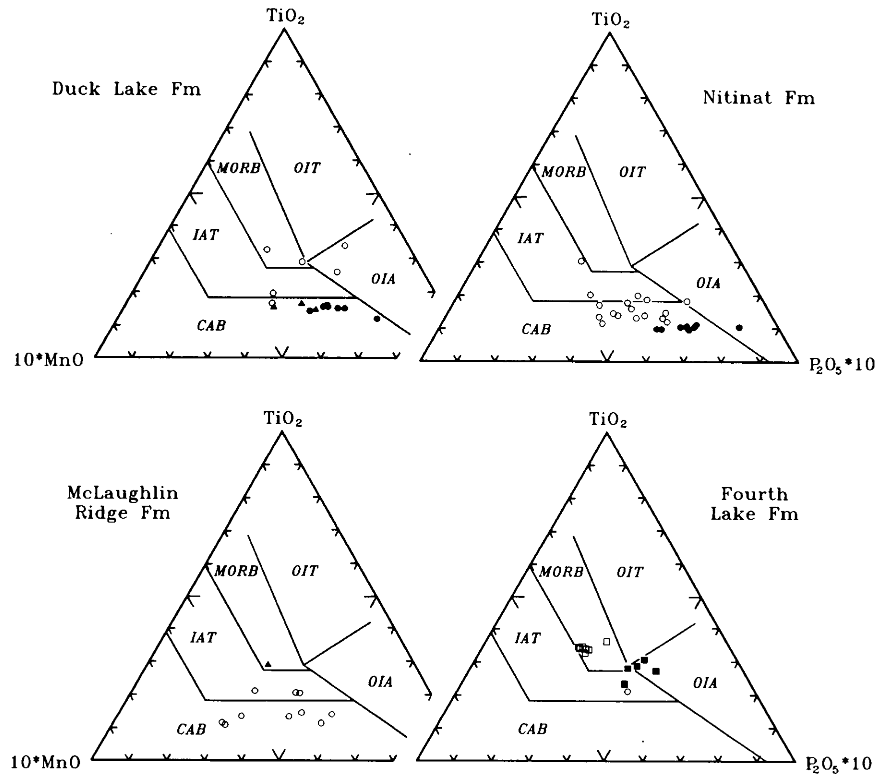

Figure 11. TiO_2-MnO-P_2O_5 diagrams for volcanic rocks of the Sicker Group and Fourth Lake Formation. Fields after Mullen (1983); CAB= calcalkaline basalts; IAT= island-arc tholeiites; MORB = mid-ocean ridge basalts; OIT= ocean-island tholeiites; OIA= ocean-island alkalic basalts. Symbols as in Figure 8.

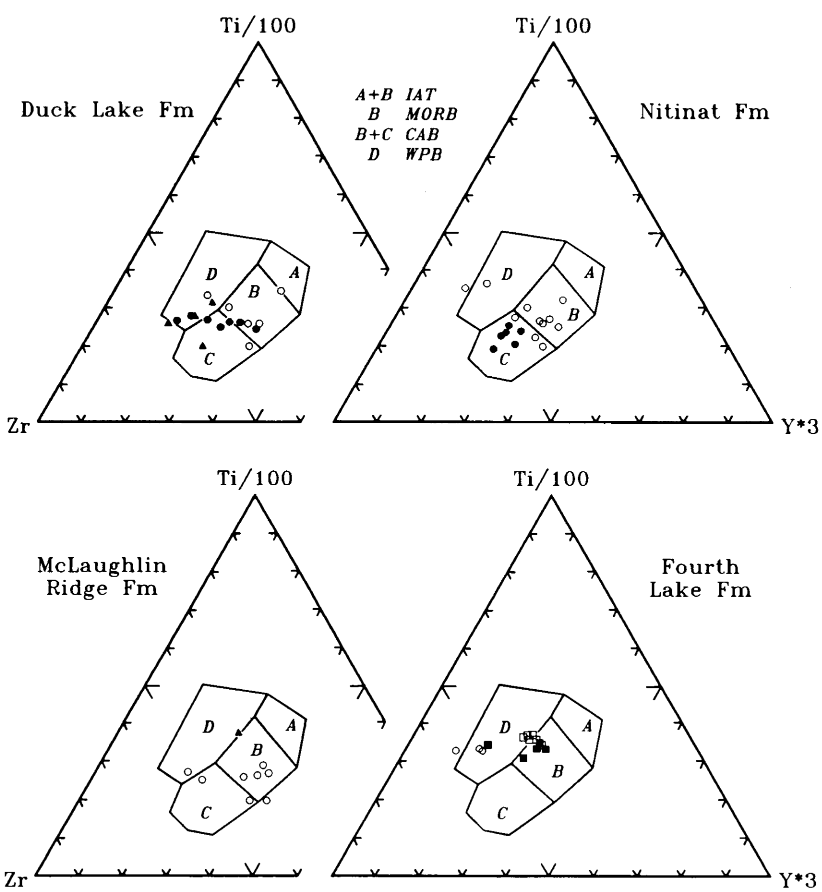

Figure 12. Ti-Zr-Y diagrams for volcanic rocks of the Sicker Group and Fourth Lake Formation. Fields after Pearce and Cann (1973); CAB = calcalkaline basalts; IAT = island- arc tholeiites; MORB= mid-ocean ridge basalts; WPB= within-plate basalts. Symbols as in Figure 8.

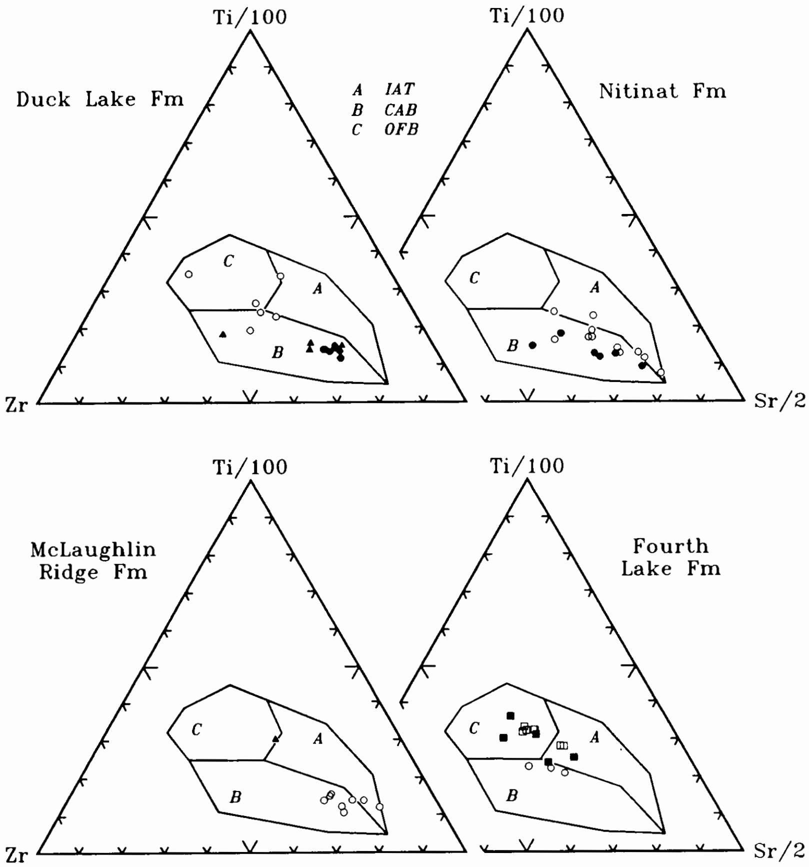

Figure 13. Ti-Zr-Sr diagrams for volcanic rocks of the Sicker Group and Fourth Lake Formation. Fields after Pearce and Cann (1973); CAB= calcalkaline basalts; IAT = island-arc tholeiites; OFB = ocean-floor basalts. Symbols as in Figure 8.

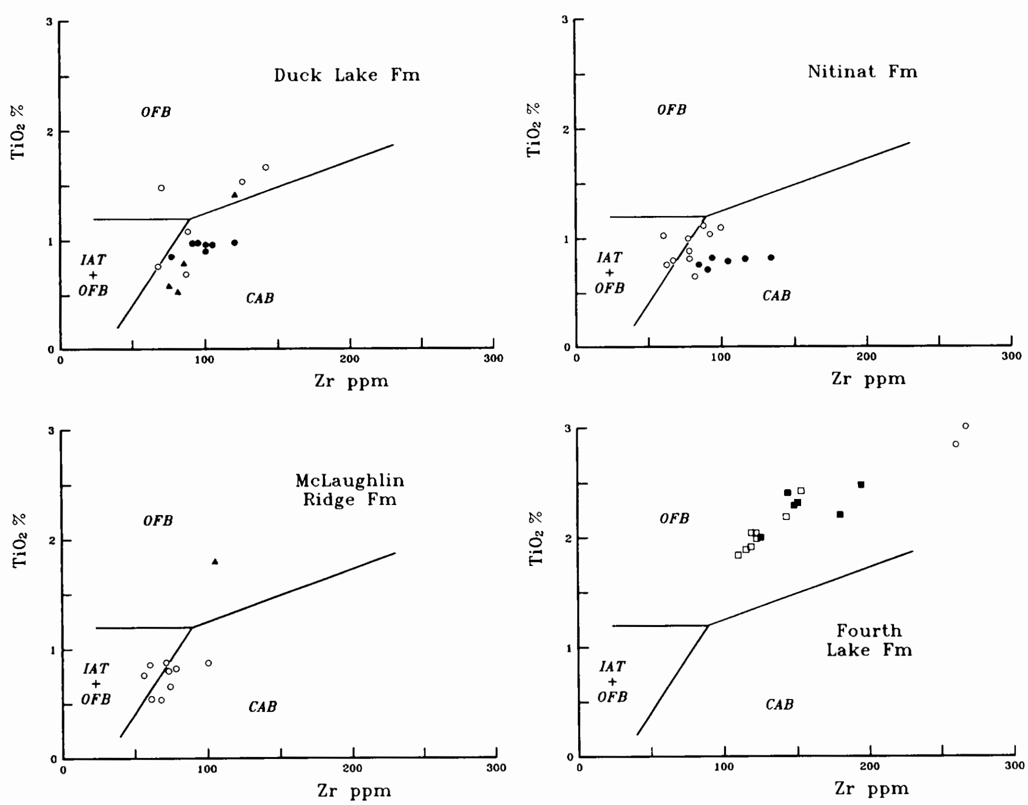

Figure 14. TiO_2-Zr diagrams for volcanic rocks of the Sicker Group and Fourth Lake Formation. Fields after Garcia (1978); CAB= calcalkaline basalts; IAT= island-arc tholeiites; OFB= ocean-floor basalts. Symbols as in Figure 8.

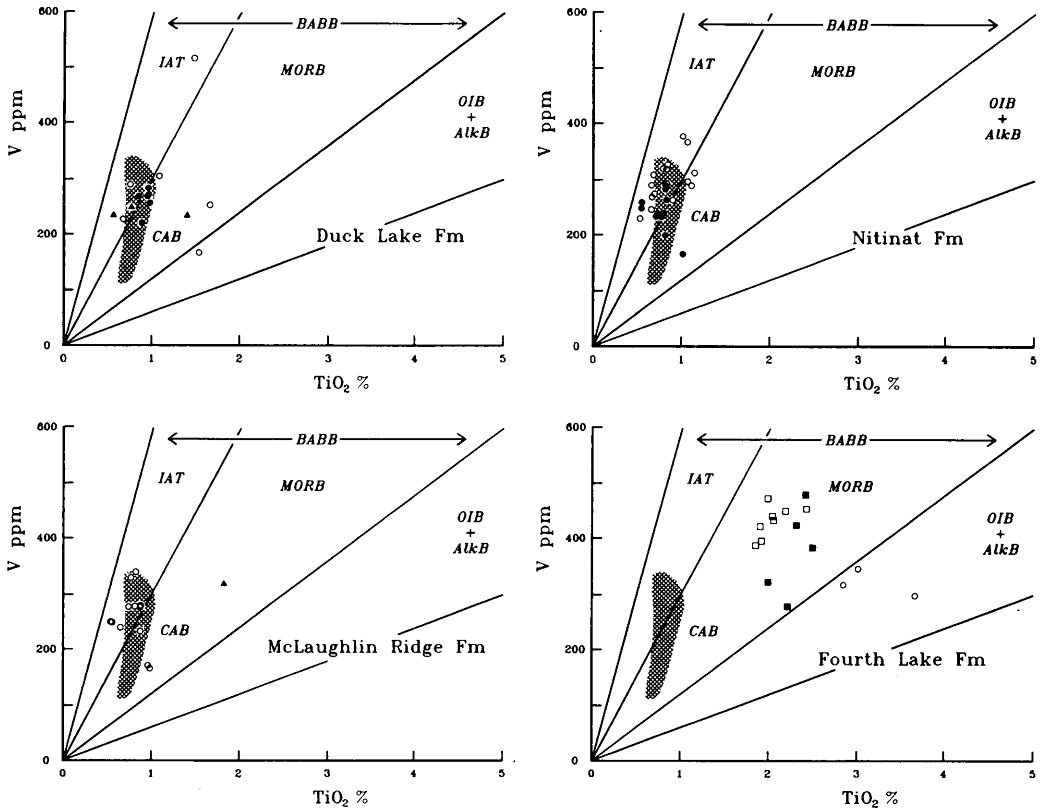

Figure 15. TiO2-V diagrams for volcanic rocks of the Sicker Group and Fourth Lake Formation. Fields after Shervais (1982); IAT= island-arc tholeiites; MORB= mid-ocean ridge basalts; BABB= back-arc basin basalts; OIB= ocean-island basalt; AlkB= alkalic basalt. Shaded area labelled CAB is that occupied by typical calcalkaline basalts. Symbols as in Figure 8.

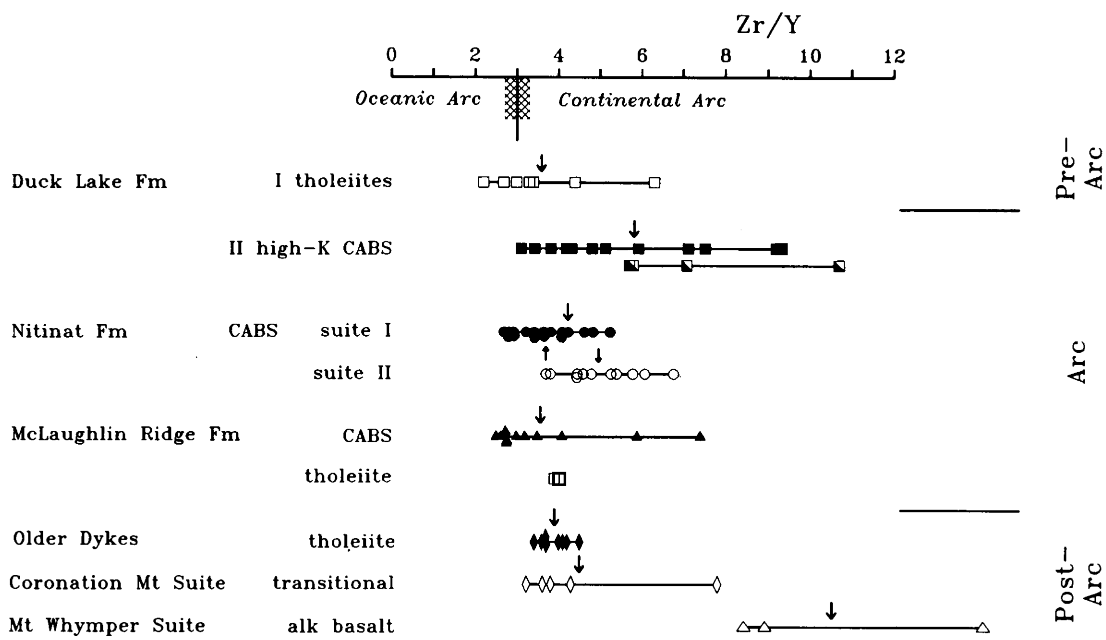

Figure 16. Zr/ Y ratios in magmas of the Sicker arc. Oceanic-continental arc division from Pearce (1983). The range of data is plotted for each magma suite and formation; samples with yttrium below detection limit are omitted. The large arrow above the range designates the average ratio for the formation (or suite for the Duck Lake Formation); smaller arrows for the Nitinat Formation designate the average ratios for the separate suites. Duck Lake tholeiites are considered to represent the pre-arc oceanic substrate; the upper Duck Lake, Nitinat and McLaughlin Ridge formations to constitute the Sicker arc; and the older dikes and Fourth Lake volcanics to represent late or post-main-arc activity.

rocks lie stratigraphically above the tholeiites. They are high-potassium calcalkaline in character (Figures 5, 8 and 9). Basalts show typical, steeply dipping lanthanum to yttrium trace-element patterns and most display the negative niobium anomaly characteristic of arc rocks (Figure 5). However, some samples, Suite IIa, have higher niobium values that are not anomalous. These samples are intermixed with normal low-niobium basalts with no apparent stratigraphic nor spatial control. Potassium, rubidium and barium show large ranges of values due to variable depletions and additions during alteration, but are generally high in these rocks even if geochemical screens such as that suggested by Hughes (1972) are used to eliminate the most altered samples. Extended traceelement patterns compare favorably with those of high-potassium calcalkaline basalts from the Sunda arc. Dacites have similar high-potassium calcalkaline trace-element patterns with low strontium, phosphorus and titanium values due to probable fractionation of plagioclase, apatite and magnetite. Petrotectonic discriminant diagrams confirm the calkalkaline nature of the Suite II lavas and their affinity with magmas found in island-arc settings.

Volcanic rocks of the Nitinat and McLaughlin Ridge formations form a coherent suite of medium-potassium calcalkaline chemistry (Figures 9 and 10) and fall within the appropriate calcalkaline or arc fields in petrotectonic discrimination diagrams (Figures 11 to 16). The Nitinat Formation is dominated by basalts and basaltic andesites with few intermediate or felsic rocks. Those dacites and rhyolites that do occur form dikes or sills and are indistinguishable from similar rocks within the McLaughlin Ridge Formation. Geochemically, the volcanics of the Nitinat Formation can be divided into two subgroups which are differentiated by incompatible element ratios (Figures 6 and 11). The TiO_2/P_2O_5 ratio for most samples is in the range 2 to 5. However, samples from the Meade Creek - east Shaw Creek area, north of Cowichan Lake, have TiO_2/P_2O_5 ratios less than 2 (Massey, 1995b). This subgroup also has lower niobium, higher zirconium, and higher La/Nb, Ce/Sr and Ce/Y ratios. Both subgroups are typically calcalkaline and show considerable overlap in other chemical characteristics. Samples from the Nitinat Pass and most other areas of the Alberni - Nanaimo Lakes sheet belong to the standard suite of high TiO_2/P_2O_5 ratios. However, one sample of Suite II was found in the Raft Creek area, suggesting that sampling may not yet be sufficient to fully delineate the areal extents of the two subgroups.

The McLaughlin Ridge Formation shows a complete range of compositions from mafic to felsic. Volumetrically, it is dominated by intermediate volcaniclastics, though these are under represented in the accompanying geochemical data which emphasizes liquid compositions, that is, flows and minor intrusions. The McLaughlin Ridge volcanics demonstrate the same typical calcalkaline geochemistry as the main Nitinat Formation Suite I (with TiO_2/P_2O_5 ratios between 2 and 5) with which they are probably consanguinous (Figures 7, 9 to 16). However, an amygdaloidal mafic flow interbedded with laminated cherty tuff on the east side of the upper Nitinat River is uniquely tholeiitic, apparently of ocean-floor or back-arc affinity (Figures 7, 9 to 16). Other Sicker Group volcanics of similar chemistry remain to be documented.

The Sicker Arc

The Sicker Group records the complete evolution of an oceanic island arc. The lower tholeiitic basalts of the Duck Lake Formation represent the oceanic substrate upon which the arc developed. The age of the substrate relative to the overlying arc is unknown but there is no evidence to suggest that it is significantly older. The initiation of the arc produced the bimodal high-potassium calcalkaline suite of the Duck Lake Formation. Enriched lavas such as this are believed to characterize the renewal stages of arc construction after an episode of back-arc rifting, such as observed in the Marianas (Stern *et al,* 1988), although evidence for the earlier back-arc basin is lacking on southern Vancouver Island. The initiation of a new subduction zone, however, though normally marked by boninitic or low-potassium tholeiitic melts (Hawkins *et al.*, 1984, Stern *et al.*, 1988), may produce enriched calcalkaline magmas where an enriched mantle wedge is involved in magma generation. The prior generation of the lower Duck Lake Formation E-MORB lavas suggests that this may be the case for the Sicker arc.

As the arc developed, magmatism became typically medium-potassium calcalkaline in composition. In the Nitinat Formation, volcanism was fairly mafic and magma probably erupted from several volcanic centres. The thick sequence of flows and coarse pyroclastics in the Nitinat River area probably developed proximal to one centre; other eruptive centres may be marked by the abundant massive flows in the Banon Creek area (Massey, 1995a) and the differing chemistry of the Suite II rocks of the Meade Creek - east Shaw Creek area (Massey, 1995b). Lithologies and sedimentary facies in the Nitinat Formation are very similar to those observed in young submarine arcs, both modern and in the geological record (Jones, 1967; Mitchell, 1970; Bogen, 1985).

Eruptive style changed during deposition of the McLaughlin Ridge Formation, with the development of a single large central volcano in the Duncan - Saltspring Island area, surrounded by a volcaniclastic apron extending to the Alberni area (Massey, 1995a, b). Magma chemistry evolved to andesitic and dacitic compositions. Rare plant material and trace fossils show that the volcano became subaerial for at least part of its history. This central volcano was contemporaneous with that developed in the Myra Falls area of the Buttle Lake uplift (Juras, 1987), though the spatial relationship between these two centres during the Late Devonian is uncertain due to later tectonic disruption and differential rotation of structural blocks within Vancouver Island (Irving and Yole, 1987; Irving and Wynne, 1990).

Volcanism waned at the end of McLaughlin Ridge time, with only comparatively minor eruptions occurring within the Fourth Lake Formation (see below). Magmatic compositions changed to enriched tholeiitic (older dikes) to transitional basalts and alkalic basalts and dacites (Fourth Lake Formation). This volcanism, and its associated sediments, was contemporaneous with the deposition of the Thelwood and Flower Ridge formations of the Buttle Lake uplift, interpreted as forming in an extensional back-arc basin environment (Juras, 1987). The Fourth Lake magma may have formed at the propagating tip of that developing rift. Extension, however, was very limited in the Cowichan uplift, the basin being dominated by sedimentary infill.

Throughout the Sicker Group, and succeeding Fourth Lake Formation, there is no evidence for continental influence on the developing arc. The oceanic substrate of the lower Duck Lake Formation, lithofacies of volcanics in the Nitinat and McLaughlin Ridge formation, the arc-derived debris of the Fourth Lake sediments, the lack of U-Pb inheritence in zircons, and the juvenile nature of neodymium and strontium isotopic data (Samson *et al.*,1990) all support an intra-oceanic arc environment. However, two pieces of geochemical data seemingly point to continental influence. Lead isotope data from galenas and whole-rocks from the Sicker Group of the Buttle Lake uplift resemble other island-arc environments, but are more radiogenic than mid-ocean-ridge basalts or the proposed Devonian mantle (Andrew and Godwin, 1989a). The radiogenic lead is interpreted to be derived from sedimentary rocks, implying that the subduction zone producing the Sicker arc was sediment rich and near a supply of continental detritus.

The ratio Zr/Y has been suggested (Pearce, 1983) as an effective discriminant between arcs formed on oceanic crust (Zr/Y< 3) and arcs formed on transitional or continental crust (Zr/Y> 3). The majority of Zr/Y ratios for Sicker rocks are higher than 3, suggesting a continental-arc environment (Figure 16). There is a tendency for the average Zr/Y ratio to decrease with time from the upper Duck Lake to McLaughlin Ridge formations, but this is complicated by possible spatial variations, for example, the differences between Suites I and II in the Nitinat Formation. However, Zr/Y is a measure of the enrichment of the mantle source of the magmas and is also a characteristic of within-plate volcanics. If subduction took place beneath the source of trace-element enriched basalts, such as the lower Duck Lake Formation, it would be possible for magmas in an oceanic arc to possess high Zr/Y ratios and hence plot in the continental-arc field (Pearce, 1983). No modern example of this has been documented. Such a mantle source could also produce radiogenic-lead enriched isotope charateristics similar to those observed in Sicker Group rocks, without the need for involvement of continental sediment.

BUTTLE LAKE GROUP

The Buttle Lake Group is made up of a dominantly epiclastic and bioclastic limestone sedimentary sequence, comprising the Fourth Lake, Mount Mark and St Mary's Lake formations, ranging from Mississippian to Lower Permian in age. This sedimentary package is apparently conformable on the underlying volcanics along the northeastern limb of the Cowichan uplift, for example, in the upper Cameron River valley and St Mary's Lake area, but is unconformable along the southwestern limb and in the Fourth Lake area. In the Green Creek and Fourth Lake areas, the Fourth Lake Formation sediments unconformably overstep Nitinat and Duck Lake volcanics. Mount Mark limestones directly overlie Mclaughlin Ridge volcaniclastics in the upper Franklin River and Limestone Mountain area, and sit on Nitinat volcanics in the Rift Creek area.

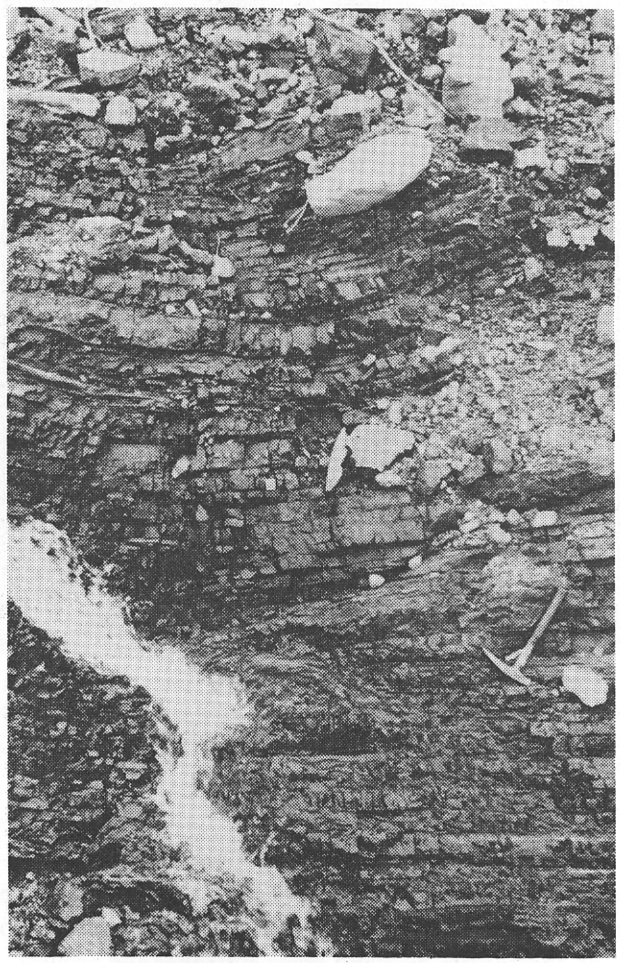

Plate 14. Red ribbon cherts, Fourth Lake Formation (headwaters of the Nanaimo River; NMA88-12-09: 5440835N; 388814E).

Plate 15. Chert-clast conglomerate at base of Fourth Lake Formation in South Cameron River valley. Some clasts are similar to the cherts in Plate 14 (NMA88-02-11: 5445641N; 387835E).

FOURTH LAKE FORMATION

The Fourth Lake Formation comprises mostly thin-bedded, often cherty sediments. These vary from green and red ribbon cherts, black cherty argillites, green and white cherty tuffs, grey and green siltstones and argillites, to thicker bedded green volcanic sandstones. In the upper Shaw Creek area, the base of the sedimentary unit is

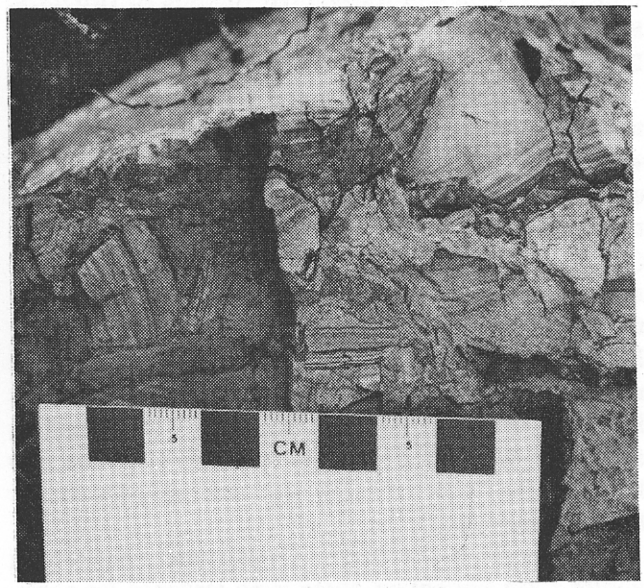

Plate 16. Sharpstone breccia, lower Fourth Lake Formation. Clasts are laminated cherty siltstone-argillite (St Mary's Lake area; SDU88-23-06: 5458695N; 380313E).

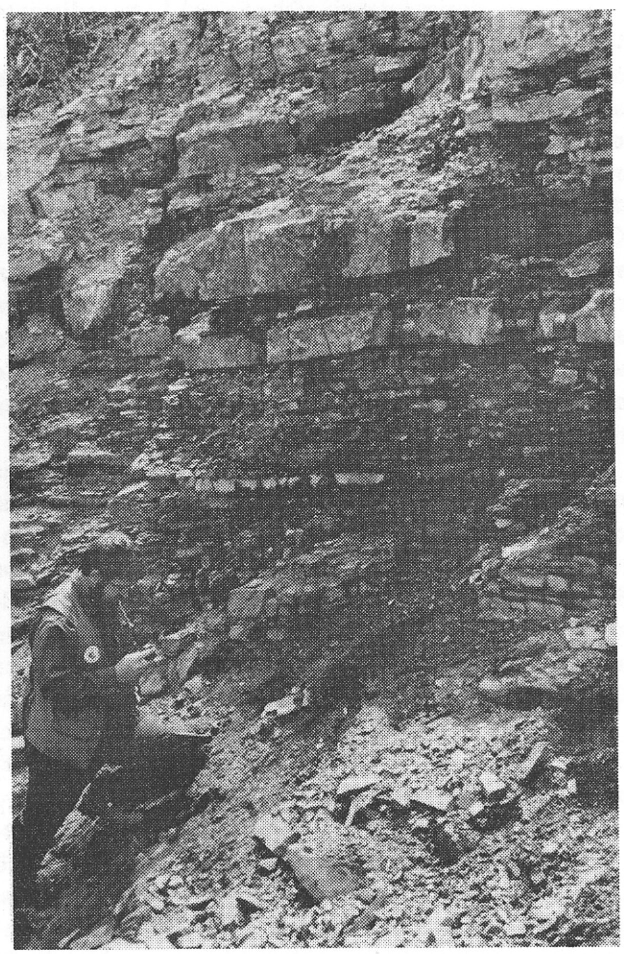

Plate 17. Interbedded argillite and silicified limestone, Fourth Lake Formation (Rift Creek; SFR88-31-03: 5440026N; 378015E).

marked by a sequence of red and cream-coloured radiolarian ribbon cherts, laminated cherts and cherty tuffs with thin argillite interbeds, 100 to 200 metres thick, informally called the Shaw Creek chert member.

Green and red radiolarian ribbon cherts, of different character to the Shaw Creek chert, outcrop along the railway line about 5 kilometres east of Port Alberni. Here the sequence is well bedded with ribbons averaging about 10 centimetres thick. Clastic components are absent. These cherts are not seen in contact with other lithologies and they are only tentatively assigned to the Fourth Lake Formation. Maroon and grey radiolarian ribbon cherts are also found near the headwaters of the Nanaimo River (Plate 14). Chert-pebble conglomerate and breccia with a sandy matrix occurs near the base of the formation in the Cameron River and St Mary's Lake area (Plates 15 and 16). Clasts are similar to the ribbon cherts found along the railway line and upper Nanaimo River valley.

The upper part of the formation is characterized by thinly bedded, turbiditic sandstone-siltstone-argillite intercalations, with some thicker beds of volcanic sandstone. These pass upwards into argillite-calcarenite interbeds at the top of the sequence (Plate 17).

The minor, though significant, volcanic flows found within the lower Fourth Lake Formation in the Duncan and Cowichan Lake map areas (Massey, 1995a, 1995b) are absent from the Alberni - Nanaimo Lakes area.

Mount Mark Formation

The Mount Mark Formation conformably overlies and laterally interfingers with the Fourth Lake Formation. However, in places along the southwest limb of the

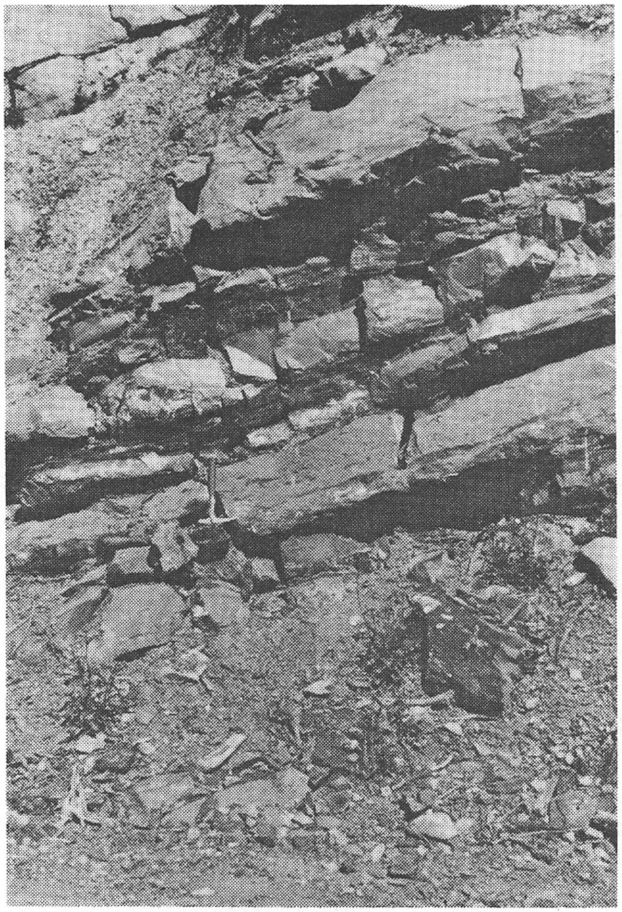

Plate 18. Interbedded calcarenite, crinoidal calcarenite and minor black argillite, Mount Mark Formation. Note argillite rip-ups in bed by hammer (*see* Plate 19) (St Mary's Lake area; NMA88-34-12: 5457979N; 380688E).

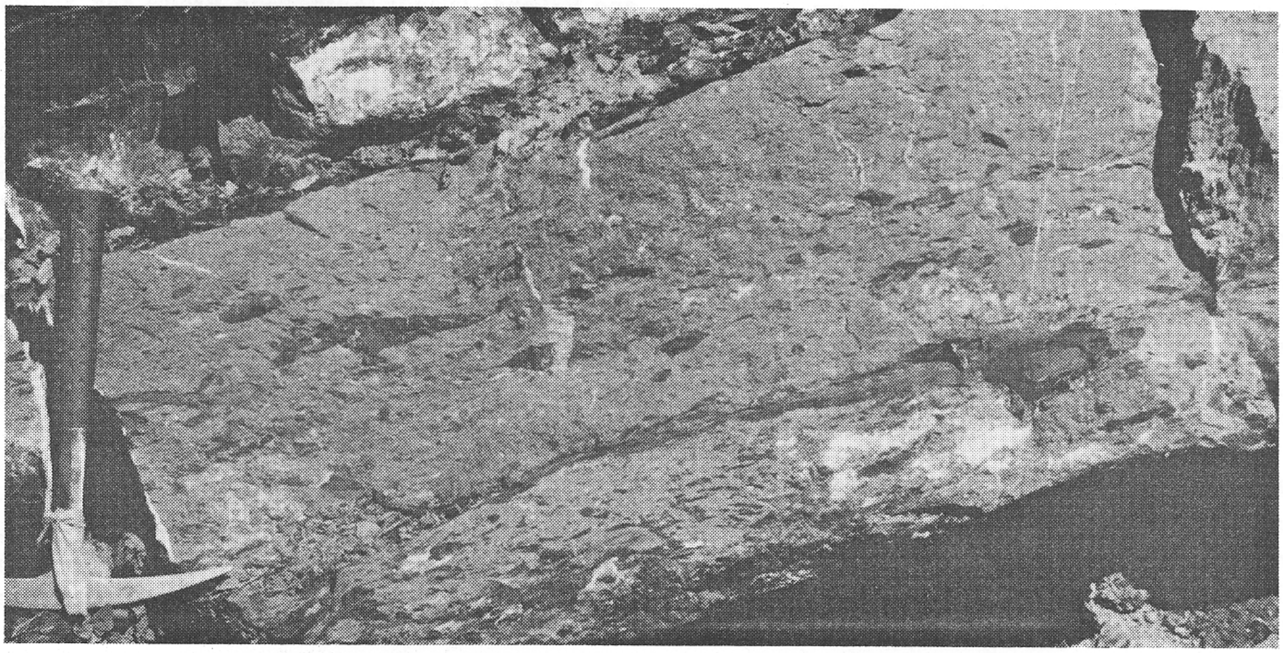

Plate 19. Close-up of calcarenite bed with argillite rip-up clasts dispersed through the bed, Mount Mark Formation (St Mary's Lake area; NMA88-34-12: 5457979N; 380688E).

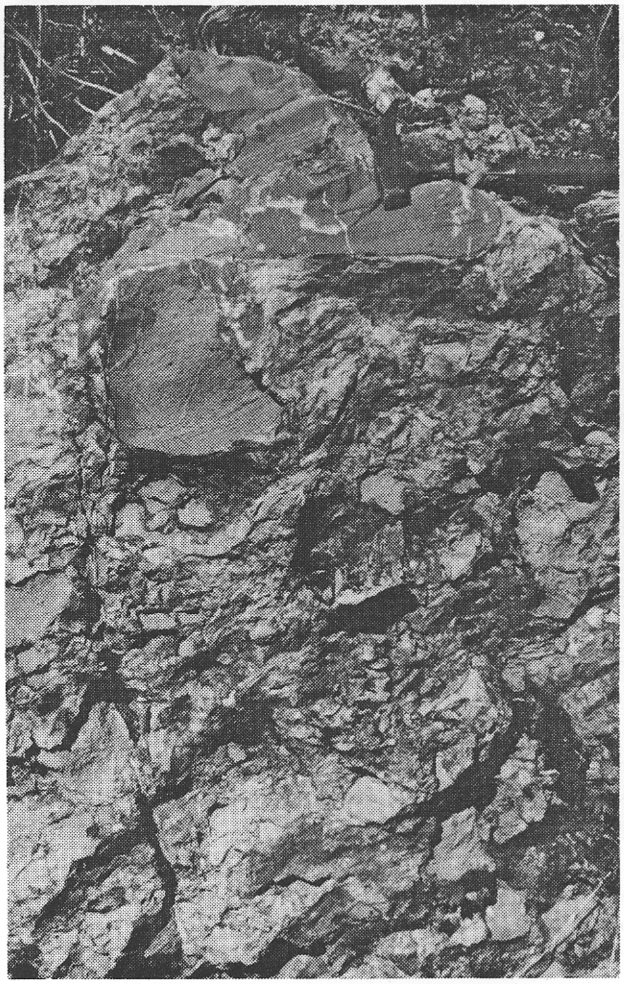

Plate 20. Bouldery calcirudite, Mount Mark Formation (St Mary's Lake area; NMA88-35-06: 5457192N; 381362E).

uplift, for example west of Rift Creek and on the south slopes of Douglas Peak, it lies directly and unconformably on the lower Sicker Group volcanics.

The formation consists of massive limestone beds with minor argillite and chert interbeds (Plates 18 and 19). The limestones are well bedded, varying from about 15 centimetres up to about 5 metres thick. They are predominantly bioclastic calcarenites and calcirudites (Plate 20), rich in broken crinoid stems ranging up to 2 centimetres in diameter. Bryozoa, brachiopods, pelecypods, corals and trilobites have also been reported from these rocks (Yole, 1964). Fossil clasts are often replaced by silica and weather positively. Some limestone outcrops contain many thin chert beds resulting from siliceous replacement of limestone. Thin black argillite and shale beds are developed in places. Black cherty argillite with minor pods of limestone overlies calcirudite at the top of the formation in the St Mary's Lake area.

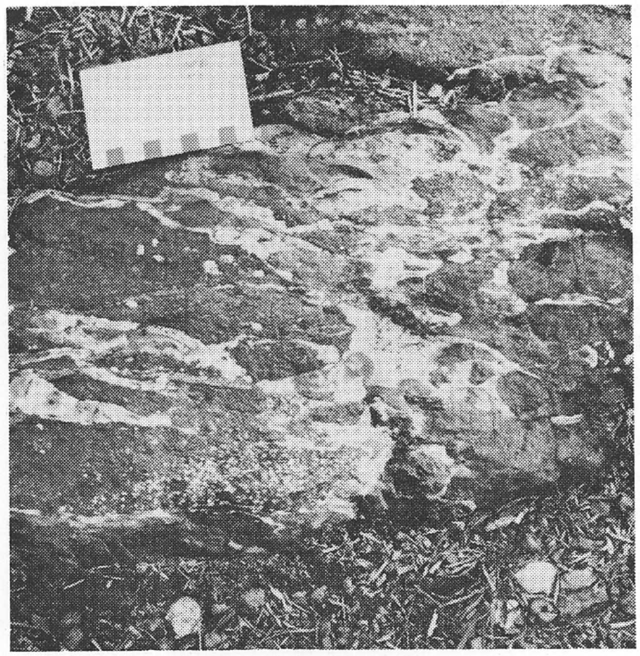

Plate 21. Maroon amygdaloidal volcanic breccia with limestone cementing matrix, Mount Mark Formation (old quarry, Lacy Lake road; NMA88-38-05-1: 5460401N; 373255E).

Maroon tuffaceous shales and rare volcanic breccia (Plate 21) are seen interbedded with limestone in the basal part of the sequence in the Horne Lake area. No geochemical data are available to characterise this volcanism or suggest correlations. The tuffs may be distal correlatives of the pillowed basalts in the upper unit of the Nanoose Complex (Figure 2) of the Nanoose Peninsula and Ballenas Islands (Sutherland Brown and Yorath 1985).

St Mary's Lake Formation

The St Mary's Lake Formation overlies the Mount Mark limestones. It is, however, poorly preserved being best seen in the St Mary's Lake area and on the eastern slope of the west branch of the Cameron River (Plate 22). It is cut out elsewhere by the unconformity beneath the Karmutsen Formation. In the St Mary's Lake area, the basal conglomerate (Plate 23) overlies the Mount Mark Formation with a moderate angular unconformity. The contact is not seen in the Cameron River area, but is paraconformable.

The formation comprises brownish weathering, grey sandstone and black argillite graded beds (Plate 24), volcanic sandstones and pebble conglomerates, black cherty argillite, greenish chert and minor jasper. Conglomerates contain volcanic, limestone and cherty argillite clasts in a volcanic sandstone matrix. Scouring, load structures, normal and inverse grading, slumping and disrupted bedding are all observed in these sediments.

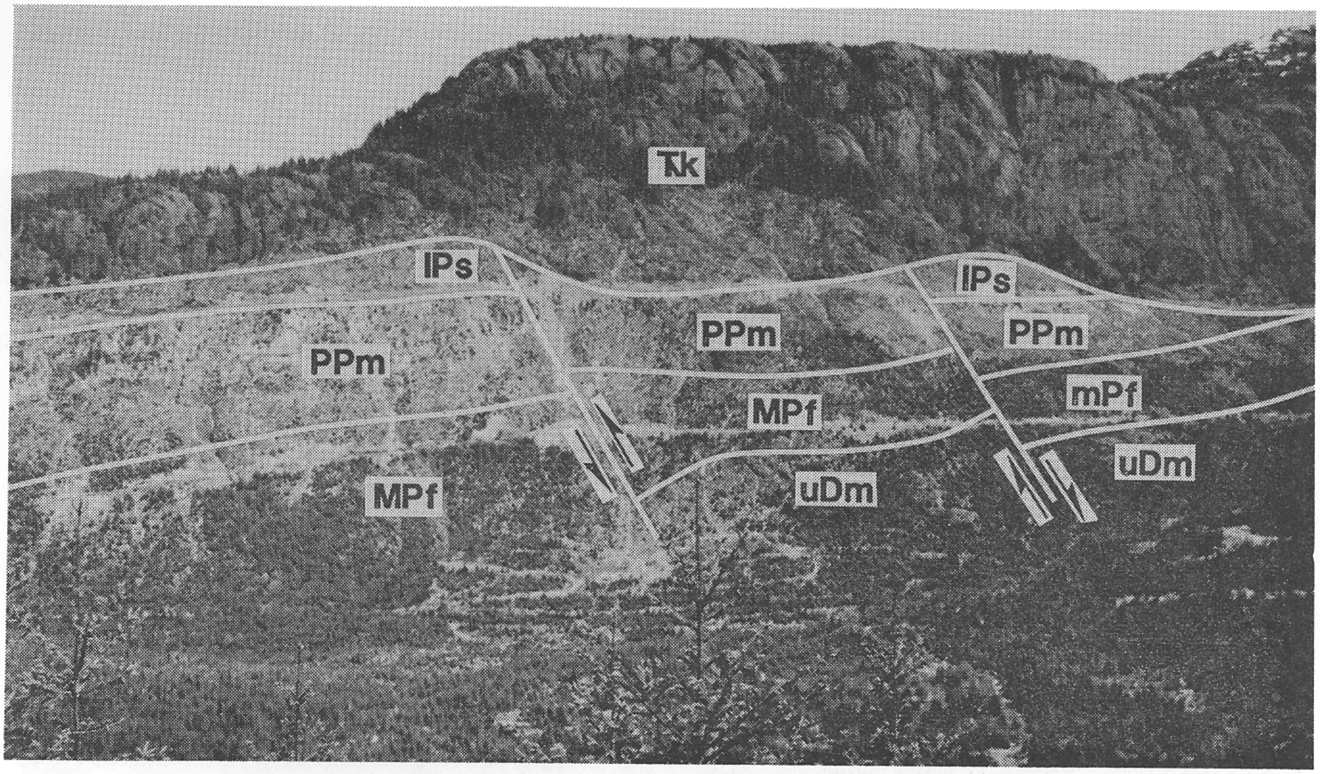

Plate 22. View eastwards across the South Cameron River valley illustrating the preservation of the St Mary's Lake Formation beneath the Upper Triassic Karmutsen Formation unconformity. uDm= McLaughlin Ridge Formation; MPf= Fourth Lake Formation; PPm= Mount Mark Formation; lPs= St Mary's Lake Formation; Trk= Karmutsen Formation.

Plate 23. Polymictic pebble conglomerate, St Mary's Lake Formation (St Mary's Lake; NMA88 35-10: 5457590N; 381770E).

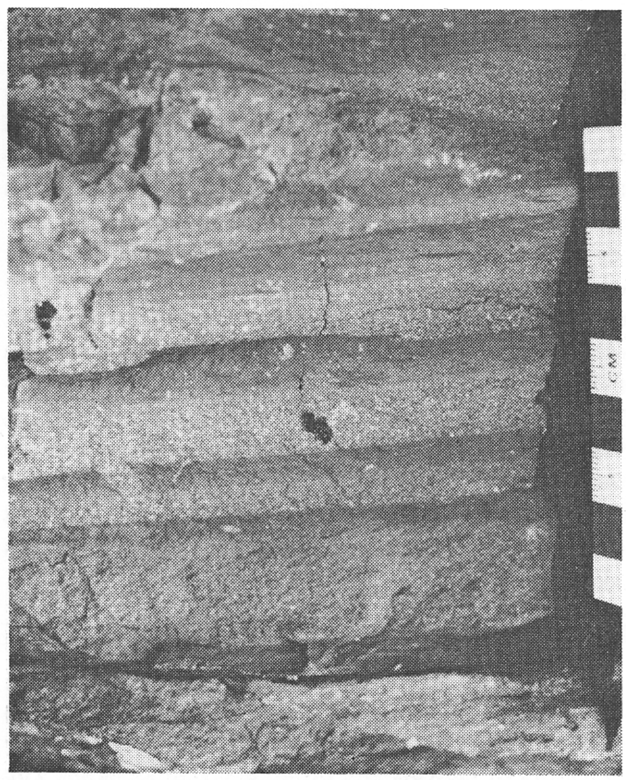

Plate 24. Sandstone-argillite rhythmites, St Mary's Lake Formation. Graded bedding and weak laminations in upper parts of units suggest that beds are AE or ABE turbidites. Note small sandstone dike at left centre of photo (South Cameron River valley; NMA88-01-12-01: 5445556N; 388232E).

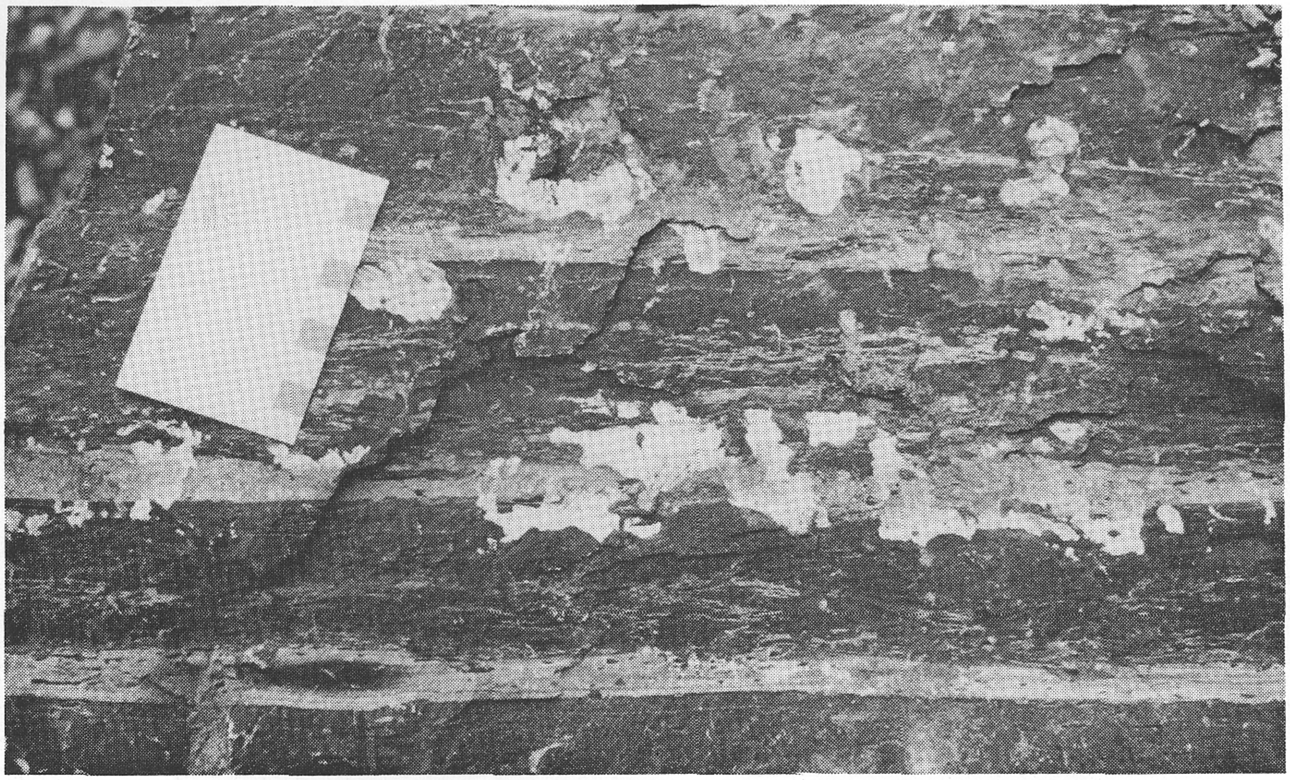

Plate 25. Graded calcareous sandstone - black argillite beds, Douglas Peak argillite, St Mary's Lake Formation (west slope of Douglas Peak; JRI88-21-03: 5443814N; 379982E).

A sequence of well-bedded calcareous argillites overlies the Mount Mark limestones on the southwestern slopes of Douglas Peak (Plate 25). The beds grade from a grey, fine-grained limestone with black argillite clasts at the base, through a wispy interlaminated limestone-argillite section, into an upper black cherty argillite. The beds have sharp lower contacts and vary from 5 to 10 centimetres in thickness (Plate 25). The argillite component dominates within a bed, ranging from about 60 to 100 per cent. The stratigraphic assignation of this Douglas Peak argillite is problematic. It overlies the massive limestones of the Mount Mark Formation and, hence, has been included in the St Mary's Lake Formation (Massey *et al.*, 1989). However, its calcareous nature contrasts with the other St Mary's Lake Formation outcrop areas and may suggest a closer affinity with the Mount Mark, perhaps with the upper cherty argillites exposed in the St Mary's Lake area.

Biostratigraphy of the Buttle Lake Group

Detailed study of the biostratigraphy of the Buttle Lake Group has not yet been undertaken. However, enough regional data have accumulated from various investigators to indicate the broad age relationships. The bulk of the Fourth Lake Formation is clastic in nature and unfossiliferous. However, its age can be bracketed by fossiliferous units at the top and bottom of the formation. The ribbon cherts of the Shaw Creek member have a rich conodont fauna which indicates an early Mississippian age. Radiolaria, though often poorly preserved in the cherts, support a Mississippian age. This is only slightly younger than the upper parts of the Late Devonian McLaughlin Ridge Formation, despite the unconformable contact with the Sicker Group along the southwestern limb of the uplift. No fossils have been found in the basal cherty sediments on the northeastern limb, which are in conformable contact with the volcanic rocks, and it is not known whether they are older than the Shaw Creek cherts. The limestone-argillite interbeds in the upper parts of the Fourth Lake Formation contain a middle to late Pennsylvanian conodont fauna. The lack of both fossil data and distinctive lithological marker horizons within the Fourth Lake Formation makes it impossible to determine if sedimentation was continuous during the Carboniferous or punctuated by one or more nondepositional interludes.

The base of the Mount Mark Formation is time transgressive. In the Alberni area, the limestones yield conodont and macrofossil faunas that range from middle to late Pennsylvanian at the base, up to Early Permian in higher beds. The basal layers are thus time equivalent to the upper Fourth Lake limestone-argillite interbeds of the Cowichan and Duncan areas. The contact between the two formations is interpreted as a major facies boundary which migrated eastwards through time. Massive limestones of the Mount Mark Formation in the eastern part of the uplift contain Early Permian macrofaunas but supporting conodont data are lacking.

Conodonts have been recovered from jaspery cherts and calcareous argillites within the St Mary's Lake Formation which indicate a late Early Permian age (Yorath, in preparation).

VANCOUVER GROUP

Rocks of the Upper Triassic Vancouver Group are exposed throughout the map area, flanking the Paleozoic core of the Cowichan uplift. The group is subdivided into a thick lower volcanic package (Karmutsen Formation) and a thin upper sedimentary package (Quatsino and Parson Bay formations). The sediments, however, are poorly developed within the map area. The lower Karmutsen Formation basalts rest unconformably on the underlying Paleozoic rocks (Plates 22 and 26). Biostratigraphic control from the Cowichan Lake area indicates that the Vancouver Group in southern Vancouver Island is predominantly Carnian in age, though the Parson Bay Formation may extend into the early Norian (Massey, 1995b).

KARMUTSEN FORMATION

Basaltic volcanics of the Karmutsen Formation underlie large parts of the map area, particularly around Mount Arrowsmith in the northeast, Mount Mark (Plate 26) in the northwest and the Museum Creek area in the southwest. They comprise orange-brown weathering pillowed flows, pillow breccias and hyaloclastite breccias interbedded with massive flows and sills. There is a tendency for massive flows to be dominant toward the top of the formation and pillowed flows in lower parts. Typically the basalts are feldspar phyric, often with ragged or glomeroporphyritic feldspars in a fine-grained groundmass. Pillows are usually large, 1 to 2 metres in diameter, with thick chloritic selvages and abundant intrapillow hyaloclastite and quartz, known locally as "dallasite" (Plate 27 and 28). Drain-away ledges are occasionally preserved within pillows (Plate 29). Amygdules are common in the basalts and are infilled with chlorite, calcite or epidote.

The geochemistry of the Karmutsen Formation lavas from the Cowichan uplift, and associated gabbros and diabases of the Mount Hall gabbro, shows that they formed from a iron-titanium-enriched tholeiitic magma. They are similar in composition to other Karmutsen lavas and Late Triassic intrusions on Vancouver Island (Barker *et al*, 1989; Kuniyoshi, 1972). Extended trace-element diagrams of this "standard suite" show moderate enrichments in niobium and the light rare-earths (Figure 17). Lanthanum may be even more enhanced in more altered samples, together with relative depletions and enrichments of

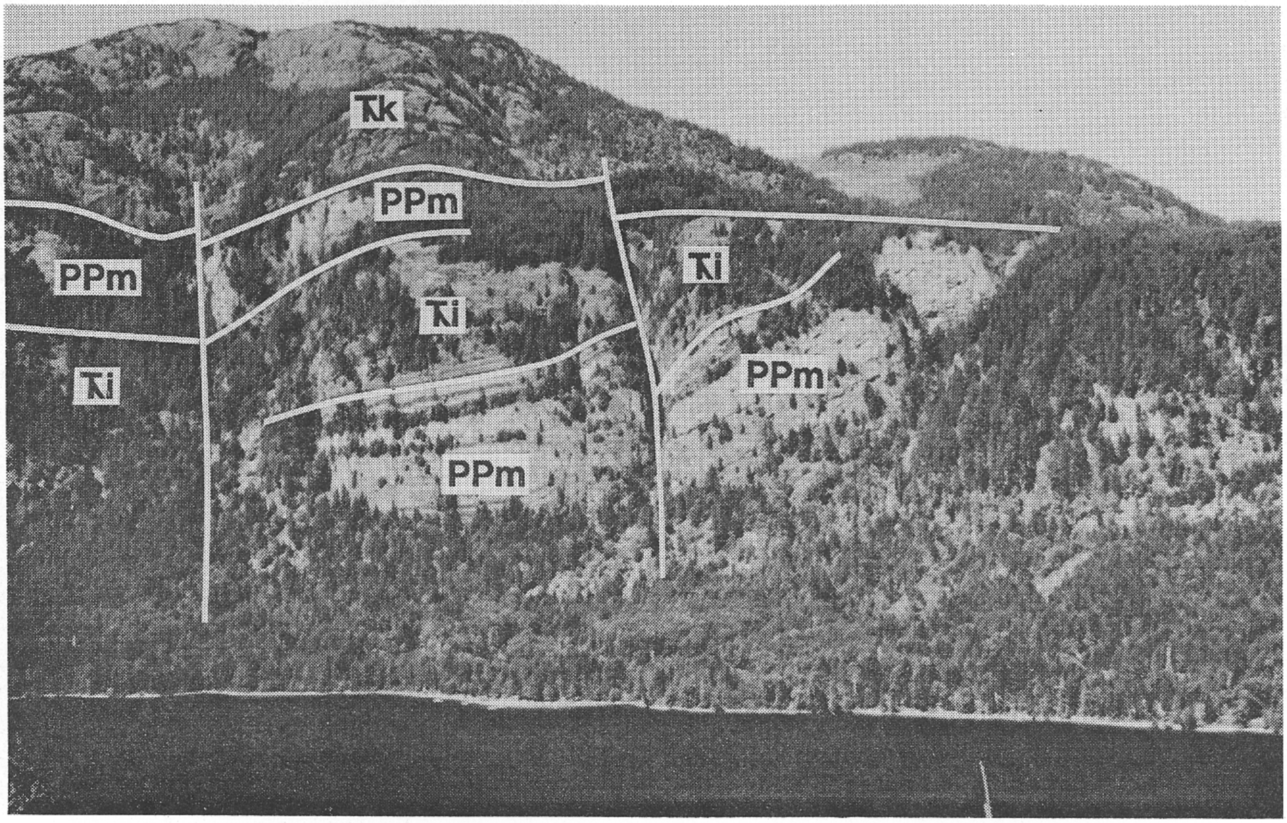

Plate 26. View northwards across Horne Lake to Mount Mark. Mount Mark Formation (PPm) in east limb of Horne Lake syncline is intruded by gabbro sills (Tri) and unconformably overlain by Karmusten Formation pillow lavas (Trk).

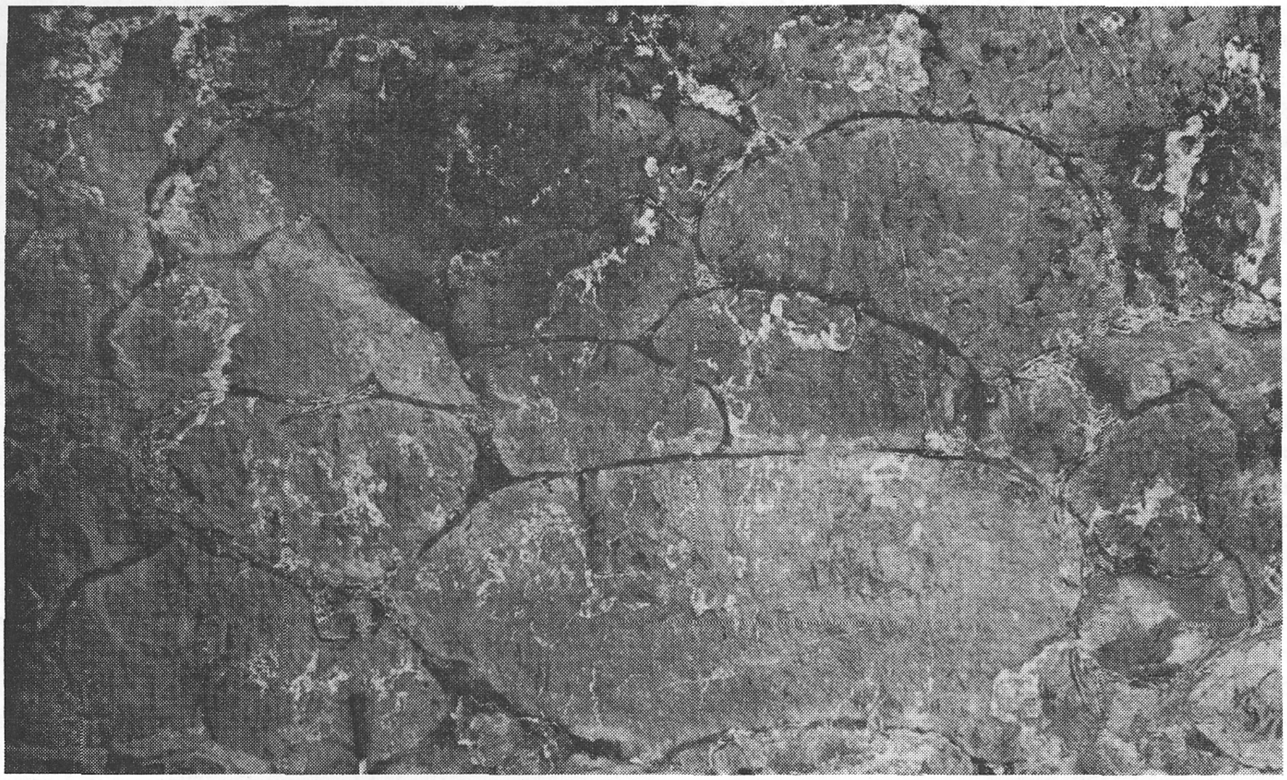

Plate 27. Pillow lavas, Karmutsen Formation. Note the variability in sizes and shapes of the pillows and the presence of the black and white "dallasite" interpillow material (northwest of Mount Arrowsmith; 5457650N; 382850E).

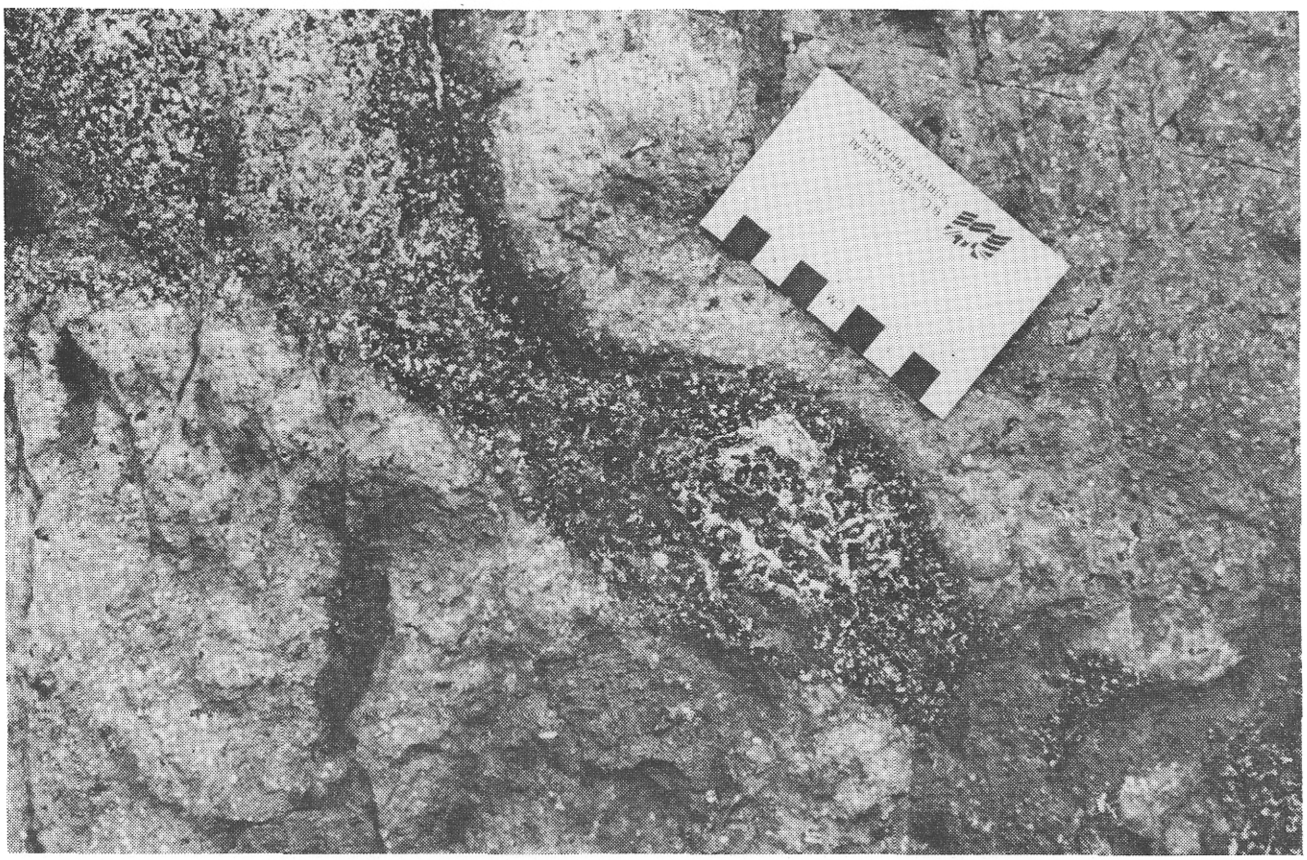

Plate 28. "Dallasitic" hyaloclastite matrix in isolated pillow breccia, Karmutsen Formation (upper Cameron River; SDU88-02-06: 5445210N; 390231E).

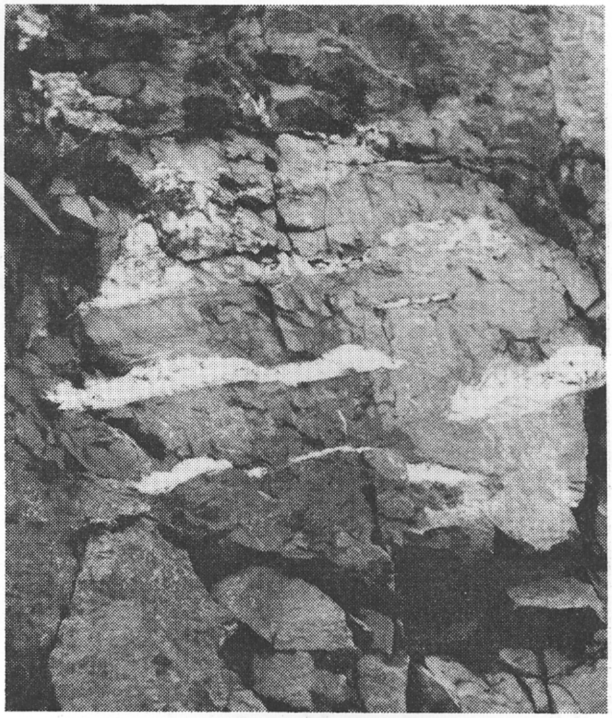

Plate 29. Carbonate-filled horizontal cavities produced by lava drain-away in lava tube in pillowed basalt, Karmutsen Formation (Mount Arrowsmith).

potassium, rubidium and barium. The major elements illustrate the tholeiitic character of the magma (Figures 18 and 19) while trace-element patterns and discriminant diagrams (Figures 20 to 26) suggest an affinity to an enriched mid-ocean-ridge basalt or continental tholeiite. These geochemical characteristics, coupled with the large areal extent and thickness of the Karmutsen Formation, its essentially basaltic character, the pillow and massive flow-dominated lithofacies, short duration of formation (entirely within the Carnian, about 6 Ma), suggest that the Karmutsen Formation formed in an oceanic flood-basalt province.

