GEOLOGY OF THE MORE CREEK AREA, NORTHWESTERN BRITISH COLUMBIA (104G/2)

By J.M. Logan, J.R. Drobe and D.C. Elsby

KEYWORDS: Regional geology, More Creek, Stikine assemblage, Stuhini Group, Mount Dilworth equivalent felsite, porphyry copper-gold, massive sulphides.

INTRODUCTION

This paper summarizes 1:50 000-scale mapping of the geology and mineral occurrences of the More Creek (NTS 104G/2) map sheet in northwest British Columbia (Figure 1-14-1). This work adjoins 1989 mapping of the Forrest Kerr (104B/15) map sheet (Logan *et al.*, 1990a, b), 1988 mapping of Sphaler Creek (104G/3) map sheet (Logan and Koyanagi, 1989; Logan *et al*, 1989), and mapping published by Souther (1972) and Brown and Gunning (1989a, b; Figure 1-14-1). The geology was mapped at a scale of 1:25 000, compiled at 1:50 000, and will be released as Open File 1992-5 (Logan *et al.*, 1992). Samples were collected for geochemical analysis (base and precious metals, major and trace elements), isotopic dating, macrofossil and conodont identification. Results will be released at a later date.

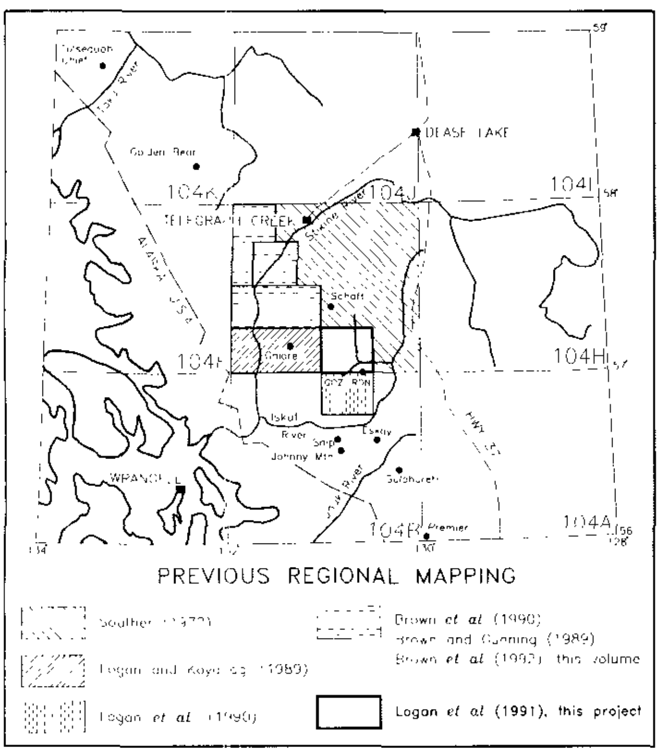


Figure 1-14-1. Location map showing previous and current field areas for Iskut North (Logan *et al.*) and Stikine (Brown *et al.*) projects.

The More Creek map area lies wholly within the Boundary Ranges of the Coast Mountains. The area is mountainous except for the high plateau around and to the south of Arctic Lake. West of Mess Creek, there is a significant increase in relief and the mountains are more rugged. The contrast in topography across Mess Creek decreases to the south and ends near its headwaters. More Creek is the main drainage in the area. It flows to the south along the Forrest Kerr fault linear, and then east after joining with a major northeast-flowing tributary, the south fork of More Creek. More Creek drains into the Iskut River off the eastern edge of the map area. Hankin Peak is the highest point in the area with an elevation of over 2560 metres.

Access to the area is by helicopter from Bob Quinn Lake airstrip, located 400 kilometres north of Smithers on Highway 37.

REGIONAL GEOLOGY AND PREVIOUS WORK

The study area lies along the margin of the Intermontane and Coast belts and is underlain by rocks of the Stikine Terrane. At this latitude, Stikinia is comprised of four unconformity-bounded, tectonostratigraphic packages (Anderson, 1989): Paleozoic volcanic and sedimentary rocks of the Stikine assemblage (Monger, 1970, 1977; Brown *et al.*,1991); Mesozoic volcanic-plutonic arc assemblages, represented in the Triassic by the Stuhini Group and in the Jurassic by the Hazelton Group (Alldrick and Britton, 1988; Anderson and Thorkelson 1990; Logan and Koyanagi, 1989b); a Middle and Upper Jurassic overlap assemblage, the Bowser Lake Group (Evenchick, 1991) and the Mesozoic to Cenozoic Coast Plutonic Complex (Woodsworth *et al.*, 1989; Anderson and Bevier, 1990). Upper Cretaceous to Tertiary transtensional continental-arc assemblages of the Sloko Group, and Neogene to Recent postorogenic bimodal plateau flows of the Edziza and Spectrum ranges (Souther, 1971; Souther and Symons, 1974) overlie these earlier island-arc assemblages.

The most economically important exploration targets are porphyry copper-gold deposits, peripheral mesothermal precious metal veins, and gold-enriched polymetallic massive sulphide deposits.

Earliest geological mapping in the area was carried out by F.A. Kerr along the Stikine and Iskut rivers (Kerr, 1948). Additional work by the Geological Survey of Canada includes: mapping on the Telegraph sheet as part of Project Stikine (1957), studies of the Tulsequah sheet (Souther, 1971), Telegraph sheet (Souther 1972) and the Edziza volcanic complex (Souther, 1970, 1988; Souther and Symons, 1974). Read *et al.* (1989) conducted feasibility studies for B.C. Hydro and Power Authority between 1980 and 1983.

STRATIGRAPHY

STIKINE ASSEMBLAGE

The Stikine assemblage forms the basement to Stikinia and includes all Late Paleozoic rocks peripheral to the Bowser Basin (Monger, 1977). These rocks underlie the western third of the map area and range in age from pre-Early Devonian to Early Permian. In the More Creek area, the Stikine assemblage can be further divided into five main packages. From the oldest up, they are: an Early Devonian and older, penetratively deformed, intermediate to mafic metavolcanic tuff, recrystallized limestone, graphitic schist and quartz sericite schist package; a variably and overall lesser deformed Carboniferous and older mafic volcanic and carbonate package; latest Early Carboniferous to earliest Late Carboniferous crinoidal limestones, which overlie the volcanic flows and clastic rocks about 5 kilometres to the south, on the Forrest Kerr map sheet; pre-Early Permian, thick-bedded, granite-bearing volcanic conglomerate, grading into lapilli tuff near the upper contact; and Early Permian packstone.

DEVONIAN AND OLDER

West and south of the headwaters of Mess Creek is an arcuate belt of penetratively foliated, polydeformed metavolcanic and metasedimentary rocks 3 to 5 kilometres wide. These rocks comprise a structurally complex succession of schistose to foliated felsic and mafic volcaniclastics with interbedded sericite and chlorite schist, graphitic and siliceous phyllite and limestones (Holbek, 1988; Barnes, 1989; Logan and Koyanagi, 1989; Logan *et al.*, 1990a). Structurally, and presumably stratigraphically lowest, is a metasedimentary package of intermixed chloritic, graphitic and maroon phyllite with interbedded quartz sericite schist (**DSgs** and **DSqs**). Intermediate to mafic, purple and green tuffs and flows (**DSst**) overly the metasediments. Contacts are gradational. Massive to variably schistose sills of metadiorite and chlorite schist are intercalated with purple and green chloritic tuff and sericite schist.

A thick section of variably deformed intermediate volcanics and numerous limestone members of variable thickness (**DSfv** and **DSlm**) overlies the metasedimentary rocks in angular discordance (Barnes, 1990). Interbedded recrystallized limestones contain *Favosites* sp. at least as old as late Early Devonian (A. Pedder, personal communication, 1991). The volcanic rocks are predominantly green, plagioclase-phyric tuffs, amygdaloidal flows and volcaniclastic rocks, with subordinate purple and maroon tuff, black siltstone and felsic tuff. Relatively thin beds and lenses of carbonate are intercalated with the volcanics. The limestones are white to light grey, thinly foliated, locally variegated and recrystallized. Interbeds of black to dark grey micrite and green calcareous tuffaceous siltstone are common. Intraformational limestone conglomerates and breccias, buff and orange dolomite, and cherty siltstone horizons also occur. Thicker units of limestone which are, in part, structurally thickened, are medium bedded, light grey and recrystallized (**DSlm**). Thin interbedded siliceous layers weather positive and outline folds in otherwise massive, amorphous bone-white marble. Limestone units clearly display the polyphase nature of deformation affecting these rocks, particularly in Unit **DSfv,** where competency contrast between volcanic and carbonate rock is high.

CARBONIFEROUS OR OLDER

Above the Devonian and older unit is a more mafic sequence of variably foliated andesitic to basaltic volcanic rocks (**CSv**). These rocks occupy the higher peaks south and east of the headwaters of Mess Creek and are correlated with rocks which underly Mississippian limestone in the Forrest Kerr map area. The lower contact with Devonian and older volcanics (**DSfv**) was not defined. Carboniferous and older volcanic rocks are thought to be comprised of an upper basaltic pillow and breccia-flow unit, and a lower intermediate to felsic plagioclase-phyric succession of volcaniclastic rocks; the lower unit may in fact be the intermediate to felsic volcanics of the Devonian package (**DSfv**).

In the southwestern corner of the map area (Figure 1-14-2), a section of weakly to unfoliated, well-stratified and graded volcaniclastics more than 400 metres thick is exposed on the flank of a nunatak. The section includes maroon, hematitic and manganiferous lapilli and crystal tuffs, maroon pillow-basalt flows and breccias, and felsic dacitic to rhyolitic lapilli tuffs. Thin-bedded ash-tuff, tuffaceous sandstone and conglomerate are interspersed with the pillowed and breccia flows; sedimentary structures indicate tops are up. Mafic volcanics and patchy limestone lenses overlie these volcaniclastics.

The upper volcanic package is characteristically a dark green, massive pile of mafic pillowed flows, flow breccia and hyaloclastite. Flows are aphyric or weakly porphyritic and commonly amygdaloidal. Scoriaceous pillows and bombs(?) occur within thick interbedded finely vesicular basalt lapilli tuff and hyaloclastite debris flows. The latter are characterized by pale green angular to globular-shaped fragments with narrow quench-alteration rims in a limy, green-grey matrix.

UPPER CARBONIFEROUS

Early Upper Carboniferous (Bashkirian) reefal limestone conformably overlies hyaloclastite in the northwest corner of the Forrest Kerr map area (Logan *et al.* 1990b). At Round Lake, 8 kilometres west of Mess Creek, these same limestones are penetratively deformed and structurally thickened to more than 500 metres. Similar discontinuous limestone mounds (**CSlm**) are interbedded with hyaloclastites, epiclastics and flows on both sides of South More Creek. These are neither thin bedded nor as continuous as the Devonian limestones (**DSlm**). They have been sampled for conodonts and are tentatively included with the Upper Carboniferous package.

PERMIAN

West and south of Arctic Lake is a fault-complicated succession of sedimentary rocks greater than 400 metres thick. It comprises, from oldest to youngest, conglomerate, limestone, siltstone, sandstone and tuffaceous conglomerate (Plate 1-14-1). Preliminary macrofossil identifications from the limestone give Early Permian ages (E.W. Bamber, personal communication, 1991). Souther (1972) included the conglomerates from this area in his Unit 13, a Lower Jurassic succession of polymictic conglomerate, granite-boulder conglomerate and sandstone. Stratigraphic relationships indicate that these conglomerates are older than the limestone and may correlate with Upper Carboniferous to Lower Permian conglomerates (Logan and Koyanagi, 1989) recognized south of Round Lake and northwest of Newmont Lake (Logan *et al.*, 1990b).

The lowermost unit is a maroon and grey, polymictic boulder to cobble conglomerate which is conspicuous west of Arctic Lake. Volcanic clasts predominate but quartz grains and granitic clasts are diagnostic components. Rounded to subangular clasts include, in order of abundance; intermediate to mafic plagioclase-porphyritic and plagioclase-hornblende porphyritic-andesite, lapilli-crystal tuff, coarse-grained granite, quartz feldspar porphyry, diorite and minor basalt. The uppermost sections of this conglomerate are finer grained, maroon, quartz-rich tuff and tuffaceous siltstone. Well-bedded limestone overlies this unit; the contact is sedimentary and conformable. The limestone forms prominent limonite and hematite-stained bluffs, which trend north along the east side of Mess Creek. High-angle normal faults have offset and tilted the stratigraphy. Areas of significant alteration are coincident with fault structures and dikes. The limestone comprises less than 200 metres of massive and medium to thin bedded grey packstone and light brown dolomite. It lies in depositional contact with either maroon tuffs and sediments or quartz-rich Mississippian granite. It contains an abundant Early Permian fauna of rugose and tabulate corals, pelecypods, productoid and rhynchonellid brachiopods and fusulinacean foraminifers. In places corals are preserved in growth positions indicating a reefal (reef mound?) environment.

