New mapping around the Slab iron oxide-copper-gold occurrence, Wernecke Mountains (parts of NTS 106C/13, 106D/16, 106E/1 and 106F/4), Yukon

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ABSTRACT

Bedrock underlying the Slab iron oxide-copper-gold occurrence consists of fine-grained sedimentary rocks and schist of the Fairchild Lake Group (oldest unit of the Early Proterozoic Wernecke Supergroup), intermediate to mafic Slab volcanics, dioritic Bonnet Plume River Intrusions, and Early Proterozoic Wernecke Breccia that crosscuts all other units. The Wernecke Breccia was divided into two units: Type 1 and Type 2. Type 1 is limited in extent and consists of sedimentary and locally abundant massive magnetite clasts in a carbonate-magnetite matrix. Type 2 cuts Type 1 and comprises sedimentary clasts in a micro-breccia matrix. Iron oxide-copper-gold mineralization is associated with Wernecke Breccia. It occurs disseminated in quartz-carbonate veins cutting metasomatized sedimentary rocks, as sulphide veins that cut Type 1 breccia, as sulphide clasts in Type 2 breccia, as well as disseminated in the matrix of Type 2 breccia, and finally as sulphide veinlets crosscutting Type 2 breccia.

RÉSUMÉ

Le substratum de l'occurrence Slab d'oxyde de fer-cuivre-or est constitué des roches sédimentaires et du schiste à grain fin du Groupe de Fairchild Lake, la plus ancienne unité du Supergroupe de Wernecke du Protérozoïque précoce, des roches volcaniques intermédiaires à mafiques de Slab, des roches intrusives dioritiques de Bonnet Plume River ainsi que de brèche de Wernecke datant du Protérozoïque précoce, qui recoupe toutes les autres unités. La brèche de Wernecke a été subdivisée en deux unités : le type 1 et le type 2. Le type 1 occupe une étendue limitée et consiste en clastes sédimentaires de magnétite massive abondants par endroits dans une matrice de carbonate-magnétite. Le type 2 recoupe le type 1 et est constitué de clastes sédimentaires dans une matrice de microbrèche. La minéralisation en oxyde de fer-cuivre-or est associée à la brèche de Wernecke. Elle est disséminée dans des veines de quartz-carbonate recoupant des roches sédimentaires métasomatisées. Elle recoupe sous forme de veines de sulfures la brèche de type 1, se présente sous forme de clastes de sulfures dans la brèche de type 2, est disséminée dans la matrice de la brèche de type 2 et recoupe sous forme de veinules de sulfures la brèche de type 2.

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INTRODUCTION

This paper briefly describes the results of new geological mapping carried out in the 'Slab Mountain'[5] area (Fig. 1) and is a companion to Open File map 2002-6 (Fig. 2; Hunt et al., in press). The mapping was carried out mainly at 1:5000 scale, with more detailed mapping in part of 'Slab Creek' (Brookes et al., this volume), on the eastern part of Slab Mountain and the western part of 'Slab Ridge' (Laughton et al., this volume; Brideau et al., this volume). Parts of Slab Ridge and Slab Mountain are cliff forming and inaccessible, and were mapped in less detail. This work builds on local mapping by/for Newmont Mines Limited (Vance et al., 1995; Owerko, 1995) and on regional mapping by Thorkelson (2000). This study is part of a research program on Proterozoic mineral occurrences and geology in the Yukon which is being undertaken by the Yukon Geology Program, Simon Fraser University (British Columbia) and James Cook University (Queensland, Australia).

LOCATION, PHYSIOGRAPHY AND ACCESS

The map area is located in northeastern Yukon Territory about 150 km northeast of the town of Mayo (Fig. 1). It covers an area of approximately 10 km^2 around Slab Mountain on the northeast side of the Bonnet Plume River, and includes parts of NTS map sheets 106C/13, 106D/16, 106E/1 and 106F/4. The northern boundary of the study area is the informally named Slab Creek, which drains into the Bonnet Plume River (Fig. 2). The Slab Mountain area is remote and mountainous with elevations from 560 to 1500 m.

Access to the map area is by fixed-wing aircraft to the 'Copper Point' airstrip immediately west of Slab Mountain, or the Bonnet Plume River, or by helicopter. In winter, access is also possible along the Wind River Trail, a rough winter road that begins near Keno (Fig. 1).

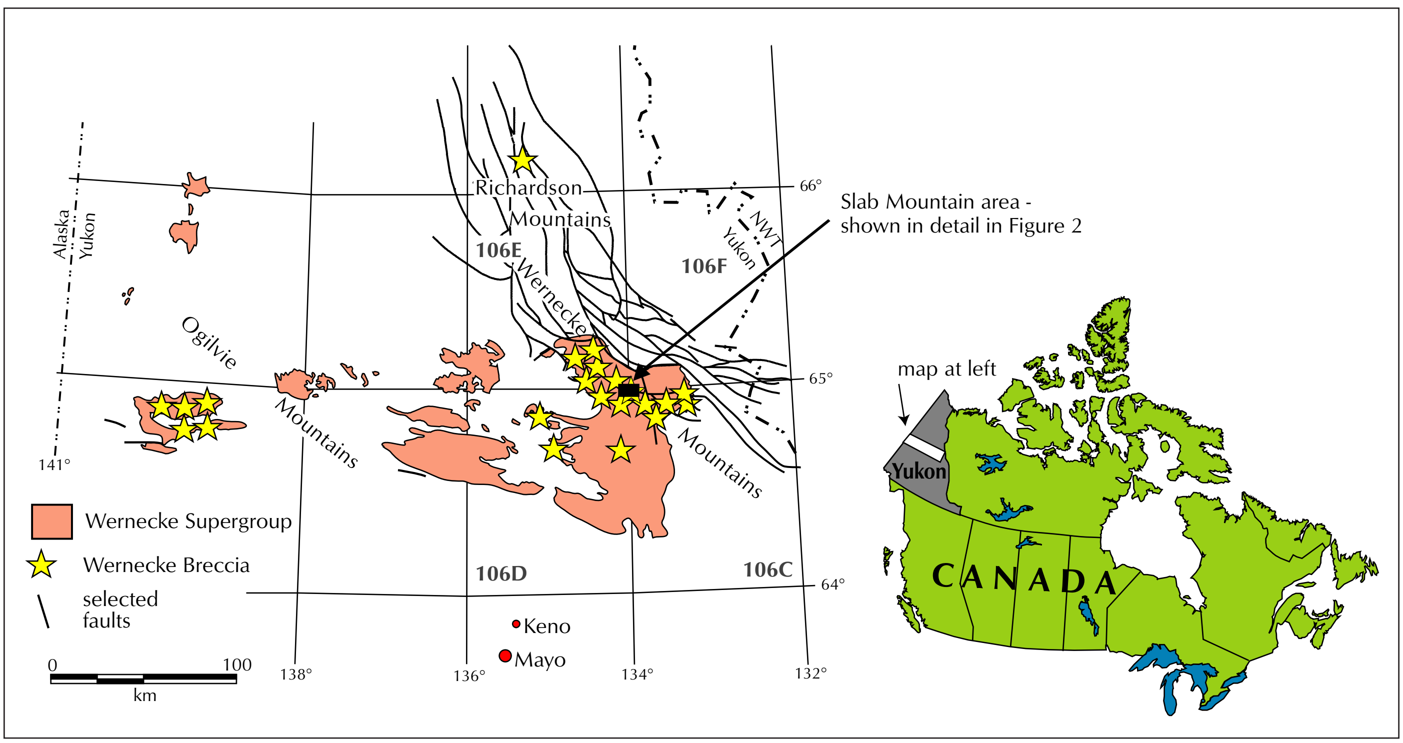


__Figure 1.__ Location of the Slab Mountain map area and distribution of Wernecke Breccia occurrences and Wernecke Supergroup rocks in the Yukon. Modified from Thorkelson (2000).

