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BEDROCK GEOLOGY ALONG INGENIKA AND FINLAY RIVERS, PEACE RIVER RESERVOIR AREA, BRITISH COLUMBIA

(Report and 1 figure)

N.W. Rutter and G. C. Taylor

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ABSTRACT

A portion of the Rocky Mountain Trench about to be flooded behind the Bennett Dam was examined. Twelve exposures of bedrock were located, samples obtained, and thin sections of these were studied. Each sample was assigned, according to its lithology and metamorphic facies, to either the Sifton Formation, Tenakihi, Ingenika, or Misinchinka Groups. The samples have been placed in the permanent collection of the Geological Survey of Canada.

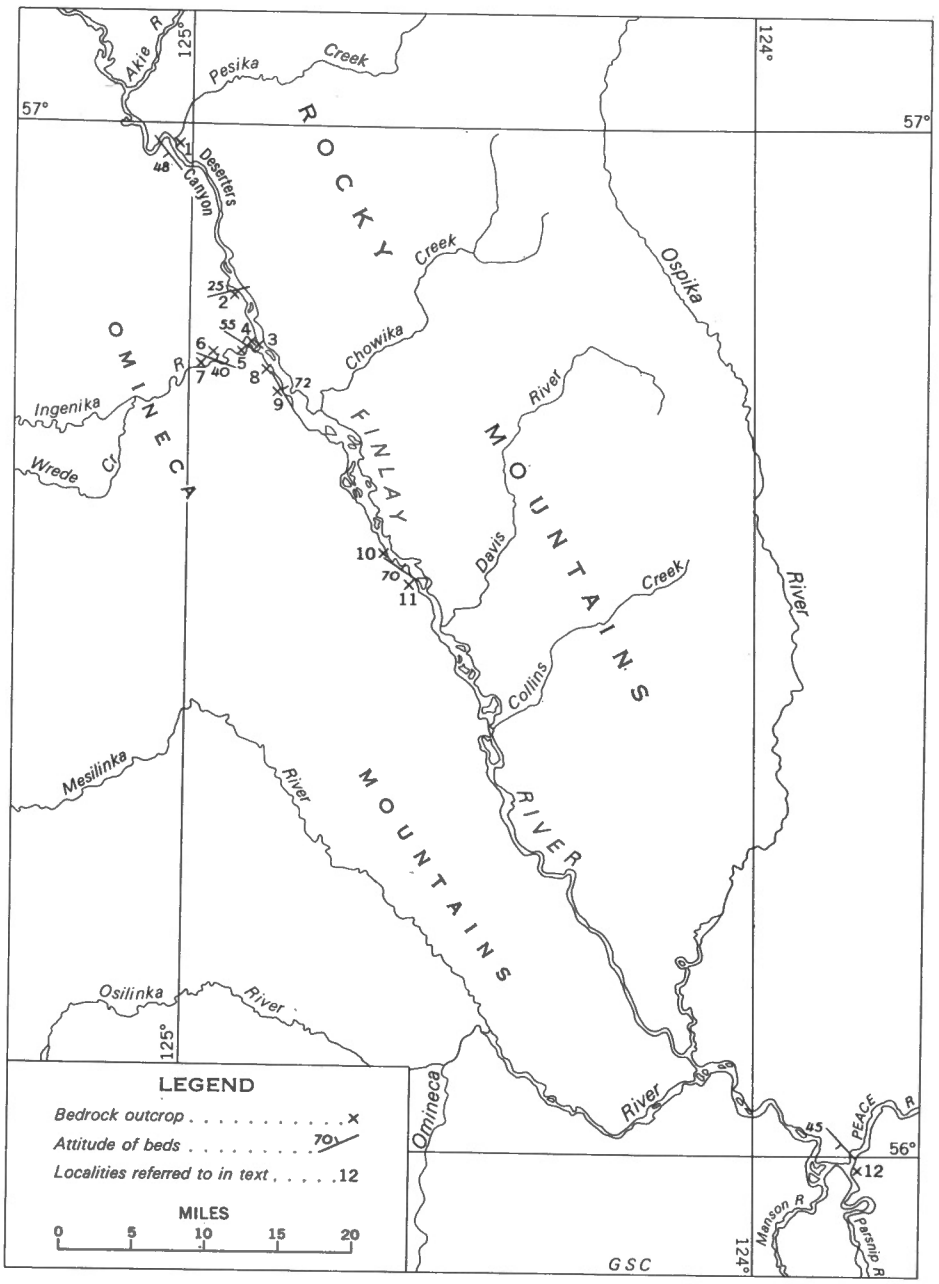

Figure 1. Finlay River portion of the Peace River Reservoir area B.C. showing location of outcrops.

