GOLD LODES IN THE UPPER KUSKOKWIM REGION.

By GEORGE C. MARTIN.

DISCOVERY AND DEVELOPMENT.

The recent discovery of deposits of high-grade gold ores in the upper Kuskokwim region has attracted attention to a part of Alaska that is comparatively little known either to the general public or to mining men or geologists.

For several years a few small placer mines have been worked on Ruby and Hidden creeks, which are tributary to Nixon Fork from the south. In the course of this placer mining it was found that the gold became more abundant as it was followed up the creeks, but that above certain points it was no longer found. Shafts sunk into the bedrock at the limits of the placer gold revealed rich gold-bearing lodes lying on or near a monzonite-limestone contact. Further prospecting at this contact revealed the presence of other gold lodes. Shafts were sunk early in 1919 on two of the more promising of these lodes, and from one of them several hundred tons of high-grade ore was mined in the winter of 1919–20. This ore was sledded to Kuskokwim River and in the summer of 1920 it was shipped to the Tacoma smelter. In the meantime prospectors had traced the contact of the monzonite boss near the margin of which the known lodes lie, had staked claims along probably the entire contact, over much if not all of the monzonite area, and over part of the surrounding limestone, and had dug many trenches and pits along the contact and at other places, revealing the presence of many ore bodies of different sizes and richness. Many of the more promising claims, including the one from which ore had been shipped, passed into the control of the Alaska Treadwell Gold Mining Co. and associated interests early in 1920. During the summer of 1920 the Alaska Treadwell Co. was actively engaged in prospecting its holdings, and prospecting was being continued on a smaller scale on some of the other claims.

SOURCES OF INFORMATION.

Although the lower part of Kuskokwim River was explored in 1832, information concerning the upper part is still scanty. Several prospectors visited the upper part of the river between 1889 and 1898.

The earliest precise information concerning the country through which the upper river flows was gained by J. E. Spurr [1] and W. S. Post, who, in the summer of 1898, crossed the Alaska Range at the headwaters of Skwentna River and of the South Fork of the Kuskokwim and descended the Kuskokwim to its mouth (Pl. III). The resulting geologic information and maps of the area adjacent to the river from the forks to McGrath have been used in this report. In 1899 Lieut. Joseph S. Herron [2] crossed the Alaska Range at the head of Kichatna River and explored areas on various tributaries of the Kuskokwim above the forks. In 1901 a steamer was taken up the Kuskokwim to the forks. In 1902 an expedition under the leadership of Alfred H. Brooks [3] crossed the Alaska Range through Rainy Pass, near the headwaters of the South Fork of the Kuskokwim, and traveled northward along the western base of the Alaska Range. In 1907 G. B. Gordon [4] reached the headwaters of the North Fork of the Kuskokwim by way of Kantishna River and Minchumina Lake and descended the Kuskokwim to its mouth. Gordon's account of his explorations contains some general information on the region and much information concerning the natives but very few accurate cartographic or geologic data. A preliminary railroad survey from the Susitna Valley to Iditarod by way of the South Fork of Kuskokwim River was made in 1914 by J. L. McPherson for the Alaskan Engineering Commission.

Information bearing upon this district is to be found in descriptions of neighboring districts, notably in accounts by Smith [5] of an area on the south, by Eakin [6] of an area on the northeast, and by Mertie and Harrington [7] of an area on the west.

The prospects in the district have been described by J. S. Rivers [8] and by an anonymous writer [9] and have been briefly mentioned by Brooks and Martin.[10]

The statements herein presented are based primarily on observations made by the writer in a brief visit in the summer of 1920, but they include also such other information as could be gathered from various sources. Acknowledgment should be made for aid

[1] Spurr, J. E., A reconnaissance in southwestern Alaska in 1898: U. S. Geol. Survey Twentieth Ann. Rept., pt. 7, pp. 31-264, pls. 7-13, maps 4-14, 1900.

[2] Herron, J. S., Explorations in Alaska, 1899, for an all-American route from Cook Inlet, Pacific Ocean, to the Yukon: War Department, Adjt. General's Office, No. 31, 1901, pp. 1-77, with maps.

