GEOLOGY OF THE TATLAYOKO LAKE - BEECE CREEK AREA (92N/8, 9, 10; 92O/5, 6, 12)

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KEYWORDS: Eastern Coast Belt, Bridge River Complex, Cadwallader Terrane, Stikine Terrane, Mount Moore formation, Methow Terrane, Mount Skinner Igneous Complex, Huckleberry formation, Tyaughton - Methow basin, Relay Mountain Group, Jackass Mountain Group, Taylor Creek Group, Powell Creek formation, Yalakom fault, Fish Lake porphyry Cu-Au deposit, Skinner gold-quartz vein.

INTRODUCTION

The Tatlayoko bedrock mapping program was designed to update the geological database for the eastern Coast Belt in parts of the Mount Waddington and Taseko Lakes map areas, and to integrate the structural and stratigraphic relationships established within this area with rapidly evolving concepts regarding the tectonic and stratigraphic framework of the region. This will provide an improved geological framework for understanding the settings and controls of known mineral occurrences in the area (*e.g.,* Fish Lake, Skinner) and for evaluating the potential for additional discoveries. The project ties in with earlier mapping by the Geological Survey Branch to the southeast, and with concurrent mapping directed by P. van der Heyden and P. Mustard of the Geological Survey of Canada to the northwest (*see* Mustard and van der Heyden, 1997, this volume), thus completing a continuous belt of recent mapping that extends for 350 kilometres along the northeast margin of the southern Coast Belt (Figure 1).

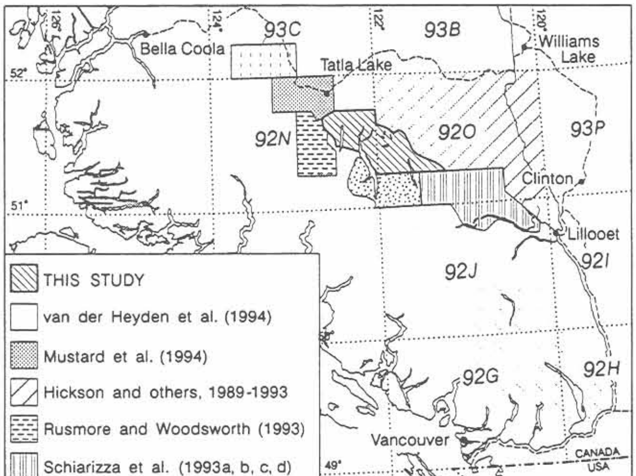

Figure 1. Location of the Tatlayoko project area, and index to recent geological mapping by the British Columbia Geological Survey Branch and Geological Survey of Canada in adjacent parts of the southeastern Coast Belt and Intermontane Belt.

The Tatlayoko project was initiated in 1992 with geological mapping of the Mount Tatlow map area (Riddell *et al.,* 1993a, b). No fieldwork was done in 1993, but the project was continued in 1994 with geological mapping of the Tatlayoko Lake map area (Schiarizza *et al.,* 1995a, b). Fieldwork was completed in July of 1995, when two and a half weeks were spent mapping in the Niut Range in the northwestern corner of the project area, and two days were spent revisiting the geology near Fish Lake (Schiarizza, 1996). This report presents an overview of the geology of the study area, and summarizes the major findings of the project. More detailed discussion of several aspects of the geology will be presented in papers that will be submitted to external scientific journals. In addition, updated 1:50 000-scale geology maps will be published (B.C. Geoscience map series) after radiometric dates and fossil identifications have been finalized.

The Tatlayoko project area covers the transition from the rugged Coast Mountains in the southwest, to gently rolling topography of the Fraser Plateau to the northeast. Mount Nemaia, in the central part of the area, is 250 kilometres north-northwest of Vancouver and 155 kilometres southwest of Williams Lake. The eastern part of the area is accessed by an all-season road that extends southwestward from Highway 20 at Hanceville to the Nemaia valley. A seasonal road branches off it at the Taseko River and continues southward to the Taseko Lakes. Tatlayoko Lake, in the western part of the area, is accessed by an all-season road that extends south from Highway 20 at Tatla Lake. A branch from this road extends eastward to the north end of Chilko Lake, and a seasonal road crosses the Chilko River and continues southward to Tsuniah Lake and the Nemaia valley.

REGIONAL GEOLOGIC SETTING

The geologic setting of the Tatlayoko project area is summarized in Figure 2. It encompasses the boundary between the Coast and Intermontane morphogeologic belts. Within the Tatlayoko project area this boundary corresponds to the Yalakom fault, a major linear feature that extends for about 300 kilometres and was the locus of more than 100 kilometres of Late Cretaceous(?) to early Tertiary dextral displacement (Riddell *et al.,* 1993a).

The eastern Coast Belt in the region of the Tatlayoko project area can be subdivided into the South Chilcotin, Methow and Niut domains, each with contrasting

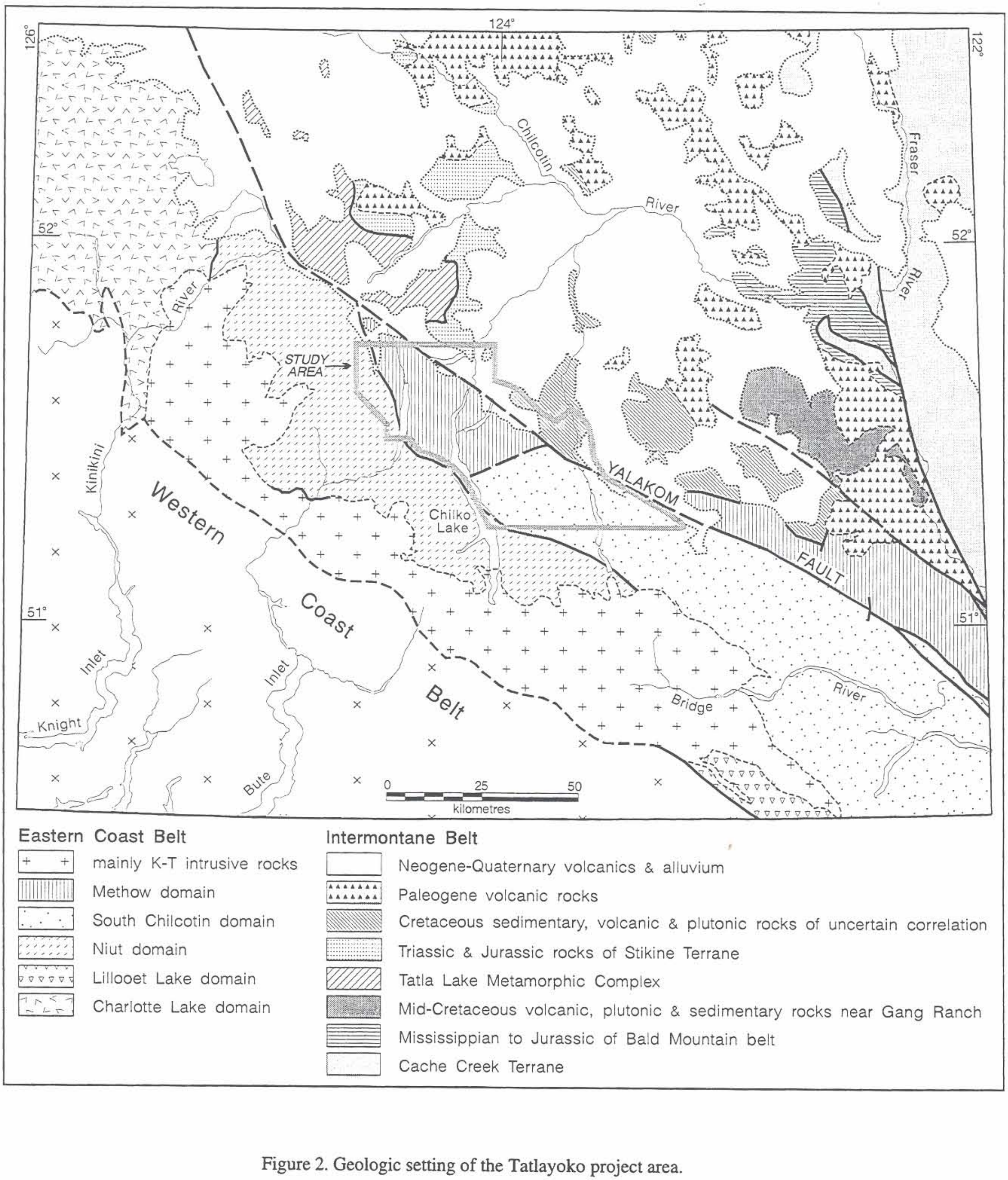

Figure 2. Geologic setting of the Tatlayoko project area.

stratigraphy and structural style (Figure 2). The South Chilcotin domain includes Mississippian to Jurassic oceanic rocks of the Bridge River accretion-subduction complex, Upper Triassic to Middle Jurassic arc-derived volcanic and clastic sedimentary rocks of Cadwallader Terrane, Permian ophiolitic rocks of the Shulaps and Bralorne - East Liza complexes, Upper Jurassic to mid-Cretaceous clastic sedimentary rocks of the Tyaughton - Methow basin, and Upper Cretaceous subaerial volcanic rocks of the Powell Creek formation. These partially coeval lithotectonic assemblages are juxtaposed across a complex network of structures that is dominated by middle to Late Cretaceous southwest-directed contractional faults, and Late Cretaceous to early Tertiary dextral strike-slip faults.

The Methow domain occurs to the north and northeast of the South Chilcotin domain, and is distinguished by a less complex structural style dominated by widely spaced faults and broad folds. The two domains are separated in part by the Yalakom fault, and in part by an earlier structure that is offset by the Yalakom fault. This earlier structure is referred to as the Camelsfoot fault in the south (Schiarizza *et al.*, 1993b; Schiarizza and Garver, 1995) and the Konni Lake fault in the north (Riddell *et al.*, 1993a). Methow domain is underlain mainly by Lower to Middle Jurassic sedimentary and volcanic rocks of the Methow Terrane, and overlying Upper Jurassic to mid-Cretaceous clastic sedimentary rocks of the Tyaughton - Methow basin. Older rocks are exposed locally and include Middle to Late Triassic quartz dioritic intrusions and overlying Upper Triassic sedimentary rocks that outcrop near Tatlayoko Lake. The Jurassic rocks of Methow Terrane are lithologically distinct from age-equivalent rocks found within the Cadwallader and Bridge River terranes of the South Chilcotin domain. The upper part of the Tyaughton-Methow basin, within the Methow domain (the Jackass Mountain Group), is also distinct from coeval rocks comprising the upper part of the basin in the South Chilcotin domain (the Taylor Creek Group). The lower part of the Tyaughton - Methow basin, represented by the Jura-Cretaceous Relay Mountain Group, is, however, common to both domains (Figure 3).

The Niut domain is underlain largely by Upper Triassic volcanic and sedimentary rocks of the Mount Moore and Mosley formations, associated Late Triassic plutons, and Lower Cretaceous volcanic and sedimentary rocks assigned to the Ottarasko and Cloud Drifter formations (Rusmore and Woodsworth, 1991a; Mustard and van der Heyden, 1994). Both the Triassic rocks, which have been correlated with those of the Stikine Terrane, and the Lower Cretaceous rocks are distinct from age-equivalent rocks to the east, but the Niut domain also includes Middle to Upper Cretaceous rocks that correlate with the upper Tyaughton basin and Powell Creek formation of the South Chilcotin domain. The stratigraphic elements of the Niut domain are deformed by early Late Cretaceous faults of the northeast-vergent eastern Waddington thrust belt (Rusmore and Woodsworth, 1991b; van der Heyden *et al.*, 1994a). The northeast boundary of the domain is a system of faults, including the Tchaikazan and West Niut faults, that juxtaposes it against the South Chilcotin and Methow domains to the northeast (Figure 2).

The Intermontane Belt is characterized by subdued topography and sparse bedrock exposure. Pre-Neogene strata north of Chilko Lake comprise volcanic and volcaniclastic rocks that have been correlated with the Lower to Middle Jurassic Hazelton Group of the Stikine Terrane (Tipper, 1969a, b). To the west, these rocks are juxtaposed against penetratively deformed metasedimentary, metavolcanic and metaplutonic rocks of the Tatla Lake Metamorphic Complex across an east to northeast-dipping normal fault. This fault formed late in the structural history of the complex, which was ductilely sheared and exhumed in Eocene time (Friedman and Armstrong, 1988), possibly in a structural regime linked to dextral movement along the Yalakom fault (Schiarizza *et al.*, 1995a).

To the southeast is a belt of mainly Cretaceous sedimentary, volcanic and plutonic rocks that extends from the Taseko River to the Fraser River. Exposures near the Taseko River include Hauterivian sedimentary and volcanic rocks that may correlate with those of Niut domain, as well as younger Aptian-Albian conglomerates that resemble the Jackass Mountain Group of the Methow domain (Fish Lake area of Figure 3). Farther to the southeast, near the Fraser River, this belt comprises Lower Cretaceous volcanic rocks of the Spences Bridge Group and an overlying succession of middle to Upper Cretaceous sedimentary and volcanic rocks (Green, 1990; Hickson, 1992; Gang Ranch area of Figure 2). Underlying rocks are not exposed, but correlative rocks to the east of the Fraser fault overlap Quesnel and Cache Creek terranes (Monger and McMillan, 1989).

LITHOLOGIC UNITS

The main tectonostratigraphic assemblages exposed in the Tatlayoko project area are summarized on Figure 3. They include late Paleozoic to Middle Jurassic volcanic, sedimentary and plutonic rocks that are assigned to Bridge River, Cadwallader, Methow and Stikine terranes, as well as Jura-Cretaceous clastic sedimentary rocks of the Tyaughton - Methow basin and Upper Cretaceous volcanic and volcaniclastic rocks of the Powell Creek formation. These assemblages are intruded by a wide variety of late Mesozoic and Tertiary dikes and plutons, and are locally overlain by Miocene-Pliocene plateau basalts of the Chilcotin Group.

BRIDGE RIVER COMPLEX

The Bridge River Complex is best exposed in the Bridge River drainage basin, 60 kilometres southeast of the

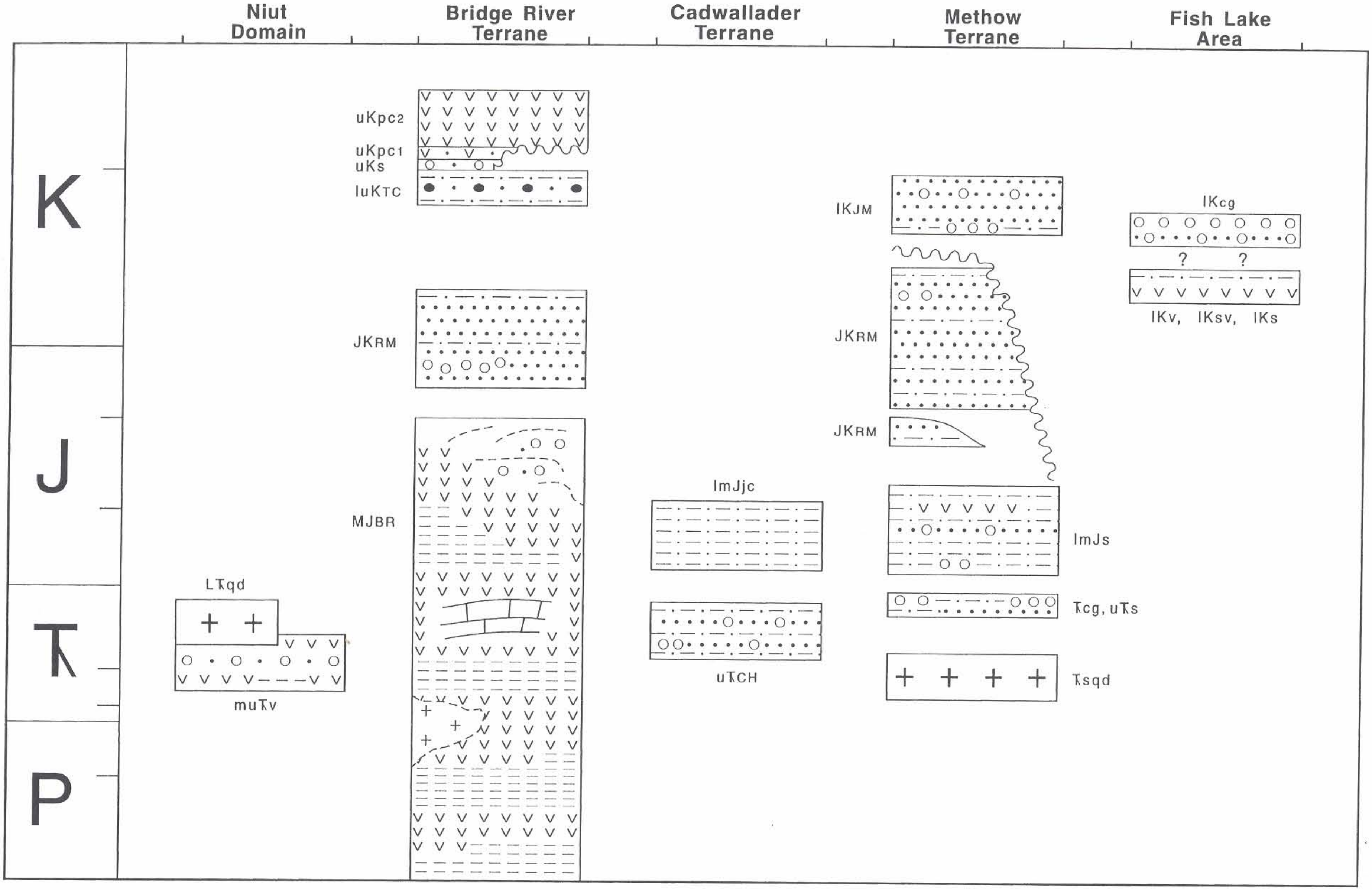

Figure 3. Main tectonostratigraphic assemblages exposed in the Tatlayoko project area. Not shown are Lower to Middle Jurassic(?) volcanic rocks of Stikine Terrane that occur northeast of the Yalakom fault in the northern part of the study area.

Tatlayoko project area. There it comprises an imbricated assemblage of chert, argillite, greenstone, gabbro, blueschist, limestone and clastic sedimentary rocks (Potter, 1986; Schiarizza *et al.*, 1989, 1990) that are thought to have accumulated as an accretion-subduction complex. Cherts range from Mississippian to late Middle Jurassic in age (Cordey and Schiarizza, 1993), and blueschist-facies metamorphism occurred in the Triassic (Archibald *et al.*, 1991). In its type area, the Bridge River Complex is structurally interleaved with Cadwallader Terrane, and is inferred to be stratigraphically overlain by Jura-Cretaceous clastic sedimentary rocks of the Tyaughton-Methow basin (Schiarizza and Garver, 1995).

The Bridge River Complex is represented in the Tatlayoko project area by a narrow east to southeast-trending belt that was traced through the forested slopes northeast of Mount Tatlow (Figure 4). It consists mainly of grey and black bedded cherts structurally interleaved with amygdaloidal greenstones, chert-rich sandstones, serpentinite and sheared muddy breccias containing boulders of greenstone, chert and marble. Foliations and mesoscopic shear surfaces in all of these rocks strike parallel to the trend of the belt and dip steeply. One sample of chert has yielded radiolarians of Permian age (GSC Loc. C-207823; F. Cordey, report FC93-4).

The Bridge River Complex apparently comprises a fault-bounded lens that separates Cadwallader Terrane to the north from the Relay Mountain and Taylor Creek groups to the south. Prior to the present study, the northernmost known occurrences of Bridge River Complex were in the Noaxe Creek map area 70 kilometres to the southeast. The intervening area is underlain by Jura-Cretaceous clastic sedimentary rocks of the Tyaughton-Methow basin. Recognition of Bridge River Complex at the northwest end of this belt lends credence to the interpretation that it forms the basement to that portion of the Tyaughton-Methow basin exposed in the south Chilcotin domain (Figure 3; Schiarizza and Garver, 1995).

CADWALLADER TERRANE

The Cadwallader Terrane, as defined in representative sections 40 kilometres southeast of the Tatlayoko project area, consists of Upper Triassic volcanic and sedimentary rocks of the Cadwallader and Tyaughton groups, and Lower to Middle Jurassic clastic sedimentary rocks of the informally named Last Creek formation and Junction Creek unit (Rusmore, 1987; Umhoefer, 1990; Schiarizza and Garver, 1995). Trace element geochemistry of volcanic rocks and the composition of the clastic sedimentary rocks suggest that the rocks of Cadwallader Terrane accumulated on or near a volcanic arc (Rusmore *et al.*, 1988).

Rocks assigned to the Cadwallader Terrane in the Tatlayoko project area outcrop within and south of the Nemaia valley, where they comprise an easterly trending belt that has been traced for 35 kilometres between Chilko Lake and the Yalakom fault (Figure 4). This belt includes siltstone, sandstone, conglomerate and limestone assigned to the Upper Triassic Hurley Formation (Cadwallader Group), together with overlying siltstone and cherty argillite correlated with the Lower to Middle Jurassic Junction Creek unit.

HURLEY FORMATION (UNIT uTCH)

The Hurley Formation in the Tatlayoko project area consists mainly of thinly bedded black and tan siltstone and shale with thin to medium interbeds of brown-weathering calcareous argillite, siltstone, sandstone and argillaceous limestone. These predominantly thin-bedded intervals are punctuated by thick, commonly graded beds of calcareous sandstone, and locally by limestone-bearing pebble to cobble conglomerates. The conglomerates have a limy sand or mud matrix and also contain clasts of granitoid and volcanic rock, chert and calcarenite. Small carbonaceous fragments derived from plant material were found in brown calcarenites that outcrop along Tsoloss and Elkin creeks. The Hurley Formation also includes massive, white-weathering limestone, which forms a lens several tens of metres thick within clastic rocks on the low slopes southeast of Konni Lake.

The belt of rocks assigned to the Hurley Formation was in large part mapped as Lower Cretaceous Taylor Creek Group by Tipper (1978), although he included the exposures of massive white limestone southeast of Konni Lake in the Upper Triassic Tyaughton Group. These rocks were assigned to the Hurley Formation by Riddell *et al.* (1993a, b) on the basis of their lithologic similarity to the formation in its type area near the Bridge River. This correlation has been confirmed by Late Triassic (early or middle Norian) conodont collections from three separate localities in the belt, including the limestone body southeast of Konni Lake (GSC Locs. C-207802, C-207805 and C-207811; M.J. Orchard, report OF-1993-41).