A subset of samples is marked by much lower niobium contents (Figures 17 and 24). Extended trace-element patterns may be either flat or depleted to the left of niobium (Figure 17) or may even show a marked negative niobium anomaly where potassium and rubidium are high. This suite also tends to have lower titanium, zirconium and yttrium and higher strontium although there is much overlap and the two suites cannot be distinguished on most geochemical diagrams (Figures 18 to 23, 25 and 26). This low-niobium suite is mostly found in flows and intrusions in the Cowichan Lake area south of the Chemainus fault (Massey 1995b). However, two intrusions of similar chemistry occur in the Alberni area. One is a feldspar-diabase dike that intrudes Duck Lake basalt and

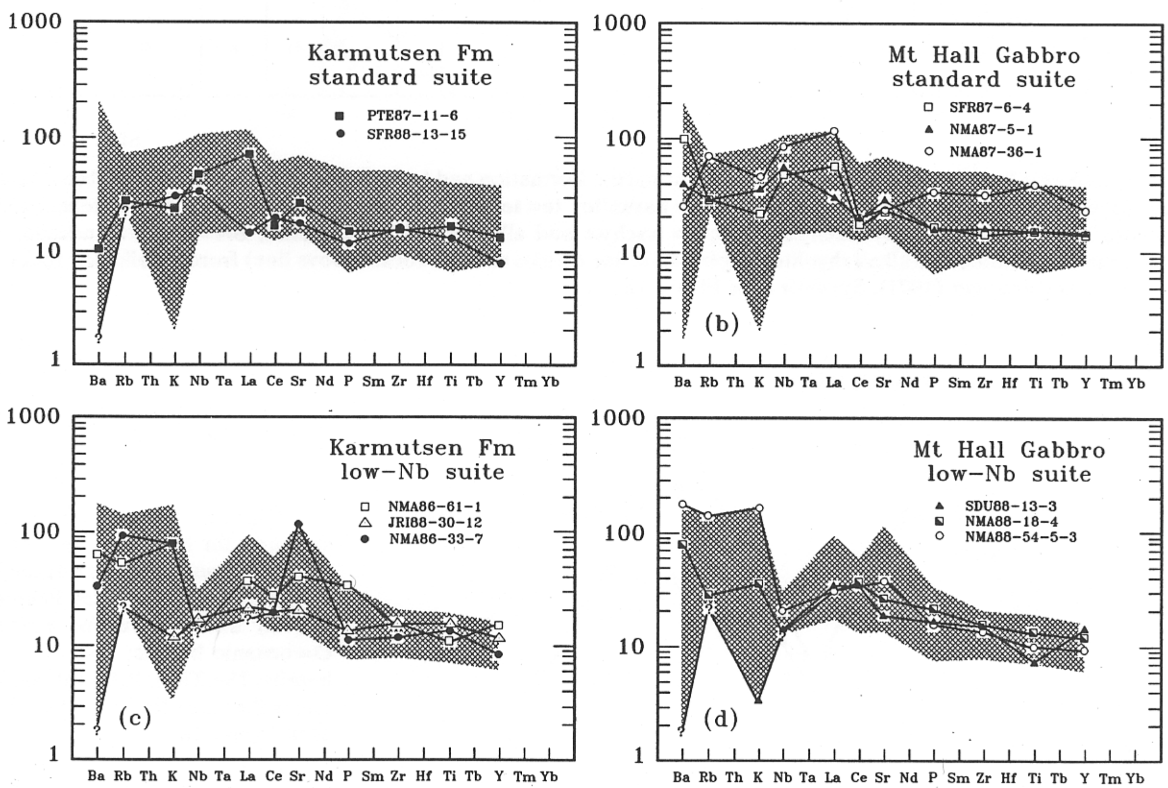

Figure 17. Normalized trace-element plots for basalts of the Karmutsen Formation and intrusions of the Mount Hall gabbro. Normalizing values after Thompson *et al.* (1983). Shaded area represents the range of values for all samples of a particular suite in the Sicker Project area. Selected representative samples are shown individually. (a) Karmutsen Formation: standard suite; (b) Mount Hall gabbro: standard suite; (c) Karmutsen Formation: low-niobium suite; (d) Mount Hall gabbro: low-niobium suite.

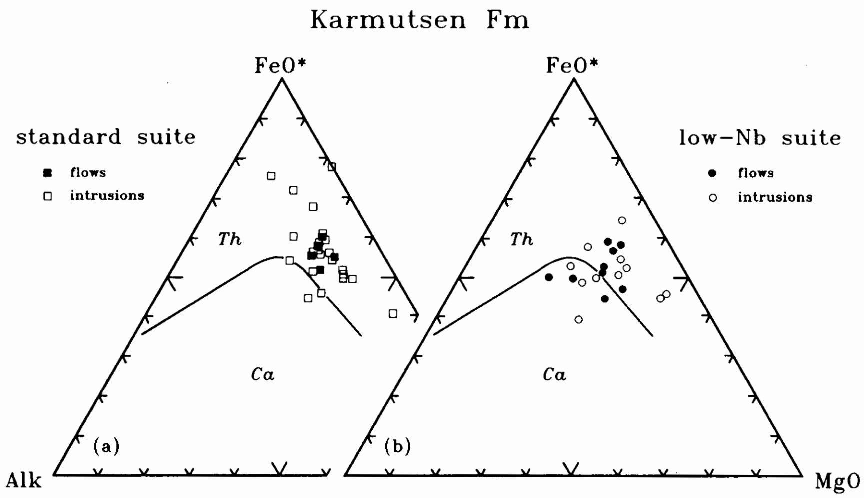

Figure 18. AFM triangle diagrams for basalts of the Karmutsen Formation and intrusions of the Mount Hall gabbro. Tholeiite (Th)-calcalkaline (Ca) dividing line after Irvine and Baragar (1971). Alk = Na_2O + K_2O; FeO* = total iron as FeO.

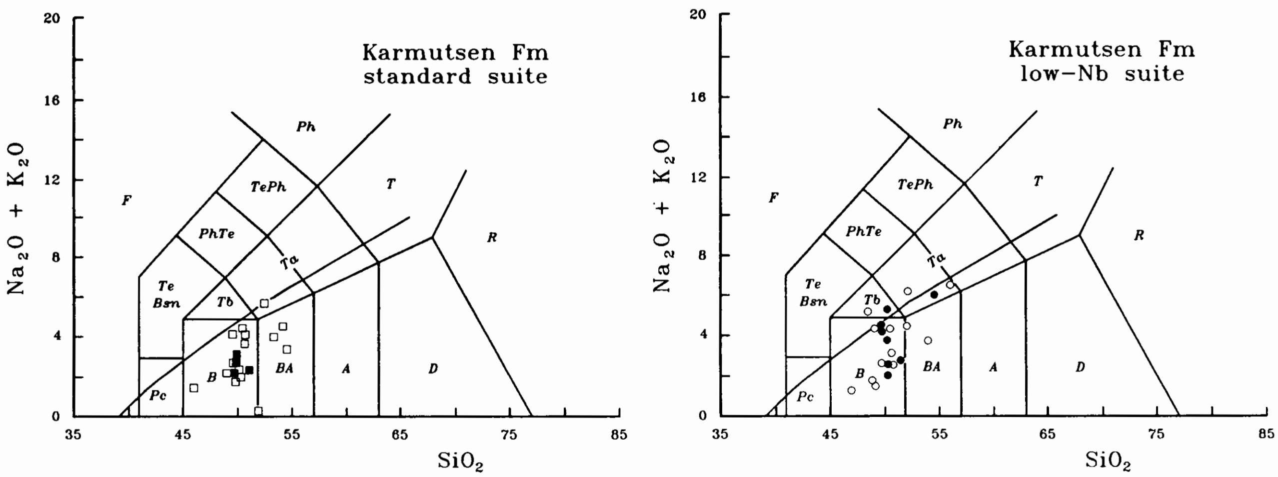

Figure 19. Alkali-silica diagrams for basalts of the Karmutsen Formation and intrusions of the Mount Hall gabbro. Fields after Le Maitre (1984); F= foidites; Pc= picrobasalt; Bsn= basanite; te= tephrite; PhTe= phonotephrite; TePh= tephriphonolite; Ph= phonolite; Tb= trachybasalt; Ta= trachyandesite; T= trachyte and alkali trachyte; B= basalt; BA= basalitc andesite; A= andesite; D= dacite; R= rhyolite and alkali rhyolite. Sloping solid line divides alkaline rocks (above line) from subalkaline rocks (below line), after Irvine and Baragar (1971). Symbols as in Figure 18.

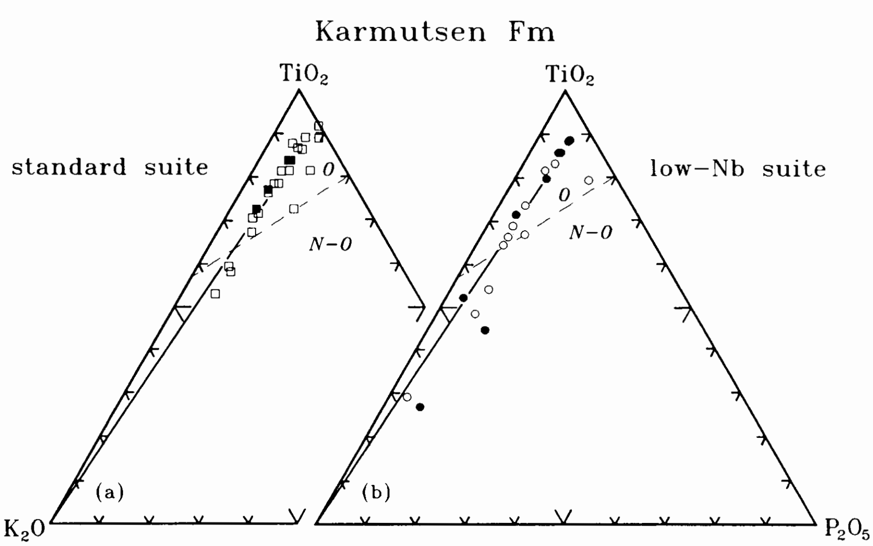

Figure 20. TiO_2-K_2O-P_2O_5 diagrams for basalts of the Karmutsen Formation and intrusions of the Mount Hall gabbro. Fields after Pearce *et al.* (1975) are shown for reference; O= oceanic basalts; N-O= continental basalts. The TiO_2/ P_2O_5 ratio reference line is the same for both plots. Symbols as in Figure 18.

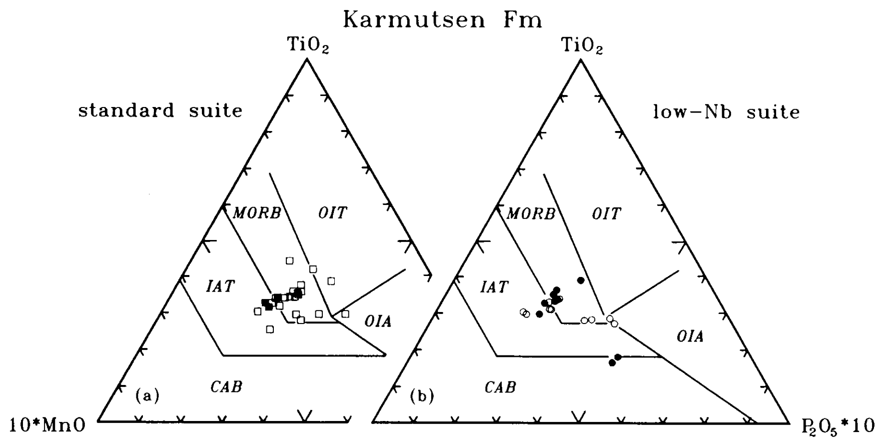

Figure 21. TiO2-MnO-P2O5 diagrams for basalts of the Karmutsen Formation and intrusions of the Mount Hall gabbro. Fields after Mullen (1983); CAB= calcalkaline basalts; IAT= island-arc tholeiites; MORB= mid-ocean ridge basalts; OIT= ocean-island tholeiites; OIA= ocean-island alkalic basalts. Symbols as in Figure 18.

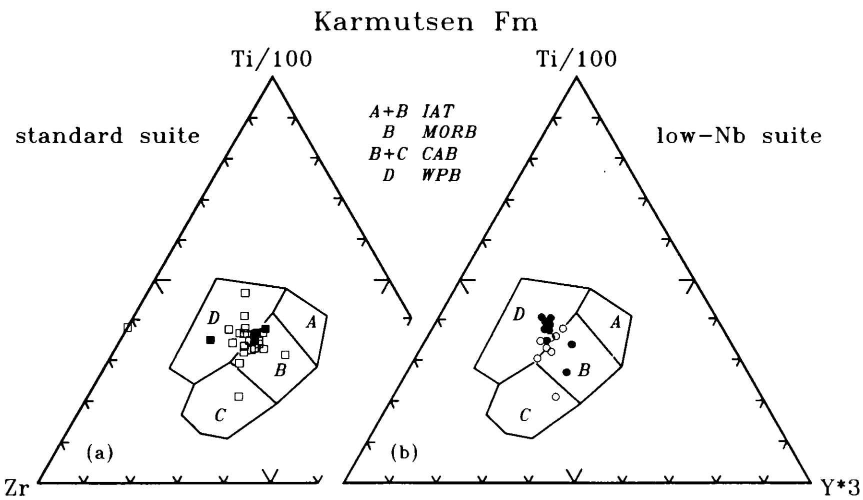

Figure 22. Ti-Zr-Y diagrams for basalts of the Karmutsen Formation and intrusions of the Mount Hall gabbro. Fields after Pearce and Cann (1973); CAB= calcalkaline basalts; IAT= island-arc tholeiites; MORB = mid-ocean ridge basalts; WPB = within-plate basalts. Symbols as in Figure 18.

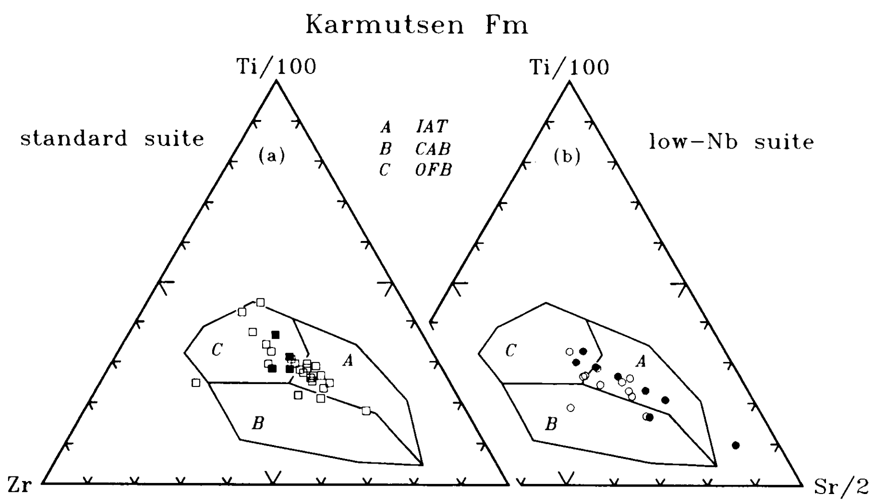

Figure 23. Ti-Zr-Sr diagrams for basalts of the Karmutsen Formation and intrusions of the Mount Hall gabbro. Fields after Pearce and Cann (1973); CAB= calcalkaline basalts; IAT= island-arc tholeiites; OFB = ocean-floor basalts. Symbols as in Figure 18.

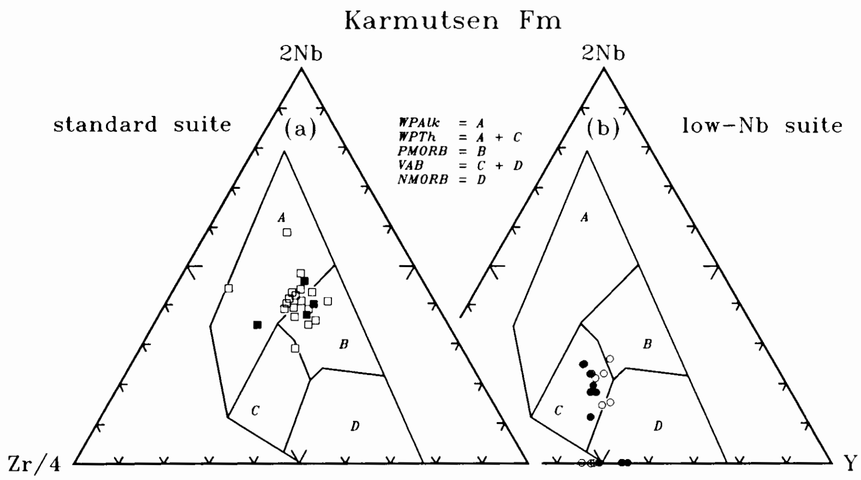

Figure 24. Nb-Zr-Y diagrams for basalts of the Karmutsen Formation and intrusions of the Mount Hall gabbro. Fields after Menschede (1986); WPAlk= within plate alkalic basalt; WPTh= within-plate tholeiite; PMORB= plume-type or enriched mid-ocean ridge basalts; NMORB= normal mid-ocean ridge basalts; VAB= volcanic arc basalts (tholeiites). Symbols as in Figure 18. Data points on the Zr-Y margin of the triangle have Nb values below detection limit.

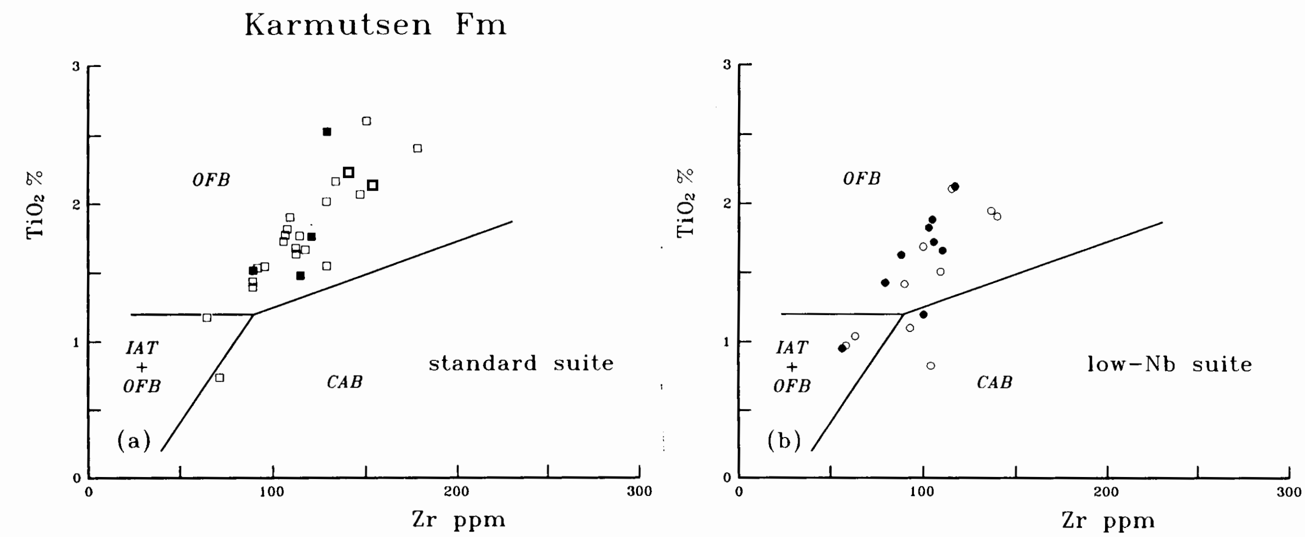

Figure 25. TiO_2-Zr diagrams for basalts of the Karmutsen Formation and intrusions of the Mount Hall gabbro. Fields after Garcia (1978); CAB= calcalkaline basalts; IAT= island-arc tholeiites; OFB= ocean-floor basalts. Symbols as in Figure 18.

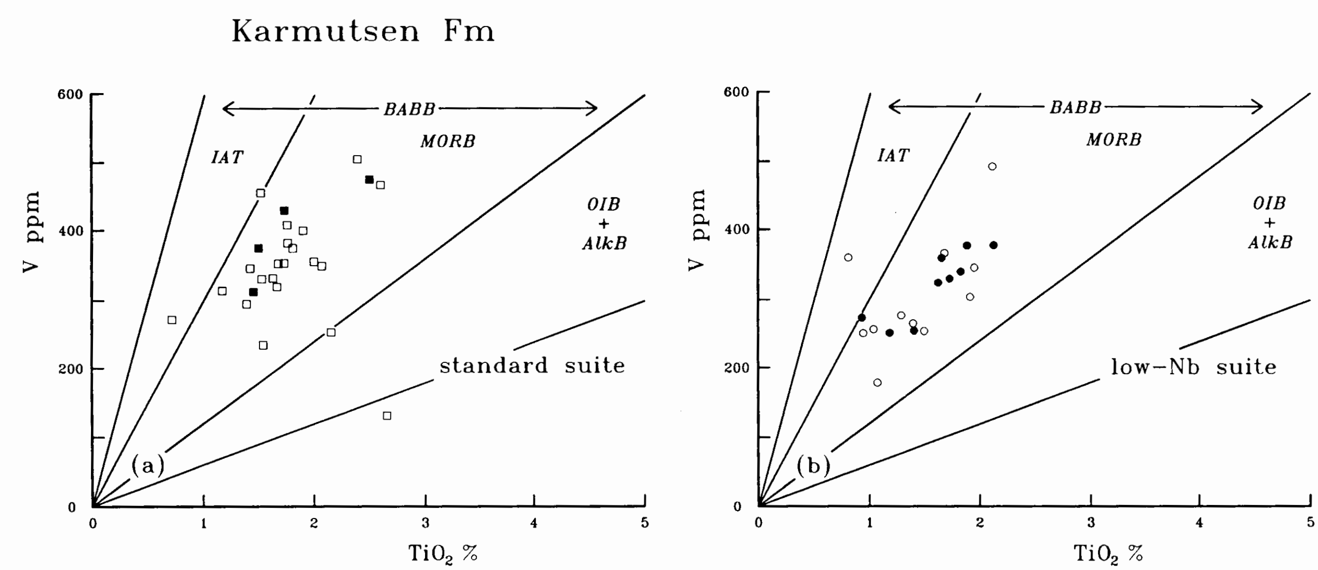

Figure 26. TiO_2-V diagrams for basalts of the Karmutsen Formation and intrusions of the Mount Hall gabbro. Fields after Shervais (1982); IAT= island-arc tholeiites; MORB= mid-ocean ridge basalts; BABB= back-arc basin basalts; OIB= ocean-island basalt; AlkB= alkalic basalt. Symbols as in Figure 18.

cherts along the railway line about 4 kilometres south of Cameron Lake; the other, a diabase sill, intrudes McLaughlin Ridge tuffs in the upper Raft Creek area. However, sampling within the Alberni area is insufficient to determine the distribution of the two magma suites and test the spatial relationships observed in the Cowichan Lake map area.

Quatsino and Parson Bay Formations

Outcrops of the Quatsino and Parson Bay formations are restricted in the map area. Massive, pale-weathering, dark grey micrite of the Quatsino Formation outcrops along the Bamfield road south of Parsons Creek. A massive, poorly bedded limestone, with abundant silicified corals and other fossils along bedding planes, is associated with medium-grained, grey, limy sandstone on the south side of Mount Spencer. These rocks probably belong to the Parson Bay Formation. Cobbles of Parson Bay Formation black calcareous argillite with ammonite remains are also found in the creeks draining this area.

BONANZA GROUP

Bonanza Group volcanic rocks overlie the Vancouver Group sediments and are similarly restricted in outcrop. On Mount Spencer, basal, pale green feldspar-crystal tuffs and maroon tuffs and lapilli tuffs are overlain by pyroxene-feldspar crystal and crystal lapilli tuffs. Sedimentary interbeds in the Bonanza Group of the Cowichan Lake area (Massey 1995b) have yielded macrofossil remains (gastropods, pelecypods and ammonites) that are suggestive of Sinemurian to Pliensbachian ages, in agreement with biostratigraphic and geochronometric findings from the Bonanza Group of northern Vancouver Island (Muller *et al.*, 1974; Armstrong *et al.*, 1986).

NANAIMO GROUP

Clastic sediments of the Upper Cretaceous Nanaimo Group unconformably overlie older volcanic units and the Island Plutonic Suite (Plate 30). The sediments are most thickly developed in the Alberni Valley, although poorly exposed, except around the margin, due to Quaternary cover. Other major outcrop areas are around Labour Day Lake and the Cameron River - Summit Lake area. The sediments of the Nanaimo Group constitute major fining-upward cycles (Muller and Jeletzky, 1970), of which the first, the Benson-Haslam, is developed in the map area.

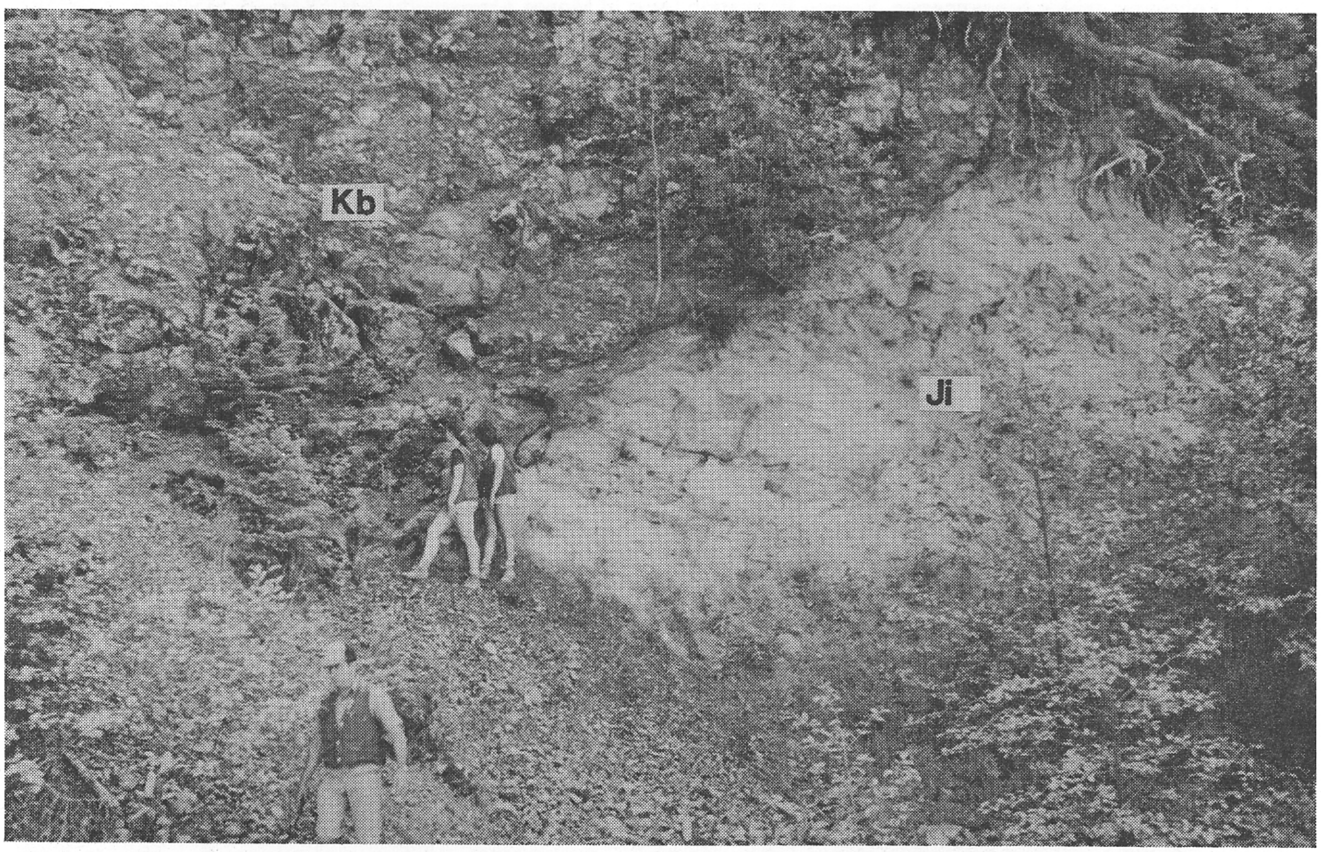

Plate 30. Basal boulder conglomerate of the Benson Formation (Kb) sitting disconformably upon white grus zone within Jurassic granodiorite (JI). The grus zone has yielded δO^{18} values suggestive of tropical weathering during the early to mid-Cretaceous (Muehlenbachs *in* Sutherland Brown and Yorath, 1985) (Bainbridge Main; NMA88-55-02: 5451512N; 374295E).

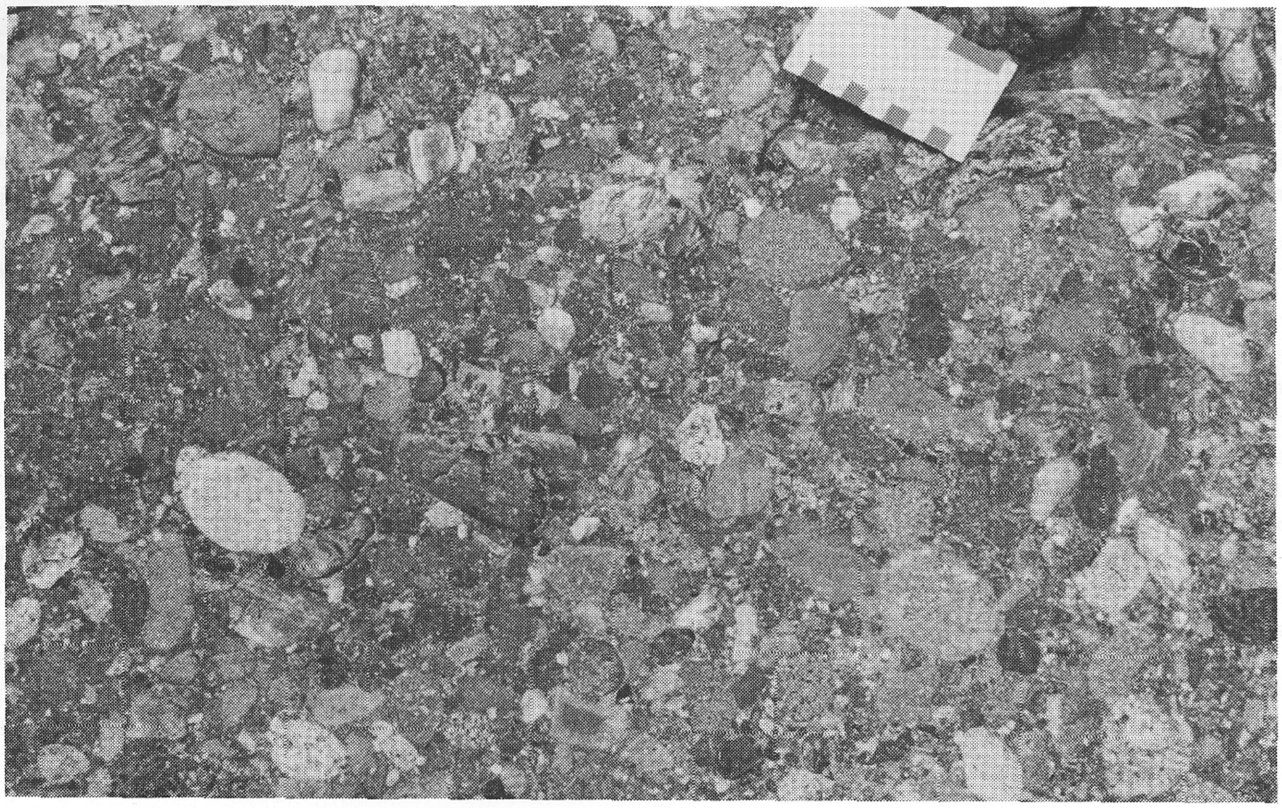

Plate 31. Polymictic pebble conglomerate, Benson Formation (west of Mount Arrowsmith; SDU88-06-10: 5454966N; 379865E).

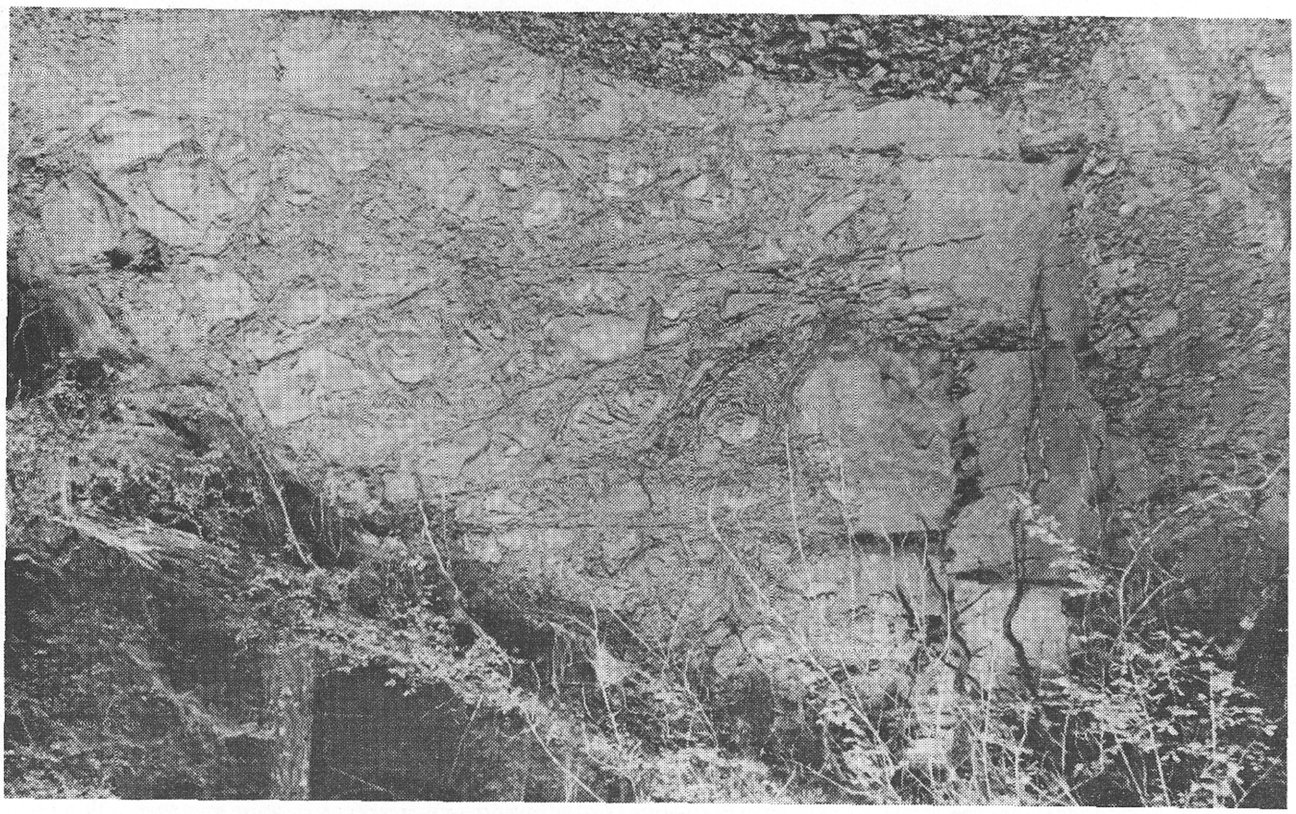

Plate 32. Spheroidal weathering in argillite, Haslam Formation (Highway 4, east of Port Alberni; JRI88-50-01: 5458200N; 373390E).

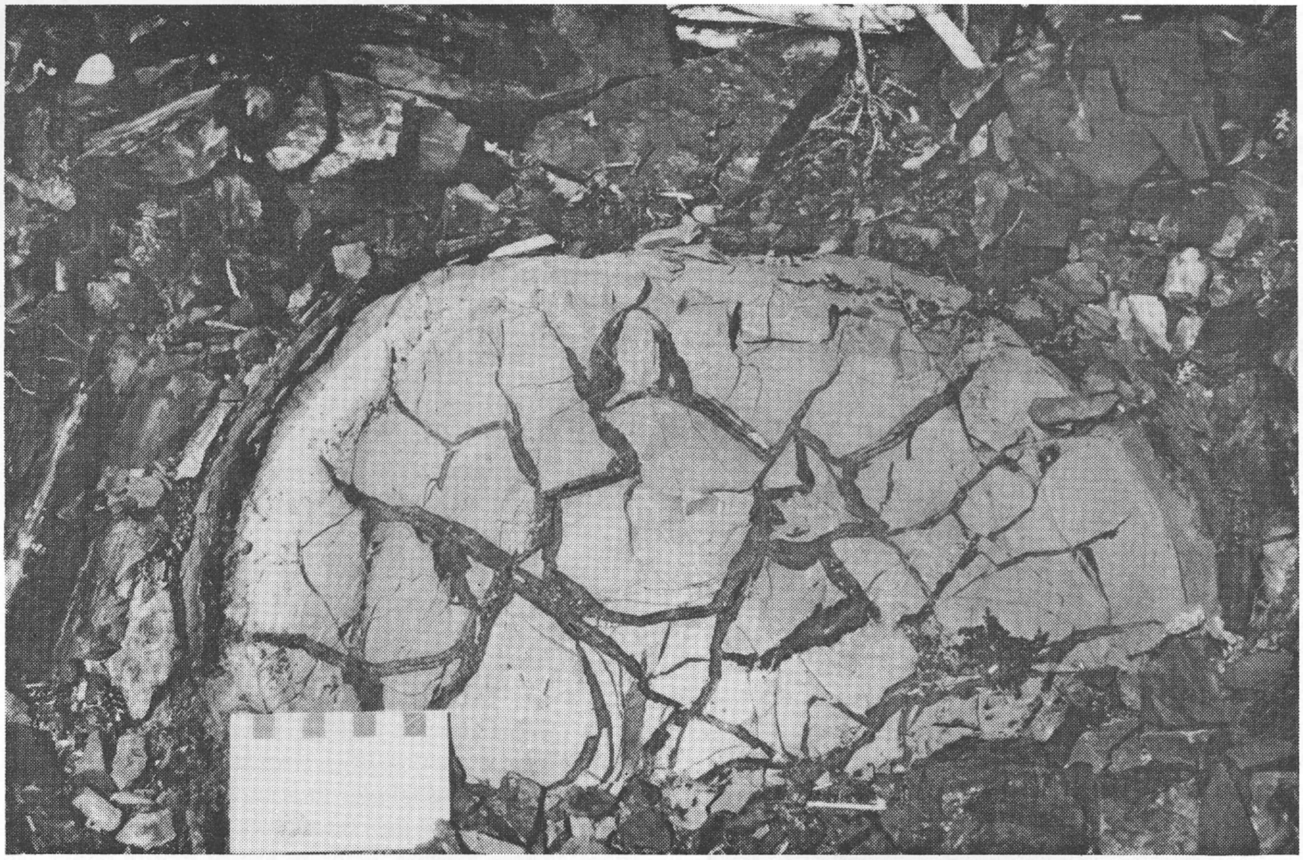

Plate 33. Calcareous septarian nodule in argillite, Haslam Formation (Mount Patlicant; SDU88-21-06: 5445285N; 376401E).

Benson Formation

The basal member of the Benson Formation (Tzuhalem Member; England, 1989) is a coarse, poorly bedded pebble and boulder conglomerate which is absent in many places. The conglomerates have rounded clasts which consist of a variety of volcanic and intrusive lithologies of immediate local origin; larger boulders are often angular (Plate 31). Minor red hematitic siltstone interbeds are occasionally seen.

Overlying sandstones (Saanich Member; England, 1989) are medium to coarse grained, grey with rusty weathered surfaces. They contain feldspar crystals and abundant lithic fragments, mostly volcanic rocks of local provenance. Black plant-fragments are characteristic of many beds. Calcareous cement is common. A few granule and pebble conglomerate beds are interbedded with the sandstones. Several sandstone beds contain abundant fossil faunas, including gastropods, pelecypods and possible broken ammonites and nautiloids.

Haslam Formation

The Haslam Formation consists of characteristic rusty weathering, black argillite and siltstone. It is fine to silty, often poorly bedded and friable, fracturing to pencil-shaped pieces or spheroidal onion-layers (Plate 32). Interbeds of fine to medium-grained, grey silty sandstone up to 1 metre thick occur within the argillites. Calcareous concretions are found (Plate 33) and replacement was extensive enough in one outcrop southwest of Mount Patlicant to result in a massive limestone that grades laterally into argillite. Fossils are present within the Haslam Formation, although poorly preserved due to the ubiquitous pencil-and-rod fracturing. They include gastropods, pelecypods, ammonites and plant material.

INTRUSIONS

Late Triassic Mount Hall Gabbro

Diabase and gabbro dikes of probable Late Triassic age are widespread in the area, intruding Paleozoic rocks of all types. These mafic intrusions have been recently defined as components of the Mount Hall gabbro (Massey, 1995a). They are medium to coarse-grained diabase, gabbro and leucogabbro with minor diorite. They are equigranular to porphyritic containing feldspar phenocrysts. The glomeroporphyritic clusters typical of gabbros in the Duncan area (Massey and Friday, 1988) are rare in the Alberni area. Mafic phenocrysts are absent. The geochemistry of the intrusions is similar to that of the Karmutsen Formation basalts with which they are probably coeval and comagmatic.

JURASSIC ISLAND PLUTONIC SUITE

Several granodioritic plutons and stocks of Early to Middle Jurassic age occur in the area. They are coeval with the Bonanza Group volcanics, although they intrude all Paleozoic and Mesozoic formations. These bodies have previously been referred to as the "Island intrusions" (Muller and Carson, 1969), but are here renamed the Island Plutonic Suite to follow lithostratigraphic conventions. Samples from several plutons throughout Vancouver Island have yielded a composite Rb-Sr isochron date of 183± 7 Ma (Armstrong *et al.*, 1986). These bodies are usually elongate in shape, although the Fourth Lake stock is roughly circular. The intrusions show considerable lithological variation. The Port Alberni pluton is fairly uniform throughout, comprising granodiorite and quartz diorite. The Fourth Lake stock is also apparently uniform in outcrop, but displays a gradual compositional variation from diorite and monzonite in the north to quartz diorite and granite in the south. The Corrigan pluton, in contrast, is heterogeneous and composite, comprising a mix of diorite, quartz diorite, granodiorite and monzogranite phases with abundant minor intrusive dikes.

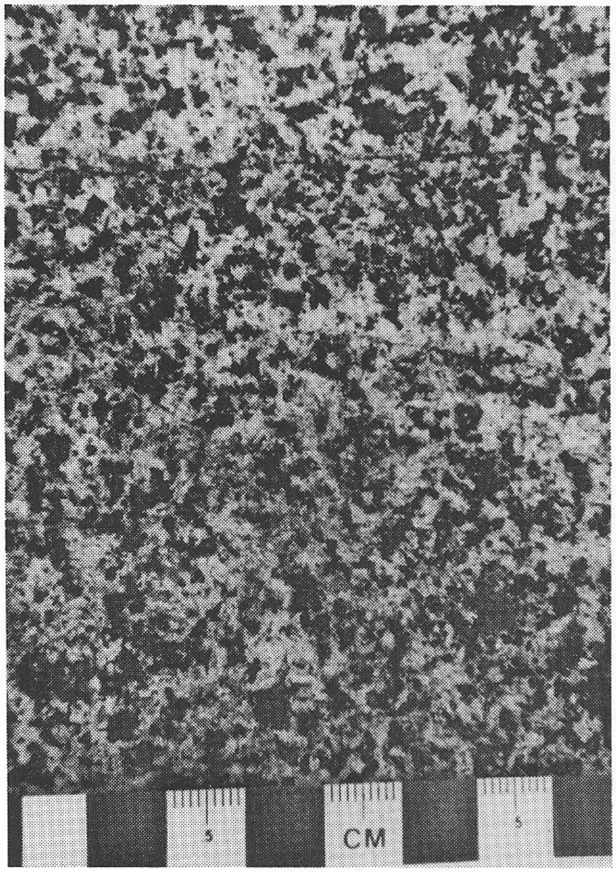

Plate 34. Granodiorite, Corrigan Creek pluton, Island Plutonic Suite (Elk Main; SFR88-22-03: 5432736N; 375264E).

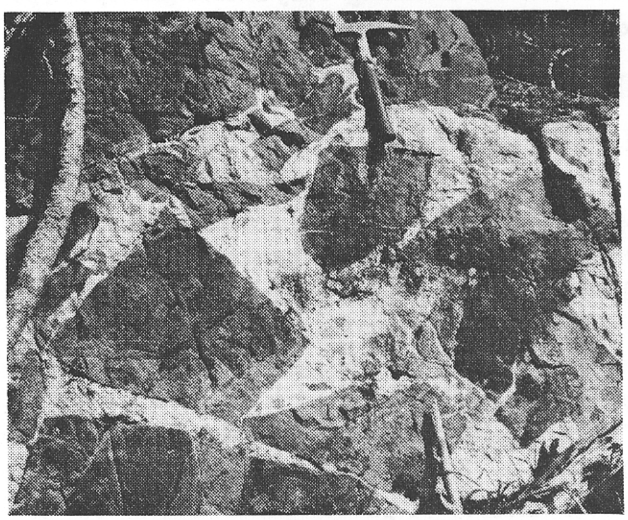

Plate 35. Agmatitic contact breccia, Corrigan Creek pluton, Island Plutonic Suite. Angular clasts of Karmutsen Formation feldspar basalt invaded by granodiorite leucosome (Pool Creek; SFR88-21-8: 5436396N; 376217E).

The dominant lithology in most bodies is a medium to coarse-grained, equigranular granodiorite to quartz diorite with a characteristic "salt-and-pepper" texture (Plate 34). Quartz is usually irregular in shape, often interstitial to the feldspars. Feldspars are white, though some pink staining is seen on weathered surfaces, and usually form subhedral laths. Hornblende is the principal mafic mineral. It is tabular to acicular, black to greenish black in colour and may be slightly larger than the feldspars. Where present, black to brown biotite books are subordinate to hornblende. Chlorite replaces hornblende and biotite in altered rocks. Colour index varies from 10 to 20 in the granodiorites, but may range up to 40 in diorites. White fine-grained aplite dikelets and veins cut the granodiorites.

Most of the larger intrusive bodies are rich in inclusions, particularly in marginal zones where agmatitic intrusive breccias are developed (Plate 35). The angular to subrounded xenoliths of local country rock lithologies show a range of amphibolitization and assimilation features. The xenoliths are normally randomly oriented.

Several small gabbro stocks and dikes are exposed in the central part of the map area from Cop Creek to Rift Creek. Lithologically they are identical to gabbros of the Mount Hall gabbro, with which they were originally included during mapping (Massey *et al.*, 1989). However, these gabbros are geochemically distinct from the Late Triassic gabbros and are here included with the Island Plutonic Suite. Definitive geochronological work is lacking, however.

Intrusions of the Island Plutonic Suite in the Cowichan uplift span the compositional range from gabbro to granite with the mean being granodiorite to quartz monzodiorite. They are a typical metaluminous, medium to high-potassium calcalkaline suite (Figures 27 to 34). Normative mineralogy suggests that the suite evolved from mafic compositions along a typical calcalkaline trend to the 5 kilobar eutectic (Figure 33). At lower pres-

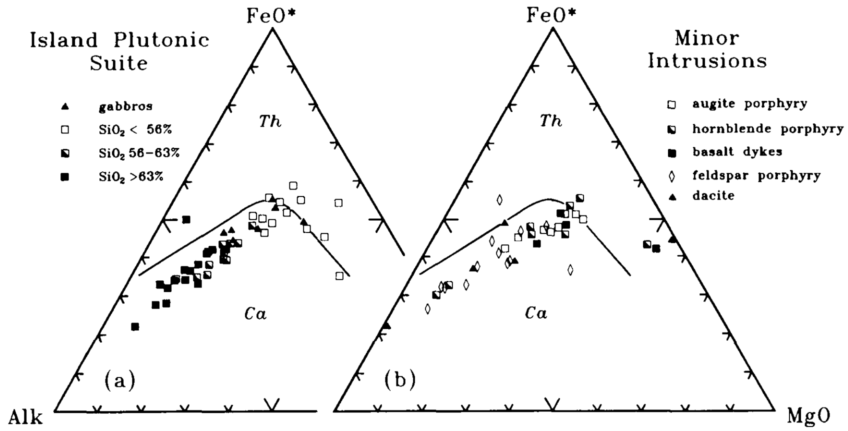

Figure 27. AFM triangle diagram for rocks of the Island Plutonic Suite and probably coeval minor intrusions. Tholeiite-calcalkaline dividing line after Irvine and Baragar (1971). Alk = Na_2O + K_2O; FeO* = total iron as FeO.

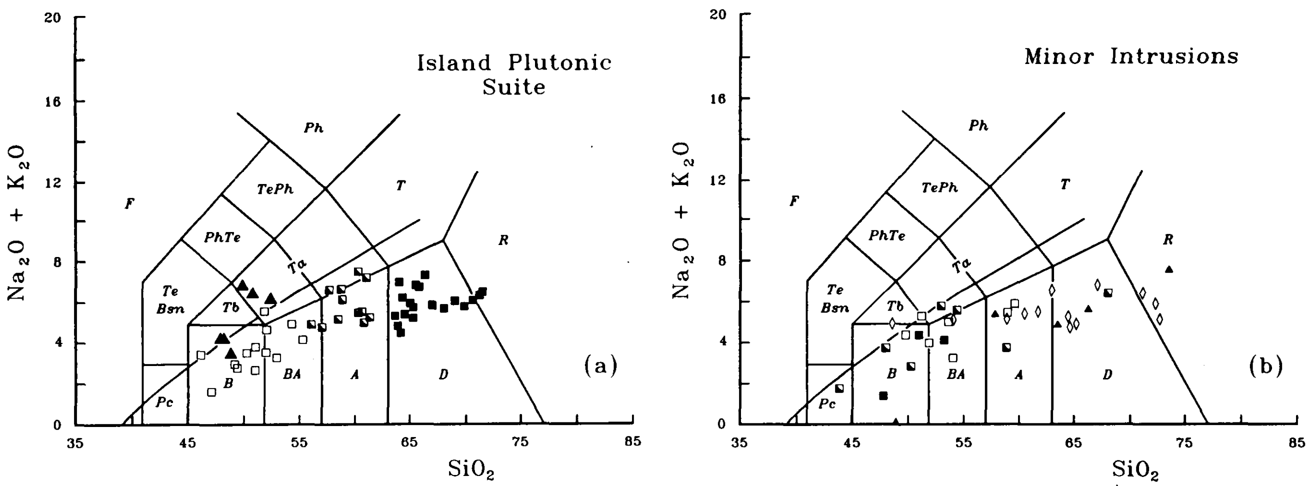

Figure 28. Alkali-silica diagram for rocks of the Island Plutonic Suite and probably coeval minor intrusions. Fields after Le Maitre (1984); dashed line divides alkaline rocks (above line) from subalkaline rocks (below line), after Irvine and Baragar (1971). Symbols as in Figure 27.

sures the melts cluster close to the trace of the isobaric minima. Major and trace-element discriminants show characteristics of a convergent-margin environment, for both the felsic and more mafic lithologies (Figures 35 to 46). Bonanza Group volcanics have very similar geochemical signatures and are probably consanguinous with the plutonic rocks (Massey, 1995b).

MINOR INTRUSIONS

A variety of dikes and small irregular intrusions occur throughout the area. They are probably coeval with the Island Plutonic Suite with which they are spatially related and geochemically indistinguishable (Figures 27 to 46). Lithologically, they include intermediate feldspar porphyry, hornblende feldspar porphyry and minor diabase.

A hornblende feldspar porphyry dike cutting Duck Lake Formation volcanics north of Green Mountain yielded a late Early Cretaceous K-Ar age of 102± 4 Ma (Table C-1, Figure C, in pocket). Lithologically the porphyry is very similar to Tertiary porphyritic dacites (*q.v.*), with which it was included originally (Massey *et al.*, 1989), although hornblende phenocrysts tend to be tabular rather than acicular. The dike is quite fresh and the age determination appears to be correct and without analytical problems. The rock contains about 7 per cent hornblende and 15 per cent feldspar phenocrysts in a light grey siliceous matrix. The black hornblendes range up to 6 millimetres in length, averaging 2 millimetres. White-weathering, laths of plagioclase are compositionally zoned and vary up to 7 millimetres long, averaging 2 millimetres. It also contains 1 to 2 per cent small cognate inclusions of a fine-grained microdiorite similar lithologically to microdiorite dikes seen nearby. Geochemically, the porphyry is a high-potassium calcalkaline rhyodacite differing from the Tertiary porphyries in having higher silica, potash, rubidium, barium and zirconium and lower magnesia, lime and alumina. It is easily discriminated from the Tertiary intrusions on most geochemical diagrams (Figures 47 to 60). More detailed mapping in the area is needed to determine how widespread these por-

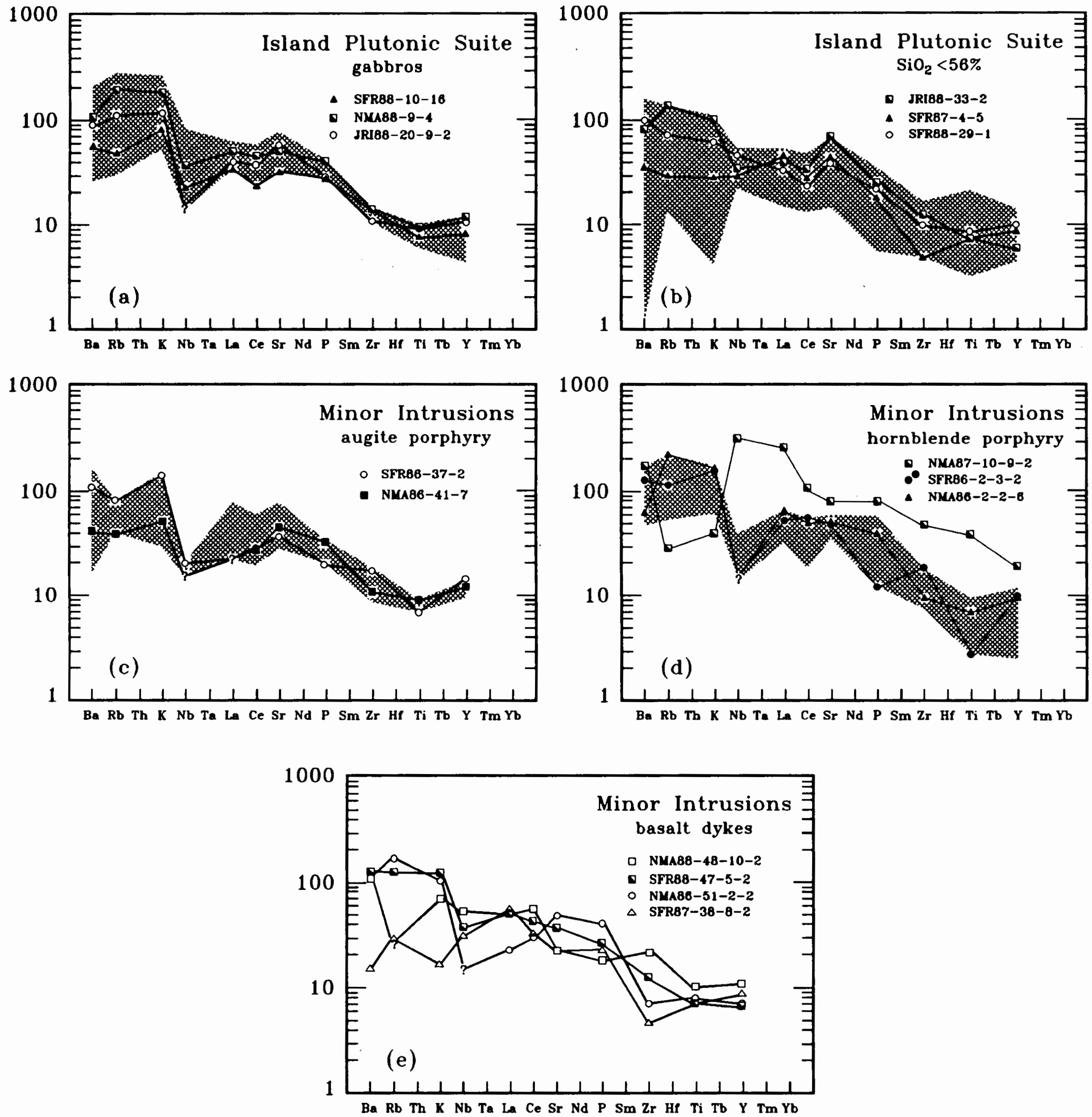

Figure 29. Normalized trace-element plots for mafic lithologies of the Island Plutonic Suite and probably coeval minor intrusions. Normalizing values after Thompson *et al.* (1983). Shaded area represents the range of values for all samples of a particular suite in the Sicker Project area. Selected representative samples are shown individually. (a) gabbros of unknown age from the Alberni area, possibly part of the Island Plutonic Suite; (b) Island Plutonic Suite, SiO_2< 56% ; (c) minor intrusions, augite porphyries; (d) minor intrusions, hornblende porphyries; (e) minor intrusions, basalt dikes.

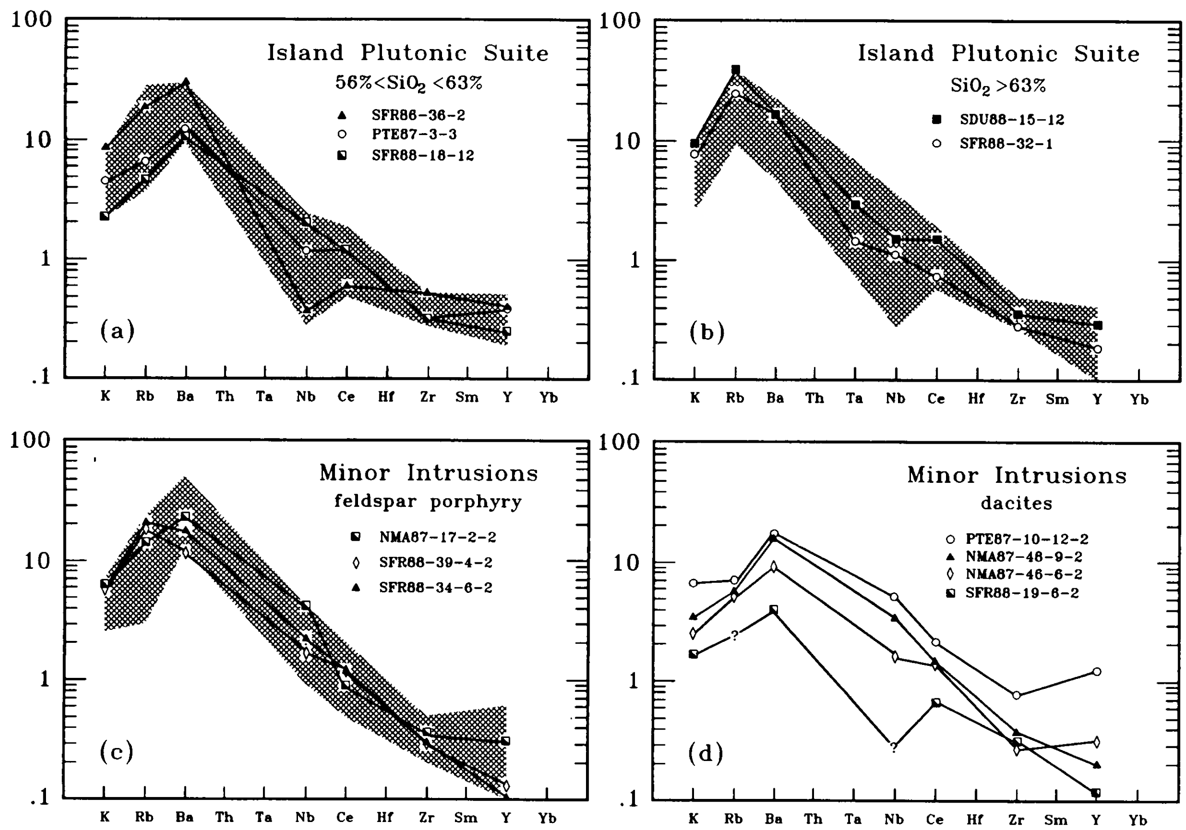

Figure 30. Normalized trace-element diagrams for intermediate to felsic lithologies of the Island Plutonic Suite and probably coeval minor intrusions. Normalizing values after Pearce *et al.* (1984). Shaded area represents the range of values for all samples of a particular suite in the Sicker Project area. Selected representative samples are shown individually. (a) Island Plutonic Suite, SiO_2 56 - 63%; (b) Island Plutonic Suite, SiO_2 > 63%; (c) minor intrusions, feldspar porphyries; (d) minor intrusions, dacites.

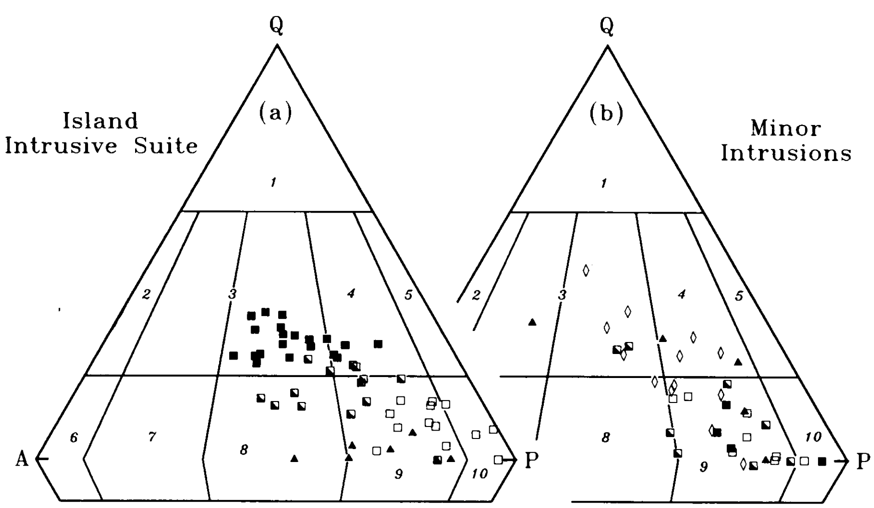

Figure 31. Normative Q-A-P-F diagram for rocks of the Island Plutonic Suite and probably coeval minor intrusions. Fields after Streckeisen (1967); 1= quartz-rich granitoids; 2= alkali feldspar granite; 3= granite; 4= granodiorite; 5 = tonalite-trondhjemite; 6= alkali feldspar syenite; 7= syenite; 8= monzonite; 9= monzodiorite, monzogabbro; 10= diorite, gabbro. Normative Ab is partitioned between alkali feldspar (A) and plagioclase feldspar (P) by the method of Le Maitre (1976); A = Or x T, P = An x T, where T = (Or + Ab + An)/(Or + An). Symbols as in Figure 27.

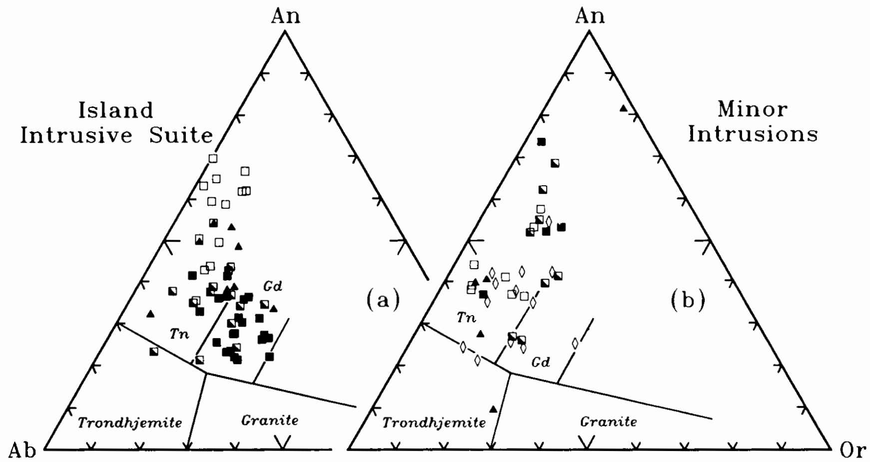

Figure 32. Normative An-Ab-Or diagram for rocks of the Island Plutonic Suite and probably coeval minor intrusions. Fields are after Barker (1979) and O'Connor (1965); Tn= tonalite; Gd= granodiorite. Symbols as in Figure 27.

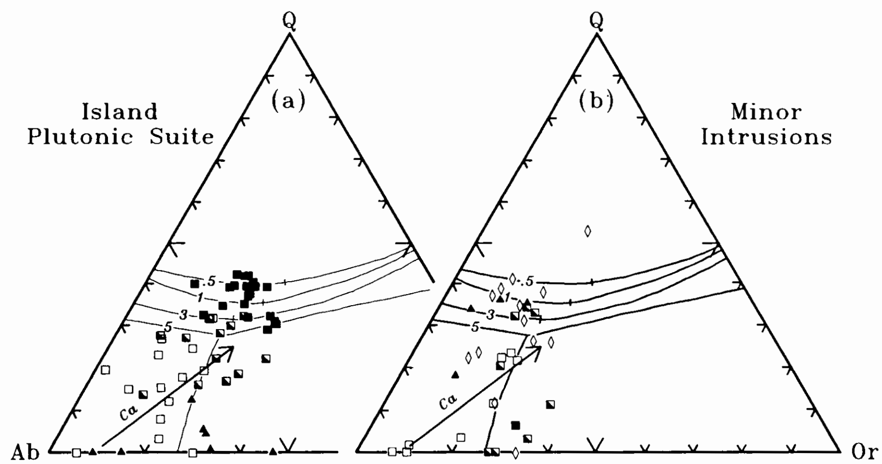

Figure 33. Normative Q-Ab-Or diagram for rocks of the Island Plutonic Suite and probably coeval minor intrusions. Curves are for water-saturated liquids in equilibrium with quartz and alkali feldspar at indicated confining pressures in kilobars (Carmichael *et al.*, 1974, after data of Tuttle and Bowen, 1958). Isobaric minima are indicated on the curves except at 5 kilobars where a ternary eutectic is generated by intersection of the alkali feldspar solvus with the liquidus surface. Ca= trend for typical calkalkine suite (Abdel-Rahman, 1990, after Arth *et al.*, 1978). Symbols as in Figure 27.

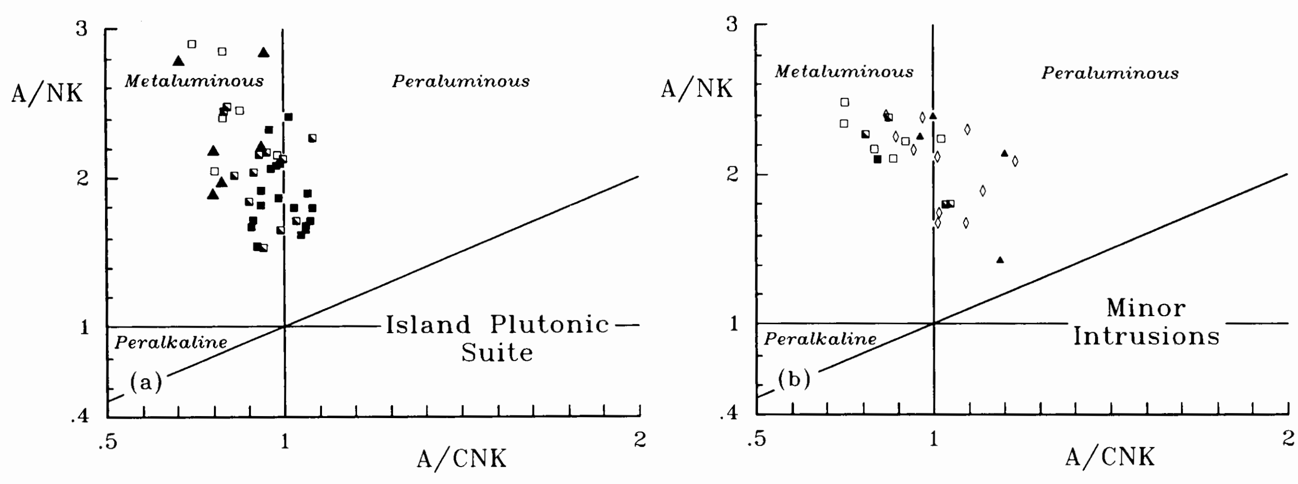

Figure 34. Shand's Index for rocks of the Island Plutonic Suite and probably coeval minor intrusions (Shand, 1927). A, C, N and K are the molar values of Al_2O_3, CaO, Na_2O and K_2O respectively. Symbols as in Figure 27.

