BRITISH COLUMBIA DEPARTMENT OF MINES
HON. R. C. MACDONALD, *Minister* JOHN F. WALKER, *Deputy Minister*

BULLETIN No. 25

THE SQUAW CREEK-RAINY HOLLOW AREA

Northern British Columbia

By K. DeP. Watson

1948

VICTORIA, B.C.:
Printed by DON MCDIARMID, Printer to the King's Most Excellent Majesty.
1948.

TABLE OF CONTENTS.

LIST OF ILLUSTRATIONS.

The Squaw Creek-Rainy Hollow Area.

SUMMARY.

The Squaw Creek-Rainy Hollow area, approximately 750 square miles in extent, lies in the Atlin Mining Division in north-western British Columbia, about 40 to 70 miles west to north-west of Skagway, Alaska. In 1943 access to the area was greatly improved by the construction through it of the Haines "Cut-off" Road, connecting Haines on Chilkoot Inlet with the Alaska Highway at a point 100 miles west of Whitehorse.

The area consists of several rugged north-westerly trending mountain ranges with intervening narrow plateaux and valleys that are either broad or narrow and deep. The north-eastern section of the area forms part of the Coast Mountains, the other mountains of the area form part of the Alsek Ranges of the St. Elias Mountains, and the plateaux and broad valleys form the south-eastern part of the Duke Depression.

Bad weather and the presence of snow restrict prospecting and surface-work in most of the area to about three and one-half months per year.

The area is untimbered except for the Klehini Valley up to an altitude of about 2,600 feet, the sides of the Tatshenshini Valley up to an altitude of about 3,200 feet, and a few other small areas.

About one-quarter of the Squaw Creek-Rainy Hollow area is underlain by Permo-carboniferous rocks consisting of limestone, argillite, quartzite, marble, gneiss, schist and some skarn, greenstone, and chlorite schist. Rocks of Mesozoic age, which include pillow lava, greenstone, breccia, chlorite schist, argillite, gneiss, mica schist and some limestone, chert, and quartzite are abundant in the northern part of the area. In general, the Permo-carboniferous and Mesozoic rocks strike north-westerly and dip at high angles. Mesozoic intrusives are exposed over approximately one-third of the area. They consist of large bodies mainly of quartz diorite and granodiorite and small bodies of peridotite and serpentine, gabbro, diorite, granite and granodiorite, and feldspar porphyry. Down-faulted blocks of Paleocene rocks consisting mainly of gently dipping rhyolite, conglomerate, sandstone, and shale occur in a few places, and down-faulted blocks of Paleocene to Miocene rocks consisting mainly of basalt, rhyolite tuff, and conglomerate occur in one place. Several small patches of almost flat-lying basalt and some basalt tuff, basalt agglomerate, and conglomerate of probable Late Tertiary age rest unconformably on some of the Mesozoic rocks.

During the Pleistocene, part of an extensive ice-sheet moved south-eastward, in general, across the region, depositing large amounts of drift in the valleys, mainly in the northern part of the area, and scouring some of the land forms, mainly in the southern part of the area, to give them a smooth appearance.

The main mineral production from the area has been placer gold, estimated to total approximately 5,000 oz., obtained from Squaw Creek. Other creeks in the area are known to contain gold, but none has yielded it in paying quantities.

The lode deposits of the area are replacement deposits in skarn, and gold-bearing quartz veins. The former consist essentially of: (1) bornite-chalcocite deposits containing important amounts of silver, (2) galena-sphalerite deposits containing minor amounts of silver, (3) pyrrhotite-sphalerite-chalcopyrite deposits, and (4) magnetite-chalcopyrite deposits. The first three types occur chiefly at Rainy Hollow and the fourth occurs in the section south-east of Mount Glave (Three Guardsmen). Several deposits of high-grade mineralization have been found at Rainy Hollow, but none has proved to be large.

Production from lode deposits in the area has totalled only about 160 tons. This consisted chiefly of high-grade copper-silver ore shipped between 1911 and 1922 from the Maid of Erin property at Rainy Hollow.

Coal occurs in some of the Tertiary rocks of the area, but the known seams are too thin to be of value.

CHAPTER I.—INTRODUCTION.

LOCATION.

The Squaw Creek-Rainy Hollow area, consisting of about 750 square miles of mountainous country, lies within the Atlin Mining Division in north-western British Columbia (Fig. 1). The area is a north-westerly trending belt about 45 miles long and 10 to 20 miles wide lying along the Haines "Cut-off" Road. It extends from the Alaska-British Columbia Boundary in the vicinity of the Klehini River (approximately 59° 25′ north, 136° 20′ west) to the Yukon Boundary in the vicinity of the Tatshenshini and Blanchard Rivers (60° north, approximately 137° west).

The Squaw Creek-Rainy Hollow area contains no permanent settlements. During the winter it is entirely uninhabited, but usually during the summer and early part of autumn placer miners live on Squaw Creek. At that time of year Mrs. F. Muncaster, of Squaw Creek, acts as Sub-mining Recorder for the district. The office of the Gold Commissioner and Mining Recorder for the mining division is at Atlin.

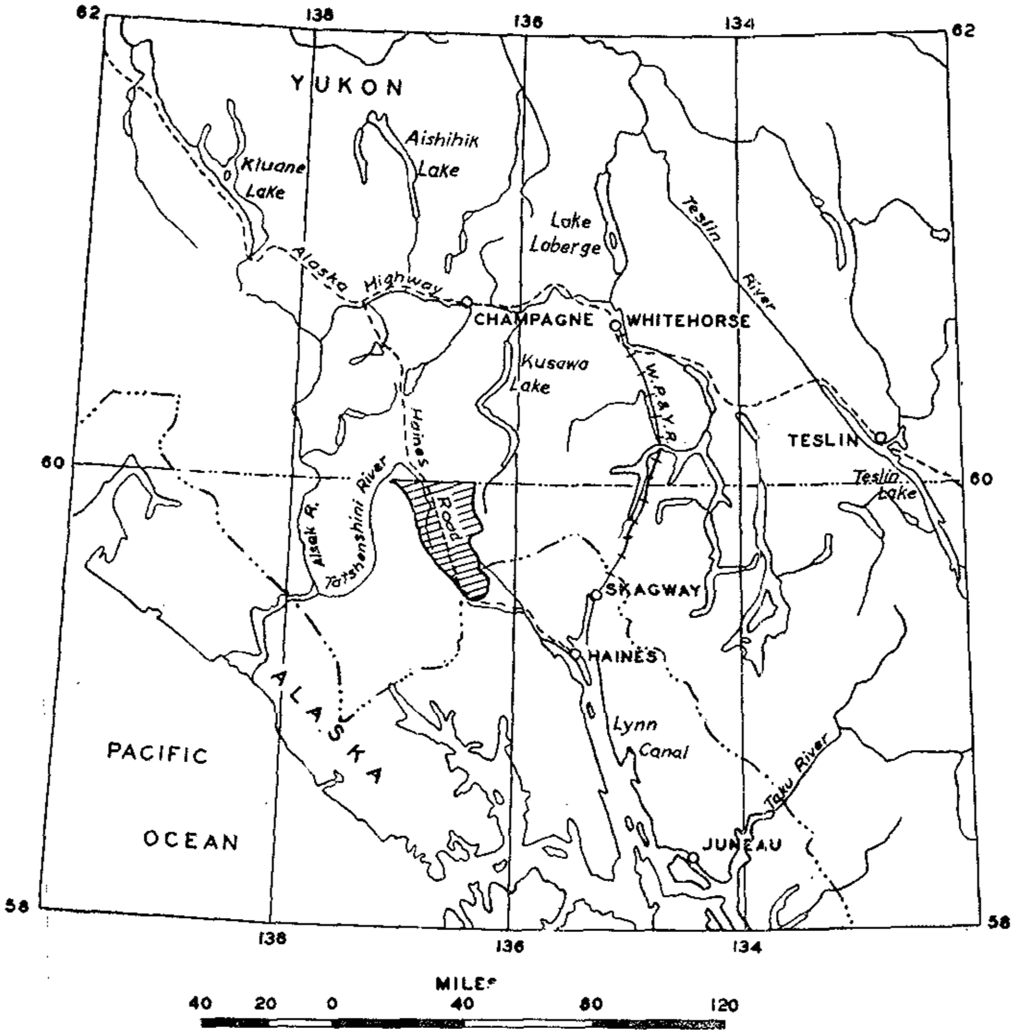


Fig. 1. Key-map of north-western British Columbia, showing location of Squaw Creek-Rainy Hollow area.

ACCESS.

In 1945, because of the impassability of the southern part of the Haines Road, the writer entered the area via Skagway in Alaska, Whitehorse in the Yukon Territory, the Alaska Highway, and the northern part of the Haines Road. Steamships operating on a ten-day schedule make the voyage between Vancouver and Skagway in three and one-half days. Steamship service is also maintained between Seattle and Skagway. Trains of the White Pass and Yukon Route meet the ships at Skagway whence they make the trip to Whitehorse in about six hours. One hundred miles west of Whitehorse the road to Haines branches off from the Alaska Highway.

Whitehorse is also provided with good aeroplane service from Vancouver, Seattle, and Edmonton; and it is accessible from Dawson Creek, in north-eastern British Columbia, via the Alaska Highway.

The Haines Road provides a convenient way of reaching the Squaw Creek-Rainy Hollow area from the south. Haines, on Chilkoot Inlet in Alaska, has weekly boat service from Skagway and from Juneau, a port of call for steamships en route to Skagway. A mud-slide has made the Haines Road, near the Alaska-British Columbia Boundary, impassable for considerable periods.

Under suitable weather conditions, aeroplanes could be landed on Kelsall Lake within the Squaw Creek-Rainy Hollow area.

The road, known as the Haines "Cut-off," that connects the Alaska Highway with Haines, is 159 miles long. The northernmost 65 miles of the road are in the Yukon Territory, the next 52 miles are in British Columbia, and the southernmost 42 miles are in Alaska. The road is fairly straight, 30 feet wide, gravel-surfaced, and in general has good grades (Plate IV, A). Shelter huts have been placed at eight points along the road in the untimbered regions between Stanley and Datlasaka Creeks and between Kusawak Lake and Rainy Hollow.

In the first part of the 1945 field-season the road was impassable because of flood damage at Blanchard River and at Stanley, Kwatini, Moi, Datlasaka, and Nadahini Creeks and because of a large slide about 3 miles north of Pleasant Camp. A crew of the Alaska Highway Maintenance Division, working southward, repaired the road until all of it was passable on August 3rd.

In the first part of the 1946 field-season the road was not passable with safety because of serious flood damage at Stanley Creek, minor damage at several other creeks, and because of a large slide near Pleasant Camp. A road crew of the Canadian Army had the road in repair by the middle of the summer and continued improving it until the end of autumn. Late in the summer, buses started running on a weekly schedule between Whitehorse and Haines and an officer of the Canadian Customs was stationed at Pleasant Camp.

During the summers of 1945 and 1946 the freight rates on camping equipment were as follows: Vancouver to Skagway, $15 per ton; Vancouver to Whitehorse, $99 per ton. The freight rates on mining machinery were: Vancouver to Skagway, $15 per ton; Vancouver to Whitehorse, $71 per ton. Trucks carrying freight from Whitehorse along the Alaska Highway charge 10 cents per ton-mile. Pack-horses may be hired from S. Chambers at Champagne, 60 miles west of Whitehorse on the Alaska Highway. The horses may be transported by truck into the area or may travel on foot over a more direct route by way of Dezadeash River, Dezadeash Lake, and Klukshu. Provisions and general supplies are obtainable at Whitehorse, Champagne, and Haines.

Within the area a tractor road leads from the Tatshenshini Valley to Squaw Creek via Blizzard Creek and the north fork of Talbot Creek. A few other trails of lesser importance are shown on the map; because that part of the Dalton Trail between Seltat and Stanley Creeks has been largely duplicated by the Haines Road it has been omitted.

In 1896 Jack Dalton established a trail from Pyramid Harbour, on Chilkat Inlet, to the confluence of the Nordenskiold and Lewes Rivers in the Yukon Territory. This trail, which followed much of the old Indian foot-path through the Squaw Creek-Rainy Hollow area, became known as the Dalton Trail. Some years previously Mr. Dalton had established trading-posts at Pleasant Camp on the Klehini River and at Dalton Post on the Tatshenshini River (Brooks, 1900, p. 342).

In 1897 J. J. McArthur surveyed the Dalton Trail, and his work was embodied in a revised edition of Dawson's map published in 1898.

From 1897 to 1899 hoards of gold-seekers en route to the Klondike travelled through this region over the well-worn Dalton Trail. In the summer of 1898 important deposits of placer gold were discovered on Porcupine Creek by a small party of these prospectors, who were delayed on their way to the interior by high water on the Klehini River and by lack of provisions (Wright, 1904, p. 12). In the autumn of that year, copper float that was found near the Dalton Trail at Rainy Hollow attracted attention to the area and a few claims were staked. In the following year 230 locations were made at Rainy Hollow (Graham, 1899, p. 649). By 1899 a wagon-road, part of which followed gravel-bars along the Klehini River, extended from Pyramid Harbour, on Chilkat Inlet, via Porcupine to Pleasant Camp.

At this time development of mineral properties in the Rainy Hollow and Porcupine districts was hindered to some extent by uncertainty regarding the position of the British Columbia-Alaska Boundary. This uncertainty arose from the dispute then in progress on the interpretation of a treaty made in 1825 between Great Britain and Russia. In 1899 a temporary working agreement was drawn up and a provisional boundary was fixed along the Klehini River. In 1903 the present British Columbia-Alaska Boundary was established and the Porcupine placer deposits definitely came under Alaskan jurisdiction (Howay, 1914, pp. 551–556).

In 1908 and 1909 the Alaska Iron Company tested some properties near Copper Butte in the Rainy Hollow district with a shot drill and shipped a few tons of high-grade copper ore (Fraser, 1908, p. 50; Fraser, 1909, p. 53). At this time a wagon-road was being built by the Provincial Government from the International Boundary to Rainy Hollow.

In 1909 copper-bearing magnetite deposits were discovered in the Three Guardsmen region situated a few miles east of Rainy Hollow.

In 1911, 30 tons of ore yielding 1,657 oz. of silver and 19,161 lb. of copper was shipped from the Maid of Erin property in Rainy Hollow.

In 1914 a flurry of excitement was caused when many prospectors stampeded to the Klehini River in search of gold. Although more than 100 placer claims were staked, none yielded gold in paying amount and they were soon abandoned (Brewer, 1914, p. 94). By this time a good wagon-road extended from Haines, on Chilkoot Inlet, along the southern side of the Klehini River to Pleasant Camp and thence along the northern side to Rainy Hollow.

In 1915 a gold-bearing quartz vein was discovered near Jarvis Glacier a few miles west of Pleasant Camp.

During the years 1920 to 1922 considerable development-work was done on the Maid of Erin property and about 100 tons of ore was shipped. During this period the Alaska Road Commission rebuilt the road from Haines to Wells, constructed a bridge across the Chilkat River, and extended the road along the northern side of the Klehini River toward Pleasant Camp.

In 1927 coarse gold was discovered on Squaw Creek by an Indian from Klukshu, and subsequently the creek became an important producer of placer gold.

In 1928 some diamond-drilling was done on the Maid of Erin property at Rainy Hollow (Munroe, 1928, pp. 121–122).

In 1928 and 1929 the Alaska Juneau Gold Mining Company held an option on a group of claims near Jarvis Glacier on which gold-bearing quartz veins had been found and did extensive exploratory work on them (Mandy, 1929, p. 120; Mandy, 1932, p. 40).

FIELD-WORK.

During the summer of 1945 about three months were spent in field-work, most of the time being devoted to reconnaissance geological mapping. In this work, positions were determined mainly by resection and by pace-and-compass traverses. An excellent topographic map, based on a survey made by W. E. Lawson of the Geological Survey of Canada in 1914 and published by the International Boundary Commission in 1923 (International Boundary from Cape Muzon to Mount St. Elias, Sheet No. 9), was used in the field. A few revisions of the drainage shown on this map were made by the writer, chiefly from vertical aerial photographs furnished by the United States Army Air Force; the Haines Road was added to the map from information supplied by the Northwest Service Command of the United States Army.

In 1945, in addition to the reconnaissance work, maps were made of the Adams and Maid of Erin properties at Rainy Hollow and brief examinations were made of several other showings in the Rainy Hollow-Three Guardsmen region.

During the summer of 1946 a period of approximately three months was spent in the field. About half this time was devoted to reconnaissance geological mapping, and the remainder to detailed mapping on Squaw Creek and on the State of Montana, Victoria, and Lawrence claims at Rainy Hollow. During the reconnaissance work, Lawson's topographic map was extended to include a small area lying west of the 137th meridian near the Yukon Boundary.

No mineral deposits have been reported on the south-western side of the Klehini Valley across from Rainy Hollow. Because of this fact, and because of the difficulty in crossing the river here, this area was not mapped.

The field-work was supplemented by microscopic examination in the laboratory of 105 thin sections of rocks and 23 polished sections of ores.

The manuscript for this bulletin was written in the first half of 1947.

ACKNOWLEDGMENTS.

The writer wishes to thank L. Higgins and G. R. Bidlake of the Yukon Territorial Government, R. Jackson of the Department of Mines and Resources, and other residents of Whitehorse for assistance given to the party. Many courtesies were also extended by prospectors and placer miners in the area and by officials of the Consolidated Mining and Smelting Company of Canada, Limited. The writer is greatly indebted to Col. C. M. Clifford and Lieut.-Col. Cheves of the Northwest Service Command and to Mr. Keith of the Alaska Highway Maintenance Division for aid given in transportation in 1945. Acknowledgment is also made of the co-operation of the United States Army in supplying aerial photographs and maps of the Haines Road; of the Geological Survey, Department of Mines and Resources, in identifying fossils; of E. W. Nuffield of the Department of Geological Sciences, University of Toronto, in doing X-ray work; and of the Department of Agriculture, Ottawa, in furnishing meteorological data.

Assistance in the field was rendered by R. G. Dennys and R. G. Newton in 1945 and by H. S. McColl and S. A. Scott in 1946.

HISTORY OF DEVELOPMENT.

Long ago the Chilkat Indians of the ancient village of Klukwan and of other settlements in that vicinity had a well-established foot-path, leading through the Squaw Creek-Rainy Hollow area, over which they journeyed to the interior to trade with other tribes. In 1882 Arthur Krause of the Bremen Geographical Society explored this old route of travel which led up the Chilkat and Klehini Rivers, across Stonehouse Creek, down Nadahini and Mansfield Creeks, and up the Blanchard River into the Yukon Territory (Dawson, 1887, pp. 180 B–181 B). His sketch-map, which is remarkably accurate, is incorporated in a map accompanying Dawson's report of 1887.

In 1937 much attention was drawn to the Squaw Creek placers by the discovery of a nugget weighing 46 oz. 5 dwt.

During 1942 and 1943 the United States Army constructed the military highway known as the Haines "Cut-off" Road, which passes through the Squaw Creek-Rainy Hollow area. Beginning in 1944 prospectors and the Squaw Creek placer miners have used the Haines Road to reach the area from the Alaska Highway and from Haines; more use of the road was made by the prospectors and miners in 1945 than in 1944 or 1946.

PREVIOUS GEOLOGICAL WORK.

In 1898 J. B. Tyrrell of the Geological Survey of Canada travelled over the Dalton Trail en route to the Yukon Territory and recorded a few observations on the geology and topography of the region (Tyrrell, 1898, pp. 36 A–46 A).

In the same year Russell L. Dunn made a journey along the trail and published some notes on the geology and mineral deposits of the district (Dunn, 1898).

In 1899 a party of the United States Geological Survey explored part of the vast territory lying between Pyramid Harbour on Chilkat Inlet and Eagle City on the Yukon River. The report of the expedition by Alfred H. Brooks (1900, pp. 331–391) includes some geological observations made along the Dalton Trail and is accompanied by a geological map on a scale of 30 miles to the inch.

In 1903 Charles W. Wright of the United States Geological Survey made a preliminary study of the geology of the Porcupine placer district, which includes the south-eastern part of the Squaw Creek-Rainy Hollow area (Wright, 1904, pp. 1–35).

In 1913 R. G. McConnell of the Geological Survey of Canada made a reconnaissance of the Rainy Hollow-Three Guardsmen region. His report, which includes brief descriptions of some of the mineral deposits, is accompanied by a geological sketch-map of the area on a scale of 2 miles to the inch (McConnell, 1913, pp. 29–33).

In 1916 Henry M. Eakin of the United States Geological Survey made further geological studies of the Porcupine placer district (Eakin, 1919, pp. 1–29).

In 1927 W. E. Cockfield of the Geological Survey of Canada did reconnaissance mapping in parts of the Dezadeash Lake area, which lies to the north of the Squaw Creek-Rainy Hollow area (Cockfield, 1927, pp. 1–7).

In 1932 Joseph T. Mandy of the British Columbia Department of Mines made a geological reconnaissance along his route of travel from Rainy Hollow to Squaw Creek. A sketch-map on a scale of 8 miles to the inch accompanies his report (Mandy, 1932, pp. 74–79).

In 1945 H. S. Bostock of the Geological Survey of Canada did reconnaissance work in the vicinity of Mush Lake, Bates Lake, and Alder Creek lying about 25 miles north-west of Squaw Creek. In 1946 E. D. Kindle of the Geological Survey continued the reconnaissance mapping in the Dezadeash Lake area.

Considerable information about the mining properties in the region is given in the Minister of Mines, British Columbia Annual Reports for the years 1900, 1907, 1914, 1918, 1921, 1927, and 1933.

CHAPTER II.—GENERAL CHARACTER OF DISTRICT.

PHYSICAL FEATURES.

The Squaw Creek-Rainy Hollow area is in a mountainous region lying south-west of the main ranges of the Coast Mountains and north-east of the loftiest ranges of the St. Elias Mountains. The area mapped consists chiefly of several rugged, north-westerly trending ranges with intervening narrow plateaux and valleys that are either broad or narrow and deep.

The part of the area north-east of the Kelsall River and the Tatshenshini Valley lies within the Coast Mountains (Plate I, A). These mountains terminate in the vicinity of Dezadeash and Kusawa Lakes, 30 miles north-west of the British Columbia-Yukon Boundary (Bostock). Most of the area lying south-west of the Tatshenshini Valley and the Kelsall River, including mainly the Kusawak and Datlasaka Mountains (Plate III, A) and the Squaw Range (Plate III, B), forms part of the Alsek Ranges of the St. Elias Mountains. The Tatshenshini Valley itself, with its broad, flanking benches, the Nadahini Valley, the plateau and valley between Mineral Mountain (Plate I, B) and the Kusawak Mountains, and the plateau north-east of the Klehini Valley between Seltat Creek and the Alaska-British Columbia Boundary form the south-eastern end of the Duke Depression. This depression is a remarkable north-westerly trending almost continuous belt of plateaux and broad valleys lying mainly within the St. Elias Mountains. It extends from the Squaw Creek-Rainy Hollow area beyond the Yukon-Alaska Boundary 200 miles to the north-west (Bostock).

RELIEF.

In much of the area the relief is about 3,500 feet only, the valley-bottoms lying at 3,000 feet and the higher peaks reaching 6,500 feet in altitude. The lowest point in the area, where the Klehini River crosses the International Boundary, is about 800 feet above sea-level and the highest, the summit of Mount Kelsall in the Coast Mountains, is about 7,500 feet above sea-level.

For the most part the ranges consist of series of sharp peaks linked by narrow, rough ridges. The southern and western slopes of the ranges, in general, are fairly smooth and are covered with slide-rock, but the northern and eastern sides are precipitous and scalloped by numerous deep cirques. Many large glaciers exist in the Datlasaka Mountains, the mountains south-west of the Klehini Valley (Plate II, A), and the Coast Mountains, and smaller ones, a few of which are shown on the map, are common in the other mountains.

A conspicuous topographic feature of the region is a broad valley which extends north-westerly across part of the Squaw Creek-Rainy Hollow area for 35 miles, from Seltat Creek into the Yukon Territory, forming part of the Duke Depression. This valley, which is followed by the Haines Road, is drained by Seltat, Stonehouse, Nadahini, and Datlasaka Creeks and by the Tatshenshini River. The greater part of this depression trends about north 35 degrees west, but part trends almost due north and part trends about north 50 degrees west. The elevation of the floor ranges from approximately 3,000 feet to approximately 3,300 feet. Its width, exceeding 2 miles in a few places, is generally great with respect to the sizes of the streams occupying it. North of Kusawak Lake the valley-bottom is drift-covered and flat (Plate III, B); near the British Columbia-Yukon Boundary the Tatshenshini River is deeply incised in this valley-fill.

North of Nadahini Creek the south-western side of the valley is flanked by a broad bench, which rises gradually from an elevation of about 3,500 feet to an elevation of about 4,250 feet at the base of the mountains (Plate III, A and B). This bench, which is generally 2 to 3 miles wide, has a very smooth surface except in a few places where low hills rise from it. North of Moi Creek the north-eastern side of the valley is also flanked by a sloping bench. This bench, however, is only half as wide as that on the opposite side of the valley, and in most places its elevation reaches only 4,000 feet at the base of the mountains.

Other gently sloping benches with approximately the same range in elevations border the valley at the north-western end of the Kusawak Mountains, south-east of Kusawak Lake, and south-west of part of Stonehouse Creek.

A plateau lying north-east of Mineral Mountain, south and south-west of the upper part of Stonehouse Valley, and west of Seltat Valley also forms part of the Duke Depression (Plates I, B, and II, A). This plateau, which has an area of about 25 square miles, ranges in elevation from about 3,750 feet to about 5,250 feet, the local relief in most places being less than 500 feet.

A gently sloping area lying south of Seltat Creek, north-east of the Klehini River, and west of Yokeak Creek forms a continuation of the benches and the plateau. This area, which is about 20 square miles in extent, rises gradually north-eastward from an elevation of a little more than 3,000 feet to approximately 4,750 feet.

Remnants of benches ranging in elevation from about 3,000 feet to 3,750 feet occur in places on the flanks of the mountains south-west of the Klehini River for about 4 miles up-stream and 4 miles down-stream from the mouth of Inspector Creek.

Drainage.

The northern and western parts of the area are drained by the Tatshenshini and O'Connor (Boundary)* Rivers, which eventually unite with the Alsek River flowing into Dry Bay on the Gulf of Alaska (*see* Fig. 1). The eastern and southern parts are drained by the Kelsall and Klehini Rivers, which are tributaries of the Chilkat River emptying into the upper part of Lynn Canal.

