GEOLOGY OF THE USLIKA LAKE AREA, NORTHERN QUESNEL TROUGH, B.C. (94C/3, 4, 6)*

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KEYWORDS: Regional geology, Quesnel trough, Cassiar Terrane, Harper Ranch Terrane, Slide Mountain Terrane, Quesnel Terrane, Hogem batholith, Uslika Formation, Sustut Group, strike-slip faults, metamorphic rocks, porphyry copper-gold, carbonate-hosted lead-zinc.

INTRODUCTION

The Aiken Lake project is a 1:50 000-scale mapping program under the Canada - British Columbia Partnership Agreement on Mineral Development (1991-1995) and is located in the northern Quesnel trough. It will consist of three years of field mapping, covering an area centred on Aiken Lake and extending southward to Uslika Lake and northward to Johanson Lake (Figure 1-11-1). The mapping will focus on the northernmost limit of Mesozoic volcanics within the Quesnel trough, Upper Paleozoic oceanic volcanics and sediments, and Lower Paleozoic carbonates. The area has known porphyry copper-gold occurrences, carbonate-hosted lead-zinc mineralization and the potential for economic mineral concentrations. The project will provide geological base maps that will detail the geology and facilitate the search for new mineral occurrences. Other goals are to update the mineral inventory data base and place known mineral occurrences within a geological framework. To assist in achieving these objectives, stream-sediment samples were collected from creeks in the map area and analysed according to Regional Geochemical Survey (RGS) procedures. Lithogeochemical samples of prospective lithologies were also collected.

During the 1991 field season, mapping was concentrated near Uslika Lake and included most of map sheet 94C/3 and parts of map sheets 94C/4 and 94C/6. The centre of the map area is located approximately 200 kilometres north of Fort St. James (Figure 1-11-1). Road access is by the gravel, all-season Omineca mining access road from Fort St. James, or a similar forestry access road which originates at the southern end of Williston Lake. These roads follow the Osilinka and Tenakihi drainages and connect to numerous secondary logging roads in the area. Approximately 50 per cent or more of the area will be accessible by logging roads by the end of 1991.

The map area is contiguous with that of the Manson Creek mapping project (Ferri and Melville 1988, 1989, 1990a and b, in preparation; Ferri *et al.*, 1988, 1989). This

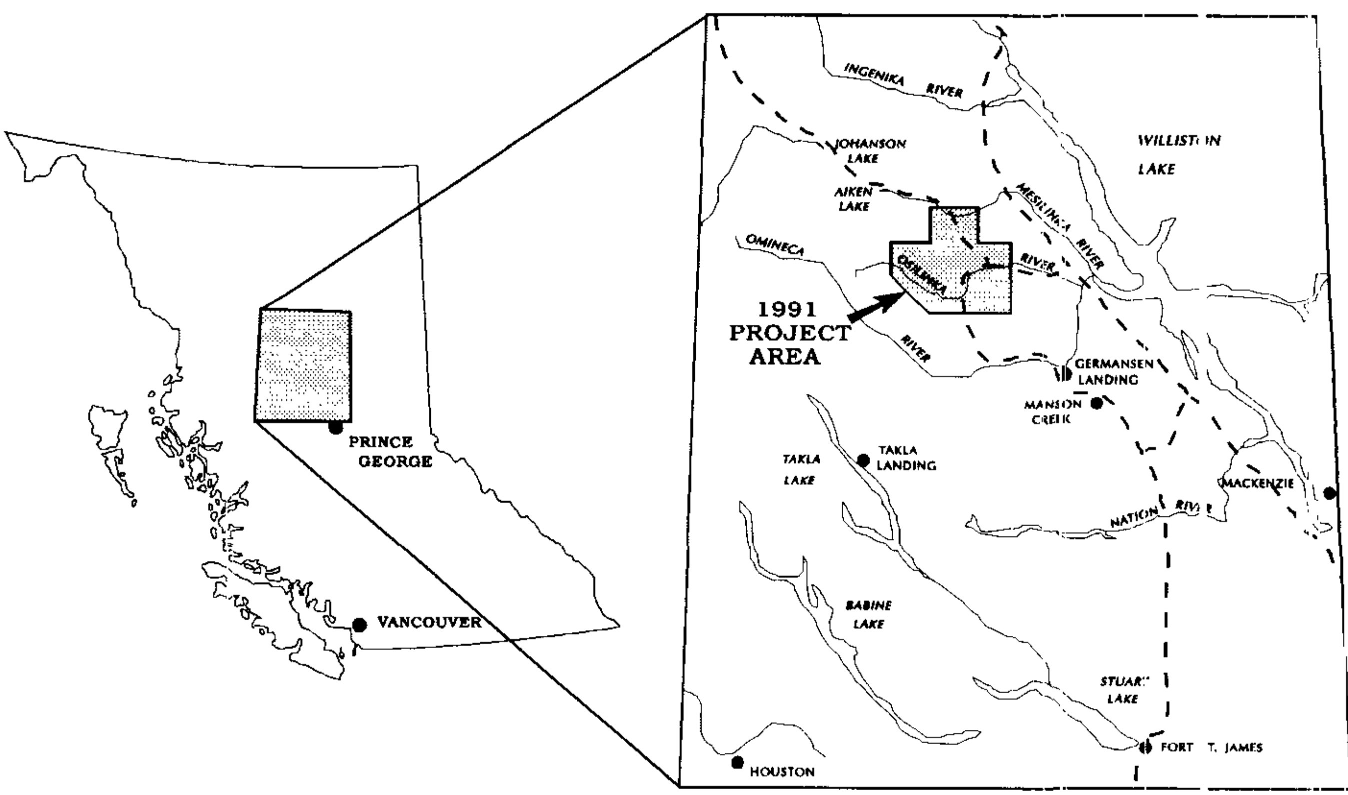

Figure 1-11-1. Location of the map area.

* Canada - British Columbia Partnership Agreement on Mineral Development.

work represents the most recent geological material published for the area. Initial mapping of the Aiken Lake region was carried out by Roots (1954) at 4-mile scale. The east half of the Mesilinka sheet was mapped by Gabrielse (1975) and mapping to the south was published at 6-mile scale by Armstrong (1949). Detailed geological studies of Paleozoic rocks within the map area were completed by Monger (1973) and Monger and Paterson (1974) and were summarized, in part, by Monger (1977). Garnett (1978) carried out an in-depth study of the southern Hogem intrusive complex and Meade (1975) mapped Takla Group rocks in the Germansen Lake area.

REGIONAL GEOLOGY

The project area straddles the boundary between the Intermontane and Omineca tectonostratigraphic belts of the Canadian Cordillera. It is underlain by accreted volcanic rocks of the Intermontane Superterrane and displaced rocks of North American affinity (Wheeler and McFeely, 1987, Figure 1-11-2).

Parts of at least four terranes are present in the map area. The easternmost are displaced continental rocks of the Cassiar Terrane. To the extreme west lies the Mesozoic island-arc terrane of Quesnellia. These are separated by two Upper Paleozoic terranes; the volcanic(arc?)-sedimentary Harper Ranch Terrane and the oceanic Slide Mountain Terrane.

Strata of the Cassiar Terrane include the Upper Proterozoic Ingenika Group through to the Devono-Mississippian Big Creek Group. The rocks are predominantly clastic with carbonates more abundant higher in the stratigraphy. The structurally and stratigraphically lower parts of this sequence are polydeformed and metamorphosed to sillimanite grade and outcrop as core complexes (Wolverine, Butler).

The Slide Mountain Terrane to the west lies structurally above the Cassiar Terrane. It is represented by the Pennsyl-

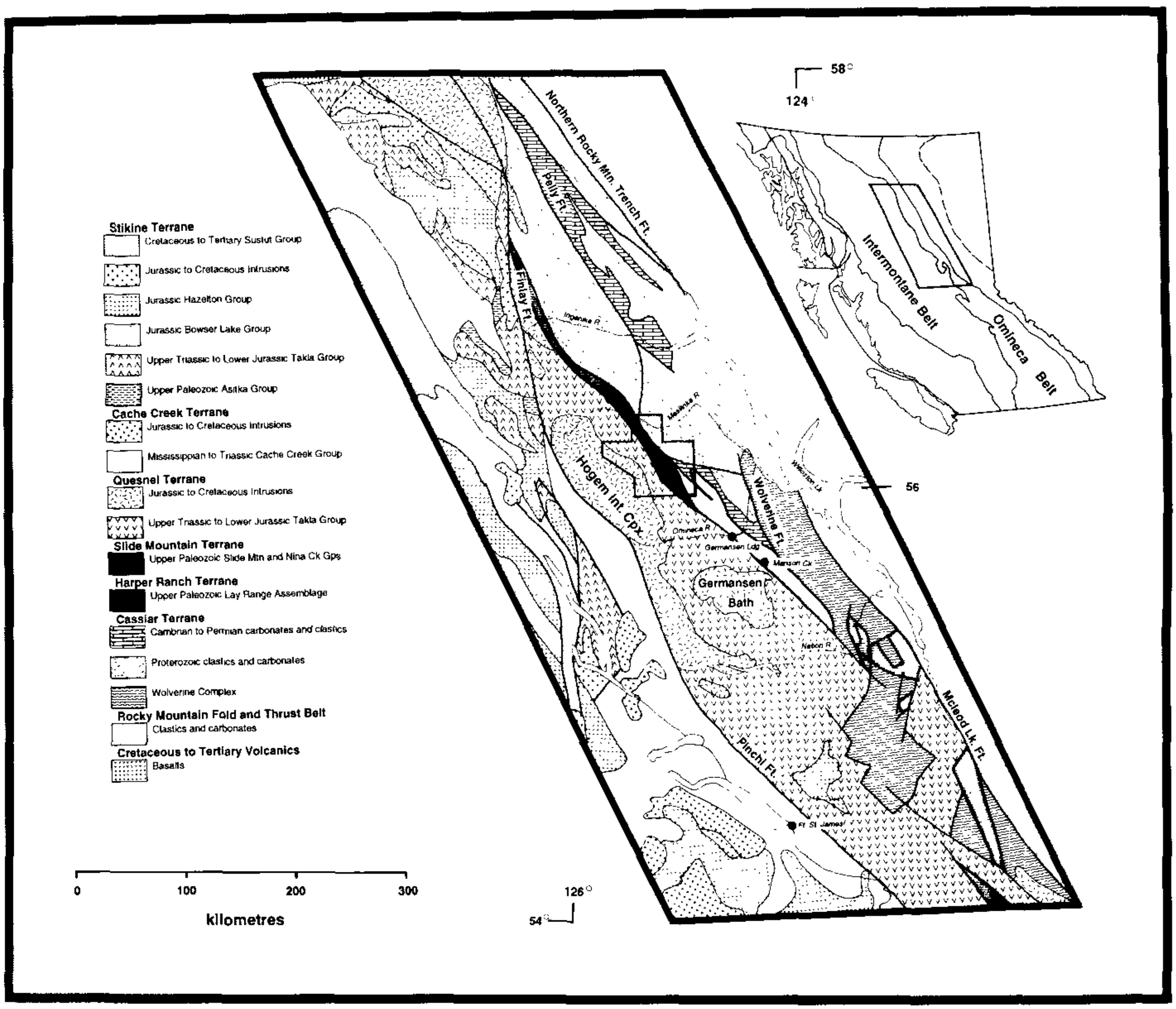

Figure 1-11-2. Regional geological setting of the Uslika Lake map area.

vanian to Permian Nina Creek Group (Ferri and Melville, in preparation). This package is composed of oceanic volcanic and sedimentary rocks (pillow basalts and cherty sediments) which have been thrust onto North American rocks.

