GEOLOGY OF THE MOUNT MCCUSKER AREA, NORTHEASTERN BRITISH COLUMBIA (94G/4W)

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KEYWORDS: Regional Geology, Paleozoic, Mississippi Valley type (MVT) deposits, Sidenius thrust, Skoki Formation, Beaverfoot Formation, Nonda Formation, Muncho-McConnell Formation, Robb Lake deposit, stratiform breccia, lead and zinc mineralization.

INTRODUCTION

This papaer reports on mapping in a portion of NTS 94G/4W (Mt. McCusker west half), conducted during the month of July 1998 (Figure 1). This area, only accessible by air, lies 80 kilometres due west of the small settlement of Pink Mountain, 151 kilometres north of Fort St. John on Highway 97. The mapping program is part of the Central Foreland NATMAP Project, led by Mike Cecile of the Geological Survey of Canada (G.S.C.). The program objectives are to update the geology of the area, tie in with ongoing G.S.C. mapping to the north and east, and complement the Robb Lake mineral deposit study of JoAnne Nelson (Nelson *et al*. this volume. The G.S.C. offered considerable helicopter support

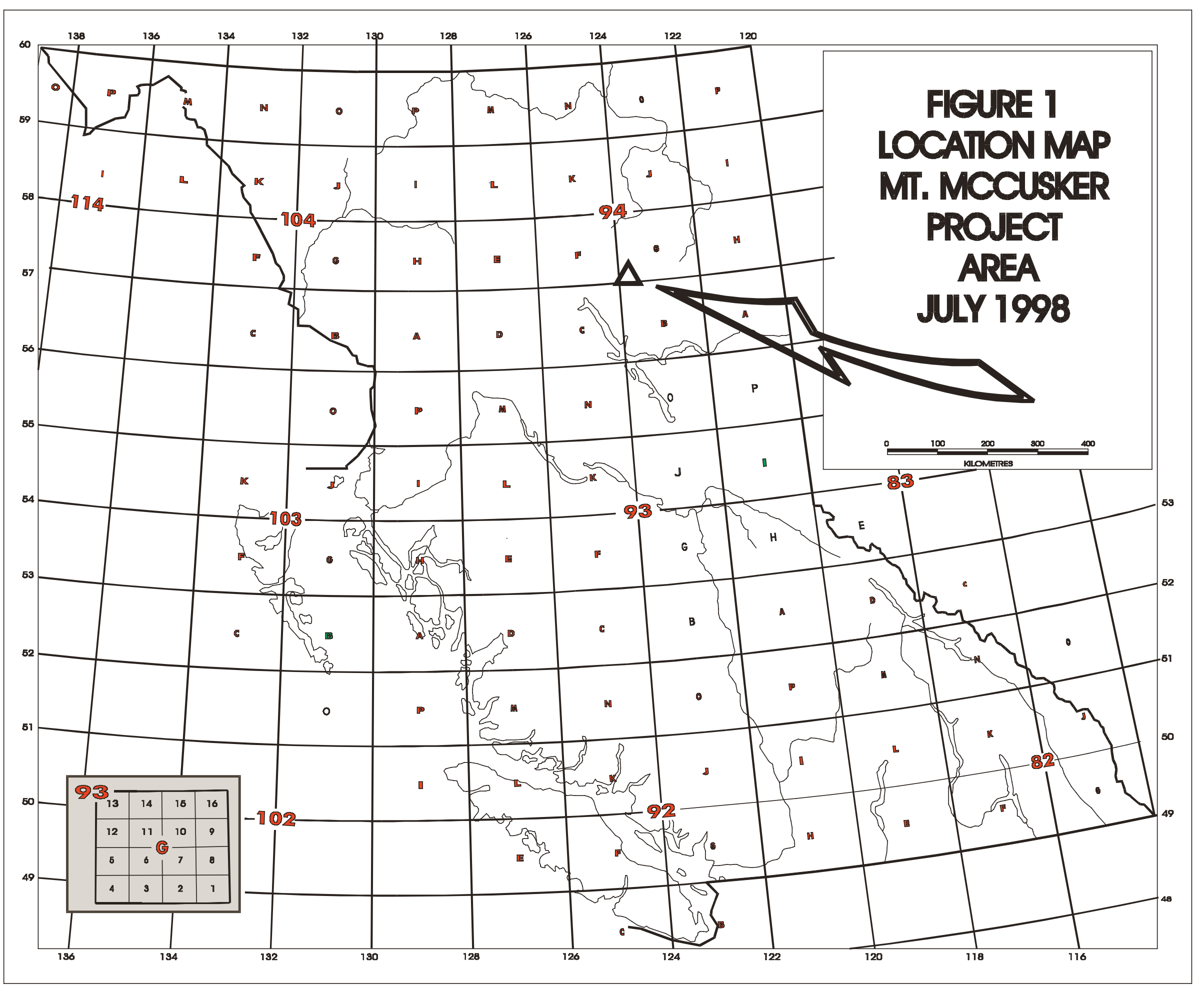

FIGURE 1
LOCATION MAP
MT. MCCUSKER
PROJECT
AREA
JULY 1998

as well as occasional lodging at Pink Mountain lodge. The work was conducted from two fly camps; at Bartle Creek, and the headwaters of the valley immediately north of Sidenius Ridge.

Data from twenty-one traverses assisted in recompiling the geology of an area of a 10 x 30 km. area at a scale of 1:30000. Preliminary results are presented in Figures 2 and 3.

