GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS

82 F/3

LEGEND

CENOZOIC

TERTIARY

18,19 — 18. *CORYELL PLUTONIC ROCKS: alkaline rocks;* **18a**, *augite-biotite monzonite;* **18b**, *basic syenite*
19. *SHEPPARD INTRUSIONS: leucocratic granite and syenite*

MESOZOIC

CRETACEOUS (?)
LOWER CRETACEOUS (?)

17 — *NELSON PLUTONIC ROCKS: granitic rocks;* **17a**, *porphyritic granite;* **17b**, *granite;* **17c**, *granodiorite;* **17d**, *quartz diorite*

JURASSIC
MIDDLE AND (?) UPPER JURASSIC
UPPER ROSSLAND GROUP

15 — *Andesite, basalt, and latite flows and flow breccia, agglomerate; intercalated siltstone, argillite, and tuff*

LOWER AND MIDDLE JURASSIC

14 — *HALL FORMATION: argillite, siltstone, shale, phyllite;* **14a**, *carbonaceous siltstone and hornfels;* **14b**, *includes abundant volcanic rocks*

LOWER JURASSIC

13 — *ELISE FORMATION: andesite and basalt flows and flow breccia, agglomerate, augite porphyry;* **13a**, *tuff, siltstone, and argillaceous quartzite;* **13b**, *amphibolite*

LOWER, MIDDLE, AND (?) UPPER JURASSIC
ROSSLAND GROUP

16 — *Andesite and basalt flows and flow breccia, agglomerate, augite porphyry; minor sediments;* **16a**, *siltstone, argillaceous quartzite and tuff*

TRIASSIC (?) AND JURASSIC
LOWER JURASSIC AND (?) OLDER

12 — *ARCHIBALD FORMATION: siltstone, argillite, argillaceous quartzite; minor tuff and lava locally abundant*

LOWER JURASSIC (?) AND OLDER
YMIR GROUP

11 — *Argillite, slate, argillaceous quartzite, and hornfels*

PALAEOZOIC

ORDOVICIAN
LOWER AND (?) MIDDLE ORDOVICIAN

9 — *ACTIVE FORMATION: black argillite and slate;* **9a**, *grey limestone and argillaceous limestone;* **9b**, *silicified argillite and limestone;* **9c**, *dolomite, dolomite breccia, and limestone*

CAMBRIAN
MIDDLE CAMBRIAN

8 — *NELWAY FORMATION: cream weathering grey dolomite; limestone and argillite;* **8a**, *limestone and calcareous argillite;* **8b**, *dark and light grey dolomite;* **8c**, *grey limestone*

LOWER CAMBRIAN

7 — *LAIB FORMATION: phyllite, argillite, schist, micaceous quartzite, and limestone;* **7a**, *Reeves Member: grey limestone; minor dolomite;* **7b**, *Emerald Member: black phyllite and argillite;* **7c**, *upper Laib Formation: phyllite, schist, micaceous quartzite; minor limestone*

6 — *RENO FORMATION: argillite, argillaceous quartzite;* **6a**, *Truman Member: phyllite and argillite with limestone lenses*

5 — *QUARTZITE RANGE FORMATION: white, green, and pinkish quartzite;* **5a**, *Motherlode Member: white quartzite; minor argillite, grit and green schist;* **5b**, *Nugget Member: white quartzite; argillaceous quartzite and argillite at base;* **5c**, *Navada Member: thin bedded argillaceous quartzite; white quartzite at top;* **5d**, *argillaceous quartzite, probably equivalent to lower Nugget Member (5b)*

LOWER CAMBRIAN AND (?) LATER

10 — *Quartzite, argillite, slate; minor limestone;* **10a**, *limestone and argillite;* **10b**, *quartzite; argillite; minor limestone;* **10c**, *white and grey quartzite;* **10d**, *black phyllite and schist*

PROTEROZOIC

WINDERMERE (?)