The Quesnel Terrane is represented by the Upper Triassic to Lower Jurassic Takla Group (Roots, 1954). This is a volcanic and sedimentary arc sequence which is intruded along its western margin by the Triassic to Cretaceous Hogem intrusive complex (Garnett, 1978) and related intrusions. The eastern part of Quesnellia is further subdivided, in this area, into the Harper Ranch Terrane (Wheeler and McFeely, 1987). This terrane is represented by the enigmatic Upper Paleozoic Lay Range assemblage, a package of volcanic and sedimentary rocks with predominantly arc affinities. Traditionally it has been included with the Quesnel Terrane but in the study area it displays links with the Nina Creek Group and contains sedimentary rocks of continental origin.

STRATIGRAPHY

Descriptions of layered rocks are organized by terrane, beginning with rocks of North American affinity, and ending with the overlap assemblages that postdate accretion of the Intermontane Superterrane to the craton (Figure 1-11-3; Table 1-11-1).

North American Cassiar Terrane

INGENIKA GROUP (LATE PROTEROZOIC)

Proterozoic rocks in the map area were originally subdivided into two units by Roots (1954): the lower Tenakihi Group and the succeeding Ingenika Group. Subsequent workers in the area found the differences between the two units too ambiguous and proposed that use of the term Tenakihi Group be dropped and that all Proterozoic rocks in the area be included in the Ingenika Group (Mansy and Gabrielse, 1978). Furthermore, Mansy and Gabrielse proposed a four-fold subdivision for the Ingenika Group which is, in ascending order, the Swannell, Tsaydiz, Espee and Stelkuz formations. All four formations are recognized in the study area. Rocks originally termed the Tenakihi Group by Roots are equivalent to the upper part of the Swannell Formation whereas Roots' succeeding Ingenika Group equates to the Tsaydiz, Espee and Stelkuz formations.

The Ingenika Group is areally the dominant unit of the Cassiar Terrane exposed in the Uslika Lake area. It occupies the north and northeastern parts of the map. Its thickness is unknown, due to poor structural and stratigraphic control, but it is estimated to be at least several kilometres thick if the ridge on Beveley Mountain represents a continuous sequence of lower Swannell clastics. It is composed of quartz and feldspathic wackes, impure quartzite, sandstone, siltstone, slate, limestone and their metamorphosed equivalents. The Ingenika Group was examined in a cursory manner in the course of this study, and the following observations were made.

Swannell Formation

The Swannell Formation was examined along the ridges east and west of Beveley Mountain. These rocks form the southwest flank of a broad F_3 anticline. They appear to comprise an uninterrupted southwest-dipping panel with an estimated thickness of 1.5 kilometres or more. They are faulted against the upper part of the Ingenika Group to the southwest. The Swannell Formation in this area consists of grey to tan, thin to thickly bedded impure quartzite in sequences several metres thick, interlayered with lesser, thin to moderately bedded garnet-bearing biotite-muscovite-feldspar-quartz schists. The impure quartzite contains up to 20 per cent feldspar and mica. The schists are commonly chloritized and contain a weak to moderate crenulation.

This unit is very similar to the upper part of the Swannell Formation described farther south in the Nina Lake area (Ferri and Melville, 1990; in preparation). To the south the upper Swannell is estimated to be only 300 metres thick whereas it is some 1500 metres thick at Beveley Mountain. This suggests tectonic thickening (which is entirely possible considering the monotonous nature of the lithologies and the polyphase deformation which has affected these rocks) or stratigraphic thickening to the northwest.

Tsaydiz Formation

The Tsaydiz Formation was observed in only a few localities; along the north side of the Osilinka River south of Beveley Mountain and northwest of Jim May Creek in a possible southwesterly overturned panel of rock.

It consists of greenish grey to dark grey slates and phyllites, interlayered with thinly bedded, buff to brown-weathering limestone to calcareous phyllite. Green-grey sandstones and siltstones, blue-quartz-bearing feldspathic wackes and buff-brown-weathering, blue-grey impure laminated limestone are of lesser importance.

The thickness of the unit is not known as it was mapped only in scattered outcrops below timberline and its basal contact is not observed. Structural sections in the Beveley Mountain area suggest a minimum thickness of 200 metres.

Espee Formation

The Espee Formation is well exposed in a northwest-plunging fold pair along a ridge immediately southwest of Beveley Mountain. A thick, northeast-dipping carbonate unit northwest of Jim May Creek has also been tentatively assigned to the Espee Formation. The formation is composed of thin to moderately bedded, tan to buff-weathering, dark grey to white or mottled limestone and dolomitic limestone which in some localities is coarsely recrystallized to a white marble. Very thin phyllite laminae (less than 2 mm) sometimes separate the limestone into layers. The Espee Formation is at least 400 metres thick in the Beveley Mountain area.

Stelkuz Formation

The Stelkuz Formation is poorly exposed on the southwest flank of Beveley Mountain, on the down-thrown side of the Camp fault. It is composed of green-grey, crenulated phyllite to quartzitic phyllite or schist, sometimes interlayered with impure quartzite beds up to 20 centimetres thick. White to bluish grey, clean limestone with micaceous partings is also found in this area and can be several metres

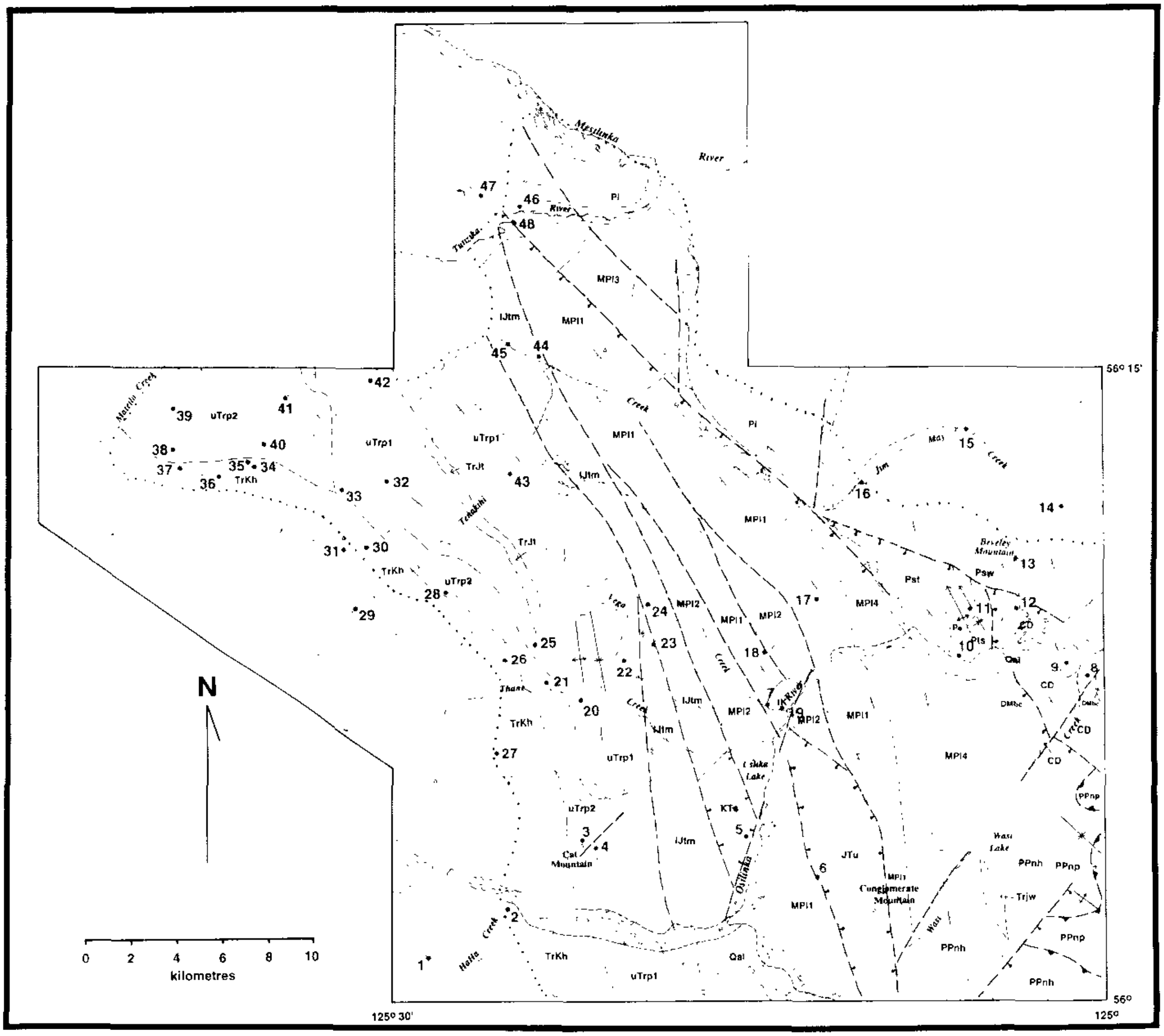

Figure 1-11-3. Geology of the map area including location of mineral occurrences.

thick. Dark blue-grey to black graphitic phyllite, slate and fine siltstone, approximately 100 metres thick, are exposed west of Beveley Mountain in the hangingwall of the Camp fault. This lithology is not typical of the Stelkuz Formation or other formations in the Ingenika Group but has been placed within the Stelkuz Formation due to its position on the northeast side of southwest-side-down normal fault along the lower parts of the Tenakihi Creek valley. This fault separates rocks of the Cassiar and Harper Ranch terranes.

PALEOZOIC SUCCESSION

A succession of Paleozoic carbonate and clastic rocks, upwards of 2 kilometres thick, is exposed in the northeastern part of the map area, and spans the Early Cambrian to Early Mississippian time periods. Areally these rocks are of minor importance in the map area, but locally and regionally, they contain significant lead-zinc-silver deposits within several of the carbonate horizons. Carbonate rocks of this succession were originally equated with the Cache Creek Group by Roots (1954) and Armstrong (1949). Monger (1973), Monger and Paterson (1974) and Gabrielse (1975) realized the distinct nature of these rocks and noted their similarities to units exposed in the Cassiar Mountains. Mapping by Ferri and Melville (1990) further corroborated this and led them to equate many of these units with similar lithologies in the Cassiar Mountains. It is now proposed that local names be applied to these units, due to their localized extent and differences with lithologies of similar age elsewhere in the Cassiar Terrane (Ferri and Melville, in preparation).

