Geology and Mineral Occurrences of the Upper Iskut River Area: Tracking the Eskay Rift through Northern British Columbia (Telegraph Creek NTS 104G/1, 2; Iskut River NTS 104B/9, 10, 15, 16)

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INTRODUCTION

The Eskay Creek gold-silver mine, located in northwest British Columbia, is the highest-grade precious-metal volcanogenic massive sulphide deposit in the world. The mining industry continues to spend more than $2 million each year on exploration for similar deposits in the area. The geologic setting at the minesite is well studied, but large tracts in north-central British Columbia require more detailed surveys to determine if favourable sites exist for formation and preservation of additional deposits. In 2003, the British Columbia Geological Survey and the Geological Survey of Canada launched a two-year mapping program to delineate the ore horizon through the region north of the mine, and to assess potential for additional Eskay Creek type deposits. This horizon lies within Lower to Middle Jurassic, arc-related, rift sequence rocks along the northwest perimeter of the Bowser Basin, a large (48,000 km^2) Middle Jurassic to Early Cretaceous sedimentary basin (Fig. 1).

The field portion of the project has now covered 1,300 km^2, extending 125 km north from the Eskay Creek mine to the Red Chris deposit (Fig. 2). The paved Stewart-Cassiar Highway (Highway 37) runs northward along the eastern edge of the map area. In 2003, the first field season, an eight-person team mapped 70 km along the rift sequence between Kinaskan Lake and More Creek (Fig. 2). In 2004, three geologists mapped 40 km along the rift sequence between More Creek and Palmiere (Volcano) Creek. Ongoing work will include compilation from published sources and completion of two final 1:50,000-scale maps and one 1:100,000-scale map, scheduled for release in 2005.

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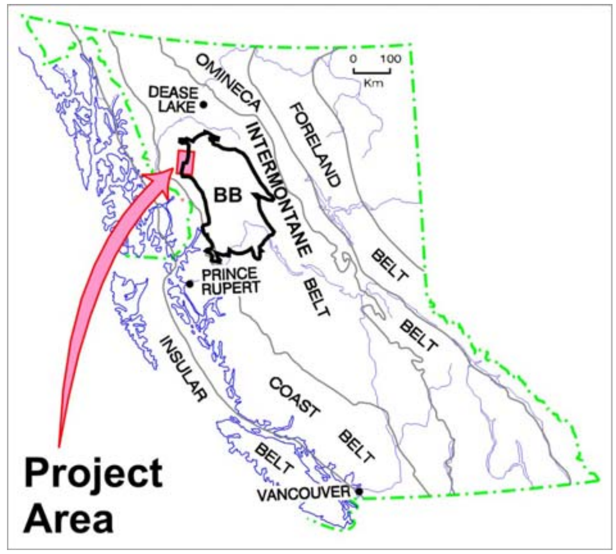


Figure 1. Project location map showing Bowser Basin (BB). Modified from Logan (2000).

The project area straddles the eastern edge of the Coast Mountains and the broad valley of the upper Iskut River. This area lies within the Tahltan First Nation traditional area and they participated directly in this project. Topography varies from rounded glacial valleys along the upper Iskut River, to the extensive Spatsizi Plateau, to high serrated ridges and peaks that are being actively glaciated. Elevations range from 250 m above sea level at the confluence of Iskut River and Forrest Kerr Creek, up to 2,662 m at the summit of Hankin Peak in the west-central region of the field area. Mount Edziza can be seen rising to 2780 m near the northern boundary of the study area. Vegetation comprises boreal spruce-pine-fir forest at low elevations. Timberline is at 1400 m elevation with subalpine fir and meadow areas above.

Regional-scale geology maps and reports for this area include Operation Stikine (1957), Souther (1972), Read *et al.* (1989), Evenchick (1991), Logan *et al.* (1990, 1992, 1993, 1997, 2000), Gunning (1996), Ash *et al.* (1995, 1996, 1997a, 1997b) and Evenchick *et al.* (2002) (Fig. 2). Detailed geological maps are available in theses by Schmitt (1977) and Kaip (1997) and in many company assessment reports cited in ARIS and MINFILE. The most recent and most comprehensive study of the Eskay Creek orebodies is the PhD thesis by Tina Roth (2002) which offers an extensive bibliography of all previous reports on the deposit, including many progress reports and final reports that were part of the Iskut Metallogeny Project of the Mineral Deposits Research Unit at the University of British Columbia (Macdonald *et al.*, 1996).

Anderson (1993) interpreted the present study area as the northern extension of a large fault-bounded belt or rift. Sections of this rift have been mapped at 1:50,000 scale by Read (1991), Logan *et al.* (1990, 1992, 1993) and Ash *et al.* (1997b). The current project will complete 1:50,000-scale coverage between these earlier mapping projects, with more detailed mapping of the strata of the upper Hazelton Group, and detailed stratigraphic investigations within the Eskay Rift (e.g. Simpson and Nelson, 2004; Barresi *et al.*, this volume). The federal and provincial governments have jointly funded this study as part of the "Bowser Basin Energy and Mineral Resource Potential Targeted Geoscience Initiative".

REGIONAL GEOLOGIC SETTING

The project area lies on the western edge of the Intermontane Tectonic Belt, within Stikine terrane, and is bounded to the east by the Bowser sedimentary basin (Fig. 1). It straddles the tectonic elements of the Bowser structural basin and the Stikine Arch to the northwest.

Souther (1972) and Logan *et al.* (2000) describe the geological history of the area as a series of five mid-Paleozoic to mid-Mesozoic volcanic arcs developed in sediment-poor and sediment-rich marine settings. Lulls in volcanism at the Triassic-Jurassic boundary and in the uppermost Lower Jurassic were marked by tectonic uplift, deformation and erosion, termed the Inklinian and Nassian orogenies respectively (Souther, 1972).

Strata range in age from Devonian to Holocene (Fig. 3). The major stratigraphic units exposed within the project area are the Paleozoic Stikine Assemblage, Triassic Stuhini Group, Lower to Middle Jurassic Hazelton Group, Jurassic-Cretaceous Bowser Lake Group and Pleistocene Mount Edziza Complex. The Stikine Assemblage was defined by a Geological Survey of Canada team (Operation Stikine, 1957) and has most recently been described by Logan *et al.* (2000). It consists of Early Devonian to mid-Permian volcanic and sedimentary strata, characterized by thick carbonate members. The Upper Triassic Stuhini Group typically consists of pyroxene porphyritic basalt flows and breccias with intercalated clastic sedimentary rocks and minor carbonate units. The Early to Middle Jurassic Hazelton Group is an island arc succession composed of a lower package of intermediate volcanic rocks and derived clastic sedimentary units; a middle interval of thin, but widely distributed felsic volcanic rocks; and an upper unit of fine clastic sedimentary rocks with local bimodal volcanic rocks dominated by basalt.

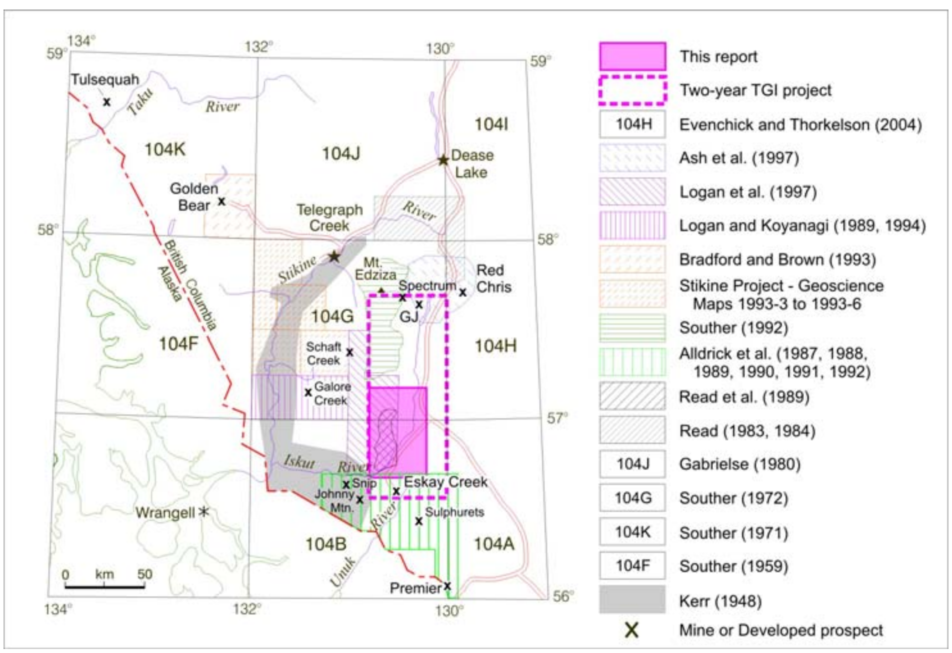


Figure 2. Current project outline and previous geologic mapping. Modified from Logan (2000).

Carbonate units are rare or absent in Hazelton Group strata. The Middle Jurassic to Early Cretaceous Bowser Lake Group is a thick, clastic marine sedimentary succession. Miocene to Recent volcanic strata from the Mount Edziza volcanic complex blanket the northwest part of the project area.

Regional-scale unconformities within the study area include a Late Permian - Early Triassic unconformity, a Late Triassic - Early Jurassic angular unconformity and nonconformity, and a late Early Jurassic angular unconformity.

Logan *et al.* (2000) describe five plutonic episodes in the area (Middle to Late Triassic Stikine; Late Triassic to Early Jurassic Copper Mountain; Early Jurassic Texas Creek; Middle Jurassic Three Sisters; Eocene Hyder). The four youngest plutonic suites generated important mineral deposits.

To the south, mid-Cretaceous regional metamorphism reached a maximum grade of lower greenschist facies (Alldrick, 1993). In the current field area, chlorite is rare to absent and prehnite is present, thus the regional metamorphic grade is interpreted as sub-greenschist, mid-prehnite-pumpellyite facies (Alldrick *et al.*, 2004).

GEOLOGY OF THE MAP AREA

Mapping in the 2004 field season covered Paleozoic to Middle Jurassic strata at the southern end of the two-year project area (Fig. 2). Several topographic features in this year's map area have been informally named to simplify description of locations (Fig. 4). Simplified geology of the 2004 map area is presented in Figure 5. Age control is provided by fossil collections from Souther (1972), Read *et al.* (1989), Logan *et al.* (2002) and Evenchick *et al.* (2001), and by isotopic age dates tabulated in the new BCAge database (Breitsprecher and Mortensen, 2004).

Stratified Rocks

STIKINE ASSEMBLAGE (MIDDLE TO UPPER PALEOZOIC)

Volcanic and carbonate upper Paleozoic strata of the Stikine Assemblage were mapped in this year's survey. A large tract of complexly faulted Permian, Triassic and Jurassic strata crops out immediately north of Pillow Basalt Ridge, underlying a well glaciated spine called Sixpack Range (Fig. 4 and 5). The strata are emplaced along a series of south verging thrust faults that stack Paleozoic to Jurassic stratigraphic successions into three repetitions (Fig. 5).

Stikine Assemblage rock types exposed in this area include green chloritic tuff, lapilli tuff, massive andesitic to dacitic feldspar-porphyritic flows, massive and flow-banded dacite and rhyolite, pillow basalt, tuffaceous and siliceous siltstone, ribbon chert and several thin, highly recrystallized white carbonate beds. These rocks are all interpreted to be Permian age.

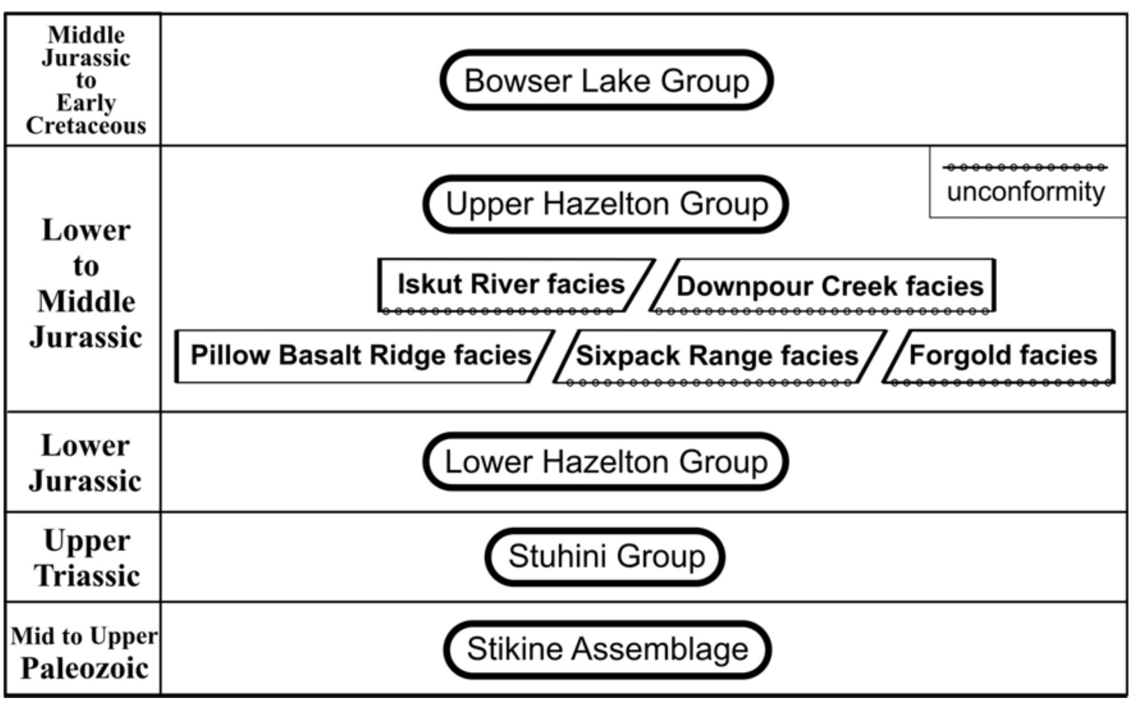


Figure 3. Schematic regional stratigraphy of the 2004 map area.

Permian strata are strongly foliated everywhere and multiple generations of foliation are apparent in most outcrops. Thin-bedded units may also show crenulations. Bedding is parallel or sub-parallel to the foliation. Some weathered outcrop surfaces in the carbonate rocks reveal sparse crinoid ossicles that are not visible on fresh surfaces of the recrystallized limestone.

Basal contacts are thrust faults. Upper contacts are commonly erosional unconformities. In one location close to Forrest Kerr Creek, pillow lavas of Early to Middle Jurassic age (?) lie unconformably upon strongly foliated Paleozoic strata.