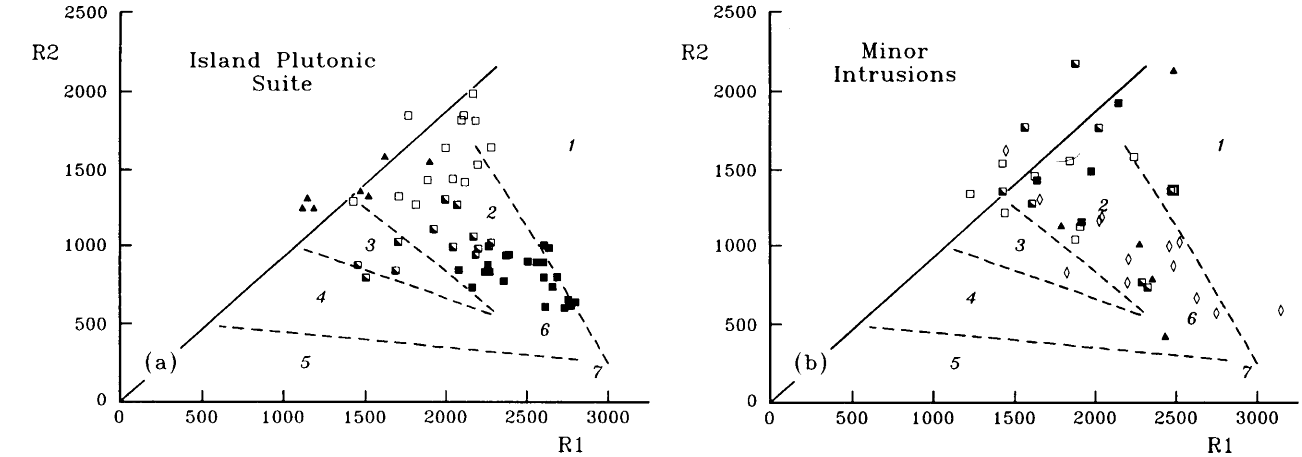

Figure 35. de la Roche R1 - R2 multicationic diagram for rocks of the Island Plutonic Suite and probably coeval minor intrusions (after de la Roche *et al.*, 1980); R1 = 4Si - 11(Na + K) - 2(Fe + Ti); R2 = 6Ca + 2Mg + Al. Fields after Batchelor and Bowden (1985): 1= mantle fractionates; 2= destructive plate margin (pre-plate collision); 3= post-plate collision ("permitted" plutons); 4= late orogenic (sub-alkaline); 5= anorogenic (alkaline-peralkaline); 6= synorogenic (anatectic); 7= postorogenic. Symbols as in Figure 27.

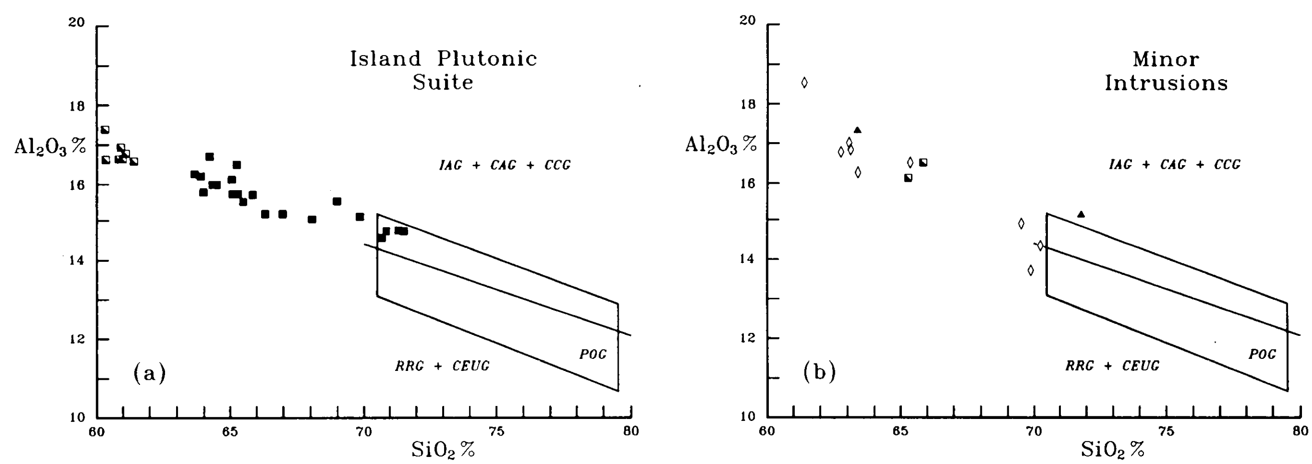

Figure 36. Al_2O_3-SiO_2 diagram for felsic lithologies of the Island Plutonic Suite and probably coeval minor intrusions; fields after Maniar and Piccoli (1989). IAG= island-arc granitoids; CAG= continental-arc granitoids; CCG= continental-collision granitoids; POG= postorogenic granitoids; RRG= rift-related granitoids; CEUG= continental epeirogenic-uplift granitoids. Symbols as in Figure 27.

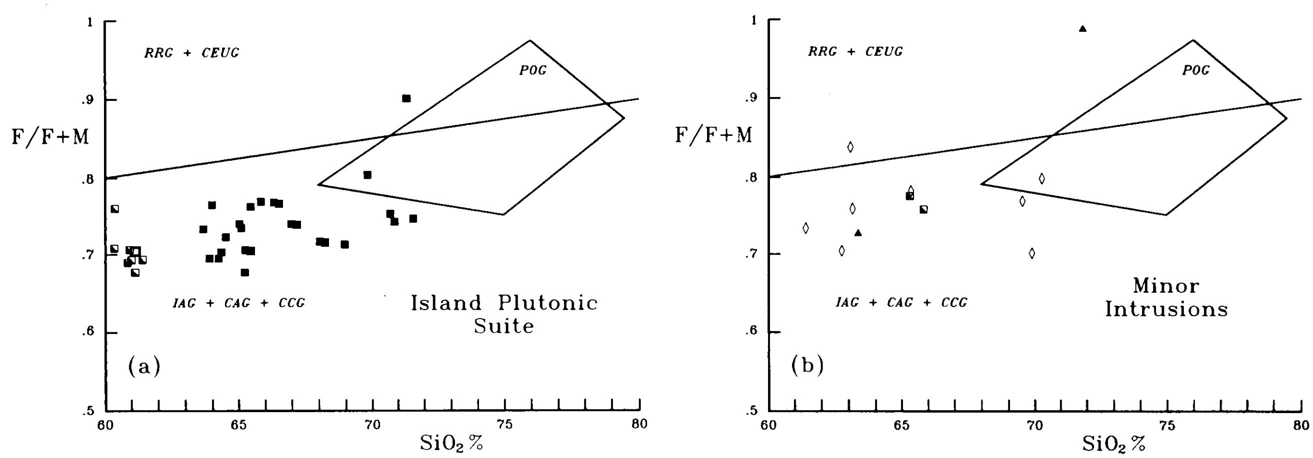

Figure 37. F/F + M versus SiO_2 diagram for rocks of the Island Plutonic Suite and probably coeval minor intrusions; fields after Maniar and Piccoli (1989). F = total iron as FeO; M = MgO. Field labels as in Figure 36. Symbols as in Figure 27.

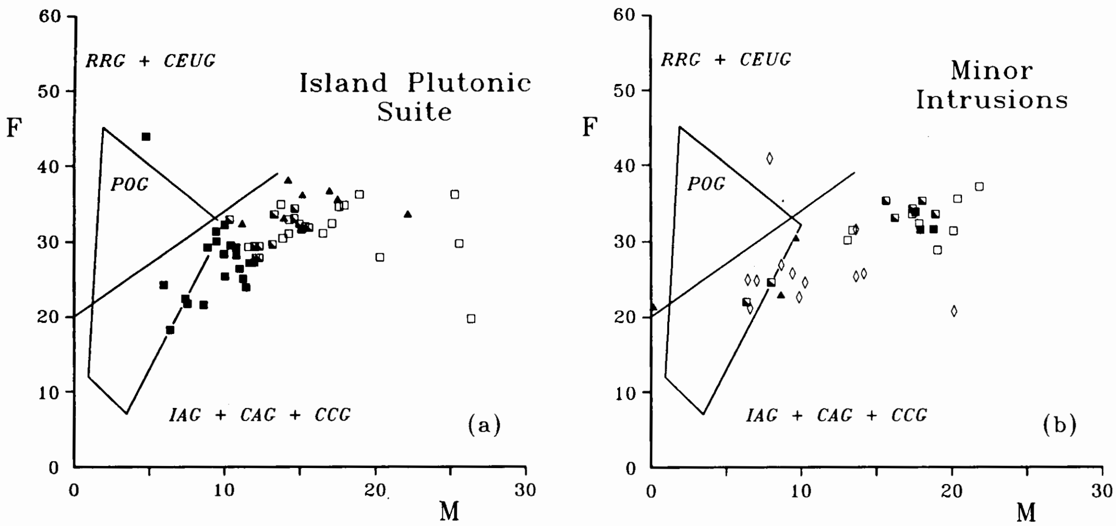

Figure 38. F-M diagram for rocks of the Island Plutonic Suite and probably coeval minor intrusions; fields after Maniar and Piccoli (1989). F = total iron as FeO; M = MgO. Note that F and M, in this diagram, are the normalized values from plotting samples in the ternary (Al_2O_3 - Na_2O - K_2O)-(FeO^*)-(MgO) diagram. Field labels as in Figure 36. Symbols as in Figure 27.

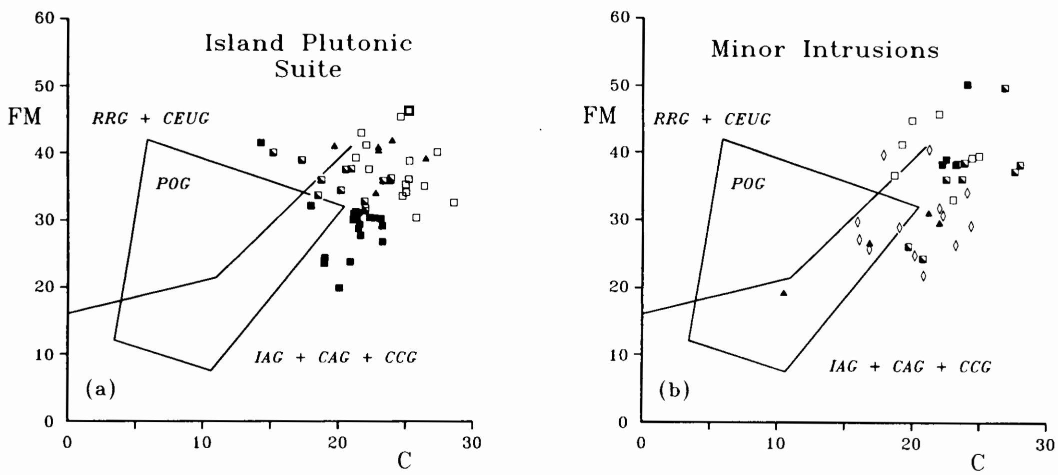

Figure 39. FM-C diagram for rocks of the Island Plutonic Suite and probably coeval minor intrusions; fields after Maniar and Piccoli (1989). F = total iron as FeO; M = MgO; C = CaO. Note that FM and C, in this diagram, are the normalized values from plotting samples in the ternary (Al_2O_3 - Na_2O - K_2O)-(FeO^* + MgO)-(CaO) diagram. Field labels as in Figure 36. Symbols as in Figure 20.

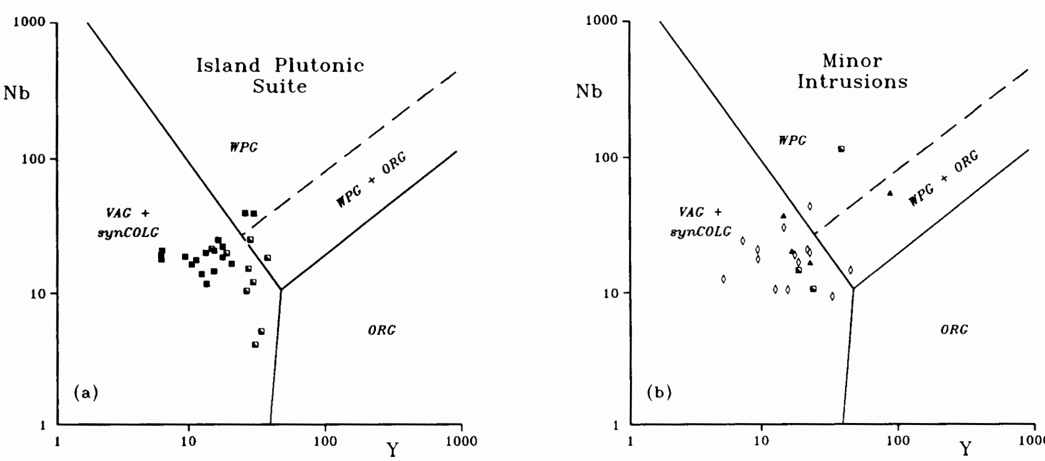

Figure 40. Nb-Y diagram for intermediate to felsic lithologies of the Island Plutonic Suite and probably coeval minor intrusions; fields after Pearce *et al.* (1984). VAG= volcanic-arc granites; synCOLG= syncollision granites; WPG= within-plate granites; ORG= ocean-ridge granites. Symbols as in Figure 27.

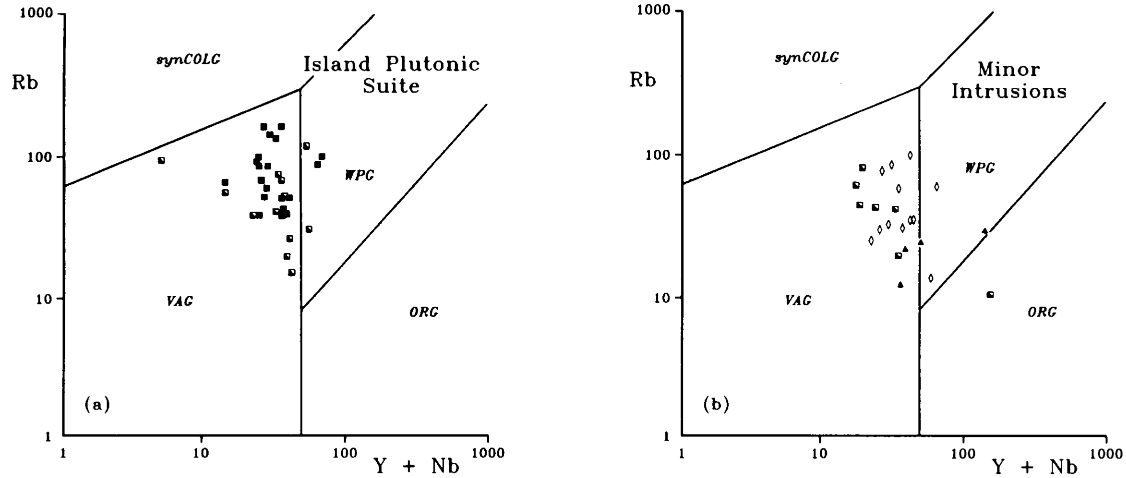

Figure 41. Rb-(Nb+ Y) diagram for intermediate to felsic lithologies of the Island Plutonic Suite and probably coeval minor intrusions; fields after Pearce *et al.* (1984), labelled as in Figure 40. Symbols as in Figure 27.

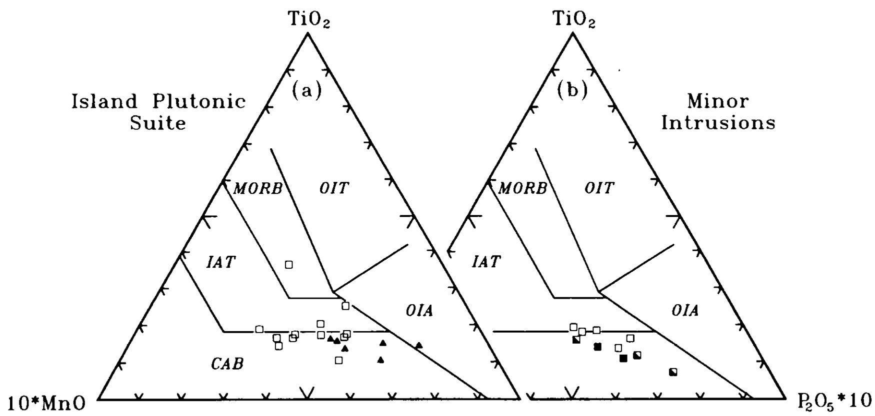

Figure 42. TiO_2-MnO-P_2O_5 diagrams for mafic lithologies of the Island Plutonic Suite and probably coeval minor intrusions. Fields after Mullen (1983); CAB= calcalkaline basalts; IAT= island-arc tholeiites; MORB= mid-ocean ridge basalts; OIT= ocean-island tholeiites; OIA= ocean-island alkalic basalts. Symbols as in Figure 27.

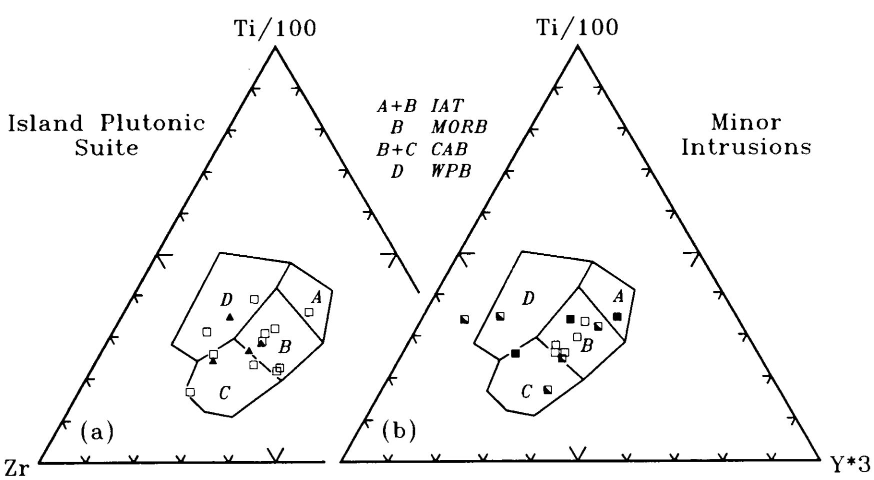

Figure 43. Ti-Zr-Y diagrams for mafic lithologies of the Island Plutonic Suite and probably coeval minor intrusions. Fields after Pearce and Cann (1973); CAB= calcalkaline basalts; IAT= island-arc tholeiites; MORB= mid-ocean ridge basalts; WPB= within-plate basalts. Symbols as in Figure 27.

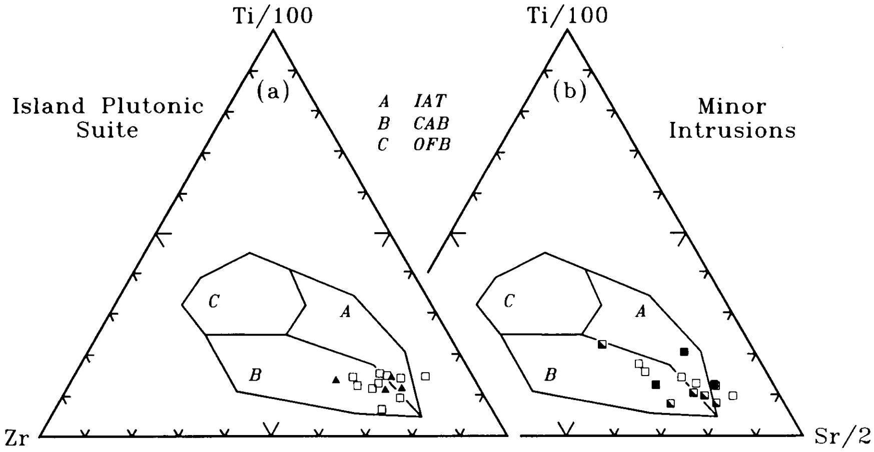

Figure 44. Ti-Zr-Sr diagrams for mafic lithologies of the Island Plutonic Suite and probably coeval minor intrusions. Fields after Pearce and Cann (1973); CAB= calcalkaline basalts; IAT= island-arc tholeiites; OFB= ocean-floor basalts. Symbols as in Figure 27.

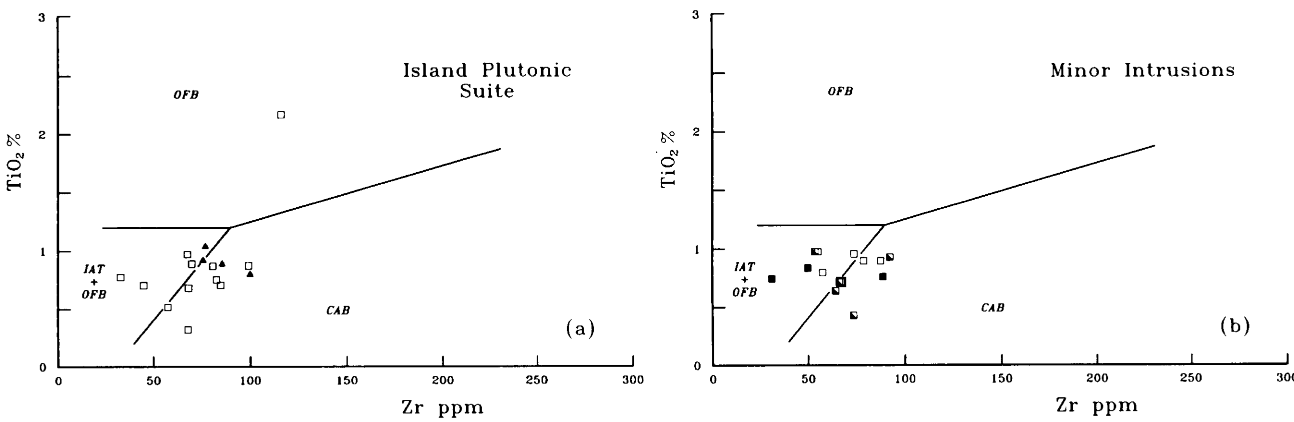

Figure 45. TiO_2-Zr diagrams for mafic lithologies of the Island Plutonic Suite and probably coeval minor intrusions. Fields after Garcia (1978); CAB= calcalkaline basalts; IAT= island-arc tholeiites; OFB= ocean-floor basalts. Symbols as in Figure 27.

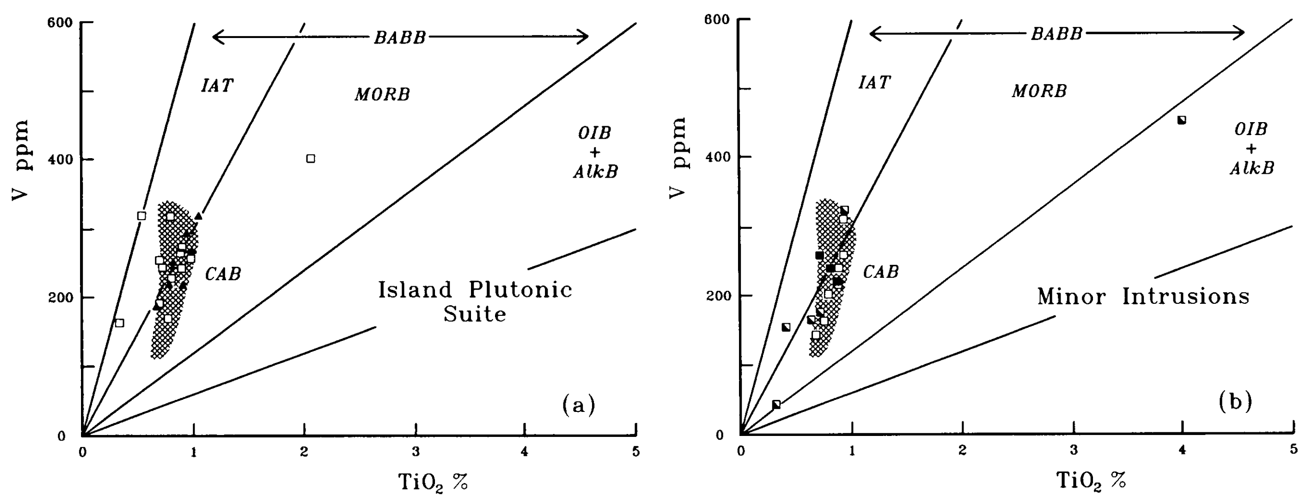

Figure 46. TiO_2-V diagrams for mafic lithologies of the Island Plutonic Suite and probably coeval minor intrusions. Fields after Shervais (1982); IAT= island-arc tholeiites; MORB= mid-ocean ridge basalts; BABB= back-arc basin basalts; OIB= ocean-island basalt; AlkB= alkalic basalt. Shaded area labelled CAB is that occupied by typical calcalkaline basalts. Symbols as in Figure 27.

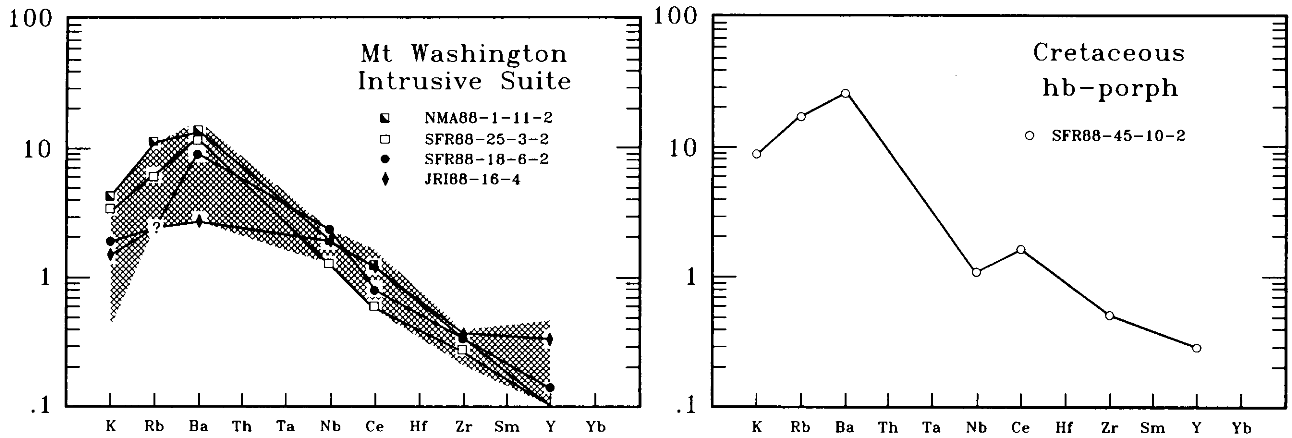

Figure 47. Normalized trace-element diagrams for the Mount Washington Intrusive Suite and a Cretaceous hornblende porphyry. Normalizing values after Pearce *et al.* (1984). Shaded area represents the range of values for all samples in the Sicker Project area. Selected representative samples are shown individually. (a) Mount Washington Intrusive Suite; (b) Cretaceous hornblende porphyry.

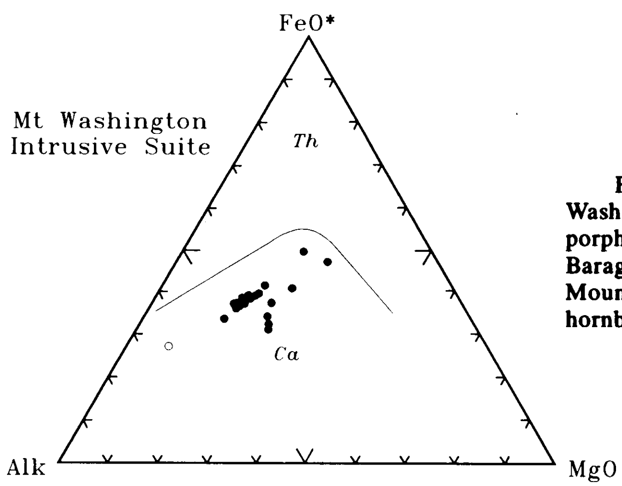

Figure 48. AFM triangle diagram for the Mount Washington Intrusive Suite and a Cretaceous hornblende porphyry. Tholeiite-calcalkaline dividing line after Irvine and Baragar (1971). Alk = $Na_2O + K_2O$; FeO* = total iron as FeO. Mount Washington Intrusive Suite, filled circles; Cretaceous hornblende porphyry, open circle.

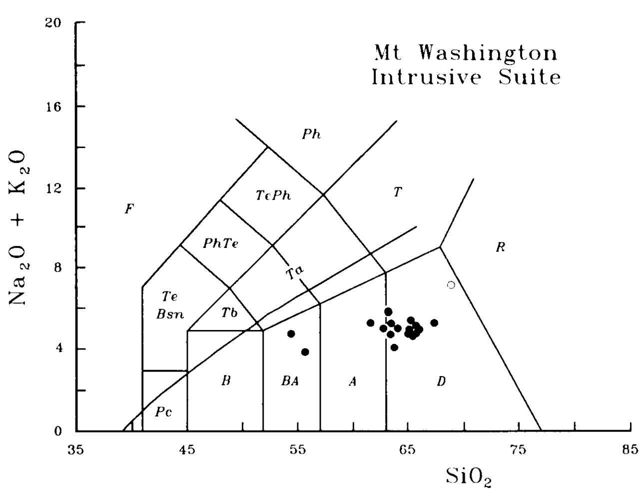

Figure 49. Alkali-silica diagram for for the Mount Washington Intrusive Suite and a Cretaceous hornblende porphyry. Fields after Le Maitre (1984); dashed line divides alkaline rocks (above line) from subalkaline rocks (below line), after Irvine and Baragar (1971). Symbols as in Figure 48.

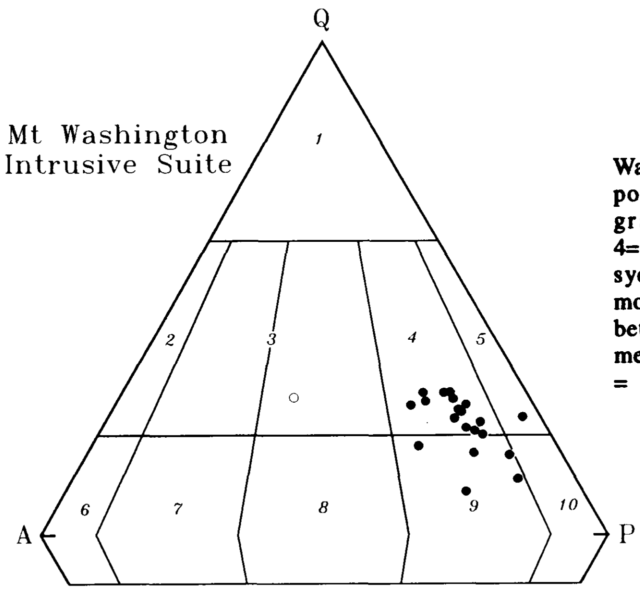

Figure 50. Normative Q-A-P-F diagram for for the Mount Washington Intrusive Suite and a Cretaceous hornblende porphyry. Fields after Streckeisen (1967); 1= quartz-rich granitoids; 2= alkali feldspar granite; 3= granite; 4= granodiorite; 5= tonalite-trondhjemite; 6= alkali feldspar syenite; 7= syenite; 8= monzonite; 9= monzodiorite, monzogabbro; 10= diorite, gabbro. Normative Ab is partitioned between alkali feldspar (A) and plagioclase feldspar (P) by the method of Le Maitre (1976); A = Or x T, P = An x T, where T = (Or + Ab + An)/(Or + An). Symbols as in Figure 48.

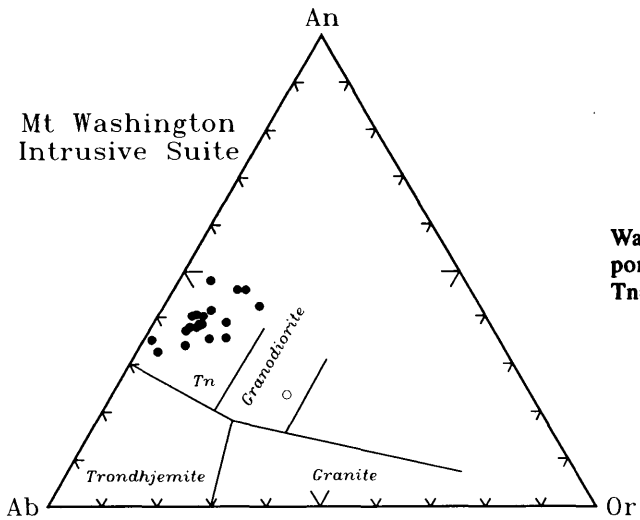

Figure 51. Normative An-Ab-Or diagram for the Mount Washington Intrusive Suite and a Cretaceous hornblende porphyry. Fields are after Barker (1979) and O'Connor (1965); Tn= tonalite. Symbols as in Figure 48.

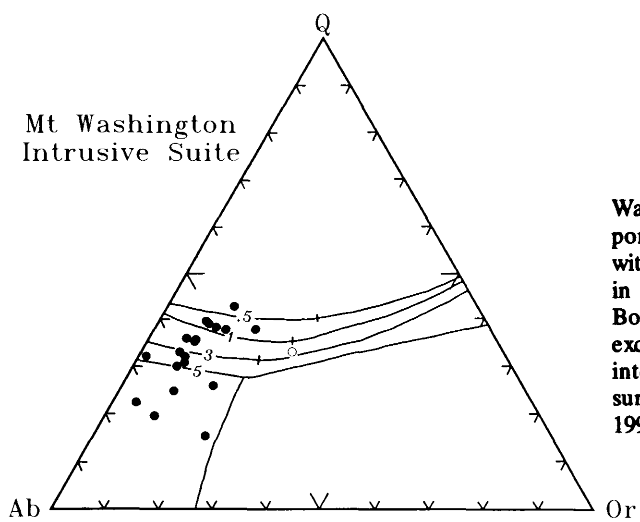

Figure 52. Normative Q-Ab-Or diagram for the Mount Washington Intrusive Suite and a Cretaceous hornblende porphyry. Curves are for water-saturated liquids in equilibrium with quartz and alkali feldspar at indicated confining pressures in kilobars (Carmichael *et al.*, 1974, after data of Tuttle and Bowen, 1958). Isobaric minima are indicated on the curves except at 5 kilobars where a ternary eutectic is generated by intersection of the alkali feldspar solvus with the liquidus surface. Ca= trend for typical calkalkine suite (Abdel-Rahman, 1990, after Arth *et al.*, 1978). Symbols as in Figure 48.

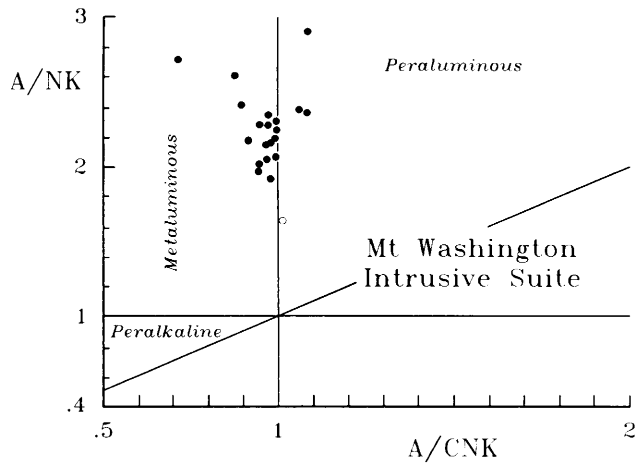

Figure 53. Shand's Index for the Mount Washington Intrusive Suite and a Cretaceous hornblende porphyry (Shand, 1927). A, C, N and K are the molar values of Al_2O_3, CaO, Na_2O and K_2O respectively. Symbols as in Figure 48.

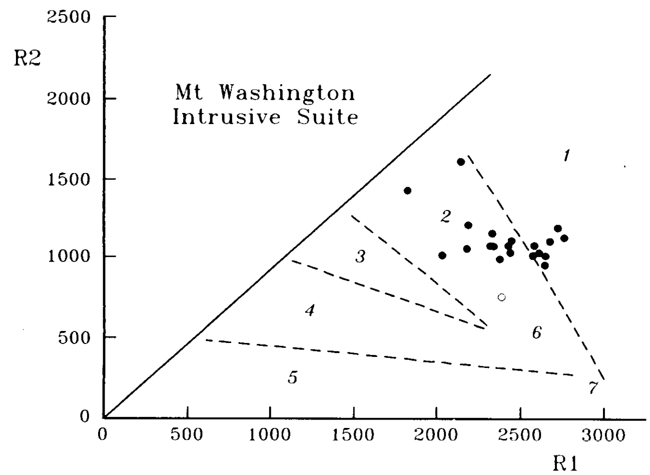

Figure 54. de la Roche R1 - R2 multicationic diagram for the Mount Washington Intrusive Suite and a Cretaceous hornblende porphyry (after de la Roche *et al.*, 1980); R1 = 4Si - 11(Na + K) - 2(Fe + Ti); R2 = 6Ca + 2Mg + Al. Fields after Batchelor and Bowden (1985): 1= mantle fractionates; 2= destructive plate margin (pre-plate collision); 3= post-plate collision ("permitted" plutons); 4= late orogenic (sub-alkaline); 5= anorogenic (alkaline-peralkaline); 6= syn-orogenic (anatectic); 7= post-orogenic. Symbols as in Figure 48.

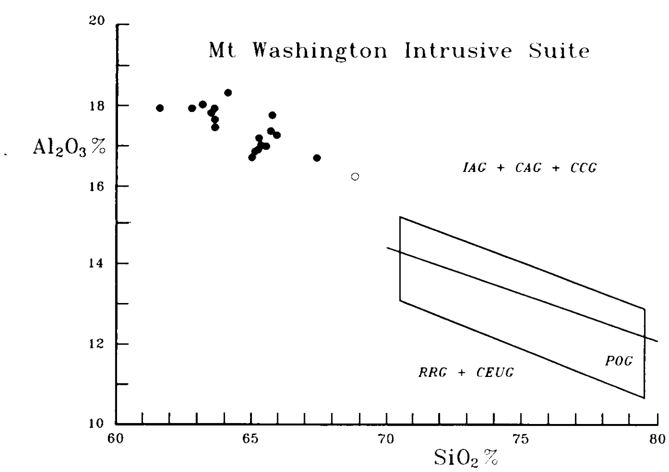

Figure 55. Al_2O_3-SiO_2 diagram for the Mount Washington Intrusive Suite and a Cretaceous hornblende porphyry; fields after Maniar and Piccoli (1989). IAG= island-arc granitoids; CAG= continental-arc granitoids; CCG= continental-collision granitoids; POG= postorogenic granitoids; RRG= rift-related granitoids; CEUG= continental epeirogenic-uplift granitoids. Symbols as in Figure 48.

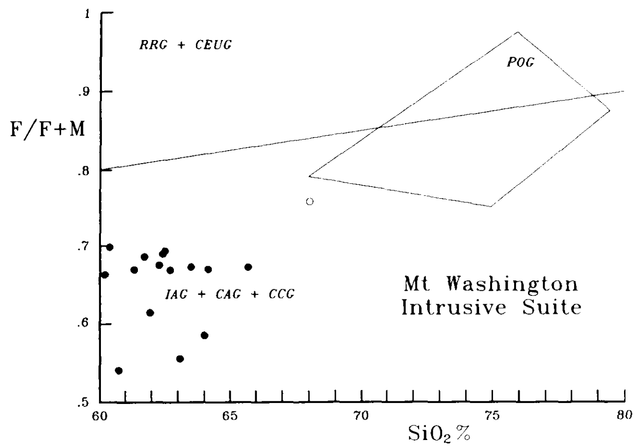

Figure 56. F/ F + M versus SiO_2 diagram for the Mount Washington Intrusive Suite and a Cretaceous hornblende porphyry; fields after Maniar and Piccoli (1989). F = total iron as FeO; M = MgO. Field labels as in Figure 55. Symbols as in Figure 48.

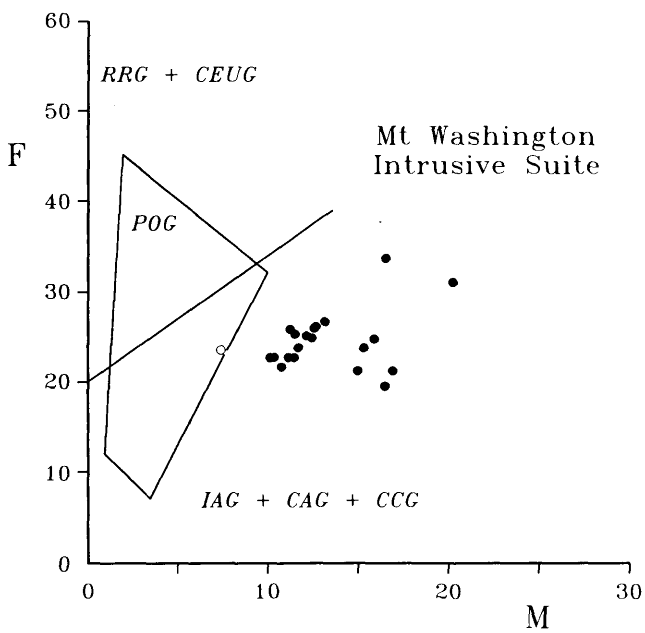

Figure 57. F-M diagram for the Mount Washington Intrusive Suite and a Cretaceous hornblende porphyry; fields after Maniar and Piccoli (1989). F = total iron as FeO; M = MgO. Note that F and M, in this diagram, are the normalized values from plotting samples in the ternary (Al_2O_3 - Na_2O - K_2O)-(FeO*)-(MgO) diagram. Field labels as in Figure 55. Symbols as in Figure 48.

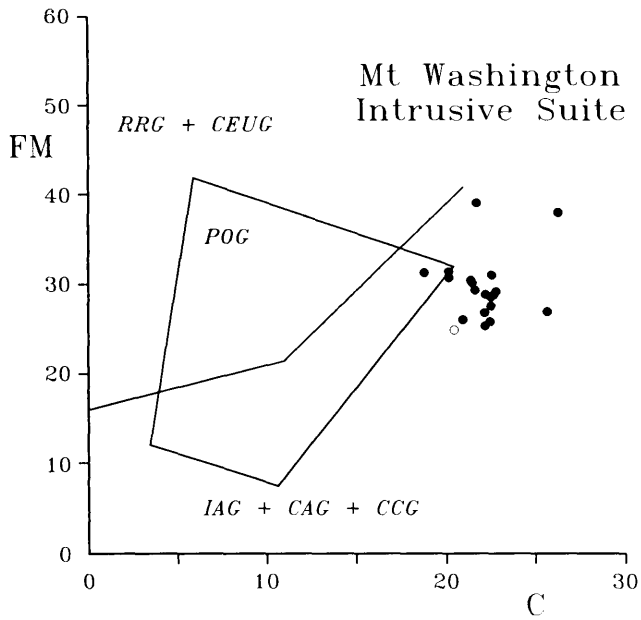

Figure 58. FM-C diagram for the Mount Washington Intrusive Suite and a Cretaceous hornblende porphyry; fields after Maniar and Piccoli (1989). F = total iron as FeO; M = MgO; C = CaO. Note that FM and C, in this diagram, are the normalized values from plotting samples in the ternary (Al_2O_3 - Na_2O - K_2O)-(FeO* + MgO)-(CaO) diagram. Field labels as in Figure 55. Symbols as in Figure 48.

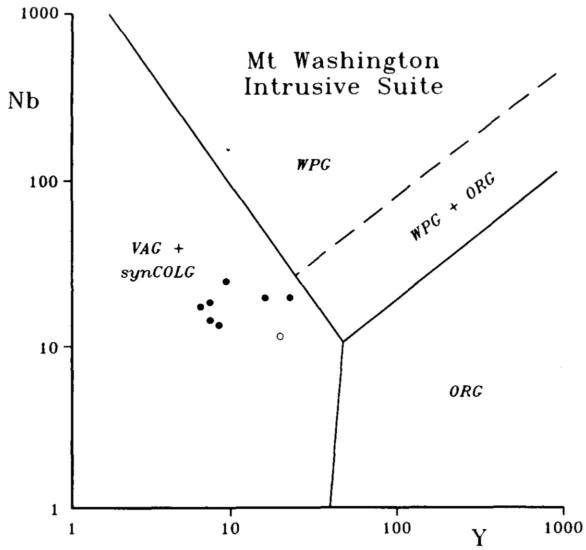

Figure 59. Nb-Y diagram for the Mount Washington Intrusive Suite and a Cretaceous hornblende porphyry; fields fields after Pearce *et al.* (1984). VAG= volcanic-arc granites; synCOLG= syncollision granites; WPG= within-plate granites; ORG= ocean-ridge granites. Symbols as in Figure 48.

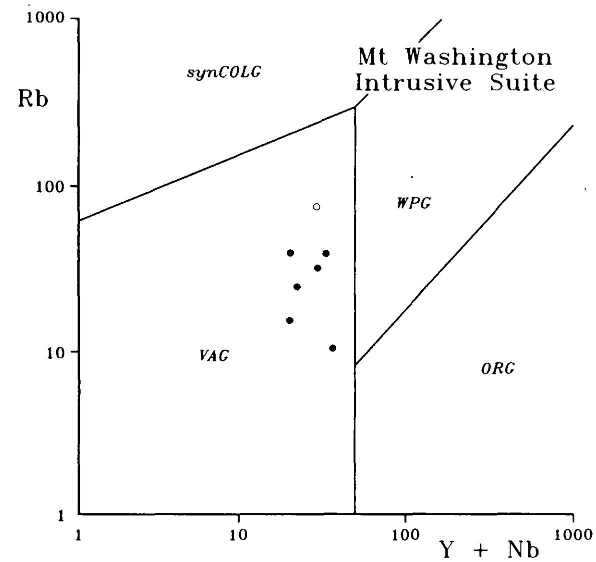

Figure 60. Rb-(Y+Nb) diagram for the Mount Washington Intrusive Suite and a Cretaceous hornblende porphyry; fields after Pearce *et al.* (1984), labelled as in Figure 59. Symbols as in Figure 48.

phyries are and to characterize and assess the tectonic significance of this otherwise unrecorded Cretaceous magmatism.

Tertiary Mount Washington Intrusive Suite

Porphyritic dacite sills and dikes occur throughout the map area. They are of Late Eocene age and probably comagmatic with other dacite porphyries and quartz diorites developed at Mount Washington and Zeballos and formerly included with all Tertiary intrusions of Vancouver Island in the "Catface intrusions" (Muller *et al.*, 1981). Whole-rock K-Ar age determinations fall within the range 38 to 47 Ma, averaging 41 Ma (Table C-1, Figure C, in pocket). These dates are typical of Tertiary intrusions occurring in a belt from Zeballos to Nanaimo Lakes, the "eastern belt" of Carson (1973), and younger than the ages of most intrusions in the Tofino area, the "western belt", which fall in the range 45 to 60 Ma. The latter are also associated with extrusive rocks of the "Flores volcanics", with which they are probably comagmatic. The spatial and temporal separation of these two belts of intrusions is significant enough to designate them as separate lithodemic units. It is proposed here to abandon the term Catface intrusions and to designate the younger eastern belt intrusions as the Mount Washington Intrusive Suite and the older western belt intrusions as the Clayoquot Intrusive Suite.

The porphyritic dacites in the map sheet contain varying proportions of feldspar and hornblende phenocrysts in a fine-grained, light to medium grey groundmass (Plate 36). Feldspar is white plagioclase typically forming subhedral to euhedral laths up to 1 centimetre long but averaging 1 to 2 millimetres. Hornblende occurs as elongate laths or needles up to 1.5 centimetres long. Phenocrysts vary in both absolute proportions (from about 10 to 30 per cent of the rock) and in relative proportions of hornblende to feldspar. Aphyric dacite is uncommon.

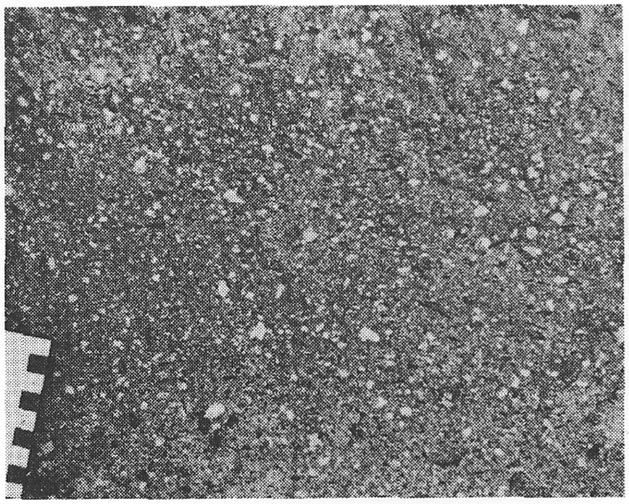

Plate 36. Hornblende feldspar porphyry, Labour Day Lake sill, Mount Washington Intrusive Suite (North Nanaimo River; NMA88-13-02: 5438520N; 393411E).

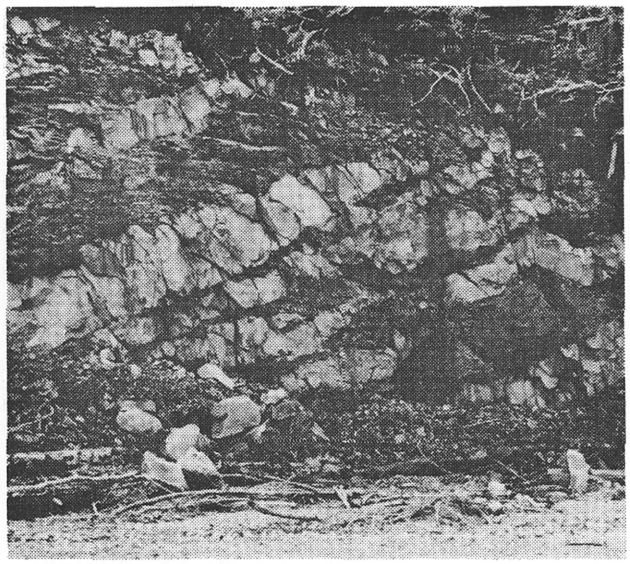

Plate 37. Hornblende feldspar porphyry sills of the Mount Washington Intrusive Suite intruding Benson Formation sandstones and siltstones (North Nanaimo River; NMA88-13-08: 543990N; 391869E).

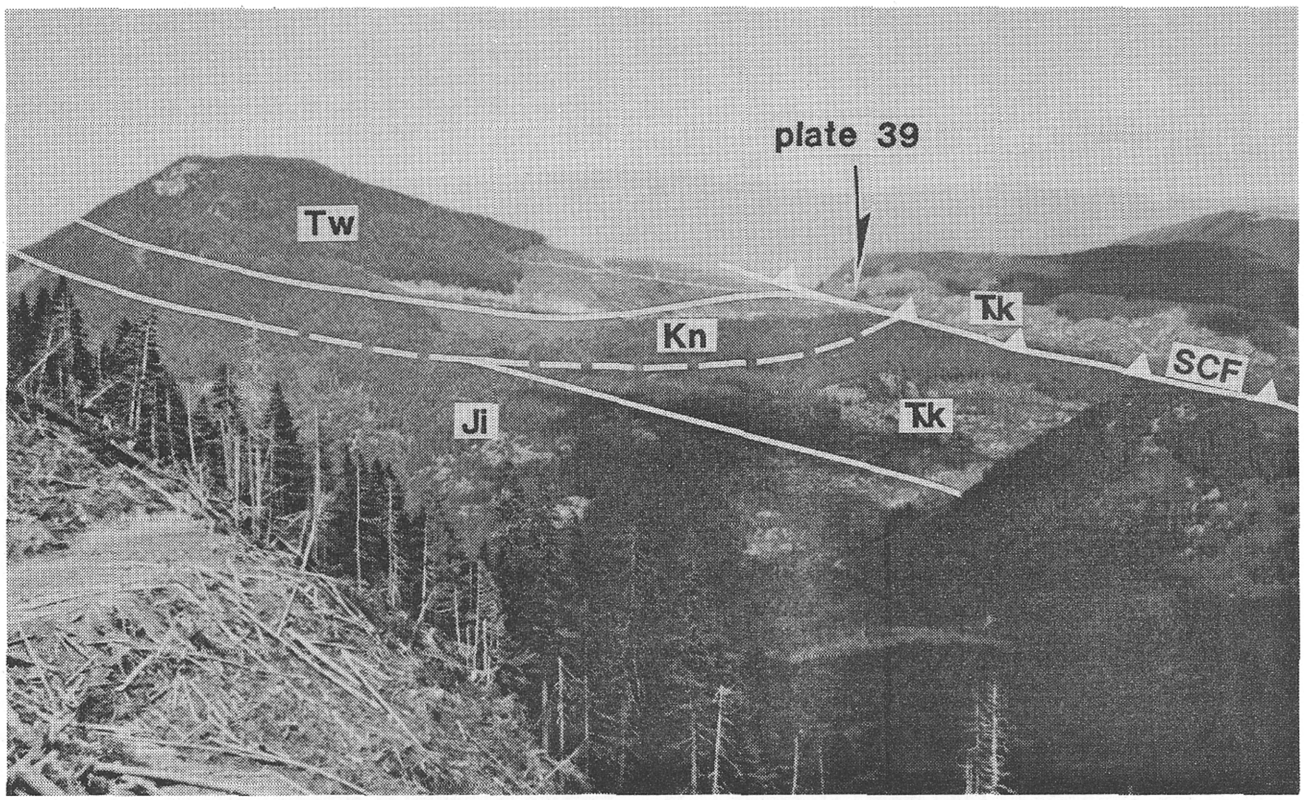

Plate 38. View looking northwards to Patlicant Mountain. Franklin River and Museum Creek in foreground; McLaughlin Ridge in background. Hornblende feldspar porphyry sill of Mount Washington Intrusive Suite (Tw) intrudes argillites and sandstones of the Nanaimo Group (KN) in the footwall of the south strand of the Cowichan fault (SCF). Trk=Karmutsen Formation; JI=Island Plutonic Suite. Location of Plate 39 (see page 52) indicated.

The Tertiary intrusions occur as dikes up to 3 metres wide, intruding most older lithologies. Dikes are also found intruding major fault zones, which appear to have acted as passage ways for the magmas. Where the porphyries have penetrated the Nanaimo Group sediments, they have spread out laterally as thick sills, for example, at Patlicant Mountain (Plate 38) and Labour Day Lake. Metamorphic aureoles around the sills are very attenuated, metamorphic effects being limited to minor silicification and increased vitrinite reflectance values in coaly material in Nanaimo Group sediments.

Geochemically, the intrusions form a metaluminous calcalkaline suite ranging from andesite to dacite in composition (Figures 47 to 51 and 53). Normative feldspar compositions suggest that the porphyries formed over a range of low to moderate pressures but are displaced from the locus of the isobaric minima. Major and trace elements show all the characteristics of convergent-margin magmatism (Figures 47 to 60). There is much similarity in chemistry with the Jurassic Island Plutonic Suite. However, the latter rocks tend to be more potassic than the Tertiary intrusions (for example, Figure 33 compared to Figure 52), though the difference is probably less than originally suggested by Carson (1973) and considerable overlap exists. Tectonic models for the Tertiary suggest that the Mount Washington Intrusive Suite formed in a fore-arc environment outboard of the Coast Mountain magmatic arc.

STRUCTURE AND TECTONICS

Southern Vancouver Island has a complex tectonic history with an alternation of major tectonic settings (Figure 2) and involving at least five major deformational events. These events have often rejuvenated previous structures, rendering specific analysis of their effects difficult. The present map pattern is dominated by the effects of Tertiary faulting, though older events are important in establishing relationships within fault blocks.

PHASE 1 - LATE DEVONIAN

The unconformity between the Buttle Lake Group sediments and the underlying Sicker Group volcanics, along the southwestern limb of the Cowichan uplift, points to a major deformational event taking place in Late Devonian to earliest Mississippian times during the final stages of the Sicker volcanic arc. Specific effects of this deformation are difficult to document with any certainty in the map area. In the Peak Lake area of McLaughlin Ridge, a fan-shaped array of north-northeast-trending folds with steep to overturned limbs runs contrary to, and appears to be deformed by, later southeast-trending structures. These north-northeast-trending folds may be of Late Devonian age.

PHASE 2 - MIDDLE PERMIAN - PRE-MIDDLE TRIASSIC

All Paleozoic rocks have been affected by a series of southeast-trending, upright to overturned, southwest-verging folds with abundant parasitic minor folds. Major fold axes are often difficult to map in the field but can be interpreted from regional map patterns. Steeply dipping to over-

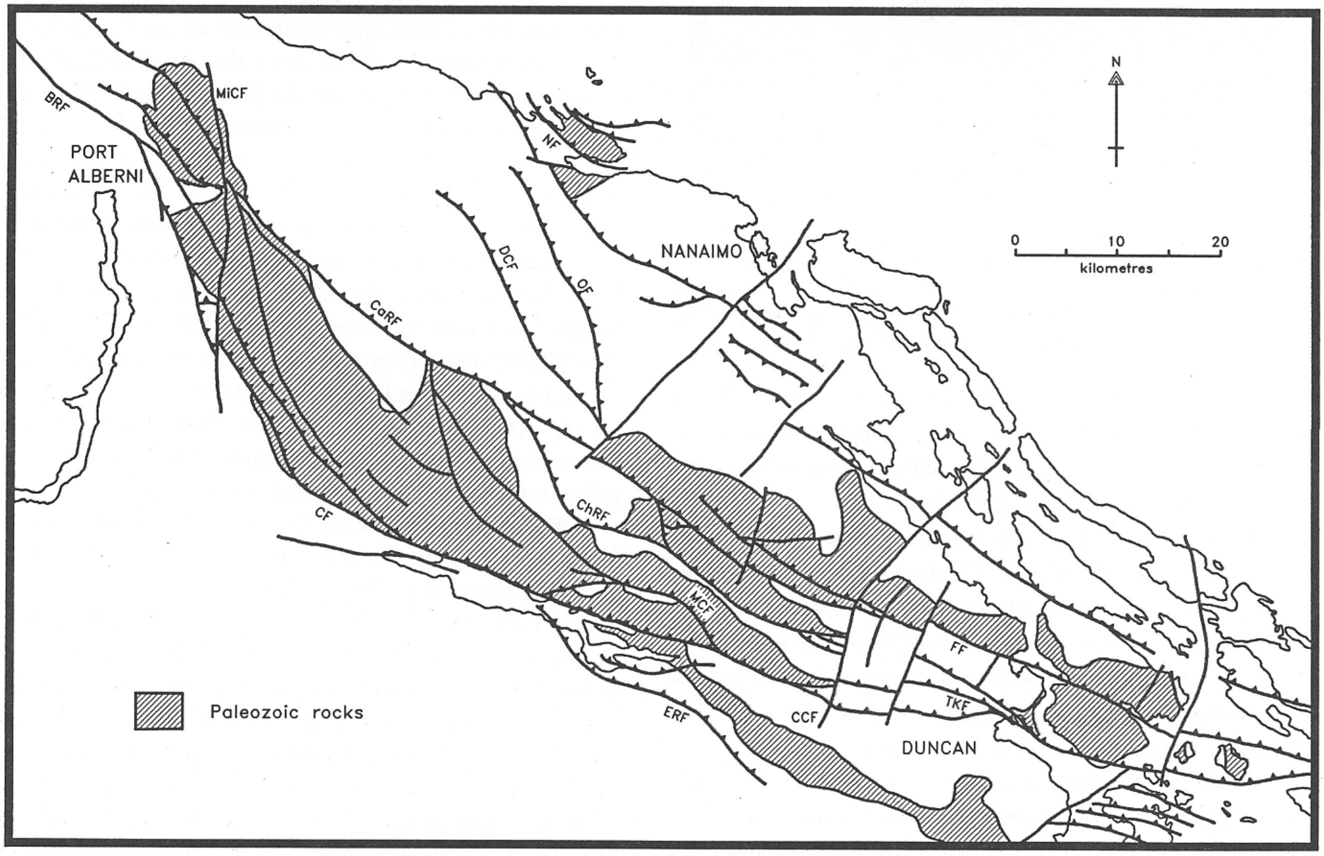

Figure 61. Major faults of the Cowichan fold and thrust system (after Massey and Friday, 1988; England and Calon, 1991). BRF=Beaufort Range fault; CF=Cowichan fault; CaRF=Cameron River fault; ChRF=Chemainus River fault; CCF=Copper Canyon fault; DCF=Dash Creek fault; ERF=East Robertson fault; FF=Fulford fault; MCF=Meade Creek fault; MiCF=Mineral Creek fault; NF=Nanoose fault; OF=Okay fault; TKF=Tzuhalem-Keppel fault.

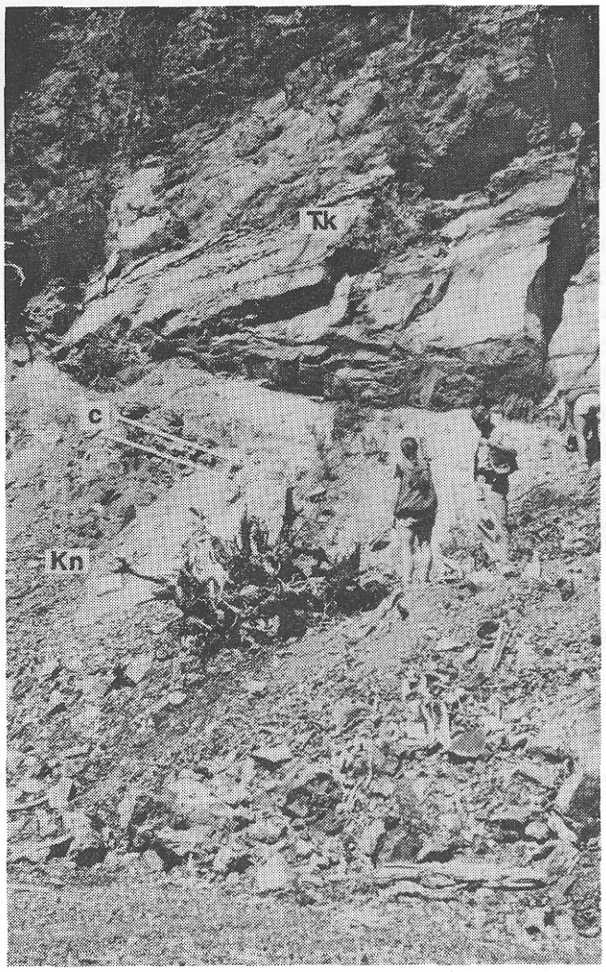

Plate 39. South strand of the Cowichan fault, just east of Mount Patlicant (*see* Plate 38). Pillowed basalt, Karmutsen Formation (Trk) in the hangingwall; argillites of Haslam Formation (Kh) in the footwall; note foliation developed in argillites parallel to the fault plane (c) (NMA88-43-09: 5444826N; 376465E).

turned beds are seen locally in minor folds throughout the area and on the southern limb of a regional anticline in the Nitinat River area (Plate 9). The folds are truncated by the overlying Karmutsen Formation (Plate 26).

Penetrative axial-planar foliation is generally absent throughout most of the area. However, Sicker Group volcanics to the west of the Mineral Creek fault and south of the Lacy fault have a well-developed north-northwest-trending schistosity with generally steep northeasterly dips. Rare chlorite crenulation lineations and elongation of pillows are subhorizontal to shallow dipping.

Faulting accompanied or postdated folding. On McLaughlin Ridge, several north to northeast-trending faults crosscut the folds, but are themselves truncated by Tertiary faults. Their age is unknown but may be pre-Triassic. On the east side of the West Cameron River valley, small-scale faults offset Buttle Lake Group sediments but do not affect the unconformably overlying Karmutsen Formation (Plate 22).

PHASE 3 - LATE TRIASSIC

Extensive crustal dilation accompanied the evolution of Karmutsen Formation lavas and intrusions. However, structures specifically associated with this event have not yet been identified within the Alberni area.

PHASE 4 - EARLY TO MIDDLE JURASSIC

Regional-scale warping of Vancouver Island produced the four major geanticlinal uplifts cored by Paleozoic rocks (Figure 1), including the Cowichan uplift. Plutons and stocks of the Middle Jurassic Island Plutonic Suite are often elongate parallel to the uplifts, although they apparently show few affects of the deformation themselves, suggesting the intrusions were syntectonic to postdeformation. Uplift and erosion followed sometime in the Late Jurassic to Late Cretaceous, establishing the pre-Nanaimo Group topography.

PHASE 5 - EOCENE

Large-scale northwesterly trending contractional faults of the Cowichan fold and thrust system (England and Calon, 1991) cut the map area into several slices (Figure 61). Two major fault zones are recognized within the area. The Cameron River fault runs southeast along the Cameron River valley, north of Labour Day Lake, past Third Lake and down Dunsmuir Creek to join the Fulton fault. To the northwest, the fault splits. The main southern splay runs just north of Loon Lake, north of Highway 4. A northern splay (Qualicum River fault) continues to the west of Horne Mountain and along the Qualicum River valley; another splay (Lacy fault) runs northwest to Lacy Lake and Esary Lake. The Cowichan fault zone trends southeast from east of Bainbridge Lake and Patlicant Mountain (Plates 38 and 39), down Rift Creek valley and continuing to the southwest to Cowichan Lake. This fault zone contains several splays. The Henry Lake fault connects the Cameron River and Cowichan fault zones, and may have a similar reverse-fault geometry although this is speculative at this time.

Where exposed, these faults are high-angle reverse faults which dip between 45° and 90° to the east or north-northeast (Plate 39). They generally place older rocks over younger and become listric at midcrustal depths (Sutherland Brown and Yorath, 1985; England and Calon, 1991). Slip-planes may be relatively sharp and narrow, but wide schistose zones have formed in receptive lithologies and splays and imbricate zones are well developed. Displacements along fault planes are undetermined. Lithological and stratigraphical comparison along the Cameron River fault suggests that offsets are probably in the order of 5 to 10 kilometres horizontally and 1 to 2 kilometres vertically. Other major faults are not expected to differ markedly from this. Direction of motion is suspected to be west-southwest, although slickensides on fault planes indicate latest movement was horizontal and northwesterly directed.

The maximum age of faulting is bracketed by the involvement of Maastrichtian sediments of the Nanaimo Group in the Cowichan fold and thrust system and sandstones of the Eocene Chuckanut Formation (England *et al.*, 1992). This is further constrained by the results of burial history modelling for the Nanaimo Group based on vitrinite reflectence data (England, 1990) which indicate that the Nanaimo Group must have been buried about 20 million years past the end of the Cretaceous, that is to 46 - 48 Ma before uplift by the thrust system. In the Alberni area, the faults are intruded by Late Eocene porphyry dikes, with an average age of 41 Ma (Massey 1995b), which show only minor late-stage brittle fracturing. Apatites in footwall granodiorites and sediments in the Chemainus and Duncan area yield apparent fission-track ages ranging from 31±3 Ma to 55±7 Ma, averaging 42 Ma. Model ages for the apatite fission-tracks average 45± 5 Ma (England *et al.*, 1991; 1992). It is thus suspected that faulting took place between about 48 and 45 Ma in the Middle Eocene, possibly during crustal shortening accompanying the formation and accretion of the Pacific Rim and Crescent terranes to the south and west of the project area.

Several faults in the northwest of the map area postdate the main reverse faults. The north-trending Mineral Creek fault can be traced from Horne Lake in the north to Corrigan Creek in the south. It offsets the Cameron River and Cowichan fault zones. It is a subvertical shear zone with apparent sinistral displacements of less than a kilometre. Vertical displacements are undetermined and appear to vary along its length, perhaps suggesting that sections of the fault may have older displacement histories. The north-northwest-trending Stokes fault has similar sinistral displacement and may be a splay or Reidel-type shear related to the Mineral Creek fault. It appears to truncate the main Chemainus fault, which cannot be traced definitively to the west. The Bostock and Beaufort faults are subparallel to the Stokes fault but appear to be normal faults where exposed. The age of this faulting is unknown though it may be related to minor extension accompanying late-stage post-contractional relaxation. Further documentation of the geometries of individual faults and their mutual relationships is needed in this area.

METAMORPHISM AND ALTERATION

The metamorphic grade in the area is generally low, but increases with the age and structural position of the rocks. Nanaimo sediments are essentially unmetamorphosed, showing only diagenetic alteration of detrital iron oxides and calcareous cements. Karmutsen basalts show amygdule infillings and veins of chlorite, calcite, epidote and quartz, and alteration assemblages typical of the prehnite-pumpellyite facies. Triassic gabbros and diabases show only minor alteration of feldspar and pyroxene, except in chloritic shear zones.

Paleozoic volcanic rocks generally show lower greenschist facies assemblages. Feldspars are variably saussuritized, pyroxenes uralitized and groundmass hydrated to chlorite. Secondary quartz, calcite, chlorite and epidote are common in veins and amygdules. Except for fault and shear zones, penetrative chloritic schistosity is well developed only in the area west of the Mineral Creek fault and north of China Creek. The typical thinly bedded sediments of the Fourth Lake Formation show very little affect of alteration except for diagenetic development of siliceous cement. Where involved in intense shearing, however, chlorite and sericite develop along foliation planes. The limestones of the Mount Mark Formation are essentially unaltered except for secondary silicification of bioclasts and diagenetic cherts. Dolomitization may be seen close to fault zones, however.

Stocks and plutons of the Island Plutonic Suite often have contact metamorphic aureoles developed around their perimeters. Porphyroblasts of chiastolite or biotite form in hornfelsed Fourth Lake sediments around several stocks. Hornblende and pyroxene porphyroblasts are present in volcanic rocks adjacent to intrusions and included as xenoliths. Garnet-diopside-epidote skarn development and silicification of limestones are only observed adjacent to the Fourth Lake stock, although garnet-diopside skarn is reported from the ore zone of the Thistle mine (Stevenson 1945).

ECONOMIC GEOLOGY

HISTORY OF EXPLORATION

Exploration and mining in the Alberni - Nanaimo Lakes area started as early as 1862 with small-scale placer-gold mining on China Creek. Activity increased in the 1890s, principally along Alberni Inlet, China Creek, Mineral Creek and in King Solomon Basin. Several gold veins were staked and modest production was achieved from the Victoria property on Mineral Creek. Exploration ceased until the 1930s when prospecting for gold was renewed, resulting in limited production from the Victoria, Havilah, Thistle, WWW and Black Panther claims (Table 2). Activity declined again after World War II. The 1960s witnessed another round of exploration, focused on the search for porphyry copper and iron-copper skarn deposits, and the regional evaluation of the Esquimalt and Nanaimo Railway Land Grant. No production resulted, however. The present cycle of exploration followed the discovery of the H-W polymetallic massive sulphide orebody at Buttle Lake in 1979. All areas of Sicker Group outcrop in the Alberni - Nanaimo Lakes area have since been staked and numerous exploration targets defined by mining companies and local prospectors. Extensive drilling has been carried out on many properties and Westmin Resources Limited collared a 2-kilometre exploration adit on the Mineral Creek zone in 1988.

