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DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

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MAPS AND DESCRIPTIONS
OF ROUTES OF
EXPLORATION IN ALASKA
IN 1898

WITH GENERAL INFORMATION CONCERNING THE TERRITORY

(TEN MAPS IN ACCOMPANYING ENVELOPE)

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PART I.—SPECIAL REPORTS OF EXPEDITIONS.

REPORT OF THE SUSHITNA EXPEDITION.¹

By G. H. ELDRIDGE and ROBERT MULDROW.

GENERAL TOPOGRAPHIC FEATURES OF THE ROUTE.

Cook Inlet is a structural basin of vast size, open to the North Pacific at its southern end. At present the sea occupies about half the total area, the remaining portion having been gradually filled and elevated until it now forms a broad valley 75 to 100 miles wide by 150 to 175 miles long. The inclosing mountain ranges have an intricate and rugged topography and an approximate average height of 8,000 to 10,000 feet, but they are sharply saw-toothed and relieved by numerous peaks 12,000 to 20,000 feet in altitude. The loftiest and most rugged mountains are those constituting the Sushitna-Tanana divide; they include the highest peak on the North American continent—Mount McKinley, 20,464 feet in elevation—and may be called the Alaskan Mountains. West of Mount McKinley, in the same range, are two peaks closely approximating 16,000 feet. The ranges which lie west of Cook Inlet and the Sushitna Valley resemble the Alaskan Mountains in ruggedness, and include a number of lofty peaks, of which the volcanoes Redoubt and Iliamna, 11,000 and 12,068 feet high respectively, are the most interesting. East of the Sushitna Valley and Cook Inlet, also, the mountain ranges have great ruggedness, and there are many points but little lower than those in the Alaskan Mountains. To the range north of the Kenai Peninsula the name Talkeetna may be applied. In all these ranges the crest line is saw-toothed, while the slopes are cut by gorges 4,000 to 10,000 feet deep, with precipitous walls, and their upper courses glacier-filled. At the head of Cook Inlet and west of the mouth of the Sushitna River lies Mount Sushitna. This peak is 4,280 feet high, forming the southern extremity of a low ridge that is cut by the Yentna, the chief western tributary of the Sushitna, a short distance above its mouth.

The vast watershed inclosed by all these mountains is drained by the Sushitna river system. What is locally regarded as the main branch of this stream rises far in the interior, in the comparatively low country between the mountains of the St. Elias and Alaskan systems, and has a course very irregular but in the main southwest. About 80 miles from the inlet it receives the Chulitna, and from this point the river has an almost due south course. The Chulitna has

²-Alaska.

¹ See map No. 2. in accompanying envelope.

Weather conditions in the Sushitna Basin in 1897—Continued.

Date.	Place.	Weather.
May 20-25		Clear.
May 26		Shower; clear.
May 27-28		Clear.
May 29-30	Vicinity of Devil Creek	Shower; clear.
May 31		Rain.
June 1		Cloudy.
June 2		Showers.
June 3	Started up river in boats	Clear.
June 4-5		Clear.
June 6		Shower; clear.
June 7		Cloudy.
June 8-30	En route	Clear, with occasional light showers. Lightning on 14th at Buckley Creek.
July 1-2		Clear.
July 3		Rain.
July 4	Independence Creek	Clear.
July 5		Cloudy; warm.
July 6		Rain.
July 7		Cloudy.
July 8		Rain.
July 9-10	En route	Clear and cool.
July 11-12		Rain.
July 13		Clear.
July 14		Cloudy.
July 15	Mouth Lake Fork	Cloudy and shower.
July 16		Clear.
July 17-26	Head of boating on 26th	Clear, with occasional showers each day.
July 27		Rain.
July 28	Reached head of river, 4 miles above boating. This below glaciers	Clear.
July 29	Start back down river	Do.
July 30	Clepper Creek	Do.
July 31	Lake Fork	Do.
Aug. 1-5	Devil Creek	Clear, with occasional showers.
Aug. 6		Rain.
Aug. 7-10	Devil Creek to Portage Creek; portage ..	Clear, with occasional showers.
Aug. 11	Sushitna River, mouth Portage Creek ..	Clear.
Aug. 12	Vicinity of Portage Creek. On 15th started down river	Do.
Aug. 13-15	Sushitna Station, 20 miles N. of Cook Inlet	Cloudy.
Aug. 16		Do.
Aug. 17-18	On 18th mouth of river	Clear.
Aug. 19	En route southward	Do.
Aug. 20	Ladds Station	Do.
Aug. 21	Tyonek	Cloudy; rain.

ROUTES TO THE INTERIOR.

There are several routes from Cook Inlet to the interior of Alaska; one from the head of the Matanuska, by way of the Delta River, to the Tanana, explored by Captain Glenn and detail, United States Army; a second from the Sushitna Valley by way of the Yentna and Kuskokwim into the western interior, followed by Mr. Spurr, of the Geological Survey; and a third, explored by the party of the Survey under the writer, by way of the Sushitna and Cantwell rivers to the Tanana. In the vicinity of the latter route are several passes by which the Alaskan Mountains may be crossed, one of which was taken by a detail from the Glenn party—Sergeant Yanert and a private, accompanied by one or two Indians. The route followed by the writer lay along the western shore of Cook Inlet from Tyonek to the mouth of the Sushitna River, thence up the river to the mouth of Indian Creek—thus far, 150 miles, by canoe. From here an old and very obscure Indian trail was taken across the uplands east of Indian

Creek to the head of this stream miles. A pass of 3,700 feet elevation. Upper Chulitna, the route first and thence to the easternmost of stream; this fork, about 10 miles two, a conspicuous conical point of the forks leads to the descent to the east of the point mentioned into the upper valley. In steady but gentle ascent to the east pass the route lay directly down the open valley of the Tanana.