[3] Brooks, A. H., The Mount McKinley region, Alaska: U. S. Geol. Survey Prof. Paper 70, 234 pp., 18 pls., 1911.

[4] Gordon, G. B., In the Alaskan wilderness, 247 pp., 1917.

[5] Smith, P. S., The Lake Clark-central Kuskokwim region, Alaska: U. S. Geol. Survey Bull. 655, 162 pp., 12 pls., 1917.

[6] Eakin, H. M., The Cosna-Nowitna region, Alaska: U. S. Geol. Survey Bull. 667, 54 pp., 8 pls., 1917.

[7] Mertie, J. B., jr., and Harrington, G. L., Mineral resources of the Ruby-Kuskokwim region: U. S. Geol. Survey Bull. 642, pp. 223-266, pl. 11, 1916.

[8] Rivers, J. S., Eng. and Min. Jour., Aug. 21, 1920.

[9] Min. and Sci. Press, vol. 121, pp. 475-476, 1920.

[10] Brooks, A. H., and Martin, G. C., The Alaskan mining industry in 1919: U. S. Geol. Survey Bull. 714, p. 93, 1921.

rendered to the writer in the field and for information furnished by all the local claim owners, miners, and prospectors and especially by Mr. Livingston Wernecke, who was in charge of the local operations of the Alaska Treadwell Mining Co. Much of the information here presented would not have been available without Mr. Wernecke's cordial and generous cooperation.

GEOGRAPHIC ENVIRONMENT.

POSITION.

The lode prospects to be described are about 12 miles north of the forks of the Kuskokwim. (See fig. 4.) The forks are in west-

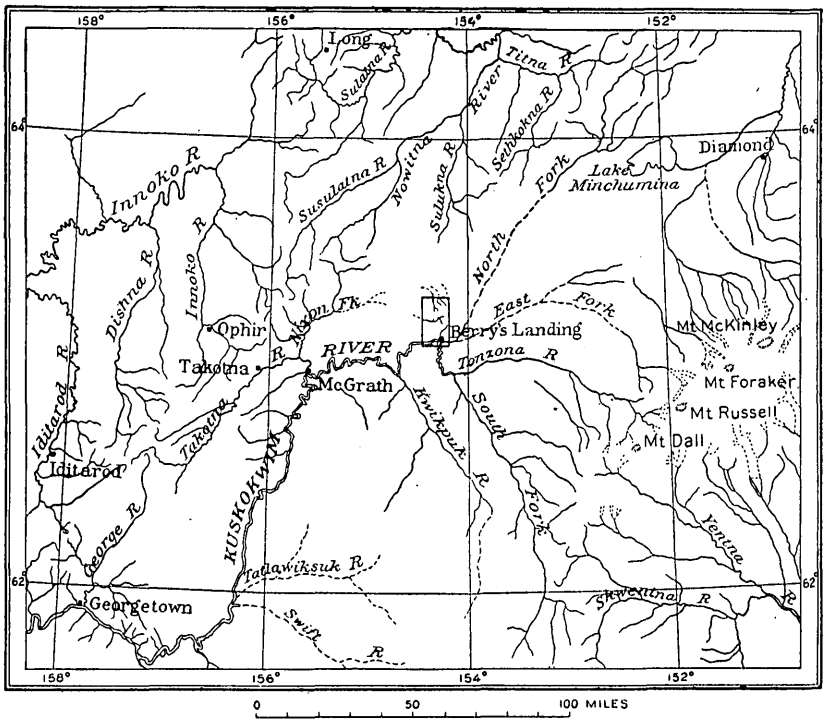

FIGURE 4.—Index map of upper Kuskokwim basin. The rectangle indicates the area shown in figure 5.

central Alaska, in about latitude 63° N., longitude 154° W., or about 500 miles above the head of deep-water navigation at Bethel and 600 miles from the mouth of the river. The prospects and the exposures described are all included within a small area near the divide between the main Kuskokwim and Nixon Fork, which is one of the larger northern tributaries of the Kuskokwim. The district has been popularly known as the "Nixon Fork country," but this name is not especially appropriate and will probably be replaced in local usage.