JUNCTION CREEK UNIT (lmJjc)

The Hurley Formation is stratigraphically overlain to the south by a belt of Jurassic rocks that is correlated with the informally named Junction Creek unit, which likewise overlies the Hurley Formation on the slopes northeast of the Yalakom and Bridge rivers, more than 100 kilometres to the southeast (Schiarizza *et al.*, 1993b; Schiarizza and Garver, 1995). These rocks consist mainly of dark grey to black, thin-bedded siliceous siltstone, cherty argillite and shale, with scattered thin interbeds of brown-weathering micritic limestone and crosslaminated silty limestone. Thin to medium beds of fine to medium-grained sandstone occur locally, and conglomerate containing argillite and less common volcanic clasts in a calcareous matrix was seen at one place southwest of Konni Lake. Belemnite guards were observed in several localities, and fragments of the Early Jurassic (Sinemurian to Toarcian) pelecypod *Weyla* were

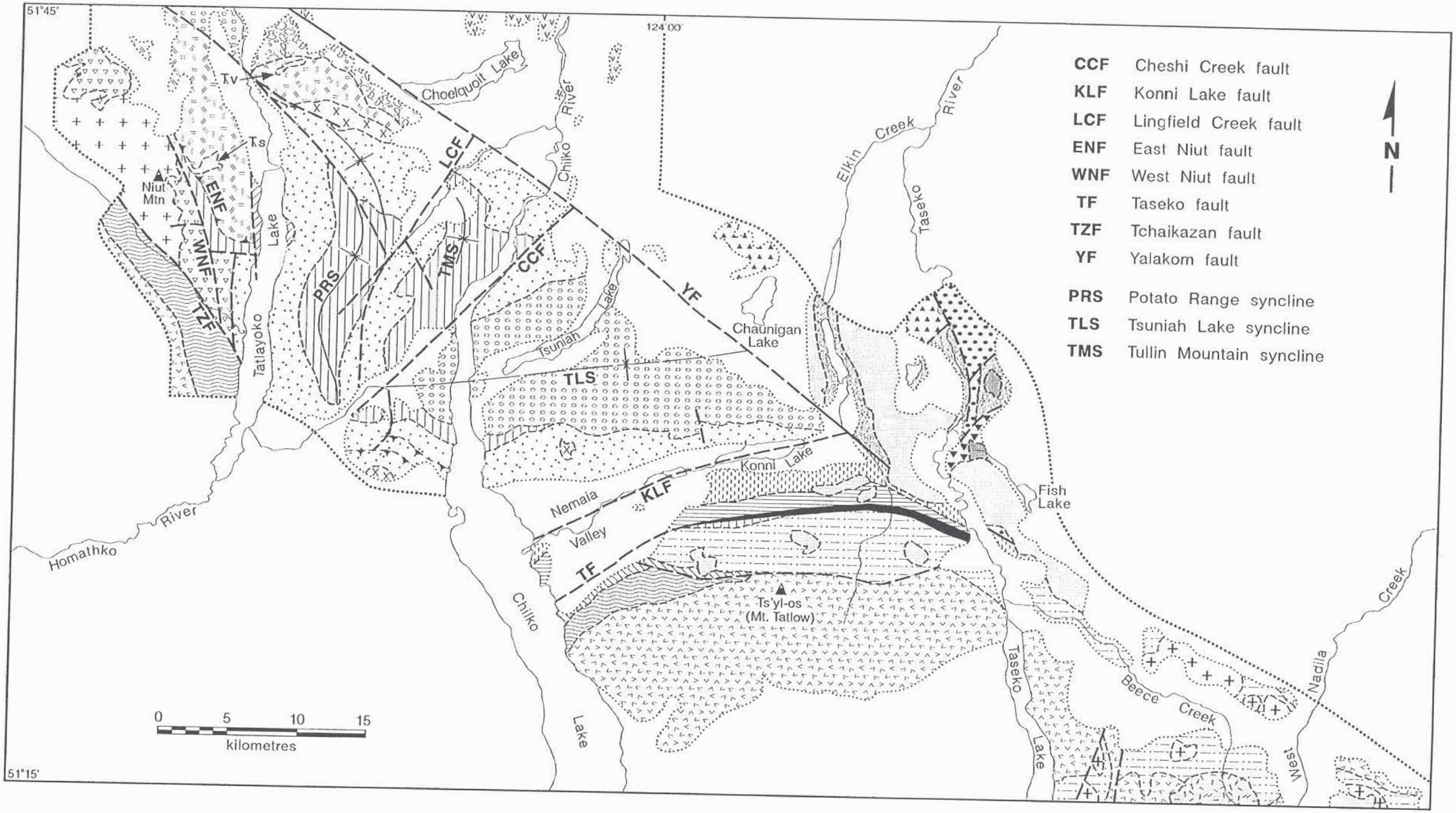

Figure 4. Generalized geology of the Tatlayoko project area.

MIOCENE AND PLIOCENE
CHILCOTIN GROUP

MPC *Olivine basalt flows*

Tyaughton - Methow Basin

UPPER CRETACEOUS
POWELL CREEK FORMATION (uKpc2 and uKpc1)

uKpc2 *Andesitic volcanic breccia, lapilli tuff, ash tuff, laharic breccia, mafic to intermediate volcanic flows; volcanic conglomerate & sandstone*

uKpc1 *Well stratified volcanic breccia and conglomerate; minor amounts of volcanic sandstone and siltstone*

uKs *Robertson Creek unit: lithic sandstone, shale, arkosic sandstone, chert-pebble conglomerate*

LOWER AND/OR UPPER CRETACEOUS
Albian and/or Cenomanian
TAYLOR CREEK GROUP

luKTC *Shale, siltstone, sandstone, chert-pebble conglomerate*

LOWER CRETACEOUS
Albian
JACKASS MOUNTAIN GROUP

lKJM *Conglomerate, arkosic sandstone, gritty sandstone*

MIDDLE JURASSIC TO LOWER CRETACEOUS
RELAY MOUNTAIN GROUP

JKRM *Lithic & arkosic sandstone, siltstone, mudstone, conglomerate, Buchia coquina*

CRETACEOUS ROCKS NORTHEAST OF YALAKOM FAULT

Aptian - Albian

lKcg *Vick Lake unit: conglomerate; minor amounts of sandstone and shale*

Hauterivian and(?) younger

lKv *Chaunigan Lake unit: andesitic to dacitic breccias, tuffs and flows*

lKsv *Fish Creek succession: sandstone, shale, conglomerate, tuffaceous sandstone, andesite, dacite*

lKs *Elkin Creek unit: sandstone, siltstone, shale, conglomerate*

Niut Domain

LATE TRIASSIC

LŦqd *Quartz diorite, diorite*

MIDDLE AND UPPER TRIASSIC

muŦv *Andesite, pillowed basalt, volcanic breccia, tuff, agglomerate; conglomerate, sandstone, shale*

Methow Terrane

LOWER TO MIDDLE JURASSIC

lmJs *Huckleberry Formation: siltstone, shale, sandstone, gritty sandstone, pebble conglomerate; minor amounts of silty limestone; locally includes andesitic tuff, volcanic breccia & rare intermediate flows or sills*

UPPER TRIASSIC

uŦs *Lithic sandstone, calcarenite, pebbly calcarenite, fossil hash, siltstone, micritic limestone, arkosic sandstone, pebble conglomerate*

TRIASSIC (?)

Ŧcg *Pebble to cobble conglomerate; sandstone, siltstone, argillite; micritic limestone*

MIDDLE TO LATE TRIASSIC

Ŧsqd *Mount Skinner Igneous Complex: quartz diorite, diorite & tonalite intruded by dikes of basalt, diabase, hornblende feldspar porphyry, quartz feldspar porphyry & aplite; also includes masses of fine-grained greenstone that may be dike swarms &/or screens of older volcanic rock; Ŧv-tuff & welded tuff; Ŧs-hornfelsed sandstone & siltstone*

Cadwallader Terrane

LOWER TO MIDDLE JURASSIC

lmJjc *Argillite, cherty argillite, siltstone; minor sandstone*

UPPER TRIASSIC
CADWALLADER GROUP

uŦCH *Hurley Formation: siltstone, shale, sandstone, calcareous sandstone, conglomerate, limestone*

Bridge River Terrane

MISSISSIPPIAN TO JURASSIC
BRIDGE RIVER COMPLEX

MJBR *Chert, greenstone, argillite, sandstone, conglomerate, serpentinite*

Jurassic Rocks Northeast of Yalakom Fault

LOWER TO MIDDLE JURASSIC

Jv *Andesite, volcanic breccia, tuff; local sandstone, conglomerate, diorite, gabbro*

Cretaceous and Tertiary Intrusive Rocks

EOCENE

Egd *Granodiorite, quartz monzonite*

LATE CRETACEOUS

LKp *Hornblende-feldspar-quartz porphyry*

LKd *Diorite, quartz diorite, hornblende feldspar porphyry*

CRETACEOUS AND/OR TERTIARY (?)

KTqd *Quartz diorite, granodiorite*

LEGEND to accompany Figure 4.

collected from the unit south of the west end of Konni Lake (GSC Loc. C-207833; H.W. Tipper, report J9-1992-HWT). An earlier fossil collection reported by Tipper (1969a) included the Sinemurian ammonite *Arniotites* cf. *kwakiutlanus* Crickmay.

The rocks here assigned to the Junction Creek unit were mapped by Tipper (1978) as the Lower to Middle Jurassic portion of the Tyaughton Group, which is equivalent to the Last Creek formation in the revised nomenclature of Umhoefer (1990). In its type area, the Last Creek formation is dominated by siltstone and shale, but includes a coarser grained facies of near-shore conglomerate and sandstone in its basal (upper Hettangian to Sinemurian) part. It overlies the Tyaughton Group, which comprises uppermost Triassic nonmarine to shallow-marine clastic sedimentary rocks and limestone that are probably a facies equivalent of the upper part of the Hurley Formation. The Junction Creek unit is clearly correlative with the Last Creek formation, as both assemblages are dominated by shale and siltstone and overlie Upper Triassic rocks that are included within Cadwallader Terrane. However, the Junction Creek unit overlies the Hurley Formation (rather than the Tyaughton Group), does not apparently contain the basal coarse-grained facies of the Last Creek formation, and generally has a more siliceous or cherty aspect.

NIUT DOMAIN

The Niut domain is underlain by Middle to Upper Triassic volcanic and sedimentary rocks intruded by Late Triassic quartz diorite of the Niut Mountain pluton. The supracrustal rocks within this belt were assigned to the Lower Cretaceous by Tipper (1969a), and the associated intrusive rocks were consequently thought to be Cretaceous or early Tertiary. Recently, however, sedimentary intervals within volcanic rocks just to the northwest of the present study area were found to contain Triassic fossils (Mustard and van der Heyden, 1994; Mustard *et al.*, 1994), and crosscutting intrusive rocks within and northwest of the study area have yielded Late Triassic U-Pb zircon dates (van der Heyden *et al.*, 1994a; Schiarizza, 1996). The volcanic and sedimentary rocks correlate mainly with the informally named Middle to Upper Triassic Mount Moore formation (Rusmore and Woodsworth, 1991a; Mustard and van der Heyden, 1994; Mustard *et al.*, 1994), which has been interpreted as a part of the Stikine Terrane.

VOLCANIC AND SEDIMENTARY ROCKS (Unit muTv)

Volcanic and sedimentary rocks occur as two separate pendants within the Niut Mountain pluton (Figure 4). The

Photo 1. Pillowed basalt of unit muTv, northwest of Niut Mountain.

southeastern body consists mainly of massive green, greenish brown to rusty brown weathered andesitic flows, tuffs and breccias. The andesites commonly contain hornblende and feldspar phenocrysts, 1 to 2 millimetres in size, and locally are pyroxene phyric. Associated fragmental rocks typically comprise angular clasts of green to purple hornblende-feldspar and pyroxene-feldspar-phyric andesite within a matrix of smaller lithic grains and feldspar, hornblende and pyroxene crystals. Volcanic rock fragments are typically 1 to 3 centimetres or less in size, but range up to 10 centimetres in some coarse-grained units. Sedimentary intervals associated with the volcanic rocks are dominated by poorly stratified polymictic conglomerates, but also include intercalations of fine to coarse-grained lithic sandstone and shale. The conglomerates contain a variety of felsic to mafic volcanic rock fragments, including abundant quartz and quartz feldspar porphyries. They also include recessive weathering fine-grained sedimentary(?) clasts and uncommon medium-grained granitoid fragments. The clasts are typically angular and poorly sorted. They range up to 20 centimetres in size, and grade into a gritty sandstone matrix that includes quartz, feldspar and volcanic-lithic grains.

Schiarizza *et al.* (1995a, b) assigned the rocks of the southeastern pendant a Triassic or Cretaceous age, based on correlation with either the Mount Moore formation (Triassic) or the Ottarasko and Cloud Drifter formations (Early Cretaceous). They are now known to be Triassic, at least in part, because the Niut Mountain pluton has yielded a Late Triassic radiometric date where it intrudes the western margin of the succession (Schiarizza, 1996).

The northwestern pendant is continuous with Middle to Upper Triassic rocks mapped as Mount Moore formation to the northwest (Mustard *et al.*, 1994), and is intruded by Late Triassic quartz diorite to the west, south and northeast (Figure 4). Within the Tatlayoko project area this pendant consists mainly of fine-grained, medium to dark green, massive to pillowed mafic volcanic rocks that weather to a grey-brown or rusty brown colour (Photo 1). Feldspar and pyroxene phenocrysts are common, and the phenocryst assemblage hornblende-feldspar occurs locally. Fragmental volcanic rocks appear to be less common, although textures are obscure in many places due to extensive chlorite-epidote alteration. Where observed, they comprise feldspar and mafic crystals, together with lithic fragments to several centimetres in size, within a very fine grained, commonly well indurated groundmass. The lithic fragments are mafic to intermediate volcanic rocks which range from aphyric to porphyritic, the latter containing various combinations of feldspar, pyroxene and hornblende phenocrysts. Light grey felsite, feldspar porphyry and quartz feldspar porphyry occur locally within the mafic volcanic succession. In part they occur as dikes and small irregular intrusive bodies, but some may be extrusive. Sedimentary rocks are a relatively minor component of the northwestern pendant, but narrow intervals of thin-bedded volcaniclastic sandstone and siltstone, or of interbedded chert and siliceous siltstone, were observed locally.

The volcanic and minor sedimentary rocks of the northwestern pendant have not been dated within the present study area, but are clearly intruded by the Late Triassic Niut Mountain pluton. They are continuous with Triassic volcanic and sedimentary rocks to the northwest which have been assigned to the Mount Moore formation (Mustard and van der Heyden, 1994). Corals from thin limestone beds within this succession have been tentatively assigned to the Upper Triassic (van der Heyden *et al.*, 1994a), and chert intercalated with mafic volcanic rocks only 1 kilometre northwest of the present study area has yielded Middle Triassic (Ladinian) radiolarians (F. Cordey and P.S. Mustard, personal communication, 1994). In its type area, about 12 kilometres south of Tatlayoko Lake, a limestone lens intercalated with basaltic breccias of the Mount Moore formation has yielded conodonts of latest Carnian to earliest Norian age (Rusmore and Woodsworth, 1991a).

NIUT MOUNTAIN PLUTON (UNIT L$\overline{T}$qd)

The Niut Mountain pluton is a large body of predominantly quartz diorite that underlies most of the Niut domain within the Tatlayoko project area, and clearly intrudes the volcanic and sedimentary rocks within the domain. It consists mainly of massive, equigranular, medium to coarse-grained hornblende±biotite quartz diorite, locally grading to medium-grained hornblende diorite. The pluton locally includes small bodies of mafic-poor medium-grained granitic rock, and it, together with the volcanic and sedimentary rocks of the domain, is cut by a suite of dikes and small plugs that includes fine-grained diorite, hornblende feldspar porphyry, pyroxene feldspar porphyry and lamprophyre. Most dikes strike northeast and dip steeply, although east, north and northwest strikes are locally predominant.

A sample of quartz diorite collected from the eastern margin of the pluton, 4.25 kilometres south-southeast of Niut Mountain, has yielded a preliminary U-Pb zircon age of 219.5±7.3 Ma (R. Friedman, personal communication, 1995). This compares closely with a U-Pb zircon date of 212.2±0.6 Ma from less than 1 kilometre west of the present study area (Mustard and van der Heyden, 1996), and confirms that the plutonic rocks within Niut domain are a single Late Triassic unit.

METHOW TERRANE

Methow Terrane is represented in the Tatlayoko map area mainly by Lower to Middle Jurassic sedimentary and local volcanic rocks of the Huckleberry formation. These rocks are assigned to Methow Terrane on the basis of their correlation with the Ladner Group and, in particular, their lithologic similarity to volcanic-derived clastic rocks and associated volcanics of the Dewdney Creek Formation, which comprises the upper part of the group near its type area (O'Brien, 1986, 1987; Mahoney, 1993). Upper Triassic sandstones and calcarenites of unit uTRs apparently underlie the Huckleberry formation along Tatlayoko Lake and are also tentatively included in Methow Terrane, as are conglomerates of probable Triassic age (unit TRcg) that outcrop in the northwest corner of Methow domain. These Triassic rocks were apparently deposited nonconformably above Middle to Late Triassic plutonic rocks of the Mount Skinner Igneous Complex and correlative(?) Crazy Creek pluton, which form the basement to Methow Terrane within the Tatlayoko project area.

MOUNT SKINNER IGNEOUS COMPLEX AND CRAZY CREEK PLUTON (UNIT TRsqd)

The Mount Skinner Igneous Complex is an assemblage of intermediate plutonic rocks and associated mafic to felsic dikes that crops out in an east-west belt centred near Mount Skinner, east of the Homathko River valley. It is dominated by medium to coarse-grained diorite, quartz diorite and tonalite that seem to comprise at least two distinct phases. The more mafic phase is a coarse-grained diorite to quartz diorite containing zero to 15% quartz, and characterized by strongly chlorite-epidote-altered mafic clots, and epidote-altered feldspars which give the rock a distinctive mottled appearance. The other common phase is a medium to coarse-grained hornblende tonalite that contains 20 to 35% quartz and is generally less altered. Associated with these plutonic rocks are abundant finer grained mafic rocks that include discrete dikes and dike swarms of aphanitic basaltic rock, diabase and hornblende±feldspar porphyry, as well as irregular masses, to many tens of metres thick, of fine-grained dark greenstone that may be dike complexes or screens of older volcanic rock within the pluton. Aplite dikes cut most of the aforementioned rock types. They range from 1 to 60 centimetres wide and contain tiny rounded quartz phenocrysts in a pinkish white, very fine grained sugary groundmass. Quartz feldspar porphyry, comprising 1 to 3-millimetre phenocrysts in a grey siliceous aphanitic matrix, was noted at one place within the complex, where it occurs as a number of metre-scale patches that are apparently intrusive into a surrounding zone of greenstone.

Samples of quartz diorite and tonalite from the Mount Skinner Complex have yielded Late to Middle Triassic U-Pb zircon dates of 226.7+8.1/-0.5 and 230±6.0 Ma respectively (R.M. Friedman, written communication, 1995). Purple welded tuff that outcrops 2.8 kilometres west-northwest of Mount Skinner (unit TRv on Figure 4) appears to be a screen within these plutonic rocks, and is therefore inferred to represent part of a Middle Triassic or older volcanic succession into which plutonic rocks of the Mount Skinner Complex were intruded. The southern margin of the complex is in part a northwest-striking fault, and in part a body of biotite hornblende tonalite to granodiorite that is mapped as a separate unit, although it may actually be a part of the complex. This igneous body is in contact with the Huckleberry formation to the south, but the contact was not observed. To the northeast, the Mount Skinner Complex is in contact with conglomerates and sandstones of the Skinner Creek unit of probable Late Triassic age. This contact was not observed, but is suspected to be a nonconformity above which the sedimentary rocks were deposited on top of the igneous complex (Figure 3).

A small outcrop of quartz-pyrite-altered granitoid rock exposed along the east shore of Tatlayoko Lake, but too small to be shown on Figure 4, is inferred to correlate with the Mount Skinner Complex because it is nonconformably overlain by Upper Triassic rocks of unit us (Schiarizza *et al.*, 1995a). The preliminary results from U-Pb dating of zircons from this body support this correlation, as they suggest an age of 234 or 235 Ma (R.M. Friedman, personal communication, 1995).

The geology west of the Homathko River and northern Tatlayoko Lake is dominated by a large, fault-bounded plutonic body that is informally referred to as the Crazy Creek pluton (Schiarizza, 1996). It consists mainly of massive, medium to coarse-grained hornblende-biotite quartz diorite and tonalite, although easternmost exposures include abundant diorite and tabular to irregular bodies of fine-grained greenstone that may be dike complexes and/or screens of older volcanic or dike rock. Schiarizza *et al.* (1995a, b) correlated these eastern exposures with the Mount Skinner Complex, but suggested that most of the pluton was Cretaceous or Tertiary in age, whereas Schiarizza (1996) suggested that the entire pluton may be Triassic. The latter interpretation is presently preferred, as a preliminary U-Pb date on zircons from a sample of quartz diorite collected from the south-central part of the pluton suggests an age of 220+7/-1 Ma (R.M. Friedman, personal communication, 1995). A pendant of hornfelsed sandstone and siltstone that occurs within quartz diorite along the southwestern margin of the Crazy Creek pluton (unit TRs of Figure 4) was therefore derived from an unknown unit of Triassic or older age, rather than from the Relay Mountain Group as suggested by Schiarizza *et al.* (1995a, b).

SKINNER CREEK CONGLOMERATE (UNIT TRcg)

A distinctive assemblage of maroon conglomerates, interlayered with lesser amounts of finer grained sedimentary rock, crops out in an east to southeast-trending belt between the Homathko River and Choelquoit Lake (Figure 4). The main belt is bounded by the Yalakom fault to the northeast, plutonic rocks of the Mount Skinner Complex to the south, and an inferred north-striking fault to the west that separates it from exposures of Jackass Mountain Group in the Homathko River valley. Similar conglomerates are also exposed in a thin sliver west of the Mount Skinner Complex, near the Skinner mine; where they are in strati-

Photo 2. Conglomerate of unit TRcg, north of Skinner Creek.

graphic or fault contact with the Huckleberry formation to the southeast.

The dominant rock type in unit uTRcg is maroon, locally green, poorly stratified pebble to cobble conglomerate containing mainly intermediate to felsic volcanic clasts (Photo 2). These include common porphyritic varieties containing feldspar or feldspar and quartz phenocrysts. Fine to medium-grained granitoid clasts are commonly present, but typically comprise only a few percent of the clast population. Some are similar to quartz diorite and tonalite of the Mount Skinner Complex and may have been derived from it. Clasts of fine-grained clastic sedimentary rock and limestone occur locally. Clasts are typically angular, poorly sorted and either supported by, or gradational into a sandy to gritty matrix containing feldspar, quartz and lithic grains. The conglomerates are generally coarser in the northern part of the belt, where clasts locally range up to 40 centimetres across.

Sandstone and siltstone are intercalated with conglomerate throughout the belt, but are most common in the southeast. Green, brown or purple sandstones to pebbly sandstones occur mainly as poorly stratified lenses or layers that grade into conglomerate, whereas grey to purple siltstone and argillite commonly occur as distinct thin-bedded intervals, up to several metres thick, between conglomerate units. Locally, fine-grained sandstone to siltstone occurs as thin graded beds with argillite tops. Dark grey to purplish brown micritic limestone is seen rarely as medium to thick beds intercalated with argillite, or as lenses to a few metres thick within conglomerate. Purple tuff or tuffaceous sandstone, composed of feldspar crystals and angular volcanic fragments in a fine-grained matrix, was observed in one outcrop at the west end of the belt.