4 — *THREE SISTERS FORMATION: green and grey grit and quartzite; minor conglomerate and green schist;* **4a**, *conglomerate;* **4b**, *chlorite schist;* **4c**, *brown micaceous schist*

WINDERMERE

3 — *MONK FORMATION: green argillite and phyllite;* **3a**, *conglomerate;* **3b**, *limestone*

2 — *IRENE VOLCANIC FORMATION: greenstone; minor argillite near base;* **2a**, *limestone*

1 — *TOBY FORMATION: conglomerate, minor argillite*

A — *Metamorphic sedimentary rocks, age unknown*

B — *Sedimentary rocks, probably Palaeozoic;* **B1**, *black argillite, calcareous argillite, slate, and phyllite;* **B2**, *grey limestone;* **B3**, *chert, quartzite, and minor greenstone*

Heavily drift-covered area
Bedding, tops known (inclined, overturned)
Bedding, tops unknown (inclined, vertical)
Schistosity (inclined, vertical)
Lineation (inclined)
Fault (defined, approximate, assumed)
Thrust fault (defined, approximate, assumed)
Anticline (defined, approximate, assumed)
Syncline (defined, approximate, assumed)
Glacial striae
Fossil locality
Adit, pits and trenches

Geology by H. W. Little, modified after Walker (1934), from field work by H. W. Little in parts of the field seasons of 1948, 1949, and 1959. Sheep Creek mining camp from Mathews (1953), and Salmo lead-zinc belt from Fyles and Hewlett (1959)

Geological Cartography by the Geological Survey of Canada, 1964

INDEX TO MINING PROPERTIES

1. *Beaver Creek*
2. *Armstrong Group*
3. *New Gordon*
4. *Arlington (New Arlington)*
5. *Gold Hill*
6. *Keystone*
7. *Second Chance*
8. *Clubine-Comstock*
9. *Lucky Boy*
10. *Silver Dollar*
11. *Double Standard*
12. *Hunter V*
13. *Jack Pot*
14. *Howard (Durango)*
15. *Cariboo*
16. *J. C.*
17. *Wolf Lake*
18. *Reno*
19. *Fawn*
20. *Nugget*
21. *Motherlode*
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23. *Clyde*
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25. *Iron Cap*
26. *Eureka*
27. *Kootenay Belle*
28. *Queen*
29. *Vancouver*
30. *Bonanza*
31. *Ore Hill*
32. *Sumit (Summit)*
33. *Victory*
34. *Salmo Consolidated*
35. *Aspen (Salmo Malartic)*
36. *H. B. (Consolidated M. & S. Co. Ltd.)*
37. *Jumbo*
38. *Dodger* (Canadian Exploration Limited)
39. *Feeney* (Canadian Exploration Limited)
40. *Emerald* (Canadian Exploration Limited)
41. *Jersey* (Canadian Exploration Limited)
42. *Tungsten King*
43. *Molly*
44. *United Verde*
45. *Ed*
46. *Lone Silver*
47. *International*
48. *Red Bird*
49. *Reeves-Macdonald*
50. *Red Rock*
51. *Bunker Hill*
52. *Gold Cup*
53. *Lost Cabin (Allouez)*
54. *Truman*

Base-map cartography by the Geological Survey of Canada from maps compiled by the Surveys and Mapping Branch, Department of Lands, Forests, and Water Resources, British Columbia

