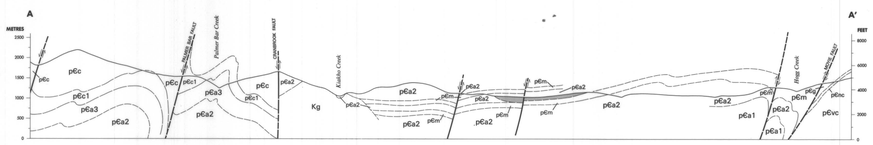

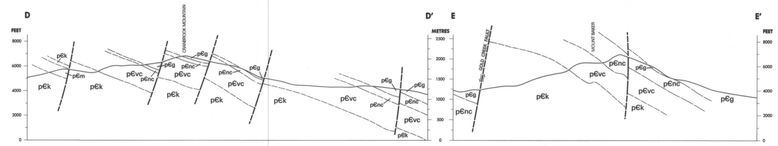

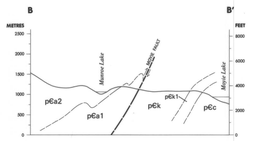

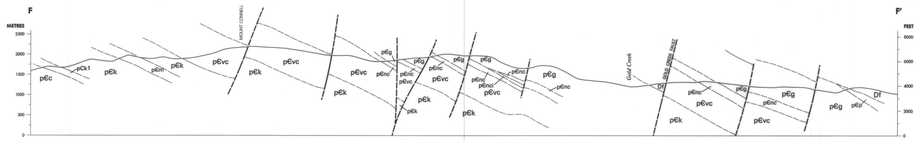

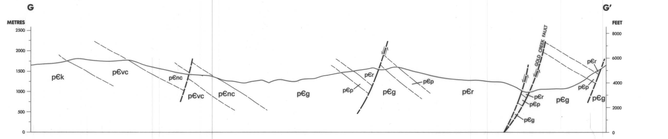

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

PRELIMINARY MAP NO. 49

GEOLOGY OF THE MOYIE LAKE AREA

GEOLOGY BY TRYGVE HØY AND L. DIAKOW, 1979–1980
CARTOGRAPHY BY F. CHICORELLI

SCALE 1:50 000

KILOMETRES 1 0 1 2 3 4 KILOMETRES

LEGEND

PLEISTOCENE AND RECENT

TILL, GRAVEL, SAND, AND ALLUVIAL DEPOSITS

LOWER CRETACEOUS

Kg QUARTZ MONZONITE, GRANODIORITE

DEVONIAN (?)

FAIRHOLME GROUP

Df DARK GREY TO BLACK, FINE–GRAINED FOSSILIFEROUS LIMESTONE; LOCAL NODULAR CHERT BEDS; BASE COMMONLY MARKED BY A FLUVIAL COBBLE CONGLOMERATE OVERLAIN BY A MEDIUM TO COARSE–GRAINED SANDSTONE

Dp 'PEAVINE CONGLOMERATE'

COBBLE TO COARSE BOULDER, POLYMICTIC PARACONGLOMERATE, WITH SILT TO SAND MATRIX; MASSIVE TO MODERATELY WELL BEDDED

MIDDLE PROTEROZOIC

pЄm **MOYIE INTRUSIONS**

METADIORITE TO METAGABBRO SILLS AND LOCALLY DYKES

PURCELL SUPERGROUP

pЄr **RODSVILLE FORMATION**

GREY TO BLACK ARGILLITE WITH INTERCALATED GREEN SILTSTONE; GREEN SILTY ARGILLITE WITH THIN MAUVE SILTSTONE INTERLAYERS; OCCASIONAL THIN DOLOMITE, STROMATOLITIC DOLOMITE, AND CONGLOMERATE LAYERS