The age of the Skinner Creek conglomerate unit is not known, as samples of limestone collected in 1994 were barren of microfossils. The unit is provisionally assigned to the Triassic following Tipper (1969a), as it is lithologically more similar to Upper Triassic rocks of the region than to younger rocks. This inferred age suggests that the conglomerates may have been deposited nonconformably above the adjacent Middle to Late Triassic Mount Skinner Igneous Complex, although the contact was not observed. This interpretation is consistent with the proximal nature of many of the conglomerates and the presence of granitoid clasts within them, and is corroborated by the nonconformable contact observed between potentially correlative rocks of unit uTRs and underlying quartz diorite to the south (*see* following section).

UPPER TRIASSIC ROCKS ALONG TATLAYOKO LAKE (UNIT uTs)

An isolated exposure of Upper Triassic sedimentary rocks occurs on a low knoll along the east shore of Tatlayoko Lake, 4.5 kilometres south of the north end of the lake. Small exposures of sandstone on the opposite side of the lake are also tentatively included in this unit (Figure 4). The eastern exposure is dominated by thin to medium-bedded, locally crossbedded calcarenite and fossil hash, intercalated with brownish weathered, fine to coarse-grained green lithic sandstone. Calcarenite units are locally pebbly, with rounded intermediate to felsic volcanic clasts and rare subangular to subrounded granitoid pebbles. Thin beds of grey siltstone are intercalated with the lithic sandstone, and medium beds of dark grey, light grey weathering micritic limestone are intercalated with sandstone and siltstone over several metres in the lower part of the unit. The base of the unit consists of about 10 metres of light grey, coarse-grained quartzofeldspathic sandstone and granule conglomerate passing downwards into pebble conglomerate comprising angular granitoid clasts in an arkosic matrix. This basal interval is underlain by a quartz-pyrite-altered granitoid rock that is exposed along the shoreline in the southwestern part of the outcrop. The contact was observed over only a short interval, where it appears to be a nonconformity above which the sedimentary interval was deposited on top of the altered intrusive rock. As noted above, preliminary U-Pb dating of zircons from the intrusive unit suggest that it is of late Middle Triassic age, and probably correlative with the Mount Skinner Complex.

Tipper (1969a) reports that fossils collected from unit uTs on the east side of Tatlayoko Lake were examined by E.T. Tozer and assigned a Late Triassic, probably late Norian age. The present study has not supplied any additional age data, as a sample of micrite collected in 1994 was barren of microfossils, and a collection of small bivalves did not yield any precise age determination (GSC Loc. C-207897; T.P. Poulton, report J8-TPP-1995).

HUCKLEBERRY FORMATION (UNIT lmJs)

Lower to Middle Jurassic clastic sedimentary and local volcanic rocks of the Huckleberry formation (informal) are widespread in the vicinity of Chilko and Tatlayoko lakes (Figure 4). This succession includes most of Tipper's (1969a) unit 8, although Callovian strata that were included in unit 8 are excluded from the formation following Umhoefer and Tipper (1991).

The Huckleberry formation is typically very well stratified, and consists mainly of fine-grained clastic rocks

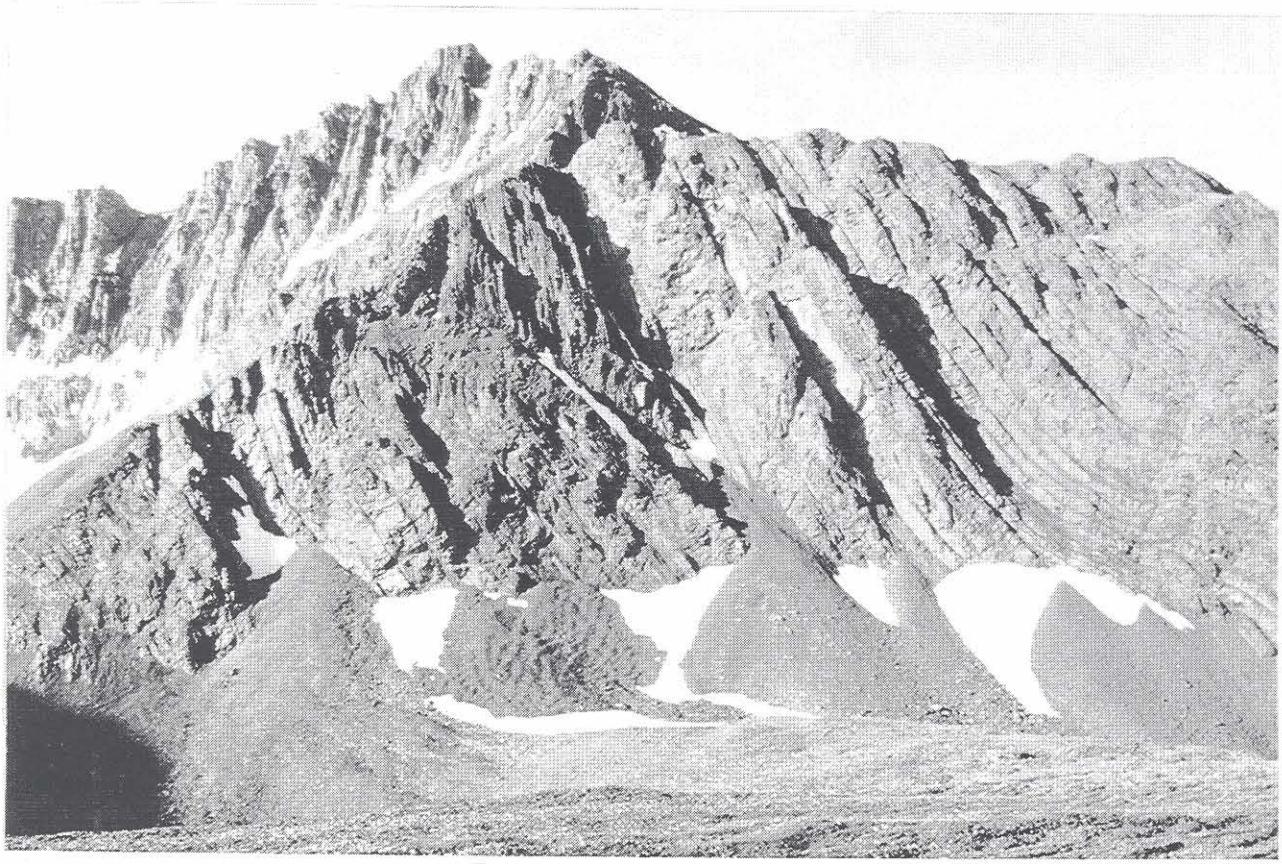

Photo 3. Looking southwest at well stratified sandstones and shales of the Huckleberry formation, west of Mount Nemaia.

intercalated with varying proportions of well indurated coarse-grained sandstone, gritty to pebbly sandstone, and granule to small-pebble conglomerate (Photo 3). Finer grained intervals are typically thin-bedded, laminated to crosslaminated siltstone and fine-grained sandstone, with scattered thin to thick beds of grey shale and fine to medium-grained lithic sandstone. Medium beds of laminated to crosslaminated calcareous siltstone or silty limestone occur locally. Coarser grained units are dominated by well indurated coarse-grained sandstone to gritty sandstone that occurs as medium to very thick, locally graded beds. The coarse sandstones consist mainly of volcanic lithic fragments and feldspar, although quartz is locally an important component. Granule to small-pebble conglomerate occurs locally as very thick, massive or weakly graded beds that are most commonly associated with intervals of coarse-grained sandstone, but also occur as isolated layers within siltstone-dominated sections. Conglomerate beds are typically dominated by intermediate to felsic volcanic clasts, and commonly include abundant shaly rip-up clasts. Limestone clasts and belemnite fragments are important constituents of some conglomerates, and rarely are the dominant clast types.

Volcanic rocks are not common in the Huckleberry formation, but were observed in several widely scattered localities. The most extensive exposures are within the isolated set of outcrops along the west side of the north end of Tsuniah Lake (Figure 4). There, several tens of metres of volcaniclastic and volcanic rock occur within an interval dominated by massive to thick-bedded sandstones and gritty sandstones typical of the unit. The base of the volcanic section is marked by about 10 metres of poorly sorted breccia or conglomerate containing angular to subrounded clasts up to 40 centimetres in size. The clasts are almost exclusively intermediate to felsic volcanic rocks, some with irregular jagged shapes indicating very little transport, and some with red cores and green rims. This coarse-grained unit is overlain by a thicker section of poorly stratified tuffs consisting of intermediate, commonly feldspar-phyric volcanic fragments up to 3 centimetres across, together with feldspar and mafic crystals. Near the top of the tuff unit is a flow or sill consisting of feldspar and mafic phenocrysts, 1 to 2 millimetres in size, within a medium green aphanitic groundmass. The lower part of the tuff unit is a distinctive muddy tuff that consists of feldspar crystals with or without volcanic rock fragments floating in a fine-grained matrix. Similar matrix-supported tuff occurs as a layer 2 to 3 metres thick within intercalated sandstone and siltstone on the opposite side of the Tsuniah Lake syncline, directly south of Mount Nemaia. Farther east within this same belt, but apparently higher in the section, is an interval, less than 10 metres thick, of blue-green andesitic lapilli tuff and breccia (Riddell *et al.* 1993a). An interval of similar tuffs and breccias was mapped about 1.5 kilometres east of the north end of Tatlayoko Lake, and again 8.5 kilometres farther to the east, west of Lingfield Creek. These occurrences may be at about the same stratigraphic level, on opposite limbs of the Potato Range syncline.

Most of the dated rocks in the Huckleberry formation are Middle Jurassic. An Aalenian fossil collection came from the vicinity of Huckleberry Mountain, and Bajocian fossils are known from several locations east of Tatlayoko Lake and the south limb of the Tsuniah Lake syncline (Tipper, 1969a; Umhoefer and Tipper, 1991). Only some of the fossils collected during the present study have so far been identified, and most of these confirm the distribution of Bajocian strata known previously. In addition, an ammonite resembling *Dactylioceras* or *Tmetoceras*, and therefore of possible Toarcian or Aalenian age, was collected 5 kilometres east-northeast of the north end of Tatlayoko Lake (GSC Loc. C-207866; T.P. Poulton, report J5-TPP-1995). This locality is stratigraphically above the only occurrence of Lower Jurassic rocks documented within the formation, which are near the north end of Tatlayoko Lake. There, early Pliensbachian fossils are reported from an interval of siltstones, sandstones and granule conglomerates (Umhoefer and Tipper, 1991).

The base of the Huckleberry formation is not exposed, but the oldest known rocks from the formation are in the same area as known and inferred Triassic rocks of units uTs and uTcg, suggesting that the Triassic rocks may be stratigraphically beneath the Jurassic section. However, as the closest outcrops of the respective units are separated by more than a kilometre of Quaternary cover, a stratigraphic relationship is not proven.

CALLOVIAN SHALE UNIT (mJs)

Fossiliferous Callovian rocks were identified on the south limb of the Tsuniah Lake syncline by Tipper (1969a), who included them in his Lower to Middle Jurassic unit 8. However, they were not included in the derivative Lower to Middle Jurassic Huckleberry formation of Umhoefer and Tipper (1991) because they were inferred to be separated from underlying Bajocian strata of the formation by a major disconformity. These Callovian rocks are here considered a separate unit (mJs on Figure 3), following Umhoefer and Tipper. However, they do not constitute a mappable unit on the scale of Figure 4, where they are included in the Huckleberry formation.

The Callovian unit is best defined on a northern spur at the west end of the Mount Nemaia ridge system, 1.5 kilometres east of Chilko Lake. There, it comprises about 100 metres of cleaved black shale containing rusty weathering calcareous concretions and local thin interbeds of fine-grained sandstone and calcareous sandstone. This shale interval is assigned an early Callovian age on the basis of a fossil collection which includes the ammonites *Xenocephalites vicarius* Imlay, *Lilloettia*(?) sp. and *Phylloceras*(?) sp. (GSC Loc. C-207889; T.P. Poulton, report J5-TPP-1995). Underlying rocks, comprising the upper part of the Huckleberry formation, consist of fine to coarse-grained sandstone that occurs as thin to medium beds intercalated with shale and siltstone. The contact is inferred to be a disconformity, as an ammonite collected from the upper part of the Huckleberry formation on an adjacent spur, 2 kilometres to the northeast, has been identified as *Stephanoceras(?)* sp. of probable early Bajocian age (GSC Loc. C-207883; T.P. Poulton, report J5-TPP-1995). The upper boundary of the Callovian shale unit is a sharp erosive disconformity at the base of the Relay Mountain Group. It is marked by 35 centimetres of sandstone packed with belemnite guards. Overlying massive fine-grained sandstone contains several shell-rich layers that contain belemnites and *Buchia* pelecypods, including *Buchia concentrica* (Sowerby) of late Oxfordian to early Kimmeridgian age (Tipper, 1969a, Section JA-F67-7). The Callovian shale unit thins eastward and is missing on the spur 2 kilometres to the northeast, where massive sandstones at the base of the Relay Mountain Group are in stratigraphic contact with the upper part of the Huckleberry formation.

The Callovian unit apparently extends westward, across Chilko Lake, to the ridges north of Huckleberry Mountain, where Tipper (1969a; GSC Loc. 79021) reports a fossil collection containing *Kepplerites*(?) sp. indet. of early Callovian(?) age. The unit is not well defined in this area, however, in part because of structural complications and in part because the fossil locality is apparently within a succession of interbedded shales and sandstones, with local limestone beds, that is not lithologically distinct from the upper part of the Huckleberry formation.

Callovian rocks are not documented elsewhere in the Methow Terrane. However, at the south end of the Potato Range, the Relay Mountain Group rests disconformably above an undated unit of crumbly shale containing calcareous concretions and micrite layers. This calcareous shale unit, which occurs above well bedded sandstones and shales typical of the Huckleberry formation, may correlate with the Callovian shale unit. Elsewhere in the area, the contact between the Relay Mountain Group and the Huckleberry formation is commonly obscured by a covered interval that may also be underlain by the recessive shale unit.

TYAUGHTON - METHOW BASIN

The Tyaughton - Methow basin is a belt of Jura-Cretaceous clastic sedimentary rocks that occurs along the northeast side of the southeastern Coast Belt and contiguous north Cascade orogen in southwestern British Columbia and northern Washington State (Jeletzky and Tipper, 1968; Kleinspehn, 1985). The northeastern or Methow part of the basin was deposited above Methow Terrane, whereas the Tyaughton basin to the southwest was deposited largely above Bridge River Terrane. The basin developed in two distinct time intervals. The older part records a relatively long period of predominantly shallow-water marine deposition in latest Middle Jurassic to Early Cretaceous time. This period is represented mainly by the Relay Mountain Group, which occurs in both the Methow and Tyaughton parts of the basin. The upper part of the basin comprises mid-Cretaceous synorogenic clastic sedimentary rocks that were deposited during a major period of contractional deformation within the southeastern Coast - north Cascade orogen. Rocks deposited in the Tyaughton part of the basin during this time period (mainly the Taylor Creek Group) are lithologically and stratigraphically distinct from age-equivalent rocks deposited in the Methow part of the basin (mainly the Jackass Mountain Group), in part because the two successions were separated by an intervening landmass that was uplifted during mid-Cretaceous contractional deformation (Garver, 1989, 1992).

RELAY MOUNTAIN GROUP (UNIT JKRM)

The Relay Mountain Group occurs in three separate areas within the Tatlayoko project area, each with different stratigraphic and structural contexts. The most extensive exposures are within Methow domain east of Tatlayoko Lake, where the group occurs above the Huckleberry formation and Callovian shale unit and beneath the Jackass Mountain Group. Lower Cretaceous sandstones assigned to the group also outcrop in a narrow belt north of Mount Tatlow, within the South Chilcotin domain. These rocks were probably deposited above the Bridge River Complex and then overlain by the Taylor Creek Group. The third outcrop belt is in the eastern Niut Range west of Tatlayoko Lake. It includes Upper Jurassic and Lower Cretaceous rocks that are preserved within a narrow fault block enclosed by rocks of Methow and Niut domains. Fault slivers of chert-pebble conglomerate, probably derived from the Taylor Creek Group, occur locally within this block, suggesting that it was derived from the south Chilcotin domain.

Methow Domain

Upper Jurassic to Lower Cretaceous marine and nonmarine clastic sedimentary rocks that outcrop between Tatlayoko Lake and the Nemaia valley were assigned to the Relay Mountain Group by Tipper (1969a). They are best exposed in the core of the Potato Range syncline, but also outcrop along northern Chilko Lake, where they are bounded by the Lingfield Creek and Cheshi Creek faults, and as a narrow belt that extends from the western Nemaia Range westward across Chilko Lake to Cheshi Creek (Figure 4). In these areas the Relay Mountain Group overlies the Callovian shale unit or, where Callovian rocks are missing, the Huckleberry formation. The upper part of the group is missing in the western part of the southern limb of the Tsuniah Lake syncline, where it has apparently been eroded beneath an unconformity at the base of the Jackass Mountain Group. Farther east, and on the north limb of the Tsuniah Lake syncline, the entire Relay Mountain Group

Photo 4. Lower Cretaceous *Buchia* coquina, Relay Mountain Group, western Potato Range.

is missing and the Jackass Mountain Group rests directly on the Huckleberry formation. Presumably the Jackass Mountain Group once overlaid the Lower Cretaceous Relay Mountain Group farther west, but nowhere in the Potato Range are strata exposed above the youngest Relay Mountain Group.

The Relay Mountain Group is on the order of 2400 metres thick in the Potato Range. The Upper Jurassic (upper Oxfordian - Tithonian) part of the group consists of about 900 metres of brown to green lithic sandstone and brown to black siltstone and mudstone. *Buchia* pelecypods and belemnites are common in parts of the interval and ammonites occur locally. Arkoses are present in the upper part of this sequence, which is interpreted to be offshore marine and generally becomes shallower marine upward. It is gradationally overlain by 150 to 200 metres of interlayered lithic and arkosic sandstones that are unfossiliferous and were deposited in near-shore to marginal marine environments. The Jurassic-Cretaceous boundary is within this interval.

The Lower Cretaceous part of the Relay Mountain Group, about 1300 metres thick, consists mainly of dark green to black volcanic-lithic sandstones up to a few hundred metres thick with local planar laminae and low-angle crosslaminae. In the lower part of the interval these sandstones are intercalated with sandy *Buchia* coquina sequences up to 140 metres thick (Photo 4). The coquinas are shell supported and consist of subequal amounts of fragmented, disarticulated, and whole articulated *Buchia*, with local beds of shell hash and fine-cobble volcanic and plutonic conglomerate. Both the volcanic-lithic sandstones and coquinas have rare belemnites, ammonites and inoceramid fossils and are interpreted to be shallow marine. Another common lithofacies in the Lower Cretaceous section is beige to green (commonly alternating) arkosic sandstone, tens of metres thick, most of which is interpreted to be fluvial deposits. The arkose locally has moderate to high-angle crossbeds and trough crossbeds, is commonly plant rich and has rare root casts. Arkoses are commonly interbedded with fissile black siltstones 1 to 5 metres thick, with plant fossils and wavy laminae. There are sparse beds of clast-supported, mostly massive pebble to cobble conglomerate, 5 to 20 metres thick, with local imbrication and rare plant fossils, that are interpreted to be fluvial channel deposits. The lower half of the Lower Cretaceous Relay Mountain Group in the Potato Range has been dated with *Buchia* and mixed inoceramid and ammonite assemblages to be Berriasian to late Hauterivian, with early to middle

Hauterivian strata missing across a disconformity (Tipper, 1969a). The upper half of the Lower Cretaceous consists of unfossiliferous shallow-marine and nonmarine strata, which are inferred to be mainly Barremian, because they lie conformably over the latest Hauterivian marine section.

The basal contact of the Relay Mountain Group was observed at the south end of the Potato Range and at the west end of the Mount Nemaia ridge system, 2 kilometres east of Chilko Lake. In each of these areas the contact is an erosional disconformity marked by a thin layer of belemnite coquina, and sandstones in the lower part of the group contain the pelecypod *Buchia concentrica* (Sowerby), indicating a late Oxfordian or early Kimmeridgian age (GSC Loc. C-207884, T.P. Poulton, report J8-TPP-1995; Tipper, 1969a, Section JA-F67-7). However, the basal part of the Relay Mountain Group in the Nemaia Range section appears to trace eastward into similar sandstones that, 2 kilometres farther east, contain the fossils *Camptonectes* sp., *Pleuromya* sp. and *Gryphaea*(?) sp., suggesting a Bathonian or Callovian age (GSC Loc. C-207899; T.P. Poulton, report J8-TPP-1995). Furthermore, an isolated exposure of sandstone at about the same stratigraphic level, 5 kilometres farther east, contains the fossils *Meleagrinella*(?) sp., *Entolium* sp., *Grammatodon*(?) sp. and *Myophorella*(?) sp., suggesting a probable middle Toarcian through early Oxfordian age (GSC Loc. C-207881, T.P. Poulton, report J8-TPP-1995).These latter two fossil localities suggest that either the basal Relay Mountain Group locally extends down into the early Oxfordian and Callovian, or the Callovian shale unit undergoes an abrupt facies change eastward on the Mount Nemaia ridge system, into sandstones that are not readily distinguished from those of the Relay Mountain Group.

South Chilcotin Domain

The Relay Mountain Group in the South Chilcotin domain is represented by a narrow interval of poorly exposed shales, siltstones and sandstones 5 to 6 kilometres north of Mount Tatlow. The sequence also includes minor amounts of pebble conglomerate containing rounded sedimentary, volcanic and plutonic clasts, as well as a layer of coquina about 3 metres thick. H.W. Tipper reports that fossils collected from this coquina include *Buchia* sp. resembling *B. pacifica* that has been squashed, suggesting an Early Cretaceous? (Valanginian) age (GSC Loc. C-207831; report J9-1992-HWT).

The exposures of Relay Mountain Group north of Mount Tatlow are bounded to the north by an interval of sheared serpentinite, about 50 metres thick, that is inferred to mark the trace of the Taseko fault. Chert, greenstone, serpentinite and clastic sedimentary rocks of the Bridge River Complex occur along this same fault zone farther to the east. Shale and chert-pebble conglomerate of the Taylor Creek Group outcrop south of the Relay Mountain Group, but the contact is obscured by Quaternary alluvium.

The lens of Relay Mountain rocks north of Mount Tatlow represents only a part of the group, and is bounded on one or both sides by faults. However, it is juxtaposed against the same units which stratigraphically underlie it (Bridge River Complex) and overlie it (Taylor Creek Group) in its type area to the southeast (Schiarizza and Garver, 1995). These relationships suggest that the Bridge River Complex probably underlies the Relay Mountain Group throughout the South Chilcotin domain. The exposures of Relay Mountain Group in Methow domain, just 20 kilometres to the northeast, were deposited above a completely different basement consisting of arc-derived clastic sedimentary and volcanic rocks of Methow Terrane. The initial juxtaposition of these two contrasting basement terranes may have been at an early to mid-Mesozoic plate boundary where the Bridge River ocean subducted beneath an adjacent plate that developed the Cadwallader and Methow arcs. This boundary has been subsequently telescoped across important late Mesozoic and early Tertiary structures such as the Taseko and Konni Lake faults.