In reference to the desirability it is quite possible that it would be the Chulitna in canoes, for from acquired that it was feasible, notwithstanding to the contrary. In any event since there could be little loss of to turn back, and if that were progress would be made than by country, for in the latter instance back. Moreover, with the canoe would not be a very difficult comparatively short interval (10 miles is also possible that the tributaries prove the natural and more direct and so to the Tanana. Moreover this route, such as the constant sides of the mountains to within conditions in this particular could not by the Survey party, where with timber occurs for a distance of 60 for long distances.

Magnetic variations

Lat. (N.)	Long. (W.)	Place.
61 19	150 38	Mouth Sushitna
61 35	150 27	Mouth Yentna
61 54	150 07	Sushitna River
62 20	150 10	Forks Sushitna
62 49	149 39	Sushitna River of Indian Cr

CONDITIONS OF ALASKA.

Tanana Basin in 1897—Continued.

	Weather.
.....	Clear.
.....	Shower: clear.
.....	Clear.
.....	Shower: clear.
.....	Rain.
.....	Cloudy.
.....	Showers.
.....	Clear.
.....	Clear.
.....	Shower: clear.
.....	Cloudy.
.....	Clear, with occasional light showers.
.....	Lightning on 14th at Buckley Creek.
.....	Clear.
.....	Rain.
.....	Clear.
.....	Cloudy: warm.
.....	Rain.
.....	Cloudy.
.....	Rain.
.....	Clear and cool.
.....	Rain.
.....	Clear.
.....	Cloudy.
.....	Cloudy and shower.
.....	Clear.
.....	Clear, with occasional showers each day.
.....	Rain.
.....	Clear.
.....	Do.
.....	Do.
.....	Do.
.....	Clear, with occasional showers.
.....	Rain.
.....	Clear, with occasional showers.
.....	Clear.
.....	Do.
.....	Cloudy.
.....	Do.
.....	Clear.
.....	Do.
.....	Do.
.....	Cloudy: rain.

THE INTERIOR.

ook Inlet to the interior of Alaska; ...
 ... Glenn and detail, United States ...
 ... a Valley by way of the Yentna and ...
 ... rior, followed by Mr. Spurr, of the ...
 ... xplored by the party of the Survey ...
 ... sushitna and Cantwell rivers to the ...
 ... ter route are several passes by which ...
 ... ossed, one of which was taken by a ...
 ... egrant Yanert and a private, accom- ...
 ... he route followed by the writer lay ...
 ... Inlet from Tyonek to the mouth ...
 ... the river to the mouth of Indian ...
 ... canoe. From here an old and very ...
 ... across the uplands east of Indian

Creek to the head of this stream, distant from the mouth about 20 miles. A pass of 3,700 feet elevation leads hence to the valley of the Upper Chulitna, the route first passing through a cove in the range and thence to the easternmost of the upper and larger forks of the stream; this fork, about 10 miles from the head, further divides into two, a conspicuous conical point marking the confluence. The western of the forks leads to the desired pass, although the trail first leads to the east of the point mentioned, passing over a high ridge and thence into the upper valley. In this portion of the valley there is a steady but gentle ascent to the eastern of the two passes. From the pass the route lay directly downstream for about 65 miles, nearly to the open valley of the Tanana.

In reference to the desirability of a portion of the foregoing route, it is quite possible that it would have been preferable to have ascended the Chulitna in canoes, for from our later observations the belief was acquired that it was feasible, notwithstanding information from Indians to the contrary. In any event the latter route is worth attempting, since there could be little loss of time even should it be necessary to turn back, and if that were not necessary, greater and easier progress would be made than by the route which was followed across country, for in the latter instance all supplies must be packed on the back. Moreover, with the canoes at the head of the Chulitna it would not be a very difficult task to pack them across the comparatively short interval (10 miles) to the waters of the Cantwell. It is also possible that the tributary ascended by Sergeant Yanert will prove the natural and more direct route to the waters of the Cantwell and so to the Tanana. Moreover, there may be other advantages by this route, such as the constant timber supply which exists on both sides of the mountains to within a very few miles of the divide. Conditions in this particular could not be worse than on the route followed by the Survey party, where with the exception of a single locality no timber occurs for a distance of 60 to 70 miles, even alder being scarce for long distances.

Magnetic variations, Sushitna River, 1898.

Lat. (N.)	Long. (W.)	Place.	Date.	Variation (E.)
61 19	150 38	Mouth Sushitna River.	May 12-15	27 15
61 35	150 27	Mouth Yentna River.	May 26, 9:45 a. m.	27 20
61 54	150 07	Sushitna River.	June 3, 4:30 p. m.	27 50
62 20	150 10	Forks Sushitna River.	June 26, 4:30 p. m.	29 30
62 49	149 39	Sushitna River mouth of Indian Creek.	July 5, 4:33 p. m.	29 30

REPORT OF THE KUSKOKWIM EXPEDITION.¹

By J. E. SPURR and W. S. POST.