[5]*Many of the names used in this report are informal and are initially shown in quotation marks.*

GEOLOGY OF THE MAP AREA

INTRODUCTION

The map area is underlain by four main geological units (Fig. 2): 1) Early Proterozoic Fairchild Lake Group sedimentary rocks that are part of the Wernecke Supergroup (*cf.* Delaney, 1981; Thorkelson, 2000); 2) crosscutting Early Proterozoic Bonnet Plume River intrusions (ca. 1.71 Ga; Thorkelson et al., 2001a); 3) undated, but possibly correlative, Slab volcanics (Thorkelson, 2000); and 4) Middle Proterozoic Wernecke Breccia that crosscuts the three older units and is, at least in part, ca. 1.6 Ga (*cf.* Thorkelson et al., 2001b). These geological units, and the contacts between them, are well exposed and provide a firm basis for clarifying aspects of the Early to Middle Proterozoic evolution of the Yukon.

The geological units are described below and their distribution is shown in Figure 2 (for more detail see Open File map 2002-6 by Hunt et al., in press).

FAIRCHILD LAKE GROUP (WERNECKE SUPERGROUP)

A large part of the Slab Mountain area is underlain by the Fairchild Lake Group (Fig. 2), the lowest of the three groups that make up the Wernecke Supergroup (Fig. 3). The base of the Fairchild Lake Group is not exposed, but is assumed to lie on ≥1.85 Ga basement (Thorkelson, 2000). The Fairchild Lake Group is conformably overlain by the Quartet Group. Delaney (1981) subdivided the Fairchild Lake Group into five formations, F1 to F5. Thorkelson (2000) was unable to consistently recognize all of these formations during regional mapping, and instead divided the Fairchild Lake Group into two units: the dominantly clastic lower Fairchild Lake Group, corresponding to formations F1 to F4, and the carbonate-dominant upper Fairchild Lake Group, equivalent to F5.

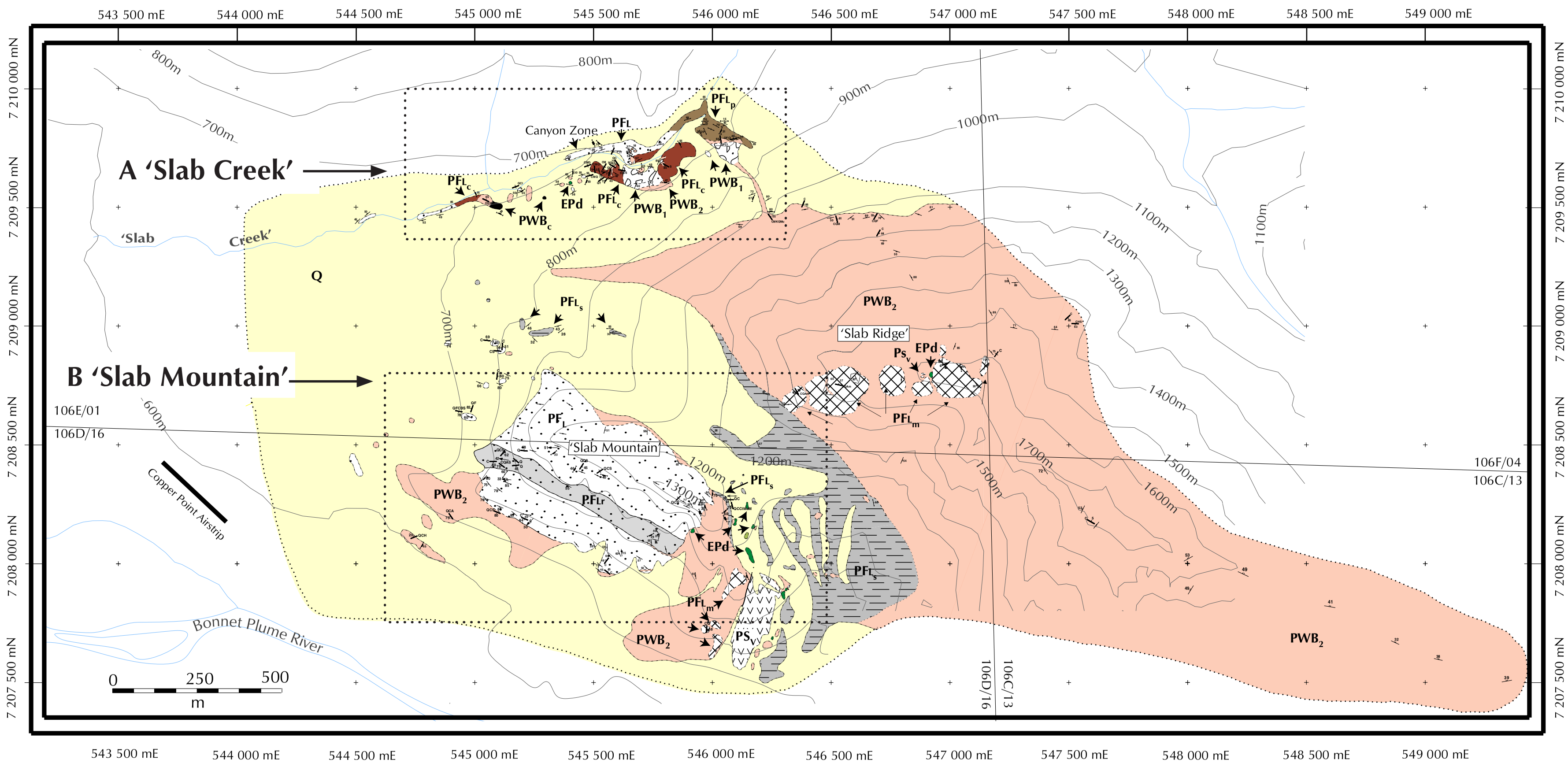
According to Delaney (1981), the Slab Mountain area is underlain by formation F4 which consists of "... at least 500 m of grey- to greenish-grey-weathering siltstone, fine sandstone and mudstone." Thorkelson (2000) included these rocks in the lower Fairchild Lake Group. Mapping in the Slab Mountain area during this study identified two general lithologies within the Fairchild Lake Group: 1) fine-grained sedimentary rock and minor carbonate that occurs as discrete outcrops and as clasts (up to 250 m across) within Wernecke Breccia; and 2) fine-grained schist and phyllite that largely form a distinct belt approximately 550 m wide within the sedimentary rocks. Following are descriptions of these two lithologies.