Niut Range

West of Tatlayoko Lake, the Relay Mountain Group occurs as a narrow northwest-trending belt that is in fault contact with volcanic and plutonic rocks of Niut domain to the southwest, and with the Crazy Creek pluton to the northeast. This belt includes conglomerates, sandstones and shales that are cut by numerous faults and intruded by abundant sills and plugs of quartz diorite. Where best exposed, about 3.5 kilometres west of Tatlayoko Lake, the relatively wide southern part of the belt comprises two main fault panels. The northeastern panel is a coherent, northeast-dipping section that includes two distinct units. The lower unit is about 300 metres thick and consists mainly of arkosic lithic sandstone. Conglomerate dominates about 100 metres in the central part of the unit, and contains rounded pebbles and cobbles of felsic to mafic volcanic rocks together with a smaller proportion of granitoid rock (Photo 5). *Buchia* fossils collected from near the base of the unit, as well as from the upper part of the conglomeratic interval, have been identified as Upper Jurassic (Tithonian) forms (GSC Locs. C-207896 and C-208756; T.P. Poulton, report J8-TPP-1995), confirming an earlier fossil report by Tipper (1969a). The base of the upper unit comprises several tens of metres of dark grey shale containing *Inoceramus* and belemnite fragments. These rocks abruptly overlie sandstones of the lower unit and pass up-section into about 100 metres of thin to medium-bedded, locally crossbedded arkosic sandstone intercalated with siltstone and friable shale. The upper unit is assumed to be Hauterivian in age, based on the presence of *Inoceramus* fossils and its strong lithologic similarity to the Hauterivian and(?) Barremian rocks of the upper part of the Relay Mountain Group where it is well exposed and dated in the adjacent Potato Range (Tipper, 1969a; Schiarizza *et al.*, 1995a).

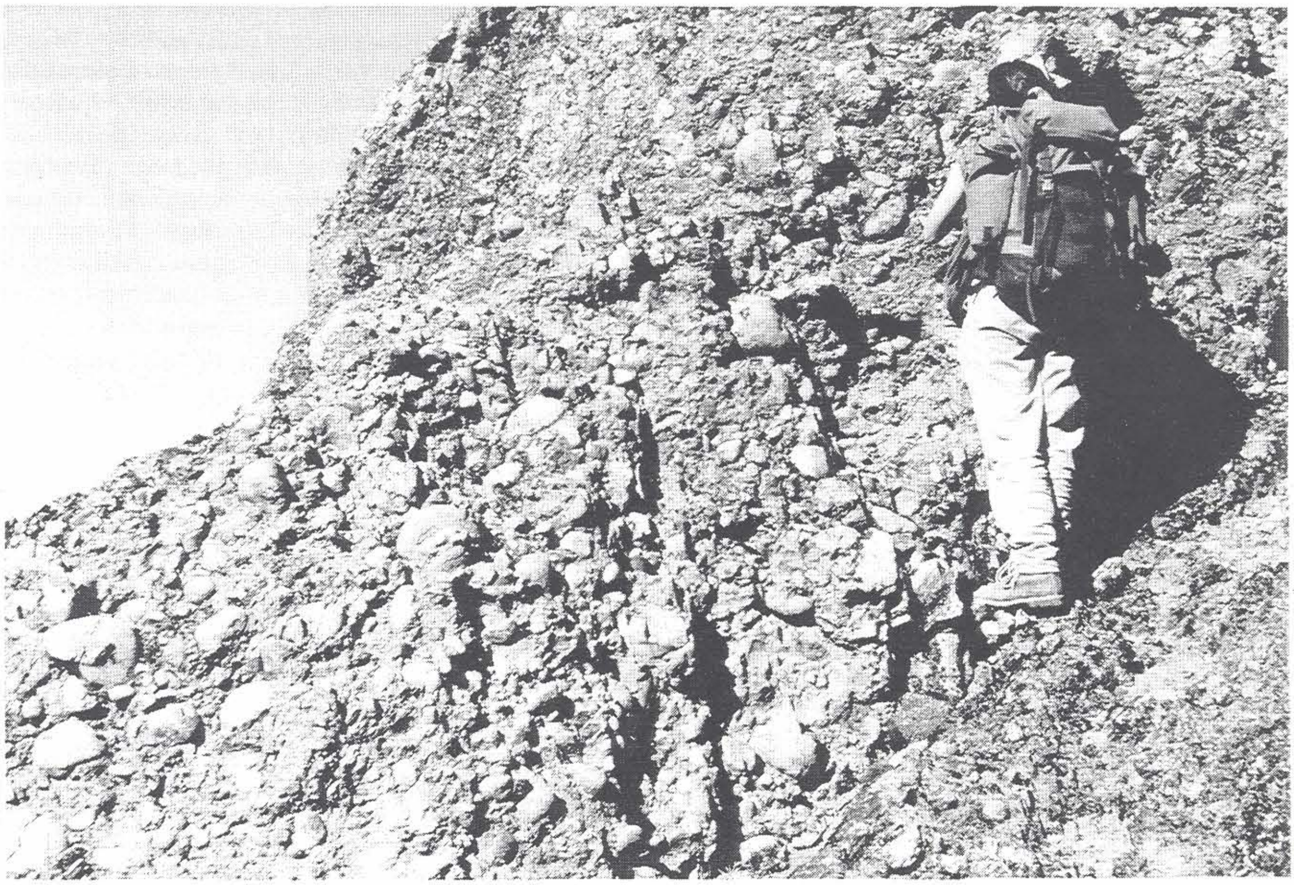

Photo 5. Upper Jurassic conglomerate, Relay Mountain Group, northeastern Niut Range.

The coherent section described above rests structurally above a southwestern fault panel that consists of faulted and folded shale containing intercalations of arkosic and lithic sandstones. These rocks are, for the most part, lithologically similar to the Hauterivian strata of the Relay Mountain Group, and this correlation is confirmed by fossil pelecypods and belemnites collected from the central part of the belt. The collection includes *Inoceramus* sp. and *Acroteuthis* sp., and was assigned a Hauterivian age by T.P. Poulton (GSC Loc. C-207893; report J8-TPP-1995). Local fault slivers of chert-pebble conglomerate occur within the upper part of the panel, however, and were probably derived from the mid-Cretaceous Taylor Creek Group, which overlies the Relay Mountain Group south of the Nemaia valley (Figure 4).

The belt of Relay Mountain Group rocks narrows to the northwest, where it becomes a series of fault-bounded slivers of sedimentary rock interleaved with quartz diorite. The sedimentary rocks include conglomerates and sandstones similar to those of the Jurassic section to the south, as well as local shale-dominated lenses that resemble the Hauterivian interval to the south. A single fossil collection from shales in the northern part of the belt was assigned a Hauterivian age based on the presence of *Inoceramus* sp. and the belemnite *Acroteuthis* sp. (GSC Loc. C-207892; T.P. Poulton, report J8-TPP-1995).

The intact section of Relay Mountain rocks exposed in the upper fault panel in the southern part of the belt differs from sections in the Potato Range, directly east of Tatlayoko Lake, in two main aspects. First of all, the thick interval of Jurassic conglomerates found in this belt does not occur to the east. Secondly, the apparent absence of Berriasian and Valanginian rocks in the Niut Range belt suggests that, here, the disconformity beneath the Hauterivian section represents much more missing stratigraphy than the disconformity beneath Hauterivian rocks in the Potato Range, where there is a thick interval of Berriasian and Valanginian strata (Tipper, 1969a). These relationships suggest that the Niut Range section originated near the margin of the Relay Mountain basin, as proposed by Jeletzky and Tipper (1968). A further difference relates to the rocks that overlie the Relay Mountain Group. In the Methow domain, east of Tatlayoko Lake, the Relay Mountain Group is stratigraphically overlain by arkosic sandstone and granitoid-bearing conglomerate of the Albian Jackass Mountain Group (Figure 3). The fault-bounded slivers of chert-pebble conglomerate imbricated with Hauterivian rocks of the Relay Mountain Group in the Niut

Range, however, suggest that the Relay Mountain Group here was overlain by the Albian Taylor Creek Group. This suggests that the Relay Mountain Group in the Niut Range relates more closely to that part of the group exposed in the South Chilcotin domain, and occurs within the Tyaughton, rather than the Methow sub-basin, as defined by Garver (1989, 1992).

JACKASS MOUNTAIN GROUP (UNIT lKJM)

Clastic sedimentary rocks of the Lower Cretaceous Jackass Mountain Group are well exposed in the core of the Tsuniah Lake syncline, in the central part of the Taseko project area (Tipper, 1969a; Kleinspehn, 1985). They also outcrop near the northwestern corner of the map area, within and adjacent to the Homathko River valley. Stratigraphic relationships are well displayed only in the former area, where the group is stratigraphically above the Huckleberry formation and, locally, an intervening sliver of Relay Mountain Group (Figure 4).

The Jackass Mountain Group comprises a thick succession of sandstones, with subordinate finer and coarser grained rocks (Photo 6). The sandstones are medium green to bluish green in colour, and typically weather light brown to brownish grey. They are predominantly medium to coarse grained, rich in feldspar, and commonly contain scattered granules and small pebbles of volcanic, sedimentary and less common granitoid rock fragments. The sandstones form massive intervals many tens of metres thick, or medium to very thick beds that are, in part, separated by interbeds of thin-bedded siltstone or fine-grained sandstone-shale couplets. Individual sandstone beds within the well bedded intervals are locally graded, with laminated tops and thin shaly caps; some beds display rip-ups, scours and load casts at their bases. Finer grained facies typically occur as relatively minor interbeds within coarse sandstone, but intervals of thin-bedded, planar to crosslaminated siltstone to fine-grained sandstone are locally more than 100 metres thick.

The basal part of the Jackass Mountain Group in the Tsuniah Lake syncline includes an interval of dark grey, grey to brownish grey weathered splintery siltstone, which was assigned to the Taylor Creek Group by Tipper (1969a). It is underlain by fine to coarse-grained sandstone containing thin layers and lenses of pebble to cobble conglomerate. The siltstone unit is best exposed on the south limb of the syncline, where it is more than 500 metres thick, and contains fossils of early and middle Albian age (Jeletzky, 1968). The underlying sandstone-conglomerate unit is only a few tens of metres thick, and comprises massive to thick-bedded sandstones that enclose two or more lenses of

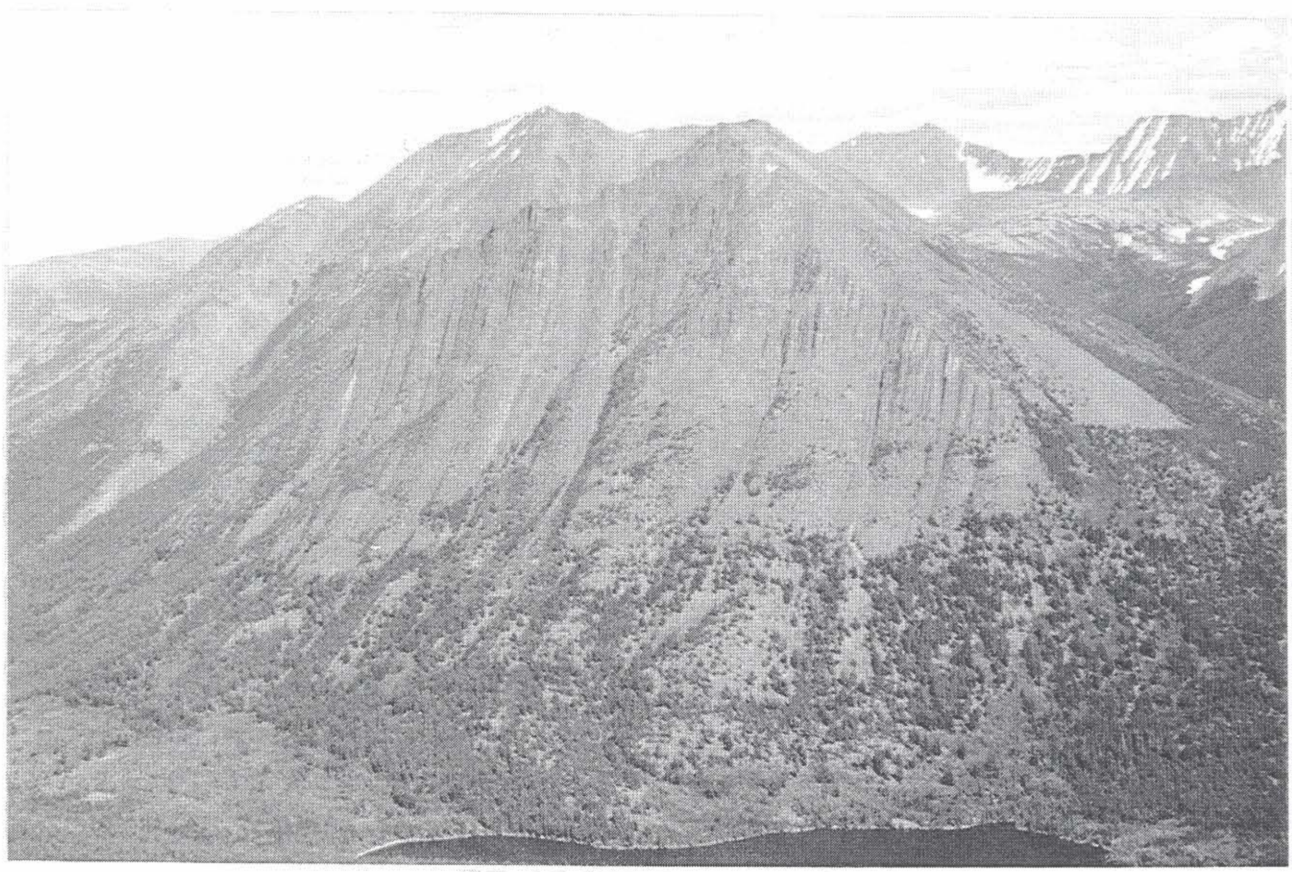

Photo 6. Looking east at Lower Cretaceous Jackasss Mountain Group, south limb of the Tsuniah Lake syncline, east of Chilko Lake

conglomerate. The conglomerate units range up to 1 metre in thickness and contain rounded clasts of mainly intermediate volcanic rocks and massive to foliated granitoid rocks. This same twofold division occurs on the north limb of the syncline, but there the siltstone unit is less than 200 metres thick and may pinch out to the east. The underlying sandstone-conglomerate unit is correspondingly much thicker than to the south; individual conglomerate units are rarely more than a metre thick, but they occur through more than 500 metres of section.

The contact between the Jackass Mountain Group and underlying rocks of the Huckleberry formation was observed at one place and is tightly constrained at three others over a 6-kilometre strike length on the north limb of the Tsuniah Lake syncline. Although mapped as a fault by Tipper (1969a), it appears to be a stratigraphic contact throughout this length. There is no angular discordance with underlying Jurassic rocks in the western part of this belt, but to the east the Jurassic rocks are locally folded and very gently dipping directly beneath the contact, whereas the overlying Cretaceous rocks maintain their moderate southward dips. On the south limb of the syncline, the basal contact of the Jackass Mountain Group was observed at one place north of Konni Lake (Riddell *et al.*, 1993a, b), and is constrained to within a few metres on the ridge system to the north-northwest of Mount Nemaia (Schiarizza *et al.*, 1995a, b). This contact is also depositional, at least in part, although it was mapped as a fault by Tipper (1969a). The Jackass Mountain Group is essentially concordant with underlying Jurassic rocks in this area. However, it rests directly above the Huckleberry formation in the east, but above an intervening, westward-thickening wedge of Upper Jurassic rocks of the lower part of the Relay Mountain Group in the vicinity of Chilko Lake (Figure 4). Furthermore, in exposures farther to the west, the Huckleberry formation is overlain by a thick section of both Jurassic and Lower Cretaceous rocks of the Relay Mountain Group. These relationships indicate that there has been an abrupt eastward bevelling of the Relay Mountain Group beneath a sub-Jackass Mountain unconformity.

The Jackass Mountain Group in the core of the Tsuniah Lake syncline is the offset counterpart of Jackass Mountain exposures on the northeast side of the Yalakom fault in the Camelsfoot Range, more than 100 kilometres to the southeast (Kleinspehn, 1985; Riddell *et al.*, 1993a). The fossiliferous shale interval and underlying conglomerates and sandstones at the base of the group in the Tsuniah Lake syncline are equivalent to Jeletzky's (1971) grey siltstone - shale division in the Camelsfoot Range, which contains the same early lower Albian *Brewericeras (Leconteites) lecontei* fauna. Overlying sandstones, which constitute most of the group in the Tsuniah Lake syncline, are equivalent to Jeletzky's massive greywacke division in the Camelsfoot Range. A major difference between the two sections, however, is that the distinctive Albian rocks are underlain by an interval of Barremian-Aptian rocks in the Camelsfoot Range that are also included in the Jackass Mountain Group (variegated clastic division of Jeletzky, 1971; unit lKJMy1 of Schiarizza *et al.*, 1993b,c). These Barremian-Aptian rocks comprise volcanic-lithic sandstones and shales that are lithologically similar to underlying Middle Jurassic rocks (unit lmJys of Schiarizza *et al.*, 1993b,c), that are equivalent to the Huckleberry formation of the Tatlayoko project area. This lower part of the Jackass Mountain group is apparently not represented in the Tsuniah Lake area, where the group appears to be entirely Albian in age, and rests unconformably or disconformably above Jurassic rocks.

TAYLOR CREEK GROUP (UNIT luKTC)

Mid-Cretaceous clastic sedimentary rocks here assigned to the Taylor Creek Group include those that were assigned to the group by Tipper (1978) as well as rocks that he included in the sedimentary unit of the Kingsvale Group. They underlie much of the southeastern corner of the map area, east of Taseko Lake, and also outcrop as an east-trending belt north of the Mount Tatlow ridge system. The group is characterized by black shale and siltstone, together with chert-rich sandstone and pebble conglomerate. Olive-green muscovite-bearing sandstones, brown limy sandstone, and green ash and crystal tuffs also occur locally within the Taylor Creek sequence.

Black to dark grey shale is the dominant lithology in the Taylor Creek Group. It typically erodes into irregular splinters, but may be cleaved into paper-thin sheets near intrusions. The shale intervals locally include lighter coloured silty and sandy interbeds, resistant carbonate-cemented interlayers, thin micrite beds and limestone concretions. Small plant fragments and cone fragments are rare.

Chert-rich pebble conglomerate to pebbly sandstone is the most distinctive lithology within the Taylor Creek Group. The conglomerates typically occur as layers or lenses, from less than 1 metre to more than 20 metres thick, enclosed within shale. Their basal contacts are locally channeled into the underlying shale. The clast population is dominated by white, grey, green, black and red chert. Other common lithologies include white and grey quartz, and felsic to intermediate volcanic rocks; clasts of calcarenite, black shale and siliceous argillite occur locally. Most of the conglomerates are clast supported, but sandy matrix-supported beds also occur. Pebbles are angular to rounded. They are commonly 1 to 2 centimetres across, and rarely larger than 4 centimetres.

The Taylor Creek Group in the Tatlayoko project area is lithologically similar to, and in part continuous with, Taylor Creek rocks in the northwestern corner of the Warner Pass map area which are assigned to the Beece Creek succession by Schiarizza *et al.* (1993d). The Beece Creek succession occurs in the upper part of the Taylor

Creek Group and is, at least in part, equivalent to the Silverquick formation (Garver, 1989, 1992) farther to the southeast. The Beece Creek succession is not dated, but is assigned a late Albian to Cenomanian age because it locally rests above the middle to upper Albian Lizard formation, and occurs beneath the Cenomanian and younger Powell Creek formation. However, as its stratigraphy is not well defined, rocks assigned to the Beece Creek succession (including the Taylor Creek Group in the Tatlayoko project area) may also include older parts of the group, correlative with the Lizard formation and the mid-Albian Dash formation (Garver, 1989).

The base of the Taylor Creek Group is not exposed in the Tatlayoko project area, although it may rest stratigraphically above the thin sliver of Relay Mountain Group on the south side of the Taseko fault (Figure 4). In its type area, 50 to 90 kilometres to the southeast, the Taylor Creek Group either rests unconformably above the Bridge River Complex, or disconformably above the Relay Mountain Group (Garver, 1989; Schiarizza *et al.*, 1993a,c,d). East of Taseko Lake, it is overlain by unit uKpc2 of the Powell Creek formation across an angular unconformity that is well exposed in several places along the southern boundary of the project area, where it was described by Glover and Schiarizza (1987). West of Mount Tatlow, however, the Taylor Creek Group grades upwards into a relatively sandstone-rich interval (unit uKs), which in turn grades upward into unit uKpc1 of the Powell Creek formation (Figure 4).

UPPER CRETACEOUS ROCKS NEAR ROBERTSON CREEK (UNIT uKs)

Unit uKs consists of clastic sedimentary rocks that form a transitional interval between the Taylor Creek Group and Powell Creek formation west of Mount Tatlow (Figure 4). The unit is dominated by intercalated dark grey to purple shale and brownish weathered, grey to green lithic sandstone (Photo 7). The sandstone is fine to coarse grained, and occurs as thin to very thick beds that are locally laminated or crosslaminated; woody debris is common in some beds. The interval also includes medium beds of light grey, commonly crossbedded arkosic sandstone, and medium to thick beds of chert-rich pebble conglomerate.

The Robertson Creek unit lies above the Taylor Creek Group across a poorly defined gradational contact marked by an increase in the amount of sandstone relative to shale, and the introduction of crossbedded arkosic sandstone that

Photo 7. Sandstone and shale of unit uKs, 13 kilometres west of Mount Tatlow.

is not common in underlying rocks. This transition is shown in Figure 13 of Kleinspehn (1985), where the lower 600 metres of section are here included in the Taylor Creek Group and the upper 200 metres are assigned to unit uKs. The contact with the overlying Powell Creek formation (unit uKpc2) is also gradational, but is more sharply defined. Where observed 13 kilometres west of Mount Tatlow, this abrupt transition occurs over a 30-metre interval of green sandstone intercalated with friable dark grey silty shale. Sandstone at the base of this unit is predominantly feldspar-lithic wacke, and encloses an interval of chert pebble conglomerate 2 metres thick. Higher in the section, sandstone beds also contain conspicuous hornblende and pyroxene crystals and are intercalated with beds of pebbly sandstone and pebble conglomerate that include clasts of pyroxene-feldspar and hornblende-feldspar-phyric volcanic rocks typical of those found in the overlying volcanic breccias of the Powell Creek formation.

POWELL CREEK FORMATION (UNITS uKpc1 and uKpc2)

The Powell Creek formation (informal) is a thick succession of Upper Cretaceous nonmarine volcanic and volcaniclastic rocks. These rocks were assigned to the Kingsvale Group by Jeletzky and Tipper (1968) and Tipper (1969a, 1978). The name Powell Creek was introduced by Glover *et al.* (1988a, b) following the work of Thorkelson (1985), who suggested that the term Kingsvale Group be abandoned as it is not a valid stratigraphic entity where originally defined by Rice (1947), and has not been used consistently by subsequent workers. The Powell Creek formation is well exposed in the southern part of the Tatlayoko project area, east of Chilko Lake (Figure 4). There it rests stratigraphically above either the Taylor Creek Group or the intervening Robertson Creek unit. The formation is also exposed west of Tatlayoko Lake, where it is separated from Triassic rocks of the Niut domain by the Tchaikazan fault.