LAYERED ROCKS

Quaternary

Qal — *alluvium, sands, gravels*

Upper Cretaceous to Tertiary
Sustut Gp

KTs — *sandstone, conglomerate, siltstone, coal*

Lower Cretaceous

lK — *conglomerate, sandstone, siltstone, argillite, minor coal*

Lower Jurassic to Lower Tertiary

JTu — ***USLIKA FM:**heterolithic boulder conglomerate, lesser sandstone*

Lower Jurassic
Takla Gp

lJtm — *maroon to grey basalts, agglomerates, tuffs, plagio-lase and augite phyric*

Upper Triassic

uTrp2 — ***PLUGHAT MOUNTAIN FM:** augite phyric agglomerates, basalts, tuffs*

uTrp1 — ***PLUGHAT MOUNTAIN FM:** tuffs, tuffaceous, silt-stone, argillite, agglomerate minor limestone*

Pennsylvanian to Permian
Nina Creek Gp

PPnp — ***PILLOW RIDGE FM:** massive to pillowed basalt, lesser chert, argillite, gabbro*

PPnh — ***MOUNT HOWELL FM:** argillite, chert, gabbro, minor basalt, wacke, felsic tuff*

Mississippian to Permian
Lay Range Assemblage

MPl1 — *green, maroon tuffs to siltstones, agglomerate, basalt, argillite, gabbro, minor limestone*

MPl2 — *basalt, gabbro, serpentine, minor amphibolite, chert, chlorite, schist*

MPl3 — *black argillite, shale, phyllite, limestone, argillaceous limestone, sandstone, quartzite*

MPl4 — *grey, quartz-feldspar (dacite) tuff, minor argillite, sandstone*

Upper Devonian to Lower Mississippian
Big Creek Gp

DMbc — *dark grey to blue grey shales, argillites, minor siltstones, siltite*

Lower Cambrian to Middle Devonian
Atan Gp, Razorback Gp,
Echo Lake Gp, Otter Lakes Gp

CD — *limestone, dolomite, lesser shale, quartzite argillaceous limestone*

Upper Proterozoic
Ingenika Gp

Pi — ***Undivided:** impure quartzite, schist, phyllite, limestone,feldspathic wacke,arkosic sandstone*

Pst — ***STELKUZ FM:** phyllite, slate, sandstone, siltstone, graphitic slate*

Pe — ***ESPEE FM:** limestone, dolomite, dolomitic limestone, marble*

Pts — ***TSAYDIZ FM:** green-grey slates, phyllites, limestone, marble, argillaceous limestone*

Psw — ***SWANNELL FM:**impure quartzite, sandstone, schist, garnet-mica schist,*

INTRUSIVE ROCKS

Late Triassic to Cretaceous
Hogem Intrusive Complex

TrKh — *monzonite, quartz monzonite, syenite, quartz syenite*

Late Triassic to Early Jurassic
Tenakihi Intrusive Body

TrJt — *monzodiorite, diorite or gabbro*

Middle Triassic to Lower Jurassic (?)
Wasi Lake Ultramafic Body

TrJw — *serpentine, gabbro, minor listwanite, aplite*

Geologic Contact(defined, assumed)

Fault

Normal Fault(defined, assumed)

Thrust Fault(defined, assumed)

Strike and dip direction of bedding

Strike and dip direction of bedding, overturned

Strike and dip of foliation

Limit of quaternary cover

Limit of mapping

Mineral Occurrence ... 23

TABLE 1-11-1
MINERAL OCCURRENCES IN THE USLIKA MAP AREA

Map Number	Style of Mineralization	MINFILE Number	Occurrence Name	Commodities	Geological Description
1	Porphyry Cu	094C 097	REM	Cu, Pb, Ag	Sulphide mineralization includes disseminated chalcopyrite, pyrite, and rare bornite and galena hosted in the Duckling Creek syenite complex within the Late Jurassic to Early Cretaceous Hogem intrusive complex.
2	Vein and shear	094C 058	HaHa Creek,	Au, Cu	Small quartz veins in sheared quartz diorite carrying a small amount of free gold and chalcopyrite, malachite and pyrite are hosted in a vertical shear parallel to HaHa Creek within the Hogem intrusive complex.
3	Porphyry Cu-Au and vein	094C 069	CAT	Cu, Au, Fe, Ag	The original showings on the ridge top consist of magnetite and pyrite in boxwork quartz veins which are host to native copper, native gold, cuprite, chalcopyrite, tetrahedrite and bornite mineralization. Recent work has concentrated on the alkalic porphyry Cu-Au potential of *propylitic and potassic-altered volcanics of the Takla Gp., located east of* the original showings.
4	Porphyry Cu	094C 100	Kiwi	Cu	Malachite staining on fracture surfaces of fragmental augite-feldspar porphyry of the Takla Gp.
5	—	094C 061	Uslika coal	coal	Thin lenses (<1-15 cm) of impure silty/sandy lignite to sub-bituminous coal hosted in sandstones and conglomerates of the Sustut Gp.
6	—	094C 101	Energy	coal	Same as #5
7	—	094C 102	Fuel	coal	Same as #5
8	Stratabound carbonate-hosted base metals	094C 103	Critter	Zn, Ba?	Disseminated sphalerite with possible barite found in recrystallized and brecciated sections of light to dark grey dolomite of the Otter Lakes Fm.
9	Stratabound carbonate-hosted base and precious metals	094C 024	Carie/ PAR	Pb, Zn, Ag, Ba	Dolomitized carbonate breccia, possibly of the Espee Fm., hosts disseminated and massive galena, disseminated sphalerite, hydrozincite and smithsonite with pyrite and barite.
10	Fracture controlled veins	094C 104	Quarry	Pb, Zn, Cu, Au, Sb	Recrystallized and dolomitized limestones of the Espee Fm. host quartz vein mineralization. Minerals identified in hand samples include sphalerite, galena, cerussite, chalcopyrite, boulangerite, malachite, azurite and possibly stibnite. Fire assays on two grab samples from this location returned values of 890 ppb and 385 ppb Au.
11	Vein/ replacement?	094C 038	Regent	Pb, Ag	An irregular pod-shaped vein of massive crystalline galena is hosted in Espee Fm. dolomite and limestone (assay: 1575 g/t Ag, 83.53% Pb).
12	Carbonate-hosted base and precious metals and fracture controlled vein/ replacement	094C 023	Beveley	Pb, Zn, Ag, Ba	Disseminated to massive galena, sphalerite, barite and argentiferous galena occur in veins and veinlets in fractures and shears within the Mt. Kison Fm. of the Atan Gp., the Echo Lake Fm. and possibly the Otter Lakes Fm. in several zones on the Beveley prospect. Mineralization appears to be localized in minor folds, flexures and warps on larger scale folds.
13	Shear-controlled quartz vein	094C 105	Gael	Ag, Au, Cu	Disseminated fine-grained argentite and arsenopyrite are hosted by a shear-controlled quartz vein within the Swannell Fm. of the Inginika Gp.
14	Vein breccia	094C 057	Silver	Ag, Au, Pb, Zn	A quartz breccia vein within sheared quartzite, phyllite, argillite and siliceous sericite schist of the Inginika Gp. hosts disseminated argentiferous galena and pyrite with minor sphalerite and gold.
15	Shear-controlled vein breccia	094C 022	Ruby	Au, Ag, Pb, Zn, Mo	A stockwork of small quartz veins in a multiply brecciated shear cutting the Swannel Fm. hosts disseminated to massive pyrite, molybdenite, sphalerite, chalcopyrite, galena, tetrahedrite, arsenopyrite, pyrargyrite, polybasite, native silver and minor gold.
16	Placer	094C 026	Jim May Creek	Au	Placer gold occurs in reworked glacial deposits 1.5-3.65 m above bedrock and from a buried preglacial channel.
17	Shear-controlled vein	094C 106	Range	Au, Cu	Massive basalt of the Lay Range assemblage is sheared, locally altered to epidote and silicified. Malachite staining, about 1% pyrite and 1300 ppb Au are present.
18	Shear-vein	094C 107	Surprise	Cu	Volcanic sediments, sandstones, siltstones and cherty argillites of the Lay Range assemblage are strongly brecciated and cut by a quartz-ankerite vein 10-15 cm thick which is stained with malachite.
19	Placer	094C 028	Vega creek	Au	Small placer workings near the mouth of Vega creek.
20	Shear controlled	094C 044	Thane creek	Hg	Mafic volcanics of the Takla Gp. are cut by a carbonatized fault zone which contains minor cinnabar.
21	Shear-vein	094C 020	Thane	Cu, Fe, Au	Silicified fault, fracture and shear zones up to 1.2 m wide in the Takla Gp. near the contact with the Hogem intrusive complex are mineralized with disseminated and massive pods of chalcopyrite, pyrite, magnetite, specularite and a little gold.
22	Cu-Au vein	094C 076	Dave	Cu, Au	Propylitically altered andesitic flows of the Takla Gp. are cut by a silicified fracture zone 1 m wide carrying chalcopyrite, magnetite, specularite and minor gold.
23	Shear	094C 043	Beg	Hg, Cu	A strongly fractured, silicified and carbonatized shear zone carries cinnabar, pyrite and minor chalcopyrite as disseminations and fracture fillings. The hostrocks are flows, breccias and tuffs of the Takla Gp.

TABLE 1-11-1
MINERAL OCCURRENCES IN THE USLIKA MAP AREA — *Continued*

Map Number	Style of Mineralization	MINFILE Number	Occurrence Name	Commodities	Geological Description
24	Cu-Au porphyry/ shear/ vein	094C 021	Vega	Cu, Au, Hg	Disseminated chalcopyrite, bornite and pyrite occur in andesitic flow breccias of the Takla Gp. These volcanic rocks are propylitically and potassically altered. Calcareous and siliceous andesite breccia associated with a major northwest-trending shear zone contains minor disseminated cinnabar.
25	Vein/ shear	094C 019	Pluto	Cu, Au	Lenses of massive arsenopyrite, pyrite, magnetite and specularite, with minor chalcopyrite and gold, occur in quartz-carbonate-healed fracture zones (up to 1 m wide) within Takla rocks adjacent to the contact with the Hogem intrusive complex.
26	Porphyry Cu	094C 108	MJW	Cu	Malachite and azurite staining with specularite, pyrite and possible chalcopyrite in strongly fractured and locally silicified dark green chloritized and hornfelsed volcanics. The mineralized zone is up to 7 m across. This is possibly a xenolithic raft of the Takla Gp. within the monzonites of the Hogem intrusive complex.
27	Vein	094C 109	Claw	Cu	Malachite staining occurs with massive crystalline specularite and magnetite in a vein 15 cm wide found in rubble on a ridge top underlain by Hogem monzonite.
28	Porphyry Cu/vein	094C 110	Bottle	Cu	Multiple occurrences of chalcopyrite, chalcocite, malachite and azurite in brecciated quartz-chacedony veins in ankerite-veined and altered zones (up to 1 m wide) in Takla volcanics. Occurrences are very near the contact with the Hogem intrusive complex.
29	Vein/ disseminated	094C 072	Gail	Cu, Mo	Quartz vein with pyrite, chalcopyrite, molybdenite and bornite cuts biotite K-feldspar monzodiorite of the Hogem intrusive complex.
30	Vein/ porphyry	094C 049	Copper 5	Cu	Hogem monzonites host quartz veins with magnetite, chalcopyrite, malachite and azurite in altered and mineralized zones up to 1.5 m wide. One zone is exposed for 8 m along strike and is open down dip, but seems to pinch out up dip. Numerous occurrences were noted.
31	unknown	094C 048	Tenakihi Creek	Cu	The area is underlain by monzonites of the Hogem batholith.
32	Vein	094C 111	Snow	Cu	Fractured argillite and siltstone of the Takla Gp. host an epidote-calcite vein (up to 15 cm wide) with 1–3% disseminated chalcopyrite and malachite and azurite staining. The wallrock is also stained with malachite and azurite.
33	Vein	094C 112	DM	Cu	Fractured tuffs of the Takla Gp. are cut by epidote veining with malachite staining. Also malachite staining in the wall rocks.
34	Vein	094C 113	Yak	Cu	Fine and coarse-grained Hogem monzonite is cut by numerous small ankerite veins in a zone 5-6 m wide. Chalcopyrite, malachite and azurite are disseminated throughout and coat fracture surfaces. Local mafic segregations in the monzonite are more strongly mineralized than the felsic sections. The zone strikes approximately 130° and can be traced for 50–75 m to the east and apparently to the northwest across a small cirque into mineral showing #35.
35	Vein	094C 114	Koala	Cu	Same as #34 with 1-2% chalcopyrite and malachite.
36	Vein/ disseminated	094C 018	Matetlo	Cu, Au	A fracture zone 40 m wide hosts at least five quartz veins, each up to 25 cm wide, containing massive coarse-grained pyrite with chalcopyrite. Epidote, malachite, azurite and chrysocolla occur as vein selvages and are disseminated in fractures in Hogem granodiorite.
37	Vein/ disseminated	094C 115	Intrepid	Cu	Ankerite and quartz veins with chalcopyrite and malachite disseminated and as fracture filling found in several locations within the Hogem monzonite near the contact with Takla Gp. volcanics.
38	Vein	094C 116	Bill	Cu	Epidotized zone in fine-grained Hogem monzonite. Contains epidote veins with pyrite, malachite and azurite in two zones up to 10 m across.
39	Disseminated/ porphyry Cu	094C 117	Yeti	Cu	Malachite staining found on fracture surfaces with minor sulphides (pyrite±chalcopyrite) in an augite porphyry flow of the Takla Gp.
40	Disseminated/ porphyry Cu	094C 118	Dragon	Cu	Minor malachite staining on some fracture surfaces, minor amounts of epidote and up to 5% pyrite blebs in a dike of aplitic granite 2 m wide which cuts the Takla Gp. volcanics.
41	Vein/ disseminated	094C 099	Mat 1	Au, Cu	Pyrite, hematite, minor chalcopyrite and an unidentified silver mineral are hosted in a quartz-carbonate vein 1.1 m wide within a volcanic breccia of the Takla Gp. The vein is exposed over 100 m of strike length and a 34 cm chip sample across the vein returned 400 g/t Ag.
42	Disseminated	094C 119	Tough	Cu	Chalcopyrite in lithic crystal tuff of the Takla Gp.
43	Vein/ disseminated	094C 071	Oy	Cu	Takla volcanics contain chalcopyrite and minor specularite as fracture coatings, within quartz veins and as minor disseminations.
44	Disseminated	094C 120	CR	Cu	Epidote alteration and malachite staining are found in massive maroon amygduloidal basalt flows of the Takla Gp.