Fine-grained sedimentary rocks and minor carbonate

Fine-grained sedimentary rocks underlying the Slab Mountain area generally weather dark brown to grey but are locally grey to rusty brown. Fresh surfaces are pale grey. The rocks are well layered and locally banded with alternating dark and light layers (Fig. 4a). Original sedimentary textures are visible in several locations and include crossbedding, scours, laminations and grading. In some exposures, banding is defined by 'spherulitic texture' with spheres up to 0.5 cm in diameter. This texture was described by Delaney (1981) as characteristic of mudstone within formation F4. He determined that the spheres are composed of silica, or in some instances, chlorite. Locally, the fine-grained sedimentary rocks are pyritic and weather rusty. The most prominent pyritic sedimentary rocks form a rusty-weathering band about 80 m wide that trends northwest across Slab Mountain (Figs. 2, 4b).

Minor carbonate occurs locally as interbeds 0.05 to 2 m thick within the fine-grained sedimentary rocks. The carbonate generally weathers pale to medium grey with a hackly surface. Fresh surfaces are white to pale grey. In some locations, the carbonate is coarsely crystalline or contains white mica flakes up to 1 cm across.

At the west end of Slab Mountain, the sedimentary rocks have undergone pervasive biotite alteration. Locally, chlorite alteration overprints the biotite; elsewhere, chlorite alteration occurs as alternating dark and light green layers in the sedimentary rocks. Quartz-chlorite-biotite alteration also occurs in the matrix of brecciated and folded sedimentary rocks. Other alteration in Fairchild Lake Group rocks includes white spots (carbonate and/or scapolite?) and the development of a pervasive purple colouration, likely due to the presence of finely disseminated hematite. Where the sedimentary rocks are proximal to Wernecke Breccia bodies, they are commonly crackle brecciated and highly fractured. At breccia contacts, the sedimentary rocks are commonly bleached (albite?) and silicified. In the 'Canyon zone' in Slab Creek, the sedimentary rocks are locally intensely carbonate-magnetite altered.



QUATERNARY

Q — unconsolidated deposits

INTRUSIVE ROCKS

PROTEROZOIC

EPd — dykes and megaclasts of diorite

VOLCANIC ROCKS

LOWER PROTEROZOIC

Slab volcanics

PSv — mafic to intermediate lava flows; minor interbeds of conglomerate, sandstone and volcanic breccia; the volcanic rocks are present as clasts and megaclasts within zones of Wernecke Breccia

LAYERED ROCKS

LOWER PROTEROZOIC

WERNECKE SUPERGROUP

Fairchild Lake Group

PFL — undivided fine-grained sedimentary rocks

PFL_p — phyllitic fine-grained sedimentary rocks; weakly foliated, crenulated and kinked; locally contain magnetite porphyroblasts

PFL_s — chloritoid-muscovite-quartz-chlorite schist and phyllite containing magnetite and chloritoid porphyroblasts

PFL_r — rusty-weathering fine-grained sedimentary rocks

PFL_c — carbonate-magnetite altered fine-grained sedimentary rocks

BRECCIATED ROCKS

Wernecke Breccia

PWB_c — crackle-brecciated fine-grained sedimentary rocks

PWB_1 — **Breccia Type 1** - dark purple-brown to brown-grey weathering breccia with dominantly grey clasts, brown to grey carbonate and magnetite matrix; locally contains numerous angular to sub-angular clasts of massive magnetite

PWB_2 — **Breccia Type 2** - tan to grey-weathering breccia with dominantly grey clasts and fewer pale pink, white and purple clasts, fragmental matrix; locally contains clasts of Breccia Type1, Fairchild Lake Group schist and phyllite, carbonate-magnetite altered sedimentary rocks, and rare rounded sulphide clasts

PFL_m — examples of megaclasts of Fairchild Lake Group (fine-grained sedimentary rock) in Breccia Type 2

Figure 2. *Bedrock geology map of the Slab Mountain area. Modified from Open File Map 2002-6 (Hunt et al., 2002).*