The Tatshenshini River rises at a low divide about 3 miles west of Kelsall Lake and meanders north-westward in a broad drift-filled valley into the Yukon Territory, 15 miles away (Plates III, B, and VII, B). Its average gradient in this part of its course is only about 20 feet per mile. Incision of the drift-filled valley begins near the mouth of Stanley Creek and at the Yukon Boundary reaches a depth of 390 feet.

The main tributaries joining the Tatshenshini in this region are the Blanchard and Parton Rivers. The former has a moderate or gentle gradient except for a short stretch up-stream from its confluence with the Tatshenshini, where it rushes through a deep rock gorge. The Parton River rises in a large glacier and, for about 8 miles north of its source, flows swiftly in a braided channel up to half a mile in width. Where it flows into the Tatshenshini Valley it has built a low gravel fan almost 2 miles wide.

Most of the smaller tributaries of the Tatshenshini, such as Blizzard, Kwatini, and Moi Creeks, have cut deep canyons through the benches that flank the valley.

About a mile down-stream from Kelsall Lake, Kelsall River enters a deep canyon, in which it flows south-eastward for about 15 miles with an average gradient of approximately 125 feet per mile. This deep, straight valley is considered to be the dividing-line between the Coast Mountains to the north-east and the St. Elias Mountains to the south-west. Datlasaka and Nadahini Creeks unite to form the main tributary of the Kelsall River; for short distances above their confluence and in the mile-long stretch between their confluence and the Kelsall River they are also deeply incised.

Within the Squaw Creek-Rainy Hollow area the Klehini River flows south-eastward with an average gradient of about 150 feet per mile. Steep rapids and low waterfalls occur near the mouth of Inspector Creek, and the river falls about 500 feet in half a mile. In this vicinity Inspector Creek has an even steeper gradient, descending about 750 feet in half a mile.

* In this bulletin, place-names that are used locally but not recognized officially are placed in parentheses.

In summer the numerous glacial streams become swollen and turbid in the latter part of the day. Caution should be used in selecting places to ford these streams because they are very swift and their muddiness makes it difficult to judge the depth.

The Haines Road crosses broad gravel fans built by Stanley Creek, Datlasaka Creek, and the eastward-flowing headwaters of Nadahini Creek where they join the main valley. Continual shifting of the stream-channels across these fans makes maintenance of the road extremely difficult.

GLACIATION.

In Pleistocene time part of an extensive ice-sheet in the Squaw Creek-Rainy Hollow area deposited large amounts of drift in the valleys, mainly in the northern part of the area, and slightly scoured some land forms, mainly in the southern part of the area, giving them a smooth appearance. Mountain glaciers, many of which still exist in the area, modified the topography in places, producing some of the present rugged upland and occasional trough-shaped valleys.

Striated outcrops showing stoss and lee effects indicate, for the most part, that the ice-sheet moved south-eastward across the area (*see* geological map). Across Copper Butte and the ridge between Yokeak Creek and the Klehini River, however, the direction of movement was southward. At the southern end of the Kusawak Mountains the ice moved eastward, its flow apparently having been controlled by the Stonehouse Valley. In the northern part of the area ice moved westward to south-westward in the Blanchard Valley at one time during glaciation.

The altitudes at which erratics and striated outcrops were found in the area suggest that the height to which the ice-sheet was effective declined from at least 6,500 feet in the north to about 4,500 feet in the south. Farther to the south, in the Porcupine district of Alaska, the level reached by the ice may have been only about 3,000 feet (Eakin, 1919, p. 6).

The ice-sheet apparently did not extensively modify the topography in the Squaw Creek-Rainy Hollow area, but it rounded off some hills and ridges and smoothed several large tracts of bed-rock. Glacially rounded hills and ridges are most evident in the areas between Inspector, Stonehouse, and Seltat Creeks, between Yokeak Creek and the Klehini River, and between the headwaters of Mansfield Creek and the Tatshenshini River. Copper Butte, a circular, steep-sided, dome-shaped hill rising about 700 feet above the adjacent terrain, is the most conspicuous glacially modified hill of the area (Plate I, B).

The large tracts of smoothed and grooved bed-rock are more noticeable effects of the ice-sheet than are the rounded hills and ridges. These tracts include an area of about 15 square miles north-west of Datlasaka Creek, underlain mainly by gabbro; an area of about 5 square miles at the north-western end of the Kusawak Mountains, underlain mainly by diorite; and an area of about 12 square miles south of the upper part of Stonehouse Creek, underlain mainly by granitic rocks. These areas, which are parts of the benches referred to on page 14, show numerous alternating smooth ridges and furrows trending south-easterly. The ridges are commonly about a mile long and about 500 feet wide, and the furrows are of comparable width and commonly about 150 feet deep. Small rôches moutonnées are abundant but few have retained their polished and striated surfaces. A somewhat similar grooved terrain about 6 square miles in area and underlain by metamorphosed sedimentary rocks occurs between Seltat and Inspector Creeks. In this locality, however, numerous rôches moutonnées and grooves having well-polished and striated surfaces are found.

Erosion by mountain glaciers, which were once more numerous and extensive than at present, has produced fretted uplands characterized by deep cirques, sharp peaks, and serrate ridges. In several places, particularly in the south-western part of the region, glaciers extending down valleys for long distances have formed troughs with steep walls and truncated spurs. The distribution of moraines and erratics indicates that a lobe of the Parton-O'Connor Glacier once extended eastward far beyond the divide at the head of Stonehouse Creek. Erosion by this lobe may have been chiefly responsible for the development of the present through valley. Large moraines, indicative of formerly extensive valley glaciers, are present in many places in the area, notable examples occurring near the head of Kelsall Lake and in the western part of the Datlasaka Mountains.

Although glacial drift was deposited by the ice-sheet in much of the area, it forms particularly widespread and continuous deposits in the part north of Glacier Camp. The extensive area of drift west of Kelsall Lake includes a broad ridge of bouldery gravel having a hummocky pitted surface and stratified deposits of sand and gravel having markedly flat surfaces. The nature of these deposits and the presence of abandoned stream-channels in them suggest a complex history of glaciation and drainage.

The drift deposits in the Tatshenshini River valley, by far the largest in the area, consist, in general, of stratified sand and gravel overlain by unsorted drift. Their thickness, shown by incision of the river, is at least 390 feet at the Yukon Boundary. In many places the surface of these deposits is hummocky and pitted with kettles. Several large kettle lakes occur between the Tatshenshini and Blanchard Rivers 1 mile to 2 miles south of the Yukon Boundary (Plate III, B).

A parallel sequence of abandoned stream-channels, the longest of which is traceable for almost 3 miles, occurs in the drift along the south side of the Blanchard Valley near the Tatshenshini Valley at an altitude of about 3,500 feet. These evidently mark the positions of westward-flowing streams which ran along the margin of a retreating ice-mass occupying the western part of the Blanchard Valley in late-Glacial time.

Abandoned channels occurring at altitudes of approximately 3,800 and 4,000 feet sweep around the south-eastern slope of Nadahini Mountain, 1½ miles west of Kusawak Lake. They probably indicate diversion of drainage to the north-east by ice that once occupied the upper part of Stonehouse Valley.

Four distinct gravel terraces occur in the Seltat Valley between altitudes of 2,900 and 3,200 feet, and abandoned channels, corresponding in altitude to the terraces, slope southward along the eastern valley-wall. The terraces are evidently ancient deltas built in lakes of successively lower levels which were dammed back by a retreating ice-mass which occupied the southern part of the Seltat Valley in late-Glacial time. The lakes were drained by streams which flowed southward along the margin of the ice-mass, cutting the distinct channels.

Evidence that ice persisted in some valleys after it had disappeared from parts of the upland is also seen near the confluence of Clayton and Stonehouse Creeks. At this place, Clayton Creek departs from its northward trending course to flow north-eastward through a narrow rock gorge, apparently having been diverted from its former channel by an ice-lobe which extended southward from an ice-mass in the Stonehouse Valley.

Thick deposits of stratified gravel, sand, and clay occur in the Klehini Valley about 2 miles north-west of the Alaska Boundary. Deep incision of these sediments by the Klehini River has produced steep cut-banks, along which the Haines Road has been very difficult to maintain. These deposits may have accumulated while the Klehini Valley was blocked for a time by Jarvis Glacier, a large valley glacier which has now retreated to a point about 2 miles west of Pleasant Camp.

CLIMATE.

Because of its high latitude and altitude the area has a relatively cold climate, most of the area probably being colder than the Dominion Experimental Farm 100 miles west of Whitehorse. The mean annual temperature at the Experimental Farm in 1945 was 27.3 degrees Fahrenheit, and the average monthly temperatures ranged from 51 degrees in July to 9.3 degrees in January. The mean annual temperature in 1946 was 26.6 degrees, and the average monthly temperature ranged from 54.5 degrees in June to 15.4 degrees below zero in December. In the parts of the Squaw Creek-

Rainy Hollow area of intermediate to high altitudes night-frosts are common in June and September.

The precipitation in most of the area is probably much greater than it is at the Experimental Farm where, in 1945, it amounted to 14.95 inches, and in 1946 to 11.13 inches. During the summer heavy rains of long duration are not frequent, but heavy showers and prolonged light rains are very common. Appreciable amounts of rain or snow fell on 60 per cent. of the days spent in the area in 1945 and on 55 per cent. of them in 1946. In the southern part of the region thick fogs often accompanied by drizzle occur frequently, particularly in the mornings and late afternoons. In September most of the precipitation is in the form of snow.

In some parts of the district large accumulations of snow may interfere with detailed geological work until late August. Bad weather and the presence of snow restrict prospecting in most of the area to about three and a half months a year.

VEGETATION.

Most of the Squaw Creek-Rainy Hollow area is untimbered. To a large extent the lower untimbered parts of the region are covered with a dense growth of dwarf birch ("buck-brush") and some willow. The intermediate and higher untimbered parts are either rocky and almost barren or drift-covered and grassy or are poorly drained and covered with bog-moss and marsh-plants.

The main timbered tracts in the area are the Klehini Valley, up to an elevation of about 2,600 feet, and the sides of the Tatshenshini Valley, up to an elevation of about 3,200 feet, from Bear Camp northward. Small patches of trees are found along the southern side of Kelsall Lake, in the vicinity of Glacier Camp, and in the southern part of the Yokeak Valley.

In the Klehini Valley spruce and hemlock trees, many of which are suitable for lumber, are abundant generally, and cottonwood is plentiful near the river (Plate V, A). In most places these forests have a dense undergrowth of "devil's-club," alder, blueberry, salmon-berry, and smaller plants.

In the Tatshenshini Valley the timber consists of sparsely distributed spruce and a few aspen. Most of the spruce trees north of Glacier Camp have been killed by the beetle *Dendroctonus borealis* Hopk. in recent years, but as yet few have fallen.

The absence of timber in most of the area makes camping difficult. However, a surprisingly large amount of fuel may be gathered from patches of dry willow occurring locally in "buck-brush" (Plate V, B) or from clumps of scrubby alpine fir occurring in a few places at higher elevations. Feed for horses is scarce before the beginning of July and after the middle of September.

AGRICULTURE.

Because of the cold short summers the area is unsuitable for agriculture. Hardy varieties of vegetables and small fruits are grown successfully on a small scale in the lower Chilkat Valley and at the Dominion Experimental Farm 100 miles west of Whitehorse. Similar results might be obtained in those low parts of the Squaw Creek-Rainy Hollow area that have favourable soil.

GAME.

Game is not plentiful enough in most of the area to allow prospectors to "live off the country" without considerable effort. Caribou are no longer found and moose, although inhabiting parts of the area, are rare in most of it. Goat and sheep are found in the rugged mountains and in some of the canyons. Grizzly and black bear are numerous and wolf and coyote are fairly abundant. Fox, weasel, mink, muskrat, fisher, marten, and otter are trapped in some parts of the area. Marmot, gopher, porcupine, wolverine, and rabbit are found also. Ptarmigan are numerous and grouse, ducks, and geese are plentiful in places. Salmon ascend the Tatshenshini River and its tributaries in great numbers. Small trout may be caught in many of the clear streams.

CHAPTER III.—GENERAL GEOLOGY.

INTRODUCTION.

In the Squaw Creek-Rainy Hollow area Permo-carboniferous rocks consisting almost entirely of sediments and Mesozoic rocks comprising volcanics and some sediments are cut by granitic and other intrusives of Mesozoic age. Down-faulted blocks of Paleocene and possibly younger volcanic and sedimentary rocks occur in a few places. Several small patches composed of volcanic and some sedimentary rocks of probable Late Tertiary age rest unconformably on some of the Mesozoic rocks. Fairly thick and continuous deposits of glacial drift and alluvium cover approximately 10 per cent. of the area.

The following table shows the main types of rock that have been grouped into the various map-units described in detail in this chapter.

Table I.—Lithology of Map-units, Squaw Creek-Rainy Hollow Area.

Era.	Period or Epoch.	Map-unit.	Lithology.
Cenozoic	Pleistocene and Recent	19	Drift and alluvium.
	Late Tertiary (?)	18	Basalt. Some basalt tuff, basalt agglomerate, and conglomerate.
	Paleocene to Miocene	17	Basalt, rhyolite tuff, conglomerate.
	Paleocene	16	Conglomerate, sandstone, and shale. Some rhyolite.
		15	Rhyolite. Some conglomerate, sandstone, and shale.
Mesozoic	Jurassic or later (?)	14	Feldspar porphyry.
		13	Granodiorite and quartz diorite. Some granite and diorite.
		12	Granite and granodiorite.
		11	Quartz diorite and granodiorite with inclusions of gneiss and schist.
		10	Gneissic quartz diorite.
		9	Diorite.
		8	Gabbro.
		7	Peridotite and serpentine.
	Triassic or later (?)	6	Gneiss and schist. Some marble and skarn.
		5	Argillite. Some greenstone, chlorite-schist, and quartzite.
		4	Greenstone, breccia, and chlorite-schist. Some argillite, chert, quartzite, and limestone.
		3	Pillow lava. Some limestone and argillite.
Palæozoic	Permo-carboniferous	2	Marble, argillite, quartzite, gneiss, and schist. Some skarn.
		1	Limestone, argillite, quartzite. Some greenstone and chlorite-schist.

PERMO-CARBONIFEROUS ROCKS (1, 2).*

Rocks of probable Permo-carboniferous age underlie approximately 175 square miles of the Squaw Creek-Rainy Hollow area. They have been mapped as two units, one (Group 1) consisting mainly of sedimentary rocks and the other (Group 2) consisting mainly of metamorphosed sedimentary rocks that originally were similar to those of Group 1. The boundary between the two groups is gradational over a wide and irregular zone and, consequently, can be represented on the map in only an approximate manner.

The group of sedimentary rocks forms most of the Squaw Range and the northern part of the Datlasaka Mountains. It comprises chiefly limestone, argillite, quartzite and small amounts of greenstone and chlorite-schist. Some of the relationships between

* These numbers correspond to those of map-units.

the various rock-types in the group may be seen in Fig. 2, which is a detailed map of part of Squaw Creek.

The limestone varies from white to dark grey and from thickly bedded to finely laminated. Much of it in the Datlasaka Mountains and some in the southern part of the Squaw Range consists of intraformational breccia and conglomerate. These rocks are composed of angular to rounded fragments of limestone, generally one-quarter inch to 1 inch in diameter, in a matrix of similar limestone of uniform texture. The fragmental structure is much more apparent on weathered surfaces than on freshly broken ones. The intraformational breccia and conglomerate occur as beds, a few inches to several feet thick, which are interstratified with non-fragmental limestone.

In several places, particularly in the north-western part of the area, the limestone has been metamorphosed to marble. The quantity of marble in this group, however, is much less than that in Group 2.

In many places the limestone becomes highly argillaceous and grades into grey-weathering calcareous argillite. Most of the argillite, however, is a brown-weathering, non-calcareous, thinly bedded black variety. Locally the argillite has been converted to lustrous graphite-schist or to grey sericite-schist.

Most of the quartzite is medium-grey coloured and is somewhat argillaceous, but some is light grey, buff, or cream-coloured and is cherty in appearance.

The amount of greenstone and chlorite-schist in Group 1 is greatest in the northern part of the area. Most of the greenstone is schistose and highly chloritic rock, but some is relatively massive and fresh amygdaloidal rock. The latter consists of amygdules, mainly of epidote and quartz, in a fine-grained aggregate of intermediate plagioclase, recrystallized hornblende, and chlorite. The origin of much of the schistose greenstone and chlorite-schist is obscure. Some is definitely interbedded with the sedimentary rocks and evidently represents lava flows or beds of pyroclastic material laid down with the sediments, but some forms irregular masses which may represent intrusives.

The group of metamorphosed sedimentary rocks (Group 2) occurs mainly in the southern part of the Datlasaka Mountains, in the vicinity of Rainy Hollow, and in an area along the Alaska Boundary between Mount Seltat and Yokeak Creek. These rocks are also found in the Kusawak Mountains, in the Klehini Valley between Pleasant Camp and Rainy Hollow, and south-west of Yokeak Creek. The rocks in these areas lie close to a large granitic intrusive and probably owe their metamorphism to it.

The group consists of marble, argillite, quartzite, gneiss, schist, and some skarn. The relationships between some of these rocks in a few small areas may be seen in Figs. 3, 4, 5, 6, 7, and 8. Descriptions of some of the rocks, particularly of the skarn, are given in chapter V in the accounts of the Maid of Erin, State of Montana, Victoria, Adams, and Lawrence claims. The marble is medium- to coarse-grained and light grey, cream-coloured, or white. In many places it forms groups of conspicuous bare knolls, but in a few places it is pitted with sink holes. The marble occurs as fairly regular layers up to 500 feet thick and as lenses and irregular masses with shapes resulting from flow. Analyses of two samples of marble show considerable difference in quantity of impurities associated with the calcite.

Table II.—Analyses of Marble.

Location of Sample.	CaO.	MgO.	R_2O_3.	Insol.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Lawrence claim	54.8	0.24	0.24	0.56
Hartford claim	49.0	0.9	2.45	7.57

Some of the marble has been altered to skarn that is important because, locally, it contains replacement deposits bearing copper and silver, or lead, zinc, and silver. The skarn forms irregular bands and lenses up to several tens of feet wide and several hundreds of feet long, which generally occur along the margins of the marble bodies. Of the many varieties of skarn found in the area, the most abundant are: one consisting mainly of medium- to coarse-grained yellowish-green garnet, and another consisting mainly of medium-grained epidote and quartz. Other types are coarse- to fine-grained rocks composed chiefly of some of the following minerals in various proportions: brown garnet, diopside, monticellite (lime-magnesia silicate), wollastonite, calcite, diopside-hedenbergite, zoisite, clinozoisite, actinolite, and idocrase (vesuvianite).

The other rocks of Group 2 contrast with the marble and skarn by being rusty-weathering. The argillite is thinly bedded black rock which is commonly micaceous. Most of the quartzite is thinly bedded, grey, fine-grained rock consisting mainly of quartz, orthoclase, plagioclase, muscovite, and biotite in various proportions. Some is described best as feldspathic quartzite and some as micaceous quartzite. The gneisses and schists are mainly light-grey rocks composed chiefly of muscovite, biotite, quartz, orthoclase, and plagioclase, but some are dark-grey rocks containing large amounts of hornblende and chlorite. Some of the gneiss in the Kusawak Mountains is dark grey and consists of small lenses of andesine and quartz and crystals of garnet in a foliated matrix rich in biotite.

The total thickness of Permo-carboniferous rocks in the area is unknown. However, along the southern side of Nadahini Mountain, a section which may be of the order of 10,000 feet in thickness is exposed.

Poorly preserved fossils collected from dark-grey argillaceous limestone of Group 1, 3 miles north 30 degrees east of Scottie Mountain, were submitted to the Geological Survey, Department of Mines and Resources, Ottawa, for examination. According to Dr. W. A. Bell, the small collection contained "an unidentifiable productid(?) which indicates only Carboniferous or Permian." Rocks which are very similar to those mapped as Groups 1 and 2 occur to the south-east of the British Columbia-Alaska Boundary (Wright, 1903, and Eakin, 1919). Fossils, which include identifiable productids found in limestone on the lower part of Porcupine Creek about 5 miles south-east of the Squaw Creek-Rainy Hollow area, are believed to indicate late Pennsylvanian or early Permian age (Eakin, 1919, p. 11).

MESOZOIC VOLCANIC, SEDIMENTARY, AND METAMORPHIC ROCKS (3, 4, 5, 6).*

INTRODUCTION.

The Mesozoic volcanic, sedimentary, and metamorphic rocks have been mapped as four units. The oldest group consists mainly of pillow lava (Group 3), and the youngest groups, which are equivalent in age, consist mainly of greenstone, breccia, and chlorite-schist (Group 4), and mainly of argillite (Group 5). Group 6 comprises gneiss and schist probably derived by metamorphism chiefly from rocks similar to those of Group 5.

GROUP 3.

The rocks of Group 3 are exposed over an area of approximately 2½ square miles only. They form a low, hummocky, north-westerly trending ridge about 5 miles long which separates the upper part of the Tatshenshini Valley from a narrow valley occupied by part of Mansfield Creek.

The group is composed almost entirely of pillow lava, but it also includes a small amount of limestone and argillite. Much of the lava is dark green altered rock showing somewhat sheared pillow structure. Some of it, however, is dark grey, relatively fresh appearing, massive rock which has well-preserved pillow structure (Plate VI, A). Most of the pillows are between a foot and 3 feet in diameter. The margins of some of the relatively fresh ones contain abundant amydules of calcite, chlorite, and quartz.

* These numbers correspond to those of map-units.

The pillow lava is cut by many veins of quartz, up to about 6 inches wide, and by some veins of carbonate and epidote. Microscopic study of a relatively fresh-appearing specimen showed that, although the texture of the rock had been only slightly changed, the minerals had been considerably altered. The lava, now consisting mainly of albite, epidote, chlorite, and carbonate, was probably andesite or basalt originally.

The limestone occurs chiefly as small irregular masses filling spaces between some of the pillows and as lenticular beds up to approximately 6 inches thick separating some layers of pillows. Part of this limestone has recrystallized to form marble. Some brown-weathering carbonate rock containing beds of grey limestone up to 2 feet thick, exposed at the north-eastern end of the ridge, is included in this group. A small amount of black siliceous argillite found at the north-western end of the ridge is likewise included.

Along the north-eastern side of the ridge the pillow lava strikes north-westerly and dips steeply to the north-east; in several places it can be seen that the tops of the pillows face toward the north-east. Along the south-western side of the belt, the pillow lava strikes north-westerly and generally dips almost vertically; in some places it appears that the tops of the pillows face toward the south-west. Thus the pillow lava evidently forms an almost isoclinal anticline with a steep north-eastern limb and an approximately vertical south-western limb.

No fossils have been found in the rocks of Group 3. However, the rocks are regarded as Mesozoic because, apparently, they are conformable with Group 4, which contains fossils of probable Mesozoic age, and because they resemble closely in lithology some of the rocks of Upper Triassic age in south-eastern Alaska (Buddington and Chapin, 1929, pp. 130–156).

Group 4.

The rocks of Group 4 form two discontinuous, irregular, north-westerly trending belts, totalling about 35 square miles, which lie on opposite sides of the Tatshenshini-Kelsall Valley and which are separated from each other by areas of drift and rocks of Group 3. Within the area mapped, the north-eastern belt extends from the southern side of Kelsall Lake to Stanley Creek, interrupted by bodies of drift and water; the south-western belt extends from the head of the Tatshenshini River to the Yukon Boundary, interrupted by intrusives of gabbro and of granitic rocks and by drift.

The group comprises chiefly greenstone, breccia, and chlorite-schist. It also includes some argillite, chert, quartzite, and limestone. The typical greenstone is light greyish-green, fine-grained, somewhat schistose rock composed mainly of albite, epidote, hornblende, actinolite, and chlorite. The mode of origin of much of the greenstone cannot be determined. However, some containing amygdules of epidote is evidently altered lava, some forming regular beds about 6 inches thick interbedded with argillite may be altered pyroclastic material, and some having blocky jointing and uniform granular texture may be altered intrusive rock. The last type of greenstone forms fairly large masses on the south-eastern part of Mount Mansfield, on the ridge south-east of Moi Creek, and in both areas of greenstone occurring between Blizzard Creek and Talbot Creek. Greenstone showing sheared pillow structure forming a layer about 100 feet thick is exposed on the southern slope of Mount Mansfield.

Much of the greenstone between Kwatini Creek and Stanley Creek on the bench lying south-west of the mountains has been sheared and highly altered. The altered rock is a conspicuous brown-weathering, light grey, fine-grained assemblage of albite, quartz, and ankeritic carbonate cut by numerous small veinlets of quartz and carbonate. The amount of alteration is greatest at the north-western end of the belt where the greenstone has been highly sheared.

The breccia composes much of the north-eastern half of the rocks of Group 4 between Talbot Creek and the Yukon Boundary. Most of the breccia consists of angular to sub-angular fragments, an inch or two in diameter, of medium to fine, even-grained, grey to green greenstone in a somewhat schistose matrix of similar material.

Some, however, consists of fragments and matrix that are porphyritic. This kind of breccia contains medium-grained phenocrysts of feldspar and mafic minerals showing rude flow structure in a very fine-grained ground-mass. Microscopic examination of a specimen of fairly fresh-appearing porphyritic breccia showed that the phenocrysts were highly altered, the plagioclase mainly to clinozoisite and the pyroxene to actinolite and chlorite. Some of the fragmental rock is apparently flow-breccia, because it forms layers a few inches to a few feet thick in massive or amygdaloidal greenstone and because the material between fragments shows flow-structure.

Argillite occurs interbedded with greenstone and chlorite-schist mainly south of Kelsall Lake, between Moi Creek and Mount Mansfield, and in the south-western half of the belt that extends from Talbot Creek to the Yukon Boundary. In the area between Moi Creek and Mount Mansfield the amount of argillite in the group increases along the strike toward the north-west and upward in the section; that is, toward the north-east. North-west of Mount Mansfield the rocks have been mapped as a separate unit (Group 5), because argillite is much more abundant than greenstone and chlorite-schist.

Small amounts of white, grey, and black chert, and of white and cream limestone occur near the Haines Road near Moi Creek and on the southern side of Kelsall Lake. Larger amounts of light greenish-grey, cream, and black quartzite and dark grey calcareous argillite and argillaceous limestone are interbedded with schistose greenstone, chlorite-schist, and argillite in the south-western half of the belt that extends from Talbot Creek to the Yukon Boundary.