TABLE 1-11-1
MINERAL OCCURRENCES IN THE USLIKA MAP AREA — *Continued*

Map Number	Style of Mineralization	MINFILE Number	Occurrence Name	Commodities	Geological Description
45	Vein/Disseminated	094C 121	Nuthatch	Cu	Same as #44 except carbonate veining present and flows are locally sheared and fractured. Minor azurite present. Mineralized zone is at least 15 m across.
46	Vein?	094C 015	Stranger	Au	Pyrite occurs in quartz-calcite veins which cut Permian calcareous black slatey argillite.
47	unknown	094C 041	Mercury 1	Hg	Carbonatized fault zone contains a little cinnabar (in Lay Range volcanics?)
48	unknown	094 042	Mercury 2	Hg	Same as #47.

Atan Group (Early Cambrian)

Rocks of Early Cambrian age were originally placed within the Ingenika Group by Roots (1954). Gabrielse (1975), working in the east half of the Mesilinka map area, partially separated these rocks from the Proterozoic succession, based on their age and similarities to Early Cambrian rocks elsewhere in the Cordillera. More detailed mapping by Ferri and Melville (1990) distinguished the Lower Cambrian succession from the Proterozoic sequence. Similar rocks were mapped in the present study area.

The Atan Group is subdivided into two formations in the project area; the lower Mount Brown Formation and the upper Mount Kison Formation. No fossils were found by the authors but archaeocyathids of possible Early Cambrian age were collected south of Beveley Mountain by D. Craig (personal communication, 1991).

Mount Brown Formation is poorly exposed in the extreme eastern part of the map area, south of Beveley Mountain and north of the Osilinka River. The best exposures are along the main logging road and old access roads leading to the abandoned camp on the Beveley showings. The base of the unit is not seen within the map area and only the upper few hundred metres are exposed. The unit consists of moderately to thickly bedded, grey-brown and maroon impure quartzite and sandstone, interlayered with thin to thickly bedded dark grey to grey-green phyllite and siltstone. Limestone nodules up to 40 centimetres long were seen within the phyllite-siltstone sequences. Some of the thinner sandstone layers contain horizontal worm burrows.

Mount Kison Formation is poorly exposed in the map area. It crops out on the north side of the Osilinka River, just south of Beveley Mountain. Grey, recrystallized limestone east and west of the mouth of Wasi Creek may also belong to this unit. The formation consists of grey to white mottled limestone with thin, wavy to indistinct bedding. In some localities the unit consists of finely crystalline grey limestone layers, 3 to 5 centimetres thick, interlayered with coarser, darker grey, discontinuous limestone and slightly argillaceous limestone beds 0.5 to 2 centimetres thick. South of Beveley Mountain, this carbonate is commonly coarsely recrystallized and sometimes dolomitized.

Razorback Group (Cambrian to Ordovician)

The Razorback Group is a name now applied to rocks previously called the Kechika and Road River groups in the Nina Creek area by Ferri and Melville (1990a, b). It is approximately 75 metres thick and comprises shale, argillaceous dolomite and dolomite. It is recessive and poorly exposed. Exposures were found only along road cuts or in trenches in the Beveley Mountain area and on the east side of Wasi Creek. The age of the unit is based on its position above Lower Cambrian carbonates of the Atan Group and below Lower Silurian carbonates and shales of the Echo Lake Group (Ferri and Melville, in preparation).

In the Beveley Mountain area, rocks assigned to the Razorback Group outcrop along the road leading to the mineral showings. They are dark grey and grey, thinly layered shales which grade upwards into thin and thickly bedded argillaceous limestone. Strongly brecciated and recrystallized dolomite and limestone can also be seen along the road.

On the east side of Wasi Creek, rocks tentatively assigned to the Razorback Group were exposed in trenches on the PAR mineral claims. The exposed sequence is upwards of 75 metres thick. Dark grey to silvery argillite and shale, with sections of white and greenish white sericitic phyllite and schist up to several metres thick, pass upward into dark grey, thinly bedded calcareous argillites which in turn grade upward into dark grey, thinly layered argillaceous to dolomitic limestone. This section is similar to sections of the Razorback Group seen in the Nina Creek area (Ferri and Melville, 1990), the only difference is the presence of sericitic phyllite in the Wasi Creek area.

Echo Lake Group (Middle Ordovician to Early Devonian)

The Echo Lake Group crops out north and south of the Osilinka River in the eastern part of the map area. Near Wasi Creek it is continuous with Lower Silurian to Lower Devonian carbonates mapped by Ferri and Melville (1990, in preparation) and was originally equated with the Sandpile Group. Similar carbonates with corals of possible Siluro-Devonian age (Roots, 1954) are exposed immediately south of Beveley Mountain.

The Echo Lake Group is some 700 metres thick near Beveley Mountain and northwest of Wasi Creek, and upwards of 500 metres thick south of Wasi Creek. These estimates are based on structural cross-sections and may be affected by structural thickening. It consists of buff-weathering, pale grey to medium grey, thin to massively bedded, medium-grained sugary dolomite and limestone. There is sporadic quartz replacement of layers up to several centimetres thick. Bioclastic limestone, oolite and carbonate breccia horizons are also present within the sequence. West of Wasi Creek, the Echo Lake Group is characterized by discontinuous or thinly interlayered, light and dark grey mottled dolomite. Dark grey and grey graptolitic argillite up to 70 metres thick is exposed at the base of the sequence and is associated with planar-bedded limestone and argillaceous limestone.

This unit lacks the sandy dolomite and quartzite which characterize it in the Nina Lake and Trail Creek areas (Ferri and Melville, 1990; in preparation). This suggests a facies transition to the northwest, perhaps reflecting deposition in deeper water.

This unit was previously believed to range in age from Early Silurian to Early Devonian (Ferri and Melville, 1990a, b; in preparation), but Middle Ordovician graptolites were recovered from the basal argillites southeast of Wasi Creek (B.S. Norford, personal communication, 1991). This new age span for the Echo Lake Group is comparable to the lithologically similar Sandpile Group in the Cassiar Mountains (Gabrielse, 1963).

Otter Lakes Group (Middle Devonian)

The Otter Lakes Group was originally mapped as the McDame Group by Ferri and Melville (1990a, b). It is important locally as it carries significant amounts of disseminated galena and sphalerite. It has been recognized in the Wasi Creek area, where it is from 200 to 300 metres thick, and can be traced southeastward into the End Lake map area. The Otter Lakes Group also outcrops on the north side of Wasi Creek along the down-thrown side of a northwest-trending normal fault. The twin-holed columnal osicles within this unit make it no younger than Middle Devonian and conodont fossils collected in the End Lake map area restrict it to the Middle Devonian (Ferri and Melville, in preparation). It is characterized by thin to medium-bedded, grey to dark grey, fetid, fine to medium-grained crystalline dolomite and limestone with fossiliferous horizons. It is also typified by vugs filled with pyrobitumen, graphite or calcite. The unit is sometimes coarsely recrystallized and appears quite massive. Fossiliferous sections contain crinoid fragments, rugosan corals, bryozoa and amphipora.

Big Creek Group (Late Devonian to Early Mississippian)

Shales, argillites and minor siltstone in the Wasi Creek area are assigned to the Big Creek Group. These were originally included in the Cache Creek Group by Roots (1954). Similar rocks in the Nina Lake area were termed the Earn Group by Ferri and Melville (1990) due to their remarkable similarities with lithologies in the Cassiar Mountains. In the Nina Creek area, these rocks are bracketed as Upper Devonian to Lower Mississippian as they overlie the Middle Devonian Otter Lakes Group and contain Lower Mississippian conodonts in the upper parts of the section (Ferri and Melville, in preparation).

The Big Creek Group is upwards of 500 metres thick and is characterized by dark grey, blue-grey and black, thin to very thinly bedded, platy to wavy shales, argillites and siltstones. Slates and argillites predominate east of Wasi Creek whereas siltstones and siltites are more common to the west.

Slide Mountain Terrane

Nina Creek Group (Pennsylvanian to Permian)

Rocks of the Nina Creek Group in the map area were placed with the Cache Creek Group by Roots (1954) due to their similar age and lithologies. Monger (1973), Monger and Paterson (1974) and Gabrielse (1975) noted their distinctive characteristics and separated the various lithologies. Detailed mapping by Ferri and Melville (1988, 1989, 1990a) in the Manson Creek and Germansen Landing areas led them to assign these rocks to the Slide Mountain Group because of similarities to rocks of comparable age and lithology in southern British Columbia. It has now been suggested (Ferri and Melville, in preparation) that this assemblage be termed the Nina Creek Group due to its restricted extent and slight differences with other rocks of the Slide Mountain Terrane.

The Nina Creek Group outcrops in the mountainous area east of the Wasi Lake - Wasi Creek valley. It can be divided into two formations within the study area; the lower Mount Howell Formation and the succeeding Pillow Ridge Formation. The Mount Howell Formation is equivalent to the Middle Division (PPsmm) of the Slide Mountain Group as defined by Ferri and Melville (1990a, b) and the Pillow Peaks Formation equates with their Upper Division (PPsmu). Each of these formations spans the Pennsylvanian to Permian interval (Ferri and Melville, in preparation), indicating that they are in structural contact with each other. The combined thickness of the two units is difficult to determine due to faulting and folding, but a minimum of some 3 kilometres is estimated.

Pillow Ridge Formation (Pennsylvanian to Permian)

The Pillow Ridge Formation is exposed in thin fault slices within broad folds along the southeastern boundary of the map area. It is approximately 500 to 1000 metres thick and is characterized by grey-green and green massive and pillowed basalt. The basalt is microcrystalline and it commonly contains narrow veins of chlorite and epidote. Siliceous sediments, intruded by sill-like bodies of gabbro, are locally associated with these basalts. The sediments are dark grey to black, thin to moderately bedded, wavy banded argillite and siliceous argillite, interbedded with moderately to thickly bedded, varicoloured chert (green, grey, cream) and ribbon chert. Gabbro forms sill-like bodies up to several metres thick and contains equal amounts of fine to medium-grained plagioclase and pyroxene phenocrysts, the latter sometimes with glomeroporphyritic textures.

