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TRAIL MAP-AREA, BRITISH COLUMBIA

82 F/4 E 1/2

(Report, figure and Map 7-1962)

H. W. Little

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By
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INTRODUCTION

This study was undertaken in 1961 primarily to extend the stratigraphy of the Jurassic sedimentary and volcanic rocks worked out in Salmo map-area in 1959, but also to establish the complex history of the Cretaceous and Tertiary plutonic rocks. It is hoped that by further study the mineral deposits, particularly those of the Rossland camp, can be fitted into the stratigraphic and structural pattern and related to the plutonic history, and that this information will be of assistance in the search for new bodies of copper, gold, and perhaps other metals.

Acknowledgments

The writer was ably assisted in the field by J.G. Payne, F.D. Corman, and W.J. McMillan. Identification of the Jurassic fossils was made by Hans Frebold of the Geological Survey, who also discovered diagnostic fossils at Waneta. The writer is grateful for the courtesies of many residents of the Rossland-Trail area, particularly the geological staff of The Consolidated Mining and Smelting Company of Canada Limited, and R.G. Yates of the United States Geological Survey.

DESCRIPTION OF FORMATIONS

Map-unit A comprises high-grade metamorphic rocks of unknown age. Those that underlie much of the northwestern part of the map-area grade, south of Sullivan Creek, into massive black siltstones that bear a close lithological resemblance to the Archibald Formation (2). On the logging road up Sullivan Creek, however, two bands of marble are exposed. No limestone has yet been seen in the Archibald Formation, although some beds are somewhat limy.

Map-unit 1 comprises the oldest rocks known in the map-area. They are restricted to the southern part of the area and are best exposed along Pend-d'Oreille River where they were studied in detail by Fyles and Hewlett (1959)[1], and south of the International Boundary where they were examined by Yates and Robertson (1958). A single collection of rather poorly preserved fossils, obtained near Sevenmile Creek, has been tentatively identified as probably upper Palaeozoic. The rocks west of Columbia River, although for the present correlated with those along Pend-d'Oreille River, do not necessarily belong to the same system.

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[1] Dates or names and dates in parentheses refer to publications listed in the References.

The rocks of map-unit 1, which are for the most part contorted, are in faulted contact with units of the Rossland Group. As a result of field work in 1959 in Salmo map-area (Frebold and Little, 1962; Little, in press), the base of the Rossland Group was placed at the base of the predominantly volcanic Elise Formation. This formation overlies with apparent conformity the predominantly sedimentary Archibald Formation which in the upper part contains ammonites of Sinemurian (early Lower Jurassic) age. In the northwest corner of Salmo area, however, north of Parks and in the valley of Bell Creek, Sinemurian sediments are underlain by lavas. In view of the relationships to the east and north it was assumed that faulting and/or folding accounted for this phenomenon. Field work to the west in 1961 has shown that in many localities Sinemurian sediments are underlain by lavas, and it now seems evident that the basal lavas are older in the Rossland-Trail map-area than to the east and north. This interpretation would also solve the anomaly that at Paterson (south of Rossland) the basal lavas rest unconformably on the Pennsylvanian(?) Mount Roberts Formation and the thick Archibald Formation is missing (Little, 1960).

Figure 1 shows diagrammatically the probable relationships of the formations comprising the Rossland Group. New information can be added to the geological section for the Kelly-Archibald Creeks area which is published elsewhere (Frebold and Little, 1962). In 1961 the writer discovered on the west side of Archibald Creek a new locality containing Arniotites kwakuitlanus at a horizon at least 3,000 feet below the base of the Elise Formation. The apparent thickness of the rocks there that are known to be Sinemurian is thus increased from 1,200 feet to that figure.

South of Mount Kelly in Salmo map-area a new exposure of beds resembling the Hall Formation yielded ammonites, one of which, according to Frebold, may belong to the Harpoceratidae, and the age is possibly Toarcian. As these beds lie between the Archibald Formation and the 'Perisphinctes beds' of Bajocian or later age, it is probable that they are Toarcian.

The Archibald Formation (2) has yielded fossils of Sinemurian age both east and west of the edge of the map-area from 1/2 mile to 1 1/2 miles south of Parks, also south of Marsh Creek 1 1/2 miles west of Beaver Creek, south of Bath Creek at elevation 2,500 feet, and at the north end of Waneta dam. Poorly preserved ammonites collected on the west side of Beaver Creek 2 miles north of Fruitvale are possibly Sinemurian. Elsewhere the Archibald Formation is correlated on the basis of lithological similarity, although this unit locally contains interbedded lavas, as for example west of Parks.