ACCESS AND SETTLEMENTS.

The only feasible route to the camp that is at present open in summer is that by way of the Kuskokwim, either from its mouth or from McGrath, which may be reached by an overland route from Iditarod. McGrath was the nearest permanent settlement in 1920, although there seemed to be promise that a small settlement would be established at Berry's Landing, near the forks of the Kuskokwim, about 90 miles above McGrath. (See Pl. III.) Berry's Landing is the head of ordinary navigation on the Kuskokwim; it can be reached by launches or small steamers. Although the river is probably navigable by small boats for some distance above the forks, Berry's Landing is the nearest point on the river to the lode prospects. From this landing a wagon road leads northward about 15 miles to the prospects. This road was not in good condition in 1920, being with difficulty kept passable for heavy freight wagons. It is believed, however, that a good road could be constructed on or near the position of the present road, although there are many very swampy areas which it may prove difficult to avoid or to improve. About halfway from Berry's Landing to the prospects the road leaves the flats and climbs onto solid ground on the slopes of the hills. From this point to the mines the road is in good condition. There was in 1920 no regularly scheduled navigation on the river. Small steamers and launches ascended the river with freight from Bethel whenever an ocean shipment arrived at that port, and launches went up from McGrath whenever business offered. A few travelers have made the summer journey to the camp from Ruby, and some possibly from points in the Tanana Valley, but there are no established summer trails, and the soft ground and brush make travel over a direct or random route from these points very difficult. Summer travel from these directions is consequently not to be recommended until trails are built.

In winter the district is accessible by sled routes from almost any desired direction. It lies not far north of the former winter mail route from Anchorage to Iditarod and can be easily reached from any of the settlements in the Tanana Valley.

Comparatively easy access to the district could probably be had in either summer or winter over a road built from some point on the Government railroad between Nenana and the foothills of the Alaska Range. Such a road would be about 200 miles long (see Pl. III) and would follow the foothills of the Alaska Range through the Kantishna district, past Lake Minchumina and the headwaters of the North Fork of the Kuskokwim, and would continue along the divide between Nixon Fork and the Kuskokwim. Much of the area that would be traversed is unsurveyed, but enough is known about the general character of the country to make it practically certain that a feasible

ENGRAVED AND PRINTED BY THE U.S. GEOLOGICAL SURVEY

100 0 100 200 300 400 500 Miles

100 0 100 200 300 400 500 Kilometers

ALASKA, MAP C
Edition of 1916

route for a road can be found. If a productive mining camp is established here it is believed that most of the transportation of passengers and light freight to and from the district will be over some such route as this, though heavy freight will probably always move over Kuskokwim River.

RELIEF AND DRAINAGE.

The camp is in a group of irregular rounded hills, which have no definite trend and stand in general about 1,000 feet above the forks of the Kuskokwim, or probably about 1,500 feet above sea level. The area is in one of the higher parts of the line of hills which forms the divide between Nixon Fork and the Kuskokwim. The hills in the immediate vicinity of the camp have steep but fairly smooth slopes. Cliffs, sharp peaks, and ridges of definite trend are noticeably absent. The area between the hills and the Kuskokwim is an imperfectly terraced flat having a general elevation of about 50 feet above the river. It is the customary river flat of interior Alaska and is probably formed of several terraces, but no detailed information concerning their number, attitude, and form is at hand. All the prospects thus far discovered are on the Nixon Fork side of the divide, on small creeks that flow out from the hills and meander across the broad, flat valley to join Nixon Fork, which follows a most meandering course, as indicated on the accompanying map (Pl. III). The courses of these creeks beyond the immediate vicinity of the prospects and the identity of possibly larger streams into which they may empty before reaching Nixon Fork is not known. The lack of knowledge concerning them is indicated by the names Puzzle, Mystery, Hidden, and Riddle, which have been applied to some of the creeks.

VEGETATION.