Mount Howell Formation

The Mount Howell Formation is at least 2 kilometres thick and is composed predominantly of sediments with lesser volcanic and igneous rocks. It crops out east of Wasi Lake and good exposures are seen in the creek valleys that drain into Wasi Lake and Wasi Creek and along the high ridges to the southeast.

The structurally lower part of the unit is typified by dark grey to black, thin to moderately bedded, wavy banded argillite with lesser cherty argillite, quartz wacke and quartz-(feldspar)-bearing tuff. The quartz wacke occurs as grey to grey-brown lenses and beds with up to 80 per cent fine to medium quartz grains in a silty to muddy matrix. The quartz-feldspar tuff crops out in several localities and may be several hundred metres thick. It is found as subcrop along the west-facing slopes south of Wasi Lake and in sections 10 metres thick along the canyon in the lower part of the creek that flows into the northeast side of Wasi Creek as it exits Wasi Lake. This tuff is light grey to grey, sericitic, and contains up to 80 per cent quartz and feldspar grains with lesser muscovite and argillite rip-up clasts. Quartz wackes and tuffaceous sequences make up less than 10 per cent of the unit. These rocks may have continental affinities.

The upper part of the Mount Howell Formation contains significantly more siliceous sediments which are interlayered with thin basaltic flows and intruded by gabbro. The sediments are grey to dark grey, thin to moderately bedded, wavy banded argillites and siliceous argillites which are interlayered with grey siltstones and grey to cream-coloured, thin to thickly bedded cherts and ribbon cherts. Fine to medium-grained gabbro sills, up to several hundred metres in thick, intrude the sediments. Basalts are massive to pillowed, green to grey-green, amygdaloidal (chlorite, quartz) and are possibly up to tens of metres thick. Sections of green mafic ash-tuff are associated with the basalts.

Harper Ranch Terrane (Lay Range Terrane?)

LAY RANGE ASSEMBLAGE

The Lay Range assemblage includes Upper Paleozoic tuffs, argillites, mafic to ultramafic igneous rocks, grits, limestone and chert (Roots, 1954). These rocks derive their name from their excellent exposure in the Lay Range (between Lay Creek and the Swannell River; Roots, 1954).

This is an enigmatic sequence within the map area. The tuffs and agglomerates are very similar to lithologies in the Plughat Formation of the Takla Group, yet an older age precludes any direct relationship. The Lay Range assemblage has some affinities with the time-equivalent Nina Creek Group. Massive to pillowed basalts and related cherty sediments are similar to lithologies in the Mount Howell Formation, but no interfingering of the two packages is seen, suggesting a fault contact between them.

The lower parts of the tuffaceous sequence contain quartz-rich detritus and its lower contact appears conformable with the upper part of a dacitic tuff unit, which may be part of the Cassiar stratigraphy. Furthermore, argillites, grits, quartzites and limestones in the structurally lower parts of the Lay Range assemblage have more similarities to North American rocks than with any other package within the map sheet.

No definitive fossils were found in the Lay Range assemblage during the 1991 field season. Bryozoa, brachiopod and crinoid ossicle fragments were recovered from tuffaceous beds. Roots (1954) describes fossils from this package which indicate a Mississippian to Permian age. Permian conodonts have been recovered from calcareous beds within the tuffs on the north side of Vega Creek (M.J. Orchard, personal communication, 1991). Ross and Monger (1978), working in the Lay Range, recovered middle Pennsylvanian fusulinids from limestones in the lower parts of the assemblage. The dacitic tuff unit bears a strong resemblance to lower Mississippian tuffs in the Germansen Landing area (Ferri and Melville, in preparation) suggesting a possible Mississippian lower age limit.

The Lay Range assemblage is subdivided into four lithologic divisions; the structurally lowest is the dacitic tuff unit followed by the argillite-grit-limestone unit which is succeeded by the mafic tuff unit which in its upper part contains a faulted sequence of basalts, gabbro and serpentinite which makes up the mafic-ultramafic subdivision.

Dacitic Tuff Unit

Grey to dark grey, massive quartzofeldspathic tuff outcrops over a large area west of the Wasi Creek - Wasi Lake valley. This unit commonly contains a weak to strong penetrative cleavage. Fine to coarse-grained quartz, feldspar and rare mica clasts constitute up to 30 per cent of the rock with quartz being dominant. Very minor occurrences of grey to dark grey phyllite are associated with the tuffs. Quartz feldspar wackes and arkosic sandstones occur along strike with the tuffs northwest of the mouth of Tenakihi Creek. These clastic rocks are also characterized by a strong penetrative fabric.

The dacitic tuff unit is very similar in appearance to a felsic tuff in the Germansen Landing area (Ferri and Melville, 1989; Ferri *et al*, 1989), now termed the Gilliland tuff and dated as Lower Mississippian (U-Pb; Ferri and Melville, in preparation). In the south these rocks have been grouped with argillites of the Mississippian to Permian Cooper Ridge Group, which is part of the Cassiar stratigraphy (Ferri and Melville, in preparation). In the present map area, the dacitic tuff unit appears to sit structurally above argillites assigned to the Big Creek Group. The argillites may be in part equivalent to the Cooper Ridge Group. Furthermore, arkosic sandstone beds within the dacitic tuff unit also suggest a North American affinity. If this is the case, tuffaceous argillites southeast of the Wasi Creek valley may also be part of the Cooper Ridge Group, suggesting that North American stratigraphy lies below the Nina Creek Group southeast of Wasi Lake.

South of the mouth of Tenakihi Creek the upper contact of this package appears to pass into lithologies of the mafic tuff unit which, together with the preceeding argument, suggests a link between North American stratigraphy and that of the Lay Range assemblage.

Argillite-grit-limestone Unit

Black argillite, shale, phyllite, dark grey to black limestone, quartzite and quartz feldspar wackes are exposed along the Tutizika River, and along road cuts to the north and south. These rocks are unlike any other lithologic package in the area. They have been grouped with the Lay Range assemblage due to their position structurally below the Lay Range tuffs and primarily on the basis of their resemblance to similar sequences described in the Lay Range (Roots, 1954). These rocks are in fault contact with the mafic tuff unit.

Strongly folded and faulted, thin to moderately bedded, dark grey to black graphitic argillite and siliceous argillite are interlayered with dark grey to black shale and phyllite in sequences up to 100 metres thick along the Tutizika River. These rocks are sometimes interlayered with brown-grey quartz feldspar wackes which contain pebbly sections carrying clasts of opalescent blue quartz.

Several sequences of massive, blue-grey pebbly quartzite up to 30 metres thick occur within these argillites. The quartzites are also distinguished by the presence of opalescent blue quartz grains which is a characteristic of North American clastic sequences. Observed contacts are conformable with the surrounding argillites.

Dark grey to black, finely crystalline and laminar limestone and argillaceous limestone up to 50 metres thick occurs within this argillite sequence. Laminar bedding is 0.1 to 3 centimetres thick and wraps around coarsely recrystallized zones up to 20 centimetres in diameter, suggesting that some of these limestone sequences have been tectonized. In one locality along the Tutizika River, large boudins or 'knockers' of limestone up to several metres thick and 5 metres long occur within the argillites.

Mafic Tuff Unit

Green to light green and maroon tuff, tuffaceous siltstone, lapilli tuff, agglomerate, basalt and lesser argillite, chert, gabbro and limestone form the most distinctive sequence within the Lay Range assemblage. These rocks appear very similar to the Plughat Mountain Formation of the Takla Group, but are commonly distinguished from Takla tuffs by their more intense greenish colour, the presence of quartz clasts and generally more penetrative deformation. It forms two linear belts of rocks some 1 to 5 kilometres wide on both sides of the Uslika Formation in the south and can be traced northwestward to the Tutizika River. Faulted equivalents of these rocks are exposed along the Vega Creek valley and are tectonically interleaved with younger clastic rocks.

Thick sequences of green, thin to thickly bedded, very fine tuffs and tuffaceous siltstones are the dominant lithologies within this unit. The beds commonly display sedimentary grading and load features. These units are interlayered with grey to dark grey argillaceous beds and rare grey to cream chert and limestone.

Tuffs are massive to thickly bedded, fine to coarse grained and are composed of lithic clasts (basalt), pyroxene and feldspar crystal fragments and fragments of chert, argillite and quartz. Some are reworked and better classified as volcanic sandstones or wackes. Rare conglomerate beds up to 1 metre thick, consisting of argillite, chert, quartz and volcanic(?) clasts, are also observed. Northeast of Vega Creek, maroon basaltic(?) clasts are abundant in the tuffs. Green, dark green and maroon basalt, amygdaloidal basalt, and pyroxene-feldspar-phyric basalt clasts predominate within lapilli tuffs and agglomerate. Graded, quartz-rich sands and wackes are a minor but conspicuous part of the tuff sequence. They are quite common northwest of the confluence of Tenakihi Creek and the Osilinka River. The coarser tuffs and lapilli tuffs sometimes contain fragments of bryozoa, crinoid ossicles and brachiopods.

Dark green, massive to amygdaloidal basalt flows from 1 to 10 metres thick, are occasionally found within these tuffs. They are well exposed along a road cut on the north side of the Osilinka River, 3 kilometres upstream from the confluence of Tenakihi Creek.

Dark green and green, fine to medium-grained gabbro sills were observed in several localities within the tuffs. They are up to 100 metres thick and traceable for several kilometres.

This unit is bounded by a strike-slip fault system on its southwest side. Its northeast margin is not well exposed but in one locality it appears that its lower parts become more argillaceous and pass into lithologies typical of the dacitic tuff unit. This transition occurs in an area with scattered outcrops and does not rule out the presence of a major fault separating the two units.

Mafic-ultramafic Unit

Basalt, gabbro and serpentinite are exposed along the high ridges northeast of Vega Creek and to the southeast across the Osilinka River valley where they are cut by a northwest-trending strike-slip fault north of Conglomerate Mountain. The unit pinches out to the northwest where it is last observed along the banks of a northeast-flowing creek, southwest of Tenakihi Creek. This package is a fault-bounded structural sequence in the middle of the mafic tuff unit.

Dark green, massive to pillowed, olivine(?)-bearing basalts form the structurally highest and lowest parts of this package northwest of the Osilinka River. They contain thin lenses of grey to cream chert, fine to medium-grained gabbro and serpentinite. Mafic tuffs are associated with basalt in the lowest fault slice.

Fine to very coarsely crystalline gabbro is associated with serpentinite northwest and southeast of the Osilinka River. It may be mylonitized and contain a strong fabric parallel to the unit boundaries. Amphibolite and foliated basalt are associated with gabbro and serpentinite southeast of the Osilinka River.

Quesnel Terrane

TAKLA GROUP (LATE TRIASSIC TO EARLY JURASSIC)

The Takla Group occupies the western half of the map area and is well exposed along the mountains extending from Cat Mountain to Matetlo Creek. It is bounded on the west by the Hogem intrusive complex and to the east by a series of northwest-trending strike-slip faults and related graben structures. The Takla exposure is relatively narrow in the southern part of the map area and then widens to the northwest as the Hogem intrusive contact swings to the west. Roots (1954) noted that the eastern base of the Takla Group is marked by a conglomerate unit 30 metres thick. It has been mapped in several localities and, from this and descriptions by Roots, it is probably a younger conglomerate sequence belonging to either the Uslika Formation or the Sustut Group and has been preserved in one of the many grabens in the area.