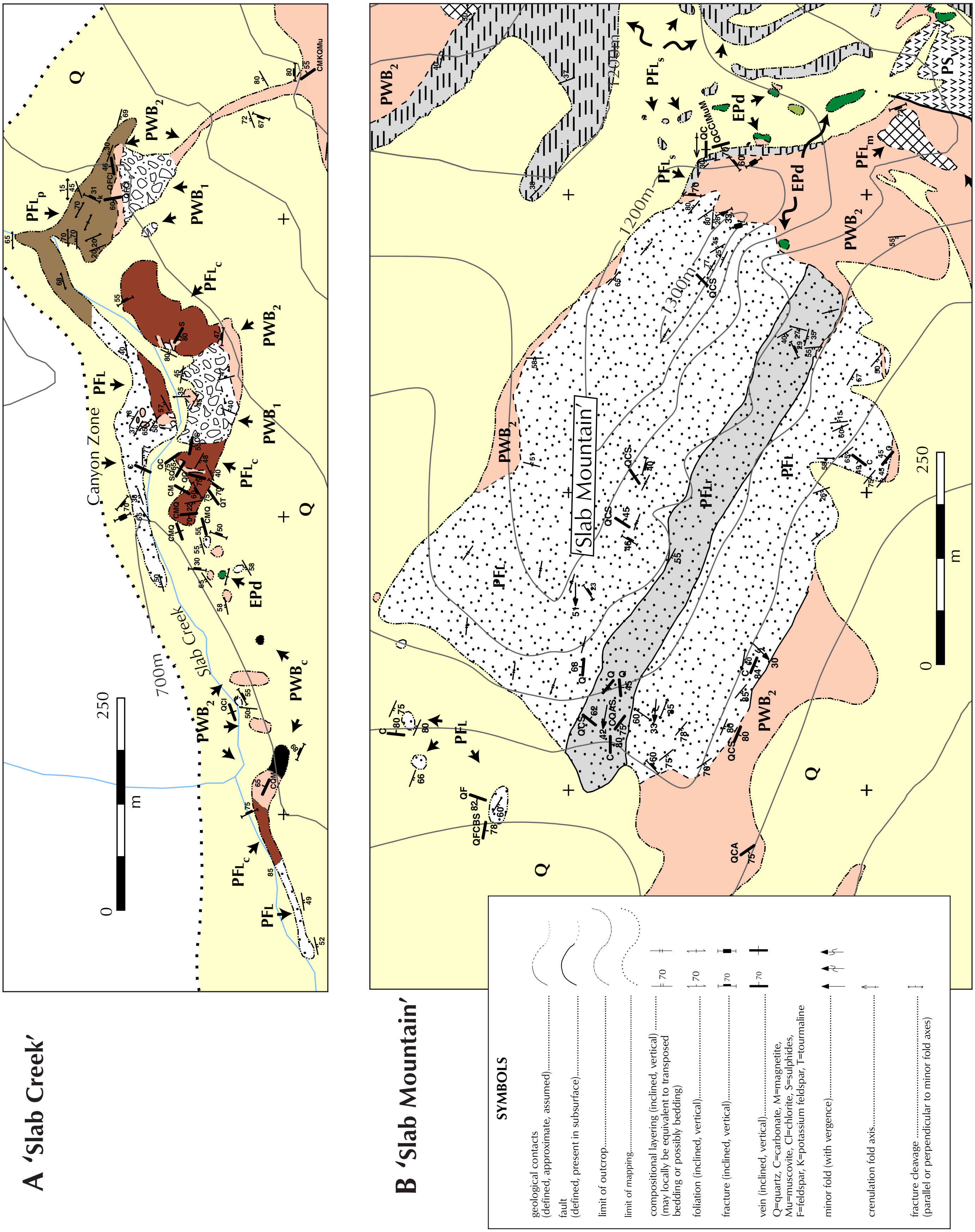


Figure 2. *(continued)*

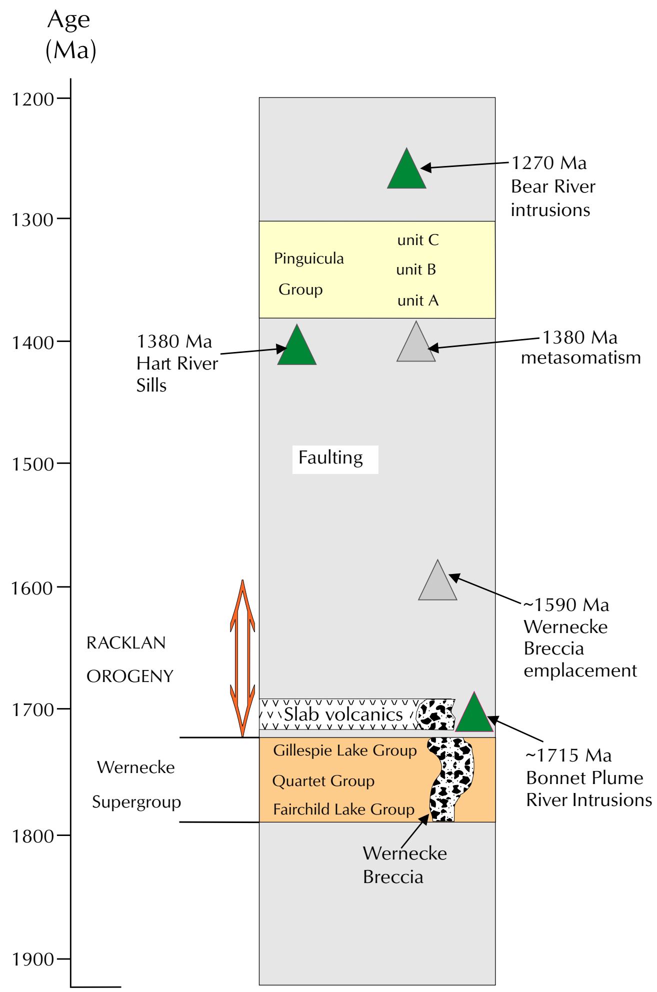


Figure 3. *Generalized partial area stratigraphic column for the Wernecke Mountains. Modified from Thorkelson (2000).*

Schist and phyllite

Chloritoid-muscovite-quartz-chlorite schist and phyllite with magnetite and chloritoid porphyroblasts occur mainly in a recessive-weathering, northwest-trending belt between Slab Mountain and Slab Ridge (Figs. 2, 4c). The rocks weather blue-grey to green-grey with green to grey-blue fresh surfaces. They are commonly compositionally banded, crenulated and kinked, and host rare veins of quartz and orange feldspar. More detail on this area is given in Brideau et al. (this volume). Schistose, kinked, fine-grained sedimentary rocks also occur at the east end of the Canyon zone in Slab Creek (see Brookes et al., this volume).

The schist and phyllite are interpreted to be the deformed and metamorphosed equivalent of flanking fine-grained clastic rocks of the Fairchild Lake Group that formed in a high strain zone and were subsequently crenulated and kinked by two separate deformational events (Brideau et al., this volume).

SLAB VOLCANICS

The informally named Slab volcanics were first recognized in 1992 and are regarded as relics of a stratigraphic succession, younger than the Wernecke Supergroup and older than the Pinguicula Group (Fig. 3; Thorkelson, 2000). Within the map area, the volcanic rocks are exposed on Slab Mountain and Slab Ridge (Fig. 2) where they appear to be fragments of a larger volcanic succession engulfed by Wernecke Breccia (see Laughton et al., this volume for a detailed description). The main locality, on the east side of Slab Mountain, is a block (0.6 x 0.25 km^2) comprising about 40 steeply dipping lava flows and minor, intercalated volcaniclastic and epiclastic units (Fig. 5). The volcanic rocks are resistant and weather dark green-brown; fresh surfaces are green-grey. Individual flows are commonly about 4 m thick, but range from 0.8 m to 14 m thick. The lavas are aphyric to rarely plagioclase-phyric, with mafic to intermediate compositions. They are variably vesicular, and host amygdules of quartz, white and pink calcite, tremolite, biotite, chlorite and apatite. The groundmass of the lavas typically consists of interlocking laths of plagioclase and anhedral grains of biotite and magnetite. Locally, the rock has a spotty appearance caused by the replacement of plagioclase and other minerals by scapolite.

BONNET PLUME RIVER INTRUSIONS

In the Wernecke Mountains, numerous small ca. 1710 Ma igneous bodies known as the Bonnet Plume River Intrusions, crosscut the Wernecke Supergroup and occur as clasts in zones of Wernecke Breccia (Thorkelson, 2000).

In the Slab Mountain, area the intrusions are fine grained, dioritic and weather green-grey; fresh surfaces are grey. Dykes range from 0.2 to 15 m across and outcrop mainly in the recessive-weathering area between Slab Mountain and Slab Ridge (Fig. 2). Intrusive clasts within Wernecke Breccia are locally abundant. For example, several large sub-rounded to sub-angular clasts of diorite occur in Wernecke Breccia (Type 2) at the eastern end of Slab Mountain, just west of the Slab volcanics (Fig. 6).