The Powell Creek formation in the Tatlayoko map area includes two mappable divisions. The lower division (unit uKpc1) only occurs in the western part of the map area, and consists of well stratified coarse volcanic breccias and conglomerates separated by thin interbeds of siltstone and sandstone. Overlying rocks, which make up most of the formation, comprise a heterogeneous succession of andesitic flow breccias, crystal and ash tuffs, laharic breccias, flows, and volcaniclastic sandstones and conglomerates. These rocks are assigned to unit uKpc2 (Figure 4).

The lower division of the Powell Creek formation crops out in a westward-thickening wedge northwest of

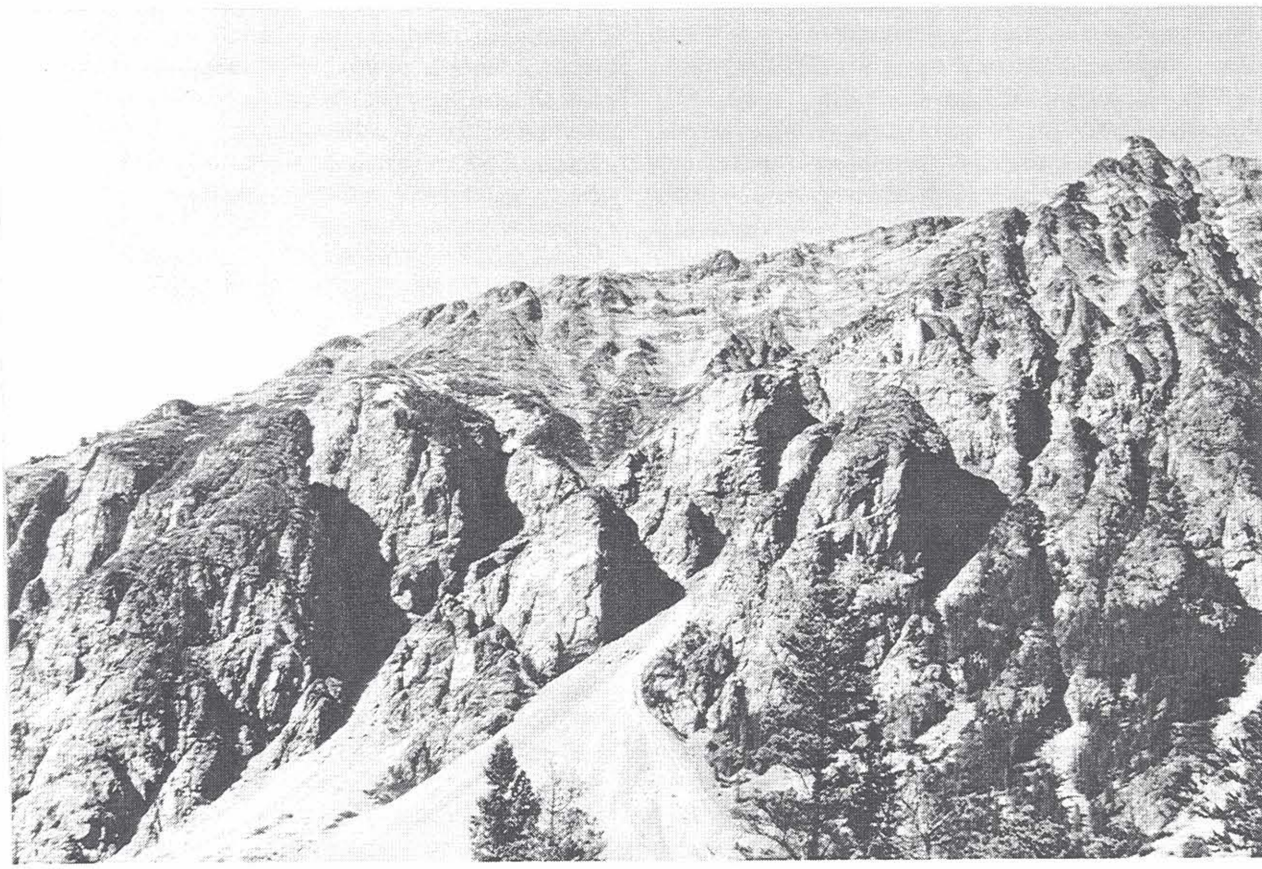

Photo 8. Massive volcanic breccia overlain by bedded crystal tuff, Powell Creek formation (unit uKpc2), west of Taseko Lake.

Mount Tatlow, and also on the northeast side of the belt that is southwest of the Tchaikazan fault. The pronounced stratification of this division readily distinguishes it from the more massive and resistant flows and flow breccias of the upper division. It consists mainly of volcanic conglomerates and breccias in beds ranging from tens of centimetres to more than 10 metres thick. Andesitic clasts are poorly sorted, angular to subrounded and generally vary in size from less than a centimetre to 30 centimetres; coarse conglomerates in the lower part of the unit, however, contain clasts more than 1 metre in size. The matrix is commonly sandy and rich in feldspar and hornblende crystals. Stratification is accented by local interlayers, from a few centimetres to more than 1 metre thick, of purplish siltstone, sandstone and pebbly sandstone. The stratigraphic base of the lower division was observed east of Chilko Lake, where it is an abrupt gradation from sandstones and shales of the underlying Robertson Creek unit, as described previously. The base of the lower division is not seen farther east, as it is bounded to the north by an east-striking fault. The east-tapering outcrop geometry of the unit in part reflects truncation along this fault, but a primary depositional pinch-out is also inferred as this unit does not occur anywhere east of Mount Tatlow, where the upper division rests directly above the Taylor Creek Group.

The upper division of the Powell Creek formation is a thick succession of andesitic flow breccias, crystal and ash tuffs, laharic breccias, flows and volcaniclastic sandstones and conglomerates. It is best exposed on the steep peaks and ridges around Mount Tatlow, and also outcrops in the hills east of Lower Taseko Lake, on ridges east and south of Anvil Mountain, and in the western part of the belt that is exposed southwest of the Tchaikazan fault. The upper division rests conformably above the lower division west of Mount Tatlow. To the east however, where the lower division is missing, it occurs directly above the Taylor Creek Group across a pronounced angular unconformity (Glover and Schiarizza, 1987; Riddell *et al.*, 1993a).

Fragmental rocks are much more abundant than flows within the upper division of the Powell Creek formation. They consist mainly of massive, unsorted breccias comprising angular to subrounded fragments within a finer matrix of lithic and crystal grains. The clasts are mainly feldspar and hornblende-feldspar-phyric andesitic volcanics in shades of purple, green and grey. They are commonly 1 to 8 centimetres across; but locally are more than half a metre in size. Most breccias have a matrix rich in plagioclase crystals; many are also rich in hornblende and some contain pyroxene.

Laharic breccias are a significant part of the upper division on the ridges south of Mount Tatlow peak. The lahars have a muddy matrix and are unsorted, with rounded cobbles and boulders of all sizes up to over a metre across. Muddy and sandy layers, centimetres to tens of metres thick, are intercalated with the coarse beds and delineate the bedding. On a gross scale, the bedded intervals are remarkably planar; individual layers can be traced without disruption for more than a kilometre. Muddy layers weather brown and maroon, and are brick-red in some sections.

Ash and crystal tuffs typically form relatively thin sections (less than 10 m) within sequences dominated by coarse breccias or lahars. An exception to this is at the Vick property on the mountain directly west of the narrows at the foot of Lower Taseko Lake. There, the top 300 or 400 metres of section on the mountaintop is dominated by crystal tuffs, with lesser intercalated flow breccia (Photo 8). The tuffs are markedly less resistant than other rock types in the Powell Creek formation and the transition to tuffs from flow breccia is marked by an abrupt break in slope. Tuff matrix is commonly calcareous and in some places the rock is friable.

Most flows within the upper division of the Powell Creek formation are andesitic, but dacites also occur, and thin bands of rhyolite are intercalated in the section at the Vick property. The andesite flows are green and feldspar-hornblende or feldspar-pyroxene phyric. In the coarsest flows crowded feldspar crystals are up to 5 millimetres across. Sills and dikes of hornblende feldspar porphyry, compositionally similar to the andesitic flows, are common in both divisions of the formation and may be comagmatic with the volcanics.

The Powell Creek formation is assigned a Late Cretaceous age, based on $^{40}Ar/^{39}Ar$ dating by J.A. Maxson (reported in Wynne *et al.*, 1995) in the Mount Tatlow area. She obtained a date of 92±1.3 Ma (Cenomanian) from near the base of the formation and a date of 79±4.1 Ma (Campanian) from the highest levels of the formation exposed in the core of the Mount Tatlow syncline.

CRETACEOUS SEDIMENTARY AND VOLCANIC ROCKS NORTHEAST OF THE YALAKOM FAULT IN THE FISH LAKE - CHAUNIGAN LAKE AREA

Pre-Miocene bedrock exposures on the northeast side of the Yalakom fault, near Fish Lake, are largely restricted to the steep slopes bordering the Taseko River, the Elkin Creek canyon, and a wooded ridge system to the northwest of Chaunigan Lake (Figure 4). The exposures in this area comprise sedimentary and volcanic rocks that were assigned to the Upper Cretaceous Kingsvale Group by Tipper (1978), which also included rocks now assigned to the Powell Creek formation on the southwest side of the fault. The sedimentary rocks in this area were remapped as the Lower Cretaceous Jackass Mountain Group by Riddell *et al.* (1993a, b) and Hickson and Higman (1993). The latter authors also assigned the volcanic rocks in the area an Early Cretaceous age, based on their lithologic similarity to 106 Ma (Albian) volcanics near Mount Alex, about 60 kilometres to the east. The geology was further revised by Schiarizza (1996), based on paleontologic reports on fossils collected during the 1992 field season, and two additional days of fieldwork in 1995. These new data suggest that, in addition to Aptian or Albian conglomerates (Vick Lake unit) that might correlate with the Jackass Mountain Group, the area also includes an older succession of Hauterivian sedimentary and volcanic rocks (Elkin Creek, Fish Creek and Chaunigan Lake units) that may correlate with Hauterivian rocks found within Niut domain.

ELKIN CREEK UNIT (lKs)

Rocks included in the Elkin Creek unit on Figure 4 consist of sandstone, siltstone, shale and local occurrences of conglomerate. These rocks are locally well exposed on the lower slopes adjacent to Elkin Creek and Elkin Lake, where they are overlain by Miocene to Pliocene plateau basalts of the Chilcotin Group. The unit is also represented by sparse exposures a short distance to the east, on the east side of Big Lake. Sandstone-dominated intervals adjacent to the Taseko River farther to the east are also tentatively included in the Elkin Creek unit, although these may actually belong to the younger Vick Lake unit.

The exposures along Elkin Creek and Big Lake are dominated by green to brownish grey, fine to coarse-grained sandstone containing feldspar, volcanic-lithic grains and quartz. The sandstones are typically massive, but locally occur in medium to very thick beds separated by interbeds of friable siltstone or shale. Granule to pebble conglomerate occurs locally and contains rounded clasts of mainly intermediate volcanic rocks, but also includes clasts of granitoid rock. Plant fragments are present in most exposures, and marine fossils occur locally. An ammonite collected from the east bank of Elkin Creek directly northeast of the Yalakom fault has been tentatively identified as *Olcostephanus* sp., which suggests a late Valanginian to early Hauterivian age (GSC Loc. C-207832; J.W. Haggart, report JWH-1992-10). A nearby fossil collection includes belemnites, oyster shell fragments, scaphopod shells and abundant shell fragments of large-valved inoceramids suggestive of the *paraketzovi* group, which also suggests a Hauterivian age (GSC Loc. C-207836; J.W. Haggart, report JWH-1992-10).

The rocks assigned to the Elkin Creek unit on either side of the Taseko River comprise green lithic-arkosic sandstones with lesser shale and conglomerate. They are lithologically similar to the Hauterivian rocks exposed near Elkin Creek and Big Lake, but have not been dated. Their inclusion in the Elkin Creek unit is tentative, however, because they also resemble sandstones intercalated with Aptian or Albian conglomerates of the Vick Lake unit, which also outcrop in this area. The relationship between the Vick Lake conglomerates and the sandstone-dominated intervals is not exposed, and it is therefore not clear if the sandstones are actually a part of the Vick Lake unit or belong to the older Elkin Creek unit.

The nearest dated Hauterivian rocks that might correlate with the Elkin Creek unit occur in the upper part of the Jura-Cretaceous Relay Mountain Group, which is exposed about 30 kilometres to the east, on the southwest side of the Yalakom fault. The Relay Mountain Group in this area occupies a stratigraphic position between the Lower to Middle Jurassic rocks of Methow Terrane and the Lower Cretaceous Jackass Mountain Group (Figures 3 and 4). Correlation with the Relay Mountain Group would therefore be consistent with the spatial association of the Elkin Creek unit with the Vick Lake unit, which may correlate with the Jackass Mountain Group. Alternatively, the Elkin Creek unit may correlate with the Hauterivian Cloud Drifter formation of Niut domain (informal; Rusmore and Woodsworth, 1993; Mustard and van der Heyden, 1994), which is a lithologically similar succession of sandstones, shales and conglomerates derived from a volcanic and plutonic source area. This correlation is consistent with the 115 kilometres of dextral offset established for the Yalakom fault (Riddell *et al.,* 1993a), as a pre-Yalakom reconstruction based on removal of this offset would place the Elkin Creek exposures opposite the north end of the Niut domain (Figure 2). It is also consistent with the presence of Hauterivian(?) volcanic rocks in the Chaunigan Lake - Fish Lake area, as the Cloud Drifter formation is stratigraphically underlain by volcanic rocks of the Hauterivian (and older?) Ottarasko formation (informal; Rusmore and Woodsworth, 1993; Mustard and van der Heyden, 1994). The relationship between the Ottarasko - Cloud Drifter succession and the Hauterivian part of the Relay Mountain Group is not well established, but the two sequences may represent, respectively, a proximal volcanic facies within a west-facing Hauterivian arc and an adjacent back-arc basinal facies (Umhoefer *et al.*, 1994).

FISH CREEK SUCCESSION (UNIT lKsv)

An assemblage of sedimentary and volcanic rocks that outcrops along the east side of the Taseko River near the mouth of the creek that drains Fish Lake has been designated the Fish Creek succession (unit lKsv) on Figure 4. These rocks may correlate with the volcanic and sedimentary package (observed only in drill core) that hosts the Fish Lake porphyry copper-gold deposit a few kilometres to the east. The Fish Creek succession includes hornblende-feldspar-phyric andesite, dacite containing quartz and feldspar phenocrysts (Photo 9), tuffaceous sandstone, well bedded flinty siltstone, dark grey shale, and pebbly sandstone and pebble conglomerate containing volcanic and granitoid clasts. The sedimentary rocks are in part lithologically similar to the those of the Elkin Creek unit, and this correlation is supported by a single fossil collection containing *Inoceramus* bivalves, tentatively identified as *I. colonicus* (Anderson) which is common in Hauterivian to lower Barremian strata of the region (GSC Loc. C-207834; J.W. Haggart, report JWH-1992-10). The associated vol-

Photo 9. Columnar jointed dacite of the Lower Cretaceous Fish Creek succession, west of Fish Lake.

canic rocks are probably the same age, and a sample of columnar jointed quartz-feldspar-phyric dacite has been submitted for U-Pb dating of zircons in an attempt to test this assertion.

CHAUNIGAN LAKE UNIT (lKv)

Volcanic rocks that are exposed on an isolated ridge system northwest of Chaunigan Lake, and on a low hill west of the Taseko River along the northern boundary of the map area, are assigned to the Chaunigan Lake unit on Figure 4. These rocks have not been dated, and their stratigraphic relationships to the Elkin Creek and Vick Lake units have not been established. They consist mainly of andesitic flows and breccias that show varying degrees of chlorite-calcite-epidote alteration. Medium green, rusty brown weathering flows contain small feldspar and mafic phenocrysts, and locally quartz amygdules, within a very fine grained groundmass. Breccias comprise angular to subrounded fragments of green, grey and purple intermediate volcanics, up to 30 centimetres across, in a matrix dominated by smaller volcanic-lithic grains and feldspar crystals. More felsic volcanic rocks occur locally, and dominate the unit at the east end of the ridge north of Chaunigan Lake. They comprise maroon to mottled green/red-weathering flows containing feldspar and quartz phenocrysts, and associated breccias that contain fragments of similar quartz feldspar porphyry and, locally, a variety of other dacitic to andesitic rock fragments.

The Chaunigan Lake unit is suspected to be of Hauterivian age, as it is compositionally similar to the volcanics of the Fish Creek succession and is also spatially associated with the Hauterivian Elkin Creek unit. As noted previously, the volcanic and sedimentary rocks of the Elkin Creek, Chaunigan Lake and Fish Creek successions may correlate with the Ottarasko and Cloud Drifter formations of the Niut belt, which are part of a volcanic-bearing facies that occurs west of coeval sedimentary rocks of the Relay Mountain Group (Umhoefer *et al.*, 1994).

VICK LAKE UNIT (lKcg)

Rocks assigned to the Vick Lake unit crop out east of the Taseko River, and comprise pebble to boulder conglomerates with only minor amounts of intercalated sandstone and shale. The conglomerates are massive to weakly stratified, with poorly sorted, rounded clasts that commonly range up to 20 centimetres across and locally are as large as 60 centimetres in diameter. The clasts consist mainly of intermediate volcanic rocks, together with a significant proportion of plutonic and mafic volcanic rock fragments; chert and foliated plutonic clasts occur locally. The interstitial sandy matrix is composed of feldspar, lithic grains and quartz. Plant fragments are generally common in the matrix and occur locally as carbonaceous remnants plastered to clast margins. Green coarse-grained sandstone and pebbly sandstone occur as relatively rare intervals up to at least several metres thick within the dominant conglomerates. The sandstones are locally crossbedded, and contain feldspar and lithic grains, in places accompanied by substantial quartz. Woody debris is common, and associated siltstones and shales locally contain moderately well preserved plant fragments. A Cretaceous, probably Aptian to Albian age, has been assigned to plant fossils, including *Pterophyllum* sp. and *Pseudocycas unjiga* (Dawson) Berry, collected from a locality 600 metres east of the mouth of Fish Creek (GSC Loc. C-207838; E.E. McIver, report EM-93-12-1).

The Vick Lake unit is lithologically very similar to parts of the Lower Cretaceous Jackass Mountain Group. In particular, it resembles conglomerates of probable Albian age that are exposed in the Noaxe Creek and Big Bar Creek map areas between 80 and 130 kilometres to the east-southeast (including the French Bar Formation of MacKenzie, 1921; unit lKJMc2 of Schiarizza *et al.*, 1993c; and the polymictic conglomerate unit of Hickson *et al.*, 1994). Correlation of the Vick Lake unit with these Jackass Mountain conglomerates is tentative, however, as no good section of the unit is exposed, and its stratigraphic context is not understood. Furthermore, associated Hauterivian rocks of the Elkin Creek, Chaunigan Lake and Fish Creek successions differ significantly from rocks which stratigraphically underlie the Jackass Mountain Group to the east, although it has not been established that these rocks are in stratigraphic contact with the Vick Lake unit, rather than being entirely in fault juxtaposition.

JURASSIC VOLCANIC ROCKS AND ASSOCIATED INTRUSIVE ROCKS NORTHEAST OF THE YALAKOM FAULT NEAR CHOELQUOIT LAKE

Bedrock exposures northeast of the Yalakom fault in the northern part of the Tatlayoko map area are assigned to unit Jv on Figure 4. They include volcanic and volcaniclastic rocks of probable Jurassic age, as well as a variety of mafic to intermediate intrusive rocks, some of which may be coeval with the volcanics and some of which are younger. The volcanic rocks include tuffs, breccias and volcanic conglomerates as well as andesitic flows. Fragmental volcanic rocks are poorly stratified and include angular green, red and purple aphyric and feldspar-phyric volcanic fragments, generally less than 5 centimetres across, in a silty to sandy matrix that commonly includes feldspar and mafic crystals as well as volcanic-lithic grains. Less common epiclastic rocks include compositionally similar volcanic conglomerates that are better stratified and include rounded clasts, as well as thin beds of feldspathic sandstone. Andesitic flow rocks are medium to dark green or mottled green and purple. They are fine to very fine grained, and locally contain small feldspar and less common mafic phenocrysts, as well as quartz-epidote amygdules.

Medium-grained, equigranular diorite and gabbro occur locally as poorly defined masses within andesitic volcanics and may be of broadly the same age. Medium-grained hornblende quartz diorite that outcrops at the southeast end of the western outcrop belt north of Choelquoit Lake is probably younger, as is a small stock of coarse feldspar porphyry exposed in the belt east of the Chilko River. Northeast and northwest-striking dikes of feldspar porphyry, hornblende feldspar porphyry and very fine grained mafic rock are common north of Choelquoit Lake, where they cut the volcanic rocks as well as a gabbroic intrusion.

The volcanic rocks of unit Jv are not dated within the Tatlayoko map area, but Tipper (1969a) reports that correlative rocks near Puntzi Lake, about 50 kilometres to the north, contain fossils of probable Bajocian age. These fossiliferous strata are part of succession of volcanic and sedimentary rocks that are widespread, but nowhere well exposed, in the Anahim Lake map area, where they were included in the Hazelton Group by Tipper (1969b). These rocks continue northward into the Nechako River map sheet, where they are assigned to the Entiako and Naglico formations (informal subdivisions of the Hazelton Group), which contain fossils of early Toarcian to early Bajocian age (Diakow and Webster, 1994; Diakow *et al.*, 1995; L.J. Diakow, personal communication, 1996).

NEOGENE PLATEAU BASALTS

Flat-lying basalt flows of the Chilcotin Group (Tipper, 1978; Bevier, 1983) are the youngest rocks exposed in the Tatlayoko project area, where they unconformably overlie all older rock units and structures, including the Yalakom fault. They are part of the southwestern margin of an extensive belt of Early Miocene to early Pleistocene plateau lavas that covers 25 000 square kilometres of the Interior Plateau of south-central British Columbia (Mathews, 1989). The most extensive exposures are in the Intermontane Belt near Fish Lake and Elkin Creek, with isolated remnants extending northwestward to the Chilko River (Figure 4). The base of the group in these areas is generally between 1300 and 1500 metres elevation. Small outliers of the Chilcotin Group also extend into the Coast Mountains, north of the Ts'yl-os ridge system and on the east side of West Nadilla Creek, where the basal contact of the group is locally as high as 2300 metres elevation.

The Chilcotin Group is dominated by dark to medium grey, orange-brown weathering basalt that locally contains olivine and plagioclase phenocrysts. Individual flows commonly range from a few metres to more than 10 metres thick. Columnar jointing at the bases of flows is common and well developed, and flow tops are normally vesicular. In almost all locations layering is near horizontal, the rocks are undeformed and the minerals are unaltered.

Spectacular debris flows are exposed beneath columnar jointed flows in the cliffs east of the Taseko River, south of Fish Creek. They are unsorted and unstratified and contain clasts up to 50 centimetres across. Clasts include Chilcotin-type rocks (amygdaloidal basalt, black glassy shards and dense black basalt with glassy rims) and foreign rocks (feldspar-porphyritic andesite, feldspathic sandstone and limestone). Unconsolidated, locally well bedded conglomerate, sedimentary breccia and sandstone, which may represent both fanglomerates and fluvial sediments, occur beneath Chilcotin basalt flows in the southwest corner of the Fish Lake deposit (Caira *et al.*, 1993).