TABLE 2
MINERAL PRODUCTION IN THE ALBERNI AREA

Property	Production Years	Tonnes	Au g	Ag g	Cu kg	Pb kg
Victoria	1898, 1934-36	365	9 425	1 679	88	
Havilah	1936 & 1939	949	8 056	43 669	1 925	5 750
Thistle	1938-42	6 283	85 874	65 969	309 088	
Black Panther	1947-48, 1950	1 715	15 832	29 642	226	5 588
WWW	1899, 1935, 1940-41	106	14 650	15 552	244	1 100
B D Q	1940	1	62	156	11	
Kitchener	1929	168	124	653	5 366	

Unrecorded production of marble has also taken place from the Home Lake property.

CLASSIFICATION OF DEPOSITS

Details of the individual mineral occurrences in the Alberni - Nanaimo Lakes area have been compiled in Appendix 1. Several types of mineral deposit are present in the area:

VOLCANOGENIC, POLYMETALLIC MASSIVE SULPHIDES AND EXHALATIVE OXIDES

Polymetallic massive sulphide deposits have been a major target within the Sicker Group since the successful development of the Westmin Resources Limited mine in the Buttle Lake area in the late 1960s. Within the Cowichan uplift, deposits have been found associated with felsic volcanics in the McLaughlin Ridge Formation (for example Lara and Mount Sicker in the Duncan area). However, in the Alberni area the McLaughlin Ridge Formation is dominated by mafic to intermediate volcaniclastic sediments and appears barren of syngenetic mineralization.

Cherts, jaspers, manganiferous cherts and massive sulphides of probable exhalative origin are found within the map area, however, occurring interbedded with and overlying pillowed basalts of the Duck Lake Formation. Minor felsic tuffs may overlie them. The most important showing so far discovered in this unit is the 900 zone on Westmin Resource's Debbie property. A low grade iron formation with a magnetite-rich base is locally isoclinally folded with fold axes plunging south-southeast. Beneath and crosscutting the chert horizon is a quartz-vein stockwork which is younger (Tertiary). Native gold, pyrite, magnetite and arsenopyrite occur in quartz veinlets in the chert and jasper and also in narrow carbonate veinlets that crosscut the quartz veinlets. Similar iron and manganese-rich cherts have been prospected in the Summit - Horne Lake area, for example, Lacy Lake, and occur at many other localities, for example, upper China Creek and the Butler Peak - Green Mountain area (Mountain/Jubilee property).

Massive sulphides also occur at this stratigraphic level, although they may have been remobilized during later shearing. The major areas of development are on McLaughlin Ridge (Regina, Cop Creek) and in the Nitinat River - Raft Creek area (Kitkat, Raft). Sulphides are also reported in felsic volcanics at the Main/Railway showing north of Stokes and within sheared mafic volcanics along Rogers Creek (Debbie 3). None of these occurrences has yet proven to be economic.

SKARNS

Granodiorite intrusions of the Jurassic Island Plutonic Suite often produce skarns when they intrude limy rocks. Iron-copper skarns, similar to those in the Cowichan area (Blue Grouse) are also found in the Alberni - Nanaimo Lakes area. These received some attention in the past for their copper potential but are now undergoing re-evaluation for gold (Ettlinger and Ray; 1988, 1989). The hostrocks include limestones of both the Mount Mark Formation (Skarn and Tangle 1) and the Quatsino Formation (Kitchener) as well as limy units within the upper part of the Karmutsen Formation. Sulphides (pyrite, chalcopyrite) and iron oxides (magnetite) occur as irregular pods, lenses and veins within the calcsilicate skarn. Gangue minerals include yellow to brown garnet, dark green pyroxene, epidote, calcite, quartz and chlorite. Skarning may be associated with the mined ore at the Thistle mine (Stevenson 1945) though none is evident at surface.

On the Villalta property, the main exploration target is a stratiform auriferous hematitic cap developed on the skarn. This subhorizontal cap unconformably overlies post-skarn karstic collapse breccias. Hematite veins also crosscut the skarn and hematite replaces garnet within it. The cap is overlain by Nanaimo Group conglomerate and may be of middle Cretaceous age.

Copper-Molybdenum Quartz Veins and Stockworks

Sulphide-bearing quartz veins occur in Jurassic granodiorite and adjacent country rock on several properties in the map area. Most of these are associated with the Corrigan Creek pluton (for example, Andy and WWW), but other showings have been found in the Mount McQuillan stock (Sol and Havilah), the Fourth Lake stock (Surprise and WO 7), and the Nanaimo Lakes batholith (Louishman-Maureenah). Most of the showings are veins but well-developed stockwork features are seen on the Andy property and disseminated sulphides on the Starlight. The quartz veins generally contain pyrite or pyrrhotite with chalcopyrite and lesser molybdenite. Skarning is associated with some of the copper-molybdenum vein deposits (Mary). Though the mineralization is generally thought to be Jurassic in age and contemporaneous with the hosting intrusions, a biotite K-Ar age determination of 40± 2 Ma (Table C-1) from mineralized, medium-grained quartz diorite of the Corrigan Creek pluton on the south slopes of Mount Olsen suggests that some mineralization may be Tertiary. Also, galena from veins on the WWW property has lead isotope values similar to those found in deposits of Vancouver Island that are known to be Tertiary (Andrew and Godwin 1989b).

Gold-bearing Pyrite-Chalcopyrite-Quartz-Carbonate Veins along Shears

As in the Cowichan Lake and Duncan areas, many of the faults and shears in the Alberni - Nanaimo Lakes map area are veined by rusty orange-weathering quartz-carbonate. The more economically important veins are localized along the Tertiary thrusts and crossfaults, for example, the Victoria vein on the Mineral Creek fault and the Black Panther vein on the Cowichan fault zone. The quartz veins are variable in strike length and range up to about 1 metre wide. Carbonate alteration zones up to several metres wide border the veins and may extend into the hangingwall and footwall. Mineralization has taken place episodically during motion on the faults, with earlier veins and alteration being disrupted and reveined. Unaltered porphyry dikes often crosscut veins, suggesting mineralization is Eocene in age. Commonly reported sulphides are pyrite, pyrrhotite, chalcopyrite and arsenopyrite. Sphalerite and galena are less common. The carbonate is principally ankerite and calcite. Clots of dark green fuchsite or mariposite occur occasionally with the carbonate. Gold is found both in the discrete quartz veins and in the alteration haloes, where it appears to be associated with the sulphides.

Most of the mineral production in the area has been from these quartz-carbonate shear-zone deposits and they are presently the targets of much exploration activity, for example, the Debbie (Mineral Creek zone), Thistle, Black Panther and Lizard Lake properties.

Other Base-Metal Veins

Several chalcopyrite-pyrite-quartz veins are hosted in Sicker Group (Rush and Nan), Karmutsen Formation (Lofstrom and Qualicum) or Bonanza Group (Union Jack and MOR) lithologies. Although poorly documented, these veins appear to be related to shears but lack the ankeritic alteration associated with the Eocene gold-copper veins, and are not obviously related to Jurassic stocks. The PD showing consists of sphalerite-arsenopyrite-bearing veins in Mount Mark Formation limestone. Undoubtedly, several ages and styles of mineralization are grouped together here and more documentation is needed to separate them.

Epigenetic Quartz-Arsenic(-antimony) Veins

Realgar, stibnite and pyrite are variably developed in Tertiary sills and Haslam Formation argillites on at least two properties (Coal and Grizzly) in the area. Strong to moderate clay-carbonate alteration and silicification accompany the mineralization and affect the porphyry sills and the argillites. Mineralization on the Coal claims is probably spatially related to the Moriarty fault. These veins, although slightly younger, are probably genetically related to the gold-bearing quartz-ankerite shear veins.

Other Deposits

Small-scale placer mining for gold was conducted along China Creek as early as 1862, mainly by immigrant Chinese labourers. Staking for hydraulic leases was reported in the 1890s. Production figures are unrecorded but were estimated by Stevenson (1945) to be in excess of $40 000.

Various nonmetallic deposits have been exploited in the area, particularly Quaternary gravels for aggregate. Marble was quarried on the Horne Lake property. Subeconomic deposits of clay, shale, rhodonite and limestone have been reported from various localities in the area.

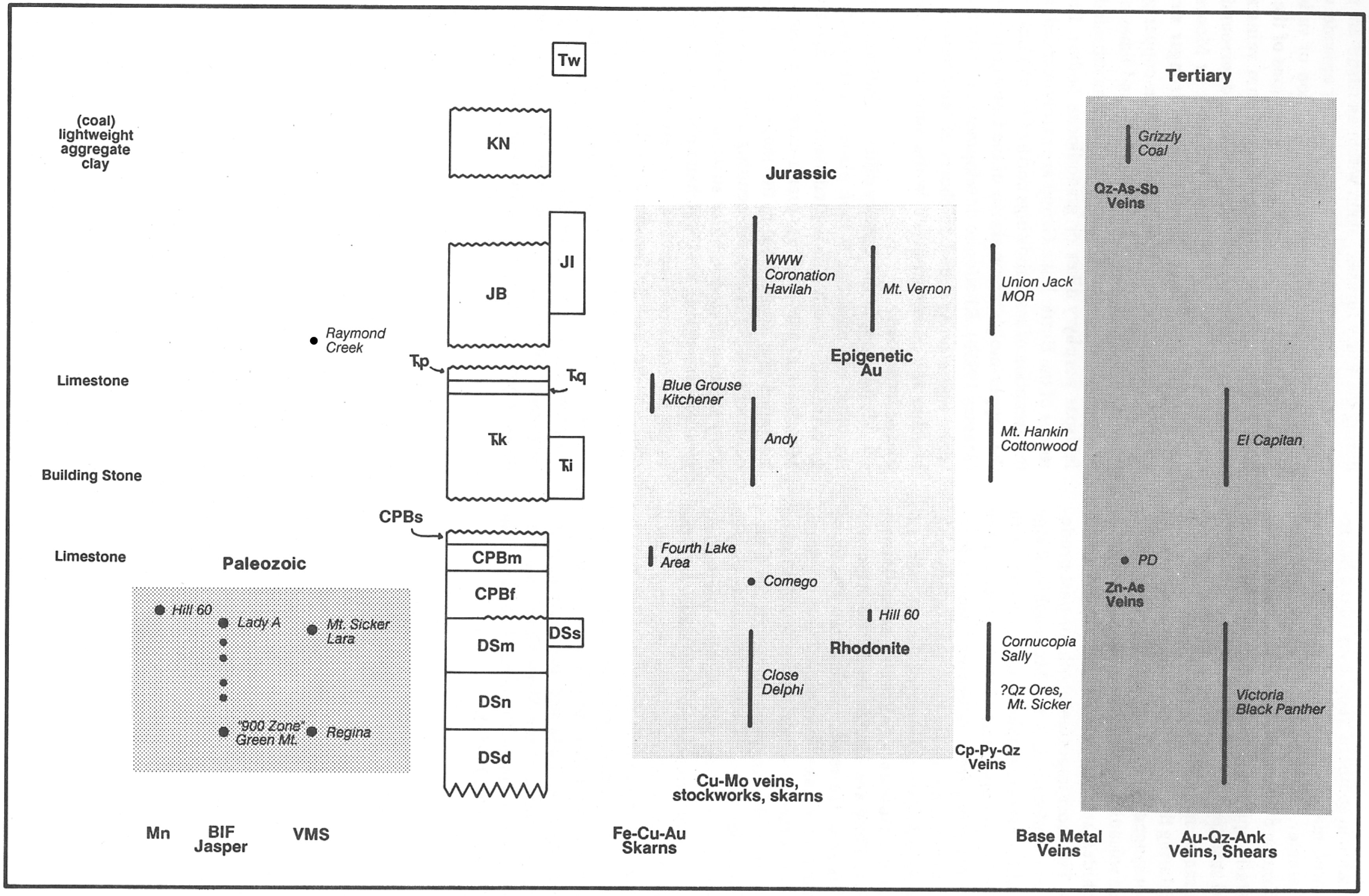

Figure 62. Stratigraphic distribution of mineral deposits in the Cowichan uplift. Stratigraphic column is diagrammatic and not to scale. Syngenetic deposits are illustrated to the left of the stratigraphic column and epigenetic deposits to the right. Shaded blocks indicate the three major metallogenic episodes.

REGIONAL METALLOGENY

Mineralization in southern Vancouver Island has resulted from three major metallogenic episodes, one of syngenetic character, the other two epigenetic (Figure 62). The localization of metal deposits is controlled by the interplay of stratigraphy and spatial association with later intrusions and structures.

The first major metallogenic episode took place in the Paleozoic during the development of the Sicker island arc. Significant syngenetic metal mineralization is associated with these volcanic rocks. Polymetallic, volcanogenic massive sulphides are restricted to two major stratigraphic units. The most important, both for past produtiion and present exploration, is the McLaughlin Ridge Formation in which massive sulphides are associated with felsic volcanics in the upper part of the sequence. They occur in a belt extending from Saltspring Island to Rheinhart Creek, bounded on the south by the Fulford fault, and appear to have formed proximal to the volcanic centre located in the Duncan - Saltspring area (Massey 1995a, 1995b). They are absent from the Alberni - Nanaimo Lakes area. However, exhalites are also found in the uppermost Duck Lake Formation. These are dominantly oxide facies though sulphides are found in some areas, for example, the Regina property in the China Creek area. The oxide facies deposits themselves may be of some importance for their gold content, particularly where cut by later structures that may have enhanced the grade, as in the 900 zone of the Debbie property. This is somewhat analogous to the gold iron-formation association common in many Archean greenstone belts. The final phase of mineralization in this episode was the development of thin manganese beds and sulphidic argillites within the ribbon cherts of the Shaw Creek member, which are best developed in the Cowichan Lake and Duncan areas (Massey 1995a, 1995b).

The second major metallogenic episode took place during the Early Jurassic, again within an island-arc setting. Unlike the Paleozoic, however, this episode was characterized by epigenetic mineralization of various types and styles, spatially related to intrusions of the Island Plutonic Suite. Copper-molybdenum veins and stockworks occur both within intrusions and surrounding volcanic country rocks of either Paleozoic or Mesozoic age (Figure 62). Other deposits show stronger stratigraphic control on the host lithology. Iron-copper-gold skarns are developed in calcareous tuffs and limestones of the Karmutsen and Quatsino formations intruded by feldspar porphyry dikes or granodiorite bodies. Limestones of the Buttle Lake Group are rarely skarned, with the exception of small showings north of Fourth Lake and the copper-molybdenum skarns of the Comego property (Massey 1995b). Rhodonite development is restricted to areas where manganiferous cherts of the Shaw Creek member are metamorphosed in the aureoles of granodiorite intrusions.

Metallogeny in the Tertiary differs significantly from the other two episodes. It took place in a contractional fore-arc setting with only limited associated magmatism. Mesothermal gold-bearing quartz-carbonate veins and alteration are common along the major west-northwest contractional faults and crosscutting north-south faults. They are also hosted in older structures. Carbonate alteration varies along the Cowichan uplift, being common in the Alberni and Cowichan Lake areas but essentially absent in much of the Duncan area. The controls on the extent of alteration along faults and the deposition of gold within the zones are still poorly understood, however. Porphyry copper style mineralization of Tertiary age may be present within the Corrigan pluton but has not yet been positively discriminated from Jurassic mineralization.

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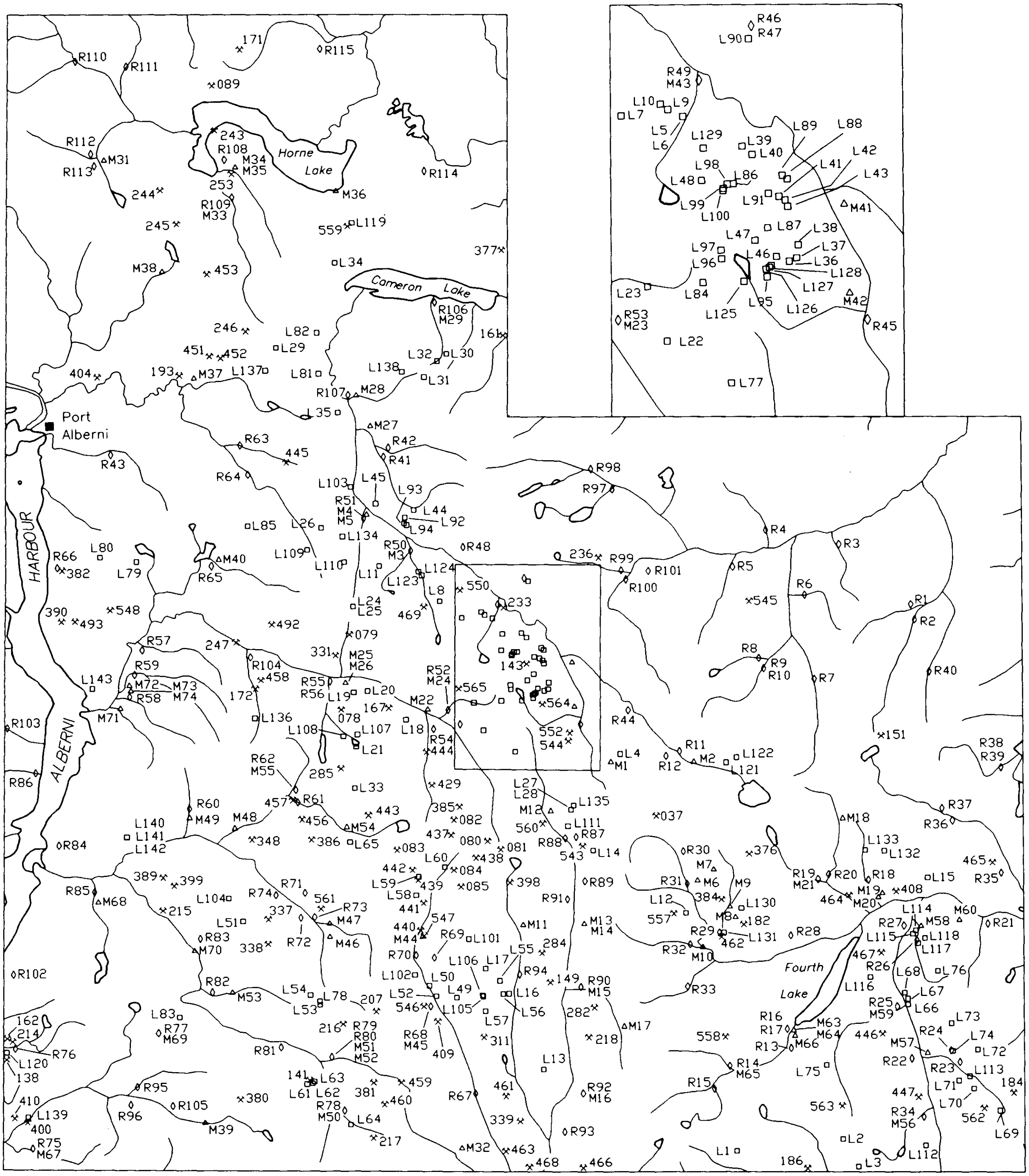
APPENDICES

APPENDIX 1

TABULATED MINFILE, LITHOGEOCHEMICAL ASSAY, MOSS MAT SAMPLE AND R.G.S. SAMPLE DATA



MINFILE (A1-1; Appendix 2)........× RGS samples (A1-4)........◊

Moss-mat samples (A1-3)........△ Lithogeochemical assay samples (A1-2)........□

APPENDIX 1 - TABLE 1
MAPPED OCCURRENCES IN THE ALBERNI - NANAIMO LAKES MAP AREA

PROPERTY NAME	MINFILE NUMBER	STATUS	COMMODITIES
I Vocanogenic massive sulphides and exhalative oxides:			
(a) McLaughlin Ridge - Cameron River area			
KAMMAT CREEK	233	SHOWING	Cu, Au, Ag
DEBBIE 3	445	SHOWING	Zn, Cu, Pb, Ag
ARROWSMITH 3	550	SHOWING	Cu
(b) Raft Creek - Nitinat River area			
KITKAT 3	149	SHOWING	Cu, Au, Ag, Co
KITKAT 4	218	SHOWING	Au, Cu
KITKAT	282	SHOWING	Cu, Au
RAFT	311	SHOWING	Cu, Zn, Ag
(c) China Creek			
REGINA (L.55G)	078	PROSPECT	Au, Ag, Cu, Zn, Pb
900	331	PROSPECT	Au, Fe, jasper
MCQUILLAN CREEK	429	SHOWING	Fe, Cu, jasper
(d) Summit - Horne Lake area			
ESARY LAKE	244	SHOWING	Fe, jasper
LACY LAKE	245	SHOWING	Mn, jasper
CAMERON LAKE	246	SHOWING	Fe, Cu
MAIN	451	SHOWING	Au, Cu
EAST TRACK	452	SHOWING	Au
(e) MOUNTAIN	184	SHOWING	Fe, jasper
(f) FRANK	557	SHOWING	Cu, Ag, Au
II Copper- and gold-bearing veins along shears:			
(a) KARLSSON	376	SHOWING	Cu
(b) SPECOGNA COPPER	037	SHOWING	Cu, Ag, Zn, Au
(c) Mineral Creek/Yellows Creek			
DEBBIE (VICTORIA)	079	PAST PRODUCER	Au, Ag, Cu
BANK GP.	167	SHOWING	Au, Cu, Ag, Pb
BAIN 4	492	SHOWING	Au, Cu
(d) Mount McQuillan			
GOLDEN EAGLE (L.198)	080	SHOWING	Au, Ag, Cu, Pb, Zn
B AND K	081	SHOWING	Au, Ag, Cu, Pb
THISTLE (L.91)	083	PAST PRODUCER	Au, Ag, Cu
BLACK PANTHER	084	PAST PRODUCER	Au, Ag, Pb, Cu, Zn
BLACK LION	085	SHOWING	Au, Pb
HAVILAH (MCQUILLAN VEIN	437	PAST PRODUCER	Au, Ag, Cu, Pb, Zn
SKYLINE (L.100G)	438	PROSPECT	Au, Ag, Pb
PANTHER ROAD	439	SHOWING	Au, Cu, Ag
PANTHER ROAD SOUTH	440	SHOWING	Au
PANTHER	441	SHOWING	Au, Cu
SADDLE	442	SHOWING	Au, Ag, Zn, Cu
DOUGLAS	443	SHOWING	Au, Cu
MCQUILLAN	444	SHOWING	Cu, Ag
WATER	547	SHOWING	Au, Ag, Cu
(e) Raft Creek - Nitinat River area			
COLUMBIA II	339	SHOWING	Cu, Ag, Au
COLUMBIA VI	463	SHOWING	Cu, Ag, Au
HOOP	466	SHOWING	Cu, Au
LOGAN	468	SHOWING	Au, Ag
SNAPPER	543	SHOWING	Au, Ag, Cu, Pb, Zn
STARBOARD	546	SHOWING	Au, Ag, Zn, Cu, Pb
MCKINLAY 1	560	SHOWING	Au, Ag, Cu, Pb, Zn
(f) Lizard Lake area			
LIZARD LAKE	285	SHOWING	Au, Ag, Cu
MUSEUM	386	SHOWING	Cu
PAT 1	457	SHOWING	Cu, Ag, Au
PAT 3	458	SHOWING	Cu, Ag
(g) Museum Creek - Corrigan Creek area			
STAR OF THE WEST (L.40)	215	SHOWING	Au, Cu
TOBY 1	337	SHOWING	Au, Ag
TOBY 2	338	SHOWING	Cu, Fe, Au
BDQ	348	SHOWING	Au, Ag, Cu
COR 14	389	SHOWING	Cu, Au
COR 6	399	SHOWING	Cu, Au, Pb
(h) McLaughlin Ridge			
HIGH GRADE	143	SHOWING	Au, Ag, Cu, Zn
DDAM	469	SHOWING	Cu
MONKEY	544	SHOWING	Au, Ag, Cu, Pb, Zn
SPRING	552	PROSPECT	Au, Zn, Ag, Cu, Pb
PEAK LAKE	564	SHOWING	Au, Ag, Cu, Zn, Mo
DEBEAUX CREEK	565	SHOWING	Au, Ni, Cr
(i) RITE 1	562	SHOWING	Au, Ag, Cu
(j) TYBER	236	PROSPECT	Cu, Zn, Ag, Pb
III Copper-molybdenite veins and stockworks:			
(a) Mount McQuillan stock			
HAVILAH (GILLESPIE VEIN)	082	PAST PRODUCER	Au, Ag, Cu, Pb, Zn
KITKAT 2	284	SHOWING	Au, Cu, Mo, Co, Zn
SOL B	385	SHOWING	Au, Ag, Cu, Pb, Zn, Mo
(b) Corrigan Creek pluton			

(APPENDIX 1 - TABLE 1 - Continued)

PROPERTY NAME	MINFILE NUMBER	STATUS	COMMODITIES
WWW (L.37, 38, 39, 53)	141	PAST PRODUCER	Au, Ag, Cu, Pb, Zn
MARY	207	PROSPECT	Cu, Mo, Ag, Pb, Zn, Au
CANADIAN	214	PROSPECT	
PORT	216	SHOWING	Au, Ag, Cu, Pb
RODEO	217	SHOWING	Cu, Au, Ag, Mo, Zn
CANON	381	SHOWING	Au, Ag, Zn, Cu, Pb
(c) Fourth Lake stock			
SURPRISE	464	SHOWING	Cu, Ag, Au, Mo
WO 7	465	SHOWING	Zn, Cu
SICKER	467	SHOWING	Au, Ag, Cu
(d) MOUNT OLSEN	460	SHOWING	Cu, Ag
(e) HEY-BERT	545	SHOWING	Cu
IV Other base-metal veins, etc.:			
(a) Cameron Lake			
ARROWSMITH	161	SHOWING	Cu, Au, Ag
LITTLE QUALICUM FALLS	377	SHOWING	Cu
MOUNT WESLEY	559	SHOWING	Cu
(b) P.D.	171	PROSPECT	Zn, Ag, Cu
(c) TAP I	380	SHOWING	Cu, Ag, Au
(d) Mt Hankin			
CAMPBELL	382	SHOWING	Cu
COPPER MOUNTAIN	390	SHOWING	Cu
MWP	493	SHOWING	Cu
NMP	548	SHOWING	Cu
(e) MOR	400	SHOWING	Cu
(f) Franklin River			
SADDLE	442	SHOWING	Au, Ag, Zn, Cu
UPPER FRANKLIN	456	SHOWING	Cu
(g) Green River			
RUSH	446	SHOWING	Cu
NAN	447	SHOWING	Cu
OLD CU-AG	453	SHOWING	Cu, Ag
(h) KIT KAT 5	461	SHOWING	Cu, Ni, Pt, Pd
(i) TONI	462	SHOWING	Cu
(j) SPARK	558	SHOWING	Cu
(k) APRIL	561	SHOWING	Cu, Ag, Au
V Manganese - rhodonite deposits:			
Upper Shaw Creek area			
SHAW CREEK	186	SHOWING	Mn, Si
FLIGHT 5	563	SHOWING	Si, Mn, Ma, Cu, jasper
VI Iron-copper skarns:			
(a) Fourth Lake			
SKARN	182	PROSPECT	Cu, Fe, Ag, Zn
VILLALTA	384	3VELOPED PROSPE	Au, Ag, Zn, Cu
(b) Corrigan Creek pluton - Alberni Inlet area			
KITCHENER	138	PAPD	Cu, Fe
DARBY AND JOAN	162	PROSPECT	Fe
(c) OEN	459	SHOWING	Cu, Zn
VII Epigenetic quartz-arsenic(-antimony) veins			
(a) MORIARTY LAKE	151	PROSPECT	Ag, Zn, Cu, Pb
(b) GRIZZLY	172	PAST PRODUCER	As, Ag, Au
(c) Horne Lake			
SILVER BELL	243	SHOWING	Sb
CAVE 1	253	SHOWING	Cu
(d) TAN	398	SHOWING	Ag
VII Others:			
CHINA CREEK	247	PAST PRODUCER	Placer gold
PORT ALBERNI	193	SHOWING	Shale
ROGERS CREEK	404	SHOWING	Clay
HORNE LAKE	089	SHOWING	Limestone
NANAIMO RIVER	408	SHOWING	Limestone
MT. SPENCER	409	SHOWING	Limestone
PARSONS CREEK	410	SHOWING	Limestone

Commodities:

Ag: Silver	Mo: Molybdenum
As: Arsenic	Ni: Nickel
Au: Gold	Pb: Lead
Co: Cobalt	Pd: Palladium
Cr: Chromite	Pt: Platinum
Cu: Copper	Ro: Rhodonite
Fe: Iron	Sb: Antimony
Gs: Gemstone	Si: Silica
Ma: Magnetite	Wo: Tungsten
Mn: Manganese	Zn: Zinc

APPENDIX 1 - TABLE 2
LITHOGEOCHEMICAL ASSAY SAMPLES FROM THE ALBERNI - NANAIMO LAKES MAP AREA

MAP NUMBER	SAMPLE NUMBER	EASTING	NORTHING	MINZ/ALT*	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Mo ppm	Cr ppm	Hg** ppb	As ppm	Sb ppm	Ba ppm	Sr ppm
L1	NMA86-01-04-3	392810	5428930	SU/GA	273	<10	49	30	87	72	36	102	29	nd	140	10	nd	nd
L2	NMA86-08-03-2	396699	5429293	SZ/SI	22	<10	45	14	89	60	22	10	53	nd	<25	<10	nd	nd
L3	NMA86-08-15-5	397248	5428169	SU/QV/GO	69	<10	43	13	81	20	10	6	32	nd	<25	<10	nd	nd
L4	NMA88-01-01-3	388812	5443593	IF/QV	1	<0.5	2	3	2	nd	13	<8	<50	<20	2	<0.5	130	41
L5	NMA88-05-07-2	384202	5448682	IF/QV	4	<0.5	13	8	2	nd	3	<8	<50	320	1	<0.5	<100	35
L6	NMA88-05-07-4	384202	5448682	IF/SU	180	<0.5	41	27	27	nd	16	<8	<50	15**	21	13	<100	46
L7	NMA88-06-10-1	383073	5448723	QC	17	1	33	8	87	nd	3	<8	<50	1.9**	50	33	140	165
L8	NMA88-06-18-1	382274	5449362	QC	1	<0.5	65	4	56	nd	150	nd	850	17	2	<0.5	370	nd
L9	NMA88-07-09-1	383927	5448818	QC	1	<0.5	49	6	115	nd	23	<8	<50	1.1**	8	10	320	275
L10	NMA88-07-10-1	383796	5448922	QC/SU	5	<0.5	107	5	67	nd	53	<8	80	600	22	6	110	100
L11	NMA88-09-10-1	380085	5450708	QC	7	0.6	15	3	29	nd	3	<8	<50	730	17	27	250	160
L12	NMA88-15-15-1	391104	5437693	QC	1	<0.5	33	5	86	nd	6	<8	<50	21	24	0.8	690	235
L13	NMA88-17-10-1	385775	5432045	QC	6	<0.5	123	5	37	nd	73	<8	330	19	<1	0.5	460	200
L14	NMA88-18-01-1	387746	5440092	QC	3	2	56	75	320	nd	26	<8	65	232	7	4	800	180
L15	NMA88-19-01-1	399981	5438856	SU	9	<0.5	71	16	68	nd	46	<8	140	21	18	1	270	315
L16	NMA88-22-02-1	384557	5434824	QC/SU	33	2	33	8	51	nd	130	<8	290	19	1	0.6	160	395
L17	NMA88-22-17-1	383704	5435767	QC/SU	1	<0.5	60	9	41	nd	12	<8	<50	13	1	0.7	1600	290
L18	NMA88-24-02-1	380953	5444999	QC	20	2	67	8	34	nd	19	<8	<50	125	115	3	450	160
L19	NMA88-24-12-1	379057	5446042	SU/SI	2	<0.5	4	8	38	nd	10	<8	<50	45	35	<0.5	<100	45
L20	NMA88-24-14-1	379566	5446089	SU/QC	8	<0.5	14	8	51	nd	155	<8	510	143	275	3	410	135
L21	NMA88-25-15-1	379084	5444163	SU/GO	5	0.6	191	8	86	nd	4	<8	<50	15	72	3	720	275
L22	NMA88-28-09-1	383797	5444558	GO	5	<0.5	53	12	54	nd	18	<8	90	20	9	9	170	57
L23	NMA88-28-15-1	383465	5445572	SU/GO	11	2	25	36	92	nd	55	<8	<50	310	72	5	<100	52
L24	NMA88-29-01-1A	379096	5449228	SU/SZ	21	0.5	52	3	100	nd	193	<8	650	54	152	3	520	170
L25	NMA88-29-01-1B	379096	5449228	SU/SZ	1910	1	36	12	83	nd	3	<8	<50	71	480	2	420	265
L26	NMA88-29-14-1	377980	5452157	SU	20	<0.5	52	6	61	nd	23	<8	98	21	2	2	590	340
L27	NMA88-30-13-1A	386965	5441588	SU/SZ	15	0.5	6	10	7	nd	12	<8	55	47	120	3	2500	48
L28	NMA88-30-13-1B	386965	5441588	SU/SZ	14	<0.5	3	5	97	nd	7	<8	<50	73	26	2	1500	88
L29	NMA88-32-17-1	376461	5458819	SU/QV	3	<0.5	11	6	290	nd	43	12	150	147	1	<0.5	1100	89
L30	NMA88-34-04-1	382704	5458476	QC	3	<0.5	38	3	46	nd	52	<8	140	1.7**	88	9	<100	56
L31	NMA88-35-16-1	381867	5457635	IF	1	<0.5	30	8	40	nd	124	<8	<50	53	20	0.6	<100	31
L32	NMA88-35-20-1	382365	5458216	SI	1	<0.5	1	3	5	nd	6	<8	<50	71	3	0.9	<100	16
L33	NMA88-42-04-2	379031	5442537	SU/QC	220	<0.5	32	6	49	nd	17	<8	<50	49	100	4	190	150
L34	NMA88-49-06-2	378673	5461915	IF	5	<0.5	26	2	24	nd	85	<8	82	53	8	<0.5	nd	nd
L35	NMA88-54-02-2	378685	5456374	IF/QV	19	<0.5	19	2	3	nd	36	<8	74	34	2	<0.5	nd	nd
L36	SFR88-02-01-1	386071	5445971	SU/QV	1050	14	225	33	85	nd	35	12	210	112	115	2	<100	255
L37	SFR88-02-03-1	386211	5446031	SU/QV	92	13	510	24	112	nd	18	<8	<50	840	55	105	210	94
L38	SFR88-02-05-1	386243	5446269	QC	1	<0.5	97	3	60	nd	62	<8	290	34	7	2	180	225
L39	SFR88-04-05-1	385271	5448104	QC/SU	84	0.6	92	5	122	nd	25	<8	81	316	31	1	390	165
L40	SFR88-04-08-1	385454	5447947	IF	18	<0.5	20	3	36	nd	10	<8	<50	51	1	<0.5	180	125
L41	SFR88-05-02-1	385921	5447168	QC/SU	18	0.7	68	62	102	nd	19	<8	<50	376	45	30	490	120
L42	SFR88-05-04-1	386030	5447100	QC	6	0.6	179	18	103	nd	43	<8	210	1.2**	29	50	320	62
L43	SFR88-05-05-1	386078	5446985	QC	29	<0.5	124	9	59	nd	34	<8	53	232	56	3	150	190
L44	SFR88-07-03-1	381396	5452729	QC/SU	2	<0.5	22	48	43	nd	103	<8	260	392	100	7	190	190
L45	SFR88-08-01-1	380007	5452992	SZ	1	<0.5	25	4	94	nd	35	<8	<50	570	34	11	<100	410
L46	SFR88-09-01-1	385840	5446067	QC/SU	1	<0.5	29	3	125	nd	120	<8	560	54	7	3	250	270
L47	SFR88-10-03-1	385453	5446373	QC	12	<0.5	17	9	50	nd	34	<8	100	48	13	1	370	120
L48	SFR88-10-12-1	384514	5447498	QC/SU	1	<0.5	176	6	69	nd	29	<8	85	5**	13	38	430	95
L49	SFR88-12-12-2	382629	5434717	GA/SU	4	0.5	53	5	25	nd	55	12	63	95	40	3	2800	69
L50	SFR88-13-01-1	381626	5435177	QC	16	21	1.42%	3	125	nd	17	<8	<50	16**	245	220	<210	19
L51	SFR88-18-04-1	374848	5437699	QC	1	<0.5	13	3	102	nd	46	<8	<50	2**	4	6	<100	180
L52	SFR88-19-06-2	381883	5434780	SU	1	<0.5	32	3	101	nd	3	<8	<50	27	39	1	400	215
L53	SFR88-21-02-2	377599	5434556	SU	2	<0.5	0.16%	135	33	nd	3	<8	<50	29	3	<0.5	560	170
L54	SFR88-21-04-1	377261	5434921	SU	1	<0.5	248	8	58	nd	55	<8	110	15	11	0.7	<100	475
L55	SFR88-23-01-2	384224	5435308	QC	16	1	47	5	53	nd	110	<8	510	28	2	0.6	210	215
L56	SFR88-23-05-1	384335	5434812	IF	5	<0.5	17	5	15	nd	113	<8	<50	16	5	0.9	<100	54
L57	SFR88-23-16-1	383676	5434200	SU	8	1	0.15%	6	49	nd	22	<8	<50	121	14	<0.5	280	125
L58	SFR88-24-01-2	381203	5438548	GO	210	1	38	12	186	nd	27	<8	<50	171	170	2	190	66
L59	SFR88-25-01-1	381316	5439233	SU	510	1	104	8	36	nd	57	<8	<50	228	50	1	230	83
L60	SFR88-25-07-1	382279	5439579	QC	2	<0.5	52	3	56	nd	91	<8	370	170	8	3	380	280
L61	SFR88-28-01-1	377073	5431735	QV	19300	7	94	0.13%	0.35%	nd	4	<8	89	1.5**	140	1	<100	722
L62	SFR88-28-03-1	377283	5431760	QV	3510	6	400	0.10%	0.60%	nd	3	<8	<50	1.7**	188	0.7	650	725
L63	SFR88-29-01-1	377305	5431812	QV	3800	16	550	204	0.10%	nd	3	12	<50	1.3**	96	1	390	45
L64	SFR88-29-10-2	378638	5430148	SU	9	<0.5	96	10	85	nd	23	<8	<50	57	<1	<0.5	<100	400
L65	SFR88-30-10-1	378825	5440568	QV	45	8	2.10%	6	42	nd	48	<8	<50	280	8	2	<100	780
L66	SFR88-35-05-1	399177	5434172	QC/SU/IF	5	0.6	11	10	91	nd	14	<8	84	45	2	1	nd	nd
L67	SFR88-35-06-1	399174	5434378	IF	1	0.5	189	8	68	nd	22	<8	109	40	2	<0.5	nd	nd
L68	SFR88-35-08-1	399056	5434599	IF	5	<0.5	65	10	72	nd	30	<8	144	30	2	<0.5	nd	nd
L69	SFR88-39-02-1	402484	5430234	SU	5	<0.5	88	13	33	nd	5	16	<50	296	8	0.7	1100	655
L70	SFR88-39-05-1	401542	5431053	GO/QV	1040	1	48	11	10	nd	2	<8	45	238	93	0.7	nd	nd
L71	SFR88-39-06-1	400990	5431366	QC	4	0.5	55	5	66	nd	14	<8	54	210	4	1	nd	nd
L72	SFR88-40-02-1	401700	5432487	QC	10	<0.5	15	22	30	nd	3	<8	<50	550	13	<0.5	920	165
L73	SFR88-40-05-1	400754	5433461	QC	2	<0.5	670	6	64	nd	3	<8	<50	44	4	0.6	760	175
L74	SFR88-40-08-1	400779	5432455	QC	1	<0.5	13	10	125	nd	82	<8	170	1.2**	4	4	<100	295
L75	SFR88-42-06-1	396144	5432019	QC	1	<0.5	14	5	49	nd	17	<8	95	34	8	3	130	75
L76	SFR88-45-13-1	400288	5435386	QC	1	<0.5	83	5	66	nd	3	<8	55	48	7	2	1000	175
L77	SFR88-48-17-1	384953	5443752	QC	1	<0.5	34	5	57	nd	10	<8	<50	54	2	0.6	190	155
L78	SFR88-49-01-1	377603	5434678	SZ	52	5	1.88%	11	166	nd	49	10	165	146	15	1	nd	nd
L79	SFR88-51-02-1	371201	5451031	QV	32	<0.5	16	12	60	nd	2	<8	11	328	26	70	nd	nd
L80	SFR88-51-04-1	369872	5451215	QV	47	0.5	21	12	71	nd	2	<8	34	1.6**	30	7	nd	nd

(APPENDIX 1- TABLE 2 - Continued)

MAP NUMBER	SAMPLE NUMBER	EASTING	NORTHING	MINZ/ALT*	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Mo ppm	Cr ppm	Hg** ppb	As ppm	Sb ppm	Ba ppm	Sr ppm
L81	SFR88-52-02-1	377995	5457832	GA	103	1	129	51	179	nd	54	<8	205	81	43	2	nd	nd
L82	SFR88-52-11-1	377955	5459345	IF	16	<0.5	42	7	39	nd	52	<8	49	58	13	0.6	nd	nd
L83	SFR88-53-03-2	372462	5434182	SZ	8	<0.5	27	7	15	nd	2	<8	nd	125	2	<0.5	nd	nd
L84	SFR88-56-03-1	384481	5445621	IF	32	0.6	19	11	25	nd	6	8	47	163	20	2	nd	nd
L85	SFR88-57-02-2	375296	5452266	GO	1	<0.5	8	8	98	nd	12	nd	90	244	14	15	610	nd
L86	JRI88-01-01-1	385094	5447424	IF	10	<0.5	39	3	2	nd	13	<8	<50	59	5	2	180	53
L87	JRI88-01-10-1	385695	5446601	QC	9	<0.5	121	8	103	nd	36	<8	130	132	29	2	<100	225
L88	JRI88-02-08-1	386078	5447482	QC	10	<0.5	101	6	66	nd	25	<8	98	47	7	2	420	150
L89	JRI88-02-10-1	385992	5447551	QC	118	<0.5	31	5	47	nd	3	<8	<50	238	140	3	340	53
L90	JRI88-03-08-2	385445	5450070	GO	1	<0.5	148	3	81	nd	78	<8	290	49	2	<0.5	<100	150
L91	JRI88-05-08-1	385729	5447228	QC	1	<0.5	52	8	86	nd	90	<8	540	208	22	4	450	105
L92	JRI88-07-12-1	381068	5452464	QC	5	<0.5	150	44	76	nd	94	<8	240	680	4	2	170	185
L93	JRI88-08-14-1	381029	5452247	QC	5	<0.5	50	15	36	nd	16	<8	<50	820	15	14	620	44
L94	JRI88-08-15-1	381119	5452193	QC	1	1	69	210	161	nd	970	<8	1500	77	8	4	290	50
L95	JRI88-09-03-1	385656	5445694	QC	161	8	900	13	208	nd	10	24	<50	2**	200	180	<100	33
L96	JRI88-10-05-1	384836	5446050	GO	1	<0.5	88	27	95	nd	39	<8	160	440	35	8	680	62
L97	JRI88-10-06-1	384830	5446209	QC	3	<0.5	66	16	93	nd	23	<8	<50	94	36	2	540	130
L98	JRI88-10-09-2	384981	5447417	SU	1	2	169	120	118	nd	23	<8	<50	60	13	0.9	550	190
L99	JRI88-10-10-1	384906	5447342	QC	1	<0.5	55	8	82	nd	27	<8	60	158	42	3	370	95
L100	JRI88-10-11-1	384898	5447302	GO	24	<0.5	105	3	140	nd	29	<8	75	354	12	2	620	88
L101	JRI88-11-04-1	383104	5436872	QC	1	<0.5	4	5	72	nd	850	<8	1700	32	1	0.6	<100	96
L102	JRI88-13-02-1	381106	5435585	QC	86	<0.5	12	76	198	nd	4	<8	<50	41	430	2	490	73
L103	JRI88-15-04-1	379105	5453634	IF	11	<0.5	31	3	20	nd	70	<8	<50	38	3	<0.5	<100	52
L104	JRI88-16-07-1	374341	5438561	GO/SU	82	0.6	0.15%	225	70	nd	46	<8	85	3**	580	0.7	<100	175
L105	JRI88-17-15-1	383604	5434744	GO	1	<0.5	60	6	44	nd	186	<8	790	<10	2	<0.5	240	140
L106	JRI88-17-16-2	383569	5434790	IF	36	<0.5	65	3	5	nd	15	<8	<50	17	11	2	170	35
L107	JRI88-19-07-1	379158	5444493	IF/SU	87	0.8	57	18	17	nd	360	<8	<50	27	80	2	180	49
L108	JRI88-21-13-1	378642	5444428	SZ	92	4	450	15	560	nd	10	48	<50	300	24	2	<100	90
L109	JRI88-23-12-1	377453	5451354	QC	5	<0.5	98	3	62	nd	160	<8	590	380	9	5	490	220
L110	JRI88-26-12-1	378806	5450866	SI	280	0.5	46	5	58	nd	17	<8	81	64	185	2	540	370
L111	JRI88-27-03-1	386840	5441009	QC/SU	220	18	0.10%	39	1.45%	nd	25	<8	<50	3**	27	2	<100	84
L112	JRI88-30-11-1	399729	5429006	GO	27	2	28	60	107	nd	54	45	43	4**	58	5	nd	nd
L113	JRI88-31-13-1	401391	5431513	QC	6	0.5	140	13	213	nd	26	<8	60	160	6	4	nd	nd
L114	JRI88-32-02-1	399508	5436899	IF	5	<0.5	10	2	6	nd	9	<8	23	28	2	<0.5	nd	nd
L115	JRI88-32-06-1	399401	5436769	GA/GO	4	2	102	17	85	nd	19	<8	88	37	14	1	nd	nd
L116	JRI88-40-11-1	397811	5435198	SI	2	<0.5	72	8	60	nd	18	<8	109	68	3	0.5	nd	nd
L117	JRI88-42-01-1	399588	5436409	SU	20	0.6	115	16	300	nd	56	<8	228	42	9	<0.5	nd	nd
L118	JRI88-42-03-1	399839	5436596	SZ	5	<0.5	10	7	35	nd	24	<8	149	24	<1	0.9	nd	nd
L119	JRI88-44-10-1	379325	5463377	QC	1	<0.5	149	2	78	nd	84	<8	218	58	13	0.8	nd	nd
L120	JRI88-49-06-1	365947	5433051	IF	132	1	0.22%	11	122	nd	9	<8	45	50	30	2	nd	nd
L121	SDU88-01-11-1	392694	5443209	QC	1	<0.5	54	35	42	nd	13	<8	<50	104	3	0.5	110	215
L122	SDU88-01-13-1	393072	5443394	QC	20	2	307	8	82	nd	41	<8	65	<20	13	1	<100	160
L123	SDU88-05-03-1	381522	5450477	QC	1	<0.5	41	10	114	nd	166	<8	180	70	5	3	<100	400
L124	SDU88-05-04-1	381638	5450331	QC	1	<0.5	36	36	81	nd	93	<8	180	70	3	1	480	225
L125	SDU88-07-02-1	385234	5445620	QC	1	<0.5	17	9	66	nd	38	<8	<50	256	8	3	220	120
L126	SDU88-07-05-1	385645	5445834	QV	14	0.6	8	18	8	nd	3	<8	<50	44	5	0.6	<100	<5
L127	SDU88-07-06-1	385707	5445869	QC	1	<0.5	51	6	183	nd	96	<8	390	44	13	4	140	230
L128	SDU88-07-07-1	385745	5445898	QC	1	<0.5	70	5	166	nd	53	<8	240	96	11	2	120	87
L129	SDU88-08-13-1	384563	5448091	SU	4	<0.5	41	43	58	nd	13	<8	<50	88	12	2	650	53
L130	SDU88-10-12-1	393144	5437847	QC	7	1	0.30%	3	74	nd	35	72	67	129	12	<0.5	590	230
L131	SDU88-11-09-1	392491	5436938	GO	5	0.6	0.11%	3	71	nd	52	<8	190	25	11	0.9	210	460
L132	SDU88-15-03-1	398412	5439885	QC	1	<0.5	12	3	92	nd	10	<8	<50	21	6	1	690	200
L133	SDU88-15-09-1	397717	5439927	QC	4	1	158	9	77	nd	65	<8	99	138	23	6	210	200
L134	SDU88-19-06-1	378757	5451810	SU	32	<0.5	159	6	112	nd	23	<8	73	540	50	3	420	235
L135	SDU88-20-04-1	387067	5441739	SU	1	1	31	13	74	nd	25	<8	<50	79	27	4	1200	45
L136	SDU88-21-02-1	375415	5445155	SU/GO	1	<0.5	74	9	111	nd	82	<8	150	23	5	<0.5	780	240
L137	SDU88-22-12-1	376049	5457981	QC	7	<0.5	174	5	38	nd	13	<8	<50	103	4	1	400	270
L138	SDU88-23-14-1	381053	5457846	SU	1	<0.5	24	6	25	nd	38	<8	<50	102	50	<0.5	150	41
L139	SDU88-30-06-1	366830	5430638	SU	9	2	0.32%	20	250	nd	71	<8	197	74	93	0.9	nd	nd
L140	SDU88-32-04-1	370660	5440898	SI	1	0.5	23	10	29	nd	2	<8	20	30	6	<0.5	nd	nd
L141	SDU88-32-04-2	370657	5440901	SU	4	0.5	75	30	280	nd	31	<8	97	85	10	1	nd	nd
L142	SDU88-32-04-3	370657	5440904	SU/SI	1	<0.5	14	5	61	nd	4	nd	<50	<10	3	<0.5	420	nd
L143	SDU88-33-04-1	369500	5446369	SU	5	<0.5	203	11	85	nd	82	<8	171	44	10	0.7	nd	nd

* **Mineralization/ alteration codes:**

GO Gossan or rusty weathering
IF Iron formation
SI Silicification
SU Sulphide mineralization
SZ Shear or fault zone
QC Quartz-ankerite alteration
QV Quartz veins

nd: not determined
<20: below indicated detection limit

** Hg results in ppm

(APPENDIX 1- TABLE 2 - Continued)

ANALYTICAL PROCEDURES FOR LITHOGEOCHEMISTRY

Analysis performed by B.C. Geological Survey - Analytical Sciences Laboratory

1. GOLD (Au)
Fire Assay/Atomic Absorption A 0.5 Assay Ton (approx. 15 gram) sample weight is subjected to a standard fire assay technique to generate a Au/Ag bead. The bead is dissolved in acid and Au is measured to a detection limit of <20 ppb by atomic absorption analysis.

2. SILVER AND BASE METALS (Ag, Cu, Pb, Zn, Co, Mo, Ni)*
Atomic Absorption Samples are digested using a mixed acid attack which includes HF. The dilute acid solution is further diluted to a specific volume and the elements are measured using AAS.

3. MERCURY (Hg)
Cold Vapour/Atomic Absorption A 0.1 g to 1 g sample is subjected to a HCl and HNO_3 digestion followed by the generation of Hg vapour using $SnCl_2$ as a reducing agent. The vapour is swept through a cell in the AAS light path and measured.

4. ELEMENTS As AND Sb
Hydride Generation A 1 g sample is digested using a mixture of HCl and HNO_3; a portion of the diluted sample solution is treated with $NaBH_4$ and the liberated hydride compound is swept into a hot cell in the light path of the AAS unit. The hydride decomposes to give a vapour of the element which is measured.

5. OTHER ELEMENTS (Sr, Ba, Cr)
X-Ray Fluorescence An approximately 4 gram pulverized sample is mixed with boric oxide and a fusion-flux (lithium tetraborate and lithium metaborate) and fused at 1150°C until completely dissolved in a platinum crucible. The resulting fused disk is then subjected to the x-ray fluorescence spectrometer.

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* - As samples are crushed using tungsten carbide equipment inevitable contamination of Co may occur.

APPENDIX 1 - TABLE 3
GEOCHEMISTRY OF MOSS-MAT STREAM SEDIMENT SAMPLES FROM THE ALBERNI - NANAIMO LAKES MAP AREA

MAP NUMBER	SAMPLE NUMBER	EASTING	NORTHING	FORMATION*	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As1 ppm	U ppm	Au1 ppm	Th ppm	Sr ppm	Cd ppm
M1	A88-001-M-0	388450	5443300	DSm, TrK	1	110	24	108	0.1	49	27	1049	5.42	17	5	nd	1	21	1
M2	A88-002-M-0	391500	5443250	Tw	1	107	24	108	0.1	58	31	903	6.60	13	5	nd	2	19	1
M3	A88-003-M-0	381390	5451350	DSn	1	67	13	61	0.1	44	22	692	4.70	2	5	nd	1	35	1
M4	A88-004-M-1	379650	5452600	DSn, DSd	1	86	17	68	1.1	61	29	736	5.41	43	5	nd	1	36	1
M5	A88-004-M-2	379650	5452600	DSn, DSd	1	93	17	70	0.1	63	29	784	5.48	40	5	nd	1	37	1
M6	A88-005-M-0	391550	5438900	Tw, DS	1	81	24	84	0.1	37	26	934	4.73	55	5	nd	1	32	1
M7	A88-006-M-0	392150	5439300	CPf, KNc	1	72	14	99	0.1	46	21	837	5.06	7	5	nd	1	31	1
M8	A88-007-M-0	392900	5437500	TrK	8	206	38	157	0.3	25	27	1096	7.00	16	5	nd	2	33	1
M9	A88-008-M-0	392700	5437900	Tw	1	114	19	117	0.2	49	28	1360	5.80	24	5	nd	1	32	1
M10	A88-009-M-0	391700	5436400	DSm	1	62	20	86	0.1	22	22	774	6.56	8	5	nd	2	27	1
M11	A88-010-M-0	385100	5437350	DSn, DSd	1	119	16	115	7.5	30	29	1047	6.62	14	5	nd	1	21	1
M12	A88-011-M-0	386200	5441550	DSd	1	76	18	82	0.3	35	24	847	4.92	17	5	nd	1	21	1
M13	A88-012-M-1	387350	5437350	DSn	1	52	14	63	0.5	22	19	655	5.30	10	5	nd	2	33	1
M14	A88-012-M-2	387350	5437350	DSn	1	53	16	64	0.1	21	20	659	5.14	5	5	nd	2	35	1
M15	A88-013-M-0	387050	5435050	DSn, DSd	1	74	13	63	0.1	47	22	743	4.37	2	5	nd	1	47	1
M16	A88-014-M-0	387100	5431200	DSd, DSn	1	71	8	57	0.1	57	25	781	4.15	2	5	nd	1	50	1
M17	A88-015-M-0	388750	5433550	DSn, DSd	1	61	20	71	0.1	49	22	912	4.29	2	5	nd	1	53	1
M18	A88-016-M-0	396900	5441100	TrK	1	124	11	80	0.1	38	24	678	5.58	10	5	nd	2	35	1
M19	A88-017-M-0	398300	5438300	TrK	1	89	22	75	0.1	79	29	1033	5.59	10	5	nd	1	22	1
M20	A88-018-M-0	398150	5438150	TrK	1	129	11	64	0.1	41	31	558	5.71	7	5	nd	2	37	1
M21	A88-019-M-0	395950	5438900	TrK	1	75	17	71	0.1	25	17	647	4.50	2	5	nd	3	30	1
M22	A88-020-M-0	381750	5445350	DSd	1	64	16	92	0.4	115	30	685	5.04	23	5	nd	2	24	1
M23	A88-021-M-0	382650	5445000	DSn, DSd	1	248	39	155	0.4	38	28	838	5.80	72	5	nd	1	25	1
M24	A88-022-M-0	382450	5445200	DSd, TrK	1	77	17	59	0.1	27	22	622	5.47	3	5	nd	7	34	1
M25	A88-023-M-1	378750	5446400	TrK	1	83	17	90	1.2	71	29	1020	5.75	360	5	3	2	23	1
M26	A88-023-M-2	378750	5446400	TrK	1	88	27	89	0.8	71	31	1084	5.90	380	5	2	2	26	1
M27	A88-024-M-0	379850	5455850	DSn, TrK	1	92	17	79	0.1	39	24	774	6.10	26	5	nd	1	21	1
M28	A88-025-M-0	379350	5457000	CPsm, TrK	1	54	11	87	0.2	29	14	815	3.58	10	5	nd	1	31	1
M29	A88-026-M-0	382350	5460450	TrK	1	140	11	88	0.1	46	28	982	6.04	9	5	nd	1	21	1
M30	A88-027-M-0	385400	5460500	TrK	1	111	19	71	0.1	30	23	1160	6.28	8	5	nd	1	26	1
M31	A88-028-M-0	370300	5465850	TrK	1	94	11	59	0.1	360	20	651	4.85	5	5	nd	1	17	1
M32	A88-029-M-0	382700	5429200	TrK	1	134	18	89	0.1	43	26	1070	5.12	4	5	nd	1	20	1
M33	A88-030-M-0	375000	5464500	DSn, DSd	1	42	13	63	0.1	25	16	2989	3.71	2	5	nd	1	34	1
M34	A88-031-M-1	375100	5465500	DSn	1	27	2	42	0.1	14	12	422	6.08	2	5	nd	2	21	0
M35	A88-031-M-2	375100	5465500	DSn	1	31	10	48	0.1	15	12	419	5.35	2	5	nd	1	22	1
M36	A88-032-M-0	378750	5464550	TrK, DSn	1	59	13	69	0.1	20	19	663	5.91	2	5	nd	1	17	1
M37	A88-033-M-0	373430	5457750	DSn, KNh	1	38	20	71	0.1	30	15	790	4.48	5	5	nd	1	20	1
M38	A88-034-M-0	372350	5461700	TrK, DS	1	51	14	66	0.1	23	15	1192	4.77	10	5	nd	1	18	1
M39	A88-035-M-0	373300	5430300	Jl, TrK	1	118	13	90	0.2	35	24	962	5.70	2	5	nd	1	29	1
M40	A88-036-M-0	374200	5451050	DSn, Jl	1	61	8	65	0.1	27	18	857	4.28	13	5	nd	1	37	1
M41	A88-100-M-0	387100	5447000	DSm	1	81	13	91	0.1	47	23	921	5.01	9	5	nd	1	22	1
M42	A88-101-M-0	387150	5445350	DSn, DSm	1	84	7	86	0.1	45	24	1016	4.78	10	5	nd	1	32	1
M43	A88-102-M-0	384550	5449100	DS, TrK	1	94	17	87	0.2	45	27	1756	6.17	12	5	nd	1	22	1
M44	A88-103-M-0	381400	5436990	DSd, Jl	1	94	52	92	0.7	58	28	713	5.01	89	5	nd	1	22	1
M45	A88-104-M-0	381850	5434600	TrK	1	357	52	160	0.8	70	31	906	5.98	193	5	nd	1	28	2
M46	A88-105-M-0	378000	5437050	TrK	1	132	12	96	0.1	56	28	924	6.50	5	5	nd	1	25	1
M47	A88-106-M-0	378000	5437550	TrK	2	176	21	129	0.1	101	34	1016	6.89	7	5	nd	1	41	1
M48	A88-107-M-0	374600	5441150	Jl	1	86	11	68	0.1	39	25	667	5.16	22	5	nd	2	33	1
M49	A88-108-M-0	372950	5441550	Jl	1	36	9	44	0.1	13	13	454	3.60	2	5	nd	3	31	1
M50	A88-109-M-0	378350	5430800	Jl	2	335	8	107	0.4	32	22	511	4.88	5	5	nd	1	41	1
M51	A88-110-M-1	377900	5432650	TrK	1	89	17	105	0.1	40	23	891	5.52	6	5	nd	1	35	1
M52	A88-110-M-2	377900	5432650	TrK	2	79	13	99	0.2	36	23	918	5.43	7	5	nd	1	36	1
M53	A88-111-M-0	374400	5435050	Jl, TrK	1	82	7	63	0.1	33	24	692	5.40	5	5	nd	2	30	1
M54	A88-112-M-0	378700	5441120	Jl	1	101	17	78	0.1	34	22	1035	4.87	14	5	nd	1	29	1
M55	A88-113-M-0	377000	5442800	TrK	1	180	17	85	0.1	49	29	1043	6.10	22	5	nd	1	29	1
M56	A88-114-M-0	399950	5430250	DSn	1	95	12	66	0.1	44	23	839	4.62	4	5	nd	1	56	1
M57	A88-115-M-0	399850	5432400	DSn, DSm	1	69	24	76	0.1	25	26	1018	7.31	4	5	nd	3	58	1
M58	A88-116-M-0	399700	5437050	DSn	1	61	17	63	0.1	25	23	645	6.36	5	5	nd	2	36	1
M59	A88-117-M-0	399050	5434200	DSm	1	60	8	59	0.1	25	17	671	4.43	6	5	nd	1	64	1
M60	A88-118-M-0	401100	5437250	DSd	1	57	17	110	0.1	20	22	1008	6.96	3	5	nd	5	78	1
M61	A88-119-M-0	406400	5428000	CPf, Jl	1	0	51	16	0.1	17	16	801	4.07	3	5	nd	1	59	1
M62	A88-120-M-0	406500	5428250	CPf, Jl	1	60	8	69	0.1	23	17	1011	3.82	6	5	nd	1	53	1
M63	A88-121-M-1	394950	5433300	DSn, DSd	1	60	12	58	0.1	24	17	572	5.16	2	5	nd	2	61	1
M64	A88-121-M-2	394950	5433300	DSn, DSd	1	58	8	53	0.1	25	18	511	5.28	2	5	nd	3	60	1
M65	A88-122-M-0	392300	5432300	DSn, DSd	1	72	7	44	0.1	46	17	492	3.08	3	5	nd	1	37	1
M66	A88-123-M-0	395000	5433100	DSn	1	48	6	53	0.1	36	19	558	4.16	2	5	nd	1	42	1
M67	A88-124-M-0	366720	5429700	Jl, TrK	1	102	16	90	0.1	65	25	710	6.04	14	5	nd	1	38	1
M68	A88-125-M-0	369550	5438500	Jl, TrK	1	34	14	53	0.2	16	15	664	4.13	5	5	nd	3	39	1
M69	A88-126-M-0	371410	5433750	TrK	1	40	12	51	0.1	16	13	754	2.96	2	5	nd	2	34	1
M70	A88-127-M-0	373050	5436620	Jl	1	54	11	62	0.1	29	20	650	5.08	2	5	nd	2	40	1
M71	A88-128-M-0	370500	5445600	Jl	1	59	10	42	0.1	22	14	434	4.82	2	5	nd	2	34	1
M72	A88-129-M-0	370850	5446450	Jl	1	45	11	56	0.1	30	18	539	4.57	7	5	nd	2	35	1
M73	A88-130-M-1	370900	5446250	Jl	1	22	5	47	0.1	11	15	432	8.33	4	5	nd	5	32	1
M74	A88-130-M-2	370900	5446250	Jl	1	22	2	48	0.1	14	14	420	8.68	2	5	nd	5	31	1

(APPENDIX 1- TABLE 3 - Continued)

