British Columbia Geological Survey
Geological Fieldwork 1988

GEOLOGY OF THE SCUD RIVER AREA, NORTHWESTERN BRITISH COLUMBIA (104G/5, 6)

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KEYWORDS: Regional geology, Scud River, Stikine assemblage, Stuhini Group, Hickman batholith, Jurassic intrusions, porphyry mineralization.

INTRODUCTION

The first summer of 1:50 000 geological mapping for the Stikine project was completed in the Scud River (104G/5) and Scud Glacier map areas (104G/6) in 1988. Fieldwork focused on Upper Paleozoic Stikine assemblage and Upper Triassic Stuhini Group stratigraphy and structure, plutonic suites, and mineral potential. The work will provide an updated geology map to complement recently released Regional Geochemical Survey (RGS) data. The Stikine assemblage was divided into four stratigraphic units and intrusive rocks were grouped into four plutonic suites. Samples were collected for geochemical (71), microfossil (75), macrofossil (31) identification and potassium-argon isotopic dating (7).

Concurrently, J. Logan and V. Koyanagi (1989, this volume) mapped the two adjoining sheets to the south (104G/3, 4). Nixon *et al.* (1989, this volume) examined the Hickman ultramafic complex in the southwest corner of the project area to evaluate its platinum-group-element potential. Our efforts in 1989 will concentrate on Upper Triassic and younger rocks along the eastern margin of the Coast Belt in map areas to the north (104G/10, 11). The work will complement the Geological Survey of Canada mapping in the Telegraph Creek map area in 1990.

LOCATION AND ACCESS

The map area is 150 kilometres southwest of Dease Lake and is accessible by helicopter, small aircraft or boat (Figures 1-29-1 and 1-29-3). A gravel airstrip suitable for DC-3 and smaller aircraft is located at the confluence of the Scud and Stikine rivers. The Stikine River provides float-plane and river-boat access to the western half of the Scud River map sheet.

The area is rugged with glacially steepened valley walls and 40 per cent alpine glacier cover. Jagged peaks of the Coast Mountains reach elevations over 2785 metres; the Spectrum Range east of Schaft Creek and the terrain north of Butterfly Creek are more subdued. Along the Stikine valley, near the mouth of the Scud River, there are more than 50 prehistoric stone cairns at elevations between 1100 and 1300 metres (Figure 1-29-3, Plate 1-29-1). Kerr described these, however little is known about them except that they may have been built by ancient Interior or Coastal Indians.

PREVIOUS WORK

Initial geological studies along the Stikine River were made in 1863 when a group of Russian geologists came to assess the area's mineral potential (Alaska Geographic Society, 1979). G.M. Dawson and R. McConnell were the first Canadian geologists to explore the Stikine River valley in 1887. Forrest Kerr worked along the Stikine River from the International border to Telegraph Creek (Kerr, 1927, 1929, 1930, 1931, 1948a).

Regional mapping by Souther (1972) produced the most complete geological study of the Telegraph Creek map area (104G). He divided the Stikine assemblage into pre-Permian and Permian units and described the Triassic rocks and the Hickman batholith in detail. Later work (Souther and Symons, 1974) established the Mount Edziza complex 20 kilometres northeast of the present study.

Biostratigraphic studies of the Stikine assemblage by Pitcher (1960), Monger (1977a), Anderson (1988) and Holbek (1988) in areas south of the Scud River have established a Devonian to Permian age range. To the north, Read (1984) documented the geology of the Stikine Canyon region.

From 1955 to 1975 exploration activity focused on the Galore Creek and Schaft Creek porphyry copper deposits (Figure 1-29-1). Upper Triassic volcanic and plutonic rocks were described and isotopic dates published. Mineralization in the Mess Creek area, 30 kilometres to the east, was studied by Holbek (1988). Recently, companies have actively explored the area for precious metal deposits.

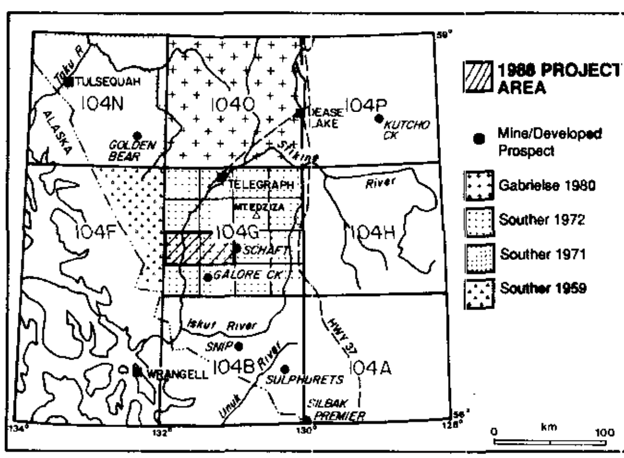

Figure 1-29-1. Location map for Stikine Project 1988.

British Columbia Ministry of Energy, Mines and Petroleum Resources, Geological Fieldwork, 1988, Paper 1989-1.

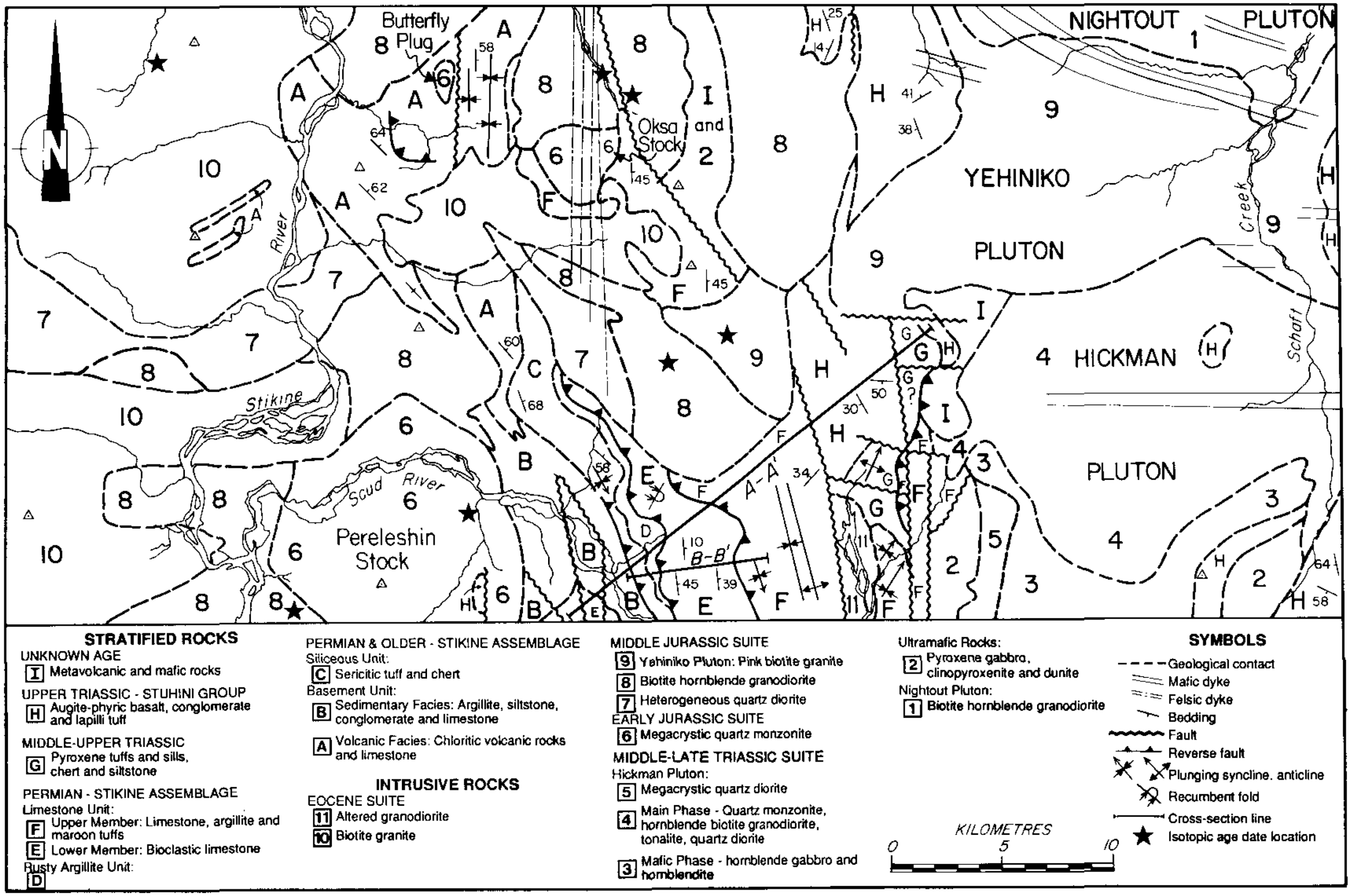

Figure 1-29-2. Simplified geology of the Scud River and Scud Glacier map areas (104G/5, 6).