The rocks of Group 4 on the north-eastern side of the Tatshenshini-Kelsall Valley strike north-westerly and dip steeply to the north-east, and those on the south-western side strike north-westerly and, in general, dip at steep to moderate angles to the south-west. They appear to be conformable with the rocks of Group 3 which form a north-westerly trending anticline, although in most places the two groups are separated by narrow drift-filled valleys. Thus the north-eastern belt of Group 4 and its north-western continuation, consisting chiefly of argillite mapped as Group 5, may form the north-eastern limb of a north-westerly trending anticline, and the south-western belt may form the other limb.

Small lots of fossils collected from limestone at three localities between Talbot Creek and Langton Creek were submitted to the Geological Survey, Department of Mines and Resources, Ottawa, for identification. Dr. F. H. McLearn, who examined the collections, reported as follows:—

Lot from southern locality (*see* map)—*Belemnites?* sp. Age: Mesozoic.

Lot from central locality (*see* map)—Belemnoid? Crinoid stems. Age: Probably Mesozoic.

Lot from northern locality (*see* map)—*Lima?* sp. Age: Probably Mesozoic.

The rocks of Group 4 are very similar to some of the Lower Mesozoic rocks of south-eastern Alaska (Buddington and Chapin, 1929, pp. 130–173). Rocks that form the north-western continuation of the belt in the Yukon Territory north of Langton Creek have been tentatively correlated on lithological grounds with the " Older Volcanics " of probable Jurassic age (Cockfield, 1927, p. 5).

Group 5.

The rocks of Group 5 are exposed in places between Mount Mansfield and the Blanchard River. The exposures, having a combined area of only 8 square miles, are in a north-westerly trending area in which large tracts of drift in the Blanchard and Tatshenshini Valleys obscure the bed-rock.

The group is composed almost entirely of black, thinly bedded argillite, but it also includes small amounts of schistose greenstone, chlorite-schist, and grey, thinly bedded quartzite. The amount of greenstone and chlorite-schist is greatest at the south-eastern end of the belt, where the group grades along its strike into Group 4.

The argillite strikes north-westerly and dips steeply to the north-east and, as described in the foregoing section, may lie on the north-eastern limb of a north-westerly trending anticline. The argillite is considered to be equivalent in age to the rocks of Group 4 and, therefore, is probably Lower Mesozoic.

Group 6.

The rocks of Group 6 underlie approximately 40 square miles in the north-eastern part of the Squaw Creek-Rainy Hollow area. They occur as an irregular, branching, north-westerly trending belt intruded by gneissic quartz diorite of the Coast Range batholith.

The group consists largely of various kinds of gneiss and schist. However, the small area of this group in the extreme north-eastern corner of the region includes, in addition, some marble and skarn.

Most varieties of gneiss and schist are brown-weathering, dark grey to black, medium- to fine-grained, foliated assemblages composed essentially of biotite, plagioclase, and quartz. They may contain larger crystals of reddish-brown staurolite and (or) light grey sillimanite. Microscopic study shows that the plagioclase is oligoclase in some rocks and andesine in others, and that cordierite, muscovite, garnet, and magnetite occur in places. Large crystals of staurolite are conspicuous in much of the gneiss and schist in the northern part of the belt, but they are particularly noticeable in an area about 3 miles west of Blanchard Lake, where flat prisms up to 2 inches long were observed.

Near the eastern end of Kelsall Lake the gneiss and schist contain chlorite and hornblende in addition to biotite, feldspar, and quartz. In this locality, and in the vicinity of the Blanchard River, many sills of granitic rock a few inches to several feet thick and many lenses of quartz a few inches thick were seen in the metamorphic rocks.

The skarn that occurs along with marble in the north-eastern corner of the area is composed mainly of medium-grained tan garnet, dark green diopside, and calcite.

In most places the foliation in the rocks of Group 6 strikes north-westerly and dips steeply to the north-east.

On the ridge north of Stanley Creek the group grades from gneiss and schist on the east to micaceous argillite on the west. This indicates that some of the rocks of Group 6 have been derived from the sedimentary rocks of probable Mesozoic age. The common occurrence of persistent, regular, alternating bands a few inches to a few feet thick of gneiss and schist of slightly differing character suggests that most of the group consists of metamorphosed sedimentary rocks. However, the presence of chlorite and hornblende in some of the metamorphic rocks near Kelsall Lake suggests that they have been derived from the Mesozoic greenstone. The metamorphic rocks in the north-eastern corner of the area, particularly the marble and skarn, are similar to the rocks of Group 2 and may, therefore, be Permo-carboniferous in age.

Probably the metamorphism of the rocks of Group 6 is related to the near-by gneissic quartz diorite of the Coast Range batholith.

MESOZOIC INTRUSIVE ROCKS (7, 8, 9, 10, 11, 12, 13, 14).*

Introduction.

Mesozoic intrusive rocks are exposed over approximately one-third of the Squaw Creek-Rainy Hollow area. These rocks have been divided into several groups on the basis of differences apparent in the field. They include relatively small bodies of peridotite and serpentine (7), gabbro (8), diorite (9), granite and granodiorite (12) and feldspar porphyry (14), and large bodies of granitic rocks. The latter have been mapped chiefly as two units. One of them (10) occurs in the Coast Mountains and

* These numbers correspond to those of map-units.

consists mainly of gneissic quartz diorite; the other (13) occurs in the Duke Depression and the St. Elias Mountains and consists of granodiorite and quartz diorite and some granite and diorite. The granitic body in the Coast Mountains includes two small areas of quartz diorite and granodiorite that contain numerous inclusions of gneiss and schist. These two areas have been mapped as a separate unit (11).

The exact ages of the intrusives classed here as Mesozoic cannot be established definitely by evidence obtained in the Squaw Creek-Rainy Hollow area. Most of the intrusives, at least, are undoubtedly pre-Tertiary, for they have been the source of the fragments of igneous rocks found in abundance in the Paleocene conglomerate. Some of the bodies cut rocks of probable lower Mesozoic age and are, therefore, probably upper Mesozoic. Others, however, can be dated only as younger than Permo-carboniferous and older than Paleocene.

The gneissic quartz diorite lying north-east of the Tatshenshini-Kelsall Valley is part of the Coast Range batholith that extends all the way from the south-western corner of British Columbia to the south-western part of Yukon Territory. This vast composite intrusive shows evidence that its age is Upper Jurassic in some places and Lower Cretaceous in other places. It seems likely that the gneissic quartz diorite of the Squaw Creek-Rainy Hollow area, and perhaps the other granitic rocks also, are of similar age.

Granitic rocks are named in this bulletin according to the classification by which rocks with the ratio of potash to soda-lime feldspar ranging between 5 to 3 and 3 to 5 are called granodiorite; those with higher ratios are granite and those with lower ratios are quartz diorite.

Peridotite and Serpentine (7).

Ultrabasic rocks form a dyke at least 5 miles long and about 500 feet wide, in the northern part of the Squaw Range, and two sills about 50 and 100 feet thick, exposed for short distances on the south-western slope of Nadahini Mountain. These sills have been exaggerated in size and generalized in shape on the map. Bodies of serpentine, far too small to show on the map, occur near the Yukon Boundary about 2 miles east of Squaw Creek and on Ahmoi Creek (Fig. 2).

The dyke, which strikes north-westerly and dips very steeply to the south-west, intrudes mainly chert, quartzite, greenstone, and chlorite-schist of probable Mesozoic age. The sills, which strike north-westerly and dip at about 60 degrees to the north-east, intrude Permo-carboniferous marble.

The dyke consists mainly of brown-weathering, dark-green medium-grained serpentinized periodotite. The rock retains its original texture in spite of considerable alteration to serpentine. Microscopic examination of a specimen of serpentinized peridotite typical of the dyke showed some pyroxene and much serpentine and magnetite derived mainly from olivine.

The sills consist of highly serpentinized peridotite, serpentine, and talc-carbonate rock. Much of the serpentinized peridotite shows mottling resulting from relic poikilitic texture. This rock consists of serpentine and magnetite derived from olivine enclosed in places by actinolite derived from pyroxene. The serpentine of the sills is dark green fine-grained rock that shows none of its original texture in hand specimens. Locally, where it has been sheared, it is light green and waxy in appearance. In a few places the serpentine has been altered to a fine-grained aggregate of grey talc and rusty-weathering buff-coloured carbonate. At one locality, veinlets of cross-fibre asbestos, up to one inch long but not of good quality, were seen in the serpentine.

The age of the ultrabasic rocks is doubtful. Some of them intrude sedimentary rocks that are probably Mesozoic. About 3 miles east of Squaw Creek near the Yukon Boundary serpentinized peridotite lies adjacent to granite. However, the contact is not exposed and nothing was learned of their relative ages.

Gabbro (8).

The only gabbro shown on the map is a north-westerly trending body, about 8 miles long and up to 2 miles wide, exposed on the bench flanking the north-eastern side of the Datlasaka Mountains. Its surface is characterized by low glaciated ridges and by large glacial grooves described on page 16. The trend of these features coincides with that of ill-defined banding in the gabbro.

The gabbro is mainly dark-grey medium- to coarse-grained rock composed essentially of labradorite and secondary actinolite. Near the north-western end of the body, however, the plagioclase is saussuritized and the mafic mineral is somewhat chloritized. Locally the gabbro contains irregular patches, a few inches to a few feet across, that are extremely coarse-grained. In several places along the south-western edge of the body, where it is in faulted contact with Tertiary rocks, the gabbro has been altered to fine-grained sheared rock resembling greenstone.

The banding in the gabbro results from variations in the proportion of light to dark minerals in adjacent layers. The layers range from less than an inch to a few inches in thickness. They strike north-westerly and dip almost vertically.

The only information regarding the age of the gabbro is that it intrudes greenstone that is probably Mesozoic.

In addition to the body of gabbro shown on the map, several small ones occur in the area. About half a mile south of the Yukon Boundary banded gabbro is exposed near the north-eastern edge of the peridotite dyke. This gabbro is grey medium-grained rock consisting mainly of clino-pyroxene and saussuritized plagioclase. It also contains a small amount of serpentine having the appearance of altered olivine.

Several dykes and small irregular masses of gabbro are exposed on and between the two ridges that lie respectively 1½ miles and 3 miles north 15 degrees east of Scottie Mountain. The gabbro in a few of these small bodies grades into pyroxenite in some places and into dioritic-appearing rock in others.

A lens of gabbro that occurs in skarn on the Maid of Erin claim (Fig. 3) is described on page 43.

Diorite (9).

The largest body of diorite in the region crops out over an area of at least 3 square miles at the north-western end of the Kusawak Mountains. Similar diorite, possibly representing a continuation of this body, is exposed in the canyon near the confluence of Datlasaka and Nadahini Creeks. Other bodies of diorite occurring near the head of Datlasaka Creek, near the southern end of Mineral Mountain, and on the ridges north-east and south-west of Squaw Creek are shown on the map. The area also contains many bodies of diorite that are too small to map.

The diorite body at the north-western end of the Kusawak Mountains forms a surface characterized by low glaciated ridges and small rock-rimmed lakes. Most of the diorite is light-grey medium-grained gneissic rock composed mainly of saussuritized plagioclase and actinolite. Some of it, however, is coarse-grained, massive, or schistose.

Diorite was mapped near the head of Datlasaka Creek and occurs as small bodies elsewhere in the Datlasaka Mountains. It is a dark-green fine- to medium-grained rock in which epidote, formed by the alteration of plagioclase, is conspicuous.

The diorite extending from the Klehini River to Inspector Creek, across the southern end of Mineral Mountain, is a highly altered fine-grained variety locally resembling schistose greenstone.

The diorite on the ridge south-west of Squaw Creek is dark greenish-grey, fine- to medium-grained, massive to slightly schistose rock composed chiefly of albite, epidote, hornblende, and actinolite. Some of the diorite may also contain small amounts of chlorite, biotite, quartz, and apatite.

Sills or dykes of diorite mapped in detail on the Maid of Erin (Fig. 3), State of Montana (Fig. 5), Adams (Fig. 6), and Lawrence (Fig. 8) claims are described on pages 43, 48, 50, and 57 respectively.

The larger bodies of diorite shown on the map intrude Permo-carboniferous rocks, and the diorite shown near the confluence of Datlasaka and Nadahini Creeks may intrude Mesozoic rocks. Small bodies of diorite not shown on the map intrude rocks of probable Mesozoic age in the north-western part of the area, and pebbles of diorite occur in Paleocene conglomerate. The fact that diorite on the Maid of Erin and State of Montana claims is replaced locally by skarn suggests that this particular diorite is older than the granitic rocks, for it seems reasonable to relate the skarn at Rainy Hollow to the granitic intrusives.

Gneissic Quartz Diorite (10).

The granitic rocks in the Coast Mountains, which consist almost entirely of gneissic quartz diorite, have been mapped as a separate unit (10). Although they underlie an area of only about 65 square miles within the Squaw Creek-Rainy Hollow area, they form part of the composite batholith, known as the Coast Range batholith, that extends from south-western British Columbia to south-western Yukon.

The main contacts of the quartz diorite observed in the area strike north-westerly and dip at high angles. The gneissic structure in the quartz diorite and the stratification and foliation in the intruded rocks are essentially parallel to the contacts.

The quartz diorite is fairly uniform in texture and composition. It is mainly light-grey medium-grained gneissic blocky jointed rock. Locally, dark-grey coarse-grained porphyritic or spheroidal-weathering varieties were found. The quartz diorite is composed chiefly of quartz, andesine, brown biotite, and green hornblende. It also contains small amounts of orthoclase, micropegmatite (a microscopic intergrowth of quartz and orthoclase), chlorite, and muscovite and accessory apatite, sphene, zircon, garnet, and epidote.

An irregular body of mafic-rich diorite, up to 500 feet wide, was seen along the contact between quartz diorite and gneiss and schist in one place north of the Blanchard River. Elsewhere the contact between the quartz diorite and metamorphic rocks is gradational, with vague inclusions of gneiss and schist occurring in the quartz diorite, and dykes, sills, and lenses of granitic rock occurring in the gneiss and schist. In contrast to this, the contact between the quartz diorite and the greenstone and argillite is abrupt.

The quartz diorite intrudes rocks of probable Mesozoic age, and it is overlain in places by volcanic rocks that may be Late Tertiary. It is probably related to the other granitic rocks of the area, some of which are known to have been exposed to erosion before the Paleocene conglomerate was deposited.

Quartz Diorite and Granodiorite with Inclusions of Gneiss and Schist (11).

Two areas consisting of granitic rocks containing inclusions of gneiss and schist lie in the north-eastern corner of the region. These areas, which can be shown only approximately on the map, total about 10 square miles.

In the area west of Blanchard Lake the granitic rock is gneissic quartz diorite similar to that of the Coast Range batholith described in the preceding section, and the gneiss and schist are staurolite- and sillimanite-bearing varieties similar to those of Group 6. The inclusions are irregular masses ranging from a few feet to a few hundred feet across. Great variation occurs in the proportion of inclusions to quartz diorite.

In the area east of Blanchard Lake the granitic rock consists of granodiorite in addition to quartz diorite, and the inclusions comprise some marble and skarn and much gneiss and schist of the composition of quartz diorite in addition to gneiss and schist similar to those of Group 6. The granodiorite is light-grey to white, medium-to fine-grained massive rock composed chiefly of quartz, oligoclase, orthoclase, and biotite. A typical specimen of quartz diorite gneiss is a dark-grey fine-grained well-foliated aggregate of andesine, quartz, hornblende, and biotite and accessory apatite and sphene.

In one locality, near the south-western edge of the area of these rocks east of Blanchard Lake, medium- to coarse-grained rock consisting chiefly of white feldspar, green diopside, and brown garnet is abundant. Microscopic study of a typical specimen of this rock shows that most of the feldspar is medium- to coarse-grained orthoclase and some is medium- to fine-grained andesine. In places the orthoclase appears to replace the andesine. Minor constituents of the rock include quartz, micropegmatite, and apatite. In one place the rock contains calcite and druses lined with euhedral crystals of orthoclase up to an inch long. This peculiar orthoclase-rich rock containing skarn minerals appears to be granitic rock that has been largely replaced.

GRANITE AND GRANODIORITE (12).

Light-coloured granite and granodiorite, underlying about 5 square miles in the north-western corner of the Squaw Creek-Rainy Hollow area, have been mapped as a separate unit (12).

The two bodies along the Yukon Boundary consist mainly of medium- to fine-grained massive granite. The granite is composed chiefly of quartz, orthoclase, and albite or sodic oligoclase. Some specimens contain microcline and a small amount of hornblende.

The body near Blizzard Creek includes some medium- to fine-grained massive granodiorite. The granodiorite consists of quartz, orthoclase, microcline, sodic oligoclase, a small amount of biotite, and some accessory minerals.

In many places the margins of the granite and granodiorite bodies contain numerous angular inclusions of black fine-grained massive rock. These inclusions are composed on intermediate plagioclase, hornblende, biotite, and small amounts of clinozoisite, apatite, and magnetite. Some of the black rock resembles recrystallized greenstone and some resembles fine-grained mafic diorite.

The granite and granodiorite intrude rocks of probable Mesozoic age, and on Blizzard Creek may be overlain by basalt of Paleocene to Miocene age.

MAINLY GRANODIORITE AND QUARTZ DIORITE (13).

Several types of granitic rock, underlying about 125 square miles in the southern part of the Duke Depression and the St. Elias Mountains, have been grouped together for convenience in mapping and description. These rocks include granodiorite, quartz diorite, and small amounts of granite and diorite.

Although sharp contacts between these various rock-types were not seen, detailed work would probably lead to some subdivision of the group. Further mapping outside the Squaw Creek-Rainy Hollow area may show that some of the quartz diorite is a continuation of that in the Coast Mountains.

Granodiorite was found mainly in the vicinity of Kusawak Lake, the upper part of Stonehouse Creek, and the upper part of Seltat Creek. Quartz diorite, some of which is gneissic, was found mainly in the vicinity of Yokeak Creek, Clayton Creek, the Klehini River, and Inspector Creek.

Granite was seen about 4 miles south 60 degrees east of the head of Kusawak Lake and about half a mile south of the outlet of the lake at the head of Seltat Creek. The granite south-east of Kusawak Lake is a porphyritic variety consisting of pink subhedral crystals of orthoclase and microcline, up to 1½ inches long, in a grey medium-grained ground-mass of quartz, oligoclase-andesine, and biotite. The rock contains small amounts of chlorite, epidote, sphene, apatite, and magnetite. The granite near the head of Seltat Creek, on the other hand, is pink medium- to fine-grained massive rock composed of quartz, orthoclase, sodic-oligoclase, and a little biotite and chlorite.

Diorite was seen chiefly between 1½ and 2 miles south-east of the head of Kusawak Lake. In this locality it is dark-grey medium-grained gneissic rock composed of mainly andesine and hornblende and of almost 5 per cent. of quartz.

The rocks of this group intrude Permo-carboniferous strata and are overlain by Paleocene rocks to the north-east of Kusawak Lake. Furthermore, pebbles of some of the granitic rocks occur in abundance in Paleocene conglomerate.

FELDSPAR PORPHYRY (14).

Feldspar porphyry is exposed over an area of about half a square mile near the southern border of the area. It forms a conspicuous group of knolls, on the edge of the plateau overlooking the Klehini Valley, that show excellent glacial polishing and scoring.

The feldspar porphyry is dark-grey to greenish-grey fresh-appearing rock. It consists of abundant well-formed phenocrysts of zoned plagioclase averaging andesine and a minor amount of rounded phenocrysts of quartz in a ground-mass composed mainly of andesine laths, hornblende, and magnetite.

The feldspar porphyry intrudes the adjacent quartz diorite. The shape of the feldspar porphyry body and the position of a chilled contact in it indicate that it is a remnant of a southward-dipping sill.

The feldspar porphyry differs in texture from the other Mesozoic intrusives. However, because it is similar in composition to much of the Mesozoic granitic rock and because pebbles of porphyry resembling it occur in Paleocene conglomerate, the porphyry is grouped with the Mesozoic rocks rather than with the Cenozoic.

PALEOCENE ROCKS (15, 16).*

Volcanic and sedimentary rocks of Paleocene age underlie approximately 20 square miles in the Squaw Creek-Rainy Hollow area. They have been mapped as two groups: one (15) consisting of rhyolite and minor amounts of conglomerate, sandstone, and shale, the other (16) consisting of conglomerate, sandstone, and shale and a minor amount of rhyolite. The Paleocene rocks occur mainly along the south-western edge of the Kusawak Mountains, where they form a down-faulted block composed of beds that dip at low to moderate angles. In that area the dominantly volcanic group is overlain conformably by the dominantly sedimentary group. The thickness of each group exposed in the Kusawak Mountains may be in the order of 1,500 to 2,000 feet.

East of Nadahini Creek the rhyolite of Group 15 occurs as flows ranging from a few feet to at least 40 feet in thickness. Some of it is vesicular and some of it is amygdaloidal. In a few places the rhyolite has excellent columnar structure (Plate VI, B). Glassy rhyolite showing flow-banding and flow-breccia was seen at one locality.

Most of the rhyolite is buff-weathering, light greyish-pink very fine-grained slightly porphyritic rock. The small phenocrysts are generally albite and quartz and the ground-mass is mainly potash feldspar, quartz, and plagioclase. Some distinctly porphyritic rhyolite containing medium-grained phenocrysts of quartz and albite also occurs.

A remnant of a gently dipping rhyolite flow of probable Paleocene age caps the ridge 1½ miles north of Scottie Mountain. This rhyolite is light-grey slightly porphyritic vesicular rock containing small phenocrysts of quartz, albite-oligoclase, and biotite in a partly spherulitic ground-mass of mainly potash feldspar, quartz, and plagioclase.

A small patch of rhyolite and conglomerate of probable Paleocene age rests on Permo-carboniferous rocks 2 miles south-east of the head of Stonehouse Creek. This rhyolite is a white to light-grey flow-banded slightly porphyritic variety.

Rhyolite occurs as occasional thin flows and as small sills and dykes in the sedimentary rocks of Group 16. Some of these rhyolite sills and dykes near the southern end of the Kusawak Mountains show chilled margins, banded and spherulitic marginal

* These numbers correspond to those of map-units.

zones, and vaguely spherulitic centres. Microscopic study of a specimen of a dark-grey aphanitic spherulitic dyke showed that it contained abundant carbonate in addition to quartz, feldspar, and black opaque material.

Bodies of rhyolite too small to show on the map were seen 1 mile north-east of, and 1¼ miles west of, the outlet of Kusawak Lake.

Sills and dykes of quartz feldspar porphyry were mapped on the Adams (Fig. 6) and Lawrence claims (Fig. 8) and were seen in several other places at Rainy Hollow and near Mount Glave. These porphyries are generally buff-weathering, light-pink to light-grey rocks that contain phenocrysts of quartz, sodic plagioclase, and rarely orthoclase in a spherulitic to granular ground-mass consisting mainly of potash feldspar, quartz, and plagioclase. The plagioclase phenocrysts of most specimens examined were albite or oligoclase, but in one they were highly zoned and had cores of sodic andesine. These porphyries cut Permo-carboniferous rocks, including some skarn (Fig. 8), at Rainy Hollow, and they cut gneissic quartz diorite near Mount Glave. Their similarity in mineralogy and texture to some of the porphyritic rhyolites east of Nadahini Creek suggests that they may be Paleocene.

The sedimentary rocks forming most of Group 16 and occurring in small amounts in Group 15 include conglomerate, sandstone, and shale. The conglomerate varies from light to dark grey. Some of it forms well-defined beds, about 1 foot to 4 feet thick, but some of it is practically structureless. The conglomerate contains well-rounded fragments, generally between a fraction of an inch and a foot in diameter, of some of the older rocks of the area. These include several varieties of granitic rock, diorite, feldspar porphyry, argillite, limestone, schist, white quartz, and greenstone. In most cases the conglomerate fractures around the pebbles through the sandy matrix.

The sandstone is mainly grey, but some is brown. It generally forms well-defined beds about 2 to 6 inches thick. The shale is thinly bedded and is black, dark grey, or dark brown. Seams of coal, less than an inch thick, occur locally in the shale and sandstone.

Plant remains are abundant in places in black or dark-grey shale and in fine-grained dark-grey sandstone. The best collections were obtained from shale and sandstone of Group 16 at a locality in the southern part of the Kusawak Mountains, 4½ miles north of Mount Glave and at an altitude of approximately 5,700 feet. A collection made from this locality in 1945 was submitted to the Geological Survey, Department of Mines and Resources, Ottawa, for study. Dr. W. A. Bell, who examined the material, reported that it contained:—

Conifers.
- *Sequoia langsdorfii* (Brongniart) Heer.
- *Sequoia nordenskioldi* Heer.

Angiosperms.
- *Celastrus taurinensis* Ward.
- *Corylites hebridica* Seward and Holttum.
- *Magnolia* sp. nov. cf. *M. inglefieldi* Heer (pars).
- *Trochodendroides arctica* (Heer).
- *Castanea castaneæfolia* (Unger) Knowlton (non *Castanea orientalis* Chaney).
- *Juglans nigelloides* Berry.
- *Plantanus* sp.

and remarked that "The flora . . . is considered to be indicative of a Paleocene age. . . . The leaves were packed so closely in the sediments that overlapping obscures many of the margins, and many of the leaves are so large that only fragments are present in the collections submitted, making reliable identifications in many instances impossible."

A second collection from this locality made in 1946 was considered by Dr. Bell as "much better suited for studying the flora." He reported that it indicated Paleocene age and that it contained:—

Conifers.

Sequoia langsdorfii (Brongniart) Heer.

Taxites olriki Heer.

Angiosperms.

Acer arcticum Heer.

Alnus alnifolia (Goeppert) Hollick.

Alnus sp.

Carpinites truncatus Hollick

Carpolithus (Trochodendroides) arachioides (Lesquereux).

Castanea sp.

Ceanothus? sp.

Celastrus ferrugineus Ward.

Diospyros cf. *wilcoxiana* Berry.

Grewiopsis alaskana Hollick.

Hicoria magnifica Knowlton.

Myrica sp.

Pterospermites auriculaecordatus? Hollick. Cf. *Populus gaudini* Hollick (non Fisher-Ooster).

Quercus grœnlandica Heer.

Salix grœnlandica? Heer.

Salix sp. (pistillate ament).

