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Geological Fieldwork 1988

THE GEOLOGY OF THE TAGISH LAKE AREA (FANTAIL LAKE and WARM CREEK) (104M/9W and 10E)

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KEYWORDS: Regional geology, Boundary Ranges metamorphic suite, Nisling terrane, Stuhini Group, Laberge Group, Coast Complex, Llewellyn fault, Teepee Mountain, skarn, gold veins.

INTRODUCTION

This report is an update on the regional mapping project begun in 1987 in the Tutshi Lake map area in northwestern British Columbia (Mihalynuk and Rouse, 1988a and b). Mapping over the past field season centred on the Tagish Lake area between Atlin, British Columbia and Skagway, Alaska (Figure 1-32-1). Fieldwork was completed between early June and mid-September. A regional geochemical program including moss-mat and stream-sediment sampling was run in concert with geological mapping at 1:25 000 scale (800 square kilometres, compiled at 1:50 000).

Lithologies in the 1988 map area do not vary significantly from those within the 1987 study area. During the past season emphasis was on subdivision of the existing gross lithologic units shown in their regional geologic setting in Figure 1-32-2. The simplified geology of the 1988 study area is portrayed in Figure 1-32-3 and regional correlations with the 1987 map area are shown in Figure 1-32-4.

Lithologies represented in Figures 1-32-2, 3, and 4 range from metamorphic rocks of probable Proterozoic marine clastic protoliths to Mesozoic volcanics and coarse clastic marine sediments. Layered rocks are crosscut by three granitoid suites loosely constrained as Late Triassic (*circa* 215 Ma), Early Cretaceous (*circa* 130 Ma) and Late Cretaceous through Paleocene (*circa* 90 to 65 Ma; *see* Table 1-32-1). A large fault zone (known as the Llewellyn fault; Bultman, 1979) transects the area diagonally and marks the western boundary of the metamorphic terrain. Stream sediment and lithogeochemical analyses indicate that the metamorphic terrain, and in particular the fault zone, are anomalous with respect to both arsenic and gold, and are thus significant mineral exploration targets.

ACCESS AND PHYSIOGRAPHY

The 1988 study area is most conveniently reached by charter float-plane or helicopter; both stationed 40 kilometres to the east at Atlin. At high water (late July through September) the Atlin River, which joins the Atlin and Tagish Lake systems, can be negotiated by powerboat, however, this route is not recommended for the uninitiated.

Approximately 20 per cent of the map area is easily reached from major lakes that follow the eastern margin (Tagish) and central east-west axis (Fantail) of the map sheet. These lakes are at 650 metres and 690 metres elevation respectively, treeline is about 1250 metres, and the major peaks exceed 2150 metres elevation. Nearly 5 per cent of this mountainous area is covered by glaciers that are presently in recession. Both permanent and fresh snow may cover much of the alpine areas throughout the summer.

REGIONAL GEOLOGIC SETTING

The map area encompasses a small segment of the north-northwest-trending boundary between the Intermontane and Coast crystalline belts; the structural fabric of three distinct lithotectonic domains within the area reflects this orientation. In the west (Domain I; Figure 1-32-5) rocks of the Coast crystalline belt intrude the Proterozoic to Paleozoic Boundary Ranges metamorphic suite of the Nisling terrane, (Domain II; Figure 1-32-5) which are in fault contact with the Upper Triassic Stuhini Group or the Lower Jurassic Inklin overlap assemblage (Wheeler *et al.*, 1988) together forming the easternmost Domain III. Plutonic bodies east of Domain I

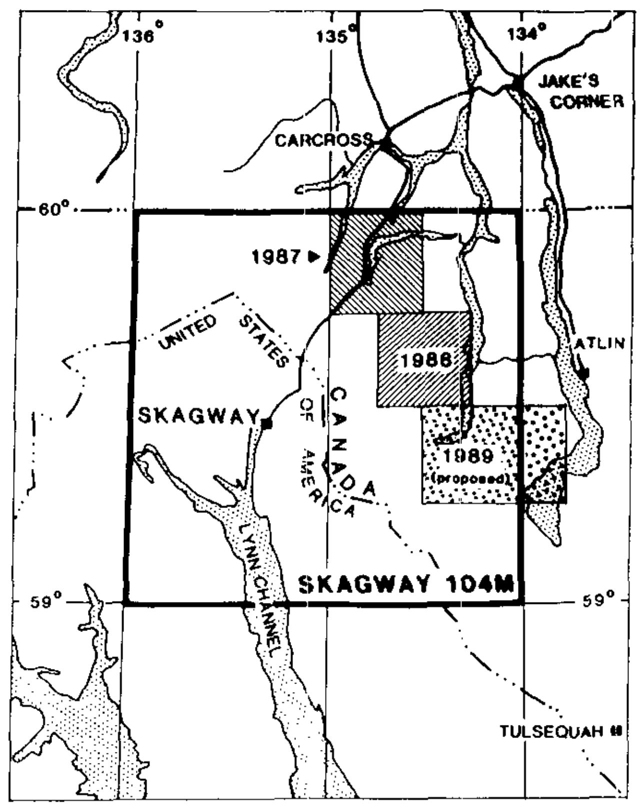

Figure 1-32-1. Location map showing 1987, 1988 and proposed 1989 field areas.

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

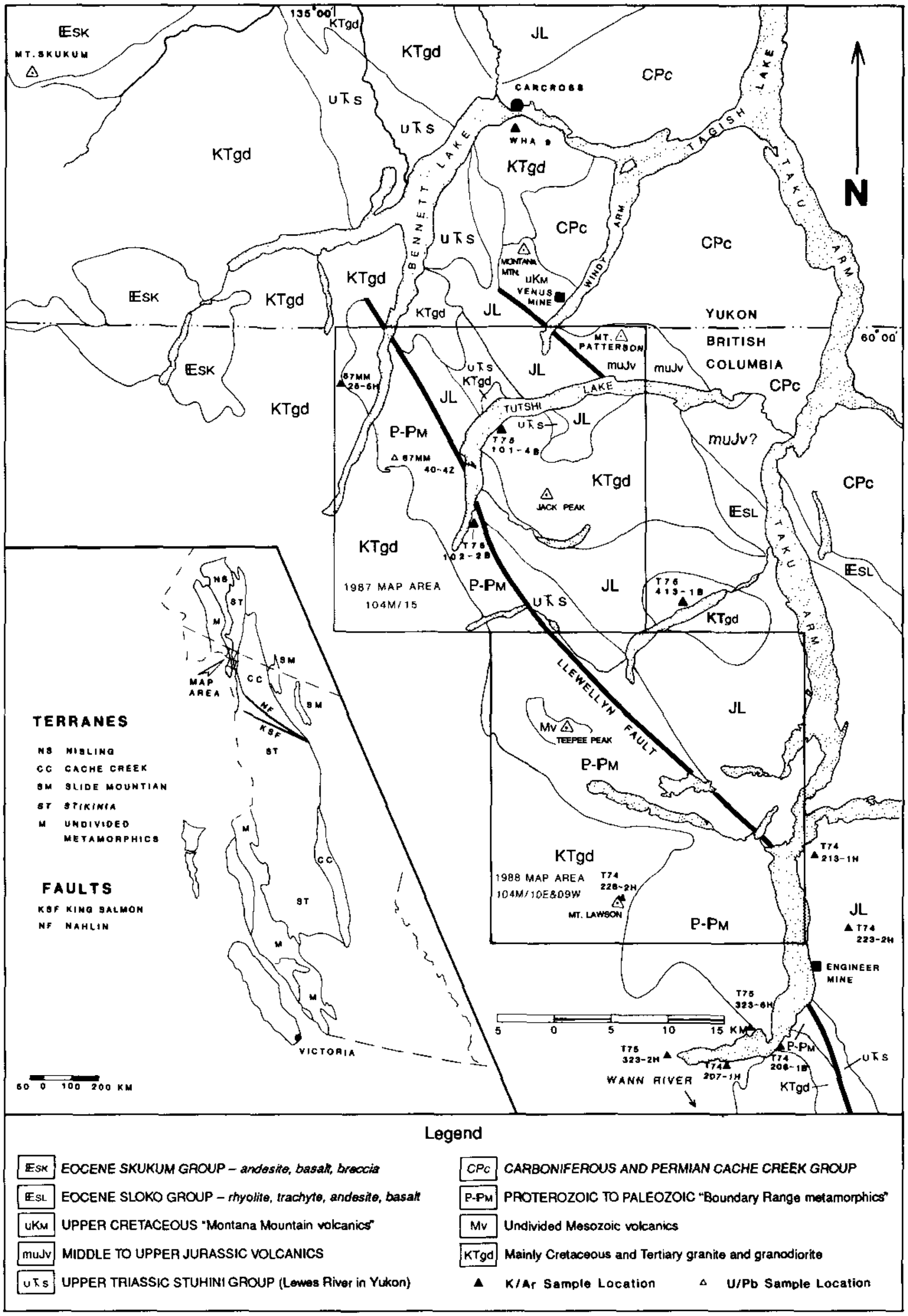

Figure 1-32-2. Regional geology with terrane map inset (Modified after Christie, 1957; Wheeler, 1961; Wheeler *et al.*, 1987). Isotopic age information from the sites indicated are listed in Table 1-32-1.

