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UPPER COPPER AND TANANA RIVERS, ALASKA

BY

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By Fred H. Moffit

INTRODUCTION

Two field parties, one topographic, the other geologic, were engaged in making surveys in the section of the Alaska Range between the Nabesna and Big Tok Rivers in 1934. Most of the area surveyed was on the northeast side of the range, within a drainage area that is tributary to the Nabesna and Tanana Rivers, but it also included a small part of the Copper River Basin.

The topographic survey, in charge of Gerald FitzGerald, was carried on in an area extending northeastward across the entire range from the Copper River to the lowlands of the Tanana River and northwestward from the Tetling River nearly to Dry Tok Creek but included only a small area west of the Slana River. (See pl. 8.) This work involved revision of some topographic mapping that was done by D. C. Witherspoon in 1902, as well as the addition to the earlier map of a considerable area of hitherto unsurveyed territory, particularly in the vicinity of the Tetling Lakes and the Big Tok River. It is hoped that further funds will be available so that this work may be extended to cover the whole north slope of the Alaska Range between the Chisana and Delta Rivers, an area which is little known but which has given evidence of the presence of valuable minerals in several localities.

The geologic party, in charge of the writer, directed its investigations chiefly to the area between the upper Tetling River (Bear Creek of earlier maps) and the Nabesna River and the area between Tuck Creek and the Tetling Lakes. The first area is drained largely by a stream that is called locally the "Cheslina River" but is mapped only in its headwater branches. In addition to these two areas several localities in the upper basin of the Little Tok River that present problems in geologic structure and stratigraphy were revisited. The chief incentive for examining the Cheslina River Basin came from the reported presence of placer gold and other mineral deposits and the knowledge that prospecting had been done there recently.