PUBLISHED, 1966
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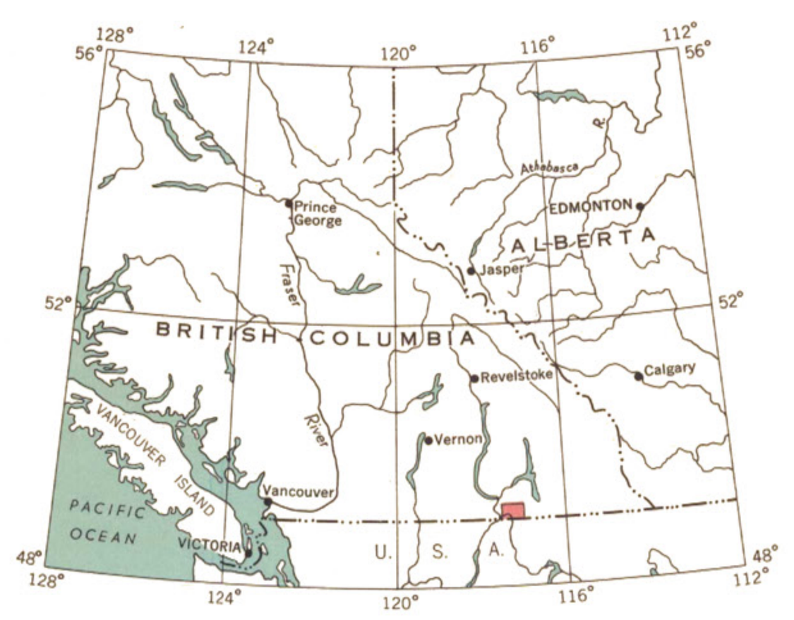

INDEX MAP

MAP 1145A

GEOLOGY

SALMO

BRITISH COLUMBIA

Scale 1:63,360
1 inch to 1 mile

Miles 1 0 1 2 3 Miles
Kilometres 1 0 1 2 3 4 5 Kilometres

Approximate magnetic declination, 21° 26' East decreasing 2.9' annually

REFERENCE

Road, all weather — Route 6, 3A
Other roads
Logging road
Trail
Railway
Aerial tramway
International boundary
Intermittent stream
Contours (interval 100 feet)
Height in feet above mean sea-level — 7273

DESCRIPTIVE NOTES

This edition of Salmo map-area incorporates the detailed mapping and interpretations of parts of the area by officers of the British Columbia Department of Mines, and recent revisions by the author elsewhere, especially in the northwestern part.

The Precambrian rocks of the Windermere system rest unconformably on Purcell (Beltian) sediments to the east of the map-area. Only the uppermost part of the extensive basal Windermere Formation, the Toby (1), is exposed in the area. It is overlain conformably by the Irene Volcanic Formation (2) which is about 5,730 feet thick at the International Boundary, but is much thinner to the southwest and pinches out entirely to the northeast. The Irene Volcanic Formation is succeeded by the argillaceous Monk Formation (3) which is estimated to be 4,200 feet thick. The basal conglomerate of the Monk Formation, which is some 200 feet thick, indicates a local unconformity.

The Monk Formation and the overlying Three Sisters Formation (4) are respectively equivalent to the lower and upper Horsethief Creek 'series' of Nelson (East Half) and Lardeau map-areas.

The Three Sisters Formation, comprising mainly massive, coarse clastic beds, is 4,334 to 6,080 feet thick in the eastern part of the map-area. The base of the formation is not exposed in the Sheep Creek anticline farther west, but the rocks there are thin bedded and finer grained.

The base of the Cambrian system is placed at the contact between the Three Sisters and Quartzite Range (5) Formations, because this horizon can be traced more than 100 miles northward, and Cambrian trilobites occur near the top of the latter formation 2 miles south of the International Boundary.

The Quartzite Range Formation (5), like the Three Sisters, is also finer grained in the western part than in the east where crossbedding is abundant. Its thickness varies also from 4,400—4,500 feet in the east to 1,500—2,400 feet in Sheep Creek camp. The overlying Reno Formation (6), though it represents a transition from the comparatively pure arenaceous rocks below through somewhat argillaceous rocks to the more calcareous Laib Formation (7) above, also exhibits a similar facies change westward. In Sheep Creek camp the upper part of the Reno, which there contains limestone lenses, was called the Truman Member (6a) by Fyles and Hewlett, who placed it in the Laib Formation. On this map, however, the Reno-Laib contact as originally defined by the writer, is placed at the base of the extensive basal limestone (Reeves Member, 7a), because it is not possible to determine the base of the Truman Member throughout Salmo map-area whereas the base of the Reeves Member is easily recognized.