The Elise Formation (3) overlies conformably the Archibald Formation. Only on the west side of the hill 1 mile east of Fruitvale has a fossil been obtained from the sedimentary members, which form only a small part of the formation. Although this fossil is of Sinemurian age, the rocks have been classed as lower Elise because of the abundance there of volcanic rocks, whereas the Archibald Formation a short distance north contains little lava. The structure,

however, is complex and those beds may belong to the Archibald Formation.

Near Fruitvale, four collections of fossils were made from the shaly rocks of the Hall Formation (4), only one of which is diagnostic and is of Toarcian (late Lower Jurassic) age. Fossils of Bajocian (early Middle Jurassic) age occur in the Hall Formation in Bonnington area, and of Bajocian or later age, as well as Toarcian, in Salmo area (Frebold and Little, 1962).

Map-unit 5 overlies the beds of Bajocian or later age in Salmo map-area.

At Fruitvale the upper boundary of the Elise Formation, but not the lower, can be defined. At Waneta and in lower Beaver Creek, on the other hand, only the lower boundary of the Elise Formation can be determined. In these localities, and where neither boundary can be defined, the predominantly volcanic rocks are mapped as Lower Rossland Group undivided (6). Lavas below the Archibald Formation are also included in this unit (see Fig. 1). Map-unit 6a includes apparently unfossiliferous beds, locally with abundant interbedded lava (6b), that resemble the Sinemurian siltstone at Waneta. This unit, which occurs on Blizzard Mountain, can be traced irregularly only a few miles along strike where it appears to terminate rather abruptly against lavas. Because no faults could be found at these localities it is suggested the sediments were deposited in a trough between volcanic islands. Rocks west of Columbia River shown as doubtfully belonging to this unit (6a) are lithologically similar but appear to be stratigraphically higher.

Map-units 7 to 10 are tentatively identified by lithological correlation of hand specimens only, and the future study of thin sections will doubtless result in changes in a later edition of this map.

The body of monzonite (7) exposed in lower Cambridge Creek is the eastern end of the so-called 'Rossland monzonite' (Little, 1960). Contacts with Nelson rocks are poorly exposed so that their relationship to the monzonite is uncertain. The monzonite is for the present regarded as older than the Nelson, but this problem requires further study. It is, however, cut by dykes believed to be Coryell.

The largest body of Nelson Plutonic Rocks (8) is the Trail batholith of which the major, eastern part is within the present map-area. It consists almost entirely of quartz diorite. East of Columbia River it is fractured and invaded by an extensive dyke swarm. These dykes may be of Tertiary age and some are aplites apparently related to the Sheppard Intrusions. The northeast corner of the map-area is underlain by quartz diorite and, possibly, granodiorite and diorite, which forms the southern lobe of the Nelson batholith. Other bodies of Nelson rocks in the north half of the area appear to be quartz diorite or granodiorite.

In the valley of Casino Creek, bodies of porphyritic biotite granite or granodiorite, invaded by dykes of Sheppard aplite, are tentatively referred to the Nelson. Other bodies resemble the

quartz diorite of the Trail batholith. Most of the bodies on Blizzard Mountain and on the slope northward to Beaver Creek and those on Lake Mountain comprise medium-grained hornblende diorite and porphyritic diorite (8a) that is doubtfully referred to the Nelson. In northeastern Washington, similar bodies have in some places been shown to be Tertiary.

Within the triangle between Trail, Casino, and Lake Mountain, and on the Pend-d'Oreille road east of Fourmile Creek, a number of small bodies and dykes of syenite, granite, and biotite monzonite bearing the distinctive pink colour of the Coryell rocks have been tentatively classified as such (9). The Coryell is known to be younger than Nelson, but its relationship to the Sheppard granite has not been established, although it is believed to be older.

The Sheppard Intrusions (10) comprise bodies of leucocratic granite, and large dykes of aplite. The largest body is the stock lying between Columbia River and Violin Lake and within parts of it the rock is coarse grained. Elsewhere in the map-area the granite is mainly medium grained and is commonly sheared. Yates and Robertson (1958) have shown that the large body of Sheppard granite west of Waneta is sill-like and follows to some degree the fold pattern of the intruded rocks. They suggest it was emplaced during folding.