ITINERARY.

The Kuskokwim expedition, as landed at Tyonek, consisted of J. E. Spurr, geologist and chief; W. S. Post, topographer; and A. E. Harrell, Oscar Rohn, George Hartman, and F. C. Hinckley, camp hands. The purpose of the expedition was to ascend the west branch of the Sushitna River and to cross over from its head-waters to those of the Kuskokwim, then if possible to descend the Kuskokwim as far as the water route to the Yukon, then by way of this water route and the Lower Yukon to reach St. Michael, where steamboats could be found to transport the party back to Seattle or San Francisco. Since nearly all of this region was entirely unknown, we hardly knew what preparations to make, but all our supplies were taken with a view of meeting so far as possible any condition which might be encountered. We started out with three light cedar canoes, specially built in Peterboro, Ontario, and these proved excellent for all-round purposes. We arrived at Cook Inlet on the 26th of April—a rather unfortunate time, since it was too late for ice and snow traveling and too early for water travel, the rivers being not yet broken; moreover, we were delayed several days by heavy gales. On the 4th of May, the gales having abated, two canoes proceeded to the mouth of the Sushitna, arriving there on the 7th, while a surveying party proceeded along the shore to the same place. On account of the condition of the ice, we were obliged to camp on an island in the delta until the 20th of May, when we started upstream in our boats, paddling or pulling ourselves up by the bushes. We had supposed the ice to be already broken, but the real break-up occurred while we were ascending the river to Sushitna Station, and we had exciting times dodging the ice jams. At Sushitna Station we attempted to secure Indians as guides, but were unable to do so, the natives claiming that the river we wished to ascend was too rapid and dangerous at that time of the year; very few of them, indeed, had any knowledge of the route at all. We accordingly left without guides and entered the western branch of the river, known to the natives as the Katcheldat or Yentna.

Although the Yentna River is not very long, it proved so difficult of ascent that it was the 3d of July before we reached the spot where we began our portage to the Kuskokwim. In the meantime we had

¹ See maps Nos. 3, 4, and 5, in accompanying envelope.

REPORT OF THE K

slowly worked our way through with short narrow canyons, and journey over the Tordrillo Mou divide between the Sushitna and nearly two weeks, as we had to pass streams and climb over a pass we finally reached, on the other considerable size, which we after. After running down this river so we saw a few Indians, for the on the 1st of August we reached Vinasale, where, however, we had visions. After leaving this place Kolmakof, but finding no provisions at the mouth of the river, where, at I and a trading post. Here our Madison, and Harrell crossing thence to St. Michael, from which the remaining four of the party attempted the exploration of the. The ascent of this river proved weeks, after which we were obliged across a high mountain pass, or large lake which is the chief source down this river, in a few days outlined on the map. At Nus paddled across Bristol Bay to the river and the lake in which it Savonoski, from which point a high and bleak Katmai Pass to. After considerable delay at this the Alaska Commercial Company on the 11th of November.

TOPIC

Cook Inlet.—Cook Inlet passes through ranges which confront the navigable British Columbia to Prince William Sound, rugged, while farther in low water flanking ranges.

The characteristic feature of Cook Inlet is the high altitudes to the sea in sharp descent from mountain gorges and gravels, which extends inland for miles northwest and north. The

xtend, with interruptions, as far
aces they contain fossils which
e. Along the axis of the range
a of volcanoes whose lava is an
ve probably been active in com-
ings and earthquakes are among

th of the Skwentna to near the
he whole region from the Togiak-
e region between Kolmakof and
ed with volcanic rocks or with
from the volcanics (tufts). The
s, only the line along the Alaska
h probably extends as far as the
ng to have been recently active,
ther more ancient lavas. The
ows no active volcanoes, but the
tiary in age.

istrict from the Tordrillo Moun-
ukon portage consists of little-
nding in general to the similar
e Yukon. The older schistose
mile series and the Birch Creek
region.

SOURCES.

seams of brown lignite, which
ag, but which in general is of a
River below the junction of the
were found. Coaly seams, and
kwim in the sedimentary rocks,
f; but so far nothing of value is
l are found on Nunivak Island
alities lying between the mouth
Yukon. Coal and oil have been
Katmai.

ls almost always contain small
gh sometimes coarse grains are
In a canyon on the Skwentna
anitic dikes cut the basalts and
ation, shown by the presence of
r the dikes. Random samples
ow-grade ore, the highest assay
l and one-fourth ounce of silver,
to the ton. On the Kuskokwim

drainage gold is found in gravels in the streams near the Tor-
drillo Mountains. Elsewhere on the Kuskokwim, however, the
gravels derived from the purely sedimentary rocks are generally
entirely barren of gold. In the region about Kolmakof, where there
are more intrusive rocks and more folding, there is a little more
mineralization also; and gold in small quantities, as well as cinnabar,
the ore of mercury, has been reported. In the southern extension of
these Kuskokwim Mountains a specimen of realgar and stibnite, the
ores of arsenic and antimony, has been seen from the Kwiklimut
River. From the Lower Kuskokwim to Katmai, also, the gravels in
general contain no trace of gold, the volcanic region being apparently
without much mineralization. On the whole, therefore, the country
traversed does not show signs of great mineral wealth. The most
favorable region is undoubtedly the Tordrillo range of mountains,
which is very difficult of access. Possibly the best way of reaching
these mountains is by Lake Clark.