The Reno Formation ranges in thickness in the eastern part of the map-area from about 1,100 feet at the International Boundary to 739 feet at the north border. In Sheep Creek camp, it ranges from 50 to 900 feet, being thinned locally by flowage on the limbs of tight folds. At the south end of Sheep Creek anticline, at lower Lost Creek-Emerald mine area, and Reeves Macdonald mine area, the thicknesses are 970, 640-650, and 295-300 feet respectively.

Archaeocyathids of late Lower Cambrian age are abundant in the Reeves Member of the Laib Formation (7) in the southeastern part of the map-area, and have been noted by Fyles and Hewlett on the southern part of Sheep Creek anticline. The thickness of the basal limestone is about 200 feet in the eastern part of the map-area, and 100-500 feet elsewhere. The total thickness of the Laib Formation ranges from 3,172 to 3,800 feet.

The Nelway Formation (8) overlies the Laib; the contact is gradational and is placed at the horizon above which the assemblage is dominantly calcareous. It is probably 4,500 to 5,000 feet thick. No diagnostic fossils have been found in the Nelway Formation, but trilobites of middle Middle Cambrian age occur in the equivalent formation south of the International Boundary.

The Active Formation (9) overlies the Nelway Formation with probable disconformity, although most contacts of the Active Formation with other formations in Salmo map-area are faults. The Active Formation has yielded graptolites of probably Deepkill (Lower Ordovician) age, but some of Normanskill (early Middle Ordovician) age also occur in the equivalent formation to the south.

Map-unit 10 comprises a folded and faulted complex in which some members of units 5, 6, and 7 have been recognized by Fyles and Hewlett.

The relationship of rocks of map-unit B to the upper Laib Formation is not known. Parts of this unit bear some resemblance to Laib and Nelway rocks, but others do not. These rocks may be younger than Cambrian.

The Windermere — early Palaeozoic succession (units 1-9) indicates a miogeosynclinal environment. Although the Irene Volcanic Formation is thick locally, it represents only a small proportion of the assemblage in general. The Three Sisters, Quartzite Range, and Reno Formations (4-6), comprising thick, coarse, clastic rocks with abundant crossbeds in the east, become thin bedded and finer grained westward, away from the gradually subsiding geanticline. The upper part of the succession is dominantly argillaceous and calcareous.

The Ymir group (11), though apparently unfossiliferous, is believed to be roughly equivalent to the Slocan Group which occurs some 50 miles to the north and is of Triassic and probably early Lower Jurassic age. The upper part of the Ymir group is correlated lithologically with the Archibald Formation (12). The Ymir Group is exposed mainly in the Ymir area to the north. Its thickness is not known because the formation is in fault contact with map-unit 10 and the base is not exposed.

The Archibald Formation (12) has yielded ammonites of Hettangian (?) and lower Sinemurian (early Lower Jurassic) age. It appears to be at least 4,000 feet thick, but the base is not exposed. The Archibald Formation is overlain conformably by the predominantly volcanic Elise Formation (13). This contact shows temporal transgression; lower Sinemurian fossils have been found in the lowermost part of the Elise Formation only on the ridge north of Parks. The upper contact of the Elise Formation likewise shows temporal transgression. North of the map-area the uppermost part yielded Toarcian (late Lower Jurassic) fossils but in Kelly Creek valley the top is much younger. The thickness of the Elise Formation is estimated to be 8,000 to 10,000 feet.

The Hall Formation (14) overlies the Elise Formation and consists mainly of sedimentary rocks. Southwest of Keystone Mountain, and possibly in Hellroaring Creek valley, the lower Hall beds contain Toarcian ammonites. In Bonnington map-area to the north, beds probably higher in the succession contain middle Bajocian (early Middle Jurassic) ammonites, and in Kelly Creek valley, perhaps 100 feet above the Elise-Hall contact, post-middle Bajocian fossils were found. In the vicinity of Keystone Mountain the thickness of the Hall Formation is indicated to be at least 2,000 to 3,000 feet, but the top is not exposed. North of Kelly Creek the thickness is about 400 feet, and the formation is overlain by the upper Rossland Group (15). The latter, of which an estimated 3,800 feet of beds are exposed in Salmo map-area, may be thicker farther west where still younger beds are probably exposed.