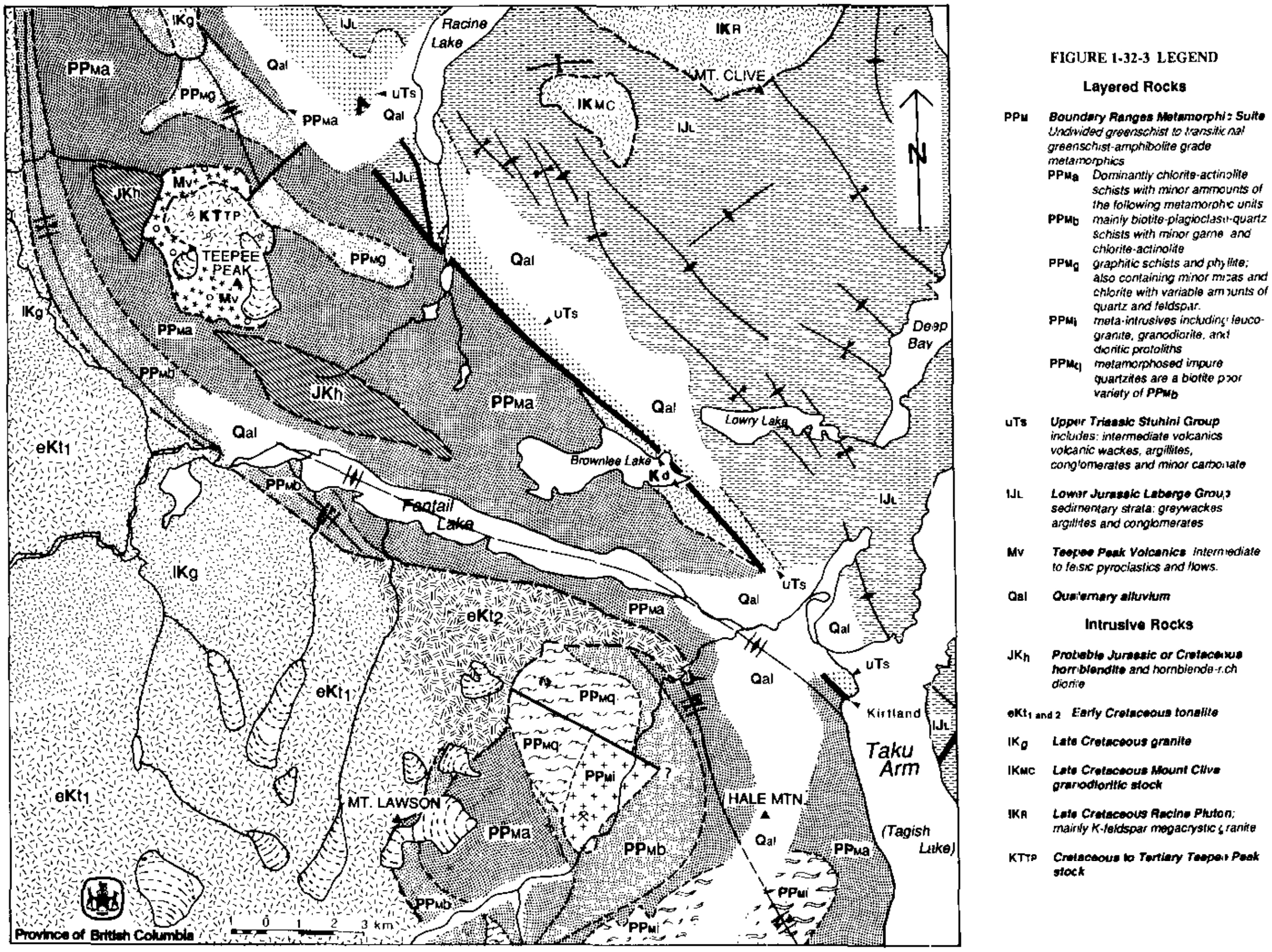

Figure 1-32-3. Simplified geology of the Tagish Lake area (*see* text for a description of the units). Unit PPM_a is primarily, but not exclusively, chlorite-actinolite schists; narrow zones of other lithologies, including marbles, are common. Hinge traces shown within units of PPM are interpreted as those of large scale F_3 folds (denoted by two ticks).

crosscut all layered rocks and represent the youngest lithologies, aside from minor late crosscutting dykes, and yield potassium-argon dates of 131 to 65 Ma (Bultman, 1979; Table 1-32-1).

Nisling rocks wrap around a small salient of slightly foliated hornblende diorite/tonalite thought to be part of a 131 Ma suite (Bultman, 1979; Mt. Lawson; Figure 1-32-2; Table 1-32-1). Older meta-intrusives are deformed and/or infolded with the metasediments to various degrees. A potassium-argon age determination on one such body on the southern border of the Tagish Lake area yielded 215.3 ± 5 Ma (Bultman, 1979), this represents the oldest of the three intrusive suites postdating regional metamorphism of the Boundary Ranges metamorphic suite. Extensive uranium-lead isotopic dating of foliated intrusive rocks will likely yield ages older than 215 Ma as structural and textural evidence suggests that they have been subjected to a longer deformational history than have the 215.3 ± 5 Ma intrusives.

LAYERED ROCKS

PROTEROZOIC TO PALEOZOIC(?) BOUNDARY RANGES METAMORPHICS (PPM)

Mihalynuk and Rouse (1988) termed low-grade metamorphic rocks in the Tutshi Lake area, previously called Yukon Group (Christie, 1957), the Boundary Ranges metamorphic suite. Templeman-Kluit (1976) suggests that the term "Yukon Group" may be misleading since juxtaposed metamorphic rocks within this package may have widely varying protolith ages. The name "Boundary Ranges metamorphics" is suitable for rocks south of the British Columbia–Yukon border as these rocks underlie the Boundary Ranges. On the other hand, as these rocks have been included in the Nisling terrane (Wheeler and McFeely, 1987), a name like "Nisling metamorphic suite" is also apt, but perhaps not recommended due to the youth and presently defined character of the Nisling terrane.

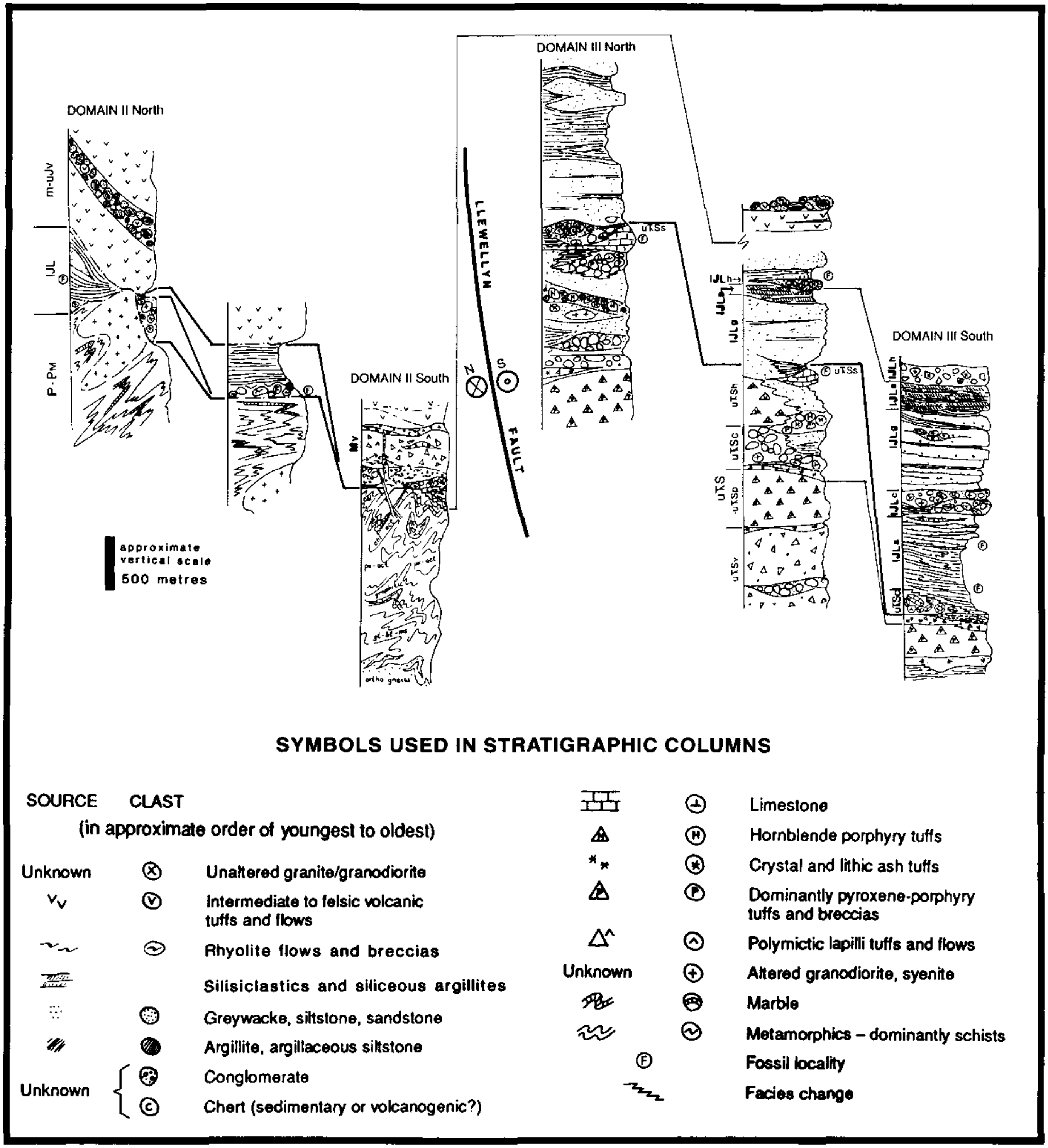

Figure 1-32-4. Stratigraphic correlation chart showing both 1987 and 1988 map areas. Unit UTsh is comprised of hornblende-rich tuffs and epiclastics (Mihalynuk and Rouse, 1988a, b). Unit muJv, defined in the Tutshi Lake map area, is tentatively correlated with Unit Mv (*see* "Hornblendite" section for age argument). See text and Figure 1-32-3 legend for description of units.

TABLE 1-32-1
K-Ar ISOTOPIC AGE DATA
(Locations Shown on Figure 1-32-8)

Sample No.[a]	Location			Rock Type	%K	$^{40}Ar^{b}$ 10^{-7} cc/g	$\%^{40}Ar^{c}$ $-^{40}Ar_{total}$	Age, error,[d] Ma[e]
		Latitude	Longitude					
T74-101-4b	104M/15	59°55′20″	134°42′31″	biotite granite	6.09 (n=3)	22.30	40	90±3 92±3
T74-207-1h	104M/8	59°24′45″	134°22′43″	granodiorite	2.54 (n=2)	6.49	53.7	64±1.3 66±1.3
T74-208-1b	104M/8	59°25′25″	134°17′10″	granodiorite	6.37 (n=3)	31.56	79.2	120±2 123±3
T74-208-1h	104M/8	59°25′25″	134°17′10″	granodiorite	0.85 (n=1)	4.98	36.0	142±4 145±4
T74-213-1h	104M/9W	59°34′45″	134°15′20″	granodiorite	0.45 (n=2)	3.41	38.3	181±5 185±5
T74-223-2h	104M/9W	59°30′35″	134°10′31″	hornblende tonalite	0.39 (n=2)	1.27	34.1	80±3 83±3
T74-228-2h	104M/10E	59°33′00″	134°31′52″	hornblende tonalite	0.60 (n=2)	3.23	41.1	131±3 133±3
T75-102-2b	104M/15	59°51′50″	134°46′15″	granodiorite	7.10 (n=3)	22.48	81.3	78±1.6 80±1.6
T75-323-2h	104M/8	59°25′20″	134°26′12″	hornblende diorite	0.38 (n=2)	1.83	40.4	117±3 120±3
T75-323-6h	104M/8	59°26′00″	134°18′52″	hornblende gneiss	1.14 (n=2)	7.89	43.9	166±3 170±3
T75-413-1b	104M/15	59°47′25″	134°24′31″	biotite granite	5.74 (n=3)	19.21	39.4	82±2.1 84±2.1
87MM-25-5h	104M/15	59°57′38″	134°57′38″	hornblendite	0.39 (n=3)	20.57	79.7	— 150±6

[a]b refers to biotite analysis; h to a hornblende analysis.
[b]Radiogenic ^{40}Ar.
[c]Radiogenic as percentage of total ^{40}Ar; all samples from Bultman (1979) except 87MM-25-5h.
[d]Error expressed as 1 standard error of the mean.
[e]First date tabulated is derived using decay constants 4.72/.584/1.19; second using 4.96/.581/1.16.