Middle Triassic

An unnamed package of Middle Triassic fine clastic rocks overlies the Paleozoic Stikine assemblage and separates it from the Upper Triassic Stuhini Group. A section of limy sediments 175 metres thick paraconformably overlies Lower Permian limestone west of Arctic Lake (Figure 1-14-2 and Plate 1-14-1). The lowermost 100 metres consists primarily of black, medium-bedded, planar-laminated, fetid, limy siltstone and fine sandstone. Elliptical concre-

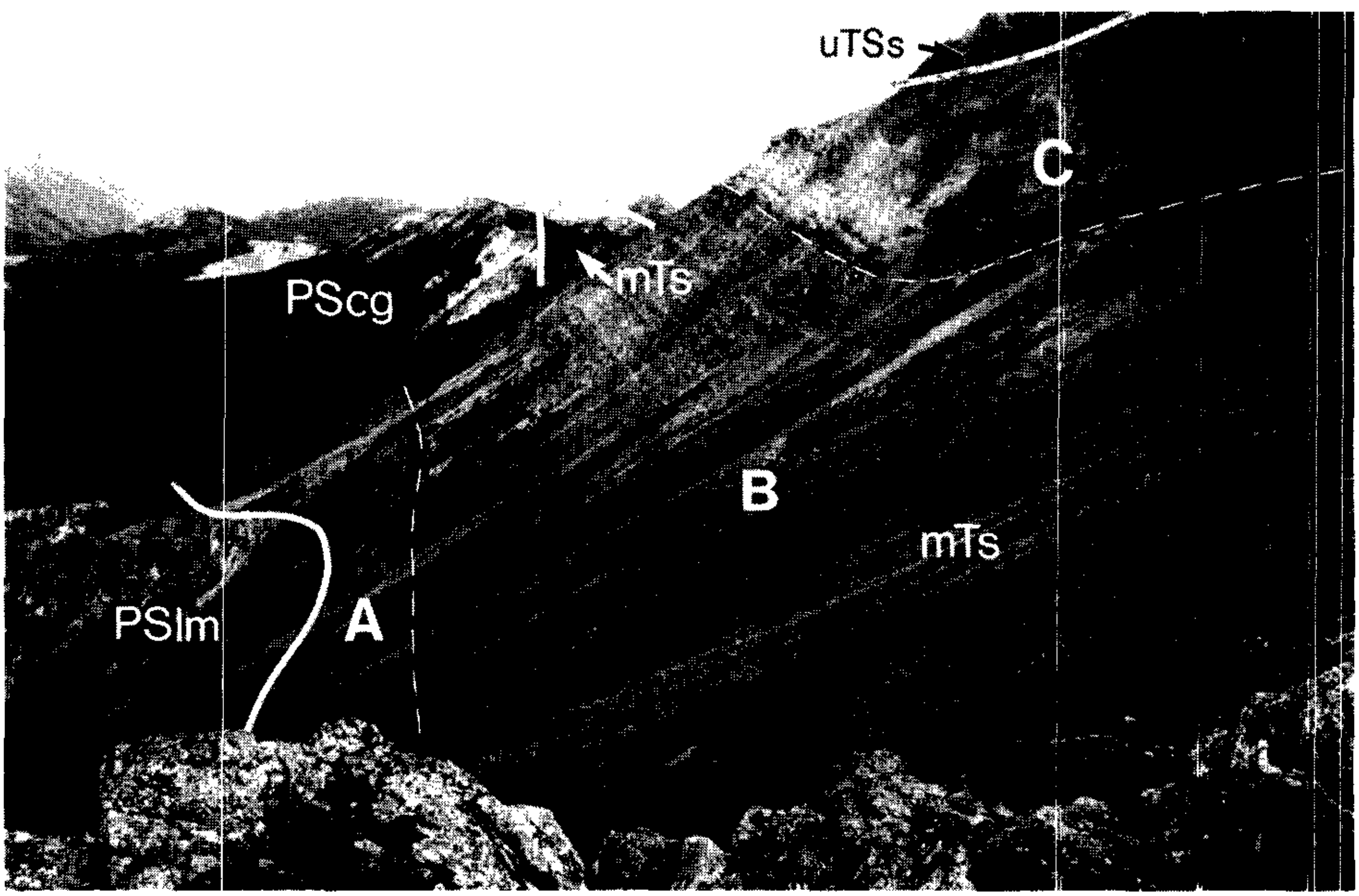


Plate 1-14-1. Well-bedded pre-Permian to Upper Triassic section exposed 4 kilometres southwest of Arctic Lake (viewed north down Mess Creek). Sediments are kinked and gently warped about a northeast-trending axis. Normal faulting has down dropped and preserved Middle Triassic sediments (mTs) in graben structures within Permian maroon quartz-rich granite conglomerate (PScg) to the north. PSlm=fossiliferous Permian limestone; mTs=Middle Triassic sediments, A=quartose sandstone, B=limy, fetid sandstone-siltstone, C=interbedded sandstone and siltstone; uTSs=Upper Triassic Stuhini Group conglomerate with potassium feldspar crystal-tuff horizons.

LEGEND

LAYERED ROCKS

QUATERNARY

Qal	*glacial till and alluvium*
Qob	*olivine basalt scoria, flow and flow breccia*

TERTIARY OR YOUNGER

Tb	*basalt flow, breccia and lapilli tuff*

LOWER AND MIDDLE JURASSIC

HAZELTON GROUP

mJHsl	*siltstone-sandstone, crystal-lapilli tuff and rhyolite-lapilli tuff, limy sandstone*
mJHb	*basalt flow, breccia and tuff, grey scoriaceous, aphyric to sparsely plagioclase-phyric, horizons of interbedded thin black shale and white tuff*
lJHv	*purple and green basaltic andesite lapilli tuff and flows, locally pillowed, plagioclase and augite-phyric flows*
lJHr	*rhyolite, ash-flow lapilli tuff and flow-layered lava, silicified conglomerate and tuff*
lJHsn	*tan-weathering sandstone, plagioclase crystal tuff, peperite flows, siltstone, carbonaceous plant fragments common*
lJHsl	*black graphitic siltstone, stratiform diagenetic pyrite to several per cent, thin interbeds of tan and grey sandstone*

UPPER TRIASSIC

STUHINI GROUP

uTSv	*medium to thin-bedded, pale green-grey tuffs, tuffaceous siltstone, orange-weathering augite-phyric and aphyric basalt flows, tuff and sills*
uTSs	*thick, poorly bedded green-grey tuffaceous, augite-bearing sandstone/siltstone, common granule and pebble conglomerate, thin-bedded black limestone*
uTSsn	*well-bedded feldspathic sandstone, greywacke and siltstone; limestone-bearing conglomerates and very thin-bedded siltstone*
uTSsl	*massive, black to grey-brown, calcareous siltstone, thin-bedded and laminated with fine-grained sandstone, typically undulose cross-stratified*

MIDDLE TRIASSIC ?

mTs	*limy, fetid sandstone, siltstone, concretionary sandstone and shale; thin bedded, carbonaceous and pyritic*

STIKINE ASSEMBLAGE

PERMIAN

PSlm	*bioclastic packstone, lesser buff silty dolomitic units; medium-bedded to massive, grey*
PScg	*cobble to boulder, maroon, grey and orange conglomerate and sandstone; clasts are granite, quartz-feldspar porphyry, plagioclase phyric andesite and lapilli-crystal tuff, minor diorite and basalt clasts, tuffaceous near upper contact with limestone*

CARBONIFEROUS OR OLDER

CSlm	*limestone, crinoidal limestone, massive to thickly bedded, medium grey*
CSv	*basalt and andesite pillowed flow and breccia, hyaloclastite, lapilli and ash tuff; massive to weakly foliated, dark green to grey*

DEVONIAN AND OLDER

DSfv	*intermediate to felsic plagioclase phyric tuffs, flow breccia, minor flows; light green to grey, minor limestone*
DSlm	*deformed coralline limestone; massive to thinly bedded, grey to buff*
DSst	*bright green chlorite and red-purple schistose tuff and minor flows, interbedded tuffaceous and siliceous dust-tuff and common thin-bedded recrystallized limestone*
DSqs	*quartz sericite schist; white to pale green-grey with crenulated foliation*
DSgs	*black graphitic schist*

INTRUSIVE ROCKS

EARLY JURASSIC AND YOUNGER

eJd	*medium-grained equigranular diorite and gabbro, plagioclase and pyroxene groundmass*
eJmz	*fine-grained and potassium feldspar porphyritic monzonite, granodiorite*

LATE TRIASSIC OR YOUNGER

lTum	*serpentinized peridotite*

PERMIAN OR YOUNGER

Pmz	*monzonite; dark grey-brown, pink weathering; plagioclase-hornblende porphyry*

MISSISSIPPIAN OR YOUNGER

Mg	*coarse to medium-grained, biotite and hornblende granodiorite, tonalite, and granite*
Md	*medium-grained hornblende diorite, quartz diorite; compositional layering (amphibolite-tonalite) common; locally foliated and gneissic, especially near margins*

DEVONIAN ?

lDd	*weakly foliated to schistose diorite; dark green and equigranular, grades into chlorite schist with crenulated foliation*

SYMBOLS

Geological contact (depositional, intrusive)..

Fault (normal, thrust)..

Limit of mapping..

Bedding..

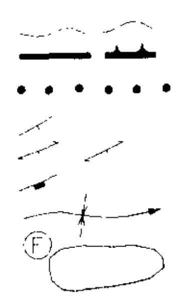
Foliation (S_{1+2}, S_3)..

Dykes..

Fold axes..

Fossil locations..

Glaciers..



tions of coarsely crystalline siderite are common. Based on lithology, these sediments are correlated with Middle Triassic sediments exposed east of Galore Creek (Souther, 1972; Logan and Koyanagi, 1989). A discontinuous thin-bedded, quartz-bearing tuffaceous sandstone/greywacke occupies the base of the section. It overlies Lower Permian limestone and is interbedded with fetid black limestone at its upper contact. The clastic component increases in size and proportion up section; micrite and limy siltstone grade into thinly interbedded siltstone and sandstone. The sandstone package is 75 metres thick, and consists of medium-bedded buff to orange sandstone with thin interbeds of black and grey siltstone. The sandstone weathers concentrically and contains carbonized wood fragments. Rare bivalves from siltstones in this package have been submitted for identification.

Black, carbonaceous siltstone containing approximately 0.5 per cent finely disseminated pyrite, stockworks of white calcite veinlets, and numerous elliptical concretions, outcrops in the eastern edge of the map area in structurally low positions. The incompetent nature of these rocks accounts for their characteristically tight disharmonic parallel folding. On the basis of lithology, they are correlated with the calcareous siltstones west of Arctic Lake.

Upper Triassic Stuhini Group

Upper Triassic Stuhini Group rocks in the More Creek area comprise a thick package of predominantly volcanic arc derived sediments, limestones and intercalated intermediate to mafic volcanic rocks. These rocks correspond, in part, to the eastern facies of Anderson (1989). Rocks of the

