CHAPTER I.—INTRODUCTION

The Cariboo River map-area includes just over 1,000 square miles of highlands and mountains on either side of the Cariboo River in east central British Columbia. The area is T-shaped, the outside limits being 52° 45' to 53° 20' north and 120° 45' to 121° 30' west. The map-area is east of the Antler Creek area (A. Sutherland Brown, 1957) and Yanks Peak-Roundtop Mountain areas (Stuart S. Holland, 1954) and overlaps these areas slightly (see index map, Fig. 1). The project that was started by Holland at Yanks Peak is completed with the publication of this bulletin. The two earlier bulletins form a necessary introduction to the understanding of this one.

Holland started mapping at Yanks Peak in 1948 at 400 feet to the inch and locally at 100 feet to the inch in order to solve the complex stratigraphic and structural problems of that part of the Cariboo district. How successful he was is shown by the fact that his rock units have subsequently been mapped throughout the whole area, and although changes occur in thickness and facies the units are essentially the same at the farthest east or south.

ACCESS

The area is not readily accessible. A road leads to the north end of Bowron Lake, 18 miles northeast of the town of Wells, which is 50 miles east of Quesnel. A road to the Cariboo Hudson mine traverses the extreme southwest of the Bowron Lake area. Otherwise there are no roads in the area. Canoe travel about the trapezoidal chain of lakes from Bowron Lake is relatively simple, with wooden rails on several of the small portages. The Cariboo River is navigable from the settlement of Keithley Creek on Caribou Lake to the lower falls above Kimball Creek. Currently a road is under construction up the valley from Keithley Creek. Trails are few and mostly in poor condition. A trail leads from the Cariboo Hudson road on Cunningham Creek to the Cariboo River at the lower falls. Another trail leads to the north end of Isaac Lake from the Rocky Mountain Trench via Goat River. The areas east of Isaac Lake and southeast of the Cariboo River are particularly difficult to reach. In the course of the present work, travel between camp-sites was by boat where possible and where not by back-packing with air supply drop.

The area enclosed by the trapezoidal chain of lakes was a game reserve when the field work was in progress but, together with a peripheral strip has recently (1961) been created a class “A” park, the Bowron Lake Park.

PREVIOUS WORK

The first systematic geological map of any part of the northeastern Cariboo district, that of Amos Bowman, published in 1889, is the only one that covers much of the present map-area. Bowman produced a map at 2 inches to the mile from Quesnel Lake to Indianpoint Lake. This map is coloured as far east as Isaac Lake, but it is apparent from the lack of plotted observations, the discussion, and the triangulation net that the area was not visited. Bowman’s main concern had been the geology of the placer- and lode-gold-producing areas.

Johnston and Uglow (1926) mapped the Barkerville area, which slightly overlaps the present map-area in the west, north of 53 degrees. A. H. Lang (1938, 1940) mapped the Little River area, which has been largely remapped as a main part of the present map-area south of 53 degrees. The Cariboo River area overlaps slightly the Roundtop Mountain (Stuart S. Holland, Bull. No. 34, 1954) and the
Figure 1. Index map.
Antler Creek (A. Sutherland Brown, Bull. No. 38, 1957) areas. These bulletins contain fuller statements on previous work in the district and a critical review.

FIELD WORK

This report is based on the following field work: One month in 1954 and one in 1955, four months in 1956, and two months in 1957. The mapping was of a much coarser scale than that of the previous bulletins and field-glass observations were used between widely spaced traverses. The geology was recorded on air photographs with an approximate scale in the centre of one-half mile to the inch, and plotted on preliminary forest base maps at the same scale. The geology was transferred to preliminary national topographic sheets at 1:40,000 when these were issued in 1958-59. The scale of the final geological map is 2 miles to the inch.

Very brief reconnaissance was done southeast of the Cariboo River in 1954 and along Spectacle Lakes and Lanezi Lake in 1955. Most of the work was done in 1956, when the geology of the Bowron Lake Park and the area fringing Isaac Lake on the east was mapped, and the geology of 1954-55 was checked and elaborated. Work in 1957 was primarily that of checking and filling in gaps, but ground north of Betty Wendle Creek was mapped and a single traverse was made across to the Rocky Mountain Trench south of the Goat River.

Capable assistance in the field was given by the following: E. Burton in 1954, W. S. Hopkins and Y. Kamachi in 1955, R. J. Cathro and R. Thompson in 1956, and R. O. Brammall in 1957.

Subsequent to completion of the field work but prior to its publication, R. B. Campbell, of the Geological Survey of Canada, began field work in the Quesnel Lake area. The area of this bulletin south of 53 degrees is common to both projects. Dr. Campbell and the writer have had the freest exchange of information, and some modification of the writer's maps has been made as a result of Campbell's work.

PHYSIOGRAPHY

The physiography of the Cariboo River area includes alpine terrain in the east and dissected plateau in the west. The alpine terrain is part of the Cariboo Mountains, and the dissected plateau is part of the Quesnel Highland* (see Stuart S. Holland, Landforms of British Columbia, Bull. No. 48, in preparation). The line separating the Cariboo Mountains from the highlands follows the valley of the lower Bowron River, Spectacle Lakes, and Matthew River (see A. Sutherland Brown, 1957, p. 13). The alpine nature of the mountains is shown in Plates II, V, and VII and the contrasting nature of the highlands in Plates III and IV.