Dykes of Sheppard aplite are particularly abundant west of Columbia River south of Trail, and north of Columbia River between Trail and lower Beaver Creek.

The entire area was glaciated during the Pleistocene epoch, the glaciers moving, in general, southward toward the low-lying Columbia Plateau. In the valleys, however, the ice flow was for the most part deflected along them. The entire area is mantled by a thin layer of till except in certain upland valleys that have gentle gradients. There, and in the valley of Columbia River, where terraces of gravel, sand, and silt of great thicknesses occur, the unconsolidated surficial material is shown as map-unit 11. Within these areas outcrops are particularly scarce or are lacking.

STRUCTURE

The structure of the area is in many places difficult to solve, owing to paucity of outcrops and fossils. Except at Waneta, no fossils have yet been found more than 3 miles from the eastern edge of the map-area.

Between Hudu and Fruitvale Creeks, and west to Champion Lake and Bear Creek, the Archibald and Elise Formations appear to be gently folded and domed, with, locally, some steep dips and erratic attitudes. Elsewhere no such folding has been detected.

From the Waneta fault northwest to Beaver Creek is a thick succession of lavas carrying interbeds of sediments, mainly thin. The sediments strike northeast and, in many places where tops

could be determined, almost invariably face northwest and are commonly overturned. The top of this succession is near Fruitvale where the Hall Formation has been identified. From lower Beaver Creek northwest to the contact of the Trail batholith the lower part of this succession appears to be repeated, but there only has the underlying Archibald Formation been established.

Along lower Beaver Creek these two successions are separated by a fault that, on stratigraphic and fossil evidence, strikes north across Bath Creek. This fault appears to be offset to the east by an east-striking cross-fault that terminates the Hall Formation against the Sinemurian lower Elise Formation that outcrops on the ridge north of Kelly Creek. Some evidence of discontinuity of the formations along Kelly Creek in Salmo area was found in 1959. North of the cross-fault the apparent continuation of the fault along lower Beaver Creek could not be found accurately, but is believed to be where shown and probably links with the Query Creek fault of Salmo map-area. The fault immediately north is of unknown magnitude and is probably a branch of the Query Creek fault.

As mentioned previously, the structure on the ridge north of Kelly Creek is complex. On the western edge of the ridge there appears to be an undulating thrust fault dipping gently west, and above it are massive lavas. The writer was unable to trace out this possible fault, but if it exists the beds that yielded the Sinemurian fossil may be Archibald Formation capped by a klippe of Elise lavas.

West of Columbia River south of Trail, little is known of the structure of the Rossland Group. A band of sedimentary rocks west of Waneta closely resembles the Archibald beds at Waneta. It will be noted, however, that in the succession to the northwest of these beds, according to several top determinations, nearly all the interbeds face north to northwest. This great apparent thickness of the rocks may be the result of repetition by the westward extension of the fault along lower Beaver Creek, but unless Sinemurian or Toarcian fossils can be obtained from the middle of the succession west of Violin Lake there appears to be little hope of discovering such a fault.

Along Waneta fault, which dips gently southward, map-unit 1 is thrust upon rocks of the Rossland Group. This fault lies south of the International Boundary for only a short distance at Columbia River. It is offset, according to Fyles and Hewlett (1959), by north-striking faults at Sevenmile Creek and Lime Creek. The northern extension of the former could not be found, but the latter, if the strike curves northwesterly, could account for the abrupt termination on the west of the thick sedimentary member on Blizzard Mountain. Farther west, near Nigger Bar Creek, the Waneta fault is offset by the fault that passes through Violin Lake.

Another major fault was discovered that extends northward from the head of the west branch of Bear Creek to a point beyond the northern edge of the map-area. It marks the contact between map-unit A on the west and the less-metamorphosed Archibald and Elise Formations.

At least two periods of faulting are evident. In Salmo map-area the Waneta fault is almost certainly pre-Nelson but in this map-area is evidently at least pre-Sheppard, as is the fault in lower Beaver Creek and likely its probable extension north of Kelly Creek. The east-striking fault at Fruitvale is later than the latter faults, and the north-trending faults in the southern part of the area are later than the Waneta fault. The Violin Lake fault seems to be post-Sheppard, or at least some movement occurred at that time. The northerly striking fault west of Champion Lakes is at least post-Nelson.