BEDROCK GEOLOGY ALONG INGENIKA AND FINLAY RIVER, PEACE RIVER RESERVOIR AREA, BRITISH COLUMBIA

INTRODUCTION

The bedrock geology was investigated along Finlay River and the lower part of Ingenika River within the proposed Peace River Reservoir area, during the field season of 1967. The study was undertaken at this time in order to obtain geological information prior to reservoir flooding which is to begin during spring 1968. The information presented should be beneficial to geologists who plan to work in that vicinity in the future.

The area studied is covered by parts of NTS maps 94C and 94O (Fig. 1). Outcrops investigated lie along Finlay River between Finlay Forks and Deserters Canyon, a distance of about 80 miles, and along Ingenika River from its mouth to about 5 miles upstream.

Bedrock outcrops are scarce. Only twelve exposures were located; most of these being in the vicinity of Ingenika River, with others near Finlay Forks, Fort Grahame, and Deserters Canyon. The survey was made by boat during the low water stage to ensure that all outcrops would be recorded.

Outcrops vary in size, rising from the water's edge from about one foot to over one hundred feet in height, with lateral extent and depth varying from about ten feet to several hundred feet. At each site, field descriptions were made, dips and strikes recorded where possible, and representative samples collected. The samples will be kept in permanent collection of the Geological Survey of Canada.

Previous Work

Exploration surveys were carried out in the general area by Selwyn (1877), Dawson (1881) and McConnell (1896) all of whom traversed the major waterways. Dolmage (1928) studied the geology in parts of the same area and, relying on McConnell's 1894 mapping, he modified or refined the ages assigned to different units. McConnell's Cretaceous was changed to Tertiary, the Palaeozoic limestone to Cambrian ? or younger and the Archean series to Precambrian.

Since the publication of Dolmage's (1928) report, no results of bedrock mapping of the area have been published. However, systematic mapping has been carried out in adjacent areas by Roots (1954), Muller (1961), and Irish (1963).

Acknowledgments

All field observations were made by Rutter who was ably assisted in the field by L.A. Barrie, Queen's University. A 36-foot river boat was supplied and manned by Jack Longstreet. The cooperation and assistance by the Peace River Power Authority and the British Columbia Forestry Service is greatly appreciated.

Manuscript received: December 23, 1967

Examination, petrographic description, and stratigraphic assignment of samples, were made by Taylor. A.L. Bowering and Santo Carbone prepared the thin sections.

GENERAL GEOLOGY

The reservoir behind the W.A.C. Bennett Dam will flood Peace, Parsnip, and Finlay Rivers, and the lower reaches of their tributaries to a proposed elevation of 2,200 feet. Throughout much of their extent, Parsnip and Finlay Rivers occupy a portion of the Rocky Mountain Trench, the major topographic feature of the area. There the Trench is essentially a broad "strike" valley and a knowledge of what underlies the valley is critical in assessing interpretations of the tectonic significance of this major feature.

The Rocky Mountain Trench, in the area under discussion, separates the folded and faulted sedimentary rocks of the Rocky Mountains to the east, from the predominantly igneous and metamorphic terrain of the Omenica Mountains to the west. The floor of the Trench has low local relief with well-defined lateral boundaries. Most of the bedrock is masked by a thick cover of Pleistocene sediments. To the north, (Gabrielse, informal address, Ottawa, 1962) facies belts of the lower Palaeozoic sedimentary units strike across the Trench without apparant offset but, in the valley of Finlay River, with the exception of Deserters Canyon, the bedrock exposures are all of Cambrian or older metamorphic rocks.

Twelve outcrops in four areas of bedrock exposure were located during the summer of 1967. From north to south these are, Deserters Canyon, the mouth of Ingenika River, in the vicinity of Fort Grahame, and, on Peace River, immediately downstream from Finlay Forks.

Deserters Canyon

The upper limit of reservoir flooding reaches as far north as Deserters Canyon of Finlay River. At Deserters Canyon, where it has carved a small canyon into conglomerates, the river is confined to a width of less than 100 feet as opposed to its normal width of 100-300 yards.

Sifton Formation.