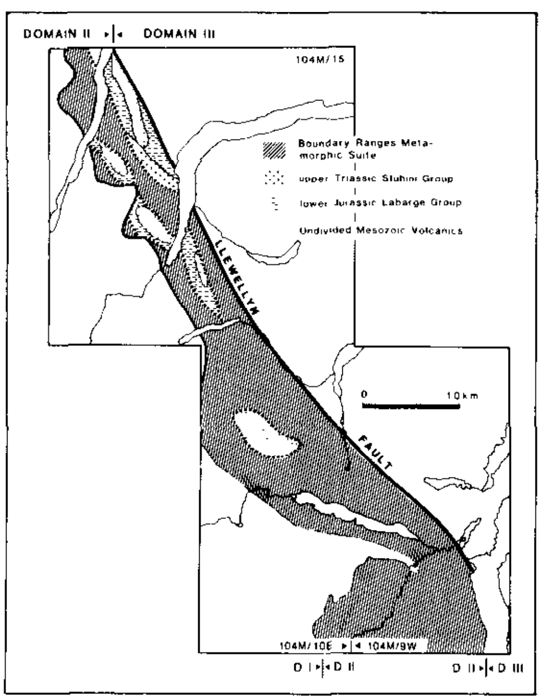

Figure 1-32-5. Distribution of Mesozoic strata overlying Boundary Ranges metamorphic rocks.

Metamorphic rocks form a polydeformed belt (Domain II, Figure 1-32-5; Plate 1-32-1) bounded on the east by the Llewellyn fault and on the west by mainly intrusive rocks of the Coast crystalline belt. Evidence exists for a variety of protoliths: quartzose to pelitic, carbonaceous and calcareous marine sediments to tuffaceous strata; small lenses to large bodies (several kilometres diameter) of ultramafic, gabbroic, dioritic, granodioritic and granitic intrusives. This lithologic variability is similar to that described by Wheeler (1961) suggesting a correlation with the metamorphic rocks in the Whitehorse map area. Thicknesses are exceedingly difficult to estimate due to the high degree of deformation, and in particular, non-coaxial folding and interstratal slip. These same factors make it impossible to trace specific layers more than a few 100 metres in outcrop.

Doherty and Hart (1988) map quartz-mica schists just north of the British Columbia–Yukon border which they correlate with the biotite schist unit of Tempelman-Kluit (1976). The only significant difference between metamorphic rocks north and south of the border seems to be the increase in metavolcanics to the south (although these do not appear to persist as far south as 104M/8; Werner, 1977, 1978). Within 104M/8, however, metamorphic rocks display characteristics that are identical to those described for the biotite schist unit.

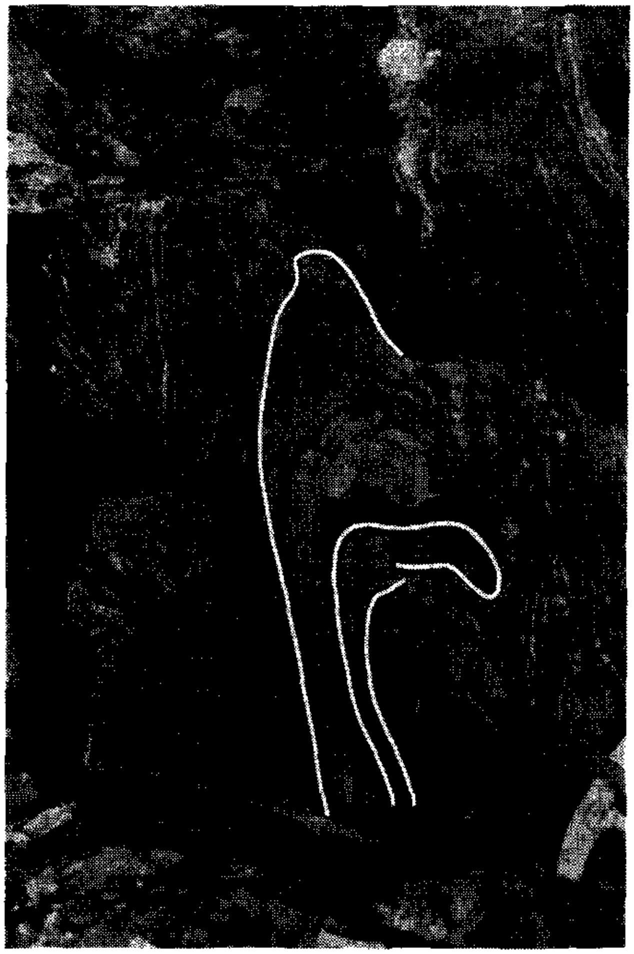

Plate 1-32-1. Folded fold within metamorphic rocks displaying typical irregular, tight to isoclinal folds *(i.e.* folded S_{0+1} surface is *highlighted in white).*

The age of Unit PPM is based on rubidium-strontium isotopic model age determinations on rocks correlated to the north and south which are: 1170 Ma (Wasserburg *et al.*, 1963); Late Proterozoic (less than 770 Ma; Armstrong *et al.*, 1986); 1200 Ma (Watson *et al.*, 1981), and a similar age for equivalent rocks immediately south of the map area in 104M/8 (Werner, unpublished data; Armstrong, personal communication, 1988). Aleinikoff *et al.* (1987) interpret an Early Proterozoic age based on uranium-lead and samarium-neodynium isotopic data for similar rocks in the Yukon-Tanana upland in eastern Alaska. Existing isotopic dating will be extensively tested in the Tagish area as part of a Ph.D. thesis at Carleton University by L. Currie using uranium-lead isotopic techniques.

META-INTRUSIVES (PPM$_i$)

Investigating the age of meta-intrusives within the PPM suite is the easiest way to determine the **minimum** age for these metamorphic rocks. At this time, isotopic dates exist only for the youngest of these intrusions which are Late Triassic in age 215±5 Ma (Table 1-32-1) and probably should not be included as a component of the Nisling terrane *sensu stricto*. Other types of early intrusives (porphyritic granodiorites, fine to medium-grained granites, among others) may be infolded with the metasediments to various degrees, and are probably older than Late Triassic. One of these bodies, located on the south flank of Hale Mountain, is a large, foliated, chlorite (12 per cent) and epidote (2 per cent) altered hornblende biotite granodiorite.

BIOTITE PLAGIOCLASE QUARTZ SCHISTS (PPM$_b$)

The biotite schists form a belt along the western edge of Domain II. The proportion of minerals is normally biotite less than plagioclase less than quartz, although nearly pure biotite layers up to 10 centimetres thick are common. These schists may contain sparse garnet porphyroblasts typically 1 to 3 millimetres in diameter, but rarely up to several centimetres. Both muscovite and actinolite are normally subordinate phases, but can be found in amounts subequal to biotite in confined layers.

Biotite schists are well foliated and this foliation is commonly folded. Despite their compact nature in outcrop they are most abundant in the lowlands. Outcrops are rusty, dark grey weathering.

IMPURE METAQUARTZITES (PPM$_q$)

These rocks can be regarded as quartz-rich biotite schists as they are texturally indistinguishable from Unit PPM$_b$, but typically contain less than 10 percent biotite and less than 20 per cent feldspars. The contact between this unit and Unit PPM$_b$, although somewhat arbitrary, is mappable.

CHLORITE SCHISTS (PPM$_c$)

These schists are not extensive but underlie a significant area north of Fantail Lake. Chlorite porphyroblasts are well developed (up to 2 centimetres diameter) in places but fine-grained schists are much more common. Chlorite schists may display well-developed crenulations and are generally more highly strained than other rock types.

CHLORITE-ACTINOLITE SCHISTS (PPM$_a$)

Chlorite-actinolite schists are the most abundant rocks of the metamorphic suite. Plagioclase and quartz may comprise up to 50 per cent or more of the rock, which results in mineral segregation so that the outcrop appears banded green and white. Biotite and rare garnet may be present as accessory phases; the abundance of biotite layers increases towards the contact with unit PPM$_b$. Chlorite may be coarse, but is generally fine grained and is oriented within a well-developed schistosity. Actinolite is easily identified as dark green acicular crystals on cleavage surfaces, ranging in size from 1 to 30 millimetres. It is almost always subordinate to chlorite in abundance. It may outline a distinct lineation at one side of an outcrop and be randomly oriented within a foliation plane only a few centimetres away.

GRAPHITIC SCHISTS AND PHYLLITES (PPM$_g$)

Poorly developed graphite and muscovite(?) impart a silver sheen to these rocks which generally form rubbly to blocky outcrops depending on the degree of induration. They may grade into Unit PPM_a and commonly contain calcareous interlayers. Quartz, chlorite and feldspar content varies but black graphitic folia are diagnostic.

Pyroxene-Plagioclase Schists (PPM_p)

Pyroxene-plagioclase schists with lesser chlorite and actinolite are common, although volumetrically minor within chlorite-actinolite schists. Pyroxenes are typically 0.5 to 1 centimetre in diameter within a matrix of chlorite, actinolite and plagioclase. The latter minerals tend to wrap around the more competent pyroxene crystals. Proportions of pyroxene in a given sample vary from a few per cent to about 50 per cent. Protoliths of these rocks are not known, but basic tuffs or intrusives are most likely. In 104M/15 very similar schists are seen to grade into a weakly foliated gabbroic body.

Marble (PPM_m)

Yellow, orange and tan-weathering, medium-grained, resistant carbonate layers up to 200 metres thick are the best marker units within the metamorphic package. Unfortunately, like all other rocks within the polydeformed metamorphic domain, these units are discontinuous and difficult to follow. Where they do crop out persistently, they clearly outline structures (*see* Figure 1-32-6).