Sapindus? glendivensis Knowlton.

Trochodendroides arctica (Heer).

Ulnus borealis Heer.

Vitis olriki Heer.

According to Dr. Bell, small collections of fragmentary and poorly preserved fossil plants from three other localities in Groups 15 and 16, marked on the map, "probably are of approximately the same age" as those in the southern part of the Kusawak Mountains.

The character of the Paleocene sedimentary rocks and the abundance of land plants in some of them suggest that they were deposited under terrestrial conditions, perhaps as large alluvial fans, flood-plains, and lake sediments.

PALEOCENE TO MIOCENE ROCKS (17).*

Volcanic and sedimentary rocks of Tertiary age, mapped as Group 17, occur along the north-eastern flanks of the Datlasaka Mountains and Squaw Range. They form north-westerly trending down-faulted slices that crop out over a total area of about 8 square miles. The rocks forming the main slice along the flank of the Datlasaka Mountains and those exposed on Blizzard Creek have synclinal structure. The group includes chiefly basalt, rhyolite tuff, and conglomerate.

The basalt is brown-weathering, dark-grey to black, vesicular or amygdaloidal rock. Columnar structure occurs in a few places, mainly along Blizzard Creek. Locally the basalt contains phenocrysts of labradorite up to one-half inch long and small phenocrysts of olivine. The ground-mass of a typical specimen of the basalt consists of labradorite and pigeonite with ophitic texture.

The rhyolite tuff is intercalated with basalt along the north-eastern flank of the Datlasaka Mountains. It is white indistinctly stratified rock consisting almost entirely of fragments of acid glass. Almost all the fragments are less than one-half millimetre in diameter. They contain abundant perlitic cracks and small elongate vesicles. Most of the fragments are round, having broken along approximately spherical perlitic cracks, but some of them are angular. In addition to glass, the tuff contains a few angular grains of quartz, albite-oligoclase, and orthoclase.

* This number corresponds to that of map-unit.

In several places black carbonaceous shale and petrified wood occur abundantly as float near outcrops of rhyolite tuff. The conglomerate occurs mainly along the north-eastern flank of the Datlasaka Mountains. It consists of well-rounded pebbles, cobbles, and boulders of volcanic rocks. Most of them are rhyolite, but a few are basalt. The matrix is composed mainly of fine fragments of rhyolite. Light-grey perlite was observed in the matrix in a few places. Most of the rhyolite of the conglomerate differs from that of Groups 15 and 16 by being red or white, distinctly flow-banded, and aphanitic or glassy. A specimen of red rhyolite from the conglomerate consists of acid glass containing feldspar microlites, dark opaque material, and small spherulites of cristobalite.

A small collection of fossil plants was obtained from white rhyolite tuff at the locality marked on the map. The lot was reported by Dr. W. A. Bell, of the Geological Survey, to contain:—

Conifers.

Cf. *Sequoia couttsiae* Heer.

Pityophyllum sp.

Angiosperms.

Prunus? sp. (if generic reference is correct, comparable with *Prunus integrifolia)*.

He states that "they are considered to be not older than Paleocene but a younger Oligocene or Miocene age is not precluded."

Coal-bearing sandstone, shale, and conglomerate exposed on the southern bank of Talbot Creek about 1,500 feet south-west of the Dalton Trail appears to be a continuation of the belt of basalt, rhyolite tuff, and conglomerate and, possibly, should be included in Group 17. Coal-bearing sandstone on the upper part of Squaw Creek may be of similar age.

LATE TERTIARY ROCKS (18).*

A few small patches composed mainly of flat-lying lava-flows and pyroclastic rocks occur in the Coast Mountains and the Blanchard Valley. These rocks, comprising basalt and minor amounts of basalt tuff, basalt agglomerate, and conglomerate, have been mapped as Group 18.

The patches above timber-line are very conspicuous because they weather reddish-brown and because they form low buttes (Plate VII, A).

Much of the basalt is vesicular or amygdaloidal, and much has excellent columnar structure. It is dark-grey to black rock containing small phenocrysts of labradorite and olivine in a ground-mass composed mainly of plagioclase, pigeonite, and glass.

Basalt tuff, basalt agglomerate, and conglomerate are exposed best in the lower part of the patch lying 2½ miles south of Blanchard Lake. The tuff and agglomerate consist chiefly of subangular fragments of black vesicular glassy basalt and dark-grey vesicular fine-grained basalt in a fine-grained matrix composed of fragments of black basaltic glass, crystals of labradorite, and crystals of clinopyroxene.

The tuff and agglomerate are interbedded with dark-grey conglomerate containing chiefly well-rounded cobbles and boulders. Most of the cobbles and boulders are basalt, but a few are quartz diorite and white quartz. Occasional layers of fine conglomerate showing cross-bedding occur in the coarse conglomerate.

The basalt that is well exposed on high cliffs about 2½ miles east of Blanchard Lake is part of a composite intrusive consisting of several steeply dipping irregular layers having approximately horizontal columnar joints.

Dykes of fresh basalt cutting quartz diorite on Seltat Creek near the Klehini River may belong to Group 18.

The rocks of Group 18 rest unconformably on argillite of Group 5, gneiss and schist of Group 6, and gneissic quartz diorite of the Coast Range batholith. They are considered to be younger than the rocks of Group 17 because they are undeformed.

* This number corresponds to that of map-unit.

Their occurrence in both the Coast Mountains and the Blanchard Valley suggests that they were laid down on a surface having relief very similar to that of the present surface. However, they are definitely older than the last glaciation, for they are partly covered with unweathered drift and erratics in many places. No evidence was seen that any volcanism had occurred after an earlier stage of Pleistocene glaciation. It is probable, therefore, that the rocks of Group 18 are Late Tertiary.

PLEISTOCENE AND RECENT DRIFT AND ALLUVIUM (19).*

A fairly thick, almost continuous mantle of glacial drift covers approximately 75 square miles of the Squaw Creek-Rainy Hollow area. The drift-cover is most extensive in the northern part of the area, particularly in the Tatshenshini and Blanchard Valleys and between Kelsall Lake and the Datlasaka Mountains. The thick extensive mantle occurs below an altitude of 3,500 to 4,000 feet, but only small patches of drift, moraines of valley glaciers, and erratics occur above this altitude.

The main deposits of glacial drift in the area are described in the section on glaciation in chapter II and in the section on Squaw Creek in chapter V.

Deposits of Recent alluvium, mainly stream-gravels, cover a very small part of the area.

* This number corresponds to that of map-unit.

CHAPTER IV.—STRUCTURAL GEOLOGY.

The structure of the Palæozoic and Mesozoic rocks of the Squaw Creek-Rainy Hollow area was not determined with certainty, mainly because of the scarcity of horizon-markers and of primary structures by which the tops of beds could be recognized. Discontinuity of the beds caused by large intrusives in the southern part of the area and by wide drift-filled valleys and by intrusives in the northern part of the area added greatly to the problem. Furthermore, faults may be numerous in the area, but they can be recognized with certainty only where they bring rocks of different kinds adjacent to each other. Because of these difficulties, only a generalized and perhaps greatly oversimplified picture of the structure was obtained.

In general, the Palæozoic and Mesozoic rocks strike north-westerly and dip steeply.

The attitudes of the Permo-carboniferous rocks at Rainy Hollow suggest that the general structure is a northward plunging syncline having a north-westerly striking gently dipping western limb and a north-easterly striking steeply dipping eastern limb. East of Inspector Creek near Copper Butte a northward plunging low anticline may occur on the eastern limb of the major structure.

The Permo-carboniferous rocks composing the north-western part of Mineral Mountain appear to form a syncline which plunges steeply to the north.

The attitudes of the Permo-carboniferous rocks forming the Datlasaka Mountains suggest that the general structure is a north-westerly-trending syncline having limbs that dip at moderate to steep angles. This syncline appears to continue to the north-west of the Parton River valley, with a slight offset of the axis toward the south-west.

The Permo-carboniferous rocks exposed on opposite sides of the north fork of Talbot Creek and of the upper part of Squaw Creek evidently form the limbs of a north-westerly trending anticline which is faulted along the axis.

The Mesozoic pillow lava of Group 3, which occurs on the ridge north-east of the upper part of the Tatshenshini River, forms a north-westerly trending anticline having a steeply-dipping north-eastern limb and an almost vertical south-western limb. The Mesozoic volcanic and sedimentary rocks of Group 4 lying south-west of the Tatshenshini Valley strike north-westerly and dip to the south-west and may form part of the south-western limb of this anticline. The rocks of Groups 4 and 5 lying north-east of the Tatshenshini Valley strike north-westerly and dip to the north-east and may form part of the north-eastern limb of the fold.

The metamorphic rocks in the Coast Mountains, mapped as Group 6, strike north-westerly and dip steeply to the north-east. They also may form part of the north-eastern limb of the north-westerly trending anticline.

The gabbro (8) exposed on the bench along the north-eastern flank of the Datlasaka Mountains shows banding that strikes north-westerly and dips almost vertically. The gneissic structure of the quartz diorite (10) in the Coast Mountains strikes north-westerly and, in general, dips steeply to the north-east. The gneissic structure shown in some of the quartz diorite exposed on the plateau between Mount Glave and the Alaska Boundary near Pleasant Camp also strikes north-westerly and dips steeply.

The main faults in the area are those along the south-western flank of the Kusawak Mountains and the north-eastern flank of the Datlasaka Mountains and Squaw Range, which separate slices of Tertiary rocks from some of the older rocks of the area. These faults strike north-westerly and dip very steeply. The Tertiary rocks have moved downward relative to the older rocks. The rocks adjacent to the faults are highly sheared, crushed, and contorted. In several places, particularly at the southern end of the Kusawak Mountains and at the northern end of the Datlasaka Mountains, the Tertiary rocks are not bounded by a single fault but by a system of parallel and intersecting faults too complex to show on the map.

The Tertiary rocks along the south-western flank of the Kusawak Mountains dip very gently in most places. At the south-eastern end of the belt mapped, however, the rocks dip at moderate angles toward the north-east.

The Tertiary rocks along the north-eastern flank of the Datlasaka Mountains form, in general, a syncline with a steeply dipping south-western limb and a gently dipping north-eastern limb. In detail, however, the structure is complex because of minor faulting.

Other north-westerly trending faults, along which blocks of gently dipping Tertiary rocks have been dropped down into older rocks, occur west of Nadahini Creek and near the head of Squaw Creek.

A north-westerly trending belt of highly sheared Mesozoic greenstone of Group 4 extends from Kwatini Creek to Stanley Creek along the bench that lies south-west of the mountains. Much of the greenstone in this area has been altered to a conspicuous brown-weathering, light-grey fine-grained assemblage of albite, quartz, and ankeritic carbonate cut by numerous veinlets of quartz and carbonate.

CHAPTER V.—ECONOMIC GEOLOGY.

INTRODUCTION.

The main mineral production from the Squaw Creek-Rainy Hollow area has been placer gold, estimated to total approximately 5,000 oz., obtained from Squaw Creek. This creek was staked first in 1927 and, although mining activity on it subsided around 1940, it is still being worked at present. Other creeks in the area are known to contain gold, but none has yielded it in paying quantities.

Lode deposits containing copper-silver, lead-zinc-silver, and copper-iron are numerous in parts of the area, and gold-bearing quartz veins occur in a few places. Lode deposits were staked first in the area at Rainy Hollow in 1898 and considerable work has been done on some claims. Production, however, has totalled only about 160 tons, consisting chiefly of copper-silver ore shipped between 1911 and 1922 from the Maid of Erin property at Rainy Hollow.

Coal occurs in some of the Tertiary rocks of the area, but the known seams, 1 inch to 8 inches thick, are too thin to be of value.

PLACER DEPOSITS.

Descriptions of Creeks.

Squaw Creek. Squaw Creek begins in British Columbia near the 137th meridian and flows north-westward to join the Tatshenshini River in Yukon Territory. The upper 5 miles of the creek lie in the north-western corner of the Squaw Creek-Rainy Hollow area and the remaining 5 miles lie in the Yukon.

The upper part of Squaw Creek may be reached conveniently by a tractor road built in 1946 by F. Muncaster, W. Ainge, and G. Gray, that connects with the Haines Road about three-quarters of a mile south-east of Stanley Creek. The distance from the Haines Road to the head of Squaw Creek by this route is approximately 10 miles, and the highest point is the pass, with an altitude slightly less than 5,000 feet, between the head of Squaw Creek and a tributary of Talbot Creek. Squaw Creek also may be reached from the Haines Road via a shorter but steeper route by following the Dalton Trail north-westward from Stanley Creek for about 2½ miles, thence following a trail which branches off to the west for an additional 2½ miles, whence the tractor road is reached. Squaw Creek is accessible also by trails leading from the Haines Road near Dalton Post in Yukon Territory. The upper trail to Squaw Creek at the British Columbia-Yukon Boundary is about 15 miles long. All routes to Squaw Creek require crossing the Tatshenshini River. In order that the river may be forded safely the crossing-place should be chosen with care and the crossing should be made at a low stage of the water. The tractor road crosses the Tatshenshini where it is split up into several channels and is, consequently, the safest route.

The first claim was staked on Squaw Creek in 1927 by Paddy Duncan, an Indian from Klukshu. The discovery claim lay in British Columbia about half a mile up-stream from the Yukon Boundary (Fig. 2, in pocket). By the autumn of 1927 more than fifty claims were staked along the part of Squaw Creek lying in British Columbia, and by the following year the creek was staked along almost its entire length. During the thirties, twenty to forty-five people worked each summer on Squaw Creek in British Columbia, but during the war few people continued mining there. In the summer of 1946, when the writer visited Squaw Creek, no one was working the creek, but in the late autumn F. Muncaster, W. Ainge, and G. Gray, having completed their tractor road, did a few days' work before freeze-up.

Descriptions of Squaw Creek and of the mining activity on it during 1932 and 1933 have been written by Mandy (1932, pp. 74–79; 1933, pp. 90–93).

The official records and estimates of the Gold Commissioners totalling about 3,500 oz. are probably incomplete. The total gold production of the British Columbia section of Squaw Creek is estimated to be approximately 5,000 oz.

Much of this production consisted of very coarse gold. Nuggets weighing more than an ounce were common and one weighing 46 oz. 5 dwt. was found in 1937 on Discovery claim by E. Peterson and B. Turbitt (illustrated in Frontispiece, *Minister of Mines, B.C.*, Ann. Rept., 1937).

At the beginning of June, 1947, the following placer-mining leases were held on the British Columbia section of Squaw Creek (Fig. 2):—

No. 851, Princess, owned by Frances Muncaster.

No. 854, Morning Glory, owned by J. A. Robertson (9/10) and Frances Muncaster (1/10).

No. 1115, Ophir, owned by William Ainge.

No. 1224, Four Aces, owned by G. R. Gray.

In addition, placer claim No. 9-89, No. 6 above Discovery, held by Frances Muncaster, was in good standing.

The bed-rock exposed on the parts of Squaw Creek and its tributaries mapped (Fig. 2) consists mainly of limestone, marble, greenstone, and argillite. Much of the limestone and marble is a dark-grey to black thinly bedded rock with argillaceous and graphitic partings. Some of the marble has a conspicuous white to cream colour and locally is rusty on weathered surfaces; it is apparently derived from the dark limestone by recrystallization and bleaching.

Two main types of greenstones are distinguished on the map. One consists chiefly of schistose varieties and chlorite-schists interbedded with the limestone and argillite. Some of the schistose greenstones are calcareous, others are siliceous, and others contain pyrite and consequently are rusty-weathering. The other principal type of greenstone is a massive amygdaloidal variety exposed mainly in the lower canyon of Paddy Creek (north fork of Squaw Creek). It is a dark-green fine-grained rock composed essentially of recrystallized plagioclase and amphibole containing amygdules of epidote and quartz.

Some of the argillites are brown-weathering siliceous rocks, others are calcareous rocks which grade into limestone, and others resemble slate and graphite schist. The quartz-sericite schist, quartzite, and other highly siliceous rocks are not abundant, and form only two outcrops large enough to be mapped.

Sheared altered diorite, somewhat resembling greenstone, is exposed in several places on the southern side of Squaw Creek, opposite the mouth of Paddy Creek. The distribution of outcrops suggests that the diorite forms a single intrusive, the base of which dips gently northward and cuts across limestone and argillite. Sheared waxy serpentine having contacts which are conformable with the adjacent limestones is exposed for about 250 feet on Ahmoi (Goat) Creek. In general the bedding and foliation of the rocks in the area mapped (Fig. 2) strike north-westward and dip at moderate to steep angles to the south-west. Several plunging folds and a few faults are indicated by the limited outcrops, suggesting that the structure is complex in detail.

South-east of the area mapped, Squaw Creek Valley is underlain mainly by limestone, greenstone, and argillite. Small bodies of diorite in limestone and argillite are abundant on the ridge between Squaw Creek and Paddy Creek, and talus of this rock mantles much of the south-western slope of the ridge. Near the head of Squaw Creek yellow to brown sandstone containing coal-seams forms a narrow down-faulted block, which is exposed in the bottom of the valley. Muncaster Creek (south fork of Squaw Creek) drains an area underlain mainly by limestone, argillite, chlorite-schist, greenstone, and diorite. The ridge south-west of the part of Squaw Creek mapped (Fig. 2) is composed chiefly of limestone and argillite intruded by massive to sheared bodies of altered diorite. Paddy Creek and its tributaries drain an area underlain by limestone, argillite, cherty quartzite, and greenstone intruded by a large body of granite and by smaller bodies of serpentinized peridotite, gabbro, and diorite.

Extensive deposits of unconsolidated material conceal bed-rock in much of the area mapped. Most of this material is Pleistocene till and stratified drift, but some is Recent stream-gravel. Inadequate cliff-exposures and lack of time prevented a study of the complexities of the unconsolidated deposits. However, it appears that the Pleistocene deposits consist essentially of till overlain by stratified drift; and the Recent stream-gravels are mainly reworked glacial material. Grey boulder-clay up to several feet thick was observed directly overlying bed-rock in a few places. Several cut-banks below the mouth of Paddy Creek expose deposits of gravel, sand, and clay reaching a thickness of approximately 300 feet and apparently resting on the till. Persistent horizontal beds of sand and clay may be seen in some of these exposures. The upper surfaces of these deposits slope gently down-stream and, in general, do not correspond closely in altitude on opposite sides of the valley. On the north-eastern side of Squaw Creek, immediately north of the British Columbia-Yukon Boundary, a high bench composed of gravel and sand terminates in a hummocky, slumped belt pitted with kettles. The deposits of gravel, sand, and clay which form the benches apparently include kame terraces built by streams flowing between the valley-walls and an ice-lobe in the valley-bottom. Near the British Columbia-Yukon Boundary they also include deposits washed into lakes formed by the blocking of the lower part of Squaw Creek Valley and the broad Tatshenshini Valley by stagnant ice after the ice had disappeared from the upland.

Since the close of the Pleistocene, Squaw Creek has cut through or cut back the deposits of drift which either blocked or flanked its valley. Much of the fine-grained material cut into was washed away, but some of the coarse material has remained to contribute to the bouldery gravel of the low terraces and of the present channel and flood-plain of Squaw Creek.

The physiographic history of the British Columbia section of Squaw Creek cannot be understood fully until more is learned about the complex history of the lower part of Squaw Creek and of the Tatshenshini River. However, it appears that the upper part of Squaw Creek had reached an early mature stage of erosion by the beginning of the Glacial epoch. During the Pleistocene ice invaded this part of the valley at least once, but, judging from the present topography, it caused very little erosion. As the ice retreated for the last time, deposits of gravel, sand, and clay were laid down above the till in marginal glacial streams and in pro-glacial lakes. After the retreat of the ice, Squaw Creek cut into these deposits, forming a narrow, bouldery flood-plain. Later the creek cut down into this flood-plain, leaving remnants of it as benches a few feet above its present flood-plain and channel.

Mining has been done in the present flood-plain and channel of Squaw Creek and in parts of the low benches which occur along the creek in several places. The depth to bed-rock in the creek ranged from about 8 feet on *No. 1 below* Discovery to about 4 feet on *No. 6 above.* Down-stream from *No. 1 below* and up-stream from about *No. 7 above* the depth increased (Mandy, 1932, p. 78).

The average grade of the part of Squaw Creek mapped (Fig. 2) is a little more than 7 per cent. Most of it is between 6 and 8 per cent., but for a distance of about 400 feet immediately south of the British Columbia-Yukon Boundary it is approximately 4 per cent., and for a distance of about 500 feet immediately up-stream from the final post of the Four Aces lease it is approximately 10 per cent. The average grade of the part of Paddy Creek mapped is about 15 per cent. In part of the lower canyon, Paddy Creek falls almost 100 feet in a horizontal distance of 200 feet.

Usually the maximum flow of Squaw Creek occurs in June and the creek is low by August. On August 4th, 1946, the flow of Squaw Creek west of Gray's cabin was about

35 cubic feet per second. On August 20th, after a heavy rain, the flow at the same place had increased to approximately 45 cubic feet per second.

Most of the mining on Squaw Creek was done by simple hand methods, but some was done by hydraulicking between Discovery and the mouth of Ahmoi Creek. The presence of numerous large boulders caused great difficulty in working the creek by these methods. F. Muncaster, W. Ainge, and G. Gray hoped to overcome most of this trouble by using the tractor which they took in from the Haines Road in 1946.

The placer concentrates from Squaw Creek commonly contain nuggets of native copper, in addition to black sand and fine pyrite. Most of these nuggets are small, but some weigh as much as 15 lb. It is interesting to note that native copper occurs in several streams along the north-eastern flank of the St. Elias Mountains, in Yukon Territory and Alaska. In a few places it has been shown that the copper has been derived from amygdaloidal greenstones of Carboniferous age (Cairnes, 1915, pp. 133–141).

Much of the gold from Squaw Creek occurred as coarse irregular nuggets. It is reported that many of these nuggets contained quartz. On the other hand, some of the gold was well-rounded. Narrow quartz veins and silicified rock, which locally contains disseminated pyrite, occur in a few places along Squaw Creek. Several rusty quartz veins, ranging from a few inches to two feet wide, are exposed along the part of Ainge Creek included in the map. Rusty silicified limestone is abundant near the diorite bodies on the ridge south-west of Squaw Creek, and narrow quartz veins are abundant in the diorite itself. Slightly rusty quartz veins are numerous on the ridges at the head of Muncaster Creek, and quartz float is very abundant on the talus-covered slopes in this vicinity. Grab samples from two veins on Ainge Creek and two at the head of Muncaster Creek assayed: Gold, *nil*. However, the occurrence of irregular coarse nuggets containing quartz strongly indicates some local source. The abundance of quartz veins in the area suggests that even if only a very small proportion of the veins which had been eroded were gold-bearing, they could have provided most of the gold now concentrated in Squaw Creek.

Blizzard (Gold Run) Creek. Gold was discovered on Blizzard (Gold Run) Creek about 1½ miles from its mouth in the autumn of 1933 by H. Darud (Mandy, 1933, p. 93). It is reported that fifteen claims and two leases were staked that autumn and that great activity took place on the creek in the early part of the following summer.

Blizzard Creek rises in high mountains in the north-western part of the area mapped and flows north-eastward, in general, to join the Tatshenshini River near the mouth of Stanley Creek. The upper half of the creek is underlain mainly by limestone and other sedimentary rocks and the lower half is underlain mainly by greenstone, basalt, and granodiorite. Although Blizzard Creek is approximately 7½ miles long, most of the work appears to have been done in a 2-mile section in the lower part, immediately west of the Tatshenshini Valley. This section occupies a youthful valley cut by the stream into the broad, rolling rock-bench that flanks the Tatshenshini Valley.

Although the prospectors found fine gold in the creek gravel, most of them were soon discouraged because they found no nuggets and because they had great difficulty handling large boulders. It is reported that none of the work done on Blizzard Creek even approached being profitable.

Klehini River. During the summer of 1914 more than 100 creek and bench placer claims were located along the Klehini River between Rainy Hollow and Pleasant Camp on the British Columbia-Alaska Boundary (Brewer, 1914, p. 94). It is reported that very fine gold mixed with a large proportion of black sand was obtained from some of the claims. However, no one found gold in paying amount and the claims were soon abandoned.

Prospecting Possibilities.

In addition to the placer deposits at Squaw Creek, important placers have been found to the south of the area in Alaska and to the north of the area in Yukon Territory. Porcupine Creek, which enters the south side of the Klehini River about 6 miles down-stream from Pleasant Camp, yielded approximately $1,200,000 worth of gold between 1898 and 1916 (Eakin, 1919, p. 24). A considerable quantity of gold has been recovered from Shorty Creek, near the southern end of Dezadeash Lake, about 25 miles north of the British Columbia-Yukon Boundary. These productive creeks are evidence that conditions favourable to the formation and preservation of placer deposits occurred in several parts of a large region, and it seems reasonable to hope that similar conditions yielded placers elsewhere in the region. Some of the favourable conditions at Squaw Creek may have been its escaping severe glacial erosion and its draining an area containing numerous quartz veins. If these were important factors, then other streams in the area that are similar in these respects are worth prospecting. Undoubtedly many streams in the area already have been tested in places. For example, it is reported that some unsuccessful work was done on the northern side of Stanley Creek about 2 miles from its mouth, but it is not known whether bed-rock was reached. Furthermore, prospectors have worked in parts of the area since 1898 and probably they have panned most of the creeks. In spite of this, Squaw Creek was not discovered until 1927, and it is certain that many of the streams in the area have not been tested on bed-rock even now, except where the gravels are very shallow. In conclusion, it seems unlikely, in view of the amount of prospecting which has been done, that the Squaw Creek-Rainy Hollow area contains many undiscovered, rich shallow placers. However, the possibility that the area contains deeper deposits discoverable only by hard careful work has not been eliminated.

LODE DEPOSITS.

The lode deposits of the Squaw Creek-Rainy Hollow area are replacement deposits in skarn and gold-bearing quartz veins. The former consist essentially of: (1) bornite-chalcocite deposits containing important amounts of silver, (2) galena-sphalerite deposits containing minor amounts of silver, (3) pyrrhotite-sphalerite-chalcopyrite deposits, and (4) magnetite-chalcopyrite deposits. The first three types occur chiefly in the area including Mineral Mountain and Copper Butte, known as Rainy Hollow, and the fourth type occurs near Clayton Creek in what is known as the Three Guardsmen area, after the local name for Mount Glave.

Rainy Hollow.