In the mountains, summit elevations range from 6,700 to 8,600 feet. The highest peaks are Kaza (8,350 feet), Ishpa (8,304 feet), Amos Bowman (8,550 feet), and an unnamed peak southeast of Bowman (8,650 feet). The major valley bottoms or lake levels are at 3,000 to 3,500 feet. The Quesnel Highland has recognizable but well-dissected upland surfaces with an average elevation of 6,000 feet. Highland peaks are small eminences on the old upland surface, with elevations lower than those of the mountain peaks. Summit heights range from 5,500 to 7,000 feet, with Mount Tinsdale (7,027 feet), Palmer Mountain (6,901 feet), and Kimball Mountain (6,894 feet) the only ones much above 6,500 feet. Except for the valley of the lower Cariboo River, elevations of valley bottoms in the highlands are greater than those in the mountains. The elevation of the valley bottom of the lower Cariboo River is about 2,800 feet, whereas that of the valleys in the main highland masses east and west of the river is about 4,000 feet.

* Holland uses the terms "highland" for a terrain transitional between mountains and plateau in which a considerable amount of upland surface is evident.
Denudation in the mountains is rapid, and much of it is accomplished by snowslides. These occur yearly in many chutes, and the ones on the northeast side of Isaac Lake have built small deltas. Where slides are frequent the topography is characteristic. Individual chutes resemble a sherry glass in section, with the fan as the foot, the chute as the stem, and the gathering area as the cup.

The area is drained largely by the Bowron and Cariboo River systems, but the northeastern corner is drained by the Goat River system. The drainage pattern is complicated as a result of having been disturbed in the Pleistocene epoch and possibly shortly before. The unique trapezoidal chain of lakes does not belong to one drainage system; Isaac, Lanzei, Sandy, and Babcock Lakes belong to the Cariboo system, and Bowron, Indianpoint, and Spectacle Lakes belong to the Bowron system. Very small changes in elevation could divert major portions of the Cariboo River system into the Bowron, or vice versa. The Cariboo River was so diverted during de-glaciation when the upper Cariboo flowed northward from Sandy Lake through the valley of Spectacle Lakes (see below). The present level of Sandy Lake is controlled by the upper falls on the Cariboo River—retreat of the falls will relatively soon drain this shallow lake. The outlet of Bowron Lake is currently being raised by bar-building, so that the delta of the upper Bowron River is being flooded. If this situation continues, the Cariboo River will relatively soon capture the Spectacle Lakes and the upper Bowron River. The origin and development of the valleys of Hockey Creek and the upper Bowron River and their relation to the valley of Isaac Lake and Betty Wendle Creek have been obscured by glacial deepening and erosion of an older drainage system.

GLACIAL GEOLOGY

The Cariboo River area contains small glaciers today, and during Pleistocene time was completely submerged by a mountain ice-sheets. At some time between the last glacial maximum and the present, the area contained extensive cirque and some valley glaciers. The direction of ice movement is not everywhere apparent, but in general the ice moved outward from the mountains to the southwest, the northwest, or both.

The upper surface of the ice indicated by topographic details of mountain and highland areas and by the distribution of erratic boulders appears to have been about 7,000 feet. All major valleys and all minor ones except post-glacial canyons such as on the Cariboo River at the lower falls have well-developed catenary shapes (see Plates II and V). The slopes of faceted spurs on the major valleys extend up to elevations of 6,000 to 7,000 feet; hence intense ice erosion occurred to these levels. This depth of ice is confirmed by the existence of numerous far-travelled erratic boulders at elevations from 6,500 to 6,900 feet, the highest levels at which erratics were found. The following table shows the known upper limit of distribution of erratics found in mountains and highland:

<table>
<thead>
<tr>
<th>Locality</th>
<th>Lithology</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Peak south of Mount Arno Bowman</td>
<td>Kaza Quartzite</td>
<td>Cunningham Limestone</td>
</tr>
<tr>
<td>2. Ridge east of Meleary Lake</td>
<td>Kaza Quartzite</td>
<td>Isaac Phyllite</td>
</tr>
<tr>
<td>3. Ridge east of Milk River</td>
<td>Kaza Quartzite</td>
<td>Kaza Phyllite</td>
</tr>
<tr>
<td>4. Mount Tinsdale</td>
<td>Kaza Quartzite</td>
<td>Slide Mountain Greensone</td>
</tr>
<tr>
<td>5. Mount Murray</td>
<td>Kaza Quartzite</td>
<td>Slide Mountain Greensone</td>
</tr>
<tr>
<td>6. Little River Stock</td>
<td>Kaza Quartzite</td>
<td>Quartz Monzonite to Granodiorite</td>
</tr>
<tr>
<td>7. South to southeast of Little River Stock</td>
<td>Quartz Monzonite to Granodiorite</td>
<td>Cunningham Limestone</td>
</tr>
</tbody>
</table>
It is doubtful whether there were many nunataks in the mountain area during maximum glaciation. If the average ice level was 7,000 feet, it would be above many peaks. Matterhorns are not well developed, and some that are slightly developed, such as the peak of Kaza Mountain (see Plate VII), probably formed mainly after the glacial maximum. Furthermore, the glaciers and icefields today occur to the highest levels of the peaks between Isaac Lake and Betty Wendle Creek.