The hills and small valleys in the vicinity of the camp are covered with a fairly uniform but in general open mixed forest of spruce and birch, and on the hillsides there are fairly numerous but not very dense thickets of alders and willows. A remarkably thick coat of moss covers all the slopes. Exposures of rock or bare ground are very scarce, even along the creeks or on the tops of the highest hills. The flats along Kuskokwim River bear scattered patches of forest, which are separated by swamps and meadows. The trees include spruce, poplar, and larch, the poplar predominating except in favored places, most of them either near the river or at the base of the hills, where there are forests of spruce.

Grass grows abundantly on the hillsides and in the more open birch forests. There is also much grass on the flats, but most of it is marsh grass. The parts of the flats seen by the writer are either swampy or have been recently burned over and bear little or no useful vegetation.

ANIMALS.

The larger animals include moose, caribou, and probably both brown and black bear. All are relatively scarce, for this district lies in one of the poorer game countries of central Alaska. The reason for the scarcity of the larger game animals is not known. They have not been exterminated by hunters, for the human population, both white and native, is small, and there has been no hunting for market or for trophies. The smaller fur-bearing animals are said to be abundant. The useful birds include numerous grouse and waterfowl of various kinds.

CLIMATE.

This district is within the more rainy part of central Alaska. Summer rains are much more frequent than in the Yukon-Tanana region, but the rainfall is of course not so great as that of the coast region. No weather records are available, but the abundance of rain is indicated not only by the general observations of the inhabitants but by the dense growth of moss on the hillsides.

GEOLOGY.

The rocks exposed in the vicinity of the prospects include Paleozoic (probably Middle Devonian, though possibly Ordovician) limestone and shale, a mass of quartz monzonite which is intruded into the limestone, terrace gravel, and stream gravel. (See fig. 5.) The limestone and shale are believed to underlie a large area throughout the region and are probably cut by numerous masses of quartz monzonite that have not yet been discovered.

LIMESTONE.

The rocks in the vicinity of the lode prospects of the Kuskokwim, except the intrusive rocks and gravels, are limestones that are believed to be part of the limestone and slate which Spurr [11] has described as the "Tachatna series" (now spelled Takotna). The fact that the writer observed only limestone with little if any interbedded shale or slate in the hills near the lode prospects, whereas Spurr described the exposures in the river bank as including much shale or slate, probably means that the limestone finds its characteristic topographic expression in the peaks and ridges, which comprise almost the only exposures of bedrock away from the river. The additional fact that the exposures are few but are practically all of limestone is perhaps an indication that limestone is not areally the most extensive rock of the district.

[11] Spurr, J. E., A reconnaissance in southwestern Alaska in 1898: U. S. Geol. Survey Twentieth Ann. Rept., pt. 7, pp. 123, 157–159, 179, 1900.

