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DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 342

Revised for map

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SURFACE WATER SUPPLY
OF THE
YUKON-TANANA REGION, ALASKA

BY

C. E. ELLSWORTH
AND
R. W. DAVENPORT

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Wsp. 342

*Geography of the
University of Alaska*



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very many more large enough for fuel
2,500 feet.

6 to 18 inches in diameter occupy
course of the Yukon and Tanana rivers
larger tributaries of these rivers also
small-size spruce, which, however, has
those in reach of the mining districts
produced more lumber than any of the
Tanana. Fairbanks received nearly its
fuel from that source and each summer through
the river and through the Chena Slough
for local use.

Annually between 60,000 and 80,000 cords of wood
from sawmills is probably between 6,000,000 and

12 inches in diameter grow in thick clumps over
particularly valuable for fuel. Cottonwood
is seen along the larger streams and
the trees attain diameters of 6 to 12
feet. Tattered tamaracks also grow in this

region. The principal use of timber
in the mining industry is the timber
for constructing flumes, mine supports,
and lands have been fairly met by the
timber. On this have now been made by both
methods, and the distance timber has to
be hauled, with a corresponding increase
in cost for fuel probably brings from \$10 to
\$20 per cord at the mines, but some of it may sell as low
as \$5, depending on distance from market
for wood. Rough sawed lumber varies
in price from a minimum of \$40 per thousand
feet at the Fairbanks mills to as much as \$200
per thousand feet at the more isolated camps.

except such as are particularly rocky
and thick, tough brush, locally known as
"gullies" and ravines cutting the mountain
sides. Many of the smaller streams grow
with alders and willows. Beyond this the
largest and best on the bottom lands.
Exceptionally, however, the best
timber and the trees diminish in size toward
the north to arrive the smaller species of vegetable

From early in June until the frosts occur in August grass suitable
for grazing can generally be found on the southern slopes and bottom
lands. On areas that have been burned over red-top grass springs
grow in abundance and grows waist-high in some favored localities.
Many berries grow abundantly during the summer; blueberries are
found nearly everywhere; small but fine-flavored cranberries can
be gathered in many places, and in some localities raspberries and
huckleberries are abundant.

Experience has shown that many varieties of vegetables can be
profitably grown for local use. In the vicinity of Fairbanks agri-
culture is extensive, and in nearly every small town and in many
outlying districts gardening has proved successful. Oat hay grows
luxuriantly in the Tanana Valley and in favored localities along the
Yukon, and, if cut green and properly cured, furnishes excellent
forage.

TRANSPORTATION.

From Seattle to the Yukon-Tanana region there are three main
routes of travel, all of which, compared with the means of transpor-
tation in the States, are very slow and expensive, though more com-
fortable than is popularly supposed. The first, commonly known as
the Dawson route, comprises 1,000 miles of ocean travel from
Seattle to Skagway by the "inside passage," which is protected from
the rough sea by many small islands. From Skagway to White
Horse, at the head of navigation on Yukon River, the trip of 110
miles is made by rail over the White Pass, thence down the Yukon
by steamboat to Dawson, a distance of 460 miles. Here passengers
and freight are ordinarily transferred to American boats for the
remainder of the trip to Fortymile, Eagle, Circle, Rampart, Tanana,
and other interior points. At Tanana, at the mouth of Tanana
River, about 700 miles below Dawson, most of the freight and pas-
sengers for Fairbanks, Hot Springs, and other mining centers of the
Tanana Valley are transferred to smaller boats that ply Tanana
River. Fairbanks, on the Chena Slough, 275 miles above Tanana, can
be reached by river steamers, except at low water, when a transfer
is made at the mouth of the Chena Slough, 12 miles below Fairbanks,
to the Tanana Valley Railroad. At favorable stages of water small
steamers navigate as far as the mouth of Delta River, and one steamer
reached the mouth of the Nabesna above the Tanana crossing. With-
out delay at transfer points the trip from Seattle to Fairbanks can
be made in about two weeks. A much longer time is taken in return-
ing by the same route because of the slow progress going upriver
against the current. This route is open for travel from the early
part of June until the later part of September.

The second route from Seattle is 2,700 miles by ocean boat to St.
Michael, thence by river steamers over 800 miles up the Yukon to

the mouth of the Tanana, then to the several distributing points along those streams. This route is the more favorable for freight because of the somewhat cheaper rates, but it has the disadvantage of a shorter season and of taking three to four weeks for the inward trip. In going out from Fairbanks to Seattle the time required is about the same as going upriver via Dawson and Skagway. Freight rates from Seattle to Fairbanks are from \$50 to \$150 per ton, with an average of about \$75, depending on classification. Passenger rates are about \$130 first class and \$100 second class.

The third, or overland, route is used mainly in the winter. Ocean boats make frequent and regular trips from Seattle to Cordova and Valdez, a distance of about 1,200 miles, requiring from four to six days. From Cordova the route leads by the Copper River Railroad to Chitina (131 miles from Cordova), then 264 miles by stage to Fairbanks. From Valdez the journey of about 360 miles is made entirely by stage. For passengers and mails this route is used extensively during the winter months, but its cost is so great that only urgent freight can bear the expense.

The Tanana Valley Railroad has 46 miles of narrow-gauge track between Fairbanks, Chena, and Chatanika. Wagon roads have been built from Fairbanks to the more important producing creeks. Winter roads have been constructed from Fairbanks to Circle and Hot Springs, and a fairly well defined summer trail leads from Fairbanks to the Miller House in the Birch Creek district. The principal mines adjacent to Rampart and Hot Springs are reconnected with Yukon and Tanana rivers by fair wagon roads.

The Birch Creek mines are reached by a wagon road from the Yukon at Circle to the Miller House, a distance of about 50 miles. Summer and winter trails leading to more isolated diggings connect with the wagon road at various points.

The Fortymile and Seventymile placers are very inaccessible and can only be reached in the summer by poling boats and pack animals. Most of the freight is transported during the winter, when the frozen swamps and rivers furnish solid footing for horses and sleds.

About 16 miles of wagon road, built from Eagle to the summit of the divide at the head of American Creek, has become nearly impassable from lack of maintenance.

Even the mines most favorably connected with roads and river steamers are so handicapped by excessive operating costs that only the richer can be worked at a profit. The proper development of the low-grade placer ground in the Yukon-Tanana region must await the construction of rail and wagon roads and lower transportation charges.

All the principal towns are connected by telegraph both locally and with outside points.

WATER SUPPLY CONDITIONS AND

SEASONAL DISTRIBUTION

in the form of rain or snow supply. In the Yukon-Tanana region the distribution of this supply is uneven, which prevents any evenness in the run-off less uniform. The main source of supply during the fall and melting snow which is related to a final junction with the Tanana. This source, however, is not so well conserved as the snow accumulations of snow in the open-cut works, he is dependent on the water supply of little value, for it comes at a time when the ground is covered with ice and snow, and of course many of the mines are exhausted before the winter accumulation appears, but even at such short duration that the water is a valuable asset.

Additional supply of water, the derived from the thawing of frozen snow in the summer low-water flow of the rugged mountains is kept up by snow in the sun-protected gullies. However, is not so well conserved as the snow in the sun-protected gullies and pondage at the head of the rainfall, even though it is distributed as to furnish the best water that forms a heavy cover over the snow which regulates the distribution of water in any factor. It is quite general in the mountains of the country that the water is well after a rain now as the water is due in part to the snow which has been largely removed. The reason may be that present methods are now more thorough than those practiced in years past.

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BULLETIN 374

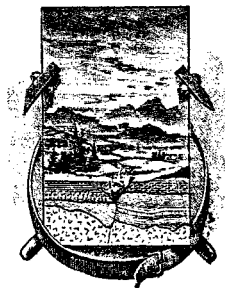
MINERAL RESOURCES

OF THE

KOTSINA-CHITINA REGION, ALASKA

BY

FRED H. MOFFIT AND A. G. MADDREN



WASHINGTON
 GOVERNMENT PRINTING OFFICE
 1909

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rugged, and lack the snow fields and glaciers so commonly seen in the Wrangell Mountains. The streams are smaller, and descend through steep gulches to the river. South of Hanagita Valley are other lofty snow-capped sierras, forming part of the Coast Range, but they are beyond the limits of the area under consideration.

TRAILS AND ROUTES.

The Kotsina-Chitina region may be reached from Valdez in summer by the Government trail between Valdez and Eagle, and in winter either by the same route or by way of Tasnuna and Copper rivers. One may also enter the region from Eagle or Fairbanks by the Government trail, but these routes are used only by those already in the interior. Skolai Pass is now frequently crossed by those going from Nizina River to the head of the White, or in the opposite direction, and it is reported that two prospectors went from Yaktag on the coast to Chitina River by way of the Tana River glacier. Neither of these, however, is a practicable route of travel. Up to the present Valdez has been the coast point from which all supplies were taken into the Copper River region. The Government trail is the route always followed in summer, and is the one usually chosen in winter. Leaving Valdez the main trail is followed till Tonsina River bridge is crossed. From there a second trail leads eastward about 25 miles along the high bluff north of Tonsina River to Copper River. The total distance from Valdez to Copper River by this route is approximately 100 miles.

Copper River is crossed at a point 2 miles above the mouth of Tonsina River. An Indian named Billum has a ferry license and transfers travelers with their baggage in two small boats. Horses must swim the river. After crossing Copper River the trail follows the east bank 6 miles to Billum's lower cabin and then, leaving the river, proceeds northeast 3 miles to Horse Creek. At Horse Creek it divides, one branch leading northeast to upper Kotsina River and Elliott Creek, the other southeast to the copper camps and gold placers of Chitina Valley.

The Tasnuna-Copper River route from Valdez to Chitina River can be used only when the river is frozen over, for the trail is on the ice all the way after leaving Tasnuna River. Supplies for the Chitina Valley leave Copper River on reaching Chitina River and are carried up that stream. Those destined for Kotsina River and Elliott Creek continue up the Copper to the summer trail at Billum's lower cabin. The great advantage of the Tasnuna River route is the saving of time under favorable conditions by the possibility of hauling heavy loads. A snow plow is used to break a trail, over

which the freight is hauled on heavy bobs in place of the narrow double-ended sleds employed elsewhere. This advantage may be entirely offset by the loss of time due to the fearful winds which sweep down the river and prevent any travel for days at a time. The Government trail has the advantage of being kept open all winter, since it is the mail route and is traveled regularly. Its chief difficulty lies in the crossing of Thomson Pass.

Returning now to the Kotsina-Chitina area: Of the two trails leading from Horse Creek—the Kotsina trail and the Chitina Valley trail—the Kotsina trail proceeds northeastward to Willow Creek, a small tributary of Kotsina River, where a branch trail, after the Hubbard-Elliott bridge over the Kotsina has been crossed, leads over a steep spur of Hubbard Peak to Elliott Creek. The main trail continues along the right, or west and north, bank of Kotsina River into Kotsina Valley. The stream issuing from Long Glacier is crossed on ice at the glacier's lower end; and bridges over Kluvesna River and over Kotsina River near Rock Creek obviate most of the difficulties and dangers formerly offered by these streams.

The Chitina Valley trail runs southeastward from Horse Creek and reaches Kotsina River at a point 8 miles below Willow Creek. A bridge recently built by the Government at this place does away with another dangerous ford. From the government bridge the trail continues eastward along the Wrangell Mountain foothills, crossing Kuskulana River 3 miles below the glacier, and reaching Chokosna River and the Lakina by way of Kuskulana Pass. Ascending Fohlin Creek, it proceeds by way of Bear Creek and Fourth of July Creek to Kennicott Glacier and Kennicott River, which is crossed on the glacier ice. A good trail has been built from the glacier's lower end to the Bonanza property. Another trail ascends McCarthy Creek 4 miles and, crossing the ridge known as Sourdough Hill, lands on Nizina River at a place from which Chititu Creek, Dan Creek, and Chitistone River are reached with ease when once the Nizina has been forded. There are no bridges east of Kotsina River, and the streams being of glacial origin are very cold and subject to great and rapid changes in the quantity of water carried, but the only ones likely to cause trouble are the Kuskulana, Lakina, and Nizina.