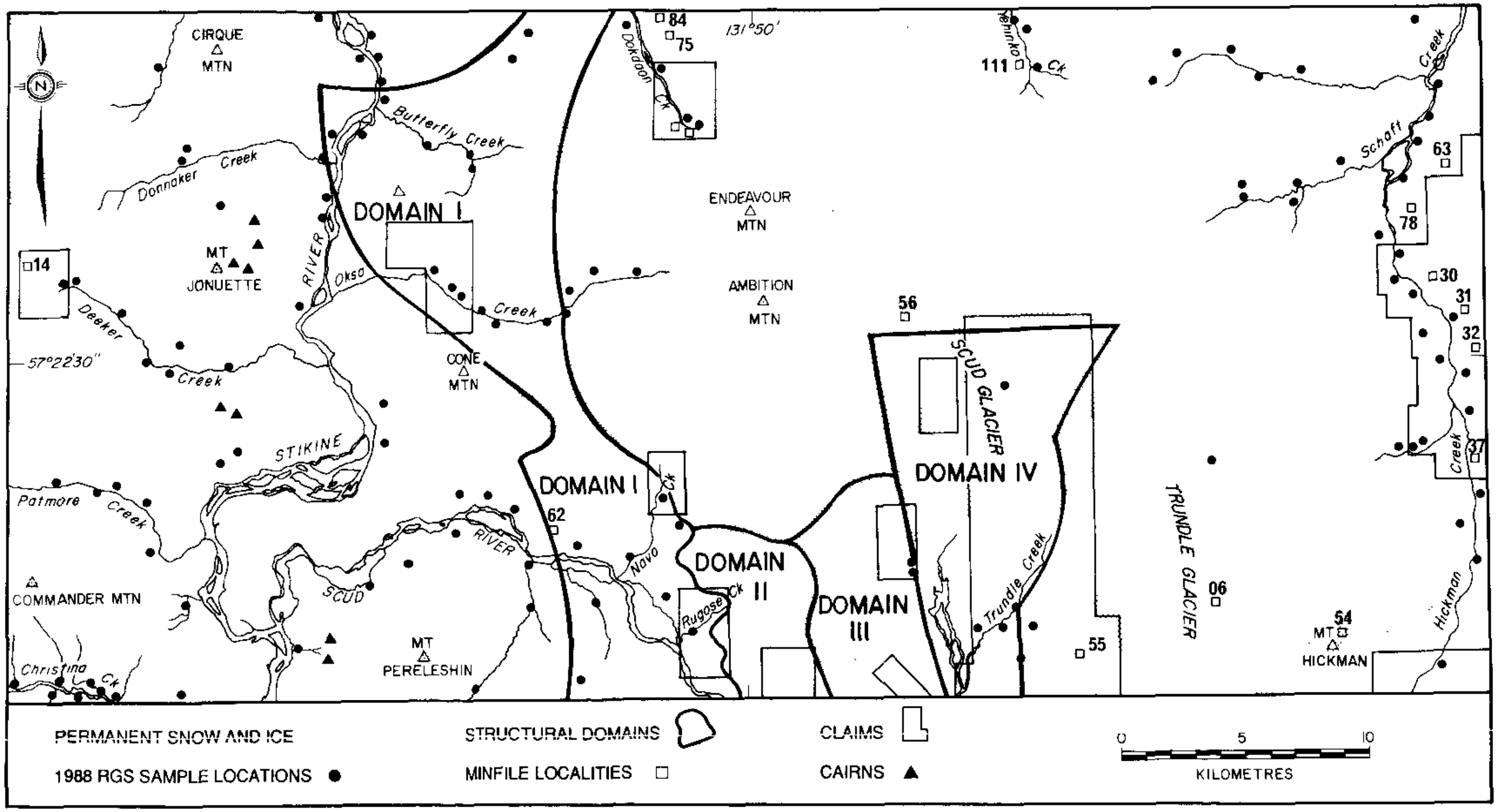

Figure 1-29-3. Scud River and Scud Glacier location map with RGS sample locations, MINFILE localities, claim locations and structural domains.

REGIONAL GEOLOGY

The map area straddles the boundary between the Coast and Intermontane tectonic belts. The Stikine terrane, an integral part of the Intermontane Belt, underlies the map area and is made up of Middle Paleozoic to Mesozoic eugeoclinal rocks, overlapped by the Bowser Lake Group, which outcrops 45 kilometres to the east.

Three of roughly ten major lithotectonic packages in northwestern British Columbia occur in the project area: Paleozoic Stikine assemblage sedimentary and volcanic rocks; unnamed Middle Triassic sedimentary rocks; and Upper Triassic Stuhini Group volcanic and sedimentary rocks.

STRATIGRAPHY

Paleozoic and Mesozoic stratified rocks are exposed in the central part of the map area (Figure 1-29-2) and are described below.

PALEOZOIC STIKINE ASSEMBLAGE

The term "Stikine assemblage" (Monger, 1977b) includes Paleozoic rocks in Stikinia of Early to Middle Devonian, Mississippian and Permian age (Pitcher, 1960; Monger, 1977a; Anderson, 1988; Logan and Koyanagi, 1989, this volume). Representative rocks occur in a northwest-trending belt across the project area and are best exposed in a 2000-metre section along the north side of the Scud River. The assemblage comprises basal (Permian? and older) cleaved intermediate metavolcanic and metasedimentary rocks (the "basement unit") overlain by silicic to felsic tuff (Unit C, the siliceous unit), rusty argillite (Unit D) and a thick sequence of Permian platformal limestone (Units E and F, Figures 1-29-4 and 1-29-5).

Plate 1-29-1. View southeast to prehistoric stone cairn built on a prominent knoll above the Stikine River.

BASEMENT UNIT (UNITS A, B)

The basement unit, over 1000 metres thick, consists of a northern **volcanic facies** and southern **sedimentary facies** that interfinger northwest of Navo Creek.

The **volcanic facies** (Unit A, Figure 1-29-2) consists of predominantly green, hornblende and chlorite-altered, pyroxene-bearing volcaniclastic rocks (including chlorite schist and heterolithic breccia) and subordinate phyllitic pyroxene-feldspar-porphyritic andesite sills or flows. An extensive chlorite schist member (greater than 500 metres thick), with elliptical (flattened?) lithic fragments and intercalated silicic tuff horizons, occurs near the top of the volcanic facies. Two framework-supported, heterolithic volcanic breccia members (20 to 30 metres thick) and silicic and plagioclase crystal tuff beds, are interlayered with the chlorite schist member. Siliceous tuff predominates towards the top of the basement unit and grades into the siliceous unit.

The basement volcanic rocks are similar in composition and appearance to the Stuhini Group, however, their stratigraphic position, more strongly deformed, metamorphosed and altered character are diagnostic and suggest an older age.

The **sedimentary facies** (Unit B) comprises light grey to pale green phyllitic greywacke, siltstone, calcareous siltstone, graphitic argillite, argillaceous chert and pebble conglomerate with a prominent platy to sericite-chlorite foliation. It is recessive and poorly exposed in the Scud River valley. The polymictic conglomerate contains subrounded to subangular argillite, siltstone and rare limestone clasts in a sandy matrix.

Discontinuous recrystallized limestone horizons with poorly preserved crinoid stems occur in both facies. The grey to white, well-bedded to massive limestones are up to 200 metres thick.

Basement unit lithologies indicate contemporaneous shallow-marine deposition to the south and andesitic volcanism to the north, with discontinuous limestone accumulation in both facies. The transition from andesitic to felsic volcanism probably reflects evolution of an Early Carboniferous(?) arc.

SILICEOUS UNIT (UNIT C)

The siliceous unit is at least 500 metres thick and extends from Rugose Creek to Butterfly Creek (Figure 1-29-3). The upper contact is an angular disconformity on which steeply dipping tuff beds are overlain by gently dipping, rusty argillite south of Navo Creek. However, locally along the creek, the contact is structurally comformable.

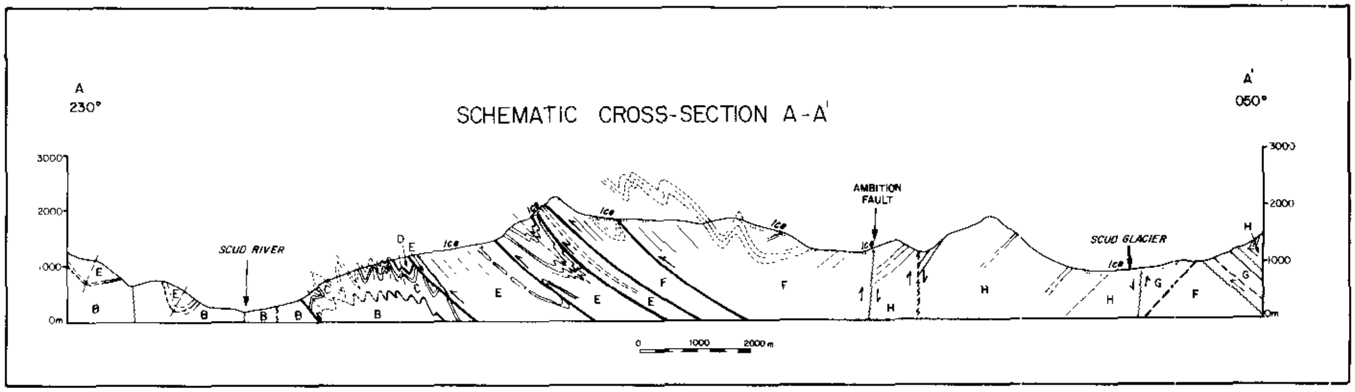

Figure 1-29-4. Schematic cross-section A-A' from the Scud River to the Scud Glacier.

The unit is characterized by weakly foliated white to pale green, fine-grained to aphanitic silicic to felsic ash tuff, lapilli tuff and tuffaceous siltstone with lesser chert. Pyrite euhedra, up to 1 centimetre in diameter, form conspicuous rusty weathering spots in some exposures. Varicoloured cherts predominate toward the top of the section with thin grey to buff dolomitic limestone and argillite beds and lenses. Prominent planar laminae and beds contain load casts, flame structures, fining-upward sequences and local crossbeds and syndepositional small-scale growth faults which consistently indicate a northeast-facing stratigraphy.

The silicic rocks are interpreted to be a tuffaceous distal turbidite facies of explosive felsic volcanism. The uppermost limy siltstone and argillite indicate the cessation of volcanism. The basement and siliceous units are believed to be pre-Permian because they are more deformed and altered than the Permian limestone that lies stratigraphically above them; this is in accord with the interpretations of both Souther (1972) and Kerr (1948a). The angular discordance between the siliceous and rusty argillite units probably reflects a deformational event.

Rusty Argillite Unit (Unit D)

The distinctive rusty weathering black argillite, siltstone and sandstone unit which overlies the siliceous unit is restricted to the southeast side of Navo Creek. It is 100 metres thick at most and pinches out to the north and south. Bedding-parallel bands of pyrite and/or pyrrhotite are ubiquitous and comprise up to 5 per cent of the rock. A gradational contact (over 30 metres) with overlying dark grey micritic limestone marks a transition from an anoxic deep-water basin to a shallow-water stable platform setting. This unit has stratabound massive sulphide potential.