The erosive effects of glaciation are different in the highlands from those in the mountains because the highlands were completely overridden by moving ice. Rounded forms are dominant, and the isolated ridges and hills in the Spectacle Lakes valley show these to a marked degree.

The area as a whole lacks glacial strie and polished rock surfaces, except immediately adjacent to contemporary glaciers, which are retreating. Elsewhere the intense frost wedging and the unsuitability of most of the rocks to maintain a polish results in the quick destruction of these features.

Glacial till mantles the lower slopes and partly fills some of the valleys. In some areas it is mantled in turn by outwash sands. Good exposures of till are relatively rare because of the heavy forest-cover on the slopes to 6,000 feet or more, and the cover of outwash sands and recent alluvium. However, a considerable thickness of till is evident on lower Tinsdale Creek and lower Antler Creek, and erratic boulders are common on the lake-shores.

The movement of glacial ice was outward from the mountains, but in detail it was complex. Unconsolidated deposits along the western side of the valley of Spectacle Lakes and the lower Cariboo River have been fluted, but the direction of ice movement is not clearly shown. On the hill between Turks Nose Mountain and Mount Tinsdale, the indicated movement is almost due south. In contrast to this, the movement indicated near Bowron Lake appears to be northwestward. The valley contains a drainage divide, and it is likely that ice may either have been extruded from the valley in opposite directions or may have moved in opposite directions at different times. From regional considerations it appears likely that ice moved down the Cariboo River valley to the south and down the Bowron River valley to the northwest and that an ice divide is represented. Movement is proven to the south and slightly southeast by the boulder train from the Little River Stock: to the west along Lanezi Lake by Kaza boulders on Cunningham Limestone on the south shore of Sandy Lake; and to the northwest along Isaac Lake by Kaza boulders all along the east side of the lake on Isaac and Cunningham Formations. Movement to the south to southwest is indicated in the adjacent Antler Creek area (Bull. No. 38, p. 14) and by Kaza boulders on Mount Tinsdale. All these movements are essentially outward from the mountains.

Following the last glacial maximum there was a stage during which cirques were developed and minor valley glaciers formed. These cirques mostly have their floors at 5,000 to 7,500 feet elevation, although a few, such as those northeast of Ishpa Mountain, have floors at 4,000 to 4,500 feet. Most of the latter ones were the largest cirques, and many supplied small valley glaciers. In some valleys, such as that of Harold Creek and the one south of Indianpoint Mountain, a definite fringing line exists at about 5,500 feet (see Plate V). In the alpine area the cirques are not very distinct from the erosional forms of the mountain ice-sheet, but in the highland area they are fretted out of the rounded forms of the upland and are developed predominantly on the northeastern slopes.

Glaciers today cover only about 4 square miles of the map-area. Several small glaciers occur in the Mowdish Group within the chain of lakes, several south of Lanezi Lake, and the rest between Isaac Lake and Betty Wendle Creek. All except one in the southeastern corner of the area and one between Isaac Lake and Betty
Wendle Creek are inactive. The active ones have their snouts below 6,500 feet elevation, whereas the others are at 6,500 feet or above. A considerable icefield occurs to the southeast of the map-area at the headwaters of the Cariboo River. This river has the characteristic milky appearance of a glacial stream, but in contrast the Isaac River and Lake are extremely clear in spite of being glacier-fed, perhaps because most of the glaciers are on limestone and much of the rock flour dissolves.

It is apparent that the drainage was changed during the time of deglaciation. Drainage by way of the Cariboo River to the south was blocked either by till or ice, and the entire drainage of the Isaac Lake area was toward the north. A plug of till across what must have been the old channel of the river occurs east of the lower falls, and diversion into the present canyon occurred when drainage was re-established to the south. Between Sandy Lake and the outlet of Bowron Lake a kettle outwash plain is evident. The plain at the bend of the Cariboo River between Sandy Lake and the upper falls is at about 3,040 feet, whereas the remnant of the plain at the north end of Bowron Lake is just over 3,000 feet. Unna, Tenas, and many more small lakes and probably the larger ones are kettles. At some late stage before the re-establishment of southward drainage, the Cariboo River flowed across the plain from Sandy Lake to approximately the upper falls. Drainage of Isaac Lake, in addition to that from McCabe Creek and Indianpoint Lake, probably was to the north in the Indianpoint River Valley. The delta built into Indianpoint Lake probably dates from this period, but that of Dewitte Reed Creek into Sandy Lake is related to the present lake level and hence was formed after the time of northward drainage.

**BIBLIOGRAPHY**


——— (1940): Little River and Keithley Creek, B.C., *Geol. Surv., Canada*, Maps 561A and 562A.