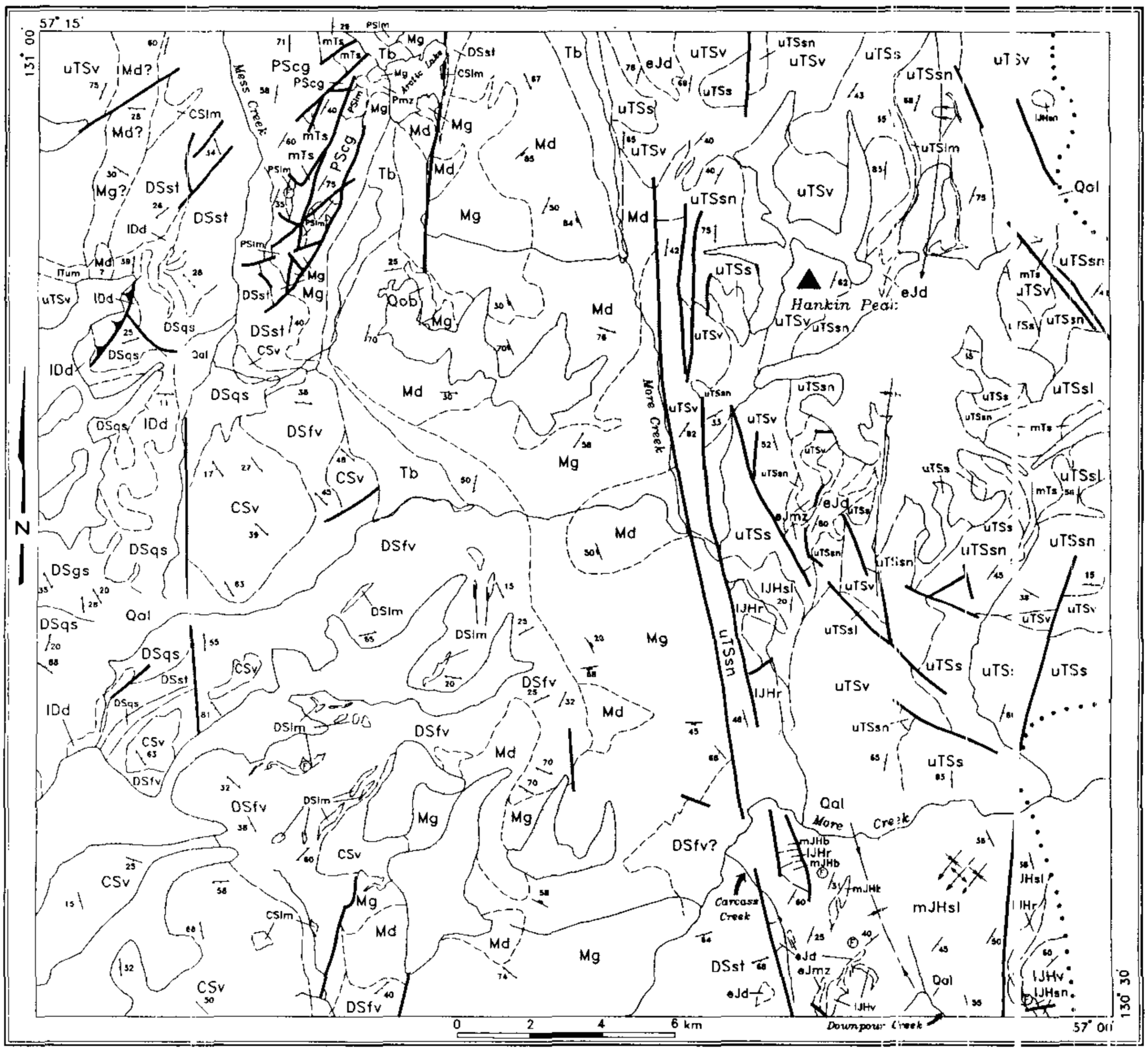


Figure 1-14-2. Simplified geology of the More Creek area (104G/2). *See* facing page for legend.

Stuhini Group crop out east of the Forrest Kerr fault north of More Creek and west of Mess Creek in the northwest corner of the map area (Figure 1-14-2). The best-exposed stratigraphic sections are on the northeast and southwest flanks of Hankin Peak, and approximately 10 kilometres south of Hankin Peak on the Lucifer claims. These rocks have been divided into five mappable units. From oldest to youngest, they are: massive, thin-laminated, black and brown siltstone (**uTSsl**); khaki feldspathic sandstone and greywacke (**uTSsn**); grey recrystallized limestone and cherty siltstone (**uTSlm**); thick-bedded augite-bearing greywacke and *sharpstone conglomerate* (**uTSs**)*; and augite-phyric and* aphyric flows, related tuffs and epiclastics (**uTSv**).

West of Arctic Lake, in gradational contact with the Middle Triassic siltstone-sandstone package, is a discontinuous unit of finely laminated, pale green cherty siltstone 1 to 2 metres thick. Overlying the siltstone is a dark green polymictic pebble to cobble conglomerate (**uTSs**). The contact is sharp, parallels bedding and appears to be depositional. Clasts are well rounded to angular and include limestone, marble, augite and hornblende-phyric volcanics, basalts and chert. In contrast to the pre-Permian conglomerates that contain granite and free quartz, this conglomerate contains augite grains. Tuffaceous sections within the conglomerate contain coarse (0.5–2 cm) white and pink potassium feldspar laths, which comprise about 5 per cent of the rock. This tuffaceous conglomeratic unit crops out west and north of Arctic Lake, in an isolated occurrence 6 kilometres north of the confluence of More and South More creeks, on the west side of More Creek, and on the Lucifer property, north of More Creek.

East of Forrest Kerr fault, the lowermost unit (**uTSsl**) is a planar-laminated siltstone interbedded with undulose to wavy cross-stratified sandstone. The unit crops out as dark grey to black, massive or thickly bedded, calcareous siltstone with light brown, orange-weathering sandstone interbeds. Common sedimentary structures include load and flame structures, soft-sediment slumping and trough crossbeds; graded bedding is less common. This unit is overlain by a well-bedded sequence of khaki feldspathic sandstone, thin interbedded dark grey siltstone to fine sandstone, poorly sorted dark grey arkosic greywacke and limestone-bearing conglomerate (**uTSsn**). Sandstone commonly contains lithic clasts and laminated siltstone rip-up clasts. Interbedded with these rocks are planar-laminated, olive-grey, dark green and black, thin-bedded siliceous siltstones and fine sandstones. Limestone conglomerate and polymictic limestone-bearing conglomerate are distinctive green, yellow or maroon-weathering coarse clastic units. Angular to rounded light grey limestone clasts in a buff matrix of coarse, tuffaceous and limy sand comprise up to 85 per cent of some outcrops. Subordinate volcanic sandstone and siltstone make up the remainder. Polymictic conglomeratic layers of variable thickness contain mixed angular and rounded fragments up to 20 centimetres (average 5 cm) in diameter. Clasts include maroon and grey pyroxene and plagioclase-phyric andesite, black siltstone and limestone. Star-shaped (isocrinus?) crinoids, of Triassic or younger age, occur within limestone clasts. White-weathering, grey, recrystallized, massive to medium-bedded limestone (**uTSlm**) crops out as discontinuous units, less than 50 *metres thick, throughout the stratigraphy.* The limestone is bioclastic, containing sparse crinoids and various pelecypod and brachiopod fossil fragments. A package of siltstone and ribbon chert (to 50 m thick) overlies the limestone and in places is interbedded with it. The siltstone and chert are variegated; black, green, yellow and grey. Recessive dark grey and black silty limestone may represent basinward facies equivalents of the bioclastic limestone. Thick-bedded tuffaceous sandstones, sharpstone conglomerates and thin-bedded black limestones (**uTSs**) comprise a succession 300 metres thick east of Hankin Peak. The sandstones are light green, *augite-bearing, medium-grained, well-sorted* arkoses; in places, they texturally resemble pyroxene diorite intrusive bodies. These massive green tuffaceous sandstones are typically chaotic slump or debris-flow deposits of poorly sorted greywacke or sharpstone conglomerate. Thick and numerous sharpstone conglomerate horizons occur within this unit. The matrix of the sharpstone conglomerate is most commonly arkosic; clasts include laminated siltstone, bedded sandstone, chert, limestone and rare aphyric volcanics. The clasts are angular to subangular, average 2 centimetres, and are as large as 10 centimetres in diameter. Bivalves, possibly Late Triassic Monotis or Middle Triassic Daonella, are present in thin siltstones and in clasts from interbedded sharpstones north of the Lucifer claims. Sharpstone conglomerate with an argillaceous matrix is exposed east of Hankin Peak. Thin-bedded black to dark grey argillaceous limestone is interbedded with tuffaceous sandstones north of Twin glaciers. The limestone contains belemnites and ammonites; the siltstone and sandstone contain bivalves.

Upper Triassic volcanic rocks (**uTSv**) are volumetrically subordinate to the previously described sedimentary rocks. Intermediate volcaniclastics and epiclastics predominate, intermediate and mafic flows are subordinate. North of More Creek, maroon and dark green plagioclase-phyric lapilli tuff is interbedded with white to brown-weathering, medium-grained feldspathic volcanic sandstone. Subangular lapilli and reworked, well-rounded 1 to 2-centimetre fragments are plagioclase and hornblende phyric in a pyroxene crystal rich matrix. The tuffs and epiclastics are stratified but thick bedded, and generally difficult to distinguish from one another. Coarse polylithic block-tuffs containing plagioclase-phyric andesite, dacite and maroon hornblende plagioclase andesite are distinctive within the thick section of interbedded ash and lapilli tuff and reworked epiclastic rocks. Northwest and northeast of Hankin Peak, maroon augite-phyric and plagioclase-hornblende-phyric flows and flow breccias are interlayered with pyroxene-rich crystal and lapilli tuffs. The flows contain augite phenocrysts to 10 millimetres in size and stubby plagioclase phenocrysts to 3 millimetres in size in a purple and green mottled groundmass. West of Mess creek is a pile of maroon amygdaloidal plagioclase and pyroxene-phyric basalt flows, breccias and tuffs, and dun-weathering, olivine-rich basaltic tuffs 800 metres thick. These are intruded by trachytic sills of coarse-bladed plagioclase and pyroxene porphyries, probable feeders to overlying volcanics. East of Hankin Peak, interlayered maroon and green ash and lapilli tuff, massive plagioclase-phyric andesite, and scoriaceous flow breccias overlie thin bedded, pyritic siltstone and sandstone.

North of Hankin Peak, weak to variably foliated volcanic, tuffaceous and epiclastic rocks crop out in creek valleys. Lithologically this package is identical to rocks of the Upper Triassic Stuhini Group. Chlorite phyllites and schists are locally developed, and generally occur structurally below less-deformed pale green, fine-grained distal tuffs. This area may contain pre-Triassic rocks, but insufficient work has been completed to be certain.

LOWER TO MIDDLE JURASSIC

Lower and Middle Jurassic sedimentary and volcanic rocks (Souther, 1972; Read *et al.*, 1989) crop out mainly south of More Creek and east of Forrest Kerr fault (Figure 1-14-2). In general, the Lower to Middle Jurassic stratigraphy comprises a lower succession of dominantly siltstone and sandstone, a middle succession of massive rhyolitic and intermediate volcanic rocks and an upper sequence of siltstone, tuff and basalt breccias and flows. The area south of More Creek is bisected by a southerly flowing tributary of Downpour Creek. Read *et al.* (1989) report Early Jurassic (late Toarcian) fossils from the ridge west of this tributary. Fossils collected from the same general location (this study) have been interpreted as Middle Jurassic (Bathonian; Poulton, 1991). East of the tributary, Souther (1972) reports fossils with Middle Jurassic (middle Bajocian) ages from three localities along the lower slopes of the ridge. At the east end of the ridge a fault-bound package contains Early Jurassic (Sinemurian) fossils. Lithology and fossil distribution indicate a general synclinal form for the Jurassic strata south of More Creek.

The stratigraphically lowest, but structurally highest Lower Jurassic rocks occur northeast of Downpour creek. At this location at least 200 metres of massive and thin-bedded black siltstone and minor standstone (**lJHsl**) are conformably overlain by at least 50 metres of tan to rusty weathering sandstone and minor pebble conglomerate (**lJHsn**). These sediments are conformably overlain by a resistant volcanic succession of rhyolite (**lJHr**) and andesitic flows and tuffs (**lJHv**; Plate 1-14-2). The rhyolitic rocks are about 120 metres thick and consist of a basal welded ash-flow tuff and an upper flow-layered, aphyric, white and rusty weathering rhyolite flow. The ash-flow tuff contains pale green aphanitic and finely flow-layered lapilli, which average 3 to 6 millimetres in size, in a white to pale grey siliceous matrix. The exact relationship of the ash-flow tuff to the overlying flow-layered rhyolite is not known, but it appears to be conformable. Pebble conglomerate adjacent to