STUHINI GROUP (UPPER TRIASSIC)

In the map area, the Stuhini Group consists of mafic to felsic (dacitic) volcanic flows; thin-bedded, interbedded black and olive green waterlain tuffs; derived clastic sediments including orange-weathering carbonate cemented sandstones; siliceous black siltstones; black and white limestone beds; and weakly pyritic black rhyolite and white rhyolite units.

Pyroxene-bearing basalts are common and typically fine-grained to weakly augite +/- feldspar porphyritic. Thick (20-30 m) massive andesitic to dacitic flow units are finely feldspar porphyritic and show faint columnar jointing in cliff-face exposures.

Extensive orange-weathering, well-sorted sandstone forms a thick stratigraphic interval that includes intercalated black siliceous siltstone, massive black and white limestone units and regionally extensive, flow-layered chert that varies from black to pale grey to white, and carries dust-size disseminated pyrite. Individual horizons within the buff- to orange-weathering sandstone host fossil wood debris.

The pyritic rhyolite units have been explored in three separate locations (Bench, Sinter and Southmore prospects) where structurally disrupted, crackled rhyolite beds are highly gossanous. Upper Triassic copper-bearing mafic volcanics exposed between 1800 to 2000 m elevation near the crest of Sixpack Range have not yet been explored (*see* Malachite Peak prospect).

On the southeast side of the Sixpack Range, these strata are cut by two small diorite and gabbro plugs and by a more extensive sill of hornblende and plagioclase porphyritic, potassium feldspar megacrystic granodiorite similar to the intrusions of the Texas Creek Suite exposed elsewhere in this region.

HAZELTON GROUP (LOWER TO MIDDLE JURASSIC)

Lower Jurassic

Strata of the Lower Hazelton Group form two belts in the northern part of the map area (Fig. 5). Northeast of Downpour Creek, a dominantly volcanic sequence includes andesite and rhyolite flows, hematitic epiclastic siltstones, sandstones and coarse, heterolithic epiclastic conglomerates, and black siltstones. The calcareous sandstone units are favourable hosts for fossil wood debris and fossil-rich bioclastic horizons that contain ammonites and bivalves. A collection from one of these intervals contains Sinemurian ammonites (Logan *et al.*, 2000, p. 45).

A second, north-trending belt of feldspar-phyric extrusive dacites and related plagioclase (± Kspar) phyric granodiorite to monzonite intrusions lies along the eastern side of the Forrest Kerr fault from the headwaters of Downpour Creek to north of More Creek. As described below, numerous showings and alteration zones on the RDN claims are related to this unit, including the Marcasite Gossan and the spectacular Gossan Creek Porphyry gossan. Three U-Pb ages of 193.0±1.3 Ma, 193.6±0.3 Ma and 193.6±1.0 Ma on both intrusive and extrusive bodies establish the age of these rocks as Late Sinemurian (Mortensen *et al.*, this volume). It is thus coeval with, but different in character from, the sequence east of Downpour Creek, giving an insight into the degree of local variability of volcanic facies in the lower Hazelton Group.

Lower to Middle Jurassic

Rocks of probable late Early Jurassic (Toarcian) to Middle Jurassic (Aalenian to Bathonian) age occur in several distinct outcrop areas located between Forrest Kerr Creek to the west, More Creek to the north, and the Iskut River to the east (Fig. 5). The different outcrop areas are described here as five different facies packages (Fig. 3 and 5) because of the pronounced variations in stratigraphy and thicknesses between them.

These units are considered to be broadly coeval (Fig. 3), although precise age controls are lacking in most areas. The Downpour Creek facies has been dated as Toarcian through Bathonian, based on macrofossils, conodonts and radiolaria (Read *et al.*, 1989; Logan *et al.*, 2000). The thick pile of pillow basalts that dominates the Pillow Basalt Ridge (PBR) facies has been correlated with the Middle Jurassic hangingwall basalt unit at the Eskay Creek mine. Similar, although much thinner, basalts crop out sporadically northwards from western PBR into the Forgold area. The Sixpack Range facies lies unconformably on Paleozoic and Triassic basement, and interfingers with and underlies the Downpour Creek facies. The Iskut River unit contains fossils dated as Middle to possibly early Late Jurassic (Collection F141, Read *et al.*, 1989). The Iskut River unit continues south and east across the Iskut River, to Iskut-Palmiere Ridge, where it overlies a basalt unit that is correlated with the hangingwall basalt at the Eskay Creek mine.

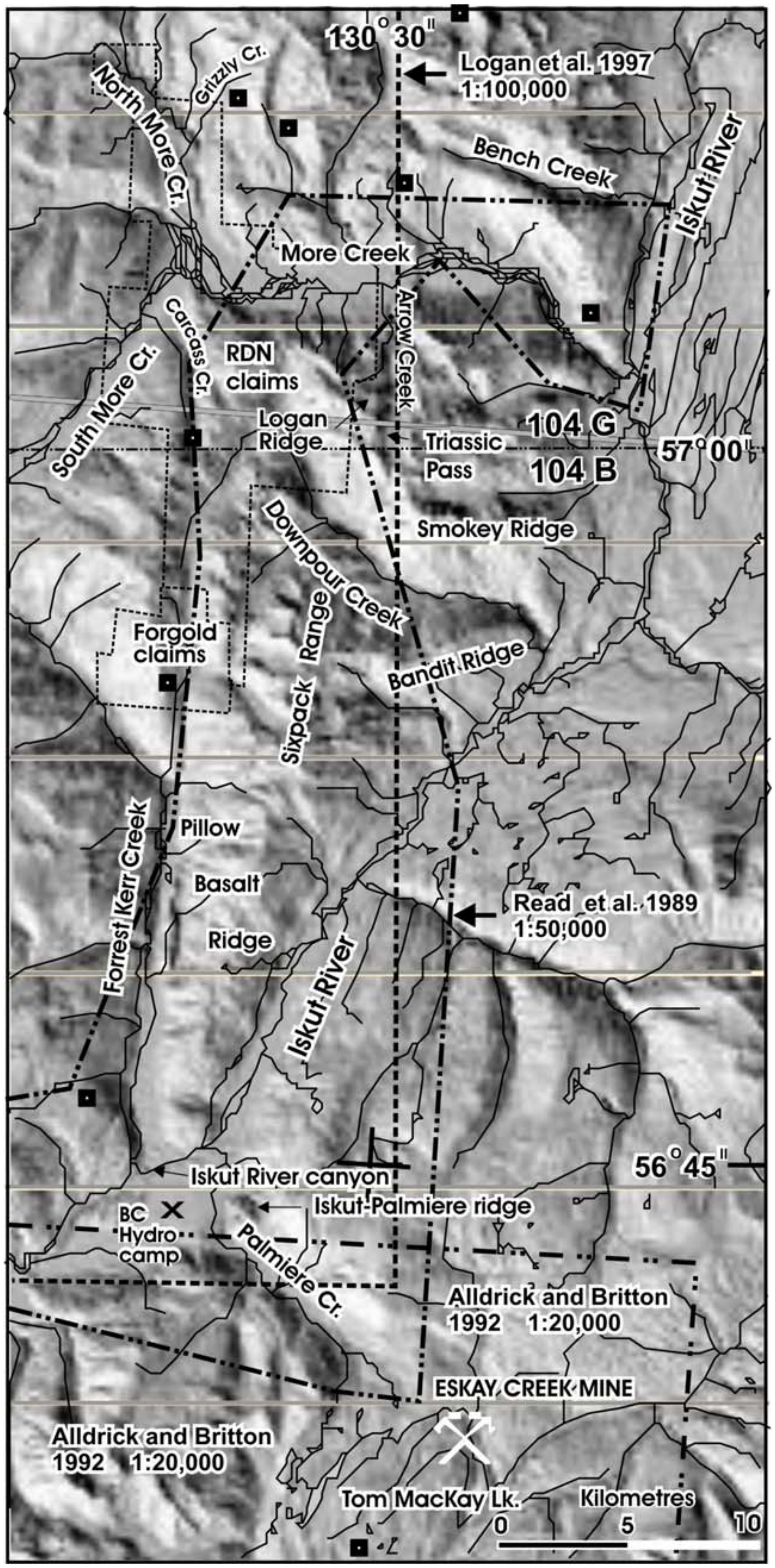


Figure 4. Shaded DEM map showing major topographic features in the 2004 map area and boundaries of previous regional mapping projects.

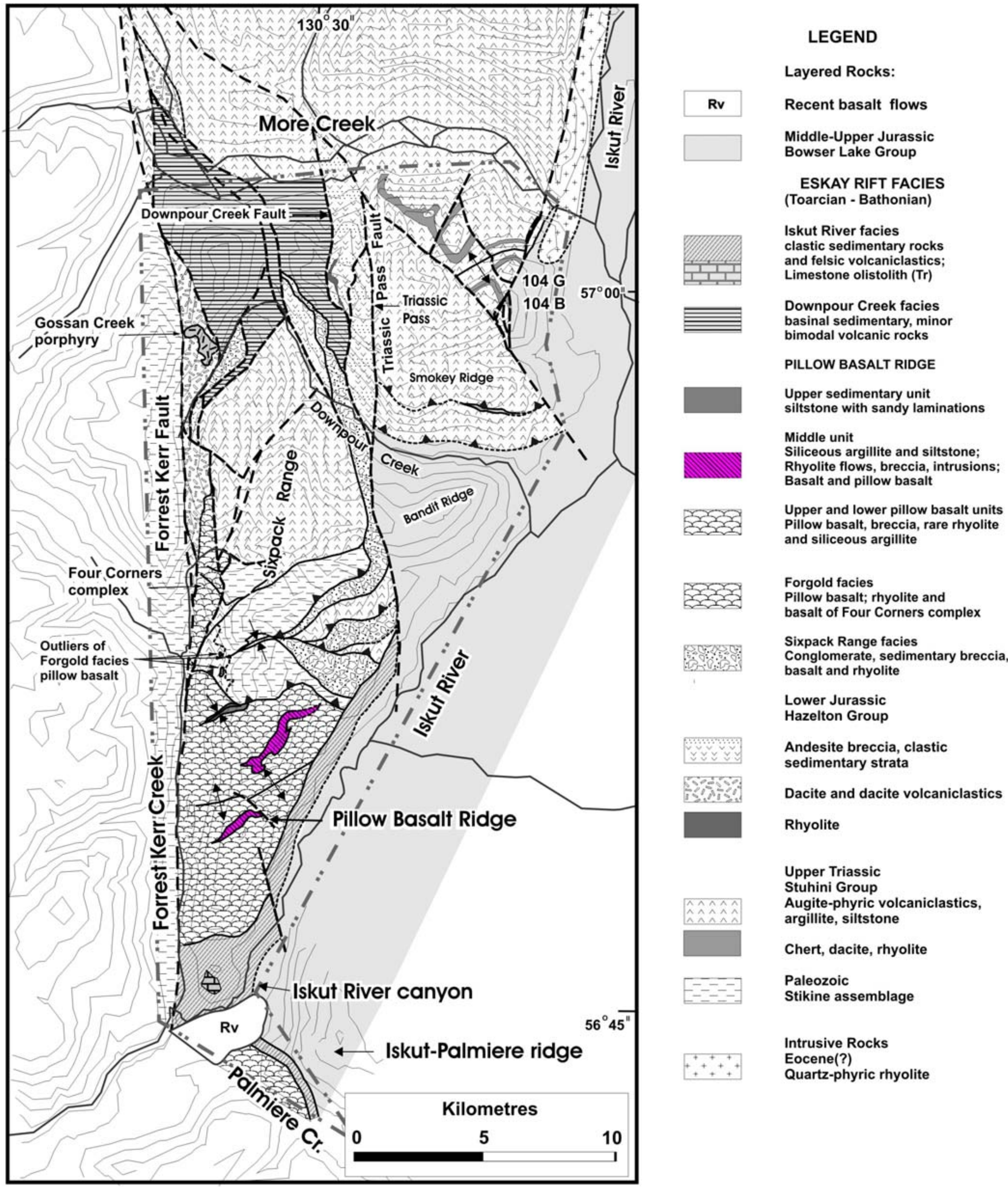


Figure 5. Simplified geologic map of the More Creek - Palmiere Creek area.

Pillow Basalt Ridge (PBR facies)

Pillow Basalt Ridge is 12 km long and 6 km wide. It is the main ridge between the Iskut River and lower Forest Kerr Creek. With the exception of overlying Iskut River unit rocks exposed at lower elevations to the east and south, the entire ridge is composed of PBR facies rocks. To the west, the Forest Kerr fault juxtaposes the PBR facies against Paleozoic rocks. To the north, the Kerr Bend fault thrusts Paleozoic, Triassic and Jurassic strata over PBR.

Features of the PBR facies are summarized here; they are fully described in Barresi *et al.* (this volume). Pillow Basalt Ridge is composed of over 2000 m of mostly pillow basalt and pillow basalt breccia. A "Middle Unit" of variable thickness within the pillow basalt sequence is composed of more than 50% mafic rock (fine- to medium-grained massive basalt and pillow basalt), rhyolite flows, domes, and breccias, and fine-grained siliceous pyritic argillite and tuff. Some individual rhyolite and sedimentary horizons within this bimodal igneous-sedimentary Middle Unit can be traced for at least 3 km along strike.

The voluminous volcanic rock and large regional extent of the Pillow Basalt Ridge facies suggests deposition within a major Middle Jurassic rift segment, similar to that of Table Mountain, located to the north (Alldrick *et al.*, 2004; Simpson and Nelson, 2004). The discovery of the bimodal igneous/sedimentary Middle Unit within the PBR facies indicates that significant intervals with potential to form and preserve Eskay Creek-style mineralization may be present within extensive, less prospective pillow basalt sequences throughout the length of the Eskay rift.

The PBR facies is overlain by two separate units: the Iskut River facies, described in the following section; and a homogeneous, siltstone-dominated unit that occupies the core of a small northeast-trending syncline next to the Kerr Bend fault (Barresi *et al.*, this volume). In the syncline, a transitional contact is observed. Pillow basalts interfinger with sand-laminated siltstone and limy siltstone fills inter-pillow interstices. The sedimentary rock types within this unit, and the nature of its contact with the PBR basalts, are in strong contrast to the Iskut River unit.

Iskut River unit

The Iskut River unit overlies the PBR facies in the lowlands along the west side of the Iskut River (Fig. 5), east and downslope of the crest of Pillow Basalt Ridge, and on the low hill south of Pillow Basalt Ridge and extending into the Iskut River Canyon near the old BC Hydro camp (Fig. 4). Correlative strata occur on the Iskut-Palmiere Ridge, where they lie depositionally between basalt assigned to the Eskay hangingwall unit, and basal strata of the Bowser Lake Group. A fossil age for this unit, from samples collected along the Iskut River canyon, is Middle Jurassic or possibly early Late Jurassic (Collection F141; H.W. Tipper in Read *et al.*, 1989), making it one of the younger units in the Lower-Middle Jurassic Eskay Rift sequence.