Most prospectors leaving the Nizina country descend Chitina and Copper rivers in small boats, either leaving the Copper at Tasnuna River and going overland to Valdez or following the river to the coast and landing in Eyak or Orca. Several days' work is required for whipsawing lumber and building a boat, but even then the river trip is much easier and quicker than the trail. The trip from the mouth of Young Creek to Tasnuna River, over 115 miles,

has been made in less than a week. A man would meet with little difficulty, but the canyon at the lower end is particularly at low water, and it is difficult in trying to run through.

In July, 1907, a small party made a trip from Tasnuna River to the mouth of the Nizina, on Chitina River. The trail carried over the snow from Horse Creek to she was completed early in the season. It is hauled out on the bank of the river, but will probably be unusable for some time because the Chitina is much higher than in the early summer. She is a small stream. She is at Abercrombie Rapids, 25 miles from Tasnuna. She may carry up the rapids or at Tasnuna River.

The mineral resources of the region are undeveloped until a more practical method of transporting freight to and from the mouth of the River can never become a reality. The Yukon is for the north, and it can be expected till a rich copper-bearing area will hardly be reached. It is hardly possible that such a rich area reaches a stable production. It appears to depend on the future of the region, strange that the future of the region is so uncertain.

There has been no large-scale mining. Some have even been carried on, but it seemed almost assured that it would be. It is probable that with the development of communication between the region and the coast, the production on Copper River will be greatly increased.

Four railroad routes are being considered by those interested in the region, furthermore, have been proposed. Some one of the others will be built. Two of them are from points adjacent to the coast. One from Valdez is practically completed. One from Lowe River to Thomson River, or Soledad, is called, and the

place of the narrow advantage may be fearful winds which days at a time. The kept open all winter, arly. Its chief diffi-

Of the two trails lead- the Chitina Valley to Willow Creek. a anch trail, after the been crossed, leads creek. The main trail unk of Kotsina River om Long Glacier is ridges over Kluvesna obviate most of the e streams.

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descend Chitina and Copper at Tasnuna owing the river to al days' work is re- boat, but even then the trail. The trip iver. over 115 miles.

has been made in less than twenty running hours. A skillful boatman would meet with little or no difficulty on the Copper or Chitina, but the canyon at the lower end of Nizina River is dangerous, particularly at low water, and a number of persons have been drowned in trying to run through it.

In July, 1907, a small steamboat called the *Chitina* made her first trip from Tasnuna River to Copper Center, on Copper River, and to the Nizina, on Chitina River. Material for her construction was carried over the snow from Valdez during the previous winter, and she was completed early in July, but after the trip up the river was hauled out on the bank for the winter. She draws very little water, but will probably be unable to run after the middle of summer, because the Chitina is much lower in the fall than during the spring and early summer. She can not descend Copper River farther than Abercrombie Rapids, 25 miles below Tasnuna River, and any freight she may carry up the river must be delivered to her either at the rapids or at Tasnuna River.

The mineral resources of the Copper River region will remain undeveloped until a more reliable and economical means of transporting freight to and from it has been provided, and since Copper River can never become a highway of communication, such as the Yukon is for the northern country, no important copper production can be expected till a railroad has been constructed to connect the copper-bearing area with a coast point. On the other hand, it is hardly possible that such a road would be profitable until the region reaches a stable productive stage. The success of the one then appears to depend on the establishment of the other, and it is not strange that the future of each has so far been more or less in doubt.

There has been no lack of projects for the building of a road. Some have even been carried to a point where their accomplishment seemed almost assured and yet have fallen through. Nevertheless, it is probable that within a few years there will be railroad communication between the coast and the lower limit of steamboat navigation on Copper River.

Four railroad routes to the interior are possible and have been considered by those interested in building a road. Preliminary surveys, furthermore, have been made over each. Each route overlaps some one of the others in part of its course and all have difficulties to surmount. Two of the four routes originate from Valdez and two from points adjacent to the mouth of Copper River. The first one from Valdez is practically that of the government trail. It follows Lowe River to Thomson Pass, over which it proceeds to the head of Tsina River, or South Fork of Tiekkel River, as it is more generally called, and then continues northward to Tonsina. The sec-

and ascends Lowe River to its head, crosses Marshall Pass to Tasnuna River, and after descending that stream follows the west bank of Copper River northward. Of the two strictly Copper River routes one starts from Cordova Bay in Prince William Sound, 24 miles west of the river's nearest point; the other from Katalla, nearly 17 miles southeast of Cottonwood Point, the southern extremity of Copper River's east bank.

There are not sufficient data at hand for a thorough discussion of these routes, but some of their advantages and difficulties may be pointed out. It will be seen that there are some discrepancies between distances given here and elsewhere, arising from the use of railroad surveys in connection with small-scale maps. The given elevations,

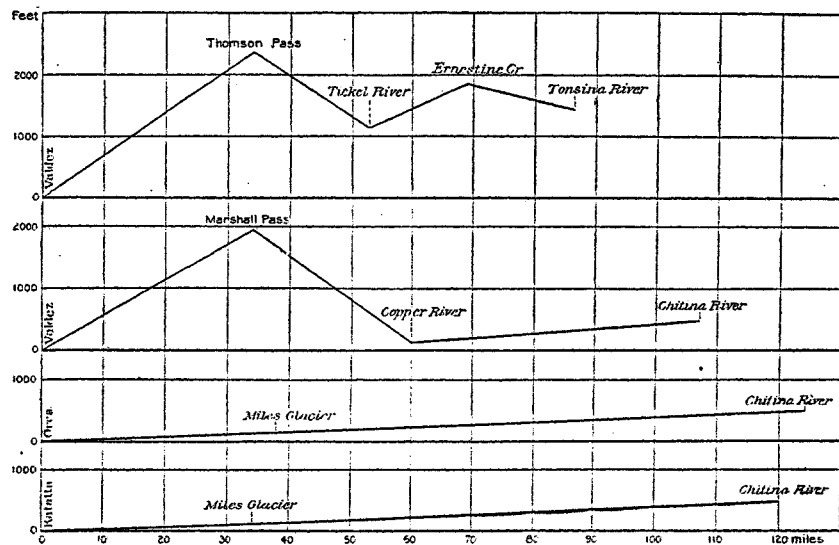


FIG. 1.—Comparative grades of the four proposed railroad routes from the coast to the interior Copper River basin.

too, take no account of minor grades and are therefore minimum quantities—less than the total number of feet a locomotive must rise in going from tide water to the interior points indicated.

The Tonsina route has the most difficult grades. (See fig. 1.) From Valdez to Thomson Pass, 34 miles distant by the railroad surveys, there is a climb of 2,370 feet. Then comes a descent of 1,250 feet in 19 miles to Tiekel River, followed by an ascent of 710 feet in 16 miles to the Ernestine divide. From Ernestine to Tonsina, 16 miles, there is a descent of about 400 feet. It will be seen that the total of the distances here given is 86 miles, or 6 miles greater than the distance from Valdez to Tonsina given by the road commission.

The greatest obstacles in the Canyon of Lowe River are crossed. These involve deep snows and snows ever, will be met on any route.

Less difficult grades are from Valdez to Marshall Pass, where comes a fall of 1,740 feet from the river mouth to Chitina River. The difficulties of Keystone are great, but Marshall Pass is 500 feet above grade from Tiekel to Ernestine.

The two Copper River routes (see fig. 1), a rise of 480 feet in 34 miles distance from Katalla to Cordova Bay slightly above sea level.

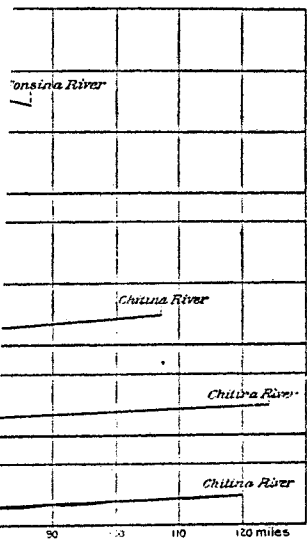
A railroad from Katalla to Cordova Bay is possible at all seasons where there is no ice. A bridge over Copper River is possible. A bridge over Miles Glacier, but there is no bridge till Abercrombie Rapids bridge is under construction and then northwest to Cordova Bay and to Bering Lake and the Chitina River and reaches Martin River and reaches Chitina River Lake Charlotte divide.

Each of these routes has a separate breakwater and pier at Cordova Bay, in connection with a protected body of water. A road from this place in connection with two bridges over Copper River. Furthermore, it will be seen that the fields. The upper bridge is fronting Miles Glacier, and since it is not long and as to the bridge below will not be removed till the fully examined.

Northward from Abasco Bay routes are the same as with the Valdez-Tasnuna. Immediately above the covered lower end of Bering Lake.

Marshall Pass to Tasnuna follows the west bank of the Copper River to the William Sound, 24 miles from Katalla, nearly to the southern extremity of

thorough discussion of the difficulties may be found in the discrepancies between the use of railroad and road. The given elevations,



and routes from the coast to the interior.

are therefore minimum. At a locomotive must rise to the heights indicated.

It grades. (See fig. 1.) The route constant by the railroad surmounts a descent of 1,250 feet by an ascent of 710 feet in the distance from Ernestine to Tonsina, 16 miles.

It will be seen that the route by road is, or 6 miles greater than that by the road commission.

The greatest obstacles encountered on this route are the Keystone Canyon of Lowe River and Thomson Pass, by which the coast range is crossed. These involve a great deal of rockwork and are subject to deep snows and snowslides in winter. The latter difficulty, however, will be met on any route.

Less difficult grades are presented by the Tasnuna route. From Valdez to Marshall Pass, 34 miles, there is a rise of 1,860 feet. Then comes a fall of 1,740 feet in 26 miles to Copper River. From Tasnuna River mouth to Chitina River, 47 miles, is an ascent of 370 feet. The difficulties of Keystone Canyon are encountered on this route also, but Marshall Pass is 500 feet lower than Thomson Pass, and the heavy grade from Tielke to Ernestine is avoided.

The two Copper River routes have practically the same grades (see fig. 1), a rise of 480 feet between the coast and Chitina River. The distance from Katalla to Chitina River is 120 miles, and from Eyak or Cordova Bay slightly farther, about 124 miles.

A railroad from Katalla involves the construction of a harbor available at all seasons where ships can discharge their cargoes in safety. A bridge over Copper River is required immediately above Childs Glacier, but there is no rockwork, except a mile or two at Katalla, till Abercrombie Rapids have been reached. Two railways are located and under construction at Katalla. One runs west from the town and then northwest to Copper River, but has a spur up Katalla River to Bering Lake and the coal fields; the other ascends Katalla River and reaches Martin River, which it descends to the Copper by the Lake Charlotte divide. The Lake Charlotte route thus passes through the coal field. Each of these Katalla roads has its own plans for a separate breakwater and terminal facilities.

Cordova Bay, in contrast with the open roadstead of Katalla, is a protected body of water that can be entered at any time, but a road from this place involves rockwork below Abercrombie Rapids and two bridges over Copper River in order to avoid Childs Glacier. Furthermore, it will be necessary to build a branch line to the coal fields. The upper bridge, between Childs Glacier and the little lake fronting Miles Glacier, can probably be built without unusual trouble, since it is not long and the foundations are believed to be good, but as to the bridge below Childs Glacier there is uncertainty that will not be removed till the nature of the river's bottom has been more fully examined.

Northward from Abercrombie Rapids the Katalla and Cordova Bay routes are the same, and above Tasnuna River they also coincide with the Valdez-Tasnuna route, following the river's steep west bank. Immediately above the rapids is the moraine or stationary debris-covered lower end of Baird Glacier. This is overgrown with a thick

growth of alders and extends down to the river's edge, where the underlying ice has been exposed occasionally in test pits. It is known as "dead glacier" and must be traversed for several miles by any road following the west side of Copper River. The surface is sometimes disturbed by melting of the ice beneath, but whether this will cause serious difficulty in maintaining the track is perhaps doubtful. Between Baird Glacier and Chitina River much of the roadbed must be cut from the solid rock, but it is not believed that any unusual engineering difficulties will be met.