Gneissic layering in map-unit A in the northwestern part of the map-area has, in general, gentle dips, except near granitic bodies. Drag-folds are not abundant, nor are linear features other than drag-fold axes. Where these were observed, most have a westerly trend.

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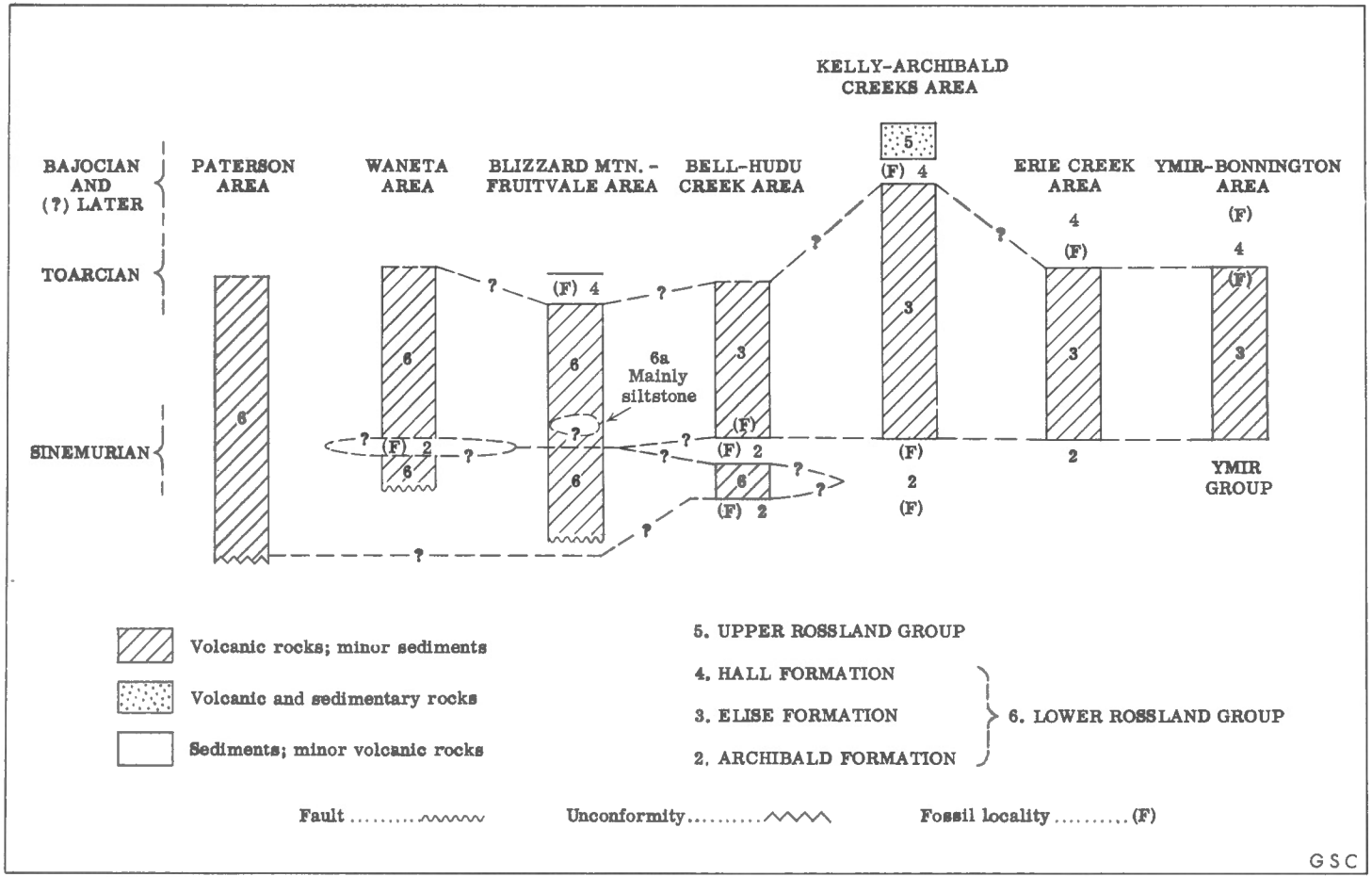

Figure 1. Correlation of Jurassic rocks in Ymir-Bonnington, Salmo, and Trail map-areas