

GEOLOGICAL SURVEY OF CANADA
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Mineral
spring.

'A sample of water from the mineral spring at the north end of Atlin town was collected in order to prove, if possible, the relation of such waters to the hydromagnesite deposits in the vicinity. This has since been examined in the laboratory of the Survey and is reported upon as follows by Dr. Hoffmann :—

Analysis of
water.

"This water was found to contain :—Potassa, traces ; soda, very small quantity ; lime, very small quantity ; magnesia, somewhat large quantity ; ferrous oxide, trace ; sulphuric acid, very small quantity ; carbonic acid, large quantity ; chlorine, very small quantity ; silica, trace ; organic matter, faint traces. The magnesia amounted, approximately, to 1.834 parts in 1,000, an amount which would correspond to 3.851 of magnesium carborate, or 5.869 of magnesium bicarbonate. It is more than probable that it is to the water of this and similar springs in the vicinity, that the deposits of hydromagnesite occurring back of Atlin township owe their origin."

Mountain
plants.

'During the season a collection of flowering plants was made, more especially of mountain species found above the timber-line on the bare grassy ridges. Fifty-four species have been determined by Prof. Macoun of which six are of special interest,—*Anemone Richardsoni*, *Pedicularis pedicellata*, *Claytonia sarmentosa*, *Pedicularis capitata* as also a *Claytonia* and an *Erigeron* which appear to be new. These are all mountain species from altitudes of about 5,000 feet above the sea, collected between June 21st and July 14th.

'The common spruce of the district, found of fair size in flats, is the white spruce, *Picea alba*.

'Acknowledgments are due to Messrs. Fraser and Wheeling, and to Mr. Gillard of the Bank of British North America at Atlin, for their courtesy and assistance during the season.

Kootenay District.

Work by Mr.
R. W. Brock.

Mr. R. W. Brock has now been at work on the geology of the area covered by the West Kootenay map-sheet for some years. During the winter of 1899-1900 his time was chiefly devoted to an examination of the rocks from this field, and as a result of the field-work of the past summer the information required for the compilation of the map-sheet is now practically complete. The topography of this new map is chiefly due to Mr. W. W. Leach. Upon the work of the summer Mr. Brock makes the following interim report :—

Topographical
work by Mr.
W. W. Leach

'On May 22nd I left Ottawa with instructions to complete, if possible, the work on the West Kootenay map-sheet, after which, if any time remained, to extend the geological observation westward toward the Boundary district. As in the previous years, I was accompanied by Mr. W. W. Leach, of this office, who took charge of the topographical work. The portion of the West Kootenay sheet still remaining

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unsurveyed included, roughly, all the area lying between the longitude of Rossland and Lower Arrow lake, and the North fork of the Kettle river, from the International boundary line to about the latitude of Monashee mountain and the head of the main Kettle river, and also part of the area in the north-east corner of the sheet, east of Kootenay lake.

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'The west shore of Lower Arrow lake, and Whatshan lake were not included, as these had been surveyed last year. The examination of these areas, with some degree of accuracy and detail, where the economic conditions seemed to warrant it, has been accomplished and it will now be possible to issue the complete West Kootenay map-sheet. Owing to the large area embraced in the sheet, the extremely mountainous character of the greater portion of the country, and the complicated nature of its geology, the geological portion of the work, in many portions of the district must, however, yet be considered as only a reconnaissance.

Geological
work accom-
plished.

'Although the season as a whole was unusually favourable, it was found impossible to do much more than complete the work on the West Kootenay sheet. Indeed, had the weather at the end of the season permitted it, some additional time might have been well spent in this district. Some information, particularly of a topographical kind, was, however, obtained regarding the country to the west, which will be valuable in carrying on the work in the adjoining sheet.

'Before the regular field-work was undertaken, a few days were spent between Penticton and Grand Forks, in ascertaining some main facts respecting the distribution of the formations in the Boundary district, which were needed for the general geological map of Canada then in course of preparation.