Limestone Unit (Units E, F)

Overlying the rusty argillite is a thick (greater than 1000 metres) sequence of structurally disrupted limestone (Figures 1-29-2, 1-29-4 and 1-29-5). East of Rugose Creek, lower and upper members are divisible. The divisions do not conform to the "Permian" and "Permian and Older" strata of Souther (1972) because conodont and macrofossil identifications suggest the lower member is at least as young as late Early Permian (M.J. Orchard and E.W. Bamber, personal communications, 1988).

The **lower member (Unit E)** comprises over 700 metres of dark grey micritic limestone, interbedded argillite and thinly bedded bioclastic limestone. A sharp contact separates lower and upper members. Dark grey, fine to medium-grained micritic limestone and minor black argillite form the lower part (less than 100 metres). The upper part consists of more than 600 metres of centimetre to decimetre-thick beds of grey limestone. Irregular concordant siliceous layers and pods are common; they are interpreted to be diagenetic features. Rugose corals up to 30 centimetres long, tabulate corals (*Syringopora*?), brachiopods, crinoid-stem fragments, sponge spicules, fusulinids, bryozoa and rare gastropods make up a diverse fauna in the unit. The corals are undeformed to slightly flattened, many are complete and intact suggesting limited transport or postdepositional deformation.

The **upper member (Unit F)** comprises primarily massive white to buff limestone with subordinate interbedded argillite and tuff which underlie the highest peaks (for example, Ambition Mountain). It is overlain unconformably by Upper Triassic shale south of the map area (Logan and Koyanagi, 1989, this volume). East of the toe of the Scud Glacier, Lower Permian limestone and tuff are disconformably overlain by Middle to Upper Triassic cherty sediments (Figure 1-29-6). Further east, Unit F is duplicated by a west-directed, probable post-Triassic, thrust.

In addition, massive limestone and dark grey argillite, irregular siliceous layers and pods are also common. Intermediate to felsic, maroon and green tuff and tuffaceous wacke/mudstone are diagnostic of the top part of this member. The tuff occurs as concordant lenses and structurally disrupted discordant bodies up to 50 metres thick. Some tuff beds are welded and eutaxitic.

Interbedded with maroon and green feldspar crystal lithic tuff is well-bedded, fusulinid-rich grey to maroon limestone (Figures 1-29-5 and 1-29-6; E.W. Bamber, personal communication, 1988). Heterolithic volcanic fragments are present within the limestone. Maroon and green plagioclase crystal-lithic ash to lapilli tuff and green silicic siltstone overlie the tuffaceous limestone.

The thick accumulation of limestone with boreal Permian faunas indicates near-shore, shallow-water sedimentation on

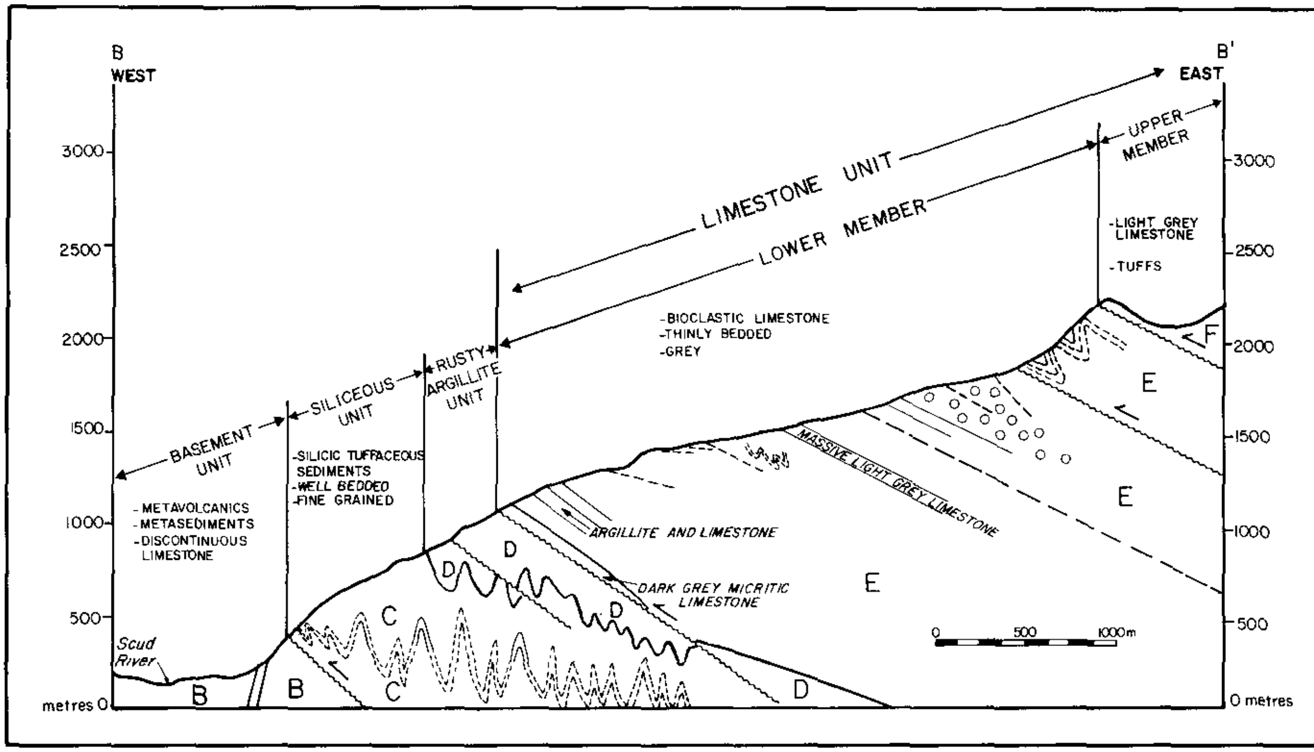

Figure 1-29-5. Schematic cross-section B-B′ of the Stikine assemblage near Rugose Creek.

a platform (E.W. Bamber, personal communication, 1988). The maroon and green tuffs represent isolated, episodic explosive Permian volcanism into an oxidizing, shallow-marine environment.

Regional correlation is hindered by deformation and facies changes. Permian rocks are missing due to nondeposition in the Mess Creek area, 30 kilometres to the east (Holbek, 1988) but the Permian limestone succession extends along strike at least 100 kilometres to the northwest (Tulsequah map area) and at least 50 kilometres to the south (Iskut map area).

MIDDLE TRIASSIC(?) ROCKS (UNIT G)

At the toe of the Scud Glacier a 200-metre-thick section of probable Middle Triassic sedimentary rocks unconformably overlies Permian limestone (Figure 1-29-6). The upper contact with Stuhini Group pyroxene-bearing volcaniclastics and basalt flows is conformable. Similar geological relationships occur in the Terrace area (G.J. Woodsworth, personal communication, 1988).

The sequence consists of black, brick-red and green chert and silicic mudstone. Well-bedded ribbon chert is overlain by argillaceous chert and highly contorted and disharmonically folded graphitic argillite. Identical ribbon chert and maroon tuff crop out in Trundle Creek, 4 kilometres south of the Scud section. The top of the succession is composed of well-bedded green siltstone and greywacke intercalated with thin shale layers. Shale rip-up fragments and local crossbeds in coarse clastics are distinctive.

The age of this section is poorly defined. A granodiorite stock, considered coeval with the Hickman pluton, intrudes the sediments and the Upper Triassic Stuhini Group overlies the sequence, suggesting a Middle to Late Triassic age.

UPPER TRIASSIC STUHINI GROUP (UNIT H)

The Stuhini Group, defined by Kerr (1948b), includes rocks in the Taku River valley of the Tulsequah map area and other Upper Triassic volcanic and sedimentary rocks that lie above a Middle Triassic unconformity and below the Late Triassic Sinwa limestone (Figure 1-29-1; Souther, 1971). In the study area, Stuhini Group volcanic rocks occur as large north-trending blocks or pendants between intrusive rocks. The best-exposed stratigraphy occurs as partly fault-bounded exposures west of the Scud Glacier.

The group comprises augite-phyric basalt flows, sills and volcaniclastics with minor andesite flows, volcanic breccia and tuff. Abrupt lateral facies changes and block faulting hinder stratigraphic reconstruction, however, the component lithologies are described below (Figure 1-29-6). The Stuhini Group is the youngest stratigraphic unit in the project area.

The base of the Upper Triassic sequence comprises distinctive medium-grained pyroxene-bearing mafic volcaniclastics. They occur as planar, graded beds of variable thickness with rare flame structures. Augite-crystal volcanic sandstone contains rounded grey chert clasts and rare augite porphyritic basalt clasts. Centimetre-scale syndepositional growth faults occur locally. Pyroxene-phyric basalt sills or flows are thin (less than 2 metres) with symmetrical fine-grained chilled margins and locally vesicular interiors. These basalts may correlate with the "eastern facies" of the Stuhini Group as used by Anderson (1988).

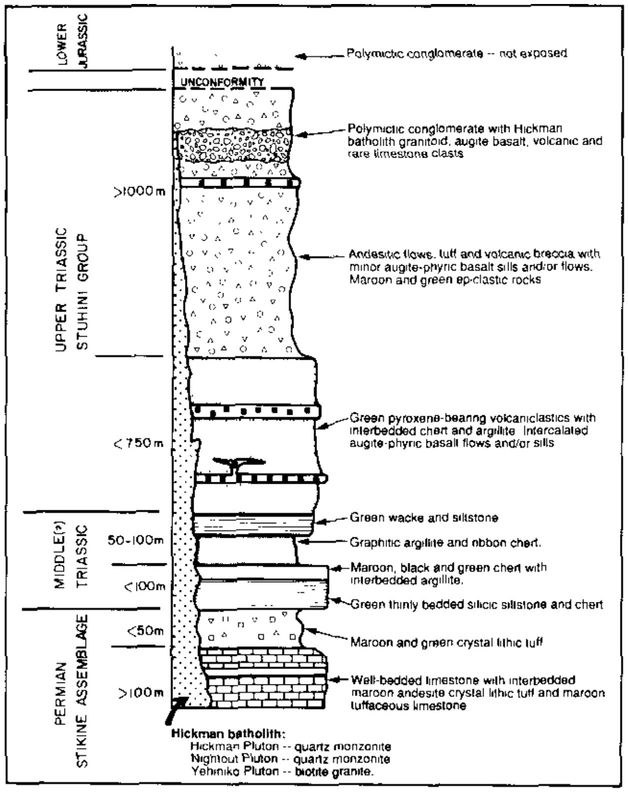

Figure 1-29-6. Schematic Triassic stratigraphic column for the Scud Glacier area.