LAND AND WATER ROUTES.

At Cook Inlet the harbors open throughout the year are Saldovia,
Kachemak (Homer post-office), Kamishak, and Snug Harbor. From
April to October Tyonek is open for specially piloted vessels of
medium draft.

The mouth of the Sushitna is impassable for anything except flat-
bottomed craft. From its mouth to its junction with the Yentna it is
navigable for small boats, as is the Yentna for 40 miles to its junction
with the Skwentna. The current is from 4 to 7 miles an hour. Shortly
above the junction the Skwentna is torrential and can hardly be
said to be navigable even for canoes. On the west side of the moun-
tains the Kuskokwim is likewise torrential and entirely unnavigable
as far as the Indian village shown on the maps. Below this village
there is good steamboat navigation 600 miles to the sea. The current
does not exceed 7 miles an hour at any point below this, and will
average about 4 miles.

The Sushitna natives follow the Beluga River from the coast and
then northward to the junction of the Yentna and the Skwentna across
the gravel plateau. This route could be extended and the Tordrillo
Mountains crossed at one of the low gaps to the gravel plateau on the
west side, from which point a route could be laid out to the Tanana
and thence to the Yukon. This route from Cook Inlet to the Yukon
would be excellent for a wagon road or railway, there being no ob-
stacles to overcome by engineering, nor any high mountains to cross.

A route long known and occasionally traveled, especially by natives,
leads from the Kuskokwim above Kolmakof to Nushagak by way of
the Holiknuk and the Nushagak rivers. The Holiknuk is said to
have an extraordinarily crooked course in its lower part.

The so-called portage to the Yukon from the Kuskokwim is in reality a water route which leaves the Kuskokwim at the native village of Kalchagamut. The total length of the route is 66 miles, although the air-line distance between the rivers is only 20 miles. The country is all clay and gravel, and the highest bank crossed on the portages is 40 feet. The relative elevation of the Kuskokwim and Yukon rivers has not been determined, but enough has been seen to warrant the possibility of opening a water route. The current of the Kuskokwim being less than that of the Yukon, the presumption is that, if diverted, the Yukon would flow toward the Kuskokwim. The latter river is free of ice nearly two weeks earlier than the Yukon, and the lower Bering Sea is comparatively open while St. Michael is still blocked. If, therefore, supplies could be brought in by way of the Kuskokwim and thence across by the water route to the Yukon, there would be many advantages. The following table gives the saving in distance of the new route, the distances being taken from Unimak Pass.

Yukon route:	Miles.
Unimak Pass to St. Michael	720
St. Michael to Talbigsak River	250
Total	970
Kuskokwim route:	
Unimak Pass to Goodnews Bay	360
Goodnews Bay to Kalchagamut	230
Kalchagamut to Talbigsak River	60
Total	650
Difference in favor of Kuskokwim route	320

The Togiak River is probably navigable for steamboats, and the Nushagak is likewise navigable for probably 90 miles. The Kvichak River, the outlet of Lake Iliamna, is not navigable for steamboats, but small boats can be towed up it. From Nushagak to Katmai two routes are used: one by way of Naknek River and Lake, and thence across the mountains to Katmai; the other by way of Igagik River and Becharof Lake to Cold Bay, and from these along the coast to Katmai.

Table of distances taken along route followed by the expedition from Tyonek to Katmai.

	Miles.
Tyonek	0
Mouth of Sushitna River	35
Sushitna Station	53
Junction Yentna and Sushitna	56
Junction Skwentna and Yentna	99
Junction Portage Creek and Skwentna	164
Summit of pass	179

Junction Styx River and Kusko
Junction East Fork and Kusko
Vinasale
Junction Chagavenapuk River.
Junction Holiknuk River
Kolmakof Trading Station.....
Kalchagamut
Oknavigamut
Bethel
Warehouse
Kwinhagamut
Beginning of portage from Kan
Togiak Lake
Mouth of Togiak River
Togiak
Head of Kululuk Bay
Mouth of Egoushik River
Nushagak
Naknek
Savonoski
Katmai

Magnetic variations,

Lat. (N.)	Long. (W.)	Place
61 10	151 10	Tyonek...
61 58	152 40	On Skwent
62 00	152 46	On Portage
61 59	152 57	On Portage
61 59	153 01	Near pass.
62 00	153 04	Do....
61 59	153 05	Do....
61 31.5	160 42	Kuskokwi
61 26	160 46	Do....
61 17	160 45	Do....
60 53.5	161 18	Do....
60 47	161 52	Bethel...
60 35	162 16	Kuskokwi
60 09	162 15	Apokagan
59 46	162 01	Kwinhaga
59 53	160 15	Kagati La
59 48	159 59.5	On portag
59 07	159 28	Oallek La
58 56	158 27	Nushagak
58 48	156 35	Naknek L
58 33.5	155 27	Savonoski
58 04	154 53	Katmai..