The replacement deposits at Rainy Hollow occur in sedimentary rocks of Permo-carboniferous age that have been intruded and metamorphosed by a large body consisting mainly of granodiorite and quartz diorite. The deposits have been found in large numbers in an area of approximately 7 square miles that extends from the granitic contact on the south-western side of Mineral Mountain, near the Klehini River, to the granitic contact near a tributary of Seltat Creek about 4½ miles to the north-east. Crown-granted claims covered most of this area at one time, but some of them have been allowed to lapse in recent years.

The metamorphosed sedimentary rocks consist mainly of argillite, quartzite, gneiss, and schist. They also include some layers of white and light-grey marble up to 500 feet thick.

On the south-western side of Mineral Mountain the sedimentary rocks strike north-westward and dip gently to the north-east, and on the southern side they strike eastward and dip to the north at moderate angles. Elsewhere in the area the rocks strike north-eastward and dip steeply to the north-west. These attitudes suggest that the general structure is a northward plunging syncline having a gently dipping western limb and a steeply dipping eastern limb. East of Inspector Creek near Copper Butte a northward plunging low anticline may occur on the eastern limb of the major structure. Faults and small folds were seen in some of the places studied in detail and may be present in other parts of the area.

The sedimentary rocks have been intruded on the north, east, and west by granitic rocks. They are also cut in places by dykes and sills of gabbro, diorite, and quartz feldspar porphyry. The gabbro and diorite are older than the skarn and the mineralization, but the porphyry is younger than the skarn and probably younger than the mineralization.

The deposits consist of lenses of fairly massive sulphides and of disseminated sulphides in skarn. The skarn occurs not at the margin of the granitic body, but mainly along contacts of marble with argillite, quartzite, schist, or gneiss. Skarn does not occur along all contacts, nor is all of it mineralized.

Several varieties of skarn having distinctive mineral compositions or textures can be recognized in the field; these are described in the detailed reports on properties which follow. It has been noticed that the bornite-chalcocite mineralization, which is the most important type in the area, favours skarn containing an abundance of yellowish-green garnet (resembling epidote in colour). On the other hand, skarn consisting mainly of brown garnet does not seem to be favourable to mineralization of any kind. The bornite-chalcocite deposits occur on the south-western side of Mineral Mountain and along the western side of Copper Butte, and the galena-sphalerite and pyrrhotite-sphalerite-chalcopyrite deposits occur throughout the rest of the area.

The bornite-chalcocite deposits contain variable amounts of sphalerite, chalcopyrite, and wittichenite (copper bismuth sulphide). Locally the galena-sphalerite deposits may contain small quantities of chalcopyrite, and the pyrrhotite-sphalerite-chalcopyrite deposits small quantities of galena and pyrite. The silver content of the bornite-chalcocite deposits averages about 1½ oz. to the per cent. of copper. The silver content of the galena-sphalerite deposits is much lower, averaging in the neighbourhood of 0.2 oz. to the per cent. of lead. Judging from previous reports, the precious-metal content of the pyrrhotite-sphalerite-chalcopyrite deposits is negligible. Samples of this type of mineralization, taken by the writer from the Mocking Bird claim and the Gilroy fraction, assayed: Gold, *nil*; silver, *nil*; and gold, 0.01 oz. per ton; silver, *nil*, respectively.

Much of the Rainy Hollow area lies above timber-line and has abundant outcrops. Claims were first staked in this part of the area as early as 1898. Numerous open-cuts and other workings indicate that this part of the area has been prospected thoroughly, and it is improbable that any important discovery could be made by simply going over the surface again. The lower part of the area is thickly wooded and much of it is covered with drift. Consequently, this part has not been prospected as effectively as the rest and may offer possibility of additional discoveries. There is, however, no reason to expect that deposits found in this part of the area would be larger than those already known.

Several deposits of high-grade mineralization have been found at Rainy Hollow, but none has proved to be large. The best showings, with respect to both grade and size, are the bornite-chalcocite deposits on the Maid of Erin claim. This property was purchased in 1946 by the St. Eugene Mining Corporation, Limited, which plans exploring it, encouraged by high metal prices and the improvement in transportation afforded by the Haines Road.

Detailed descriptions and maps follow of parts of the Maid of Erin, State of Montana, Adams, Victoria, and Lawrence claims. These properties were examined in detail because they include the largest showings, because they are the claims on which most work has been done, and because the mineralization displays geological relationships regarded as typical of the area. Exposures at the properties not described in this report consist mainly of smaller showings of the same types of mineralization or of low-grade pyrrhotite-sphalerite-chalcopyrite mineralization. Brief descriptions of many of the claims in the area are included in a report by McConnell (1913, pp. 30–33), and in Annual Reports of the British Columbia Minister of Mines, especially for the years 1900, 1907, 1914, 1918, 1921, 1927, and 1931.

Maid of Erin. The Maid of Erin Crown-granted claim, on which copper-silver mineralization occurs, is owned by the St. Eugene Mining Corporation, Limited. After holding an option on the claim since 1943, this corporation bought the Maid of Erin in 1946 from Richard Kennedy, of Haines, Alaska.

The Maid of Erin lies on the south-western slope of Mineral Mountain, 2¼ miles north-west of and about 1,500 feet higher than the hairpin bend in the Haines Road at Rainy Hollow. The part of the claim that was mapped (Fig. 3) ranges in altitude from 3,200 to 3,700 feet. Some of this area is occupied by a gently sloping, hummocky bench, but most of it is steeply sloping. Beyond the area mapped the ground continues to rise steeply to the north-east toward the top of Mineral Mountain and to fall steeply to the south-west toward the Klehini River (Plate II, B). The claim lies above timber-line and has numerous outcrops in most places.

The property is accessible from the Haines Road by approximately 3½ miles of tractor road built in 1918, which starts at the abandoned construction camp near the hairpin bend. The first 2 miles of this road are now badly overgrown, and the bridge across Inspector Creek has been swept away.

The Maid of Erin, which includes ground staked originally in 1900 as the Carmichael and Pretoria claims, was located in 1903 and was Crown-granted in 1910. Considerable work was done on the property at intervals during the first fifteen years, notably in 1918. However, most of the development, including about 250 feet of underground work, was done between 1920 and 1922 when the property was under bond to Robert Wiley of Seattle. In 1928 the Maid of Erin was explored with 339 feet of diamond-drilling by the Calumet and Arizona Company, but since then it has lain idle.

Sorted ore totalling 157 tons was shipped to Tacoma from the property in 1911, 1918, 1921, and 1922. This yielded 77,658 lb. of copper, 5,849 oz. of silver, and 6 oz. of gold.

The Maid of Erin has been described at various stages of its development by Robertson (1907, p. 46), McConnell (1913, pp. 30, 31), Brewer (1914, p. 95), Clothier (1918, pp. 86, 87, and 1921, pp. 76, 77), and James (1927, pp. 110, 111).

Geology.

The rocks exposed (Fig. 3) are quartzites, marble, and argillite of Permo-carboniferous age, skarn which replaces mainly marble, quartz diorite which forms part of a batholith, a small body of diorite, and one of gabbro. In most places the quartzites, marble, and argillite strike north-westward and dip at low angles to the north-east. The mineralization, consisting mainly of bornite and chalcocite, occurs as irregular replacement deposits in various types of skarn.

Most of the quartzites are light-coloured highly feldspathic varieties. In places, however, brown biotite-rich beds, usually less than an inch thick, alternate with white feldspar-rich beds. The feldspathic quartzites are composed chiefly of fine-grained quartz, albite, and orthoclase in various proportions; some also contain small amounts of biotite, hornblende, apatite, sphene, and magnetite. The brown beds include much fine-grained biotite and muscovite, in addition to quartz, albite, orthoclase, and accessory minerals. In some of the feldspathic quartzites, small lenses, thin streaks, and narrow veinlets of light-green diopside or light-brown garnet are abundant.

The marble exposed at the surface is light-grey medium- to coarse-grained rock in which bedding is rare. It occurs as irregular lenticular bodies which trend northward to north-westward and dip gently to the east. Some of the irregularity appears to have been caused by flowing of the marble and by faulting. Underground, near the face of

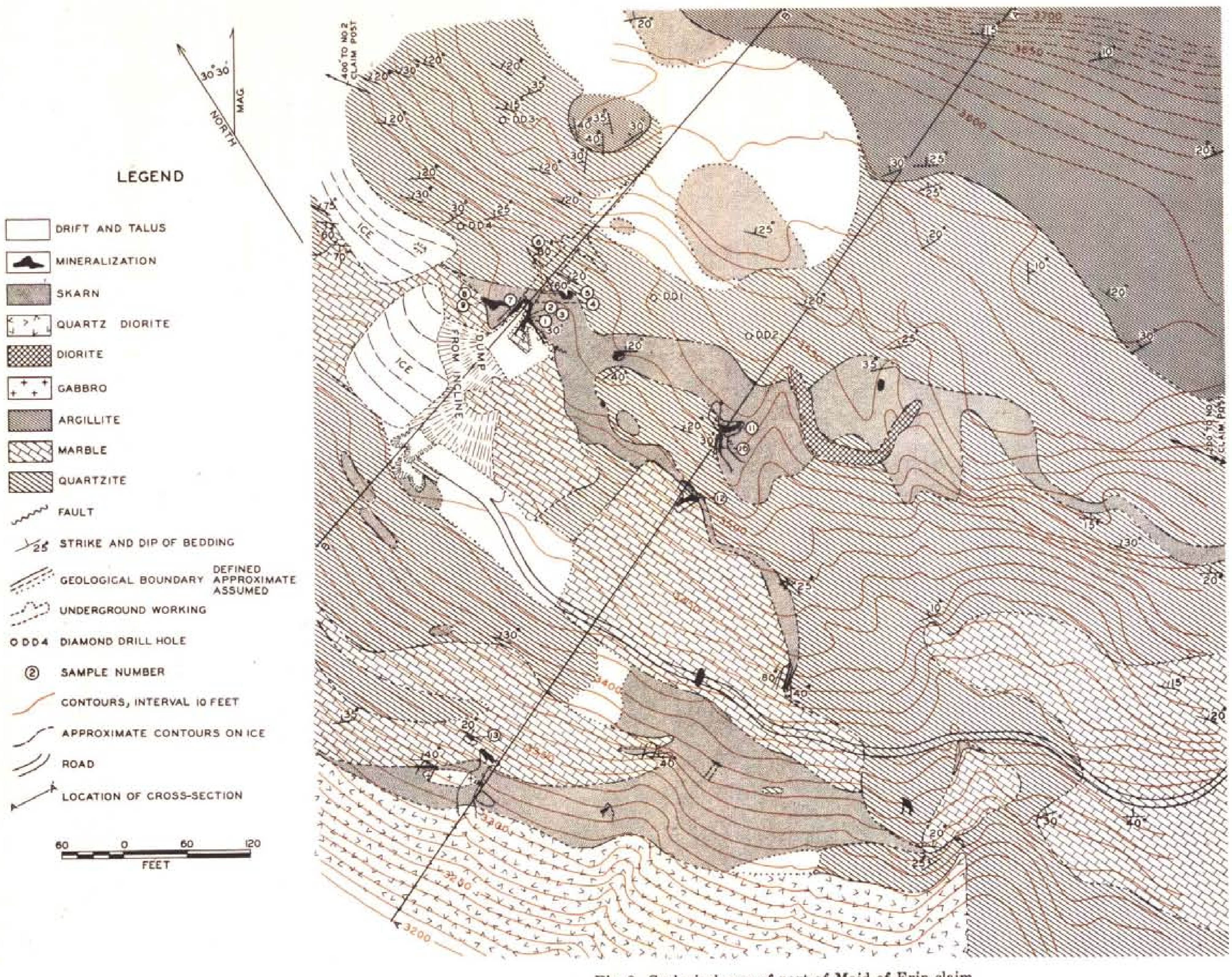


Fig. 3. Geological map of part of Maid of Erin claim

#25 ①

the incline (Fig. 4), much of the marble is medium-grained dark-grey rock containing numerous irregular lenses and veins of coarse white calcite. In places this rock is a breccia consisting of fragments of dark-grey marble in a matrix of white calcite.

The argillite, overlying quartzites and skarn in the eastern corner of the area mapped, is a black variety in which biotite is visible locally.

The quartz diorite, which intrudes the Permo-carboniferous rocks in the western corner of the area, is part of a granitic body exposed for at least 3 miles west of the Maid of Erin. Most of the contact mapped on the claim strikes north-westward and dips gently to the north-east, but the south-eastern part strikes north-eastward and dips steeply. The quartz diorite is light-grey medium-grained massive unaltered rock composed mainly of andesine, orthoclase, quartz, and biotite. Some of the plagioclase crystals are zoned, having labradorite cores and oligoclase rims. Chlorite, apatite, zircon, and pyrite are present in minor amounts.

The diorite occurs as a small body in skarns and quartzites. The eastern part of the intrusive is dyke-like, striking eastward and dipping steeply to the north, and the western part is sill-like, striking north-westward and dipping gently to the north-east. The least-altered part of the body is dark fine-grained massive diorite composed of green hornblende, andesine, and small amounts of sphene, apatite, and ilmenite. Some of the diorite is partly replaced by diopside and epidote, thereby forming a mottled or breccia-like rock, and some is almost completely replaced, producing a rock difficult to distinguish from other skarn.

The gabbro is exposed in two open-cuts near the western corner of the area mapped. Much of it is a white fine-grained altered rock resembling massive feldspathic quartzite. The least-altered gabbro is a light-grey medium-grained rock composed of labradorite, augite, sphene, and apatite.

The skarns are coarse- to fine-grained massive rocks of several colours, consisting chiefly of andradite garnet, monticellite (a hard white equidimensional-grained lime-magnesia silicate), zoisite, wollastonite, diopside, carbonate, clinozoisite, and idocrase (vesuvianite) in various proportions. Small amounts of anorthite, blue gahnite spinel, sphene, quartz, and muscovite are also present in some of the skarns.

Mineralization seems to occur in some types of skarn and not in others. Ore has been found in light-green medium-grained skarn composed mainly of yellowish-green andradite garnet and white monticellite; in white, rusty-weathering fine-grained skarn consisting chiefly of monticellite and carbonate; in green medium-grained skarn composed essentially of dark-green zoisite and yellowish-green andradite garnet; in white medium-grained skarn consisting mainly of diopside; and in light-grey coarse-grained skarn composed principally of wollastonite and calcite. On the other hand, practically no mineralization has been found in the abundant, light-brown fine-grained type of skarn that consists mainly of andradite garnet, or in the rarer, coarser-grained variety composed of buff-coloured clinozoisite and pink and green idocrase.

Ore Minerals.

The principal metallic minerals in approximate order of abundance are: bornite, chalcocite, chalcopyrite, black sphalerite, magnetite, and wittichenite, a copper bismuth sulphide ($3Cu_2S.\ Bi_2S_3$).* No silver minerals were seen with the unaided eye or under the microscope, except a very minor amount of native silver which appears to be related to alteration under near-surface conditions. The ore minerals form small veinlets in the skarn locally, but, for the most part, they replace the mineral grains of the skarn, occur between the grains, and are intergrown with them. Most of the chalcocite occurs as exsolution intergrowths with bornite. The relationship of the chalcocite and bornite to the gangue minerals, and their exsolution texture, indicate that they are hypogene rather than products of surface enrichment. Evidence of glacial

* The identity of the wittichenite was established by X-ray powder photographs made by Dr. E. W. Nuffield (1947, p. 157).

scouring found on the claim and elsewhere in the region lends support to this conclusion. On the other hand, covellite, occurring in a few places as minute veinlets in chalcocite, bornite, and chalcopyrite; native silver, found as a film on a joint surface in one place; and malachite and azurite commonly forming thin encrustations and minute veinlets near the surface are evidently supergene.

Showings and Workings.

The showings at the Maid of Erin have been explored by an incline, several open-cuts, a vertical shaft, two short adits, and four short diamond-drill holes.

The incline was driven eastward at a gentle dip in ore occurring in skarn immediately overlying marble (Fig. 3). The contact between the mineralized skarn and the marble is generally sharp and is marked in places by a narrow gouge-filled shear. The ore consists mainly of bornite and chalcocite in a gangue of yellowish-green garnet, monticellite, and carbonate. On the southern wall of the incline, near the portal, the ore is 12 feet thick. The incline passes through ore for 100 feet from the portal and then through sheared marble and unmineralized skarn to the face.

The short working driven northward about 80 feet from the face of the incline exposes an abrupt contact between ore and marble. This contact between the ore on the west and the marble on the east dips steeply westward.

The working driven southward for 35 feet from a point about 75 feet from the face of the incline exposes mineralized skarn overlying marble. The skarn at the face of this working and along much of its eastern wall is only sparsely mineralized.

Assays of six samples (Nos. 1 to 6) taken at various places in the incline, indicated in Fig. 3, are given in Table III. During the summer of 1945 water flooded much of these workings and, even in September, it was deep enough in places to make examination difficult.

The open-cut lying immediately north of the portal of the incline exposes bornite-chalcocite mineralization, about 4 feet thick, in gangue consisting mainly of monticellite and carbonate. Table III includes an assay of a sample (No. 7) taken across this mineralization.

The ore lenses out 35 feet north of the incline portal and the skarn lenses out 35 feet farther north. The mineralization near its termination consists mainly of bornite and chalcocite in a gangue of monticellite, carbonate, and yellowish-green garnet, overlying magnetite, bornite, and chalcocite in calcite. Assays of samples (Nos. 8 and 9) taken across the mineralization 10 feet from its termination are given in Table III.

The large open-cut immediately south of the portal of the incline exposes for a distance of 45 feet mineralization which dips gently eastward. This mineralization consists mainly of bornite, chalcocite, and black sphalerite disseminated through skarn which overlies marble. At the northern end of the open-cut the skarn contains much medium-grained dark-green zoisite, but elsewhere it is composed chiefly of yellowish-green garnet. The thickness of the mineralized skarn decreases from about 12 feet at the northern end of the open-cut to 1½ feet at the southern end. Near the portal of the incline the contact between the skarn and marble is very irregular, but in the southern part of the open-cut it is fairly regular and is marked in places by a clearly defined gouge-filled shear.

About 100 feet south-east of the portal of the incline a vertical shaft was sunk to a depth of 14 feet. An irregular layer of mineralized skarn about 2 feet thick that dips gently to the north-east is exposed at the collar, and an irregular layer about 5 feet thick is exposed at the bottom. These layers are separated by skarn that contains lenses consisting mainly of wollastonite or clinozoisite and that is sparsely mineralized in places.

A vertical diamond-drill hole (D.D. 1, Fig. 3) was put down at a point 120 feet south 60 degrees east of the portal of the incline. It is reported to have cut mineralization from 25.8 feet to 35 feet from the surface and to have reached a depth of 54 feet.

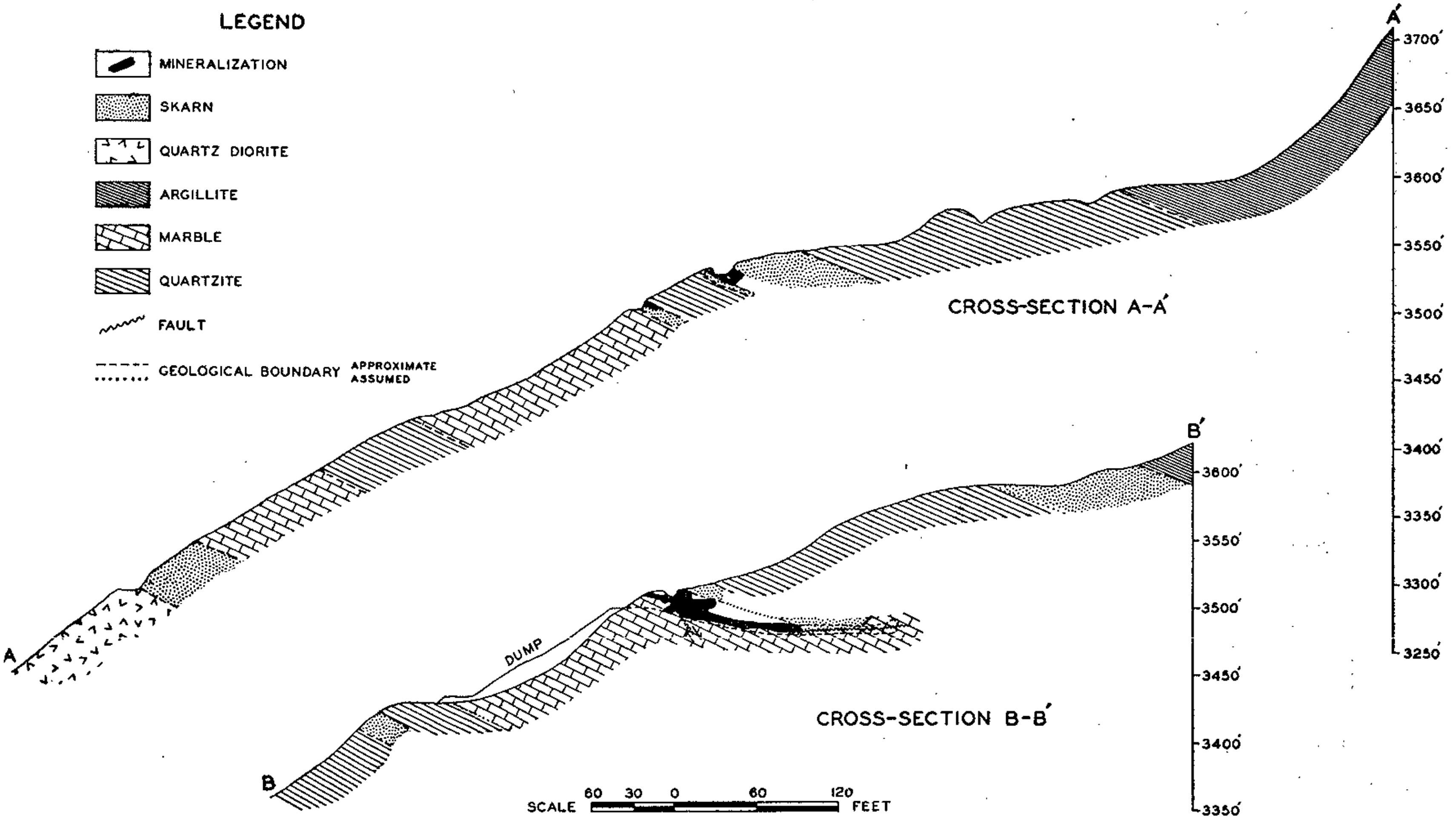


Fig. 4. Cross-sections of part of Maid of Erin claim.

A second hole (D.D. 2, Fig. 3) was drilled vertically to a depth of 127 feet at a point 215 feet south 50 degrees east of the portal. It is reported to have penetrated sparse mineralization from 36 feet to 44 feet from the surface and better mineralization from 61 feet to 71 feet.

Two other vertical drill-holes (D.D. 3 and D.D. 4, Fig. 3), 175 feet north-east and 95 feet north of the portal respectively, did not cut any mineralization. No. 3 is reported to have entered marble at a depth of 132 feet and No. 4 is reported to have been drilled to a depth of only 26 feet.

The open-cut about 200 feet south-east of the portal of the incline exposes an irregular lens of mineralized skarn that plunges gently eastward. The mineralization is composed mainly of chalcopyrite, bornite, and chalcocite in a gangue of white diopside and yellowish-green garnet. The mineralized skarn is underlain and overlain by barren or very sparsely mineralized skarns in which brown garnet or wollastonite are conspicuous. On the eastern wall the lens has a maximum thickness of about 2½ feet; on the western wall it consists of about 3 feet of well-mineralized skarn overlying 1½ feet of sparsely mineralized skarn. Assays of samples (Nos. 10 and 11) taken across parts of the lens on the eastern and western walls are given in Table III.

At the southern end of the open-cut much fine-grained massive skarn composed mainly of light-brown andradite garnet is exposed. Near its contact with the mineralized lens, this skarn is cut by small veinlets which consist of sulphides, diopside, and yellowish-green andradite garnet. In general the sulphides and diopside occur in the centres of the veinlets and the garnet at the margins.

The open-cut 225 feet south of the portal of the incline explores mineralization that occurs in a thin northward-striking band of skarn and in marble that underlies it. The northern part of the cut exposes a lens of mineralized skarn 10½ feet long and 1⅔ feet in maximum thickness that strikes northward and dips gently eastward. The southern part exposes an irregular lens, 20 feet long, that trends eastward. Most of this lens is sparsely mineralized monticellite-carbonate rock that has sharp irregular contacts with the marble. Its eastern part, however, occurs within the thin skarn band and is more highly mineralized. An assay of a sample (No. 12) taken across the eastern part of this lens is given in Table III.

The large open-cut about 450 feet south-west of and about 200 feet below the portal of the incline exposes part of a steeply dipping irregular lens of mineralization that is about 4 feet in maximum thickness. This lens, consisting mainly of bornite, chalcocite, chalcopyrite, sphalerite, and magnetite in a gangue of garnet occurs in marble close to its contact with skarn. Ten feet to the north, a similar lens, about 3 feet in maximum thickness, has been partly exposed by stripping. Table III includes an assay of a sample (No. 13) taken across this lens.

The other open-cuts and the two short adits on the property expose only narrow bodies of sparse mineralization. The adit which is now inaccessible, about 70 feet below the portal of the incline (Section B-B′, Fig. 4), is reported to be entirely in marble (Clothier, 1918, p. 86).

Table III.—Assays of Samples from Maid of Erin Claim.