Mapping has suggested a rather sharp platform to basin facies transition in several Paleozoic Formations between the McCusker and Robb Lake areas. The transitions suggest a re-entrant, rather than a simple indentation to the Ospika Embayment in this area (Thompson 1989, Fig. 7,9). The Middle to Upper Devonian Besa River shale has been usually invoked as a source of metals and transporting fluids for the Robb Lake deposit (MacQueen , R.W. and Thompson, R.J. 1978). A local and thickened Late Ordovician to mid Devonian shale package may have been a more important factor in the subsequent location, size and relative richness of this lead-zinc deposit.

Regional Setting and Previous Geologic Mapping

The area of study lies at the eastern edge of the northern Rocky Mountains, about 20 kilometres north of the Robb Lake lead-zinc deposit. Main streams within the map area are the upper Sikanni Chief River and Sidenius Creek. Secondary drainages include Bartle, Embree and Gautschi Creeks.

Early work in the area dates from the 1960's and focused on the regional stratigraphic and structural framework of the Paleozoic rocks for assessment of oil and gas potential. Mineral exploration received its impetus from active assessment (drilling, sampling) of the Robb Lake prospect 20 kilometres to the south in the early 1970's. This led to spin-off exploration for Mississippi valley type deposits along the entire eastern border of the Northern Rockies. In the study area a number of showings were found and one, Mt. McCusker (Minfile 094B 005), was drilled.

The area has not been mapped in detail, except for the immediate vicinity of the McCusker prospect which was done at a scale of 1:12000 (McHale and Pearson 1974). The region is generally covered by a 1:250000 scale compilation by the G.S.C. (Taylor 1979). Bob Thompson mapped and compiled the Halfway sheet south of the study area (Thompson 1989), publishing both 1:50,000 and 1:250,000 scale maps.

In the following geological description of the area major ridges are referenced by using the name of a nearby drainage (Figures 2,3). The ridge extending south from Sikanni Chief River, drained by Bartle and Embree Creeks, is Bartle Ridge. Sidenius Ridge is the east-west trending ridge on the north side of the Creek of the same name.

PROJECT AREA STRATIGRAPHY

The stratigraphic succession ranges from Ordovician to Devonian in age. Dolostones dominate the succession but quartzites, calcarenites, dolomitic siltstones, limestones , variegated shales and sandstone are also present. The succession in stratigraphic order (oldest to youngest), comprises the Ordovician Kechika, Skoki and Beaverfoot Formations, the Silurian Nonda Formation, and the Devonian Muncho-McConnell, Wokkpash and Stone Formations.

The Sikanni Chief section on Bartle Ridge (Norford *et al*., 1966) was walked out and used as a frame of reference for mapping. Units were mapped on lithologic grounds although specific fossils and biogenic features assisted in pinning down some units. For example the colonial coral Halysites assists in recognizing the Nonda, while algal oncolites and large gastropods (Maclurites) facilitate recognition of the Skoki. Units above the Muncho-McConnell are difficult to distinguish on lithology alone. Here further work on fossil assemblages would be useful.

A quartzite marker unit, up to 50 metres thick, is useful in the tracing of structures and stratigraphy within the dolostone dominated succession. The marker forms resistant ribs in outcrop, is paler in tone, and is traceable in the field with airphoto in hand.

Since the quartzite marker is mappable in the area, it is designated as a separate unit. Thompson (1989, Sections 3 and 4, p. 117) included it in the basal Muncho-McConnell while Norford *et al*. (1966, fig. 3) placed it in the upper part of the Nonda. It is probably equivalent to a thinner (15 metre) sandy interval noted at the base of the Muncho-McConnell by JoAnne Nelson (Nelson *et al*. this volume).

Kechika Group

The Kechika Group forms the ridge crest extending north and south of Mt. McCusker, the head of the ridge SSE of the confluence of Sikanni Chief River and Gautschi Creek (Figure 3), and most of the area immediately adjacent to the western limit of mapping. Large nearly recumbent chevron folds with axial planar cleavage are visible in rock walls of western peaks. The most common lithology is a well recrystallised thin to medium bedded calcareous shale to dolostone. Flaggy cleavage plates typically have a slight phyllitic sheen. It is perhaps more dolomitic in the McCusker area than seen regionally. On the ridge overlooking the south side of Sikanni Chief River, thick, massive beds appear to form the top of the Group. Normally a strong cleavage obscures bedding characteristics.

Skoki Formation

The Skoki Formation in the area comprises medium to thick beds of dark grey to tan dolostones. Oncolites (up to several centimetres long) and large coiled gastropods (up to 5 cm. long) are a characteristic feature of the formation. Solitary corals (Bighornia) are present, except in basal beds near the Kechika contact. A chert nodule facies was seen at more than one stratigraphic position but was best developed in stratigraphically high beds on Sidenius Ridge. Extensively burrowed and bioturbated beds are also interbedded at various stratigraphic levels. Trace fossils occur in a maze-like fashion both on bedding surface and in section. Most trace fossils appear to be subhorizontal grazing trails. Some branching was evident.

The contact with the Beaverfoot on Sidenius Ridge is marked by a change in lithology to orange dolostone, limestone, and dark calcareous shale. Skoki beds immediately below are pale, oncolitic in part and have a reddish to orange tone. This is due in part to red hematitic shale partings. The section is approximately 500 metres thick. These beds dip gently and the thickness can be estimated from the elevations of the upper and lower contacts.

Norford measured a minimum 406 metres of Skoki from the Kechika contact to the peak on the high ridge that overlooks the south side of the Sikanni Chief River (section 707). Along the ridge crest, the transition to Beaverfoot facies occurs and thus the thickness measured is probably close to that of the entire formation. North of the river rather massive, oncolite-poor beds characterize the Skoki sequence.