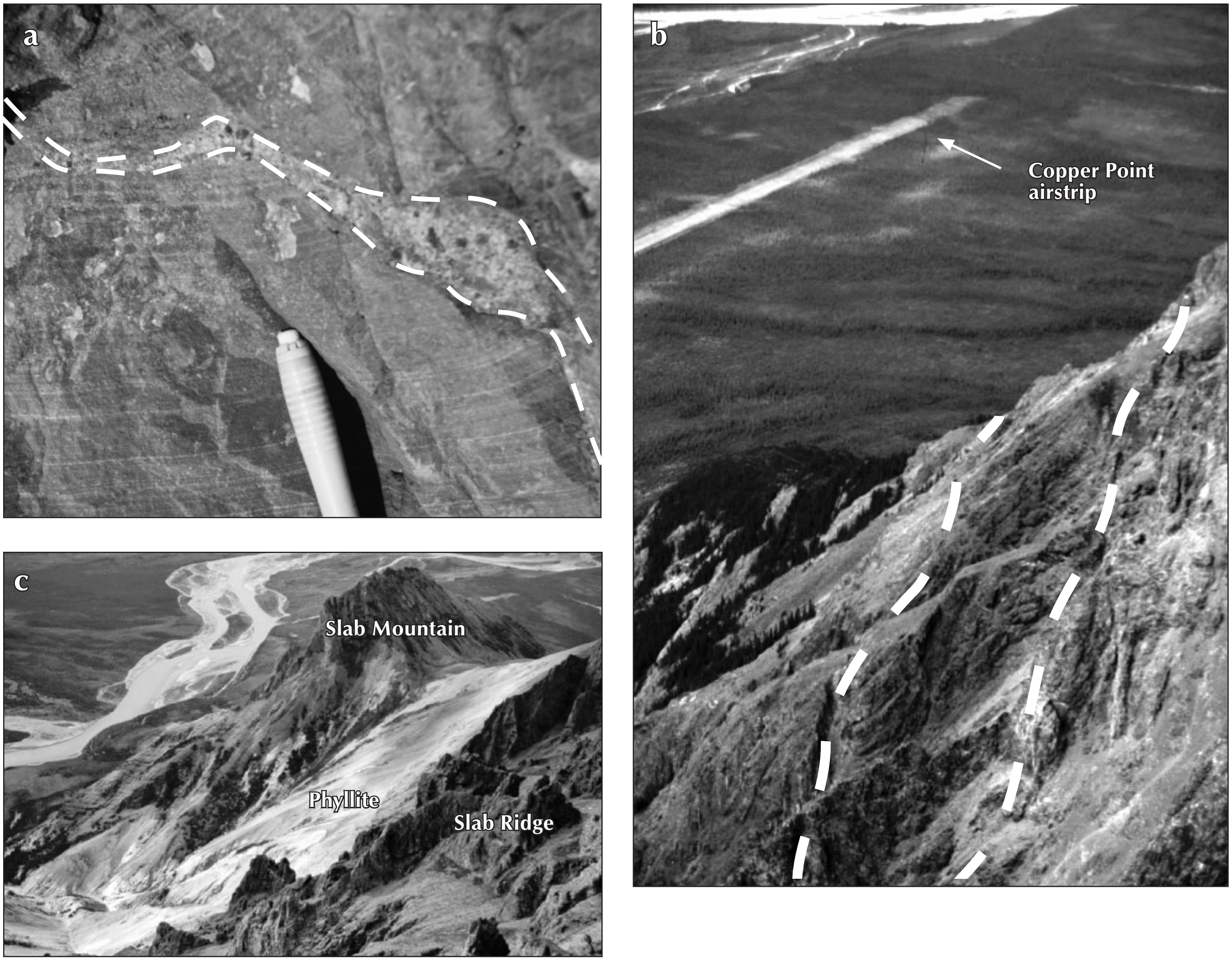


Figure 4. *(a) Fine-grained sedimentary rocks of the Fairchild Lake Group cut by Type 2 Wernecke Breccia (within dashed lines); (b) band of pyritic siltstone on the southwest side of Slab Mountain; and (c) band of recessive-weathering phyllite (about 500 m across) exposed between Slab Mountain and Slab Ridge.*

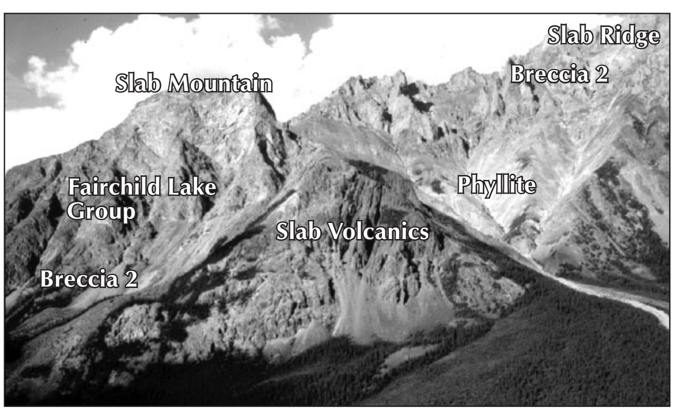


Figure 5. *Slab volcanics exposed at the east end of Slab Mountain (photo by Grant Abbott).*

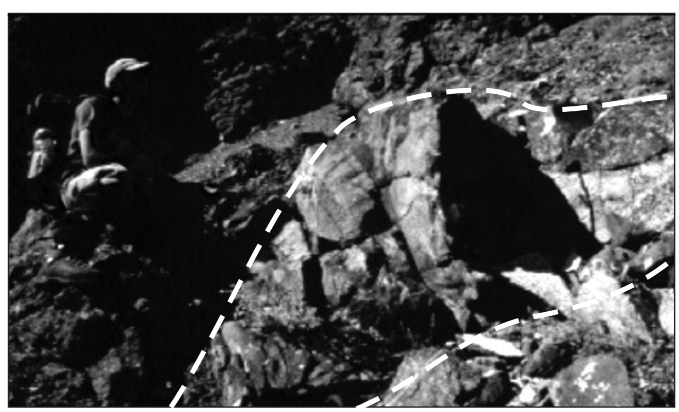


Figure 6. *Large clast of Bonnet Plume River diorite in Type 2 Wernecke Breccia.*

WERNECKE BRECCIA

Wernecke Breccia is a collective term for numerous breccia zones in the Wernecke Mountains (Fig. 1). The breccia zones range from 0.1-10 km^2 and occur in curvilinear arrays over about 3500 km^2 (Archer and Schmidt, 1978; Bell, 1986a,b; Wheeler and McFeeley, 1991; Thorkelson, 2000). Breccia emplacement took place after the deposition of the Wernecke Supergroup and Slab volcanics, but before deposition of the ca. 1.38 Ga Pinguicula Group (Fig. 3; Thorkelson, 2000).

At least two types of Wernecke Breccia occur in the Slab Mountain area based on crosscutting relationships; they are referred to informally as Type 1 and Type 2. Type 1 Wernecke Breccia is limited in extent and was observed only in the Slab Creek area where it is cut by Type 2 breccia (Fig. 2). Type 2 Wernecke Breccia is the most extensive unit in the map area and underlies large parts of Slab Ridge, Slab Mountain and Slab Creek (Fig. 2). The two breccia types are described below.

Type 1 Wernecke Breccia

Type 1 Wernecke Breccia generally weathers dark purple-brown to brown-grey with dominantly grey clasts and varies from clast- to matrix-supported (Fig. 7a). The breccia matrix is typically brown to grey and made up of carbonate and magnetite; locally, the matrix contains sulphide crystals (dominantly pyrite, lesser chalcopyrite). Clasts make up 40-70% of the breccia and are primarily fine-grained, dark to medium grey to maroon sedimentary rock. The clasts vary from angular to sub-rounded, but are mainly sub-angular. They range in size from 1-12 cm, but are generally <5 cm across. Some Type 1 breccia exposures contain numerous angular to sub-angular clasts of fine-grained, massive black magnetite up to 5 cm across. Rarely, the breccia contains angular, glassy quartz clasts from 2-5 cm across.