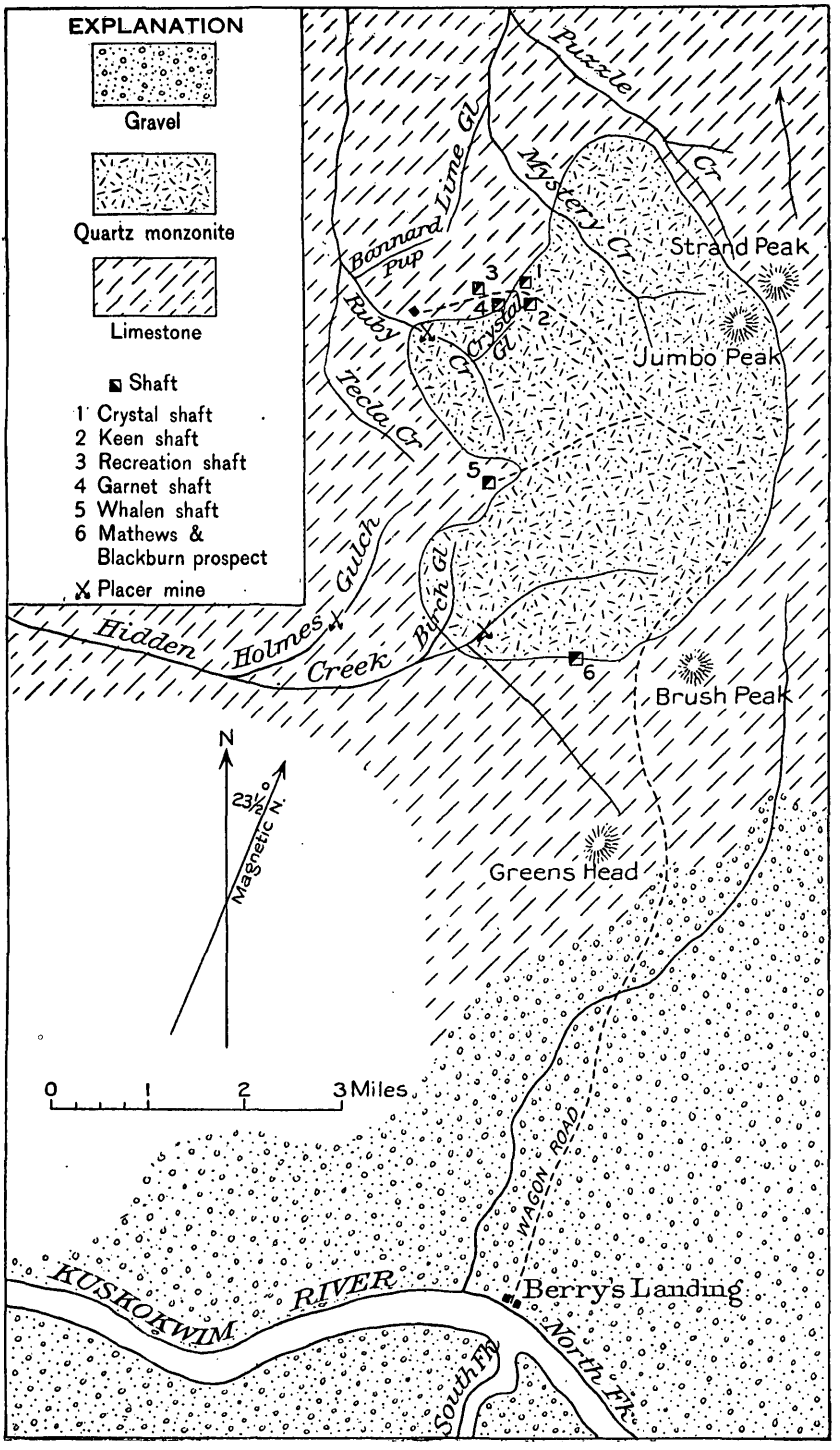

FIGURE 5.—Geologic map of Nixon Fork lode district, upper Kuskokwim basin.

The exposures noted by the writer are of fine-grained blue limestone, which is recrystallized to a moderate extent and cut by a multitude of irregular joints and by many thin seams of calcite. The bedding is obscure and possibly has been destroyed by shattering and recrystallization. No other rocks interbedded with the limestone were observed. No estimate of thickness or determination of the structure was made. Fossils were sought with considerable care, but none were found.

These limestones are believed to be the equivalent of the Takotna "series," which, as described by Spurr, includes the exposures on the north bank of the Kuskokwim between the forks and the mouth of Takotna River. The Takotna "series" was described by Spurr [12] as follows:

> The Tachatna series consists of a series of gray, generally thin-bedded limestones, with limy, carbonaceous, and chloritic shales and some fine-grained arkoses. The rocks have been considerably folded and contain frequent quartz veins. They are cut by granitic dikes in rare cases. From the light-gray limestone in this series fossils have been obtained which indicate a probable Middle Devonian age for this horizon. The Tachatna series is separated from the overlying Holiknuk series, in which probable Cretaceous fossils occur, by an unconformity, while the series underlying the Tachatna was not exposed.