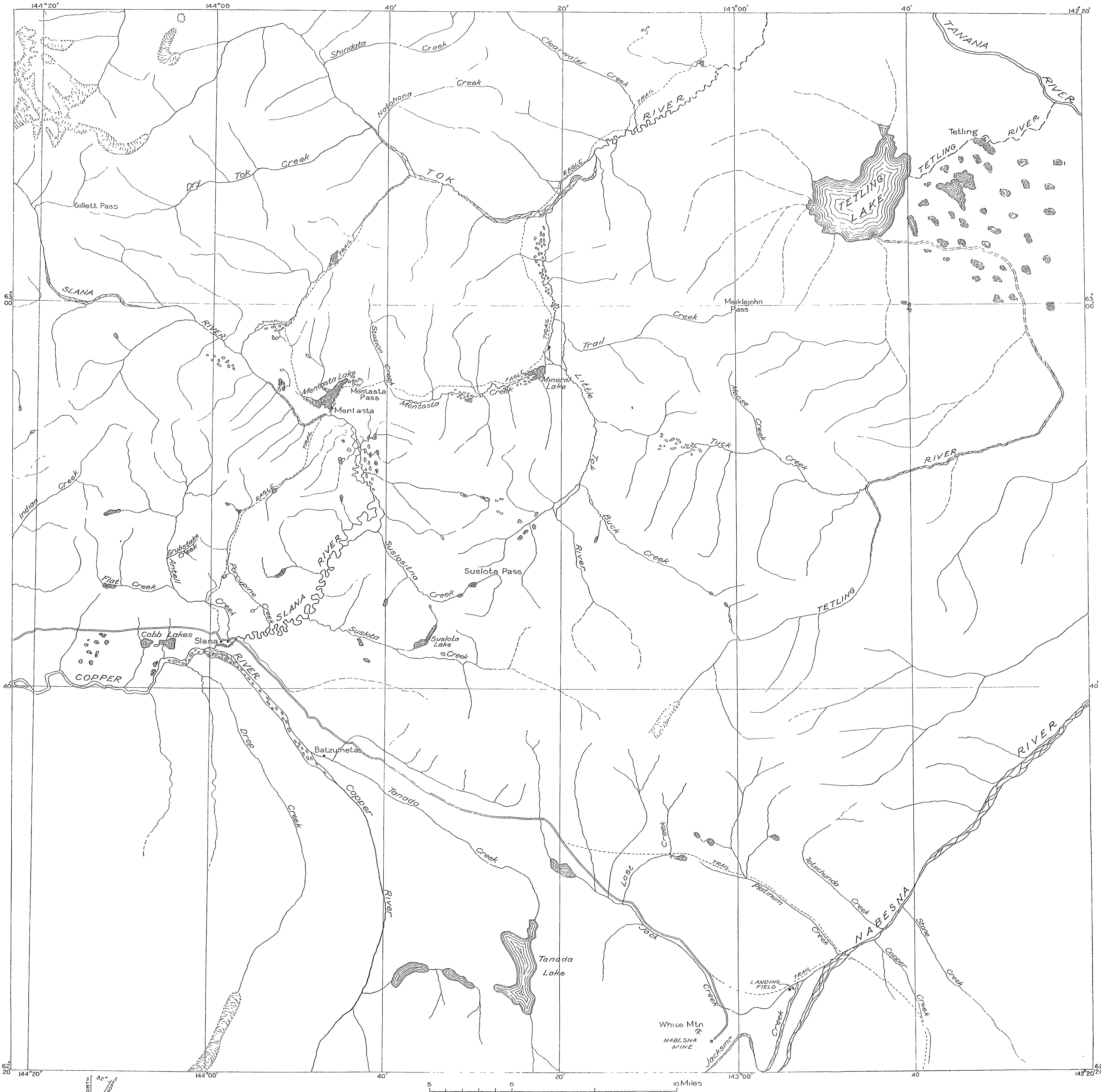
GEOGRAPHY

Most of the area examined in the geologic investigation lies between the crest of the main Alaska Range, which here is sometimes referred to as the "Nutzotin Mountains", and the lowlands bordering the Tanana River. Until recently this part of Alaska has been remote from lines of travel and difficult to reach, but it has become more readily accessible since the highway connecting the Nabesna River with the Richardson Highway near Gulkana was built. Prospectors with their supplies and equipment have been landed on the Cheslina River by airplane—much the easiest and quickest way to reach the stream when snow provides the necessary landing field. The frozen Nabesna River and its snow-covered gravel bars offer a route for sleds in winter, but as the river is difficult to cross in summer and the rocky cliffs in places prohibit travel along its north bank, it is not a favorable route of approach in the open season. The route followed by the Geological Survey party led from Slana to Suslota Pass and thence by the Buck Creek Valley to the Tetling and Cheslina Rivers. There is no trail, but for the most part the footing is fair or good, with relatively little soft ground, so that pack animals have no more than the usual difficulties of Alaskan cross-country travel.

The Nabesna River is the southeastern boundary of the territory examined. It is a glacial stream that rises in the heart of the Wrangell Mountains and flows northeastward through the Nutzotin Mountains to join the Tanana River. The other larger streams of the area are the Tetling River, the head of which appears on the earlier maps as "Bear Creek", and the Little Tok River. Both streams have glacial sources but in times of low water are practically clear.

The lower course of the Cheslina River is not known to the writer, but it is a tributary of either the Nabesna River or the Tanana River. Its upper tributaries drain the high, snow-covered mountains between the head of the Tetling River and the Nabesna River, and its general course is northeastward, although its branches form a ramifying pattern.

The crest of the range between the Nabesna River and the glacier at the head of the Tetling River reaches an altitude of over 9,000 feet and in this part of the range trends northwest. To the northeast lie two nearly parallel, lower ridges. The first is between the Buck Creek and Tuck Creek Valleys and extends into the Cheslina area. The second is between Buck Creek and the Tetling Lakes and ends at the Tetling River on the southeast or east. These are all rugged mountains, separated by open valleys, and have undergone vigorous glaciation, as is shown by the form of the valleys, the morainal deposits, and other glacial evidences.



SKETCH MAP OF A PART OF THE UPPER COPPER RIVER AND TANANA RIVER BASINS, ALASKA

Compiled from surveys by C F Fuechsel, 1932, Gerald FitzGerald, 1934, and maps of the United States Geological Survey

The bordering mountains or foothills on the northeast are low and smooth-topped. Here young valleys of V-shaped cross section appear instead of the U-shaped valleys of the high mountains. Mountains and valleys of this sort extend along the front of the range from the Nabesna River to the Tanana River beyond the Tetling Lakes. A characteristic feature of many of these bordering hills and mountains is that they rise abruptly from the lowland area without intermediate slopes, as if their bases had been buried by the lowland gravel deposits.