A great advantage of the two Copper River routes, in addition to their lower grades, is their nearness to the Controller Bay coal fields. This is doubtless one reason why they are regarded with greater favor than the shorter routes from Valdez.

VEGETATION AND CLIMATIC CONDITIONS.

Chitina Valley is a timbered region and furnishes a supply of wood suitable for most of the miner's requirements. The greater part of the timber is spruce, but cottonwood is abundant on many river banks and deltas; and though it is of little value for lumber, it is nevertheless useful for some purposes. The broad, marshy, valley lowland supports a scanty growth of very inferior spruce and of aspen. Better timber grows along the borders of the lowland and on the lower mountain slopes. It covers the slopes to an elevation varying from 2,000 to 3,000 feet above sea level, but trees growing near timber line are of course dwarfed and of little use except for firewood. Near glaciers or in the narrow valleys leading to them the timber line does not reach as great an elevation as on the interstream slopes. Some of the best timber in the valley grows in the vicinity of Chititu and Young creeks. Trees 18 inches in diameter at the butt and tall enough to give two 16-foot cuts are not unusual, but the large majority of them are smaller than this.

South of Chitina River between Nizina River and the Copper there is a heavy growth of spruce on the north slopes of the mountains. It is of much poorer quality, however, than that on the Wrangell Mountains. The wood is brittle and has little strength. Most of the trees, too, are of small diameter and will probably be of more value as fuel for the steamboat *Chitina* than for any other purpose.

Inadequate and expensive means of transportation have been the chief obstacle in developing the copper resources of Chitina Valley, but another adverse condition, which, however, affects prospecting more than mining, is the short summer season. Up to the present practically all supplies have been carried during the winter with sleds drawn by horses. In the earlier days dogs, or even man power,

were sometimes used, but almost entirely. Sufficient is carried in from the coast of the country." Early snow comes between a late spring and to find their own feed lots. June till the first of September timber line in June, July found at lower elevations number of years. Some of with fine feed by following. Horses frequently have valley bottoms, even in r killed the grass on the m locally as "pea vine," of excellent forage. Since horses for packing in sum readily seen that the ma determining the number. The prospecting season i the high mountains, whe much snow often remains.

Figures for the yearly able, but it may be said t and winter are much gre is very much less.

Native copper from t Valley was used by the entered the country. Sp by them and have been f and Dan creeks. Ceremo by the natives for cuttin of the season's run. Li him specimens of bornit Creek. He also showed natives "over the mount. A much-worn wooden s waste below an outcrop o on Glacier Creek, a trib Indians also knew of nat they had any knowledge creeks is not known to th

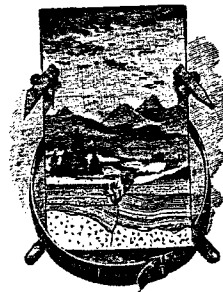
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DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

BULLETIN 375

THE
FORTYMILE QUADRANGLE
YUKON-TANANA REGION
ALASKA

BY
L. M. PRINDLE



WASHINGTON
GOVERNMENT PRINTING OFFICE
1909

TRANSPORTATION.

Transportation of supplies to the localities where mining is in progress has always been a time-consuming and expensive process. Eagle is the main supply point on the Alaskan side of the boundary, but many of the localities are so situated that it has hitherto been more feasible to procure supplies from Dawson on the Canadian side. Most of the supplies for the Fortymile area are purchased in Dawson and freighted up the Fortymile on the ice by horse sleighs during the winter months. The Fortymile affords access to the remote tributaries where work is being done, but is a roundabout road, and the overflows to which it is subject are often an additional source of delay. Several hundred tons of dredge material were shipped by this route during the winter of 1906-7, when the freight rate to the vicinity of Franklin Creek was about \$70 per ton. Summer freighting on the Fortymile is done by poling boats, but it is a difficult stream to navigate even by this method. Long reaches of quiet water are separated by bed-rock riffles where the water is swift and shallow. Supplies are frequently lost or long delayed by low water, and the rates from Fortymile Post on the Yukon to Chicken Creek—the farthest locality to which supplies are carried by this method—is 25 cents per pound (1907). The Canadian wagon road from Dawson to Glacier—a distance of about 60 miles in Canadian territory—is utilized during the summer to a certain extent for the transportation of supplies to creeks on the Alaskan side in the vicinity of the boundary.

The road commission has surveyed a government wagon road from Eagle to the Fortymile country and has already completed about 9 miles of it, from Eagle to American Creek. It is hoped by the construction of such a road to bring Eagle into closer relations with the Fortymile country. Work is also being done by the commission on a road that will make the Seventymile area more accessible from Eagle. In the fall of 1907 a road was in process of construction from the head of Canyon Creek to Walker Fork, in order to avoid the long haul up the Fortymile.

The mail route from Eagle to Valdez passes through the Fortymile country and affords a mail service to the miners of that country. The mail is carried by pack train during the summer season, and in consequence of the large mail-order business the facilities are generally overtaxed.

There are stations of the Government telegraph line at Eagle, at North Fork, and at Kechumstuk, both the latter localities being outside the limits of the quadrangle. The installation of a telephone line has been under discussion by the miners, and a system connecting all the creeks with the supply points would be of great service.

Work was commenced in 1907 on boundary southward from the Yukon country for 2 miles on each side of representatives of both Governments to the miners as to the position

The Fortymile quadrangle is composed of metamorphosed rocks, predominantly schists, provisionally to the pre-Ordovician phyllites, limestones, and greenstone shales, slates, limestone, sandstone of the Carboniferous; of clays, lignites belonging to the Tertiary; of Pleistocene and stream gravels; and of intrusions which have been metamorphosed.

The vertical distribution of the formations is shown in Plate 16; their areal distribution is shown in Plate 17.

The quadrangle is not one of a type containing constant characters over a wide area in which there is wide variation of character. The different formations possess characters which their representation in the map does not express with a fair degree of accuracy. Furthermore, the complexity of the geology has been increased by their metamorphism, and the igneous rocks, as to be easily overlooked in recognition of the succession and the distribution of the formations on the map are therefore generalized to such an extent that they express with a fair degree of accuracy the conditions of the material occurring in the quadrangle.

An inspection of the geological map shows that the rocks form nearly the whole of the quadrangle and that the northern half is composed of

* The rocks designated pre-Ordovician and Fortymile have been given by Spurrier in this report to enter into a detailed description by geologists. This is one of the most important features to be treated fully in a later report on the



Two channels intersect each other, the upper channel being 60 feet above the lower. The pay streak or old channel on the bench is on the face of the bench, but is covered through a tunnel starting from the surface. The workings are of course 60 feet above the pay streak in the lower channel. The pay streak is 40 feet, and is about 400 feet from the face of the bench.

On Valdez Creek below Willow, most of the work of washing is done by hand. This plant includes a power house. For the most part Valdez Creek is used for tailings, but unfortunately the water where this plant is in operation is very shallow, averaging about 4 feet. The yield in the product of this gulch is very small, being frequently obtained. The yield in 1897. Lucky Gulch is reported to have been discovered in 1897.

In mining on Valdez Creek during the summer of 1908, about 120, of whom 20 expected to be employed in winter. With better facilities about 200 men employed by the operators.

MINERAL RESOURCES OF THE NABESNA-WHITE RIVER DISTRICT.^a

By FRED H. MOFFIT and ADOLPH KNOPF.

INTRODUCTION.

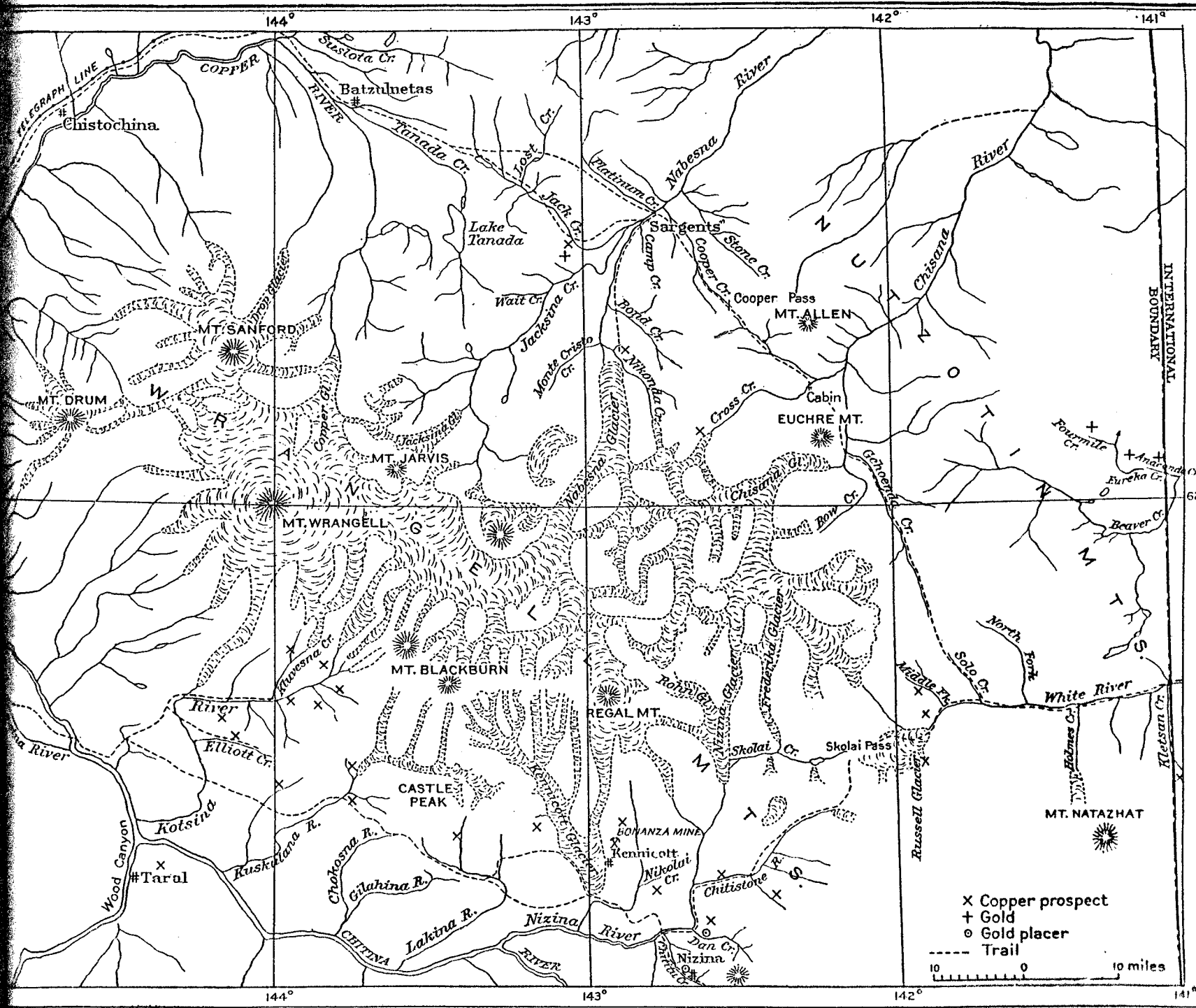
The district of which this paper treats lies on the northeast side of the Wrangell Mountains and includes the headwaters of Copper, Nabesna, and White rivers. Nearly all of the area is within the rectangle formed by parallels 61° 40' and 62° 40' north latitude and meridians 141° and 143° 20' west longitude. Like the district south of the Wrangell Mountains, it has attracted the attention of prospectors and miners through reports of wonderful copper deposits. These reports have originated partly in stories told by Indians and partly in accounts of ornaments and implements found in their possession by the early explorers.

The region is difficult to reach, and supplies are not easily obtained, so that the search for valuable minerals has been carried on by a few men since shortly after the discovery of gold in the Klondike, and it was to aid in the development of the mineral resources that the surveys of 1908 and of previous years were undertaken.