Downhill and east of Pillow Basalt Ridge, the Iskut River unit consists of mixed siliciclastic and felsic volcanic strata, with a preponderance of coarse clastic material. The felsic rocks are mostly light green to pale grey volcaniclastics, rhyolite and dacite breccias, and fine crystal-dust tuffs. One outcrop ridge of massive rhyolite was located in the course of two traverses in the area; it is likely that more could be identified with further detailed work. The siliciclastics comprise interbedded white arkosic sandstone, sedimentary breccia, quartz-feldspar granule conglomerate and dark grey silty argillite. In some areas, thinly interbedded sandstone and argillite resemble the Bowser Lake Group. They are distinguishable, however, based on the presence of felsic detritus and the absence of chert clasts in the sandstones, and on the presence of interbeds of felsic volcaniclastic material. In other exposures, bedding is uneven and soft-sediment deformation features and sedimentary intraclasts are present. A notable feature of this sequence is the common occurrence of large felsic volcaniclastic olistoliths as well as small white, pale green and bright sea-green felsic clasts within sedimentary breccias. They show irregular, wispy outlines indicative of incorporation in the matrix while still unconsolidated. Felsic detritus decreases in abundance northward. North of Pillow Basalt Ridge (north of the Kerr Bend fault), the sequence consists of a thick, cliff-forming unit of white arkosic sandstone overlain by dark grey slate that extends east as far as the Iskut River.

South of Pillow Basalt Ridge, the Iskut River unit is dominated by dacitic volcaniclastic material, with subordinate black argillite and other rock types. The felsic breccias are chaotic and unsorted. Clasts range in size up to olistoliths many metres across. All clasts are angular. Concentrations of coarser clasts show incipient fragmental (crackle breccia) to disaggregated (mosaic breccia) textures. Pulverised, fine-grained, sand-sized material occurs as both the clast component with an aphanitic groundmass, and as the groundmass component to larger clast populations. The source volcanic rock, as seen in clasts, is pale green, aphanitic to porphyritic dacite with small, sparse feldspar crystals. Massive dacite is rare. One outcrop of black, flow-banded rhyolite was noted. Its contact relationships are unknown, it could be either a local flow or a large block within the breccia.

Read *et al.* (1989) show a single outcrop of limestone at the base of the felsic unit on the south slope of Pillow Basalt Ridge from which they extracted Early Permian conodonts (collection F129). This limestone is an olistostromal block surrounded by felsic breccia matrix. Other smaller limestone exposures occur within the felsic breccia. The nearest present exposures of Early Permian limestone are 4 km west of Forrest Kerr

Creek, and 10 km to the north within the uplifted block of Paleozoic rocks north of the Kerr Bend fault.

The hill immediately south of Pillow Basalt Ridge, and immediately northeast of the mouth of Forrest Kerr Creek is underlain by basalt, andesite and dacite flows or tuffs and mixed sedimentary rocks, and is intruded by small diorite and gabbro plugs. This strata is cut by a recent volcanic chimney south of the hill's summit area, where a small circular lake fills the vent. Carbonates on this hill have given Triassic conodont ages (Collection F138, Read *et al.*, 1989); they could be olistrostromes like the Paleozoic body described above.

North of Palmiere (Volcano) Creek, a thin unit of felsic volcaniclastics and argillite crops out in the saddle between the main high ridge to the northeast and the small spur that overlooks the lower Iskut River Valley to the west. The lower part of this unit consists of chaotic, unsorted felsic breccia similar to the breccias of the Iskut River unit exposed at the south end of Pillow Basalt Ridge. The source rock is a pale grey-green to white, aphanitic to microporphyritic dacite or rhyolite. Clasts of medium-grained granodiorite are also present in the breccia. Most common are angular-clast breccias and crystal-dust tuffs, all without visible bedding. Rhyolite mosaic breccia with a black, siliceous matrix is present in places. The felsic breccias are overlain transitionally by black, siliceous, pyritic argillite which hosts the Iskut-Palmiere mineral occurrence. Beds of felsic breccia and individual felsic clasts occur within the basal part of the argillite. All these rocks overlie basalt, which is correlated with the Eskay hangingwall unit and the PBR basalts, and these rocks are overlain in turn by sandstones and mudstones of the Bowser Lake Group.

The Iskut River unit overlies the pillow basalts and siliceous siltstones of Pillow Basalt Ridge facies with angular discordance, truncating units in the gently folded underlying sequence. A strong set of northeasterly topographic linears on southeastern PBR, interpreted as flow-layering between separate eruptions of pillow basalt, is deflected northwards towards the base of the Iskut River unit. The Kerr Bend fault does not penetrate the base of the Iskut River unit. North of the fault, Iskut River unit arkose overlies rocks of the hangingwall strata of the Kerr Bend fault. The upper contact of the Iskut River unit with the Bowser Lake Group was not observed during this study.

The Iskut River unit exhibits a marked departure in volcanic and sedimentary regime from the underlying PBR facies. Quiet basalt effusion was succeeded by explosive felsic, mainly dacitic volcanism, while the pelagic, distal sedimentation associated with PBR was succeeded by coarse siliciclastic sedimentation in the Iskut River unit. Steep slopes are indicated by coarse grain sizes, synsedimentary deformation, and olistoliths sourced from both felsic breccias within the sequence, and from Paleozoic and Triassic limestones and possibly other strata from within the basement. Its unconformable relationships with the PBR rocks and with the Kerr Bend fault suggest that it postdated thrust displacement on the fault. Thus the Iskut River unit marks a profound change in basin geometry, with renewed uplift of rift margins, fault reactivation and the development of new fault patterns.

Forgold facies and the Four Corners complex

The Forgold facies, which hosts the Four Corners volcanic complex, is located east of Forest Kerr Creek, and south of the headwaters of Downpour Creek. It is a north-south elongated, fault-bounded segment of mainly volcanic rock, inferred to be Middle Jurassic rift-related strata (pending U/Pb dates). The main Forest Kerr fault to the west, and a splay of the Forest Kerr fault to the east, juxtapose the Forgold facies units with Paleozoic, Triassic and Lower Jurassic units. To the south, basalts of the Forgold facies lie in unconformable contact on Paleozoic and Triassic strata, exposed in a waterfall as remnant patches of undeformed pillow basalt resting on highly deformed basement. At the northernmost extent of the Forgold facies, on the eastern side of Downpour Creek’s headwaters, pillow basalts lie in unconformable contact on Lower Jurassic strata to the west and in faulted contact with Triassic strata to the east.

Overall, the volcanic and sedimentary rocks of the Forgold facies are similar to those of Pillow Basalt Ridge. In contrast to Pillow Basalt Ridge, the Forgold facies is dominated by a local felsic volcanic centre (the Four Corners complex) which is similar to, but larger than, the volcanic complexes found in the Middle Unit of the Pillow Basalt Ridge facies. With the exception of the Four Corners felsic volcanic complex, the Forgold facies is composed of aphanitic, rarely vesicular, pillow basalt, pillow basalt breccia, and rare flow-banded basalt.

The Four Corners complex is a volcanic centre composed of intrusive and extrusive felsites and fine- to medium-grained basalt, with onlapping pillow basalts and fine, siliceous sedimentary rock. The structural orientations of sedimentary and layered volcanic rocks on and around the dome are largely controlled by the paleotopography of the dome. The core of the dome is composed of feldspar-phyric felsic rock (Fig. 6a) that is crosscut by 1 to 3 m thick aphanitic and feldspar phyric, flow-banded rhyolite dikes, and sets of medium-grained diabase (basalt) dikes. Near the core of the dome, the contacts between felsic and mafic dikes, and between the dikes and the surrounding dome, are amoeboid (Fig. 6b), indicating that they are magma-mixing textures developed between coeval intrusions. The flanks of the dome are composed of 1 to 5 m thick, layered rhyolite flows with interbedded layers of siliceous sedimentary rocks, massive basalt flows and pillow basalt flows. All are crosscut by rhyolite dikes. Overlying the felsic dome are a decreasing proportion of coarse-grained, massive basalt and fine-grained rhyolite flows, and an increasing proportion of pillow basalt flows. Felsic

A)

B)

Figure 6. A) Rhyolite intrusion in the centre of the Four Corners complex. B) Detail of irregular contacts between felsic and mafic dikes in the complex, indicating coeval emplacement.

dikes are less common. Basalt that erupted above the felsic dome was likely superheated, as suggested by the presence of fire fountain deposits.

The suite of rocks that comprise the Four Corners complex and immediate surrounding area is similar to that found in the Middle Unit of the Pillow Basalt Ridge facies. Felsic rocks include aphanitic white and cream weathering, flow-banded rhyolite with semi-translucent fresh surfaces; and white to salmon weathering feldspar-phyric rhyolite. These are accompanied by medium-grained basalt that has characteristic radiating feldspar microlites (first described near the Eskay Creek mine by Lewis *et al.* [2001]) and, in places, a distinctive glomeroporphyritic texture of feldspar and/or pyroxene. On the flanks of the dome, these rocks are extrusive, and take the form of breccias and flows. In one location, a breccia of toppled columnar-jointed basalt is preserved. Onlapping sedimentary rocks are rusty weathering, siliceous, pyritic, fine-grained, dark grey to black mudstones and/or tuff and/or chert. They are bedded on a 1 to 15 cm scale and have sharply eroded upper contacts. Some beds have spherical, white weathering crystals up to 1 cm in diameter, similar to prehnite found in the mudstones at Eskay Creek mine and on Pillow Basalt Ridge (Ettlinger, 2001; Barresi *et al.*, this volume).

The Forgold facies is fault bounded. Consequently its relationship to other rift fragments is uncertain. The facies bears a strong resemblance to that of Pillow Basalt Ridge, and may represent a narrower northern extension of the rift basin that accommodated the Pillow Basalt Ridge facies. Alternatively it may be an independent rift fragment. The unconformable contact between this facies and underlying Upper Paleozoic, Upper Triassic and Lower Jurassic strata suggests that it was deposited on a block of these strata which had already undergone significant uplift and erosion.

Sixpack Range facies

Strata of the Upper Hazelton Group crop out extensively on the eastern slopes of Sixpack Range, extending from the Kerr Bend fault in the south to Downpour Creek in the north.

The basal units are well exposed immediately north of Kerr Bend fault. The basal talus breccia (Fig. 7a) is overlain by a thick (>500 m) interval of massive crystalline basalt flows cut by rare white rhyolite dikes, sills and flows. Towards the top of this thick mafic volcanic interval, these rocks are progressively interlayered with overlying monolithic to heterolithic volcanic breccias, conglomerates and sandstones. These thick sequences of volcanic sandstones and granule to pebble conglomerates consist predominantly of felsic volcanic clasts. Locally, clast composition varies and can include up to 20% limestone clasts, up to 25% hornblende-plagioclase porphyritic potassium feldspar megacrystic granodiorite clasts, or up to 10% black siltstone clasts. Local concentrations of scattered clasts of pyritic siltstone produce weakly gossanous weathered surfaces. Sandstones locally display graded bedding and good cross-bedding (Fig. 7b and 7c). Intercalated rock units are grey to black limestone, black siltstone, a single minor rhyolite flow, and minor sills and dikes of rhyolite and hornblende-plagioclase porphyritic potassium feldspar megacrystic granodiorite.

At its southern limit, the base of this stratigraphic unit is a thick talus breccia of predominantly carbonate clasts, that rests unconformably above foliated Permian carbonate rocks. The talus breccia evolves in character moving away from the Permian footwall rocks, changing from monolithic carbonate breccia, to heterolithic, volcanic-dominated breccia to coarse, well-bedded to cross-bedded sandstones and grits. These in turn are overlain by the thick succession of massive basalt flows.

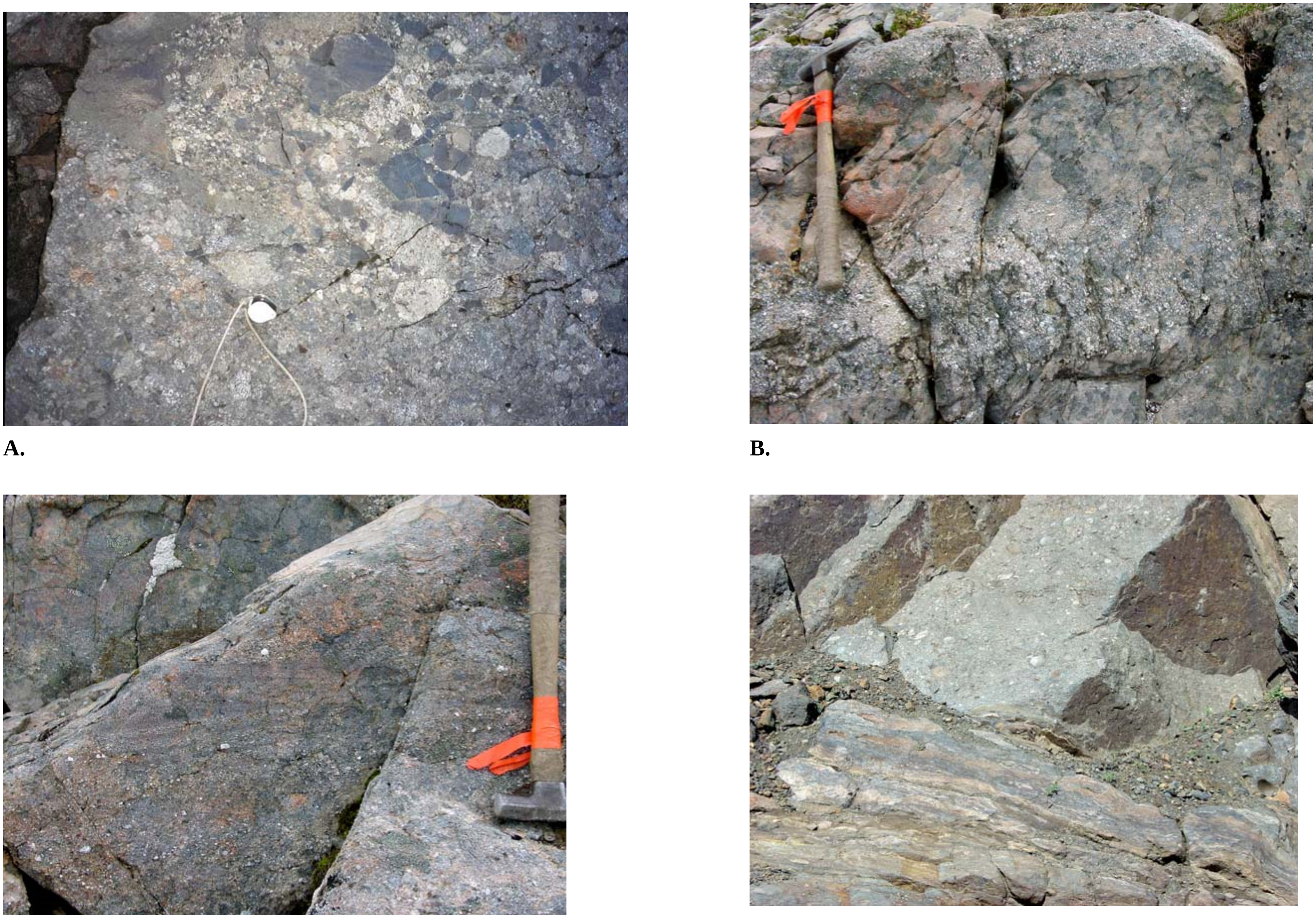
Elsewhere the basal contact of the Jurassic strata is an unconformity, overlying Triassic or Permian footwall rocks (Fig. 7d). Where exposed, the upper contact for this strata is a thrust fault contact, with overlying Permian or Triassic rocks in the hangingwall.