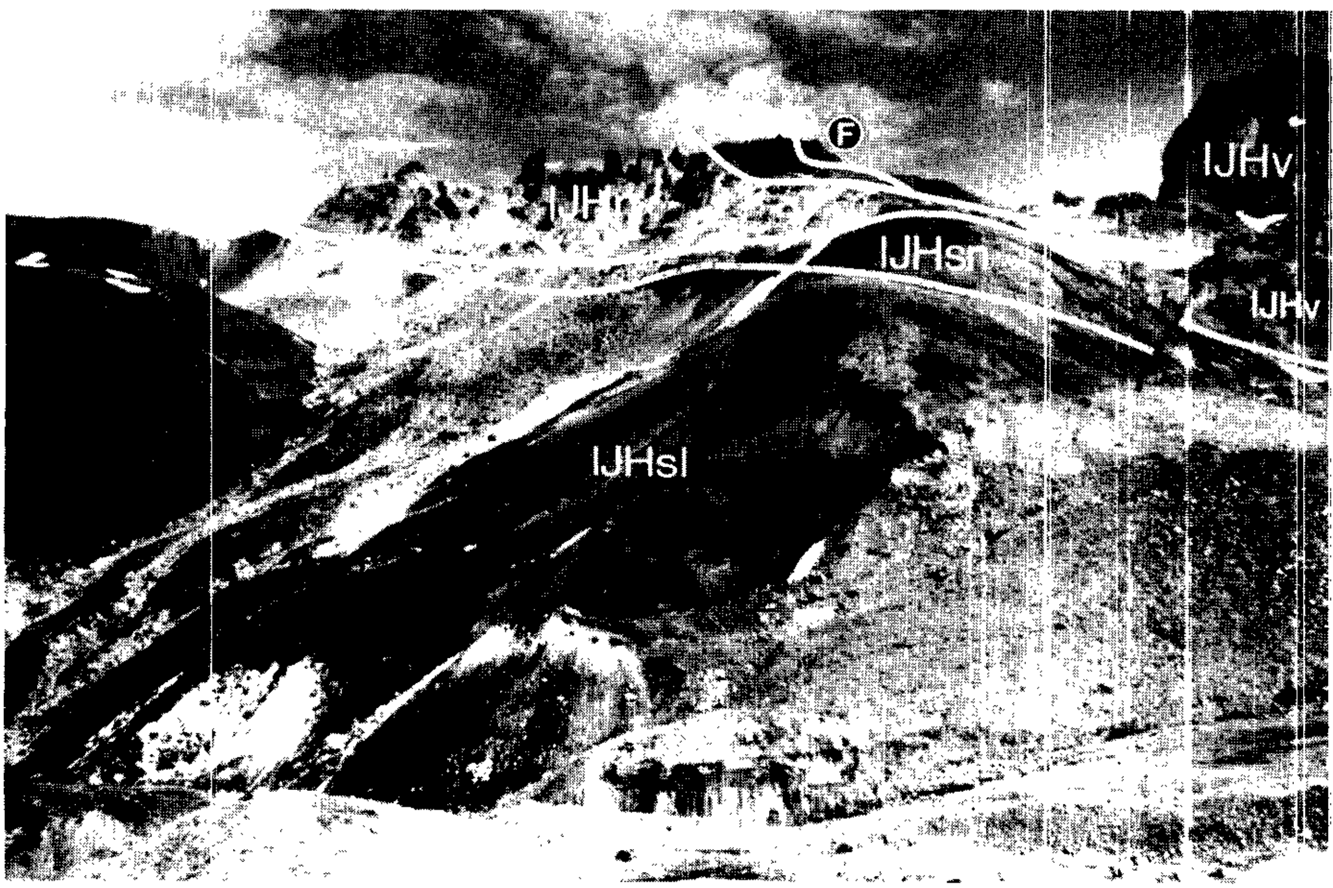


Plate 1-14-2. Lower Jurassic stratigraphic section 8 kilometres southeast of confluence of South More and More Creeks, viewed northeastward. Thin-bedded black siltstone and sandstone (lJHsl) are conformably overlain by tan sandstones and minor conglomerates (lJHsn). Conformably overlying these sediments is a white and rusty weathering, silicified rhyolite flow and tuff unit (lJHr). Maroon plagioclase-phyric andesite flow, breccia and tuff (lJHv) form the top of the section. Separating Unit lJHr from Unit lJHv is a sandstone and conglomerate unit, 10 to 20 metres thick which contains Sinemurian fossils.

the rhyolite and up to 5 metres above is intensely silicified and has a characteristic pale bluish green hue. The conglomerate is unaltered where it is in apparent fault-contact with the rhyolitic rocks. Souther (1972) mapped these rhyolitic rocks as Late Cretaceous to Tertiary dikes. However, because they are pyroclastic, at least in part, they are now interpreted as a Jurassic extrusive unit. Silicification of adjacent sedimentary rocks may be due either to primary synvolcanic or secondary hydrothermal fluid circulation, or both.

About 10 to 20 metres of fossiliferous sandstone, conglomerate, and a variety of green, thin-bedded tuffs and tuffaceous sediments (included with **lJHsn**) overlie the rhyolitic rocks. The sediments and tuffs have rapidly changing inclinations, apparently due to faulting and folding. A fossil from this horizon returned a mid-Early Jurassic (Sinemurian) age (Poulton, 1991).

The rhyolite unit and adjacent sediments are overlain by maroon plagioclase-phyric andesitic flows, breccias and tuffs (**lJHv**). These volcanic rocks were originally mapped by Souther (1972) as Triassic in age. However, their stratigraphic position indicates they are Early Jurassic, unless contact relationships with the underlying sediments are structural. Poorly formed pillows occur in the andesite. The rocks weather maroon-grey and contain about 30 per cent euhedral, felty plagioclase phenocrysts. Debris-flow deposits more than 30 metres thick and containing subrounded clasts of green-grey aphyric to plagioclase-phyric andesite in a maroon matrix overlie the pillowed and fragmental rocks. These grade upward into a thick sequence of massive to poorly bedded dark green-grey and reddish grey andesitic tuffs. Most fragments have narrow rims that weather a lighter shade of grey. The green-grey tuffs contain about 30 to 40 per cent euhedral, equant plagioclase crystals and lapilli-sized fragments containing chloritized augite phenocrysts. Similar tuffs and augite-phyric flows crop out on the ridge between Carcass and Downpour creeks, in the vicinity of the Early Jurassic fossil locality of Read *et al.* (1989).

Several isolated outcrops of thin-bedded siltstone and sandstone, conglomerate, felsic tuff, and flow-layered rhyolite occur on both the east and west sides of More Creek, a few kilometres north of the confluence with the south fork. Lithology suggests that these rocks correlate with Units **lJHsn** and **lJHr**. On the west side, moderately west-dipping, white-weathering, resistant rhyolite breccias and tuffs overlie thin-bedded deformed sediments. The felsic rocks are well stratified and graded; tuffs contain pink, flow-layered angular fragments of rhyolite and aphanitic grey, white and blue-green fragments. On the east side of More Creek, about 30 metres of felsic, orange-weathering lapillis crystal tuff crops out and appears to be, at least structurally, overlain by thinly interbedded carbonaceous siltstone and sandstone. The tuff contains about 1 per cent quartz grains and grey andesitic lapilli to 3 centimetres in size. Two aphyric, sparsely amygdaloidal rhyolite or dacite flows, 5 to 7 metres thick, occur within the tuffs. The carbonaceous black siltstone and tan, well-sorted, feldspathic sandstone which overlie the tuffs are poorly indurated and deeply weathered. Carbonaceous plant stems and leaves are ubiquitous.

Sedimentary rocks of possible Early Jurassic age also form isolated outliers within Triassic rocks on ridges a few kilometres southeast and northeast of Hankin Peak.

East of the Forrest Kerr fault, near Carcass Creek, is a thick succession of massive and thin-bedded siltstone (**mJHsl**). Numerous lenses of crystal tuff and lapilli tuff, from about 5 to 30 metres thick, are interbedded with these siltstones. The lapilli tuffs contain mainly pale grey rhyolitic fragments that average 1 centimetre in diameter. The crystal tuffs are typically maroon weathering and contain up to 30 per cent plagioclase crystal fragments averaging 2 to 4 millimetres in size; finely vesicular basaltic lapilli to 7 millimetres in size are common. These intermediate volcaniclastic rocks are similar to Unit **lJHv** and may represent the gradational change from a dominantly volcanic facies to a sedimentary one. Rare sandy limestones are interbedded with the tuff and siltstone. A fossil assemblage from one locality high on the ridge, returned a Middle Jurassic (probable Bathonian) age (Poulton, 1991). The volcanic component of these Bowser Lake Group age-equivalent rocks is problematic.

South of More Creek, about 200 metres of dark grey, fine-grained, aphyric basaltic rocks (**mJHb**) are interbedded with graphitic and pyritic siltstones. These basaltic volcanic rocks structurally underlie folded siltstone, but may overlie them stratigraphically. An ammonite was collected from interbedded tuffaceous sandstone near the top(?) of the volcanic sequence and yielded an early Middle Jurassic (Aalenian) age (Poulton, 1991). Flows are most abundant, but coarse fragmental rocks, similar to basaltic hyaloclastite in pillowed successions, also occur. Fragments are mainly scoriaceous lapilli and block-size clasts. The volcanic rocks are generally dark grey but are bleached light grey where pyritized. A sequence of thin, alternating black siltstone and white tuff, 10 metres thick, is interbedded with massive to thick-bedded basaltic fragmentals. These rocks resemble the 'pajama bed' rocks of the Troy Ridge facies of the Salmon River Formation (Anderson and Thorkelson, 1990).

Tertiary and Younger

Flat-lying, columnar-jointed basaltic flows (**Tb**) underlie the plateau north and south of Arctic Lake and at the north end of More Creek. The flows occupy north-trending valleys in the area extending for about 10 kilometres south of Arctic Lake. The distribution of the flows indicates that the paleosurface was similar to present topography. They unconformably overlie diorite of probable Mississippian age, Paleozoic schists and poorly consolidated sediments of unknown age. Souther (1972) assigned a Late Tertiary to Pleistocene age to these rocks based on correlations with similar rocks to the north, near Mount Edziza. A sample is currently being analyzed by the K-Ar isotopic dating method.

Dark grey basalt with a maximum of 2 to 3 per cent plagioclase, 1 per cent clinopyroxene, less than 1 per cent magnetite and rare olivine phenocrysts is the most common rock type. The mineralogy varies little in all the exposures examined. Phenocrysts are vitreous and unaltered. Fragmental aphyric rocks only occur in one outcrop at the south edge of Arctic Lake. Flows are vesicular near their tops and bases, and individual lava flows are identifiable where the flows are dissected by More Creek.

Quaternary

South of Arctic Lake, basaltic scoria, angular debris and lava flows (**Qob**) form a small knob built on Mississipian granitic rocks (Figure 1-14-2). The basalt contains an average of 5 per cent vitreous olivine and less than 1 per cent each of clinopyroxene and plagioclase; the phenocrysts range up to 5 millimetres in size. Several small dikes, all less than a metre wide, cut the scoria deposits. Along the flanks of the knob, the scoria are cemented, forming beds about 30 centimetres thick. The north side of the knob comprises mainly thin lava flows, underlain by weakly indurated, till-like sediments (diamictite) with rounded cobbles of granite and diorite to 10 centimetres in diameter. Minor stratified tuff is also present.

Souther (1972) correlated these olivine-bearing scoria and basalt flows with olivine basalt and related pyroclastic rocks of Pleistocene age (radio-carbon dated at 1340 years B.P.; Souther, 1970). They contain more olivine and fewer plagioclase phenocrysts than the Tertiary basalt flows around Arctic Lake and in More Creek.

INTRUSIVE ROCKS

Intrusive rocks have been subdivided into six age groups on the basis of intrusive relationships. The present designation favours a maximum age of intrusion. Thus, for example, the potassium feldspar megacrystic syenite intrusives that cut Late Triassic Stuhini Group rocks are assigned a Late Triassic and younger age. These ages will be refined with K-Ar, Ar-Ar step-wise heating, and U-Pb dating techniques now in progress.

Devonian (?)

Weakly foliated to schistose diorite sills and stocks (**lDd**) intrude Devonian schistose rocks west of and at the headwaters of Mess Creek (Figure 1-14-2). These are interpreted to be the oldest intrusions in the More Creek map area. Equigranular, medium-grained textures are preserved where the intrusions are not deformed. Undeformed chlorite metadiorite grades into strongly deformed chlorite schist in which intrusive textures have been destroyed. The massive, textureless nature of these schists helps distinguish them from similar chloritic, schistose mafic tuffs and flows, in which some primary textures are generally preserved.

Mississippian and Younger

An elongate, north-trending composite pluton of dioritic to granitic composition occupies the central third of the More Creek map area. It is bounded on the east by the Forrest Kerr fault zone, is overlain by Late Paleozoic rocks and intrudes mid-Paleozoic rocks to the west. It does not seem to crop out west of Mess Creek. The pluton extends 3 kilometres to the north of the map area where it is covered by Tertiary basalts, and to the south onto the Forrest Kerr map sheet (Figure 1-14-2). The Forrest Kerr pluton is mineralogically similar, consisting of a more mafic diorite phase at its northern end; it is also roughly the same size as the More Creek pluton. Biotite from a granitic phase in the Forrest Kerr map area gave a K-Ar isotopic age of 346±10 Ma. Step-heating $^{40}Ar/^{39}Ar$ analyses of hornblende separates from the mafic phase indicate excess argon and a minimum apparent cooling age of Early Permian. Nowhere in either map area was this intrusion seen to intrude rocks younger than Permian; southwest of Arctic Lake, Permian limestone and marble appear to unconformably overlie the pluton. The contact may also be structural in part. Weakly to moderately foliated outliers and possible dikes with mineralogy and textures similar to the main pluton (where it is undeformed) intrude deformed Mississippian or older rocks east of Mess Creek. The pluton has been sampled for U-Pb dating of zircons.

The earliest phase of the pluton is an equigranular medium-grained hornblende diorite (**Md**). Hornblende and plagioclase are the dominant constituents, though, in places, 1 to 2 per cent biotite coexists with the hornblende. In some outcrops, quartz is present to 5 per cent or less; it forms "eyes" averaging 4 millimetres in size, which often have a distinct blue colour. In other outcrops, hornblende forms pegmatitic clusters and rows of elongate crystals up to 20 centimetres long. Amphibolite forms irregular lenses and pods with diffuse margins which grade into more typical hornblende diorite. Parts of the intrusion are compositionally layered, with variations in hornblende to plagioclase ratios, phenocryst size, and alternating homogeneous diorite and intrusive breccia zones tens of metres thick. Deformed zones within the body are gneissic.