Work in the
Boundary
district.

'The regular work of the season was begun at Rossland. Using the Dewdney trail as a base, the country between Rossland and Christina lake was surveyed. My operations were then transferred to the district about Gladstone, from which point expeditions were made first east, and then north through Burnt and North basins to Badger and Gladstone mountains. Grand Forks formed the next base. From here the North Fork of the Kettle river was ascended. A wagon road, with branches to Volcanic, Pathfinder and Little Bertha claims, extends up the east side of the river to Knights camp on Cedar creek. From Cedar creek the North Fork trail continues to Bunch Grass mountain, where it forks, one branch ascending the main North Fork, while the main trail runs up the east branch of the North Fork to McKinley, Franklin, and Newby camps. After lightening the packs for our horses at Newby's, the end of the trail, we explored the country lying north through to Fire Valley. Fire Valley, and the

Routes
followed
areas ex-
amined.

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'East of Christina lake, more particularly on Sutherland and Baker creeks, the rocks are in places heavily mineralized with iron sulphides and some chalcopyrite. The gabbroidal rock, as well as the ordinary greenstone, is mineralized. The limestone, as a rule, is only slightly so, but along the contact between the limestone and the greenstone, in the altered garnetiferous rock, mineralization seems to be particularly likely to have taken place. While the ore is said to be very low grade, some of the sulphide bodies are large and are on that account worth testing.

Sulphides,
east of Chris-
tina lake.

'On the Cannon Ball there is a steam hoist, and some work has been done, but beyond this, none of a serious nature can be said to have been attempted. The area between Christina lake and the Rossland granite of the Sheep Creek divide should be carefully prospected.

Claims near
Gladstone.

'The serpentine spoken of, already may prove of some value as ornamental stone. Gladstone, on McRae creek, is the centre of an area of the older rocks showing wider-spread mineralization. On the mountains to the east of Gladstone, and north of Mount St. Thomas, the greenstone and gray granite are more or less mineralized, usually near the porphyry dykes. On the Talisman claims is a magnetite showing strong polarity. It has probably resulted from the oxidation of pyrite, which is also present. The gray granite furnishes some very pretty specimens of chalcopyrite.

Claims in
Burnt and
North basins.

'In Burnt and North basins, lying west and north-west of Gladstone, the rocks show the effects of great stresses. Owing to the diversity of rocks and consequent varying powers of resistance, the region is much broken and faulted. It is extensively dyked by porphyries from the surrounding areas of 'Rossland' granite. Owing to these causes mineralization is widespread, but often lacks concentration. On some of the properties, however, there is quite a fair showing, and if the ore carries the reported values, they are worthy of some attention. But for successful development, careful and intelligent supervision is indispensable. Free gold in quartz veins is found in both the greenstone and gray granite. Below the zone of atmospheric and ground-water weathering, a considerable amount, if not all the gold, will probably be found to be held by sulphides. The Mother Lode may be taken as a type of some of these deposits. The main vein, which is about two feet wide, lies in crushed and banded greenstone, between two large dykes of porphyry. The ore is principally quartz, carrying pyrite, sphalerite and galena, with a little chalcopyrite. Native copper is said to have been found in this as in some other claims. The oxidized ore at least, furnishes specimens of free gold. A little molybdenite and some calcite are also present. An incline on the vein is down 43 feet, from the bottom of which is a 75-foot drift. About 20 feet down the incline the vein faults. In the drift, ore, supposed to be part of



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the same vein, is again caught. Several veins occur on the claim. At the south end of the claim the greenstone is full of little stringers of zinc blende. British Columbia—
Cont.

'On the Tammany claim, is a vein of quartz of varying width, sometimes of several feet. It lies along the contact of a light-coloured porphyry. Galena and sphalerite become more prominent in the southern portion of the basin. Cooper's claims, on the south fork of Josh creek, have a dark fissile limestone as the principal country rock. The mineralization is often parallel to the foliation of the limestone, and frequently follows the contact of a dyke. Sphalerite, galena and chalcopryrite are the principal economic minerals, with a strong preponderance of sphalerite. One vein of pure sphalerite attains a thickness of about a foot. Little more than assessment work was being done in the Gladstone district.