Downpour Creek facies

The Downpour Creek facies is exposed north of Downpour Creek on both sides of the pass that separates Downpour Creek from More Creek. To the west, rocks of this facies are cut off by the Forrest Kerr fault. Their eastern limit is the north-striking Downpour Creek fault that juxtaposes them against Lower Jurassic strata (Fig. 8a).

These rocks were previously mapped by Read *et al.* (1989) and Logan *et al.* (2000). Remapping in 2004 has led to a modified structural interpretation and revised stratigraphic context. The Downpour Creek facies is dominated by fine-grained clastic rocks, with less than 10% basalt, diabase, gabbro, and felsic volcanic and intrusive rocks. Clastic rocks are dark grey to black argillite with minor thin beds of orange-weathering ankeritic siltstone and sandstone, and rare granule to pebble conglomerate (Fig. 8b). Laminated siliceous siltstone beds become more common in the higher parts of the sequence, whereas coarser interbeds become more rare.

A variety of volcanic rock suites are exposed in this facies. Lenticular pillow basalt flows, black matrix rhyolite breccia, and cobble conglomerate are present within the thick sedimentary sequence. In addition, the ridgetops to the west and northwest of Downpour Creek are capped by volcanic and intrusive rock. The resistant igneous caprock mapped by Logan *et al.* (2000) includes Lower Jurassic and Middle Jurassic volcanic sequences as well as mafic intrusive bodies. The Lower Jurassic volcanic sequences, like those in the Middle



A.

B.

C.

D.

Figure 7. Mid-Jurassic Sixpack Range facies exposures. A. Polymictic talus breccia. B. Graded bedding in granule conglomerate. C. Crossbedding in pebble conglomerate D. Basal unconformity showing polymictic conglomerate overlying well-foliated Paleozoic Stikine Assemblage tuffs.

Jurassic, have pillow basalts and rhyolites, but also contain varied volcaniclastic rocks including volcanic conglomerates and ash and lapilli tuffs. Complicating the volcanic stratigraphy in this area are stocks of diabase and gabbro that have the same radiating microlites and glomeroporphyritic textures as the extrusive Middle Jurassic basalt mapped at Pillow Basalt Ridge, the Four Corners complex, and the Sixpack Range.

The internal stratigraphy of the Downpour Creek facies is not completely understood. Fossil collections are reported from this unit by Souther (1972), Read *et al.* (1989) and Logan *et al.* (2000). Along the ridgecrest west of the pass between Downpour and More creeks, Late Toarcian conodonts occur at two sites (Read *et al.*, 1989); however, Logan *et al.* (2000) report Bathonian macrofossils from the same area. Further north, Logan *et al.* (2000) collected an Aalenian ammonite. Souther (1972) lists Middle Bajocian macrofossil collections east of the pass. Structures in the Downpour Creek area are complex, involving tight folds and multiple fault strands that significantly modify the single syncline inferred in Logan *et al.* (2000).

On the eastern side of Downpour Creek, fine-grained sedimentary beds of the Downpour Creek facies overlie coarse polymictic conglomerates of the Sixpack Range facies in a gradational, interfingering contact. A similar relationship can be inferred several kilometres to the southwest near the headwaters of Downpour Creek, in spite of extensive fault slivering. There, conglomerates are accompanied by monolithologic, chaotic, volcanic-derived debris-flow breccias and minor basalt flows like those seen farther south in the Sixpack Range. East of Downpour Creek, the conglomerates are relatively thin and overlie plagioclase-phyric volcanic rocks correlated with the lower Hazelton Group (Fig. 8b). Based on these observations, the Sixpack Range facies is interpreted as a basal conglomerate to the finer-grained Downpour Creek facies, and as its more southerly, coarse-grained, more proximal equivalent.

Lower – Middle Jurassic facies summary

The units described above illustrate pronounced facies variations in time and space that characterize the late Early to early Middle Jurassic rift environment between the Eskay Creek mine and More Creek.

Pillow Basalt Ridge facies is a 2000 m thick basaltic sequence with a prominent interval in which rhyolites and rhythmically bedded, siliceous, pyritic siltstones are also important. The PBR basalt, which thins dramatically southwards towards the Eskay Creek mine, is overlain by coarse siliciclastic and felsic breccia deposits of the Iskut River unit, which indicates major felsic volcanic eruption and rapid erosion. This unit records a higher energy depositional environment that developed prior to the onset of Bowser Lake Group sedimentation. By contrast, in the syncline on northwestern Pillow Basalt Ridge, only black argillite interfingers with the uppermost PBR basalts, indicating a more quiescent part of the basin.

The massif north of the Kerr Bend fault contains two distinct facies (Fig. 9). On its eastern side, facing the Iskut River, conglomerates, debris-flow breccias, rhyolites and basalts of the Sixpack Range facies unconformably overlie deformed Paleozoic and Triassic basement. To the west, north of the Kerr Bend fault on the slopes facing west over Forrest Kerr Creek and its northern tributary, thin sediment-free pillow basalt outliers of the Forgold facies unconformably overlie the same basement. These sub-Middle Jurassic unconformities on rocks as old as Paleozoic are unique within the Eskay rift system: everywhere else, the base of the sequence ranges from conformable on slightly older Jurassic strata to an unconformity on Upper Triassic or Lower Jurassic basement.

The relationships between these two facies, north of Kerr Bend fault, to each other and to the Pillow Basalt Ridge facies are not well understood. Clasts in the polymictic conglomerates are correlated with Paleozoic and early Mesozoic rocks in the core of the uplift and with quartz-plagioclase-potassium feldspar porphyry inrusions that are known to occur both in the core of the uplift and to the northwest, along the northern tributary of Forrest Kerr Creek. It seems reasonable to derive these conglomerates from the west. If so, the lack of a basal conglomerate below the pillow basalts on the west side of the Sixpack Range must be explained. A possible scenario is that this area was initially exposed subaerially and eroded, and later became a north-trending rift basin.

Both of these facies are juxtaposed abruptly with the thick, monotonous pillow basalt pile south of the Kerr Bend fault (Fig. 3 and 9). The base of the PBR facies is not exposed. It is not known whether it has a basal conglomerate like the Sixpack Range facies to the northeast, or whether the pillow basalts lie directly on older basement as seen to the northwest.

Facies relationships northwards into the Downpour Creek area are clearer. The coarse, proximal Sixpack Range facies passes northward into basinal sediments and lesser bimodal igneous rocks of the Downpour Creek facies (Fig. 9). The northernmost basalts of the Forgold facies unconformably overlie Lower Jurassic dacites in the headwaters of Downpour Creek, just southwest of the proximal to distal transition in the clastic strata. These basalts are over 200 m thick and have no associated sedimentary strata, like those along strike to the south in the western hangingwall strata above the Kerr Bend fault.

The following scenario integrates the various facies packages (Fig. 3 and 9). The Sixpack Range proximal clastic facies is probably oldest, since it in part underlies the Late Toarcian and younger Downpour Creek basinal

A.

B.

Figure 8. Mid-Jurassic Downpour Creek facies exposures. A. View eastward to the fault contact of black, carbonaceous Downpour Creek facies argillite and siltstone against Lower Jurassic rhyolite on Logan Ridge, east of the Downpour Creek fault. B. Looking northwest towards the pass betweeen Downpour Creek and More Creek. Downpour Creek facies argillites in foreground with thin ankeritic sandstone beds overlie ankeritic lower Hazelton Group volcanics. Topographic linears in background are fault strands related to the main Downpour Creek fault.

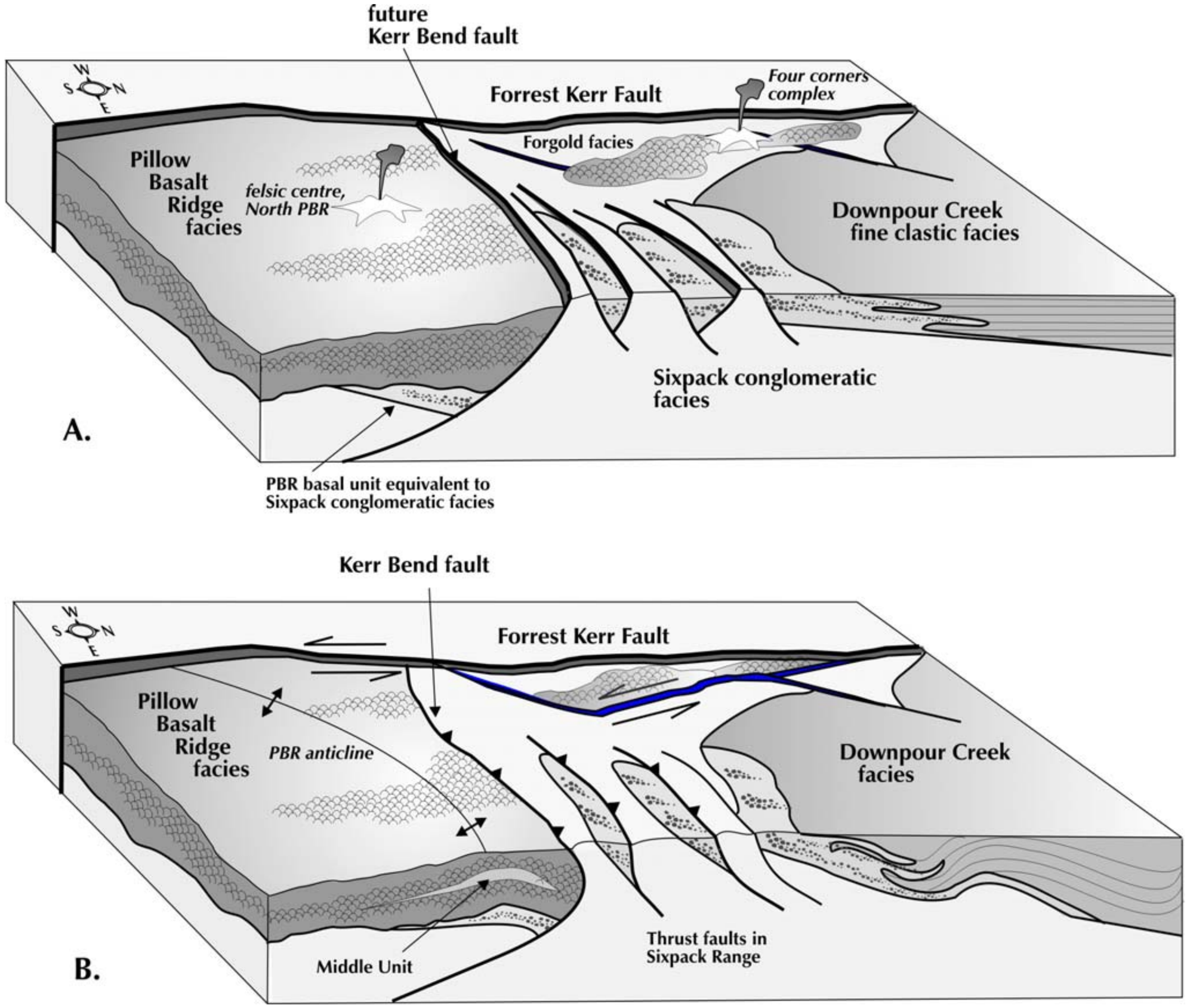


Figure 9. Cartoon block diagrams of map area - view from southeast. Shows the relationships between different mid-Jurassic facies: A. In their inferred syn-rift structural context, and B. during later sinistral shear and basin inversion.

facies. We infer that these two clastic facies were deposited on the eastern and northern flanks of a horst within the Eskay rift system, now preserved as the Paleozoic-Triassic uplift in the core of the Sixpack Range. The horst could have been an elongate, north-tilted block with steepest scarps along its southeastern margin near the present Kerr Bend fault where the coarsest conglomerates and breccias occur. We also infer that the adjacent graben to the immediate south of this scarp filled first with clastic detritus from the north, and later became the site of eruption for the voluminous PBR pillow basalts. The absence of a basal conglomerate in the Forgold facies and Four Corners complex suggests that these volcanic rocks were erupted at a still later stage, as faulting and uplift waned and the exposed highlands were drowned.

The Kerr Bend fault separates two distinctive Middle Jurassic facies - a thick pile of basalts to the south versus a clastic-dominated package to the north (Fig. 9). Thrust faults that demarcate abrupt facies and thickness changes may be remobilized original growth faults (McClay *et al.*, 1989). As shown in Figure 9, the locus of the present Kerr Bend fault is interpreted as a remobilized graben-bounding fault which separated the Sixpack Range horst from an adjacent graben to the south. The Kerr Bend fault corresponds roughly in position and orientation to the precursor normal fault. Read *et al.* (1989) inferred 2.5 km of post-Middle Jurassic displacement on the Forrest Kerr fault, based on offsets of the northeast- to east-northeast–trending faults and folds such as the PBR anticline. These features, which are only developed near the Forrest Kerr fault, can be related kinematically to sinistral transcurrent motion along it (Fig. 9 and 10).

The change in kinematics to sinistral transpression first steepened the original fault surface, and then overturned it to the south. Continued thrust motion on this fault would have obscured any basal clastic facies rocks on the southern (PBR) side, by burying them in the footwall.

Since deposition of the Iskut River unit likely post-dates the last movement on the Kerr Bend fault, its Middle to early Late Jurassic fossil age constrains the episode of sinistral motion on the north-trending Forrest Kerr fault and related deformation of the PBR facies to a time immediately after the formation of the Eskay Creek orebodies. Renewed high relief created by offsets on the Forrest Kerr and Kerr Bend faults could account for the high energy sedimentary environment in the unit and gravity transport of olistoliths into the basin. This model is revisited in the discussion of structure in the area.