On the northwest side of Gautschi valley, McHale and Pearson (1974) describe oncolitic grey to dark grey thin bedded dolostones with the planispiral gastropods Maclurites and Palliseria cf. Robusta. Though not named, theses beds can be reasonably assigned to the Skoki Formation. According to McHale and Pearson (1974) the associated fossils are probably Late Ordovician.

Immediately south of the map area Thompson records 617 metres of Skoki near Mt. Kenny and 450 metres from a section ten kilometres west of Mt. Kenny (section 2-3, 2-4 of Thompson 1989).

Beaverfoot Formation

The Beaverfoot Formation is not the lithologic equivalent to the formation of the same name in the southern Rockies, but is approximately the same age (Thompson 1989). As the Beaverfoot is an areally significant unit on the G.S.C. map of the Trutch area, it seems useful to retain this nomenclature rather than several descriptive terms, pending redefinition of the stratigraphy. The Beaverfoot, as mapped, is equivalent to Upper Ordovician strata mentioned by Cecile and Norford (1979), the quartz dolostone unit of Thompson (1989); and his brown quartzite and shale unit of the Road River strata.

The Beaverfoot weathers in tones of brown, red and orange and is a more clastic detrital sequence in contrast to dolostones above and below. This is an interesting formation showing lateral and vertical facies variation worthy of further study.

Eastern area (Bartle Ridge, north side of Sikanni Chief River

The Beaverfoot Formation in the Sikanni Chief section consists of a lower member of brownish beds (not accessible but visible on precipitous slopes), overlain by reddish (bioturbated) dolomitic siltstones. The upper member consists of laminated to cross-bedded quartz arenite, arenaceous dolostone and orange dolostone.

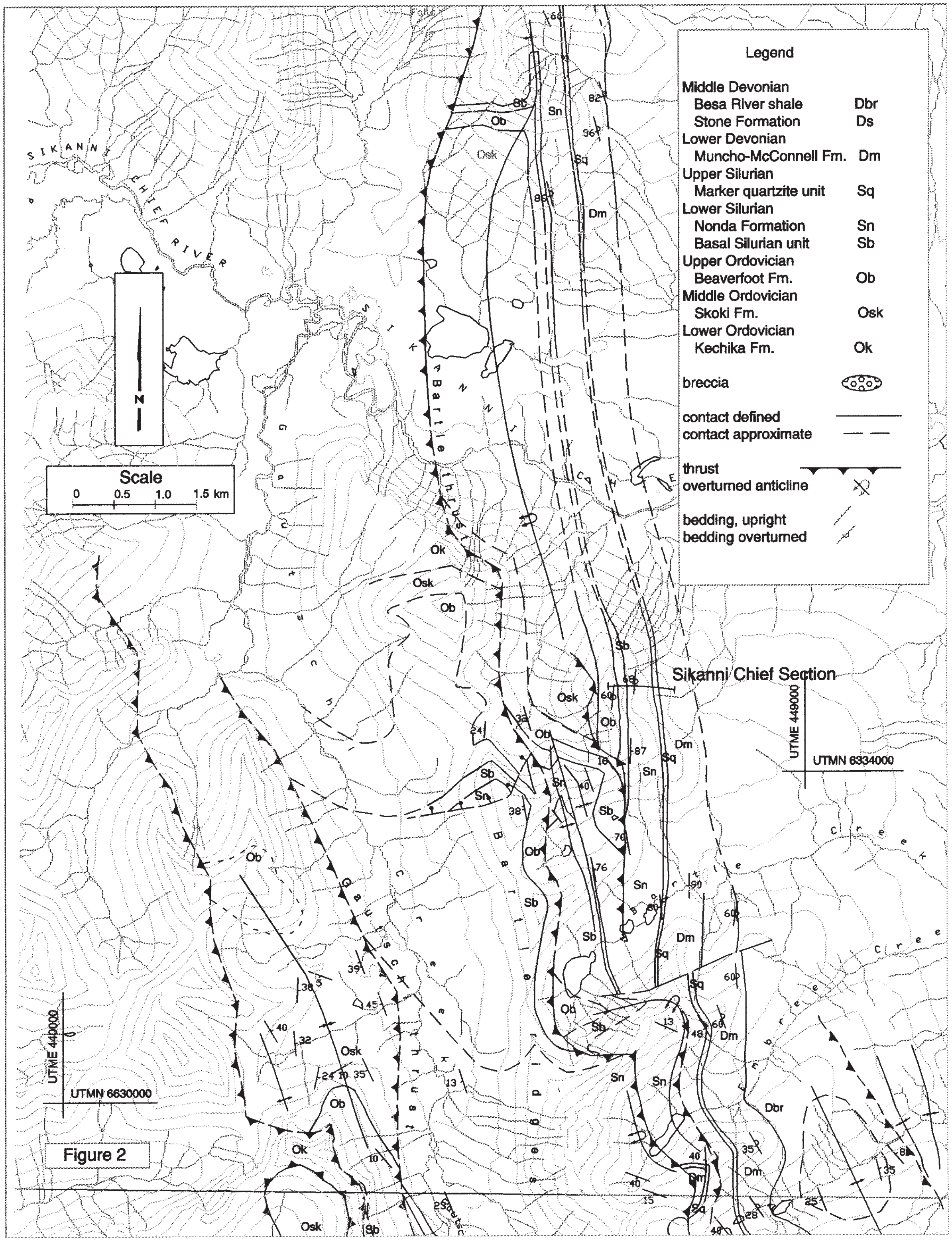

Figure 2. Geology of the northern portion of the study area.