LATE MESOZOIC AND TERTIARY INTRUSIVE ROCKS

The largest plutons in the Tatlayoko project area are terrane-specific Triassic bodies, including the Mount Skinner Igneous Complex, the Crazy Creek pluton and the Niut Mountain pluton, which have been discussed previously. Mesozoic rocks in the area are cut by an assortment of younger plutons and dikes, of mainly Late Cretaceous and Tertiary age, which are described here.

ANVIL MOUNTAIN PLUTON

Hornblende diorite, quartz diorite and hornblende feldspar porphyry occur as stocks, plugs and dikes that are common within the Taylor Creek Group east of Taseko Lake (Figure 4). The largest mappable pluton comprises diorite to quartz diorite that underlies the Anvil Mountain ridge system, northeast of Beece Creek. These bodies were assigned tentative Eocene ages by Tipper (1978), but Riddell *et al.* (1993a) suggested that at least some of the intrusive activity was mid-Cretaceous in age, because intrusive bodies of this composition were far more abundant in the Taylor Creek Group than in the overlying Powell Creek formation. Zircons extracted from a sample of quartz diorite from the Anvil Mountain pluton have subsequently yielded a U-Pb date of 93.4±0.1 Ma. This compares closely with the Ar-Ar date of 92±1.3 Ma obtained from volcanic rocks near the base of the Powell Creek by J.A. Maxson (reported in Wynne *et al.*, 1995) in the Mount Tatlow area. It suggests that the intrusive rocks cutting the Taylor Creek Group may be comagmatic with the overlying Powell Creek formation.

FISH LAKE - CONE HILL INTRUSIVE SUITE

Numerous dikes and plugs of quartz dioritic composition intrude Lower Cretaceous sedimentary and volcanic rocks of the Elkin Creek unit and Fish Creek succession on the east side of the Taseko River near Cone Hill and Fish Creek. Most are porphyries containing feldspar, hornblende and quartz phenocrysts in a light grey aphanitic groundmass. They resemble the synmineralization Fish Lake Intrusive Complex of the Fish Lake porphyry copper-gold deposit to the southeast (Riddell *et al.*, 1993a; Caira *et al.*, 1993, 1995). They are therefore assumed to be Late Cretaceous in age, as a core sample of hornblende-quartz-feldspar porphyry from the Fish Lake Intrusive Complex has yielded a U-Pb zircon date of 80 Ma (J. E. Gabites, written communication, 1993).

BEECE CREEK PLUTON

The Beece Creek pluton consists of light grey, medium-grained hornblende-biotite quartz monzonite to granodiorite of Eocene age. It intrudes the Taylor Creek Group and Powell Creek formation on the ridges east and west of Beece Creek near its headwaters, and extends south into the Warner Pass map area (Glover and Schiarizza, 1987; Schiarizza *et al.*, 1993d). Biotite from a sample collected on the west side of Beece Creek, just north of the southern boundary of the Tatlayoko project area, yielded an Ar-Ar total fusion date of 43.9±0.6 Ma (Archibald *et al.*, 1989).

TONALITE STOCKS IN METHOW DOMAIN

Two small stocks of hornblende biotite tonalite intrude the Huckleberry formation on the south limb of the Tsuniah Lake syncline, one to the south of Huckleberry Mountain and one on the ridge directly west of Mount Nemaia. These stocks must be Middle Jurassic or younger in age, but neither is dated. Similar hornblende biotite tonalite to granodiorite outcrops along the southern margin of the Mount Skinner Igneous Complex and may be the same age. Alternatively, this body may be older and related to the Middle to Late Triassic Mount Skinner Complex.

DIKES

Dikes and sills are common throughout most of the area. They have a variety of compositions, the most common being fine-grained diorite, hornblende feldspar porphyry, and light grey felsite with or without quartz and feldspar phenocrysts.. They are particularly abundant in all belts of Taylor Creek Group exposure, where they may represent, at least in part, subvolcanic intrusions related to the overlying Powell Creek formation and coeval Anvil Mountain pluton. Dikes are also abundant in the vicinity of Huckleberry Mountain and to the southwest of Tullin Mountain, between the Lingfield Creek and Cheshi Creek faults.

STRUCTURE

THE YALAKOM FAULT

Leech (1953) first used the name Yalakom fault for a system of steeply dipping faults bounding the northeast margin of the Shulaps Ultramafic Complex along the Yalakom River, 60 kilometres southeast of the Tatlayoko project area. The fault system was traced northwestward through the Taseko Lakes and Mount Waddington map areas by Tipper (1969, 1978) who postulated that it was the locus of 80 to 190 kilometres of right-lateral displacement. It was traced southeastward through the northeastern corner of Pemberton map area by Roddick and Hutchison (1973), from where it extends into the western part of the Ashcroft map area (Duffell and McTaggart, 1952; Monger and McMillan, 1989). There, it is truncated by the more northerly trending Fraser fault system, along which it is separated by about 90 kilometres from its probable offset equivalent, the Hozameen fault, to the south (Monger, 1985).

Within the Tatlayoko project area the Yalakom fault is well defined, although not well exposed, on either side of the Taseko River in the central part of the area, and near Skinner Creek to the northwest (Figure 4); elsewhere its trace is hidden beneath Miocene or Quaternary cover. Although indications of dextral movement were not observed along the fault itself, many structures within Methow domain to the southwest fit the pattern expected for subsidiary structures related to a major dextral strike-slip fault (Wilcox *et al.*, 1973). These include the east-striking Tsuniah Lake syncline, a northwest-striking synthetic dextral fault northeast of Tatlayoko Lake, and northeast-striking antithetic sinistral faults along Lingfield and(?) Cheshi creeks (Figure 4).

Near the Taseko River the Yalakom fault truncates, on its southwest side, a succession of east-striking fault panels that include, from north to south, Methow Terrane and overlying Jackass Mountain Group of the Tyaughton-Methow basin, Cadwallader Terrane, and the Bridge River Complex. Recognition of these truncated fault panels is an important result of the present study, as they correlate with an identical three-part structural succession that is truncated on the northeast side of the Yalakom fault in the Camelsfoot Range to the southeast (Schiarizza *et al.*, 1993b,c), and thus provide an estimate of 115 kilometres of dextral offset along the fault (Riddell *et al.*, 1993a; Schiarizza and Garver, 1995). This correlation refines and strengthens the argument of Kleinspehn (1985) who postulated 150±25 kilometres of displacement by matching only a part of this structural succession, the Jackass Mountain Group of the Tyaughton - Methow basin.

The Yalakom fault displaces mid-Cretaceous and older rocks, and is overlapped by Neogene plateau lavas of the Chilcotin Group (Figure 4; Schiarizza *et al.*, 1993b,c,d). Coleman and Parrish (1991) relate dextral shear within Bridge River schists and associated 46.5-48.5 Ma intrusions in the southern Shulaps Range to movement on the adjacent Yalakom fault, suggesting that at least some of the displacement was Eocene in age. Eocene movement is also indicated by relationships just to the north and northwest of the Tatlayoko Lake map area, where the Yalakom fault defines the southwestern boundary of the Tatla Lake Metamorphic Complex (Figure 2). Friedman and Armstrong (1988) document 55 to 47.5 Ma extensional shear along subhorizontal west-northwest-trending mineral lineations within the mylonite zone comprising the upper part of the complex, followed by folding and brittle faulting during the final stages of uplift. Although they implicate the Yalakom fault only in the post-ductile deformation phase of folding and brittle faulting, the earlier ductile strain is also kinematically compatible with dextral slip along the Yalakom system. The Yalakom fault has not been mapped beyond the Tatla Lake Complex but Schiarizza *et al.* (1995a) infer that it, or a kinematically linked extensional fault segment, extends north-northwestward from there, along the Dean River, to mark the western limit of a belt of metamorphic tectonites that are locally exposed beneath an extensive cover of Quaternary alluvium and Late Tertiary volcanics (Figure 2; Tipper, 1969b). The right-stepping, extensional geometry of the system is consistent with the regional pattern of Eocene dextral strike-slip and associated extension that has been documented by numerous workers in the province, including Price (1979), Ewing (1980), Price and Carmichael (1986), Coleman and Parrish (1991) and Struik (1993).

STRUCTURE OF SOUTH CHILCOTIN DOMAIN SOUTHEAST OF THE NEMAIA VALLEY

The southeastern part of the map area, east of the Taseko River and Upper Taseko Lake, is underlain mainly by the Taylor Creek Group and overlying Powell Creek formation. The contact is an angular unconformity that was observed 2 kilometres east of Taseko Lake, and is well exposed at several localities in the Warner Pass map area to the south (Glover and Schiarizza, 1987). The mid-Cretaceous deformation documented by this unconformity included southwest-vergent folding and thrusting that is well displayed in the Taseko - Bridge River area to the southeast (Schiarizza and Garver, 1995). Younger structures in this area include a series of northerly striking faults along the southern boundary of the area between Taseko Lake and Beece Creek. These faults have apparent west-side-down displacement of the Powell Creek formation, but their actual sense of movement is unknown.

Farther northwest, the structure of the East Chilcotin domain is dominated by three fault panels separated by east to east-northeast striking faults. The northernmost panel comprises Cadwallader Terrane, which is separated from Methow domain to the north by an inferred fault (the Konni Lake fault) in the Nemaia Valley. The central panel consists of a narrow fault-bounded sliver of Bridge River Complex, which is separated from Cadwallader Terrane by the Taseko fault. The southern panel includes a belt of Tyaughton basin rocks, dominated by the Taylor Creek

Group, which is in contact with the Powell Creek formation, and locally with intervening Upper Cretaceous sedimentary rocks of the Robertson Creek unit, to the south. The latter contact is at least locally faulted (Mount Tatlow fault of Riddell *et al.*, 1993a), but this is probably not a major structure as it separates units that are in stratigraphic contact at both the eastern and western ends of the belt.

The rocks of the Cadwallader Terrane, the Bridge River Complex and the Taylor Creek Group are strongly deformed by east-plunging folds that are observed on the mesoscopic scale, and indicated on a larger scale by domains of opposing facing directions. Folds with both north and south vergence were mapped, but the macroscopic geometry of the belts is not well constrained. It is suspected, but not proven, that much of the internal deformation within these belts occurred during the mid-Cretaceous contractional deformation documented beneath the sub-Powell Creek unconformity to the southeast. The Powell Creek formation directly to the south does not display this internal deformation and comprises the north limb of a major east-trending syncline, the axial trace of which occurs just to the south of the study area (Tipper, 1978; McLaren, 1990). The orientation of this structure suggests that it may be related to the Yalakom dextral strike-slip fault system. This interpretation is corroborated by paleomagnetic studies which suggest that the fold formed in latest Cretaceous time (Wynne *et al.* 1995), as the oldest dextral strike-slip faults related to the Yalakom system are also of latest Cretaceous age (*e.g.* the Castle Pass fault: Garver, 1991; Umhoefer and Schiarizza, 1993).

STRUCTURE OF METHOW DOMAIN BETWEEN THE NEMAIA VALLEY AND TATLAYOKO LAKE

The rocks of the Methow domain between Tatlayoko Lake and the Nemaia valley are separated into three structural blocks by the northeast-striking Lingfield Creek and Cheshi Creek faults. The western block encompasses the Potato Range and adjacent mountains between Tatlayoko Lake and Lingfield Creek. The structure of this area is dominated by an open syncline cored by the Relay Mountain Group. The trace of the fold's axial surface is broadly Z-shaped, as it plunges north-northwest and south-southeast at its south and north ends, respectively, but trends north-northeasterly in the central part of the range (Potato Range syncline of Figure 4). The fold is truncated by a prominent northwest-striking fault east of the north end of Tatlayoko Lake. Its probable continuation to the north is a tight syncline within the Huckleberry formation, which shows 2 to 3 kilometres of dextral offset from the southern fold segment. The Potato Range fold deforms Barremian(?) and older rocks, and is cut by a northwest-trending dextral strike-slip fault that may be related to the Yalakom fault system. It is suspected that it is mid to early Late Cretaceous in age, as this was a period of major contractional deformation within the eastern Coast Belt (McGroder, 1989; Journeay and Friedman, 1993; Rusmore and Woodsworth, 1991b). The present sigmoidal trace of the fold may reflect rotation during later dextral strike-slip faulting (Umhoefer and Kleinspehn, 1995).

The structure of the Tullin Mountain area, between the Lingfield Creek and Cheshi Creek faults, is also generally synclinal in nature, as it includes Relay Mountain Group strata which are underlain by the Huckleberry formation to both the northeast and west (Figure 4). A northerly trending syncline that is well defined by the internal stratigraphy of the Relay Mountain Group 1.5 kilometres southwest of Tullin Mountain, is apparently the dominant structure within this domain (Tullin Mountain syncline of Figure 4). A subsidiary anticline-syncline pair deforms the basal contact of the Relay Mountain Group into a Z-shape north of Tullin Mountain, and an S-shaped fold pair is outlined by the same contact to the southwest, on the opposite side of the main syncline. Just to the north of the latter area the contact is offset several hundred metres to a kilometre across a northwest-trending dextral strike-slip fault. If this fault correlates with the dextral fault north of the Potato Range, then it shows about 1.5 kilometres of apparent sinistral offset across the Lingfield Creek fault. Farther southwest, the Lingfield Creek fault apparently becomes a relatively minor northwest-side-down normal fault in the southern Potato Range, and the main displacement transfers to a south-striking splay that extends from the head of Lingfield Creek southward to the Cheshi Creek valley. This fault separates east-facing rocks of the Huckleberry formation within the Tullin Mountain block from correlative west-facing strata on the east limb of the Potato Range syncline.

The strata southeast of the Cheshi Creek fault are disposed as a large, upright, gently east-plunging, open to closed syncline (the Tsuniah Lake syncline) that is truncated by the Yalakom fault to the east. The fold is cored by the Jackass Mountain Group, which is underlain by the Huckleberry formation throughout most of the block, but by an intervening eastward-tapering sliver of Relay Mountain Group in the western part of its southern limb. West of Chilko Lake, Huckleberry strata on the southern limb of the fold are deformed by a series of south-dipping thrust faults and associated northerly overturned folds (Photo 10). The Tsuniah Lake syncline deforms the Albian Jackass Mountain Group and so is Late Cretaceous or younger in age. It is discordant to the more northerly trending folds to the west, suggesting that it may have formed in a different structural regime. The orientation of the fold is consistent with it having formed during dextral movement on the adjacent Yalakom fault (Wilcox *et al.*, 1973); this was predominantly an Eocene event, although Late Cretaceous deformation is documented on parts of the Yalakom system (Umhoefer and Schiarizza, 1993). The thrust faults and

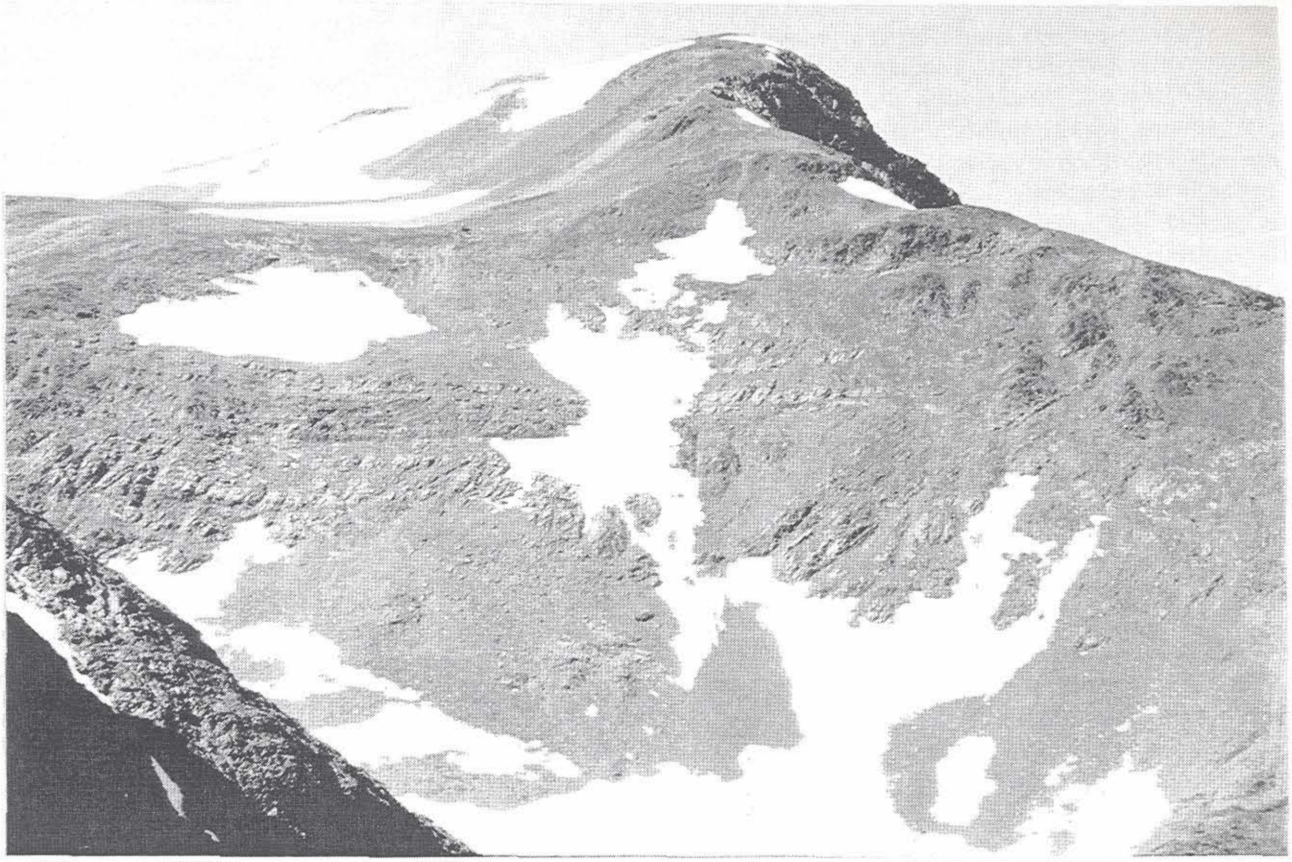

Photo 10. Looking west-southwest at an overturned antiform in the Huckleberry formation, south limb of the Tsuniah Lake syncline, west of Chilko Lake.

overturned folds on the south limb of the syncline may be older structures, but their age is not well constrained.

The southern boundary of the Tsuniah Lake block is an inferred fault which occupies the Nemaia valley and is truncated by the Yalakom fault to the east. This structure, referred to as the Konni Lake fault, separates Methow Terrane to the north from Cadwallader Terrane to the south. The reconstruction of Riddell *et al.* (1993a) suggests that it is the offset counterpart of the Camelsfoot fault, which is truncated by the Yalakom fault along the Yalakom River, 115 kilometres to the southeast (Schiarizza *et al.*, 1993b,c). The Camelsfoot fault is interpreted as a mid-Cretaceous structure with components of contractional and sinistral displacement (Schiarizza and Garver, 1995).

STRUCTURE OF THE CRAZY CREEK PLUTON AND RELAY MOUNTAIN GROUP WEST OF TATLAYOKO LAKE

Plutonic rocks of the Crazy Creek pluton appear to be bounded by faults on all sides. The eastern contact was not observed, but is suspected to be a northerly striking fault or shear zone, as easternmost exposures of plutonic rock west of the north end of Tatlayoko Lake display a steeply east dipping mylonitic foliation and an associated stretching lineation that plunges 45° to the south-southeast. This fault system is inferred to truncate the belt of Relay Mountain Group to the south and from there extend into Tatlayoko Lake (Figure 4). Its presence there is suggested by a zone of steeply east dipping brittle faults and fractures within Jurassic sedimentary rocks of the Methow Terrane along the lake shoreline. The northern boundary of the Crazy Creek pluton is a northwest-striking fault that places it against unmetamorphosed sedimentary rocks of the Jackass Mountain Group near the northern boundary of the map area. This fault has been traced from near Lingfield Creek, and is thought to be a component of the Yalakom dextral strike-slip fault system. The southwestern margin of the Crazy Creek pluton is a fault or system of faults that Tipper (1969a) called the Niut fault, and which is here referred to as the East Niut fault. This structure juxtaposes the plutonic rocks, together with a pendant of hornfelsed metasedimentary rocks, against unmetamorphosed sedimentary rocks of the Relay Mountain Group. It was observed locally, where it is vertical to steeply east or northeast dipping. Although no movement sense was established along it, a component of northeast-side-up movement is suspected.

A fault that is thought to have accommodated southwest-directed thrust or reverse movement has also been

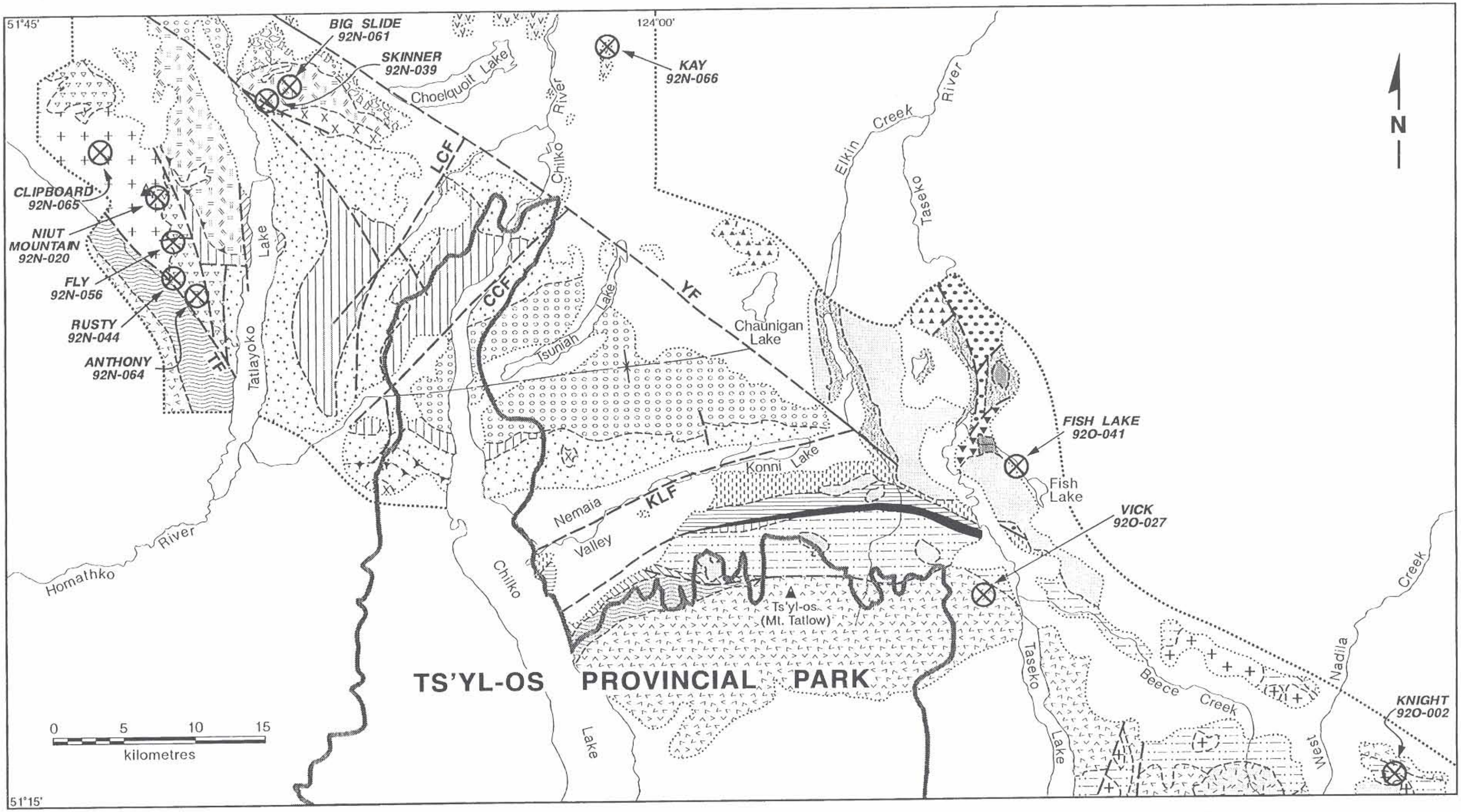

Figure 5. Main mineral occurrences in the Tatlayoko project area, identified by name and MINFILE Number. Also shown is the boundary of Ts'yl-os Provincial Park.

traced for several kilometres within the southern part of the Relay Mountain Group belt. This fault was observed in several places and dips between 35° and 75° to the east-northeast. It is generally parallel to bedding in the footwall rocks, and commonly places them against small bodies of quartz diorite in the immediate hangingwall. In one place this fault places quartz diorite that intrudes upright, northeast-dipping *Buchia*-bearing Upper Jurassic conglomerates and sandstones above shales, siltstones and sandstones that are thought to be Early Cretaceous in age. This older-over-younger relationship suggests reverse movement along the fault, as does a tight syncline within the footwall rocks directly beneath it.