BOWSER LAKE GROUP

Strata of the Middle to Upper Jurassic Bowser Lake Group overlap the older volcanic sequences along the eastern part of the study area and have been most recently mapped by Evenchick (1991) and Ricketts and Evenchick (1991). To the east, stratigraphy and nomenclature for the Bowser Lake Group in the Spatsizi River map sheet (NTS 104H) have been wholly revised and updated (Evenchick and Thorkelson, 2005).

Regionally, the basal contact of the Bowser Lake Group grades upward from the upper sedimentary strata of the Salmon River Formation (Spatsizi Formation) of the underlying Hazelton Group. The Middle Jurassic boundary between these similar sedimentary packages roughly coincides with the Bajocian-Bathonian transition at 166 Ma.

Anderson (1993) describes the lowest units within the Bowser Lake Group as thin- to thick-bedded, fine- to coarse-grained siliciclastic rocks including turbiditic shale, siltstone, greywacke, fine- to medium-grained sandstone and rare conglomerate. Anderson cautions that these units are indistinguishable in the field from similar rock types at the top of the underlying Salmon River Formation of the Hazelton Group.

Evenchick (1991), mapping in the current study area, correlated black siltstone, fine-grained sandstone and minor to large proportions of chert pebble conglomerate with the Ashman Formation of the Bowser Lake Group. Evenchick and Thorkelson (2005) note that the Hazelton Group - Bowser Lake Group contact is gradational, however, they place the boundary where thin, white-weathering tuffaceous laminae, typical of the upper Spatsizi Formation (Salmon River Formation), are no longer present in black siltstones.

Bowser Lake Group strata are well exposed along Bandit Ridge, an east-trending ridge immediately southwest of the mouth of Downpour Creek. The western contact of this unit is an east-dipping fault against older strata of the Sixpack Range facies. Sedimentary strata of the Bowser Lake Group are highly contorted and disrupted within 500 m of this fault contact. Within this zone, pebble conglomerate units correlated with the Ashman Formation of the Bowser Lake Group display stretched pebbles with length to width ratios of 4:1. For the next 4 km to the east, Bowser Lake Group rock types include a thick, highly folded and faulted succession of siltstone, mudstone, sandstone and rare thin limestone beds.

MOUNT EDZIZA VOLCANIC COMPLEX

The Late Cenozoic Mount Edziza volcanic complex blankets an area of 1,000 km^2, including part of the northwest corner of the project area. The complex is comprehensively described and illustrated in Geological Survey of Canada Memoir 420 (Souther, 1992). Volcanic rocks range in age from 7.5 Ma to 2 Ka. The complex comprises alkaline basalt and hawaiite with lesser intermediate and felsic volcanic flows, and records five major cycles of magmatic activity.

Intrusive Rocks

STIKINE SUITE

Middle to Late Triassic tholeiitic to calcalkaline granitoid plutons of the Stikine Suite intrude Stuhini Group volcanic and sedimentary strata in this region and are interpreted as comagmatic intrusions (Logan *et al.*, 2000). Examples are the small stocks of diorite and gabbro mapped near the south end of the Sixpack Range.

COPPER MOUNTAIN PLUTONIC SUITE

Small ultramafic stocks of the Late Triassic to Early Jurassic Copper Mountain Suite (Logan *et al.*, 2000) are distributed throughout this region, but have not been noted in the present map area.

TEXAS CREEK PLUTONIC SUITE

A variety of fine- to medium-grained, commonly porphyritic, leucocratic intrusive rocks found in the map area are correlated with the Early Jurassic Texas Creek Suite (Logan *et al*., 2000). The intrusions appear as simple stocks or as clusters of anastomosing dikes. Intrusions of this suite are important regional loci for porphyry copper-gold, transitional gold, and epithermal gold-silver deposits. In the 2004 map area, a string of small stocks of this age trend northward along both sides of the Forrest Kerr fault (Fig. 5).

THREE SISTERS PLUTONIC SUITE

Fine- to medium-grained equigranular diorite stocks and a small medium-grained gabbro plug cut Lower to Middle Jurassic strata to the northwest of northern Downpour Creek. These plutons are assigned to the Middle Jurassic (179-176 Ma) Three Sisters Suite defined by Anderson (1983).

HYDER PLUTONIC SUITE

The Eocene Hyder Suite forms the eastern margin of the Coast Crystalline Belt to the west of the study area. This continental-scale magmatic event is recorded within the map area by a series of north-trending, fine-grained to aphanitic rhyolite dikes first identified by Souther (1972). One of these north-trending dikes intrudes Triassic strata north and south of the mouth of More Creek (Fig. 5). These intrusions are likely feeders to overlying felsic flows that have been subsequently eroded.

Structure

The large-scale structural framework of the area is dominated by north-striking faults of regional significance (Fig. 5 and 10). The Forrest Kerr fault is the most prominent of these, with a mapped strike length over 50 km, east-side-down throw of more than 2 km and post-mid Jurassic sinistral displacement of more than 2.5 km (Read *et al.*, 1989). It has a number of splays. Some of them bound blocks of mid-Jurassic exposures near the Four Corners complex. Another significant set of fault splays deflects northeastward into the headwaters of Downpour Creek and includes the north-striking Downpour Creek fault, which appears to be cut off by the Triassic Pass fault. Both the Downpour Creek fault and the Triassic Pass fault have down-to-the-west stratigraphic throws, opposite to that on the Forrest Kerr fault. Their northern extensions are inferred to turn northwestward and merge with the main Forrest Kerr fault somewhere along the north branch of More Creek**.** To the south, the Downpour Creek fault may extend along the eastern side of Pillow Basalt Ridge roughly along the outcrop belt of the Iskut River unit (Fig. 5 and 10). Overall, the fault pattern is one of anastomosing, braided strands typical of a regional transcurrent fault system.

The main strand of the Forrest Kerr fault crosses the pass at the head of Carcass Creek on the RDN property between the Downpour Creek and More Creek drainages. It is expressed as a zone of finely comminuted, highly altered fault breccia.

Field relationships show that motion on the Forrest Kerr fault system accompanied as well as post-dated mid-Jurassic bimodal igneous activity. Detailed mapping of strands of the Forrest Kerr fault located east of the main fault near the Four Corners complex showed

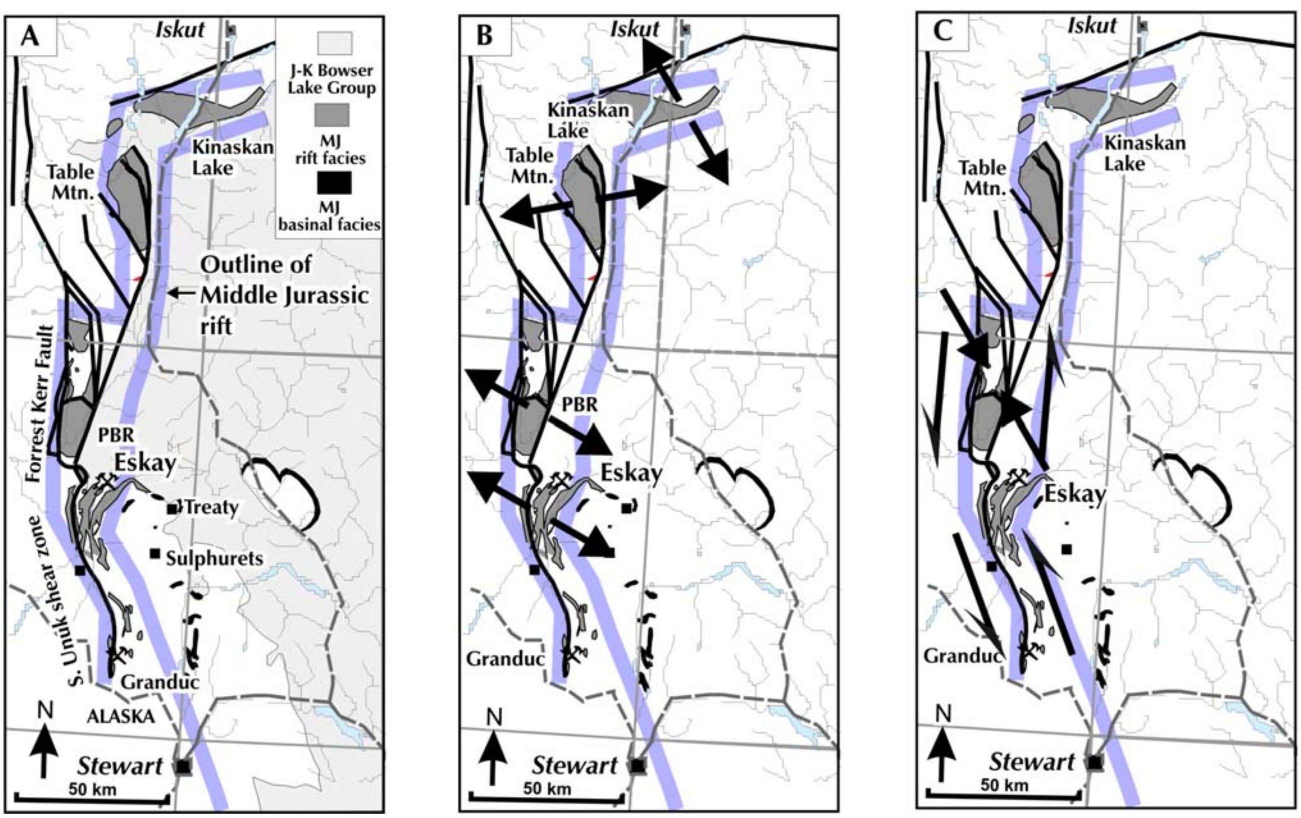


Figure 10. Cartoon regional structural history of west-central Stikinia in mid-Jurassic time. A. Present faults and outcrop areas of mid-Jurassic strata. B. Circa 180 to 174 Ma, the extensional rift regime that gave rise to the bimodal volcanic and related sedimentary sequences. Orientations of tensional features such as dikes and feeder zones suggests straight-on extension in northern part of the belt, and a slight dextral transtensional component in the south, with northeasterly extension. C. Circa 172 to 167 Ma, sinistral strike-slip regime imposed on the pre-existing rift system gives rise to northeasterly compressional features within it.

them to be zones of intense deformation tens of metres wide over a minimum strike length of 2 km. They consist of fault breccia with black argillite matrix probably derived from Triassic strata that crop out nearby. Clasts include disrupted siltstone beds from within the argillite, and exotic fragments such as basalt and plagioclase porphyries. Typically, the clasts are centimetre to decimetre size, but larger basalt blocks are also present. Some of them are strongly altered to carbonate and, less commonly, quartz-carbonate-mariposite assemblages. Mid-Jurassic pillow basalts and the bimodal Four Corners complex lie west of the fault strands and are truncated by minor splays from them. Two outcrops of fault breccia are surrounded by the rocks of the Four Corners complex. One outcrop is in the bottom of a small cirque on the north side of the complex. The cirque walls south of it form a continuous outcrop of basalt and felsite that isolates the northern outcrop of fault breccia from the fault zone farther south. In the other outcrop, fault breccia contains numerous clasts of plagioclase-phyric hypabyssal granodiorite. They are unlike the igneous rocks of the Four Corners complex, but similar to unit Jfp (Jurassic feldspar porphyry) of Read *et al.* (1989). A rhyolite dike cuts off the breccia. Thus construction of the Four Corners igneous complex postdated major motion and brecciation on some splays of the Forrest Kerr fault; however, other splays containing identical breccias outlasted it.

In the main through-going splay that truncates the Four Corners complex to the east, lineations defined by clast elongations generally plunge at less than 25°. Clast asymmetries and shear bands show a consistent sinistral sense of motion both in outcrop and in thin section. Steep lineations, such as slickenlines and clast elongations, are also present but are less common. The pre-Four Corners breccia outcrops contain inconclusive kinematic indicators and poorly developed steep lineations.

A set of east-northeast–striking, south-directed reverse faults and related folds affects the uplifted Paleozoic/Triassic block east of the Forrest Kerr fault (Fig. 5 and 9). The most significant of these, the Kerr Bend fault, first recognized by Read *et al.* (1989), places Paleozoic and younger hangingwall strata on top of the mid-Jurassic basalts of Pillow Basalt Ridge. The layered rocks on Pillow Basalt Ridge are also involved in northeasterly folding. The eastern extents of these faults and folds are truncated by exposures of the Middle to early Late Jurassic Iskut River clastic-felsic unit. Northward deflection of bedding and structures on Pillow Basalt Ridge as they approach the base of the Iskut River unit (Fig. 5) may be related to a north-striking sinistral fault, possibly an extension of the Downpour Creek fault, either along the basal contact or buried beneath the Iskut River unit itself. The coarse, unsorted deposits and olistoliths in this unit are consistent with deposition in a fault-controlled basin. We infer that its western bounding fault lies at or near the present western contact of the unit.

Read *et al.* (1989) calculated a minimum 2.5 km sinistral displacement along the Forrest Kerr fault based on the offset of folds across it. We are in accord with their structural interpretation, although we have modified it in several respects. First, we interpret the Kerr Bend fault and other northeast to east-northeast compressional features as the consequence of the sinistral motion on the north-striking Forrest Kerr fault. Second, detailed work has shifted and realigned the mapped axis of the PBR anticline on Pillow Basalt Ridge such that it does not intersect, and thus does not fold the Kerr Bend fault. Instead, both the PBR anticline and the small syncline to the northwest of it are folds in the footwall strata cut off by the Kerr Bend thrust fault. Read *et al.* (1989) considered the dark grey shale-siltstone unit in the core of the syncline on northwestern Pillow Basalt Ridge to be Bowser Lake Group strata, and structures affecting it – the syncline itself and the Forrest Kerr fault by association – were thought to be post-Bowser, mid-Cretaceous in age. However, the intimate interbedding of the shale and siltstone with pillow basalts (Barresi *et al.*, this volume) indicates that this is an uppermost unit in the mid-Jurassic Hazelton Group sequence. Structures affecting it are only required to be post-mid-Jurassic.

This set of east-northeast– to northeast-striking– folds and reverse faults can be modeled as a compressional transfer zone between the Forrest Kerr fault to the west and the southern extension of the Downpour Creek fault to the east (Fig. 5 and 10). Northeast-striking faults link the two north-striking fault systems into a single sinistral transcurrent zone.