Type 1 Wernecke Breccia is in gradational contact with carbonate-magnetite altered sedimentary rocks (Fig. 2). In one location, Type 1 breccia is in sharp contact with fine-grained sedimentary rock (non-carbonate magnetite altered), however, this is close to a contact with Type 2 breccia, and the sedimentary rock may be a clast in this breccia. Type 1 breccia was not observed cutting any of the other units.

Type 2 Wernecke Breccia

Type 2 Wernecke Breccia generally weathers tan to grey with dominantly grey clasts and fewer pale pink, white and purple clasts. The breccia varies from clast- to matrix-supported. The matrix itself is fragmental (herein referred to as micro-breccia). It is typically green to pale grey and made up of carbonate and grey fine-grained sedimentary rock clasts from < 1 cm to 3 cm across, and lesser pink, purple and white clasts (Fig. 7b). Commonly, the matrix contains magnetite crystals up to 5 mm across, flakes of white mica up to 1 cm across, and biotite crystals up to 0.5 cm across. Locally, the matrix is composed of feldspar.

Clasts make up 40-75% of Type 2 breccia and are dominantly composed of fine-grained, grey sedimentary rock. The clasts are generally sub-angular to sub-rounded and range from 5 cm to several hundred metres across. Less abundant clasts include rounded to sub-angular clasts of diorite up to 3 m x 2 m; sub-angular to sub-rounded clasts of Slab volcanics up to 250 m x 600 m (see Laughton et al., this volume); sub-rounded clasts of cream-coloured carbonate up to 0.5 m x 3 m; sub-angular clasts of dark brown-weathering carbonate-magnetite up to 3 m x 7 m; sub-rounded clasts of fine-grained sedimentary rock, with white alteration spots, cut by quartz-sulphide veinlets; sub-rounded clasts of fine-grained sedimentary rock with dark alteration spots (biotite or chlorite or chloritoid); sub-rounded clasts of limey, fine-grained sedimentary rock up to 15 m x 15 m; rare sub-rounded, glassy quartz vein clasts <5 cm across; rare, rounded sulphide clasts up to 20 cm x 8 cm across; rare fine-grained sedimentary clasts containing disseminated malachite; and rare micro-breccia clasts <5 cm across.

At the western end of Slab Mountain, Type 2 breccia is locally dominated by two types of clasts: 1) 1-25 cm, angular to sub-rounded clasts of pink to grey, fine-grained sedimentary rock, with biotite porphyroblasts, in a non-calcareous matrix; and 2) sub-angular to sub-rounded, laminated, grey to pink silty dolomite clasts >2 m across, locally containing up to 1-cm-thick bands of actinolite crystals. On Slab Ridge, Type 2 breccia is dominated by very large clasts (several hundred metres across) of sedimentary rock with fingers (<1 m to 80 m across) of matrix between them. These large clasts are dominantly composed of fine-grained, grey sedimentary rock; less common are clasts of brecciated, deformed limey siltstone in a white carbonate matrix (Fig. 7c).

Contacts between Type 2 Wernecke Breccia and sedimentary rocks of the Fairchild Lake Group are sharp to gradational. Where gradational, the fine-grained sedimentary rocks are crackle brecciated. The extent of crackle brecciation ranges from a few centimetres to several tens of metres. At the eastern end of Slab Mountain and at the eastern end of the Canyon zone in Slab Creek, Type 2 breccia cuts schist and phyllite. At the breccia-schist/phyllite contacts, the breccia contains angular clasts of schist/phyllite up to 0.5 m x 1 m. Away from the breccia-schist/phyllite contacts, the breccia contains fine-grained sedimentary rock clasts up to 0.3 m x 1 m and no schist/phyllite clasts. Contacts between Type 2 breccia and large clasts of Slab volcanics or Bonnet Plume River diorite are sharp to crackle brecciated for a few centimetres. Type 2 breccia is in sharp contact with Type 1 breccia and, close to contacts, locally contains clasts of Type 1 breccia.

STRUCTURE

The Slab Mountain area has been affected by contractional deformation associated with the Racklan Orogeny, a period of mountain building that occurred after deposition of the Wernecke Supergroup and before emplacement of Wernecke Breccia (Thorkelson, 2000). This deformation produced northeast- to east-trending folds, schistosity, crenulations and kink bands (Thorkelson, 2000; Brideau et al., this volume). A large south-verging

Figure 7. *(a) Typical Type 1 Wernecke Breccia; (b) typical Type 2 Wernecke Breccia; and (c) clast of deformed Fairchild Lake Group in Type 2 Wernecke Breccia exposed on Slab Ridge.*

anticline related to this period of deformation was identified by Delaney (1981), Bell (1986a) and Thorkelson (2000) about 1.5 km south of the Slab Mountain area in the Bonnet Plume River valley. In this area, the anticline generally trends west, but bends to the northwest near Slab Mountain. Schistose rocks form a northwest-trending belt between Slab Mountain and Slab Ridge (Fig. 2), roughly parallel to the trend of the anticline. Brideau et al. (this volume) suggest that the schist belt represents a region of high strain, possibly developed in a region of tight parasitic folding. Schistose to phyllitic rocks also occur at the eastern end of the Canyon zone in Slab Creek (Fig. 2). Here, foliation trends roughly west and dips shallowly to moderately to the north.

Fairchild Lake Group strata on Slab Mountain have been deformed into a moderate to steep southwest-dipping monocline (Fig. 8). Minor folds within this sequence generally trend west and plunge gently to the west (Fig. 2). Fairchild Lake Group rocks in Slab Creek, where undisturbed by breccia emplacement, generally trend northeast. On the north side of the creek, compositional layering commonly dips to the north, and on the south side of the creek, to the south (Fig. 2), suggesting a northeast-southwest trending fold axis may lie in Slab Creek; rare minor folds with this orientation occur on Slab Mountain.

VEINING AND MINERALIZATION

Iron oxide-copper-gold mineralization, dominantly hematite-magnetite-chalcopyrite, is associated with Wernecke Breccia and occurs within breccia zones and in adjacent metasomatized country rock throughout the Wernecke Mountains (*cf.* Hitzman et al., 1992; Thorkelson, 2000; Yukon MINFILE, 2001).

Figure 8. *Fairchild Lake Group strata folded into a southwest-dipping monocline on Slab Mountain.*

The map area is host to the Slab mineral occurrence (Yukon MINFILE 106D 070), which has been explored sporadically since 1910, the most recent exploration taking place between 1992 and 1997 by the Newmont-Westmin-Equity-Pamicon joint venture. Highly visible mineralization occurs in this area as large patches of malachite staining on the peak of Slab Mountain (Fig. 9a). Here chalcopyrite is disseminated in <1-cm- to 10-cm-thick quartz-carbonate veins that trend from north-northeast to east, to east-southeast, parallel to prominent fractures. Mineralization also occurs in the band of pyritic sedimentary rocks that trends northwest across Slab Mountain, roughly parallel to a monoclinal fold hinge. Here, chalcopyrite is disseminated in quartz-carbonate veins that trend approximately east-northeast to east-southeast, roughly parallel to minor fold axial planes.