The work on which this paper is based was a continuation and extension of the work begun by F. C. Schrader and D. C. Wither- spoon, of the United States Geological Survey, in 1902, and Mr. Schrader's field notes and maps have been used freely in the field and office studies. During the course of the summer all the better-known prospects on the northeast side of the Wrangell Mountains and in the Alaskan portion of the White River valley were visited, and the geologic and topographic mapping begun by Schrader and Wither- spoon was extended down White River to the international boundary. In this work the writers were assisted by S. R. Capps, whose time was given chiefly to topographic mapping, but who also helped in geologic work during the earlier part of the season.

The party consisted of seven men and was equipped with a pack train of eleven horses and the usual camp outfit. Supplies for the

^a This paper is a preliminary statement of the results of a geologic and topographic reconnaissance survey made in 1908, concerning which a more comprehensive report is in preparation.



MAP OF THE REGION OF THE WRANGELL AND NUTZOTIN MOUNTAINS.

own by the glaciers, and the deposition of their overload has built the wide gravel flats of the valley floors.

In the late fall of 1908 the surveyors sent out by the United States and Canadian governments located the position of the international boundary line on White River. It proved to be a short distance east of the mouth of Kletsan Creek, or about 3 miles farther west than it was formerly supposed to be. During the summer of 1909 the line will be permanently marked with the usual monuments, and the custom of recording claims in both Alaska and Yukon Territory when their location is doubtful will no longer be necessary.

TRAILS.

There are three routes by which the Nabesna-White River region may be reached. Prospectors usually approach Nabesna River from the northwest by a trail that leaves the military trail from Valdez to Eagle near the mouth of Slana River. It ascends Copper River to Batzulnetas, whence it continues southeastward to the heads of Jack Creek and Platinum Creek, either of which leads directly to the Nabesna, although Platinum Creek offers the better route for summer travel. After leaving Batzulnetas the trail bears to the east and follows the ridge northeast of Tanada Creek. This portion of the trail is a little hard to pick up at Batzulnetas because of the presence of numerous Indian trails, but when once found it can be followed with little difficulty except that much of it is exceedingly swampy, although possibly no worse than some stretches of the government trail between Tonsina and Copper Center, or between Gakona River and Chistochina. The distance from Slana River to "Sargent's," on Nabesna River at the mouth of Camp Creek, is approximately 40 miles by way of Platinum Creek, and a few miles farther by way of Jack Creek.

The customary route of travel followed by prospectors in entering the White River region is either from the east through Canadian territory or, less commonly, from the Chitina Valley on the southwest by way of Skolai Pass. There is a choice of two Canadian routes, dependent on the means of transportation which it is desirable to use. White River may be ascended from the Yukon in small boats, or the overland trail may be followed from White Horse by way of Kluane Lake. This last-named trail is probably the easiest and best way of reaching either White or Nabesna River with stock in summer, and the best way of reaching White River with stock at any season. A wagon road leads from White Horse to Kluane Lake, a distance of 142 miles, and thence a good trail approximately 20 miles long leads to "Canyon City," on the north side of White River a few miles below the boundary line. Prospectors often bring their supplies up White River from Dawson in poling boats or by

tracking, and most of them leave the country by boat in the fall as it gives them an easy and quick method of reaching the Yukon.

The route from Chitina River by way of Skolai Pass is not regularly traveled, but is used by a few prospectors who have claimed both the Chitina and the White valleys and cross over from the south to do their assessment work. During the earlier days of use the trail extended over the lower end of Nizina Glacier from a point on the west side about 4 miles above the head of Nizina River to the mouth of Skolai Creek, whose north bank it followed to the pass. At present this trail along Skolai Creek is not used, as Nizina Glacier is so traversed with crevasses as to be practically impassable and though horses have been taken high on the mountain around the east side of the small lake formed by the damming of Skolai Creek by Nizina Glacier the climb is so great and so difficult that it has been attempted but a few times. Travelers now ascend Chitina River to its head and cross a broad, high pass with abrupt north-south slope to the foot of Russell Glacier, which occupies Skolai Pass, and thence reach the head of White River. This trail will be described in a little more detail, in the hope that such a description may possibly benefit some one who has occasion to use it. It must be borne in mind, however, that the condition of a glacier changes from year to year and that a route followed this year may be impassable the next year. In crossing with horses from White River to Skolai Creek the north side of the glacier should be followed as closely as possible. The top of the "moraine," the débris-covered east end of the glacier is gained by ascending one of two or three narrow gulches that lead to the surface. These gulches are located somewhat north of the lateral front of the moraine and lead with an easy grade to the summit. When once fairly on top, the traveler will not find it difficult to follow the ill-defined trail or to pick a way across the moraine to the bare ice, a distance of 2 or possibly 3 miles. Little direction can be given for crossing the bare ice further than to follow as close to the possible its north side and not to get out on the middle. The west end of the glacier at the head of Skolai Creek is greatly crevassed and terminates in an abrupt face or wall not less than 25 feet high at the lowest point. With a little difficulty horses can be taken over the glacier at a point a short distance east of the source of Skolai Creek, but they could not be taken on there without a great deal of work. A better way is to leave the glacier at some point further east, along the side of Castle Mountain, but it is difficult to determine the proper place where this may be done. From six to eight hours time are required in crossing the glacier. After leaving it the traveler should immediately cross to the south side of the Skolai valley, being careful to avoid quicksand. If it is needed, a camp place with feed for horses and willows for firewood is available

low bench above the river flat, and a climb to the pass between Skolai and Chitina. The first mile or two after crossing the pass that care must be taken to avoid the difficulty to be overcome on Chitina River, 5 miles below the summit, where a climb is necessary to avoid the deep crevasses. This portion of the trail should not be attempted after dark. Light packs should be carried, and the trip, unless the trail is completed, unless the trail is completed.

The trail from Nabesna River to the pass between the Wrangell and Chitina Creeks, following its eastern front, leads down which it leads to the upper or Cross Creek, and then to the head point to Chisana River and then to Chisana River the trail follows the lower side, keeping close along the lower side, crosses a broad, open divide to White River.

Supplies intended for use in this winter unless it is intended to stay. The cost of freighting either from White Horse to Canyon Creek is a pound when conditions are more.

WORKING

The climatic conditions here are derived from the Pacific by a broad belt, outside of the immediate influence of the increase precipitation and minor rainfall is moderate in summer. Feed for horses is good on the river bars there is an abundance of grass and White rivers. For season on the White River bars. The Chitina River for Valdez at the end of 25, or not later than September till October without danger. Horse. Thus the working season is longer than on the Nabesna

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low bench above the river flat, at the foot of the steep 1,400-
 climb to the pass between Skolai Creek and Chitistone River.
 the first mile or two after crossing the summit traveling is easy,
 pt that care must be taken to avoid soft ground. The greatest
 culty to be overcome on Chitistone River is encountered sev-
 miles below the summit, where a high climb over loose talus
 is necessary to avoid the deep canyons of the river's northern
 etaries. This portion of the trail, as well as the glacier in Skolai
 should not be attempted after the first winter snows have fallen.
 light packs should be carried, and two days should be allowed
 completing the trip, unless the traveler is perfectly familiar with
 trail.

The trail from Nabesna River to White River traverses the de-
 sion between the Wrangell and Nutzotin mountains. It ascends
 per Creek, following its eastern fork to the head of Trail or Notch
 k, down which it leads to the Indian village on the south side
 pper or Cross Creek, and thence southeastward across the low
 bered point to Chisana River and the mouth of Gehoenda Creek.
 n Chisana River the trail follows Gehoenda Creek to its head
 keeping close along the lower slope of the mountains on the
 , crosses a broad, open divide to the head of Solo Creek, and
 to White River.

Supplies intended for use in this region should be taken in during
 winter unless it is intended to bring them up White River in
 s. The cost of freighting either from Valdez to Nabesna River
 from White Horse to Canyon City is probably not less than 35
 s a pound when conditions are favorable, and may be consider-
 more.

WORKING SEASON.

The climatic conditions here are those of interior Alaska. Sepa-
 ed from the Pacific by a broad belt of lofty mountains, the region
 outside of the immediate influence of the ocean, with its tendency
 to increase precipitation and minimize the temperature variations.
 The rainfall is moderate in summer and the winter snows are not
 excessive. Feed for horses is good in May or early June. On some
 the river bars there is an abundance of grass, particularly on upper
 Nabesna and White rivers. For several years horses have even win-
 ted on the White River bars. Prospectors using stock leave
 Nabesna River for Valdez at the end of a summer's work about
 August 25, or not later than September 1, but those on White River
 remain till October without danger of lack of feed on the trail to
 White Horse. Thus the working season on White River is consider-
 ably longer than on the Nabesna or anywhere in the Copper River
 basin.

1. Modern methods in electric development seem the most feasible. Lower problems of the Yukon—utilizing the available water supply—ditch construction and would but also with power for running water from the mines, light water to the sluice box, and, in

GOLD PLACERS OF THE RUBY CREEK DISTRICT.

By A. G. MADDREN.

INTRODUCTION.

Late in the summer of 1907 a report was circulated that prospects of placer gold had been discovered on Ruby Creek, a small stream about 3 miles long that flows into Yukon River on its south side, opposite the mouth of the Melozitna. (See map, Pl. IX.) The discovery was made at the mouth of the creek, in some fine gravel at the level of the spring high-water mark of the Yukon. As this locality is very accessible, especially from the settlements of Tanana, Rampart, and Fairbanks, a good many men went to Ruby Creek during the latter part of 1907, and extensive tracts of land on a number of the streams were located as placer-mining ground. About 30 men remained in the vicinity of Ruby Creek during the winter of 1907-8, prospecting on the various creeks in this district. A number of shafts were sunk during the winter, largely with the aid of three small steam boilers, but the results of these operations do not appear to have been very encouraging, for by July, 1908, most of the men had left the district, and Discovery claim, on Ruby Creek, was the only property that was being actively worked. The writer spent seven days in this locality in July, 1908, and made a hasty examination of the general geology.

GEOGRAPHIC SKETCH.

LOCATION.