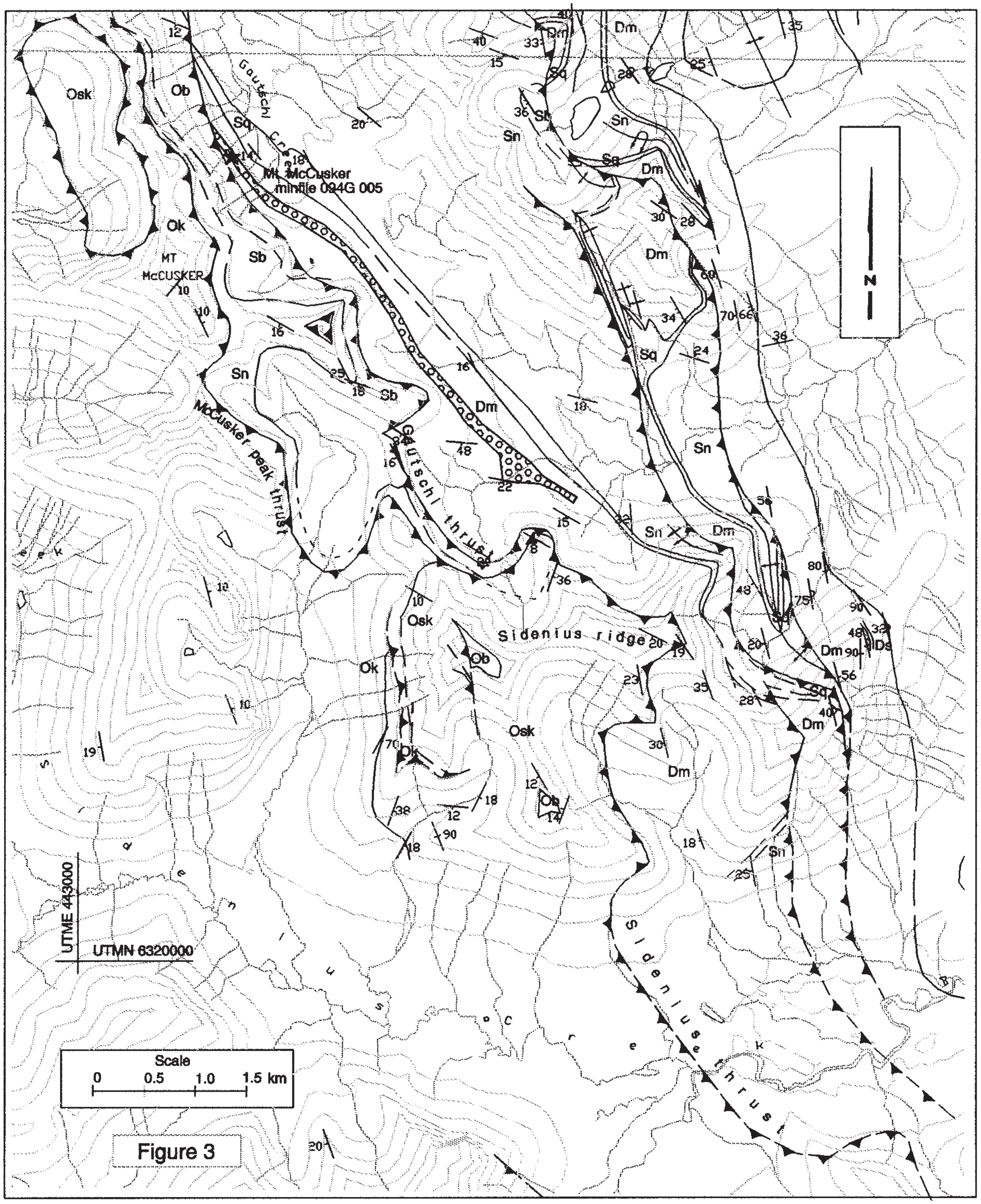

Figure 3. The southern border of Figure 2 adjoins the northern border of Figure 3. Geology of the southern portion of the study area.

Quartz arenite beds are horizontally laminated to cross-bedded. Cross bedding is low angle to medium and there are some scour and fill features in the form of shallow troughs filled with horizontally laminated sand. Individual quartz beds appear to thin rapidly along strike. Dolostones grade into arenaceous dolostones, often cross-bedded with resistant “highlights” of sandy foreset laminae. Similarly quartz arenites grade to sandy dolostones with sandpaper texture. Dolomitic lenses may occur within arenite beds.

The upper contact is placed at the highest siliciclastic bed. In the Sikanni Chief section this contact is a breccia with rounded dolostone clasts to 50 centimetres and hematite rich nodules within a sandy matrix. The breccia lies ten metres above a resistant sequence of quartzites. Just to the west, on a fold limb, the highest siliclastic bed is brown-grey laminated dololutite with quartz filled mudcracks. Further west, below the Bartle thrust, the highest bed is a five metre thick quartzite with an irregular top, containing mudchips and limonitic nodules. A few kilometres to the north, on the other side of the Sikanni Chief River, the top of the Beaverfoot comprises a gritty granule quartzite with dark chert and chips of dolostone.

The Beaverfoot in the eastern part of the map area appears to reflect an upward shallowing marine sequence capped by one or more unconformities. The environment of deposition includes exposed dolomitic mudflats and washover deposits of quartz sands. Some limonitic and hematitic nodules may represent ferricrete developed at the water table. A laterally restricted redbed quartz sandstone may be a subaerial deposit.