STUHINI GROUP VOLCANICS (uTs)

The Stuhini Group in the Tagish Lake area may be represented by less than 500 metres of strata. Near the south end of Racine Lake the apparent thickness exceeds 3 kilometres, but much of this succession is strongly foliated and its correlation

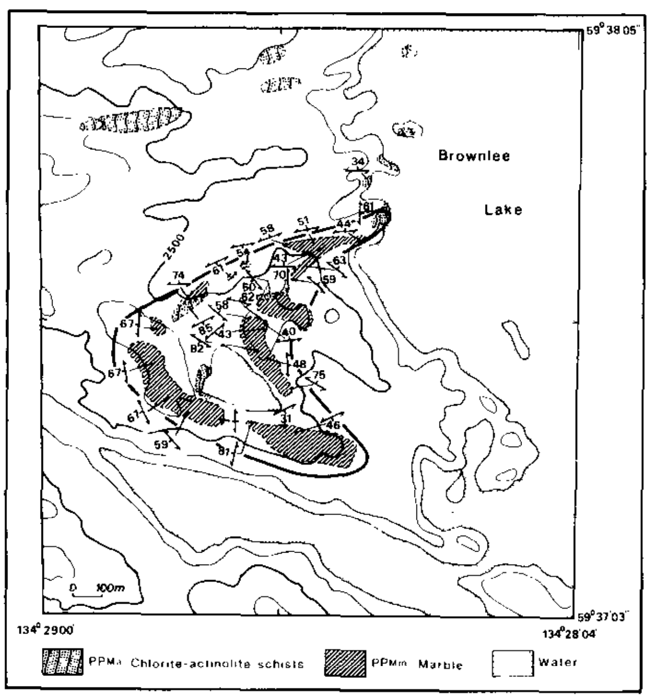

Figure 1-32-6. Outcrop distribution and structural data are shown for an F_3 interference structure west of Brownlee Lake, outlined by a massive carbonate band within dominantly chlorite-actinolite schists.

with Stuhini Group strata is largely conjectural. Protoliths for part of the foliated strata were rhyolite lapilli tuffs – unlike any *bona fide* Stuhini Group lithologies within either the 1987 or 1988 map areas, adding further to the uncertainty of this correlation.

Contacts between units in the Stuhini Group are rarely exposed in the Tagish Lake area and are often faulted, particularly where adjacent to the Llewellyn fault. As a result it is difficult to map contacts within these rocks with a high degree of confidence. A stratigraphic succession can, however, be developed based upon the same relative position of strata for more than half the exposed length of the belt. Tops are inferred to a large degree from the general eastward younging of lithologies. The stratigraphy appears to be: argillites, volcanic wackes and/or arenites followed by fetid, scoria-rich carbonate, which is succeeded by varicoloured, heterolithic, lapilli tuffs, augite porphyry pyroclastic breccias, and finally conglomerates comprised mainly of carbonate and volcanic cobbles.

Augite Porphyry Breccias (uTs_p)

This lithology is characteristic of the Stuhini Group and is best displayed just east of the Llewellyn fault on the ridges south of Brownlee Lake, where its apparent thickness exceeds 300 metres. The breccias are resistant, rounded to blocky weathering, dark green and monolithologic, composed dominantly (50 to 80 per cent) of blocks and bombs(?). Idiomorphic pyroxene phenocrysts (20 to 40 per cent, up to 1.5 centimetres diameter) are conspicuous within both clasts and matrix. Plagioclase occurs as subhedral phenocrysts of lesser, but variable abundance and size. Matrix and phenocryst alteration includes chlorite and lesser epidote.

Argillites and Volcanic Litharenites/ Wackes (uTs_a)

This sedimentary package is best exposed near Brownlee Lake where it is involved in the Llewellyn fault zone. Massive argillites are maroon, green and brown and weather to angular gravel-sized fragments. These argillites are easily mistaken for aphanitic intrusives except that in rare instances weathered surfaces preserve original sedimentary layering. Immediately adjacent to the fault these rocks are transformed to chlorite schists which may be tectonically mixed with fault material derived from other lithologies.

Argillites grade "upwards" (tops uncertain) and eastwards into volcanic wackes and arenites. Volcanic sandstones and wackes (wacke herein indicating at least 15 per cent clay minerals in the matrix), are brown to grey, recessive weathering, calcareous, fissile and common throughout the meagre Stuhini stratigraphy. On the ridges northwest of Brownlee Lake wackes sit "above" (east of) the augite porphyries, but south of Brownlee Lake the opposite relationship is observed. Foliation of this unit generally increases towards the Llewellyn fault with zones of high strain, 1 to 2 metres across, existing several hundred metres away from the main fault trace.

Heterolithic Lapilli Tuffs (uTs_v)

Dark green to grey (less commonly maroon), angular, scoriaceous fragments to rounded volcaniclasts comprise 20 to 80 per cent of the rock. Fragments are aphanitic or porphyritic (crystals less than 3 millimetres), although phenocrysts may be replaced by chlorite. Rare fragments have trachytically aligned plagioclase phenocrysts and microlites.

Limestone-Boulder Conglomerate and Fetid and/or Volcaniclast-rich Carbonate (uTs_c)

This conglomerate is orange to yellow weathering, clast supported and varies from a conglomerate with 100 per cent limestone boulders to one with a large proportion of intrusive and volcanic clasts (clasts other than limestone increase in abundance to the east). The conglomerate may be several hundred metres thick and is persistent laterally. In places, however, it is not developed. For example, at the same statigraphic level at Kirtland there is instead a dark grey, orange-weathering, foliated carbonate with scoria-rich layers (less than 10 metres thick) overlain by epiclastics. The lithologies and succession at Kirtland are identical to a section in 104M/15 on the ridges southwest of Moon Lake. It is not known if this conglomerate is Late Triassic or Early Jurassic in age as it sits between strata of Late Triassic Stuhini Group affiliation and Laberge Group argillites of Pliensbachian age.

LABERGE GROUP

The contact between the Upper Triassic Stuhini Group and the Lower Jurassic Laberge Group is probably not exposed within the map area unless it is represented by the conglomerate (Unit uTs_c) at the top of the Stuhini succession. A broad covered interval between the Stuhini and Laberge Group rocks exists along most of the contact region. In rare outcrops within this interval, lithologies are fine grained – normally argillites and/or wackes (similar to the Upper Triassic–Lower Jurassic transition mapped in 104M/15). The oldest age determination for rocks immediately to the east of this zone comes from an ammonite suite (identified by H.W. Tipper, Geological Survey of Canada) of Pliensbachian age. The top of the Laberge Group stratigraphy has not been identified within the map area. Youngest fossils from these strata are Toarcian.

Many of the units within the Laberge Group sediments have a limited facies-dependent distribution which results from their depositional environment – interpreted as one of coalescing subaqueous turbiditic fans (Bultman, 1979).

Argillites (lJL_a)

Laberge Group argillites are of two major types: rhythmically bedded (2 to 5 centimetre beds, showing good internal normal grading) and irregularly, thinly bedded.

Rhythmically bedded argillites form successions 10 to 100 metres or more thick. A typical graded bed consists of a light grey base of fine-grained wacke to siliceous argillite, grading upwards to a dark grey to black argillite; individual beds lack internal sedimentary structures (Plate 1-32-2a). Bedding tops may display bioturbation and feeding trails; these are especially prominent in calcareous beds which may attain a thickness of 10 centimetres. The beds generally have slightly irregular tops and bottoms. Very sparse cobbles (less than 1 per cent) of a variety of protoliths are not uncommon.

Irregularly and thinly bedded argillites are typically found as sets between massive wacke beds. They are dark brown to black and have thicknesses ranging from a few millimetres to several centimetres. Individual layers may display good normal grading, but this is not a feature of most beds. The grain size and composition ranges from siltstone to argillite, with common interbeds of lithic wacke. The argillites are typically recessive and rusty weathering.

Greywackes (lJL_g)

The term greywacke is herein used to denote a rock dominated by sand-sized grains, but containing 15 to 75 per cent muddy matrix. Greywackes are by far the dominant rock type within the Laberge Group. Feldspathic wackes are generally subordinate to lithic wackes; grain sizes vary significantly from very fine sand to granules, with medium to coarse sand being the estimated modal grain size. An example of compositional and textural variations between two widely spaced outcrops (a and b) follows:

quartz:	(a) subrounded, 10 to 15 per cent (b) subangular, 1 to 5 per cent
feldspar:	(a) plagioclase about 50 per cent, angular (b) less than 10 per cent
micas:	(a) altered muscovite and biotite total 1 per cent
combined lithic:	(a and b) the remaining rock volume is composed of lithic grains (chloritized) and matrix; often difficult to distinguish except in coarse-grained wackes.

Other mafic minerals, hornblende in particular, may comprise up to 5 per cent of the rock. Locally, greywackes grade into lithic arenites, but these do not persist. Neither quartz arenites nor quartz wackes have been observed.

Wackes are invariably calcareous and may display elongate bulbous concretions up to several metres long and half a metre thick. Beds are massive or graded and vary considerably in thickness from a few centimetres to 10 metres or more. Massive beds or sets of massive beds are typically interlayered with sets of graded siltstone and argillite generally less than 2 metres thick. Greywackes are grey to green and orange weathering and are resistant compared to adjacent argillites. In several isolated localities they occur as discordant dykes, probably dewatering structures.