STRUCTURE OF NIUT DOMAIN

Steeply dipping, east-striking faults cut volcanic and sedimentary rocks in the southeastern part of Niut domain, and two northeast-striking faults are mapped within the Niut Mountain pluton to the northwest (Schiarizza *et al.*, 1995a, b). The latter faults are marked by steeply dipping zones of fracturing and brecciation, several tens of metres wide, that are colinear with prominent topographic lineaments. The structure of the northwestern pendant is poorly understood because it contains few bedded rocks and no distinctive markers. Where observed, bedding dips at moderate angles to the north or west, and the strata are right way up, based on graded beds and pillow shapes.

The northwest-striking Tchaikazan fault bounds the Triassic rocks of Niut domain to the southwest, and separates them from Upper Cretaceous volcanic rocks of the Powell Creek formation. Tipper (1969a) interpreted the Tchaikazan fault as a right-lateral transcurrent fault based on speculative correlation of two faults that were offset by about 30 kilometres along it. More recently Mustard and van der Heyden (1994) have postulated 7 to 8 kilometres of apparent dextral displacement based on offset of a distinctive fossiliferous limestone unit within the Mount Moore formation, a short distance to the northwest of the Tatlayoko Lake map area.

The northeastern limit of plutonic, volcanic and sedimentary rocks of the Niut domain is a system of north to northwest-trending faults that separates them from Jurassic and Cretaceous sedimentary rocks to the northeast. The oldest of these faults is an unexposed north-striking structure that separates a panel of sedimentary and volcanic rocks, tentatively included within Niut domain, from rocks assigned to the Huckleberry formation a short distance west of Tatlayoko Lake (Figure 4). This fault is truncated by an east-striking fault to the north, which in turn is truncated by a northwest-striking fault to the west. The latter structure, referred to as the West Niut fault, forms the northeastern boundary of Niut domain east of Niut Mountain, and juxtaposes it against a narrow lens of Relay Mountain Group (Figure 4). Where exposed, this fault dips steeply east to east-northeast, and is commonly marked by a metre-wide zone of brittle faults and fractures; Niut domain rocks are typically silicified and quartz veined along the fault whereas the adjacent Relay Mountain Group is not. Locally, the rocks on both sides of the main fault are slivered into several parallel fault strands, resulting in a fault zone several hundred metres wide. This fault is truncated by, or merges with, the Tchaikazan fault to the south. It is a relatively young structure because, in addition to the east-striking fault on its east side, it also truncates a northeast-dipping thrust fault within the Relay Mountain Group and east-striking faults within Niut domain to the west (Schiarizza *et al.*, 1995b). It is suspected that it may be a splay from the dextral-slip Tchaikazan fault, which was probably active in Eocene time (Umhoefer and Kleinspehn, 1995). Neither the age nor the sense of movement are known for the older north-striking fault segment that locally forms the domain boundary to the east.

STRUCTURE NORTHEAST OF THE YALAKOM FAULT

The structure of the Mesozoic rocks northeast of the Yalakom fault is poorly understood because much of the area is covered by Neogene basalts and thick glacial deposits. The only structures mapped in this area are north and northeasterly trending faults that in part control the distribution of Cretaceous rocks along the Taseko River. Major structures outlined by diamond drilling at the Fish Lake deposit to the east include the Carramba fault, an east-striking subvertical fault that juxtaposes the southern part of the deposit against unmineralized clastic rocks, and a gently east-southeast-dipping fault that marks the base of the deposit (Caira *et al.*, 1993, 1995). The latter structure, referred to as the Fish Lake fault, places mineralized volcanic and intrusive rocks above unmineralized sedimentary rocks. The 10° to 25° dip of the fault suggests that it will intersect the surface 2 to 4.5 kilometres west of the deposit, and thus might constitute part of the boundary between the Fish Creek succession and adjacent sedimentary rocks of the Elkin Creek and Vick Lake units, where they outcrop near the mouth of Fish Creek (Riddell *et al.*, 1993a).

Outcrop-scale brittle faults, most dipping at moderate to steep angles to the northeast, are common within Jurassic volcanic and intrusive rocks exposed near Choelquoit Lake. Where movement sense could be determined these faults typically show components of normal and dextral displacement. They may be Eocene in age, and related to the east to northeast-dipping fault system that separates this same package of rocks from the Tatla Lake Metamorphic Complex a short distance to the northwest.

MINERAL OCCURRENCES

The known mineral occurrences within the Tatlayoko project area are shown on Figure 5. They are described by Riddell *et al.* (1993a) and Schiarizza *et al.* (1995a), and are

TABLE 1
SUMMARY OF MINFILE OCCURRENCES IN THE TATLAYOKO PROJECT AREA

MINFILE No.	NAME	COMMODITY	CAPSULE DESCRIPTION
092N-020	Niut Mountain	Cu, Au	A gossanous zone within pyritized volcanic rocks of unit muTv locally contains malachite, chalcopyrite and traces of gold.
092N-039	Skinner	Au, Cu	Northeast-striking gold-quartz veins, of Eocene age, occur within Trassic diorite and quartz diorite of the Mount Skinner Igneous Complex. A 172-tonne bulk sample extracted from the Victoria vein in 1992 and 1993 produced over 11 000 grams of gold and 8000 grams of silver.
092N-044	Rusty	Cu	Disseminated chalcopyrite occurs in faulted sedimentary rocks of unit muTv.
092N-056	Fly	Cu	Disseminated malachite, azurite, pyrite and chalcopyrite occur within quartz-epidote-carbonate veins and fracture fillings hosted in quartz diorite of unit LTqd and an associated body of hornblende feldspar porphyry.
092N-061	Big Slide	Au, Cu	Gold and copper mineralization occurs within a number of subparallel northwest-striking sheeted quartz veins hosted in Triassic quartz diorite of the Mount Skinner Igneous Complex.
092N-064	Anthony	Cu, Zn, Ag	Malachite, pyrite, chalcopyrite and sphalerite occur in quartz veins and silica-flooded andesite of unit muTv
092N-065	Clipboard	Cu	Disseminated malachite occurs in a small stock of granite porphyry that intrudes quartz diorite of unit LTqd.
092N-066	Kay	Cu	Disseminated malachite and azurite occur in calcite veinlets within a mafic porphyry of unit lmJv
092O-002	Knight	Au, Ag	Gold and silver occur within silicified and pyritized sedimentary rocks of the Taylor Creek Group which are intruded by dikes and stocks of Late Cretaceous diorite and hornblende feldspar porphyry
92O-027	Vick	Au, Cu, Ag	Pyrite, chalcopyrite, malachite, azurite and iron carbonates occur within quartz veins that follow a northeast-striking shear zone cutting volcanic rocks of the Upper Cretaceous Powell Creek formation.
92O-041	Fish Lake	Cu, Au, Ag, Mo, Zn	Porphyry Cu-Au mineralization occurs within and adjacent to a Late Cretaceous quartz diorite stock and associated quartz feldspar porphyry dikes, which intrude Lower Cretaceous(?) andesitic volcanic rocks and a pre-mineralization diorite plug. Geological reserves are 1148 million tonnes averaging 0.22 % Cu and 0.41 g/t Au.

summarized in Table 1. The present study has provided insights into the age and genesis of several of these occurrences, as described in the following sections.

FISH LAKE PORPHYRY COPPER - GOLD DEPOSIT (MINFILE 92O-041)

The Fish Lake porphyry copper-gold deposit is located in an area of virtually no bedrock exposure about 5 kilometres east of the Taseko River (Figure 5). Recent summaries of the geology of the deposit are provided by Riddell *et al.* (1993a) and Caira *et al.* (1993, 1995), who report geological reserves of 1148 million tonnes at an average grade of 0.22% Cu and 0.41 g/t Au. The Fish Lake deposit is spatially and genetically related to a steeply dipping lenticular body of porphyritic quartz diorite which is surrounded by an east-west elongate complex of steep, southerly dipping, subparallel quartz feldspar porphyry dikes. These rocks, referred to as the Fish Lake Intrusive Complex, cut volcanic and volcaniclastic rocks as well as an older intrusive body of porphyritic diorite, which may be coeval with the volcanics. Mineralization occurs within both the intrusive complex and adjacent volcanic, volcaniclastic and plutonic country rocks.

A core sample of hornblende-quartz-feldspar porphyry from the Fish Lake Intrusive Complex was collected in 1992 and submitted to the Geochronology Laboratory at the University of British Columbia for U-Pb dating of zircons. Two zircon fractions define a discordia line with a lower intercept of about 80 Ma, which is interpreted as the probable age of the syn-mineralization intrusion (J. E. Gabites, written communication, 1993). This is consistent with a previous whole-rock K-Ar date of 77.2±2.8 Ma obtained from a hornfels containing 40% secondary biotite, which was interpreted as the date of mineralization (Wolfhard, 1976). The volcanic rocks which host the Fish Lake Intrusive Complex and associated mineralization are not dated at the deposit, but are possibly Hauterivian in age, based on correlation with volcanics of the Fish Creek succession just to the west, which are also intruded by small stocks and dikes of hornblende-quartz-feldspar porphyry that may be related to the Fish Lake Intrusive Complex (Fish Lake - Cone Hill intrusive suite of Riddell *et al.*, 1993a, b). This correlation suggests that the host volcanics and syn-mineralization intrusions represent completely different magmatic episodes separated by 40 to 50 million years, in contrast to earlier suspicions that they might be related (Wolfhard, 1976).

AGE AND STRUCTURAL CONTROL OF THE SKINNER GOLD-QUARTZ VEIN SYSTEM

The Skinner gold-quartz vein system occurs within early Late Triassic quartz diorite and diorite of the Mount Skinner Igneous Complex, 5 kilometres north of the north end of Tatlayoko Lake (Figure 5). It is a system of en echelon veins within a presumably structurally controlled lineament that trends 070° (Berniolles, 1991). Work to date has been concentrated on the Victoria vein, at the southwest end of the system, which strikes between 050° and 060° and dips steeply to the northwest. A 172-tonne bulk sample extracted from the vein by Ottarasko Mines Limited in 1992 and 1993 produced over 11 000 grams of gold (average grade 65.83 g/t) and 8000 grams of silver (Meyers, 1993, 1994; Schroeter, 1994).

The Victoria vein has been traced for more than 130 metres. It pinches and swells, locally attaining a thickness of 1.4 metres. The vein walls are defined by slickensided faults, and the veins themselves are cut by parallel faults, at least some of which accommodated sinistral movement. Clay gouge commonly occurs along the vein walls, and sericite and chlorite occur locally along fault surfaces. The vein consists almost entirely of quartz, with minor amounts of pyrite, chalcopyrite, malachite and rare visible gold. Gold values are variable, and concentrations as high as 136 grams per tonne across 0.65 metre have been recorded (Berniolles, 1991). Copper shows little relationship to gold, and is locally concentrated in the wallrock adjacent to the vein.

White mica locally lines vugs and open fractures in quartz of the Victoria vein. A sample provided by Louis Berniolles in 1994 was submitted to the Geochronology Laboratory at the University of British Columbia for K-Ar dating of the mica. The mica separate has recently yielded a preliminary Early to Middle Eocene date of 50 to 54 Ma (J. Mortensen, personal communication, 1995). This provides a minimum age for the vein and most likely dates the late stages of the hydrothermal system responsible for the veining. If this interpretation is correct, then the veining was coincident with dextral movement along the Yalakom fault, which is just 5 kilometres northeast of the Skinner occurrence. This suggests that the Skinner vein system formed along an antithetic sinistral fault system related to the Yalakom fault, although its orientation is slightly more easterly than would be expected for antithetic riedel shears in an ideal simple shear model (*e.g.* Wilcox *et al.*, 1973). The Lingfield Creek and Cheshi Creek faults to the southeast may have had a similar origin, but are likewise oriented slightly more easterly than would be expected. These departures may reflect varying degrees of clockwise rotation in the structural blocks southwest of the Yalakom fault, as is suggested by the structural analysis of Umhoefer and Kleinspehn (1995), who relate this block rotation to the area's position between the Tchaikazan and Yalakom faults.

MINERAL OCCURRENCES OF NIUT DOMAIN

The rocks of the Niut domain contain a higher density of mineral occurrences than rocks elsewhere in the Tatlayoko project area (Figure 5). Most of the exploration work to date has been concentrated on the Fly occurrence (MINFILE 92N-056), about 4 kilometres southeast of Niut Mountain. Most of the mineralization occurs in the Ridge zone, which extends for more than 200 metres within quartz diorite of the Niut Mountain pluton and an adjacent body of hornblende feldspar porphyry that intrudes along the contact between the quartz diorite and altered volcanic and sedimentary rocks of unit muTv to the east. It consists of malachite and azurite, with lesser amounts of pyrite and chalcopyrite, that occur as disseminations and as a minor component of quartz-epidote-carbonate veins and fracture fillings. A pyrite halo is developed mainly within altered volcanic rocks to the east of the intrusions. The intrusive and volcanic rocks display a predominantly vein-controlled propyllitic alteration suite of epidote-chlorite-sericite±silica±carbonate.

The Triassic rocks of Niut domain host four other mineral occurrences that contain disseminated or fracture-controlled pyrite, chalcopyrite and malachite, either within the Niut Mountain pluton or in bordering volcanic and sedimentary rocks. An additional four occurrences are known in the same belt, 1 to 7 kilometres northwest of the Tatlayoko project area, and other occurrences of malachite are scattered throughout the Niut Mountain pluton and bordering volcanic rocks. These showings probably represent a series of porphyry-style mineralizing systems within and adjacent to the Niut Mountain pluton. The Mount Moore formation, which hosts the pluton and much of the mineralization, is correlated by Rusmore and Woodsworth (1991a) with the Upper Triassic Stuhini Group, which comprises part of the Stikine Terrane in northern British Columbia. This correlation is strengthened by the association of the Niut Mountain pluton with the Mount Moore formation, as plutons of similar age intrude the Stuhini Group and are locally responsible for porphyry-style mineralization. This relationship is exemplified by the Hickman batholith, which was emplaced into the Stuhini Group at about 220 Ma, and is genetically related to the Schaft Creek porphyry deposit which is hosted mainly by Stuhini volcanic rocks (Spilsbury, 1995). This correlation also sheds a favourable light on the mineral potential of the Niut domain, as Schaft Creek is one of the largest calcalkaline porphyry deposits known within the Canadian Cordillera (McMillan *et al.*, 1995).

SUMMARY OF MAIN CONCLUSIONS

The following points summarize some of the main contributions that the Tatlayoko mapping program has made toward an improved understanding of the geology and mineral occurrences of the project area.

- Rocks of the Bridge River Complex had not been recognized within the map area prior to this study. Their presence in a narrow belt bounding the Relay Mountain and Taylor Creek groups north of Mount Tatlow suggests that Bridge River Terrane underlies the main outcrop belt of the Jura-Cretaceous Tyaughton basin from Tyaughton Creek northwestward to the Nemaia valley.
- Rocks of the Upper Triassic Hurley Formation (Cadwallader Terrane) had not been recognized within the map area prior to this study. They, together with overlying Jurassic rocks of the Junction Creek unit, are now mapped in a belt that extends for 35 kilometres within and south of the Nemaia valley.
- Upper Triassic and Lower to Middle Jurassic rocks that outcrop between the Nemaia valley and Tatlayoko Lake had previously been assigned to the Cadwallader Terrane (*e.g.* Wheeler *et al.*, 1991). These rocks are here assigned to the Methow Terrane, based mainly on the lithologic characteristics of the Middle Jurassic portion of the Huckleberry formation. These strata are characterized by thick beds of volcanic-derived sandstone and granule conglomerate, as well as local occurrences of andesitic breccias, tuffs and flows, within a succession of predominantly siltstones, shales and fine-grained sandstones. They are readily correlated with the age-equivalent Dewdney Creek Formation of Methow Terrane (O'Brien, 1986, 1987; Mahoney, 1993), but are distinct from the Middle Jurassic portion of the Cadwallader Terrane, which is predominantly shale with no coarser clastics and no volcanic rocks (Umhoefer, 1990; Schiarizza *et al.*, 1993b).
- The Upper Triassic rocks of units us and ucg, which apparently underlie the Huckleberry formation, are not recognized within Methow Terrane anywhere to the southeast. These rocks do resemble, in some respects, the Upper Triassic Tyaughton Group of the Cadwallader Terrane, which includes a redbed sequence of conglomerates and sandstones containing volcanic and plutonic clasts, as well as overlying nonmarine to shallow-marine clastic rocks that include a similar *Cassianella* fauna to the one collected from unit us on the east side of Tatlayoko Lake (Tipper, 1969a). This, in combination with their mutual association with late Paleozoic ophiolitic rocks farther to the south (Ray, 1986, 1990; Schiarizza and Garver, 1995), suggests that the Cadwallader and Methow terranes may represent different parts of a single intra-oceanic arc-basin complex.
- Quartz diorite and tonalite of the Mount Skinner Igneous Complex have yielded Middle to Late Triassic U-Pb zircon dates. These plutonic rocks were previously thought to be younger, and intrusive into Triassic and Jurassic rocks now included in Methow Terrane. They are now interpreted as part of the basement on which these Late Triassic and Jurassic sedimentary sequences were deposited. Their uplift and erosion reflects an important pulse of Late Triassic tectonism within Methow Terrane.
- The Jura-Cretaceous Relay Mountain Group rests stratigraphically above Methow Terrane east of Tatlayoko Lake. In its type area, about 100 kilometres to the southeast, the Relay Mountain Group is inferred to overlie Bridge River Terrane, although locally preserved remnants may also be above Cadwallader Terrane (Schiarizza and Garver, 1995). It therefore constitutes an overlap assemblage that ties Bridge River, Cadwallader and Methow terranes together by latest Middle Jurassic time. This linkage closely follows a protracted episode of Triassic to latest Middle Jurassic accretion-subduction style deformation within the Bridge River Complex (Cordey and Schiarizza, 1993), as well as Triassic and Middle Jurassic arc-related magmatism within Cadwallader and Methow terranes (Rusmore, 1987; Umhoefer, 1990; Mahoney, 1993). Cadwallader and Methow terranes are therefore reasonably interpreted as part of an arc-basin system that formed in response to subduction of Bridge River oceanic crust. The present distribution of these three terranes suggests that the Bridge River Complex originated west of the Cadwallader and Methow terranes, and therefore accumulated above an east-dipping subduction zone.
- This study, in combination with MDA-funded research by P. van der Heyden and P.S. Mustard, directly to the northwest, has established that volcanic, sedimentary and plutonic rocks within Niut domain are Middle to Late Triassic in age, rather than Cretaceous as previously mapped. The volcanic and sedimentary rocks are assigned to the Mount Moore formation, which is correlated by Rusmore and Woodsworth (1991a) with the Upper Triassic Stuhini Group of Stikine Terrane. The recognition that the Niut Mountain pluton is Late Triassic strengthens this correlation, as plutons of similar age intrude the Stuhini Group.
- The geology on the southwest side of the Yalakom fault near the Nemaia valley, as mapped during the

present study, consists of fault-bounded panels derived from the Methow, Cadwallader and Bridge River terranes. This three-part structural succession is correlated with an identical structural succession truncated on the northeast side of the fault in the Camelsfoot Range (Schiarizza *et al.*, 1993b). This correlation provides a compelling estimate of about 115 kilometres of dextral offset along the Yalakom fault. It corroborates and improves an earlier estimate of 150±25 kilometres by Kleinspehn (1985), who matched facies within the Lower Cretaceous Jackass Mountain Group, which overlies Methow Terrane.

- Zircons from the Fish Lake Intrusive Complex have yielded an 80 Ma U-Pb age, which dates the Fish Lake porphyry copper-gold deposit. The host volcanic rocks were previously assumed to also be of Late Cretaceous age (Wolfhard, 1976; Tipper, 1978). Hauterivian fossils collected from the volcanic and sedimentary Fish Creek succession a short distance west of the deposit suggest, however, that the hostrocks are actually Lower Cretaceous. They are tentatively correlated with the Ottarasko and Cloud Drifter formations of the Niut domain. This correlation is consistent with a pre-Yalakom fault reconstruction based on removing the 115 kilometres of displacement which was established by independent evidence, as described above.

- Gold-quartz veins at the Skinner deposit are controlled by an east-northeast striking fault system that, at least locally, accommodated sinistral movement. White mica from the Victoria vein has yielded an Early to Middle Eocene K-Ar date. This suggests that the veining was coincident with dextral movement along the Yalakom fault, 5 kilometres to the northeast. The Skinner vein system is therefore interpreted to have formed within an antithetic riedel fault system related to Eocene displacement along the Yalakom dextral strike-slip fault.

- The highest density of mineral occurrences within the Tatlayoko project area is in Triassic rocks of the Niut domain, where porphyry-style mineralization occurs within the Mount Moore formation and adjacent intrusive rocks of the Niut Mountain pluton. Correlative rocks within Stikine Terrane include the Stuhini Group and Hickman batholith of northern British Columbia, which host the Schaft Creek porphyry deposit. This correlation sheds a favourable light on the mineral potential of the Niut domain, as Schaft Creek is one of the largest calcalkaline porphyry deposits known within the Canadian Cordillera.

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REFERENCES

Archibald, D.A., Glover, J.K. and Schiarizza, P. (1989): Preliminary Report on $^{40}Ar/^{39}Ar$ Geochronology of the Warner Pass, Noaxe Creek and Bridge River Map Areas (92O/3,2; 92J/16); *in* Geological Fieldwork 1988, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1989-1, pages 145-151.