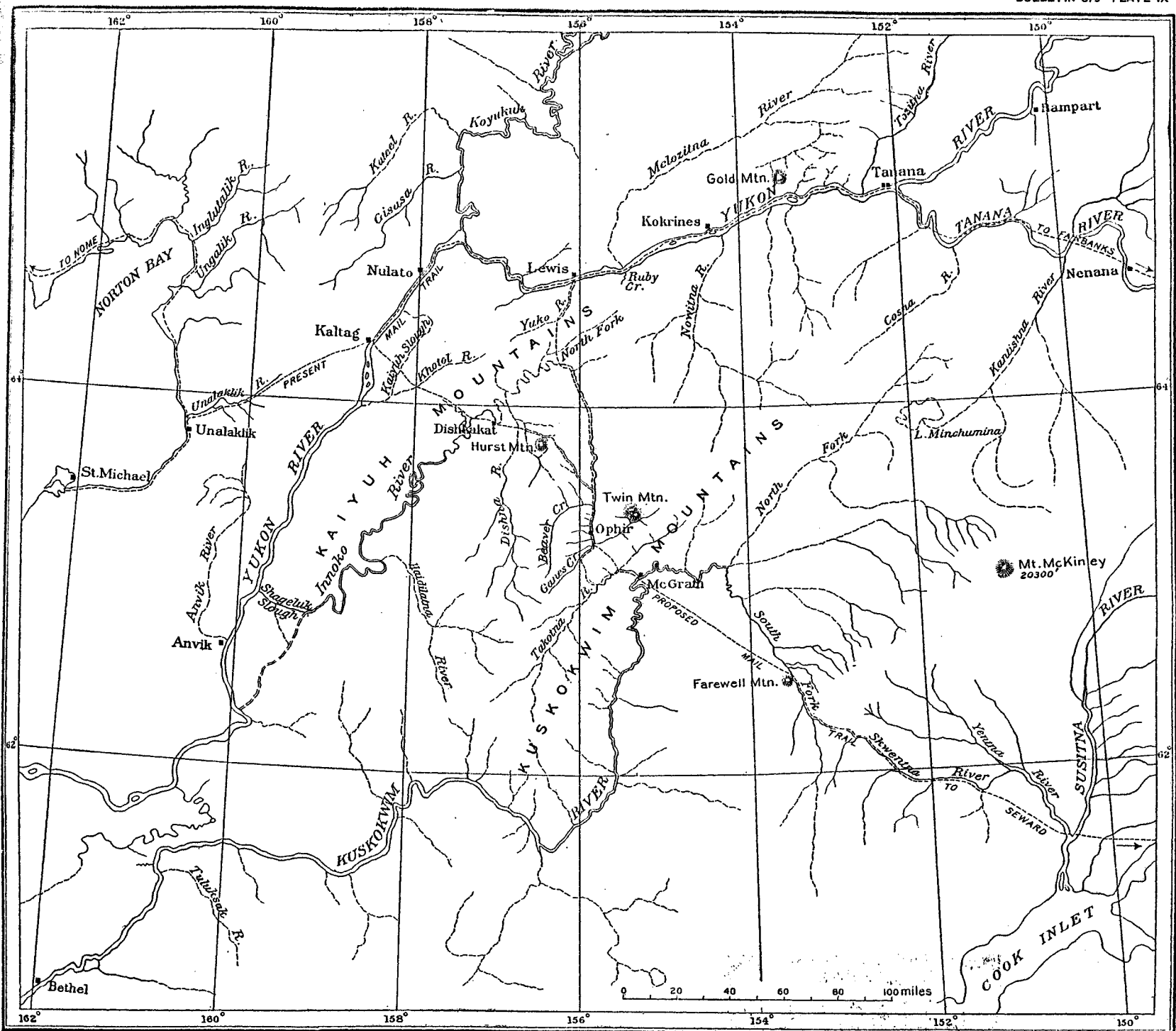
The locality known as the Ruby Creek district—from the name of the small stream on which gold was first discovered in the area—is situated along the south bank of Yukon River, directly south of and opposite the mouth of Melozitna River, about 175 miles below the town of Tanana or 110 miles above Nulato, the two nearest large settlements on the Yukon.

The district is within the St. Michael recording precinct, as it is now defined by the court for the second judicial division of Alaska. The nearest points where supplies may be obtained are at the village of Kokrines, 24 miles up the Yukon; and at Lewis's store, 23 miles

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8 miles below Ruby
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streams carry much
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The largest streams
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and the headwater
Beaver, and Dome
rise in the Ruby
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g lower course of
out 23 miles below
n named—Ora and



SKETCH MAP OF LOWER YUKON AND KUSKOKWIM VALLEYS.

GOLD PLACERS OF THE INNOKO DISTRICT.

By A. G. MADDREN.

INTRODUCTION.

Since the discovery of placer gold in paying quantities on some of the headwaters of Innoko River, in 1906, that part of Alaska has received more attention from prospectors looking for new fields than any other district in the Yukon Valley. During the last three years probably as many as 1,500 men have visited the Innoko country and remained there for the whole or part of a season. Although it is reported that prospectors visited the Innoko in 1898, during the earlier days of the gold excitement in Alaska, they do not appear to have been much encouraged by what they found, for they did not remain in the valley. The real discovery of placer gold in commercial quantities was made during the summer of 1906 by a party of prospectors consisting of Thomas Gane, F. C. H. Spencer, Mike Roke, and John Mall. These men came into the headwater country of the Innoko Valley from the Kuskokwim and found a few colors of gold on the bars of the main Innoko a short distance below the mouth of its principal headwater tributary, now named Ganes Creek. Later in the season of 1906 they ascended Ganes Creek with the hope of finding the source from which these colors of gold were derived, and during August or September they located Discovery claim on Ganes Creek about 10 miles above its mouth. At this time, their provisions having become exhausted, the party returned to the Kuskokwim for a new outfit of supplies; but there they failed to find them, so they again crossed to the headwaters of the Innoko and descended that river to the settlements on the lower Yukon. They returned to Ganes Creek during the winter of 1906-7, hauling supplies with them on sleds. In the meantime news of the discovery had spread to prospectors who were scattered in various parts of the upper Kuskokwim Valley, and that during February and March, 1907, stampeders from the Kuskokwim arrived on Ganes Creek. The news also reached Nulato, on the Yukon, and others rushed to the Innoko from that place and the settlements near by. By early spring encouraging reports of the discovery

every had reached Nome and navigation of the rivers was possible to go to the new placer district about 800 or 900 people went several hundred from Nome.

Up to the time of the 1907 devoted to locating claims on located on this stream below above it. These claims covered the mouth to its source. Besides valley floor, all of the promising located, though more as a last resort to get creek claims than from the values were to be found, for was done before the winter snow.

Many of those who flocked in of 1907, finding Ganes Creek and left the country. Others, energies toward prospecting of prospects were found on Little the Innoko to the north were thoroughly covered by although gold in paying quantities on them at that time.

production of gold on one or two Little was done during the summer claims on nearly every water the upper Innoko Valley. As to the region during the summer means that they could not reach Fairbanks and Nome.

The recording office for the 1907, on Ganes Creek at the claim No. 6 above Discovery listed of about 20 log cabins present at the diggings during the

It is estimated that about 1 Innoko precinct. The great taken up with the task of prospecting points on Yukon and large amounts of supplies had previous summer. However notwithstanding the discovery holes were sunk on Ganes Creek on Little and Ophir creeks

situated about midway between the present source of the stream and its mouth. The rapidity of the downcutting is shown not only by the typical box-canyon features, but also by the rock-cut bluffs, with bench gravels on top of them, that rise on either side of the valley at intervals below the canyon for a distance of about 8 miles, to the point where its flood plain widens out to coalesce with that of the Innoko.

TRANSPORTATION TO INNOKO VALLEY.

SUMMER ROUTES.

There are two principal summer routes available by which the Innoko placer district may be approached. These are determined by the geographic position of the Innoko Valley between the easily navigable portions of the two largest rivers in Alaska—the Yukon and the Kuskokwim.

YUKON RIVER.

By way of Yukon and Innoko rivers it is about 244 miles from Anvik to Dishkakat, and about 190 miles farther upstream to Ophir or 434 miles by the summer water route from Anvik to the digging. As already stated, small river steamboats can deliver freight as far up the Innoko as Dishkakat throughout the season of navigation, from June to October. In early June and at other uncertain times of high water, these boats can occasionally ascend the main river to points within 55 to 75 miles of Ophir.

As the summer of 1907 was one of much rainfall and a consequent high stage of water in the streams, and that of 1908 was one of very scanty rainfall with a low stage of water, a comparison of the navigation limits reached in these two years probably represents the maximum and minimum availability of the Innoko as a route for transporting supplies into the country with steamboats of the size and type now employed. In 1907, during a period of high water, a steamboat with a draft of about 22 inches when loaded reached a point on the upper Innoko about 55 miles below the present town of Ophir. A cargo of 50 or 60 tons of freight might be landed at this distance below Ophir under such conditions of high water. It will probably always be necessary to transport freight from this point to Ophir in small lots of 3 or 4 tons by light-draft flat-bottomed scows, or in 1 or 2 ton lots by still smaller poling boats. In 1908 conditions were not so favorable. Even at the time of the early summer high water the same steamboat could get only within 70 miles of Ophir, and during July and August this boat found it difficult to ascend the Innoko to the village of Dishkakat and was obliged to discharge its freight there, being unable to go farther upstream.

Most of the freight shipped into Fairbanks, the largest town in the Territory, 770 miles above Anvik and 1,000 miles above the mouth of the river. The freight charges on the Yukon are about \$80 a ton. The transportation charges on the Yukon from St. Michael to Anvik or near-by points have also published a through rate from Seattle or San Francisco, Alaska to Anvik, but the competition from the Yukon River and reserved the right to change rates only when business warranted.

In 1908. No attempt has yet been made to transport freight from the United States to the Innoko. The distance from St. Michael is 2,846 miles, and the freight charges. If the traffic should amount to a tonnage a charge would be quoted over the Yukon over shipping from Fairbanks, which is much lower in the United States.

A few individual outfits have attempted to transport freight a distance of 115 miles by ocean from Nome to the Yukon River boats to Anvik, but the freight was transferred to the small boats on the Yukon. The distance from Nome to Dishkakat is 115 miles, and it appears that if a direct line were established between Nome and Dishkakat, the merchants of Nome, enjoying the advantages afforded by direct ocean communication with the United States, should be able to compete with the merchants of Fairbanks. However, whether the Innoko River or the Kuskokwim River if an equally direct line were established from Nome to Beaufort.

KUSKOKWIM

The Kuskokwim is the second largest river in Alaska. It is the best river for steamboating in Alaska, except the Yukon. Steamboats run about 633 miles, to the confluence of the North and South forks, the North Fork about 40 miles from the mouth of the South Fork about 40 miles. It could also ascend the North Fork. A draft of 2 feet have ascended the Kuskokwim that heads against the

present source of the stream
cutting is shown not only
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OF INNOKO VALLEY.

ROUTES.

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s obliged to discharge its freight
upstream.

Most of the freight shipped into the Innoko has been brought from Fairbanks, the largest town in the Yukon Valley, situated on Tanana River, 770 miles above Anvik and about 1,014 miles from Dishkakat by the rivers. The freight charge from Fairbanks to Dishkakat has been \$80 a ton. The transportation companies operating large steamboats on the Yukon from St. Michael, where they connect with ocean steamers, have quoted a rate of \$38 a ton from Seattle or San Francisco to Anvik or near-by points on the Yukon. One of these companies has also published a through rate of \$70 a ton to Dishkakat from Seattle or San Francisco, and a local rate of \$35 a ton to Dishkakat from Anvik, but the company did not offer a regular service on Innoko River and reserved the right to operate steamers thereon only when business warranted. These rates expired on September 1, 1908. No attempt has yet been made to ship freight direct from the United States to the Innoko. The ocean distance from San Francisco to St. Michael is 2,846 miles, and from Seattle to St. Michael 2,487 miles. If the traffic should amount to much, probably a lower freight charge would be quoted over this route, and another advantage it has over shipping from Fairbanks is that the original cost of supplies is much lower in the United States.

A few individual outfits have been purchased at Nome and shipped a distance of 115 miles by ocean vessels to St. Michael, there reshipped on Yukon River boats to Anvik, 405 miles from St. Michael, and there again transferred to the smaller boats which ascend the Innoko. The distance from Nome to Dishkakat by this route is about 764 miles, and it appears that if a reliable line of transportation was established between Nome and Dishkakat by way of the lower Yukon the merchants of Nome, enjoying a comparatively low freight tariff afforded by direct ocean communication with the Pacific ports of the United States, should be able to bid successfully for the Innoko trade in competition with the merchants of Fairbanks. It is doubtful, however, whether the Innoko route is as good as that by way of Kuskokwim River if an equally reliable line of communication should be established from Nome to Bethel.

KUSKOKWIM RIVER.

The Kuskokwim is the second largest stream in Alaska, and is perhaps the best river for steamboating in that country, with the possible exception of the Yukon. Steamboats of large size can ascend the river about 633 miles, to the confluence of its two principal headwater branches, the North and South forks, and smaller steamboats have been up the South Fork about 40 miles above this junction, and no doubt could also ascend the North Fork for some distance. Boats with a draft of 2 feet have ascended Takotna River, a large tributary of the Kuskokwim that heads against the sources of the Innoko, for a distance

of about 60 miles to a point within 25 miles of Ganes Creek, where supplies may be forwarded 30 miles farther up the Takotna to the mouth of Big Creek, which is only about 12 miles from Ganes Creek.