About 195 metres of section is estimated from map contacts and dip measurements on strata on Bartle Ridge. On the north side of the Sikanni Chief River the section is thinner, estimated at 110 metres.

Gautschi valley

To the west of Bartle Ridge, a synclinal structure along the west valley wall of Gautschi Creek exposes approximately 200 metres of interbedded dolomitic shale and shaly dolostone. The lithologic contrast between the brownish dolomitic shales and pale Skoki strata is discernible from across the valley. The formation outcrops on rugged slopes and was not examined in detail. Some minor pale resistant beds in lower cliffs of Mt. McCusker may be sandstones near the top of the formation. Otherwise it is recessive and obscured by scree. This section lies in the hangingwall of the Gautschi thrust.

Sidenius Ridge

A 15 metre section of brownish-red dolomitic siltstone and fine sandstone lies above Skoki strata on a spur of Sidenius Ridge. The beds form a rather recessive flat tabletop to the spur and were mapped as basal Beaverfoot. At the base of the unit are a few metres of black calcareous shale with thin limestone bands, and minor phosphatic? brown sandstone. Fossils in these beds were identified as an open coiled nautiloid cephalopod, orthid and inarticulate brachiopods, echinoderm fragments, bryozoan and minute gastropods by Brian Norford (G.S.C Paleontological Report 0-3-BSN-1998). Unfortunately the collection is not age diagnostic. A sample has been collected for conodont determination.

Basal Silurian facies

A basal Silurian facies of platy yellowish shaly dolostone and thin bedded mottled limy dolostone, lying below the Nonda Formation and above the Ordovician Beaverfoot Formation, forms a mappable unit in the study area. This basal Silurian facies appears to be equivalent to the carbonaceous limestone unit (Scl) of Thompson (1989). This rather recessive facies has been previously recognized by petroleum consultants (Riddell 1972) and Norford *et al*. (1966) in section descriptions.

The facies is typically thin bedded with a yellowish weathering cast. It varies from thin bedded mottled and “donut” nodular dolomitic limestone to laminated dolomitic siltstone to laminated calcareous shale. It represents an incompletely dolomitised facies. A few dark biostromal and rubbly bioclastic beds, which resemble stratigraphically higher Nonda beds, are found within the basal Silurian. Along Bartle Ridge and on the slopes north of the Sikanni Chief River, the thickness of these units is in the order of 100 metres. Thickness is difficult to compare from one section to another due to the transitional contact with the Nonda. The thickness to the west, in the hangingwall strata of the Gautschi thrust is estimated as 100 to 150 metres. Here basal Silurian, represented by shaly fossiliferous limestone, is underlain by Beaverfoot dolomitic shale and overlain by thick bedded dolostone containing abundant Halysites and Favosites which are assigned to the Nonda Formation.

The basal Silurian facies is easily confused with the Kechika Group in exposures near thrusts or in the core of folds. Both units are similar lithologically in that they are thin bedded mixed clastic and carbonate off-shelf "calcareous shale" facies. Both develop strong axial plane cleavage during deformation, in contrast to more competent and massive carbonate and dolostone beds. In exposures where Silurian fossils are not present, designation of these platy, highly cleaved beds is problematic.

Nonda Formation

The Nonda Formation is mainly composed of grey, medium bedded dolostone. The unit is medium grey to dark grey for the most part, but pale subunits were noted during mapping. One pale subunit occurs locally in the middle of the formation, and often beds immediately below the quartzite marker unit are pale. Silicified fossils are common and there are beds of chert nodules and cherty dolostone layers. Fossils include corals, crinoids (usually in hash), brachiopods (dense colonies), corals and stromatoporoids. Some of these occur in discrete biostromal beds. Coral mounds were seen in growth position. The most diagnostic fossil is Halysites.

Norford measured 350 metres of Nonda in the Sikanni Chief section, but this included about 48 metres of the quartzite marker, which the writer has mapped separately. The writer calculates that the Nonda section is about 300 metres (minus quartzite) thick on the slopes north of Sikanni Chief River. Similar thicknesses are noted nearby Riddell (1972, section B-10-72).

The Nonda is relatively homogenous and uniform in thickness within the map area. Just below the southern border of the map area, towards Mt. Kenny, Thompson (1989) noted dramatic facies changes in the Nonda Formation. Tongues of carbonate debris are interlayered with off shelf carbonaceous limestone along the foreslope of a Nonda reef. In the Mt. McCusker area the slope breccia facies of the Nonda Formation is not present.

Quartzite marker unit

The quartzite marker unit, which is up to 50 metres thick and laterally persistent, is in sharp contact with the rocks of the underlying Silurian Nonda Formation. At one locality, inclined quartzite filled burrow casts were noted at the top of Nonda dolostones; just below the base of the quartzites. Elsewhere quartz filled fracture networks of uncertain origin are present in the dolostone immediately below the first quartzite.

Locally the unit is composed of several massive quartzite beds, up to 10 metres thick. In other areas quartzites a few metres thick are interbedded with paler dolostones and sandy dolostone over 20 to 30 metres. The quartzite beds display abundant intersecting low angle crossbeds and trough crossbeds. The beds are interpreted as marine sand bars, subjected to strong waves and currents, possibly due to a low stand in sea level. According to McHale and Pearson (1974) Silurian fossils persist into overlying beds of the Muncho-McConnell for about 10 metres. The quartzite marker is therefore Silurian in age.

Muncho-McConnell Formation

The Muncho-McConnell Formation consists of pale, fossil-poor, massively bedded dololutites. Locally dolostone can contain discontinuous sand laminae. In other areas bedding is well laminated to crinkly or wavy laminated suggestive of algal origin. MacQueen and Thompson (1978) noted dessication features and flat pebble conglomerate indicative of exposure. The random distribution of spherical quartz grains in dololutite suggests an aeolian component.