Two units are recognized within the Takla Group; augite-phyric volcanics and tuffaceous sediments of the Plughat Mountain Formation and maroon to green-grey basalts and related volcaniclastic rocks of an unnamed unit which may be equivalent to the Early Jurassic Chuchi Lake Formation of Nelson *et al.* (1992, this volume). The Plughat Mountain Formation (Ferri and Melville, in preparation) is the name applied to the thick pile of Takla Group basalts exposed below Plughat Mountain, east of Manson Creek. These rocks lie above Middle to Upper Triassic slates and argillites of the Slate Creek Formation (Ferri and Melville, *ibid.*). Units recognized within the Takla Group are very similar to those described by Nelson *et al.* (1991, 1992, this volume) who have carried out detailed mapping immediately to the south in the Chuchi Lake area.

PLUGHAT MOUNTAIN FORMATION [LATE TRIASSIC, NORIAN(?)]

The Plughat Mountain Formation forms the western two-thirds of the Takla Group exposure. It occupies a south to southwest-dipping panel of rocks which is in fault contact with the Early Jurassic maroon volcanics to the east. Two subdivisions of the formation can be made; an easterly, and in part, lower sequence of predominantly tuffs, tuffaceous sediments with lesser agglomerate, argillite, siltstone and carbonate (Unit 1) and a western, and in part, upper sequence of augite and plagioclase-phyric massive to agglomeratic* basalts (Unit 2). Unit 1 is equivalent to Unit 2 of Ferri and Melville (1989) and the Inzana Lake Formation of Nelson *et al.* (1991, 1992, this volume). Unit 2 is equivalent to Units 3 and 4 of Ferri and Melville (1988) and the Witch Lake Formation of Nelson *et al.* (1991, 1992, this volume).

We believe that Units 1 and 2 of the Takla Group are time equivalent; Unit 1 represents a distal, volcaniclastic and epiclastic facies derived from a volcanic centre to the west which is represented by Unit 2. In such a setting, facies changes can be abrupt and, in some places, one facies may lie stratigraphically over the other. In the northwestern part of the map area, coarse volcaniclastic rocks of Unit 2 overlie tuffs of Unit 1, whereas in the south these two units interfinger in a manner similar to that seen in the Germansen Landing area by Ferri and Melville (1989). The epiclastic sequence of Unit 1 is locally interrupted by small intrusive bodies and related volcanics as seen south of Tenakihi Creek.

Diagnostic fossils have not been collected from the Plughat Mountain Formation in the map area. Rocks of similar lithology have been dated to the southwest and are Late Triassic (middle Norian; K. Bellefontaine, personal communication, 1991).

Unit 2 is characterized by grey to greenish grey augite and augite-plagioclase-phyric agglomerates and coarse lapilli tuffs with lesser massive flows, tuffs and tuffaceous sediments. It is well developed in the northern part of the map area whereas in the southeast only thin remnants of it are found near the contact of the Hogem intrusive complex. Agglomerates and flows are massive on outcrop scale and bedding or flow tops are seen only rarely. Clasts in the agglomerates are mostly porphyritic basalt with rare monzonite. Occasionally basalt clasts show a wide variation in the percentage and size of phenocrysts, indicating that numerous volcanic horizons were sampled prior to their deposition. Augite phenocrysts, up to 1 centimetre in diameter, constitute from 10 to 40 per cent of the rock. Plagioclase phenocrysts up to 0.5 centimetre in length are subordinate to augite and range from to 5 to 20 per cent. Both large clasts and flows may be amygdaloidal with infills of chlorite, calcite and prehnite(?). Grey-green, massive to poorly bedded crystal tuffs are subordinate to the agglomerates. Grey to greenish, moderately to thickly bedded tuffaceous siltstones and grey and dark grey argillites are a minor constituent of this facies.

Unit 1 consists of grey to greenish tuffs, tuffaceous siltstones and argillites, lesser lapilli tuffs and agglomerates, argillite and argillaceous limestone. The finer clastic units appear reworked. The tuffs are moderately to massively bedded, fine to coarse grained and composed of crystal (augite and plagioclase) and lithic fragments. They commonly contain lapilli fragments of predominantly augite-plagioclase-phyric basalts with lesser argillite, limestone and tuff. These tuffs are interlayered with grey to dark grey, thinly to thickly bedded tuffaceous siltstones which contain sections of dark grey argillite. Occasional beds of dark grey argillaceous limestone, 10 to 50 centimetres thick, occur

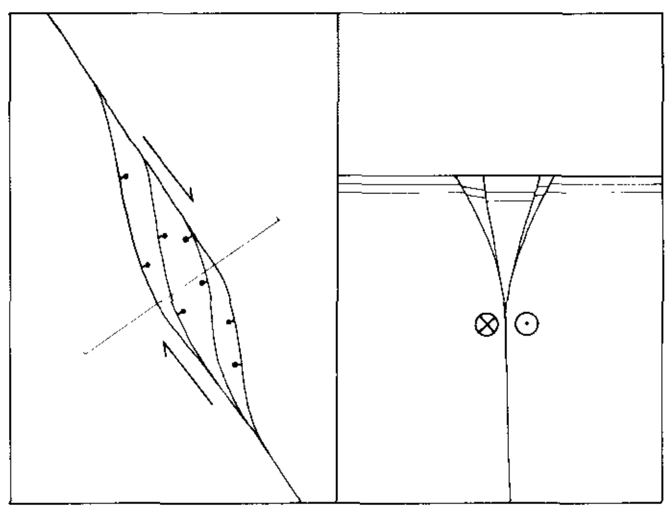

Figure 1-11-4. Diagramatic representation of strike-slip graben systems. (a) Plan view showing how motion is transferred between en echelon strike-slip faults along a graben system (negative flower structure). Movement on the bounding blocks of the main fault zone, in conjunction with the bend in the fault system, causes the blocks to drop within the transfer zone. Note that if motion were reversed on the faults, the grabens would be horsts (positive flower structure). (b) Cross-sectional view showing how the faults merge at depth.

* Agglomerate is used here solely as a descriptive term for primary volcaniclastic units with clasts greater than 64 mm and has no genetic implications.

within the more argillaceous sequences. Coarse lapilli tuffs and agglomerates of Unit 2, tens of metres thick, are interfingered with the finer grained clastics.

A small monzonite body and related subvolcanic rocks are found within this facies south of the big bend in Tenakihi Creek. An intrusive breccia is associated with this body and the coarse lapilli tuffs and agglomerates contain abundant intrusive clasts very similar in appearance to the intrusion. This monzonite may be related to a small volcanic centre within Unit 1.

Maroon Volcanics (Lower Jurassic)

A series of maroon to dark grey volcanics outcrops in the eastern part of the Takla Group and appears to lie stratigraphically below tuffs of the Plughat Mountain Formation. These are quite distinct from lithologies of the Plughat Mountain Formation and Roots (1954) recovered Early Jurassic ammonites, making them younger. This implies that these volcanics have been structurally emplaced. They are bounded on both sides, and are cut by, a series of steep, northwest-trending faults with possible strike-slip motion. These faults are associated with negative flower structures (or grabens, *see* Structure section, Figure 1-11-4; Woodcock and Fischer, 1986). It is believed that these younger volcanics have been preserved within one of these structures.

The age and composition of the volcanics is very similar to rocks of the Early Jurassic Chuchi Lake Formation which lies above rocks of the Witch Lake Formation in the Chuchi Lake area (Nelson *et al.*, 1992, this volume).

Grey-brown and maroon magnetic basalts outcrop along the Tutizika River and continue southwards to Tenakihi Creek and southeastwards to Thane Creek. These basalts are aphanitic or plagioclase and pyroxene phyric. They are commonly massive, amygdaloidal (with infills of calcite and chlorite) and may contain flow-top breccia. Typically plagioclase is the dominant phenocryst and constitutes up to 20 per cent of the rock.

The basalts are associated with dark grey to greenish polymictic agglomerates and tuffs which are exposed along a ridge south of the big bend in Vega Creek and continue south of Thane Creek. In the Vega Creek area the clasts are composed of augite-plagioclase-phyric, plagioclase-phyric and augite-phyric basalts, and syenite and monzonite which appear very similar to Hogem intrusive complex lithologies. The clasts are somewhat rounded and reworked. Roots (1954) described large feldspar porphyry clasts up to 60 centimetres in diameter in the vicinity of the Vega showing. Augite-plagioclase-olivine(?) and/or hornblende-phyric basalt flows and agglomerates are common south of Thane Creek.

Younger Rocks (Overlap Assemblages?)

USLIKA FORMATION (EARLY JURASSIC? TO EARLY TERTIARY)

Massive to thickly bedded, well-indurated, coarse pebble to boulder conglomerate and minor sandstone crop out along the ridges of Conglomerate Mountain. It is green to grey-green with rounded to well-rounded clasts up to 40 centimetres in diameter. Clasts are composed of granitic material (primarily monzonite, syenite(?) and gabbro) with white to grey quartzite, grey to black chert, volcanic material (green, aphanitic basalt, augite-plagioclase porphyries and tuff) and lesser argillite and rare schistose rock. Massive sandstone layers range in thickness from 10 centimetres to over 2 metres. Rare cross-bedding indicates a northwesterly flow. The northern and southern margins of this unit are sheared, suggesting that it may be a fault sliver.

The age of the conglomerate is difficult to deduce as no macroscopic fossils have been found. Roots (1954) correlated chert-pebble conglomerate, sandstone, argillite and coal in the Vega Creek valley with the Uslika Formation. Fossils in the valley indicate an Early Cretaceous (Aptian) age (Roots, *ibid.*). Sediments on the northwest side of the Osilinka River do not resemble rocks of the Uslika Formation and may not be correlatable. Eisbacher (1974) correlated Late Cretaceous to Early Tertiary rocks of the Sustut Group within the map area (south of Thane Creek) with rocks of the Uslika Formation, but we see little resemblance and feel this correlation is invalid.

The age of the Uslika Formation can be inferred from a study of the clast composition. All clasts are locally derived, with quartzite from the Atan Group, chert from the Nina Creek Group, syenite and monzonite clasts from the Hogem intrusive complex and volcanic clasts from the Takla Group. The youngest rocks in this suite are the granitics from the Hogem intrusive complex and the Takla volcanics. Thus the conglomerate can be no older than Early Jurassic, based on the youngest ages of the Takla Group and K-Ar ages for monzonite and granodiorite reported by Garnett (1978). Younger granitic phases (Late Cretaceous) are not present. Uplift and erosion of the Atan quartzite to the west may have occurred as early as late Early Jurassic (Ferri and Melville, in preparation).

Roots (1954) describes minor occurrences of schistose and gneissic clasts. Locally, metamorphic cooling ages are as old as Middle Jurassic with a predominance of Late Cretaceous to Early Tertiary ages within the metamorphic complexes (Ferri and Melville, in preparation). All that can be confidently stated about the age of this unit is that it ranges from Early Jurassic to Early Tertiary.

SUSTUT GROUP (LATE CRETACEOUS TO EARLY TERTIARY)

Sandstone, conglomerate and siltstone assigned to the Sustut Group outcrop within fault-bounded areas on either side of the Osilinka River valley, west of Conglomerate Mountain. The finer grained rocks are grey-green to brown or red-brown, thin to thickly bedded and very friable. They commonly contain abundant coaly lenses and plant fossils dated as Late Cretaceous and Early Tertiary (Roots, 1954). Pebble conglomerate layers 1 to 2 metres thick and composed of chert, quartzite, grey and maroon argillite, grey-green basalt and tuff, vein quartz and schist clasts are associated with these lithologies.

The two bodies of Sustut Group rocks are bounded by northwest-trending strike-slip faults and it is suggested that these rocks are preserved within a negative flower structure (*see* Structure section). Sustut rocks west of the Osilinka River are strongly fractured at their contact with intensely fractured rocks of the Lay Range assemblage. They are also in contact with fractured rocks of the Uslika Formation south of Conglomerate Mountain. The northern contact of the body south of Thane Creek may rest unconformably on the Early Jurassic volcanics but such a contact was not observed.