The Kuskokwim has not been used to any great extent as a route for the transportation of supplies, because the country within its drainage basin has not been prospected or developed, as has the territory within the Yukon basin. Another reason is that Kuskokwim Bay and the estuary or tidal portion of the river's mouth has been considered a hazardous locality in which to navigate ocean vessels, but this opinion appears to be due rather to the fact that this part of the Alaskan coast is mapped only in rough outline and is not known in detail, even by the very few who have some personal knowledge of these waters, than to the presence of any real dangers to navigation other than those caused by lack of acquaintance and proper charts for guidance. When accurate surveys of Kuskokwim Bay and the mouth of the river are made and the good channels that run through its extensive shoals are properly marked, ocean vessels with a draft of 12 feet may enter and ascend it to Bethel with safety and dispatch.

The Kuskokwim route was traveled by many of the people who went to the Innoko from Nome in 1907. The passengers and the supplies were taken across Bering Sea from Nome to the mouth of the Kuskokwim, a distance of 480 miles, by various small unseaworthy craft. Thence they were taken up the river on several steamboats to Takotna River and up the very winding course of that stream to points 12 to 20 miles from Ganes Creek, which may be reached by several trails across a low mountain range over which supplies can be packed by men or horses during the summer or hauled on sleds during the winter.

In the spring of 1908 a company with trading interests on Kuskokwim River brought several hundred tons of freight direct from San Francisco to Bethel on a large two-masted ocean schooner equipped with auxiliary gasoline power. During the summer this company sent about 40 tons of supplies up the Kuskokwim and Takotna to the mouth of Big Creek, a point about 90 miles above McGrath, which is on the Kuskokwim at the mouth of the Takotna. This freight was taken up the Takotna about 60 miles by a small stern-wheel boat which could go no farther owing to the unusually low water. From this point the goods were taken in scows and poling boats the remaining 30 miles to the mouth of Big Creek. Here a log store has been built and the place is known as Joaquin. From Joaquin it is about 12½ miles to the settlement called Moore City, on Ganes Creek, half a mile below Glacier Gulch. A trail that may be used by pack horses in summer and sleds during winter follows Big Creek for 9 miles to its head with an ascent of about 900 feet, all of which is graded

cept in the upper quarter of the trail for 200 feet. This trail is the head of Glacier Gulch, down which there is an even descent of 600 feet. The difficulties to the construction of a permanent winter trail is to be avoided to the Innoko Valley, however, a longer route which would lead directly with the Innoko to the town of Moore City. This point is a placer-gold area, as it is no doubt the side lies in the fact that it can be reached at all stages of the season. Bethel, where direct connection can be made with Seattle or San Francisco. Deliver freight at a central point in the region with fewer transfers and a lower charge, than is possible by the portion of the Innoko Valley. A winter sled trail, could be made to 25 miles above its confluence with the Innoko Valley near the mouth of the river to the town of Ophir. The trail is 12 miles long, and the divide between the Innoko is not high or rugged. There is no high or present as steep grade as it does, and it would lead to a good starting point for the placer region. A schooner of about 150 tons could make a continuous trip from Bethel to 25 miles above its mouth, without the disadvantages of this route, for the trail is shorter than Dishkakat by the Yukon. Successful in reaching that point by winter trail from Ophir. The distance from Kuskokwim to a point on the Yukon is 35 miles of the Innoko Valley. The Yukon-Innoko route, if made by winter trail, is about 100 miles. The difference in favor of the Yukon is the shorter distance of its terminus. The number of transfers of freight is a more or less shallow harbor, it is necessary to land the shore and then reload

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 steeply for 200 feet. This trail passes over a saddle divide to
 the head of Glacier Gulch, down which it goes for 3 miles to Ganes
 Creek with an even descent of 600 feet. This route offers no particular
 difficulties to the construction of a wagon road. If a wagon road or
 permanent winter trail is to be built from the Kuskokwim drainage
 area to the Innoko Valley, however, it appears best to select a some-
 what longer route which would connect a point on the lower Takotna
 more directly with the Innoko at the mouth of Ganes Creek, 10 miles
 below Moore City. This point on the Innoko side is more central to
 the placer-gold area, as it is now known; the advantage on the Kus-
 kokwim side lies in the fact that some point on the lower Takotna
 can be reached at all stages of water by steamboats plying direct
 from Bethel, where direct connection can be made with ocean vessels
 from Seattle or San Francisco. By such a route it may be possible
 to deliver freight at a centrally located distributing point in the
 mining region with fewer transfers, and consequently a lower trans-
 portation charge, than is possible by any other route into the head-
 water portion of the Innoko Valley. A wagon road, or at least a
 good winter sled trail, could be built from a point on Takotna River
 15 to 25 miles above its confluence with the Kuskokwim to the upper
 Innoko Valley near the mouth of Ganes Creek, or about 5 miles
 farther to the town of Ophir. Such a road would not be over 30 or
 35 miles long, and the divide to be crossed from the Kuskokwim to
 the Innoko is not high or rugged. The road would probably not be
 as high or present as steep grades as the Big Creek-Glacier Gulch
 trail does, and it would lead more directly to a suitable central dis-
 tributing point for the placer region. In the fall of 1908 an auxiliary
 gasoline schooner of about 15 tons burden, with a draft of 4 feet,
 made a continuous trip from Nome to a point on the Takotna, 30
 miles above its mouth, without any difficulty. This trip shows the
 advantages of this route, for the same boat could not have proceeded
 farther than Dishkakat by the Yukon-Innoko route, and even if
 successful in reaching that place it would still be 55 miles by the
 winter trail from Ophir. The distance from Nome by way of the
 Kuskokwim to a point on the Takotna 25 miles above its mouth and
 within 35 miles of the Innoko diggings is 1,170 miles. The distance
 over the Yukon-Innoko route from Nome to Dishkakat, 55 miles from
 Ophir by winter trail, is about 764 miles.

The difference in favor of the Kuskokwim route is not only in the
 shorter distance of its terminus from the diggings, but also in the
 smaller number of transfers of freight necessary. At St. Michael,
 which is a more or less shallow, open roadstead rather than a pro-
 tected harbor, it is necessary to lighter all cargo from ocean vessels
 to the shore and then reload the freight into the river boats at the

docks or warehouses. Moreover, it is often necessary for the river boats to wait several days or even a week, after being loaded, for calm weather on Norton Sound during which to make the passage of 60 miles around the shoal coast to the mouth of the Yukon. This passage is hazardous for the small steamboats that can ascend the Innoko. Consequently, safety will make it advisable to send freight from St. Michael to Anvik on large steamboats and to transfer it again at Anvik to smaller boats for the trip up the Innoko. Thus three transfers are necessary between starting point and destination. By the Kuskokwim route, on the other hand, only one transfer is necessary, that at Bethel, and it can be made directly from the ocean vessel to the river boat in a safe port.

During 1907-8 supplies have been transported to the Innoko gold diggings in a rather unsatisfactory manner by means of small river steamboats to the head of navigation and thence by small scows towed by horses and poling boats propelled by men to Ophir. This settlement has never been a well-stocked distributing point, however. In fact, many of the necessities have often been entirely lacking, and a shortage of provisions in the whole Innoko Valley has prevailed throughout the last two years. During the winter of 1907-8 it became necessary for many of those who wished to remain in the country to journey over difficult winter trails to Anvik, Kaltag, and Nulato, on the lower Yukon, and haul back with them on hand and dog sleds the bare necessities for existence, thus expending much time in unprofitable labor.

The cost of transporting freight from points where the steamboat may be able to land it on Innoko River to Ophir, by means of man-propelled boats, varies from 10 to 20 cents per pound, according to the distance it must be carried. At present it costs from \$280 to \$450 a ton for freight charges alone to have supplies brought to the Innoko diggings from the larger centers of supply on the Yukon. Besides this heavy freight toll, the initial cost of provisions in Fairbanks is much higher than at the ocean ports of Nome or St. Michael. By establishing reliable communication with St. Michael, the freight charge from Seattle may probably be reduced to about \$70 a ton for goods delivered at Dishkakak, but the difficulty of carrying them from that place to Ophir will still remain. The writer was told that the charge for hauling freight with horses and sleds over the 55 miles of winter trail from Dishkakak to Ophir was about 7 or 8 cents a pound, so that the lowest estimate it is now possible to make with the figures at hand is a freight cost of \$210 a ton for delivering supplies at Ophir from Seattle by way of St. Michael and the Yukon. This figure is based on the current freight tariffs, but there appears to be no reason why this cost might not be materially reduced by an organized and well-regulated effort.

There is no doubt that from Seattle to Bethel fully a river boats can be loaded and handling being necessary. from and the Takotna to in the vicinity the overland h made by summer wagon railroad if developments s question that the Kuskok records the most expeditio portation problem; that ev reason why supplies from S 100 a ton; and that with over this route may be red

Distances by the winter r are much shorter than by ment of flat, swampy cou frozen over, so that more place to another. It is ab Dishkakak, and about 55 m altogether. This trail is f but between Dishna and u km range at an elevation of a low, wide pass, with ea Kaltag is a military telegra winter mail route from Fa 1907-8 a moderate amoun dog teams from Kaltag an a number of personal outf eds, and some new arrival herd of reindeer of about Innoko and sold for the me Another winter route to trading station called Lewi the Yukon, about 15 miles station called Melozi. Th valley of Yuko River, cross alley of the North Fork down this valley to a poi The route then follows I parties traveled over this r dog-team loads of freight ted to be about 100 mile

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There is no doubt that freight can be brought from San Francisco
Seattle to Bethel fully as cheaply as to St. Michael. At Bethel
the river boats can be loaded directly from the ocean vessel, only one
handling being necessary. The river boats can ascend the Kuskok-
wim and the Takotna to its forks without any difficulty, and from
this vicinity the overland haul of about 35 miles to Ophir can easily
be made by summer wagon road or winter sled trail, or by a light
railroad if developments should warrant. There appears to be no
question that the Kuskokwim route to the Innoko placer camp
affords the most expeditious and satisfactory solution of the trans-
portation problem; that even under present conditions there is no
reason why supplies from Seattle may not be delivered at Ophir for
\$100 a ton; and that with good management the actual freight cost
over this route may be reduced considerably below that figure.

WINTER ROUTES.

Distances by the winter routes from the lower Yukon to the Innoko
are much shorter than by the summer water routes. The wide
extent of flat, swampy country of the lower Innoko Valley is then
frozen over, so that more direct courses may be followed from one
place to another. It is about 57 miles by sled trail from Kaltag to
Dishkakat, and about 55 miles from Dishkakat to Ophir, or 112 miles
altogether. This trail is for the most part over flat-lying country,
but between Dishna and upper Innoko rivers it crosses a low moun-
tain range at an elevation of about 1,300 feet above sea level by way
of a low, wide pass, with easy grades approaching it from either side.
Kaltag is a military telegraph station and a regular post-office on the
winter mail route from Fairbanks to Nome. During the winter of
1907-8 a moderate amount of freight was hauled over this trail by
dog teams from Kaltag and Nulato to Ophir for 50 cents a pound.
A number of personal outfits were hauled over it by means of hand
sleds, and some new arrivals even hauled their provisions from Nome.
A herd of reindeer of about 30 head was driven from Unalaklik to the
Innoko and sold for the meat.

Another winter route to the Innoko leaves Yukon River at a small
trading station called Lewis's, which is located on the north bank of
the Yukon, about 15 miles below the United States military telegraph
station called Melozi. The trail goes south from the Yukon up the
valley of Yuko River, crosses the wide, flat pass at its head into the
valley of the North Fork of the Innoko, and continues southward
down this valley to a point on the Innoko 65 miles below Ophir.
The route then follows Innoko River to its headwaters. Several
parties traveled over this route during the winter of 1907-8, and a few
dog-team loads of freight were hauled over it. The distance is esti-
mated to be about 100 miles, and it is by far the shortest winter route

for those who wish to go from Ophir to upper central Yukon points such as Tanana, Rampart, or Fairbanks. Under present conditions this route would be the shortest and most direct for a winter mail service to Ophir, as all the winter mail for western Alaska now passes down the Yukon from Fairbanks, but no service to Ophir has yet been established.

EFFECT OF HIGH TRANSPORTATION RATES.