At one locality, massive coarse-grained hornblende gabbro grades into hornblendite with hornblende crystals aligned perpendicular to compositional layering, and equigranular clinopyroxene hornblendite, clinopyroxenite and biotite hornblendite. This pod of ultramafic rock (**Mum**) is about 200 metres square in area and is intruded by, and apparently suspended within, a later granitic phase. Layering within the hornblende gabbro is defined by zones slightly more rich in plagioclase, averaging 10 to 50 centimetres in width, and typically 3 to 5 metres in length. The boundaries are usually diffuse with hornblende crystals protruding into the plagioclase matrix from the enclosing hornblendite. Hornblende is mainly fresh and unaltered, but epidote veins are common and disseminated epidote occurs in places. Poikilitic hornblende encloses clinopyroxene in the clinopyroxene hornblendite and magnetite in the biotite hornblendite. Biotite books in the latter are up to 2 centimetres in size and green in colour, but are not chloritized. The textures and mineralogy are consistent with Alaskan-type ultramafic bodies (G.T. Nixon, personal communication, 1991).

Granodiorite, tonalite and granite (**Mg**) comprise the granitic phase of the pluton. Textures are usually medium to coarse grained and equigranular. Quartz is usually the coarsest mineral, and typically forms "eyes" making up between 10 and 30 per cent of the rock. Potassium feldspar occurs as anhedral, slightly finer grains between plagioclase crystals. Chloritized and rare pristine biotite is present from about 2 to 10 per cent; hornblende is uncommon. Contacts with the diorite are commonly irregular and curviplanar, with complex interfingering. Intrusive breccia textures of angular blocks of amphibolite suspended in diorite and diorite suspended in granite can be followed into areas where the granite clearly crosscuts the diorite. The contact between granitic rocks and diorite has been drawn as close to such a transition zone as possible. Where the diorite appears to be suspended as blocks within the granitic phase (*i.e.* an intrusive breccia), the outcrop was mapped as granite.

Near the south edge of the map area, a large complex of mainly plagioclase-phyric andesite dikes intrudes Mississippian volcanic rocks and Mississippian granite. Plagioclase occurs as phenocrysts from 2 to 5 millimetres in size. Some dikes have seriate and equigranular textures. Pyroxene is the only mafic phase and is usually interstitial to plagioclase or forms finer, less abundant phenocrysts; augite porphyry is uncommon. Most dikes are weakly propylitized.

Numerous fine-grained aphyric and aphanitic dikes and a variety of plagioclase porphyry diorite dikes cut the main Mississippian diorite-granite pluton. Most of them are less than 3 metres wide, but a few larger dikes are exposed above the south fork of More Creek and east of Arctic Lake.

Permian or Younger

A small porphyritic monzonite stock (**Pmz**) is exposed in several isolated outcrops northwest of Arctic Lake and in the lower reaches of a small creek draining west into Mess Creek. Sharp intrusive contacts with Permian limestone are exposed west of Arctic Lake. The stock appears to intrude granite of Mississippian age, but no clear contact was observed. The pluton is post-Permian, based on intrusive relationships, and correlated on its textural and compositional similarity with porphyritic monzonite near Newmont Lake in the Forrest Kerr map area. In outcrop, the monzonite weathers light pink and is brown or greenish purple on fresh surfaces. It is characterized by about 10 per cent plagioclase and 15 to 20 per cent oxidized hornblende phenocrysts in an aphanitic, hematized matrix.

Late Triassic and Younger

Stocks, sills and dikes of intermediate to felsic composition intrude Late Triassic rocks east of Forrest Kerr fault and Early Jurassic rocks south of More Creek.

Serpentinized peridotite plugs (**lTum**) and fault slices crop out southwest and west of Arctic Lake. The intrusions are medium grained, equigranular and olive-green on fresh surfaces. They weather dun to dark green and commonly have zones of pervasive, rusty weathering carbonate veins. Where exposed, contacts with adjacent Permian limestone and Triassic sedimentary rocks are faults.

Dikes of coarsely porphyritic syenite (**lTs**) are very common cutting Late Triassic rocks between Hankin Peak and More Creek. They range from a metre to over 20 metres in width. Tabular phenocrysts of potassium feldspar in the syenite range in size from 2 to over 30 millimetres and average 20 per cent of the rock. They are grey, pink or, where chloritized, green. The crystals often impart a trachytic texture to the rock. The groundmass of these dikes is either grey or pink, and equigranular or aphanitic. Sedimentary rocks are often hydrothermally altered adjacent to the syenites and copper mineralization commonly occurs within and adjacent to the dikes.

Early Jurassic and Younger

About 6 kilometres south of Hankin Peak, a series of diorite sills (**eJd**) up to 100 metres wide intrudes Late Triassic siltstones and sandstones. They are fine to medium grained and equigranular with subequal amounts of plagioclase and pyroxene. Contacts with the enclosing sedimentary rocks are often well exposed and knife sharp. The only contact effect is an increase in the induration of the sediments and minor addition of epidote and chlorite. Some of the sills have poorly developed columnar joints. A similar diorite sill intrudes both siltstone and green andesitic tuffs 2 kilometres east of Hankin Peak. It has a distinct felty texture imparted by 40 to 50 per cent plagioclase laths to 4 millimetres in length; equigranular textures are also common. North of Hankin Peak, propylitized, equigranular diorite appears to intrude Late Triassic volcanic rocks. Relationships with the volcanic rocks are confusing because intrusive textures repeatedly grade in and out of pyroclastic textures.

A stock of monzonite to syenite (**eJmz**) intrudes siltstones and volcanic rocks in the same area as the diorite sill swarm, 6 kilometres south of Hankin Peak. The intrusion is mainly light grey to pink-weathering, equigranular, medium-grained monzonite, but grades into medium-grey weathering, seriate-textured syenite near its base. Phenocrysts of potassium feldspar range up to 1 centimetre in size. Fine, chloritized biotite occurs to about 2 per cent. A similar stock intrudes Early Jurassic rocks south of More Creek on the GOZ/RDN property.

South of More Creek, numerous dikes and sills of dark green-grey, fine to coarse-grained gabbro (Read *et al.*, 1989) intrude Early and Middle Jurassic siltstone and sandstone. Textures vary with the size of the intrusions. Smaller dikes (less than about 2 metres in width) are fine grained and equigranular. Larger dikes and stocks, though mainly equigranular, are commonly felty textured with slender laths of plagioclase to 4 millimetres in length. Anhedral pyroxene is interstitial to the plagioclase laths. Some stocks are coarse grained and weather light grey with 10 to 20 per cent dark green chloritic clinopyroxene to 5 millimetres in size. These intrusions are thought to be feeders to the basaltic pillow lavas and flow breccias of Unit **mJHb.**

Lamprophyre dikes intrude Late Triassic rocks east of Forrest Kerr fault. A 2-metre dike also intrudes Late Triassic (?) rocks southwest of Arctic Lake, and another 1-metre dike intrudes an andesitic dike complex of probable Mississippian age or younger near the south edge of the map area. The dikes are up to 10 metres wide and have conspicuous biotite phenocrysts up to 2 centimetres in size. The matrix grain size averages 2 to 4 millimetres.

A basaltic dike 1.5 metres wide, with 2 to 5 per cent vitreous plagioclase and a pristine grey groundmass, intrudes schists along the east side of the headwaters of Mess Creek. This is the only dike noted which has a lithology identical to the Tertiary or younger basalt flows, and is probably a feeder to them.

STRUCTURE

The structural grain of the map area is controlled by north-trending faults. Polyphase deformation has affected all rocks; those west of the Forrest Kerr fault are affected by an earlier phase not present in younger rocks east of the fault. In general, Paleozoic rocks are penetratively deformed, metamorphosed and affected by four phases of folding. Early, low-angle ductile shearing in Paleozoic rocks has interleaved panels of largely undeformed rocks with more deformed rocks of similiar age. Movement along these shear zones is east-directed and associated with early isoclinal folding. The age and relationships of thrusting are unknown. The anisotropic deformation of Mesozoic rocks reflects the competency contrasts between volcanic and sedimentary units and Paleozoic metamorphic rocks. South of More Creek, rocks as young as Early and Middle Jurassic are affected by two macroscopic, nearly orthogonal fold events.

FOLDS

Read *et al.* (1989) describe three phases of folding in the Iskut River and More Creek areas: a post-Early Permian to pre-Middle Triassic phase (D_1), a post-Middle to Late Jurassic phase (D_2), and similarly aged phase (D_3), which is orthogonal to D_2. Holbek (1988) and Elsby (1992, this volume) recognized an additional phase of folding (D_4) within Paleozoic rocks west of Mess Creek and west of Forrest Kerr Creek, respectively.

The earliest deformation (D_1) is characterized by a prominent, northeast-striking, moderately northwest-dipping penetrative foliation. This foliation is axial planar to northwest-trending, mesoscopic, recumbent isoclinal folds, which have an overall east vergence. Development of axial planar foliation (S_1) is prominent in schists west of Mess Creek and coincided with lower greenschist grade metamorphism. Triassic and younger rocks lack these first-phase folds and foliations. Associated with D_1 are numerous discrete west-dipping layer-parallel ductile shear zones which separate packages of deformed and largely undeformed rocks. Shearing along these zones is east directed.

The second phase (D_2) deforms and transposes S_1 in Paleozoic rocks and (?) deforms bedding (S_0) in Mesozoic rocks. It is accompanied by lower greenschist grade metamorphism and characterized by northwest-trending recumbent to moderately upright, southeast-plunging isoclinal to open folds in Paleozoic rocks and upright northwest-trending open folds in Mesozoic rocks. Second phase cleavage (S_2) in Paleozoic rocks is a southwest-dipping, locally developed axial planar cleavage. In the Mesozoic rocks, S_2 is characterized by fracture and crenulation cleavage.

The third phase (D_3) is characterized by mesoscopic, disharmonic upright, open to tight crenulation folds and kink bands which deform all earlier structures. Fold axes plunge gently westward, axial planes dip steeply south. Third phase cleavage (S_3) is defined by a strong crenulation cleavage in Paleozoic rocks and a fracture cleavage in Mesozoic rocks. No significant fold development associated with (D_3) is recognized in the Paleozoic rocks. East of Forrest Kerr fault, D_3 is characterized by typically open, upright, east and northeast-trending folds. The third deformation accompanied north-south compression.

The fourth phase (D_4) folds are moderate to open north-trending upright mesoscopic to macroscopic structures with fold wavelengths up to several kilometres. Folds are mainly north or south plunging, chevron or open box-folds and minor kink bands. Folds are similar in Paleozoic and Mesozoic rocks. Folding close to the Forrest Kerr fault is tight, disharmonic and asymmetric and becomes progressively more open eastward, away from the fault. Everywhere S_4 is developed as spaced crenulation and fracture cleavage.

FAULTS

Regional-scale faults strike north (Souther, 1972) and control the distribution of tectonostratigraphic packages. Other fault trends are mainly northeasterly to northwesterly. East and northeasterly trending structures are important controls for Mesozoic mineralization. The Forrest Kerr fault trends northerly and separates Mesozoic volcanic and sedimentary rocks on the east from Paleozoic metavolcanic and metasedimentary rocks and coeval granitic plutons on the west (Figure 1-14-2). The fault is generally vertical to steeply east dipping. Slickensides measured on the fault plane plunge 24° at 181° and indicate a left-lateral strike-slip component of movement. Read *et al.* (1989) suggest a minimum of 2 kilometres of east-side-down and 2.5 kilometres of left-lateral oblique-slip motion on the fault north of the Iskut River. The deep-rooted nature of this north-trending structure is evidenced by the peralkaline character of the Mount Edziza volcanic complex (Souther and Symons, 1974), which is typical of melts produced by crustal rifting. Normal faulting has displaced flows as young as 20 000 years but movement occurred before 1340 years B.P. (Souther, 1970).

The abrupt topographic contrast across Mess Creek marks a north-trending fault zone which separates the rugged high peaks of Late Triassic volcanics on the west from Paleozoic rocks of the Arctic Lake plateau east of Mess Creek. North-northeast-trending splay faults and block faults are related to the regional trend. These faults have produced an abrupt escarpment on the east side of Mess Creek and control alteration and copper gold mineralization on the Bam 8 and Bam 10 claims. The Mess Creek fault was active from Early Jurassic to Recent time (Souther and Symons, 1974).

Northerly trending, gently-dipping ductile thrust faults are exposed west of Mess Creek (Holbek, 1988 and this study). These zones occur within sericite and chlorite-sericite schists and are related to east-directed ductile shearing active during D_1 deformation and probably continued into D_2. On the BJ property the competency contrast between quartz-sericite schist (DSqs) and metadiorite (JDd) has localized easterly directed thrusting along this contact.