CONGLOMERATE AND SANDSTONE ALONG VEGA CREEK (EARLY CRETACEOUS)

Grey-brown and maroon pebbly conglomerate, sandstone and argillite are exposed along Vega Creek and as a large body at its confluence with the Osilinka River. The conglomerate is composed of granite, basalt, tuff, quartzite, chert and argillite clasts. Fine to coarse-grained sandstone and siltstone layers up to 1 metre thick are found within the conglomerate and contain plant remains and very thin lenses of black coal.

Strongly sheared, black to dark grey argillite and siltstone outcrop at several localities along the lower reaches of Vega Creek. These argillites contain lenses of coal up to several centimetres thick and nodules of sandstone with abundant plant fossils. Roots (1954) collected Lower Cretaceous fossils from one such locality. Fossil collections made during this study are inconclusive and suggest an age from Late Jurassic to Late Cretaceous (E. McIver, personal communication, 1991).

These sediments do not resemble rocks of the Uslika Formation and though they look similar to those of the Sustut Group, their older age precludes this. Roots (1954) equates the conglomerate along Vega Creek with that of the Uslika Formation. If this correlation is correct these conglomerates and sandstones must represent a different facies of the Uslika Formation.

INTRUSIVE ROCKS

Intrusive rocks in the map area are subdivided into four groups: the Hogem intrusive complex; the Tenakihi body; monzonite to syenite porphyry stocks, dikes and sills within the Takla Group; and subvolcanic quartz and/or feldspar porphyry to felsite dikes and sills. All are part of the Omineca intrusive suite as defined by Roots (1954). Many of the intrusions mapped by Roots (*ibid.*) within the Lay Range assemblage are actually gabbroic bodies of probable upper mantle derivation (*i.e.* ophiolite).

HOGEM INTRUSIVE COMPLEX (LATE TRIASSIC TO CRETACEOUS)

The Hogem igneous suite consists of numerous intrusive bodies of distinct ages (Garnett, 1978). It has been suggested that the name Hogem batholith be replaced by the term Hogem intrusive complex (Nelson *et al.*, 1992, this volume). Several rock types outcrop at the edge of the complex. Field observations indicate a predominantly quartz-poor, alkali-rich suite. Rocks vary in composition between gabbro, diorite, monzonite, syenite and alkali-feldspar syenite. Gabbro and monzonite appear to be the oldest intrusive phases and are cut by stocks and dikes of syenite or alkali-feldspar syenite. Typically, an intrusive breccia is present at the contact with the Takla Group. Strong hornfelsing and granitization of the Takla Group extends several hundred metres to over a kilometre away from the contact with the intrusive rocks. The hornfelsing is accompanied by moderate to intense flattening or mylonitization of the Takla rocks indicating that ductile flow was occurring at the contact in response to emplacement of the batholith. The hornfelsing is also important economically in that it is almost always associated with copper-gold mineralization (see section on Mineralization). Both the monzonitic and syenitic phases of the Hogem intrusive complex carry copper mineralization, although it is more prevalent in the syenite end members.

The age of the Hogem rocks is not precisely known in the map area. It is post-Late Triassic based on its crosscutting relationships with the Takla Group. Potassium-argon dating by Garnett (1978) south of the Omineca River suggests an Early to Middle Jurassic age for the syenitic phases. Monzonite is related to early mafic phases of the complex and has been dated Late Triassic to Early Jurassic (Garnett, *ibid.*). Younger granitic phases are Early Cretaceous (Garnett, *ibid.*).

MONZONITE

Tan, brown and pinkish megacrystic monzodiorite, monzonite and quartz monzonite is the most abundant phase in the Hogem intrusive complex. Pinkish feldspar megacrysts up to 2 centimetres long constitute up to 30 per cent of the rock. Accessory minerals are hornblende, biotite and magnetite.

SYENITE

Pink to tan, very fine to coarse-grained syenite and quartz syenite form dikes and small stocks in the monzonite and the Takla volcanics. They are usually magnetic and contain hornblende as an accessory mineral. Syenite grades into the alkali-feldspar syenite described below. Pegmatitic phases of this lithology were observed at the contact with the Takla volcanics.

ALKALI-FELDSPAR SYENITE

Pink, fine to medium-grained alkali-feldspar syenite and alkali-feldspar quartz syenite also intrude the monzonite suite described above. These rocks contain magnetite and hornblende as accessory minerals.

MONZONITE AND SYENITE IN THE TAKLA GROUP (LATE TRIASSIC TO MIDDLE JURASSIC)

Small stocks and dikes of porphyritic monzodiorite, monzonite and syenite intrude the tuffs and agglomerates of the Takla Group close to the Hogem intrusive complex. These bodies are barely discernable at a scale of 1:50 000, but their association with copper-gold mineralization warrants their mention.

Porphyritic to crowded porphyritic syenite to monzonite outcrop at the top of Cat Mountain. These intrusions are tan to beige, with phenocrysts of plagioclase set in a very fine grained matrix of potassic feldspar and hornblende. The phenocrysts may constitute over 30 per cent of the rock. These bodies are sometimes strongly altered to chlorite, epidote and potassium feldspar in association with copper and gold mineralization. Another lenticular body of similar rocks (although lacking the alteration), up to 1 kilometre in length, was mapped southeast of Matetlo Creek. It has hornfelsed the Takla Group agglomerates around it.

Numerous dikes and small stocks of megacrystic monzonite or syenite intrude the Takla rocks throughout the area. They are grey to greenish in colour with 5 to 20 per cent plagioclase phenocrysts set in a finely crystalline groundmass of potassium(?) feldspar and hornblende. These bodies may also exhibit a crowded porphyry texture.

These rocks are assumed to be Late Triassic to Early Jurassic in age as they appear to be concentrated near the margin of the Hogem intrusive complex and are similar in composition to Hogem phases of this age.

TENAKIHI INTRUSIVE COMPLEX (LATE TRIASSIC TO EARLY JURASSIC)

A sill-like body up to 1 kilometre in thickness and traceable for over 10 kilometres is exposed at the headwaters of Tenakihi Creek. It may continue to the northwest beyond the present limit of mapping. It is composed of fine to coarse-grained diorite and monzodiorite, commonly with layered, cumulate textures. Layering is roughly parallel to bedding in the surrounding tuffs. The rocks are typically massive, and predominantly coarse grained with 30 to 70 per cent pyroxene and hornblende. Cumulate layers can be as thin as 10 centimetres or up to several metres thick. These cumulate textures were seen sporadically along the length of the body.

This body may be related to the Hogem intrusive complex and may be Early Jurassic in age. Another possibility is that the Tenakihi intrusive complex is related to the Alaskan-type ultramafic intrusions in the area, the most prominent of which is the Polaris Complex in the Lay Range. Recent geochronometry on these Alaskan-type intrusions has yielded Middle Triassic to Early Jurassic ages (G.T. Nixon, personal communication, 1991).

WASI ULTRAMAFIC COMPLEX (EARLY JURASSIC OR OLDER)

A lenticular ultramafic body some 4 kilometres long and 1 kilometre wide at its centre, is exposed within Nina Creek Group rocks along a ridge south of Wasi Lake. It is composed predominantly of dark green serpentinite and medium to coarse-grained gabbro. The serpentinite is commonly quite massive and may contain large crystals of pyroxene. The gabbro contains between 30 and 50 per cent green pyroxene. It is commonly massive and may exhibit a weak foliation and listwanite alteration. A small tan-coloured aplite dike cuts this body along the ridge crest.

Examination of the northeast contact of the ultramafite indicates that it is intrusive. Ultramafic and gabbroic bodies of Alaskan affinities intrude the time-equivalent Lay Range assemblage north of the map area and recent geochronometry suggests a Middle Triassic to Early Jurassic age (G.T. Nixon, personal communication, 1991).

TERTIARY(?) INTRUSIONS

Tan, beige, pink or white hypabyssal quartz feldspar porphyry (dacite) sills intrude schists of the Swannell Formation near Beveley Mountain and rarely rocks of the Takla Group. Numerous bodies in the Beveley Mountain area vary from a few centimetres to over 100 metres in thickness. Quartz and feldspar phenocrysts constitute up to 5 per cent of the rock. Biotite or hornblende are accessory minerals. A single occurrence of these felsites was seen within the Takla Group in the northwest corner of the map area. A small dacitic stock is described by Roots (1954) within Swannell schists southwest of Beveley Mountain.

These rocks appear quite fresh and are assumed to be younger than other lithologies in the area. They are very similar to hypabyssal intrusions described by Ferri and Melville (1988) in the Manson Creek area which have been dated as Early Tertiary (Ferri and Melville, in preparation).

STRUCTURE

The character of deformation within the map area is quite diverse and attests to the disparate tectonic histories of the different terranes. Deformation is strongest, and most complex, within the Cassiar Terrane and least developed in rocks of the Quesnel Terrane. Some elements of folding and faulting are common to more than one terrane and must reflect deformation during and after accretion

The most prominent structural features are northwest-trending faults. They are well developed in and around the Vega Creek valley and separate or cut rocks of the Takla Group and Lay Range assemblage. Large areas of brittly deformed and altered rock are also seen along Thane Creek and the gorge at the big bend in Tenakihi Creek. Evidence from several localities indicates strike-slip and dip-slip movement. Furthermore, rocks between the fault zones are younger than the surrounding rocks, suggesting preservation within graben-like structures. These faults are believed to be part of a negative flower structure and produced by the northward translation on the Manson fault zone (Woodcock and Fischer, 1986; Figure 1-11-4). This northward shift and concurrent splaying in the fault zone allows the blocks within the splayed zone to drop as the strata on either side of the main fault move past each other. This mechanism reconciles strike-slip and dip-slip motion within a single structural system. The southern extent of these faults coincides with the extrapolated northwestern extension of the Manson fault zone and related faults along the Discovery Creek valley. The number and spacing of the faults decreases to the northwest, reflecting their more northwestward trend and loss of the dip-slip component.

The Uslika Formation is bounded by two of these faults and the position of these younger rocks against older rocks of the Lay Range suggests dip-slip movement. They dip steeply towards each other and contain both brittle and ductile deformational features. The north bounding fault is well exposed and is expressed by a zone of deformed Uslika and Lay Range lithologies several metres thick. Slickensides on this fault zone show both subhorizontal and moderately south to southwest-plunging orientations which together indicate left-lateral motion for the strike-slip component. This is in complete discord with strike-slip motion on the Manson fault zone, and other major fault zones in the region, which is right-lateral (Ferri and Melville, in preparation; Gabrielse, 1985). Alternatively, if strike-slip motion is right-lateral along this fault zone, the southwest-plunging slickensides suggest up-dip movement. Most of the motion on the bounding faults of the Uslika Formation must be down-dip as they place younger against older rocks. Any up-dip motion may be quite late and minor in magnitude.

The age of these structures is difficult to deduce. Rocks of the Uslika Formation, Sustut Group and conglomerates along Vega Creek are found within some of the graben structures. There is no evidence for syntectonic deposition of any of these clastic sequences. If there was syntectonic deposition, then fault movement has occurred from Early Jurassic to Early Tertiary time. Alternatively, if the clastic sequences are only preserved within younger graben structures, then movement is only as old as the youngest clastic package, which in this case would be Early Tertiary (Sustut Group). Evidence elsewhere in the northern Canadian Cordillera suggests regional strike-slip motion in Cretaceous and Early Tertiary time (Gabrielse, 1985).

Several other prominent faults transect the map area. A major northwest-trending southwest-side-down normal fault (Camp fault) drops Early Paleozoic carbonate stratigraphy against higher grade metamorphic rocks of the Swannell Formation in the Beveley Mountain area. It may continue down the Tenakihi Creek valley, separating Lay Range from Swannell rocks. Several other parallel structures cut Nina Creek and Lower Paleozoic stratigraphy in the Wasi Creek area.