Overlying the volcaniclastic strata are green, hornblende-feldspar-phyric andesite flows. Heterolithic volcanic breccia comprising angular green and maroon andesitic to basaltic fragments in a fine-grained volcanic matrix are less important. Matrix and framework-supported polymictic conglomerates contain prominent clasts of light grey granitoid, together with variably epidotized volcanic rocks, dark green augite basalt, and rarely amphibolite, limestone and ultramafite. Poorly sorted, maroon, crystal-rich epiclastic rocks display graded bedding and occur throughout the section. Pale green to grey, fine-grained to aphanitic, silicic and felsic tuffs near Schaft Creek are interpreted to be waterlain ash tuffs.

The Stuhini Group is a bimodal suite with mafic/intermediate rocks evolving to less abundant felsic rocks. It represents a terrain with basaltic to felsic subaerial and subaqueous volcanism, in part reworked by fluvial processes with contemporaneous shallow-marine deposition. The coarse breccias indicate significant relief and the diverse clast compositions indicate significant unroofing of the Hickman batholith with synchronous erosion of the upper portion of the Upper Triassic volcanic pile.

METAVOLCANIC AND MAFIC INTRUSIVE(?) ROCKS (UNIT 1)

Metavolcanic, mafic and lesser ultramafic intrusive(?) rocks on Dokdaon and Endeavour mountains, east of the Scud Glacier, east of Trundle Creek, and northeast of Mount Hickman (Figure 1-29-2) are dark grey to black, fine to medium grained and of unknown protolith. Textures vary from biotite schist to massive or brecciated pyroxenites and metavolcanic rocks. Local faint layering, interpreted to be relict bedding, indicates at least part of the unit is mafic volcanic material. Pyroxene-phyric basalt flows or sills are recognized in some localities. However, on Dokdaon and Endeavour mountains, massive amphibolitic rocks grade into ultramafic rocks that appear to intrude Permian limestone.

Souther (1972) used the same term to encompass nondescript mafic rocks and he suggested they could be in part metamorphosed Permian dolomitic limestone. No evidence was found for this although there does seem to be a spatial association with Permian limestone. The Scud Glacier body, intruded by the Hickman pluton, may represent Permian metavolcanic rocks.

INTRUSIVE ROCKS

Plutonic rocks underlie 75 per cent of the project area and are well exposed due to the rugged topography. Four composite plutonic suites are defined (Table 1-29-1): Middle(?) to Late Triassic; Early Jurassic; Middle Jurassic; and Eocene.

MIDDLE(?) TO LATE TRIASSIC SUITE

The Hickman batholith covers 1200 square kilometres of which half is in the eastern part of the project area. The batholith is a composite body composed of three, I-type plutons: the Middle(?) to Late Triassic Nightout and Hickman plutons and the Middle Jurassic Yehiniko pluton (Souther, 1972; Holbek, 1988). The older plutons are subvolcanic intrusions, spatially and genetically associated with coeval Stuhini Group volcanic rocks.

NIGHTOUT PLUTON (UNIT 1)

The Nightout pluton occupies 80 square kilometres in the northeast corner of the map area. It is composed of a medium-grained, equigranular, mesocratic hornblende-biotite granodiorite to quartz monzodiorite. Titanite is a common, locally medium-grained, accessory mineral. Mafic inclusions are common along pluton margins. The pluton is lithologically similar and coeval with the main phase of the Hickman pluton that lies 10 kilometres to the south.

Potassium-argon isotopic ages of 236 ± 18 Ma for biotite and 228 ± 16 Ma for hornblende (two sigma errors; Holbek, 1988) suggest a Late Triassic age for the pluton.

ULTRAMAFIC ROCKS (UNIT 2)

Ultramafic rocks are found in the Mount Hickman, Trundle Creek and Endeavour Mountain areas. The ultramafic rocks are intruded by the main phase of the Hickman pluton.

The Mount Hickman ultramafic complex forms an oblong body about 5 kilometres long and 3 kilometres wide. It comprises mainly medium-grained, equigranular, black to tan-weathering clinopyroxenite and olivine clinopyroxenite which contains 10 to 15 per cent fractured serpentinized olivine and 3 to 5 per cent euhedral chromite and magnetite

TABLE 1-29-1
SUMMARY OF INTRUSIVE ROCKS

Plutonic Suite	Phase (Unit)	Isotopic Age(K-Ar)	Rock Name	Accessory Minerals	Contact Relations	Mineral Potential	Type Area
Eocene	Unit 11		Altered Gd	Chlorite	Intrudes Unit F	Structural host	Scud River
	Unit 10		Bi Gr	Trace Mt	Intrudes Units 7,8	Porphyry Mo-Cu	Cirque Mtn.
Middle Jurassic	Yehiniko Pluton(9)	Bi 172±12 Ma	Hb-Bi Gr	Mt, trace Ti	Intrudes Units H,1,4	Porphyry Cu-Au	Schaft Ck
	Unit 8		Bi-Hb Gd to Qz Mz	Variable Ti and Py	Intrudes Units A,6	Skarns	Dokdaon Ck
	Unit 7		Bi-Hb Di to Qz Di	Py	Cogenetic with Unit 8		Decker Ck
Early Jurassic	Unit 6		Hb Qz Mz to Gr	Ti, trace Mt	Intruded by Unit 8	Porphyry Cu-Au	Pereleshin Mt.
Middle to Late Triassic	Hickman Pluton: Unit 5		Megacry Qz Di	Py	Intrudes Unit 2		Trundle Ck
	Main Phase (4)	Bi 209±15 Ma	Hb-Bi Gd to Qz Mz	Mt, trace Ti	Intrudes Units 2,G,H		Trundle Glacier
	Mafic Phase (3)		Hb-Gabbro	Mt	Gradational with Unit 4		Mt. Hickman
	Ultramafic Rocks (2)		Ol-Pxt, Dunite	Mt, Cr	Intruded by 4,5	Asb,Listwanite PGE	Mt. Hickman, Trundle Ck
	Nightout Pluton (1)	Bi 236±18 Ma	Hb-Bi Gd to Qz Mz	Ti	Not seen	Porphyry Cu-Au	Schaft Ck

Note 1. Isotopic dates from Holbek (1988) with 2 sigma errors.
Note 2. Hickman batholith = Hickman pluton, Yehiniko pluton, Nightout pluton.

Abbreviations: Asb = Asbestos; Au = Gold; Bi = Biotite; Cr = Chromite; Ck = Creek; Cu = Copper; Di = Diorite; Gd = Granodiorite; Hb = Hornblende; Megacry = Megacrystic; Mo = Molybdenite; Mt = Magnetite; Mz = Monzonite; Mt. = Mount; Ol = Olivine; PGE = Platinum group elements; Py = Pyrite; Px = Pyroxene; Pxt = Pyroxenite; Qz = Quartz; Sy = Syenite; Ti = Titanite.

(Nixon *et al.*, 1989, this volume). Part of the core is a small dunite body with serpentinized and fresh olivine. The dunite core surrounded by clinopyroxenite, abundance of magnetite and lack of orthopyroxene are characteristic of Alaskan-type ultramafic complexes (Nixon and Rublee, 1988). The ultramafic phase intrudes plagioclase-porphyritic andesitic flows tentatively correlated with the Stuhini Group.

The Trundle Creek ultramafic body comprises variably serpentinized, fine-grained pyroxenite. It is in fault contact with Permian limestone and is intruded by the megacrystic quartz diorite phase (Unit 5). The north-trending Endeavour Mountain body displays attributes of both the ultramafic bodies and metavolcanic rocks. Leucoxene was noted by Souther (1972) which led him to suggest a volcanic protolith.

Hickman Pluton

The composite Hickman pluton underlies an area of 300 square kilometres and is made up of three distinct phases as described below with the oldest first.

The **mafic phase (Unit 3)** is composed of a medium-grained, equigranular, hornblende gabbro and plagioclase-bearing hornblendite. The contact with the main phase is gradational locally and elsewhere mafic xenoliths (Unit 3) occur within the main phase.

The heterogeneous **main phase (Unit 4)** is the most extensive and is dominated by medium-grained, equigranular, dull grey hornblende-biotite granodiorite to quartz monzodiorite. Tonalite and quartz diorite are subordinate and their relationship to the main body is uncertain. Magnetite and rare titanite are accessory minerals. Late Triassic potassium-argon ages of 209±15 Ma (biotite) and 221±16 Ma (hornblende; Holbek, 1988) were determined for the main phase. It intrudes ultramafite, the mafic phase of the pluton, Stuhini Group volcanic rocks near Schaft Creek, and Middle Triassic sediments at the toe of the Scud Glacier.

Megacrystic quartz diorite (Unit 5) outcrops on the west margin of the Hickman pluton. It is a large intrusive body (12 square kilometres) that outwardly resembles the megacrystic quartz monzonite (Unit 6), however, the rectangular megacrysts, up to 5 centimetres long and comprising 60 to 80 per cent of the rock, are plagioclase, not potassium feldspar. Quartz (up to 20 per cent) and about 10 per cent hornblende, altered biotite and magnetite fill interstitial spaces between megacrysts.

The body intrudes ultramafic rocks along its western contact, however, the character of its eastern margin is uncertain. The body is at least spatially associated with the Hickman pluton. At one locality it has a gradational, poorly defined contact with the main phase (Unit 4) and in another it intrudes the mafic phase (Unit 3). It may be Late Triassic or Early Jurassic in age.