¹ Observed with a transit

from the Kuskokwim is in reality
 kokwim at the native village of
 the route is 66 miles, although
 is only 20 miles. The country
 t bank crossed on the portages is
 e Kuskokwim and Yukon rivers
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 uskokwim. The latter river is
 than the Yukon, and the lower
 ile St. Michael is still blocked.
 ht in by way of the Kuskokwim
 e to the Yukon, there would be
 ble gives the saving in distance
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	Miles.
.....	720
.....	250
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.....	360
.....	230
.....	60
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route.....	320

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 atmai.

	Miles.
.....	0
.....	35
.....	53
.....	56
.....	99
.....	164
.....	179

	Miles.
Junction Styx River and Kuskokwim.....	189
Junction East Fork and Kuskokwim.....	296
Vinasale.....	393
Junction Chagavenapuk River.....	463
Junction Holiknuk River.....	508
Kolmakof Trading Station.....	637
Kalchagamut.....	706
Oknavigamut.....	716
Bethel.....	787
Warehouse.....	865
Kwinhagamut.....	880
Beginning of portage from Kanektok to Togiak.....	982
Togiak Lake.....	1,006
Mouth of Togiak River.....	1,061
Togiak.....	1,067
Head of Kululuk Bay.....	1,108
Mouth of Egoushik River.....	1,203
Nushagak.....	1,223
Naknek.....	1,302
Savonoski.....	1,376
Katmai.....	1,425

Magnetic variations,¹ southwestern Alaska, 1898.

Lat. (N.)	Long. (W.)	Place.	Date.	Variation. (E.)
61 10	151 10	Tyonek.....	May 1	27 15
61 58	152 40	On Skwentna River..	July 5, 9 a. m.	27 20
62 00	152 46	On Portage Creek....	July 6, 1 p. m.	27 19
61 59	152 57	On Portage Creek....	July 12, 8 p. m.	26 58
61 59	153 01	Near pass.....	July 14	26 29
62 00	153 04	Do.....	July 15, 8 p. m.	25 58
61 59	153 05	Do.....	July 16, 2 p. m.	25 45
61 31.5	160 42	Kuskokwim River...	Aug. 7, 2 p. m.	23 51
61 26	160 46	Do.....	Aug. 7, 7 p. m.	23 50
61 17	160 45	Do.....	Aug. 8, 2 p. m.	25 37
60 53.5	161 18	Do.....	Aug. 9, noon	20 22
60 47	161 52	Bethel.....	{ Aug. 10, noon	21 14
			{ Aug. 10, 6 p. m.	21 20
60 35	162 16	Kuskokwim Bay....	Aug. 20, noon	20 44
60 09	162 15	Apokagamut.....	Aug. 22, noon	21 25
59 46	162 01	Kwinhagamut.....	Aug. 24, 11 a. m.	20 38
59 53	160 15	Kagati Lake.....	Sept. 8, 1 p. m.	21 14
59 48	159 59.5	On portage.....	Sept. 12, noon	22 01
59 07	159 28	Oallek Lake.....	Sept. 22, 6 p. m.	23 13
58 56	158 27	Nushagak.....	Oct. 2, 10 a. m.	25 02
58 48	156 35	Naknek Lake.....	Oct. 11, 5 p. m.	24 53
58 33.5	155 27	Savonoski.....	Oct. 13, 3 p. m.	23 56
58 04	154 53	Katmai.....	Oct. 23, 11 a. m.	24 33

¹ Observed with a transit reading to 1'. Results ± 5' about.

REPORT ON THE REGION BETWEEN RESURRECTION
BAY AND THE TANANA RIVER.¹

By W. C. MENDENHALL.

INTRODUCTION.

As geologist attached to Military Expedition No. 3, commanded by Capt. E. F. Glenn, I had opportunity during the last summer to examine geologically the shores about the western end of Prince William Sound and a belt of country extending from Resurrection Bay, on the eastern side of Kenai Peninsula, to the Tanana River at the mouth of the Delta River. Incidentally the accompanying maps, covering a route which lay almost wholly within hitherto unexplored territory, were prepared.

The trip across Kenai Peninsula was made very early in June, before the snow had entirely disappeared, and that from Turnagain Arm to Knik Arm late in the same month. Both of these were packing trips, each member of the party carrying his provisions and bedding, and gathering such scientific data as circumstances permitted.

The main expedition from Knik trading post to the Tanana River was begun on July 23, and the party returned to Knik on the 24th of September, having traveled about 675 miles by trail in two months. This trip, although hurried, was made under more favorable conditions for scientific work than the earlier shorter ones, since the pack train relieved the explorer of the embarrassing necessity of carrying on his own back food, blankets, and instruments.

The route lay up the Matanuska Valley nearly to its head, then north up Hicks Creek, across the head of Caribou, and out into the valley of Bubb Creek, one of the upper tributaries of Taxlina River. Here we found ourselves north of the coastal mountains and at the southern edge of a plateau basin with a level floor which stretched to the Alaskan Mountains, 100 miles by trail to the north. By the 21st of August we were on northward-flowing waters, which later proved to belong to the Delta River. This stream led us by an easy route through the Alaskan Range. A week later, when within the Tanana Valley and about 10 miles from the river itself, we turned back. The return journey was made more rapidly, and followed in the main the same course which we had established when outbound, until Bubb Creek was reached. Here we left our old trail to the west and entered Matanuska Valley at its head, picking up the old line again at the mouth of Hicks Creek. Seven days more of travel and we were back at salt water.