It may be seen that the transportation of supplies to the Innoko placer district for a reasonable cost has not been accomplished and that the exorbitant operating expenses in this district are the direct result of poor and inadequate transportation. For this reason under present conditions and possibilities have been described in detail, the transportation problem is of vital importance and its solution as soon as possible is imperative to the success of the Innoko placer district as a mining community.

During 1907-8 the prices of staple provisions at Ophir were as follows:

Flour.....per pound..	\$0.30	Bacon.....per pound..	\$0.50
Corn meal.....do....	.50	Ham.....do.....	1.00
Rice.....do.....	.50	Butter.....do.....	1.00
Rolled oats.....do....	.45	Cheese.....do.....	1.00
Beans.....do.....	.50	Dried fruit.....do....	1.00
Coffee.....do.....	1.00	Canned fruit.....per can..	1.00
Tea.....do.....	1.00	Canned vegetables.....do....	1.00
Sugar.....do.....	.50	Canned milk.....do.....	1.00

GEOLOGIC SKETCH OF THE INNOKO REGION.

The bed rock of the Innoko region is for the most part primarily sedimentary origin, although the original condition of the rocks has been greatly changed by metamorphic alterations, so that now they are mostly in the form of schists and slates, with some cherts and crystalline limestones. Associated with these metamorphosed sediments, more particularly with the slates, and making up considerable areas of the bed rock, are large masses of basic volcanic rock, principally diabase, that may be related with part of the slates as one or more extensive original effusive stratigraphic members, which may be distinct from the slates in a stratigraphic sense. In addition to this large amount of apparently extrusive igneous rock, in the form of diabase, both the schists and slates contain locally intrusive dikes of more acidic igneous rocks. These dikes may be considered younger than either the schists or the slates into which they have intruded, and they have no purely stratigraphic relation with the rocks such as the diabases may have with the slates. All the rocks above mentioned, with the possible exception of the acidic igneous intrusives, are considered to be of Paleozoic age because of the

geologic and stratigraphic similarity of the Yukon Valley.

lying unconformably above the altered sedimentary formations of limy sandstones and shales between the southern headwaters there is a belt that shows prominent intrusive character. The entire most part of basic type, typical during Mesozoic time, for the Innoko, and other sedimentary rocks remains, giving evidence of the Innokwim River, where it cuts through the Innoko Mountains from Kolman River. A number of occurrences of old flows of lava contemporaneous with which form most of the Innoko dikes these interbedded effusives are also of common occurrence and they are of siliceous variety with a fine-grained texture. These dikes are considered to be of Tertiary age because they cut sedimentary rocks. With the exception of a very few and sands containing some pebbles the writer knows of no sedimentary rocks to be of Tertiary age in the Innoko region of this age may occur. The Paleozoic and Mesozoic volcanic rocks of the Innoko have an aspect on the lower Innoko Range. These rocks are considered, through similarity, to be related to the Tertiary volcanic rocks of the lower Yukon from Nulato to the Innoko. Thus there appears to be evidence of volcanic activity, in the Innoko region, during the Paleozoic, Mesozoic, and Tertiary periods—the Paleozoic, Mesozoic, and Tertiary.

ECONOMIC

The only mineral of commercial value is gold, in placer deposits. At present time the only productive gold lode discovered is the Innoko. The owners hope to prove it.

J. E., A reconnaissance in southwest Alaska, U. S. Geol. Surv. Bull. 7, 1900, pp. 159-163.

THE IRON CREEK REGION.

By PHILIP S. SMITH.

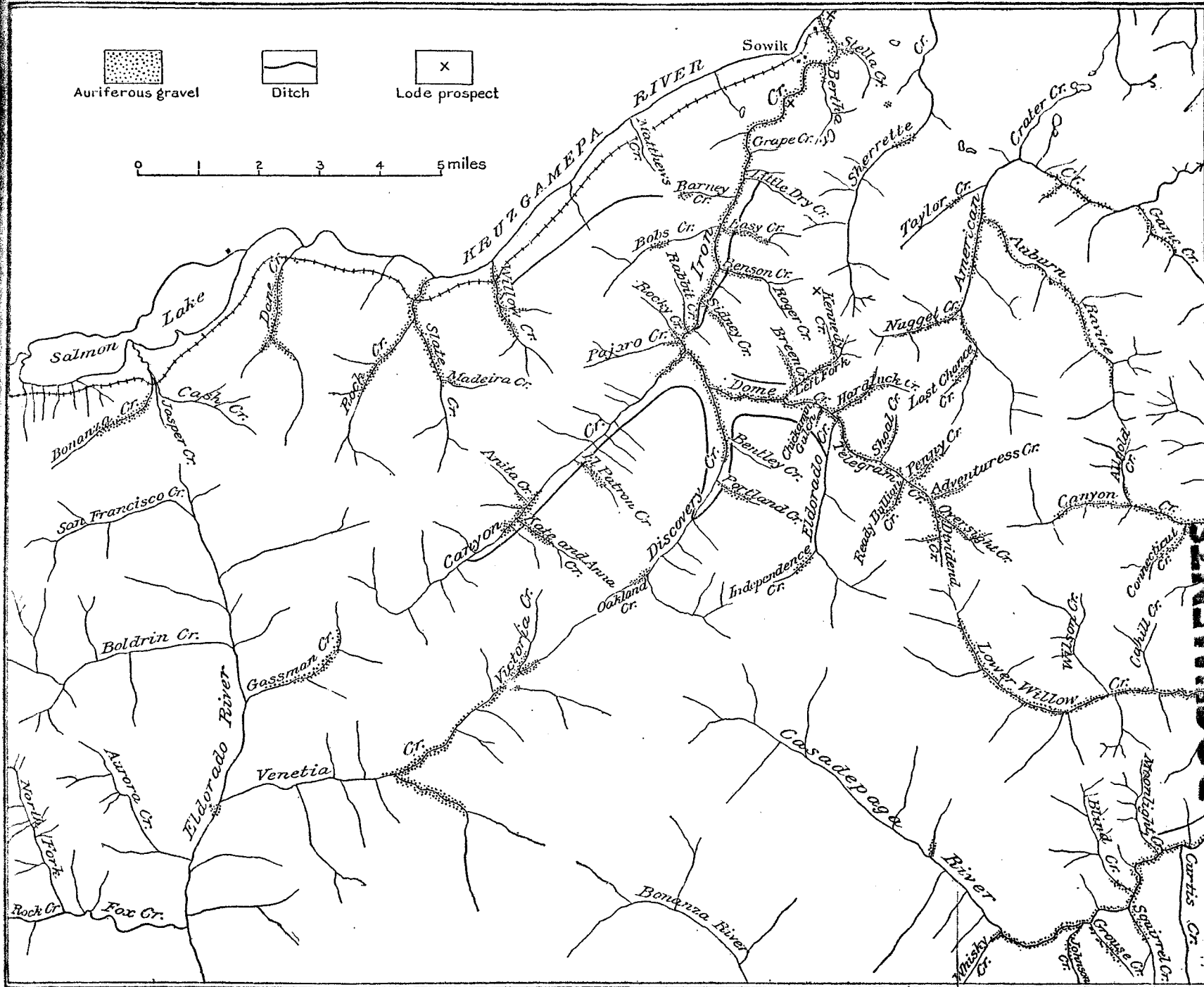
INTRODUCTION.

In 1905 and 1906 parties from the Geological Survey mapped in detail the geology of a rectangular area extending from Norton Sound on the south to the crest of the Kigluaik Mountains on the north and from the meridian of Cape Nome on the east to a meridian 2 miles west of Nome on the west. In 1907 and during a few weeks in the early part of the field season of 1908 the mapping of the geology of another quadrangle was completed. This area is bounded on the south by Norton Bay, on the north by Niukluk River and the flats between that river and the Kruzgamepa, on the west by a north-south line 2 miles west of the town of Solomon, and on the east by the meridian of Topkok Head. Between these two regions only reconnaissance studies had been made. With the completion of the detailed investigations it became desirable to connect the two separated regions by study in the intervening area in order to see whether the various groups of strata could be correlated. Not only was such a closure desirable from the standpoint of the geologist, but it was recognized that the mining industry had developed in this area gold-bearing gravels that were similar to those in other parts of Seward Peninsula, and it was hoped that a study of these gravels might assist in explaining the origin and distribution of the gold gravels of the peninsula as a whole. This intervening area includes a large part of the basins of Bonanza, Eldorado, and Iron creeks, of which only the Iron Creek basin has been important as a placer region. It was not possible to complete the mapping of the geology of more than the Iron Creek basin and the northern part of the others, though some additional data were procured on the adjacent areas. Valuable notes were furnished by A. H. Brooks and F. H. Waskey and have been used in this report without specific acknowledgment, but the writer desires to express thanks for the assistance thus afforded, which can not be measured by reference.

Although it is the intention in this paper to direct the discussion mainly to the mining industry of the Iron Creek basin, it becomes

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MAP SHOWING DISTRIBUTION OF MINERAL RESOURCES IN IRON CREEK REGION, SEWARD PENINSULA.

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ch it was intended to work. It may be a warning not amiss, especially in connection with mining, desire to invest rather

re gold is known to occur in places where obtaining water under head at a small volume of water under low pressure. In such places it will be necessary to trans-fer a large volume of water under low pressure to a great height. So far, two methods have received but slight attention. The hydraulic ram has, however, been effective in some places. An inquiry into its availability for certain cases is suggested by the problem of obtaining a water

supply in sufficient quantity within the Fairhaven district. Itches afford a ready method of transport. Water must be carried from one creek to another. In the exception of Iron Creek, which have a ditch, water can be delivered at an elevation of 100 feet by an inverted siphon, having a pressure of 100 feet.

Iron Creek water to be effective for a distance of 100 feet. If the ditch were lower it would be necessary to treat the known gold placers. It would encounter much bare limestone, which is extremely expensive. To bring Iron Creek water would require a higher intake and a ditch almost all the way in broken fissured vegetation. Water could not be taken from the Pinnell River or its tributaries, or from the Fairhaven River, except at such an elevation that the water would be lost.

No water could be obtained from the Fairhaven River or Iron or American creeks. Water from some of the streams rising in the hills can be obtained either by inverted siphons across the lowlands or by a tunnel a couple of miles across the Colorado divide. Either of these plans is suggested at a low elevation, which could be used in some places. It has already been pointed out, that the Fairhaven River does not seem to be sufficiently auriferous for hydraulic ram work.

MINING IN THE FAIRHAVEN PRECINCT.

By FRED F. HENSHAW.

INTRODUCTION.

The Fairhaven precinct was examined by Moffit in 1903,^a but had not been visited by any other member of the Geological Survey until 1908, when the writer spent about seven weeks in this region. The studies of the placers and mining conditions were incidental to stream-gauging work, so that the following notes are not as complete as could be wished. They will, however, give a general idea of conditions in this extensive area and of the recent mining developments.

The Fairhaven district has been developed mostly by the efforts of the miners themselves, for hardly any outside capital was invested in it until 1906. Since that time a considerable amount of money has been spent, in ditches and mining equipment; it has, on the whole, been wisely spent, and the chances seem good of clearing a considerable net profit from the mining operations in the precinct. A sketch map (fig. 21) has been prepared, showing the location of placers, ditches, and points of stream measurements.

INMACHUK RIVER BASIN.

The basin of Inmachuk River was the scene of the discovery of gold in the Fairhaven precinct, the first finds having been made on Old Glory and Hannum creeks in the fall of 1900.^b Considerable mining was done during the next summer, but in the fall most of the miners joined the stampede to Candle Creek. In 1903 a number of them had returned, and since that time mining and development work have steadily progressed. Prior to 1903 most of the work had been done on the smaller streams, but since that time a large part of the production has come from the Inmachuk itself between the mouth of Pinnell River and the point where it leaves the hills and flows across the coastal plain.

^a Moffit, F. H., The Fairhaven gold placers, Seward Peninsula, Alaska: Bull. U. S. Geol. Survey No. 247, 1905.

^b Moffit, F. H., op. cit., p. 49.