MAP NUMBER	Sb1 ppm	Bi1 ppm	V ppm	Ca %	P %	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm	Au2 ppb	Hg ppb	LOI %	As2 ppm	Sb2 ppm	Bi2 ppm	Ge ppm	Se ppm	Te ppm
M1	3	2	119	1.10	0.068	7	54	1.91	93	0.18	46	3.04	0.01	0.04	2	15	50	14.3	18.7	1.3	0.3	0.2	2.1	0.3
M2	2	2	137	0.67	0.040	7	68	1.80	50	0.16	4	3.60	0.01	0.05	1	6	60	12.3	13.5	0.9	0.4	0.3	1.0	0.8
M3	2	2	125	1.26	0.056	6	66	2.13	49	0.18	11	3.31	0.01	0.30	1	4	50	4.9	4.5	1.1	0.3	0.3	0.5	0.5
M4	2	2	108	0.93	0.066	6	123	2.23	57	0.16	8	2.89	0.01	0.04	1	156	80	6.6	50.6	1.6	0.1	0.4	2.0	0.8
M5	4	2	111	0.96	0.074	7	131	2.31	62	0.21	7	3.00	0.01	0.04	2	27	70	7.8	44.6	1.6	0.3	0.6	1.1	0.8
M6	2	2	86	0.51	0.045	7	44	1.07	99	0.10	7	3.33	0.01	0.06	1	16	50	13.7	62.6	1.0	0.3	0.4	0.6	0.8
M7	2	2	101	0.62	0.049	8	48	1.46	123	0.13	6	3.20	0.01	0.07	1	63	30	8.6	7.4	0.4	0.2	0.2	0.6	0.3
M8	2	2	103	0.60	0.091	10	27	0.95	66	0.11	7	3.62	0.01	0.07	1	48	70	14.6	20.1	1.4	1.0	0.3	1.8	0.9
M9	2	2	92	0.79	0.056	6	41	1.09	112	0.07	3	2.95	0.01	0.11	1	92	80	17.8	26.9	0.7	0.3	0.6	1.1	0.8
M10	2	2	201	1.00	0.084	11	32	1.31	146	2.70	8	2.56	0.01	0.06	1	4	70	5.4	12.5	0.8	0.3	0.3	0.9	0.4
M11	2	2	154	0.72	0.046	4	48	2.30	33	0.16	2	3.06	0.01	0.04	1	196	190	9.0	19.9	0.5	0.2	0.2	0.9	0.8
M12	2	2	115	0.96	0.068	6	68	2.04	58	0.15	6	2.91	0.01	0.04	1	1190	40	6.2	17.9	0.7	0.6	0.2	0.5	0.3
M13	2	2	150	1.14	0.114	14	38	1.53	107	0.25	10	2.46	0.01	0.06	2	28	30	4.9	9.9	0.5	0.1	0.2	0.6	0.4
M14	2	2	143	1.19	0.118	15	38	1.58	112	0.25	15	2.57	0.01	0.07	1	7	30	5.3	6.5	0.3	0.2	0.3	0.3	0.3
M15	2	2	123	1.73	0.074	7	71	2.18	45	0.24	19	3.33	0.01	0.05	1	9	30	7.6	3.8	0.4	0.1	0.2	0.6	0.3
M16	2	2	112	1.42	0.064	5	89	2.33	25	0.21	6	3.20	0.01	0.04	1	36	20	8.8	1.9	0.3	0.1	0.2	0.4	0.3
M17	2	2	110	1.63	0.073	5	73	2.24	33	0.17	13	3.37	0.01	0.05	1	74	40	13.8	2.8	0.3	0.1	0.2	1.0	0.3
M18	2	2	131	0.97	0.044	7	37	1.54	31	0.33	6	2.80	0.01	0.03	1	21	30	5.2	13.1	0.9	0.2	0.2	0.5	0.3
M19	2	2	113	0.84	0.045	6	110	2.48	82	0.13	12	3.25	0.01	0.05	1	12	9100	10.4	10.0	1.3	0.2	0.2	0.8	0.3
M20	2	2	120	0.73	0.061	6	39	1.08	37	0.22	7	2.32	0.01	0.04	1	10	60	6.1	8.4	1.0	0.3	0.2	0.3	0.5
M21	2	2	95	0.79	0.066	7	31	0.94	68	0.18	6	2.47	0.02	0.05	1	2	70	7.9	6.6	0.5	0.3	0.2	0.3	0.5
M22	2	2	104	0.67	0.063	7	192	2.77	51	0.13	2	3.11	0.01	0.04	1	52	40	7.6	25.2	1.0	0.4	0.2	0.5	0.4
M23	2	2	146	0.66	0.050	4	62	2.62	57	0.13	4	3.29	0.02	0.11	5	111	60	11.1	80.5	1.1	0.6	0.2	0.8	0.5
M24	3	2	111	0.52	0.066	13	31	0.73	100	0.11	3	2.21	0.01	0.08	1	26	50	7.8	6.5	0.7	0.2	0.2	0.6	0.3
M25	3	2	83	0.60	0.095	10	116	2.08	84	0.04	7	2.84	0.01	0.05	2	2330	480	10.9	362.6	4.7	0.2	0.2	0.7	0.3
M26	3	2	84	0.73	0.096	11	120	2.12	93	0.04	10	2.92	0.01	0.05	2	3830	800	11.6	365.3	4.5	0.2	0.2	0.6	0.3
M27	2	2	103	0.97	0.045	6	38	1.09	176	0.16	14	1.85	0.01	0.05	1	19	310	8.9	21.6	2.6	0.2	0.2	0.2	0.4
M28	2	2	78	1.38	0.046	10	27	1.05	83	0.11	34	1.94	0.01	0.06	1	2	100	18.8	12.5	1.1	0.2	0.2	1.2	0.4
M29	2	2	155	1.37	0.048	7	53	1.73	71	0.33	27	3.21	0.01	0.04	1	5	280	10.4	10.0	2.3	0.2	0.2	0.7	0.3
M30	2	2	175	1.33	0.055	6	44	1.02	43	0.30	8	2.61	0.02	0.05	1	34	220	26.5	7.4	1.5	0.1	0.5	0.3	0.5
M31	2	2	142	0.99	0.027	5	42	1.00	46	0.34	5	3.00	0.01	0.03	1	15	90	10.3	6.8	1.4	0.1	0.2	0.3	0.3
M32	2	2	109	0.75	0.042	5	67	1.93	51	0.20	5	3.44	0.01	0.04	1	24	70	17.8	8.1	0.7	0.3	0.3	0.8	0.4
M33	4	2	71	1.52	0.077	10	41	0.90	159	0.05	14	1.99	0.01	0.07	1	1	210	39.5	3.4	1.4	0.2	0.2	0.9	0.4
M34	2	2	178	1.02	0.040	6	39	0.50	65	0.16	6	1.33	0.02	0.04	1	440	30	6.1	2.2	0.9	0.1	0.3	0.2	0.4
M35	2	2	155	1.07	0.037	6	35	0.51	69	0.15	5	1.39	0.02	0.07	1	360	60	10.2	2.4	0.9	0.2	0.2	0.3	0.3
M36	2	2	138	0.61	0.052	6	44	1.23	97	0.11	8	2.45	0.01	0.04	1	2	70	7.2	6.9	1.0	0.4	0.3	0.5	0.4
M37	2	2	96	0.61	0.043	6	35	0.62	104	0.04	5	1.57	0.01	0.03	1	7	80	11.7	6.6	0.8	0.3	0.2	0.5	0.3
M38	2	2	129	0.83	0.054	5	33	0.80	72	0.17	5	1.89	0.01	0.06	1	3	90	11.2	11.9	1.8	0.2	0.4	0.6	0.4
M39	1	2	147	0.95	0.060	5	44	1.63	46	0.27	4	2.90	0.02	0.02	1	2	80	16.1	4.0	0.5	0.3	0.2	0.3	0.3
M40	2	3	80	0.95	0.076	8	43	1.25	75	0.10	10	2.22	0.01	0.04	2	590	200	12.0	12.5	1.6	0.2	0.3	0.4	0.4
M41	2	2	118	0.90	0.067	8	71	1.98	69	0.18	10	3.04	0.01	0.04	2	2	70	7.5	11.8	1.0	0.5	0.2	0.8	0.3
M42	2	2	113	0.83	0.073	7	89	2.15	47	0.18	7	2.98	0.01	0.05	5	38	110	8.4	10.1	0.6	6.8	0.2	0.3	0.6
M43	4	2	106	0.60	0.062	7	61	1.75	93	0.05	8	2.68	0.01	0.05	2	179	280	14.7	12.7	2.1	0.1	0.3	0.5	0.9
M44	2	2	100	0.65	0.065	6	89	2.04	40	0.08	6	2.45	0.01	0.03	3	1360	80	5.3	99.1	1.1	0.1	0.2	0.6	0.4
M45	3	2	130	1.87	0.055	6	73	2.84	23	0.24	11	3.10	0.02	0.03	3	480	60	14.4	204.2	1.3	0.7	0.2	1.0	0.6
M46	2	2	178	1.12	0.038	5	75	2.09	16	0.37	12	3.78	0.01	0.02	1	74	80	15.9	5.3	0.3	0.1	0.2	0.2	0.5
M47	5	2	154	0.95	0.060	5	122	3.34	49	0.21	7	4.09	0.04	0.04	4	24	60	10.0	9.5	0.4	0.3	0.3	0.4	0.9
M48	2	2	118	0.80	0.065	7	62	1.75	55	0.17	8	2.61	0.01	0.03	2	46	70	6.7	18.5	1.0	0.1	0.2	0.5	0.3
M49	2	2	90	0.82	0.032	10	22	0.97	70	0.11	9	2.23	0.01	0.03	2	2	60	6.2	3.0	0.2	0.1	0.2	0.2	0.6
M50	2	2	102	1.00	0.048	4	36	1.34	57	0.19	16	3.17	0.06	0.08	10	50	40	9.0	7.8	0.2	0.6	0.2	0.3	0.7
M51	5	2	114	0.83	0.081	7	59	1.85	53	0.10	8	2.88	0.01	0.06	2	42	50	20.0	8.5	0.6	0.3	0.2	0.8	0.8
M52	2	2	111	0.88	0.080	7	58	1.83	54	0.10	5	2.90	0.01	0.06	1	101	60	20.4	8.2	0.4	0.1	0.2	1.0	0.5
M53	2	2	128	0.65	0.047	9	62	1.72	76	0.17	5	2.70	0.01	0.03	1	115	50	6.0	6.5	0.5	0.2	0.2	0.2	0.8
M54	2	2	104	0.84	0.059	7	47	1.58	68	0.12	5	2.70	0.01	0.03	2	70	80	13.6	19.6	0.9	0.2	0.2	0.8	0.3
M55	3	2	140	0.94	0.045	4	69	1.82	38	0.29	14	3.17	0.02	0.03	1	118	170	13.0	24.6	2.4	0.1	0.3	0.7	0.3
M56	2	2	104	1.00	0.082	6	80	2.00	40	0.23	8	2.94	0.01	0.09	1	20	70	12.1	4.7	0.3	0.1	0.5	0.5	0.7
M57	2	2	106	0.69	0.143	21	31	1.14	92	0.14	3	2.24	0.01	0.10	2	8	80	5.5	6.6	0.6	0.4	0.2	0.5	0.5
M58	2	2	112	0.65	0.078	9	32	0.97	64	0.10	4	1.92	0.01	0.04	1	2	60	6.5	8.9	0.7	0.1	0.2	0.3	0.5
M59	2	4	101	1.01	0.073	8	45	1.36	83	0.16	10	2.52	0.02	0.06	1	2	80	6.6	3.7	0.1	1.6	0.2	0.4	1.2
M60	2	2	114	1.10	0.179	24	26	1.00	60	0.16	6	2.28	0.05	0.15	2	1	60	5.1	7.9	1.3	0.1	0.2	0.4	0.3
M61	2	2	90	0.82	0.045	7	33	1.34	53	0.16	7	2.17	0.01	0.08	1	2	70	20.7	1.8	0.3	0.2	0.2	0.3	0.3
M62	2	2	75	0.91	0.088	7	32	1.58	76	0.13	7	2.64	0.01	0.08	1	1	110	23.4	6.3	0.3	0.1	0.2	0.9	0.3
M63	2	2	119	0.84	0.081	8	39	1.14	60	0.16	7	2.39	0.01	0.06	1	25	60	6.2	4.9	0.5	0.6	0.2	0.2	0.5
M64	2	2	123	0.82	0.077	9	41	1.09	60	0.16	10	2.27	0.01	0.05	2	350	100	4.5	4.3	0.6	1.2	0.2	0.2	0.3
M65	2	2	83	1.15	0.055	4	50	1.76	6	0.23	13	2.35	0.01	0.02	2	28	60	6.7	1.6	0.2	0.1	0.2	0.2	0.3
M66	2	2	100	1.00	0.064	5	58	1.81	18	0.19	16	2.45	0.01	0.03	2	2	70	5.9	2.7	0.2	0.2	0.3	0.2	0.5
M67	2	2	154	0.96	0.049	6	72	2.15	62	0.18	9	3.48	0.01	0.04	1	26	90	15.6	14.0	0.6	0.2	0.4	1.0	1.0
M68	2	2	87	0.93	0.045	7	19	0.90	63	0.10	4	2.26	0.01	0.04	2	7	70	12.8	6.2	0.4	0.2	0.2	0.2	0.3
M69	2	2	71	0.79	0.033	5	22	0.85	44	0.14	3	1.86	0.02	0.02	1	10	60	24.2	2.3	0.2	0.2	0.2	0.2	0.3
M70	2	3	133	0.90	0.050	8	43	1.53	66	0.16	7	2.55	0.01	0.03	1	26	70	10.0	4.7	0.5	0.1	0.2	0.2	0.3
M71	2	2	135	1.11	0.034	7	35	0.91	47	0.14	12	2.22	0.02	0.03	2	37	100	11.1	5.6	0.4	0.1	0.2	0.2	0.3
M72	2	2	109	0.82	0.062	9	51	1.37	38	0.15	8	2.20	0.01	0.04	1	48	120	5.8	10.1	0.8	0.1	0.2	0.2	0.3
M73	2	2	260	0.79	0.044	12	35	0.64	39	0.12	7	1.77	0.01	0.03	5	17	50	5.5	5.0	0.8	0.1	0.2	0.2	0.3
M74	2	2	274	0.77	0.045	12	38	0.62	77	0.12	5	1.67	0.01	0.03	2	1	60	5.9	4.6	0.8	0.1	0.2	0.2	0.3

***Dominant Formation in watershed:**

DSd: Duck Lake Fm.
DSn: Nitinat Fm.
DSm: McLaughlin Ridge Fm.
CPf: Fourth Lake Fm.
CPsm: St Mary's Lake Fm.
TrK: Karmutsen Fm.
JI: Island Plutonic Suite
Tw: Mt Washington Intrusive Suite

APPENDIX 1 - TABLE 4
REGIONAL GEOCHEMICAL SURVEY MOSS-MAT STREAM SEDIMENT SAMPLES FROM THE ALBERNI-NANAIMO LAKES MAP AREA

MAP NUMBER	RGS ID	NTS MAP SHEET	EASTING	NORTHING	FORM**	Au1 ppb	Au2 ppb	Sb ppm	As ppm	Bi ppm	Cd ppm	Cr ppm	Co ppm	Cu ppm	F ppm	Fe %	Pb ppm	Mn ppm	Hg ppm	Mo ppm	Ni ppm	Ag ppm	Sn ppm	W ppm	U ppm	V ppm	Zn ppm	LOI %	F# ppb	U# ppb	pH#
R1	891068	92F01	399665	5449069	uKN	5	0	0.3	6	0.1	0.1	86	10	45	130	3.39	15	255	47	3	21	0.2	1	1	2.5	65	57	5.5	22	0.02	6.6
R2	891072	92F01	399791	5448494	uKN	1	0	0.4	8	0.1	0.1	47	7	23	110	2.56	1	280	30	2	14	0.1	1	1	1.9	43	48	5.3	20	0.05	6.7
R3	891073	92F01	397069	5451337	MJgd	1	0	0.3	4	0.1	0.2	46	8	22	170	2.79	3	657	95	2	14	0.1	1	2	3.3	43	48	12.5	26	0.02	6.9
R4	891074	92F01	394405	5451906	MJgd	1	0	0.2	5	0.1	0.2	79	12	54	160	2.86	2	423	80	3	14	0.1	1	1	2.3	69	34	15.1	n.d.	n.d.	n.d.
R5	891075	92F01	393165	5450579	uTK	26	0	0.8	6	0.1	0.1	190	27	131	140	5.86	1	639	69	1	47	0.1	1	1	0.9	136	80	4.1	22	0.16	7.0
R6	891076	92F01	395785	5449491	MJgd.	4	0	0.4	4	0.1	0.2	64	9	33	120	3.40	2	328	47	2	19	0.1	1	2	2.8	64	51	5.0	20	0.06	6.7
R7	891077	92F01	396074	5446373	MJgd	880	2	0.2	3	0.1	0.1	63	9	72	150	2.15	6	582	54	1	13	0.5	1	1	2.8	52	39	8.5	10	0.02	6.6
R8	891078	92F01	394063	5447185	MJgd	5	6	0.4	3	0.1	0.1	232	22	212	110	5.51	2	545	49	1	47	0.1	1	1	0.4	166	69	7.6	n.d.	n.d.	n.d.
R9	891079	92F01	394237	5446800	MJgd	4	0	0.5	4	0.1	0.2	181	25	158	100	5.69	4	751	73	2	48	0.1	1	2	0.7	172	84	10.4	10	0.07	6.6
R10	891080	92F01	394237	5446800	MJgd	15	0	0.5	5	0.1	0.2	179	24	166	110	5.64	4	800	77	2	50	0.2	1	2	0.6	179	88	10.3	10	0.08	6.7
R11	891083	92F01	391096	5443807	uTK	4	0	1.0	12	0.1	0.2	163	28	100	320	6.05	9	829	100	4	58	0.1	1	2	1.1	151	137	11.6	20	0.11	7.0
R12	891084	92F01	390590	5443642	uTK	8	16	0.4	5	0.1	0.5	258	30	178	160	5.58	11	1400	165	4	57	0.3	1	1	0.3	149	158	23.4	10	0.02	6.6
R13	891317	92F01	394969	5432809	Cs	6	0	0.3	6	0.2	0.1	133	11	59	160	2.50	4	997	140	3	18	0.1	1	1	0.8	51	48	40.4	10	0.02	6.7
R14	891318	92F01	392706	5432200	Cs	2	0	0.1	2	0.1	0.1	588	20	81	170	3.03	2	524	33	1	51	0.1	1	1	0.5	72	49	5.5	10	0.02	6.6
R15	891319	92F01	392120	5431370	Cs	27	0	0.2	2	0.1	0.1	307	18	77	210	2.88	6	669	51	4	32	0.1	1	1	0.8	75	54	10.4	10	0.02	6.6
R16	891402	92F01	394834	5433511	MJgd	24	0	0.6	4	0.2	0.1	135	15	60	250	3.30	2	455	40	2	19	0.1	1	1	2.2	88	52	4.9	20	0.02	6.2
R17	891403	92F01	394834	5433511	MJgd	2	0	0.7	4	0.2	0.1	124	14	62	250	3.34	2	512	59	2	21	0.1	1	1	2.0	83	54	5.0	10	0.02	6.4
R18	891404	92F01	397906	5438975	Cs	2200	14	1.3	6	0.2	0.1	133	31	159	130	5.88	4	508	110	4	44	0.4	1	2	1.2	127	73	4.8	10	0.02	6.4
R19	891405	92F01	396072	5439028	uTK	7	2	0.4	4	0.2	0.1	89	12	53	190	2.97	2	407	37	4	19	0.1	1	2	2.2	62	56	4.5	20	0.02	6.2
R20	891406	92F01	396457	5439196	uTK	9	0	0.7	6	0.2	0.1	101	16	90	130	4.26	3	526	72	3	26	0.1	1	2	2.8	93	71	3.6	22	0.02	6.3
R21	891407	92F01	402267	5437246	MJgd	1	0	0.5	5	0.1	0.3	48	14	49	260	3.35	13	762	33	2	14	0.1	1	1	3.9	74	109	4.5	20	0.02	6.6
R22	891408	92F01	399376	5432355	Cs	7	0	0.4	4	0.1	0.2	130	17	63	160	3.99	3	594	26	2	26	0.1	1	1	1.9	71	59	4.4	20	0.02	6.5
R23	891409	92F01	401143	5432196	Cs	1200	16	0.4	4	0.1	0.1	72	18	58	240	4.07	7	588	42	2	15	0.1	1	2	1.8	60	64	3.9	20	0.02	6.8
R24	891410	92F01	400830	5432635	Cs	7	0	1.0	5	0.2	0.2	58	15	55	260	4.17	7	1500	44	2	17	0.2	1	1	3.3	74	80	5.0	20	0.02	7.0
R25	891411	92F01	398884	5434253	Cs	3	0	0.3	3	0.1	0.1	180	14	53	190	2.80	2	442	23	2	22	0.1	1	1	1.4	70	50	3.9	24	0.12	6.4
R26	891412	92F01	399638	5436684	Cs	27	0	0.7	5	0.1	0.1	91	14	52	220	3.47	3	610	70	2	19	0.2	1	2	1.5	62	59	9.3	22	0.10	7.5
R27	891413	92F01	399182	5437229	Cs	40	0	0.7	7	0.3	0.1	58	9	43	200	2.74	2	501	76	3	13	0.1	1	3	2.0	64	64	5.9	28	0.02	7.1
R28	891414	92F01	395035	5436934	MJgd	153	21	0.6	7	0.3	0.1	44	13	72	210	3.46	4	1240	63	7	12	0.2	1	2	4.8	67	101	11.1	64	0.02	6.3
R29	891415	92F01	392424	5437095	MJgd	21	88	1.7	38	1.0	0.6	129	22	139	160	5.79	6	638	76	7	35	0.2	1	1	1.4	109	160	7.4	20	0.02	6.6
R30	891416	92F01	391162	5440149	ETqd	3	0	0.5	5	0.1	0.1	148	18	76	180	4.77	5	692	44	2	37	0.1	1	2	1.1	103	88	6.7	36	0.02	6.7
R31	891417	92F01	391271	5438940	uTK	8	0	0.5	5	0.1	0.2	103	17	57	180	4.31	8	709	38	2	26	0.1	1	1	1.1	76	72	5.8	32	0.02	6.6
R32	891418	92F01	391340	5436672	Cs	4	0	0.7	7	0.1	0.1	114	15	52	230	4.22	5	583	37	3	20	0.1	2	6	1.4	112	73	5.1	24	0.02	6.8
R33	891419	92F01	391219	5435120	Cs	18	0	0.4	5	0.1	0.1	284	16	48	160	3.57	3	484	37	2	30	0.2	1	2	1.7	82	50	5.5	22	0.02	6.8
R34	891486	92F01	399778	5430205	Cs	274	36	0.2	3	0.1	0.1	262	18	82	220	3.07	3	524	37	2	34	0.1	1	1	1.3	69	52	8.1	24	0.02	6.8
R35	891562	92F01	402804	5439137	MJgd	1	0	0.3	4	0.1	0.1	45	10	25	130	2.44	3	587	74	1	8	0.1	1	1	1.5	61	38	9.4	22	0.02	6.9
R36	891563	92F01	401032	5441105	MJgd	2	45	0.5	7	0.1	0.1	60	9	32	100	2.49	3	363	49	2	12	0.1	1	1	1.9	50	40	3.3	22	0.02	6.9
R37	891564	92F01	400656	5441553	MJgd	68	0	2.3	20	0.3	0.3	49	9	43	100	2.63	6	297	41	1	12	0.1	1	2	2.4	51	51	2.4	24	0.02	6.8
R38	891565	92F01	402864	5443001	MJgd	3	0	1.0	19	0.2	0.1	48	8	20	110	2.61	4	308	53	1	12	0.1	1	2	2.9	46	44	4.2	20	0.02	6.4
R39	891566	92F01	402864	5443001	MJgd	2	0	1.5	18	0.1	0.1	49	8	21	90	2.38	5	326	43	1	11	0.1	1	2	1.8	47	43	4.6	20	0.02	6.4
R40	891608	92F01	400294	5446577	uKN	1	0	0.6	17	0.2	0.1	59	13	35	110	3.77	3	562	59	2	21	0.1	1	2	1.7	52	61	10.5	22	0.02	7.1
R41	891036	92F02	380425	5454865	uTK	13	0	1.7	16	0.1	0.2	124	20	83	110	5.88	2	604	300	1	36	0.1	1	1	1.9	101	84	3.6	24	0.02	7.3
R42	891037	92F02	380611	5455197	uTK	2	0	1.2	7	0.1	0.1	213	26	139	90	6.21	1	760	190	1	45	0.1	1	2	0.7	139	85	9.3	22	0.07	7.0
R43	891038	92F02	370448	5455130	uKN	1	0	0.6	4	0.1	0.2	111	14	32	90	2.91	4	658	130	2	28	0.1	1	1	1.2	85	66	8.2	22	0.08	6.8
R44	891085	92F02	389236	5445340	uTK	10	0	0.3	3	0.1	0.2	96	30	142	120	6.25	9	1800	230	3	37	0.1	1	1	0.4	145	100	35.4	10	0.02	5.9
R45	891086	92F02	387472	5444858	uTK	5	5	1.0	11	0.1	0.1	187	23	84	210	4.93	6	1265	74	3	43	0.1	1	1	1.3	136	98	13.2	10	0.07	6.7
R46	891087	92F02	385502	5450306	uTK	13	0	0.2	2	0.1	0.1	166	34	211	190	7.40	8	1200	62	2	60	0.1	1	1	0.2	223	118	13.9	24	0.06	7.1
R47	891088	92F02	385502	5450306	uTK	6	0	0.2	1	0.1	0.3	169	33	235	150	7.62	9	1185	65	3	59	0.1	1	2	0.4	207	116	16.0	26	0.06	7.2
R48	891089	92F02	383273	5451492	uTK	8	0	0.2	2	0.1	0.2	248	32	173	110	7.28	1	1100	61	3	61	0.1	1	1	0.2	201	93	13.8	26	0.09	7.2
R49	891090	92F02	384513	5449341	uTK	10	0	2.2	9	0.1	0.2	141	25	76	250	5.34	3	997	375	2	44	0.1	1	1	0.7	99	69	9.6	22	0.02	7.0
R50	891091	92F02	381347	5451401	Cs	3	0	1.5	3	0.1	0.2	254	21	62	150	4.51	1	604	205	2	44	0.1	1	1	0.8	95	53	7.1	22	0.02	7.2
R51	891092	92F02	379651	5452618	Cs	700	40	1.9	25	0.1	0.3	322	23	79	220	4.34	3	613	88	3	61	0.1	1	1	1.1	98	56	7.6	28	0.02	7.3
R52	891102	92F02	382606	5445473	Cs	10	0	0.9	6	0.1	0.2	326	25	78	130	4.68	4	1025	155	2	75	0.1	1	2	0.5	95	71	10.6	20	0.02	7.2
R53	891103	92F02	382905	5444970	uTK	65	480	1.4	56	0.6	0.8	198	27	260	160	5.00	28	763	82	3	37	0.4	1	7	0.5	142	144	11.1	20	0.02	7.1
R54	891104	92F02	382062	5444788	Cs	155	135	0.8	22	0.2	0.6	488	25	59	180	4.42	10	645	57	2	105	0.3	1	3	1.0	91	88	6.9	20	0.07	7.3
R55	891106	92F02	378307	5446629	Cs	37	0	2.6	48	0.1	0.2	175	27	96	180	4.95	5	1210	175	3	55	0.1	1	2	1.0	89	88	12.4	20	0.08	7.1
R56	891107	92F02	378307	5446629	Cs	45	0	2.7	49	0.1	0.3	190	26	95	210	4.82	4	1040	170	2	53	0.1	1	4	1.1	87	89	10.3	20	0.05	7.2
R57	891108	92F02	371458	5447906	MJgd	1205	13	0.3	3	0.1	0.2	82	7	20	110	2.38	3	692	110	2	11	0.4	1	1	4.1	46	40	22.1	20	0.09	7.1
R58	891109	92F02	370971	5446192	MJgd	2	0	0.5	3	0.1	0.1	74	7	35	180	2.64	7	275	61	2	7	0.1	1	2	3.4	76	30	2.9	24	0.34	7.1
R59	891110	92F02	371163	5447000	MJgd	85	0	1.0	8	0.1	0.1	152	15	36	200	3.23	1	399	130	3	24	0.1	1	7	1.8	71	43	4.1	22	0.02	6.7
R60	891111	92F02	373062	5442045	MJgd	1	0	0.3	2	0.1	0.1	32	7	21	190	2.50	2	421	69	3	3	0.1	1	1	4.1	57	35	9.2	22	0.20	6.9
R61	891112	92F02	377040	5442199	Cs	15	0	1.2	10	0.1	0.1	236	21	74	220	3.98	2	598	58	4	39	0.1	1	1	0.7	81	54	3.4	22	0.10	7.0
R62	891113	92F02	376975	5442657	Cs	20	0	1.5	19	0.1	0.1	195	26	181	190	5.27	2	673	315	2	47	0.1	1	2	0.5	126	72	8.2	20	0.02	6.8
R63	891177	92F02	375183	5455391	uKN	17	0	0.9	6	0.2	0.2	161	14	56	180	3.45	2	436	77	3	29	0.1	1	1	1.0	78	46	3.3	20	0.02	7.3

(APPENDIX 1- TABLE 4 - Continued)

MAP NUMBER	RGS ID	NTS MAP SHEET	EASTING	NORTHING	FORM**	Au1 ppb	Au2 ppb	Sb ppm	As ppm	Bi ppm	Cd ppm	Cr ppm	Co ppm	Cu ppm	F ppm	Fe %	Pb ppm	Mn ppm	Hg ppm	Mo ppm	Ni ppm	Ag ppm	Sn ppm	W ppm	U ppm	V ppm	Zn ppm	LOI %	F# ppb	U# ppb	pH#
R64	891178	92F02	375448	5454305	Cs	6	1	4.0	29	0.2	0.1	148	21	60	310	4.22	2	672	350	3	37	0.1	1	5	1.2	66	60	5.4	20	0.02	7.4
R65	891179	92F02	374037	5450970	Cs	175	37	1.4	9	0.2	0.2	121	15	58	180	3.43	2	756	595	2	23	0.1	1	1	0.8	68	59	9.6	20	0.05	7.4
R66	891180	92F02	368389	5451012	MJgd	3	0	0.5	3	0.2	0.2	67	9	35	120	3.08	13	837	135	2	15	0.1	1	2	2.9	65	37	24.0	20	0.05	7.2
R67	891222	92F02	383340	5431344	Cs	61	0	0.6	13	0.1	0.2	196	31	118	120	6.00	7	1505	95	2	56	0.1	1	2	0.2	140	99	37.0	n.d.	n.d.	n.d.
R68	891223	92F02	381676	5434561	Cs	320	640	1.8	98	0.8	0.7	203	28	346	210	5.37	22	808	89	4	70	0.8	1	2	0.8	115	164	9.8	10	0.05	7.1
R69	891224	92F02	381931	5436352	Cs	8	2	0.2	3	0.1	0.2	302	23	102	170	3.84	2	736	46	2	75	0.1	1	1	0.5	117	57	11.3	10	0.05	7.3
R70	891225	92F02	381267	5436451	Cs	725	900	1.3	96	0.2	1.2	257	24	93	220	4.02	68	596	70	1	59	0.9	1	3	0.9	78	105	6.2	10	0.02	7.6
R71	891226	92F02	377239	5438864	Cs	3	0	0.1	1	0.2	0.1	99	20	126	90	5.30	10	1820	150	1	34	0.1	1	1	2.4	135	67	34.1	n.d.	n.d.	n.d.
R72	891227	92F02	377076	5437941	Cs	118	7	0.3	6	0.2	0.7	258	30	161	190	6.58	9	938	37	4	102	0.3	2	2	1.8	150	126	8.6	20	0.15	7.4
R73	891228	92F02	377578	5437954	Cs	109	27	0.3	2	0.1	0.1	195	26	122	120	5.49	2	1085	74	2	54	0.2	1	2	0.6	169	92	12.8	20	0.02	7.3
R74	891229	92F02	376178	5438802	Cs	260	8	0.3	3	0.1	0.2	219	25	113	160	5.42	4	734	44	3	71	0.1	1	2	1.3	137	83	5.9	20	0.16	7.3
R75	891248	92F02	367074	5429629	uTK	7	0	0.7	7	0.1	0.4	131	20	79	190	4.44	3	595	140	3	59	0.1	1	2	1.1	127	78	14.7	10	0.05	7.0
R76	891249	92F02	366425	5433333	MJgd	2	0	0.2	2	0.1	0.1	28	7	20	150	2.20	3	383	58	3	6	0.1	1	1	2.1	55	32	7.1	10	0.02	6.8
R77	891250	92F02	371774	5433775	uTK	1	0	0.2	3	0.1	0.1	74	16	102	140	3.43	2	829	120	2	21	0.1	1	1	1.0	89	62	17.1	10	0.16	6.8
R78	891251	92F02	378523	5430812	MJgd	15	365	0.6	8	1.6	0.1	93	18	265	150	3.62	2	437	57	5	22	0.3	1	5	1.3	84	90	10.1	10	0.02	6.5
R79	891252	92F02	378084	5432791	MJgd	22	0	0.6	6	0.3	0.4	142	20	77	250	4.13	7	801	96	5	35	0.2	1	2	2.7	95	92	13.1	10	0.10	7.4
R80	891253	92F02	378084	5432791	MJgd	440	0	0.7	6	0.2	0.7	145	19	73	250	4.35	5	767	94	5	35	0.2	1	2	2.2	97	92	11.5	20	0.10	7.3
R81	891254	92F02	376234	5433174	MJgd	65	0	0.2	3	0.4	0.3	41	12	51	200	3.53	7	1080	155	4	10	0.1	1	1	2.0	65	81	16.1	10	0.02	7.0
R82	891255	92F02	373779	5435235	MJgd	41	0	0.6	3	0.1	0.1	103	17	69	170	3.83	2	572	59	2	27	0.1	1	1	1.2	95	51	5.6	10	0.02	6.9
R83	891256	92F02	373379	5437226	uTK	12	0	0.5	4	0.2	0.1	96	26	85	200	5.00	1	711	680	4	25	0.1	1	2	1.8	131	58	7.8	10	0.02	7.2
R84	891257	92F02	368264	5440796	MJgd	1	0	0.3	2	0.1	0.1	20	8	30	250	2.88	6	1045	91	2	5	0.1	1	1	4.0	76	53	27.2	10	0.08	7.1
R85	891258	92F02	369540	5439037	MJgd	12	0	0.2	2	0.1	0.1	45	7	25	200	2.12	3	532	74	5	10	0.1	1	1	2.1	54	38	18.9	10	0.06	7.0
R86	891455	92F02	367452	5443460	MJgd	6	0	0.3	7	0.2	0.1	54	13	39	140	3.32	4	698	69	3	13	0.1	1	2	2.3	90	44	7.0	n.d.	n.d.	n.d.
R87	891522	92F02	387235	5440750	Cs	42	0	0.9	17	0.4	0.6	184	23	86	160	5.10	12	1300	85	1	44	0.2	1	2	1.3	94	101	8.8	26	0.02	7.6
R88	891523	92F02	386828	5440722	Cs	40	0	0.6	14	0.4	0.4	310	21	77	200	4.60	6	789	79	2	38	0.2	1	1	0.9	99	77	5.9	26	0.02	7.4
R89	891524	92F02	387523	5439105	Cs	11	25	0.5	9	0.2	0.2	146	20	83	140	5.01	10	1105	61	2	31	0.1	1	1	1.3	104	84	11.3	34	0.02	7.8
R90	891526	92F02	387297	5435175	Cs	7	0	0.2	3	0.1	0.1	752	18	55	120	3.67	2	524	36	1	50	0.1	1	3	1.1	77	50	4.9	24	0.02	7.4
R91	891527	92F02	386865	5438442	Cs	13	0	0.1	3	0.1	0.1	796	20	75	150	3.59	20	665	49	2	60	0.2	1	2	0.4	84	52	11.2	n.d.	n.d.	n.d.
R92	891528	92F02	387306	5431277	Cs	5	0	0.1	1	0.1	0.1	580	23	63	160	3.90	19	790	40	1	61	0.1	1	2	0.9	79	55	4.0	26	0.02	7.5
R93	891529	92F02	386604	5429879	Cs	88	0	0.3	4	0.1	0.1	516	24	82	110	3.95	16	758	58	1	59	0.3	1	2	0.9	84	47	6.5	26	0.02	7.8
R94	891530	92F02	385049	5435676	Cs	77	0	1.0	8	0.1	0.1	221	20	72	120	5.29	6	689	310	1	44	0.1	1	1	1.2	111	79	3.8	22	0.02	7.7
R95	891531	92F02	370967	5431811	MJgd	2	0	0.1	3	0.1	0.1	52	9	30	60	2.71	3	658	77	2	10	0.1	1	2	1.3	58	34	17.5	n.d.	n.d.	n.d.
R96	891532	92F02	370715	5431163	MJgd	4	0	0.2	2	0.2	0.1	76	11	38	100	2.76	9	450	59	2	15	0.1	2	1	1.9	69	45	6.6	20	0.02	6.2
R97	891578	92F02	388814	5453508	uTK	10	0	0.2	4	0.1	0.1	204	22	166	70	4.04	3	1385	70	2	37	0.1	1	1	0.5	126	66	10.1	26	0.02	6.8
R98	891579	92F02	388053	5454264	uTK	1	6	1.5	8	0.1	0.1	153	23	189	100	6.80	1	725	190	2	39	0.1	1	2	0.6	155	81	7.3	22	0.02	6.6
R99	891604	92F02	389082	5450524	uTK	1	19	0.4	3	0.1	0.2	221	24	185	90	6.65	1	802	89	1	47	0.1	1	2	0.4	156	86	6.6	22	0.02	7.6
R100	891605	92F02	389251	5450189	uTK	1	0	0.6	4	0.1	0.1	229	25	142	50	6.80	1	789	71	1	52	0.1	1	2	0.6	164	85	4.7	22	0.02	7.5
R101	891606	92F02	390071	5450486	uTK	9	0	0.3	5	0.1	0.1	222	26	176	80	6.85	1	1210	94	2	56	0.1	1	1	0.5	169	83	13.9	20	0.02	7.7
R102	893152	92F02	366480	5436023	MJgd	1	0	0.2	2	0.1	0.1	28	10	18	80	2.76	10	1145	115	3	6	0.1	1	2	2.2	40	43	13.5	20	0.02	6.8
R103	895187	92F02	366308	5445127	MJgd	1	0	0.3	4	0.1	0.1	48	15	44	150	3.66	5	536	85	2	9	0.1	1	2	2.3	103	52	7.9	20	0.02	7.6
R104	895193	92F02	375415	5447569	Cs	8	1	2.4	110	0.5	0.1	116	20	50	100	3.89	6	653	180	2	38	0.2	1	1	1.3	77	84	12.4	20	0.02	7.4
R105	895194	92F02	372250	5431093	uTK	4	0	0.2	2	0.1	0.1	130	24	106	90	4.66	1	800	74	1	31	0.1	1	1	1.0	109	82	8.8	10	0.02	7.3
R106	891034	92F07	382409	5460534	uTK	7	0	1.6	5	0.1	0.1	152	26	129	130	5.44	2	818	285	3	49	0.1	1	2	0.4	153	85	7.5	22	0.02	7.2
R107	891035	92F07	379163	5457169	PBL	7	0	1.2	9	0.1	0.4	95	13	55	200	2.82	4	736	110	2	30	0.1	1	1	1.5	77	82	13.1	26	0.15	7.6
R108	891170	92F07	374815	5465937	Cs	2	0	0.4	2	0.1	0.1	106	7	30	110	2.34	1	386	53	3	13	0.1	1	1	1.7	63	30	8.3	22	0.02	7.7
R109	891171	92F07	375059	5464560	Cs	2	0	1.6	2	0.3	0.1	103	14	41	160	3.84	2	1300	240	3	27	0.1	1	1	0.8	70	56	16.4	22	0.10	7.6
R110	891173	92F07	369431	5469647	uTK	5	0	0.6	3	0.2	0.1	164	19	97	110	4.37	1	707	250	2	35	0.1	2	1	1.0	138	66	10.3	20	0.07	7.1
R111	891174	92F07	371297	5469428	uTK	20	4	3.3	26	0.1	0.2	193	28	142	110	5.99	1	690	310	2	57	0.1	1	2	0.6	157	80	7.5	20	0.05	7.1
R112	891175	92F07	369941	5466244	uTK	8	18	1.8	7	0.2	0.1	166	34	222	90	8.21	1	1320	260	4	69	0.1	1	2	0.4	223	116	9.5	n.d.	n.d.	n.d.
R113	891176	92F07	370057	5465797	uTK	20	0	1.0	3	0.2	0.1	155	23	115	80	5.10	1	746	140	2	43	0.1	1	1	0.6	151	67	5.3	10	0.08	7.5
R114	891342	92F07	382132	5465377	uTK	1	0	0.3	4	0.1	0.1	116	17	75	110	3.83	6	1040	85	1	32	0.2	1	2	0.5	125	59	15.9	24	0.02	7.1
R115	891344	92F07	378394	5469928	uTK	3	0	0.3	2	0.1	0.1	166	5	23	140	2.14	1	196	37	2	9	0.1	1	1	3.1	72	22	4.3	n.d.	n.d.	n.d.

* Complete data and methods of sample analysis are contained within Matysek *et al.*, 1990

n.d. not determined

** Dominant geological formation in watershed (determined from Roddick *et al.*, 1979)

Cs : Sicker Group & lower Buttle Lake Group
PBL : Upper Buttle Lake Group
uTK : Karmutsen Formation
MJgd : Island Plutonic Suite
uKN : Nanaimo Group
ETqd : Mount Washington Intrusive Suite

Au1: Initial gold determination
Au2: Repeat determination if sample was anomalous for Au1 (100ppb) or a pathfinder element (As,Cu,Pb,Zn,Sb,Hg)

\# in waters

APPENDIX 2

MINERAL OCCURRENCES IN THE ALBERNI - NANAIMO LAKES MAP AREA

The data in this appendix has been extracted from the British Columbia Ministry of Energy, Mines and Petroleum Resources mineral inventory database MINFILE. Only the geological descriptions of the occurrences are included here; the complete data set is included in the MINFILE release for 92F Alberni (June, 1990).

NOTE: This material is reproduced directly from the MINFILE database (June, 1990) for the convenience of the reader.

MINFILE NUMBER: 092F 037 **NAME: SPECOGNA COPPER**
NORTHING: 5441451 EASTING: 390179 STATUS: Showing

CAPSULE GEOLOGY:

The Specogna Copper showing is located on the north side of the Nanaimo River.

A major northwest trending fault separates volcanics of the Upper Devonian McLaughlin Ridge Formation (Myra Formation), Sicker Group with basalts of the Upper Triassic Karmutsen Formation, Vancouver Group. The basalts are overlain by sandstone and conglomerate of the Cretaceous Nanaimo Group. The rocks are cut by feldspar porphyry of the Tertiary Mount Washington Intrusive Suite (Labour Lake Pluton), previously Catface Intrusions (Personal Communication - Nick Massey, May 1990).

Chalcopyrite, pyrite, bornite and sphalerite occur in lenses, pods and stringers in sheared and altered Karmutsen pillow basalts. The mineralized shear zone measures 60 by 15 metres, strikes 175 degrees and dips 80 degrees east. Quartz, calcite and chlorite are the main gangue minerals. A grab sample assayed 15.8% copper, 481 grams per tonne silver, 2.02% zinc and 0.9 gram per tonne gold (Assessment Report 10302). A 1.1 metre drill intersection assayed 2.14% copper, 9.6 grams per tonne silver and 2.5 grams per tonne gold (Assessment Report 10996).

MINFILE NUMBER: 092F 078 **NAME: REGINA (L.55G)**
NORTHING: 5445553 EASTING: 378670 STATUS: Prospect

CAPSULE GEOLOGY:

The mineralization occurs at the northwest edge of a 10 kilometre belt of Paleozoic Sicker Group rocks known as the Cowichan uplift. The belt was best described by Muller (1980) as a complex anticlinal uplift. Volcanic and sedimentary rocks of the Devonian Duck Lake and Nitinat formations underlie the area. The occurrence is located near the fault contact between these formations.

Work done on a crown grant in the 1890s consisted of at least 8 adits driven into green andesite to explore the tight quartz-sulphide lenses and veins found within. Locally, the andesite is highly silicified and pyritized. Westmin Resources Limited conducted a drill program in 1987 immediately adjacent to the crown grants and found that the area was underlain by basaltic flows, volcaniclastic rocks and less extensively by massive crystalline dacitic flows and lapilli tuffs. Intercalated with the basalts are narrow magnetite bearing tuffaceous units with associated sedimentary chert. Mineralized quartz veins are found within the basalts.

One adit sunk on a tight shear partly filled by quartz, strikes 050 degrees and dips 20 degrees southeast. Quartz-chalcopyrite-galena veins up to 5 centimetres and quartz stringers up to 13 centimetres are observed. One grab sample returned 22.6 grams per tonne gold and 480.0 grams per tonne silver. One 60 centimetre sample assayed 0.69 gram per tonne gold and 27.43 grams per tonne silver.

Mineralization in the drill core consists of quartz veins containing massive pyrite and chalcopyrite with specks of sphalerite. A 1 metre interval returned a value of 1.41 grams per tonne gold. Another 1 metre sample returned a value of 2% copper (Assessment Report 16144).

MINFILE NUMBER: 092F 079 **NAME: DEBBIE**
NORTHING: 5448325 EASTING: 379034 STATUS: Past Producer

CAPSULE GEOLOGY:

The area is underlain by andesitic to basaltic flows, pillowed basalts, tuff, agglomerates, cherty tuffs and chert of the Paleozoic Sicker Group. These comprise the Devonian Nitinat, Duck Lake and McLaughlin Ridge formations. The north-northeast striking Mineral Creek fault cuts the subparallel striking stratigraphy. Four mapable units include intermediate to mafic volcanics, bedded volcaniclastics, mylonite and foliated volcanics.

The Yellow and adjoining Debbie properties contain two main gold zones known as the Mineral Creek and Linda zones. The Mineral Creek Zone occurs within the immediate hangingwall of the east-dipping Mineral Creek fault and has a 600 metre strike length. The width ranges from 46 to 61 metres. The Mineral Creek zone is 150 metres north and on strike with the old Vancouver Island Gold Mine and extends onto the Yellow claims.

Two styles of mineralization are present in the Mineral Creek Zone: 1) gold occurs in a wide zone of cataclasis and pervasive ankerite-quartz-sericite-pyrite alteration and minor arsenopyrite inbedded volcaniclastic and aphyric basalt flow rocks adjacent to the fault and 2) gold occurs in quartz veins with minor pyrite and arsenopyrite cutting both the alteration zone and its immediate hangingwall aphyric basalt host. The veins are considered to be younger, possibly Tertiary, in age.

Inferred reserves (geological mineral inventory or volume of mineralized rock) for the Mineral Creek Zone are estimated at 99 443 tonnes grading 3.017 grams per tonne gold and for the extension onto the Yellow claim an additional 73 960 tonnes at 3.67 grams per tonne gold are inferred (Northern Miner Dec. 18, 1989).

The Linda Zone (Yellow), located 200 metres east of the Mineral Creek fault, is a set of quartz-clay-ankerite/calcite-minor pyrite and arsenopyrite veins with native gold. The veins, which are haloed by narrow ankerite-sericite-pyrite selvages, occur within a 600 metre northeast strike and 230 metre width. The Linda Zone includes the various veins described under the old Vancouver Island Gold Mine which produced 365 tonnes of ore yielding 9425 grams of gold, 1679 grams of silver and 88 kilograms of copper from 1898 to 1936.

Inferred reserves (geological mineral inventory or volume of mineralized rock) for the Linda Zone are estimated at 41 164 tonnes grading 9.153 grams per tonne gold (Northern Miner Dec. 18, 1989).

A 2 kilometre exploration tunnel was completed in March 1989. The tunnel was constructed to allow access to the Mineral Creek and Linda zones and for use as a drilling platform. Drilling and bulk sampling continue. The highest assay as a result of 1988 drilling in the tunnel on the Mineral Creek zone was 19.78 grams per tonne gold (Assessment Report 18936). Anomalous gold values were found to be associated with quartz veins in argillaceous cherts and visible gold was observed.

The three main gold-bearing quartz veins that were developed from the old workings are, from west to east, the Mac (called the Dunsmuir to the north), the Belcher and the Waterfall. The veins follow well developed shear zones on the east side of Mineral Creek. They are lense shaped and consist of two generations of quartz. Pyrite, arsenopyrite and minor sphalerite are disseminated in the veins and free gold has also been reported.

The Mac vein, the main working, was traced for 75 metres by several open-cuts and two adits. The vein averages 0.14 metres in width, ranging from 0.07 to 0.45 metres. The vein strikes northeast in the south part and north in the north part, dipping between 40 to 55 degrees. Sixty three samples taken over the length of the vein averaged 126.5 grams per tonne gold over 15 centimetres (Assessment Report 14483).

The Belcher vein is exposed in several open-cuts and one adit over 290 metres. It strikes north, dips 40 to 45 degrees and is up to 1.2 metres wide, averaging 0.20 metres. Sampling in 1973, resulted in assays from 0.1 to 9.95 grams per tonne gold and from 2.1 to 3.4 grams per tonne silver over 1.5 metre lengths (Assessment Report 14483).

The Waterfall vein is exposed by a few trenches over 35 metres, strikes north and dips about 65 degrees east. Widths range from 0.08 to 0.75 metres. Sample values were generally low except for one which assayed 404 grams per tonne gold over 0.15 metres (Assessment Report 14483).

MINFILE NUMBER: 092F 080 **NAME: GOLDEN EAGLE (L.198)**
NORTHING: 5440651 EASTING: 383957 STATUS: Showing

CAPSULE GEOLOGY:

The Golden Eagle showing is located approximately 16 kilometres southeast of Port Alberni and about 12 kilometres southeast of the Debbie deposit (092F 079).

CAPSULE GEOLOGY:

The area is underlain by volcanic and sedimentary rocks of the Devonian Duck Lake Formation (Sicker Group). A major vertical north trending fault cuts the rocks. The volcanics are intruded by diorite (McQuillan diorite stock) of the Early to Middle Jurassic Island Intrusions.

Several small quartz veins, variably mineralized with pyrite, chalcopyrite, galena, sphalerite, and arsenopyrite occur in andesite. The main quartz vein, and old workings, strikes 030 degrees, dips 65 degrees southeast and occurs in a 150 by 60 metre body of feldspar porphyry. The vein is a few centimetres to 1.5 metres in width, is about 120 metres long, and has a vertical depth of 100 metres. Mineralization consists of ribbon-quartz with pyrite and minor sulphides. A one metre sample of the vein assayed 1.7 grams per tonne gold, 24 grams per tonne silver, 0.1% lead and 0.85% zinc (Gunnex Limited, 1965).

A sub-parallel vein, known as the BSF vein, lying to the southwest of the main vein, occurs in andesite. The vein is 0.1 to 1 metre wide, strikes northeast and dips 70 degrees east. A 1.1 metre chip-channel sample assayed 17.5 grams per tonne gold, 1.46 grams per tonne silver, 0.35% lead, 0.27% zinc, and 0.05% copper (Assessment Report 10194).

MINFILE NUMBER: 092F 081 **NAME: B AND K**

NORTHING: 5440332 EASTING: 384437 STATUS: Showing

CAPSULE GEOLOGY:

The B and K showing is located 2 kilometres east of the Golden Eagle showing (092F 080), about 19 kilometres southeast of Port Alberni.

The area is underlain by volcanic and minor sedimentary rocks of the Devonian Duck Lake Formation (Sicker Group). A major vertical north trending fault cuts the rocks.

Several widely scattered narrow (up to 20 centimetres) quartz veins, with pyrite and minor sulphides, occur in shear zones within tuffs, cherts and andesite. A sample of one of these veins at the south end of Summit Lake assayed 87.8 grams per tonne gold (Minister of Mines Annual Report, 1944). To the north of the lake one hundred metres, quartz stringers with chalcopyrite, pyrite, sphalerite and galena occur. A 1.5 metre sample from a vein in a trench assayed 2.7 grams per tonne gold, 13.7 grams per tonne silver and 0.15% copper (Laanela, 1965).

MINFILE NUMBER: 092F 082 **NAME: GILLESPIE**

NORTHING: 5441449 EASTING: 382737 STATUS: Past Producer

CAPSULE GEOLOGY:

The Gillespie vein, one of the Havilah mine deposits, is located about 3 kilometres south of McKinlay Peak, 18 kilometres southeast of Port Alberni.

Paleozoic Sicker Group volcanics of the Devonian Duck Lake Formation are cut by a body of coarse-grained hybrid diorite of the Early to Middle Jurassic Island Intrusions. A north trending fault bounds the diorite to the west and cuts andesite to the north of the diorite.

The Gillespie vein occurs in andesite along a north-northeast trending shear zone for about 200 metres, strikes 010 degrees and dips 65 to 80 degrees east. The vein, 10 to 80 centimetres wide, averages 30 centimetres in width and contains ribbon-quartz with pyrite, sphalerite, galena, pyrrhotite, arsenopyrite and chalcopyrite. The wallrock is replaced by mariposite and carbonate minerals. A 0.20 metre chip sample assayed 7.33 grams per tonne gold and 317.09 grams per tonne silver (George Cross News Letter #2, 1990). From the Gillespie vein in 1936 and 1 939 949 tonnes was mined produced 8056 grams of gold, 43 669 grams of silver, 4244 kilograms of copper, and 12 677 kilograms of lead. The McQuillan vein (O92F 437) lies 600 metres to the south.

MINFILE NUMBER: 092F 083 **NAME: THISTLE (L.91)**

NORTHING: 5440382 EASTING: 380625 STATUS: Past Producer

CAPSULE GEOLOGY:

The Thistle mine is located about 16 kilometres southeast of Port Alberni, just south of Father and Son Lake.

Basaltic flows and pillow basalt of the Triassic Karmutsen Formation (Vancouver Group) are underlain by a complexly interlayered succession of volcanics and sediments of the Paleozoic Sicker and Mississippian to Lower Permian Buttle Lake groups. These include basaltic flows, agglomerates and bedded tuffs of the Upper Devonian McLaughlin Ridge Formation (Myra Formation), Sicker Group and limestones and marbles of the Upper Pennsylvania to Lower Permian Mount Mark Formation (Buttle Lake Group, previously Buttle Lake Formation).

Disseminated to massive sulphide mineralization, consisting of pyrite, chalcopyrite and minor pyrrhotite plus sulphide rich quartz-carbonate veins, occur in sheared pyritic quartz-sericite schists with chloritized mafic volcanic flows ("Mine Flow Unit") and tuffs of the Upper Devonian McLaughlin Ridge Formation. A nearby limestone, which strikes 170 degrees and dips 65 degrees southwest, has largely been replaced by diopside (skarn). Disseminated magnetite, some of which has been oxidized to hematite, occurs in the calcite and malachite occurs in places.

Two ore zones, 40 metres apart, measure 2 to 20 metres long by 1 to 8 metres wide. A 1.8 metre chip channel sample of a high grade shear at the south end of the lower glory hole assayed 38.4 grams per tonne gold, 30.5 grams per tonne silver and 2.69% copper(Assessment Report 11064). Drilling in 1984, intersected 20 centimetres of 17.6 grams per tonne gold in chloritic basalt, including 2 centimeters of massive pyrite (Assessment Report 15288).

The Thistle Mine was reported by early workers to be a skarn deposit in altered limestone, intruded by fine-grained diorite.

MINFILE NUMBER: 092F 084 **NAME: BLACK PANTHER**
NORTHING: 5439596 EASTING: 382697 STATUS: Past Producer

CAPSULE GEOLOGY:

The Black Panther mine, originally discovered in 1936, is located approximately 20 kilometres southeast of Port Alberni.

In the area, a north striking fault separates andesites of the Devonian Duck Lake Formation (Sicker Group) from Early to Middle Jurassic Island Intrusions diorite.

Quartz veins, lenses, stockworks and stringers containing variable amounts of sulphides, mainly pyrite, chalcopyrite, minor galena and sphalerite, occur in a shear zone which subparallels the andesite/diorite contact. The wallrock is strongly altered by ankeritic carbonate for widths of several centimetres to 9 metres. The main shear zone, which has been traced for at least 3.2 kilometres, is locally cut by quartz stringers. The stringers are 2.5 centimetres to 0.9 metres wide and up to 12 metres long. A subordinate shear set, trending 20 to 30 degrees, is also present. Ore grades are highest where these two shear sets intersect.

Reserves have been estimated at 12 250 tonnes grading 6.86 grams per tonne gold (Assessment Report 9639). The Black Lion showing (092F 085), about .5 kilometre to the southeast, is considered to be an extension of the main shear zone.

Sampling of the workings in 1987 averaged 18.5 grams per tonne over vein material from 1.7 to 2.1 metres wide (George Cross Newsletter #34, 1987). Production in 1947, 1948 and 1950 totalled 1715 tonnes which yielded 15 832 grams gold, 29 642 grams silver, 226 kilograms copper and 5588 kilograms lead.

MINFILE NUMBER: 092F 085 **NAME: BLACK LION**
NORTHING: 5438973 EASTING: 382948 STATUS: Showing

CAPSULE GEOLOGY:

The Black Lion showing is located approximately 20.5 kilometres southeast of Port Alberni. The mineralization is related to the Black Panther mine (092F 084) about .5 kilometre to the northwest.

In the area, a north striking fault separates andesites of the Devonian Duck Lake Formation (Sicker Group) diorite of the Early to Middle Jurassic Island Intrusions.

Pyrite and galena occur in quartz veins within a 0.25 to 2.8 metres wide carbonate altered shear zone within andesite and diorite. The veins are 30 to 50 centimetres wide over a 53 metre long zone which strikes north and dips 75 degrees east.

A shear zone sampled in 1987 assayed 1.71 grams per tonne gold over 4 metres (Assessment Report 17235).

MINFILE NUMBER: 092F 089 **NAME: HORNE LAKE**
NORTHING: 5468660 EASTING: 374400 STATUS: Showing

CAPSULE GEOLOGY:

The deposit consists of a limestone bed of the Upper Pennsylvanian to Lower Permian Mount Mark Formation, Buttle Lake Group (reassigned from the Sicker Group). It is exposed as an arc along the steep bluffs on the north and west sides of Horne Lake. The limestone is unconformably overlain by massive to pillowed basalts of the Upper Triassic Karmutsen Formation (Vancouver Group) and underlain by bedded tuffs and volcanic breccias of the Upper Devonian McLaughlin Ridge Formation (Sicker Group). Exposed thicknesses are up to 360 metres, as revealed on the south face of Mount Mark, north of Horne Lake. To the east, and west, of Mount Mark the limestone thins to less than 120 metres. The unit is folded into a broad northwesterly plunging syncline that is segmented by a series of steeply dipping faults.

The deposit is consists of medium to light grey, fine to coarse-grained recrystallized, yet well bedded bioclastic limestone, containing abundant crinoid remains. Thin sections display numerous whole and fragmented crinoid discs in a very fine grained limy mud matrix with minor secondary silica. At Mount Mark, the limestone contains minor thin chert beds in the upper and lower portions of the exposed section. In the middle of this unit, the limestone is interbedded with lenses and beds of argillite and tuff. Several gabbro sills intrude the limestone near the top of the section.

Development is limited to some mapping and sampling by B.C. Cement in the 1950s.

MINFILE NUMBER: 092F 141 NAME: WWW (L.37, 38, 39, 53)
NORTHING: 5431844 EASTING: 376947 STATUS: Past Producer

CAPSULE GEOLOGY:

The WWW veins are located east of Alberni Inlet, about 23 kilometres southeast of Port Alberni.

Three northeast trending quartz veins mineralized with pyrite, sphalerite and galena occur over a 300 metre length in granodiorite and diorite (Corrigan Creek Pluton) of the Early to Middle Jurassic Island Intrusions. The pluton intrudes volcanics of the Upper Triassic Karmutsen Formation.

The No. 1 vein is 90 metres long, 10 to 25 centimetres wide and dips 45 degrees southeast. It is exposed in one adit and 4 open cuts. In 1935, a 10 centimetre sample taken across the vein assayed 205.7 grams per tonne gold and 137 grams per tonne silver (Annual Report 1935). A 20 centimetre sample taken in 1970 assayed 7.3 grams per tonne gold and 57 grams per tonne silver (Assessment Report 2771).

The No. 2 vein, exposed by an adit, is 50 metres long, 0.20 metre wide and also dips 45 degrees southeast. A 0.10 metre sample assayed 58.6 grams per tonne gold and 84 grams per tonne silver (Assessment Report 2771).

The No. 3 vein dips about 25 degrees north, and measures 94 metres by 5 to 35 centimetres. A grab sample assayed 35.3 grams per tonne gold, 136.8 grams per tonne silver, 0.3% copper, 0.13% lead and 1.2% zinc (Assessment Report 2771).

MINFILE NUMBER: 092F 143 NAME: HIGH GRADE
NORTHING: 5447115 EASTING: 385525 STATUS: Showing

CAPSULE GEOLOGY:

The High Grade vein and CM-240 zone are located 1 and 1.8 kilometres respectively, north of Peak Lake.

The area is underlain by rocks of the Paleozoic Sicker Group comprising deformed breccia, tuff, argillite, greenstone, greenschist, narrow dikes of andesite porphyry, and argillaceous and calcareous sedimentary rocks. There are numerous faults and shear zone in the area suggesting a north-northeast fault through the Peak Lake area. A number of quartz veins and carbonatized zones are present.

The High Grade vein is hosted within a tightly folded sequence of cherty tuffs. The zone is characterized by tightly folded and fault bounded volcaniclastic rocks with minor pillow basalt of the Upper Devonian McLaughlin Ridge Formation, Sicker Group. Numerous quartz veins cut the volcaniclastic rocks and frequently yield anomalous values for gold upon geochemical analysis. The zone is broadly defined as having an average width of 200 metres, extending 700 metres northeast. The vein, open to the southwest, strikes 175 degrees and dips 32 degrees east. The vein is mineralized with sphalerite, pyrite, chalcopyrite and arsenopyrite. A grab sample(16215B) from the vein assayed 24.5 grams per tonne gold, 63.1 grams per tonne silver, 1.0% copper and 21.28% zinc. Drilling on the vein typically resulted in assays of 0.107 grams per tonne gold, 0.7 grams per tonne silver, 0.0071% copper and

The CM-240 zone, 800 metres north of the High Grade vein, is characterized by numerous north-northeast trending quartz and quartz-carbonate veins cutting tuffs, cherty tuffs and cherty argillaceous tuffs. The veins, up to 15 centimetres wide, contain pyrite and sphalerite. A sample from a 3 centimetre vein containing 50% pyrite and trace chalcopyrite assayed 0.5 gram per tonne gold, 17.1 grams per tonne silver and 0.17% copper (Assessment Report 17207).

MINFILE NUMBER: 092F 149 NAME: KITKAT 3
NORTHING: 5435354 EASTING: 386160 STATUS: Showing

CAPSULE GEOLOGY:

The Kitkat 3 showing is located east of Alberni Inlet on the slopes of Mt. Logan.

The area is underlain mainly by basalt, pillowed basalt, basaltic tuff and agglomerate of the Devonian Duck Lake Formation, Sicker Group. The mafic volcanics contain gabbroic sills probably related to the Early to Middle Jurassic Island Intrusions.

Discontinuous shearing and fracturing tend to parallel large-scale regional structures, specifically the fault zone forming the Nitinat River valley. Gossans are associated with the mineralized shears, which occur mainly in coarse-grained, hornblende-rich basalt. Pyrite occurs as a replacement of hornblende. The basalt is typically chloritized and less altered to pyrite, sericite and epidote. Areas of intense shearing contain quartz veins with pods of massive sulphides (mainly pyrite).

A lens of semi-massive pyrite and minor pyrrhotite occur in a gabbroic flow (Showing C). The lens contained low assay values, however, a 20 centimetre sample, 400 metres to the south, assayed 0.17% copper and 0.05% cobalt, and a 20 centimetre sample of massive pyrite in hornblendite, 400 metres to the west, assayed 2.94 grams per tonne gold, 1.4 grams per tonne silver and 0.11% cobalt (Assessment Report 13945).

MINFILE NUMBER: 092F 151 **NAME: MORIARTY LAKE**
NORTHING: 5444225 EASTING: 398460 STATUS: Prospect

CAPSULE GEOLOGY:

The Moriarty Lake occurrence area is underlain by biotite-hornblende granodiorite of the Early to Middle Jurassic Island Intrusions unconformably overlain by the Upper Cretaceous Nanaimo Group consisting of pebbly sandstone, siltstone and mudstone. The Nanaimo Group is intruded by thick dacite sills of the Late Eocene to Early Oligocene Mount Washington Intrusive Suite. The sedimentary sequence dips gently to the northeast and has been transected by an east trending fault, the Moriarty fault. The Moriarty fault has acted as a feeder zone for the intrusion of the dacite sills and is the locus of several stages of dike emplacement and brecciation associated with locally intense hydrothermal alteration and sporadic sulphide mineralization. The alteration appears to be vertically zoned, with propylitization and silicification dominating where the fault cuts basement granodiorite and clay-carbonate alteration in the overlying Nanaimo Group sediments and Tertiary sills.

The main showing is located in the fault zone in intensely carbonated and clay altered dacite at the base of a major sill, about 40 metres vertically above the Cretaceous unconformity. It is exposed in a creek gully where intensely altered carbonated rock carrying trace pyrite is intermittently exposed for 78 metres. The lower 30 metres of the section appears to consist of intensely altered sandstone with an outcrop of intensely altered dacite near the base. The upper part of the section is altered dacite within which the main showing is located just above the contact with the sandstone. The mineralized zone consists of a 12 metre section of intensely altered dacite with ankeritic carbonate veins 1 centimetre wide. The veins carry pyrite, sphalerite, galena, chalcopyrite and tetrahedrite. These minerals also occur in disseminated zones up to 18 centimetres wide in altered dacite with irregular ankeritic gashes. The veins generally strike 025 degrees and dip 75 degrees southeast and appear to be tension gashes *en echelon* to the Moriarty fault which is inferred to lie on the south side of the showing. This suggests a component of left-lateral movement on the fault. A grab sample assayed 1405.4 grams per tonne silver, 1.7% zinc, 0.2% copper and 0.04% lead (Assessment Report 10025).

Minor disseminated pyrite and chalcopyrite occur in both silty mudstone and dacite where the Moriarty fault juxtaposes the two units about 600 metres east of the main showing. A rock sample assayed 0.14% copper (Assessment Report 10025).

Further east, pebbly sandstone contains minor disseminated pyrite and traces of chalcopyrite associated with ankerite veins about 200 metres south of the Moriarty fault.

MINFILE NUMBER: 092F 161 **NAME: ARROWSMITH**
NORTHING: 5459260 EASTING: 385000 STATUS: Showing

CAPSULE GEOLOGY:

The Arrowsmith occurrence is underlain by massive and locally porphyritic andesite of the Upper Triassic Karmutsen Formation (Vancouver Group) near the fault contact with an extensive body of diorite 2.4 kilometres to the east. The andesite is cut by several shear zones up to 6 metres in width. Mineralization consists of chalcopyrite, bornite, pyrrhotite and pyrite hosted in quartz veins and veinlets up to 60 centimetres wide in a shear zone. The veinlets strike 210 degrees. Some minor fault offsets of the veins are evident. An altered limestone bed 4.5 to 6 metres wide occurs locally in the andesite and carries minor disseminated chalcopyrite. A grab sample across 1.2 metres from a lower adit assayed 9.05% copper, 27.4 grams per tonne silver and 6.8 grams per tonne gold (Property File - Report by H. Laanela).

Past work included two adits, some crosscutting and a winze developed along the shear zone. One adit is at 454 metres elevation and the second is at 480 metres elevation (ASL). Surface work consisted of stripping and pits.

MINFILE NUMBER: 092F 167 **NAME: BANK GP.**
NORTHING: 5445577 EASTING: 380413 STATUS: Showing

CAPSULE GEOLOGY:

The Bank Group showing is located on the north bank of China Creek, 21 kilometres east of Port Alberni. It is located on or near the southwestern corner of the Singapore claim just southeast of the Debbie/Yellow property (092F 079, 331).

The area is underlain by volcanic and volcaniclastic rocks of the Devonian Duck Lake Formation (Sicker Group) which have been intruded by Early to Middle Jurassic Island Intrusions dioritic rock. The showing is hosted in andesitic rocks that have been altered, fractured and sheared.

A series of open cuts have been dug on quartz veins carrying pyrite, chalcopyrite and galena. The mineralized zone, striking 200 degrees and dipping 20 to 40 degrees west, was reported to be 3 metres wide extending 100 metres or so along strike. A grab sample from the dump assayed trace gold, 34 grams per tonne silver and 3.2% copper (Annual Report 1917 p. 247).

Quartz-carbonate veining, generally 1 to 5 millimetres in width, is common in the area and pyrite content increases in veined rocks.

Exploration in 1984 resulted in one anomalous sample (0.9 gram per tonne) from a quartz-carbonate veined, sulphide rich volcanic rock taken from near the south boundary of the claim. Results from a 1987 geochemical survey were not significant. The 1988 program results confirmed the previous anomalous results and demonstrated the erratic nature of the high values.

MINFILE NUMBER: 092F 171 **NAME: P.D.**
NORTHING: 5469950 EASTING: 375450 STATUS: Prospect

CAPSULE GEOLOGY:

A zinc skarn or replacement deposit occurs in crystalline limestone of the Pennsylvanian to Permian Mount Mark Formation, Buttle Lake Group, just north of Horne Lake. The limestone is in contact with Upper Triassic Vancouver Group, Karmutsen Formation volcanics to the north of the occurrence.

The deposit consists of lenses and pods of predominantly massive sulphides and disseminated sphalerite exposed over a length of 122 metres and a width of 24 metres. An early report describes the massive sulphides as arsenopyrite with some sphalerite (Minister of Mines Annual Report 1927), however, a more recent report describes them as consisting of pyrite, marcasite and sphalerite (Assessment Report 14415). The individual zones of sulphide are reported to be up to 7.5 metres in width with a 025 degree strike and a 70 to 90 degree west dip.

A trench sample taken across 2.4 metres assayed 20% zinc (Minister of Mines Annual Report 1927). Another zone was sampled across 0.5 metres and was found to contain 21.98% zinc, 0.39% copper and 43.89 grams per tonne silver (Assessment Report 13105).

Three shafts were sunk on the deposit circa 1927, totalling about 72 metres in depth, and numerous trenches also exposed the showings. In 1964 Cominco was reported to have drilled 4 holes in the vicinity of the shafts. Recent work includes more diamond drilling and various geophysical surveys.

MINFILE NUMBER: 092F 172 **NAME: GRIZZLY**
NORTHING: 5446395 EASTING: 375548 STATUS: Past Producer

CAPSULE GEOLOGY:

The Grizzly showing is located about 3 kilometres east of the Alberni Inlet and 7 kilometres southeast of Port Alberni.

The area is underlain by Haslam Formation sediments of the Cretaceous Nanaimo Group which are intruded by granite porphyry of the Tertiary Mount Washington Intrusive Suite (formerly known as the Catface Intrusions) (Personal Communication - N. Massey, May 1990).

A vein of calcite, striking 75 degrees and dipping vertically, and quartz stringers occur in 60 degree striking, vertically dipping argillites and shales. These are mineralized with disseminations and stringers of arsenopyrite, pyrite and nodules of native arsenic. The vein, which is 30 to 60 centimetres wide, 4.6 metres deep and about 9 metres long, follows a fracture zone 1.2 to 1.5 metres wide. A 30 centimetre sample across the vein assayed 10.6% arsenic and 6.9 grams per tonne silver (Minister of Mines Annual Report 1924). A 60 centimetre sample over the main vein assayed 5.97% arsenic and 0.34 grams per tonne gold (Laanela, 1965).

High-grade ore and arsenic specimens are reported to have been removed from the site.

MINFILE NUMBER: 092F 182 **NAME: SKARN**
NORTHING: 5437374 EASTING: 393304 STATUS: Prospect

CAPSULE GEOLOGY:

The Skarn showing is located about 4 kilometres south of Labour Day Lake, 28 kilometres southeast of Port Alberni.

Volcaniclastics, volcanics and sediments of the Paleozoic Sicker Group and the Mississippian to Permian Buttle Lake Group are intruded by quartz-monzonite to granodiorite of the Early to Middle Jurassic Island Intrusions. These are overlain by sediments of the Cretaceous Comox Formation of the Nanaimo Group. The Sicker Group includes andesite and volcaniclastics of the Upper Devonian McLaughlin Ridge Formation and the Buttle Lake Group includes limestone and chert of the Upper Pennsylvanian to Lower Permian Mount Mark Formation.

Mineralized skarns have developed along the contact of quartz-diorite and limestone, limey sediments and volcanics. The skarns form garnet-epidote-actinolite-minor diopside-phlogopite-quartz-calcite-vesuvianite mineral assemblages. They contain lenses, layers, veinlets and patches of chalcopyrite, magnetite and minor pyrite, sphalerite, specularite and pyrrhotite.

The skarn zone outcrops over a distance of 550 metres with an average width of 150 metres. A drill hole intersected 14.5 metres containing 2.1% copper and 2.6 metres containing 0.59% copper, 0.62% zinc, and 216.3 grams per tonne silver (Laanela, 1965). Holes drilled in 1980, intersected 18.6 metres containing 0.91% copper and 14 grams per tonne silver and 4.6 metres containing 3.72% copper, 53.5 grams per tonne silver and 0.12% zinc (Assessment Report 8487).

MINFILE NUMBER: 092F 184 **NAME: MOUNTAIN**
NORTHING: 5431019 EASTING: 402932 STATUS: Showing

CAPSULE GEOLOGY:

Massive and stringer magnetite, jasper, pyrite and marcasite occur in shears within volcanics, likely of the Devonian Nitinat Formation (Sicker Group). One tunnel has been driven on the zone for 150 metres and another, higher up the mountain, for 45 metres.

MINFILE NUMBER: 092F 186 **NAME: SHAW CREEK**
NORTHING: 5428375 EASTING: 395468 STATUS: Showing

CAPSULE GEOLOGY:

The Shaw Creek showing is located on the creek north of Cowichan Lake. The showing is located on the Flight claims, *see also* 092F563.

Lenses of manganese silicates, mainly rhodonite, occur in highly folded red and white cherty tuffs of the Mississippian to Pennsylvanian Fourth Lake Formation, Buttle Lake Group. The lenses, which appear conformable, are occasionally coated with hard, black siliceous oxide.

The mineralization is exposed over an area measuring 100 by 30 metres. Three metre samples assayed from 22.2 to 40.8% manganese and 30 to 57% silica (Minister of Mines Annual Report, 1918).

Tests in 1940 showed samples contained pyrolusite, rhodochrosite and rhodonite, which are the oxide, carbonate and silicate of manganese, respectively. The manganese is often finely divided and associated with a highly siliceous gangue.

MINFILE NUMBER: 092F 193 **NAME: PORT ALBERNI**
NORTHING: 5458000 EASTING: 373000 STATUS: Showing

CAPSULE GEOLOGY:

The characteristic rock of this shale member of the Nanaimo Group, Haslam Formation is a black, dense, homogenous, very fine-grained, non-calcareous mud rock, occurring in massive beds, as much as 4.6 metres thick. The best and most continuous exposure is in Roger Creek and its tributary Fourmile Creek. For the most part, however, the shale does not outcrop and the area underlain by it is drift covered.

Samples of this shale were collected from a pit on the Alberni-Nanaimo highway about 5 kilometres from Alberni and sent to a ceramics laboratory for testing. The material had a fusion temperature of cone 5 (1235 degrees Celsius). When ground and tempered with 14.5% water it was found to be low in plasticity and could not be used alone for making hollow-ware. Tests were completed using both the wet moulded and semi-dry press methods of brick making. The fired bricklets were pink-buff in colour and hard in texture, however, the wet moulded bricklets were scummed and the semi-dry bricklets were friable on the edges. Refer to Geological Survey of Canada Summary Report of 1922, Part A, page 58A for a complete data tabulation of the firing characteristics.