EXPLORATION ACTIVITY

The major exploration activity in 1991 was focused west of the map area at the Galore Creek alkaline porphyry copper-gold deposit. Kennco Explorations (Canada) Limited began reassessing the geology and mineral potential of

TABLE 1-14-1
MINERAL OCCURRENCES IN THE MORE CREEK MAP AREA 104G/2

Type Prob. Age	MINFILE Name 104G	Host	Commodity	Description	Reference
STRATABOUND VEINS					
Early Jurassic	GOZ/RDN	lJHr, eJmz	Au, Ag, Zn, Cu, Pb	Gold-enriched chalcopyrite, sphalerite, galena, pyrite and arsenopyrite-bearing veins hosted in silicified and pyritized Mount Dilworth equivalent. Mineralization and alteration related to coeval subvolcanic feldspar porphyritic monzonite intrusives. WEDGE ZONE 11.6 g/t Au over 4.4 m SOUTH BOUNDARY ZONE 23.9 g/t Au over 11.6 m MAIN GOSSAN ZONE 18.6 g/t Au over 0.4 m	Savelle (1990)
STRATIFORM MASSIVE SULPHIDE					
Devonian-Mississippian	FOREMORE	DSst, DSfv DSlm	Zn, Pb, Cu, Ag	Laminated sphalerite and galena occurs in felsic volcanic horizons within foliated package of grphitic schists, argillites and intermediate to mafic volcanics of Devonian-Mississippian age. Mineralized boulders include pyrite, sphalerite and chalcopyrite-rich varieties. Cu% / Pb% / Zn% / Ag g/t / Au g/t / Fe% chalcopyrite-rich (n=12): 2.3 / 0.5 / 6.2 / 186 / 1.5 / 16 sphalerite-rich (n=29): 0.22 / 3.5 / 10.2 / 96 / 1 / 16 pyrite-rich (n=112): trace / 1 / 6.2 / 78 / nil / 23	Barnes (1989), Mawer (1988)
GOLD-COPPER PORPHYRY					
Late Triassic - Early Jurassic 79	LITTLE LES, TWO MORE	uTSs, lTs	Cu, Au, Ag	Disseminated and veinlet chalcopyrite mineralization in a propylitic-pyrite alteration zone associated with potassium feldspar porphyry syenite dikes grab sample, 5.9% Cu and 13.1 g/t Au.	Bobyn (1990), Folk (1981)
Late Triassic-Early Jurassic	LUCIFER	uTSv, lTs	Cu, Au	Structurally controlled propylitic alteration zone (1 x 2 km) coincident with potassium feldspar porphyry syenite dike swarm. Mineralization includes chalcopyrite, galena and gold in quartz-carbonate pyrite veins.	Baerg and Wong (1991)
Late Triassic-Early Jurassic	BIS BISKUT	uTSsn, lTs	Au, Au, Cu, Pb, Zn	Quart-sericite-pyrite-clay alteration zone (300 m x 50-100 m wide). All original textures obliterated by supergene leaching. Contains up to 5% pyrite, minor galena and arsenopyrite.	Brown (1990)
MESOTHERMAL GOLD-SILVER-QUARTZ VEINS					
Early Jurassic 27	BAM 8, ARCTIC	PScg, PSlm	Cu, Ag, Zn	Disseminated blebs and veinlets of tetrahedrite, minor chalcopyrite, pyrite, sphalerite and galena occupy fractures and breccia zones in limestone, sandstone and conglomerate. Mineralization and carbonate alteration follow northeasterly trending structures. INVENTORY / Tonnes / Cu% / Ag g/t Southwest Zone: 299 400 / 0.76 / N.A. East Zone: 4 540 / 2.45 / 17.83	Dearin (1983), Gillen *et al.* (1984), Rayner (1965), Souther (1972)
Early Jurassic 110	BAM 10	Mg, Md	Au, Ag, Bi, Sb	Gold and fine-grained pyrite occur in quartz and carbonate veinlets in fractured granite. Discontinuous mineralization occupies silicified and sericitized fault and shear zones in the granite. Gold values range from 8.57 g/t over 18.9 m in trench 86-1 to 1.72 g/t over 2.43 m in DDH 87-1, drilled to test the ground beneath Trench 86-1.	Diner (1987), Hewgill and Walton (1986), Walton (1986)
Early Jurassic 70	BJ	DSqs, lDd	Au, Cu, Pb, Zn, Ag	Mineralization includes mesothermal quartz veins and an iron carbonate breccia zone. Veins contain pyrite, tetrahedrite, chalcopyrite, sphalerite, trace arsenopyrite, galena, gold and prominent iron-carbonate alteration envelope. Northeast-trending quartz veins crosscut strata, iron carbonate breccia is strataform. Free gold occurs in creeks below the showing.	Folk (1986), Holbek (1982), Holbek (1988)
IRON-COPPER-GOLD SKARNS					
	DUNDEE, GLA	DSst, Mg, PP	Fe, Cu, Zn, Au	Iron-copper skarns develop where feldspar-porphyritic andesite dikes intrude granite and carbonate pendant rocks. Mineralization comprises magnetite and lesser pyrite, pyrrhotite, chalcopyrite, sphalerite and gold.	Webster *et al.* (1991)

the Central zone (125 million tonnes, 1.06% copper, 0.40 g/t gold and 7.7 g/t silver). Several properties in the More Creek map area were actively explored this year. Noranda Exploration Company Limited and joint venture partner High Frontier Resources Ltd. carried out mapping, prospecting, soil sampling, ground magnetic and electromagnetic surveys and drilled ten holes on the GOZ/RDN property. Drilling resumed in September with a total of 2000 metres projected for the entire 1991 program. Noranda also conducted mapping and sampling followed by magnetic and induced polarization surveys and two diamond-drill holes on the Lucifer property. Cominco Ltd. continued detailed lithostratigraphic and biostratigraphic mapping on the Foremore prospect, 15 kilometres up-ice from the 1990 drilling. Keewatin Engineering Ltd. carried out exploration on the Arctic claims which cover the Little Les mineral occurrence.

MINERAL PROSPECTS

Mineral showings and prospects are concentrated south of Hankin Peak, southwest of Arctic Lake, south of the headwaters of Mess Creek and adjacent to the Forrest Kerr fault. They can be grouped into the following categories: stratabound polymetallic massive sulphide; stratiform massive sulphide; porphyry copper-gold; gold-silver-quartz vein and replacement deposits; and iron-copper-gold skarn. Data on individual occurrences are summarized in Table 1-14-1; locations are shown on Figures 1-14-3 and 1-14-4.

At least two separate mineralizing events are postulated for deposits within the map area. Devonian limestone and volcanic rocks host conformable, massive polymetallic sulphide occurrences. Preliminary lead isotope data on boulders from the Foremore property define two clusters. On the Wrangellia growth curve these clusters correspond with a Devonian and possibly Mississippian model ages. These data points cluster with data from the Tulsequah Chief and Myra Falls deposits (M. Westcott, personal communication, 1991).

Alkalic porphyry copper-gold mineralization south of Hankin Peak is hosted by Late Triassic volcanics and subvolcanic intrusives. In the region this type of mineralization is generally latest Triassic to Early Jurassic in age. Lead isotope studies of galena samples from the GOZ/RDN property and a gold-bearing vein on the Foremore properties both plot in the Jurassic cluster (Godwin *et al.*, 1991). An Early Jurassic (194±6 Ma; Holbek, 1988) age for mineralization is inferred from K-Ar dating of chrome-bearing muscovite from a carbonate-sulphide vein on the BJ property.

Silver-rich base metal mineralization of Tertiary age is widespread to the east and elsewhere in northwestern British Columbia, but none has been recognized in the More Creek map area.

STRATABOUND-VEIN DEPOSITS

The GOZ/RDN property is located west of the Forrest Kerr fault, 5 kilometres south of the confluence of South More and More creeks, within an Early to Middle Jurassic package of volcanic and fine clastic rocks (Figure 1-14-3). In 1990, 1545.5 metres of diamond drilling was completed in 15 holes. The best results included 7.8 metres grading 7.88 grams per tonne gold and 4.4 metres of 11.65 grams per tonne gold.

The claims are underlain by maroon intermediate volcanic rocks comprising felsic tuffs and rhyolite flows which are overlain or interlayered with a sandstone-siltstone unit, basalt flows and tuffs. The hostrocks are age equivalents of the Mount Dilworth Formation and Eskay Creek facies of the Salmon River Formation. Mineralization consists of gold-enriched polymetallic quartz veins in silicified and pyritized rhyolite and felsic tuffs and subvolcanic porphyritic monzonite intrusions. The exploration target is a precious metal enriched polymetallic massive sulphide deposit similiar to Eskay Creek.

In 1991 exploration on the claims continued. Three areas of mineralization have received the most attention: the Wedge zone, the Main Gossan zone and the South Boundary zone. The most recent results released in the Northern Miner (September 16, 1991) report an 11.6-metre intersection in the South Boundary zone grading 2[illegible].9 grams per tonne gold with minor base metals. This drill hole was collared in plagioclase-porphyritic andesitic rocks intruded by porphyritic-syenite dikes. The details of this mineralization are not known, however, the spatial and genetic association of gold and copper mineralization with porphyritic syenite dikes is a regional phenomena associated with Late Triassic to Early Jurassic porphyry deposits. The Main Gossan zone is a large, spectacular ferricrete gossan and argillic alteration zone associated with a subvolcanic monzonite intrusion. The gossan zone contains disseminated copper and gold. This style of mineralization may better fit a porphyry classification.

Stratabound mineralization consists of massive to brecciated quartz veins and stringer zones (Wedge Zone) hosted in silicified felsic volcanics of the Mount Dilworth Formation. The gold-enriched quartz veins strike north and generally dip easterly, parallel to the stratigraphy. The veins are narrow (about 1 metre) and contain from 5 to 10 per cent sulphides of copper, zinc, lead and arsenic in a quartz gangue. Drilling indicates the felsic succession is underlain by maroon, feldspar-porphyritic volcaniclastics, equivalent to the Betty Creek Formation, and black siltstones. Alteration and mineralization are related to coeval(?) subvolcanic porphyritic monzonite intrusions.

STRATIFORM MASSIVE SULPHIDE

Cominco's Foremore claims are located at the headwaters of the south tributary of More Creek, about 10 kilometres north of Forrest Kerr airstrip (Figure 1-14-3). The exploration target is the source of massive sphalerite and pyrite-bearing boulders. Electromagnetic conductors located below 120 metres of glacier ice were drill tested in 1990. Four holes were collared, three reached bedrock. Drilling intersected graphitic shear zones. The property is underlain by Stikine assemblage rocks: foliated basaltic flows, volcaniclastics, sediments and limestones as old as Early Devonian. Foremore float resembles Kuroko volcanogenic massive sulphide ore and similiar Devonian-Mississippian

Stikine assemblage rocks are potential exploration targets for deposits of the Kuroko type.

Several thousand mineralized boulders have been found on the Foremore claims in outwash plains at the eastern and northern lobes of the More Glacier. The distribution of polymetallic massive sulphide float suggests the source is beneath the main icesheet of the glacier. Boulders vary mineralogically, including pyrite-rich, zinc-rich, and copper-rich (Table 1-14-1) and texturally from massive to laminated. This mineral and textural variation suggests either a single zoned sulphide body or possibly several distinct bodies. Limestone boulders host massive sulphide replacements. One such boulder contains stromatoporoid *Favosites* sp. of Late Ordivician to Middle Devonian age (Logan *et al.*, 1990a).