Sample No.	Location of Sample (*see* Fig. 3).	Thickness.		Gold.	Silver.	Copper.	Zinc.	Bismuth.
		Feet.	Inches.					
				Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
1.	Portal of incline, south wall; from foot-wall across 5 feet (0 to 5)	5	0	Trace	40.2	22.2	0.07	0.32
2.	Portal of incline, south wall; across next 4 feet 2 inches (5 to 9 feet 2 inches)	4	2	0.01	34.0	18.1	0.11	0.26
3.	Portal of incline, south wall; across next 2 feet 6 inches (9 feet 2 inches to 11 feet 8 inches) to hanging wall	2	6	0.01	60.7	28.5	0.07	0.34
4.	Incline, south wall	5	8	*Nil*	15.5	10.8	0.13	0.20
5.	Incline, south wall	5	8	Trace	13.4	7.2	0.10	0.10
6.	Incline, north wall	5	8	Trace	23.9	16.2	0.13	0.38
7.	Open-cut immediately north of portal	4	4	0.01	10.9	6.0	0.23	0.17
8.	North of portal, 10 feet from end of mineralization; from hanging wall across 2 feet 10 inches (0 to 2 feet 10 inches)	2	10	*Nil*	12.7	7.7	0.10	0.20
9.	North of portal, 10 feet from end of mineralization; across next 10 inches (2 feet 10 inches to 3 feet 8 inches) to foot-wall	....	10	*Nil*	6.8	5.1	0.13	0.34
10.	Open-cut 200 feet south-east of portal, west side	2	8	0.04	39.2	17.3	0.10	0.25
11.	Open-cut 200 feet south-east of portal, east side	2	6	0.02	7.3	4.7	0.10	0.24
12.	Open-cut 225 feet south of portal	2	8	0.01	10.8	11.2	0.10	0.29
13.	Open-cut 420 feet south-west of portal	2	10	0.01	23.3	11.8	8.10	0.29

State of Montana. The State of Montana Crown-granted claim is owned by Richard C. Turner of Seattle. The main showings, consisting of copper-silver mineralization, lie at the western base of Copper Butte, about 1½ miles north of and 1,600 feet higher than the hairpin bend in the Haines Road at Rainy Hollow.

The part of the claim that includes the main workings (Fig. 5) slopes westward, ranging in altitude from 3,590 feet in the east to 3,470 feet in the west. From this small area the ground rises abruptly to the east toward the top of Copper Butte and slopes very gently to the west, forming a broad, hummocky bench pitted with small sink-holes. The claim lies above timber-line and has bed-rock exposed in many places.

The property may be reached from the Haines Road by starting at the abandoned construction camp near the hairpin bend and following the old tractor road, now badly overgrown, for approximately 2 miles to Inspector Creek and thence by travelling above timber-line for one-half mile north-eastward toward Copper Butte. An alternative route, which avoids most of the thick brush, is by way of an old trail which may be found by leaving the Haines Road 2½ miles north-east of the hairpin bend and travelling north-westward up the north-eastern side of a broad ridge for about one-half mile. This trail continues north-westward along the side of the ridge, crosses the plateau, skirts the southern edge of Copper Butte, and thence leads down a short distance to the State of Montana claim.

The State of Montana claim was located in 1905 and was Crown-granted in 1908. Most of the exploration on this claim, including shot drilling, was done by the Alaska Iron Company in 1908 and 1909. At that time a trial shipment of a few tons of ore was sent to the Tacoma smelter.

Geology.

The most abundant rocks on the claim are light-grey marble and brown-weathering feldspathic and micaceous quartzites which strike eastward to north-eastward and dip steeply to the north. An irregular band of skarn, consisting chiefly of yellowish-green garnet, lies between the marble and the quartzites. This band trends north-eastward to eastward and ranges from 10 to 60 feet in width. Dark-grey fine-grained diorite, locally replaced by garnet, crops out to the south-west of the dump. Immediately to the west of the area mapped the marble, having been offset to the north by a fault, abuts along its strike with quartzites.

Ore Minerals.

The main mineralization consists of several small lenses, composed chiefly of bornite and chalcocite, which lie in the yellowish-green garnetite. In addition, a few small streaks of similar mineralization occur within marble to the south-east of the main skarn band. Malachite is generally conspicuous near the bornite-chalcocite lenses; black sphalerite is locally abundant, wittichenite (copper bismuth sulphide) occurs in bornite as microscopic grains.

Showings and Workings.

The chief surface working on the property is a deep, eastward trending trench, 130 feet long, which explores a steeply dipping band of mineralization occurring in skarn adjacent to marble. The mineralization is exposed intermittently for 70 feet and ranges in width from a few inches to 1½ feet. A grab sample taken from a small pile beside the trench, probably representing the highest-grade mineralization found in trenching, assayed: Gold, trace; silver, 34.2 oz. per ton; copper, 22.3 per cent.; bismuth, 0.63 per cent.

The other surface workings expose either very small lenses of fairly massive mineralization or very narrow streaks of disseminated mineralization.

The underground workings, totalling 380 feet in length, expose a few small lenses of mineralization lying chiefly in skarn. The adit penetrates skarn from the portal

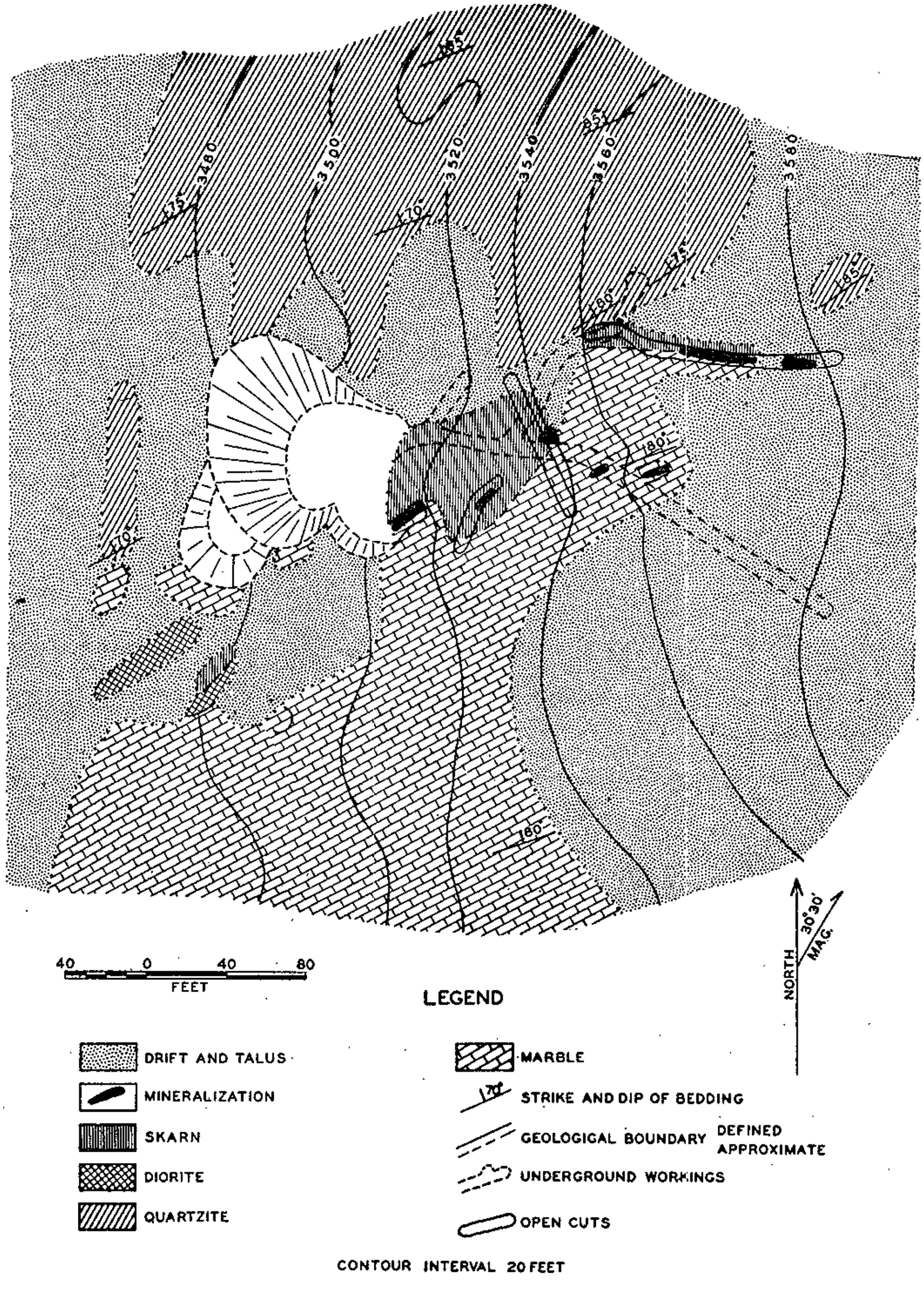


Fig. 5. Geological map of part of State of Montana claim.

for 50 feet to the main split in the workings. Forty feet from the portal the skarn is cut by a vertical north-eastward striking fault which contains mineralized gouge about 2 inches thick. At the split the skarn contains a few short lenses of mineralization, 2 to 3 inches wide, and one about a foot wide. Beyond the split the adit continues eastward and south-eastward in unmineralized grey- and white-banded marble.

The short north-eastward trending drift near the portal is in skarn and follows a malachite-stained zone of disseminated bornite and chalcocite up to 2 feet wide. This mineralization lies on the foot-wall of a fault that dips steeply to the south-east.

The north-eastward trending drift, which starts 50 feet from the portal, follows a few very narrow lenses of mineralization in skarn for about 30 feet and then passes into unmineralized marble. Near the face of this working the marble contains a few lenses of mineralization about 1 to 3 inches wide and 1 foot long.

A grab sample from a small pile at the portal, apparently representing the highest grade mineralization found underground, assayed: Gold, 0.02 oz. per ton; silver, 76.5 oz. per ton; copper, 45.9 per cent.; bismuth, 0.92 per cent.

No information was obtained regarding the shot drilling done on the property by the Alaska Iron Company in 1908 and 1909.

Adams. The Adams Crown-granted claim, on which lead-zinc mineralization occurs, is held by the estates of M. I. O'Connor and R. H. Turner. It lies about a mile north-east of and 1,500 feet higher than the hairpin bend in the Haines Road at Rainy Hollow.

Although altitudes range from 3,500 to 3,600 feet, most of the claim lies between about 3,540 and 3,590 feet. The south-west corner of the claim is the part approaching 3,500 feet. The claim lies above timber-line and has numerous outcrops. Beyond the area mapped the ground rises gently to the north-west, falls gently to the north-east, and drops steeply to the south-east and south-west.

In order to avoid most of the thick brush and steep climb, one may reach the claim by leaving the Haines Road at a point 2½ miles north-east of the hairpin bend and thence travelling north-westward up the north-eastern side of the ridge. Apparently a wide trail or possibly a wagon-road followed part of this general route up the side of the ridge many years ago.

The Adams was located in 1899 and was Crown-granted in 1908. Work done on the claim, including about 500 lineal feet of trenching and a small amount of stripping, was completed before 1914 and probably most of it was done before 1907. Some of the showings have been described briefly by Robertson (1907, p. 46), McConnell (1913, p. 32), and Brewer (1914, pp. 97, 98).

Geology.

The claim is underlain mainly by marble, argillite, and quartzite and by diorite and quartz-feldspar porphyry. The main mineralization occurs in skarn found along both contacts of a band of marble. This band ranges in width from 260 to 380 feet, strikes about north 30 degrees east, and dips steeply to the north-west. The marble, which is a light-grey coarse-grained variety, is underlain and overlain conformably by brown-weathering well-bedded argillite and quartzite.

The diorite occurs in the marble and extends from the No. 1 post north-eastward for about 1,100 feet as a series of aligned lenses which may be continuous at depth. The lenses reach 25 feet in width and some of them are irregular or branched. Another lens, which is blunt, intrudes the marble at the north-eastern boundary of the claim.

The diorite is dark-grey to almost black medium-grained massive rock composed chiefly of green hornblende and andesine. It also contains small amounts of brown biotite, chlorite, sphene, apatite, and magnetite.

The quartz feldspar porphyry occurs as several sills intruding argillite, quartzite, and marble, and as two dykes cutting argillite, quartzite, marble, and diorite. The sills, which are fairly regular in attitude and width, range from 4 feet to 40 feet wide.

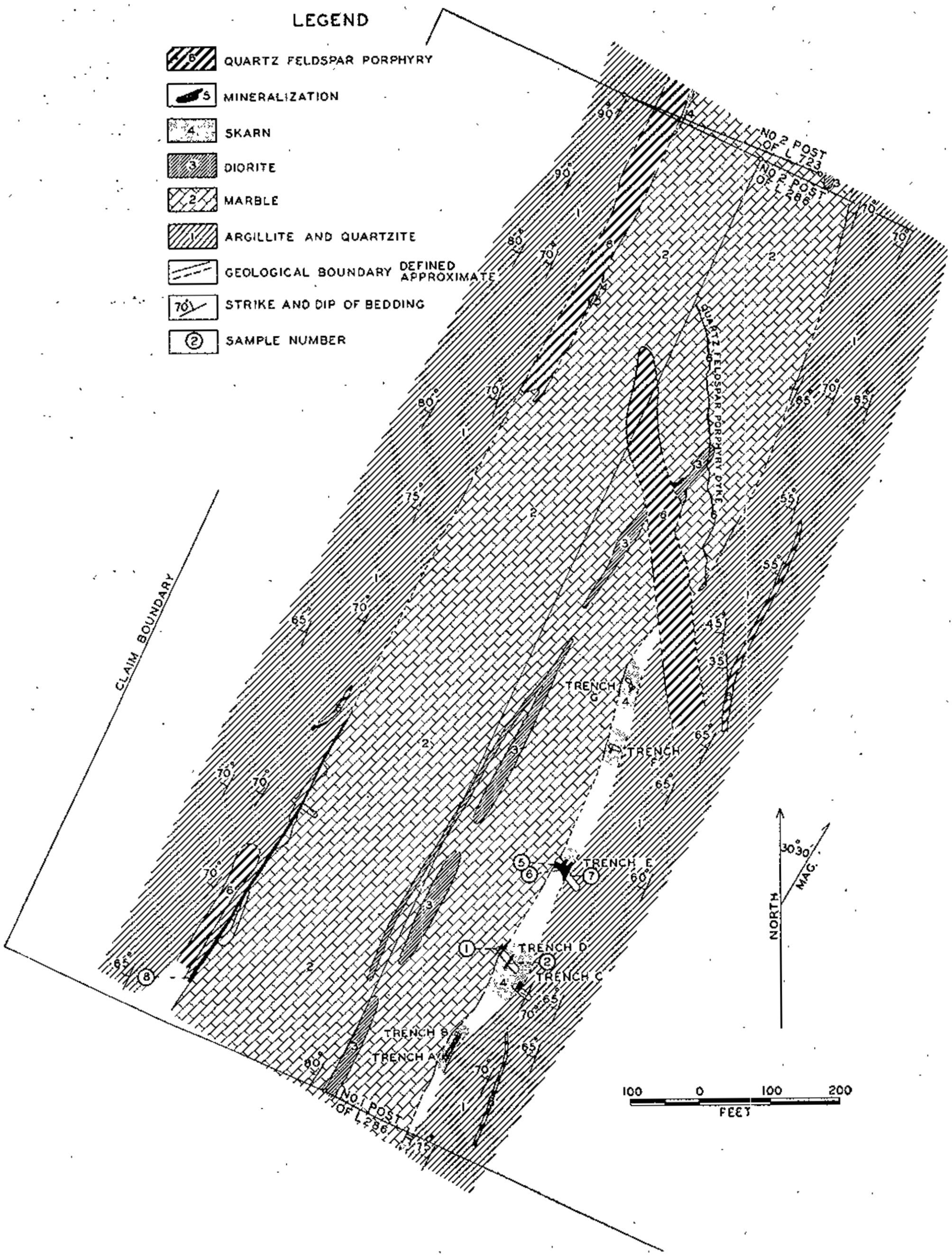


Fig. 6. Geological map of part of Adams claim.

The dykes, about 3 feet and 50 feet in width respectively, strike northward and dip steeply.

The quartz feldspar porphyry is buff-weathering light-pink massive rock. It contains phenocrysts of quartz, albite, and orthoclase in a fine-grained ground-mass consisting mainly of granular intergrowths and spherulites of potash feldspar and quartz. The ground-mass also contains small amounts of chlorite, zircon, sphene, apatite, and pyrite. The porphyry is similar in mineralogy and texture to porphyries of Paleocene age occurring elsewhere in the Squaw Creek-Rainy Hollow area.

The most important zone of mineralization on the claim is in skarn along the south-eastern margin of the marble band. The skarn, exposed at intervals in trenches and outcrops for 750 feet, ranges from 10 feet to 50 feet in width. It is mainly a light yellowish-green fine-grained massive rock composed of epidote, quartz, and yellowish-green garnet. Some irregular lenses and bands in the skarn consist of fibrous aggregates of wollastonite and calcite which contain some diopside and garnet.

Ore Minerals.

The mineralization is chiefly galena and dark-brown sphalerite which form north-eastward striking steeply dipping lenses and bands replacing skarn. The ore contains very little silver and practically no gold. Assays of selected samples indicate that most of the silver is associated with galena. A small amount of chalcopyrite was seen under the microscope. In most of the exposures some sphalerite has been leached, leaving rusty voids or porous limonite. Effort was made to sample the least-altered material, but the zinc content of the samples taken is less than it would be in the fresh material.

Showings and Workings.

Seven trenches, spaced along a distance of 600 feet, expose several lenses and bands of mineralization in the skarn. Float suggests that additional bodies of mineralization or continuations of those in the trenches occur in this zone, but it is likely that the trenching was done where the float was most abundant and that the best mineralization has been exposed.

For convenience in description the workings shown in Fig. 6 are referred to by letters. Trench A exposes skarn containing two bands of mineralization, each about 1¼ feet wide, separated by 3 feet of barren skarn. The exposures in Trench B are poor, but, apparently, two bands of mineralization comparable in width with those in Trench A are present.

The north-eastern wall of Trench C cuts wollastonite-rich skarn containing two 8-inch lenses of mineralization separated by 15 inches of marble.

Trench D cuts across the contact between marble and skarn. It exposes a 6-inch lens of mineralization in the marble 3 feet from the contact, an 8-inch lens at the contact, and a 3-foot lens in the skarn 18 feet from the contact. The mineralization is chiefly a medium-grained mixture of sphalerite and galena, but some coarse-grained galena with only sparse sphalerite occurs locally. Assays of samples (Nos. 1 and 2) taken across the 8-inch and 3-foot lenses and of samples (Nos. 3 and 4) selected from the dump are given in Table IV.

The south-western wall of Trench E exposes mineralization for 20 feet. Assuming that it has the same attitude as smaller bands and lenses on the claim—namely, strike north-eastward, dip steep to the north-west, the distance 20 feet is approximately the true width of the mineralization. Assays of three samples (Nos. 5, 6, and 7) taken across the mineralization are given in Table IV. The north-eastern wall of the trench is badly caved, but it is apparent that even within the width of the trench the body has split into two bodies that total less than 10 feet in width.

Trench F exposes skarn containing a steeply dipping 10-inch band of mineralization which tapers rapidly in the north-eastern part of the trench. Trench G cuts skarn containing a north-eastward striking sparsely mineralized zone only about 2 inches wide.

Sphalerite and galena in gangue consisting mainly of wollastonite, garnet, epidote, and calcite are exposed almost continuously for 450 feet along the north-western contact of the marble. This mineralized band dips steeply to the north-west and ranges from approximately 6 inches to 18 inches in width. In most places its foot-wall is marble and its hanging-wall is skarn, graphitic argillite, or quartzite. The assay of a sample (No. 8) taken across this band is given in Table IV.

A small amount of lead-zinc mineralization occurs in marble 300 feet northward from Trench G along the contacts of the diorite body near the large quartz feldspar porphyry dyke. On the north-western contact, the mineralization extends for 20 feet and ranges from a few inches to about 5 feet in width. A lens about 2 feet long and 6 inches wide occurs at a bend in the opposite contact.

A few other trenches on the claim explore rusty zones in skarn and marble but do not expose mineralization.

Table IV.—Assays of Samples from Adams Claim.

Sample No.	Description of Sample.	Gold.	Silver.	Lead.	Zinc.
		Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
1	Trench D; across 8-inch lens	Trace	1.2	17.4	22.0
2	Trench D; across 8-foot lens	Trace	1.3	10.2	9.1
3	Trench D; selected, fresh, galena-rich mineralization	0.01	15.3	76.9	2.9
4	Trench D; selected, fresh, galena-sphalerite mineralization	Trace	2.9	28.7	28.0
5	Trench E; south-west side; from hanging wall across 8 feet (0–8)	Trace	4.1	24.2	16.7
6	Trench E; south-west side; across next 7 feet (8–15)	Trace	0.6	8.0	7.6
7	Trench E; south-west side; across next 5 feet (15–20) to foot wall	*Nil*	0.3	4.1	4.0
8	250 feet N. 50° W. of No. 1 post; across 14 inches	Trace	4.1	12.9	17.4

Victoria. The Victoria Crown-granted claim, on which lead-zinc mineralization occurs, is owned by Richard Kennedy of Haines, Alaska. Since 1943 an option on the claim has been held by the St. Eugene Mining Corporation, Limited.

The claim lies immediately east of Inspector Creek, about a mile north-west of and 1,000 feet higher than the hairpin bend in the Haines Road at Rainy Hollow.

The part of the claim that includes the showings and main workings slopes westward from an elevation of about 2,930 feet in the east to about 2,810 feet in the west (Fig. 7). Beyond this small area the ground is rolling and hummocky to the north and east and steeply sloping, in general, toward Inspector Creek and the Klehini River to the west and south.

The Victoria claim was located in 1905 and was Crown-granted in 1910. The mineralization has been explored by five surface cuts and by a crosscut adit 92 feet long. Most of the work on the claim, including driving the crosscut adit, was done before 1913.

The old tractor road to the Maid of Erin claim, which starts at the abandoned construction camp on the Haines Road at Rainy Hollow, passes close to the adit on the Victoria (Fig. 7). The 2-mile stretch of this old road leading up to the Victoria claim is badly overgrown, and a few parts of the claim itself are covered with low clumps of alder. Outcrops are abundant on much of the property, but some fairly large areas are buried with drift.

Geology.

The mineralization occurs in irregular bodies of skarn which lie within a broad band of light-grey marble (Fig. 7). The marble strikes north-eastward, dips steeply to the north-west, and is flanked on both sides by brown-weathering, white to dark-grey impure quartzite. The two main showings lie near the north-western margin of the marble and consist chiefly of brown sphalerite and galena in a gangue of yellowish-green garnet, wollastonite, and calcite.

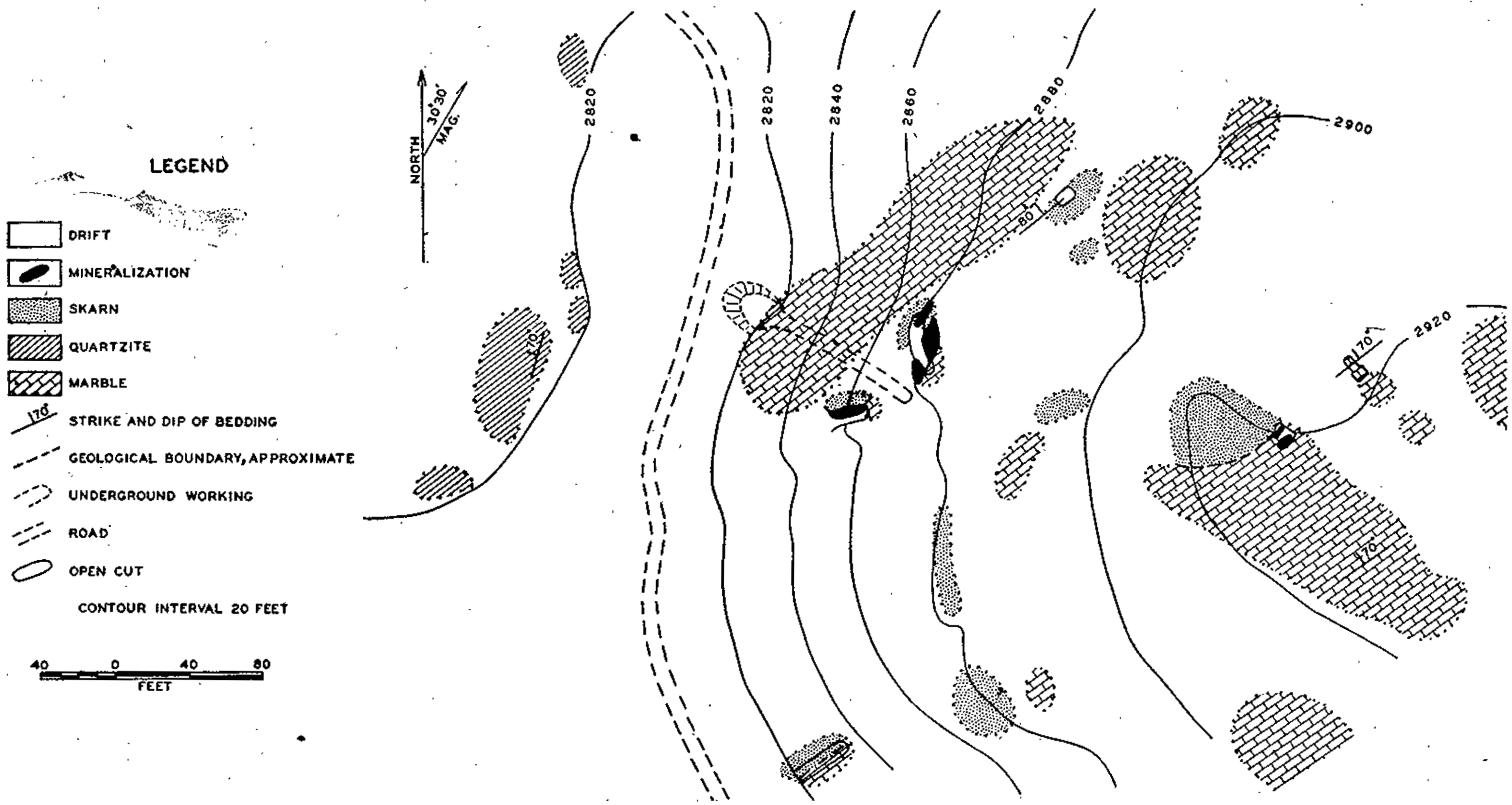


Fig. 7. Geological map of part of Victoria claim.

Showings and Workings.

The northern wall of the trench lying 60 feet south-east of the adit exposes an irregular north-eastward trending mass of mineralized skarn about 6 feet wide. This is capped by barren, fine-grained grey skarn on the northern wall and is flanked by marble on the eastern wall. A sample taken across the 6 feet of mineralization assayed: Gold, 0.01 oz. per ton; silver, 8.5 oz. per ton; lead, 22.1 per cent,; zinc, 26.6 per cent.

It is reported that a hole drilled vertically from a point 30 feet south-west of this trench did not intersect any mineralization.