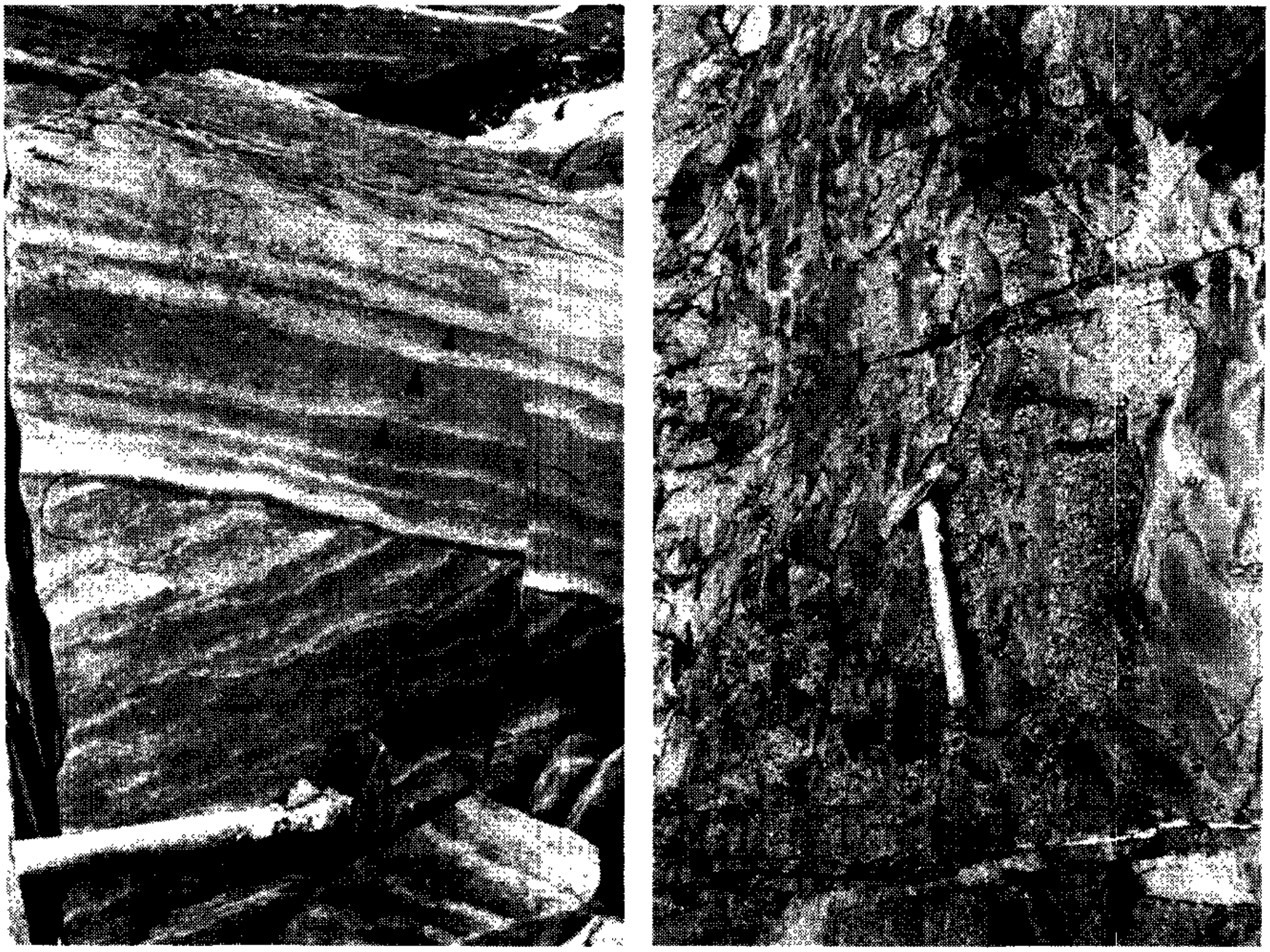

Plate 1-32-2. Fine-grained facies of the Lower Jurassic Laberge Group: (a) angular intraformational unconformity in rhythmically bedded argillites (the grading and tops of three beds are indicated by the arrows) and (b) associated intraformational conglomerate derived from argillites (note granule pebble conglomerate matrix).

Conglomerates (lJL_c)

Conglomerates are common as minor units within a stratigraphic succession dominated by argillites and wackes. Mappable conglomerate units, however, are uncommon. Conglomerate units exceed 200 metres in thickness only in the lower parts of the Laberge Group. Both clast and matrix composition are variable. Clasts may include volcanic, sedimentary and intrusive lithologies. Volcanic clasts range in composition from pyroxene and hornblende feldspar porphyries, feldspar porphyries, and aphanitic mafic to felsic rocks. Intrusives vary from syenites through leucogranites, generally medium grained, altered and rarely foliated. North of Whitehorse, boulders of intrusives within the Laberge Group have been potassium-argon dated at 199, 179 and 174 Ma (Tempelman-Kluit, 1976). Sedimentary clasts are dominated by light and dark grey, rarely fossiliferous, carbonates (probable upper Norian Sinwa Formation equivalent; Unit uTss on Figure 1-32-4) with lesser wacke and argillite. There appears to be a gross change from volcanic-clast dominated to intrusive/carbonate-clast dominated conglomerates higher in the Laberge section, however, certain horizons may be more than 90 per cent intraclasts (Plate 1-32-2b). Conglomerates are typically clast supported with a coarse wacke matrix, but varying percentages (generally 1 to 2 per cent, rarely up to 30 per cent) of clasts floating within an irregularly bedded argillite matrix are also common.

Conglomerates are conspicuous in outcrop due to the contrast between clasts of light-coloured carbonate and intrusive rock and the dark wacke (or argillite) matrix. Boulders of intrusive rock may attain a diameter of 1.2 metres, however, both intrusive and limestone clasts are most commonly less than 15 centimetres in diameter.

The most likely source for many of the conglomerates is the Upper Triassic Stuhini Group (including the reefal Sinwa Formation). Clasts of intrusives are probably derived from Late Triassic bodies within the Boundary Ranges metamorphics (*see* "Meta-intrusives" above).

Siliciclastics (lJL_s)

Indurated siltstones to quartz-rich lithic wackes are included within the siliciclastic subdivision. They commonly display small-scale trough cross-stratification (Plate 1-32-3) and very good internal layering (unlike massive wackes) and

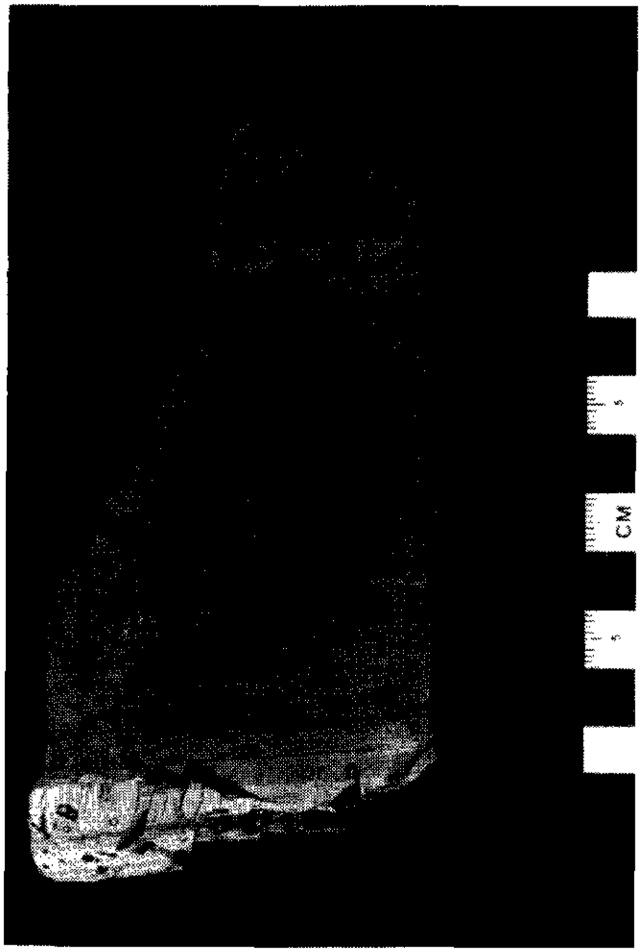

Plate 1-32-3. Sample of Laberge Group siliciclastics. Note small-scale trough cross-stratification, truncation of ripple foresets, and sequences of graded beds. Tops are towards the top of the plate.

are rusty weathering. A conchoidal fracture and surprisingly high hardness are also diagnostic.

These strata are probably over 100 metres thick and form the northeastern dip-slope to the northwest-trending belt of high peaks in central Domain III. They sit relatively high in the stratigraphic succession and, because of their uniqueness and continuity, are a useful marker within the Laberge Group (Figure 1-32-4).

Hornblende-feldspar-porphyry Conglomerate (lJL_h)

These rocks occur both above and below the siliciclastics and superficially look like coarse lithic and feldspathic wackes except for the abundance of hornblende feldspar porphyry granules and pebbles, and crystals derived from them (moderately fresh hornblende may comprise several per cent of the rock). Clasts may be subangular to rounded and rare cobbles are matrix supported within a quartz-feldspar-rich wacke. In rare instances the conglomerate is clast supported, and, except for minor intraclasts, the clasts are monolithologic.

This unit, with associated siliciclastics, correlates well with the section exposed on the peaks due east of Mount Brown in 104M/15, where they are found together with Toarcian fossil fauna (Figure 1-32-4).

TEEPEE PEAK VOLCANICS (Mv)

The volcanic succession at Teepee Peak has been previously mapped as "Mesozoic Volcanics of Uncertain Age" (Christie, 1957) and lately has been included with the Upper Triassic Stuhini Group (Lhotka and Olsen, 1983). These rocks, however, have little in common with Stuhini Group lithologies; they are conspicuously more felsic, and the conglomerates and augite porphyries so common in the Stuhini Group are absent, as is the epidote-chlorite alteration and folding displayed by Stuhini rocks. A sample was collected from a spherulitic rhyolite flow for uranium-lead isotopic age determination.

Basal Breccia/Conglomerate (Mvb)

A conspicuous basal conglomerate is present at most places where the Teepee volcanics are seen in contact with probable Upper Proterozoic metamorphic rocks. It is best developed on the south and eastern contacts. The most common components are angular to subrounded blocks of well-foliated metamorphics (generally less than 25 centimetres) mixed with a lesser proportion of (less than 20 centimetres) feldspar and quartz-phyric rhyolite fragments (*see* Plate 1-32-4). Minor constituents include intermediate volcanic fragments and, in one instance, a large transported boulder of the breccia contained a fragment of horneblendite identical to an intrusive phase that appears to crosscut the volcanics.

Dyke-like breccia bodies that are lithologically very similar to the basal breccia, except for the higher degree of chlorite alteration and their discordant nature, crosscut the metamorphic rocks.

Hornblende Feldspar Porphyry Breccias (Mvh)

These volcanic breccias are typically dark grey-green to brown-black, monolithologic, blocky weathering and indurated. Fragmental textures are obscured on all but the cleanest weathered surfaces. Polymictic coarse ash and lapilli tuffites are occassionally interbedded with the breccias. These strata sit relatively low in the volcanic succession in the southeast and west-central parts of the Teepee Peak exposures.

Rhyolite Flows, Domes and Pyroclastic Breccias (Mvr)

These rocks appear stratigraphically equivalent to Unit Mvh. Sparsely feldspar-phyric, pink, grey and white-banded spherulitic flows are interlayered with pyroclastic breccias containing a large proportion of clasts of the same rock together with intermediate fragments and ash. Subvolcanic

Plate 1-32-4. Outcrop of breccia at base of Teepee Peak volcanics. Dark, banded blocks are biotite-chlorite-actinolite-quartz-albite schists of probable Late Proterozoic age; white and light grey fragments are rhyolite and intermediate volcanics.

(?) intrusives (or very thick non-brecciated and poorly banded flows) form a continuum with the extrusive rocks. Some of these may attain thicknesses of more than 500 metres. Feeder dykes to rhyolites crosscut the basal breccia/conglomerate. Younger felsic dykes may display flow banding and crosscutting relationships with the entire exposed volcanic sequence. These rhyolites are generally not quartzphyric.

Heterolithic Lapilli Tuff (Mv_v)

A cliff-forming vitrophyric, crystal and heterolithic lapilli tuff underlies Teepee Peak. It contains variable proportions of lithic fragments (green, brown and grey, sparsely feldsparphyric to white and grey aphanitic rhyolite) in a black vitric matrix displaying eutaxitic texture. Euhedral and fragmented plagioclase comprises up to 15 per cent of the rock. Weathered surfaces are tan, red or maroon.

INTRUSIVE ROCKS

Foliated Granodiorite/Tonalite (eKt_1)

This body is blocky and tabular grey-green weathering, grey to white on fresh surfaces. It is typically medium grained with sparce hornblende megacrysts (xenocrysts?). Abundant hornblende and hornblende-biotite xenoliths are conspicuous as aligned plate-like inclusions less than 30 centimetres long. Hornblende most commonly occurs as glomeroporphyritic patches (10 per cent, single grains less than 4 millimetres in diameter), black when fresh, but often chlorite-altered to a greenish colour. Biotite may comprise 5 to rarely 7 per cent of the rock as glomeroporphyritic and subidiomorphic booklets up to 3 millimetres in diameter. Feldspars comprise 60 per cent of the rock, but only plagioclase can be readily identified in hand sample. Quartz is xenomorphic, generally less than 4 millimetres in diameter and comprises 20 per cent of the rock. Sphene is conspicuous as an abundant accessory with subidiomorphic grains up to 3 millimetres long.