GEOLOGY

The area under consideration gives a complete cross section of the rocks that make up this part of the Alaska Range. These rocks are dominantly sediments, showing varying degrees of metamorphism, but locally include lava flows and granitic intrusives. Although the age of the sediments is imperfectly known, rocks of Devonian, Permian or Mississippian, Upper Triassic, and Cretaceous age are present. Further, more detailed field study may extend or fill out this stratigraphic section. In general the structure is characterized by several major folds, the most prominent of which is a great syncline, trending west-northwest, that includes the Mesozoic sediments and makes the backbone of the range. On the northeast side of the area the rocks dip to the northeast and rarely show any reversal.

The oldest rocks include schist, slate, quartzite, sandy slate, and limestone. The schist includes quartzitic schist, argillaceous schist, graphitic schist, and garnetiferous (?) schist. The limestone is crystalline and in many places has a platy cleavage. Some of it is fossiliferous, but for the most part it either contains few if any fossils or such fossils as may have been present originally have been destroyed or obscured by the alteration of the limestone. Limestone is present at several horizons, but one especially prominent line of outcrops extends from the Buck Creek Valley southeastward to the Nabesna River and forms a succession of jagged, toothlike ledges that stand above the softer surrounding schist and may be seen for miles. This limestone furnished Devonian fossils.

These older sediments have been intruded by granitic rocks in the form of large, irregular bodies and numerous sills that are both thick in the stratigraphic sense and extensive in the direction of their strike. The older rocks occupy most of the northeast side of the range and possibly include sediments of more than one period or era, although no conclusive evidence on which to base such a separation was recognized. So far as is now known, however, they are all of Paleozoic age.

The next younger group of rocks includes a great thickness of less altered, banded argillite and a siliceous sediment, either fine sand or sandy mud, of a lighter color than the argillite. In parts of the section the sandstone is arkosic and of much coarser grain, becoming a grit or fine conglomerate. Beds of coarse conglomerate are also present. The series of banded argillite and sandstone is remarkably uniform in composition. Hundreds of feet, stratigraphically, consist of alternating beds of these two contrasting rocks, none of which exceed an inch or two in thickness. Where the lighter beds become coarse, however, they are commonly thicker, and beds a foot or more thick were noted. A conglomerate probably represents the base of the formation in places, although intraformational conglomerate beds are present. No limestone or at most only one or two thin beds of limestone were seen interstratified with the banded argillite beds of this area, but limestones are present southwest of the axis of the range and furnish fossils from which it is known that this series of rocks includes both Upper Triassic and Cretaceous sediments. The relation of the banded argillites to the older schist and limestone was not determined, although it is probably one of unconformity of structure as well as of great separation in time.

The banded argillites are much folded, occupy the axial part of a great syncline, and form the high mountains of this part of the range. The valley of Buck Creek and a well-developed valley in line with it, extending from the Tetling River to the Nabesna River and crossed by the headwater branches of the Cheslina River, mark the northeast boundary of the younger rocks. In the Buck Creek Valley the older schists and limestones already noted appear and are succeeded on the northeast by the batholith of granitic rocks that makes up most of the ridge between Buck and Tuck Creeks and its extension beyond the Tetling River. On both sides of this batholith the schist, limestone, or other sedimentary beds dip away from the granite, steeply on the southwest side but less steeply on the northeast. North of Tuck Creek the altered sediments are intercalated with sills of fine-grained igneous rock and make up the ridge as far as the crest. They are succeeded on the Tetling Lake side of the ridge by northeastward-dipping quartzite and sandy siliceous slate that form a well-defined stratigraphic unit, with a thickness of at least 1,500 feet. The foothills on the Tetling side are made up of black argillaceous schist and siliceous schist. These schists are folded and faulted, and their relation to the quartzite is not definitely known, although they probably overlie it. The ridge nearest the Tetling Lakes is granite, at least in part, but siliceous schist is also present.

The field studies of the season of 1934 brought out the fact that the stratigraphy and structure of this district are even more complicated than had been supposed, yet they furnished clues that will aid in reaching a clearer understanding of the geology and that point out definite problems for future study. In some respects, notably the widespread distribution of granitic intrusive rocks, the conditions seem particularly favorable for the occurrence of valuable minerals, yet such prospecting as has been done in the district examined has yielded only negative results.