Where map-units 13, 14, and 15 cannot be distinguished — as south of Hellroaring and Kelly Creeks where the Hall Formation seems to pinch out — the rocks are shown as undivided Rossland Group (16).

The Mesozoic assemblage (units 11-16), comprising interfingering volcanic and sedimentary rocks, was deposited in a eugeosyncline.

Bodies of Nelson plutonic rocks (17) are satellites of the Nelson batholith and for the most part exhibit crosscutting relationships, chilled margins, dilation, and other intrusive phenomena. Most of these bodies are white, coarse-to medium-grained granite which in the stock east of Active Creek is porphyritic. Along the east margin of the map-area the stocks are mainly granodiorite, and in the northwest corner, quartz diorite. Diaschistic dykes related to the Nelson are common, and aplite dykes, some of which were shown by Walker (1934), are so numerous in many parts of the map-area that they have been omitted from this edition of the map.

The Coryell alkaline rocks (18) form small bodies of augite-biotite monzonite in which the euhedral crystals of augite are characteristic. In the stocks at the heads of Archibald and Tillicum Creeks, however, large, thin lamellae of biotite are more conspicuous than the augite, some olivine is present, and the rock is a basic syenite that has a distinctive facetted appearance. Leucocratic granite and syenite of the Sheppard intrusions (19), occurring in the lower reaches of Pend-d'Oreille River, are possibly younger than the Coryell rocks, and so are probably also of Tertiary age.

Salmo map-area lies on that part of the Kootenay arc where the trend changes abruptly from roughly south to southwest and, locally, west. Along this arc, folds were formed, for the most part isoclinal (Laib syncline, Sheep Creek and Western anticlines, and other unnamed folds) together with low-angle thrust faults, in post-Middle Jurassic time. These bedding faults (Black Bluff, Argillite, and Waneta) form the boundaries between folded belts that have been thrust successively, from southeast to northwest, upon one another. Along the Argillite fault younger rocks have overridden older ones, but elsewhere the reverse is true.

It is probable that the Black Bluff fault, which northwest of Reno Mountain appears to be sharply folded, is the same as the Porcupine fault. Similarly the Oxide fault is probably the extension of the Argillite fault. The northeastern extension of the Waneta fault has not been recognized north of the map-area, but there it is presumed to lie at the boundary between the Ymir Group and map-unit 10. These primary folds and faults were formed before the emplacement of the Nelson rocks, as was also the complex structure in upper Hidden Creek valley.

Most of the post-Nelson faults (Styx Creek, Ripple Creek, Doubtful Creek, and numerous unnamed faults) are transverse, and offset the primary folds and faults as well as bodies of Nelson rocks wherever these are encountered. Some of the post-Nelson faults are not transverse, however, such as that on Iron Mountain. This is a normal fault that dips west and forms the contact between the Laib and Active Formations.

South of Ripple Creek fault, from the head of Ripple Creek eastward to the head of South Salmo River, the geology has been modified slightly from Walker's interpretation, but further field work is required there. Elsewhere the geology is believed to be reasonably accurate.

For further information see the following selected publications:

Frebold, Hans: Marine Jurassic Rocks in Nelson and Salmo Areas, Southern British Columbia; Geol. Surv., Canada, Bull. 49, (1959).
Frebold, Hans and Little, H. W.: Palaeontology, Stratigraphy, and Structure of the Jurassic Rocks in Salmo Map-area, Southern British Columbia; Geol. Surv., Canada, Bull. 81, (1962).
Fyles, J. T., and Hewlett, C. G.: Stratigraphy and Structure of the Salmo Lead-Zinc Area; B.C. Dept. Mines, Bull. 41, (1959).
Little, H. W.: Nelson Map-area (West Half), British Columbia; Geol. Surv., Canada, Mem. 308, (1960).
Mathews, W. H.: Geology of Sheep Creek Camp; B.C. Dept. Mines, Bull. 31, (1953).
Walker, J. F.: Geology and Mineral Deposits of Salmo Map-area, British Columbia; Geol. Surv., Canada, Mem. 172, (1934).