pЄp **PHILLIPS FORMATION**

THIN–BEDDED PURPLE AND RED ARGILLITE, SILTSTONE AND QUARTZITE; MINOR GREEN SILTSTONE INTERLAYERS NEAR BASE

pЄg **GATEWAY AND SHEPPARD FORMATIONS**

UPPER: THIN–BEDDED, FINELY LAMINATED GREEN SILTSTONE; MINOR PURPLE ARGILLITE
MIDDLE: GREEN, BROWN, AND REDDISH BROWN SILTSTONE AND QUARTZITE, INTERBEDS OF GREEN AND PURPLE ARGILLITE; DIAGNOSTIC SALT CRYSTAL CASTS THROUGHOUT
LOWER (SHEPPARD FORMATION): THIN–BEDDED DOLOMITE, STROMATOLITIC DOLOMITE; MAUVE, GREY, AND GREEN SILTSTONE, DOLOMITIC SILTSTONE, AND QUARTZITE; COBBLE–BOULDER POLYMICTIC PARACONGLOMERATE AT BASE

PURCELL SUPERGROUP *(CONTINUED)*

pЄnc **NICOL CREEK FORMATION**

PURPLE AND GREEN, AMYGDALOIDAL AND VESICULAR BASALT, LOCALLY PORPHYRITIC (PLAGIOCLASE PHENOCRYSTS); INTERLAYERED GREEN TUFF BEDS AND THIN–BEDDED, COMMONLY GRADED, GREEN AND PURPLE SILTSTONE LAYERS (nc); PURPLE VOLCANICLASTIC SILTSTONE AND SANDSTONE

pЄvc **VAN CREEK FORMATION**

THINLY LAMINATED PALE GREEN AND PURPLE SILTSTONE AND SHALE, CHARACTERISTICALLY REDDISH ORANGE WEATHERING; THIN–BEDDED PURPLE AND RED ARGILLACEOUS LIMESTONE; GREEN SILTY QUARTZITE; MINOR ARGILLACEOUS LIMESTONE NEAR BASE

pЄk **KITCHENER FORMATION**

MEDIUM TO DARK GREY SILTY AND ARGILLACEOUS DOLOMITE, DOLOMITIC ARGILLITE, AND ARGILLACEOUS LIMESTONE; GREY SILTY DOLOMITE WITH BLACK ARGILLACEOUS PARTINGS; MINOR GREEN SILTSTONE AND ARGILLITE

$pЄk_1$ PALE YELLOWISH GREEN SILTSTONE AND ARGILLITE WITH INTERLAYERED BUFF–WEATHERING DOLOMITIC SILTSTONE AND ARGILLITE; MINOR DARK GREY LIMY ARGILLITE

pЄc **CRESTON FORMATION**

LIGHT TO MODERATE GREEN SILTSTONE AND ARGILLITE; LESSER GREY, LIGHT BROWN, AND PURPLE–TINGED SILTSTONE AND ARGILLITE, WHITE QUARTZITE; MINOR BUFF–WEATHERING DOLOMITIC SILTSTONE

$pЄc_1$ GENERALLY RUSTY WEATHERING LIGHT TO DARK GREY SILTSTONE, ARGILLITE, AND SILTY QUARTZITE; LENTICULAR–BEDDED DARK GREY SILTY ARGILLITE; INTERLAYERED GREEN SILTSTONE AND GREY ARGILLITE

pЄa **ALDRIDGE FORMATION**

$pЄa_3$ (UPPER: ALDRIDGE): THINLY LAMINATED, RUSTY WEATHERING, LIGHT TO DARK GREY ARGILLITE AND ARGILLACEOUS SILTSTONE

$pЄa_2$ (MIDDLE: ALDRIDGE): THIN TO THICK–BEDDED GREY QUARTZITE WACKE INTERLAYERED WITH LAMINATED SILTSTONE; SILTSTONE AND RUSTY WEATHERING ARGILLITE DOMINATE NEAR TOP