In the North zone, felsic volcanic horizons host finely laminated and disseminated galena, sphalerite and pyrite mineralization. These felsic (quartz-eye) volcanics occur within a penetratively foliated sequence of graphitic schists, argillites and intermediate to mafic volcanics. Assay results from outcrop sampling average 87 ppb gold, 8 grams per tonne silver, 0.1 per cent copper, 0.3 per cent lead and 2.7 per cent zinc over an average sample width of 0.4 metre (Barnes, 1989)

Porphyry Copper-Gold Deposits

Porphyry deposits are regionally important exploration targets (*e.g.*, Galore Creek and Schaft Creek). Schaft Creek is a calcalkaline copper-molybdenum deposit of 1 billion

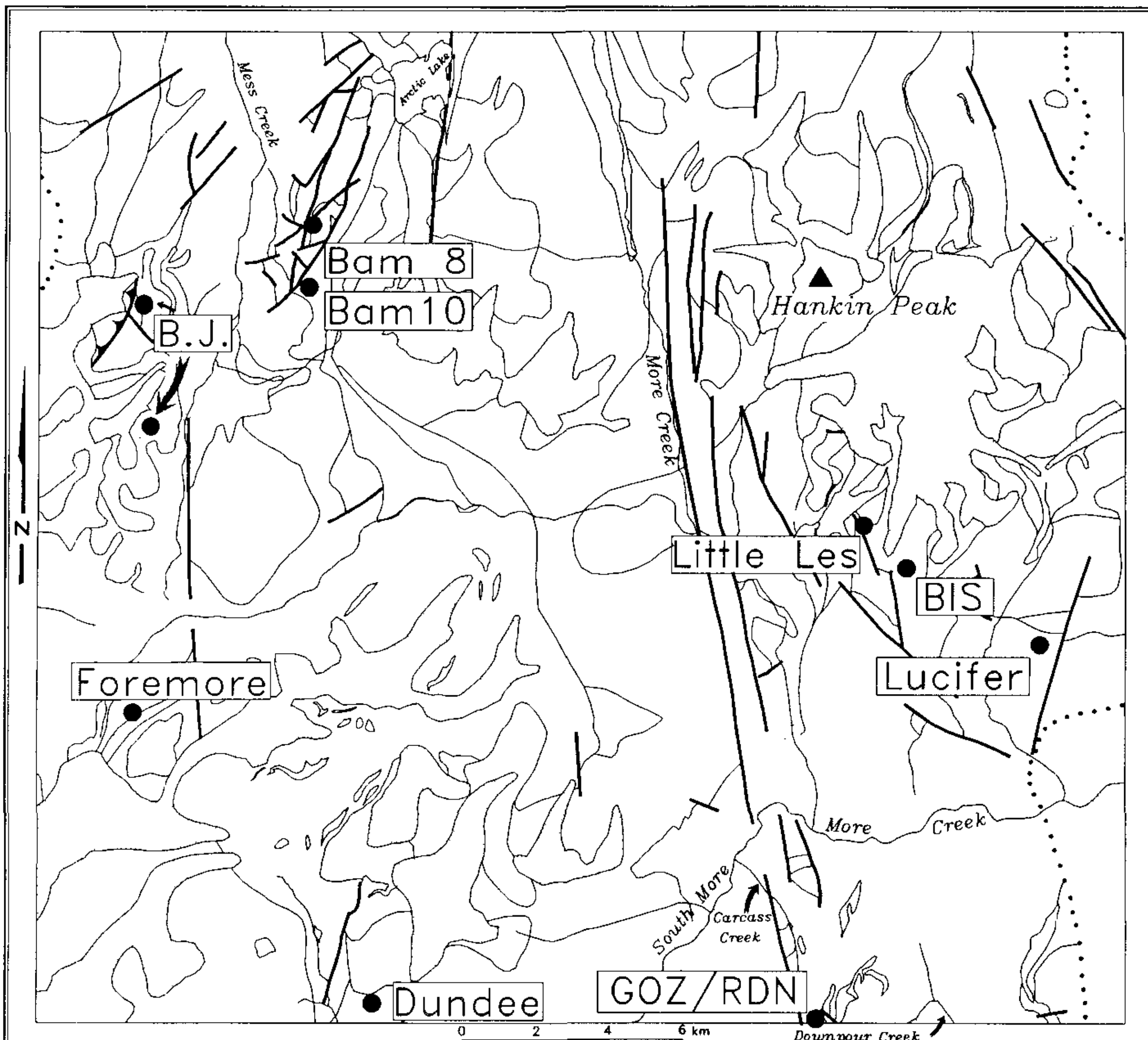


Figure 1-14-3. Mineral occurrence map showing locations of occurrences discussed in the text.

tonnes, which contains 0.12 gram per tonne gold. Galore Creek is an alkaline copper deposit of 125 million tonnes with a gold grade of 0.4 gram per tonne. The alkaline deposits are generally enriched in copper and gold and associated with high-level intrusions of potassium feldspar megacrystic syenite.

The Lucifer property is located 2 kilometres north of More Creek (Figure 1-14-3). Tuffaceous sediments, reworked tuffs and minor limestones of the Upper Triassic Stuhini Group underlie the claims. Maroon ash-tuffs and tuffaceous conglomerates containing coarse potassium feldspar crystals crop out high on the ridge west of the alteration zone. These lithologies are intruded by northerly trending megacrystic potassium feldspar porphyry dikes.

The area of interest occupies the headwall and steep upper reaches of a south-draining tributary of More Creek. It consists of a large (1 x 2 km) northerly trending limonite-carbonate-pyrite alteration zone. Weak silicification in the form of narrow stringer zones and veinlets crosscuts this chiefly propyllitic alteration zone. The alteration zone lies west of a northeast-trending fault and coincides with a northeast-striking swarm of megacrystic potassium feldspar porphyry dikes. Pyritic and propylitically altered and unaltered dikes crosscut the zone and indicate complex and episodic intrusive and mineralizing events. Mineralization consists of quartz-carbonate-pyrite veins containing chalcopyrite and galena. Results from the two 1991 diamond-drill holes do not explain the anomalous gold soil geochemistry of the alteration zone (R. Baerg, personal communication, 1991).

The Little Les (MINFILE 104G 079) limonitic gossan crops out 9 kilometres north of the confluence of More and South More creeks on the Arctic claims (Figure 1-14-3). It is derived from a pyrite-rich alteration envelope which flanks a 200 by 50 metre core zone of propylitically altered andesite flows and tuffs. Alteration and mineralization are related to intrusion by syenite porphyry dikes. Mineralization consists of 2 to 5 per cent disseminated and fracture-filling chalcopyrite and traces of galena and molybdenite.

Midway between the Lucifer and Little Les showings is the Bis occurrence (Figure 1-14-3), a substantial limonitic gossan easily visible from the air. This northeast-trending gossan, 300 metres long by 50 to 100 metres wide, is hosted in volcanics, tuffaceous sediments and limestone. The gossan consists predominantly of limonite, clay, sericite, pyrite and quartz. All original textures are obliterated. The gossan contains up to 5 per cent disseminated pyrite and traces of arsenopyrite and galena. A single grab sample from the gossan returned 16.1 grams per tonne gold (Bobyn, 1990). The gossan was mapped by Souther (1972) as a Late Cretaceous to Tertiary felsite dike. Bobyn (1990) interpreted the felsite as an Early Jurassic, Mount Dilworth equivalent (after Read *et al.*, 1989).

Vein Deposits

The Bam 8 prospect (MINFILE 104G 027) is located 4 kilometres southwest of Arctic Lake on top of the eastern escarpment of Mess Creek valley (Figure 1-14-3). In 1967, diamond drilling defined the Southwest zone containing 299 400 tonnes grading 0.76 per cent copper and the East zone containing 4540 tonnes grading 2.45 per cent copper and 17.83 grams per tonne silver.

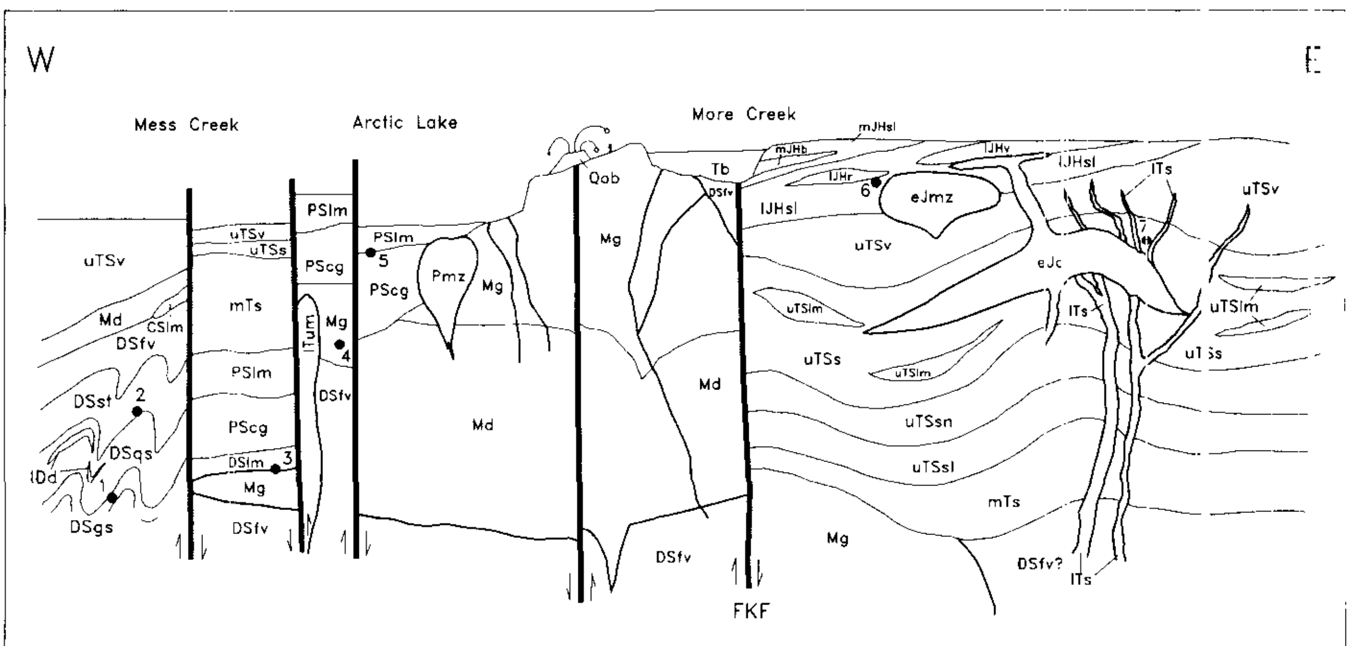


Figure 1-14-4. Schematic representation showing stratigraphic relationships of the various units across the northern part of the More Creek map area. Mineral occurrences are shown in their respective stratigraphic positions. See text and Figure 1-14-2 legend for description of units. Numbers correspond to mineral occurrences; 1=Foremore, 2=BJ, 3=Dundee, 4=Bam 10, 5=Bam 8, 6=GOZ/RDN, 7=Lucifer, Little Les and Bis. FKF=Forrest Kerr fault.

This property is underlain by green chlorite schists, purple schistose tuffs and flows and thin limestone (**DSst**) which are overlain by maroon polymictic granite-bearing cobble conglomerate (**PScg**). Thick-bedded Permian limestone (**PSlm**) and limonitic brecciated dolomitic limestone conformably overly the conglomerate and host most of the copper and silver mineralization. Overlying the carbonates are variably altered and mineralized, thin-bedded limy fetid sandstone and siltstone (**mTs**) and conglomerate (**uTSs**). Granite and diorite underlie much of the Arctic Lake plateau, east of the prospect. They do not intrude Permian or younger rocks and have been tentatively dated (K-Ar) as Early Mississippian. Fine-grained and porphyritic plagioclase hornblende monzonite dikes (**Pmz**) cut the granite and limestone. Serpentinized peridotite bodies are intruded along northeast-trending fault zones (**lTum**).

Mineralization consists of disseminations, stringers and east-northeast-trending veinlets of tetrahedrite, with minor chalcopyrite, pyrite, sphalerite and galena. Secondary minerals include azurite and malachite. Alteration includes dolomitization of limestone, carbonitization of volcanic rocks, dolomite, sandstone and conglomerate, and hydrothermal alteration and associated quartz veining in the granitic rocks (Gillan *et al.*, 1984). Alteration (limonitic orange cliffs) and mineralization are spatially related to north-trending regional faults and northeast-trending splays off them.

The Bam 10 showing (MINFILE 104G 110) is located 1 kilometre southwest of Bam 8 and is lower in the same stratigraphy. Strongly schistose flows, tuff and subordinate limestone (**DSst**) underlie the claims. Quartz-rich granite and diorite intrude these metavolcanics. The contact, which is in part structural, dips moderately westward. Diamond drilling in 1987 totalled 837 metres in nine holes. From drilling data, Diner (1987) recognized predictable and mappable alteration halos peripheral to mineralization, and that most mineralization occurs within 50 metres of the granite contact. Mineralized zones are poddy and associated with carbonate, chlorite and sericite alteration and silicification developed along north and northeast-trending faults in the granite. Mineralization consists of gold and fine-grained blebs of pyrite, chalcopyrite, galena and rare molybdenite in quartz and carbonate veinlets hosted within fractured, sericitized and silicifed granite.

The BJ showing (MINFILE 104G 070) is located west of Mess Creek (Figure 1-14-3). This occurrence is hosted by quartz-sericite schists (**DSqs**), part of a polydeformed and metamorphosed volcanic and sedimentary succession of Devonian to Mississippian age unconformably overlain by Upper Triassic volcanic and sedimentary rocks to the west.

Mineralization includes precious metal bearing mesothermal quartz veins and an iron-carbonate breccia zone. In addition, bull quartz veins parallel to foliation and related to greenschist metamorphism are common. These metamorphogenic veins contain minor pyrite but no precious metals. They are deformed, often recumbently folded and predate or are synchronous with early deformation. Younger, Early Jurassic (Holbek, 1988) quartz and carbonate veins trend east to northeast across an earlier foliation. Brown, limonitic-weathering carbonate alteration is commonly associated with faults, breccia zones and quartz veining. The veins contain pyrite, tetrahedrite, chalcopyrite, sphalerite and traces of arsenopyrite, galena, hematite and gold.