'In places the crystalline rocks, between Christina lake and Grand Forks, are mineralized to some extent by pyrite and pyrrhotite. The pegmatites grade into quartz veins and carry a little mineral. At a few points a little work has been done. A number of specimens were collected to be assayed for gold, as the quantity of material available and the accessibility of the region would enable rocks of a low grade to be successfully treated. Mineraliza-
tion of crys-
talline rocks.

'Up the North fork of the Kettle, on the east side, little mineralization of consequence was seen till the area of older rocks about Volcanic creek was reached. There several prospects upon which considerable work has been expended, are situated. Just north of Volcanic creek, on Volcanic mountain, one of the landmarks of the country by reason of its highly coloured surface, is the claim best known as the Volcanic. Volcanic
claim.

'The iron oxide which stains the whole side of the mountain and gives its colour to the soil below, comes from the oxidation of pyrite and probably other iron sulphides, which are exposed on the top of the cliff. The rock here is a mixture of limestone cut by greenstone, (probably a porphyrite) altered and partially replaced by the iron sulphides. The limestone, which is also altered, is not so heavily mineralized. Below this, and forming the western face of the cliff, are several hundred feet of bedded limestone, with intercalated dykes, squeezed and contorted, probably by the porphyrite which cuts it off. This limestone is not mineralized. Below the limestone the greenstone is again found. Into this greenstone, near the base of the cliff, hundreds of feet below the exposure of sulphides and separated from it by the belt of barren limestone, a tunnel had been run (which at the time of my visit was 700 feet long) with the expectation of striking the lead at great depth. The ore exposed at the top of the cliff is said to be very low grade, but such a strong showing as this is worthy of careful

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Cont.

examination, which can be most effectively and economically accomplished at the point where the ore is known to occur.

Eagle claim.

' A short distance to the east and a little to the south of the Volcanic is the Golden Eagle claim. It also lies in the greenstone, which here contains small fragments of crystalline limestone. Two large wide dykes of porphyry, from the north east, cut the greenstone, and along the western contact of the west dyke, the Golden Eagle vein is found. The greenstone has here been altered by silicification and pyritization. The pay-chutes are two narrow veins of saccharoidal calcite and quartz, bearing chalcopyrite, pyrite and probably arsenopyrite. In places the veins widen to about seven feet, by the replacement of greenstone with vein material. Even down to the deepest workings (150 feet) the sulphides are oxidized to iron oxide, malachite and chrysocolla. A little native copper has also been found. Some small shipments of ore were being made to the Grand Forks smelter.

Earthquake
claim.

' The Earthquake claim lies south-east of the Golden Eagle claim. The geological conditions are similar, except that the Earthquake lies near the eastern contact of the east dyke of porphyry. The main vein on the Earthquake is unusually well defined. It preserves its width (2 to 3 feet with "gouge" along each wall) and its dip, of 85°, to the bottom of the shaft, down 33 feet at the time of my visit. The ore (iron sulphides and chalcopyrite) has not suffered oxidation like the Golden Eagle ore. Its average value is said to be about eighteen dollars to the ton.

Pathfinder
claim.

' On the Pathfinder, situated on the first ridge north of Volcanic mountain, across Pathfinder creek, a considerable amount of work has been done, and machinery, embracing pumps, a compressor and a hoist have been installed to aid in the development and testing of the property. The geological conditions are similar to those obtaining on the above mentioned Volcanic mountain prospects.