¹ See map No. 6, in accompanying envelope.

Prince William Sound, for Inlet are the two most important line west of the Alexander Archipelago meridians of 146° and 149° irregular shore line, insuring connection. Its narrow inland opening open all the year round, and is not accessible from the southern extremities, Port Valdez and a natural barrier to the north.

Cook Inlet, separated from the peninsula, is about 200 miles long to the head of Knik Arm, and an easterly bay. Its tides are very rapid with a bore which is a serious hindrance. The precipitation along its shores is heavy. Sound, so that snow is never melted so late in the spring; and the timber is more abundant and the timber enters the head of the inlet, with the sound; and these streams transform the head of the inlet unfavorable for navigation. Highways to the interior. Precipitation throughout the year, but for five months by ice. Its climate in months is very pleasant, and many hardy vegetables and cereals are raised under agricultural conditions than in

GENERAL

Kenai Peninsula is a rough coast line and a broad lowland in other directions its shores rise to the ocean, but from Kachemak Bay a gravel-covered platform enters and the water of Cook Inlet. Several hundred feet above sea level heavily timbered and moss-covered the largest rivers of the peninsula Tustumena, and the Kenai, and heads near the eastern

stream. The range is a series of lofty, isolated mountain masses rather than a definite and continuous chain. It is characterized by broad passes at an elevation of about 2,700 feet, and the groups between these passes reach heights of 10,000 to 15,000 feet. By the Delta River route the width of the range north and south is about 35 miles, and immediately after passing through it the traveler enters the broad valley of the Tanana River, which separates the Alaskan Mountains from the Ketchumstock and Tanana hills, farther to the north.

ROUTES.

An investigation in early April revealed the fact that between Portage Bay and Port Valdez there is no practicable route northward from Prince William Sound to the interior, that body of water being bounded in this direction by an extremely rough mountain barrier without passes and with culminating peaks 10,000 feet high. From Portage Bay, the most easterly extension of Prince William Sound waters, an easy winter trail exists across the isthmus to the head of Cook Inlet. During the summer this route is not used because at that time the waters of Cook Inlet are open and navigable for sea-going vessels.

From Resurrection Bay about halfway down the southeastern shore of Kenai Peninsula—Resurrection Bay itself being a harbor that is open winter as well as summer—there is easy access to the interior of the peninsula. A trail has been established up the valley of Salmon Creek, and thence across a low divide to Snow River, which empties into Lake Kenai. From Lake Kenai the Sunrise City mining district may be reached either by going up Trail Creek, which enters the lake near its eastern end, and thence crossing to the head of Bench Creek, a tributary of the east fork of Sixmile, or by going up the valley of Quartz Creek, a tributary which enters Lake Kenai near its lower or western end, and crossing to the head of Canyon Creek. The latter of these routes is the shorter from Lake Kenai, but neither of them offers serious obstacles to the construction of either a pack trail or, if need ever should arise, a railroad line. The divides in both instances are low, standing at an elevation of something less than 1,500 feet above sea level, and very broad and flat. At present a part of this route from Resurrection Bay to Turnagain Arm is by water, there being no trail constructed around Lake Kenai. The building of a trail along the shores of this lake would be somewhat difficult, since the shores are steep and are subject to destructive snow-slides in spring. After reaching the head of the Sixmile drainage by either of these routes, the traveler finds fair trails already established by the miners at work on the waters of this stream.

From Juneau Creek, which enters Kenai River from the north, just

below the outlet of the lake, a route is reported across the divide to the north into the basin of Resurrection Creek, thence down this creek to Hope City at its mouth. Before the trail down Sixmile Creek was established, pack trains with supplies for the miners on Canyon Creek went from Hope City up Resurrection Creek to Pass Creek near its head, and then climbed through the low divide to the head of Summit Creek, which enters Canyon Creek in the heart of the mining district.

From Turnagain Arm northwestward to Knik Arm at least two overland routes are available at present. One of these is by way of Indian Creek and is reported to be very short and to offer no serious obstacles. The other, which appears on the map (No. 6), is from the head of Turnagain Arm by way of the valley of Glacier Creek, and leads over a rather high divide—3,750 feet above sea level—to the upper waters of Yukla Creek. This stream enters Knik Arm almost due south from the North American Trading and Transportation Company's station.

The route from the head of Cook Inlet to the Tanana, which was examined last summer, while probably longer than the one by way of Valdez Inlet and Copper River, is perfectly feasible for the establishment of a trail or railroad, which would pass up the valley of the Matanuska to a 3,000-foot divide at its head. The approach to this divide, however, is at least 100 miles long, and gives ample distance for overcoming the elevation. After passing from the valley of the Matanuska to the interior plateau, no obstacles of importance are encountered until the foothills of the Alaskan Range, 75 miles to the north, are reached. Here a short climb of 400 or 500 feet out of Gakona River Valley must be made in order to reach the head waters of the Tanana drainage. Probably by swinging eastward or westward from this interior plateau other routes may be found down other branches of the Tanana which will possess special advantages, depending upon the point at which it is desired to reach the latter stream. Along practically the entire distance from Cook Inlet to the Tanana sufficient timber is found for furnishing ties and fuel, and the open character of the valleys and of the interior plateau reduces the danger of earth- or snow-slides to a minimum. It is scarcely necessary to add that over any route which permits the establishment of a railroad a pack trail can be built at comparatively small cost.