MINFILE NUMBER: 092F 207 **NAME: MARY**
NORTHING: 5434408 EASTING: 379745 STATUS: Prospect

CAPSULE GEOLOGY:

Pillowed and massive andesite and associated volcaniclastics of the Upper Triassic Karmutsen Formation are intruded by gabbroic and basaltic dikes and feldspar porphyry dikes. The volcanics are overlain by thin to medium-bedded limestone, likely of the Triassic Quatsino Formation.

Several types of mineralization occur in an east-west trending area, measuring approximately 1000 by 400 metres, south of Mt. Spencer. These include: pyrrhotite, chalcopyrite, molybdenite and minor sphalerite and galena within quartz veins and shear zones in andesite; basalt dike margins with pyrrhotite; copper-bearing skarn zones in limestone and; chalcopyrite, pyrrhotite and pyrite near feldspar porphyry dike contacts.

In Zone 1, disseminated to massive pyrrhotite, pyrite and chalcopyrite, up to 0.6 metre thick, occur along fractures and joint surfaces over a 61 to 122 metre wide by 366 metre long area. The average grade of the zone is 0.15% copper, including a 6 metre section of 0.63% copper (Assessment Report 8177). A drill hole intersected 180 grams per tonne silver and 10.30% copper over 0.8 metres (Assessment Report 6134).

Zone 2, located 250 metres to the northeast of Zone 1, measures 15 by 300 metres and contains pods and disseminations of chalcopyrite and pyrrhotite. The average grade of the zone is 0.8% copper, including a 6 metre section of 0.97% copper (Assessment Report 8177).

One hundred meters north of Zone 2, Zone 3 contains disseminated and massive pyrrhotite and minor chalcopyrite on fracture planes in andesite.

Zone 3a, about 600 metres to the east of Zone 1, contains disseminated and massive chalcopyrite, pyrrhotite and molybdenite mineralization in narrow veins. A drill hole intersection contained 24.7 metres of 1.22% copper and 0.066% MoS_2, including 3.1 metres of 71.7 grams per tonne silver and 6.56% copper (Assessment Report 8177).

There are several other small mineralized zones in the area. Pat's vein, located 100 metres south of Zone 3a, is a highly oxidized, chloritized and fractured quartz vein near a feldspar porphyry dike. It contains pyrrhotite, pyrite and chalcopyrite and assayed 0.61% copper and 1.1 grams per tonne gold (Assessment Report 8177). Ball's vein, located 350 metres northwest of Zone 1, is a 40 centimetre by 50-metre quartz vein containing galena, pyrite and chalcopyrite. A 20 centimetre sample assayed 221.5 grams per tonne silver, 0.7% copper, 1.21% lead and 0.5% zinc (Assessment Report 14470).

MINFILE NUMBER: 092F 215 **NAME: STAR OF THE WEST (L.40)**
NORTHING: 5438288 EASTING: 372017 STATUS: Showing

CAPSULE GEOLOGY:

The Star of the West showing is located 5 kilometres east of Sproat Narrows in Alberni Inlet.

The area is underlain by Upper Triassic Karmutsen Formation (Vancouver Group) volcanics which are intruded by biotite granodiorite (Corrigan Creek Pluton) of the Early to Middle Jurassic Island Intrusions. The volcanics consist of greenstones, andesites and basalts. Quartz-carbonate veins, carrying minor pyrite and chalcopyrite, cut both rock types (volcanics and intrusives) but are more common in the andesites.

An old adit on the Star of the West Crown Grant follows a calcite vein, from 15 to 25 centimetres wide, along a 70 degree trending, 80 degree south dipping fault zone in granodiorite. Very minor gold and copper values were obtained from samples (Assessment Report 6676).

A 0.9 tonne shipment of ore, in 1895, contained about 17 grams per tonne gold (Minister of Mines Annual Report, 1895). It is likely some of the ore came from other showings in the area (*See* Cor 14, 092F 389 and Cor 6, 092F 399).

MINFILE NUMBER: 092F 216 **NAME: PORT**
NORTHING: 5433971 EASTING: 378517 STATUS: Showing

CAPSULE GEOLOGY:

The Port showing is located 1.6 kilometres southwest of Mt. Spencer, 22 kilometres southeast of Port Alberni. The Cup (Mary or Balls vein) (092F 207) showing is located at the northeast corner of the Port claim.

Pyrite and minor chalcopyrite in quartz stringers occur along a fault contact between hornblende diorite of the Early to Middle Jurassic Island Intrusions and Lower Jurassic Bonanza Group volcanic rocks. The 30 centimetre fault strikes 130 degrees and dips 85 degrees northeast. A 1.5 metre chip sample of the footwall in diorite assayed 2.9 grams per tonne gold and 1.714 grams per tonne silver (Assessment Report 14470).

An old adit occurs in the area and an 1895 report documented free gold with galena in altered diabase. Alteration minerals are quartz, pyrite and calcite.

MINFILE NUMBER: 092F 217 **NAME: RODEO**
NORTHING: 5429779 EASTING: 379543 STATUS: Showing

CAPSULE GEOLOGY:

Mafic volcanics of the Upper Triassic Karmutsen Formation and basalt of the Lower Jurassic Bonanza Group are intruded by diorite to quartz diorite (Corrigan Creek Pluton) of the Jurassic Island Intrusions. The Karmutsen volcanics are primarily basalts which exhibit lower greenschist metamorphism and are cut by feldspar porphyry dikes.

Mineralization occurs as fine-grained disseminations hosted in the intrusives and in vuggy quartz and quartz carbonate veins. Mineralization consists of pyrite, chalcopyrite, pyrrhotite, sphalerite, molybdenite, bornite and covellite.

A sample of quartz diorite adjacent to a vein on the Andy claim assayed 4.10% copper, 41.1 grams per tonne silver, 1.7 grams per tonne gold, 0.123% zinc and 0.0866% molybdenum. In this sample the pyrite replaces hornblende (Assessment Report 14930). An old adit occurs to the south of these showings. A typical grab sample from a quartz vein on the Rodeo claim assayed 1.1 grams per tonne gold, 5.5 grams per tonne silver, 0.026% copper and 0.224% zinc (Assessment Report 17419).

Prospecting and underground work on the Golden Slipper and Golden Rule claims were carried out in 1899 and 1900. These claims were likely in this area.

MINFILE NUMBER: 092F 218 **NAME: KITKAT 4**
NORTHING: 5433318 EASTING: 387540 STATUS: Showing

CAPSULE GEOLOGY:

The Kitkat 4 showing is located about 1 kilometre north of the Kitkat 3 showing (092F 149), about 14.5 kilometres east of Alberni Inlet.

The area is underlain mainly by basalt, pillowed basalt, basaltic tuff and agglomerate of the Devonian Duck Lake Formation, Sicker Group. The mafic volcanics contain gabbroic sills.

Mineralization occurs in shear zones within fine to medium grained, medium to dark green flows. The shears commonly contain 3 to 5 centimetre wide quartz veins and are crosscut by quartz-carbonate veinlets. Saussuritic alteration accompanies intense shearing.

A sample from a 30 metre wide shear (Showing BR35A) contained 3.42 grams per tonne gold. A sample, 850 metres to the south, from an epidotized fracture filling with malachite, azurite and sphalerite, assayed 0.99% copper (Assessment Report 13945). Pyrite is present as disseminations and pods in the sheared flows.

MINFILE NUMBER: 092F 233 **NAME: KAMMAT CREEK**
NORTHING: 5449250 EASTING: 384600 STATUS: Showing

CAPSULE GEOLOGY:

The Kammat Creek showing is located on the Emma 21 claim, 19 kilometres southeast of Port Alberni. The zone is characterized by intense carbonatization of mafic volcaniclastic rocks of the Upper Devonian McLaughlin Ridge Formation (Sicker Group) related to north-northeast trending faults which transect the area. Pyritic jasper with magnetite and minor black chert of the Devonian Duck Lake Formation (Sicker Group) also hosts mineralization in the area.

A number of graphitic, quartz-carbonate flooded shear zones were sampled. A sample of jasper, hematite and pyrite assayed 0.290 grams per tonne gold (Assessment Report 17207). A sample of silicified volcaniclastic rock containing up to 90% massive pyrite assayed 0.40 grams per tonne gold, 5.2 grams per tonne silver and 0.0103% cobalt. Other samples contained up to 0.0217% nickel. The Cup Creek showing, possibly obliterated, consisted of minor amounts of native copper, malachite, azurite, and bornite exposed in volcanic rock in a road cut on the Su 3 claim. A sample from a 5 centimetre quartz vein cutting basalt and containing 20% pyrite assayed 0.260 grams per tonne gold (Assessment Report 17207).

MINFILE NUMBER: 092F 236 **NAME: TYBER**
NORTHING: 5451000 EASTING: 388240 STATUS: Prospect

CAPSULE GEOLOGY:

The Tyber occurrence is underlain by Upper Triassic Karmutsen Formation (Vancouver Group) volcanic rocks consisting of andesitic to basaltic amygdaloidal and porphyritic massive flows, pillow breccia, minor tuff and a few thin interlava limestones. The stratigraphy is nearly flat lying and is cut by at least one regional fault and by numerous fracture and shear zones.

The occurrence area contains a number of separate but genetically related quartz vein systems hosted in shear and fracture zones. The vein systems vary in character from anastomosing to lensoidal and *en echelon* and range from hairline to approximately 1.5 metres in width. They are traceable in adits and on the surface for lengths from less than a metre to tens of metres. The gangue consists of mainly quartz matrix with wallrock fragments and varied amounts of carbonate. Mineralization is predominantly pyrite and/or chalcopyrite with locally abundant sphalerite and widely scattered pods of chalcocite. Locally galena is significant and pyrrhotite, arsenopyrite, magnetite and bornite have been observed. The sulphide mineralization is spotty, occurring in small massive pods and in clusters of aggregates of grains with zones that are pyrite rich, chalcopyrite rich or sphalerite rich. The highest assays from channel samples taken across veins and wallrock contained 16% copper, 3.84% zinc, 402.4 grams per tonne silver, 0.51% lead and 0.1 grams per tonne gold (Assessment Report 15171).

Past work included several open cuts and two adits.

MINFILE NUMBER: 092F 243 **NAME: SILVER BELL**
NORTHING: 5467050 EASTING: 374450 STATUS: Showing

CAPSULE GEOLOGY:

The Silver Bell showing occurs at the northern end of the Cowichan uplift, near the southern shore of Horne Lake. A quartz vein, up to 20 centimetres in width and 21 metres in length, hosting massive stibnite, arsenopyrite and pyrite occurs in volcanics of the Devonian Nitinat Formation, Sicker Group. The wallrock is sericite quartz carbonate altered. The vein has a 015 degree strike and 70 degree northwest dip. Samples of massive stibnite assayed up to 14.20% antimony (Assessment Report 17730). In 1939 an adit was driven for about 30 metres on the vein.

MINFILE NUMBER: 092F 244 **NAME: ESARY LAKE**
NORTHING: 5464848 EASTING: 372430 STATUS: Showing

CAPSULE GEOLOGY:

Northwest trending volcanic volcaniclastic sedimentary rocks of the Devonian Sicker and the Mississippian to Permian Buttle Lake groups are bounded by younger mafic volcanics of the Vancouver Group and sediments of the Nanaimo Group. The Sicker Group stratigraphy is very complex with numerous intercalations and rapid lateral facies changes. The rocks are commonly schistose with associated carbonate and silica alteration in the vicinity of faults.

The Esary Lake showing occurs in a chemical sedimentary unit probably within the Devonian Duck Lake Formation, which forms the base of the Sicker Group. The sedimentary rocks include grey to green chert and lenses of pale red jasperoidal chert (taconite). The deposit is reported to be larger than the Lacy Lake (092F 245) or Cameron River (092F 246) jasper deposits which have widths up to 30 metres and lengths up to 150 metres. The deposit is described as an iron rich chert.

MINFILE NUMBER: 092F 245 **NAME: LACY LAKE**
NORTHING: 5463599 EASTING: 373007 STATUS: Showing

CAPSULE GEOLOGY:

Northwest-trending volcanic volcaniclastic sedimentary rocks of the Devonian Sicker and Mississippian to Permian Buttle Lake groups are bounded by younger mafic volcanics of the Vancouver Group and sediments of the Nanaimo Group. The Sicker Group stratigraphy is very complex with numerous intercalations and rapid lateral facies changes. The rocks are commonly schistose with associated carbonate and silica alteration in the vicinity of faults.

The Lacy Lake showing occurs in a chemical sedimentary unit probably within the Devonian Duck Lake Formation, which forms the base of the Sicker Group. The sedimentary rocks include grey to green chert and lenses of pale red jasperoidal and manganiferous chert (taconite). The lenses are up to 50 metres thick and differ from the Cameron Lake Iron showing (092F 246) in their notable lack of magnetite and sulphides, and the paler pink to brick red colour of the jasperoidal chert. Pyrolusite occurs locally along fractures within the chert. A sample assayed 0.5% manganese (Assessment Report 16138).

MINFILE NUMBER: 092F 246 **NAME: CAMERON LAKE**
NORTHING: 5459589 EASTING: 375441 STATUS: Showing

CAPSULE GEOLOGY:

The Cameron Lake showing occurs in basaltic to andesitic volcanic rocks of the Devonian Duck Lake Formation, Sicker Group. Pillowed flow textures are common along with quartz and calcite filled amygdules and plagioclase/hornblende porphyritic textures.

Multiple contorted and crackle brecciated jasper lenses ranging in thickness up to 3 metres, and exposed over a strike length of about 250 metres occur within the basalts. Magnetite seams 2 to 3 centimetres thick occur within the dark red jasper. The breccia open spaces contain white quartz with minor pyrite. Quartz veinlets containing pyrite and malachite assayed 0.12% copper (Assessment Report 16138). A sample assayed 12.64% iron (Assessment Report 14941).

MINFILE NUMBER: 092F 247 **NAME: CHINA CREEK**
NORTHING: 5448109 EASTING: 374877 STATUS: Past Producer

CAPSULE GEOLOGY:

The China Creek placer occurrence is located near the confluence of China and McLaughlin creeks, about 8 kilometres southeast of Port Alberni. The area is underlain by argillites and shales of the Cretaceous Haslam Formation, Nanaimo Group.

Reported production of placer gold from China Creek, prior to 1895 was about $40,000 (Minister of Mines Annual Report 1895, page 649). The source of the gold is likely from goldbearing quartz veins in the upper part of China Creek and its tributaries.

The area is covered by a dam and pondage for Port Alberni's water supply.

MINFILE NUMBER: 092F 253 **NAME: CAVE 1**
NORTHING: 5465400 EASTING: 375050 STATUS: Showing

CAPSULE GEOLOGY:

Sericite-quartz-carbonate altered volcanics of the Devonian Nitinat Formation, Sicker Group contain finely disseminated pyrite and chalcopyrite. A major northwest-trending fault occurs to the east of the showings. One sample (JW8815R) containing about 5% pyrite, 2% chalcopyrite and traces of stibnite and arsenopyrite assayed 0.32% copper (Assessment Report 17730). One of the copper-bearing samples was described as a schist.

MINFILE NUMBER: 092F 282 **NAME: KITKAT**
NORTHING: 5434394 EASTING: 387765 STATUS: Showing

CAPSULE GEOLOGY:

The Kitkat showing is located near the Nitinat River, 20 kilometres east of Alberni Inlet.

The property is underlain by a sequence of basalt, pillowed basalt and pyroclastic rocks of the Devonian Duck Lake Formation. Mineralization consists of massive sulphide lenses containing pyrite, and lesser chalcopyrite, magnetite plus/minus pyrrhotite and anomalous gold values hosted in basaltic rocks. The rocks have been chloritized and epidotized.

MINFILE NUMBER: 092F 284 **NAME: KITKAT 2**
NORTHING: 5436441 EASTING: 385878 STATUS: Showing

CAPSULE GEOLOGY:

The Kitkat 2 showing is located near the Nitinat River, just north of the Raft showing (092F 311) and northwest of the Kitkat showing (092F 282), about 17 kilometres east of Alberni Inlet.

The area is underlain mainly by basalt, pillowed basalt, basaltic tuff and agglomerate of the Devonian Nitinat Formation and lesser pyroclastics the Upper Devonian McLaughlin Ridge Formation (Myra Formation), both of the Paleozoic Sicker Group. The volcanics have been intruded by Early to Middle Jurassic Island Intrusions. The mafic volcanics contain gabbroic sills.

In this area, discontinuous shearing and fracturing tend to parallel large scale regional structures, specifically the fault zone forming the Nitinat River valley. Gossans are associated with the mineralized shears, which occur mainly in coarse-grained, hornblende rich basalt. Pyrite occurs as a replacement of hornblende. The basalt is typically chloritized, with lesser alteration minerals consisting of pyrite, sericite and epidote. Areas of intense shearing contain quartz veins with pods of massive sulphides (mainly pyrite).

Two zones of massive sulphides, showings A and B, occur in hornblende basalt. Showing A contains massive pyrite and minor pyrrhotite and magnetite, with samples assaying over 1% copper. One hundred metres to the north, Showing B contains patches and disseminations of pyrite in vuggy quartz veins and sheared basaltic rock. A sample assayed 1.7 grams per tonne gold and 0.06% copper and another sample assayed 0.24% molybdenite, 0.1% cobalt and 0.1% zinc (Assessment Report 13945).

MINFILE NUMBER: 092F 285 **NAME: LIZARD LAKE**
NORTHING: 5443391 EASTING: 378622 STATUS: Showing

CAPSULE GEOLOGY:

The Lizard Lake showing is located slightly east of the lake, 15 kilometres southeast of Port Alberni.

Basaltic flows and pillowed basalt of the Triassic Karmutsen Formation of the Vancouver Group are underlain by a complexly interlayered succession of volcanics and sediments of the Sicker and Buttle Lake Groups. These include limestones and marbles of the Lower Permian to Upper Pennsylvanian Mount Mark Formation and basaltic flows, agglomerates, bedded tuffs and andesite of the Upper Devonian McLaughlin Ridge Formation.

Chalcopyrite and some malachite occur in quartz-carbonate stringers within epidotized shears in fractured, silicified, carbonate-altered andesite. Massive sulphides occur in a tuffaceous pyritic chert layer (pyritic-dacitic-cherty tuff-exhalative horizon) below the quartz vein-bearing andesite.

Gold mineralization is associated with quartz veining and crosscutting small fault structures. The north-trending Williams Creek fault occurs in the area. The faults are associated with siliceous, calcareous and ankeritic alteration zones which average 34 metres in width and sometimes contain up to 3% pyrite.

The Discovery showing assayed 4.46 grams per tonne gold, 24 grams per tonne silver and 0.13% copper over 2.0 metres (Assessment Report 8981). A diamond drill hole (DDH 845) intersected the chert horizon with sections assaying up to 1.13 grams per tonne gold and 3.6 grams per tonne silver over 1.8 metres (Assessment Report 14880). A chip sample (#62556), just east of the discovery showing, across 0.4 metre of a quartz splay vein and gouge assayed 0.24% copper, 0.26% zinc, 0.21% lead, 130 grams per tonne silver and 1 gram per tonne gold (Assessment Report 18314).

MINFILE NUMBER: 092F 311 **NAME: RAFT**
NORTHING: 5433397 EASTING: 383683 STATUS: Showing

CAPSULE GEOLOGY:

The Raft showing is located about 18 kilometres east of Alberni Inlet and 23 kilometres southeast of Port Alberni.

The area is underlain mainly by basalt, pillowed basalt, basaltic tuff and agglomerate of the Devonian Duck Lake Formation, Sicker Group. The basaltic rocks are intruded by numerous white feldspar porphyritic sills. As well, small bodies of diorite, quartz diorite and granodiorite of the Early to Middle Jurassic Island Intrusions occur in the area. The volcanics have been folded into a north-northwest trending syncline-anticline pair and are cut by a major similar trending regional shear zone up to 400 metres wide.

A quartz filled shear zone in the basalt contains massive pyrite and minor chalcopyrite. A sample assayed 2.08% copper (Assessment Report 14993). A massive sulphide zone, measuring 0.7 metres wide and 8 metres long, occurs in the basalt, 800 metres north of the mineralized shear zone. It comprises siliceous bands with pyrite and minor chalcopyrite. A grab sample assayed 0.138% copper (Assessment Report 13954). The basalts, which are locally saussuritized, epidotized and chloritized, also contain disseminations and stringers of pyrite. Two outcrop samples assayed 0.15% copper and 0.657% zinc respectively (Assessment Report 13954). These are located 800 metres southeast of the massive sulphide zone. Disseminated pyrite also occurs in dacite sills with associated quartz veins intruding the basalts. A sample assayed 0.43% copper and 5.6 grams per tonne silver (Assessment Report 14993). Gold values have been obtained from float samples.

MINFILE NUMBER: 092F 331 **NAME: 900**
NORTHING: 5447564 EASTING: 378511 STATUS: Prospect

CAPSULE GEOLOGY:

The area is underlain by andesitic to basaltic flows, pillowed basalts, tuff, agglomerates, cherty tuffs and chert of the Devonian Duck Lake and Nitinat formations of the Paleozoic Sicker Group. The north-northeast striking Mineral Creek fault cuts the volcanic sequence, which trends 140 degrees (subparallel to the fault) and dips 20 to 40 degrees east. A volcaniclastic interval overlies and is in sharp contact with mainly a phyric and amygdaloidal basalt units. The volcanic rocks are intruded by an andesitic porphyry body.

The 900 Zone is located 1300 metres southwest of the Mineral Creek Zone (092F 079 Debbie) and 200 metres west of the Mineral Creek fault. A lean iron formation with a magnetite-rich base is locally isoclinally folded. Beneath and cross cutting the chert horizon is a quartz vein stockwork which may be younger (Tertiary?) in age. Native gold, pyrite, magnetite and arsenopyrite occur in quartz veinlets in the chert and jasper and also in narrow carbonate veinlets. The 900 zone contains gold in magnetite-jasper-sulphide-bearing bedded chert, in quartz veins and in stockworks cutting ankeritic a phyric pillow basalt. The mineralized area strikes north for 180 metres, is 150 metres wide and over 120 metres deep. The 900 Zone is a pipelike body which occurs in a flexure resulting from the offset of the north-northeast 900 fault by the west northwest Wfault.

Three different geological environments host gold 1) the cherty iron formation which is generally flat and folded 2) a north trending, steeply west dipping fault which contains a quartz stockwork and 3) the intersections of a series of moderately altered east trending faults with the north trending faulted quartz stockwork underlying the cherty iron formation.

Drilling on the zone in 1988 intersected quartz stockworks with visible gold and a series of northerly trending narrow quartz veins south of the stockwork contained native gold. Trenching to expose high grade gold veins and diamond drilling to test the strike projection was proposed for 1989.

Inferred reserves (geological mineral inventory or volume of mineralized rock) for the 900 zone are estimated at 28 285 tonnes grading 11.65 grams per tonne gold (Northern Miner Dec. 18, 1989).

Several old trenches and an old shaft occur within the zone.

MINFILE NUMBER: 092F 337 **NAME: TOBY 1**
NORTHING: 5437892 EASTING: 375863 STATUS: Showing

CAPSULE GEOLOGY:

The Toby 1 showing is located about 16 kilometres southeast of Port Alberni, between Museum and Corrigan creeks.

The area is underlain by Upper Triassic Karmutsen basalts of the Vancouver Group intruded by Early to Middle Jurassic Island Intrusion diorites. Narrow pyritic quartz veins occur along a shear zone cutting the diorite intrusive. Ankerite alteration is associated with this zone. Gold and silver values from these quartz veins are reported to be high. One sample ran 6.95 grams per tonne gold and 99.5 grams per tonne silver (Assessment Report 15957).

MINFILE NUMBER: 092F 338 **NAME: TOBY 2**
NORTHING: 5436966 EASTING: 375843 STATUS: Showing

CAPSULE GEOLOGY:

The Toby 2 showing is located just south of the Toby 1 showing (092F 337), approximately 16.5 kilometres southeast of Port Alberni.

The area is underlain by Upper Triassic Karmutsen basalts of the Vancouver Group, intruded by diorite of the Early to Middle Jurassic Island Intrusions. The basalts range from fine-grained to gabbroic in texture.

Mineralization is hosted in basalts and is considered to be of skarn origin. Chalcopyrite, magnetite and epidote generally occur along faults and shears. Best assays from one rock sample are 6.29% copper and 38.57% iron (Assessment Report 15957). Gold is slightly anomalous but is not significant in the skarn mineralization. However, a narrow pyritic quartz vein along a shear, apparently unassociated with the skarn event, assayed 2.88 grams per tonne gold and is genetically related to the Toby 1 showing (092F337).

Soil sampling in 1988 indicated a limited extent to anomalous gold values. Mapping and sampling resulted in a few erratic high gold values associated with ankeritic shear zones and with minor quartz pyrite veinlets in granitic rocks.

MINFILE NUMBER: 092F 339 **NAME: COLUMBIA II**
NORTHING: 5430282 EASTING: 384959 STATUS: Showing

CAPSULE GEOLOGY:

The Columbia II showing is located 27 kilometres southeast of Port Alberni.

The area is underlain by Sicker Group rocks of the Devonian Nitinat Formation and the Upper Devonian McLaughlin Ridge Formation which occur along the western part of the Cowichan uplift.

The dark coloured volcanics consist of massive and pillowed basalt and agglomeratic flow breccia with minor chert and jasper. Small patches of epidote, and lesser amounts of quartz are common throughout the sequence, as is a pervasive "uralization" alteration, which is distinctive of the Nitinat Formation. This gives the rocks a dark spotted appearance due to the pseudomorphing of diopside by actinolite. These rocks are steeply dipping and become younger to the west. The metamorphic grade is usually low greenschist.

Quartz veins up to 20 centimetres wide with subordinate amounts of epidote and carbonate occur in a silicified shear zone. This shear zone (Main zone) is about 50 metres wide and trends north-northwest through basalts for 2 kilometres. Chalcopyrite and pyrite is found disseminated and in fractures locally within these veins and in silicified wallrock. A grab sample containing semimassive sulphides in altered basalt assayed 0.96% copper, 2.7 grams per tonne silver, 0.062 gram per tonne gold, and 0.01 gram per tonne platinum and palladium (Assessment Report 17769).

MINFILE NUMBER: 092F 348 **NAME: BDQ**
NORTHING: 5440870 EASTING: 375322 STATUS: Showing

CAPSULE GEOLOGY:

The location of the BDQ showing is unknown, but it is inferred to occur near the junction of Franklin River and Museum Creek on the present day PT claims. Work done in 1940 reportedly produced 62 grams of gold, 156 grams of silver and 11 kilograms of copper (Annual Report 1940, page A27). The area is underlain by granodioritic, dioritic and granite rocks of the Early to Middle Jurassic Island Intrusions and volcanic rocks of the Upper Triassic Karmutsen Formation, Vancouver Group.

During the 1988 mapping program by the B.C. Geological Survey, a moss matt sediment sample was taken near this location, the values for base and precious metals were low (Open File 1989-6). There is no other geological information available for this showing.

MINFILE NUMBER: 092F 376 **NAME: KARLSSON**
NORTHING: 5439995 EASTING: 393557 STATUS: Showing

CAPSULE GEOLOGY:

The Karlsson showing is located approximately 2 kilometres south of Labour Day Lake. An inlier of volcanics of the Upper Triassic Karmutsen Formation (Vancouver Group) within feldspar porphyry of the Tertiary Mount Washington

Intrusive Suite (Labour Day Lake pluton, Personal Communication, N. Massey, May 1990) contains minor chalcopyrite, pyrite, and bornite as fracture fillings. The 055 degree trending, vertically dipping fracture is 1.2 metres long and 5 centimetres wide.

MINFILE NUMBER: 092F 380 **NAME: TAP I**
NORTHING: 5431276 EASTING: 374699 STATUS: Showing

CAPSULE GEOLOGY:

The area is underlain by volcanics of the Upper Triassic Karmutsen Formation (Vancouver Group). Diorite of the Early to Middle Jurassic Island Intrusions lie to the northeast and northwest.

Mineralized quartz veins hosted in andesite and volcanic breccia occur within two main fracture zones. One of these zones strikes at 065 degrees and the other at 005 degrees. Mineralization consists of disseminated pyrite, chalcopyrite and malachite. The extent of the mineralization appears to be controlled by the fracture zones.

A grab sample across 30 centimetres of rusty, sheared and altered andesite assayed 0.55 gram per tonne gold, 34.3 grams per tonne silver and 6.75% copper (Assessment Report 16119).

MINFILE NUMBER: 092F 381 **NAME: CANON**
NORTHING: 5431817 EASTING: 379587 STATUS: Showing

CAPSULE GEOLOGY:

The Canon showing is located on the slopes of Mount Olsen, about 24 kilometres southeast of Port Alberni.

Tholeiitic basalts of the Upper Triassic Karmutsen Formation (Vancouver Group) are intruded by diorite to quartz diorite and minor feldspar porphyry of the Early to Middle Jurassic Island Intrusions (Corrigan Creek pluton). An intraformational layer of limestone and narrow band of dacite occur within the volcanics. A northeast trending joint or fracture system cuts all rock types.

A northeast trending mineralized quartz vein, averaging 5 centimetres in width and up to 25 metres long, is hosted in diorite. The vein, which trends 040 degrees and dips 60 degrees southeast, occurs along a major fracture system. It contains masses and blebs of pyrite, pyrrhotite, sphalerite, and lesser chalcopyrite, covellite, malachite and azurite. Alteration of the diorite on either side of the vein include silicification and epidotization. An 8 centimetre chip sample of the vein assayed 73.5 grams per tonne gold, 42.5 grams per tonne silver, 0.07% copper, 2.26% zinc and 0.076% lead (Assessment Report 13875).

MINFILE NUMBER: 092F 384 **NAME: VILLALTA**
NORTHING: 5438316 EASTING: 392510 STATUS: Developed Prospect

CAPSULE GEOLOGY:

The Villalta occurrence area is underlain by volcanics, clastic sediments and limestone of the Paleozoic Sicker and Buttle Lake groups. Poorly sorted conglomerates and hematitic mudstones of the Cretaceous Comox Formation (Nanaimo Group) unconformably overlie the limestones. Tertiary porphyritic dacite intrudes the conglomerates to the north.

The Sicker rocks include volcanic breccia, tuff, andesite, argillite and chert of the Devonian Nitinat and McLaughlin Ridge formations, Sicker Group. The overlying crinoidal limestone, with minor chert and tuff, likely belongs to the Upper Pennsylvanian to Lower Permian Mount Mark Formation. These rocks are tightly folded with an axial trend of 135 degrees and 20 degree plunge to the northwest.

Extensive areas of powdery to massive hematite with gold values occur at the top of the limestone unit, in a well-developed paleokarst topography. The stratabound hematite measures 110 by 30 by 14 metres and appears to lie in a north-northeast trending depression, which is possibly fault bounded. Randomly distributed massive sulphide bodies, comprised of pyrite, pyrrhotite, chalcopyrite, arsenopyrite, marcasite and minor galena and magnetite, which occur in the limestone, are the likely source for the hematite zone. Other minerals include siderite, calcite, quartz, serpentine, goethite, and minor ilvaite.

A 1980 drill hole assayed 126 grams per tonne gold, 19.2 grams per tonne silver, 7.65% zinc and 0.76% copper over 30 centimetres (Assessment Report 8458). Drill indicated reserves are 31 500 tonnes grading 4.32 grams per tonne gold over a zone averaging 7.3 metres in width (Assessment Report 16719). Drilling to the north intersected 10.7 metres of 2.06 grams per tonne gold and 9.9 grams per tonne silver, including 1.0 metre of 8.5 grams per tonne gold and 22.3 grams per tonne silver (Vancouver Stockwatch July 13, 1987).

MINFILE NUMBER: 092F 385 **NAME: SOL B**
NORTHING: 5441908 EASTING: 382949 STATUS: Showing

CAPSULE GEOLOGY:

The Sol B showing is located about 6 kilometres southeast of the Debbie deposit, near the Havilah mine workings (092F 437), 25 kilometres southeast of Port Alberni.

The area is underlain by Devonian Sicker Group (Duck Lake Formation) volcanic rocks which are cut by diorite of the Early to Middle Jurassic Island Intrusions and quartz feldspar porphyry of the Tertiary Mount Washington Intrusive Suite (Personal Communication N. Massey, May 1990). The volcanic rocks include massive andesite and purple fragmental volcanics. A northeast trending fracture system appears to have controlled intrusion of the quartz-feldspar porphyries and mineralized quartz veins and veinlets.

Three low-grade mineralized zones contain pyrite, pyrrhotite and minor chalcopyrite and locally minor molybdenite, sphalerite and galena as disseminations and in quartz veins and fractures. The andesites and porphyry dikes are the common host for the mineralization. Sericite and kaolin alteration occur in the quartz-feldspar porphyry and epidote, garnet and chlorite occur in the andesite.

The middle zone contains a 38 centimetre wide vein assaying 2.4 grams per tonne gold, 85.7 grams per tonne silver, 0.24% copper, 1.95% lead and 1.1% zinc (Assessment Report 5354). This vein is likely a northern extension of the same mineralized shear zone that the Gillespie vein (092F 082) occurs in. A composite chip sample from the north zone, which lies 350 metres north of the middle zone, assayed 1.4 grams per tonne gold, 3.1 grams per tonne silver, 0.1% copper and 0.006% molybdenum (Assessment Report 5354). The south zone lies about 700 metres southeast of the middle zone.

MINFILE NUMBER: 092F 386 **NAME: MUSEUM**
NORTHING: 5440825 EASTING: 377500 STATUS: Showing

CAPSULE GEOLOGY:

The Museum showing is located on Bear Creek, 20 kilometres southeast of Port Alberni. The area is underlain by pillowed and massive basaltic flows and breccias of the Upper Triassic Karmutsen Formation, Vancouver Group.

A rock sampling program was undertaken along Bear Creek in 1988 in an effort to test the southern strike projection of the Williams Creek/Mineral Creek fault. The Mineral Creek fault hosts the Mineral Creek deposit (092F 079) on the Debbie property 5 kilometres to the north. The samples contained disseminated pyrite, minor pyrrhotite and trace chalcopyrite. In this area, mineralization is associated with pyrite in fracture controlled zones of strong epidote-carbonate-chlorite-quartz alteration within basaltic to diabasic flows (Panther showings 092F 439442).

A 1.5 metre channel sample of the ankeritized shear zone, striking 175 degrees and dipping 63 degrees east, assayed 0.0157% copper, 0.0109% zinc, and 0.013 gram per tonne gold (Assessment Report 18689).

MINFILE NUMBER: 092F 389 **NAME: COR 14**
NORTHING: 5439524 EASTING: 372045 STATUS: Showing

CAPSULE GEOLOGY:

The Cor 14 showing is located 4.5 kilometres east of Alberni Inlet, 16 kilometres south of Port Alberni.

The area is underlain by Upper Triassic Karmutsen Formation (Vancouver Group) volcanics which are intruded by biotite granodiorite of the Early to Middle Jurassic Island Intrusions. The volcanics consist of greenstones, andesites and basalts. Quartz-carbonate veins mineralized with minor pyrite and chalcopyrite, cut both rock types (volcanics and intrusives) but are more common in the andesite.

A quartz carbonate vein, up to 50 centimetres wide, occurs in brecciated greenstone. Pyrite, chalcopyrite and minor arsenopyrite are disseminated in the vein. The best assays from vein samples taken from this area were 0.9 gram per tonne gold and 0.09% copper (Assessment Report 6676).

The vein has been exposed by trenching and a small adit, which are likely connected to work on the Star of the West showing (092F215).

MINFILE NUMBER: 092F 398 **NAME: TAN**
NORTHING: 5439100 EASTING: 384750 STATUS: Showing

CAPSULE GEOLOGY:

The Tan showing is located 24 kilometres southeast of Port Alberni, slightly east of the B&K (092F 081) and Golden Eagle (092F080) occurrences.

The area, located in the Cowichan uplift, is underlain by volcanics and minor sediments of the Upper Devonian McLaughlin Ridge Formation (formerly the Myra Formation) and the Devonian Nitinat Formation, both of the Sicker Group. Diorite of the Early to Middle Jurassic Island Intrusions occurs to the south.

The showing occurs in basaltic pyroclastics of the McLaughlin Ridge Formation which comprised of tuff, agglomerate, flows with minor interbedded chert and argillite. A quartz-sulphide mineralized shear zone strikes 150 degrees and dips 45 degrees east. The zone has been traced along strike for 70 metres and is 1.8 metres wide. The sulphides, with the exception of pyrite, have not been specified.

A grab sample from a trench (#1) on the shear zone assayed 0.06 gram per tonne gold, 2.1 grams per tonne silver, 0.05% molybdenum, 0.01% copper, 0.16% arsenic and 33.39% iron (Assessment Report 16072).

MINFILE NUMBER: 092F 399 **NAME: COR 6**

NORTHING: 5439205 EASTING: 372444 STATUS: Showing

CAPSULE GEOLOGY:

The Cor 6 showing is located 5 kilometres east of Alberni Inlet, just southeast of the Cor 14 showing (092F 389) and 16 kilometres south of Port Alberni.

The area is underlain by Upper Triassic Karmutsen Formation (Vancouver Group) volcanics which are intruded by biotite granodiorite of the Early to Middle Jurassic Island Intrusions. The volcanics consist of greenstones, andesites and basalts. Quartz-carbonate veins, carrying minor pyrite and chalcopyrite, cut both rock types (volcanics and intrusives) but are more common in the andesite.

An adit at the 400 metre elevation follows a quartz-carbonate vein striking 055 degrees and dipping 040 degrees southeast within greenstone. The vein which extends for about 200 metres and is up to 1 metre wide, contains disseminated pyrite, galena and minor chalcopyrite. The best assay for gold was 2 grams per tonne and for copper, 0.20% (Assessment Report 6676).

A similar vein occurrence lies about 200 metres to the east. An assay of dump material from an old adit assayed 0.51% copper (Assessment Report 6676). A further 200 metres to the east, a lens of massive pyrite and chalcopyrite in greenstone measures about 1 metre long and 10 centimetres thick. A sample assayed 2.80% copper (Assessment Report 6676).

These showings are likely the ones worked on in 1890 and known as the Star of the West (*see* 092F 215).

MINFILE NUMBER: 092F 404 **NAME: ROGERS CREEK**

NORTHING: 5458000 EASTING: 370000 STATUS: Showing

CAPSULE GEOLOGY:

Glacial clay of large extent occurs in the Rogers Creek area, east of the head of Alberni Inlet. The Rogers Creek clay is described as yellowish, tough and silty. The area is underlain by sediments of the Upper Cretaceous Nanaimo Group, Haslam Formation.

MINFILE NUMBER: 092F 408 **NAME: NANAIMO RIVER**

NORTHING: 5438500 EASTING: 398900 STATUS: Showing

CAPSULE GEOLOGY:

A band of impure, siliceous, crinoidal limestone of the Upper Pennsylvanian to Lower Permian Mount Mark Formation (Buttle Lake Formation limestone), extends discontinuously north northeast for 4 kilometres. The Nanaimo River limestone crosses the Nanaimo River 2 kilometres below the outlet of Fourth Lake and is up to 500 metres in width. The limestone is in contact with sandstone, chert and limestone of the Mississippian to Pennsylvanian Fourth Lake Formation, Buttle Lake Group, to the east. Bedding at one point strikes 048 degrees and dips 25 degrees northwest. This sequence is hornfelsed by a granitic intrusion outcropping to the west.

MINFILE NUMBER: 092F 409 **NAME: MT. SPENCER**

NORTHING: 5434000 EASTING: 382000 STATUS: Showing

CAPSULE GEOLOGY:

A band of limestone extends north northwest for 13.5 kilometres on the east flanks of Mount Spencer and Limestone Mountain, west of the Nitinat River and 20 kilometres southeast of Port Alberni.

The Mount Spencer limestone is part of the Upper Pennsylvanian to Lower Permian Mount Mark Formation (previously the Buttle Lake Formation), Buttle Lake Group. Several east dipping thrust faults displace the limestone. The unit dips shallowly to near vertically to the west and southwest. The limestone is underlain by andesites of the Devonian Nitinat Formation (Sicker Group) and chert, argillite and limestone of the Mississippian to Pennsylvanian Fourth Lake Formation, Buttle Lake Group. Basalts of the Upper Triassic Vancouver Group, Karmutsen Formation unconformably overlie the limestone.

MINFILE NUMBER: 092F 429 **NAME: MCQUILLAN CREEK**
NORTHING: 5442725 EASTING: 381950 STATUS: Showing

CAPSULE GEOLOGY:

The McQuillan Creek showing is located 17 kilometres southeast of Port Alberni on McQuillan Creek. The area is underlain by volcanic rocks of the Devonian Duck Lake Formation, Sicker Group which have been intruded by Late Eocene Mount Washington Intrusive Suite rocks to the south.

The rocks comprise hematitic jasper, basalt flows, hematitic basalt breccia, feldspar-porphyry basalt intrusives, basalt and tuff.

Hematitic jasper is exposed in a 1.7 metre wide by 15 metre long outcrop, trending approximately 155 degrees. The jasper consists of 75 to 90% bright brick red jasper with 10 to 20% interstitial clear quartz containing about 5 to 10% very fine grained disseminated hematite. Irregular hematite filled fractures, up to 2 centimetres thick, crosscut the jasper. Locally the jasper contains massive hematite bands, 0.5 to 1.5 metres thick. A sample from the outcrop assayed low values for copper, zinc, silver and gold (Assessment Report 14880). An outcrop of jasper somewhere along the creek, occurring between a large bed of argillaceous schist and crystalline rock and containing abundant hematite, was noted in the Minister of Mines Annual Report 1895. This is possibly the same outcrop.

MINFILE NUMBER: 092F 437 **NAME: HAVILAH**
NORTHING: 5440895 EASTING: 382624 STATUS: Past Producer

CAPSULE GEOLOGY:

The McQuillan vein is located 600 metres southeast of the Gillespie vein (092F 082) and the Havilah mine workings, about 20 kilometres southeast of Port Alberni.

The area is underlain by Devonian Sicker Group volcanic rocks (Duck Lake Formation). These are cut by a body of coarse-grained hybrid diorite of the Early to Middle Jurassic Island Intrusions. A north-trending fault bounds the diorite to the west and cuts andesite to the north of the diorite.

The McQuillan vein and the adjoining Alberni vein to the south, occur along a shear zone which cuts andesite, diorite and Tertiary quartz-feldspar porphyry. The shear zone trends 020 degrees for about 80 metres, dips 70 degrees east and is about 5 metres wide. Quartz lenses along the shear contain pyrite, sphalerite, galena and lesser chalcopyrite and arsenopyrite. A 60 centimetre sample of a vein assayed 5.5 grams per tonne gold and 20.6 grams per tonne silver (Minister of Mines Annual Report 1936).

MINFILE NUMBER: 092F 438 **NAME: SKYLINE (L.100G)**
NORTHING: 5440042 EASTING: 383518 STATUS: Prospect

CAPSULE GEOLOGY:

The Skyline occurrence is located just south of the Havilah mine workings (092F 082, 437), approximately 21 kilometres southeast of Port Alberni.

The area is underlain by volcanics of the Devonian Duck Lake Formation, Sicker Group which have been intruded by Early to Middle Jurassic Island Intrusions.

Two parallel quartz veins, 3 to 9 metres apart, lie in a north trending shear within carbonate altered andesite. The veins are 15 to 30 centimetres wide, 40 metres long and dip 70 degrees west. Banded mineralization consists of pyrite, arsenopyrite and galena.

A 30 centimetre sample assayed 52.1 grams per tonne gold and 113.8 grams per tonne silver (Gunnex Limited, 1965). Two drill holes in 1980 resulted in an inferred reserve of 6000 tonnes of 5.8 grams per tonne gold in two zones (Assessment Report 9639).

The showing lies in the Golden Eagle group of claims (*see* 092F080) and has been described as the "High Grade vein" of the B and K group (092F081).

MINFILE NUMBER: 092F 439 **NAME: PANTHER ROAD**
NORTHING: 5439254 EASTING: 381372 STATUS: Showing

CAPSULE GEOLOGY:

The Panther Road showing is located approximately 1 kilometre southeast of the Thistle mine (092F 083), about 21 kilometres southeast of Port Alberni.

Basaltic flows and pillow basalts of the Upper Triassic Karmutsen Formation (Vancouver Group) are underlain by a complexly interlayered succession of volcanics and sediments of the Paleozoic Sicker Group. These include limestones and marbles of the Upper Pennsylvanian to Lower Permian Mount Mark Formation (Buttle Lake group), and basaltic flows, agglomerates and bedded tuffs of the Upper Devonian McLaughlin Ridge Formation (Myra Formation).

A 2.2 metre wide interval of pyritic chlorite-altered basalt and sericite-altered basalt, of the basaltic flow unit ("Mine Flow Unit"), contains an 80 centimetre width of massive pyrite. The mineralized zone strikes about 150 degrees and dips southwest. Chloritic alteration is most common but chlorite-epidote-carbonate-quartz alteration is also present.

A sample across the 2.2 metre width assayed 16.8 grams per tonne gold, 1.7 grams per tonne silver and 0.09% copper (Assessment Report 13711). Drilling in the vicinity of this showing in 1988 resulted in one sample assaying 2.06 grams per tonne gold, 9.0 grams per tonne silver, 0.0175% copper and 0.0078% zinc from pyritic zones within chloritic alteration zones (Assessment Report 17661).

Three other showings, located 230 metres southeast to 200 metres south of the Panther Road showing, grade up to 12.0 grams per tonne gold over 17 centimetres (Assessment Report 15288).

MINFILE NUMBER: 092F 440 **NAME: PANTHER ROAD SOUTH**
NORTHING: 5437368 EASTING: 381433 STATUS: Showing

CAPSULE GEOLOGY:

The Panther Road South showing is located south of the Panther Road showing (092F 439), about 22 kilometres southeast of Port Alberni.

Basaltic flows and pillowed basalt of the Upper Triassic Karmutsen Formation (Vancouver Group) are underlain by a complexly interlayered succession of volcanics and sediments of the Paleozoic Sicker and Mississippian to Lower Permian Buttle Lake groups. These include limestones and marbles of the Upper Pennsylvanian to Lower Permian Mount Mark Formation, and basaltic flows, diabase, agglomerates and bedded tuffs of the Upper Devonian McLaughlin Ridge Formation (Myra Formation).

A zone of semi-massive pyrite, up to 10 centimetres thick and 50 centimetres long, occurs in McLaughlin Ridge basalts ("Mine Flow Unit" of the Thistle mine, 092F 083). A sample across the zone assayed 2.1 grams per tonne gold (Assessment Report 13711).

Drilling in 1988 in this area, encountered a stockwork of hematitic quartz carbonate veinlets (DDH 8801) containing disseminated pyrrhotite and chalcopyrite. A sample containing disseminated chalcopyrite assayed 1.19 grams per tonne gold, 0.0024% copper, 0.0023% zinc, trace silver and trace lead (Assessment Report 17661). Chloritic alteration is common, but epidote-carbonate-chlorite-quartz alteration is also present. Mineralization is associated with alteration.

MINFILE NUMBER: 092F 441 **NAME: PANTHER**
NORTHING: 5438385 EASTING: 381556 STATUS: Showing

CAPSULE GEOLOGY:

The Panther showing is located between the Panther Road (092F439) and the Panther Road South (092F 440) showings, about 23 kilometres southeast of Port Alberni.

Basaltic flows and pillowed basalt of the Upper Triassic Karmutsen Formation (Vancouver Group) are underlain by a complexly interlayered succession of volcanics and sediments of the Paleozoic Sicker and Mississippian to Lower Permian Buttle Lake groups. These include limestones and marbles of the Upper Pennsylvanian to Lower Permian Mount Mark Formation (Buttle Lake Group), and basaltic flows ("Mine Flow Unit" of the Thistle mine, 092F 083), agglomerates and bedded tuffs of the Upper Devonian McLaughlin Ridge Formation (Myra Formation), Sicker Group.

Copper-gold mineralization (likely pyrite and chalcopyrite)occur in basaltic rocks of the McLaughlin Ridge Formation. A sample assayed 2.47 grams per tonne gold and 0.16% copper (George Cross News Letter #96, 1985). Chloritic alteration is common, bu t chlorite-epidote-carbonate-quartz alteration is also present.

MINFILE NUMBER: 092F 442 **NAME: SADDLE**
NORTHING: 5439629 EASTING: 381177 STATUS: Showing

CAPSULE GEOLOGY:

The Saddle showing is located north of the Panther showing (092F441) about 20 kilometres southeast of Port Alberni.

Basaltic flows and pillow basalt of the Upper Triassic Karmutsen Formation (Vancouver Group) are underlain by a complexly interlayered succession of volcanics and sediments of the Paleozoic Sicker and Mississippian to Lower Permian Buttle Lake groups. These include basaltic flows, agglomerates and bedded tuffs of the Upper Devonian McLaughlin Ridge Formation (Myra Formation), Sicker Group.

Chalcopyrite, and likely sphalerite, occur on fractures cutting basaltic rocks ("Mine Flow Unit" of the Thistle mine, 092F 083) of the McLaughlin Ridge Formation. A 0.9 metre sample assayed 1.1% zinc, 0.04% copper and 0.27 gram per tonne gold (George Cross News Letter #96, 1985).

Drilling in 1988 encountered strong chloritic alteration and semi-massive to massive auriferous pyrite. A sample (DDH 8804, #147923) assayed 1.695 grams per tonne gold, 1.0 gram per tonne silver, 0.010% copper and 0.0064% zinc (Assessment Report 17661). Chlorite-epidote-carbonate-quartz alteration is also present in the area.

MINFILE NUMBER: 092F 443 **NAME: DOUGLAS**
NORTHING: 5441671 EASTING: 379598 STATUS: Showing

CAPSULE GEOLOGY:

The Douglas showing is located to the southeast of Douglas Peak, about 19 kilometres southeast of Port Alberni.

Basaltic flows and pillow basalt of the Upper Triassic Karmutsen Formation (Vancouver Group) are underlain by a complexly interlayered succession of volcanics and sediments of the Paleozoic Sicker and Mississippian to Lower Permian Buttle Lake groups. In the area, the rocks comprise basaltic flows, agglomerates and bedded tuffs of the Upper Devonian McLaughlin Ridge Formation (Myra Formation), Sicker Group.

Gold-copper mineralization (likely pyrite and chalcopyrite) occurs in basalts. A sample assayed 28.1 grams per tonne gold and 0.9% copper (George Cross News Letter #96, 1985).

MINFILE NUMBER: 092F 444 **NAME: MCQUILLAN**
NORTHING: 5443941 EASTING: 381776 STATUS: Showing

CAPSULE GEOLOGY:

The McQuillan showing is located just southwest of McKinlay Peak, about 16 kilometres southeast of Port Alberni.

The area is underlain by volcanics of the Paleozoic Sicker Group. These are a complex, interlayered succession of basaltic pillowed flows, basaltic volcaniclastics, hematitic jasper and dacitic agglomerate-lapilli tuff. The succession is upright, strikes northwest to north and dips 20 to 40 degrees southwest.

Pillowed amygdaloidal basalt of the Devonian Duck Lake Formation (Sicker Group), contains one or two pyritic alteration fracture zones up to 3 centimetres wide with disseminated pyrite and fracture-filled chalcopyrite. A grab sample assayed 0.184% copper, 0.01% zinc and 1.8 grams per tonne silver (Assessment Report 13904).

MINFILE NUMBER: 092F 445 **NAME: DEBBIE 3**
NORTHING: 5454707 EASTING: 376848 STATUS: Showing

CAPSULE GEOLOGY:

The Debbie 3 occurrence is underlain by porphyritic mafic volcanic rocks of the Devonian Nitinat and Duck Lake formations of the Sicker Group. These include massive and pillowed basalts and volcaniclastics. The volcanic sequence is crudely stratified, strikes north-northwest and dips moderately east and contains narrow to broad zones of schistosity conformable with stratification. Chlorite schist represents the metamorphosed and deformed mafic rock.

A north-trending, 200 metre wide, pyritic sericite-chlorite-carbonate schist zone occurs in the area. A drill hole, cutting the alteration zone, assayed 2.06% zinc, 0.32% copper, 0.04% lead and 5.8 grams per tonne silver over 0.6 metre (Assessment Report 15287). Mineralization intersected in the drill hole includes thin bands and disseminations of pyrite and minor gypsum, sphalerite and chalcopyrite. The drill hole also intersected a 1.3 metre width of disseminated and massive stibnite (9.40% over 7 centimetres). This alteration zone appears coincident with a fault (Geological Survey of Canada Open File 1272).

Three hundred and fifty metres south of the drill hole and 350 metres east of the alteration zone is a surface showing of banded, fine grained sphalerite with minor chalcopyrite and galena in four lenses, 4 to 20 centimetres thick, conformable within schistose porphyritic basalt clastics. Schistosity strikes 160 degrees and dips 49 degrees east, with lineation plunging

14 degrees south southeast. A 20 centimetre sample assayed 14.1% zinc, 0.87% lead and 0.12% copper (Assessment Report 13758).

MINFILE NUMBER: 092F 446 **NAME: RUSH**
NORTHING: 5433264 EASTING: 398301 STATUS: Showing

CAPSULE GEOLOGY:

The Rush showing is located near Fleece Creek, about 3 kilometres east of Fourth Lake.

Minor fracture fillings of chalcopyrite, malachite and pyrite occur over a 2 square metre area of dark green massive basalt of the Upper Devonian McLaughlin Ridge Formation (Sicker Group). Epidote alteration rims the fractures. A grab sample assayed 0.5% copper (Assessment Report 16592).

MINFILE NUMBER: 092F 447 **NAME: NAN**
NORTHING: 5430924 EASTING: 399579 STATUS: Showing

CAPSULE GEOLOGY:

The Nan showing is located slightly southeast of Fourth Lake and east of the Flight 5 showing (092F 563).

Malachite and trace chalcopyrite on fractures occur in agglomeratic basalts of the Upper Devonian McLaughlin Ridge Formation (Sicker Group). A 20 centimetre chip sample assayed 0.51% copper (Assessment Report 16592).

MINFILE NUMBER: 092F 451 **NAME: MAIN**
NORTHING: 5458693 EASTING: 374107 STATUS: Showing

CAPSULE GEOLOGY:

The Cowichan uplift consist mainly of northwest-trending volcanic volcaniclastic sedimentary rocks of the Paleozoic Sicker and Buttle Lake groups. These are bounded by younger mafic volcanics of the Upper Triassic Vancouver Group and sediments of the Lower Cretaceous Nanaimo Group. The Sicker Group stratigraphy is very complex with numerous intercalations and rapid lateral facies changes. The rocks are commonly schistose in the vicinity of faults with associated carbonatization and silicification.

A large gabbroic intrusion, likely coeval with Upper Triassic Karmutsen Formation (Vancouver Group) volcanism, cuts dacites and andesites of the Mississippian to Pennsylvanian Fourth Lake Formation (formerly the Cameron River Formation) and limestones of the Upper Pennsylvanian to Lower Permian Mount Mark Formation. The Fourth Lake and Mount Mark formations, formerly of the Sicker Group, have been reassigned to the new Upper Paleozoic Buttle Lake Group.

Coarse-grained massive pyrite occurs in seams and pods over an area 10 by 7 metres on a vertical rock-cut face. The pods are contorted and irregular in shape and up to 10 by 50 by 100 centimetres in size. They do not express consistent strike direction or lineations, but suggest, rather, a complex infolding within the enclosing rocks. The host rock consists of fine to medium-grained, multiphase diabase-gabbro intrusions which contain magnetite and pyrrhotite. A grab sample assayed 14.9 grams per tonne gold (Assessment Report 16138).

Veinlets are common throughout the rock, but are most concentrated near the pyrite pods. Bleaching and sericitic alteration are adjacent to these quartz-carbonate-epidote veinlets. Malachite is associated with some veinlets, where a grab sample assayed 0.2% copper (Assessment Report 16138).

MINFILE NUMBER: 092F 452 **NAME: EAST TRACK**
NORTHING: 5458622 EASTING: 374509 STATUS: Showing

CAPSULE GEOLOGY:

The Cowichan uplift consists mainly of northwest-trending volcanic volcaniclastic sedimentary rocks of the Paleozoic Sicker and Buttle Lake groups. These are bounded by younger mafic volcanics of the Vancouver Group and sediments of the Nanaimo Group. The stratigraphy is very complex with numerous intercalations and rapid lateral facies changes. The rocks are commonly schistose in the vicinity of faults with associated carbonatization and silicification.

The East Track showing is a 2 to 3 metre wide zone of quartz veining and silicification within foliated dacite of the Mississippian to Pennsylvanian Fourth Lake Formation (formerly the Cameron River Formation). Some of the veins are rusty and contain fine disseminations and blebs of pyrite. A grab sample assayed 2.3 grams per tonne gold (Assessment Report 16138).

The Fourth Lake Formation, formerly the Upper part of the Myra Formation (Sicker Group), has been reassigned to the new Upper Paleozoic Buttle Lake Group.

MINFILE NUMBER: 092F 453 **NAME: OLD CUAG**
NORTHING: 5461721 EASTING: 374075 STATUS: Showing

CAPSULE GEOLOGY:

The Cowichan uplift consists mainly of northwest-trending volcanic volcaniclastic sedimentary rocks of the Paleozoic Sicker and Buttle Lake groups. These are bounded by younger mafic volcanics of the Vancouver Group and sediments of the Nanaimo Group. The stratigraphy is very complex with numerous intercalations and rapid lateral facies changes. The rocks are commonly schistose in the vicinity of faults with associated carbonatization and silicification.

Two small copper stained pits (1 by 1 metre) occur 130 metres apart in silicified volcanics of the Devonian Duck Lake Formation (Sicker Group). A north-trending fault cuts the volcanics, which are porphyritic andesites. Mineralization consists of numerous quartz veinlets with trace chalcopyrite, bornite, azurite and pyrite.

Sampling of the northern pit assayed 8.57 grams per tonne silver and sampling of the southern pit assayed 76.1 grams per tonne silver. Another sample of the southern pit assayed 17.1 grams per tonne silver and 0.05% copper (Assessment Report 16138).

MINFILE NUMBER: 092F 456 **NAME: UPPER FRANKLIN**
NORTHING: 5441570 EASTING: 377163 STATUS: Showing

CAPSULE GEOLOGY:

The Upper Franklin showings are located in the area of the Upper Franklin River, 15 kilometres southeast of Port Alberni.

Chalcopyrite and malachite occur in quartz stringers and epidotized shears within andesite of the Upper Triassic Karmutsen Formation (Vancouver Group).

One zone, up to 0.6 metre wide, assayed 1.74% copper from a grab sample. Another zone, 1.5 to 1.8 metres wide, assayed 2.75% copper from a grab sample (Laanela, 1966). These showings are about 600 metres apart.

MINFILE NUMBER: 092F 457 **NAME: PAT 1**
NORTHING: 5442192 EASTING: 376974 STATUS: Showing

CAPSULE GEOLOGY:

The Pat 1 showing is located just southwest of Douglas Peak, about 12 kilometres southeast of Port Alberni.

Basalts of the Upper Triassic Karmutsen Formation (Vancouver Group) are overlain by siltstones of the Cretaceous Nanaimo Group and intruded by diorite of the Early to Middle Jurassic Island Intrusions.

Chalcopyrite occurs in altered basalt, likely associated with a shear. A grab sample assayed 1.66% copper, 14.8 grams per tonne gold and 0.88 gram per tonne silver and another nearby grab sample assayed 2.7 grams per tonne silver (Assessment Report 15192).

This showing is near the Webb showing described by Laanela in 1966.

MINFILE NUMBER: 092F 458 **NAME: PAT 3**
NORTHING: 5446699 EASTING: 375757 STATUS: Showing
CAPSULE GEOLOGY:

The Pat 3 showing is located on Patlicant Mountain, just north of the Pat 1 showing (092F 457), about 12 kilometres southeast of Port Alberni.

The area is underlain by siltstone, shale and coal of the Cretaceous Haslam Formation (Nanaimo Group) which are intruded by diorite of the Tertiary Mount Washington Intrusive Suite (Personal Communication, N. Massey, May 1990).

A sulphide lens up to 1 metre long occurs in the intrusive rocks. A sample assayed 0.142% copper and 2.0 grams per tonne silver (Assessment Report 15196). Mineralization is likely chalcopyrite and pyrite.

MINFILE NUMBER: 092F 459 **NAME: OLSEN**
NORTHING: 5431795 EASTING: 380602 STATUS: Showing

CAPSULE GEOLOGY:

The Olsen showing is located on Mount Olsen, 25 kilometres southeast of Port Alberni.

A 600 metre long zone hosts disseminated and stringer pyrrhotite, pyrite and minor sphalerite, magnetite and chalcopyrite and occurs in basalt of the Upper Triassic Karmutsen Formation (Vancouver Group). The basalts are locally altered to chlorite and epidote saussurite. Samples assayed up to 0.08% copper (Assessment Report 13857).

Diorites of the Early to Middle Jurassic Island Intrusions occur to the west.

MINFILE NUMBER: 092F 460 **NAME: MOUNT OLSEN**
NORTHING: 5431005 EASTING: 379976 STATUS: Showing

CAPSULE GEOLOGY:

The Mount Olsen showing is located southwest of Mount Olsen, near Logan Peak, about 24 kilometres southeast of Port Alberni.

Tholeiitic basalts of the Upper Triassic Karmutsen Formation (Vancouver Group) are intruded by diorite to quartz diorite and minor feldspar-porphyry of the Early to Middle Jurassic Island Intrusions. A northeast-trending joint or fracture system cuts all rock types.

Pyrite, chalcopyrite and malachite are hosted by brecciated volcanics and quartz stockwork. The occurrence lies in one of the northeast-trending fracture systems. A grab sample assayed 1.32% copper and 40 grams per tonne silver (Assessment Report 13723).

MINFILE NUMBER: 092F 461 **NAME: KIT KAT 5**
NORTHING: 5431219 EASTING: 384450 STATUS: Showing

CAPSULE GEOLOGY:

The Kit Kat 5 occurrence is located west of Mount Hooper, 27 kilometres southeast of Port Alberni.

The area is underlain mainly by basalt, pillowed basalt, basaltic tuff and agglomerate of the Devonian Duck Lake Formation (Sicker Group) which have been intruded by Early to Middle Jurassic Island Intrusions.

Disseminated and rare podiform pyrite occur in a sheared medium-grained basaltic tuff or flow. Fracture surfaces are gossan stained with lesser amounts of malachite and azurite staining. A sample from a pod of pyrite in hornblendite assayed 0.14% copper, 0.1% nickel, 1.2 grams per tonne palladium and 0.027 gram per tonne platinum. Another grab sample assayed 1.65 grams per tonne platinum, 4.85 grams per tonne palladium, 2.2 grams per tonne silver, 0.655% copper and 0.2% nickel (Assessment Report 13945).

A third grab sample assayed 1.65 grams per tonne platinum, 4.85 grams per tonne palladium, 2.2 grams per tonne silver, 0.655% copper and 0.2% nickel (Assessment Report 13945).

A sample from gouge material containing malachite and azurite, 250 metres to the north, assayed 0.67% copper (Assessment Report 13945). The showing is likely at the northern extension of the Main showing of the Columbia occurrence (92F 339).

MINFILE NUMBER: 092F 462 **NAME: TONI**
NORTHING: 5436926 EASTING: 392483 STATUS: Showing

CAPSULE GEOLOGY:

The Toni showing is located on the Nanaimo River, about 4 kilometres south of Labour Day Lake.

Volcaniclastics, volcanics and sediments of the Sicker and Buttle Lake groups are intruded by quartz monzonite to granodiorite of the Early to Middle Jurassic Island Intrusions. These are overlain by sediments of the Cretaceous Comox Formation of the Nanaimo Group. The Sicker Group includes andesite and volcaniclastics of the Upper Devonian McLaughlin Ridge Formation. The Buttle Lake Group includes limestone and chert of the Mississippian to Pennsylvanian Fourth Lake Formation. These two formations were previously known as the Myra Formation.

Pyrite and minor pyrrhotite and chalcopyrite occur in quartz-carbonate veins in shear zones within the volcanics. A sample assayed 0.175% copper (Assessment Report 14729).

MINFILE NUMBER: 092F 463 **NAME: COLUMBIA VI**
NORTHING: 5429212 EASTING: 384408 STATUS: Showing

CAPSULE GEOLOGY:

The Columbia VI showing is located 27 kilometres southeast of Port Alberni. The area is underlain by rocks of the Devonian Nitinat Formation and the Upper Devonian McLaughlin Formation which occur along the western part of a 10 kilometre belt of the Paleozoic Sicker Group, known as the Cowichan uplift.

The volcanics consist of massive and pillowed basalt with minor chert and jasper. Small patches of epidote, and lesser amounts of quartz are common throughout the sequence. These rocks are steeply dipping and become younger to the west. The metamorphic grade is usually lower greenschist facies.

A shear zone contains ankerite and quartz veinlets heavily mineralized with pyrite. A sample from a quartz or pyrite vein containing massive pyrite hosted in silicified basalt assayed 16.22 grams per tonne gold, 3.7 grams per tonne silver and 0.08% copper (Assessment Report 17769).

MINFILE NUMBER: 092F 464 **NAME: SURPRISE**
NORTHING: 5438382 EASTING: 397178 STATUS: Showing

CAPSULE GEOLOGY:

The Surprise showing is located on Rockyrun Creek, about 4.5 kilometres south of Moriarty Lake, about 30 kilometres southeast of Port Alberni.

The area is underlain mainly by granodiorite, monzonite and tonalite of the Early to Middle Jurassic Island Intrusions and by lesser volcanics of the Middle Triassic Karmutsen Formation and limestone, tuff and sediments of the Paleozoic Sicker Group. The intrusive rocks are cut by northwest and northeast trending faults,with the older rocks exposed in faulted sections.

Pyrite, chalcopyrite, bornite, tetrahedrite and molybdenite occur as disseminations, blebs and veins in two parallel shears within biotite monzonite and lesser tonalite and diabase dikes. The shears, which trend 135 degrees and dip 70 degrees northeast, are 5 to 20 centimetres wide and intermittently traced for 200 metres, and broken up by crosscutting faults. Alteration minerals in and around the shear zones are malachite, tenorite, pyrite, chlorite and saussurite. A 1.5 metre drill core sample assayed 3.43% copper, 89.5 grams per tonne silver and 2.7 grams per tonne gold (Assessment Report 11010).

MINFILE NUMBER: 092F 465 **NAME: WO 7**
NORTHING: 5439521 EASTING: 402472 STATUS: Showing

CAPSULE GEOLOGY:

The Wo 7 showing is located on Rockyrun Creek, 2.5 kilometres south of Mount Moriarty, about 27 kilometres southeast of Port Alberni.

Early to Middle Jurassic Island Intrusions are cut by granite porphyry of the Tertiary Mount Washington Intrusive Suite (Personal Communication, N. Massey, May, 1990). A shear zone in the younger intrusives contain calcite veinlets with sphalerite, pyrite, chalcopyrite and magnetite.

MINFILE NUMBER: 092F 466 **NAME: HOOP**
NORTHING: 5428536 EASTING: 387240 STATUS: Showing

CAPSULE GEOLOGY:

The Hoop showing is located just south of Mount Hooper, about 30 kilometres southeast of Port Alberni. The area is underlain by northwest-trending Sicker Group rocks, including mafic to intermediate flows and pyroclastics of the Devonian Nitinat Formation and cherts and tuffs of the Upper Devonian McLaughlin Ridge Formation (Myra Formation).

A 200 metre wide, northwest-trending carbonatized shear zone cuts the volcanics. Associated with the shear are abundant quartz and carbonate veinlets which contain disseminations and pods of pyrite. Anomalous gold values occur in and around the shear zone.

A 2 metre channel sample across a shear in chloritic basalt/schist assayed 0.09% copper and 0.1 gram per tonne gold. A nearby sample of a diorite dike, cut by quartz stringers with disseminated pyrite, assayed 0.267% copper and 0.072% nickel (Assessment Report 14461).

MINFILE NUMBER: 092F 467 **NAME: SICKER**
NORTHING: 5436352 EASTING: 398358 STATUS: Showing

CAPSULE GEOLOGY:

The Sicker showing is located just east of the north tip of Fourth Lake. The area is underlain by a northwest-dipping succession of sediments and volcanics of the Paleozoic Sicker and Buttle Lake groups. This is truncated to the west by granodiorite of the Jurassic Island Intrusions. Disseminated and fracture filled pyrite and minor chalcopyrite occur in quartz filled veins within cherts, tuffs, cherty tuffs and sediments and sericitic schist. Minor skarn occurs along the igneous contact.

An 8 centimetre wide fracture zone containing pyrite cuts metagraphitic argillaceous chert, likely of the Carboniferous Fourth Lake Formation (Myra Formation). A grab sample assayed 0.1% copper and 0.1 gram per tonne gold (Assessment Report 15452).

A sample of diorite with disseminated chalcopyrite, taken in 1965, 500 metres to the south-southwest, assayed 0.3% copper (Laanela, 1965).

Exploration in 1988 revealed a broad 800 metre wide northwest trending zone of ankeritic alteration most likely associated with shearing. The zone extends from the northern boundary of the Sicker 2 claim to the Staking Reserve boundary on the Rush 3 claim. In addition to quartz and quartz-carbonate veining, local pods of arsenopyrite, chalcopyrite, pyrrhotite and magnetite were noted. Visible gold was observed in drill core from the northwestern corner of the Rush 3 Claim; this sample over 0.59 metres assayed 2.93 grams per tonne gold, 3.2 grams per tonne silver and 0.04% copper (Assessment Report 17600).