EARLY JURASSIC SUITE (UNIT 6)

MOUNT PERELESHIN STOCK

The Mount Pereleshin stock is a circular body, about 10 kilometres in diameter. It is composed of grey, medium-grained, porphyritic hornblende quartz monzonite to granite. Potassium feldspar megacrysts account for 20 to 40 per cent of the rock; anhedral quartz, 10 to 25 per cent, and fresh euhedral black hornblende and trace biotite, 10-20 per cent. Large titanite crystals, magnetite and apatite are distinctive accessory minerals. Fine-grained mafic inclusions are common. West of Mount Pereleshin this body is intruded by hornblende-biotite granodiorite of Unit 8.

BUTTERFLY CREEK PLUG

The Butterfly Creek plug is a small elongate body about 1 kilometre wide and less than 2 kilometres long, located northwest of the headwaters of Butterfly Creek. Foliated potassium feldspar megacrysts are abundant (up to 70 per cent), coarse grained (up to 5 centimetres) and distinctive. Epidotized and chloritized hornblende comprise less than 5 per cent of the rock. Disseminated pyrite and magnetite are important accessories locally. A mylonitic northeast margin and a commonly finer grained and chloritic selvage marks the contact with chloritic, foliated basement rocks of the Stikine assemblage.

A dyke-like polymictic intrusive breccia crops out on the northeast side of Butterfly Lake. It contains fragments of green, grey and black chert, granitic rocks and potassium feldspar crystals, in a dark green, chloritic matrix.

A biotite hornfels contact metamorphic aureole surrounds this intrusion and contains an altered metamorphic mineral believed to be relict andalusite(?); if so, shallow emplacement is indicated.

OKSA CREEK STOCK

The Oksa Creek stock is about 3 kilometres in diameter and is exposed in the headwaters of Oksa Creek. It is a massive, coarse to medium-grained crowded megacrystic quartz monzonite. Abundant potassium feldspar megacrysts (up to 60 per cent), hornblende (up to 25 per cent), coarse-grained titanite (up to 2 centimetres) and epidote (up to 5 per cent) are distinctive.

Similar orthoclase-megacrystic quartz monzonite to syenite stocks with aegirine-augite, biotite and garnet outcrop in the Galore Creek area to the south, where they are related to porphyry copper mineralization. Three potassium-argon ages for hydrothermal biotite from the main Galore Creek intrusive body range from 177 ± 18 to 201 ± 14 Ma (White *et al.*, 1968; all dates are recalculated using decay constants of Steiger and Jäger, 1977). Early Jurassic alkaline plutonism is associated with mineralization on a regional scale from Silbak Premier (Brown, 1987) northward to Sulphurets and Galore Creek. Although the alkaline intrusions in the project area are not hosted by Triassic or Jurassic volcanic rocks, they warrant further exploration.

MIDDLE JURASSIC SUITE

Three different intrusive phases make up the Middle Jurassic suite. Two phases, quartz diorite (Unit 7) and hornblende granodiorite (Unit 8), occur in the western and central parts of the map area. The third phase, the Yehiniko pluton (Unit 9), together with the adjacent Nightout and Hickman plutons, constitutes the Hickman batholith in the eastern part of the map area.

QUARTZ DIORITE (UNIT 7)

The oldest, most mafic and heterogenous phase of this suite is best exposed in an east-trending body south of Deeker Creek. It is composed mainly of medium-grained, equigranular biotite hornblende diorite to monzodiorite. Less common are mafic pegmatites and hornblendites, characterized by irregular dark patches of coarse-grained acicular hornblende (up to 3 centimetres), and scattered interstitial quartz, plagioclase and potassium feldspar.

A highly deformed contact between foliated diorite-amphibolite schlieren (Unit 7) and foliated limestone (Unit E) is exposed in the headwaters of Navo Creek; there the contact zone contains layers and pods of garnet and garnet-diopside skarn up to 75 metres from the contact.

HORNBLENDE BIOTITE GRANODIORITE (UNIT 8)

This intermediate phase is the most extensive and underlies 350 square kilometres of the southeastern and central parts of the map area. It is composed of mesocratic, medium-grained, equigranular hornblende-biotite quartz monzodiorite to granodiorite. Titanite is a ubiquitous accessory mineral. Miarolitic cavities are common near Mount Pereleshin. This phase is compositionally similar to, and difficult to distinguish from, the Nightout pluton, however, it is isotopically younger.

The contact with quartz diorite (Unit 7) is gradational south of Deeker Creek. Elsewhere, diorite occurs as angular xenolithic blocks in granodiorite, or intruded along joints by Unit 8.

Granodiorite intrudes and disrupts bedding and cleavage in basement limestone between Navo and Oksa creeks. Hornblende from the granodiorite phase east of Galore Creek has a discordant potassium-argon age of 197 ± 10 Ma (hornblende) and 120 ± 10 Ma (biotite; Panteleyev, 1976).

YEHINIKO PLUTON (UNIT 9)

The Yehiniko pluton outcrops over an area of 200 square kilometres and is composed of a medium-grained, equigranular, distinctive flesh to salmon-pink biotite hornblende granite. It is distinguished from the biotite granite (Unit 10) by its flesh to tan colour and higher mafic content, which includes hornblende. The rock contains 30 to 40 per cent quartz, 30 per cent potassium feldspar, 25 per cent plagioclase and 10 to 15 per cent mafic minerals. Plagioclase is moderately saussuritzed, unlike the inferred younger biotite granite (Unit 10). Magnetite and subordinate titanite are ubiquitous. Along the Scud Glacier, the pluton intrudes pyroxene-porphyritic Stuhini Group volcanic rocks on the east and the Nightout and Hickman plutons to the north and south, respectively. The Yehiniko pluton biotite has a potassium-argon age of 172 ± 12 Ma (Holbek, 1988).

EOCENE SUITE

Biotite Granite (Unit 10)

The youngest plutonic suite comprises biotite granite of about 350 square kilometres area in the central and western parts of the map area. It is composed of a medium to coarse-grained, equigranular to quartz-phyric, dull grey to pink, biotite granite. Quartz is commonly coarse grained and makes up 40 to 50 per cent of the rock: potassium feldspar, 30 per cent (locally forming megacrysts); plagioclase, 20 per cent; and biotite, less than 4 per cent comprise the balance. Miarolitic cavities filled with quartz, epidote and pyrite occur near Oksa Creek.

Limestone blocks within the granite are skarnified, foliated and exhibit two-dimensional, "chocolate tablet" boudinage at Mount Jonquette where exoskarn in limestone pendants and endoskarn within the intrusion are exposed. Biotite granite intrudes Stikine limestone in the headwaters of Oksa Creek where exoskarn (two garnet phases, diopside, epidote and wollastonite) extends up to 10 metres from the irregular contact. Boudinaged calc-silicate layers and pods in grey marble contain quartz cores surrounded by radiating wollastonite needles and an outer rim of diopside. Malachite-stained fractures occur near the contact, in both the limestone and intrusions.

The granite phase intrudes diorite (Unit 7) and granodiorite (Unit 8) north of Oksa Creek. Contacts are very irregular and distinguishing this phase from the pink granite of the Yehiniko pluton is often difficult; both have prominent joint sets.

Two small plugs south of Galore Creek, included in this phase, yielded potassium-argon ages of 48.9 ± 4 and 53.5 ± 4 Ma for biotite (Panteleyev, 1975 and 1976).

Feldspar-porphyritic Granodiorite (Unit 11)

A north-trending body of limonitic porphyritic granodiorite along the Scud River is elongate subparallel to a major fault. The body contains prominent white plagioclase laths in a fine-grained green groundmass. The rock is anomalous in its degree of fracturing and pervasive propylitic alteration relative to the other intrusions. Chlorite, sericite and pyrite are abundant. The granodiorite intrudes Permian limestone and apparently crosscuts the fault zone because postemplacement movement along the fault is minor.

The intense hydrothermal alteration and apparent structural control of the intrusion suggest it has mineral potential. The Trophy Gold property is located to the south (104G/3) along the same fault system. The age of this porphyry is unknown; it is tentatively grouped with the Tertiary suite, but may correlate with an unaltered granodiorite south of the Scud River (104G/3) that yielded an Early Jurassic age (White *et al.*, 1968).

DYKES

Dykes of different age, composition and orientation are abundant. Felsic dykes are the most prominent. A steeply dipping, north-striking felsic dyke swarm extends more than 20 kilometres from the headwaters of Navo Creek to Dokdaon Creek across an area 2 kilometres wide (Figure 1-29-2). The buff-weathering, quartz-phyric dykes are 1 to 7 metres wide. Some are flow banded and others are stained with manganese oxide on joint surfaces. These felsic dykes cut a swarm of vesicular basalt dykes in the Oksa Creek area. The vertical, north-striking mafic dykes are generally narrower, closer spaced and more uniform in width. The felsic dykes may be related to Eocene Sloko Group subaerial volcanic rocks exposed farther to the north.

East-trending, olivine(?)-pyroxene-porphyritic basalt dykes are generally less than 3 metres wide and form two major swarms up to 3 kilometres wide. The most significant exposures occur in the centre of the Hickman pluton and near the Yehiniko-Nightout pluton contact. In these areas, they intrude both Middle Jurassic and older plutonic rocks of the Hickman batholith and volcanic rocks of the Stuhini Group. These mafic dykes are probably Miocene or younger, and related to the Mount Edziza complex.

METAMORPHISM

Metamorphic grade ranges from lower greenschist in the Stikine basement unit to subgreenschist in the Stuhini Group. Chlorite-sericite-pyrite comprise the greenschist assemblage. Stuhini Group amygdaloidal basalts contain low pressure and temperature zeolites and, therefore, were never deeply buried. The timing of metamorphism is unconstrained in the study area.

STRUCTURE

Four structural domains are defined on the basis of fold geometry, foliation and bounding faults (Figure 1-29-3). These domains are a preliminary attempt to sort field data. In general, stratified rocks above the rusty argillite (that is, Permian and younger) are less deformed and lack the pervasive foliation found in the older rocks.