The Triassic Pass fault is located east of the Downpour Creek fault, and truncates it at a low angle (Fig. 5). Its southern, unmapped extension lies in the Iskut River valley. East of the Triassic Pass fault, the Smokey Ridge thrust fault imbricates Triassic and overlying pebbly sandstone on the mountainside immediately north of Downpour Creek (Fig. 5). The fault crops out in several incised gullies. In its footwall, cross-stratified Bowser Lake Group(?) sandstone with scattered chert pebbles and plant debris unconformably overlies Triassic tuffaceous mudstone above a well-developed regolith (Fig. 11). The fault is a zone of strong shearing that places Upper Triassic black phyllite and tuffaceous mudstone on top of undeformed sandstone of the Bowser Lake Group (Fig. 11). A second thrust fault is inferred lower down this slope, in the valley of Downpour Creek, that places the Triassic exposures below the unconformity on top of the Bowser Lake Group section that is exposed on Bandit Ridge, south of Downpour Creek. Folds in the Upper Triassic sequence and in the Bowser Lake Group trend eastward; these are consistent with the orientation of the Smokey Ridge Thrust fault.

The Triassic Pass fault truncates both of these thrust faults, as well as footwall Bowser Lake Group strata. Thus, motion on it must be younger than the Jurassic-Cretaceous Bowser Lake Group.

In the northeastern part of the area, a north-trending, near-vertical fault is exposed both north and south of More Creek. A large quartz-phyric rhyolite dike and a panel of highly sheared tuffaceous sedimentary beds and coal of probable Eocene age occur within the fault zone (Fig. 5 and 10).

MINERAL DEPOSITS

Northwestern BC hosts a variety of mineral deposit types characteristic of magmatic arc environments, including calc-alkaline porphyry copper-gold deposits (Fig. 1 in Schroeter and Pardy, 2004); Eskay Creek-type subaqueous hotspring deposits (Massey, 1999a); Kuroko-type VMS deposits (Massey, 1999b); and low-sulphidation epithermal deposits (Fig. 1 in Schroeter and Pardy, 2004). Near the current study area, intrusive-related Cu-Ni deposits (Lefebure and Fournier, 2000) and Besshi-type VMS deposits (Massey, 1999b) are hosted in rock units that may be present locally. Sedimentary strata of the Bowser Lake Group host coal deposits and have elevated concentrations of molybdenum and nickel (Alldrick *et al.*, 2004c). Recent study of the Bowser Lake Group has shown potential for the generation and accumulation of petroleum (Evenchick *et al.*, 2002; Ferri *et al.*, 2004).

Figure 12 shows the distribution of mineral deposits and prospects in the study area. Occurrences are concentrated in the volcanic strata that pre-date deposition of the Bowser Lake Group. This distribution is reflected in metal concentrations detected in the Regional Geochemical Surveys (*see* Fig. 5 and 7 in Lett and Jackaman, 2004). The metal-rich region lies west of Highway 37 and corresponds to the eastern edge of the Coast Mountains. Bowser Lake Group sedimentary strata, with its coal, petroleum and sediment-hosted metal potential, generally lie east of Highway 37.

Intrusion-related deposit types in or near the study area include porphyry copper-gold deposits, which are particularly common in this region (Schroeter and Pardy, 2004); intrusion-related low-sulphidation epithermal deposits; and magmatic copper-nickel deposits. Volcanic-hosted deposits include both the Eskay Creek deposits and some low-sulphidation epithermal veins (Massey, 1999a). Stratiform or stratabound deposit types include sediment-hosted molybdenum and nickel, Besshi-type sediment-hosted massive sulphide deposits, as well as volcanic-hosted VMS deposits (Massey, 1999b). Limestone units are favourable host rocks for gold-rich skarn deposits (*e.g.*, McLymont Creek).

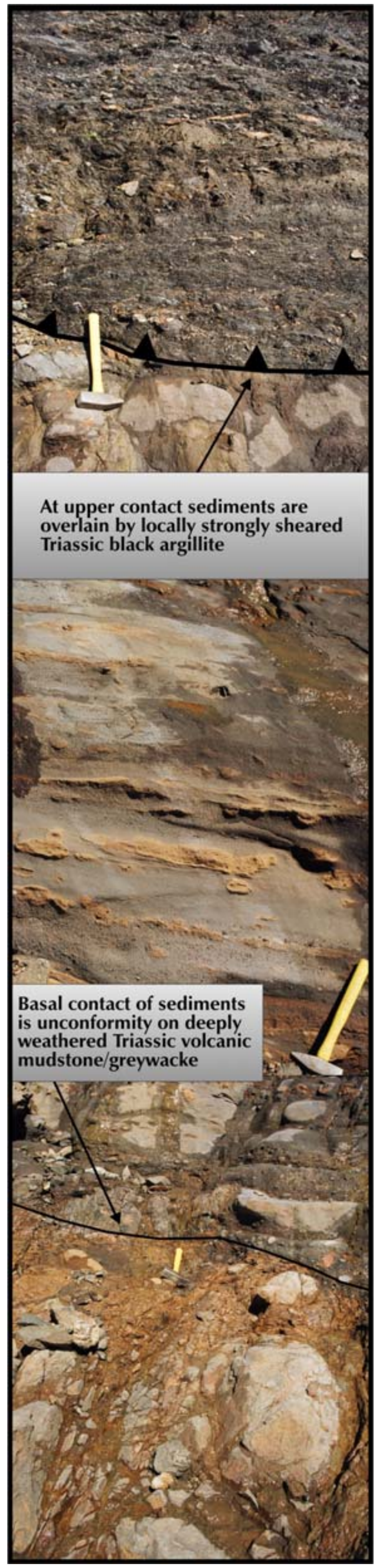


Figure 11. Composite photo of the thin Bowser Lake Group clastic sequence on Triassic basement, in the footwall of the Smokey Ridge thrust fault, which is expressed as highly sheared Triassic argillite overriding the undeformed pebbly sandstones of the Bowser Lake Group. Actual thickness of Bowser sediments in this exposure is about 50 m.

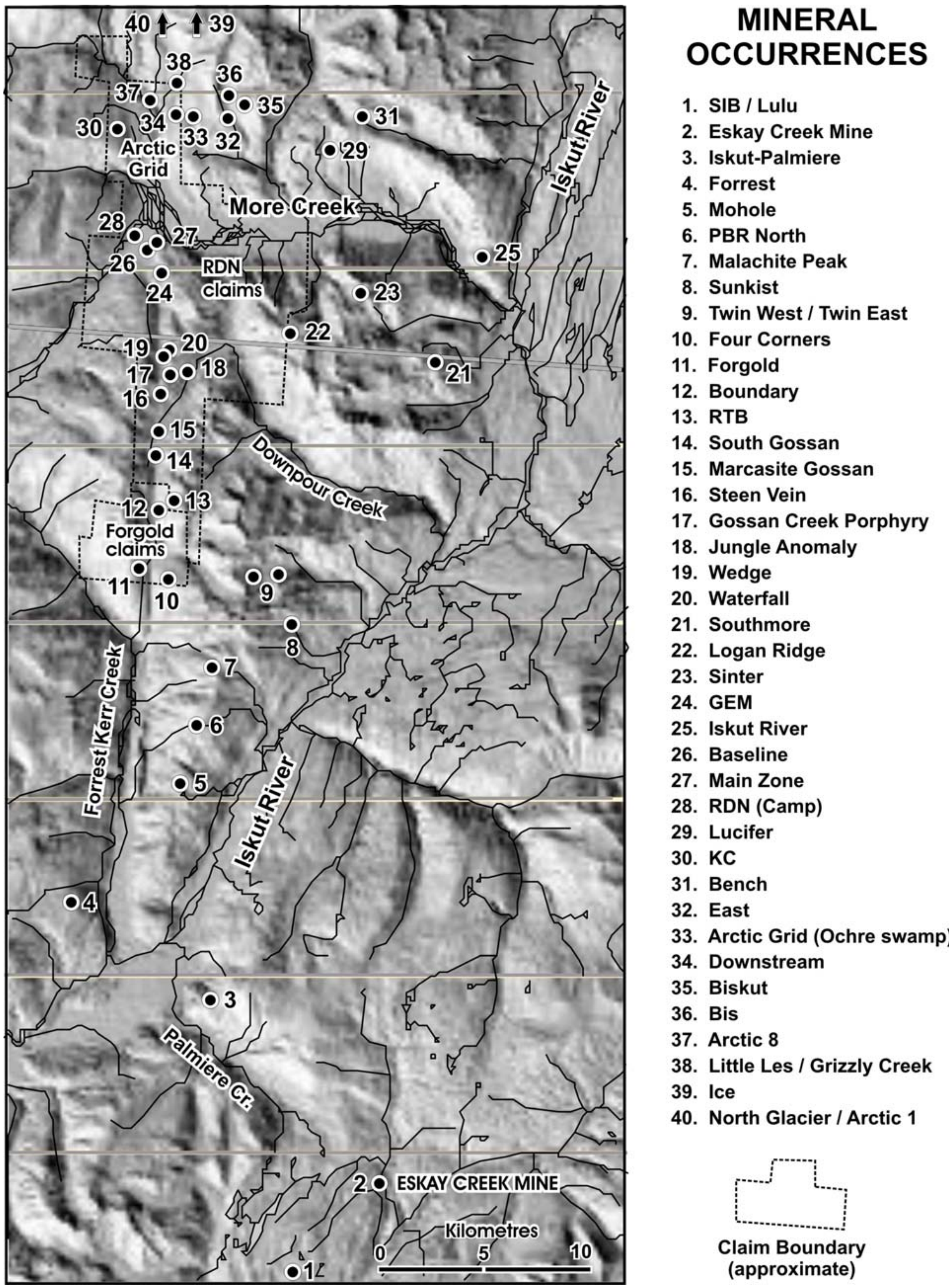


Figure 12. Mineral deposits and prospects in the 2004 map area. Note the concentration of mineral showings along the Forrest Kerr fault.

During the 2004 mapping program, six new mineral showings were located by government geologists working on the Targeted Geoscience Initiative project. As these crews focus on mapping, not prospecting, this is a surprisingly high number of new mineral occurrences, which reflects the high mineral potential of the region. More exploration work is justified based on these discoveries and on the presence of Eskay-equivalent strata in this map area.

The following deposit descriptions are listed from south to north; see Figure 12 for locations.

1. SIB / Lulu (104B 376) (UTM 09 / 0408589E / 6273080N)

This showing crops out near middle of the 9 km long trend of gossans and alteration that extends southwestward from the Eskay Creek mine area. Mudstones interbedded with felsic volcanics host pyrite, stibnite and sphalerite with trace native gold, pyrargyrite and arsenopyrite. A 2002 drillhole intersected 11.7 m grading 19.5 ppm Au and 1703 ppm Ag.

2. Eskay Creek (104B 008) (UTM 09 / 0412514E / 6279588N)

Roth (2002) classifies Eskay Creek as a polymetallic, precious metal rich, volcanogenic massive sulphide and sulphosalt deposit. Ore is contained in a number of stratiform zones and stockwork vein systems that display varied textures and mineralogy. The deposits formed during two periods of early Middle Jurassic hydrothermal activity, both of which were characterized by evolving fluid chemistry and mineralogy. Past production and reserve and resource estimates total 2.34 million tonnes grading 51.3 g/t Au and 2,326 g/t Ag.

3. Iskut-Palmiere (UTM 09 / 0403565E / 6287490N)

Realgar ± orpiment is hosted in both black siliceous siltstones and in a cross-cutting quartz vein. This small outcrop is exposed in a north-draining creek, and lies stratigraphically above a thick dacite unit on the north side of Palmiere (Volcano) Creek. Assays of two grab samples returned arsenic values greater than 1.0%, with negligible associated precious metals. However, creeks draining this low ridge to the north and south returned anomalously high gold grain counts in the heavy mineral concentrates collected during the recent Regional Geochemical Survey (Lett *et al.*, this volume).

4. Forrest (104B 380) (UTM 09 / 0396988E / 62192649N)

This prospect is located on the west side of Forrest Kerr Creek, opposite the south end of Pillow Basalt Ridge. Gold- and silver-bearing quartz-chalcopyrite veins occur in extensive quartz stockworks and individual veins associated with the Forrest Kerr fault. Grab samples assay up to 17.1 g/t Au. Visible gold occurs with bornite and hematite in quartz veins that assay up to 110.4 g/t Au.

5. Mohole (UTM 09 / 0401956E / 6297577N)

A deep drillhole has been completed in central Pillow Basalt Ridge. Hole PBR01-01 was located near the anticlinal fold axis on Pillow Basalt Ridge, to intersect the Eskay Creek horizon ("Contact Mudstone") at depth (see Baressi *et al.*, this volume). This drillhole was completed in two stages. In 2001, Homestake completed the hole to a depth of 1419 m. In 2003 Roca Mines Inc. deepened the hole to 1770 m.

6. PBR North (new showing) (UTM 09 / 0403150E / 6300650N)

On Pillow Basalt Ridge, locally thickened units of weakly pyritic, massive to flow-banded rhyolite are deposited within a succession of pillow lava, massive crystalline basalt flows and interlayered pyritic siliceous siltstones. The thicker rhyolite zones are interpreted as cryptodomes marking eruptive centres; thinner rhyolite units are interpreted as flows. Assays of grab samples collected from the pyritic siltstones have anomalous Zn, Ag and Ba values.

7. Malachite Peak (new showing) (UTM 09 / 0403620E / 6304260N)

North of the Kerr Bend fault, copper-bearing mafic volcanics crop out between 1800 to 2000 m elevation near the crest of Sixpack Range. Host rocks are fine-grained equigranular to weakly augite-feldspar porphyritic basalts. The massive basalt is cut by a network of fine fractures hosting pyrite and chalcopyrite. Malachite is prominent on weathered surfaces and along near-surface fractures.

8. Sunkist (new showing) (UTM 09 / 0406950E / 6305900N)

Ankerite alteration within an east-trending fault forms prominent bright orange gossans near the toe of Fourth Glacier. Best assays from three chip samples are 239 ppm Zn and 279 ppm As .

9. Twin (new showing) Twin East (UTM 09 / 0405840E / 6308160N) Twin West (UTM 09 / 0405120E / 6308015N)

Two prominent orange-weathering gossan zones are exposed on north-facing cliffs near the northeast end of Sixpack Range. A single elongate gossan is divided into two zones where a north-flowing valley glacier cuts through the host strata. The outcrops have not been examined, but this showing may be similar to Sunkist.

10. Four Corners (new showing) (UTM 09 / 0401000E / 6307715N)

A major volcanic centre is preserved northwest of Pillow Basalt Ridge. Numerous rhyolite dikes and flows are emplaced in a sequence of intercalated basalt and sedimentary rocks. Mineralization consists of minor to sparse disseminated pyrite and rare galena.