The conglomerates are a part of a belt of clastic rocks mapped by McConnell (1886, p. 35C) from the mouth of the Ingenika River, northward, to Sifton Pass and beyond. Hedley and Holland (1941) gave the name Sifton Formation to this unit following their investigations of Turnagain and Upper Kechika Rivers. Roots (1954) also encountered the formation in Aiken Lake map-area to the west.

> Sample RR67-40 (Fig. 1, Loc. 1) Conglomerate, medium grey, hard, poorly sorted, mainly pebble-sized (limestone, quartzite, quartz, some sandstone, schistoze sandstone, volcanics,

"gritty" sandstone, greenstone, chert, and siltstone), well-rounded; bedding poorly defined; weathers light yellow-brown with oxidized coatings. Intercalated sandstone, calcareous, dark grey-brown, fine- to medium-grained with large (2-3 mm) clastic plates of muscovite.

attitude N 140° E at 48° SW.

Thin sections show that the grains are angular to subangular with elongation ratios as high as 5:1. Quartz is the most common mineral, with grains of chert, quartzite, and calcite common; rare volcanic fragments. Opaque iron oxides are all altered to limonite.

Sample RR67-38-39. (Fig. 1, Loc. 2) Conglomerate, hard, poorly sorted with pebbly sand lenses, well-rounded to rounded pebbles, coarse sand matrix. Pebble frequency same as RR67-40.

attitude N 105° E at 25° SW.

No fossils were found in the conglomerates. McConnell (1896) collected plant fossils that were assigned an Upper Laramie age by Sir William Dawson. W.A. Bell of the Geological Survey subsequently restudied the fossils and proposed an Upper Cretaceous or Paleocene age.

Ingenika River

A series of bedrock exposures (Fig. 1, Loc. 3-9) occurs along Ingenika River near its mouth, and on the Finlay River upstream and downstream from the junction of Ingenika River. All the exposures are of low to medium rank metamorphic rocks. They can be tentatively assigned to two stratigraphic successions described by Roots (1954) from the adjacent Aiken Lake map-area.

Tenakihi Group

The name Tenakihi Group was proposed by Roots (op. cit. p. 33) for a succession of golden brown, to grey, relatively coarse-grained, quartz-mica schists. Three exposures (Fig. 1, Loc. 5, 6, and 7) on the Ingenika River can be assigned to this group.

Sample RR67-30 (Fig. 1, Loc. 7) Quartz-mica schist, silvery grey, medium crystalline; well-developed schistosity, strong mineral lineation, rare quartz-rich "augens"; weathers light brown. Approximately 40 feet of outcrop exposed above water level.

attitude N 150° E at 70° NE.

Thin sections show prominent foliation defined by the micas. Quartz is granoblastic and strained; biotite and muscovite occur as ragged laths, biotite being the more common; minor amounts of oligoclase; accessory apatite and rare staurolite ?

Sample RR67-32 (Fig. 1, Loc. 6) Garnetiferous, quartz-mica schist, silvery grey, medium crystalline; weakly developed foliation; rare garnet porphyroblasts (2 mm); weathers medium grey, resistant.

attitude N 110° E at 40° NE.

Thin sections show that the micas define a weak foliation, quartz is granoblastic and exhibits strained extinction; biotite, muscovite, and partially altered (to biotite) chlorite show cleavage crenulation; biotite is more common than muscovite, chlorite is rare; plagioclase common, both fresh and sericitized; rare poikilitic garnets (inclusions mainly quartz); accessory pyrite and apatite.

Sample RR67-35 (Fig. 1, Loc. 5) Garnetiferous, quartz-mica schist, light grey, medium crystalline, large (1-2 cm) garnet porphyroblasts; strongly foliated, prominent crenulation lineation; weathers light brown with iron stains.

attitude N 000° E at 76° E.

Thin sections show that garnet porphyroblasts are skeletal with inclusions arranged in spiral or "S"-shaped pattern; crystal form varies from well-developed dodecahedrons to irregular patchworks. Quartz is granoblastic and strained; plagioclase is common; biotite occurs as laths and partial replacements of chlorite; muscovite is concentrated in the foliation plane and is crenulated; pyrite, in part altered to limonite, and apatite occur as accessory minerals.