' The greenstone country-rock is cut by the prophyry dykes. Along these contacts and the neighbouring fissures, the greenstone is altered and replaced. At certain points the mineralization has taken place on an extensive scale. Vein No. 1 is about 12 feet wide on the surface, and 11 feet wide at the 50 foot level. Prophyry dyke No. 1, towards which it runs at a low angle, is only a short distance away. Vein No. 3 lies parallel to, and generally speaking along the contact of dyke No. 1. Number 2 vein lies along the opposite contact of this dyke, in the greenstone bands between dyke No. 1 and dyke No. 2. The ore bodies are apt to be irregular, due to the mode of origin, the complicated fracturing of the country-rock and subsequent faulting. The ore is largely pyrrhotite with chalcopyrite, pyrite and arsenopyrite, in a gangue of quartz, calcite and country-rock. Some melaconite

occurs in the weathered ore. The values are said to average from eleven to fifteen dollars to the ton. On the Little Bertha claim, near the river base of Pathfinder mountain, under conditions similar to those in the Pathfinder, a vein of quartz, with sulphides, etc., occurs in the gray granite.

The district known as Franklin camp, on the east branch of the North Fork, about thirty-five miles from Grand Forks, attracted a great many prospectors this season. It is reached from Grand Forks by trail up the North fork, the natural supply route into this camp. A shorter trail for going and coming might be constructed over the divide to Arrow lake. A glance at the map will show that a feasible route from Christina lake does not exist. Broadly speaking, Franklin camp covers the area of older rocks in this east branch basin. It is locally subdivided into McKinley camp on McKinley mountain, Franklin camp proper, or McFarlane camp, on Franklin mountain, and Newby camp on Gloucester creek. Most of the available ground has now been staked, but beyond a little assessment work, the only claim having any development is the Banner, the pioneer claim of the district. On this a tunnel 194 feet long has been run, with the last thirty feet or so in ore. The ore is quartz, carrying sphalerite and chalcopryrite. In an open-cut a little to the east of the tunnel, is a large exposure of quartz, carrying some galena as well. The ore is reported to assay \$18 to the ton.

On the Homestake claim, a little to the west of the Banner, the country rock is silicified often in large masses. This quartz carries pyrite oxidized in places to red ochre. It is said to assay from \$2 to \$50 to the ton.

On the Montreal claim, near the Homestake, is a quartz vein, two feet or so wide, carrying galena, sphalerite and chalcopryrite. A greenstone breccia is the country rock.

The McKinley claim, just over the north-east face of McKinley mountain, has greenstone exposed in a stream bed for over 100 feet. This rock is altered by silicification. The quartz occurs in stringers, blebs and irregular patches. In the quartz, and also in the greenstone, are small irregular patches of chalcopryrite and pyrite. No work of any consequence has been done on this claim, and not enough of the surface is exposed to furnish much information regarding the deposit. On the Gloucester claim, on the Gloucester Creek slope of Franklin, the country rock seems to be gray granite, calcified and silicified. At the bottom of a shaft, down fifteen feet at the time of my visit, several feet of solid chalcopryrite and pyrite, with a little molybdenite, were exposed. This ore is said to carry \$5.60 in gold per ton and from eight to twenty per cent copper. On the G. H. claim, just east of the Glou-

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cester, also in the gray granite, is a vein of magnetite with some pyrite. The vein of almost solid magnetite, in places at least, is forty feet wide, and it has been traced for several hundred feet. It is reported to carry only traces of gold, silver and copper.

Polass and
Mineral
Hill claims.

'On the slope of the mountain, north of Gloucester creek, the gray granite on the Polass claim shows considerable crushing, which has developed a kugel structure, giving the rock an agglomeratic appearance. Round these balls the granitic material has flowed. In a band about ten feet wide the granite, particularly along fracture-planes, is more or less impregnated or replaced with copper- and iron-pyrites. On the Mineral Hill claim, near the western end of this mountain, the crushed gray granite carries copper-pyrites. A ledge about one foot wide contains irregular masses of this mineral, of about one-half to one inch in diameter. Since the time of my visit some work has been done, which is said to have exposed a good showing of ore.

'A good deal of prospecting has been carried on at the heads of Fire valley and the Kettle river last fall and during the present season. The townsite of Wauchope has been staked and a few buildings erected, at the mouth of Eight-mile creek, near the head of Fire valley.