11. Forgold (104B 378) (UTM 09 / 0399429E / 6309294N)

This property is located west of Downpour Creek and just south of the RDN claimblock. Epithermal gold- and silver-bearing pyrite and chalcopyrite stringer veins assayed up to 30.5 g/t Au and 15.85% Cu (Assessment Report 20,540). Malensek *et al*. (1990) identified three styles of mineralization which are controlled by the Forrest Kerr fault. Chalcopyrite, galena and sphalerite stringers, and quartz-carbonate-sphalerite- galena-chalcopyrite stockwork veins grade up to 2.09 g/t Au. Disseminated chalcopyrite within silicified zones grade up to 112.46 g/t Au and 17.16% Cu. Proximal stocks of monzonite may be genetically associated with the alteration and mineralization.

12. Boundary (RDN) (UTM 09 / 0400040E / 6310950N)

A narrow silicified zone hosts a thin chalcopyrite veinlet. Assays returned anomalous gold values (Savell, 1990). Noranda Exploration Ltd. drilled five holes on this target area in 1991. The best intersection was 11.6 m grading 23.9 g/t Au (Logan *et al.*, 1992 and Awmack, 1997). The best assays obtained from 1998 surface samples were 56.7 ppm Au, 44 ppm Ag, 44 ppm As, 6.34% Cu, 18.7 ppm Hg, 3.900 ppm Pb, and 9,360 ppm Zn (Awmack and Baknes, 1998).

13. RTB (new showing) (RDN) (UTM 09 / 0400710E / 6311425N)

This prospect consists of disseminated and fine fracture-hosted pyrite, chalcopyrite, tetrahedrite and galena in flow-banded rhyolite and adjacent fine sandstone. Rare tetrahedrite and native silver were noted in some samples. Nearby pillow lavas of plagioclase-potassium feldspar porphyry display interbeds and selvages of pyrite- and tetrahedrite-bearing jasper. Best assay results from five chip samples are 0.5% Cu, 2.2% Pb, 8.8% Zn, 245 ppm Ag, 1.4 ppm Au, 2690 ppm Sb, 87 ppm Hg and 499 ppm As.

14. South Gossan (RDN) (UTM 09 / 0399935E / 6313870N)

South Gossan is a large resistant knob of massive dacite flow on the east bank of the headwaters of Downpour Creek. Ubiquitous fine hairline fractures host a weakly developed `stockwork' of pyrite, calcite and quartz. Subsequent weathering has coated the entire surface of this large outcrop area with striking buff-orange ankeritic weathering. No significant metal values have been obtained (Savell, 1990).

15. Marcasite Gossan (UTM 09 / 0400135E / 6314780N)

This prominent gossan crops out on the east bank of upper Downpour Creek, 900 m north of South Gossan. In this area, strata dip moderately westward with tops up to the west. The showing consists of three stacked dacitic flow units separated by locally fossiliferous siltstone, sandstone and limestone. Dacites are weakly to strongly pyritic, the sedimentary units host only trace to minor pyrite. The middle dacite unit is the most intensely mineralized, and hosts a stockwork of marcasite-pyrite-chalcedony-calcite-pyrobitumen-barite veins. Individual veins range up to 10 cm thick. Mineralization ends abruptly along strike at the north side of the outcrop area against a synmineralization fault. The easternmost, topographically higher but stratigraphically lower, Upper Marcasite Gossan consists of a weaker quartz-chalcedony-pyrite-pyrobitumen stockwork. Savell (1990) reports that gold and base metal values are negligible, but assay results from surface samples include 141 g/t Ag, 2,750 ppm As, 122 ppb Sb, 124 ppm Mo and 5,240 ppb Hg. Even higher values have been obtained from mineralized float boulders near the Upper Marcasite Gossan. Four drillholes completed to date did not intersect mineralization.

16. Steen Vein (RDN) (UTM 09 / 0400290E / 6316195N)

This polymetallic vein crops out in the north wall of the lower gorge of Cole Creek, a small creek that drains southeastward into upper Downpour creek, just south of the Gossan Creek Porphyry. Discovered in 1997, this quartz-galena-sphalerite-tetrahedrite vein follows an east-northeast–trending fault. Chip samples across a true vein width of 2.0 m averaged 279 g/t Ag, 1.86% Pb, 0.77% Zn and 350 ppb Au.

17. Gossan Creek Porphyry (RDN) (UTM 09 / 0400910E / 6317240N)

The Gossan Creek porphyry intrusion (Fig. 5), located near the headwaters of Downpour Creek, roughly correlates with a large bleached gossan (Fig. 13a, b). Three geophysical targets were drill-tested by Noranda in 1991 (Savell and Grill, 1991). DDH 18 intersected argillic-altered feldspar porphyry hosting 5 to 15 % fine- to medium-grained pyrite disseminations and veinlets. From 103.4 to 113.3 m, stringers of sphalerite and chalcopyrite assayed 0.18% Cu, 0.14% Pb, 0.43% Zn 1.17 g/t Ag and 0.07 g/t Au. Other drillholes cut pyritic stockwork with up to 25% fine pyrite.

18. Jungle Anomaly (RDN) (UTM 09 / 0401420E / 6317365N)

This exploration target is a 100 by 450 m soil geochemical anomaly located in thick brush on the west bank of upper Downpour Creek, 2.6 km north of the Marcasite Gossan and just north of the Gossan Creek Porphyry. Samples indicate anomalous Au, As, Ag and Pb values in soils overlying bedrock of clastic sedimentary rocks, rhyolite and basalt. A float cobble of pyritic, silicified argillite collected near the centre of the anomaly assayed 25.44 g/t Au. Pyritic chert float also collected from this area does not occur elsewhere on the extensive property. Subsequent geophysical surveys and drilling have not located a bedrock source.

19. Wedge (RDN) (UTM 09 / 0399975E / 6319070N)

The Wedge prospect crops out low on a west-facing, heavily wooded hillside, just northeast of the headwaters of Carcass Creek at the toe of a glacier, and 5 km south of the current exploration camp. Five drillholes completed in 1990-91 cut mineralized veins in eleven intersections with best assays of 137.8 ppm Au, 62.4 ppm Ag, 2.7% Cu, 0.48% Pb and 3.26% Zn (Awmack and Baknes, 1998).

20. Waterfall (RDN) (UTM 09 / 0400115E / 6319230N)

A quartz-sulphide vein is discontinuously exposed for 50 m (Savell, 1990).

21. Southmore (UTM 09 / 0413310E / 6318760N)

The east wall and south wall of a small north-draining cirque reveal six outcrop areas of strongly gossanous, pyritic, flow-layered white rhyolite. This unit is correlated with the regionally distributed Upper Triassic pyritic rhyolite that also hosts the Bench and Sinter showings. Adjacent units of thin-bedded black siltstone are also pyritic. Associated rock types include buff-weathering sandstone with horizons of wood debris, black limestone, and one rhyolite flow. The strata are cut by a 1.5 m thick sill of flow-banded basalt. Three gossanous outcrops were sampled, the best assays are 28 ppm Mo, 16 ppm Cu, 10 ppm Pb, 25 ppm Zn, 214 ppb Ag, 24 ppm As, 777 ppb Hg and 4 ppm Sb.

22. Logan Ridge (UTM 09 / 0406030E / 6319780N)

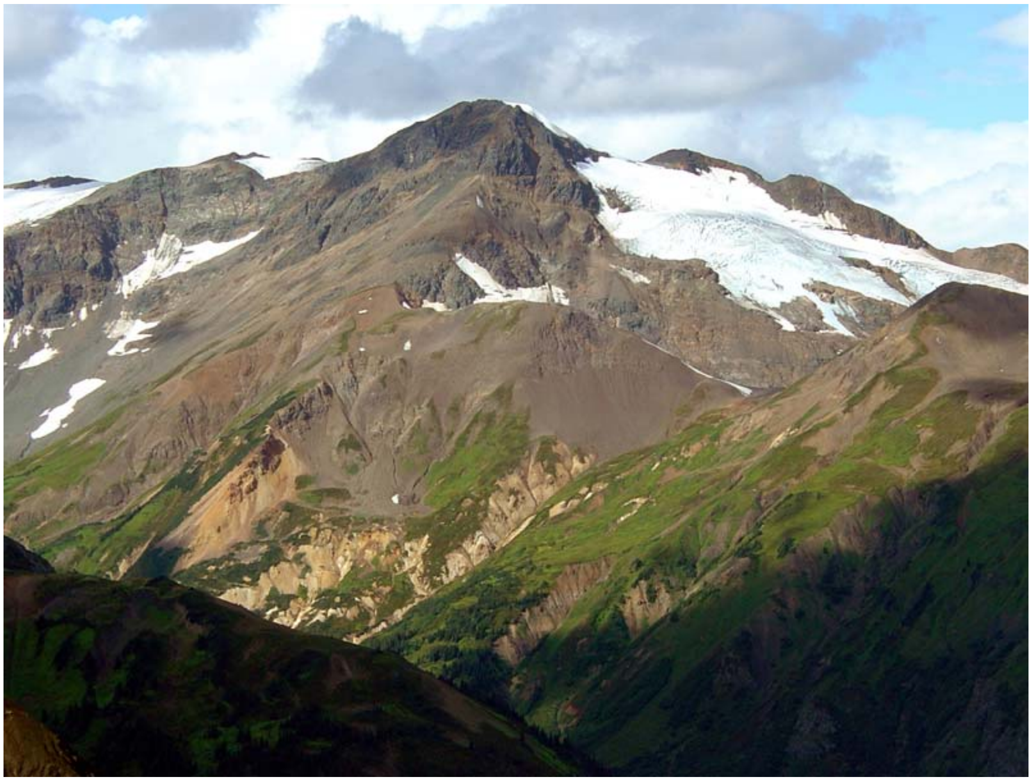
A prominent, resistant ridge of intensely gossanous rhyolite spines marks the skyline west of Arrow Creek. Since 1990, this ground has been held as the STOW and PINE claims, and is currently registered as the MOR 8 claims; no exploration results have been reported.

23. Sinter (UTM 09 / 0409560E / 6322175N)

Recent glacier retreat has exposed an extensive area of strong pyritic stockwork, south of More Creek and east of Arrow Creek. During the summer of 1988, the area was explored by Valley Gold Ltd., Noranda Ltd. and Corona Corporation (Bale and Day, 1989). Follow-up work by Noranda Ltd in 1990 (Grill and Savell, 1991) discovered no base or precious metal mineralization, but anomalous mercury (up to 196 ppm Hg), arsenic and antimony were obtained all along the 2 km long trace of the northwest-trending Citadel fault. Barrick Resources sampled the prospect in 2003. An unreported single drillhole was collared at the toe of the west-flowing glacier by Noranda; no results are known. The best assay results from three chip samples collected in 2004 are 122 ppm Cu, 350 ppm Zn, 7 ppm Pb, 24 ppm Ag, 5,750 ppm Ba, 13 ppm Hg and 24 ppm As.

24. GEM (RDN) (UTM 09 / 0399565E / 6322980N)

This prospect crops out 1000 m south of the Main showing on the east side on Carcass Creek, and is hosted in the same massive dacite unit. Discovered by Noranda geologists in 1991 (McArthur *et al.,* 1991), the best assay obtained from grab samples was 5.1 ppm Au. Resampling in 1997 returned a best assay of 2.16 ppm Au and 32 ppm Ag (Awmack, 1997). A soil survey over the area indicates that the dacitic volcanic hostrocks have anomalous Au, Ag, Cu, Pb, Zn, As, Sb and Mn values.



A.

B.

Figure 13. The Gossan Creek Porphyry gossan. A. Looking southwest. The glaciated peak in background lies on the west side of the Forrest Kerr fault. B. The same gossan zone viewed from the south across Downpour Creek

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25. Iskut River (104G 104) (UTM 09 / 0415471E / 6324464N)

A major (>100 m thick) fossiliferous limestone unit of Upper Triassic age is exposed on cliffs near the mouth of More Creek.

26. Baseline (RDN) (UTM 09 / 0399180E / 6323665N)

This prospect is a quartz vein breccia exposed 240 m southwest of the Main Zone. A chip sample assayed 6.21 g/t Au.

27. Main Zone (RDN) (UTM 09 / 0399355E / 6323810N)

This prospect crops out on the east side of Carcass Creek, 700 m east of the current exploration camp. This showing was discovered by Noranda geologists in 1991 (McArthur *et al.,* 1991) and has remained a focus of exploration efforts on this large property. Host rock is Early Jurassic dacite that is locally porphyritic, spherulitic or silicified. Mineralization consists of disseminated sulphides in areas where the dacite is bleached and silicified. The best assays reported from a series of chip samples (McArthur *et al.,* 1991) are 5 ppm Au, 32.8 g/t Ag, 0.5% Cu, 0.5% Pb, and 10% Zn. A soil survey over the area indicates that the dacitic volcanic rocks have anomalous Au, Ag, Cu, Pb, Zn, As, Sb and Mn values. Subsequent exploration has shown that the prospect is an intensely silicified fault breccia trending 060 degrees (Awmack, 1996); a chip sample across its 8.3 m width returned 3.1 ppm Au, 0.49% Pb and 1.13% Zn. A separate outcrop area 130 m to the west-southwest is called the Club Zone. This 7m long outcrop of silicified breccia returned maximum assays of 2700 ppm Pb, 1205 ppm Zn and 515 ppb Au from three chip samples.

28. RDN (UTM 09 / 0398770E / 6323970N)

The name RDN refers to a large north-trending claim block containing several prospects. The core claims were staked in 1987, predating the discovery of the Eskay Creek 21 Zone. Additional claim blocks to the north and south have been added over the last 17 years. The UTM coordinates above give the location of the current exploration camp. Noranda Exploration Ltd. explored these claims from 1989 to 1991, including a fifteen-hole drill program in 1990 and a further 15 drillholes in 1991. Pathfinder Resources explored the claim block from 1994 to 1996. Rimfire Minerals acquired all the claims in 1997 and conducted soil sampling, geological mapping, trenching and prospecting in 1997 and 1998. Barrick explored the property under option in 2002 to 2003. Northgate Minerals Corporation and Rimfire Minerals completed a nine-hole drill program in 2004, targeting the Wedge Zone, Jungle Anomaly and Marcasite Gossan prospects.

29. Lucifer (104G 145) (UTM 09 / 0407979E / 6329387N)

An extensive carbonate-pyrite-sericite-silica alteration zone has anomalous Au, As, Ba, Cd, Cu, Mo, Pb and Zn values. Country rock is Upper Triassic sedimentary and volcanic rocks intruded by a set of Early Jurassic potassium feldspar megacrystic dikes. Alteration is most intense along steep northeast-trending faults. Two holes drilled on the property in 1991 intersected 1.36 m grading 15 ppm Au and 5.7 m grading 0.7 ppm Au (Dewonck, 1991).