A breccia unit of potential economic interest lies within the Muncho-McConnell Formation. The unit was found in several locales on separate thrust blocks in about the same stratigraphic position, 70 metres above the quartzite marker. The breccia is described under Structure (see below).

Wokkpash, Stone and Dunedin Formations

A thin discontinuous sandy dolostone was locally recognized about 350 metres above the base of the Muncho-McConnell Formation. It does not form a traceable unit, except in the immediate footwall of the Gautschi thrust near Sidenius Ridge, where it forms a crossbedded dolomitic sandstone, 10 to 15 metres thick. This unit typically forms a thin discontinuous interval of sandy dolostone with 10-20% dispersed quartz. Locally a single half metre of quartzite is interbedded with it.

The Stone Formation is a pale crystalline dolostone that is difficult to distinguish from the Muncho-McConnell, into which it grades. Some alternation in dark and light (sometimes bluish) thick beds is apparent. The unit is most evident in the eastern areas of the map area where it is underlain by thin sandy (Wokkpash) beds.

A thin unit of dark fossiliferous dolostone and limestone is found at the contact with the Besa River shale and is tentatively assigned to the Dunedin Formation. South of Mt. Helen, the Dunedin thins and passes laterally into Besa River shales according to regional maps by Riddell (1972). About 40 metres of Dunedin equivalent dark grey dolomitised carbonate with Amphipora is reported near the Sikanni Chief section by Riddell (1972, pg. 28, section F-2-72). Conodont samples were taken in two areas to determine the age of the basal Besa River contact in the McCusker area.

STRUCTURE

The Northern Rocky Mountain front (Main Ranges) near Sikanni Chief River is marked by a large anticline, extending from Mt. Helen across the river to Bartle Creek (Figure 2). A significant section, from Ordovician Skoki to Devonian Stone Formation, is exposed on the east limb of the fold, on the topographic slopes slopes draining southeast into Sikanni Chief River. In the north, the fold is box-like, with the eastern limb subvertical. South of the Sikanni Chief ,the fold is overturned, tighter and chevron in form. The west limb of the chevron fold is crumpled into tight folds cut by steep axial plane faults. The Bartle thrust overrides the west limb continuing south of Bartle Creek to the headwalls of the cirques of Bartle Ridge.

Between Bartle Creek and Embree Creek an east northeast trending tear fault offsets quartzite marker beds on the east limb of the fold. The tear fault is related to a secondary, northeast verging, overturned fold.

South of Embree Creek, the eastern overturned limb persists but the amplitude and wavelength of the fold diminishes. Southward toward Sidenius Creek, an additional thrust is mapped west of the Bartle thrust (Figure 3). In essence, the ridges west of the eastern overturned limb consist of two to three thrust panels of repeating Nonda Muncho-McConnell sequences with overturned folds in the footwalls and hangingwalls.

The Bartle and associated faults lying east of the Gautschi valley show little lateral displacement of hangingwall relative to footwall. The Bartle thrust juxtaposes Ordovician beds over Silurian rocks in the north, whereas in the south Silurian Nonda Formation overrides Devonian rocks. An oblique section across the Bartle thrust is present on the north end of Bartle Ridge overlooking Sikanni Chief River. The view from a vantage point on the north side of the Sikanni Chief suggests a westward steepening of dip in the thrust.

The eastern overturned to subvertical limb along the entire mountain front is much more persistent than individual fold elements. It probably originally constituted the eastern limb of a large south plunging anticlinorium whose western limb is preserved in the Gautschi valley. This crumpled anticlinorium forms the footwall to the Gautschi Valley thrust.

Several late small scale normal faults were noted. At one location, a normal fault displaces a nearly recumbent fold in the footwall of the Bartle thrust, indicating that the normal fault postdates the thrust.

Gautschi Valley thrust (figure 4)

A significant shallowly dipping thrust fault is exposed on the west side of the Gautschi valley. It juxtaposes Ordovician over Silurian rocks in the north, and basal Silurian over Devonian rocks in the south. The westernmost exposures of Devonian beds occur in the footwall of this thrust; they host the principal showing in the area.

McCusker Peak thrust (figure 4)

Topographically above the Gautschi thrust, on the high ridges extending north and south of Mt. McCusker, is a flat-lying thrust with Kechika Group strata exposed in the hangingwall and basal Silurian facies in the footwall. Variable erosion through the thrust has left a klippe to the east and a tectonic window to the west. The klippe indicates that the thrust is flat to the east. Its transect of contour lines in the west indicates that it steepens to the west. Projection of flat dips indicates the thrust should be present on valley walls of western drainages, but it is not. The western side of the tectonic window is