MINING AND PROSPECTING

In the following paragraphs a short account is given of some prospecting that was done on the Cheslina River in 1933, also of a recent discovery of placer gold on Ahtell Creek and of the season's operations at the Nabesna mine.

Cheslina River.—The Cheslina River lies between the Tetling and Nabesna Rivers. Some doubt exists as to the exact application of the name as used by the Indians of the district, but the stream possibly is the same as or is a tributary of a stream that flows into the Tanana River above the Tetling and is there called the "Kalutna." The name "Cheslina" is used in this report to designate the stream that drains most of the northeast side of the high mountains between the head of the Tetling and the Nabesna River.

These mountains are made up of banded argillite, sandstone, and conglomerate. To the northeast of them the rocks are chiefly schist of different kinds and crystalline limestone. They are intruded by granite that forms the core of a secondary parallel ridge of mountains. It is in this area of older metamorphosed rocks that the evidences of mineralization are greatest.

The stream basin contains extensive gravel deposits that are in large part of glacial origin and merge into the valley filling of the Tanana lowland. The area has been examined by prospectors at various times and has been looked on with favor, although it is not easy of access and has not yet been productive of valuable minerals. The most recent prospecting was done in 1933, when a party of five or six men spent most of the open season sinking holes in the deep gravel of the lower part of the valley. The results obtained in the process of this work were not encouraging, and the effort to find valuable placer gravel was not continued in 1934.

Ahtell Creek placer.—A new placer-gold discovery was made on a small tributary of Ahtell Creek in 1934. Ahtell Creek (see pl. 8) heads in the group of mountains west of the Slana River and joins the Slana about a mile from the point where that stream empties into the Copper River. The small tributary, which has been named "Grubstake Creek," flows into Ahtell Creek from the east side 4 miles from the highway, or 6 miles from Slana. It may be reached by going up Ahtell Creek or crossing the ridge west of the Indian Pass trail.

Ahtell Creek Valley is a typical U-shaped valley walled in by mountains that are high and rugged at its head but become lower and more rounded as the stream approaches the valley floor of the Copper River. It shows the common evidences of intensive mountain glaciation, characteristic of the region.

The placer gold was discovered at the forks of the creek, and mining was carried on in a small way during the summer. This locality is 3,500 feet above sea level and nearly 500 feet above the mouth of the creek. It is above timber line.

The country rock of the vicinity consists dominantly of lava flows, faulted, folded, and somewhat altered chemically. In places sedimentary beds are present, and fossils collected from an inconspicuous limestone member show that the succession, at least in part, is of Permian age. These lava flows and sediments were invaded by granitic intrusives, which are prominently displayed in the Ahtell Creek Valley.

The valley of Grubstake Creek is narrowly V-shaped below the forks but somewhat more open above. A considerable quantity of unconsolidated material has accumulated at and above the forks and appears as creek wash and bench deposits. The open cut in the creek where mining was carried on is about 150 feet long and shows a depth of 16 feet of deposits but at no place discloses the bedrock. Neither the open cut nor prospecting holes away from it had given much idea of the depth and areal extent of the deposits.

The material disclosed in the cut is mostly angular rock debris like the country rock, cemented together with mud or fine silt, but it contains a large number of well-rounded cobbles and boulders of granite and dark fine-grained igneous rock that may be in part of local origin but are certainly in part foreign, representing material brought into the valley of Grubstake Creek by glacial ice.

Gold is distributed throughout the thickness of the deposits shown in the cut and is associated with native silver, native copper, and magnetite. The proportion of silver is great. Both gold and silver are unworn and rough. Pieces of dendritic form are numerous. Much of the silver and some of the gold looks as if it had been squeezed out of its original matrix under great pressure. The copper nuggets, on the other hand, are rounded and worn. The magnetite occurs as sand and as pebbles and much larger pieces. Boulders of magnetite and boulders of dark igneous rock cut by veins of magnetite were seen in the cut. The appearance of the gold and silver points strongly to a local origin for both. Prospecting indicates the same thing, as panning in other parts of Grubstake Valley appears to indicate that gold does not occur above a certain mineralized zone in the valley above the forks.