MINFILE NUMBER: 092F 468 **NAME: LOGAN**
NORTHING: 5428516 EASTING: 385207 STATUS: Showing

CAPSULE GEOLOGY:

The Logan showing is located on Rift Creek near its outlet into the Nitinat River. The showing occurs at the southern extent of the Cowichan Thrust which cuts through the Logan claims. Paleozoic Sicker Group rocks comprising of the Devonian Nitinat and/or McLaughlin Ridge formations, are exposed in the hangingwall of the fault. The Sicker Group rocks are intruded by Jurassic Island Intrusions. In the footwall, rocks of the Nitinat Formation are intruded by Triassic diabase sills and overlain in fault contact with pillowed and massive flows of the Upper Triassic Karmutsen Formation,Vancouver Group.

Mineralization occurs primarily on the Logan 2 claim which straddles the northwest striking fault zone. Outcrops in this area show intensive fracturing, shearing and brecciation and silicification, epidotization and pyritization are reported. Mineralization consists of pyrite and chalcopyrite in silicified zones and as fillings in vugs and narrow fractures.

Fourteen chip samples averaged 6.44 grams per tonne gold and 6.34 grams per tonne silver (high of 12.75 grams per tonne gold and 10.97 grams per tonne silver) (Property File Antony Resources Ltd. Prospectus, May 1988).

MINFILE NUMBER: 092F 469 **NAME: DDAM**
NORTHING: 5449300 EASTING: 381780 STATUS: Showing

CAPSULE GEOLOGY:

The Ddam occurrence is underlain by Devonian Sicker Group rocks, predominantly mixed lapilli tuffs and agglomerates of the Nitinat Formation. Included within the tuffs is a siliceous, banded, grey black aphanitic tuff layer. There are silicified, bleached,altered pyritic zones at stratigraphic contacts.

Mineralization consisting of mainly pyrite with trace amounts of chalcopyrite occur in shear zones with occasional milky, grey-white, quartz veins ranging from 1 centimetre stockwork veinlets to 10 centimetre wide veins. A barren quartz-epidote-silica phase postdates the milky quartz veins.

MINFILE NUMBER: 092F 492 **NAME: BAIN 4**
NORTHING: 5448750 EASTING: 376200 STATUS: Showing

CAPSULE GEOLOGY:

The Bain 4 showing is located just west of the Yellow property, (092F 079) 6 kilometres southeast of Port Alberni.

The area is underlain by volcanic and sedimentary rocks of the Devonian Duck Lake Formation, Sicker Group and by volcanic rocks of the Upper Triassic Karmutsen Formation, Vancouver Group. These have been intruded by Early to Middle Jurassic Island Intrusions. The rocks comprise basaltic and andesitic tuffs, breccias and flows, argillite, siltstone and chert intruded by dioritic rocks.

A copper anomaly was delineated in 1980 and exploration in 1987 resulted in samples containing anomalous gold values from this zone. One sample (R103), described as a mafic intrusive with malachite staining, initially assayed 0.39 gram per tonne gold, 0.266% copper and 0.0082% zinc. This sample was reassayed for platinum, palladium and gold and assayed 1.8 grams per tonne gold with insignificant platinum and palladium values (Assessment Report 16631).

Quartz-carbonate veins and stringers with pyrite, chalcopyrite and minor arsenopyrite occur in the area. Pyrite is also disseminated in silicified andesitic and dioritic rocks.

MINFILE NUMBER: 092F 543 **NAME: SNAPPER**
NORTHING: 5440400 EASTING: 387450 STATUS: Showing

CAPSULE GEOLOGY:

The Snapper showing is located 22 kilometres southeast of Port Alberni, slightly east of the Tan (092F 398) showing.

The area, located in the Cowichan uplift, is underlain by volcanics and minor sediments of the Upper Devonian McLaughlin Ridge Formation (formerly the Myra Formation) and the Devonian Nitinat Formation, Sicker Group. Diabase and gabbro dikes and sills, considered to be coeval with the Triassic Karmutsen Formation, outcrop to the south.

The showing occurs in volcanic and sedimentary rocks of the Nitinat Formation. These comprise basalt, andesite, flow breccia, volcaniclastic sediments, greywacke, siltstone, argillite and black chert.

Quartz-carbonate veins hosted in shear zones are mineralized with pyrite, chalcopyrite, sphalerite and galena. Disseminated sulphides also occur in carbonatized volcanics. Shear zones extend 600 metres along strike and are up to 10 metres wide.

A grab sample across 10 centimetres of a quartz vein striking 170 degrees with vertical dips and containing 7% sulphides assayed 3.154 grams per tonne gold and 119.98 grams per tonne silver (Assessment Report 17058).

MINFILE NUMBER: 092F 544 **NAME: MONKEY**
NORTHING: 5444240 EASTING: 387000 STATUS: Showing

CAPSULE GEOLOGY:

The Monkey showing is located 27 kilometres east of Port Alberni. Two old short adits, driven on a gold-bearing quartz vein, were found on this claim.

The area is underlain by rocks of the Paleozoic Sicker Group comprising the Upper Devonian McLaughlin Ridge Formation and the Devonian Nitinat Formation. These rocks consist primarily of andesitic, basaltic and dacitic tuffs and flows, lesser argillite and chert and minor conglomerate or breccia.

A conformable quartz vein occurs within a thick band of argillite. The vein is heavily mineralized with pyrite (up to 50%) and sphalerite (up to 10%), and minor chalcopyrite and galena. The vein is up to 7.5 centimetres wide with a 7.5 centimetre zone of silicified wallrock containing many quartz stringers, and has been traced for 120 metres. Two other small quartz veins, one possibly an offshoot of the main vein and the other similar in appearance but thinner, occur in the area. A fault is parallel to the main vein 2 to 3 metres to the north and separates argillite from Tertiary(?) feldspar porphyritic andesite, believed to be intrusive.

A 1984 grab sample from a quartz vein assayed 1.04 grams per tonne gold, 10.8 grams per tonne silver, 0.13% copper, 0.07% lead and 1.08% zinc (Assessment Report 12564).

MINFILE NUMBER: 092F 545 **NAME: HEYBERT**
NORTHING: 5449290 EASTING: 393735 STATUS: Showing

CAPSULE GEOLOGY:

The area is underlain by Upper Triassic Karmutsen Formation (Vancouver Group) volcanic and volcaniclastic rocks intruded by Jurassic Island Intrusions granodiorite to quartz monzonite. Unconformably overlying these rocks are Cretaceous Nanaimo Group bedded conglomerates, greywackes and sandstones.

The HeyBert occurrence comprises Karmutsen Formation massive basalt, feldspar porphyry basalt, basalt flow breccia and basalt tuffs intruded by granodiorite and quartz monzonite of the Island Intrusions. The quartz monzonite rocks contain sporadic zones of intense shearing and/or fracturing with associated potassic (potassium feldspar) or carbonate alteration. An alteration assemblage of quartz, epidote and chlorite occurs primarily in the Karmutsen rocks as fracture fillings, veinlets or veins. Mineralization consisting of pyrite with trace chalcopyrite are associated with shear/fracture zones and alteration zones in granodiorite and quartz monzonite, with strong linear shears in feldspar porphyry basalt and as pervasive disseminations in altered basalt. A rock sample from sheared granodiorite assayed 0.07% copper (Assessment Report 11356).

MINFILE NUMBER: 092F 546 **NAME: STARBOARD**
NORTHING: 5434560 EASTING: 381500 STATUS: Showing

CAPSULE GEOLOGY:

The Starboard showing is located approximately 20 kilometres southeast of Port Alberni, just east of the Cup (Mary) showings (092F207).

The area is underlain by sedimentary rocks of the Upper Pennsylvanian to Lower Permian Mount Mark Formation, Buttle Lake Group and by volcanic rocks of the Devonian Nitinat Formation, Sicker Group. These comprise siltstone, bioclastic and calcareous siltstone, fossiliferous limestone, tuffs, andesite and Jurassic(?) feldspar porphyry dikes of unknown affinity.

Mineralization consisting of pyrite, arsenopyrite, chalcopyrite, pyrrhotite, sphalerite, galena, malachite and hematite occurs in narrow quartz veins hosted by Mount Mark Formation siltstone. The veins or stringers, perpendicular to bedding, are up to 30 centimetres wide. The veins occur over an area 1600 metres long by 100 to 400 metres wide as outlined by geophysical and geochemical surveys. Several interesting zones have been delineated and tested by chip sampling (Nicki Creek, M6). A typical assay, from the Nicki Creek zone (sample #20140), assayed 12.80 grams per tonne gold, 21.3 grams per tonne silver and 7.88% zinc (Assessment Report 16731).

MINFILE NUMBER: 092F 547 **NAME: WATER**
NORTHING: 5437170 EASTING: 381560 STATUS: Showing

CAPSULE GEOLOGY:

The Water showing is located 3.5 kilometres south of the Thistle mine (092F 083), approximately 20 kilometres southeast of Port Alberni.

The area is underlain by volcanic rocks of the Devonian Duck Lake Formation, Sicker Group and by sediments of the Late Pennsylvanian to Early Permian Mount Mark Formation, Buttle Lake Group. These comprise massive and pillowed basaltic flows, breccia, andesite,agglomerate lapilli and cherty tuffs, limestone, siltstone, jasper and Late Triassic(?) feldspar porphyry dikes. The Rift Creek thrust fault occurs slightly east of the showing.

Mineralization consists of pyrite, chalcopyrite and galena in quartz veins with associated quartz-carbonate and sericite alteration. The veins are hosted in sheared pillow basalt and breccia of the Duck Lake Formation. The associated alteration occurs over a width of more than 100 metres. On the Lat claim, just to the east, finely laminated black argillite with 10 to 20% disseminated pyrite occurs between sequences of basaltic and cherty tuff.

A typical assay (sample #20112) from the North Rift Creek zone assayed 1.96 grams per tonne gold and 0.4 gram per tonne silver (Assessment Report 16731).

MINFILE NUMBER: 092F 550 **NAME: ARROWSMITH 3**
NORTHING: 5449900 EASTING: 383115 STATUS: Showing

CAPSULE GEOLOGY:

The Arrowsmith 3 occurrence is underlain by an assemblage of Devonian Sicker Group rocks (Nitinat Formation) consisting of tuff, volcanic siltstone, pyroxene porphyry and agglomerate unconformably overlain by conglomerate of the Upper Cretaceous Nanaimo Group (Comox Formation). The stratigraphy strikes north-northwest and dips to the east. Malachite staining is associated with jasperoid lenses and silicification apparently localized along stratigraphic contacts in the volcanic sequence.

MINFILE NUMBER: 092F 552 **NAME: SPRING**
NORTHING: 5444540 EASTING: 387060 STATUS: Prospect

CAPSULE GEOLOGY:

The Spring occurrence area is underlain by rocks of the Paleozoic Sicker and Buttle Lake groups, and the Upper Triassic Karmutsen Formation (Vancouver Group). The oldest rocks, the Devonian Nitinat Formation (Sicker Group) are poorly exposed and comprise pyroxene porphyritic basaltic agglomerate and breccia. These rocks are apparently conformably overlain by Upper Devonian McLaughlin Ridge Formation (Sicker Group) rocks comprised of an interbedded package of dominantly fine-grained tuff, argillite and chert/cherty siltstone and tuff with local beds of lapilli tuff. Bedding is planar to slightly undulatory and generally thin (less than 30 centimetres) and strikes east with moderate to steep dips to the south. Variability in bedding orientations suggests gentle folding about a south plunging axis. A south-southeast trending ault juxtaposes Sicker Group rocks with Mississippian to Pennsylvanian Fourth Lake Formation (Buttle Lake Group) rocks consisting of argillite, massive crinoidal limestone, chert, cherty siltstone and sandstone. Bedding strikes south-southeast and dips moderately to the northeast. Massive, mainly crinoidal limestone and interbedded siltstone and shale of the Upper to Lower Pennsylvanian Mount Mark Formation (Buttle Lake Group) conformably overlies Fourth Lake Formation rocks. Interbedded sandstone and shale of the Permian St. Mary's Lake Formation (Buttle Lake Group) overlies the Mount Mark Formation. These rocks trend north-northwest. Unconformably overlying the St. Mary's Lake Formation, and in places the Mount Mark Formation, is massive basalt of the Karmutsen Formation. Intermediate hornblende-feldspar porphyritic dikes crosscut the overall stratigraphic sequence. The Tertiary dikes are generally oriented parallel to bedding and dip steeply north and south and are up to 15 metres wide. Faulting on the property includes major northwest-trending faults (Cameron River fault) and northwest-trending splay faults. Minor northeast to east-trending faults also occur and appear to localize the dikes and/or mineralized quartz veins and alteration zones.

Mineralization includes quartz veins spatially associated with hornblende-feldspar porphyry dikes, quartz and quartz-carbonate veins in shear zones and minor sulphide disseminations in hornblende-feldspar porphyry dikes. The quartz veins are up to 50 centimetres wide and have been traced along strike for up to 400 metres (three veins have been located). The veins cut chert and cherty tuff of the McLaughlin Ridge Formation and occur on either side of hornblende-feldspar porphyry dikes. Mineralization consists of pyrite, sphalerite, chalcopyrite and galena. Several short adits explore the quartz veins. A rock sample from these veins near the adits assayed up to 3.6 grams per tonne gold, 2.8% zinc, 30.5 grams per tonne silver and 0.18% copper (Assessment Report 18108). An east-northeast trending shear zone lying 200 to 300 metres south of and parallel to the quartz veins developed by the adits, contain sulphide-bearing quartz and quartz-carbonate veins up to 5 centimetres wide. The veins generally occupy imbricate shears and are variably mineralized with pyrite, chalcopyrite, sphalerite and galena. Rock samples from these veins assayed up to 2.64 grams per tonne gold, 0.39% lead and 0.13% zinc (Assessment Report 18108). Hornblende-feldspar porphyry dikes locally contain trace to minor disseminated pyrite and minor chalcopyrite.

MINFILE NUMBER: 092F 557 **NAME: FRANK**
NORTHING: 5437825 EASTING: 390750 STATUS: Showing

CAPSULE GEOLOGY:

The Frank showing is located 40 kilometres west of Nanaimo at the head of the Nanaimo River.

The area is underlain by volcanic rocks of the Upper Devonian McLaughlin Ridge Formation, Sicker Group (formerly lower Myra Formation) and sedimentary rocks of the Mississippian to Pennsylvanian Fourth Lake Formation, Buttle Lake Group (formerly upper Myra Formation). These have been intruded by late Triassic dikes and sills of unknown affinity.

The showing is hosted in rocks mapped as breccia, tuff and argillite; the actual host rocks are not described. Massive sulphide mineralization, pyrite and chalcopyrite are assumed, was discovered during a geochemical survey. The mineralization occurs in a northeast striking zone, outlined by the geochemical survey, 400 metres long and 100 metres wide. A sample assayed 3.6% copper, 11.5 grams per tonne silver and 0.046 gram per tonne gold (Assessment Report 16585).

MINFILE NUMBER: 092F 558 **NAME: SPARK**
NORTHING: 5433250 EASTING: 392550 STATUS: Showing

CAPSULE GEOLOGY:

The Spark showing is located 1.5 kilometres west of the southern tip of Fourth Lake.

The area is underlain by volcanic and sedimentary rocks of the Devonian Nitinat Formation or possibly the Duck Lake Formation both of the Paleozoic Sicker Group.

The rocks comprise porphyritic hornblende andesite, black andesite, minor rhyolite, conglomerates, greywacke, banded chert and hornblende granodiorite of unknown affinity.

There are two sets of quartz veins in the area. The first set are very tight, closed veins which have been metamorphosed with the surrounding rocks. The veins in the second set, possibly related to the hornblende granodiorite intrusive, are vuggy and often contain pyrite and chalcopyrite.

MINFILE NUMBER: 092F 559 **NAME: MOUNT WESLEY**
NORTHING: 5463400 EASTING: 379250 STATUS: Showing

CAPSULE GEOLOGY:

The Mount Wesley area is underlain primarily by basalt of the Upper Triassic Karmutsen Formation (Vancouver Group). On the western slope of the mountain, a large northwest-trending lense of limestone of the Upper Pennsylvanian to Lower Permian Mount Mark Formation, (Buttle Lake Group) occurs. It is bounded on the east by basalt, and on the west by volcanics and sediments of the Devonian Sicker Group.

Rusty, altered limestone was initially reported to host veins and some malachite specks (Laanela, 1965). Later prospecting located numerous quartz stringers from 1 to 10 centimetres wide and randomly oriented within rusty, fractured and sheared basalt. Some minute specks of chalcopyrite and bornite were present. This showing occurs in a fault zone exposed in a road cut just east of the limestone lense. Several samples taken in 1985 failed to show any elevated values in copper, lead, zinc, silver or gold (Assessment Report 14443).

MINFILE NUMBER: 092F 560 **NAME: MCKINLAY 1**
NORTHING: 5441250 EASTING: 386000 STATUS: Showing

CAPSULE GEOLOGY:

The McKinlay 1 showing is located south of McKinlay peak and 20 kilometres southeast of Port Alberni.

The area is underlain by volcanic and volcaniclastic rocks of the Devonian Nitinat Formation, Sicker Group. These comprise andesitic tuff, massive green andesite, lapilli tuff, pyroxene-feldspar porphyritic agglomerates and tuffs and cherty siltstone.

A soil survey conducted in 1987 outlined five anomalous zones, the most significant zone is 400 metres long and partly coincident with a pyrite-silica-iron carbonate alteration zone which is greater than 5 metres wide. A chip sample assayed 0.0685 grams per tonne gold, 8.6 grams per tonne silver, 0.4% copper, 0.13% lead and 0.465% zinc from a zone that trends northeast (Assessment Report 16822). Alteration is accompanied by disseminated pyrite, iron carbonate and mariposite with minor galena and sphalerite.

MINFILE NUMBER: 092F 561 **NAME: APRIL**
NORTHING: 5438250 EASTING: 377800 STATUS: Showing

CAPSULE GEOLOGY:

The April showing is located 19 kilometres southeast of Port Alberni on the north side of Museum Creek.

The area is underlain by volcanic rocks of the Upper Triassic Karmutsen Formation, Vancouver Group intruded by Early to Middle Jurassic Island Intrusions. These comprise dark green chloritic greenstone, altered pillow breccia, basaltic greenstone and diorite intrusives.

Quartz-epidote-calcite stringers are hosted in greenstone with disseminated to semi-massive pyrite, chalcopyrite, pyrite and possibly magnetite. Propylitic alteration in the host rock is common. A grab sample from an outcrop (#2963) assayed 0.4294% copper, 1.5 grams per tonne silver and 0.012 gram per tonne gold (Assessment Report 15953). The sample contained epidote stringers, up to 8 centimetres wide striking 320 degrees, with quartz and minor sulphides.

MINFILE NUMBER: 092F 562 **NAME: RITE 1**
NORTHING: 5430475 EASTING: 401990 STATUS: Showing

CAPSULE GEOLOGY:

The Rite 1 showing is located 40 kilometres southwest of Nanaimo on the east side of Green Creek.

The area is underlain by volcanic and volcaniclastic rocks of the Devonian Duck Lake Formation, Sicker Group which have been intruded by Early to Middle Jurassic Island Intrusions. These comprise tuff, chert, argillite, diorite and granodiorite. A broad zone of imbricate faulting and shearing is present and exposures of fault breccia, intense shearing and alteration occur.

Exploration in 1988 identified four target areas characterized by gold, silver, arsenic, copper and molybdenite mineralization hosted in quartz-sulphide veins within quartz-ankerite-sericite-fuchsite-hematite bearing shear zones. The main target has a strike length of 3.2 kilometres with widths up to 1 kilometre, within which a series of 10 to 100 metre wide alteration sequences occur. The molybdenum showings occur to the south of the Rite 1 claim on the Rite 2 claim (092C 109) and the Close occurrence (092C 112).

Anomalous gold mineralization occurs in pyritic quartz and quartz-carbonate veins up to 0.20 metres wide. The veins are associated with the imbricate fault and shear zone which is up to 2.2 kilometres long and 1 kilometre wide. The zone is characterized by abundant localized intense quartz-ankerite-limonite-sericite-hematite-epidote alteration.

A chip sample (TN95) taken across 10 centimetres of a rusty quartz vein, on the Laura claim, assayed up to 25% pyrite and 6.48 grams per tonne gold (Assessment Report 18635). In the southern portion of the Rite 1 claim, veins containing up to 4% pyrite, trace malachite and trace chalcopyrite are slightly anomalous in gold, silver and copper.

Mineralization along the same trend, from a parallel vein/shear system, is exposed on the adjacent Rush/Sicker property (092F446, 467).

MINFILE NUMBER: 092F 563 **NAME: FLIGHT 5**
NORTHING: 5430650 EASTING: 396775 STATUS: Showing

CAPSULE GEOLOGY:

The Flight 5 showing is located 9 kilometres northeast of the west tip of Cowichan Lake.

The area is underlain by volcanic and volcaniclastic rocks of the Paleozoic Sicker Group. These rocks comprise jasper, tuff, basaltic to andesitic agglomerates, volcanic breccia and minor flows of the Upper Devonian McLaughlin Ridge Formation and the Devonian Nitinat Formation. Minor shearing and faulting have been identified in the area.

An extensive jasper body containing minor magnetite occurs at the McLaughlin Ridge Formation\Nitinat Formation contact. A 10 centimetre band of conformable massive pyrrhotite is reported to occur near this contact, however, it does not appear to have been mapped or documented.

The jasper body is 10 to 15 metres thick, traceable for 250 metres, dips vertically and is hosted in basaltic rocks overlain by epiclastic sandstones and siltstones. The jasper is locally broken with minor infillings of magnetite and is laterally succeeded by lenses, blocks or wedges of jasper with minor pyrite. These are overlain by fine-grained chloritic tuff, laminated cherty tuff and finally by hematitic altered lapilli tuff. The tuff contains graphitic partings and quartz veining carrying pyrite and trace chalcopyrite. A 30 centimetres wide associated shear zone contains chlorite, kaolinite, sericite, pyrite, trace chalcopyrite and malachite. Rock samples of the jasper body assayed only low values for gold, silver, copper, lead and zinc (Assessment Report 15887).

MINFILE NUMBER: 092F 564 **NAME: PEAK LAKE**
NORTHING: 5445600 EASTING: 386075 STATUS: Showing

CAPSULE GEOLOGY:

The Peak Lake showing is located 700 metres southeast of Peak Lake on the Emma 2 claim.

The area is underlain by rocks of the Paleozoic Sicker Group comprising deformed breccia, tuff, argillite, greenstone, greenschist, narrow dikes of andesite porphyry, and argillaceous and calcareous sedimentary rocks. There are numerous faults and shear zones in the area suggesting a north northeast fault through the Peak Lake area. A number of quartz veins and carbonatized zones are present.

The Peak Lake zone is characterized by widespread pyrite and pyrrhotite mineralization in Devonian Nitinat Formation volcaniclastic rocks. Pyritic dacite has intruded the volcaniclastic rocks and is the likely source of mineralization. Alteration varies from quartz-epidote flooding for up to 500 metres distal to the Peak Lake fault to pervasive carbonatization proximal to the fault with abundant quartz veins, up to 25 centimetres wide, throughout. The veins locally contain sphalerite, chalcopyrite and molybdenite in addition to pyrite. Gold concentration appears to increase with sphalerite content and with proximity to the strong north-trending Peak Lake fault which cuts the zone. The zone is up to 600 metres wide, extends south of Peak Lake and is open to the south.

A typical assay result from drilling on the Peak Lake zone (87.17 to 87.72 metres) over 0.55 metre is 0.375 gram per tonne gold, 6.6 grams per tonne silver, 0.063% copper, and 0.0302% zinc (Assessment Report 17207).

MINFILE NUMBER: 092F 565 **NAME: DEBEAUX CREEK**
NORTHING: 5446250 EASTING: 383000 STATUS: Showing

CAPSULE GEOLOGY:

The Debeaux Creek showing is located about 2.5 kilometres west of Peak Lake.

The area is underlain by rocks of the Paleozoic Sicker Group comprising deformed breccia, tuff, argillite, greenstone, greenschist, narrow dikes of andesite porphyry, and argillaceous and calcareous sedimentary rocks. There are numerous faults and shear zones in the area suggesting a north-northeast fault through the Peak Lake area. A number of quartz veins and carbonatized zones are present.

The Debeaux Creek zone is characterized by locally intensely carbonatized basaltic and andesitic volcaniclastic rocks of the Devonian Duck Lake Formation and extensively serpentinized diabasic gabbro. These are likely related to the northeast trending faults which transect the area.

A Late Triassic(?) diabasic gabbro of unknown affinity has intruded along the Debeaux Creek fault. Later-stage movement along the fault combined with hydrothermal processes has altered portions of the gabbro to magnetite-rich serpentinite with associated nickel-bearing sulphide mineralization. The zone of serpentinization is up to 300 metres wide with an undetermined strike length. This zone bears certain similarities to a magmatogenic deposit, in that the gold is associated with nickel sulphide segregations in ultramafic to mafic rocks. A grab sample (16232) assayed 0.0382% nickel and 0.913% chromium (Assessment Report 17207). A sample from a 5 centimetre quartz-carbonate vein containing pyrite and pyrrhotite and cutting basalt near the serpentinite contact assayed 0.20 gram per tonne gold (Assessment Report 17207).

APPENDIX 3

SUMMARY OF ASSESSMENT REPORT WORK RECORDED WITHIN THE ALBERNI — NANAIMO LAKES MAP AREA

Data is abstracted from the Ministry's ARIS database which should be consulted for more complete information and for assessment reports filed after December 1989.

ASSESSMENT REPORT NO.	NTS	EASTING	NORTHING	MINING DIVISION*	CLAIM(S) WORKED ON	OPERATOR(S)/ AUTHOR(S)	REPORT YEAR	WORK TYPE**
2771	092F02E	377302	5431372	ALBI	Jan	Cotowick J.	1970	GEOL
					WWW	Stevenson W.G.		
4875	092F02E	378033	5453414	ALBI	Amy	Western Mines	1973	GEOL
						Scott G.H.		GEOC
4915	092F02E	380003	5449107	ALBI	Sam	Keywest Res.	1974	GEOL
						Szakacs J.		
5315	092F01W	407835	5442456	NIMO	African	Kinneard G.E.	1974	PROS
					Alliance	Kinneard G.E.		PHYS
					Austrian			
5354	092F02E	382898	5442372	ALBI	Sol	Cominco	1975	GEOL
						Kalnins T.E.		GEOC
						Cooke D.L.		
5400	092F02E	371986	5438722	ALBI	COR	Focus Res.	1974	GEOL
					Star of the West	Phelps G.		
5443	092F02E	380003	5449107	ALBI	Sam	Keywest Res.	1974	GEOC
						Sheppard E.		
5594	092F02E	378426	5454703	ALBI	Amy	Western Mines	1975	PHYS
						Randall A.		
6134	092F02E	380424	5434826	VICT	Wine	Gold Valley Res.	1976	DRIL
						Elwell J.		
6138	092F02E	382898	5442372	ALBI	Sol	Cominco	1976	GEOP
						Klein J.		
6153	092F02E	378452	5444878	ALBI	Dog	Western Mines	1976	GEOL
					Rupert	Tschach R.		GEOC
					Shannon			
6585	092F01W	393760	5437890	NIMO	KAR	MacKenzie E.	1977	PHYS
						White G.E.		
6643	092F02E	382898	5442372	ALBI	Sol	Cominco	1977	GEOP
						Klein J.		
6676	092F02E	371986	5438722	ALBI	COR	Focus Res.	1977	GEOL
					Star of the West	Sadlier-Brown T.		PHYS
						Nevin A.		GEOC
6865	092F02E	376449	5431391	ALBI	Daisy	Golden Ram Res.	1978	PROS
						Trenholme L.		
7600	092F02E	382898	5442372	ALBI	Sol	Cominco	1977	DRIL
						Armstrong W.		
7719	092F02E	378306	5443769	ALBI	Dinosaur	Union Miniere Ex.	1979	GEOC
					Lizard	Pauwels A.M.		
7768	092F01W	394300	5440660	NIMO	AJ	Kargen Dev.	1979	PHYS
						White G.E.		GEOC
7792	092F01W	393416	5439009	NIMO	Villalta	Specogna E.	1979	DRIL
						Specogna E.		GEOC
7834	092F01W	393502	5437154	NIMO	Jane	Westmount Res.	1979	GEOP
					Kathy	White G.E.		
					Larry			
					Toni			
7857	092F02E	382569	5438302	VICT	Jan	Jan Res.	1979	GEOC
					Mar	Sawyer J.B.		
7953	092F01W	393019	5437348	NIMO	Wolfram	Specogna E.	1979	PROS
						Specogna E.		
7984	092F02E	377029	5451953	ALBI	Debbie	Western Mines	1979	PHYS
				NIMO	Linda	Walker B.		GEOC
					Lucy	Benvenuto G.		

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8088	092F02E	378812	5439124	ALBI	Crow Sue	Kargen Dev. White G.E.	1979	PHYS GEOC
8177	092F02E	380404	5433900	VICT	Cup	Summit Pass Res. Poloni J.R.	1979	PROS
8227	092F02E 092F07E	377104	5455288	ALBI	Oets	Western Mines Benvenuto G.	1980	GEOC
8249	092F02E	375991	5449011	ALBI	Lily	Western Mines Benvenuto B.	1980	GEOC
8289	092F02E	379433	5445227	ALBI	Jenny Loupy	Western Mines Benvenuto G.	1980	GEOC
8458	092F01W	393416	5439009	NIMO	Villalta	Canamin Res. Bristow J.F.	1980	DRIL
8487	092F01W	393502	5437154	NIMO	Toni	Westmount Res. Sawyer J.B.	1980	DRIL
8568	092F02E	378306	5443769	ALBI	Crinosaurus Dinosaur Diplodocus Lizard	Union Miniere Ex. Pauwels A.M.	1980	GEOC
8571	092F01W	394300	5440660	NIMO	AJ	Oliver Res. White G.E.	1980	GEOP PHYS GEOC
8687	092F01W	390636	5439990	NIMO	WO	Canamin Res. Specogna E.	1980	PROS
8688	092F01W	390636	5439990	NIMO	WO	Canamin Res. Specogna E.	1980	PROS
8722	092F02E	378370	5435612	ALBI	Lightstar Star	Esperanza Ex. Guild J.	1980	GEOC
8981	092F02E	378306	5443769	ALBI	Crinosaurus Dinosaur Diplodocus Lizard	Union Miniere Ex. Pauwels A.M.	1980	GEOC
9111	092F02E	377029	5451953	ALBI NIMO	Cam Debbie Linda Lucy	Western Mines Benvenuto G.	1980	GEOP PHYS GEOC
9126	092F02E	378812	5439124	ALBI	Crow Levi Sue	McQuillan Gold White G.E.	1981	GEOP
9140	092F01W	399950	5436848	NIMO	Elk Horn	Tarbo Res. Pezzot E. White G.E.	1981	GEOP
9292	092F02E	380404	5433900	VICT	Cup	Summit Pass Res. Craig S.	1981	PROS
9432	092F02E	387453	5450989	NIMO	Tyber	Stevens E. Stevens E.	1980	PROS
9639	092F02E	382569	5438302	VICT	Mar	Jan Res. Yacoub T. Sawyer J.B.	1980	DRIL
9986	092F02E	373928	5454433	ALBI	Joy Sandy	Heather Res. Bullis A.	1981	GEOC
10025	092F01W	399466	5443714	NIMO	Coal	BP Min. Marten B.	1981	GEOL DRIL GEOP PHYS GEOC
10176	092F02E 092F07E	378695	5444873	ALBI NIMO	Cop Debbie Jenny Lucy	Westmin Res. Benvenuto G. Walcott P.E.	1981	GEOP PHYS GEOC
10194	092F02E	383502	5442174	ALBI	Golden Eagle Okolona Sol Twins	MacDonald O. Armstrong C.	1981	GEOL PHYS GEOC
10206	092F02E	378635	5447654	ALBI	Yellow	Silver Cloud Mines Allen D.G.	1981	GEOC
10237	092F02E	379571	5440405	ALBI	Crow Jumbo Levi	McQuillan Gold Hawkins T.G.	1981	GEOP GEOC PHYS

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10282	092F01W	399625	5439078	NIMO	Rand Tangle	Canamin Res. Champigny N.	1981	PROS
10302	092F01W 092F02E	391366	5439975	NIMO	Specogna Copper	Amhawk Res. Specogna E.	1981	PROS
10390	092F01W	394178	5440662	NIMO	AJ	Oliver Res. Pezzot E. Vincent J.	1981	PHYS GEOC
10391	092F01W	394178	5440662	NIMO	AJ Ajay	Oliver Res. White G.E.	1981	GEOP
10395	092F02E	387575	5450987	NIMO	Tyber	Tyber Res. Read W.S.	1981	PHYS GEOP GEOC
10401	092F02E	378306	5443769	ALBI	Crinosaurus Dinosaur Diplodocus Lizard	Umex Felder F.	1981	GEOL GEOP GEOC
10789	092F01W 092F02E	393305	5439567	NIMO	Villalta WO	Asarco Ex. of Can. Fletcher D.	1982	GEOL GEOC
10890	092F02E	378306	5443769	ALBI	Crinosaurus Dinosaur Diplodocus Lizard	Umex Nadeau I.	1982	GEOC
10902	092F02E	382569	5438302	VICT	Jan Mar Nat Remy	Jan Res. Hawkins T.	1982	GEOL GEOC
10983	092F01W	399466	5443714	NIMO	Coal	BP Min. Findlay A.R.	1982	GEOL DRIL GEOC
10996	092F01W 092F02E	390515	5439992	NIMO	Specogna WO 2	Canamin Res. McDougall J.J.	1982	DRIL GEOC
11010	092F01W	395947	5437663	NIMO	Surprise	Canamin Res. Couroy P.	1982	PROS DRIL PHYS GEOC
11024	092F07E	375536	5466445	NIMO	SB	Asarco Ex. of Can. Fletcher D.	1982	GEOC
11064	092F02E	378983	5441345	ALBI VICT	Crow McQuillan Rose Thistle	Nexus Res. Hawkins T. White G.E.	1982	GEOL GEOP
11079	092F01W	401354	5433672	NIMO	Green Imperial	Imperial Metals Quin S. De Carle R.J.	1982	GEOP
11080	092F01W 092F02E	389648	5439268	NIMO	East Imperial West Imperial	Imperial Metals Quin S.	1982	GEOP
11278	092F02E	379850	5447628	ALBI	Yellow	Silver Cloud Mines Fuller E. Allen D.G.	1983	GEOC
11315	092F02E	384183	5434005	VICT	Raft 1-2	Jan Res. House G.D.	1983	GEOC
11356	092F01W 092F02E	393016	5449766	NIMO	Hey-Bert	Noranda Ex. Stewart C.	1983	GEOL GEOC
11622	092F02E	383008	5447560	NIMO	Daughters	Armstrong C. Armstrong C.	1983	GEOC
11913	092F01W	397557	5439116	NIMO	Surprise Tangl 1 WO 6	Canamin Res. Zastavnikovich S.	1983	GEOP GEOC
11926	092F01W	409707	5452804	NIMO	Songbird 1-4	Eureka Res. Kerr J.	1983	GEOL GEOP GEOC PHYS
11949	092F02E	379571	5440405	ALBI VICT	Crow Levi Museum Rand Sue	Westmin Res. Benvenuto G. Walcott P.E.	1983	GEOP PHYS GEOC

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11988	092F02E	382510	5441269	ALBI	B & M	Goldwest Res.	1983	GEOL
					Mum	Green N.E.		GEOC
					Rita			
12070	092F02E	386277	5446936	VICT	Emma 1-2	Au Res.	1983	PROS
				NIMO	Emma 5-11	Phendler R.		PHYS
								GEOC
12128	092F01W	394154	5439365	NIMO	Min	Falconbridge	1984	GEOP
	092F02E				Specogna Copper	Chandler T.		
					Surprise	Smith P.A.		
					Tangl 1			
					Villalta			
					WO 1-2			
					WO 5-7			
					Wolfram 3			
12132	092F01W	400036	5428136	NIMO	Dixie 1	Noranda Ex.	1983	GEOL
					Snooky	Stewart C.		GEOP
					Snuffy	Bradish L.		GEOC
12150	092F02E	385010	5438621	VICT	Tan	Lode Res.	1984	GEOC
						House G.D.		
12444	092F02E	384183	5434005	VICT	Raft 1-2	Lode Res.	1983	GEOL
						House G.D.		GEOP
								GEOC
12538	092F02E	380851	5443343	ALBI	McQuillan	Nexus Res.	1984	GEOL
						Neale T.		GEOC
						Hawkins T.G.		
12563	092F02E	380923	5446678	ALBI	Alberni	Sunfield Management	1984	PROS
						Neale T.		GEOC
						Hawkins T.G.		
12564	092F02E	388791	5445031	NIMO	Legend	Sunfield Management	1984	GEOL
					Monkey	Neale T.		GEOC
					Quill	Hawkins T.G.		
					Sol			
12664	092F02E	377853	5445262	ALBI	Crinosaurus	Noranda Ex.	1983	GEOL
					Dinosaur	Wilson R.		GEOP
					Diplodocus	Bradish L.		PHYS
					Lizard			GEOC
12696	092F02E	378926	5438751	ALBI	April	Nexus Res.	1984	GEOC
						Neale T.		
						Hawkins T.G.		
12735	092F02E	374500	5431435	ALBI	Par I-II	Toro Res.	1984	GEOC
						Dickson M.		
12809	092F02E	377019	5435086	ALBI	Toby 1-2	Imperial Metals	1984	PHYS
						Clark A.M.		GEOC
12832	092F01W	394154	5439365	NIMO	Wolfram 4	Falconbridge	1984	DRIL
	092F02E					Chandler T.		GEOC
12878	092F01W	398935	5434643	NIMO	Sicker 1-2	Ladysmith Min.	1984	GEOL
					Sicker 4-6	Neale T.		GEOC
						Hawkins T.G.		
13105	092F07E	375361	5469415	NIMO	Hill	Black Sheep Ventures	1984	GEOP
						Sookochoff L.		
13214	092F02E	377832	5444336	ALBI	Dinosaur	Noranda Ex.	1984	DRIL
						Wilson R.G.		GEOC
13236	092F01W	394154	5439365	NIMO	Fido	Falconbridge	1984	GEOL
	092F02E				Min	Chandler T.		DRIL
					Specogna Copper	Runkle D.		GEOP
					Surprise			GEOC
					Tangl			PHYS
					Villalta A			
					Villalta C			
					Villalta D			
					WO 1-2			
					WO 5-7			
					Wolfram 3-4			
13291	092F01W	400036	5428136	NIMO	Snooky	Noranda Ex.	1984	GEOL
					Snuffy	Stewart C.		GEOC
13385	092F02E	383361	5446996	NIMO	Daughters 1-4	Armstrong C.	1984	PHYS
						Armstrong C.		GEOC
13520	092F07E	379454	5462836	NIMO	Wes	Villebon Res.	1985	PROS

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						Neale T.		GEOC
						Hawkins T.G.		
13564	092F02E	380651	5434080	ALBI	Cup	Imperial Metals	1985	GEOL
				VICT		Clark A.		PHYS
						Harris J.F.		GEOP
								GEOC
13573	092F01W	403806	5434556	NIMO	Green Imperial	Imperial Metals	198	GEOC
						Clark A.		
13575	092F01W	389287	5439461	NIMO	East Imperial	Imperial Metals	1985	GEOC
	092F02E				West Imperial	Clark A.		
13668	092F02E	380651	5434080	ALBI	Lat	Schreiber Res.	1985	GEOL
				VICT	Water	Hawkins T.G.		GEOC
						Neale T.		
13670	092F02E	384409	5439004	VICT	Tan	Lode Res.	1985	GEOL
						Neale T.		GEOC
						Hawkins T.G.		
13671	092F02E	380572	5430374	ALBI	Aft	Ladysmith Min.	1985	PROS
					Rodeo	Neale T.		GEOC
						Hawkins T.G.		
13672	092F02E	379434	5434106	ALBI	Port	Lode Res.	1985	GEOL
					Starboard	Neale T.		GEOC
						Hawkins T.G.		
13700	092F02E	379149	5448941	ALBI	Yellow	Silver Cloud Mines	1985	GEOC
					Yellow M	Allen D.G.		
13711	092F02E	379555	5439664	ALBI	Crow	Westmin Res.	1985	DRIL
				VICT	Jumbo	Benvenuto G.		GEOP
					Levi	Walcott P.E.		PHYS
					Pansy			GEOC
					Primrose			
					Quill			
					Rand			
					Rose			
					Thistle			
13723	092F02E	380612	5432227	ALBI	Canon	Nexus Res.	1985	GEOL
					Olsen	Neale T.		GEOC
						Hawkins T.G.		
13743	092F02E	376279	5456419	ALBI	Oets	Noranda Ex.	1985	GEOP
	092F07E				Stokes	Wilson R.G.		PHYS
						Bradish L.		GEOC
13758	092F02E	376238	5454566	ALBI	Debbie 3	Noranda Ex.	1985	DRIL
				NIMO		Walker R.R.		
						Benvenuto G.		
13759	092F02E	378501	5447101	ALBI	China	Noranda Ex.	1985	GEOP
				NIMO	Jenny	Wilson R.G.		PHYS
						Bradish L.		GEOC
13857	092F02E	380612	5432227	ALBI	Canon	Goldenrod Res.	1985	GEOL
					Olsen	Willoughby N.		PHYS
						Hawkins T.G.		GEOC
13875	092F02E	385841	5449354	NIMO	Emma 20-21	Au Res.	1985	GEOC
						Lisle T.E.		
13904	092F02E	382067	5443317	ALBI	McQuillan	Nexus Res.	1985	GEOL
						Neale T.		GEOC
13934	092F02E	380991	5449827	NIMO	Cop	Noranda Ex.	1985	GEOL
						Wilson R.G.		GEOP
						Bradish L.		PHYS
								GEOC
13945	092F02E	387958	5433927	VICT	KitKat 1-7	JBL Res.	1985	GEOL
						Neale T.		GEOP
						Hawkins T.G.		PHYS
								GEOC
13954	092F02E	384305	5434002	VICT	Raft 1-2	Vanwin Res.	1985	GEOL
						Neale T.		GEOC
						Hawkins T.G.		
14201	092F02E	374793	5444404	ALBI	Pat 3	Victoria Diego Res.	1986	PROS
						Leriche P.D.		GEOC
14202	092F02E	374751	5442551	ALBI	Pat 2	Gator Res.	1986	PROS
						Neale T.		GEOC
						Hawkins T.		

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14203	092F02E	373493	5440726	ALBI	Pat 1	Victoria Diego Res.	1986	GEOC
						Leriche P.D.		
14338	092F02E	388089	5440411	VICT	Black 1-3	Jones O.A.	1985	GEOC
						Schorn T.F.		
14376	092F02E	383696	5434015	VICT	Raft 1	Vanwin Res.	1986	PHYS
						Neale T.		GEOC
14389	092F02E	380263	5444282	ALBI	Loupy	Westmin Res.	1986	GEOL
						Lyons E.M.		GEOC
14415	092F07E	376196	5468840	NIMO	Hill	Goldsmith L.B.	1986	DRIL
					Hill 2	Goldsmith L.B.		GEOP
								PHYS
								GEOC
14431	092F02E	385010	5438621	VICT	Tan	Lode Res.	1986	GEOC
						Laanela H.		
14443	092F07E	378848	5462849	NIMO	Wes	Victoria Diego Res.	1986	GEOL
						Laanela H.		GEOC
14461	092F02E	388493	5430209	VICT	Hoop 1-5	Gator Res.	1986	GEOL
						Neale T.		GEOC
						Hawkins T.		
14470	092F02E	378825	5434119	ALBI	Port	Lode Res.	1986	PROS
				VICT	Starboard	Laanela H.		GEOC
14483	092F02E	378890	5448205	ALBI	Yellow	Silver Cloud Mines	1986	GEOL
						Neale T.		GEOC
						Hawkins T.		
14520	092F02E	373848	5429596	ALBI	Par II	Toro Res.	1985	PROS
						Dickson M.		
14729	092F01W	392572	5439396	NIMO	Jane	Goldbrae Dev.	1986	GEOL
					Kathy	White G.E.		GEOP
					Larry	Freeze J.C.		PHYS
					Toni			GEOC
14768	092F02E	380971	5448901	NIMO	DDAM 1-2	Jones P.	1986	PROS
						Konst R.		GEOC
						Jones P.		
14821	092F01W	397730	5428734	VICT	Flight 1	BHP-Utah Mines	1986	GEOL
				NIMO	Flight 3	Cowley P.		GEOC
14830	092F01W	401851	5434220	NIMO	Green Imperial	Imperial Metals	1986	GEOC
						Clark A.		PHYS
14869	092F02E	377369	5450834	ALBI	Ace of Spades	Amstar Venture	1986	PROS
						Royer G.		GEOC
14873	092F02E	377019	5435086	ALBI	Toby 1	Imperial Metals	1986	GEOC
						Clark A.		
14876	092F02E	379676	5445222	ALBI	Jenny	Westmin Res.	1986	GEOL
					Linda 1-2	Watkins J.		GEOP
								GEOC
14880	092F02E	381475	5444071	ALBI	McQuillan	Hollycroft Res.	1986	GEOL
						Neale T.		PHYS
						Hawkins T.		GEOC
14928	092F02E	381068	5436480	ALBI	Fitz	Eystar Holdings	1986	GEOL
				VICT	Lat	Neale T.		GEOC
					Water	Hawkins T.		
14930	092F02E	379097	5429850	ALBI	Aft	Eystar Holdings	1986	GEOL
					Rodeo	Neale T.		GEOC
						Hawkins T.		
14941	092F07E	377119	5461405	NIMO	Horne 2-4	Reward Res.	1986	GEOL
						Hawkins T.		GEOC
14965	092F02E	382192	5437754	VICT	Jan	Lode Res.	1986	PHYS
						Laanela H.		GEOC
14987	092F02E	373651	5431640	ALBI	Par 2	Toro Res.	1986	GEOL
					Tap 1	Dickson M.		
14993	092F02E	383676	5433088	VICT	Raft 1-2	Vanwin Res.	1986	GEOL
						Neale T.		GEOP
						Hawkins T.		GEOC
15016	092F02E	375179	5445322	ALBI	Katrina	MacNeil J.	1986	GEOC
						Neale T.		
15171	092F02E	388296	5450601	NIMO	Tyber	Stevens E.	1986	GEOC
						Northcote K.		
15196	092F02E	375405	5444575	ALBI	Pat 3	Victoria Diego Res.	1986	GEOL
						Scroggins E.		GEOC

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15197	092F02E	376575	5442510	ALBI	Pat 1	Victoria Diego Res.	1986	GEOL
						Scroggins E.		GEOC
15272	092F01W	390467	5437584	NIMO	East Imperial	Imperial Metals	1986	GEOC
	092F02E				West Imperial	Clark A.		
15286	092F01W	392829	5433831	NIMO	Spark	Baseline Res.	1986	PROS
						Brett D.W.		GEOC
15288	092F02E	378906	5437825	ALBI	April	Nexus Res.	1986	GEOL
						Neale T.		GEOC
						Hawkins G.		
15368	092F02E	378254	5446921	ALBI	China	Nexus Res.	1986	GEOP
					Grizzly	Watkins J.		GEOC
15449	092F02E	373688	5449248	ALBI	Bain 1-4	Ashworth C.E.	1986	GEOL
						Scroggins E.		GEOC
15452	092F01W	398138	5437623	NIMO	Sicker 1-2	Ladysmith Min.	1987	GEOL
						Hawkins T.		GEOC
						Thomae B.		
15557	092F07E	377788	5458795	NIMO	Mero 1-3	Nexus Res.	1987	GEOC
						Getsinger J.S.		GEOL
15590	092F02E	387211	5445063	NIMO	Spring 2-3	Angus S.	1987	GEOC
								PHYS
15694	092F02E	381158	5434995	VICT	Starboard	Lode Res.	1986	GEOC
						Hill A.R.		GEOL
								PHYS
15887	092F01W	396379	5428203	VICT	Flight 1	BHP-Utah Mines	1987	GEOC
					Flight 4-5	Cowley P.		GEOL
						Ord R.S.		GEOP
15909	092F02E	379149	5448941	ALBI	Linda 2	Nexus Res.	1987	DRIL
				NIMO		Lyons E.M.		GEOC
15939	092F01W	392307	5438289	NIMO	Villalta D	Canamin Res.	1987	DRIL
						Lisle T.E.		GEOC
						Quin S.		
15953	092F02E	379555	5439664	ALBI	April	Nexus Res.	1987	GEOC
						Getsinger J.S.		GEOL
15957	092F02E	378216	5434133	ALBI	Toby 1-2	Imperial Metals	1987	GEOC
						DeLancey P.		PHYS
16020	092F02E	382699	5450161	NIMO	Arrowsmith 2-3	Angus S.	1987	GEOC
						MacLeod J.		PHYS
16072	092F02E	384888	5438624	VICT	Tan	Nexus Res.	1987	GEOL
						Getsinger J.S.		GEOC
								PHYS
16083	092F02E	379463	5429842	ALBI	Aft	Crew Min.	1987	GEOC
					Rodeo	Getsinger J.S.		GEOL
						Kang H.		
16118	092F07E	377846	5461389	NIMO	Horne 1-4	Nexus Res.	1987	GEOL
						Cope G.R.		GEOC
						Hawkins T.		
16119	092F02E	374495	5431250	ALBI	Tap 1	Toro Res.	1987	GEOC
						Yacoub F.F.		GEOL
16138	092F07E	373960	5461106	ALBI	Esary 1	Lode Res.	1987	GEOC
				NIMO	Lacy 1-4	Laanela H.		GEOP
					Stokes 1-4			GEOL
16144	092F02E	379076	5445606	ALBI	Jenny	Nexus Res.	1987	DRIL
						Lyons E.M.		GEOC
16167	092F02E	385100	5431205	VICT	Columbia I-VI	Payton Ventures	1987	GEOC
					Platinum	Laanela H.		GEOL
								PHYS
16197	092F07E	374939	5466830	NIMO	Cave 1	Nexus Res.	1987	GEOL
					Horne 6	Cope R.		GEOC
						Hawkins T.		
16522	092F02E	374991	5436985	ALBI	PT 5	Amstar Venture	1987	PROS
						Dodd E.A.		GEOC
16559	092F07E	384538	5462541	NIMO	Cam 1-4	Rosebrugh G.	1987	PROS
					GR 2	Buskell B.		
					Heather			
16585	092F01W	390634	5437797	NIMO	Frank	Renaudat F.	1988	PROS
	092F02E					Renaudat F.		GEOC
16592	092F01W	399339	5435624	NIMO	Rush 1-3	Roap Res.	1987	GEOC
					Sicker 1-2	Hardy J.		GEOL

ASSESSMENT REPORT NO.	NTS	EASTING	NORTHING	MINING DIVISION*	CLAIM(S) WORKED ON	OPERATOR(S)/ AUTHOR(S)	REPORT YEAR	WORK TYPE**
						Holtby M.H.		
16631	092F02E	375936	5449228	ALBI	Bain 3-4	Ashworth Ex.	1987	GEOC
						Leriche P.D.		PROS
16719	092F01W	392530	5439335	NIMO	Villalta	Canamin Res.	1987	DRIL
						Lisle T.E.		
						Quinn S.P.		
16731	092F02E	381417	5434743	VICT	Starboard	Crew Min.	1987	GEOL
					Water	Neale T.		GEOP
					Aud Fr.			DRIL
					Aud 2 Fr.			GEOC
16799	092F02E	385734	5447132	NIMO	Emma	Au Res.	1987	GEOC
					Emma 7-8	Hawkins T.G.		
					Emma 10-11	Cope G.R.		
					Emma 20			
16822	092F02E	385125	5444148	VICT	McKinlay	Swift Min.	1987	GEOC
					McKinlay I	Verzosa R.S.		GEOP
								PHYS
16890	092F02E	378306	5443769	ALBI	Dinosaur	Noranda Ex.	1988	GEOL
					Diplodocus	Bull D.R.		GEOC
					Crinosaurus	Wilson R.G.		PHYS
16982	092F02E	383986	5428448	VICT	Logan	Antony Res.	1987	GEOP
					Logan I-II	Cukor V.		GEOC
17058	092F02E	388089	5440411	VICT	Snapper 1-2	Saga Res.	1987	GEOL
						Wood D.H.		GEOC
								GEOP
								PHYS
17110	092F02E	380911	5446122	ALBI	Singapore	Angus S.	1988	PROS
						Angus S.		PHYS
								GEOC
17183	092F02E	387211	5445063	VICT	Spring 1-4	Int. Cherokee Dev.	1987	GEOL
				NIMO	Sed 1	Allen G.J.		GEOC
								GEOP
								PHYS
17207	092F02E	385734	5447132	NIMO	Emma	Au Res.	1988	GEOL
				ALBI	Emma 1-5	Cope G.R.		GEOP
					Emma 7-15			GEOC
					Emma 20-21			DRIL
					Su 2-3			
17222	092F02E	383502	5442174	ALBI	Sol A	Labyrinth Res.	1987	GEOL
					Sol B	Butler S.P.		GEOP
								GEOC
								PHYS
17230	092F07E	377534	5458244	ALBI	Stokes	Westmin Res.	1988	GEOC
					Oets 2	Lyons E.M.		PHYS
						Bundred O.		
17235	092F02E	382515	5439600	VICT	Mar	Candorada Mines	1987	GEOL
					Jan	Hawkins P.A.		GEOP
					Black Panther 1-8	Jurcic P.		GEOC
								PHYS
17258	092F01W	407557	5441596	NIMO	Wandering Star	Stow Res.	1988	GEOL
					Rhino XIV-XV	Henneberry T.		GEOC
					Rhino XII			GEOP
					Rex 1			
17408	092F02E	381051	5452606	NIMO	Arrowsmith	Edsons Res.	1988	GEOC
						Angus S.		
17419	092F02E	379826	5429711	ALBI	Rodeo	TP Res.	1988	GEOL
					Aft	Naciuk T.M.		GEOC
					Andy 22			
17474	092F07E	373873	5460770	NIMO	Horne 1-4	Nexus Res.	1988	GEOL
						Cope G.R.		
17552	092F02E	378406	5447381	ALBI	Linda 1	Nexus Res.	1988	DRIL
						Westmin Res.		
						Lyons E.M.		
17562	092F02E	381618	5450741	NIMO	DDAM 1-2	Lacana Min.	1988	GEOL
						Jones P.W.		GEOP
								GEOC
17600	092F01W	399121	5444833	NIMO	Sicker 1-2	Int. Capri Res.	1988	GEOL
					Rush 1-3	Lorenzetti G.M.		GEOC

ASSESSMENT REPORT NO.	NTS	EASTING	NORTHING	MINING DIVISION*	CLAIM(S) WORKED ON	OPERATOR(S)/ AUTHOR(S)	REPORT YEAR	WORK TYPE**
					Nan 1	Lund K.D.		GEOP
					Nan 5-7			DRIL
17640	092F02E	388493	5430209	VICT	Hoop 1-5	Haglund Ind. Int.	1988	GEOL
						Getsinger J.S.		GEOC
17661	092F02E	381379	5439624	ALBI	Rand	Nexus Res.	1988	DRIL
				VICT	Crow	Walker J.E.		
17730	092F07E	375277	5465710	NIMO	Cave 1	Nexus Res.	1988	GEOC
					Horne 5-6	Walker J.E.		
17948	092F02E	378297	5437838	ALBI	Toby 2	Imperial Metals	1988	GEOC
						Delancey P.R.		GEOL
18108	092F02E	388183	5445043	NIMO	Spring 1-4	Int. Cherokee Dev.	1988	GEOL
					Sed 1	Naciuk T.M.		GEOP
					Sed 2			GEOC
								PHYS
18222	092F02E	372426	5447238	ALBI	Barclay 2	Ashworth Ex.	1989	GEOC
						Leriche P.D.		
18314	092F02E	377832	5444336	ALBI	Lizard	Noranda Ex.	1988	GEOL
					Dinosaur	Wilson R.G.		GEOC
					Diplodocus	MacIntosh R.		GEOP
					Crinosaurus	Bradish L.		PHYS
					Frostbite			
					Dylan			
18317	092F01W	407358	5443020	NIMO	Vulcan	Stow Res.	1988	DRIL
						Dynes B.		
18355	092F02E	385029	5439547	VICT	Tan	Lode Res.	1989	PROS
						Dickson M.		GEOC
18400	092F02E	382635	5441451	ALBI	Sol A-B	Goldwest Res.	1989	GEOL
					B&M 1-8	Roberts P.S.	GEOC	
					Rita 1-2	Hunter A.E.		GEOP
					MVM			
18460	092F02E	296920	5477327	ALBI	Abco 2-3	Gold Parl Res.	1989	GEOL
						Ven Huizen G.L.		GEOP
								GEOC
								PHYS
18557	092F02E	382106	5445170	ALBI	Arrowsmith 1-4	Newport Metals	1989	GEOC
				NIMO	Singapore	Hawkins T.G.		
						Naas C.O.		
18635	+092F01W	400036	5428136	NIMO	Rite 1-2	Galico Res.	1989	GEOC
					Rain 1-2	Hawkins T.G.		
					Laura 1-2			
18668	092F01W	402735	5442914	NIMO	Able 2	Geo P.C. Services	1989	GEOP
						Dynes B.		
18689	092F02E	379555	5439664	ALBI	Sue	Nexus Res.	1989	GEOC
				VICT		Walker J.E.		GEOP
18936	092F02E	379797	5450780	ALBI	Lucy 2	Westmin Res.	1989	DRIL
				NIMO		Nexus Res.		PHYS
						Lyons E.M.		GEOC
						Oiye H.		
19156	092F02E	384421	5439560	VICT	Skyline	Can. Imperial Mines	1989	GEOL
						Laanela H.		

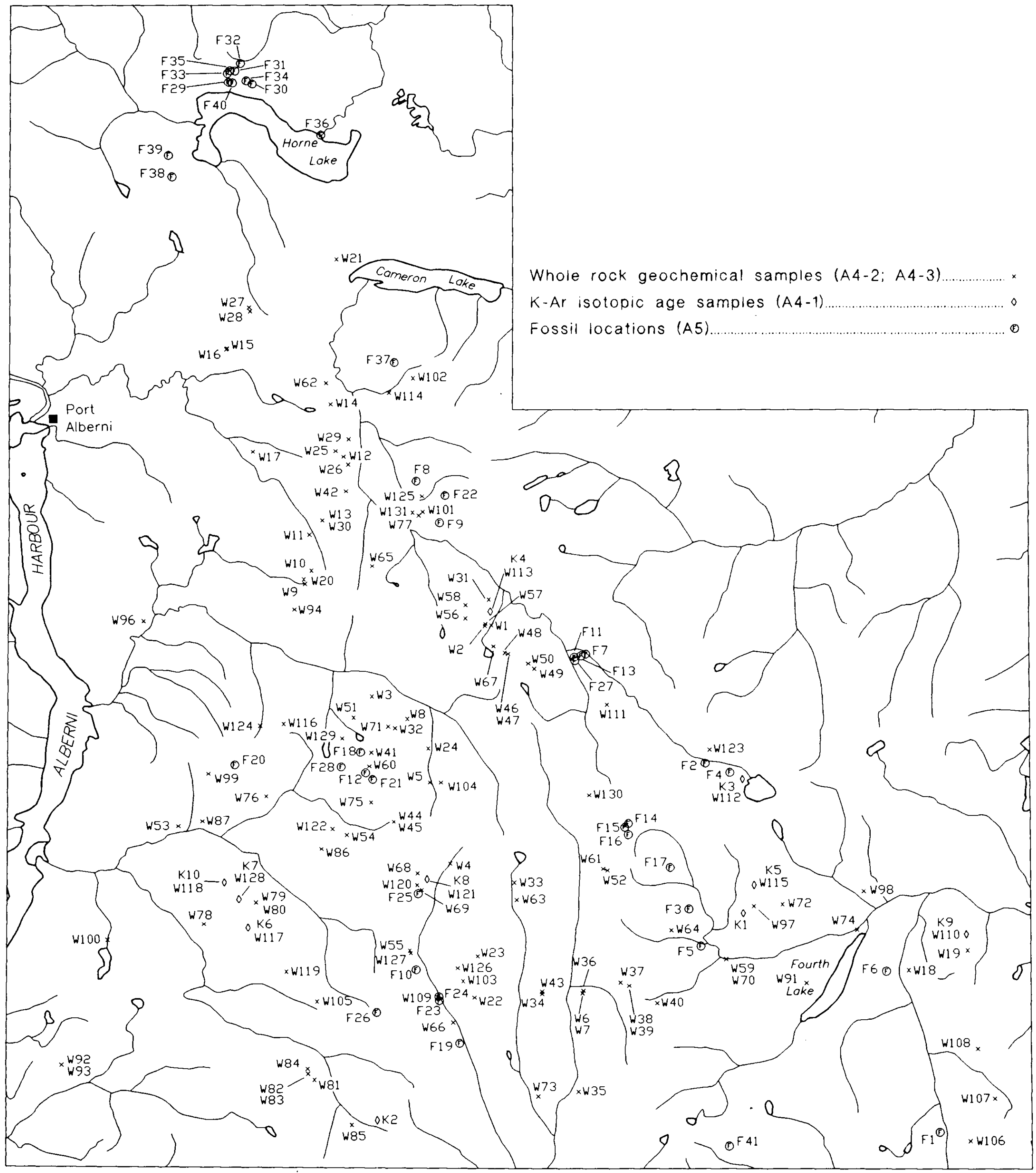
Mining Division:

ALBI: Alberni
NIMO: Nanaimo
VICT: Victoria

*** DRIL: Drilling*
GEOC: Geochemistry
GEOL: Geological mapping
GEOP: Geophysics
PHYS: Physical work (trenching, etc.)
PROS: Prospecting

APPENDIX 4

TABULATED K-Ar ISOTOPIC AGE SAMPLE DATA, WHOLE-ROCK GEOCHEMICAL ANALYSES



APPENDIX 4 - TABLE 1
POTASSIUM-ARGON ISOTOPIC AGE DETERMINATIONS IN THE ALBERNI - NANAIMO LAKES MAP AREA

MAP NO.	SAMPLE NO.	UTM (ZONE 10) EASTING	UTM (ZONE 10) NORTHING	ROCK TYPE	MINERAL	K (%)	40*Ar (x10-6 cc/gm)	40Ar (%)	AGE±δ (Ma)	REFERENCE
K1	NL-7	393000	5437500	Quartz monzodiorite (Island Plutonic Suite)	Hornblende	0.470±0.002	3.028	92.3	159±6	1
K2	GSC-72-21	379450	5425285	Quartz diorite (Island Plutonic Suite)[a]	Biotite				40±2	2
K3	NMA88-3-2-1	393067	5442408	Feldspar-hornblende porphyry (Mt.Wash.Int Suite)	Whole rock	0.784±0.017	1.17	80.8	38.0±1.4	
K4	NMA88-7-8-1	383957	5448694	Hornblende-feldspar porphyry (Mt.Wash.Int Suite)	Whole rock	1.37±0.01	2.114	79.7	39.3±1.4	
K5	NMA88-13-2	393411	5438520	Hornblende-feldspar porphyry (Mt.Wash.Int Suite)	Whole rock	0.607±0.001	0.969	70.3	40.6±1.4	
K6	SFR88-18-2-2	374878	5437293	Feldspar-hornblende porphyry (Mt.Wash.Int Suite)	Whole rock	0.669±0.004	1.024	69	39.0±1.5	
K7	SFR88-18-6-2	374051	5438963	Dacite dyke (Mt.Wash.Int Suite)	Whole rock	0.624±0.003	1.047	63.8	42.7±1.5	
K8	SFR88-25-3-2	381454	5438937	Feldspar-hornblende porphyry (Mt.Wash.Int Suite)	Whole rock	1.14±0.01	1.807	78.1	40.3±1.4	
K9	SFR88-45-10-2	401121	5436584	Hornblende-feldspar porphyry (?Cretaceous)[b]	Whole rock	3.07±0.03	12.489	94.9	102±4	
K10	JRI88-16-4-1	374568	5438339	Feldspar-hornblende porphyry (Mt.Wash.Int Suite)	Whole rock	0.595±0.014	1.097	72.8	46.8±1.8	

* = Radiogenic argon.

Decay constants: 40Ke = 0.581 x 10-10 year-1; 40Kb = 4.96 x 10-10 year-1; 40K/K = 1.167 x 10-4.

Potassium determined at The University of British Columbia, Geochronology Laboratory.

Argon determination and age calculation by J.E. Harakal, The University of British Columbia.