PASMUSONI TRAPAY

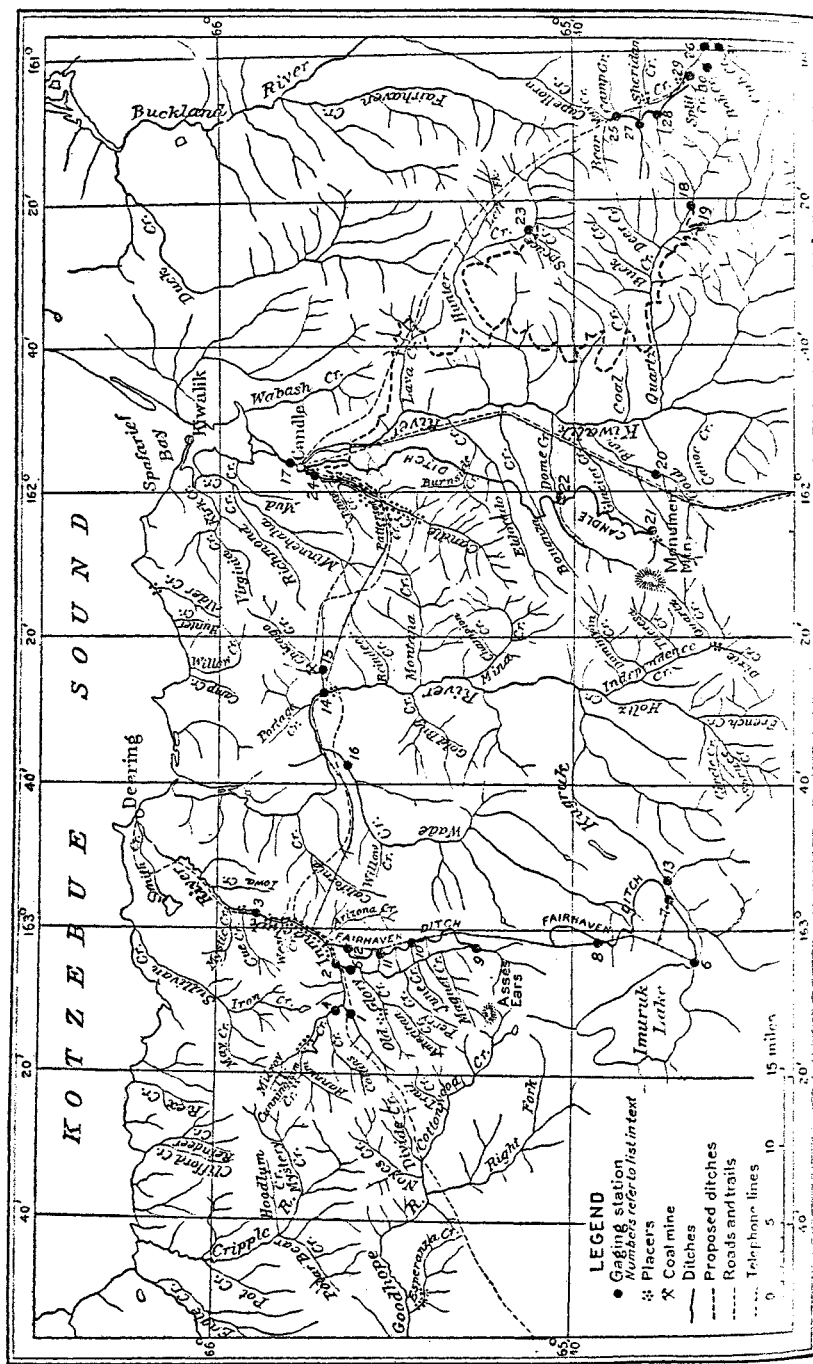


FIGURE 21.—Sketch map of part of Fairhaven precinct.

Practically no work was done on the old workings on Old Creek, which were abandoned.

A ditch built on Hannum Creek for irrigation has its intake at the mouth of the creek for 5 miles along the right bank of the creek above the mouth of Collins Creek. The ditch was built on a grade of 4.2 feet to the mile, which is unfavorable for ditch construction, containing little sediment and much muck. There are also many rocks in the bed, and these conditions cause the banks of the ditch to be solid. In 1907 the ditch was in use, from the mouth of Hannum Creek to the mouth of Collins Creek, and was being used to strip the muck from the right bank of Hannum Creek. So far as is known, the bed at this point in previous

INMACHUK RIVER

Little mining has been done on the Inmachuk River at the mouth of the Pinnell, and in 1907 little prospecting just above Fairhaven. In the stream bed is here about 10 feet. Prospects were found, but they were not worked. It was reported in the fall of 1907 that the mouth of Pinnell River to the mouth of the Inmachuk River would come under one control and that the springs for hydraulic mining costs in this way, so that the springs would be worked. The springs furnish 8 second-feet, and a pressure on most of the ground.

INMACHUK RIVER

The 7 miles of Inmachuk River contributed a large share of the amount to date, as nearly as \$500,000, nearly all of which was from the gravel flat. The gravel flat in this part of

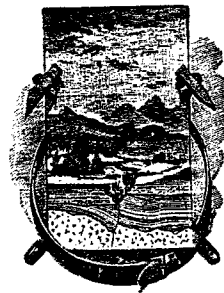
* The second-foot is equal to 40 miner's inches.

Bulletin No. 335

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

GEOLOGY AND MINERAL RESOURCES
OF THE
CONTROLLER BAY REGION, ALASKA

BY
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tains. They extend from the edges of the alluvial flats to an elevation of 800 to 1,000 feet, where they begin to gradually thin out. The interspaces between the groups and areas of trees, which widen toward the higher altitudes, are filled with grass and with dense thickets of alder and willow. The general upper limit of the forests is at an altitude of about 1,200 feet, and the extreme upper limit of good trees is 1,700 feet. The trees on the lower slopes are very large and densely spaced, and the quality of the lumber is fair.

Mountain-top vegetation: The upper slopes and summit of the hills and mountains above the tree line, as defined above, are partly bare (see Pl. IV, A, p. 16) and partly covered with grass, small herbs and bushes, and stunted alders and spruce. It is worthy of note that vegetation of this type descends far lower in this region than is usual in this latitude. The importance of this characteristic lies in the fact that it restricts the area of valuable timber and affords easy travel in considerable areas above timber line.

SETTLEMENTS.

The post-office and chief trading center for the entire Controller Bay region is Katalla, which is situated on the shore of Katalla Bay and is now the landing place of the steamers. Chilkat, near the mouth of Bering River, is a mixed settlement of whites and natives and is a stopping place on the way up the river to the coal field. The town of Kayak, on Wingham Island, which was formerly a post-office and steamer landing, is now practically abandoned. There are no other settlements except the camps of the various coal and oil companies, which are scattered throughout all parts of the region.

TRANSPORTATION.

EXISTING FACILITIES.

The only communication with other regions is by water. Katalla is a regular stopping place for steamers from Seattle to Valdez and Seward, there being five or six boats a month. The voyage from Seattle to Katalla requires three and a half to four days "outside route" or seven to eight days "inside route" via Juneau. The nearest large towns are Juneau, which is from two to three days' journey to the east, and Valdez and Seward, which are from ten to eighteen hours and from twenty-four to thirty-six hours, respectively, to the west. There are telegraph and cable offices^a at these towns. Valdez and the other Prince William Sound ports can also be reached by crossing the Copper Delta in a small boat to Orca, a two-day journey, from which place there is regular and frequent communica-

^a Plans are also under way to connect Katalla with the existing cable.

tion with Valdez and the other ports, in addition to the other launches, in addition to the other launches.

There is regular transportation from Katalla to all parts of Controller Bay and much of the rest of the region. The Bering River as far as the mouth of Shepherd Creek, Gandil, Nichol, and other of the larger streams are navigable. Most of the local transportation is by water.

Land travel is not practical because of the dense vegetation and the large number of streams. The maps (Pls. II, V, VIII) include those from Katalla to the beach to Strawberry Harbor, from the mouth of Bering River to Dick Creek to Lake Tokum, from Lake Charlotte with a branch to Lake Charlotte to Kushtaka Lake, from the mouth of Kushtaka Lake, from the mouth of Clear water Creek up Canyon Creek to Berg Lake. From this last place a highway into all the valleys (which borders the five Berg Islands) which borders the five Berg Islands, practically all the camps which are on the roads have been built from the mouth of Redwood Creek to the Landing to a coal opening.

Reference has already been made to the roads which have hitherto been made, and the proposed roads is to be made for shipment, or to provide a means of utilizing the resources of the Copper River. The selection of the harbor at the terminus, the character of the road, and the prospective fre-

^a Brooks, Alfred H., Railway routes in Alaska: Nat. Geog.

f the alluvial flats to an elevation to gradually thin out. The mass of trees, which widen toward the base and with dense thickets of fir limit of the forests is at an extreme upper limit of good lower slopes are very large and lumber is fair.

per slopes and summit of the mountain, as defined above, are partly covered with grass, small herbs and spruce. It is worthy of note that fir is more common in this region than is usual and that this characteristic lies in the valuable timber and affords easy lumber line.

POINTS.

center for the entire Controller region situated on the shore of Katalla for the steamers. Chilkat, near the settlement of whites and natives up the river to the coal field. The point which was formerly a post-office is now practically abandoned. There are no roads of the various coal and oil companies out all parts of the region.

TRANSPORTATION.

CONVENIENCES.

Other regions is by water. Katalla is reached by steamers from Seattle to Valdez and back in about a month. The voyage from Seattle and a half to four days "outside route" via Juneau. The "inside route" which is from two to three days' voyage to Seward, which are from ten to thirty-six hours, respectively, and cable offices at these towns. Katalla Sound ports can also be reached by a small boat to Orca, a two-day voyage. Regular and frequent communication

connects Katalla with the existing cable.

tion with Valdez and the other Prince William Sound towns by launches, in addition to the ocean-steamer service.

There is regular transportation of passengers and freight from Katalla to all parts of Controller Bay and to Bering Lake by launches, and much of the rest of the region is accessible by means of canoes. Bering River as far as the mouth of Canyon Creek, Stillwater Creek, Shepherd Creek, Gandil, Nichawak, and Katalla rivers, and others of the larger streams are navigable for canoes and poling boats. Most of the local transportation is consequently effected in this way.

Land travel is not practicable except where trails have been built, because of the dense vegetation, the swampy character of the flats, and the large number of streams. Most of the trails are indicated on the maps (Pls. II, V, VIII). The most important of these trails include those from Katalla to Mirror Slough, from Katalla along the beach to Strawberry Harbor and to the head of Katalla Slough, from the mouth of Bering River to the head of Katalla Slough (which is practically a well-built wagon road), from the mouth of Dick Creek to Lake Tokum, from Canoe Landing up Shepherd Creek to Lake Charlotte with a branch from Carbon Creek across Kush-taka Ridge to Kushtaka Lake, from Canoe Landing direct to Kushtaka Lake, from the mouth of Stillwater Creek to Lake Kushtaka with branches up Clear and Trout creeks, from the mouth of Stillwater Creek up Canyon Creek, and across Carbon Mountain to First Berg Lake. From this last point the shores of Berg Lakes (see Pl. VI, 1, p. 46) and a portion of the surface of Bering Glacier affords a highway into all the valleys opening on the lobe of Bering Glacier, which borders the five Berg Lakes. Other shorter trails reach practically all the camps which are not accessible by water. Short tram-roads have been built from the head of Katalla Slough and from the mouth of Redwood Creek to neighboring oil wells and from Canoe Landing to a coal opening.

RAILWAY ROUTES.

Reference has already been made (p. 15) to the railway surveys which have hitherto been made or which are in progress. The object of these proposed roads is to make the Bering River coal accessible for shipment, or to provide a route "to the copper deposits and other resources of the Copper River region, or both. The conditions which will govern the selection of the route include the character of the harbor at the terminus, the cost of construction and operation of the road, and the prospective freight tonnage.

Brooks, Alfred H., Railway routes: Bull. U. S. Geol. Survey No. 284, 1906, pp. 10-17; Railway routes in Alaska: Nat. Geog. Mag., 1907, pp. 16-190.