METHODS OF TRAVEL.

The Sunrise mining district may be reached previous to the 1st of May by the Portage Bay route within a distance of 40 miles, or by the Resurrection Bay route within a distance of 90 miles, from open water; before that date travel is wholly by sled or packing. After May 1 steamers reach the head of the inlet and give direct access to this district. The interior of Kenai Peninsula is also reached by way

of Resurrection Bay in winter. In winter it can be approached by trail either with pack animals or on foot up the Kenai or Kussilof rivers. This is laborious and slow.

At present the best methods of reaching Cook Inlet are by sledding up the coast by the use of pack trains in the fall, or by the use of pack animals to be able to live off the native game a part of September. Often it is possible to reach the coast upon the coast side of the divide before the freezing begins in August, and the pack animals have a nutritive value. The Tanana River is reached from Knik in a month, but it is not insure the arrival of the stock. The time at least should be estimated for this work than mules, because the trail which must be crossed; in the smaller feet of the mule are a disadvantage. It should be chosen which have been accustomed to depending entirely upon the trail.

Heretofore supplies have been brought to the Tanana River in boats, but the stream is too shallow for tracking, which is the only possible method. This is too slow and is attended with much danger, and is regarded as practicable.

GENERAL

SUNRISE

About the western end of the Peninsula of Kenai Peninsula, and the gray tuffaceous sandstones and gray tuffaceous sandstones altered somewhat, developing in the more massive beds. At the base of the harder rocks, usually persisting across the boundary pockets, which may locally reach times at least are mineralized. Dikes and more numerous highly aplites. These latter are probably at the time of the great have been subjected.

Age.—No fossils have been found in relations to the Matanuska series that they are pre-Cretaceous.

NS OF ALASKA.

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RE.

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REPORT ON PRINCE WILLIAM SOUND AND THE
COPPER RIVER REGION.¹

By F. C. SCHRADER.

ITINERARY.

The United States Army Copper River Alaskan Expedition No. 2, of 1898, to which the writer was attached, left Seattle on the steamship *Valencia* April 7 and landed at Port Valdez, Alaska, on April 19. At the beach the snow was 6½ feet deep, and our tents were pitched in deep pits dug in it. As the reindeer counted on for transportation had not been brought, our camp remained here until August 5, when, with a pack train of 23 horses, a hasty and somewhat hazardous trip of nearly two days was made across the Valdez glacier, over the Coast Mountains, 5,000 feet high, and into the Copper River drainage, our objective field of work. As the season was now already far advanced, it was apparent that a survey to the head of the Copper and the Mount Wrangell district would be impossible. The work of the writer was therefore carried down the Klutena to Copper Center on the Copper River, then down the Copper to the mouth of the Tasnuna, and thence westward, closing the circuit to Valdez by way of Tasnuna and Lowe rivers.

During most of the time spent in the interior, from late in August till the return to Valdez on October 19, one party of the expedition was in charge of the writer, who carried on the geologic work, while the topography was done principally by Mr. Emil Mahlo. Two other parties were in charge of Captain Abercrombie and of Lieutenant Lowe, respectively; of these the former proceeded to Mentasta Pass and the latter to Fortymile on the Yukon.

From Valdez to the Tonsina River the work was carried on by transit. By the wrecking of a raft in crossing the Tonsina the transit was lost, and the remainder of the circuit was completed by compass. From Valdez to Taral transportation was principally by pack train, although some supplies were sent down from Copper Center by boat; but at Taral all further progress with the pack train was cut off by Woods Canyon, whose walls slope up into high snow-peaked mountains on either side. From this point to the mouth of the Tasnuna, therefore, travel was by boat; and thence, packing on the backs of

¹ See maps Nos. 7 and 8, in accompanying envelope.

at the foot of the Valdez glacier. Some coarse gold has also been panned from the gravels in Dutch Camp Basin.

In the Copper River country the thick deposit of gravels and lake beds, which during most of the summer carry considerable water, is a great impediment to effectual prospecting. According to seemingly reliable prospectors, good coarse gold was found last summer on a branch of the Slana River near the head waters of the Copper, and on Quartz Creek, one of the upper tributaries of the Tonsina, where many claims are reported staked and some men are wintering. Mr. Charles Brown, United States Quatermaster at Valdez, has lately reported that men are working on Manker Creek and Mahlo River, both tributaries to the Klutena, and on some of the head waters of the Teikell.

COAL.

So far as seen by the writer the formations met with seem to be barren of coal. It may be mentioned, however, that on the Upper Gakona River some prospectors report the occurrence of coal in workable quantities.

ROUTES AND TRAILS.