Eureka claim.

'Just beyond the head of Eight-mile creek, on a branch of Barnes creek, lies a group of claims of which the Eureka is the best known. They are situated on a dyke of white rock which cuts and alters the Nisconlith rocks. In some parts of this dyke, felspar crystals may be detected, but some of it is a fine-grained aphanitic quartz-like rock, which, however, weathers to some extent on the surface and effervesces with acid. The surrounding Nisconlith rocks are silicified and calcified to some extent. The dyke and neighbouring rocks are impregnated, especially along minute fractures, with small, usually silvery, metallic particles, which often weather bronzy, and also with some of yellow chalcopryrite. Three different assayers are reported to have found tellurides, with high gold values, in specimens from the Eureka. But the tellurides, if they occur, are not scattered uniformly throughout the rock, as in a specimen examined in this office last winter, the metallic particles contained were found to be pyrrhotite and specular iron, and no telluride was detected. A number of specimens of the most likely looking material were selected and have been passed over to Dr. Hoffmann to be examined for tellurides.

Palladora
claim.

'On Olds mountain, north of Fire valley, a little above Wauchope, is the Palladora claim. In the rather basic, altered, somewhat greenish Nelson granite, is a vein of quartz and vein matter, varying in width, but averaging about four feet, running N. 85° E. (mag.) and underlying about 20° N. The quartz is bluish and holds 'spiders' of pyrite, chalcopryrite, galena, and some marcasite or arsenopyrite. It is said

to assay over \$30, but the average values will probably be much lower, as the amount of sulphides present varies considerably. Another parallel vein, one and one half feet wide, occurs about twenty yards north of the main vein, and a third parallel quartz vein, in places, at least, eight feet wide, occurs on the hill just north-west of the cabin. It is also mineralized, but not so heavily as the first vein.

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'On the Shamrock claim, situated on Kettle river, at the base of Monashee mountain, two small parallel quartz veins have been uncovered. The quartz is heavily mineralized, especially with jamesonite, but sphalerite and pyrite also occur. Free gold occurs in the jamesonite amid the quartz, and in the cavities left by the oxidation of the sulphides, flakes of gold are quite plentiful. One specimen of the jamesonite obtained, holds a nugget of gold as large as a pea. The veins are about four inches wide. They occur in a black silicious argillite parallel to a porphyry dyke. As the claim is drift-covered and work was only starting, little can be said about the extent of mineralization upon it. A number of claims have been staked on the north side of Monashee mountain, which are said to have encouraging showings of ore. The old Monashee mine passed into new hands during the summer. Modern machinery is to be installed to give this property a fair trial.

Shamrock
claim.

Monashee
mine.

'About a mile below the new trail on the east bank of the Kettle, a prospector was doing a little placer mining. Although no mercury was being used, and all the fine gold was consequently escaping, fair wages were reported to be made. All of the drift along this part of the Kettle is said to yield colours of gold. Along the Arrow Lake divide, and from Franklin camp to Fire valley, no mineralization was observed; though such might possibly occur in the gray granite area on the plateau at the head of the east branch.

Placer
mining.

'From what has already been said, it will appear that, for the most part, the ore deposits of the district examined this season, have a marked similarity in their mode of occurrence and origin to those of the Trail creek and other portions of West Kootenay. Of their nature and mode of formation there can be no question. They are what are sometimes known as composite veins, or shear-zone veins, formed by mineralizing solutions traversing the country-rock, principally along fissures or zones of fissures, from which they replace with their mineral contents, particle by particle, sometimes only partially, sometimes completely, the original material of the country rock. Since the deposits are found only in districts traversed by the porphyry dykes so often referred to, and usually in the rock in the immediate vicinity, if not along the actual contact of these dykes, and since the dykes are themselves to some extent mineral-bearing, it seems altogether probable that a genetic relationship exists between the dykes

Mode of
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