Several observations are pertinent to the stratigraphic assignment of the above exposures. Roots (op. cit. p. 35) notes that garnets, some "S"-shaped and rotated, are characteristic of the upper 6,000 feet of the Tenakihi Group and that garnets vary in degree of crystallinity and the amount of poikilitic inclusions according to stratigraphic position. Roots also reports the close correlation of metamorphic rank with stratigraphic position in Aiken Lake map-area. He places the kyanite zone (op. cit. p. 49) approximately 2,500 feet below the top of the Tenakihi Group. No kyanite was observed in the samples collected along the Finlay and Ingenika River. Assuming that no abrupt change of the metamorphic zones relative to stratigraphic position occurs between the two areas, then the exposures (Fig. 1, Loc. 5, 6, and 7) investigated in the present study should be from units less than 2,500 feet stratigraphically below the top of the Tenakihi Group.

Ingenika Group

The name Ingenika Group was proposed by Roots (op. cit. p. 55) for an assemblage of interbedded, quartz-chlorite schist and phyllite, sericite schist, crystalline limestone, quartzite, conglomerate, shale and argillite. Four exposures (Fig. 1, Loc. 3, 4, 8, and 9) near the mouth of Ingenika River have been assigned to the Ingenika Group.

Sample RR67-37 (Fig. 1, Loc. 3) Greenstone, hard, dark greenish grey, finely crystalline; weakly foliated; weathers dark brown; numerous discordant quartz veins; foliation variable.
attitude N 160° E - N 075° E at 75° NE-NW.
Thin sections show that the rock is a normal amphibolite; hornblende is the most common mineral in a matrix of oligoclase, minor chlorite, epidote, biotite and rare quartz.

Sample RR67-36 (Fig. 1, Loc. 4) Chlorite schist, pyritic, dark greenish grey, finely crystalline; foliated; banded with lighter colored quartz-chlorite greenstone; weathers dark brown. Thin concordant and discordant quartz veins.
attitude N 125° E at 75° NE (variable)
Thin sections show that the quartz is granoblastic, plagioclase is common but sericitized, the foliation is defined by chlorite and muscovite; minor amounts of clinozoisite and tourmaline. Local cataclastic zones. Some plagioclase, and composite quartz grains retain their original well-rounded outline. The chlorite has been partially replaced by biotite.

Sample RR67-126 (Fig. 1, Loc. 8) Greenstone, hard, dark greenish grey, finely crystalline; weakly foliated, mullion type lineation; weathers dark brown. Discordant quartz veins.
attitude N 043° E at 70° NW (contorted)
Thin sections show that the rock is composed mainly of epidote and quartz; minor amounts of biotite and albite; accessory apatite, tourmaline, and pyrite. Relict, well-rounded, medium- to coarse-grained, composite quartz grains are locally preserved.

Sample RR67-125 (Fig. 1, Loc. 9) Interbedded greenstone, hard, dark grey, finely crystalline, weakly foliated; and quartz-muscovite schist, medium grey, finely crystalline, well-foliated.
attitude N 120° E at 72° NE.
Thin sections show the greenstone to be an epidote amphibolite, with minor amounts of biotite and plagioclase. The quartz-muscovite schist has been considerably deformed. It contains minor amounts of biotite with accessory tourmaline, apatite, and pyrite. Relict, well-rounded, medium-grained, quartz and quartzite grains are locally preserved.

Roots (op. cit. p. 56) notes that quartz-chlorite schists make up 60 percent of the Ingenika Group. The only amphibolites that he reports are those of the Wolverine Complex, considered to be contact metamorphosed Ingenika rocks (op. cit. p. 97). Localities 3, 4, 8, and 9 are outside the area of the Wolverine Complex, where Roots had observed the amphibolites. The interlayed quartz-chlorite phyllites and the underlying Tenakihi schists show no evidence of contact metamorphism. It is, therefore, reasonable to assume that amphibolites are a normal part of the Ingenika succession, rather than attributable to "Wolverine" contact metamorphism.

Whether the amphibolites represent original impure carbonates altered by regional metamorphism, or volcanic sediments is unknown, but the occurrence of relatively unchanged limestones, admittedly much higher in the Ingenika succession, would seem to favor the latter interpretation.

Fort Grahame

Two exposures of metamorphosed limestone were located near Fort Grahame, on the west bank of Finlay River. One (Fig. 1, Loc. 10) is visible only at the stage of very low water. Because of proximity to Locality 11 and similarity to the bedrock exposed there, no samples were taken.

Ingenika Group

Roots (1954) recognized two divisions in his Ingenika Group. The first is characterized by chloritic schists and grits, the second by massive limestones. The limestones exposed near Fort Grahame have been assigned to the latter division.