The trench 80 feet east of the adit exposes north-easterly striking steeply dipping skarn, mineralized skarn, and marble. The section along the eastern wall, from north to south, is: skarn; 3½ feet of soft rusty-weathered originally sphalerite-rich mineralization; 2 feet of skarn; 7 feet of mineralization consisting of sphalerite, galena, and some chalcoyprite in yellowish-green garnet; marble. A sample taken across the 7 feet of mineralization assayed: Gold, *nil*; silver, 2.5 oz. per ton; lead, 8.7 per cent.; zinc, 19.5 per cent. A selected sample of the chalcopyrite-bearing mineralization near the southern end of the trench assayed: Gold, 0.02 oz. per ton; silver, 5.6 oz. per ton; copper, 0.9 per cent.; lead, 16.9 per cent.; zinc, 32.8 per cent.

The open-cut 170 feet north-east of the adit exposes skarn containing only a rusty, malachite-stained streak about 1 inch wide. The pit 280 feet east of the adit is in marble that contains a few small, steeply dipping lenses of yellowish-green garnet, black sphalerite, and galena.

The other two open-cuts shown in Fig. 7 do not expose any mineralization.

The adit driven south-eastward for 92 feet penetrates unmineralized grey and white marble which strikes north-eastward and dips steeply to the north-west.

Lawrence. The Lawrence Crown-granted claim, on which lead-zinc mineralization occurs, is owned by the estate of Mike Cassin, c/o N. Freeborn, Seattle. The property lies 3½ miles north-east of and about 2,200 feet higher than the hairpin bend in the Haines Road at Rainy Hollow. The claim may be reached most easily by leaving the Haines Road near mile-post 57, where it crosses a south-eastward flowing tributary of Seltat Creek. From this point, lying slightly above timber-line, the property may be reached by travelling north 60 degrees west for a mile, with a steady climb of 1,000 feet.

The claim lies on a rolling, hummocky plateau that forms part of the Duke Depression (Plate II, A). The section of the claim that was mapped (Fig. 8) ranges from 4,040 feet to 4,140 feet in altitude. Some flat or gently sloping areas underlain by marble are pitted with small sink-holes. The claim lies above timber-line and outcrops are abundant.

The Lawrence claim was located in 1904 and was Crown-granted in 1910.

Geology.

The mineralization consists of sphalerite and galena disseminated in skarn that occurs mainly at or near contacts between marble and quartz feldspar porphyry and between marble and mica schists. The marble strikes approximately north 30 degrees east and dips steeply to the north-west, forming a belt about 500 feet wide. A sample of marble from the Lawrence claim, typical in appearance of much of the marble in the Rainy Hollow area, was found by analysis to consist almost entirely of calcite (Table II, p. 20). The schists lie to the north-west and south-east of the marble belt and have the same attitude as it. They are brown-weathering, light- to dark-grey rocks composed essentially of alternating thin biotite-rich, muscovite-rich, and quartz-rich layers. Chlorite and feldspar are abundant locally in the rocks and generally epidote is present in small amounts. In places the rocks have such a high content of quartz that they are described best as micaceous quartzites.

Most of the skarn on the claim occurs in a wide, irregular belt lying to the south-east of the marble belt. The rock is mainly a black-weathering, greenish-grey to yellowish-green medium- to fine-grained banded aggregate of epidote and quartz in various proportions. The zone of mineralized skarn, however, which lies along the north-eastern contact of the porphyry dyke (Fig. 8), and part of that which lies immediately along the south-eastern contact of the marble band, is composed almost entirely of the pyroxene diopside-hedenbergite. This skarn is a brownish-black weathering, greenish-grey medium- to coarse-grained massive rock consisting of radiating aggregates of diopside-hedenbergite prisms and a small amount of interstitial calcite and quartz.

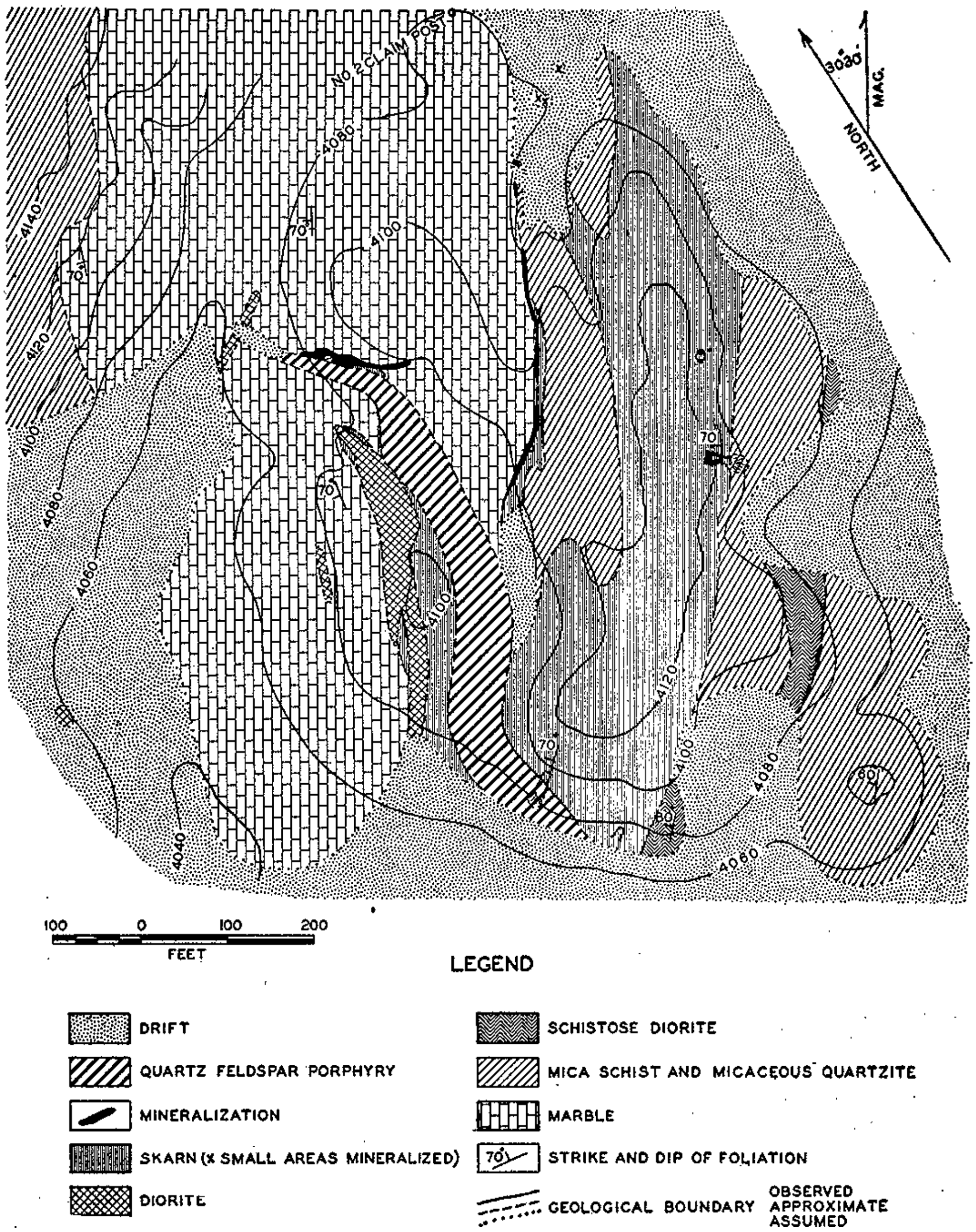


Fig. 8. Geological map of part of Lawrence claim.

Irregular sills of diorite occur in marble, mica schist, and skarn. The rock intrusive into marble is massive dark-grey medium-grained diorite consisting chiefly of hornblende and recrystallized intermediate plagioclase. The diorite occurring mainly in mica schists in the south-eastern part of the area mapped (Fig. 8) is, however, a schistose to gneissic dark-grey fine-grained rock composed chiefly of recrystallized hornblende and intermediate plagioclase.

A quartz feldspar porphyry dyke cuts marble and skarn. Most of the dyke strikes northward and dips steeply to the east, but the northern end strikes north-westward and probably dips to the south-west. The porphyry is a light-grey rock consisting of crystals of quartz and albite in a fine-grained granular or spherulitic ground-mass composed essentially of quartz, orthoclase, and albite.

Showings and Workings.

A shaft has been sunk to a depth of 18 feet in a north-westward trending steeply dipping lens of mineralized skarn that lies north-east of the porphyry dyke. This lens, which extends for 130 feet and has a width up to 15 feet, consists of dark-brown sphalerite, galena, and, locally, small amounts of chalcopyrite disseminated in diopside-hedenbergite skarn. A sample taken across the lens 15 feet north-west of the shaft, where it is 6 feet wide, assayed: Gold, trace; silver, 7.2 oz. per ton; copper, trace; lead, 5.3 per cent.; zinc, 12.2 per cent. Selected samples of galena-rich and sphalerite-rich mineralization from the shaft assayed; Silver, 4.5 oz. per ton; lead, 58 per cent.; zinc, 6.1 per cent.; and silver, 0.9 oz. per ton; lead, 13.8 per cent.; zinc, 16.9 per cent., respectively.

Narrow, steeply dipping lenses of mineralized skarn occur at intervals along the south-eastern margin of the marble for a distance of about 500 feet. A sample taken across a lens 1 foot wide at a point 240 feet south 82 degrees east of the shaft assayed: Gold, 0.01 oz. per ton; silver, 0.4 oz. per ton; lead, 0.99 per cent.; zinc, 12.9 per cent.

A deep trench and pit near the south-eastern edge of the wide band of skarn exposed a few streaks, up to an inch wide, containing sphalerite and small amounts of chalcopyrite and galena. The other showings on the property consist of small irregular zones of sparsely disseminated sphalerite, galena, and chalcopyrite in skarn.

Three Guardsmen Area.

The deposits in the Three Guardsmen area lie to the east of those at Rainy Hollow and are separated from them by about 3 miles of granitic rocks in which no mineral deposits are known. The mineralization occurs in a tongue of metamorphosed sedimentary rocks about 1,000 to 1,500 feet wide and about 2½ miles long intruded by gneissic quartz diorite. This belt extends from the 6,250-foot peak lying 2 miles south-east of Mount Glave (Three Guardsmen), across Clayton Creek, and towards Mount Seltat on the British Columbia-Alaska Boundary, where it joins a large mass of sedimentary rocks. Bed-rock is concealed on the lower slopes of Clayton Creek Valley, but the talus suggests that the belt extends right across the bottom of the valley.

The metamorphosed sedimentary rocks consist chiefly of schist, gneiss, argillite, quartzite, marble, and skarn. West of Clayton Creek these rocks strike northward and dip westward at 60 to 70 degrees. East of Clayton Creek they strike north-eastward to eastward and dip to the north mainly at 40 to 50 degrees. The contact with the granitic rocks is parallel to the bedding in general, but locally it cuts across the bedding. The gneissic structure in the intrusive is generally parallel to its contacts.

The marble occurs in many places in the belt as lenses and irregular masses, ranging from a few feet to a few hundred feet wide. Skarn replaces the marble chiefly along parts of its contacts with the other metamorphosed rocks and with the quartz diorite. Much of the mineralized skarn is a green medium- to fine-grained variety containing abundant actinolite along with diopside, garnet, and epidote.

The mineralization is in skarn and consists of magnetite containing minor amounts of chalcopyrite which produces conspicuous green malachite stains at the surface. Sampling indicated that the precious-metal content of the chalcopyrite-bearing magnetite deposits is very low. A small amount of molybdenite was seen on the Simcoe claim and a small bornite-chalcocite deposit, similar in mineralogy to those at Rainy Hollow, was seen on the Canadian Verdee.

The showings seen on the Simcoe Crown-granted claim lie immediately east of Clayton Creek at altitudes of approximately 4,300 feet and 3,900 feet. The upper showing consists of a lens about 20 feet wide and at least 35 feet long containing approximately 75 per cent. of magnetite and small amounts of chalcopyrite. Almost massive magnetite extends across a width of 6 feet in one part of the lens. A grab sample, typical of the whole lens in appearance, assayed: Gold, 0.03 oz. per ton; silver, *nil;* copper, 0.8 per cent.

At the lower showing an adit about 35 feet long explores narrow lenses of chalcopyrite-bearing magnetite in skarn on the hanging wall of the northward dipping quartz-diorite contact. At the contact molybdenite occurs as films along joints in silicified quartz diorite and in skarn across a maximum width of about 6 inches. A sample taken across a magnetite lens 6 inches wide in the adit assayed: Gold, *nil;* silver, *nil;* copper, 0.3 per cent.

The showings seen on the Mildred Crown-granted claims are at an elevation of approximately 5,250 feet on jagged cliffs that slope north-eastward toward Clayton Creek. Magnetite containing chalcopyrite forms about 30 per cent. of an irregular westward dipping zone of skarn about 100 feet wide and about 500 feet long which is overlain by quartz diorite and underlain by grey marble. Almost massive magnetite constitutes occasional lenses about 10 to 15 feet wide and numerous streaks about 1 inch to 6 inches wide. A chip sample taken across a magnetite lens 10 feet wide and about 30 feet long assayed: Gold, *nil;* silver, 0.2 oz. per ton; copper, 0.3 per cent.

The showings seen on the Canadian Verdee Crown-granted claim are on the ridge between Clayton Creek and Seltat Creek at an altitude of approximately 5,400 feet. At one locality a lens of massive magnetite 3 feet wide lies in a band of skarn about 10 feet wide that occurs in marble. A grab sample of malachite-stained magnetite from the lens assayed: Gold, trace; silver, 2.8 oz. per ton; copper, 2.5 per cent.

About 500 feet north-east of this deposit a few narrow lenses of coarse-grained skarn consisting mainly of yellowish-green garnet occur within marble. A prospect-pit in one of the bodies of skarn exposes a lens about 1 foot wide and 3 feet long composed chiefly of bornite, chalcocite, and sphalerite with minor amounts of chalcopyrite and wittichenite (copper bismuth sulphide). A sample taken across the lens assayed: Gold, 0.03 oz. per ton; silver, 23.6 oz. per ton; copper, 20.5 per cent.; zinc, 14.6 per cent.; and bismuth, 0.55 per cent.

South-west of the Canadian Verdee a band of skarn up to 20 feet wide, which is underlain by marble and overlain by schist and quartzite, crops out intermittently for 500 feet. The skarn contains lenses of massive magnetite up to a foot wide, and in some places 50 to 60 per cent. of 15-foot widths is composed of magnetite.

Discoveries were first made in the Three Guardsmen area in 1909. At one time Crown-granted claims covered the entire belt of metamorphosed sedimentary rocks, but some of them have been allowed to lapse in recent years. Prospecting was easy in the Three Guardsmen area because it lies entirely above timber-line and because most of the bed-rock is exposed. Furthermore, the green malachite stain on the deposits can be seen for long distances. The fact that the area has probably been prospected very effectively already and the fact that the precious-metal content of the magnetite deposits is low do not offer encouragement for further search.

During the summer of 1945 a group of claims was staked by prospectors employed by the Consolidated Mining & Smelting Company on the ridge between Stanley Creek and Kwatini Creek about 1½ miles south-east of Mount Mansfield. In this locality gneissic quartz diorite intrudes mica schist, gneiss, and interbedded greenstone and argillite, all of which strike north-westward and dip steeply to the north-east. On the crest of the ridge, immediately east of the belt of schist and gneiss, abundant float of white quartz mineralized with galena, pyrite, and chalcopyrite occurs in the loose overburden of frost-riven angular fragments of quartz diorite. The gold content of most samples of the float was low, but in one it was high enough to encourage the owners to do some digging and blasting in an attempt to find the lode. This work was unsuccessful and the claims have been allowed to lapse.

About one-half mile south-west of this showing, large pieces of quartz float are abundant at an altitude of approximately 5,500 feet in a long greenstone talus slope. The float is from a vein at least 5 feet wide in places, which is composed of white quartz sparsely mineralized with galena, pyrite, and chalcopyrite. The vein is evidently enclosed in highly chloritic greenstone. Locally the quartz shows ribbon-structure produced by chloritic partings and it is vuggy in places. Search in the greenstone cropping out a few hundred feet above the float did not disclose the lode.

Gold Cord. Gold-bearing quartz veins occur on a property now known as the Gold Cord, which lies about 4 miles west of Pleasant Camp, near the British Columbia-Alaska Boundary. The prospect is west of the area mapped and was not visited by the writer. The following information has been obtained mainly from reports by Eakin (1919), James (1927), and Mandy (1932).

The veins are exposed on the steep valley-wall north of Jarvis Glacier, between elevations of 4,100 and 4,600 feet. The first vein was discovered in 1915 (Fraser, 1915, p. 65). At one time a good trail about 6 miles long led to the showings from the south-western side of the Klehini River opposite Pleasant Camp, but in recent years the lower part of it has become badly overgrown.

Limestone and argillite occurring on the southern part of the property are intruded by dioritic rock occurring on the northern part. The contact between the sedimentary rocks and the intrusive dips steeply southward.

After visiting the property in 1927, when it was known as the Stampede, James (p. 112) reported as follows:—

". . . The principal showing is a quartz vein in the diorite striking east–west (mag.) and nearly parallel to the contact and 200 or 300 feet north of it. The vein dips north into the diorite. Since locating the property the owners have done a great deal of stripping and have traced the vein by a series of open-cuts for a distance of about 3,000 feet west of the International Boundary and claim to have located another, 1,500 feet west of this again, on the far side of a rubble-filled draw. The easterly 1,500 feet of the vein is very narrow and apparently of no great importance, for the values are essentially low grade. For the next claim-length west, however, the vein is more promising in appearance. At two shafts, where the most work has been done, the vein, or lead, is found to consist of three distinct quartz veins separated by a few inches to a foot and a half of slightly pyritized diorite. At these places the total width of the lead, including the mineralized diorite, is from 5 to 7 feet or more, the individual quartz veins varying from 1 to 4 feet. . . .

" The veins consist of white quartz mineralized with a very small amount of pyrite. Free gold is conspicuous in some of the oxidized croppings. . . ."

In 1928 and 1929 the Alaska-Juneau Gold Mining Company explored these veins with thirty open-cuts, seven shafts, and some stripping. Their sampling showed a few high assays from oxidized surface material, but, elsewhere, only low gold values across narrow widths in general. In 1929 the Alaska-Juneau Gold Mining Company dropped its option on the Stampede, and in 1930 the property was restaked as the Gold Cord Nos. 1 to 8 along with the Yellow Jacket claim.

After visiting the property in 1931 Mandy (p. 41) reported that stripping and open-cutting were done in 1930 and 1931 by William Bunting, the owner, "on the several oblique veins outcropping in the limestone between altitudes 4,100 and 4,600 feet, over a distance of about 2,000 feet. . . . There are about fifteen or sixteen of these veins varying in width from 6 to 18 inches. They strike between north and north-westerly and dip at between 30 degrees and 70 degrees into the hill. The veins consist of white quartz with very sparse sulphide mineralization consisting of an occasional patch or bleb of pyrrhotite and rare grains of chalcopyrite. The veins are generally appreciable distances apart. Low gold values up to $1.20 are claimed by the owners to occur in these veins. Before the close of the 1931 season the owner reported the discovery of additional subsidiary veins of fairly appreciable width."

Since the early thirties the property has lain idle.

References.

Eakin, Henry M. (1919): The Porcupine Gold Placer District, Alaska—*U.S. Geol. Surv.*, Bull. 699, p. 14 and Plate I.

James, H. T. (1927): Stampede—*Minister of Mines, B.C.*, Ann. Rept., pp. 111, 112.

Mandy, J. T. (1932): Gold Cord—Lode-gold Deposits of British Columbia—*B.C. Dept. of Mines*, Bull. 1, pp. 40, 41.

PROSPECTING POSSIBILITIES.

The distribution of the known lode deposits in the Squaw Creek-Rainy Hollow area indicates that the localities which are geologically favourable for prospecting are: (1) those containing limestone and other sedimentary rocks that have been intruded and metamorphosed by granitic rocks and (2) the margins of intrusives and adjacent sedimentary rocks or greenstones.

In general the Rainy Hollow and Three Guardsmen areas, which have geological conditions favouring the occurrence of replacement deposits in skarn, offer little opportunity to the individual prospector because much of the ground is held by Crown grant. Furthermore, most of these areas lie above timber-line and have good exposures and hence have been effectively prospected already.

A small body of similar metamorphosed sedimentary rocks surrounded by quartz diorite lies about 3 miles north-east of Pleasant Camp. The area contains a small amount of skarn but at one time it was staked and was thoroughly prospected.

The metamorphic rocks lying near the British Columbia-Yukon Boundary in the north-eastern corner of the area mapped contain some marble and skarn. A small amount of copper-stained skarn, occurring mainly as float, was seen in this locality. Because this area is very inaccessible and because it lies far from any camp-sites having timber, it probably has never been carefully prospected.

The gold-bearing quartz veins south-east of Mount Mansfield and on the Gold Cord contain small amounts of sulphides and occur near the margins of intrusives and in the adjacent sedimentary rocks or greenstone. The writer noticed a little sparsely mineralized quartz float, a few narrow, sparsely mineralized quartz veins, and a few small lenses of silicified greenstone containing pyrrhotite and chalcopyrite in the vicinity of the contact between quartz diorite and greenstone and argillite that extends from the vicinity of Mount Mansfield to Kelsall Lake. None of the showings was large, but they may indicate widespread occurrence of a type of mineralization which is known to contain some gold in one place.

Slightly rusty quartz veins are abundant in parts of the area drained by Squaw Creek and by the middle and south forks of Talbot Creek. Samples from a few of the veins, however, contained no gold or silver.

The distribution of lode deposits indicates that the centres of the larger intrusives are not favourable to prospecting. The Paleocene and Late Tertiary rocks, which evidently were formed after mineralization, can be eliminated for prospecting.

COAL.

Coal has been found in a few places in the Tertiary rocks of the area, but no large seams are known.

On the upper part of Squaw Creek, almost at its head, thin seams of sub-bituminous coal occur in a narrow down-faulted block of yellowish-brown sandstone. An analysis of a sample of a seam about 8 inches thick taken from a badly sloughed exposure on the creek bank gave:—

Volatile combustible matter	28.2%
Ash	19.1%
Moisture	9.5%
Fixed carbon	53.2%
Sulphur	0.2%
British thermal units	9,227

A small amount of coal crops out on the southern bank of Talbot Creek about 1,500 feet south-west of the Dalton Trail in sandstone, shale, and conglomerate. It forms thin lenses apparently derived from trunks and limbs of trees, and seams only about one-half inch thick.

Float of carbonaceous shale and coal, indicating beds up to 6 inches in thickness, was seen in a few places in the belt of rocks belonging to Group 17 in the northern part of the Datlasaka Mountains.

BIBLIOGRAPHY.

Bostock, H. S.: Physiography of the Canadian Cordillera, with special reference to the area north of the fifty-fifth parallel—*Geol. Surv., Canada* (in press).

Brewer, W. M. (1914): Rainy Hollow—*Minister of Mines, B.C.*, Ann. Rept., pp. 94–99.

Brooks, Alfred H. (1900): A reconnaissance from Pyramid Harbour to Eagle City, Alaska, including a description of the copper deposits of the Upper White and Tanana Rivers—*U.S. Geol. Surv.*, 21st Ann. Rept., Pt. II, pp. 331–391.

Buddington, A. F., and Chapin, Theodore (1929): Geology and mineral deposits of Southeastern Alaska—*U.S. Geol. Surv.*, Bull. 800.

Cairnes, D. D. (1915): Upper White River District, Yukon—*Geol. Surv., Canada*, Mem. 50.

Clothier, Geo. A. (1918): Rainy Hollow Section—*Minister of Mines, B.C.*, Ann. Rept., pp. 85–87.

——— (1921): Rainy Hollow Section—*Minister of Mines, B.C.*, Ann. Rept., pp. 75–77.

Cockfield, W. E. (1927): Dezadeash Lake Area—*Geol. Surv., Canada*, Sum. Rept., 1927, Pt. A, pp. 1–7.

Dawson, George M. (1887): Report on an exploration in the Yukon District, N.W.T., and adjacent northern portion of British Columbia—*Geol. and Nat. Hist. Surv., Canada*, Ann. Rept., Vol. III, Pt. 1, pp. 1B–277B.

Dunn, Russell L. (1898): The country of the Klondike—*Min. and Sci. Press*, Vol. LXXVII.

Eakin, Henry M. (1919): The Porcupine Gold Placer District, Alaska—*U.S. Geol. Surv.*, Bull. 699.

Fraser, J. A. (1908): Rainy Hollow—*Minister of Mines, B.C.*, Ann. Rept., pp. 50, 51.

——— (1909): Rainy Hollow—*Minister of Mines, B.C.*, Ann. Rept., pp. 52, 53.

——— (1915): Atlin Mining Division—*Minister of Mines, B.C.*, Ann. Rept., pp. 64, 65.

Graham, J. D. (1899): Bennett Lake Mining Division—*Minister of Mines, B.C.*, Ann. Rept., p. 649.

Howay, F. W. (1914): The Alaska boundary dispute—Chap. XXXI in British Columbia, Vol. II, *S. J. Clarke Publishing Co.*, pp. 551–566.

James, H. T. (1927): Rainy Hollow Section—*Minister of Mines, B.C.*, Ann. Rept., pp. 110–112.

Kindle, E. D. (1947): Dezadeash map area, Yukon—*Geol. Surv., Can.*, Paper 47-15.

Mandy, Joseph T. (1929): Rainy Hollow Section—*Minister of Mines, B.C.*, Ann. Rept., pp. 119, 120.

——— (1931): Rainy Hollow Section—*Minister of Mines, B.C.*, Ann. Rept., pp. 63, 64.

——— (1932): Rainy Hollow Section—Lode-gold deposits of British Columbia—*B.C. Department of Mines*, Bull. 1, pp. 40, 41.

——— (1932): Tatshenshini River Section—*Minister of Mines, B.C.*, Ann. Rept., pp. 74–79.

——— (1933): Tatshenshini River Section—*Minister of Mines, B.C.*, Ann. Rept., pp. 90–93.

McConnell, R. G. (1913): Rainy Hollow Mineral Area, B.C.—*Geol. Surv., Canada*, Sum. Rept., 1913, pp. 29–33.

Munroe, C. L. (1928): Rainy Hollow Section—*Minister of Mines, B.C.*, Ann. Rept., pp. 121, 122.

Nuffield, E. W. (1947): Studies of mineral sulpho-salts: XI—Wittichenite (Klaprothite)—*Econ. Geol.*, Vol. XLII, pp. 147–160.

Robertson, William Fleet (1900): Chilkat Section of Bennett Lake Mining Division—*Minister of Mines, B.C.*, Ann. Rept., pp. 762–770.