$pЄa_1$ (LOWER: ALDRIDGE): RUSTY WEATHERING SILTSTONE AND QUARTZITE WITH INTERBEDS OF SILTY ARGILLITE; INTERLAYERED RUSTY WEATHERING QUARTZ WACKE AND SILTSTONE NEAR TOP

SYMBOLS

ROCK OUTCROP
GEOLOGICAL CONTACT: DEFINED, APPROXIMATE, ASSUMED
FAULT: DEFINED, APPROXIMATE, ASSUMED
THRUST OR REVERSE FAULT
NORMAL FAULT
FOLD AXIAL TRACE: ANTICLINE: OVERTURNED
SYNCLINE: OVERTURNED
BEDDING: INCLINED, OVERTURNED
TOPS UNKNOWN
FLOW STRUCTURE IN VOLCANIC ROCKS
FOLIATION, CLEAVAGE
LINEATION
MINOR FOLD AXIS (SHOWING VERGENCE)
SMALL SHEAR (SHOWING DIP)
MINERALIZED VEIN (SHOWING TREND) Zn
MINE, PROSPECT, OR OCCURRENCE (Pb, Zn)
SILT SAMPLE LOCATION M69A
EDGE OF MAPPING
TOPOGRAPHIC CONTOUR (500-FOOT INTERVAL)
ROAD: HARD SURFACE
LOOSE OR STABILIZED SURFACE
LAKE

DESCRIPTIVE NOTES

The Moyie Lake area is underlain dominantly by clastic rocks of the Purcell Supergroup of Helikian and Hahrynian age. Two past producers, the Midway mine and the St. Eugene mine, numerous small silver-lead-zinc and copper vein occurrences, and placer gold on Moyie River make the area an attractive exploration target area. Virtually the entire area is below timberline with relief varying from approximately 929 metres (3,050 feet) near Moyie Lake to 2 302 metres (7,554 feet) in the northwest corner. Exposure is generally poor, because many of the rounded hills and most valleys are covered by a veneer of Quaternary and Recent sand and gravel.

The following notes are not intended as a summary of the geology of the Moyie Lake area. Rather they attempt to focus on stratigraphic and structural problems, many still unresolved, that were encountered during our mapping. We gratefully acknowledge the field assistance of Peter Mustard, Jack Hamilton, and Tom Mueller, and discussions with a number of persons including John Hamilton, Ian McCartney, and Dave Pighin of Cominco Ltd., John Reesor, and G. Leech of the Geological Survey of Canada, and Les Tihor and John Wilson of Falconbridge Nickel Mines Limited. Previous reconnaissance maps by Schofield (1915), Rice (1937), and Leech (1960) provided excellent base for more detailed work of this study. Recently published maps and notes (Höy, 1979 and McMechan, 1979) portray the contrast in structural style and stratigraphy of Purcell Supergroup rocks on the east side of the Trench with those of this study area.

The oldest rocks within the map-area, rusty weathering siltstone and quartzite of the lower Aldridge Formation ($pЄa_1$), occur in the hangingwall of the Moyie fault. They are sheared, tightly folded, and locally overturned adjacent to the fault. Moyie intrusive rocks (metadiorites) crosscut lower Aldridge rocks, although the general aspect of most are sill-like. Only the largest and most continuous are shown on the map, and these (as in the middle Aldridge) commonly consist of a number of separate intrusions with screens of sedimentary rocks. The boundary between the lower and middle Aldridge is gradational. It has been placed at the surface above which grey-weathering quartz-wacke beds predominate over siltite, although quartz wackes occur throughout the upper part of the lower Aldridge, and rusty weathering thin to medium-bedded graded siltite beds, typical of the lower Aldridge, occur in the basal part of the middle Aldridge.