Domain I is confined to the basement and siliceous units and is characterized by a steep to vertical, northwest-striking chlorite-sericite foliation and upright, tight to isoclinal chevron folds that plunge gently to the southeast, as observed in Navo and Rugose creeks (Plate 1-29-2; Figures 1-29-4 and 1-29-5). Where folds are not visible, bedding-cleavage intersections indicate strata are tightly folded. The deformation accounts for at least 35 per cent shortening of the siliceous unit in the Rugose Creek area. Lithic fragments are flattened in the foliation plane with length-to-width strain ratios of 10 to 1.

Following this early deformation, a period of southwest-directed compression produced southwest-verging minor folds and reverse faults. Asymmetric west-verging, northwest-trending minor folds and crenulations occur near Oksa Mountain (Plate 1-29-3). Folds are distinctly southwest-verging near reverse faults. Locally beds are overturned to the southwest on the hangingwall of inferred thrust faults. Domain I appears to be an imbricated stack of southwest-directed thrusts involving basement and siliceous unit rocks crosscut on the west by intrusive rocks.

Domain II is characterized by apparently uniform, shallow to moderate easterly dips in the rusty argillite and limestone succession. In fact, the domain is complicated by east-dipping reverse (thrust?) faults, as in Domain I, and recumbent folds. A large recumbent syncline with S, Z and M-type minor folds can be followed along a cliff face for over 2 kilometres on the north side of Rugose Glacier. The upper limb is truncated by a fault inferred to be an east-dipping, west-directed thrust. Minor fault splays occur lower in the section. These thrusts are consistent with faults mapped by Souther (1972) in 104G/3, where Permian limestone overlies Middle Triassic shale and siltstone. The section was structurally thickened by folding and thrust faulting and beds were locally overturned. Common southwest-verging asymmetric minor folds (Plate 1-29-4) geometrically similar to Domain I, suggest that the entire sequence may be on the northeast limb of a larger anticlinorium, however, the southwest limb was not recognized.

The lower, western boundary of this domain is either an angular unconformity or a detachment fault between the often steeply dipping siliceous unit and the moderate northeast-dipping rusty argillite unit that is conformable with overlying Permian limestone. The upper, eastern boundary is largely covered by ice, but is interpreted to be a detachment between Domains II and III, which exhibit different fold styles.

Domain III forms a narrow zone of large, upright, open to tight, north-trending folds in the upper member limestone (Unit F), between Domain I and the north arm of the Scud

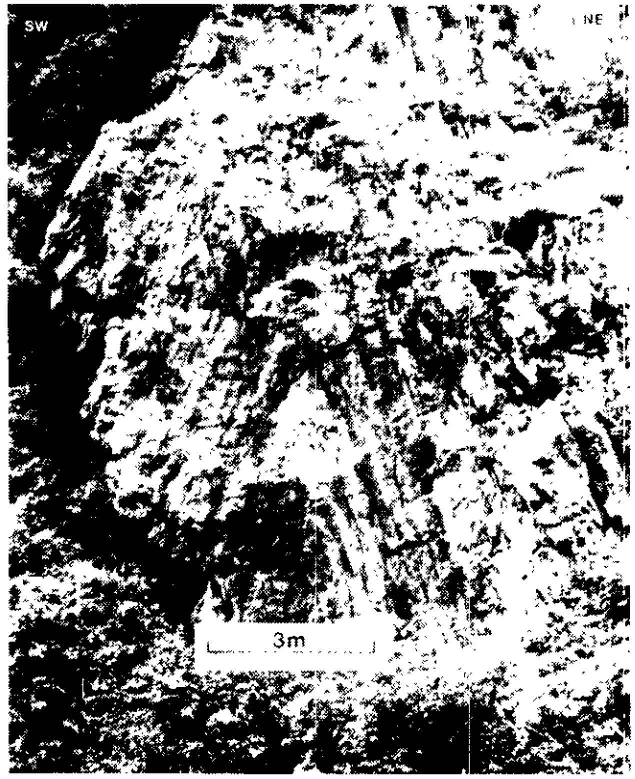

Plate 1-29-2. View southeast to tight, upright chevron fold that is characteristic of siliceous unit (Unit C) in structural Domain I.

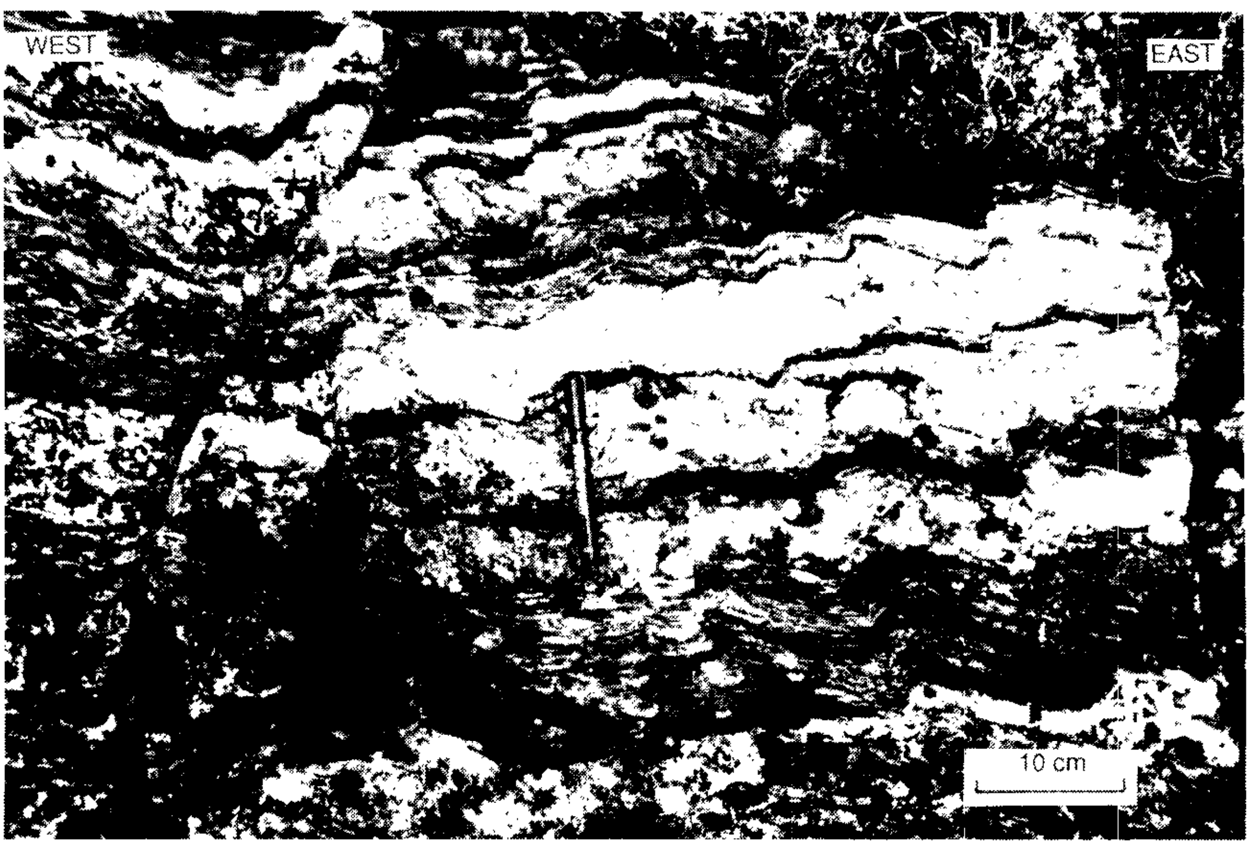

Plate 1-29-3. View north to west-verging, asymmetric minor folds in well-foliated silicic tuff of the volcanic facies (Unit A) in structural Domain I.

River. This zone is typified by folds with near-vertical axial planes and parasitic minor folds. Tight, north-trending folds are also common in the Tulsequah map area (Souther, 1971) and in the Mess Creek area (Holbek, 1988).

Domain IV comprises an open, gently northeast-plunging anticline cored by Permian limestone and Triassic strata, east of the Scud Glacier. Three kilometres further south, the limestone is deformed into asymmetric synform-antiform pairs disrupted by faults, interpreted to be southwest-directed reverse (thrust?) faults. The thrust faults, delineated by strongly foliated zones up to 2 metres wide, occur either within or above a Permian(?) limestone east of Scud Glacier. Folds adjacent to the thrusts are gently southeast plunging and southwest verging, with northeast-dipping axial planes. West-striking normal faults crosscut the thrust faults. Local, northeast-plunging tight syncline-anticline pairs involving Upper Triassic rocks extend as far as the Hickman pluton. Near the toe of the Trundle Glacier, a large, upright, tight southeast-plunging anticline is intruded by a border phase of the Hickman pluton, which itself is reverse faulted against limestone in the core of the anticline. The contractional deformation is post-Late Triassic, involving the Stuhini Group and border phases of the Hickman pluton.

Plate 1-29-4. View northwest to southwest-verging tight to isoclinal folds in lower limestone (Unit E) in structural Domain II.

FAULTING

Five sets of faults identified in the Scud River area include: (1) northeast-dipping reverse faults; (2) north-trending vertical faults; (3) steep to vertical, northwest-striking faults; (4) west-striking extensional faults; and (5) northeast-striking shear zones.

A northeast-dipping set of reverse faults in Domains I and II forms an imbricate stack of Stikine assemblage rocks. East of Scud Glacier mylonitic Permian limestone was thrust onto thinly bedded Permian(?) limestone, argillite and volcanics. Near Cone Mountain one of these faults juxtaposes basement volcanics and foliated granodiorite (Unit 8). Therefore, the deformation is probably post-Early Jurassic. Platy, planar mylonites are associated with ductile faults. Foliated intrusions associated with reverse faults have a penetrative biotite and/or chlorite foliation.