The Uslika Lake and Wasi Lake valleys form prominent lineaments and suggest the presence of northeast-trending normal(?) faults with only minor displacement. These faults die out away from the strike-slip fault structures, suggesting a genetic link.

Cryptic and visible thrust faults cut rocks of the Nina Creek Group. Northeast-verging thrust faults are seen southeast of Wasi Lake where sediments of the Mount Howell Formation are placed on top of volcanics of the Pillow Ridge Formation. The Nina Creek Group sits structurally above rocks of the Cassiar Terrane, carried on a cryptic, northeast-verging, layer-parallel thrust fault (Ferri and Melville, in preparation). This thrust separates rocks of the Slide Mountain Terrane from those of the Cassiar Terrane in the map area. A similar thrust separates the two formations of the Nina Creek Group (Ferri and Melville, *ibid.*).

The structurally and stratigraphically lower parts of the Cassiar Terrane are polydeformed and affected by a prograde metamorphic event which reaches upper greenschist grade in the map area. At least three phases of deformation affect the metamorphosed rocks. An early synmetamorphic folding event (D_1) produced isoclinal folds with bedding transposed parallel to foliation. A second period of folding (D_2) also produced isoclinal folds with crenulated S_1 schistosity in their hinges. This folding was rarely seen and may in fact be related to D_1 deformation and produced by local instabilities in the flow regime during D_1 deformation, leading to the refolding of S_1 schistosity. An upright series of open folds and associated short-wavelength crenulations is locally produced by the third phase of deformation (D_3). These may be related to the large northwest-trending antiform in the Swannell Formation north of Beveley Mountain. The vergence of these structures is not known. Bedding and S_1 schistosity are overturned to the southwest on the north side of the Tutizika River and north of Jim May Creek, suggesting southwest-verging D_1 or D_2 structures. This is only seen locally and typically structures verge to the northeast as seen in the Germansen Landing and Manson Creek areas (Ferri and Melville, 1988, 1989, 1990a). Southwesterly directed structures are consistent with similarly oriented structures mapped by Bellefontaine (1990) in the Ingenika Range north of the study area.

The relationship of these structures to higher structures within the Cassiar and other terranes is not known. Large-scale northeast-verging thrust faults in the Nina Creek Group and other packages may be related to D_1 and D_2 deformation as suggested by Ferri and Melville (in preparation).

The Slide Mountain Terrane is characterized by kilometre-scale open folds that affect the entire package. Macroscopic, open to tight chevron folds can be seen within the lower argillites of this package and are associated with an axial planar, penetrative cleavage.

Rocks of the Lay Range assemblage are steeply dipping and, based on top reversals, tightly folded and generally overturned to the southwest. The monotonous nature of this sequence does not allow the delineation of any large-scale structures and only rarely were outcrop-size folds observed. A penetrative cleavage is present in the more argillaceous members but only rarely developed in the tuffs. Commonly, large clasts within the tuffs are flattened parallel to the steeply dipping bedding, suggesting tight to isoclinal folding. Faults of unknown origin appear to separate the various main lithologies of the Lay Range. Those that separate the mafic and ultramafic rocks north of Vega Creek may be part of the strike-slip fault system, although this is not certain on the basis of currently available data.

Rocks of the Quesnel Terrane (Takla Group) west of the graben structure, form a moderately southwest-dipping homoclinal succession interrupted by local upright folds.

METAMORPHISM

Metamorphism is most intense in Cassiar rocks where garnet-grade assemblages are found within the Swannell Formation. The grade drops off to lower greenschist within younger stratigraphy where biotite and chlorite isograds can be discerned locally. Textural relationships between large porphyroblasts and the other fabric elements indicate that their formation coincided roughly with D_1 deformation. These relationships are similar to those described by Ferri and Melville (1990a) and by Parrish (1976) and Bellefontaine (1990) to the north. Garnets and biotite porphyroblasts are retrogressed to chlorite, muscovite and quartz in various localities, suggesting a late retrogression event of uneven distribution.

This prograde metamorphic event has been dated as Middle Jurassic by Ferri and Melville (in preparation) with the later retrogression possibly related to Tertiary uplift, as suggested by the prevalence of Early Tertiary ages in these rocks to the south (Gabrielse, 1975; Ferri and Melville, *ibid.*).

Metamorphic grade of rocks of the Slide Mountain and Lay Range terranes is lower to subgreenschist and the Takla Group has been metamorphosed to prehnite-pumpellyite grade.

ECONOMIC GEOLOGY

Mineral prospects are numerous and of various types within the map area, including porphyry copper-gold and carbonate-hosted lead-zinc showings, shear-controlled veining, placer deposits and minor coal occurrences. The following discussion describes the characteristics of each type of occurrence. For a brief description of individual prospects refer to Table 1-11-1; the locations of the showings are plotted on Figure 1-11-3.

The Takla Group hosts the majority of the known mineral occurrences; abundant small copper showings are found along the length of the Hogem-Takla contact. Mineralization in the Takla Group is related to syenite and monzonite intrusions, probably related to the Hogem intrusive complex, and shear zones, possibly related to the Manson fault zone mapped south of this area (Ferri and Melville, 1989).

The Upper Proterozoic and Lower to Middle Paleozoic carbonates in the northwest part of the map area also host numerous base and precious metal prospects.

Lay Range volcanics and sediments host two newly discovered shear-related copper-gold showings and maroon basalt flows of the Takla Group (Chuchi Lake Formation?) host copper mineralization in the northwest part of the map area.

Thin coal seams are present in the Upper Cretaceous Sustut Group. Placer gold is known on Jim May and Vega Creeks (Roots, 1954).

PORPHYRY COPPER-GOLD PROSPECTS

Porphyry copper-gold prospects are exemplified by the Cat Mountain and Vega showings. Disseminated and fracture-filling chalcopyrite with secondary malachite, azurite and chalcocite occur within the intrusive rocks and the coarse-fragmental basaltic augite porphyry flows, finer pyroclastics and volcanic sediments of the Takla Group. Propylitic and potassic alteration characterize mineralized zones.

Syenomonzonite porphyry and hornblende diorite bodies on the Cat property are believed to be satellites of the Hogem intrusive complex. The porphyries are cut by numerous faults. Some of these faults appear to postdate alteration and mineralization (Anomaly fault) while others are mineralized. This suggests a complex structural history which may involve reactivation of early, and possibly, synintrusive structures.

Massive, gossanous magnetite-quartz veins and boxwork host copper and coarse visible gold mineralization at the summit of Cat Mountain (BET claims). Magnetite-rich zones, like the MBX zone at Mount Milligan, often occur in alkaline porphyry systems. Similar magnetite-quartz veins were found in other locations close to the Takla-Hogem contact north of Cat Mountain.

MINERALIZATION RELATED TO THE HOGEM CONTACT

Copper mineralization (chalcopyrite, malachite, azurite, bornite, chalcocite) occurs along the Hogem-Takla contact. Copper is associated with ankerite veining, as disseminated blebs of chalcopyrite along fracture surfaces, disseminated throughout the host and in magnetite±specularite veins containing massive to disseminated chalcopyrite±bornite. Mineralization occurs in zones from a few centimetres to several metres wide cutting augite porphyry flows and tuffs, the Hogem monzonites and other peripheral phases of the intrusive complex. Prospects around the fringes of the Hogem intrusive complex are associated with swarms of syenitic dikes, potassium feldspar alteration and metasomatization of the Takla Group and the intrusive complex suggesting the roots of a porphyry system (Garnett, 1978).

CARBONATE-HOSTED MINERALIZATION

Two types of carbonate-hosted mineralization occur in the map area; disseminated and replacement lead-zinc mineralization of possible Mississippi Valley type and lead-zinc veins.

Mineralization in the Otter Lakes limestone occurs as replacement of dolomite or as open-space fillings. Mineralization appears stratabound and is found in pods or blebs. The mineralogy consists of fine-grained galena (which may be argentiferous), sphalerite (yellow-brown to red-brown) and pyrite. Similar mineralization is found along this horizon southeast of the map area (Ferri and Melville, 1990a).

The Beveley prospect, on the south slope of Beveley Mountain, is a series of occurrences of disseminated and massive galena, sphalerite, acanthite, tetrahedrite and barite which appear to have been emplaced in veins cutting the carbonates of the Middle Ordovician to Early Devonian Echo Lake Group. Mineral inventory calculations indicate approximately 100 000 tonnes grading 36.13 grams per tonne silver, 1.42 per cent lead and 2.24 per cent zinc (Coveney, 1981).

Southeast of the Beveley prospect, across the Osilinka River, lead-zinc-silver-barite veins carbonate rocks at the Carie showing. This occurrence was not visited, but it appears similar to the Beveley (Fahrni, 1979).

The Quarry showing (No.10), a new mineral prospect found in a limestone quarry at the base of Beveley Mountain, consists of several mineralized quartz veins cutting a dolomitized section of the Espee Formation. Quartz veins up to 20 centimetres wide appear to occur in a conjugate system with mineralization present throughout the veins but strongest at vein intersections. Coarsely crystalline minerals include galena, sphalerite, cerussite, chalcopyrite, boulangerite, stibnite and tetrahedrite. Two grab samples returned analyses of 890 ppb and 385 ppb gold.

SHEAR-CONTROLLED VEINING

Grits, impure quartzites and quartz-feldspar-garnet schists of the Ingenika Group at the top of Beveley Mountain host the Gael showing, a shear-controlled gold-silver-copper vein. The mineralized zone is clearly visible due to the yellow scorodite staining on the rocks. The hostrocks are strongly brecciated and silicified within the mineralized zone.

The Mississippian to Permian Lay Range assemblage is host to two copper-gold occurrences. Malachite staining on fracture surfaces was found in sheared, epidote-altered basalt flows on a ridge-top west of the mouth of Tenakihi Creek. A gold analysis of 1300 ppb was obtained from a grab sample. Fine-grained sediments northeast of Vega Creek are cut by quartz-ankerite veins carrying malachite.

Mercury mineralization (cinnabar) is reported at several locations within the Takla Group (Roots, 1954), always in sheared zones associated with ankerite veining and alteration. These strike-slip shear zones are most likely a northern extension of the Manson fault zone mapped to the southeast (Ferri and Melville, 1989).

The HaHa Creek showing consists of free gold in small quartz veins and copper mineralization in shears within the Hogem intrusives (Roots, 1954).

The Pluto showing consists of massive arsenopyrite and pyrite within strongly sheared Takla Group rocks along a tributary of Thane Creek. This occurrence has been known since the 1940s (Roots, 1954) and contains significant amounts of gold.

Minor Coal Occurrences

Late Cretaceous Sustut Group sandstones and conglomerates host discontinuous, low-grade coal seams up to 45 centimetres thick (Roots, 1954). Early Cretaceous sandstones, siltstones and argillites exposed along Vega Creek contain coaly lenses 5 to 10 centimetres thick.

CONCLUSIONS

- The map area covers parts of the Cassiar, Slide Mountain, Harper Ranch and Quesnel terranes.
- The Lay Range assemblage has characteristics which are consistent with an arc or back-arc setting and has similarities with the Nina Creek Group.
- The Takla Group comprises both Upper Triassic and Lower Jurassic units which are equivalent to recognized units farther south.
- The area is transected by a major northwest-trending system of strike-slip faults and associated graben structures.
- Mineral occurrences are diverse and abundant within the map area. Most are porphyry copper-gold prospects within the Takla Group and at the Hogem-Takla contact. Significant carbonate-hosted lead-zinc mineralization is found in Paleozoic rocks.

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