Grey-weathering graded quartz-wacke beds interpreted to be turbidite deposits (Bishop, Morris, and Edmunds, 1970) occur throughout the middle Aldridge ($pЄa_2$). Basal scour marks indicate northerly directed current transport. In general, in the middle Aldridge, quartz-wacke beds become thinner, less pure, and less volumetric up-section; the upper part comprises a number of distinct cycles of massive, grey quartzite-wacke beds capped by siltstone and argillite (Höy and Diakow, 1981). The contact with the upper Aldridge ($pЄa_3$) is placed above the last bed of massive grey quartzite. Metadiorite sills are the most important markers within the thick middle Aldridge section and allow correlation across many of the faults. Some of the larger of these sills have been designated by letter symbols on the map.

The base of the Creston Formation (pЄc) is commonly marked by a thick, generally massive grey quartzite unit. It is commonly overlain by dark argillite and siltstone that is distinguished from the upper Aldridge by the presence of thin green siltstone lenticles and occasional mud cracks. Green siltstone is characteristic of much of the Creston Formation, but may also be dominant in the basal unit ($pЄc_1$) of the overlying Kitchener Formation (pЄk). The base of the Kitchener is placed beneath the first section containing prominent buff-weathering dolomitic siltstone. The contact between the Kitchener and the Van Creek (pЄvc) Formation is gradational, from thin-bedded grey argillaceous limestone into grey siltstone with a few green and brown silty limestone layers in the basal part of the Van Creek Formation.

The Nicol Creek Formation (pЄnc) (McMechan, Höy, and Price, 1980) includes the Purcell lavas and intercalated clastic and volcaniclastic rocks. A number of west-dipping normal faults that repeat the lava sequence on the Cranbrook Mountain-Moyie Mountain ridge shows the marked thinning of the lava sequence to the west. The Nicol Creek Formation also thins to the south but this is in part due to erosion at the base of the overlying Gateway Formation (pЄg). On the ridge east of Mount Connell the base of the Gateway is marked by a fluviatile conglomerate that cuts into the Nicol Creek Formation and removes the upper flows and an underlying siltstone sequence (nc).

Stromatolitic dolomite, quartzite, and dolomitic siltstone of the Sheppard Formation (included within the Gateway on the map) overlie the Nicol Creek Formation. The Gateway consists of intercalated quartzite and purple argillite and a thick monotonous sequence of finely laminated green and purple siltstone. Salt crystal casts are diagnostic in the middle part of the Gateway. The overlying Phillips Formation (pЄp) consists primarily of thin-bedded purple and red argillite, siltstone, and quartzite. It is overlain by black argillite in the basal part of the Rossville Formation (pЄr) which grades upward into green and locally purple argillite and siltstone of the Upper Roosville. Mud-chip breccias, cross-laminations, ripple marks, mud cracks, and thin-bedded purple and red siltstone and argillite intervals indicate a shallow marine to intertidal environment for most of the Upper Purcell Supergroup (Creston through Roosville).

Grey-white and purplish red dolomite and dolomitic sandstone of Middle Devonian age (Df) unconformably overlie Upper Purcell strata. These are overlain in turn by dark grey fossiliferous Upper Devonian limestone. Locally, a fluviatile conglomerate marks the base of the Devonian. The similar Peavine conglomerate (Dp) unconformably rests on the Van Creek Formation at the north end of Moyie Lake and on the Kitchener Formation near Lamb Creek in the southwest corner of the map-area where it forms the footwall of the Moyie fault (Leech, 1962).

The Moyie anticline dominates the structure south of Moyie fault. It is a northeast-plunging, upright anticlinal fold. North of the fault, lower and middle Aldridge rocks are folded into moderately tight to open, north to northeast-trending folds that are outlined by gabbroic sills. In the hangingwall, immediately adjacent to the Moyie fault, folds are tight and locally overturned. Fold structures are most complex in the northwest corner of the map-area where detailed mapping of the upper part of the Aldridge and lower part of the Creston has outlined a number of tight overturned folds. These trend north-northwest and plunge variably to the north and locally to the south.