North-trending vertical to steeply east-dipping normal faults separate Permian limestone from Stuhini Group volcanics near the toe of Scud Glacier and extend south to Sphaler Creek (104G/3). The coplanar Mess Creek fault zone, 30 kilometres to the east, was active from Early Jurassic to post-Pleistocene (Souther and Symons, 1974).

Northwest-striking faults occur along the Scud River valley and some predate the north-trending set (Souther, 1972).

Narrow west-striking extensional fault zones are subvertical or dip gently to the north. North-side-down motion on the faults postdates the north-trending faults and northeast-dipping thrust faults east of Scud Glacier. In Trundle Canyon a prominent west-striking fault with horizontal slickensides juxtaposes Permian limestone with quartz monzonite of the Hickman pluton.

The youngest faults in the Scud River area are **northeast-striking shear zones** that are more common to the south. Mineralization at the Trophy Gold property (104G/3) appears to be associated with the intersection of the small shears and major north-trending faults (D.B. Forster, personal communication, 1988).

BRITTLE EXTENSION

Localized Tertiary east-west extension is evident from a prominent steeply dipping, felsite dyke swarm in the Oksa and Navo Creek areas (Figure 1-29-2). Older north-south extension is indicated by a prominent east-striking swarm of basalt dykes in the Hickman batholith that predates the Tertiary rhyolite dykes but must be post-Middle Jurassic.

DEFORMATION OF INTRUSIONS

In general, intrusions are massive unfoliated bodies with steep contacts. Along Oksa Creek, pluton intrusion either crosscut moderately dipping, little-deformed limestone or induced bedding-parallel cleavage in limestone whose orientation changes with proximity to the granodiorite contact. Other structures in intrusive rocks are scattered, narrow (less than 1 metre wide), east-trending ductile and brittle shear zones superimposed on massive granitoids west of the Stikine River.

STRUCTURAL SYNTHESIS

The marked structural discordance between Domains I and II suggests a pre-Permian deformational event that folded and cleaved the basement and siliceous units prior to limestone deposition. Two phases of deformation are assumed, based on fold geometry and orientation, although no interference patterns were observed. Farther south, near Sphaler Creek, there is evidence of a post-Mississippian, pre-Permian unconformity (Souther, 1972) that supports this interpretation.

The ages of deformation are poorly constrained and are difficult to correlate regionally. In the Grand Canyon of the Stikine River, 50 kilometres to the north-northeast, there is an older north-northeast and a younger west-northwest structural trend (Gabrielse *et al.*, in preparation). Middle Jurassic (Toarcian to Bajocian) southwest-directed folding and thrusting of the Upper Triassic King Salmon assemblage in the Cry Lake map area has been documented by Thorstad and Gabrielse (1986). Pre-Early Cretaceous east-northeast-trending folds are found in the northwest corner of the Bowser Basin (Gabrielse *et al.*, in preparation). Evenchick (1986) identified Cretaceous to Early Cenozoic northeast contraction in the Bowser and Sustut basins.

Souther (1972) used the term "Tahltanian orogeny" to describe a Permo-Triassic event that deformed Middle Triassic and older rocks. A pre-Permian thermal event is evident in conodont colour alteration indices greater than 5 for Permian and older strata and less than 5 in Triassic and younger rocks (Anderson, 1988). The presence of fusulinid-bearing limestone boulders in Upper Triassic conglomerate suggests the Paleozoic section was eroded in the map area.

GEOCHEMISTRY – STREAM SEDIMENT SAMPLING

Data from the 1987 Regional Geochemical Survey (RGS) were released for the Telegraph (104G) and Sumdum (104F) map sheets in July 1988 and include analyses of 136 silt and water samples collected from within the project area (Figure 1-29-3).

Arbitrarily determined anomalous samples fall in the 90th percentile and higher for the entire sample population for each element on both the Telegraph and Sumdum map sheets. Known deposits in the area such as Galore Creek and Schaft Creek display strong stream-sediment signatures. In addition, many multi-element anomalies are present in little-explored and unstaked areas.

Precious metal anomalies are scattered. Only five stream sediment samples are anomalous in gold, and only one of these is anomalous in other base or precious metals. The highest gold value (258 ppb) came from a sample on Christina Creek in the southwest corner of the map area where an Eocene pluton outcrops. Samples along this creek are also anomalous in barium, tungsten and molybdenum. Anomalous gold, silver, arsenic, lead, cadmium, tungsten and molybdenum values at the head of Dokdaon Creek are one of the strongest multi-element anomalies in the map area. The area is underlain by Middle Jurassic granodiorite (Unit 8) and the mineralization located on the Marg claims (MINFILE 104G 058, 089) may be the anomaly source.

Several other significant multi-element anomalies are located east of the toe of the Scud Glacier, in the middle reaches of Oksa and Schaft creeks, and near the headwaters of Hickman and Yehiniko creeks.

Samples along Yehiniko Creek at the northern edge of the project area are anomalous in silver, arsenic, antimony, copper, lead, cadmium, tungsten and cobalt. The stream drains an area underlain by Upper Triassic volcanic rocks and the anomalies may be associated with the Yehiniko East copper showing (MINFILE 104G 111) located farther upstream. Midway up Oksa Creek there are several samples anomalous in silver, arsenic, lead, barium, cadmium, tungsten, tin and fluorine. This area is underlain primarily by basement volcanic rocks (Unit A) near the contact with several different plutonic bodies.

West of the toe of the Scud Glacier, two sample sites are anomalous in silver, lead, cadmium, tin and molybdenum. This area is underlain by Upper Triassic sedimentary and volcanic rocks and Permian limestone with a major north-trending fault juxtaposing the units. On Schaft Creek there are several very strong multi-element anomalies. These sites are anomalous in arsenic, copper, lead, zinc, barium, tungsten and molybdenum. The area is underlain by both the Yehiniko and Nightout plutons, near their eastern contact with Upper Triassic volcanic rocks. These samples occur 10 kilometres north of the Schaft Creek porhyry copper deposit.

The two ultramafic bodies associated with the Hickman pluton have strong nickel-cobalt anomalies. On lower Trundle Creek, the samples are also highly anomalous in arsenic and antimony. This area contains numerous north-trending faults juxtaposing and crosscutting Permian and Triassic strata and the Hickman ultramafic body. East of Mount Hickman, near the headwaters of Hickman Creek, two samples are highly anomalous in nickel and cobalt and probably reflect the Hickman mafic and ultramafic phases outcropping to the west. These samples however, are also anomalous in silver, arsenic, antimony and tin. The area is underlain by Upper Triassic volcanic rocks near the eastern contact of the Hickman pluton.

The study area contains one-third of all samples from the Sumdum and Telegraph sheets that are anomalous in tungsten. Fluorine and uranium anomalies occur almost exclusively within Lower and Middle Jurassic and Eocene plutonic rocks in the western half of the project area. This may provide a useful geochemical signature for differentiating these plutonic suites from the Hickman batholith. There are no mercury anomalies and only two vanadium anomalies.

MINERALIZATION

The project area lies within a metallogenic belt that hosts precious and base metal deposits from Alice Arm north to the Taku River, along the eastern margin of the Coast Belt. The remoteness and rugged topography are key factors influencing the economics of exploration in the Scud River area.

Prospectors first came into the Stikine River valley in search of placer gold during the late 1800s. Activity peaked during the early 1860s, however, production was insignificant. During the early 20th century, attention turned to the

TABLE 1-29-2
SUMMARY OF MINFILE OCCURRENCES (104G/5 AND 6)

Number (104G)	Name	Commodity	Economic Minerals	Deposit Type	Description
006	ALBERTA	Cu	Cpy, Mt	Vein	The showing is hosted in a small pendant of Stuhini Group mafic flows and pyroclastics within the Hickman pluton. Chalcopyrite and magnetite occur as fracture fillings with minor malachite.
014	BEN	Mo, W, Ag,	Mo, Cpy, Py, Tet	Vein/Stck	Showing is hosted in a large felsic Tertiary(?) dyke hosted in Eocene biotite granite. Pervasive silica, manganese and sericite alteration host molybdenite, chalcopyrite, pyrite, and tetrahedrite stockworks.
030	NABS 21	Cu	Cpy, Bo	Stck/Dis	Showing is hosted mainly in silicified and chloritized quartz monzonite of the Yehiniko pluton near the contact with the Stuhini Group. Finely disseminated chalcopyrite and lesser bornite occur.
031	NABS 13	Cu	Cpy, Bo	Stck/Dis	Showing is hosted largely in fractured Stuhini Group volcanic rocks near quartz monzonite of the Yehiniko pluton. Stringers of chalcopyrite and lesser bornite occur.
032	NABS 30 FR	Cu, Au Mo	Cpy, Bo, Mo, Py	Stck/Dis	Prospect located immediately north of the Liard copper deposit is hosted mainly in Stuhini Group volcanics near the Yehiniko pluton. Stringers and disseminations of chalcopyrite and bornite occur.
037	HICKS	Cu, Mo	Bo, Cpy, Mo, Py	Stck/Dis	Showing is hosted mainly in Stuhini Group volcanics near the eastern margin of the Hickman pluton. Blebs, stringers and disseminations of pyrite, chalcopyrite, bornite, and lesser molybdenite occur.
054	MOUNT HICKMAN	Asb	Asb	Repl	Showing occurs near the southeast margin of the mafic/ultramafic phase of the Hickman pluton. Narrow seams of antigorite occur in pyroxene gabbros and olivine pyroxenites.
055	MIDDLE SCUD	Cu, Ag	Tet, Agt Cpy	Podiform	Showing occurs within the Trundle Creek ultramafic body along its eastern fault contact with Permian limestone and argillite. Pyroxenite hosts a 75 cm long pod of massive tetrahedrite and chalcopyrite.
056	NORTH SCUD	Cu	Cpy, Bo,	Podiform	Showing occurs within Stuhini Group andesite tuff and breccia near the western margin of the Hickman pluton. Small lenses up to 25 cm long consist of massive chalcopyrite, bornite, and magnetite.
058	MARG WEST	Au, Ag, Cu, W, Mo, Pb	Cpy, Mo, Sch, Gln	Stck	Showing occurs in a 300 by 600 metre pendant of Stuhini Group volcanic breccia within Middle Jurassic granodiorite. Narrow quartz veinlets <10 cm wide occur over a width of 100 metres and contain chalcopyrite, molybdenite, pyrite, scheelite, and minor galena.
062	COS	Cu	Cpy, Bo	Stck	Showing occurs at the contact of pre-Permian limestone with Lower Jurassic orthoclase-megacrystic granite. Mineralization consists of chalcopyrite and bornite stringers within a large skarn zone.
063	LATE	Cu, Au	Cpy, Bo, Ply	Stck/Dis	Showing occurs on a sheared contact between the Yehiniko pluton and flows and pyroclastics of the Stuhini Group. Sulphides consist of pyrite, chalcopyrite and bornite as stringers and disseminations.
075	GU	Cu, Pb, Zn, Mo, W	Cpy, Gln, Sphl, Mo, Sch	Stck	Showing occurs in a small volcanic pendant within a large body of Middle Jurassic granodiorite. Sulphides occur in narrow quartz veinlets within prominant northwest joint sets and consist of chalcopyrite, galena, sphalerite, molybdenite, and rare scheelite.
078	ARC, POST	Cu	Cpy, Bo, Cc, Py	Vein/Dis	Mineralization occurs within purple pyroclastics of the Stuhini Group and along shears within the Yehiniko pluton. Sulphides comprise chalcopyrite, bornite, chalcocite and pyrite as stringers and blebs.
084	GU NORTH	Cu	Cpy	Vein	Showing occurs in a small volcanic pendant within a large body of Middle Jurassic granodiorite. Narrow quartz veinlets peripheral to a 1.5 metre wide ankerite vein contain trace chalcopyrite.
089	MARG EAST	Au, Ag, Cu, W,	Cpy, Py	Vein/Alt	Showing ocurs at the sheared contact of a Stuhini Group volcanic pendant within a Middle Jurassic granodiorite body. Chalcopyrite and pyrite occur in zones of pervasive silica and epidote alteration.
111	YEHINIKO EAST	Cu	Unknown	Unknown	Occurrence comprises unspecified copper mineralization (Souther,1972) along large, possibly fault-controlled alteration zones along the contact of Stuhini Group volcanics and the Yehiniko pluton.