Notes: (a) ?reset during mineralization; (b) originally mapped as Tertiary dyke (*see* text for discussion)

References: (1) Ray and Webster, unpublished data; (2) Wanless *et al.*, 1973, Carson 1973 (sample K-Ar 1653)

APPENDIX 4 - TABLE 2
WHOLE ROCK GEOCHEMICAL DATA FOR ROCKS FROM THE ALBERNI - NANAIMO LAKES MAP AREA

MAP NUMBER	SAMPLE NUMBER	FORMATION	LITHO-LOGIC CODE	EASTING	NORTHING	SiO_2 %	TiO_2 %	Al_2O_3 %	Fe_2O_3 %	FeO %	MnO %	MgO %
Sicker Group:												
W1	NMA88-5-6-1	Duck Lake Fm: suite 1	BSLT	384100	5448342	48.02	1.58	15.56	3.08	6.27	0.17	7.44
W2	NMA88-7-6-1	Duck Lake Fm: suite 1	PLLV	383874	5448328	45.22	0.97	13.53	6.06	6.69	0.05	14.50
W3	NMA88-24-8-1	Duck Lake Fm: suite 1	PLLV	379671	5445842	48.79	0.63	13.32	1.26	6.13	0.14	7.37
W4	SFR88-25-6-1	Duck Lake Fm: suite 1	PLLV	382420	5439642	48.50	0.72	14.71	3.60	6.52	0.20	8.39
W5	JRI88-22-4-1	Duck Lake Fm: suite 1	BSLT	381733	5442647	42.09	1.32	13.28	0.45	6.56	0.12	5.50
W6	NMA88-20-12-1	Duck Lake Fm: suite 2	BSLT	387179	5434832	48.29	0.90	17.04	2.74	6.10	0.19	6.95
W7	NMA88-20-12-1	duplicate analysis	BSLT	387179	5434832	48.08	0.90	16.82	2.56	6.22	0.18	6.91
W8	NMA88-24-2-3	Duck Lake Fm: suite 2	BSLT	380947	5444998	48.47	0.92	18.18	2.72	6.42	0.16	4.91
W9	NMA88-26-5-1	Duck Lake Fm: suite 2	BSLT	377314	5449969	52.55	1.05	18.89	2.85	5.49	0.16	3.10
W10	NMA88-26-11-1	Duck Lake Fm: suite 2	PLLV	377557	5450453	53.07	1.01	17.68	3.37	5.77	0.14	2.83
W11	NMA88-26-16-1	Duck Lake Fm: suite 2	PLLV	377500	5451787	45.91	0.89	17.00	2.80	6.13	0.17	5.05
W12	NMA88-27-8-1	Duck Lake Fm: suite 2	PLLV	378799	5454617	51.22	1.15	15.50	2.87	7.70	0.21	4.74
W13	NMA88-29-15-3	Duck Lake Fm: suite 2	FBSLT	377979	5452297	49.99	0.85	17.55	3.15	6.91	0.22	3.98
W14	NMA88-32-5-1	Duck Lake Fm: suite 2	BSLT	378363	5456570	45.28	0.87	14.81	0.74	4.70	0.15	6.11
W15	NMA88-53-11-2	Duck Lake Fm: suite 2	BSLT	374625	5458694	47.55	0.81	16.74	2.51	6.34	0.16	7.84
W16	NMA88-53-11-3	Duck Lake Fm: suite 2	FBSLT	374592	5458667	53.84	1.05	17.09	2.09	5.99	0.13	2.61
W17	NMA88-55-13-1	Duck Lake Fm: suite 2	FBSLT	375491	5454869	52.25	0.92	19.57	2.70	4.77	0.12	2.72
W18	SFR88-45-3-1	Duck Lake Fm: suite 2	RYDCT	399099	5435463	56.10	0.67	16.27	3.20	3.05	0.13	1.46
W19	SFR88-45-8-1	Duck Lake Fm: suite 2	RYDCT	401267	5436154	55.77	0.60	17.43	3.58	3.47	0.21	2.50
W20	NMA88-26-7-1	Duck Lake Fm: suite 2a	PLLV	377274	5450141	54.27	0.85	18.91	2.57	4.35	0.28	2.07
W21	NMA88-49-7-1	Duck Lake Fm: suite 2a	PLLV	378670	5461866	48.89	0.73	14.80	4.80	4.42	0.17	7.54
W22	SFR88-11-1-1	Duck Lake Fm: suite 2a	PLLV	383219	5434743	49.50	0.53	12.38	2.08	5.35	0.16	6.06
W23	JRI88-11-7-1	Duck Lake Fm: suite 2a	PLLV	383359	5436239	43.79	0.46	12.89	1.60	4.56	0.11	6.63
W24	JRI88-22-6-1	Duck Lake Fm: suite 2a	BSLT	381699	5443902	48.24	1.30	16.25	2.63	6.49	0.14	7.02
W25	NMA88-27-5-1	Duck Lake Fm: suite 2, felsic	DCIT	378507	5454838	70.28	0.55	13.76	0.74	2.85	0.07	1.16
W26	NMA88-27-9-2	Duck Lake Fm: suite 2, felsic	DCIT	378959	5454327	70.94	0.46	13.53	0.38	2.42	0.04	0.68
W27	NMA88-33-9-1	Duck Lake Fm: suite 2, felsic	BSLT	375454	5460187	62.92	0.71	16.01	1.07	2.99	0.07	3.09
W28	NMA88-33-10-1	Duck Lake Fm: suite 2, felsic	DCIT	375482	5460034	74.63	0.42	12.43	0.19	1.56	0.04	0.52
W29	JRI88-46-6-2	Duck Lake Fm: suite 2, felsic	DCIT	378998	5455262	71.19	0.46	13.76	2.84	0.35	0.06	0.51
W30	NMA88-29-15-2	Duck Lake Fm: suite 2a, felsic	RYLT	377978	5452297	62.58	0.50	15.99	2.74	3.99	0.19	2.55
W31	NMA88-5-13-1	Duck Lake Fm: affinity uncertain	PLLV	384024	5449273	53.58	0.98	16.86	11.37	2.28	0.02	2.99
W32	NMA88-24-6-1	Duck Lake Fm: affinity uncertain	PLLV	380488	5444670	45.06	0.42	10.02	0.60	5.42	0.14	6.04
W33	NMA88-16-2-3	Nitinat Fm: suite 1	BSLT	384758	5438907	49.14	0.98	15.73	4.90	8.55	0.22	5.16
W34	NMA88-17-18-1	Nitinat Fm: suite 1	BSLT	385696	5434838	50.58	0.85	14.46	3.16	6.55	0.20	8.14
W35	NMA88-20-6-1	Nitinat Fm: suite 1	BSLT	386966	5431211	49.27	1.04	17.89	3.57	6.20	0.17	5.81
W36	NMA88-20-12-2	Nitinat Fm: suite 1	BSLT	387210	5434925	49.01	1.06	16.75	2.91	6.48	0.17	6.57
W37	NMA88-20-14-2	Nitinat Fm: suite 1	BSLT	388575	5435204	44.90	0.93	16.77	4.37	6.48	0.19	5.61
W38	NMA88-20-16-1	Nitinat Fm: suite 1	PLLV	388895	5435079	47.43	0.60	11.71	3.10	5.13	0.16	11.42
W39	NMA88-20-16-2	Nitinat Fm: suite 1	PLLV	388895	5435079	47.32	0.47	7.55	2.59	4.49	0.16	11.84
W40	NMA88-21-1-1	Nitinat Fm: suite 1	BSLT	389910	5434424	47.57	0.63	11.76	2.92	5.63	0.18	10.45
W41	NMA88-25-1-1	Nitinat Fm: suite 1	FBSLT	379611	5443785	48.21	0.97	19.38	2.13	5.92	0.11	4.22
W42	NMA88-29-17-1	Nitinat Fm: suite 1	PLLV	378864	5453356	50.45	0.61	13.42	1.34	5.92	0.16	7.21
W43	NMA88-17-19-1	Nitinat Fm: suite 2	PLLV	385698	5434918	47.99	0.52	7.96	2.85	5.77	0.17	13.60
W44	NMA88-42-13-1	McLaughlin Ridge Fm	PXPP	380383	5441211	50.35	0.52	12.03	1.91	6.27	0.27	9.30
W45	NMA88-42-13-1	duplicate analysis	PXPP	380383	5441211	50.32	0.52	12.05	2.25	5.96	0.28	9.36
W46	SFR88-10-7-2	McLaughlin Ridge Fm	BSLT	384702	5447304	48.78	0.81	16.08	2.17	6.42	0.14	7.66
W47	SFR88-10-7-2	duplicate analysis	BSLT	384702	5447304	48.89	0.82	15.82	3.19	5.59	0.14	7.77
W48	SFR88-10-10-2	McLaughlin Ridge Fm	BSLT	384578	5447346	48.27	0.80	16.27	2.48	5.56	0.20	8.88
W49	JRI88-1-9-2	McLaughlin Ridge Fm	PXPP	385650	5446747	49.26	0.60	11.48	1.74	6.70	0.19	11.36
W50	SDU88-7-8-1	McLaughlin Ridge Fm	PLLV	385429	5446934	48.04	0.77	16.92	3.14	8.77	0.17	6.54
W51	NMA88-23-3-1	McLaughlin Ridge Fm: dacite	RYLT	378986	5445078	65.28	0.76	15.89	1.49	3.13	0.06	1.95
W52	NMA88-18-7-1	McLaughlin Ridge Fm: tholeiite	BSLT	388174	5439286	45.71	1.66	14.99	3.43	7.98	0.22	10.18
Late Triassic:												
W53	SFR88-13-15-1	Karmutsen Fm: standard suite	PLLV	372520	5441200	49.03	1.44	15.68	4.06	6.62	0.18	6.46
W54	SFR88-30-12-1	Karmutsen Fm: standard suite	BSLT	378658	5440754	50.25	2.46	12.13	9.45	4.25	0.24	5.99
W55	JRI88-13-9-1	Karmutsen Fm: low-Nb suite	BSLT	380886	5436495	49.52	1.62	14.32	5.90	6.27	0.21	6.08
W56	NMA88-6-9-1	Mount Hall Gabbro: standard suite	DIAB	383158	5448612	50.67	1.45	14.59	6.37	7.41	0.26	4.87
W57	NMA88-7-7-1	Mount Hall Gabbro: standard suite	DIAB	383890	5448401	48.79	1.49	15.87	3.41	5.70	0.16	6.56
W58	NMA88-7-12-1	Mount Hall Gabbro: standard suite	DIAB	383173	5449086	50.25	0.68	14.43	4.70	6.41	0.32	8.13
W59	SDU88-11-13-1	Mount Hall Gabbro: standard suite	GBBR	392451	5435980	51.14	1.95	14.60	3.79	8.41	0.22	4.18
W60	JRI88-21-6-1	Mount Hall Gabbro: standard suite	GBBR	379522	5443276	39.19	1.83	11.50	2.17	8.56	0.16	13.69
W61	NMA88-18-4-1	Mount Hall Gabbro: low-Nb suite	GBBR	388029	5439353	48.50	1.43	15.16	4.07	6.84	0.18	6.32
W62	NMA88-54-5-3	Mount Hall Gabbro: low-Nb suite	FDIAB	378214	5457358	46.21	1.03	21.45	3.08	3.85	0.12	5.20
W63	SDU88-13-3-1	Mount Hall Gabbro: low-Nb suite	GBBR	384837	5438283	44.32	0.77	17.98	4.28	6.70	0.15	4.71
W64	NMA88-15-19-2	Mount Hall Gabbro: affinity uncertain	GBBR	390479	5437060	54.19	1.32	15.63	4.21	7.27	0.19	1.87
Early to Middle Jurassic:												
W65	NMA88-9-4-0	?Island Plutonic Suite: gabbros*	FDIAB	379774	5450579	50.76	0.97	19.86	3.77	4.27	0.16	2.69
W66	NMA88-41-12-2	?Island Plutonic Suite: gabbros*	BSLT	382423	5433838	48.29	0.88	18.20	2.11	8.41	0.22	4.34
W67	SFR88-10-16-1	?Island Plutonic Suite: gabbros*	DIAB	384171	5447585	48.91	0.81	15.71	3.56	5.91	0.18	6.09
W68	SFR88-24-8-1	?Island Plutonic Suite: gabbros*	DORT	381220	5439312	52.39	0.76	18.44	3.45	4.46	0.09	3.22

(APPENDIX 4 - TABLE 2 Continued)

MAP NUMBER	CaO %	Na_2O %	K_2O %	P_2O_5 %	LOI %	CO_2 %	S %	Ba ppm	Sr ppm	Rb ppm	La ppm	Ce ppm	Ni ppm	Cr ppm	V ppm	Sc ppm	Y ppm	Zr ppm	Nb ppm
Sicker Group:																			
W1	8.73	3.28	1.04	0.22	3.67	0.49	0.10	140	375	25	11	28	51	210	251	35.0	48	142	7
W2	1.43	1.33	0.30	0.14	8.29	1.53	-0.01	-100	67	-10	-5	12	47	67	302	33.0	20	88	-5
W3	12.61	2.40	0.10	0.12	6.40	3.01	0.01	-100	170	-10	12	22	190	500	225	34.0	26	87	9
W4	8.46	3.75	0.34	0.17	3.94	0.75	0.01	300	150	20	7	25	120	410	288	40.0	20	68	14
W5	13.08	2.63	0.92	0.26	13.16	9.43	-0.01	150	260	-10	13	37	120	310	168	22.0	20	125	7
W6	5.86	0.32	6.81	0.31	3.84	-0.15	0.05	2100	475	110	14	38	84	150	266	27.0	14	105	16
W7	5.85	0.30	6.47	0.31	3.86	-0.15	0.05	2300	480	120	15	43	67	150	269	27.0	24	91	20
W8	9.17	3.21	0.29	0.35	4.68	0.24	0.01	110	525	-10	20	47	-20	51	258	28.0	22	95	10
W9	5.68	4.22	2.21	0.43	2.62	-0.15	0.01	740	490	44	23	51	-20	-50	237	21.0	29	100	-5
W10	7.21	3.07	1.58	0.42	2.34	0.54	0.01	420	410	34	21	47	-20	-50	332	22.0	26	110	8
W11	11.79	3.11	0.27	0.34	5.75	2.75	0.04	130	460	-10	18	44	27	99	286	31.0	17	100	-5
W12	6.87	4.99	0.22	0.32	3.32	1.13	0.04	-100	130	-10	9	29	48	64	317	35.0	19	96	11
W13	7.64	3.65	1.71	0.30	2.89	1.00	0.19	760	480	35	18	42	39	-50	220	18.0	21	100	11
W14	11.37	2.74	3.37	0.51	7.94	5.20	0.08	4800	655	54	41	85	57	96	269	23.0	13	120	15
W15	8.11	1.31	4.06	0.28	3.24	0.15	0.02	1300	410	70	11	26	130	190	272	32.0	25	77	-5
W16	4.44	6.71	0.35	0.43	4.47	2.36	0.01	140	335	-10	22	55	-20	-50	182	21.0	31	120	10
W17	7.38	3.50	2.22	0.45	2.17	-0.15	-0.01	490	960	50	24	57	-20	-50	195	20.0	13	92	12
W18	11.12	2.11	1.46	0.29	3.77	2.28	0.24	390	1100	24	23	49	28	-50	145	13.0	8	94	11
W19	6.40	2.71	4.21	0.37	2.31	1.43	-0.01	930	725	82	59	120	-20	-50	116	8.5	25	165	20
W20	5.93	5.89	0.98	0.38	2.73	0.43	-0.01	480	440	-10	18	51	-20	-50	173	17.0	14	100	23
W21	8.89	3.36	1.31	0.21	4.33	1.36	0.01	260	325	50	13	24	220	690	249	38.0	12	85	27
W22	12.30	4.46	0.10	0.14	6.30	4.02	0.01	-100	280	-10	9	19	200	490	233	32.0	7	75	15
W23	17.98	1.99	0.23	0.16	9.00	5.90	0.03	-100	115	-10	11	18	290	710	418	26.0	14	81	19
W24	7.96	2.64	0.10	0.29	6.05	1.80	0.01	-100	685	-10	12	36	130	190	234	27.0	21	120	34
W25	1.07	4.43	3.02	0.09	1.48	0.17	0.04	730	150	48	34	86	-20	-50	24	12.0	33	165	7
W26	1.30	4.43	3.53	0.08	1.61	0.99	0.07	1200	150	46	31	69	-20	-50	23	10.0	31	160	19
W27	3.91	2.45	2.30	0.13	3.97	1.28	-0.01	700	330	68	34	73	-20	-50	34	11.0	31	160	-5
W28	1.90	3.92	2.47	0.08	1.52	0.57	0.02	1000	220	39	25	66	28	-50	27	7.8	22	145	15
W29	1.76	4.18	1.99	0.07	2.62	1.28	-0.01	520	110	46	20	53	-20	-50	17	9.4	30	155	11
W30	4.58	4.17	0.21	0.12	2.10	-0.15	0.05	170	345	-10	8	27	24	-50	128	20.0	18	85	12
W31	0.87	0.94	5.74	0.07	3.98	0.43	-0.01	230	73	150	-5	-10	-20	100	74	31.0	37	85	-5
W32	17.21	2.66	0.79	0.14	11.04	8.67	0.01	950	155	-10	8	20	210	700	204	27.0	14	82	-5
W33	7.12	2.38	0.15	0.17	4.43	-0.15	0.08	110	395	-10	13	27	-20	-50	343	40.0	26	93	6
W34	7.04	3.52	1.75	0.26	2.80	-0.15	0.02	550	455	34	11	25	79	280	239	40.0	6	79	10
W35	6.06	4.30	0.97	0.28	3.60	-0.15	-0.01	290	410	30	13	33	31	120	267	27.0	29	100	20
W36	7.48	3.40	1.11	0.25	4.13	-0.15	0.01	370	385	18	11	29	77	250	290	27.0	21	89	11
W37	11.74	2.61	0.22	0.24	4.71	-0.15	0.04	-100	215	-10	6	17	-20	-50	356	39.0	9	78	7
W38	12.66	1.41	0.60	0.22	4.62	1.14	0.01	240	1100	-10	7	22	270	930	221	36.0	-5	41	15
W39	17.41	0.99	0.90	0.14	5.51	2.98	-0.01	290	205	15	-5	-10	210	950	207	37.0	17	78	10
W40	12.64	2.38	0.62	0.19	4.33	1.40	-0.01	230	600	16	7	12	210	590	251	37.0	16	66	17
W41	5.46	2.18	3.43	0.33	7.01	3.09	-0.01	730	140	72	16	41	-20	-50	274	27.0	21	110	14
W42	8.91	4.00	1.71	0.14	5.13	2.79	-0.01	280	220	-10	7	12	76	110	245	31.0	24	82	11
W43	15.48	0.55	0.91	0.32	3.32	0.26	0.02	110	160	17	8	24	170	890	247	51.0	13	89	17
W44	11.63	2.19	0.91	0.13	3.75	0.93	0.02	250	385	19	-5	16	81	360	247	45.0	21	68	6
W45	11.60	2.22	0.89	0.14	3.78	1.28	0.03	220	350	-10	5	-10	47	380	252	46.0	23	61	14
W46	8.76	2.98	1.50	0.17	3.58	-0.15	-0.01	570	495	34	10	24	140	320	278	30.0	22	60	24
W47	8.63	3.05	1.42	0.18	3.46	-0.15	0.01	500	480	26	10	28	160	280	279	24.0	24	71	15
W48	4.45	2.59	2.89	0.26	6.21	1.66	-0.01	1700	560	61	19	43	110	300	232	32.0	17	100	20
W49	8.98	1.97	0.92	0.21	5.58	-0.15	0.02	350	335	27	10	25	140	550	241	42.0	10	74	-5
W50	7.30	3.78	0.10	0.12	3.54	0.38	0.04	-100	390	-10	9	20	-20	-50	342	36.0	19	78	19
W51	1.54	5.13	1.91	0.16	2.24	0.21	0.01	390	275	48	41	82	-20	-50	30	15.0	29	140	11
W52	3.58	3.84	0.61	0.18	6.06	0.90	0.02	1300	285	-10	8	26	51	110	318	37.0	27	105	6
Late Triassic:																			
W53	11.35	2.59	0.44	0.11	1.07	-0.15	-0.01	-100	220	-10	5	18	83	240	314	29.0	16	115	12
W54	10.97	2.03	0.27	0.20	1.06	-0.15	0.02	160	260	-10	11	39	74	-50	480	34.0	39	130	24
W55	12.23	1.80	0.16	0.12	0.81	2.44	0.01	-100	240	-10	7	17	72	160	364	39.0	24	110	6
W56	5.41	3.75	0.03	0.16	3.76	0.73	-0.01	-100	315	-10	5	21	-20	-50	458	32.0	36	92	20
W57	9.91	3.17	1.13	0.19	3.08	-0.15	0.06	210	425	16	11	37	56	180	237	37.0	29	130	21
W58	3.41	4.14	0.05	0.06	6.48	1.98	-0.01	-100	180	-10	-5	12	110	110	275	39.0	-5	71	9
W59	7.39	4.76	0.74	0.20	1.91	0.55	0.15	520	300	-10	14	30	-20	-50	363	30.0	39	140	37
W60	6.22	1.16	0.16	0.27	13.06	0.72	0.04	-100	255	-10	12	39	300	480	255	28.0	29	135	22
W61	8.96	3.68	0.53	0.19	3.31	-0.15	0.10	530	320	-10	10	33	42	-50	253	34.0	25	110	-5
W62	9.14	2.49	2.39	0.14	4.06	-0.15	-0.01	1200	445	50	10	29	39	96	179	25.0	19	94	7
W63	13.69	1.14	0.05	0.15	5.17	-0.15	0.05	-100	215	-10	11	29	-20	-50	361	33.0	28	105	5
W64	5.17	6.11	0.16	0.46	2.53	0.15	0.02	-100	210	-10	28	82	-20	-50	47	16.0	62	190	6
Early to Middle Jurassic:																			
W65	6.66	3.72	2.67	0.39	3.37	-0.15	0.01	740	610	67	17	41	-20	-50	266	21.0	23	100	13
W66	7.05	3.33	0.85	0.33	5.06	1.49	0.13	380	590	-10	20	50	-20	-50	220	16.0	21	86	14
W67	8.73	2.26	1.19	0.25	5.49	1.94	0.01	400	390	17	11	21	34	130	248	28.0	16	100	8
W68	7.26	5.41	0.78	0.37	2.78	-0.15	0.16	180	555	-10	11	27	-20	-50	217	13.0	12	88	10

(APPENDIX 4 - TABLE 2 Continued)

MAP NUMBER	SAMPLE NUMBER	FORMATION	LITHO-LOGIC CODE	EASTING	NORTHING	SiO_2 %	TiO_2 %	Al_2O_3 %	Fe_2O_3 %	FeO %	MnO %	MgO %
W69	SFR88-25-2-1	?Island Plutonic Suite: gabbros*	DIAB	381367	5438700	51.96	1.04	17.24	4.17	5.03	0.21	4.37
W70	SDU88-11-13-2	?Island Plutonic Suite: gabbros*	BSLT	392452	5435980	49.95	0.66	17.67	4.10	4.99	0.17	3.28
W71	JRI88-20-9-2	?Island Plutonic Suite: gabbros*	GBBR	380240	5444736	48.15	0.93	16.59	4.21	5.84	0.21	4.50
W72	NMA88-14-11-1	Island Plutonic Suite	MONZ	394540	5437950	64.01	0.52	15.80	3.28	1.99	0.12	1.52
W73	NMA88-17-23-1	Island Plutonic Suite	DORT	385480	5431062	49.50	0.33	18.52	2.26	3.56	0.09	7.63
W74	NMA88-21-10-1	Island Plutonic Suite	QDORT	397246	5436964	66.31	0.43	15.24	2.41	1.92	0.10	1.23
W75	NMA88-42-9-1	Island Plutonic Suite	DORT	379565	5441947	52.00	0.99	16.68	3.70	5.56	0.18	4.72
W76	NMA88-48-9-1	Island Plutonic Suite	GRDR	375740	5442246	65.28	0.39	15.74	1.88	2.71	0.10	1.85
W77	SFR88-7-6-2	Island Plutonic Suite	DORT	381504	5452416	52.13	0.87	16.58	3.43	5.70	0.19	4.58
W78	SFR88-18-12-1	Island Plutonic Suite	GRDR	373383	5437603	60.88	0.63	16.92	1.60	4.56	0.08	2.47
W79	SFR88-20-8-1	Island Plutonic Suite	GRDR	375303	5438360	60.95	0.53	16.60	2.07	3.56	0.12	2.39
W80	SFR88-20-8-1	Island Plutonic Suite	GRDR	375303	5438360	61.37	0.52	16.53	2.31	3.26	0.11	2.33
W81	SFR88-29-1-1	Island Plutonic Suite	DORT	377305	5431812	51.15	0.88	18.27	4.08	5.67	0.22	4.96
W82	SFR88-29-3-1	Island Plutonic Suite	GRDR	377082	5432023	69.87	0.27	15.15	1.38	1.98	0.09	0.79
W83	SFR88-29-3-2	Island Plutonic Suite	FHBPP	377081	5432023	53.02	0.87	18.58	3.26	5.39	0.17	3.83
W84	SFR88-29-4-2	Island Plutonic Suite	HBFPP	377063	5432206	51.10	0.68	18.37	4.41	5.74	0.23	4.30
W85	SFR88-29-10-2	Island Plutonic Suite	FSPPP	378638	5430148	64.22	0.62	16.65	1.39	3.61	0.11	2.14
W86	SFR88-31-9-2	Island Plutonic Suite	DORT	377727	5440263	52.02	0.78	15.55	3.07	5.88	0.14	4.43
W87	SFR88-31-14-1	Island Plutonic Suite	QDORT	373406	5441367	68.04	0.33	15.10	0.29	3.40	0.09	1.44
W88*	SFR88-38-9-1	Island Plutonic Suite	GRAN	406435	5430253	71.29	0.29	14.77	0.00	7.16	0.09	0.79
W89*	SFR88-38-12-1	Island Plutonic Suite	GRDR	406448	5429157	50.46	0.96	20.58	4.50	4.42	0.11	3.35
W90*	SFR88-42-10-1	Island Plutonic Suite	QDORT	404621	5437516	63.68	0.57	16.24	2.48	3.12	0.13	1.94
W91	SFR88-44-4-1	Island Plutonic Suite	GRAN	395369	5435072	65.84	0.46	15.75	2.55	1.91	0.13	1.28
W92	SFR88-46-2-1	Island Plutonic Suite	GRDR	368114	5432524	70.86	0.28	14.77	0.91	1.84	0.08	0.92
W93	SFR88-46-2-1	Island Plutonic Suite	GRDR	368114	5432524	70.69	0.27	14.59	1.13	1.70	0.07	0.90
W94	JRI88-23-1-1	Island Plutonic Suite	MONZ	376912	5449048	46.29	0.53	19.68	4.99	4.28	0.18	6.41
W95*	JRI88-33-2-1	Island Plutonic Suite	MONZ	403656	5428742	54.39	0.75	17.67	3.80	5.06	0.20	3.41
W96	JRI88-53-5-1	Island Plutonic Suite	GRDR	371417	5448732	63.91	0.46	16.18	2.03	3.28	0.12	2.23
W97	SDU88-10-9-1	Island Plutonic Suite	DORT	393503	5437895	60.35	0.65	16.58	1.94	3.56	0.09	1.68
W98	SDU88-15-12-1	Island Plutonic Suite	DORT	397514	5438377	65.48	0.47	15.54	1.93	2.56	0.13	1.35
W99	NMA88-48-10-2	Minor Intrusions: basalt dyke	MFDYK	373657	5443111	56.64	1.11	15.99	1.88	5.13	0.12	3.88
W100	SFR88-47-5-2	Minor Intrusions: basalt dyke	MFDYK	369872	5437079	51.47	0.75	17.53	2.42	6.38	0.19	5.10
W101	SFR88-7-2-2	Minor Intrusions: hornblende porphyry	HPFPP	381659	5452552	48.26	0.93	16.87	5.47	4.99	0.23	5.09
W102	NMA88-35-3-2	Minor Intrusions: feldspar porphyry	FHBPP	381400	5457472	52.13	0.88	17.28	4.30	4.85	0.18	4.53
W103	SFR88-11-3-2	Minor Intrusions: feldspar porphyry	FSPPP	382814	5435354	69.92	0.56	13.72	1.41	1.71	0.11	1.26
W104	SFR88-17-4-2	Minor Intrusions: feldspar porphyry	FSPPP	382139	5442626	45.84	0.85	21.98	2.10	4.20	0.11	5.94
W105	SFR88-21-3-2	Minor Intrusions: feldspar porphyry	FSPPP	377453	5434706	70.24	0.29	14.35	0.00	3.10	0.09	0.79
W106	SFR88-34-6-2	Minor Intrusions: feldspar porphyry	FHBPP	401223	5429159	63.05	0.49	16.95	0.00	9.08	0.14	1.77
W107	SFR88-39-4-2	Minor Intrusions: feldspar porphyry	FSPPP	402155	5430693	55.86	0.58	16.49	2.68	4.32	0.17	2.86
W108	SFR88-40-2-2	Minor Intrusions: feldspar porphyry	FQZPP	401568	5432523	63.14	0.50	16.77	1.97	3.33	0.12	1.62
W109	SFR88-19-6-2	Minor Intrusions: dacite	RYLT	381883	5434780	59.80	0.58	16.22	2.65	2.20	0.07	2.67
Cretaceous:												
W110	SFR88-45-10-2	hornblende-feldspar porphyry	HBFPP	401121	5436584	68.05	0.40	15.84	1.59	1.56	0.05	0.95
Eocene:												
W111	NMA88-1-11-2	Mt Washington Intrusive Suite	HBFPP	388275	5445377	60.34	0.53	16.97	0.68	3.99	0.09	1.99
W112	NMA88-3-2-1	Mt Washington Intrusive Suite	FHBPP	393069	5442408	64.16	0.52	16.68	0.60	3.84	0.08	2.15
W113	NMA88-7-8-1	Mt Washington Intrusive Suite	HBFPP	383957	5448694	60.73	0.50	15.41	0.45	2.92	0.04	2.81
W114	NMA88-11-9-2	Mt Washington Intrusive Suite	FHBPP	380505	5456954	52.64	0.86	17.51	3.85	5.27	0.18	4.31
W115	NMA88-13-2-1	Mt Washington Intrusive Suite	HBFPP	393411	5438520	62.46	0.46	17.56	1.14	3.27	0.09	1.92
W116	NMA88-43-10-1	Mt Washington Intrusive Suite	FHBPP	376424	5444899	60.09	0.52	16.93	1.38	3.56	0.09	2.43
W117	SFR88-18-2-2	Mt Washington Intrusive Suite	FHBPP	374878	5437293	61.32	0.54	17.07	2.48	2.99	0.11	2.57
W118	SFR88-18-6-2	Mt Washington Intrusive Suite	DCIT	374051	5438963	59.32	0.57	16.03	1.11	3.70	0.08	2.40
W119	SFR88-21-7-2	Mt Washington Intrusive Suite	HBFPP	376359	5435812	62.22	0.54	17.20	2.18	2.85	0.09	2.30
W120	SFR88-24-2-2	Mt Washington Intrusive Suite	FHBPP	381201	5438883	58.23	0.55	16.67	1.30	3.68	0.10	3.12
W121	SFR88-25-3-2	Mt Washington Intrusive Suite	FHBPP	381454	5438937	62.66	0.49	16.30	1.91	2.12	0.05	1.89
W122	SFR88-30-14-2	Mt Washington Intrusive Suite	DCIT	378150	5440990	63.07	0.56	16.16	1.90	2.12	0.06	3.07
W123	SDU88-2-2-2	Mt Washington Intrusive Suite	FHBPP	392005	5443663	64.01	0.46	16.33	1.88	2.21	0.07	2.77
W124	SDU88-21-3-1	Mt Washington Intrusive Suite	HBFPP	375567	5444848	61.97	0.56	16.91	0.88	4.27	0.07	3.22
W125	JRI88-6-11-1	Mt Washington Intrusive Suite	FSPPP	381644	5453121	59.68	0.52	16.79	0.82	3.97	0.09	2.31
W126	JRI88-11-12-2	Mt Washington Intrusive Suite	FSPPP	382623	5435823	61.69	0.51	16.36	1.38	2.71	0.07	1.82
W127	JRI88-13-8-2	Mt Washington Intrusive Suite	FSPPP	380914	5436407	63.46	0.46	16.37	0.31	3.68	0.06	1.93
W128	JRI88-16-4-1	Mt Washington Intrusive Suite	FSPPP	374568	5438339	53.31	0.93	15.66	2.22	5.70	0.13	4.99
W129	JRI88-21-13-2	Mt Washington Intrusive Suite	FSPPP	378556	5444325	62.44	0.66	15.91	1.27	3.13	0.15	1.92
W130	JRI88-27-12-1	Mt Washington Intrusive Suite	FSPPP	387560	5442059	65.69	0.38	16.08	1.45	2.21	0.08	1.72
Age uncertain:												
W131	SFR88-7-4-2	post-Sicker mafic dyke; ?Jurassic	MFDYK	381283	5452533	51.85	1.46	15.04	4.70	4.77	0.15	5.25

(APPENDIX 4 - TABLE 2 Continued)

MAP NUMBER	CaO %	Na_2O %	K_2O %	P_2O_5 %	LOI %	CO_2 %	S %	Ba ppm	Sr ppm	Rb ppm	La ppm	Ce ppm	Ni ppm	Cr ppm	V ppm	Sc ppm	Y ppm	Zr ppm	Nb ppm
W69	7.39	3.38	2.18	0.25	2.17	-0.15	-0.01	730	600	57	11	26	-20	-50	316	29.0	14	77	28
W70	6.81	2.99	3.75	0.38	4.46	2.14	0.07	1400	900	98	15	45	23	-50	184	13.0	9	83	15
W71	9.64	2.51	1.68	0.27	4.37	1.76	0.11	620	670	38	13	32	-20	-50	289	21.0	21	76	-5
W72	4.37	3.30	3.69	0.25	0.79	0.92	-0.01	1000	690	130	26	59	-20	-50	83	6.3	13	120	19
W73	11.61	2.57	0.23	0.05	3.10	-0.15	0.02	-100	410	-10	5	18	91	180	161	46.0	9	68	12
W74	3.61	3.32	4.06	0.20	1.06	-0.15	0.02	830	550	160	24	52	-20	-50	59	5.2	6	120	20
W75	6.87	3.92	1.57	0.21	2.71	-0.15	-0.01	490	485	28	10	26	-20	-50	3301	32.0	23	71	15
W76	4.57	3.17	2.06	0.08	1.47	-0.15	-0.01	690	280	39	15	32	-20	-50	89	10.0	17	100	21
W77	7.17	3.33	1.30	0.22	3.39	0.96	0.05	1100	580	26	13	39	-20	-50	263	27.0	16	100	8
W78	5.68	4.19	0.90	0.17	1.55	-0.15	-0.01	520	460	19	19	42	-20	-50	130	16.0	18	110	20
W79	5.45	3.42	1.71	0.12	2.62	-0.15	-0.01	780	300	37	16	36	-20	-50	135	15.0	14	110	21
W80	5.34	3.52	1.72	0.11	2.49	-0.15	-0.01	730	310	40	15	43	-20	-50	135	14.0	18	110	14
W81	7.79	2.86	0.92	0.19	2.25	-0.15	-0.01	690	460	26	11	21	-20	-50	273	27.0	20	70	16
W82	3.09	3.56	2.32	0.09	1.13	-0.15	0.01	1100	370	50	12	35	-20	-50	22	4.4	10	120	16
W83	9.06	2.64	0.60	0.26	1.81	-0.15	0.06	390	515	-10	14	24	-20	-50	241	23.0	11	81	17
W84	9.88	1.76	0.91	0.32	1.65	-0.15	0.01	390	570	37	11	30	-20	-50	194	17.0	24	69	19
W85	5.20	3.50	1.07	0.11	0.96	-0.15	0.37	240	350	38	11	20	-20	-50	85	7.8	6	120	18
W86	8.51	2.80	0.70	0.22	2.29	-0.15	0.65	360	390	22	9	18	-20	-50	228	19.0	28	83	16
W87	3.99	3.18	2.59	0.07	1.20	-0.15	-0.01	840	230	85	17	26	-20	-50	74	8.1	6	100	18
W88*	2.72	3.51	2.91	0.06	0.79	-0.15	-0.01	1100	260	84	15	34	-20	-50	40	5.0	11	115	17
W89*	9.98	2.28	1.26	0.18	1.57	-0.15	0.06	490	510	35	8	15	-20	-50	255	30.0	20	68	12
W90*	4.94	3.45	2.00	0.14	1.07	-0.15	0.02	1100	365	42	14	34	-20	-50	103	13.0	20	140	16
W91	4.37	3.18	3.64	0.21	0.55	-0.15	-0.01	960	640	140	29	68	-20	-50	68	5.5	15	130	14
W92	2.84	3.42	2.70	0.07	1.06	-0.15	0.03	1000	285	67	24	46	-20	-50	41	5.8	12	115	13
W93	2.81	3.50	2.63	0.07	1.06	-0.15	0.03	980	290	60	23	46	-20	-50	45	5.9	9	110	18
W94	10.59	2.11	1.29	0.13	2.98	-0.15	0.01	420	475	47	5	12	27	-50	318	29.0	15	58	13
W95*	7.07	3.40	1.46	0.23	2.04	-0.15	-0.01	560	805	47	13	30	-20	-50	168	17.0	12	83	12
W96	5.43	3.01	1.83	0.10	1.19	-0.15	-0.01	720	270	39	12	21	-20	-50	107	12.0	15	105	20
W97	3.71	4.87	2.64	0.34	3.28	1.32	-0.01	1000	720	93	24	60	-20	-50	104	8.1	-5	110	10
W98	4.30	3.12	3.75	0.22	0.61	-0.15	-0.01	850	670	160	27	54	-20	-50	70	5.7	20	125	15
W99	6.21	3.94	1.02	0.17	3.30	-0.15	-0.01	750	270	-10	17	50	38	65	147	17.0	22	150	19
W100	8.24	2.13	1.89	0.25	2.90	-0.15	0.01	910	445	46	18	39	29	-50	238	29.0	14	89	13
W101	11.04	1.91	0.91	0.24	3.60	1.00	0.08	340	745	-10	14	35	-20	-50	304	27.0	5	93	12
W102	6.91	3.28	1.67	0.27	2.99	0.36	0.03	750	575	55	16	33	-20	-50	237	24.0	18	89	16
W103	2.49	2.20	2.75	0.08	3.62	1.55	0.01	700	240	96	30	72	-20	-50	17	12.0	32	155	9
W104	8.35	2.75	1.88	0.11	5.49	0.91	0.03	920	860	24	5	17	60	160	148	20.0	12	71	10
W105	2.51	4.16	1.56	0.07	2.57	1.14	0.03	620	210	33	20	45	-20	-50	25	4.0	21	140	20
W106	4.80	3.35	2.30	0.19	1.08	-0.15	0.03	870	560	82	18	40	-20	-50	83	8.2	7	100	23
W107	6.60	2.67	2.27	0.22	4.77	2.57	0.04	590	510	73	19	41	-20	-50	151	13.0	9	100	17
W108	4.40	3.68	1.13	0.19	2.96	1.22	-0.01	790	740	31	18	45	-20	-50	77	7.1	9	80	20
W109	5.26	3.95	0.68	0.11	5.44	2.96	0.01	200	425	-10	8	23	-20	-50	79	9.2	8	105	-5
Cretaceous:																			
W110	3.28	3.49	3.58	0.08	0.95	1.21	-0.01	1300	365	72	22	59	-20	-50	58	7.0	21	175	11
Eocene:																			
W111	5.04	3.91	1.69	0.19	4.26	1.60	0.01	710	650	44	18	42	-20	-50	66	8.4	-5	115	20
W112	5.35	3.86	0.91	0.10	1.47	-0.15	-0.01	380	610	22	9	20	-20	-50	68	8.1	-5	89	12
W113	5.90	2.75	1.73	0.10	6.44	3.36	-0.01	230	625	39	6	19	32	51	77	10.0	8	83	14
W114	7.25	3.11	1.46	0.26	2.40	-0.15	0.02	820	705	38	16	44	-20	-50	233	24.0	17	115	19
W115	5.50	4.12	0.73	0.13	2.07	-0.15	-0.01	470	620	-10	11	28	-20	-50	54	7.7	-5	87	24
W116	5.73	4.00	0.77	0.15	3.39	1.14	0.03	560	710	-10	13	41	-20	-50	80	9.0	-5	92	16
W117	4.65	3.94	0.71	0.15	3.29	0.45	0.07	750	645	32	13	26	-20	-50	80	9.0	-5	110	18
W118	4.97	4.03	0.77	0.13	6.42	3.06	-0.01	440	260	-10	11	29	43	-50	81	8.2	10	115	24
W119	5.26	4.22	0.94	0.14	1.64	-0.15	0.01	510	620	24	13	33	-20	-50	74	9.5	7	110	17
W120	5.76	4.02	0.93	0.11	5.14	2.73	-0.01	340	410	31	9	27	33	-50	78	10.0	-5	105	23
W121	4.98	3.49	1.40	0.10	4.51	2.26	-0.01	590	585	24	8	21	-20	-50	63	7.9	-5	95	13
W122	4.94	4.74	0.17	0.10	2.72	0.46	-0.01	240	860	-10	5	21	33	-50	78	8.2	-5	74	15
W123	5.35	3.59	0.98	0.11	2.01	-0.15	-0.01	470	635	24	10	20	25	63	65	7.4	-5	100	-5
W124	5.33	2.80	1.13	0.12	2.16	-0.15	0.02	540	535	34	10	33	47	-50	84	11.0	-5	95	-5
W125	4.60	5.02	0.45	0.12	4.85	2.21	0.01	710	800	12	10	32	-20	-50	78	10.0	-5	83	24
W126	4.66	3.60	0.90	0.11	6.00	3.17	-0.01	400	545	15	9	24	-20	-50	67	6.2	9	105	13
W127	4.93	3.94	0.91	0.09	3.54	1.86	-0.01	370	415	25	11	21	27	-50	58	7.6	-5	100	12
W128	8.82	3.10	0.59	0.18	3.45	-0.15	-0.01	140	300	-10	13	43	110	90	166	21.0	24	130	19
W129	4.78	4.30	0.90	0.21	3.88	1.76	1.36	410	835	-22	18	57	-20	-50	78	7.2	8	135	18
W130	4.58	3.88	1.28	0.10	2.17	0.52	0.16	690	740	23	11	27	22	-50	56	5.5	33	100	-5
Age uncertain:																			
W131	4.11	5.36	1.30	0.65	4.96	1.50	0.01	640	375	32	32	79	70	110	220	20.0	21	230	10

* samples located immediately to the east of map sheet

Rockcodes:

- BSLT - basalt
- DCIT - dacite
- DIAB - diabase
- DORT - diorite
- FBSLT - feldspar basalt
- FDIAB - feldspar diorite
- QDORT - quartz diorite
- GRAN - granite
- GRDR - granodiorite
- HBFPP - hornblende-feldspar porphyry
- MFDYK - mafic dyke
- MONZ - monzonite
- PLLV - pillow lava
- RYDCT - rhyodacite
- FHBPP - feldspar-hornblende porphyry
- FQZPP - feldspar-quartz porphyry
- FSPPP - feldspar porphyry
- GBBR - gabbro
- PXPP - pyroxene porphyry
- RYLT - rhyolite

APPENDIX 4 - TABLE 3
REE, Sc, Hf, Ta and Th DATA FOR ROCKS FROM THE ALBERNI - NANAIMO LAKES MAP AREA

MAP NUMBER	SAMPLE NUMBER	FORMATION	LITHOLOGIC CODE	EASTING	NORTHING	La ppm
W4	SFR88-25-6-1	Duck Lake Fm: suite 1	PLLV	382420	5439642	6.3
W9	NMA88-26-5-1	Duck Lake Fm: suite 2	BEXV	377314	5449969	19.2
W13	NMA88-29-15-3	Duck Lake Fm: suite 2	FBSLT	377979	5452297	13.5
W15	NMA88-53-11-2	Duck Lake Fm: suite 2	BSLT	374625	5458694	9.4
W21	NMA88-49-7-1	Duck Lake Fm: suite 2a	PLLV	378670	5461866	10.0
W35	NMA88-20-6-1	Nitinat Fm: suite 1	BEXV	386966	5431211	11.2
W39	NMA88-20-16-2	Nitinat Fm: suite 1	PLLV	388895	5435079	5.3
W40	NMA88-21-1-1	Nitinat Fm: suite 1	BEXV	389910	5434424	6.6
W44	NMA88-42-13-1	McLaughlin Ridge Fm	PXPP	380383	5441211	4.5
W46	SFR88-10-7-2	McLaughlin Ridge Fm	BEXV	384702	5447304	9.4
W52	NMA88-18-7-1	McLaughlin Ridge Fm: tholeiite	BSLT	388174	5439286	8.1

MAP NUMBER	Ce ppm	Nd ppm	Sm ppm	Eu ppm	Tb ppm	Yb ppm	Lu ppm	Sc ppm	Hf ppm	Ta ppm	Th ppm
W4	16	9	2.3	0.66	0.4	1.41	0.20	35	0.9	-0.3	0.8
W9	41	21	4.6	1.37	0.8	2.24	0.33	18	2.2	0.3	2.2
W13	31	16	3.3	1.00	0.6	1.81	0.27	15	1.8	-0.3	1.8
W15	22	13	3.0	1.02	0.5	1.36	0.21	28	1.2	-0.3	0.9
W21	23	11	2.6	0.78	0.4	1.49	0.22	33	1.4	-0.3	1.7
W35	24	13	2.9	0.96	0.5	1.85	0.27	22	1.7	0.3	1.3
W39	12	7	1.8	0.61	0.4	1.00	0.14	36	0.9	-0.3	0.7
W40	15	8	2.1	0.71	0.4	1.29	0.19	36	1.2	-0.3	0.9
W44	11	7	1.7	0.50	0.4	1.20	0.17	38	0.9	0.3	0.6
W46	23	12	2.9	0.94	0.5	1.51	0.22	27	1.2	0.3	1.2
W52	22	13	3.5	1.25	0.7	2.28	0.31	31	2.3	0.5	0.9

Analyses by Activation Laboratories Ltd., Ancaster, Ontario
Negative Ta values are below the detection limit (0.3 ppm)
Lithological codes are the same as for Appendix 4, Table 2

APPENDIX 5

FOSSIL SAMPLES FROM THE ALBERNI — NANAIMO LAKES MAP AREA

The following tabulation of fossil identifications combines data extracted from published literature as well as samples collected during the present mapping project. Locations of the samples are plotted on Map C, in pocket.

References for already published data:

1: Muller, J.E. (1980): The Paleozoic Sicker Group of Vancouver Island, British Columbia; Geological Survey of Canada, Paper 79-30, 24 pages.

2: Stevenson, J.S. (1945): Geology and Ore Deposits of the China Creek Area, Vancouver Island, British Columbia; B.C. Minister of Mines Annual Report 1944, pages 142-161.

3: Yole, R.W. (1965): A Faunal and Stratigraphic Study of Upper Paleozoic Rocks of Vancouver Island, British Columbia; unpublished Ph.D. thesis, The University of British Columbia, 254 pages.

4: Sado, K. and Danner, W.R. (1974): Early and Middle Pennsylvanian fusulinids from Southern British Columbia, Canada and Northwestern Washington, U.S.A., Transactions Proc. Palaeontological Society of Japan, N.S., Number 93, pages 249-265.

New material was submitted to the Geological Survey of Canada for identification and archiving. Identifications were made by:

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ETT E.T. Tozer; GSC-Cordilleran Section, Vancouver

ALBERNI FOSSIL DESCRIPTIONS

MAP NUMBER: F1 **NTS MAP: 92F/01**
SAMPLE NUMBER: JRI88-29-10-1
EASTING: 400084 NORTHING: 5429486
LOCATION: Delphi Lake
STRATIGRAPHIC UNIT: uDm
FOSSIL TYPE: conodonts - ramiform elements
(GSC C-168449)
AGE: Ordovician - Triassic
IDENTIFIED BY: MJO

MAP NUMBER: F2 **NTS MAP: 92F/01**
SAMPLE NUMBER: NMA88-03-07-1
EASTING: 391804 NORTHING: 5443145
LOCATION: Labour Day Lake
STRATIGRAPHIC UNIT: uKb
FOSSIL TYPE: *Acila (Truncacila)* sp.
nuculid bivalve, indeterminate
(GSC C-168465)
AGE: Late Cretaceous (post-Turonian) or younger
IDENTIFIED BY: JWH

MAP NUMBER: F3 **NTS MAP: 92F/01**
SAMPLE NUMBER: NMA88-15-14-1A/B
EASTING: 391105 NORTHING: 5437812
LOCATION: West of upper Nanaimo River
STRATIGRAPHIC UNIT: ?MPf
FOSSIL TYPE: A: conodonts - scaphate element
(GSC C-168409)
B: conodonts - ramiform elements
CAI: 6 -7
(GSC C-168410)
AGE: Silurian - Triassic
IDENTIFIED BY: MJO

MAP NUMBER: F4 **NTS MAP: 92F/01**
SAMPLE NUMBER: SDU88-01-02-1
EASTING: 392699 NORTHING: 5442786
LOCATION: Labour Day Lake
STRATIGRAPHIC UNIT: uKh
FOSSIL TYPE: *Sphenoceramus* ex gr. *schmidti* (Michael, 1899)
(GSC C-168467)
AGE: Latest Santonian to earliest Campanian
IDENTIFIED BY: JWH

MAP NUMBER: F5 **NTS MAP: 92F/01**
SAMPLE NUMBER: SDU88-12-09-1
EASTING: 391513 NORTHING: 5436451
LOCATION: Upper Nanaimo River, P1 road system
STRATIGRAPHIC UNIT: ?uDm
FOSSIL TYPE: conodonts - ramiform elements
CAI: 6
(GSC C-168431)
AGE: Ordovician - Triassic
IDENTIFIED BY: MJO

MAP NUMBER: F6 **NTS MAP: 92F/01**
SAMPLE NUMBER: SFR88-43-10
EASTING: 398255 NORTHING: 5435423
LOCATION: Between Fourth Lake and Green Creek
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: *Echinoderm ossicles*, indeterminate
bryozoans, indeterminate
poorly preserved ?brachipods
(GSC C-168363)
AGE: No age determination possible
IDENTIFIED BY: EWB

MAP NUMBER: F7 **NTS MAP: 92F/02**
SAMPLE NUMBER: 78-31A
EASTING: 387519 NORTHING: 5447220
LOCATION: From a limestone quarry 0.5 km past entrance East Main Road, West Fork of Cameron River, MacMillan Bloedel Cameron, Logging Division
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: bryozoa
echinoderms
calcareous sponges
sponge spiculites
Apterrinellidae
Biseriella? sp.
Bradyina sp.
Deckerella sp.
Endothyra sp.
Eolasiodiscus sp.
Globivalvulina sp.
cf "*Hemigordius*" sp. (a new genus)
Komia sp.
Nodosaria sp.
Nodosariidae
Orthovertella
porcellenous foraminifers
Protonodosaria sp.
Tetrataxis sp.
AGE: Permian (probably Early Permian)
IDENTIFIED BY: REFERENCE:1

MAP NUMBER: F8 **NTS MAP: 92F/02**
SAMPLE NUMBER: JRI88-06-10-1
EASTING: 381409 NORTHING: 5453651
LOCATION: Mt. Arrowsmith
STRATIGRAPHIC UNIT: uKh
FOSSIL TYPE: *Sphenoceramus orientalis ambiguus* (Nagao & Matsumoto, 1940)?
Polyptychoceras? sp.
bivalves, indeterminate
nuculid bivalves, indeterminate
leaf impressions
(GSC C-168459)
AGE: Probably late Santonian
IDENTIFIED BY: JWH

MAP NUMBER: F9 **NTS MAP: 92F/02**
SAMPLE NUMBER: JRI88-08-12-1
EASTING: 382238 NORTHING: 5452117
LOCATION: South of Mt. Arrowsmith
STRATIGRAPHIC UNIT: uKb
FOSSIL TYPE: Unidentified twig with branch scar
(GSC C-168460)
AGE: Indeterminate
IDENTIFIED BY: EM

MAP NUMBER: F10 **NTS MAP: 92F/02**
SAMPLE NUMBER: JRI88-13-04-1
EASTING: 381072 NORTHING: 5435777
LOCATION: Rift Creek
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: conodonts - gnathodid
CAI: 5
(GSC C-158119)
AGE: Carboniferous - Early Permian
IDENTIFIED BY: MJO

MAP NUMBER: F11 **NTS MAP: 92F/02**
SAMPLE NUMBER: JRI88-14-01-1
EASTING: 387094 NORTHING: 5447121
LOCATION: Cameron River Main
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: conodonts - *Rhachistognathus*? sp.
gnathoids
CAI: 5
(GSC C-158122)
AGE: Probably Late Carboniferous (Pennsylvanian)
IDENTIFIED BY: MJO

MAP NUMBER: F12 **NTS MAP: 92F/02**
SAMPLE NUMBER: JRI88-21-08-1
EASTING: 379358 NORTHING: 5443014
LOCATION: Duck Lake - Lizard Lake area
STRATIGRAPHIC UNIT: lPsm
FOSSIL TYPE: A: spicules
(GSC C-168446)
B: spicules
(GSC C-168447)
AGE: Phanerozoic
IDENTIFIED BY: MJO

MAP NUMBER: F13 **NTS MAP: 92F/02**
SAMPLE NUMBER: NMA88-02-8
EASTING: 387344 NORTHING: 5447165
LOCATION: Upper Cameron River, quarry just past bridge over Cameron River.
STRATIGRAPHIC UNIT: MPf
FOSSIL TYPE: A: spicules
(GSC C-168480)
B: spicules
(GSC C-168481)
AGE: Phanerozoic
IDENTIFIED BY: MJO

MAP NUMBER: F14 **NTS MAP: 92F/02**
SAMPLE NUMBER: NMA88-12-07-1
EASTING: 388949 NORTHING: 5440976
LOCATION: Upper Nanaimo River, P1 road system
STRATIGRAPHIC UNIT: MPf
FOSSIL TYPE: spumellarian radiolarians
(GSC C-168403)
AGE: Indeterminate
IDENTIFIED BY: MJO

MAP NUMBER: F15 **NTS MAP: 92F/02**
SAMPLE NUMBER: NMA88-12-09-1A
EASTING: 388814 NORTHING: 5440835
LOCATION: Upper Nanaimo River, P1 road system
STRATIGRAPHIC UNIT: MPf
FOSSIL TYPE: spumellarian radiolarians
(GSC C-168404)
AGE: Phanerozoic
IDENTIFIED BY: MJO

MAP NUMBER: F16 **NTS MAP: 92F/02**
SAMPLE NUMBER: NMA88-12-10-3B
EASTING: 388936 NORTHING: 5440562
LOCATION: Upper Nanaimo River, P1 road system
STRATIGRAPHIC UNIT: MPf
FOSSIL TYPE: spumellarian radiolarians
conodonts - ramiform elements
CAI: 6 -7
(GSC C-168406)
AGE: Ordovician - Triassic
IDENTIFIED BY: MJO

MAP NUMBER: F17 **NTS MAP: 92F/02**
SAMPLE NUMBER: NMA88-15-04-1
EASTING: 390449 NORTHING: 5439336
LOCATION: West of upper Nanaimo River
STRATIGRAPHIC UNIT: ?MPf
FOSSIL TYPE: conodonts - ramiform elements
(GSC C-168408)
AGE: Ordovician - Triassic
IDENTIFIED BY: MJO

MAP NUMBER: F18 **NTS MAP: 92F/02**
SAMPLE NUMBER: NMA88-25-09-1
EASTING: 379186 NORTHING: 5443784
LOCATION: South Duck Lake
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: conodonts - *Hindeodus* sp.
ramiform elements
CAI: 5
(GSC C-158250)
AGE: Carboniferous - Early Triassic
IDENTIFIED BY: MJO

MAP NUMBER: F19 **NTS MAP: 92F/02**
SAMPLE NUMBER: NMA88-41-10-1
EASTING: 382612 NORTHING: 5433040
LOCATION: Rift Creek
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: A: Ichthyoliths
conodonts - *Gondolelloides* sp.
CAI: 5
(GSC C-158113)
C: ichthyoliths
bryozoans
(GSC C-158115)
AGE: Early Permian, Asselian - Sakmarian
IDENTIFIED BY: MJO

MAP NUMBER: F20 **NTS MAP: 92F/02**
SAMPLE NUMBER: NMA88-48-07-1
EASTING: 374590 NORTHING: 5443406
LOCATION: SW Patlicant Mountain
STRATIGRAPHIC UNIT: uKb
FOSSIL TYPE: brachiopods, indeterminate
bivalve, indeterminate
(GSC C-168466)
AGE: Indeterminate
IDENTIFIED BY: JWH

MAP NUMBER: F21 SAMPLE NUMBER: NMA88-57-09-1
NTS MAP: 92F/02
EASTING: 379614 NORTHING: 5442765
LOCATION: Douglas Peak
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: ichthyoliths
(GSC C-158117)
AGE: Phanerozoic
IDENTIFIED BY: MJO

MAP NUMBER: F22 **NTS MAP: 92F/02**
SAMPLE NUMBER: SFR88-06-03-2
EASTING: 382459 NORTHING: 5453112
LOCATION: Mt. Arrowsmith
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: conodonts - *Neogondolella* sp.
CAI: 3?
(GSC C-158132)
AGE: Probably Early Permian
IDENTIFIED BY: MJO

MAP NUMBER: F23 **NTS MAP: 92F/02**
SAMPLE NUMBER: SFR88-19-05
EASTING: 381898 NORTHING: 5434630
LOCATION: Museum Creek, logging road M-6
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: *Neospirifer* sp.
echinoderm ossicles, indeterminate
bryozoans, indeterminate
(GSC C-168361)
AGE: Late Carboniferous or Permian
(*Neospirifer* indicates post-Mississippian)
IDENTIFIED BY: EWB

MAP NUMBER: F24 **NTS MAP: 92F/02**
SAMPLE NUMBER: SFR88-19-06
EASTING: 381883 NORTHING: 5434780
LOCATION: Museum Creek, logging road M-6
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: *Echinoderm ossicles*, indeterminate
bryozoans, indeterminate
brachipod fragments, indeterminate
tabulate coral?
collection too poorly preserved for age determination
(GSC C-168362)
AGE: Paleozoic
IDENTIFIED BY: EWB

MAP NUMBER: F25 **NTS MAP: 92F/02**
SAMPLE NUMBER: SFR88-24-01-1
EASTING: 381202 NORTHING: 5438548
LOCATION: Panther - Limestone Mountain
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: ichthyoliths
bryozoans
(GSC C-158140)
AGE: Phanerozoic
IDENTIFIED BY: MJO

MAP NUMBER: F26 **NTS MAP: 92F/02**
SAMPLE NUMBER: SFR88-49-10-1
EASTING: 379596 NORTHING: 5434238
LOCATION: Mt. Spencer
STRATIGRAPHIC UNIT: uTrq
FOSSIL TYPE: ichthyoliths
corals, unidentified
(GSC C-158144)
AGE: Phanerozoic
IDENTIFIED BY: MJO

MAP NUMBER: F27 **NTS MAP: 92F/02**
SAMPLE NUMBER: SFR88-56-01-1
EASTING: 387113 NORTHING: 5446992
LOCATION: South branch of Cameron River (unnamed on maps), in river just upstream of bridge. Close to quarry at start of E10.
STRATIGRAPHIC UNIT: MPf
FOSSIL TYPE: conodonts - *Adetognathus* sp.
Neognathus spp.
Neogondolella sp.
Rhachistognathus? sp.
ramiform elements
CAI: 5
(GSC C-158145)
AGE: Late Carboniferous (Pennsylvanian)
IDENTIFIED BY: MJO

MAP NUMBER: F28 **NTS MAP: 92F/02**
SAMPLE NUMBER: STEVENSON-45-1
EASTING: 378469 NORTHING: 5443255
LOCATION: From limestone bluff northwest of Franklin Creek, elev. 1130 m (Douglas Peak)
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: crinoid disks and stems
brachiopod
Spiriferella sp.
AGE: Late Carboniferous or Permian
IDENTIFIED BY: REFERENCE:2

MAP NUMBER: F29 **NTS MAP: 92F/07**
SAMPLE NUMBER: 60-H-2
EASTING: 374856 NORTHING: 5468429
LOCATION: Base of limestone cliff, north of power-line crossing road, west end of Horne Lake
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: *Schizophoria* sp. (UBC20180, 183, 184)
Hustedia?
Michelinia sp. B. (UBC20186)
Penniretepora grandis (UBC20186)
Sulcoretepora sp. (UBC20141, 20142)
Goniocladia cf. G. *intermedia* (UBC20147)
AGE: Lower Permian
IDENTIFIED BY: REFERENCE:3

MAP NUMBER: F30 **NTS MAP: 92F/07**
SAMPLE NUMBER: 61-24TF
EASTING: 375715 NORTHING: 5468348
LOCATION: Talus slope on north side of Horne Lake, 1.3 km southeast of 3,165' peak of Mt. Mark, elev. 245 m
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: *Squamularia*? sp. (UBC20091)
Horrindia sp. A. (UBC20200, 20201)
corals
bryozoans
AGE: Indeterminate (?Early Permian)
IDENTIFIED BY: REFERENCE:3

MAP NUMBER: F31 **NTS MAP: 92F/07**
SAMPLE NUMBER: 62-55-4F
EASTING: 375104 NORTHING: 5468839
LOCATION: On south side of logging road, 0.8 km on east spur of Mt. Mark, 0.6 km southeast of 3,037' peak; elev. 630 m
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: brachiopods
AGE: Indeterminate (?Early Permian)
IDENTIFIED BY: REFERENCE:3

MAP NUMBER: F32 **NTS MAP: 92F/07**
SAMPLE NUMBER: 62-55-9F
EASTING: 375306 NORTHING: 5469110
LOCATION: On logging road, 0.8 km east-southeast of 3037' peak on Mt. Mark; elev. 520 m
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: brachiopods
bryozoans
AGE: Indeterminate (?Early Permian)
IDENTIFIED BY: REFERENCE:3

MAP NUMBER: F33 **NTS MAP: 92F/07**
SAMPLE NUMBER: 62-56-1F
EASTING: 374824 NORTHING: 5468753
LOCATION: Base of limestone cliff, east side of large gully on south face of Mt. Mark, 0.25 mi. NE of power- line crossing logging road near W of Horne Lake
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: *Tetrataxis*
Michelinia? sp. A. (UBC20175, 20179)
brachiopods
solitary rugose corals
AGE: Lower Permian
IDENTIFIED BY: REFERENCE:3

MAP NUMBER: F34 **NTS MAP: 92F/07**
SAMPLE NUMBER: 62-56-2
EASTING: 375497 NORTHING: 5468469
LOCATION: Mt. Mark section, above diabase
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: 120 m above diabase (unit 25)
fusulinids
105 m above diabase (unit 25)
Schwagerina?
15-35 m above diabase (unit 23)
Streblescopora pulchra
Sulcoretepora sp.
fusulinids
brachiopods
AGE: Early Permian
IDENTIFIED BY: REFERENCE:3

MAP NUMBER: F35 **NTS MAP: 92F/07**
SAMPLE NUMBER: 62-56-2A
EASTING: 374916 NORTHING: 5468857
LOCATION: Base of Mt. Mark limestone section, about 150 m east of locality 56-1F, elev. 260 m (Unit 1)
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: brachiopods
Chaetetes sp. (UBC20177, 20178)
solitary rugose corals
fenestrate bryozoans
AGE: Early Permian
IDENTIFIED BY: REFERENCE:3

MAP NUMBER: F36 **NTS MAP: 92F/07**
SAMPLE NUMBER: 62-58-1F
EASTING: 378173 NORTHING: 5466403
LOCATION: On west side of logging road 0.25 mi. southwest of upper bridge over Qualicum River, elev. 620'
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: *Cladochenus* sp. (UBC20099)
bryozoans
AGE: Indeterminate (?Lower Permian)
IDENTIFIED BY: REFERENCE:3

MAP NUMBER: F37 **NTS MAP: 92F/07**
SAMPLE NUMBER: NMA88-34-12-2
EASTING: 380693 NORTHING: 5458040
LOCATION: St Mary's Lake, section through Mount Mark Fm.
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: B: ichthyoliths
(GSC C-158103)
E: conodonts - *gnathodid*
ramiform elements
CAI: 6.5
(GSC C-158104)
F: ichthyoliths
(GSC C-158105)
G: ichthyoliths
sponge spicules
conodonts - *Streptognathodus* ex gr. *elongatus* (Gunnell, 1933)
CAI: 5
(GSC C-158106)
AGE: Late Carboniferous (Pennsylvanian) - Early Permian
IDENTIFIED BY: MJO

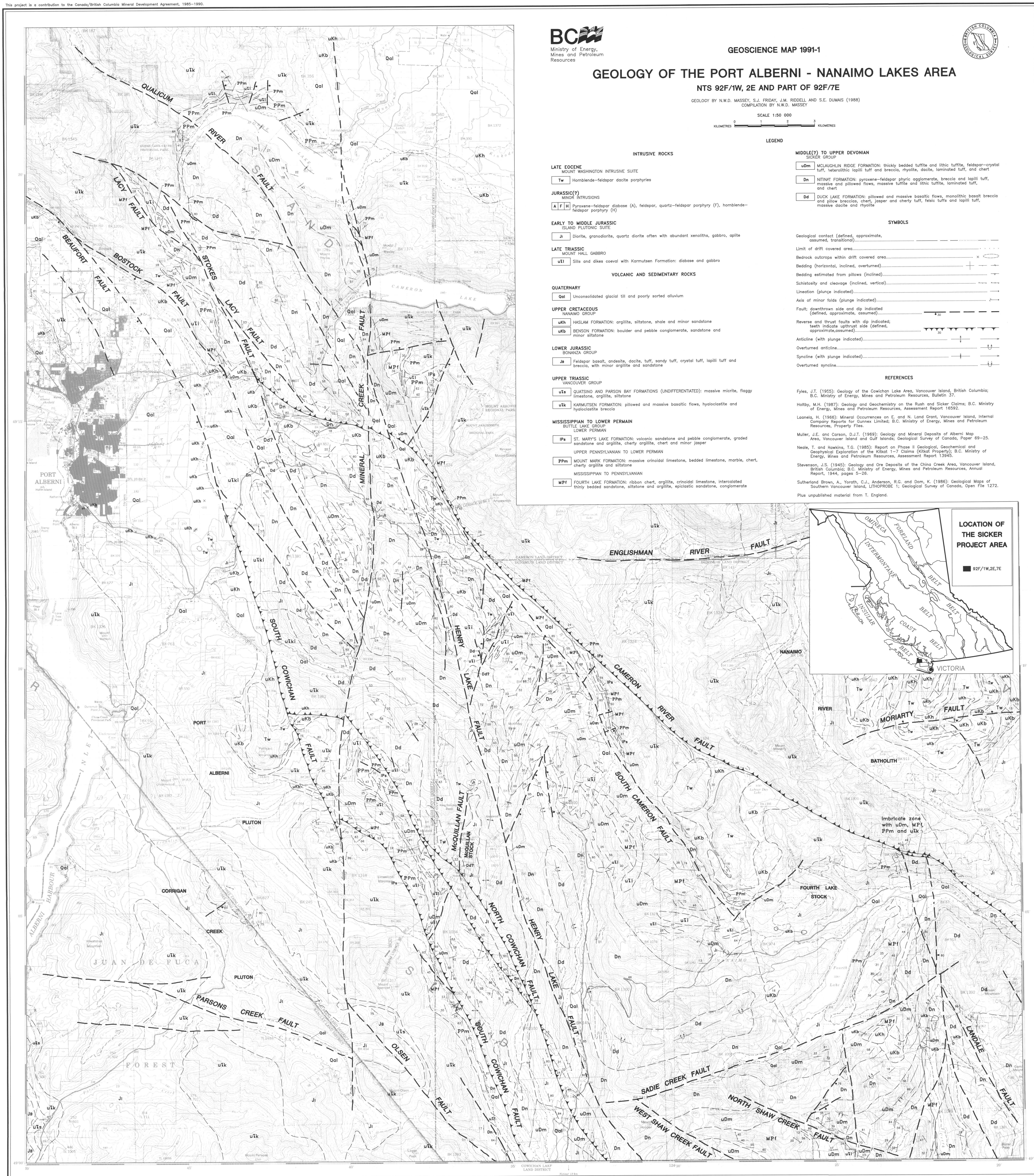
MAP NUMBER: F38 **NTS MAP: 92F/07**
SAMPLE NUMBER: NMA88-37-15-1
EASTING: 372726 NORTHING: 5464978
LOCATION: Horne Lake trail
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: ichthyoliths
(GSC C-158108)
AGE: Phanerozoic
IDENTIFIED BY: MJO

MAP NUMBER: F39 **NTS MAP: 92F/07**
SAMPLE NUMBER: SADA-DANNER-1
EASTING: 372614 NORTHING: 5465771
LOCATION: Outcrops along logging road above west side of Horne Lake
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: *Eoschubertella*? sp.
Endothyra sp.
AGE: Middle Pennsylvanian
IDENTIFIED BY: REFERENCE:4

MAP NUMBER: F40 **NTS MAP: 92F/07**
SAMPLE NUMBER: SADA-DANNER-2
EASTING: 375000 NORTHING: 5468400
LOCATION: Talus slope at base of Mt. Mark along logging road on north side of Horne Lake. Coordinates approximate.
STRATIGRAPHIC UNIT: PPm
FOSSIL TYPE: *Eostaffella* sp.
Endothyra sp.
AGE: Middle Pennsylvanian
IDENTIFIED BY: REFERENCE:4

MAP NUMBER F41 **NTS MAP: 92F/1**
SAMPLE NUMBER: GSC C12751921
EASTING: 392397 NORTHING: 5429113
LOCATION: West of north Shaw Creek logging road
STRATIGRAPHIC UNIT: MPf
FOSSIL TYPE: conodonts
Siphonodella sp.
Pseudopolygnathus sp.
AGE: Early Mississippian (Kinderhookian)
IDENTIFIED BY: MJO REFERENCE:2

Energy, Mines and Resources Canada
BC Province of British Columbia
This project is a contribution to the Canada/British Columbia Mineral Development Agreement, 1985-1990.



BC Ministry of Energy, Mines and Petroleum Resources

GEOSCIENCE MAP 1991-1

GEOLOGY OF THE PORT ALBERNI - NANAIMO LAKES AREA

NTS 92F/1W, 2E AND PART OF 92F/7E

GEOLOGY BY N.W.D. MASSEY, S.J. FRIDAY, J.M. RIDDELL AND S.E. DUMAIS (1988)
COMPILATION BY N.W.D. MASSEY

SCALE 1:50 000

KILOMETRES 0 1 2 3 KILOMETRES

LEGEND

INTRUSIVE ROCKS

LATE EOCENE
MOUNT WASHINGTON INTRUSIVE SUITE

- **Tw** Hornblende–feldspar dacite porphyries

JURASSIC(?)
MINOR INTRUSIONS

- **A F H** Pyroxene–feldspar diabase (A), feldspar, quartz–feldspar porphyry (F), hornblende–feldspar porphyry (H)

EARLY TO MIDDLE JURASSIC
ISLAND PLUTONIC SUITE

- **Ji** Diorite, granodiorite, quartz diorite often with abundant xenoliths, gabbro, aplite

LATE TRIASSIC
MOUNT HALL GABBRO

- **uTi** Sills and dikes coeval with Karmutsen Formation: diabase and gabbro

VOLCANIC AND SEDIMENTARY ROCKS

QUATERNARY

- **Qal** Unconsolidated glacial till and poorly sorted alluvium

UPPER CRETACEOUS
NANAIMO GROUP

- **uKh** HASLAM FORMATION: argillite, siltstone, shale and minor sandstone
- **uKb** BENSON FORMATION: boulder and pebble conglomerate, sandstone and minor siltstone

LOWER JURASSIC
BONANZA GROUP

- **JB** Feldspar basalt, andesite, dacite, tuff, sandy tuff, crystal tuff, lapilli tuff and breccia, with minor argillite and sandstone

UPPER TRIASSIC
VANCOUVER GROUP

- **uTs** QUATSINO AND PARSON BAY FORMATIONS (UNDIFFERENTIATED): massive micrite, flaggy limestone, argillite, siltstone
- **uTk** KARMUTSEN FORMATION: pillowed and massive basaltic flows, hyaloclastite and hyaloclastite breccia

MISSISSIPPIAN TO LOWER PERMIAN
BUTTLE LAKE GROUP
LOWER PERMIAN

- **lPs** ST. MARY'S LAKE FORMATION: volcanic sandstone and pebble conglomerate, graded sandstone and argillite, cherty argillite, chert and minor jasper

UPPER PENNSYLVANIAN TO LOWER PERMIAN

- **PPm** MOUNT MARK FORMATION: massive crinoidal limestone, bedded limestone, marble, chert, cherty argillite and siltstone

MISSISSIPPIAN TO PENNSYLVANIAN

- **MPf** FOURTH LAKE FORMATION: ribbon chert, argillite, crinoidal limestone, intercalated thinly bedded sandstone, siltstone and argillite, epiclastic sandstone, conglomerate

MIDDLE(?) TO UPPER DEVONIAN
SICKER GROUP

- **uDm** MCLAUGHLIN RIDGE FORMATION: thickly bedded tuffite and lithic tuffite, feldspar–crystal tuff, heterolithic lapilli tuff and breccia, rhyolite, dacite, laminated tuff, and chert
- **Dn** NITINAT FORMATION: pyroxene–feldspar phyric agglomerate, breccia and lapilli tuff, massive and pillowed flows, massive tuffite and lithic tuffite, laminated tuff, and chert
- **Dd** DUCK LAKE FORMATION: pillowed and massive basaltic flows, monolithic basalt breccia and pillow breccias, chert, jasper and cherty tuff, felsic tuffs and lapilli tuff, massive dacite and rhyolite

SYMBOLS

Geological contact (defined, approximate, assumed, transitional)

Limit of drift covered area

Bedrock outcrops within drift covered area

Bedding (horizontal, inclined, overturned)

Bedding estimated from pillows (inclined)

Schistosity and cleavage (inclined, vertical)

Lineation (plunge indicated)

Axis of minor folds (plunge indicated)

Fault; downthrown side and dip indicated (defined, approximate, assumed)

Reverse and thrust faults with dip indicated; teeth indicate upthrust side (defined, approximate, assumed)

Anticline (with plunge indicated)

Overturned anticline

Syncline (with plunge indicated)

Overturned syncline

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LOCATION OF THE SICKER PROJECT AREA

OMINECA
FORELAND
INTERMONTANE
BELT
INSULAR
COAST
VICTORIA
92F/1W,2E,7E