The Middle Devonian age of the Takotna "series" has been determined from fossils collected by Spurr at a locality on the north bank of the Kuskokwim, about halfway between the forks and the mouth of Takotna River. The following statement [13] concerning these fossils was written by Charles Schuchert:

> The material submitted consists of a blackish, weather-worn limestone, containing the following corals:
>
> *Favosites*, much like *F. billingsi* of the Hamilton formation.
>
> *Favosites*, with smaller corallites. It may, however, be a variation of the one mentioned above.
>
> *Alveolites*, with very small corallites.
>
> *Striatopora*, sp. undet.
>
> *Crepidophyllum?*
>
> Stromatoporoids, two species, one having a globular and the other a ramose mode of growth.
>
> There are no corals in this fauna pointing unmistakably to the Silurian (Upper), and since there is nothing present to disprove a Middle Devonian aspect, I assume that to be the age.
>
> The only other Devonian locality known to me in Alaska is Kuiu Island, Saginaw Bay, in southern Alaska, south of Sitka. (See U. S. Geol. Survey Seventeenth Ann. Rept., pp. 900 and 902.) The fossils from Cape Lisburne, in north Alaska, are also all corals and appear to indicate the Upper Silurian, but there is also a possibility of their being Devonian. The few fossils gathered last summer by Mr. Brooks may also be Devonian.

It is also possible that the limestone exposed near the prospects may be the equivalent of an Ordovician limestone found near the

[12] Spurr, J. E., op. cit., p. 179.

[13] Idem, pp. 158–159.

headwaters of the North Fork of the Kuskokwim and described by Eakin.[14] This Ordovician limestone occurs at the north end of the range of hills which extends northeast from the locality herein described. The intervening area has not been traversed by geologists, and it is not known that the limestone extends through it continuously, but observations made by Eakin and by the writer from the north and south ends of the intervening belt indicate that this intervening area is probably chiefly limestone. It is therefore possible that the limestone at the prospects is continuous with the limestone near the headwaters of the Kuskokwim and is of Ordovician age instead of being continuous with the nearer Devonian limestone exposed on the banks of the river.

INTRUSIVE ROCKS.

A roughly oval area of quartz monzonite, about 3 by 5 miles in size, cuts the limestone in the vicinity of the prospects. A few small basic dikes, one of which (p. 161) is of pyroxenite, have also been intruded into both the monzonite and the limestone. The monzonite is locally known as granite and may properly be so called in popular speech, although microscopic examination shows that it differs somewhat from a true granite, being more basic and therefore intermediate in composition between granite and diorite. The monzonite of this area is very similar to the monzonite of the Iditarod and Candle Creek gold placers. It is a sodic quartz monzonite composed of quartz, andesine, albite, biotite which is partly chloritized, apatite, and zircon. It is possible that there are other masses of monzonite in the vicinity, and other igneous rocks may also be present.

GRAVELS.

The flats bordering Kuskokwim River are covered with bench gravels that extend in places for several miles back from the river. No record of the altitude of the highest benches was made, but the writer believes that the general upper limit of the well-developed benches is about 100 feet above the river. Spurr[15] records a silt bluff 100 or 150 feet high about halfway between the mouth of the East Fork and the mouth of Takotna River and notes that the silt banks between this locality and some localities well up on the South Fork do not rise more than 20 feet above the river. The writer agrees with this observation but believes that higher terraces, not cut by the river, are present in this interval. These deposits are the usual river benches of interior Alaska and call for no special description.

The small streams near the lode prospects have the customary alluvial wash, which is locally gold bearing.

[14] Eakin, H. M., The Cosna-Nowitna region, Alaska: U. S. Geol. Survey Bull. 667, pp. 23–25, 1918.
[15] Op. cit., p. 122.

Glacial deposits are not known in the region, although much of the material in the terraces and bars of the Kuskokwim was derived from glacial deposits in and near the Alaska Range.

MINERAL RESOURCES.

GOLD LODES.

OCCURRENCE.