Elsewhere in the map area, mineralization includes up to 10-cm-thick, northwest-trending, steeply dipping, pyrite-chalcopyrite veins with quartz-white mica selvages. These veins cut carbonate-magnetite altered sedimentary rocks (Fig. 9b), rare clasts of massive pyrite-chalcopyrite up to 20 cm across in Type 2 Wernecke Breccia (Fig. 9c), local occurrences of disseminated chalcopyrite in the breccia matrix of Type 2 breccia, and rare chalcopyrite veinlets that cut Type 2 breccia.

In the Slab Mountain area, veins and alteration are abundant, and crosscutting relationships suggest the following **preliminary** paragenesis:

1. Quartz-feldspar-white mica ± carbonate ± chlorite veins. These veins are rare and were observed only in phyllitic siltstone at the eastern end of the Canyon zone in Slab Creek. They are, however, significant because they are deformed by kink-bands and hence formed prior to the Racklan Orogeny.
2. Quartz-magnetite veins cut deformed Fairchild Lake Group rocks prior to carbonate-magnetite alteration.
3. a) Carbonate-magnetite alteration of Fairchild Lake Group sedimentary rocks occurs locally and varies from partial to complete replacement.

   b) Emplacement of Type 1 Wernecke Breccia. Type 1 breccia contains clasts of carbonate-magnetite altered rock, but occurs only in areas with carbonate-magnetite altered rocks, and is therefore likely a continuation of the same event.

4. Dark brown carbonate-magnetite ± quartz veins crosscut kink-banded phyllite and Type 1 breccia in Slab Creek. These occur mainly in the Canyon zone where they are up to 0.5 m thick (Fig. 9b). Rare carbonate-magnetite veins cut Fairchild Lake Group rocks on Slab Mountain.
5. Hematite deposition on fractures and in veinlets that crosscut earlier veins and breccia. Locally, hematite replaces magnetite.
6. Light brown carbonate ± quartz ± hematite ± pyrite-chalcopyrite ± chlorite veins. These veins crosscut the dark brown carbonate-magnetite veins, and hematite veinlets and fractures. They are very coarse grained with carbonate and quartz crystals up to 3 cm across. Pink carbonate ± quartz ± hematite veins also occur prior to the emplacement of Type 2 breccia, but their relation to other veins is not clear. Pyrite-chalcopyrite-quartz-white mica veins cut carbonate-magnetite altered rock, but their timing is not clear, as crosscutting relationships with other veins or breccia were not seen. However, the veins are likely pre-Type 2 breccia as the breccia contains clasts of massive pyrite-chalcopyrite (Fig. 9c) and clasts of mineralized siltstone (Fig. 9d).
7. Emplacement of Type 2 Wernecke Breccia. This breccia is extensive and contains clasts of Fairchild Lake Group, kink-banded phyllite, Bonnet Plume River diorite, Slab volcanics, Type 1 breccia and massive sulphide. It also contains rare clasts of the micro-breccia that forms the Type 2 breccia matrix, suggesting that more than one phase of Type 2 brecciation occurred.

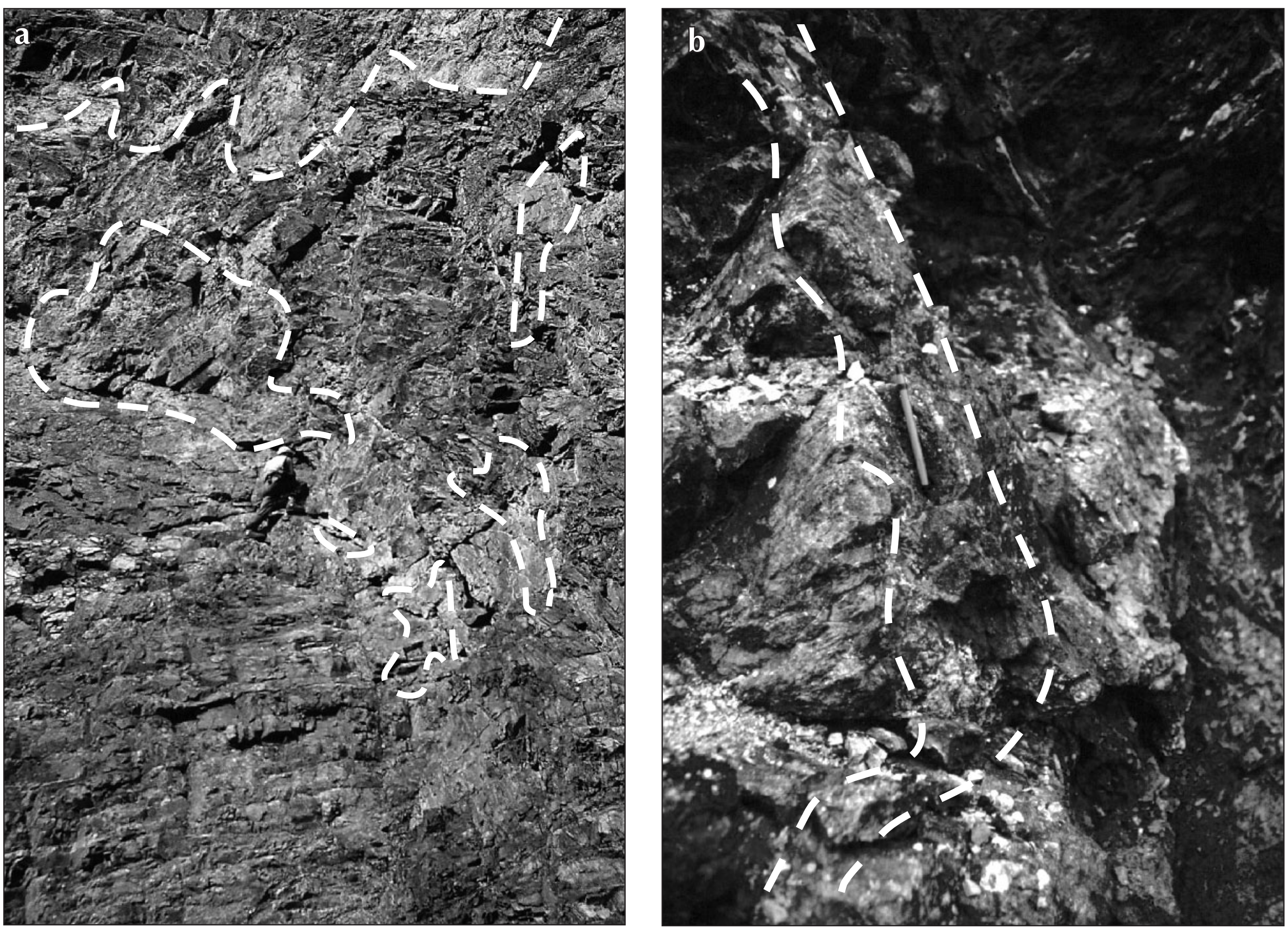


Figure 9. *(a) Malachite-stained (area inside dashed lines) Fairchild Lake Group sedimentary rocks form the peak of Slab Mountain (person for scale). (b) A 10-cm-thick pyrite-chalcopyrite-quartz-white mica vein (inside dashed lines) cutting carbonate-magnetite altered rock in the Canyon zone.*