——— (1907): Rainy Hollow Camp—*Minister of Mines, B.C.*, Ann. Rept., pp. 43–48.

Tyrrell, J. B. (1898): Yukon District (with adjacent parts of British Columbia)—*Geol. Surv., Canada*, Ann. Rept., Vol. XI, pp. 36A–46A.

Wright, Charles W. (1904): The Porcupine Placer District, Alaska—*U.S. Geol. Surv.*, Bull. 236.

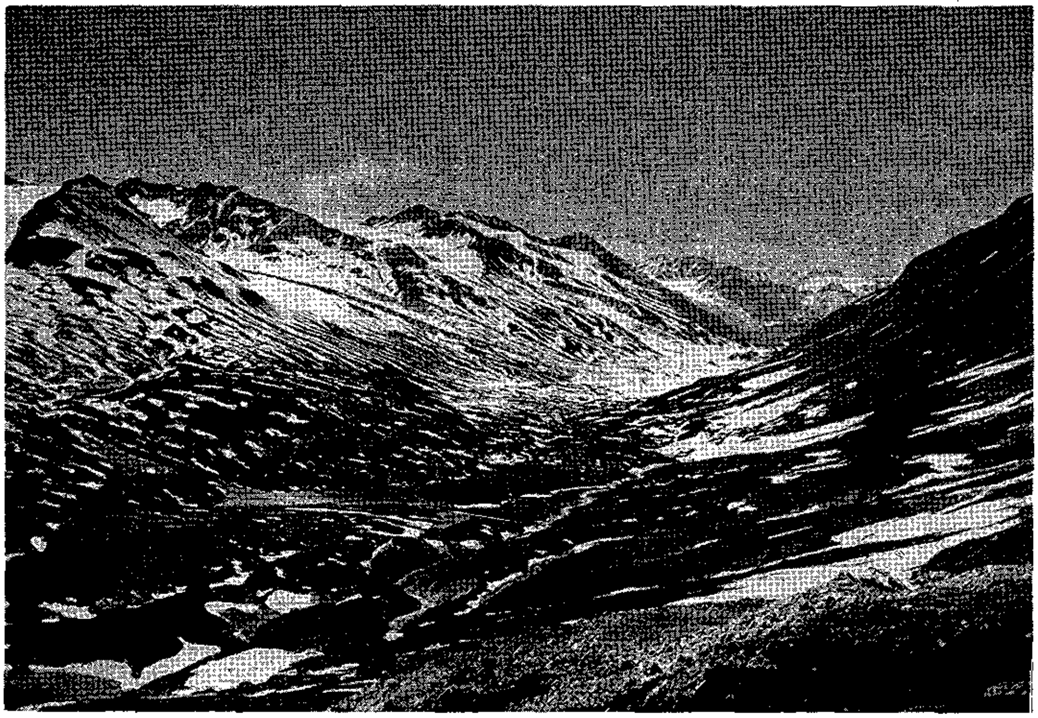
PLATE I.

A. Coast Mountains; view eastward across head of Clayton Creek. High peak in cloud on left is Mount Seltat on British Columbia-Alaska Boundary.

B. View up valley of Inspector Creek toward Nadahini Mountain. Alsek Ranges of St. Elias Mountains on left, Mineral Mountain and Copper Butte in left foreground, plateau forming part of Duke Depression on right.

PLATE II.

A. Looking south-westward from Lawrence claim, Rainy Hollow, across plateau which forms part of Duke Depression, to Alsek Ranges of St. Elias Mountains. Top of Copper Butte is seen on right.



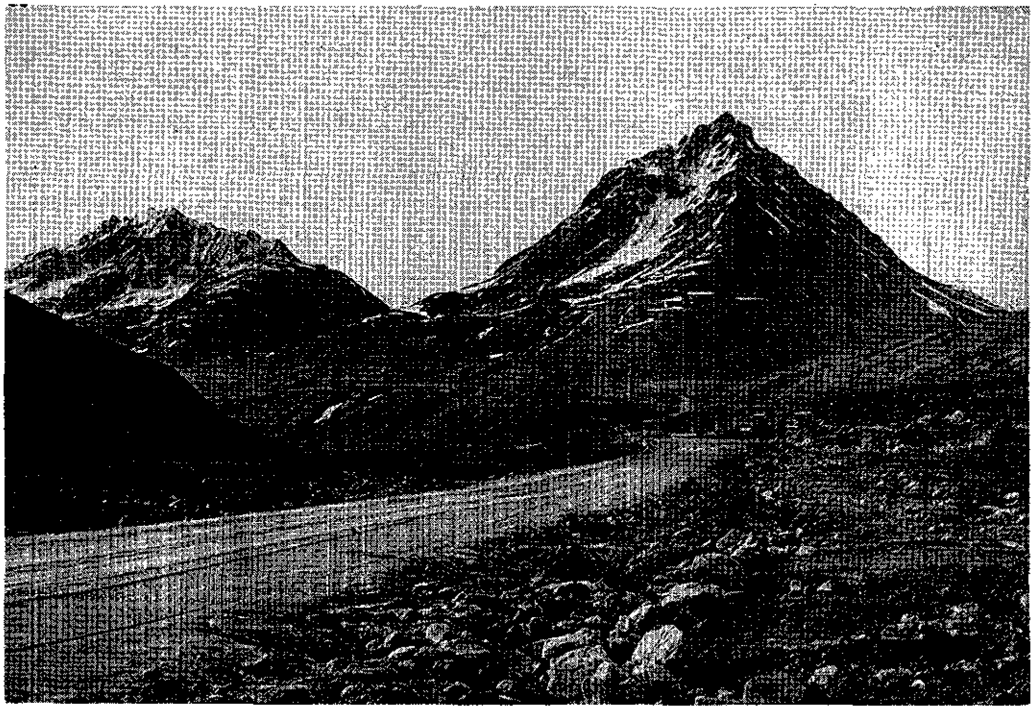
B. Looking north-westward from Maid of Erin claim, Rainy Hollow, to head of Klehini River. Dump at portal of incline is seen in right foreground.

PLATE III.

A. Looking southward from Coast Mountains near Stanley Creek across Tatshenshini Valley at Datlasaka Mountains. Note bench along flank of Datlasaka Mountains.

B. Looking westward from Coast Mountains near Stanley Creek across Tatshenshini Valley at Squaw Range. Note bench along flank of Squaw Range, kettles in Tatshenshini Valley, and Haines Road.

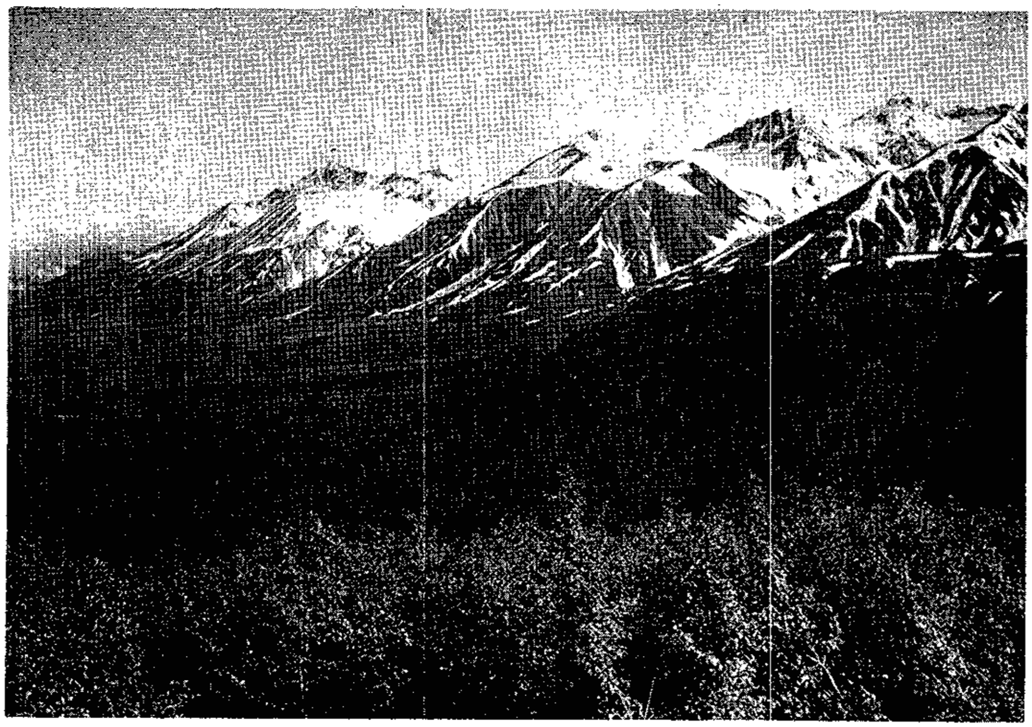
PLATE IV.



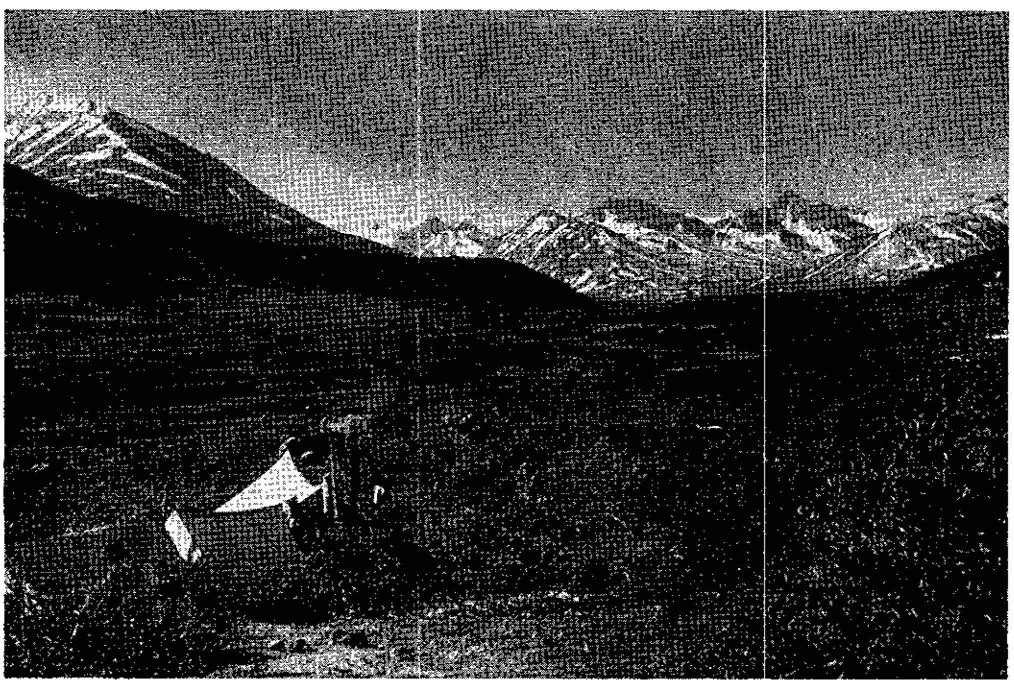
A. View south-eastward along Haines Road toward Mount Glave (Three Guardsmen) on the right and Mount Seltat on the left.

B. Blanchard Lake; view southward. Glacial erratic of granitic rock resting on gneiss.

PLATE V.



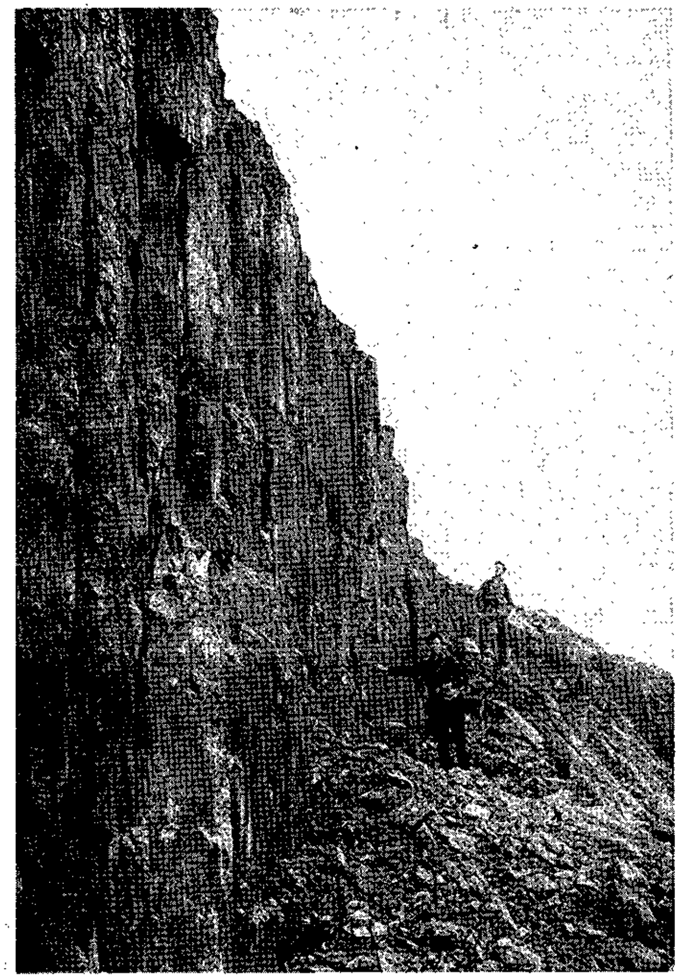
A. Klehini River valley; looking southward from Haines Road at an altitude of about 2,500 feet at Rainy Hollow.



B. Parton River valley; looking westward from camp in dwarf birch and willow at 3,250 feet altitude.

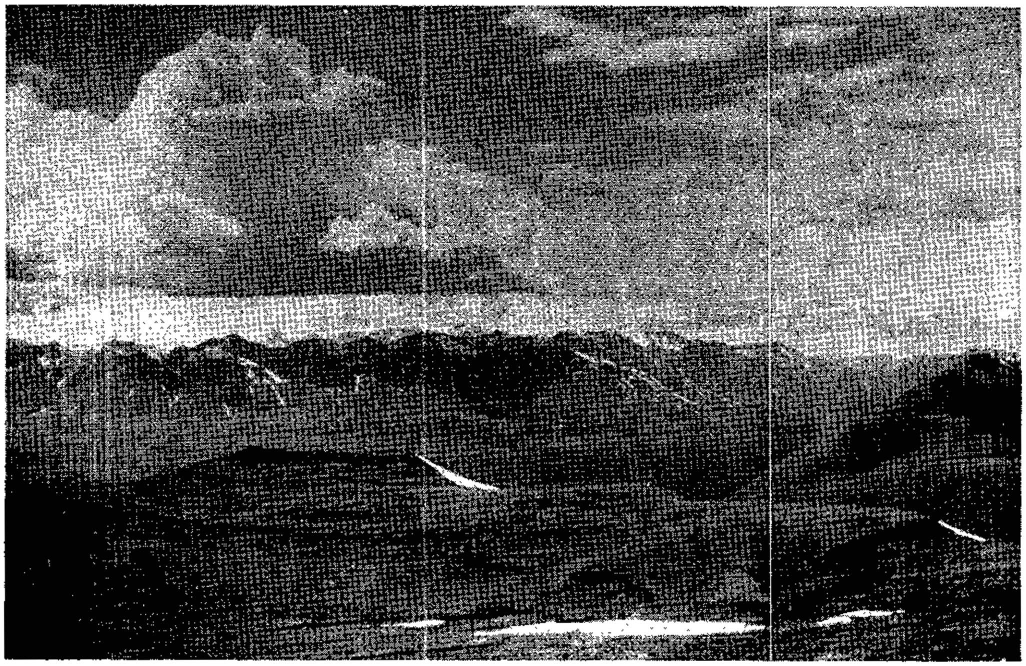
PLATE VI.

A. Pillow lava; Haines Road about 1 mile north of Moi Creek.

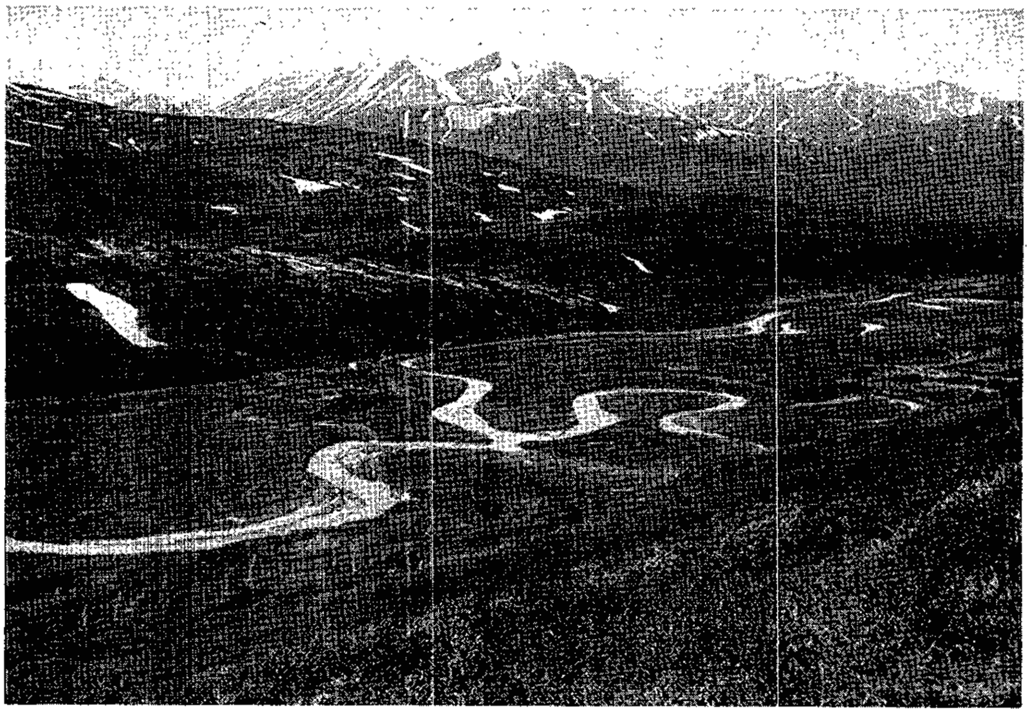


B. Columnar structure in Paleocene rhyolite; 1½ miles north of Kusawak Lake.

PLATE VII.

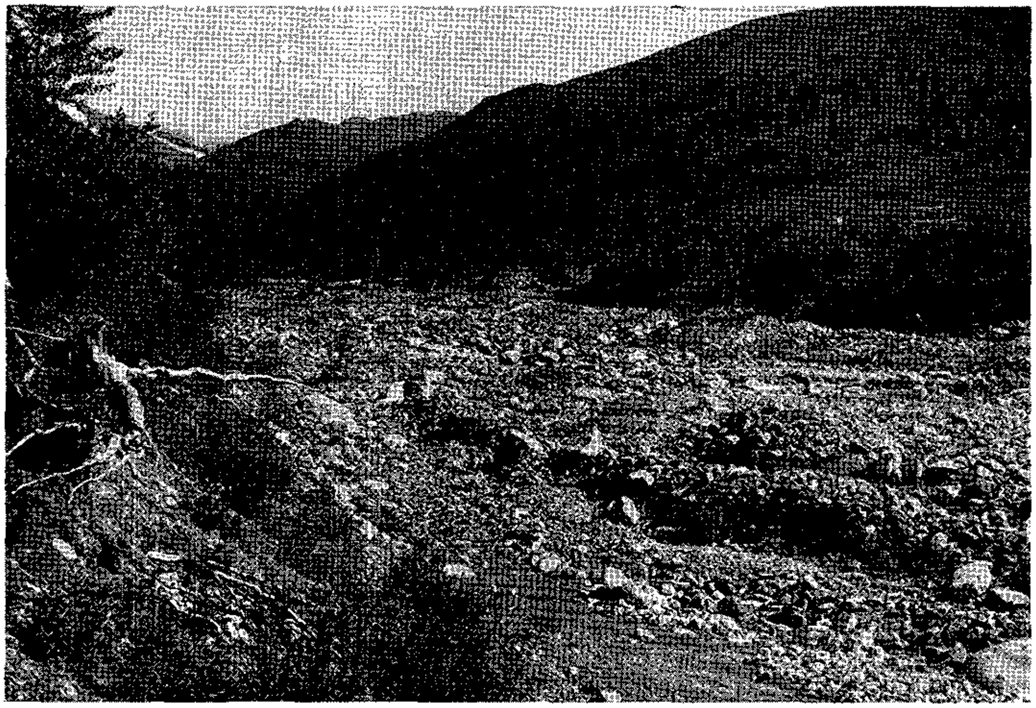


A. Horizontal Late Tertiary basalt between Stanley Creek and Blanchard River. Tatshenshini Valley and Squaw Range in background.

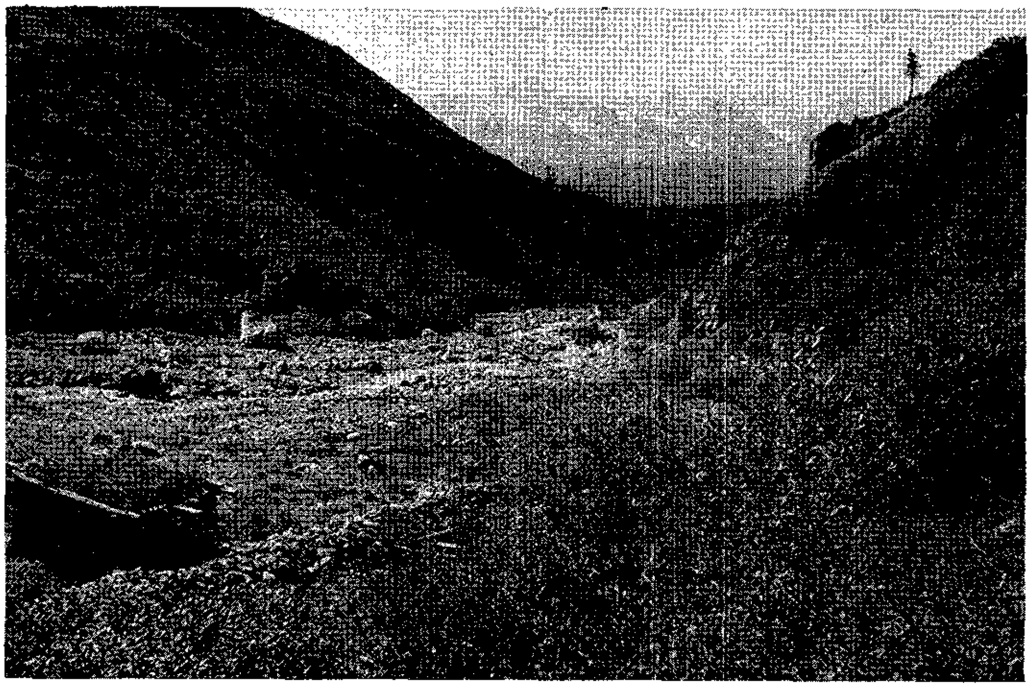


B. Meanders and oxbows along upper part of Tatshenshini River. Looking westward toward Squaw Range.

PLATE VIII.



A. Squaw Creek; looking up-stream from Discovery.



B. Squaw Creek; looking down-stream from Discovery. Nugget weighing 46 oz. 5 dwt. was found near large boulder on left in 1937.

INDEX.

VICTORIA, B.C.:
Printed by DON MCDIARMID, Printer to the King's Most Excellent Majesty.
1948.

1,200 448-9991

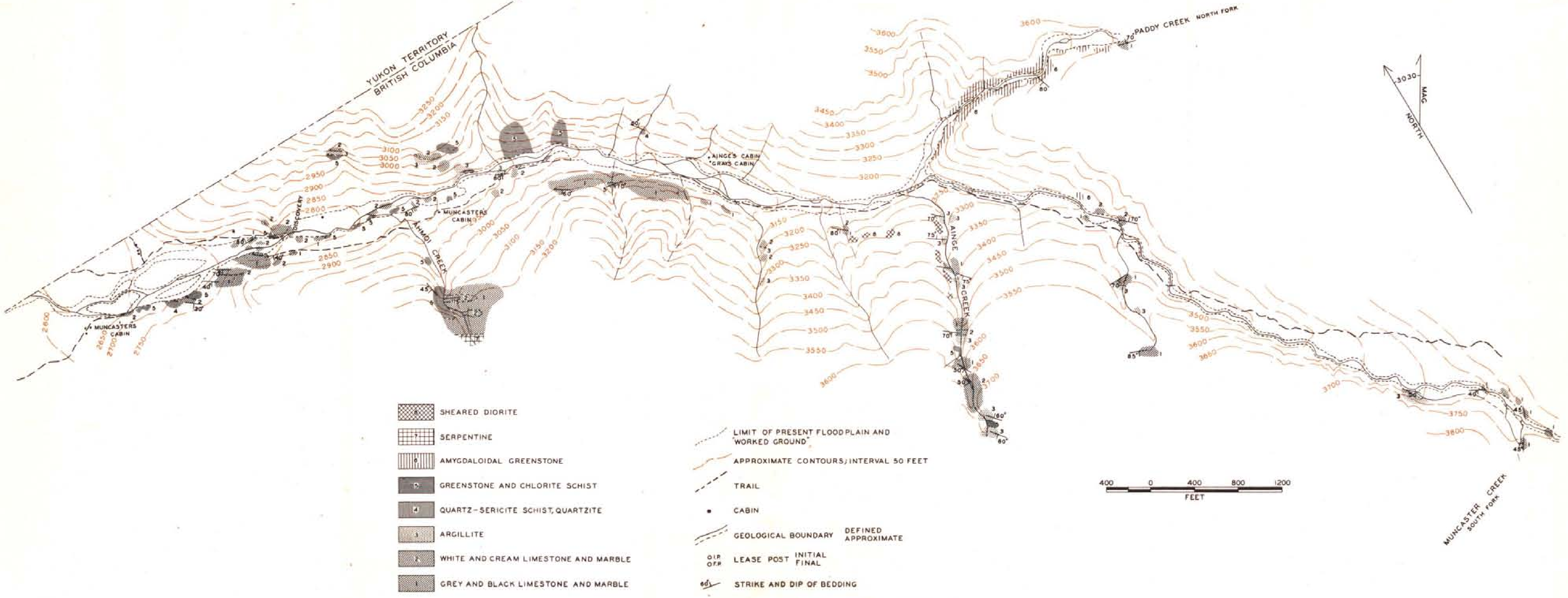


Fig. 2. Map of part of Squaw Creek

#25 (2)