The gold lodes herein described lie on or near a contact between quartz monzonite ("granite") and limestone. The monzonite outcrops in a roughly elliptical area measuring about 3 by 5 miles. The west side of the monzonite has an irregular outline that may be due either to erosion along a sloping contact, to original irregularity in the shape of the monzonite mass, or to deformation. The rocks are so poorly exposed that the contact relations are not well known, but it is believed that the monzonite is intrusive into the limestone, that the western margin of the monzonite slopes westward at an angle departing appreciably and perhaps considerably from the vertical, and that the contact has been modified by faulting along lines diagonal to its original direction.

All the known ore bodies and most of the indications of mineralization have been found at or near the contact of the monzonite and the limestone, near the western margin of the monzonite, at places where the contact departs sharply from its general northerly trend. The ore does not occur in one continuous body but in several lenticular masses, none of which has yet been traced for any considerable distance. It is believed that workable ore is more likely to be found where the contact has been cut by faults or by zones in which the rocks are shattered. The ore bodies perhaps extend along the faults for considerable distances from the intrusive contact or along the contact for considerable distances from the faults.

Although the ore shows considerable differences in appearance and in richness from one prospect to another, it is probably of one general type, characterized by the presence of gold-bearing copper sulphides, which have been deeply and thoroughly weathered in most of the prospects to iron oxides and hydroxides and copper carbonates. The ore in all the prospects except the Crystal shaft is thoroughly oxidized to the extreme depth reached by the workings in August, 1920. The ore in the Crystal shaft, on the contrary, is unoxidized, even at the surface. The lack of alteration at the Crystal shaft may be due to some unexplained tightness of the fissure or to the fact that this ore body is within the monzonite, whereas most of the others are in the limestone or on the contact.

No assays of the ore have been made by the Geological Survey. A published description,[16] which is believed to be based on reliable first-hand information, says:

> The ore is valuable chiefly for gold, but it carries 2 or 3 ounces of silver, and some of it contains from 2 to 8 per cent copper. * * * Several lenses of ore have been disclosed; they consist of high-grade ore—for example, 38 feet assaying $56 and 32 feet assaying $65 per ton. A large proportion of the ore assays between $30 and $35 per ton, for a full stoping width, but the ore bodies are comparatively short—for example, 40 to 60 feet.

Most of the ore seen by the writer is believed to contain not more than 2 per cent of copper. A specimen which was sent to the Geological Survey and which is said to have come from the Whalen claim contains copper and a little nickel.[17] Samples collected by the writer from the Recreation, Garnet, Whalen, and Crystal shafts, the Garnet trench, and the Mathews & Blackburn prospect were analyzed in the laboratory of the Geological Survey, and no trace of nickel was found.

Additional ore bodies may be sought not only along the contact of the limestone with the mass of monzonite but on the margins of any other monzonite areas that may be discovered in this district. The geographic and geologic province of which the known mineralized area is a part and in which similar geologic conditions may be expected and additional mineralized areas of this type may perhaps be found includes the belt of hills between Kuskowim River and Nixon Fork extending northeastward from the mouth of Takotna River for a considerable distance beyond the forks of the Kuskowim and possibly as far as the headwaters of the North Fork. Most of this area has not been examined geologically, but limestone is visible for a considerable distance from the hills near the prospects. Special search should be made in this belt for other areas of monzonite, and they should be carefully prospected, although it is not certain that they will contain valuable ores.

MINE AND PROSPECT OPENINGS.

Crystal shaft.—The Crystal shaft is near the head of Crystal Gulch, a tributary of Ruby Creek (fig. 5). It is in the monzonite not far from the limestone. The shaft was begun in January, 1919, and was sunk in the winter of 1919–20 to a depth of 65 feet. The workings, which were inaccessible at the time of the writer's visit, were made for the purpose of mining whatever ore could then be shipped at a profit. It is said that the ore body thus mined was a lens 10 by 20 by 65 feet in dimensions and that there was "6 feet of sulphides in

[16] Min. and Sci. Press, vol. 121, pp. 475–476, 1920.
[17] U. S. Geol. Survey Bull. 714, p. 93, 1921.

the bottom of the shaft." The ore is unoxidized and, as shown by specimens on the dump, consists of chalcopyrite, pyrite, and bornite in a gangue of calcite, siderite, and a zeolite, probably scolecite.