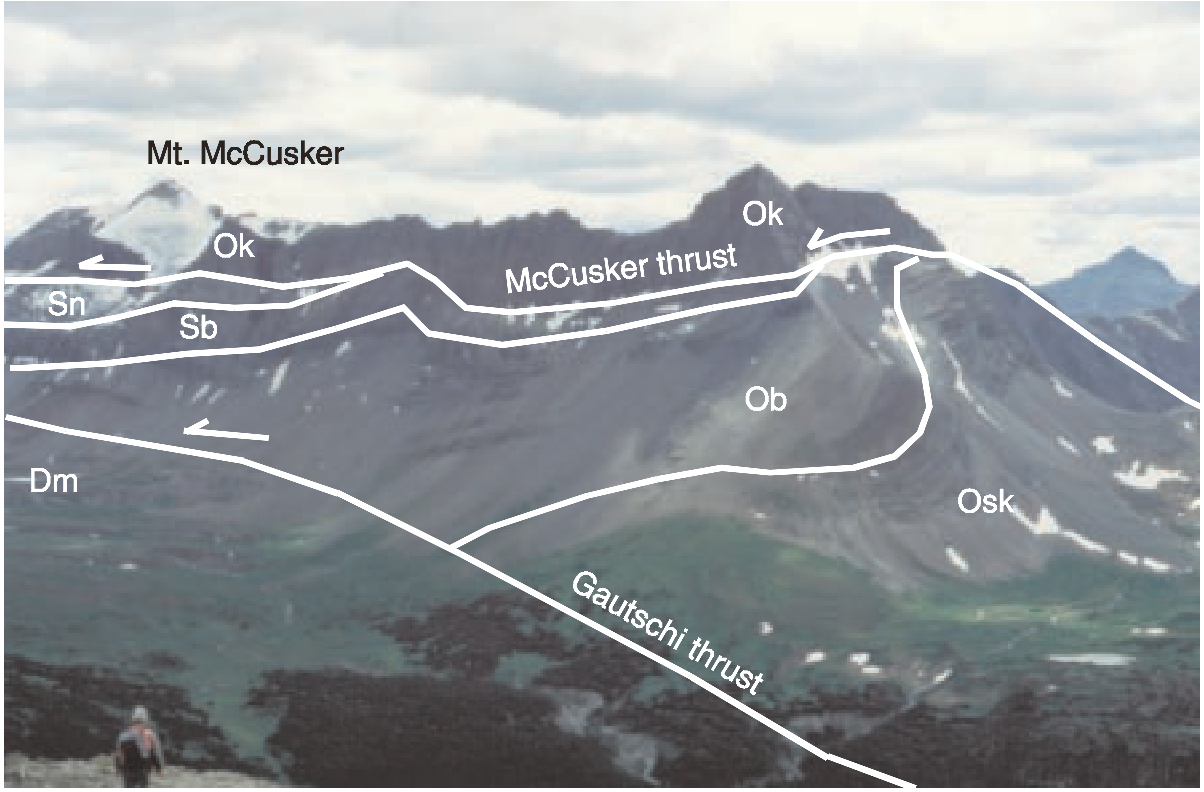

Figure 4. View southwest across Gautschi valley to thrusts at Mt. McCusker.

closed off, an observation that is also compatible with a steep fault dip in the west.

Sidenius thrust

The stratigraphic and vertical interval between the Gautschi and McCusker peak thrusts diminishes southward; in the saddle between Sidenius Ridge and Mt. McCusker the two thrusts are separated by less than a 100 metres of basal Silurian beds (figure 5). On the north side of Sidenius Ridge the thrusts appear to merge and a single west dipping fault cuts the ridge top. This single, possibly ramping thrust of Ordovician Skoki over Muncho-McConnell continues to the south side of Sidenius Ridge. Its strike extension across Sidenius valley appears to be the Sidenius thrust of Thompson (1989). The Sidenius thrust as depicted in cross-section (fig. 5 of MacQueen and Thompson 1978) is a folded thrust with a gentle undulating surface in the east and a steep segment to the west.

Breccias in Muncho-McConnell Formation

A breccia zone in the Muncho-McConnell is present about 70 metres stratigraphically above the quartzite marker on the west side of the Gautschi valley. The McCusker Minfile showing is located in breccia exposures in the immediate footwall of the Gautschi thrust. To the northwest the breccia zone terminates against the thrust. The breccia zone continues to the southeast where it diverges in trend from the thrust but maintains its stratigraphic position. According to McHale and Pearson (1974) it becomes less prospective in this direction. Initially the Mt. McCusker breccia was thought to lie near a facies front. Subsequent work showed that a covered thrust (the Gautschi thrust) rather than a dramatic facies change was present near the showing. Figure 3 shows this cut off by the Gautschi thrust, an important indicator of its relative age (ie. pre-thrust).

Breccias were found on other structural panels. Evaluation of their position indicates that they are in a comparable stratigraphic position to the McCusker breccia. One of these was slightly gossanous and was sampled for assay with negative results. These particular breccias were not traced along strike due to time constraints. Their presence confirms some stratigraphic, rather than structural, control of brecciation.