> Sample RR67-26, -27 (Fig. 1, Loc. 11) Exposure rises 30 feet above low water level; limestone, light grey, finely crystalline; massive; fine (1-2 mm) lamination, lineated; weathers light grey to light orange-brown; calcite veined, small scale folding and contortion.
>
> attitude N 105° E at 77° SW.
>
> Thin sections show the rock to be a fine mosaic of calcite, with floating subangular to subrounded, medium-grained sand. Most grains are albite; rare quartz. Fine sheaths of phlogopite disseminated throughout the section.

No fossils were found in the limestones. Roots (op. cit. p. 89) reports rare archaeocyathids of Lower Cambrian age from the Ingenkia limestones north of Osilinka River. Recent work has demonstrated the very widespread distribution of this limestone unit over much of northeastern British Columbia. Gabrielse (1954) proposed the name Atan Group for a succession of sedimentary rocks that includes this limestone in the McDame map-area. He (1963) subsequently re-defined the limits of the Atan Group though still not naming the constituent units. Muller (1967, map-unit 7), recognized the same unit in the Pine Pass area to the south. Taylor (1966) found the unit widespread in the Operation Liard area. The Atan Group either overlies early Proterozoic strata unconformably as in Tuchodi Lakes map-area, or overlies late Proterozoic units pseudo-conformably over much of its remaining extent. Commonly the underlying units are weakly metamorphosed though the unconformity, if present, is difficult to recognize.

Finlay Forks

At the junction of Finlay and Parsnip Rivers and downstream on Peace River an extensive exposure of the Misinchinka Group was observed. The outcrop has been reported by Muller (1961) and Irish (1963).

Misinchinka Group

Sample RR67-112 (Fig. 1, Loc. 12) Carbonaceous mica-schist, pyritic, dark silvery grey, finely crystalline; well-developed foliation, strong microfold; weathers dark grey. attitude N 110° E - N 175° E at 30-57° SW (variable). Thin sections exhibit a granoblastic mixture of quartz and calcite; muscovite on the foliation planes; with accessory tourmaline, apatite, and pyrite. Carbonaceous material finely disseminated throughout section. Strong internal deformation.

Several minor lithologic units are included within the mica schist.

Sample RR67-113a (Fig. 1, Loc. 12) Quartzite, light grey, fine-grained, weakly foliated, muscovite concentrated on the foliation planes; weathers light grey-brown. Thin sections show predominantly granoblastic quartz, large (1 mm) plagioclase porphyroblasts, minor amounts of calcite, muscovite, accessory apatite.

Sample RR67-113b (Fig. 1, Loc. 12) Carbonaceous, quartz-mica schist, pyritic, dark, silvery-grey, finely crystalline; very well foliated; strong microfold lineations in two directions; weathers dark grey with iron staining. Thin sections show it to be predominantly quartz, granoblastic; with minor calcite and muscovite; rare chlorite; accessory apatite and pyrite. Finely disseminated carbonaceous material throughout the section.

Sample RR67-113c (Fig. 1, Loc. 12) Quartz-mica schist, pyritic, light silvery grey, finely crystalline; very well developed foliation; microfold lineation; weathers light silvery grey. Thin sections show it to be dominantly quartz with minor calcite and muscovite and rare albite.

Sample RR67-113d (Fig. 1, Loc. 12) Limestone, pyritic, dark grey, finely crystalline; well-bedded with micaceous partings; weathers dark grey. Thin sections show it to consist predominantly of calcite, minor well-rounded, fine-grained (0.3 mm) quartz grains; rare muscovite.

The highly micaceous Misinchinka schists were first observed by Selwyn in 1875 and subsequently named by Dawson (1881 p. 109B). Muller (1961) subdivided the Misinchinka Group into three lithologic units on his Pine Pass map, but gave little descriptive information of each unit. On the basis of map distribution it appears that the exposures near Finlay Forks may be assigned to his lowermost unit. No fossils have been found in the Misinchinka. It apparently conformably underlies the Atan Group in Pine Pass (Muller 1961). In Halfway River area (Irish, 1963) weakly metamorphosed Misinchinka (chlorite zone of green schist facies) underlies the Atan Group. Near Pesika Creek, in the Ware map-area, Taylor has observed unmetamorphosed Atan strata overlying Misinchinka rocks of the biotite zone. It appears that the Misinchinka is probably late Proterozoic in age, correlating in part to the Ingenika Group, and to an unnamed unit near Gundahoo Pass in the Tuchodi Lakes area.

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