8. Veins that crosscut Type 2 Wernecke Breccia, but have unclear timing relationships to one another, including:

- Quartz ± carbonate ± fluorite ± white mica ± chlorite ± biotite ± feldspar ± hematite ± actinolite ± pyrite ± chalcopyrite veins. These veins are locally coarsely crystalline with large (up to 2 cm) quartz, carbonate, fluorite and white mica crystals.
- Carbonate ± quartz ± hematite ± magnetite ± pyrite veins. A prominent vein of this type occurs on the southwest side of Slab Mountain at the contact between Fairchild Lake Group sedimentary rocks and Type 2 Wernecke Breccia (Fig. 9e). This vein is 0.2-1 m thick and dominantly composed of 5 mm pink to white carbonate crystals that are loosely held together, giving the vein a sandy/crumbly texture. The vein contains sparse euhedral, grey to white quartz crystals from 0.2 cm to 1 cm long, euhedral magnetite crystals up to 3 mm across and rare disseminated 2-3 mm pyritahedrons.
- Quartz-tourmaline veins
- Pale pink feldspar-white mica veins that crosscut the quartz-tourmaline veins

SUMMARY

New mapping in the Slab Mountain area indicates that it is underlain by Fairchild Lake Group fine-grained sedimentary rocks and their schistose equivalents, intermediate to mafic Slab volcanics, dioritic Bonnet Plume River dykes, and Wernecke Breccia; all are cut by numerous veins. Wernecke Breccia is herein divided into two units known informally as Type 1 and Type 2, based

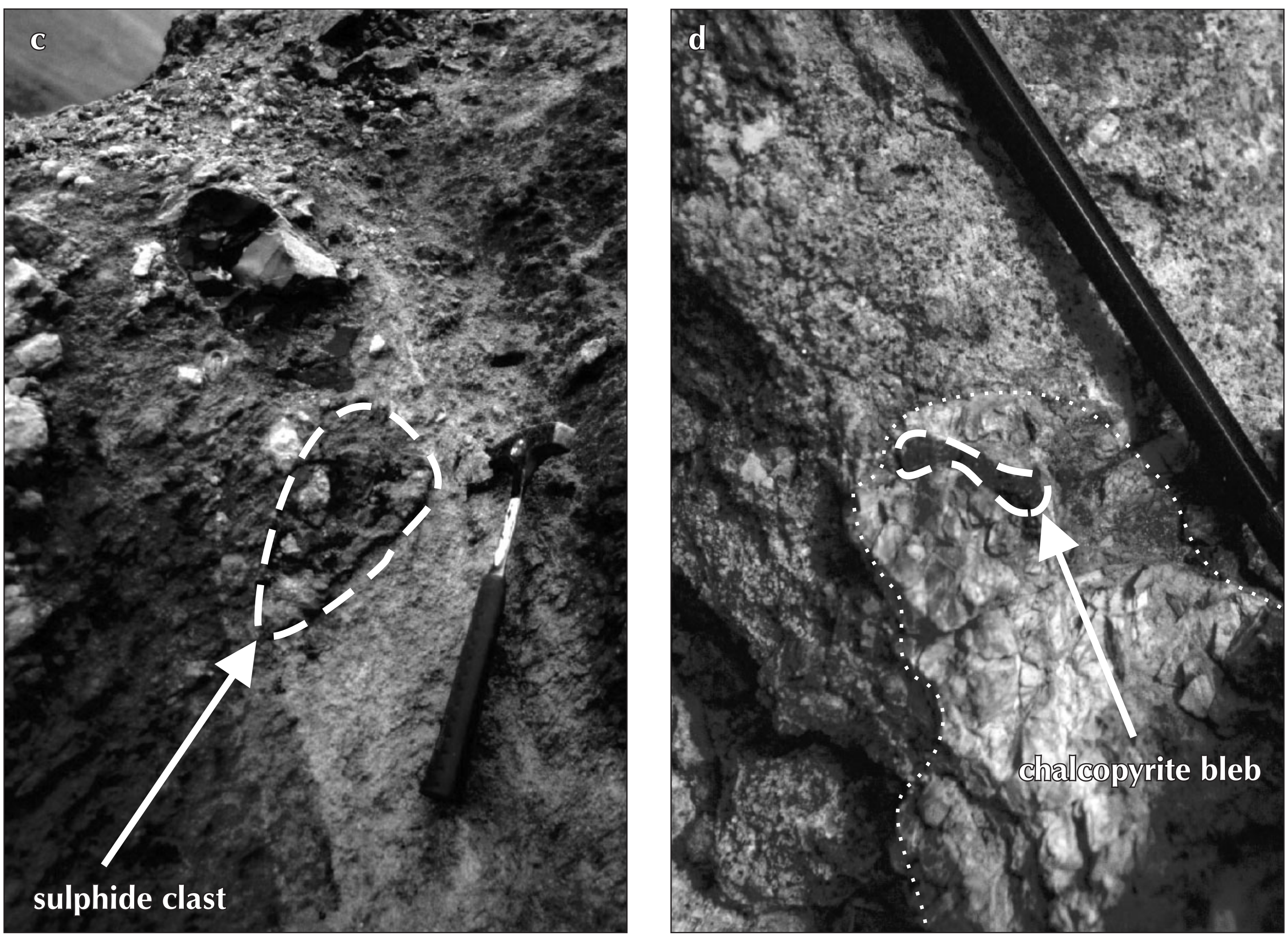


Figure 9. *(c) Massive sulphide clast in Type 2 Wernecke Breccia at Slab Creek; (d) chalcopyrite bleb (dashed line) in a siltstone clast (dotted line) in Type 2 Wernecke Breccia on Slab Mountain.*

on crosscutting relationships. Type 1 breccia typically weathers dark purple to brown and consists of grey sedimentary rock clasts in a matrix of carbonate mineral(s) and magnetite. Type 2 breccia cuts Type 1 and is typically tan to grey. Clasts are generally grey with fewer pink and purple clasts. The matrix is generally green to grey and is itself fragmental. Magnetite-hematite-chalcopyrite mineralization in this area is associated with Wernecke Breccia. Crosscutting relationships suggest that this mineralization likely occurred after the emplacement of Type 1 breccia and continued until after the emplacement of Type 2 breccia. Evidence for this sequence includes pyrite-chalcopyrite-quartz-white mica veins that cut carbonate-magnetite altered rock, massive pyrite-chalcopyrite clasts up to 20 cm across in Type 2 breccia, clasts of Fairchild Lake Group with sulphide veinlets in Type 2 breccia, disseminated sulphides in the matrix of Type 2 breccia, and rare sulphide veinlets that crosscut Type 2 breccia.

Figure 9. *(e) Carbonate-magnetite vein (inside dashed lines) cutting carbonate-magnetite altered rock in the Canyon zone, Slab Creek.*

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