These rocks are radiometrically dated by potassium-argon as 131.2±3.2 Ma (using hornblende; Bultman, 1979).

Mildly Foliated Hornblende Diorite/Tonalite (eKt_2)

This unit is probably a fine to medium-grained equivalent of Unit eKt_1. Although the contact relationships between these two tonalitic bodies are far from unequivocal, most evidence points to this unit being the younger of the two. It is generally more mafic than Unit eKt_1 with hornblende occurring as partly aligned 12-millimetre laths up to 18 per cent; medium-grained biotite, 0.5 to 4 per cent; and quartz 15 per cent. In hand sample biotite appears fresh; hornblende moderately so. Plagioclase is generally the only feldspar identified comprising 65 per cent of the rock; but potassium feldspar may rarely comprise up to 5 per cent, especially in coarser zones. Sphene and lesser pyrite are conspicuous accessory phases.

Late Cretaceous Granite (lKg)

Its pink colour and non-foliated character provide striking contrast to Unit eKt_1 which it cuts. It is medium to coarse grained, containing 1 to 5 per cent potassium-feldspar megacrysts up to 5 centimetres long. Total potassium feldspar is generally about 40 to 45 per cent; grains are perthitic, zoned, and less than 1 centimetre in diameter. Plagioclase occurs as white-weathered or fresh translucent hypidiomorphic grains less than 6 millimetres long, comprising 10 to 15 per cent of the sample. Xenomorphic quartz occurs interstitially (40 per cent). Biotite is fine to less commonly medium grained, occurring as euhedral booklets (2 to 3 per cent); macroscopic sphene is generally absent. Outcrops are rounded to blocky weathering and resistant.

Teepee Peak Stock (KT_{TP})

This body is a medium-grained granodiorite to tonalite. Near its northern contact it displays a mineralogy of biotite, 10 per cent; hornblende, 15 per cent; quartz, 30 per cent;

altered plagioclase, 40 per cent; potassium feldspar, 5 per cent. On its eastern contact a chilled margin 20 centimetres wide, hosts veins of pyrophyllite and 2 per cent coarse molybdenite rosettes. At this locality the modal composition is quartz, 60 per cent; feldspar, 35 per cent (propylitically altered plagioclase?), muscovite, 5 per cent; and altered biotite(?).

Racine Pluton (lK$_R$)

This is a homogeneous pluton of slightly potassium feldspar porphyritic, medium to coarse-grained granite with 20 to 40 per cent potassium feldspar (commonly mantled by plagioclase), 20 to 40 per cent quartz, 30 to 40 per cent plagioclase, 3 to 6 per cent hornblende, and 3 to 8 per cent chloritized biotite. It is lithologically very similar to the Jack Peak body (104M/15) dated as 89.5±2.6 Ma (Bultman, 1979; Table 1-32-1).

Mount Clive Stock (lK$_{MC}$)

The Mount Clive stock, 3.5 kilometres long, crops out over an ovoid area only 1.5 kilometres southwest of the Racine pluton. It is a medium-grained granodiorite with a composition of quartz, 30 to 40 per cent, rarely coarse grained; plagioclase, 30 to 50 per cent; potassium feldspar, 15 to 25 per cent, white, up to 1.5 centimetres long; biotite, 10 to 15 per cent; and minor magnetite. A chilled apophysis of this body thins to 5 metres thick but persists for over 1.5 kilometres through the thin wedge of Laberge strata separating it from the Racine pluton. The apophysis may be the surface expression of a link between the two bodies but unfortunately its point of entry into the Racine pluton is obscured by glacial drift, so that a definite age relationship could not be ascertained in the field.

Altered Diorite (K$_d$)

On the eastern shores of Brownlee Lake is an elongate, altered dioritic body with an intrusive western margin and a probable faulted eastern margin. The mineralogy is difficult to determine due to alteration, but is approximately 70 to 90 per cent white argillically altered feldspars (plagioclase?); up to 10 per cent chloritized mafic minerals; and, in more severly altered zones, 3 to 10 percent pyrite, and 10 per cent epidote. Outcrops display localized foliation and are white, green and pink (potassium metasomatism?) weathering and have blocky jointing.

Hornblendite (JKh)

Black hornblendites, veined by epidote and feldspar, are strung out along the central axis of Domain II. These bodies intrude into and assimilate the metamorphic rocks, hornfelsing them, in some cases over 1 kilometre from the main body. Hornfelsing may result in a "dioritized" host rock where feldspar and chlorite clots produce a medium to fine-grained igneous texture often crosscut by a plexus of irregular, green (chlorite and actinolite?) veinlets and clots. Assimilation is selective, with more refractory units, such as carbonate bands, preserved at the margins and several hundred metres inside the intrusive body. Alternatively, the contact may be highly silicified (multiple quartz and much lesser carbonate stringer/breccia events) hackley, and bright red weathering, in a zone tens of metres thick, best displayed along the northern margin of the largest body (Figure 1-32-3). Internally it is an inhomogenous, very coarse to fine-grained hornblendite to hornblende diorite, in which multiple intrusive/canibalistic events preceded its final emplacement.

The age of these bodies is poorly constrained. They clearly crosscut the metamorphic rocks and also appear to thermally affect the Teepee Peak volcanic rocks, however, hornblendite fragments have been observed in boulders of Unit Mvb. A new potassium-argon age determination on green hornblendite bodies within Unit PPM near the Yukon border (Figure 1-32-2, Table 1-32-1) indicates an age of 150±6 Ma. Considering the proximity of this sample locality to the large intrusive mass of Domain I, thermally induced argon loss is a distinct possibility and this age should be regarded as a minimum. In the Tagish area similar hornblendites crosscut and occur as clasts within the Teepee Peak volcanics suggesting that they are of about the same age. If the age of the hornblendites in the Tagish area is similar to those of the Tutshi Lake area then the Teepee Peak volcanics must be of Late Jurassic age. Such an age would be consistent with their correlation with the Middle to Upper Jurassic volcanics of the Tutshi Lake mapsheet with which they share many characteristics (*see* correlation between Units Mv and muVv on Figure 1-32-4).

Dykes

Tabular-feldspar porphyry dykes: brown to green-brown-weathering tabular-feldspar porphyry dykes are particularly abundant within Lower Jurassic Laberge Group strata. They most commonly trend northeast as bodies 0.5 to 20 metres thick, in places comprising 10 to 20 per cent of the section. Feldspars (10 to 30 per cent) are generally tabular, 0.5 to 2 centimetres long, and may be trachytically aligned within a fine-grained to aphanitic brown-green matrix. Hornblende is a rare accessory phase. Contacts are invariably chilled. The age of these dykes is constrained by the age of their hosts and that of the Racine pluton which crosscuts them.

Pyroxenites: crosscutting the metamorphic suite are northwest-trending pyroxenite dykes up to 25 metres thick (one body is intermittently exposed over a width of more than 120 metres). These dykes pinch and swell along their length and have an internal fabric parallel to the foliation of the enclosing metamorphic rocks. They are highly compact, ringing when struck, charcoal grey, and reddish weathering. Pyroxenes are medium grained and pristine, comprising in excess of 85 per cent of the rock, with magnetite (10 per cent, variable) and phlogopite (or biotite?; 0 to 7 per cent) forming the remainder. Their age is unknown but they crosscut the thermal aureole of the hornblendite. This crosscutting relationship suggests that they are younger than 150±6 Ma, if an extrapolation of the hornblendite age date from northern 104M/15 to north-central 104M/10E is correct.

STRUCTURE

FOLD STYLES WITHIN METAMORPHIC ROCKS

Folds at an outcrop-scale give the impression of an incoherent mess; however, on a regional scale, elongate synforms and antiforms are resolved as shown by the interpreted fold hinge traces on Figure 1-32-3. These structures represent the third deformational phase (F_3, *see* below) which is roughly coaxial with structures within the Laberge Group which are crosscut and modified by Cretaceous intrusions. Such folds tend to be open to tight, upright, and subhorizontal to gently plunging. This phase of folding is at least in part non-coaxial with earlier phases as evidenced by an interference fold pattern near Brownlee Lake illustrated by Figure 1-32-6.

Phase 1 folds (F_1) are invariably isoclinal and display axial planar schistosity. Phase 2 folds (F_2) are open to isoclinal, developed on both mesoscopic and megascopic scales. Orientations of F_2 hingelines and mineral lineations (mostly actinolite) are shown in Figure 1-32-7. This figure presents a preliminary structural analysis of a small dataset from the north, central and southern parts of Domain II (Domain II divisions are shown in Figure 1-32-8). F_2 hingelines and mineral lineations form vague girdles with approximate, subhorizontal axes of 020° and 045° produced in Domain II_{N+C} during a Phase 3 deformational event. Dispersion of lineation orientations and rotation of girdles occurs in Domain II_S as F_3 folds are wrapped around the intrusive salient to produce a Phase 4 fold. A summary of the deformational history of the metamorphic rocks is briefly outlined in Table 1-32-2.

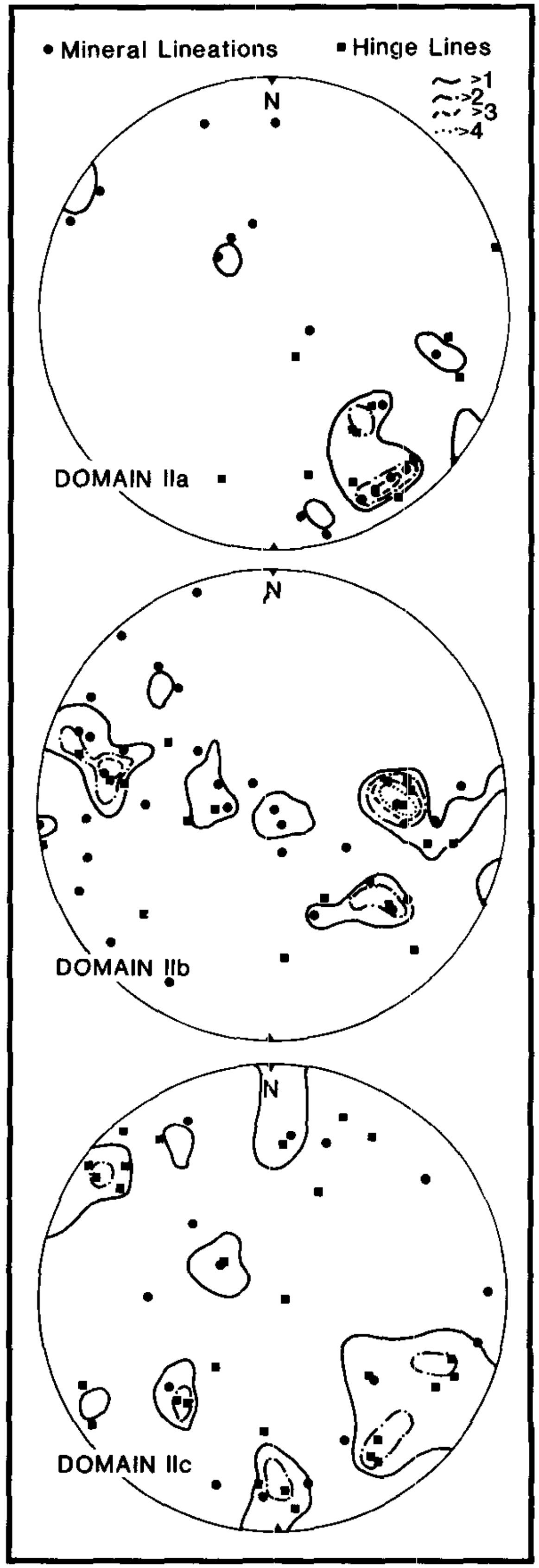

Figure 1-32-7. Three contoured stereoplots showing the change in structural style from north to south in Domain II, mainly resulting from F_4 warping of F_3 folds.