Keen shaft.—The Keen shaft is on the wagon road near the head of Crystal Gulch, about 1,000 feet east of the western border of the monzonite. It is said to have revealed a vein 4 feet wide, and material from this vein on the dump shows quartz with much yellow stain containing numerous small flakes of a grayish mineral with metallic luster (probably arsenopyrite) and a few small cubes of pyrite.

Recreation shaft.—The Recreation shaft is near the wagon road on the hillside northeast of Ruby Creek. It is in the limestone about 600 feet west of the margin of the monzonite. A shaft 50 feet deep with a drift 35 feet long exposes a vein having a maximum thickness of 6 feet. The vein has been traced by surface cuts for about 200 feet. The ore is thoroughly oxidized and shows in thin section iron oxides and hydroxides, quartz, chlorite, which is in part spherulitic, malachite, probably some azurite, and a little apatite. The specimens show much dark-green and some blue stain, probably derived from copper minerals. No sulphides or metallic minerals were seen.

Garnet shaft.—The Garnet shaft is south of the wagon road near the head of Crystal Gulch. It is in limestone, about 100 feet from the outcrop of the monzonite, but masses of monzonite show in the lower workings. The shaft was 76 feet deep when visited, and there was about 70 feet of drift. At the surface the ore is the full width of the shaft, which does not show the walls. At the bottom of the shaft the vein is not more than 4 feet wide. The ore, which is thoroughly oxidized, consists of chloritic material, iron ores, and quartz with many thin films and small masses of malachite and azurite.

Whalen shaft.—The Whalen shaft is on the divide between Ruby and Hidden creeks. At the end of August, 1920, it was 100 feet deep, and there was 160 feet of drift on the 40-foot level. Crosscuts on the 40-foot level show 32 feet of ore reported to average $68 per ton in gold. The vein is in limestone not far from the monzonite, and at the south end of the workings it lies very close to the monzonite. The ore, which is thoroughly oxidized even in the deepest workings, consists of chloritic material, iron ores, and quartz, containing many small masses of copper carbonates and a few small masses of chalcopyrite or pyrite.

Garnet trench.—The Garnet trench is on the contact between the monzonite and limestone, south of Mystery Creek and near the northeast corner of the Southern Cross claim. The ore consists chiefly of garnet containing many thin films and small masses of malachite and azurite. The thin section shows, in addition to garnet,

augite, a little sericitized plagioclase, apatite, epidote, and chloritic material.

Twin shafts.—The Twin shafts are near the center of the Southern Cross claim. They are in an oxidized zone on the contact of a fine-grained porphyry dike intrusive into limestone. The ore was so much decomposed that no microscopic study or determination of the constituent minerals was possible. It is said to carry about $10 worth of gold per ton.

Mathews & Blackburn prospect.—The Mathews & Blackburn prospect is in the valley of Hidden Creek, near the south end of the area of monzonite. Only a small, shallow excavation had been made at the time of the writer's visit, and no well-defined ore body had been exposed. The prospect is situated on the outcrop of a basic dike intrusive into limestone, near the margin of the main mass of monzonite. The dike is of pyroxenite and is composed of augite, which is the chief constituent, magnetite, which also is present in considerable amount, melilite, a green garnet that is probably melanite, iron oxides, calcite, chloritic material, and copper carbonates.

GOLD PLACERS.

The Mathews & Blackburn placer mine is on Hidden Creek, just inside the area of the monzonite. It was worked on a small scale by shoveling in from an open cut. The pay gravel is said to be 75 to 125 feet wide, and it has been shoveled in to a depth of about 4 feet.

The O'Malley & Walden placer mine is on Ruby Creek near the contact of the monzonite and limestone. It is worked by drifting.

The Griffin & Whalen placer mine, on claim "No. 1 above," on Holmes Gulch, is in the limestone about a mile west of the margin of the monzonite. It was worked by sluicing in the early part of the summer of 1920, as in previous years.