Archibald, D.A., Schiarizza, P. and Garver, J.I. (1991): $^{40}Ar/^{39}Ar$ Evidence for the Age of Igneous and Metamorphic Events in the Bridge River and Shulaps Complexes, Southwestern British Columbia (92O/2; 92J/15, 16); *in* Geological Fieldwork 1990, *B.C. Ministry of Energy, Mines and Petroleum Resouces*, Paper 1991-1, pages 75-83.

Bernoilles, L. (1991): Prospecting Report - Skinner Group; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 22007.

Bevier, M.L. (1983): Regional Stratigraphy and Age of Chilcotin Group Basalts, South-central British Columbia; *Canadian Journal of Earth Sciences*, Volume 20, pages 515-524.

Caira, N., Findlay, A. and Riddell, J. (1993): The Fish Lake Porphyry Copper-Gold Deposit; *in* Exploration in British Columbia 1992, *B.C. Ministry of Energy, Mines and Petroleum Resources*, pages 57-67.

Caira, N.M., Findlay, A., DeLong, C. and Rebagliati, C.M. (1995): Fish Lake Porphyry Copper-Gold Deposit, Central British Columbia; *in* Porphyry Deposits of the Northwestern Cordillera of North America, Schroeter, T.G., Editor, *Canadian Institute of Mining, Metallurgy and Petroleum*, Special Volume 46, pages 327-342.

Coleman, M.E. and Parrish, R.R. (1991): Eocene Dextral Strike-slip and Extensional Faulting in the Bridge River Terrane, Southwest British Columbia; *Tectonics*, Volume 10, p. 1222-1238.

Cordey, F. and Schiarizza, P. (1993): Long-lived Panthalassic Remnant: The Bridge River Accretionary Complex, Canadian Cordillera; *Geology*, Volume 21, pages 263-266.

Diakow, L.J. and Webster, I.C.L. (1994): Geology of the Fawnie Creek Map Area (NTS 93F/3); *in* Geological Fieldwork 1993, Grant, B. and Newell, J.M., Editors, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1994-1, pages 15-26.

Diakow, L.J., Webster, I.C.L., Whittles, J.A. and Richards, T.A. (1995): Stratigraphic Highlights of Bedrock Mapping in the Southern Nechako Plateau, Northern Interior Plateau Region (NTS 93F/2 and 7); *in* Geological Fieldwork 1994, Grant, B. and Newell, J.M., Editors, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1995-1, pages 171-176.

Duffell, S. and McTaggart, K.C. (1952): Ashcroft Map Area, British Columbia; *Geological Survey of Canada*, Memoir 262, 122 pages.

Ewing, T.E. (1980): Paleogene Tectonic Evolution of the Pacific Northwest; *Journal of Geology*, Volume 88, pages 619-638.

Friedman, R.M. and Armstrong, R.L. (1988): Tatla Lake Metamorphic Complex: An Eocene Metamorphic Core Complex on the Southwestern Edge of the Intermontane Belt of British Columbia; *Tectonics*, Volume 7, pages 1141-1166.

Garver, J.I. (1989): Basin Evolution and Source Terranes of Albian-Cenomanian Rocks in the Tyaughton Basin, Southern British Columbia: Implications for Mid-Cretaceous Tectonics in the Canadian Cordillera; unpublished Ph.D. thesis, *University of Washington*, 227 pages.

Garver. J.I. (1991): Kinematic Analysis and Timing of Structures in the Bridge River Complex and Overlying Cretaceous Sedimentary Rocks, Cinnabar Creek Area, Southwestern British Columbia (92J/15); *in* Geological Fieldwork 1990, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1991-1, pages 65-74.

Garver, J.I. (1992): Provenance of Albian-Cenomanian Rocks of the Methow and Tyaughton Basins, Southern British Columbia: a Mid-Cretaceous Link between North America and the Insular Terrane; *Canadian Journal of Earth Sciences*, Volume 29, pages 1274-1295.

Glover J.K. and Schiarizza, P. (1987): Geology and Mineral Potential of the Warner Pass Map Area (92O/3); *in* Geological Fieldwork 1986, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1987-1, pages 157-169.

Glover, J.K., Schiarizza, P. and Garver, J.I. (1988a): Geology of the Noaxe Creek Map Area (92O/2); *in* Geological Fieldwork 1987, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1988-1, pages 105-123.

Glover, J.K., Schiarizza, P., Garver, J.I., Umhoefer, P.J. and Tipper, H.W. (1988b): Geology and Mineral Potential of the Noaxe Creek Map Area (92O/2); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Open File 1988-9.

Green, K.C. (1990): Structure, Stratigraphy and Alteration of Cretaceous and Tertiary Strata in the Gang Ranch Area, British Columbia; unpublished M.Sc. thesis, *University of Calgary*, 118 pages.

Hickson, C.J. (1990): A New Frontier Geoscience Project: Chilcotin-Nechako Region, Central British Columbia; *in* Current Research, Part F, *Geological Survey of Canada*, Paper 90-1F, pages 115-120.

Hickson, C.J. (1992): An Update on the Chilcotin-Nechako Project and Mapping in the Taseko Lakes Area, West-central British Columbia; *in* Current Research, Part A, *Geological Survey of Canada*, Paper 92-1A, pages 129-135.

Hickson, C.J. and Higman, S.(1993): Geology of the Northwest Quadrant, Taseko Lakes Map Area, West-central British Columbia; *in* Current Research, Part A, *Geological Survey of Canada*, Paper 93-1A, pages 63-67.

Hickson, C.J., Read, P., Mathews, W.H., Hunt, J.A., Johansson, G. and Rouse, G.E. (1991): Revised Geological Mapping of Northeastern Taseko Lakes Map Area, British Columbia; *in* Current Research, Part A, *Geological Survey of Canada*, Paper 91-1A, pages 207-217.

Hickson, C.J., Mahoney, J.B. and Read, P. (1994): Geology of Big Bar Map Area, British Columbia: Facies Distribution in the Jackass Mountain Group; *in* Current Research 1994-A; *Geological Survey of Canada*, pages 143-150.

Jeletzky, J.A. (1968): Stratigraphy and Palaeontology of Lower Cretaceous and Upper Jurassic Rocks of Northeastern Corner of Mount Waddington Map-area, British Columbia (92N); *in* Report of Activities, Part A, *Geological Survey of Canada*, Paper 68-1A, pages 103-106.

Jeletzky, J.A. (1971): Cretaceous and Jurassic Stratigraphy of some Areas of Southwestern British Columbia; *in* Report of Activities, Part A, *Geological Survey of Canada*, Paper 71-1A, pages 221-227.

Jeletzky, J.A. and Tipper, H.W. (1968): Upper Jurassic and Cretaceous Rocks of Taseko Lakes Map Area and their Bearing on the Geological History of Southwestern British Columbia; *Geological Survey of Canada*, Paper 67-54, 218 pages.

Journeay, J.M. (1990): A Progress Report on the Structural and Tectonic Framework of the Southern Coast Belt, British Columbia; *in* Current Research, Part E, *Geological Survey of Canada*, Paper 90-1E, pages 183-195.

Journeay, J.M. (1993): Tectonic Assemblages of the Eastern Coast Belt, Southwestern British Columbia: Implications for the History and Mechanisms of Terrane Accretion; *in* Current Research, Part A, *Geological Survey of Canada*, Paper 93-1A, pages 221-233.

Journeay, J.M. and Csontos, L. (1989): Preliminary Report on the Structural Setting along the Southeast Flank of the Coast Belt, British Columbia; *in* Current Research, Part E, *Geological Survey of Canada*, Paper 89-1E, pages 177-187.

Journeay, J.M. and Friedman, R.M. (1993): The Coast Belt Thrust System: Evidence of Late Cretaceous Shortening in Southwest British Columbia; *Tectonics*, Volume 12, pages 756-775.

Journeay, J.M. and Northcote, B.R. (1992): Tectonic Assemblages of the Eastern Coast Belt, Southwest British Columbia; *in* Current Research, Part A, *Geological Survey of Canada*, Paper 92-1A, pages 215-224.

Journeay, J.M., Sanders, C., Van-Konijnenburg, J.-H. and Jaasma, M. (1992): Fault Systems of the Eastern Coast Belt, Southwest British Columbia; *in* Current Research, Part A, *Geological Survey of Canada*, Paper 92-1A, pages 225-235.

Kleinspehn, K.L. (1985): Cretaceous Sedimentation and Tectonics, Tyaughton-Methow Basin, Southwestern British Columbia; *Canadian Journal of Earth Sciences*, Volume 22, pages 154-174.

Leech, G.B. (1953): Geology and Mineral Deposits of the Shulaps Range; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Bulletin 32, 54 pages.

MacKenzie, J.D. (1921): A Reconnaissance between Taseko Lake and Fraser River, British Columbia; *in* Summary Report, 1920, Part A, *Geological Survey of Canada*, pages 70-81.

Mahoney, J.B. (1993): Facies Reconstructions in the Lower to Middle Jurassic Ladner Group, Southern British Columbia; *in* Current Research, Part A, *Geological Survey of Canada*, Paper 93-1A, pages 173-182.

Mathews, W.H. (1989): Neogene Chilcotin Basalts in South-central British Columbia: Geology, Ages, and Geomorphic History; *Canadian Journal of Earth Sciences*, Volume 26, pages 969-982.

McGroder, M.F. (1989): Structural Geometry and Kinematic Evolution of the Eastern Cascades Foldbelt, Washington and British Columbia; *Canadian Journal of Earth Sciences*, Volume 26, pages 1586-1602.

McLaren, G.P. (1990): A Mineral Resource Assessment of the Chilko Lake Planning Area; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Bulletin 81, 117 pages.

McLaren, G.P. and Rouse, J.N. (1989): Geology and Geochemistry of the Taseko Lakes Area (92O/3,4,5,6); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Open File 1989-25.

McMillan, W.J., Thompson, J.F.H., Hart, C.J.R. and Johnston, S.T. (1995): Regional Geological and Tectonic Setting of Porphyry Deposits in British Columbia and Yukon Territory; *in* Porphyry Deposits of the Northwestern Cordillera of North America, Schroeter, T.G., Editor, *Canadian Institute of Mining, Metallurgy and Petroleum*, Special Volume 46, pages 40-57.

Meyers, R.E. (1993): South-Central District; *in* Exploration in British Columbia 1992, *B.C. Ministry of Energy, Mines and Petroleum Resources*, pages 35-44.

Meyers, R.E. (1994): South-Central Region; *in* Exploration in British Columbia 1993, *B.C. Ministry of Energy, Mines and Petroleum Resources*, pages 43-46.

Monger, J.W.H. (1985): Structural Evolution of the Southwestern Intermontane Belt, Ashcroft and Hope Map Areas, British Columbia; *in* Current Research, Part A, *Geological Survey of Canada*, Paper 1985-1A, pages 349-358.

Monger, J.W.H. and McMillan, W.J. (1989): Geology, Ashcroft, British Columbia (92I); *Geological Survey of Canada*, Map 42-1989, sheet 1, 1:250 000 scale.

Mustard, P.S. and van der Heyden, P. (1994): Stratigraphy and Sedimentology of the Tatla Lake - Bussel Creek Map Areas, West-central British Columbia; *in* Current Research 1994-A, *Geological Survey of Canada,* pages 95-104.

Mustard, P.S. and van der Heyden, P. (1996): Geology of Tatla Lake (92N/15) and the East Half of Bussel Creek (92N/14) Map Areas; *in* Interior Plateau Geoscience Project: Summary of Geological, Geochemical and Geophysical Studies, Newell, J.M. and Diakow, L.J., Editors, *B.C. Ministry of Employment and Investment*; Paper 1997-2, this volume.

Mustard, P.S., van der Heyden, P. and Friedman, R. (1994): Preliminary Geologic Map, Tatla Lake - Bussel Creek (East Half), NTS 92N/15, 92N/14 (East Half); *Geological Survey of Canada,* Open File 2957, 1:50 000 scale.

O'Brien, J. (1986): Jurassic Stratigraphy of the Methow Trough, Southwestern British Columbia; *in* Current Research, Part B, *Geological Survey of Canada*, Paper 86-1B, pages 749-756.

O'Brien, J.A. (1987): Jurassic Biostratigraphy and Evolution of the Methow Trough, Southwestern British Columbia; unpublished M.Sc. thesis, *University of Arizona*, 150 pages.

Potter, C.J. (1986): Origin, Accretion and Post-accretionary Evolution of the Bridge River Terrane, Southwest British Columbia; *Tectonics*, Volume 5, pages 1027-1041.

Price, R.A. (1979): Intracontinental Ductile Crustal Spreading Linking the Fraser River and Northern Rocky Mountain Trench Transform Fault Zones, South-central British Columbia and Northeast Washington; *Geological Society of America*, Abstracts with Programs, Volume 11, p. 499.

Price, R.A. and Carmichael, D.M. (1986): Geometric Test for Late Cretaceous-Paleogene Intracontinental Transform Faulting in the Canadian Cordillera; *Geology*, Volume 14, pages 468-471.

Ray, G.E. (1986): The Hozameen Fault System and Related Coquihalla Serpentine Belt of Southwestern British Columbia; *Canadian Journal of Earth Sciences*, Volume 23, pages 1022-1041.

Ray, G.E. (1990): The Geology and Mineralization of the Coquihalla Gold Belt and Hozameen Fault System, Southwestern British Columbia; *B.C. Ministry of Energy, Mines and Petroleum Resources,* Bulletin 79, 97 pages.

Rice, H.M.A. (1947): Geology and Mineral Deposits of the Princeton Map Area, British Columbia; *Geological Survey of Canada,* Memoir 234, 136 pages.

Riddell, J., Schiarizza, P., Gaba, R.G., Caira, N. and Findlay, A. (1993a): Geology and Mineral Occurrences of the Mount Tatlow Map Area (92O/5, 6, and 12); *in* Geological Fieldwork 1992, Grant, B. and Newell, J.M., Editors, *B.C. Ministry of Energy, Mines and Petroleum Resources,* Paper 1993-1, pages 37-52.

Riddell, J., Schiarizza, P., Gaba, R., McLaren, G. and Rouse, J. (1993b): Geology of the Mount Tatlow Map Area (92O/5, 6, 12); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Open File 1993-8.

Roddick, J.A. and Hutchison, W.W. (1973): Pemberton (East Half) Map Area, British Columbia; *Geological Survey of Canada*, Paper 73-17, 21 pages.

Rusmore, M.E. (1987): Geology of the Cadwallader Group and the Intermontane-Insular Superterrane Boundary, Southwestern British Columbia; *Canadian Journal of Earth Sciences*, Volume 24, pages 2279-2291.

Rusmore, M.E. and Woodsworth, G.J. (1991a): Distribution and Tectonic Significance of Upper Triassic Terranes in the Eastern Coast Mountains and adjacent Intermontane Belt, British Columbia; *Canadian Journal of Earth Sciences*, Volume 28, pages 532-541.

Rusmore, M.E. and Woodsworth, G.J. (1991b): Coast Plutonic Complex: A Mid-Cretaceous Contractional Orogen; *Geology*, Volume 19, pages 941-944.

Rusmore, M.E. and Woodsworth, G.J. (1993): Geological Maps of the Mt. Queen Bess (92N/7) and Razorback Mountain (92N/10) Map Areas, Coast Mountains, British Columbia; *Geological Survey of Canada*, Open File 2586, 2 sheets, 1:50 000 scale.

Rusmore, M.E., Potter, C.J. and Umhoefer, P.J. (1988): Middle Jurassic Terrane Accretion along the Western Edge of the Intermontane Superterrane, Southwestern British Columbia; *Geology*, Volume 16, pages 891-894.

Schiarizza, P. (1996): Tatlayoko Project Update (92N/8, 9, 10; 92O/ 5, 6, 12) *in* Geological Fieldwork 1995, Grant, B. and Newell, J.M., Editors, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1996-1, pages 77-94.

Schiarizza, P. and Garver, J.I. (1995): Guide to the Geology and Tectonic Evolution of the Bridge River Area, Southeastern Coast Belt, Southwestern British Columbia; a guide to accompany days 2 and 3 of Field Trip A5, *Geological Association of Canada - Mineralogical Association of Canada*, Annual Meeting, Victoria, B.C., 87 pages.

Schiarizza, P., Gaba, R.G., Glover, J.K. and Garver, J.I. (1989): Geology and Mineral Occurrences of the Tyaughton Creek Area (92O/2, 92J/15,16); *in* Geological Fieldwork 1988, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1989-1, pages 115-130.

Schiarizza, P., Gaba, R.G., Coleman, M., Garver, J.I. and Glover, J.K. (1990): Geology and Mineral Occurrences of the Yalakom River Area (92O/1,2; 92J/15,16); *in* Geological Fieldwork 1989, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1990-1, pages 53-72.

Schiarizza, P., Gaba, R.G., Garver, J.I., Glover, J.K., Macdonald, R.W.J., Archibald, D.A., Lynch, T., Safton, K.E., Sajgalik, P.P., Calon, T., Malpas, J. and Umhoefer, P.J. (1993a): Geology of the Bralorne (North Half) and Northeastern Dickson Range Map Areas (92J/14, 15); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geoscience Map 1993-7.

Schiarizza, P., Gaba, R.G., Coleman, M.E., Glover, J.K., Macdonald, R.W.J., Garver, J.I., Archibald, D.A., Lynch, T. and Safton, K.E. (1993b): Geology of the Bridge River Map Area (92J/16); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geoscience Map 1993-8.

Schiarizza, P., Glover, J.K., Garver, J.I., Umhoefer, P.J., Gaba, R.G., Riddell, J.M., Payne, D.F., Macdonald, R.W.J., Lynch, T., Safton, K.E. and Sajgalik, P.P. (1993c): Geology of the Noaxe Creek and Southwestern Big Bar Creek Map Areas (92O/1, 2); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geoscience Map 1993-9.

Schiarizza, P., Glover, J.K., Umhoefer, P.J., Garver, J.I., Handel, D., Rapp, P., Riddell, J.M. and Gaba, R.G. (1993d): Geology and Mineral Occurrences of the Warner Pass Map Area (92O/3); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Geoscience Map 1993-10.

Schiarizza, P., Melville, D.M., Riddell, J., Jennings, B.K., Umhoefer, P.J. and Robinson, M.J. (1995a): Geology and Mineral Occurrences of the Tatlayoko Lake Map Area (92N/8, 9 and 10); *in* Geological Fieldwork 1994, Grant, B. and Newell, J.M., Editors, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1995-1, pages 297-320.

Schiarizza, P., Melville, D.M. and Jennings, B.K. (1995b): Geology, Mineral Occurrences and Geochemistry of the Tatlayoko Lake Map Area (92N/8, 9, 10); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Open File 1995-7, 2 sheets, 1:50 000 and 1:100 000 scale.

Schroeter, T.G. (1994): British Columbia Mining, Exploration and Development, 1993 Highlights; *in* Exploration in British Columbia 1993, *B.C. Ministry of Energy, Mines and Petroleum Resources*, pages 1-29.

Spilsbury, T.W. (1995): The Schaft Creek Copper-Molybdenum-Gold-Silver Porphyry Deposit, North-western British Columbia; *in* Porphyry Deposits of the Northwestern Cordillera of North America, Schroeter, T.G., Editor, *Canadian Institute of Mining, Metallurgy and Petroleum*, Special Volume 46, pages 239-246.

Struik, L.C. (1993): Intersecting Intracontinental Tertiary Transform Fault Systems in the North American Cordillera; *Canadian Journal of Earth Sciences*, Volume 30, pages 1262-1274.

Tipper, H.W. (1969a): Mesozoic and Cenozoic Geology of the Northeastern Part of Mount Waddington Map Area (92N), Coast District, British Columbia; *Geological Survey of Canada*, Paper 68-33.

Tipper, H.W. (1969b): Geology, Anahim Lake; *Geological Survey of Canada*, Map 1202A.

Tipper, H.W. (1978): Taseko Lakes (92O) Map Area; *Geological Survey of Canada*, Open File 534.

Thorkelson, D.J. (1985): Geology of the Mid-Cretaceous Volcanic Units near Kingsvale, Southwestern British Columbia; *in* Current Research, Part B, *Geological Survey of Canada*, Paper 85-1B, pages 333-339.

Umhoefer, P.J. (1990): Stratigraphy and Tectonic Setting of the Upper Part of the Cadwallader Terrane, Southwestern British Columbia; *Canadian Journal of Earth Sciences*, Volume 27, pages 702-711.

Umhoefer, P.J. and Kleinspehn, K.L. (1995): Mesoscale and Regional Kinematics of the Northwestern Yalakom Fault System: Major Paleogene Dextral Faulting in British Columbia, Canada; *Tectonics*, Volume 14, pages 78-94.

Umhoefer, P.J. and Schiarizza, P. (1993): Timing and Offset on Strike-slip Faults in the SE Coast Belt, B.C. and WA, and 40-80 Ma Fault Reconstructions; *Geological Society of America*, Abstracts with Programs, Volume 25, page 156.

Umhoefer, P.J. and Tipper, H.W. (1991): Stratigraphic Studies of Lower to Middle Jurassic Rocks in the Mt. Waddington and Taseko Lakes Map Areas, British Columbia; *in* Current Research, Part A, *Geological Survey of Canada*, Paper 91-1A, pages 75-78.

Umhoefer, P.J., Rusmore, M.E. and Woodsworth, G.J. (1994): Contrasting Tectono-stratigraphy and Structure in the Coast Belt near Chilko Lake, British Columbia: Unrelated Terranes or an Arc - Back-arc Transect?; *Canadian Journal of Earth Sciences,* Volume 31, pages 1700-1713.

van der Heyden, P., Mustard, P.S. and Friedman, R. (1994a): Northern Continuation of the Eastern Waddington Thrust Belt and Tyaughton Trough, Tatla Lake - Bussel Creek Map Areas, West-central British Columbia; *in* Current Research 1994-A; *Geological Survey of Canada*, p. 87-94.

van der Heyden, P., Calderwood, A. and Huntley, D.H. (1994b): Preliminary Geologic Map, Charlotte Lake - Junker Lake (East Half), NTS 93C/3, 93C/4 (East Half); *Geological Survey of Canada*, Open File 2919, 1:50 000 scale.

Wheeler, J.O., Brookfield, A.J., Gabrielse, H., Monger, J.W.H., Tipper, H.W. and Woodsworth, G.J. (1991): Terrane Map of the Canadian Cordillera; *Geological Survey of Canada*, Map 1713A, 1:2 000 000 scale.

Wilcox, R.E., Harding, T.P. and Seely, D.R. (1973): Basic Wrench Tectonics; *American Association of Petroleum Geologists*, Bulletin, Volume 57, pages 74-96.

Wolfhard, M.R. (1976): Fish Lake; *in* Porphyry Deposits of the Canadian Cordillera, Sutherland Brown, A., Editor, *Canadian Institute of Mining and Metallurgy*, Special Volume 15, pages 317-322.

Wynne, P.J., Irving, E., Maxson, J.A. and Kleinspehn, K.L. (1995): Paleomagnetism of the Upper Cretaceous Strata of Mount Tatlow: Evidence for 3000 km of Northward Displacement of the Eastern Coast Belt, British Columbia; *Journal of Geophysical Research*, Volume 100, pages 6073-6091.