DEFORMATIONAL HISTORY OF THE LABERGE GROUP

Deformation of the Laberge Group sediments began in the early depositional stages as evidenced by intraformational angular unconformities and associated conglomerates (Plates 1-32-2a and 2b) in strata of probable Pliensbachian age. Slump folds are common on the scale of hand-sample to hillside. Later axial-surface cleavages bear no relation to these early-formed slump folds (Plate 1-32-5).

The most apparent deformational event affecting the Laberge sediments occurred following the deposition of overlying volcanics (in 104M/15) and predates late Cretaceous intrusions. Folds produced during this deformation have axial planar (or near planar) surfaces that consistently trend northwest and most commonly dip steeply both to the east and west. Axial cleavages are well developed in argillites, but are rare in massive wackes. Major folds are upright, gentle to close, and gently plunging.

Smaller east-northeast-trending structures also deform the stratigraphy, apparently postdating the northwest-trending structures. This age relationship is based on folded axial planar cleavages in central Domain III and an apparently folded axial trace in the northeast corner of the map area. However, an interference structure in south-central Domain III suggests the opposite relationship.

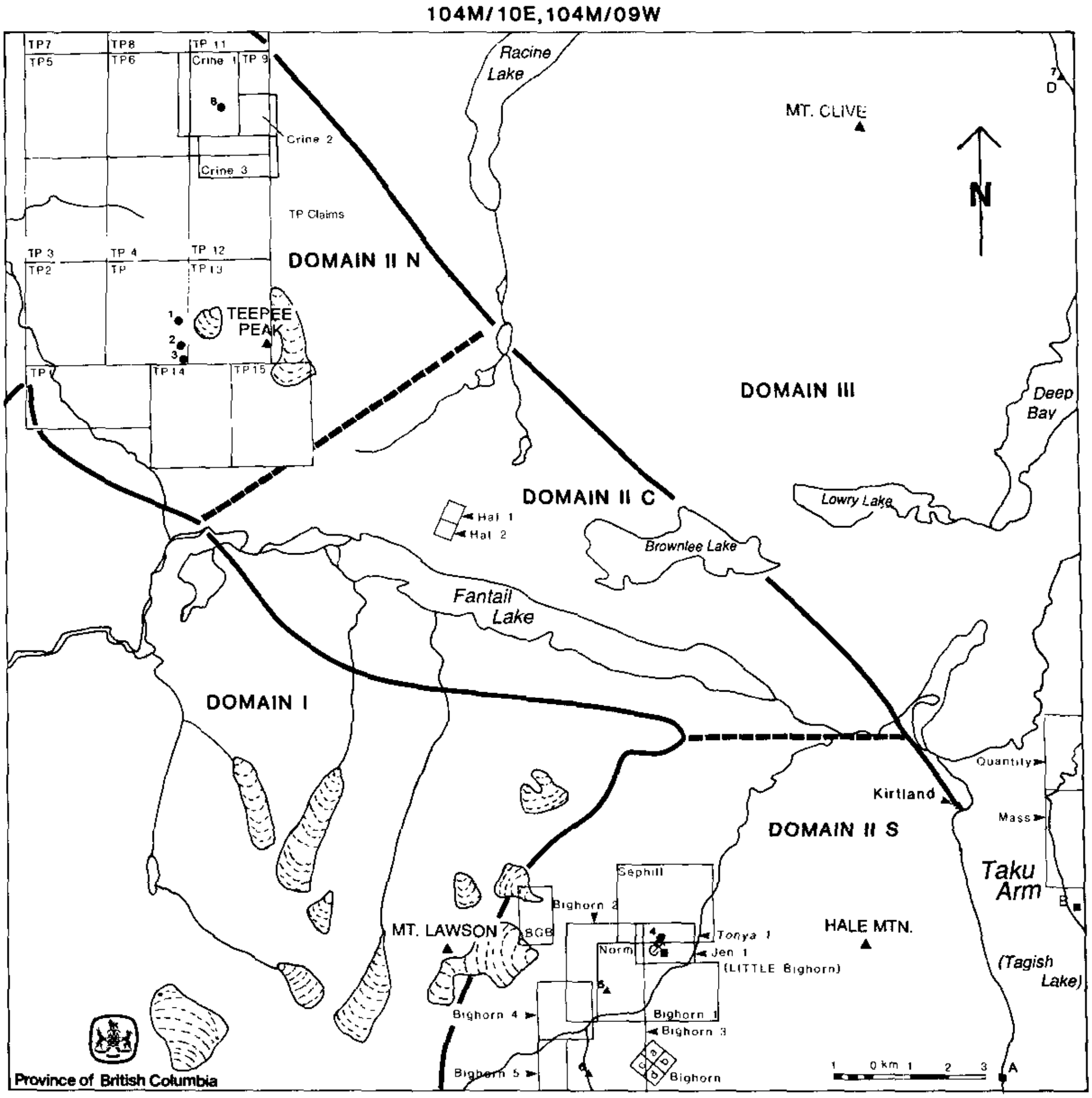

Figure 1-32-8. Claim map and domains of the Tagish map area including MINFILE occurrences and locations of assay samples listed in Tables 1-32-2 and 1-32-4 respectively.

MINERALIZATION

Three distinct styles of mineralization are present within the Tagish area including the Teepee gold-cobalt skarn; Bighorn, Red Rupert and Crine gold-bearing quartz veins; and the Lakefront antimony-silver veins. The Teepee property received a large share of exploration activity in 1988 with Cypress Gold (Canada) Limited conducting a major program from mid-July to September.

GOLD-COBALT-BEARING SKARNS

The successful application of the gold-enriched skarn model at places such as Hedley has brought the Teepee prospect into prominence. The Teepee Peak gold-bearing skarn occurs within bands of carbonate (several metres combined thickness) or at their contact with chlorite-actinolite schists (both are lithologies of the Boundary Ranges metamorphic suite). Visible gold occurs in one trench at the principal Teepee Peak showing where an amphibole-rich skarn is developed near the hinge of a fold involving the carbonate. The host rocks are extensively crosscut by a variety of predominantly intermediate to felsic dykes and are overlain unconformably by Teepee Peak volcanics. Youngest dykes crosscut both the metamorphic and volcanic rocks, while older ones terminate at the unconformity, but no phase of late (post unconformity) dyking appears to be extensively affected by thermal metamorphism. Nearby, two large intrusive bodies, a hornblendite, and the Teepee Peak stock, crosscut the unconformity. This combination of geologic elements is repeated at several localities north and northeast

TABLE 1-32-3
MINERAL OCCURRENCES-104M/10E & 9W

Map No.	Name (MINFILE No.)	Commodity	Assay (reference)	Sample width	Description
1	TP Main (104M/048)	Au Ag Co	22.7 g/t <10 g/t 3.91% (AR 11300)	grab grab grab	Skarn zones within the pre-Permian metamorphics display erythrite-cobaltite-arsenopyrite; mineralization develops near a quartz feldspar porphyry stock.
2	TP Central (104M/050)	Au Ag Co Cu	10.8 g/t 147.4 g/t 0.02 % NA (AR 11300)	grab grab grab	Pyrrhotite-chalcopyrite-arsenopyrite mineralization is hosted in a magnetite and calc-silicate skarn zone.
3	TP Camp (104M/049)	Fe	NA (AR 11300)		Pyrrhotite and massive magnetite occur in a northwesterly trending skarn within the pre-Permian metamorphics.
4	Spokane (104M/006)	Au Ag Zn Cu Pb	23.3 g/t 6.2 g/t NA NA NA (AR 1933-79)	grab grab	Pre-Permian metasediments host an east-trending 1.1-metre sulphide-bearing quartz vein.
5	Lawsan (104M/007)	Au Ag Pb Cu	NA NA NA NA (AR 5910, AR 10069)		A narrow quartz vein contains small amounts of sphalerite, galena and native gold.
6	Red Rupert (104M/024)	Au Ag	34.3 g/t 13.7 g/t (AR 1933-80)	0.6 m 0.6 m	A 30 to 60-centimetre quartz vein is hosted within the pre-Permian metamorphics.
7	Lakefront (104M/005)	Sb Pb	6.48% 6 g/t	grab grab	A 1.0 metre conformable vein composed mostly of quartz and stibnite is hosted within the Jurassic Labarge Group.
8	Crine Vein (new)	Au	NA		Discovered during the 1988 regional mapping program. Assay of 2 grab samples in progress. A 0.5-2.0-metre-wide northwest-trending, brecciated and sheared silicified quartz veined zone hosts stibnite, pyrite and arsenopyrite up to 15% combined. A faulted western margin is in some places well defined. Total strike length may be 1 km or more.

of the main showing. However, it is not known if the main control on ore formation is intrusive activity, the proximity of the profound unconformity, host rock related, structural, or some combination of these possibilities. Hence, the potential for discovery of more gold-enriched skarns in areas north of the main showing is difficult to assess. Controls on mineralization will be addressed by a petrology-based B.Sc. thesis at the University of Calgary by K. Mountjoy.

GOLD-QUARTZ VEINS

Gold-bearing quartz veins have historically been the mainstay of mine development in the region. The old Engineer mine, 2 kilometres outside the southeast corner of the map area, produced approximately 560 kilograms of gold during its 40-year production history (1913 to 1952). Ore at the Engineer was within a series of narrow quartz and carbonate veins cutting Lower Jurassic Laberge Group strata.