The Moyie fault is a north-dipping, right lateral and reverse fault. Its hangingwall juxtaposes highly deformed lower and middle Aldridge rocks against less deformed Kitchener, Van Creek, Nicol Creek, and Gateway rocks in the footwall. A number of splays in the hangingwall are also reverse faults.

Northwest-trending faults with downthrow to the west are the most important structures in the area southeast of the Moyie fault. Net normal (west-side-down) displacement on the largest of these, the Gold Creek fault, decreases southward from approximately 3 000 metres west of Mount Baker (section E-E') to 1 500 metres near Plumbob Creek. As noted by Leech (1960), exposure is poor and the exact locations of many faults west of Gold River are not known. These exposed dip steeply to the west. They repeat lavas of the Nicol Creek Formation along Moyie Mountain-Cranbrook Mountain ridge, extend the distribution of the Kitchener Formation eastward in the valleys, and cause apparent thickening of the Van Creek and Gateway Formations.

North of the Moyie fault in the "St. Mary block" (Benvenuto and Price, 1980) northeast-trending faults are more complicous. They dip steeply to the north and have net normal displacement.

Mineral occurrences and deposits within the area are indentified by British Columbia Mineral Inventory numbers on the map. Occurrences that are not numbered were noted or discovered during the course of mapping. The St. Eugene deposit and its extension to the west (Aurora) and east (Society Girl) form a northwest-trending silver-lead-zinc vein structure that produced, until its closure in 1929, 1.46 million tonnes containing approximately 8 per cent lead, 1 per cent zinc, and 125 grams per tonne silver. Vine, a recently discovered lead-zinc-silver deposit at the north end of Moyie Lake, is a north-east-trending massive sulphide zone. It is generally less than 2 metres thick and cuts across quartzite-wacke beds near the base of the middle Aldridge.

REFERENCES

Benvenuto, G. and Price, R. A. (1979): Structural Evolution of the Hosmer Thrust Sheet, Southwestern British Columbia, Bull., *Can. Soc. Pet. Geol.*, Vol. 27, No. 3, pp. 360-394.

Bishop, D. T., Morris, H. C., and Edmunds, F. R. (1970): Turbidites and Depositional Features in the Lower Belt–Purcell Supergroup (abstract): *in* Program, *Geol. Soc. Am.*, Boulder, Colorado, p. 797.

Höy, T. (1979): Geology of the Estella–Kootenay King Area, Southeastern British Columbia, *B.C. Ministry of Energy, Mines & Pet. Res.*, Prelim. Map 36.

McMechan, M. E. (1979): Geology of the Mount Fisher–Sand Creek Area, *B.C. Ministry of Energy, Mines & Pet. Res.*, Prelim. Map 34.

McMechan, M. E., Höy, T., and Price, R. A (1980): Van Creek and Nicol Creek Formations (new): A Revision of the Stratigraphic Nomenclature of the Middle Proterozoic Belt–Purcell Supergroup, Southeastern British Columbia, Bull., *Can. Soc. Pet. Geol.*, Vol. 28, No. 4, pp. 542-558.

Leech, G. B. (1960): Geology, Fernie (West Half), Kootenay District, British Columbia, *Geol. Surv., Canada*, Map 11-1960.

_____ (1962): Structure of the Bull River Valley near Latitude 49° 35', *Jour., Alta. Soc. Pet. Geol.*, Vol. 10, No. 7, pp. 396-407.

Rice, H.M.A. (1937): Cranbrook Map-Area, British Columbia, *Geol. Surv., Canada*, Mem. 207, 67 pp.

Schofield, S. J. (1915): Geology of the Cranbrook Map-Area, British Columbia, *Geol. Surv., Canada*, Mem. 76, 245 pp.

PRELIMINARY MAP NO. 49
GEOLOGY OF THE MOYIE LAKE AREA
(N.T.S. 82F/1,8,9; 82G/3,4,5,6,11,12)
100,000 JANUARY 1982