Abbreviations: Alt = Alteration; Agt = Argentite; Asb = Asbestos; Bo = Bornite; Cc = Chalcocite; Cpy = Chalcopyrite; Dis = Disseminated; Gln = Galena; Mo = Molybdenite; Mt = Magnetite; Py = Pyrite; Repl = Replacement; Sch = Scheelite; Sphl = Sphalerite; Stck = Stockwork; Tet = Tetrahedrite; W = Tungsten.

lode deposits (Kerr, 1948a). By the late 1950s the search for asbestos around Mount Hickman had resulted in the discovery of significant copper deposits near Schaft Creek and later Galore Creek. The Silbak Premier, Snip, Sulphurets, Johnny Mountain and Golden Bear projects are prime examples of more recent development of precious metal deposits in the belt (Figure 1-29-1).

MINERAL PROSPECTS

There are 19 known mineral occurrences (16 recorded in MINFILE) and one major prospect in the map area (Table 1-29-2; Figure 1-29-3). Exploration activity was moderate in 1988; Continental Gold Corporation drilled its Trophy Gold property (104G/3). The Regional Geochemical Survey release stimulated additional staking and grassroots exploration. Following are brief descriptions of the important mineral prospects.

SCHAFT CREEK PORPHYRY COPPER-MOLYBDENUM DEPOSITS (MINFILE 104G 090, 099)

The Schaft Creek (Liard Copper) deposits on the eastern side of Schaft Creek were staked in 1957 and have been explored by Silver Standard Mines Ltd., American Smelting and Refining Company, Hecla Mining Company and Teck Corporation. Up to 1975, about 34 500 metres of surface diamond drilling in 115 holes had been completed (Fox *et al.*, 1976). The deposit geology is reviewed by Linder (1975) and Fox *et al.* (1976).

Ninety per cent of copper mineralization (Linder, 1975) is hosted in Stuhini Group volcanic rocks and 10 per cent in felsic dykes and quartz feldspar porphyry correlated with the Early Jurassic Yehiniko pluton. Mineralization is dominantly fault and fracture controlled, and is discordant to volcanic strata. A whole-rock potassium-argon age for mineralized rocks with hydrothermal biotite yielded 185 ± 10 Ma (recalculated with decay constants of Steiger and Jäger, 1977; from Panteleyev and Dudas, 1973), which may indicate the age of mineralization. Ore reserves are 330 million tonnes of 0.40 per cent copper and 0.036 per cent molybdenum with an open-pit stripping ratio of 1.5:1. Precious metal values are estimated at 0.32 gram gold and 1.5 grams silver per tonne (Fox *et al.*, 1976).

BEN OCCURRENCE (MINFILE 104G 019)

The Ben porphyry molybdenum-copper occurrence is located at the headwaters of Deeker Creek, west of the Stikine River. The property was explored in 1962, 1963 and 1971 when about 1150 metres of surface diamond drilling in six holes was completed by Dictactor Mines Limited. The occurrence consists of a zone, up to 1000 metres wide, of argillic, silicic and manganese alteration associated with a fine-grained felsic intrusion of probable Tertiary age and a medium-grained biotite granite (Unit 10). The zone is clearly visible as a huge limonitic stain zone. The showing consists mainly of quartz stringers and disseminations of molybdenite with lesser chalcopyrite, pyrite and tetrahedrite.

MARG WEST AND MARG EAST (MINFILE 104G 058, 089)

The property is located at the headwaters of Dokdaon Creek (Figure 1-29-3) and consists of two prominent limonitic stain zones related to Tertiary(?) felsite dykes that intrude massive biotite hornblende granodiorite (Unit 8). The property was staked in 1958 and mapped in 1980 and 1981 by Teck Corporation. Since then, little work has been done. Isolated pendants of Stuhini Group(?) heterolithic volcanic breccia outcrop along the creek that drains the main showing. Massive, north-trending magnetite-pyrite lenses and pods, up to 5 metres long, parallel the dyke contact. Northwest-striking quartz veins contain pyrite, chalcopyrite, molybdenite, scheelite and minor galena (Folk, 1981).

NEW SHOWINGS

Two types of mineralized boulders were found in Deeker Creek south of the Ben prospect, in the course of this study. The first consisted of rusty weathering, semimassive to massive pyrite layers in fine-grained white vuggy quartz. The second was a vuggy quartz-carbonate vein and breccia with disseminated chalcopyrite, galena and pyrite, and stained with manganese oxide. The source of these rocks is not known. The Ben occurrence is also characterized by weathered surfaces stained with manganese oxide but none of the drill core contained copper and lead mineralization of comparable grade.

At the headwaters of Rugose Creek there is an abundance of skarn material in glacial outwash. The boulders are malachite-stained, limonitic, fine-grained garnet-actinolite rock with disseminated pyrite, with or without magnetite and minor chalcopyrite. The Rugose Glacier overlies the contact of limestone with granodiorite (Unit 8), the probable source area for the float.

Several narrow, buff-weathering, siderite-quartz-pyrite veins and brecciated veins cut green siltstone and amphibolite east of the Scud Glacier. The veins are less than 10 centimetres wide. Similar but more strongly foliated veins with green mica occur along shears within or adjacent to the ultramafic and mafic units. These veins (listwanites) have an untested but potential association with gold mineralization.

AGES OF MINERALIZATION

Limited data suggest Early Jurassic and Tertiary ages of mineralization. Potassium-argon dates for hydrothermal biotite associated with mineralization at Galore and Schaft creeks range from 177 to 201 Ma and about 185 Ma, respectively (White *et al.*, 1968; Panteleyev and Dudas, 1973). These ages indicate an empirical association of mineralization with Lower Jurassic alkaline intrusions and coeval volcanic rocks. Galena from the Trophy property has radiogenic lead isotope signatures typical of Tertiary deposits (J.E. Gabites, personal communication, 1988), which may indicate the approximate age of mineralization.

MINERAL POTENTIAL

The rugged and remote aspect of the study area has hindered mineral exploration. The geological setting is favourable for: (1) calcalkaline porphyry copper-molybdenum deposits (Schaft Creek); (2) alkalic porphyry copper-gold deposits (Galore Creek); (3) porphyry molybdenum deposits (Ben); (4) structurally controlled epigenetic precious metal deposits (Golden Bear and Trophy Gold properties); (5) precious metals in carbonate veins associated with listwanites; (6) skarns; (7) volcanogenic massive sulphides; (9) sediment-hosted massive sulphides in the rusty argillite unit; and (9) platinum-group elements in Alaskan-type ultramafic rocks. However, even Galore Creek is currently subeconomic because of the infrastructure costs in this remote area.

SUMMARY

Preliminary conclusions based on one field season of geological mapping are:

- The Stikine assemblage north of the Scud River comprises six mappable units.
- Middle Triassic sedimentary rocks are overlain with structural conformity by Upper Triassic Stuhini Group rocks.
- Four plutonic episodes are evident, each contains various phases.
- Pre-Early Permian deformation and possibly lower greenschist grade metamorphism is apparent in Domain I.
- Southwest-verging minor folds are characteristic of Domains I and II and indicate pre-Triassic(?) southwest-directed compression.
- Permian, Middle Triassic and Late Triassic rocks are structurally conformable at the toe of the Scud Glacier.
- Three new mineral occurrences were located and the area warrants additional mineral exploration.

ACKNOWLEDGMENTS

We would like to thank Continental Gold Corporation for its logistical support, and Vancouver Island Helicopters, Fly West Air and Dease Lake Expediters for their services. Michael McDonough and David Carmichael were excellent assistants who contributed to the success of the field season. C. Grieg helped prepare mineral separates for potassium-argon dating at The University of British Columbia. R.G. Anderson and D. Lefebure reviewed the manuscript and provided helpful comments.

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