Sulphide-poor veins on the Spokane, Lawsan and Red Rupert (?) claims crosscut Units PPM_i and PPM_b. Spokane (Tonya) and Lawsan (Bighorn) claims have had significant development work. The mineralogy of these veins is galena, chalcopyrite and sphalerite with native gold. The Lawsan showing is a shear zone containing brecciated quartz-vein material. Veins on the Tonya claims are continuous and have been drifted along on three levels with a vertical separation of 460 metres. Assay values obtained from both showings are listed in Table 1-32-3; new assay data are listed in Table 1-32-4.

The Crine vein (Locality 8 on Figure 1-13-8), was discovered during the 1988 regional mapping program. Hosted within Unit PPM_g, the vein is a concordant, 0.5 to 2.0-metre-wide quartz-veined zone that intermittently displays a sheared and brecciated fabric, particularly along its western margin. Sulphide mineralogy includes pyrite and arsenopyrite (up to 15 per cent). The vein was traced for 200 metres, but its full length is unknown. Assay data are not available, however, anomalous gold values in stream sediments and soils were found by Dupont of Canada Exploration Limited (Copeland and Neelands, 1983) downslope from this vein, and can probably be attributed to it. The Crine claims were staked on the basis of geochemical results over the vein (Figure 1-32-8), but the vein itself was not discovered. Several arsenic-gold-silver soil anomalies (Dupont survey) that are uphill from the Crine vein, suggest the possibility of more veins of this type.

A similar vein is exposed in an overgrown trench on the west shore of Tagish Lake near the southern border of the map area (Locality A′ on Figure 1-32-8). The vein is a drusy-quartz-flooded shear and breccia zone within Unit PPM. A sample of vein material assayed 35 grams per tonne gold (Table 1-32-4).

ANTIMONIAL VEINS (LAKEFRONT PROSPECT)

Layered veins containing stibnite, minor galena, and crustiform quartz were observed to have an *in situ* thickness of 15 centimetres, although reported vein thicknesses are up to 1.2 metres. On the wall of a partly caved adit the vein strikes 350° with a 63° dip to the east within strongly foliated argillites and argillaceous siltstones of the Lower Jurassic Laberge Group. At the showing, (Locality D′ on Figure 1-32-8) approximately 40 tonnes of high grade material are reported by Schroeter (1986) to be scattered just above the shore of Tagish Lake.

TABLE 1-32-2
DEFORMATION AND METAMORPHISM OF BOUNDARY RANGES METAMORPHIC SUITE

Deformation I

S_0 original bedding/layering is visible but thicknesses are distorted – both thickened and thinned. Competent layers are boudinaged.

S_1 generally seen coplanar with S_0 and defined by growth of chlorite, muscovite, actinolite, biotite and rare garnet. Only rarely are F_1 folds observed, but in these S_1 distinctly crosscuts the hinge. They are typically close to isoclinal and pervasively affect the original strata.

Deformation II

Two fold styles are apparent depending upon lithologic competency:

F_{2A} hinge-line orientations are variable. Sheath folds indicate differential strain along hinge-lines, typically within chlorite schists.

F_{2B} occurs in more competent units. Fold-styles are open to closed and commonly chevron in nature (Plate 1-32-1).

S_2 is only locally developed as a crenulation cleavage. Crenulations may fold actinolite, biotite, chlorite and muscovite.

Deformation III

F_3 is observed on kilometre-scale as refolding of closed F_2 folds within the chlorite schist/marble succession (see Figure 1-32-6).

S_3 is parallel to limbs of refolded F_2 folds and may be seen decapitating F_2 folds on an outcrop scale.

Deformation IV

F_4 is developed as F_3 is warped around the intrusive salient seen in Figures 1-32-3 and 7.

GEOCHEMICAL DATA

A regional stream sediment geochemical survey in the Tutshi Lake area in 1987 (Rouse *et al.*, 1988) indicated that anomalously high arsenic and gold values correlated well with a belt of rocks underlain by Unit PPM, and bounded to the east by the Llewellyn fault (Figure 1-32-9). The highest stream-sediment gold anomalies plot adjacent to this major structure. Although the results of the 1988 stream sediment survey of the Tagish Lake area are not yet available, it is expected that high gold and arsenic geochemical values will again correlate with the Unit PPM and the Llewellyn fault.

Plate 1-32-5. Slump folds within Laberge argillites have an irregular form displaying no logical relationship to cleavage. The strongest cleavage, probably related to regional structures, trends parallel to the plane of the plate.

TABLE 1-32-4
NEW ASSAY DATA FOR THE TAGISH AREA

Location on Figure 1-32-8	Sample Number	Au* ppm	Au† ppm	Ag ppm	Cu ppm	Pb ppm	Zn ppb	Hg ppm	As ppm	Sb ppm
A SW Tagish Lk.	88MM-05-06	41	35	20	215	30	9	183	118	10
B E of Kirtland	88MM-06-03	5	5	19	19	0.15%	380	30	0.7%	270
C Bighorn mine	88MM-28-3-2	11	9	13	131	0.18%	0.1%	70	<50	6
C Bighorn mine	88MM-28-3-6	8	9	11	21	250	26	23	<50	3
D Lakefront	88MM-07-05	0.07	N/A	1	9	6	6	37	160	6.48%

Au analyses performed at both private sector (*) and Ministry (†) labs.

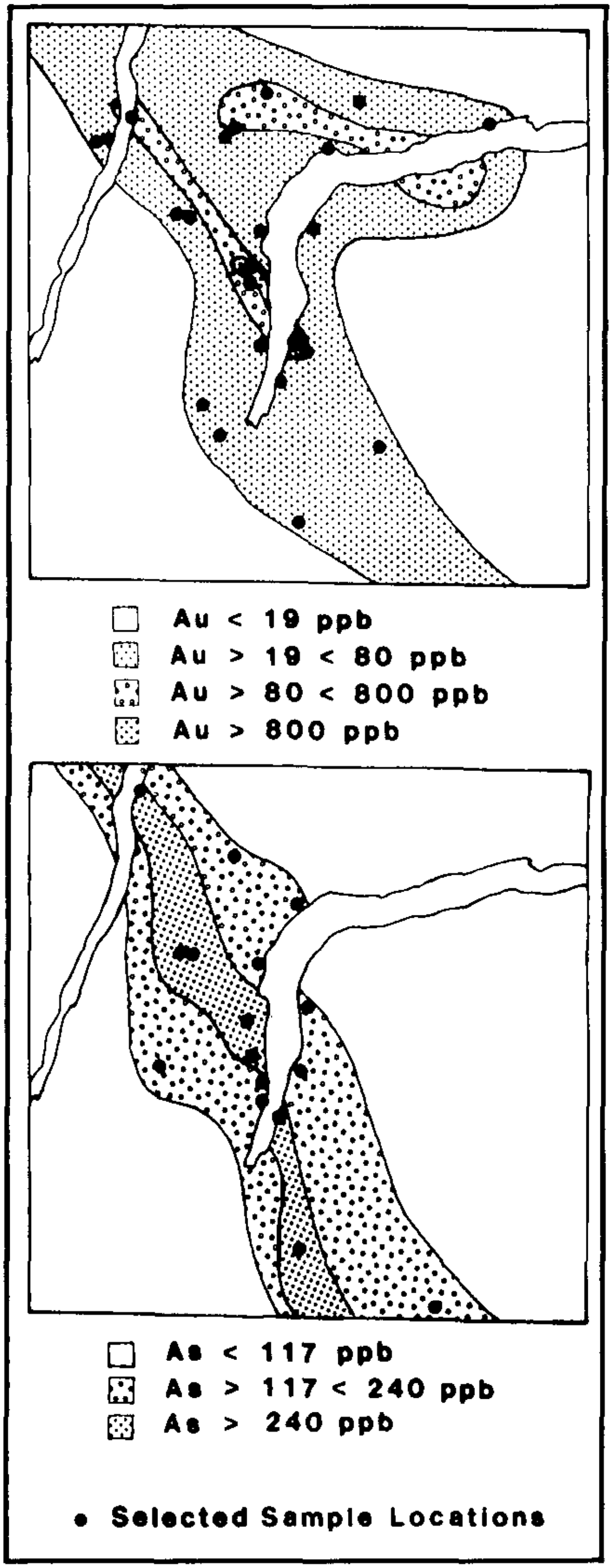

Figure 1-32-9. Contoured anomalous gold and arsenic values from the 1987 regional stream sediment sampling program.

ASSESSMENT OF MINERAL POTENTIAL

Four geologic environments appear most prospective for precious metals; these are:

(1) Veins hosted in Laberge Group strata that are associated with splays off the Llewellyn fault zone as at the old Engineer mine. A possible splay is inferred east-southeast of Kirtland where brecciated argillite and drusy quartz occur within a linear steep-walled valley with slickensided walls. A grab sample from Locality B' on Figure 1-32-8 returned assays of 5.35 and 4.74 grams per tonne gold (Table 1-32-4).

(2) Both concordant and discordant veins and breccia zones within the Unit PPM. Large numbers of barren quartz veins and "sweats" require that careful prospecting and/or geochemistry be used to focus in on precious metal-bearing veins.

(3) Sheared and altered/silicified rocks within and immediately adjacent to the Llewellyn fault zone are shown to yield anomalous, albeit sporadic gold assays (Mihalynuk and Rouse, 1988b; Rouse *et al.*, 1988).

(4) Skarns within the Unit PPM, particularly those that are related to ultramafic and/or granodioritic bodies and/or extensive dyking have precious metal potential.

SUMMARY

Mapping was conducted with an emphasis on subdividing the poorly understood Laberge and Stuhini Groups, Boundary Ranges metamorphic and Coast Crystalline rocks which generally conform to three northwest trending belts. The recognition of distinctive units within the Laberge Group has enabled correlations to be made with strata 20 to 30 kilometres away to the northwest. Mapping separate lithologies within the metamorphic suite has permitted a more comprehensive understanding of fold styles and the recognition of four phases of deformation.

The Llewellyn fault diagonally bisects the area from southeast to northwest, separating probable Upper Proterozoic Boundary Ranges metamorphics in the west from Mesozoic strata of the Whitehorse trough to the east. One exception is the Teepee Peak volcanic outlier, possibly of Late Jurassic age, which sits unconformably above the metamorphic rocks. A previously unmapped hornblendite body crosscuts this unconformity near the Teepee Peak gold-cobalt skarn locality and may be genetically related to it. Skarn zones at other places within Unit PPM may also have precious metal potential. The potential of two other exploration targets within the map area is indicated by the assay results presented in Table 1-32-4. These include: (1) sulphide-bearing quartz veins, both concordant and discordant, within Unit PPM; and (2) inferred splays off the Llewellyn fault. Both the belt of Unit PPM, and the Llewellyn fault zone, have previously been shown to be anomalous with respect to gold and arsenic in the 1987 regional geochemical survey in the Tutshi Lake map area.

ACKNOWLEDGMENTS

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