The stratiform breccia unit at Mt. McCusker

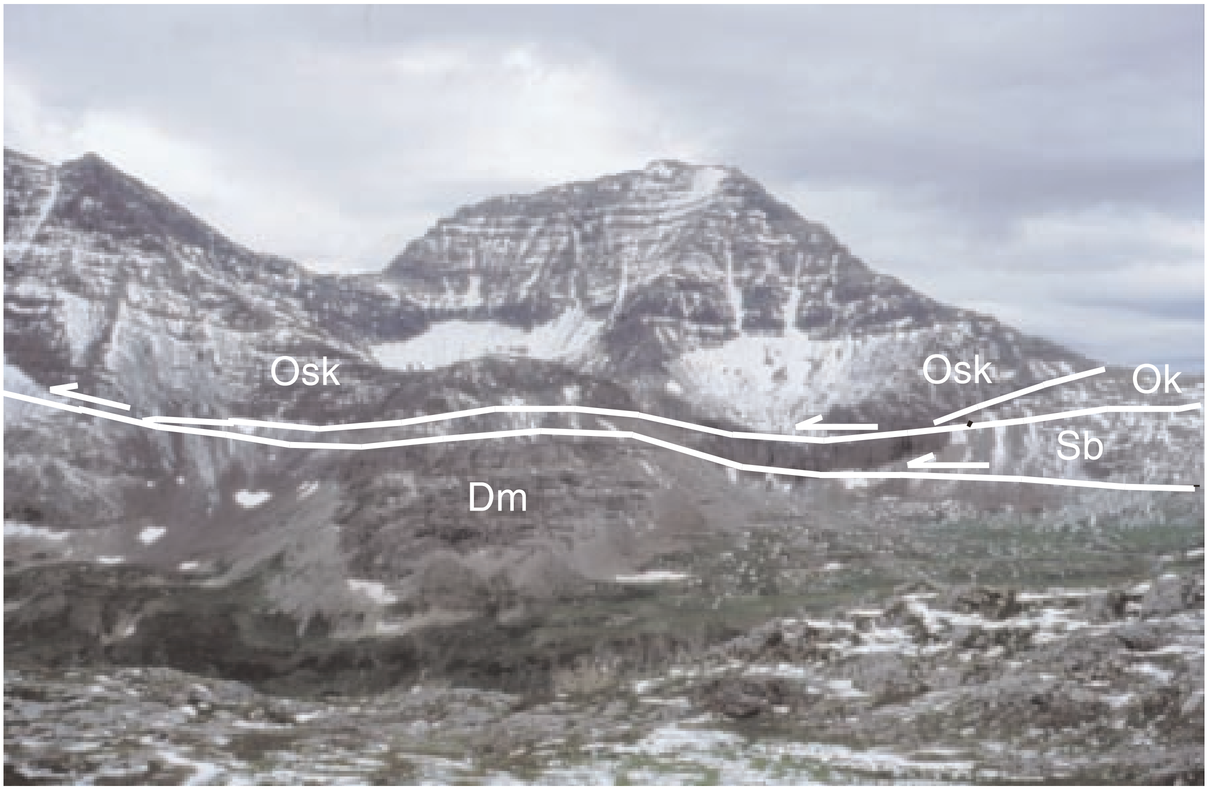

Figure 5. Looking southwest to merging thrusts on Sidenius Ridge.

was traced for several kilometres to the southeast. It varies from "mosaic angular" to "rounded rubble" type with fragments, up to half metre in dimension, enclosed in a coarser recrystallised, often iron stained, yellowish to pale orange-brown dolostone matrix. Brecciation varies widely in intensity. Locally it is pervasively developed across 5 to 15+ metres of stratigraphy, elsewhere it occurs as discrete veins filled with fragments that border undisturbed beds. A few crosscutting limonitic fractures are present. These are quite narrow but crosscut several tens of metres of section. Some fragments in vein breccias are rounded and rotated, the rounding difficult to reconcile with solution collapse.

The spectrum of breccias includes crackle breccias. These extend outside the main stratigraphic zone and into higher stratigraphy. Vug fillings of white calcite and quartz are more common in crackle breccias, with white calcite rinds about some fragments.

At the Mt. McCusker showing, one to two percent combined lead zinc over five to ten metres of section has been reported from chip samples. The best drilling results are 3.58% zinc with trace lead over 1 metre (Williams 1975). This is a much less significant prospect than Robb Lake. The facies change from Muncho-McConnell dolostone to the brown siltstone unit described at Robb Lake, is not present in the map area. The platformal edge apparently lay further to the west. At this showing proximity to a thrust is not a controlling factor in brecciation, but it may be a factor in the development of weak mineralisation.

COMMENTS AND SPECULATIONS

The ongoing mapping program suggests that the east to west transition from platformal Beaverfoot to basinal Road River strata can be traced across three thrust panels from Bartle Ridge to the Mt. Kenny and the Robb Lake area of the Halfway sheet. On Bartle Ridge, in both the footwall and hangingwall of the Bartle thrust, a shelf edge quartz dolostone unit represents the Beaverfoot. An off shelf facies outcrops in the hangingwall of the Gautschi thrust. Near Robb Lake are equivalent Road River Group strata represented by the quartz graptolite facies of Thompson (1989). This facies is exposed in the hangingwall of a third, more westerly, thrust. The quartz graptolite facies is a deep water facies that includes quartz turbidites. Thompson (1989) in a composite section indicated it is up to 600 metres thick but Nelson *et al*. (this volume, Fig. 2) found a much thinner interval between the Skoki and Silurian breccia unit at Robb Lake. Further work is warranted. Suffice to say a subsiding basin developed at the end of Skoki time. Thompson (1989) described this basin as the Ospika Embayment, essentially the southern termination of the Kechika Trough. He showed that the embayment endured for a considerable period of time (Late Ordovician to mid Devonian). Significantly his reconstructions (Fig. 7,9) show an indentation in this embayment in the immediate area of Robb Lake.

Work this summer suggests the indentation may be a re-entrant. Between Mount McCusker and Mount Kenny there seems to be a basinal facies trend in the Beaverfoot Formation, development of shelf break facies in the Nonda Formation, and off shelf facies development in the Muncho-McConnell. The re-entrant may have persisted to mid or even upper Devonian time given the anomalously thin Dunedin Formation. (see also Nelson *et al*, this volume). A local and thickened shale package, rimmed on three sides by platformal carbonates may have been a factor in the subsequent location, size and relative richness of the Robb Lake prospect. It is the only significant prospect known along the Northern Rocky Mountain front.

The presence of a re-entrant shale facies may have facilitated eastern migration of thrusts along surfaces of reduced friction, for example the Sidenius thrust. The identification of re-entrant shales may be an exploration guide to locating other Mississippi valley type deposits in the Northern Rockies.

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