A zone of quartz veins is localized along the faulted contact between metadiorite (**lDd**) and chlorite-sericite schists (**DSqs**) on the Windy claim. Gold values average 0.34 gram per tonne with a single sample assaying 1.36 grams per tonne (Folk, 1986). An extensive iron carbonate breccia zone crops out on the Bee Jay claims, 5 kilometres to the south. Gold values range from 0.34 to 1.71 grams per tonne (Folk, 1986).

SKARN

The Dundee showing straddles the south fork of More Creek 13 kilometres southwest of its confluence with More Creek (Figure 1-14-3). The property is underlain by hornfelsed and silicified Paleozoic rocks intruded by a Mississippian or younger monzonite to biotite granite pluton. Mineralized skarns are developed where younger feldspar-porphyritic andesite dikes crosscut limestone bodies and the main intrusive body. There appear to be at least two stages of skarning; one is related to the main intrusion which surrounds the pendant rocks, the second to later dikes. Magnetite sulphide endoskarns occur in the pegmatitic diorite dikes. Coarse-grained diopside envelopes formed adjacent to the dikes. Pyrite and pyrrhotite mineralization is best developed in noncalcareous pendant rocks; garnet, diopside, epidote, magnetite and chalcopyrite skarns occur in limestone bodies. Webster and Ray (1991) provide a detailed description of the geology and skarn mineralization.

SUMMARY

The More Creek area is underlain by three fault-bounded stratigraphic packages which, from west to east, consist of the middle to late Paleozoic Stikine assemblage, an Early Carboniferous or younger granitic pluton and, separated by the Forrest Kerr fault zone, a Mesozoic volcanic-plutonic assemblage of Stuhini and Hazelton Group rocks (Figures 1-14-2 and 1-14-4). West of the Forrest Kerr fault the oldest rocks are a thick package of Early Devonian to Early Carboniferous metasedimentary and bimodal metavolcanic rocks intruded in part by early Mississippian (340±12 Ma, K/Ar) quartz monzonite to quartz diorite plutons (**Mg** and **Md**). A pre-Permian quartz-grain, granite-clast conglomerate (**PScg**) with tuff interlayers marks a profound post-Carboniferous unconformity. Clasts resemble the quartz-rich granite of the early Mississippian More Creek pluton. Early Permian limestones, the regional hallmark of the Stikine assemblage, are here no thicker than 200 metres. The limestone is overlain paraconformably by Middle Triassic sedimentary rocks. Rocks of the Late Triassic Stuhini Group conformably overly the Middle Triassic rocks.

East of the Forrest Kerr fault are Middle(?) Triassic rocks and possibly unrecognized Paleozoic rocks. North of More Creek, the Stuhini Group is a succession of chiefly volcanic arc derived sediments, reworked tuffs and subordinate flows more than 2000 metres thick. South of More Creek is an Early to Middle Jurassic succession of at least 1500 metres of thin-bedded sediments, tuffs, rhyolite and basalt.

The distribution of mineral occurrences, their stratigraphic positions and relationships to structure and intrusions are shown in Figure 1-14-4. Stratabound polymetallic sulphide mineralization is hosted by mid-Paleozoic rocks of the Stikine assemblage. Early Jurassic mineralization is manifest as: stratabound gold-enriched polymetallic massive sulphides in rocks correlated with the Eskay Creek facies of the Salmon River Formation; alkalic copper-gold porphyries in Upper Triassic Stuhini Group strata and feldspar porphyry dikes; mesothermal gold-quartz and silver-copper veins cutting Paleozoic metavolcanic and plutonic rocks. Pre-Mississippian(?) rocks host skarn mineralization, age constraints are not known.

ACKNOWLEDGMENTS

The authors would like to thank James Gough for his good natured and capable assistance in the field. Thanks also to Mike Savell and Rob Berg of Noranda Exploration Company Limited for sharing their alluvial fan, logistics and geological expertise, and Don Harrison for fossil submissions. Ron Batty and Darrell Adzich of Vancouver Island Helicopters provided safe, friendly and dependable flying. Wayne Bamber, Terry Poulton and Allan Pedder of the Institute of Sedimentary and Petroleum Geology in Calgary provided prompt and invaluable fossil identifications. This manuscript benefited from reviews by Bill McMillan, Brian Grant and John Newell.

REFERENCES

Alldrick, D.J. and Britton, J.M. (1988): Geology and Mineral Deposits of the Sulphurets Area (NTS 104A/15, 104A/12, 104B/8 and 104B/9); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Open File 1988-4.

Anderson, R.G. (1989): A Stratigraphic, Plutonic, and Structural Framework for the Iskut River Map Area, Northwestern British Columbia; *in* Current Research, Part E, *Geological Survey of Canada*, Paper 89-1E, pages 145-154.

Anderson, R.G. and Bevier, M.L. (1990): A Note on Mesozoic and Tertiary K-Ar Geochronometry of Plutonic Suites, Iskut River Map Area, Northwestern British Columbia; *in* Current Research, Part E, *Geological Survey of Canada*, Paper 90-1E, pages 141-147.

Anderson, R.G. and Thorkelson, D.J. (1990): Mesozoic Stratigraphy and Setting for Some Mineral Deposits in the Iskut River Map Area, Northwestern British Columbia; *in* Current Research, Part E, *Geological Survey of Canada*, Paper 90-1E, pages 131-139.

Baerg, R. and Wong, T. (1991): Geological, Geochemical and Geophysical Report on the Lucifer Property; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 21091.

Barnes, D.R. (1989): Geological-Geochemical Report, Foremore Group, Liard Mining Divison; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 19379.

Bobyn, M.G. (1990): Geological Mapping, Prospecting and Geochemistry of the Arctic/Upper More Claim Group; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 20667.

Brown, D.A. and Gunning M.H. (1989a): Geology of the Scud River Area, Northwestern British Columbia; *in* Geological Fieldwork 1988, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1989-1, pages 251-267.

Brown, D.A. and Gunning M.H. (1989b): Geology, Geochemistry and Mineral Occurrences of the Scud River Area, Northwestern British Columbia (104G/5, 6); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Open File 1989-7.

Brown, D.A., Greig, C.J. and Gunning M.H. (1990): Geology and Geochemistry of the Stikine River - Yehiniko Lake Area, Northwestern British Columbia (104G/11W, 12E); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Open File 1990-1.

Brown, D.A., Harvey-Kelly, F.E.L., Neill, I. and Timmerman, J. (1992): Geology and Geochemistry of the Tahltan Lake and Parts of the Chutine River Map Areas, Northwestern British Columbia (104G/12W, 13); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Open File 1992-2.

Brown, D.A., Logan, J.M., Gunning, M.H., Orchard, M.J. and Bamber, W.E. (1991): Stratigraphic Evolution of the Paleozoic Stikine Assemblage in the Stikine and Iskut Rivers Area, Northwestern British Columbia; *Canadian Journal of Earth Sciences*, Volume 28, pages 958-972.

Brown, R.F. (1990): Report on the Rock Geochemical Sampling in the Biskut Claim; *B.C. Ministry of Energy Mines and Petroleum Resources*, Assessment Report 19605.

Dearin, C. (1983): Evaluation of the Arctic Lake Property, Mess Creek Area; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 11515.

Diner, Y. (1987): Geological, Geochemical and Geophysical Report on the Bam Claims; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 17570.

Elsby, D.C. (1991): Structure, Ductile Thrusting and Mineralization within the Stikine Assemblage, South Forrest Kerr Area, Northwestern British Columbia (104B/10, 15); *in* Geological Fieldwork 1991, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Grant, B. and Newell, J.M., Editors, Paper 1992-1, this volume.

Evanchick, C.A. (1991): Structural Relationships of the Skeena Fold Belt West of the Bowser Basin, Northwestern British Columbia; *Canadian Journal of Earth Sciences*, Volume 28, pages 973-983.

Folk, P. (1981): Geological and Geochemical Report on the More and Two More Claims; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 9041.

Folk, P. (1986) Report on the Geology and Geochemistry of the Bee Jay Group of Claims; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 14982.

Godwin, C.I., Pickering, A.D.R., Gabites, J.E. and Alldrick, D.J. (1991): Interpretation of Galena Lead Isotopes from the Stewart-Iskut Area (103O, P; 104A, B, G); *in* Geological Fieldwork 1990, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1991-1, pages 235-243.

Gillan, J.F., Forster, D. and O'Donnell, M. (1984): Geological and Geochemical Evaluation of the Bam Claims; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 12561.

Hewgill, W. and Walton, G. (1986): Geological, Geochemical, and Geophysical Report on the Bam Claims, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 15827.

Holbek, P.M. (1982): Report on Geology and Soil Geochemistry of the BJ, Bee, Jay, Windy, Grey, Rainy, Day, Very, Fall, Valley Claims; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 9692.

Holbek, P.M. (1988): Geology and Mineralization of the Stikine Assemblage, Mess Creek Area, Northwestern British Columbia; unpublished M.Sc. thesis, *The University of British Columbia*, 174 pages.

Kerr, F.A. (1948): Lower Stikine and Western Iskut River Areas, British Columbia; *Geological Survey of Canada*, Memoir 246, 94 pages.

Logan, J.M. and Koyanagi, V.M. (1989): Geology and Mineral Deposits of the Galore Creek Area, Northwestern B.C. (104G/3, 4); *in* Geological Fieldwork 1988, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1989-1, pages 269-284.

Logan, J.M., Koyanagi, V.M. and Rhys, D. (1989): Geology and Mineral Occurrences of the Galore Creek Area, (104G/3, 4); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Open File 1989-8

Logan. J.M., Koyanagi, V.M. and Drobe, J.R. (1990a): Geology of the Forrest Kerr Creek Area, Northwestern British Columbia (104B/15); *in* Geological Fieldwork 1989, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1990-1, pages 127-140.

Logan, J.M., Koyanagi, V.M. and Drobe, J.R. (1990b): Geology, Geochemistry and Mineral Occurrences of the Forrest Kerr - Iskut River Area, Northwestern British Columbia (104B/10, 15); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Open File 1990-2.

Mawer, A.B. (1988): Geological-Geochemical Report, Foremore Group; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 18105.

Monger, J.W.H. (1970): Upper Paleozoic Rocks of the Stikine Arch, British Columbia; *in* Report of Activities, Part A, *Geological Survey of Canada*, Paper 70-1, pages 41-43.

Monger, J.W.H. (1977): Upper Paleozoic Rocks of Northwestern British Columbia; *in* Report of Activities, Part A, *Geological Survey of Canada*, Paper 77-1, Part A, pages 255-262.

Officiers of the Geological Survey of Canada (1957): Stikine River Area, Cassiar District, British Columbia; *Geological Survey of Canada*, Map 9-1957.

Poulton, T.P. (1991): Report on Seven Collections of Jurassic and Triassic(?) Fossils Collected by J. Logan and Colleagues in Telegraph Creek Map Area, B.C., in 1991 (NTS 104G/2); *Institute of Sedimentary and Petroleum Geology, Geological Survey of Canada*, Report No. J5-1991-TPP.

Rayner, G. (1965): Arctic Lake Examination, Bam Claim Group; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 695.

Read, P.B., Brown, R.L., Psutka, J.F., Moore, J.M., Journeay, M., Lane, L.S. and Orchard, M.J. (1989): Geology of Parts of Snippaker Creek (104B/10), Forrest Kerr Creek (104B/15), Bob Quinn Lake (104B/16), Iskut River (104G/1), and More Creek (104G/2); *Geological Survey of Canada*, Open File 2094.

Savell, M. (1990): Geological, Geochemical, Geophysical and Diamond Drilling Report on the RDN and GOZ Mineral Claims; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 20769.

Souther, J.G. (1970): Volcanism and its Relationship to Recent Crustal Movements in the Canadian Cordillera; *Canadian Journal of Earth Sciences*, Volume 7, pages 553-568.

Souther, J.G. (1971): Geology and Mineral Deposits of Tulsequah Map-area, British Columbia; *Geological Survey of Canada*, Memoir 362.

Souther, J.G. (1972): Telegraph Creek Map Area, British Columbia; *Geological Survey of Canada*, Paper 71-44, 38 pages.

Souther, J.G. (1988): Mount Edziza Volcanic Complex, British Columbia; *Geological Survey of Canada*, Map 1623A.

Souther, J.G. and Symons, D.T.A. (1974): Stratigraphy and Paleomagnetism of Mount Edziza Volcanic Complex, Northwestern British Columbia; *Geological Survey of Canada*, Paper 73-32, 48 pages.

Walton, G. (1986): Geochemical Survey, Bam Claims, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 14859.

Webster, I.C.L. and Ray, G.E. (1991): Skarns in the Iskut River - Scud River Region, Northwest British Columbia; *in* Geological Fieldwork 1990, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1991-1, pages 246-253.

Woodsworth, G.J., Anderson, R.G. and Armstrong, R.L. (1989): Plutonic Regimes in the Canadian Cordillera; *Geological Survey of Canada*, Open File 1983.