Mining operations on Grubstake Creek were little more than prospecting to determine the character and gold content of the gravel. The water supply was obtained by impounding the water of the creek with an automatic dam that furnished water for ground sluicing and for use in the boxes when shoveling in. A cut 150 feet long, ranging in width from 12 feet at the lower end to 16 feet at the upper end and in depth from 6 to 16 feet, was made. At the time of visit, in September, cold weather had frozen the gravel and the last box-length ground sluiced off had not been shoveled in. From rough measurements that were made it appeared that the ground was running a little more than $1 to the cubic yard. Although the quantity of gold-bearing gravel present is unknown and a sufficient water supply will have to be provided if the property is to be fully developed, this occurrence is of interest from many points of view and suggests the advisability of further prospecting, both for placer gold and for lode gold. The occurrence of gold on lower Grubstake Creek below the forks was known in the early days, and some attempt to mine it was made, but without success. The present developments seem to indicate that the attempt was made in the wrong place.

Nabesna mine.—The Nabesna mine, under the management of Carl F. Whitham, president of the Nabesna Gold Mining Co., completed its fourth year of successful operation in 1934. This mine is in an auriferous body of quartz and associated minerals, formed at the contact of much-altered limestone and an intrusive mass of granitelike rock. It is on the east face of White Mountain, between Jacksina and Jack Creeks and about 5 miles from the Nabesna River. Since the mine was visited by the writer[1] in 1931 the highway along the north side of the Copper River has been extended from Slana to the Nabesna River. This new road, known as the "Abercrombie Trail", begins at a point on the Richardson Highway a short distance north of Gulkana and furnishes a route for passenger cars and trucks from the mine to either Valdez or Chitina. Although the work of surfacing the road is not completed, the softer stretches have been graveled and are now passable without difficulty except in the most unfavorable weather. The distance to Gulkana is about 100 miles.

White Mountain is made up chiefly of bluish-gray limestone that is capped by lava flows and intruded by large irregular masses of diorite. The limestone is folded and faulted and is profoundly altered, particularly near the intrusive, where it is so thoroughly silicified and garnetized that its original character is scarcely recognizable. The metallic minerals present in the ore include gold, lead

[1] Moffit, F. H., The Suslota Pass district; U. S. Geol. Survey Bull. 844, pp. 137–162, 1933.

sulphate, pyrite, a little chalcopyrite, and magnetite. The silver content is low, so that the value of the ore lies chiefly in the gold. One or more faults cut the ore body and reduce it in part to a mass of crushed vein matter which, at least in the upper levels, was frozen into a solid mass that slacked down when exposed to the warm air.

The ore is treated by the flotation process, and about 65 tons a day was being put through the mill during the season of 1934. The average value of the ore milled during the third quarter of the year, as stated in the report to stockholders, was $33.69 to the ton, which shows that ore of much lower grade is now being mined than was produced in the beginning.

When the mine was previously visited work was in progress on two levels, one 98 feet below the outcrop, or practically 1,000 feet above the mill and camp, the other 164 feet below the upper level. Since then, besides stopes and many feet of development work on these levels, a longer level, the 650 or Tower Knob level, has been driven about 900 feet to tap the main ore body, and it is stated that a still lower level is now being started at about the elevation of the mill.

In addition to development work in the mine, the mill has been enlarged, new equipment has been installed, and permanent buildings have been built to replace the tent structures formerly used. Also bunkers and a new tramway connecting the mill with the 650-foot level have just been completed. Between 50 and 60 men are employed at the mine, and a fleet of trucks is kept on the road hauling supplies to the mine and concentrates from the mine to Chitina, where they are shipped to the smelter in Tacoma.

According to the report to stockholders for the second and third quarters of 1934, new construction included an addition to the mill, a mine office building, a mill office building, three buildings for staff quarters, a concentrate storage shed, a garage and heating-plant quarters, a warm-storage building for perishable supplies, and insulation of the mill and other buildings. New installation includes a Marcy grinding unit, a Dorr classifier, an air compressor at the portal of the 650-foot level, a pump for winter pumping, and a heating-plant boiler with a radiation capacity of 5,000 feet. Perhaps one of the most important announcements was that preparation was being made for continuing mining operations throughout the winter and thus making an all-year industry of the mine.

It has been the policy of the management to finance the recent development and equipment of the mine from the profits of the mine itself, so that to this time earnings have gone back into the property, which now stands high in the list of producing gold lodes of Alaska.

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