30. KC (RDN) (UTM 09 / 0397140E / 6329780N)

Chalcopyrite veins and veinlets are hosted in Early Jurassic feldspar porphyritic, potassium feldspar megacrystic granodiorite. Several massive chalcopyrite veins up to 12 cm wide are hosted by a dioritic phase of the leucocratic granodiorite (Bobyn, 1991, p.13, 15). The veins are vertical and exposed in a small creek bed over a width of 4 m. Selected grab samples have anomalous Au, Cu and Ag values.

31. Bench (UTM 09 / 0409490E / 6330105N)

A band of massive to semi-massive, fine-grained, bright pyrite crops out at the base of a high cliff of black, pyritic, flow-layered rhyolite near the head of Bench Creek. The upper part of the cliff is faintly banded, black to charcoal rhyolite with a fine dusting of pyrite evenly disseminated throughout the rock. Within the lower 5 m along the base of the cliff, the rhyolite is transected by many fine hairline cracks filled with pyrite. Along most of the length of the cliff, a talus pile of coarse blocks and boulders is piled up against the basal rhyolite layer with the pyritic fractures. At one location near the upstream end of the cliff, the top of the talus pile is lower and exposes 2 feet of massive, fine-grained granular pyrite and semi-massive granular pyrite disseminated in white, fine-grained quartz. The significance of this small showing is its stratabound character and the high probability that this mineralization extends laterally under the blocky talus cover. In 2004, eight samples were collected from this unit along a 2 km strike length. Best assays were 51 ppm Mo, 70 ppm Cu, 44 ppm Pb, 89 ppm Zn, 15 ppb Au, 1099 ppb Ag, 15 ppm As, 2.7 ppm Sb and 394 ppb Hg.

32. East (RDN) (UTM 09 / 0402900E / 6330095N)

Mineralized float samples collected downstream from the Bis prospect assayed 1.9 ppm Au and 771 ppm As.

33. Arctic Grid (RDN) (UTM 09 / 0401400E / 6330165N)

The Arctic Grid is the northernmost claim block of the RDN claim package. The Arctic claims were staked and extensively explored in 1990 by Skeena Resources (Bobyn, 1991). Eight mineral prospects lie on the Arctic claim block: Grizzly Creek (Little Les), North Glacier, Arctic 8, KC, Ice, Bis, Downstream and East. The coordinates above give the location of a large ochre-coloured swamp east of the centre of the claim block.

34. Downstream (RDN) (UTM 09 / 0400485E / 6330215N)

This showing is located 2.5 km downstream of the Grizzly showing, on the southeast bank of Grizzly Creek. Narrow chalcedony veins within pyritic felsite/rhyolite host stringers of massive pyrite up to 5 cm wide. Grab samples from two of these pyrite veins assayed 75 ppm Hg, 580 ppm Sb and 4860 ppm As (Bobyn, 1991; Awmack, 1997).

35. Biskut (104G 146) (UTM 09 / 0403381E / 6331472N)

High on the north slope of More Creek, a 300 by 100 m alteration zone of quartz-sericite-pyrite-clay is developed in Upper Triassic volcanic and sedimentary rocks. Sulphide mineralization locally ranges up to 5% pyrite, with minor galena and arsenopyrite.

36. Bis (RDN) (UTM 09 / 0402915E / 6331215N)

Felsite dike or flow rock hosts 3 to 5% disseminated pyrite and trace arsenopyrite. A grab sample of strongly gossanous felsic rock assayed 5 ppm Au, 570 ppm Cu, 41.9 ppm Ag, 391 ppm As and 124 ppm Mo (Bobyn, 1991, p. 8 and 12).

37. Arctic 8 (RDN) (UTM 09 / 0399065E / 6331145N)

One creek north of Grizzly Creek, and near the unnamed creek's junction with More Creek, several carbonate lenses up to 0.75 m wide are interbedded with greywacke and conglomerate. The carbonate rocks host 1 to 2% galena and trace chalcopyrite and sphalerite (Bobyn, 1991, p. 12 and Map 1). No assays are reported.

38. Little Les / Grizzly Creek (RDN) (104G 079) (UTM 09 / 0400720E / 6331860N)

This is the only prospect on the extensive RDN claim group where pre-1987 exploration is recorded. Initially named Little Les, this prospect has also been named More, Two More and is now referred to as the Grizzly showing on the Arctic Grid, RDN property. To the east of the north branch of More Creek, on the present Arctic Grid, a large gossan is developed where volcanic rocks are intruded by dikes of potassium feldspar megacrystic granodiorite dikes (Folk, 1980). Pyritic alteration hosts trace chalcopyrite, galena, sphalerite, malachite and molybdenite(?). Average grades from 11 chip samples are 0.3% Cu, 1.71 g/t Ag and 0.41 g/t Au. Newmont drilled two short holes on this target in 1970; no results are available (Geology, Exploration and Mining, 1971). Bobyn (1991, p. 12) described porphyry copper-style mineralization exposed over a 300 by 25 m area along the upper part of the northernmost tributary of Grizzly Creek. The host rock is carbonate-chlorite-sericite altered andesitic flows and tuffs. Mineralization is 2 to 5% disseminated chalcopyrite with 1 to 3% disseminated and fracture-fill pyrite. Throughout the area of the showing, stringers of massive chalcopyrite range up to 5 cm wide, with pods and lenses up to 50 cm wide. Trace galena and sphalerite are also present. Mineralization is fracture controlled and best developed proximal to the many feldspar porphyry and felsite dikes, which cut the volcanics.

39. Ice (RDN) (UTM 09 / 0401535E / 6336200N)

Hornblende diorite hosts up to 25% pyrrhotite near the intrusive contact of this large stock (Bobyn, 1991, Map 1). A grab sample assayed 31 ppb Au, 3.7 ppm Ag and 3152 ppm Cu. Similar mineralization occurs in a similar setting 3 km south; in the southwest corner of Upper More 1 claim, on the north bank of the stream immediately northwest of the Grizzly Creek prospect, gossanous cliffs host up to 7% disseminated pyrrhotite and pyrite (Bobyn, 1991, p. 12-13).

40. North Glacier / Arctic 1 (RDN) (UTM 09 / 0400065E / 6337235N)

Mineralized float samples collected from glacial moraines returned assays ranging up to 4.5 ppm Au, 9,034 ppm Cu, 74.6 ppm Ag and 20,147 ppm As.

METALLOGENY

In the map area and in the surrounding region, Upper Triassic mineralization includes large porphyry copper-gold systems (GJ, Galore Creek), Besshi-type VMS deposits (Rock and Roll), pyritic rhyolite/exhalite (Bench, Citadel, Southmore) and vuggy rhyolite dikes and flows with elevated Au, Ag, Hg, Sb and As concentrations (Rainbow). Lower Jurassic mineralization that predates the erosional interval marked by Nassian uplift is represented by large porphyry copper-molybdenum systems (Mary, Red-Chris), stratabound bulk-tonnage epithermal mineralization (Hank), and precious metal-rich skarn deposits (McLymont). Lower to Middle Jurassic mineralization that post-dates the Nassian uplift includes the Griz prospect and many areas of pyritic felsic volcanic units and derived volcaniclastic sedimentary rocks (*e.g.*, Fig. 4 in Simpson and Nelson, 2004), plus the Eskay Creek gold mine and numerous nearby prospects (Lulu, 22 Zone, HSOV).

Exploration Potential

Discovery of a number of small prospects during this season's regional mapping program indicate that the potential of this area has not yet been thoroughly assessed.

Due to the highly dissected terrain, geochemical stream sediment sampling has proven to be a particularly successful and cost-effective tool for assessing the potential of larger areas (Lett and Jackaman, 2004; Lett *et al.*, 2005) and should be equally powerful as a second phase follow-up technique. The middle unit of Pillow Basalt Ridge is favourable for the deposition and preservation of exhalative sulphides and should be selectively prospected. Other areas of quiescent, distal sedimentation will be particularly conducive to the accumulation and preservation of exhalative sulphides (*e.g.*, northern Downpour Creek area).

DISCUSSION AND CONCLUSIONS

This project has provided important new detailed geological surveys of the northern Eskay Rift rocks within the Iskut map area. Tracts of "Eskay equivalent" strata crop out on Pillow Basalt Ridge and north to More Creek. They are correlative in general with sequences mapped in 2003 on Table Mountain, on Willow Ridge and on ridges east and west of Kinaskan Lake (Alldrick *et al.*, 2004a, 2004b)

Fieldwork in 2004 has clarified the nature, stratigraphic and structural context, and mineral potential of the "Eskay equivalent" strata in northern Iskut map area. They can be divided into five separate facies units, Pillow Basalt Ridge, Forgold, Sixpack Range, Downpour Creek and Iskut River. The Sixpack Range is a coarse, proximal, conglomeratic facies (Fig. 7), similar to conglomerates identified in 2003 on Table Mountain and near Kinaskan Lake (Alldrick *et al.*, 2004a, 2004b). They represent rift-margin deposits related to scarps. By contrast, the Forgold basalts rest directly on older basement without intervening clastic units.

Felsic centres are located in the Four Corners complex and the "middle unit" on Pillow Basalt Ridge. Laminated siliceous argillite and rhyolitic tuffaceous siltstones - the "pajama beds" (Anderson, 1993) - are also present at both of these sites.

The Forrest Kerr fault and related faults form the present structural framework for the rift system that localized the Eskay VMS deposit, its host rocks, and correlative strata (Fig. 10). It forms the western boundary of mid-Jurassic exposures as far north as the headwaters of More Creek. Its northern extension is buried under the Mt. Edziza volcanic centre (Fig. 2). North of More Creek, the zone of mid-Jurassic bimodal/sedimentary exposures steps east to the Table Mountain/Kinaskan Lake area. There, it is bounded to the west by local scarps that Alldrick *et al.* (2004b) interpreted as rift margins. Coarse, unsorted conglomerates related to the scarps underlie sedimentary strata containing Toarcian-Bajocian macrofossils.

The trace of the Forrest Kerr fault coincides with a major magnetic lineament (Alldrick, 2000). South of the Iskut River, the Forrest Kerr fault is connected to the Harrymel fault through a complex step-over zone (Read *et al.*, 1989; Alldrick, 2000). This structure continues south to the Granduc mine area, where it is expressed as a 2 km wide zone of transcurrent ductile deformation, the South Unuk shear zone (Lewis, 1992). Uranium-lead dates on syn- and post-kinematic plutons constrain sinistral motion to between 172 and 167 Ma (Fig. 10c; Lewis, 2001).

Geological observations in the present project area are consistent with the interpretation of Read *et al.* (1989) that an episode of sinistral motion on the Forrest Kerr fault post-dated deposition of the Pillow Basalt Ridge strata. The Middle to early Late Jurassic Iskut River unit is interpreted as a fault-related deposit localized along a north-striking sinistral fault that is a splay of the Forrest Kerr fault zone. This offset is contemporaneous with sinistral motion on the South Unuk shear zone. We infer that a regional sinistral shear couple existed along the north-striking bounding faults of the mid-Jurassic rift system, deforming strata and modifying structures created during earlier stress regimes.

Evidence for the stress regime during deposition of the Eskay Creek host rocks and their correlatives consists mainly of observed orientations of rift-related features. These vary along strike of the rift (Fig. 5 and

10). In the Table Mountain area, lines of rhyolite centres and dike swarms are oriented north-northwesterly (Alldrick *et al.*, 2004a, 2004b). This season, a north-northwesterly horizon of pyritic sinters has been discovered on south-central Table Mountain (A. Birkeland, pers comm, 2004). On northern Pillow Basalt Ridge, a line of small rhyolite intrusive centres trends northeasterly (30 degrees). Finally, in the vicinity of the Eskay mine the alignment of felsite centres, feeder dikes and stockwork-style mineralized zones parallel to the fold axis of the northeast-trending Eskay anticline suggests that this fold could be an inverted rift basin (McClay *et al.*,1989).

The combined Forrest Kerr and Harrymel faults provide a possible locus for the western margin of the rift zone. A northerly-trending line of altered Early(?) Jurassic porphyry intrusions lies immediately west of the Forrest Kerr fault along Forrest Kerr Creek (Read *et al.*, 1989; Logan *et al.*, 2000). Similarly, mapping by Equity Engineering and this project team has outlined a northerly trend of Early Jurassic dacite intrusive/extrusive centres east of the fault, near the headwaters of Downpour Creek. The alignment of these centres along the Forrest Kerr fault suggests that it was a zone of crustal weakness in Early Jurassic time, prior to development of the Eskay rift. The east-side-down West Slope fault truncates the Early Jurassic plutons, but is older than the main Forrest Kerr strand (Read *et al.*, 1989). It could have been a mid-Jurassic, graben-bounding normal fault. The Forrest Kerr splay that is cut off by the Four Corners complex is another example of a probable syn-rift fault.

In the Table Mountain area, north-northwesterly tensional features parallel the western rift margin, consistent with orthogonal extension (Alldrick *et al.*, 2004). In contrast, the northeasterly orientation of mid-Jurassic dikes on Pillow Basalt Ridge suggests an oblique component to extension across the north-striking bounding faults (Fig. 10b). Because these features are extensional rather than compressional, movement due to this component would have been opposite to that manifested in the latest mid Jurassic event, *i.e.*, dextral rather than sinistral. Similarly, in the vicinity of the Eskay mine, north-northeasterly extensional features require an oblique stress component. Thus, evidence for dextral, syn-rifting offset is seen in the area from More Creek at least as far south as Tom Mackay Lake. It corresponds to the unique Paleozoic horst and deep graben in this area, evidenced by the unusually thick Pillow Basalt Ridge basalts.

Figure 10 summarizes the inferred structural development of the Eskay rift zone. In mid-Jurassic time, rifting took place in en echelon zones between Kinaskan Lake and the Granduc mine. Over most of the area, orthogonal rifting prevailed. A dextral component across the Forrest Kerr fault led to strong horst and graben development, oblique to the main northerly trend.

In early Bajocian time (172 to 167 Ma), a new stress regime, controlled by a sinistral shear couple across the dominant northerly faults, was superimposed on the rift basins and terminated their development. It caused fault reversal and created local high energy depositional environments in the Iskut River unit.

SUMMARY

Mapping has refined the stratigraphic and structural picture of the More Creek – Palmiere Creek area. Important contributions include the recognition of the near absence of strata representing the lower Hazelton Group, and recognition of regional-scale unconformities that form irregular boundaries between major stratigraphic packages.

Strata deposited within the Eskay rift extend northward through the present map area, displaying a range of different facies which reflect the proximity to volcanic centres and the depositional setting. The Pillow Basalt Ridge facies and the Four Corners complex comprise bimodal volcanic rock types and related sedimentary strata correlative with strata that host the Eskay Creek orebodies to the south.

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