The only route used for getting into the Copper River country from Valdez during the season of 1898 was the Valdez glacier route. Starting from Valdez, the trail leads 4 miles northeast, with a very gentle rise over the delta gravels, to the foot of the Valdez glacier, thence about north for 18 miles up the glacier to the summit, which is 4,800 feet high. The glacier is broken or transversely marked by four or five successive long benches or terraces, from one to the other of which the rise of 100 feet or more is usually sharp and sometimes difficult, the topography of the ice being very rugged, with crevasses, ridges, and turrets. With the exception of these benches the ascent from the foot of the glacier to near the summit is gradual; but just before reaching the top there is a steep rise of a thousand feet at an angle of 15° to 20°. The pass is guarded by a couple of prominent peaks, one on either side and standing about a mile apart. From the summit the trail descends rapidly, but nowhere abruptly, for a distance of 6 miles through a canyon-like valley to the foot of the Klutena glacier, which is the source of the Klutena River.

From the foot of the Valdez glacier to the foot of the Klutena glacier, a distance of 25 miles, there is no vegetation, timber, or brush, but only a waste of barren rock walls, peaks, and snow and ice, so that fuel for camping while on the glacier must be brought from either end. From the foot of the Klutena glacier the trail continues down the north side of the river and lake to Copper Center, where the elevation is about 1,050 feet.

S OF ALASKA.

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ARTZ.

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From Copper Center to the Tanana, Yukon, and Fortymile rivers, the best and shortest route is the Millard trail by way of Mentasta Pass. This trail, crossing the Copper, bears northeastward somewhat near the base of Mounts Drum and Sanford, over the high ground of the big bend of the Copper, and is said to be a good, cut horse trail from Copper Center to near the Copper River below the mouth of the Slana. From Copper Center another route leads along the northwest side of the Copper River to the mouth of the Slana; this trail, however, is much longer than and not so good as the Millard trail.

From the northwest bend of Lake Klutena at Cranberry Marsh a trail branches off up Salmon Creek Valley and leads by way of Lake Lily northward to the Tazlina River, thence down that river to the Copper. This route seems to have been started chiefly by prospectors before the snow disappeared in the spring of 1898, after which the marshiness of the country over which it ran led to its disuse. That part of it down the Tazlina, however, is an Indian trail, and is said to be pretty fair and to continue westward down the Matanuska and Knik rivers to Cook Inlet. Long ago it was in use by the Russians in traveling from Cook Inlet to Copper River.

Previous maps have reported a good trail from Taral northward on both sides of the Copper. This is a mistake, for although portions of a trail are here and there met with, they are liable at any time to run out, usually extending but a short distance from the native villages. The Survey party, in coming down the Copper to Taral, found it necessary to cut trail most of the way. From Taral southward, on the east side of the Copper River, there is a portage trail of about 4 miles, for foot only, to the lower end of Woods Canyon, from which point southward through the mountains there is no trail save that recently cut by prospectors at difficult points for towing up boats. An Indian trail is said to ascend the Chittyna River from Taral to above the forks, but is not suitable for pack animals.

A proposed route from Valdez into the Copper River country starts up Lowe River Valley, which it would leave at Dutch Camp Basin, and, bearing off to the north, would cross the head waters of the Tonsina and, descending Manker Creek Valley, strike the Klutena River and trail just below the lake. It runs over some unexplored country, but seems to be by far the most suitable of all for railroad and pack-train purposes. At the head of the Tonsina a branch trail strikes off to Sawmill camp just below Twelvemile camp. Some engineering will be required through Keystone Canyon on Lowe River to make the trail practicable for all-summer travel.

Another feasible route would be from Valdez up Lowe River, across the divide (which is only 1,800 feet high), and down the Tasnuna River to the Copper, whence the transportation up the Copper would be by boat, preferably a light-draft steamer of special power.

Table of approximate distances from Copper Center and thence by

	Place
Valdez.....	
Foot of Valdez glacier.....	
Top of third bench.....	
Twelvemile camp, at foot of	
Foot of summit.....	
Summit.....	
Foot of Klutena glacier.....	
Onemile camp.....	
Twelvemile camp.....	
Sawmill camp.....	
Twentyfourmile camp, at head	
Cranberry Marsh.....	
Foot of Lake Klutena.....	
Amee Landing.....	
Coxe Landing.....	
Cook Bend.....	
Bowlder Spring, on bluff....	
Copper Center, at mouth of	
Mentasta Pass (by Millard trail)	

5-Alaska.

Table of approximate distances from Valdez by Glacier trail to Copper Center and thence by Millard trail to Mentasta Pass.

Place.	Miles.	Elevation in feet.
Valdez.....	0	0
Foot of Valdez glacier.....	4	210
Top of third bench.....	8	830
Twelvemile camp, at foot of fourth bench.....	16	2,750
Foot of summit.....	22	3,800
Summit.....	23	4,800
Foot of Klutena glacier.....	29	2,020
Onemile camp.....	30	1,960
Twelvemile camp.....	33	1,930
Sawmill camp.....	35	1,740
Twentyfourmile camp, at head of Lake Klutena.....	46	1,673
Cranberry Marsh.....	64	1,673
Foot of Lake Klutena.....	79	1,670
Amee Landing.....	85	1,370
Coxe Landing.....	90	1,320
Cook Bend.....	95	1,240
Boulder Spring, on bluff.....	97	1,590
Copper Center, at mouth of Klutena.....	112	1,050
Mentasta Pass (by Millard trail).....	205	2,300

5-Alaska.

Yukon, and Fortymile rivers, and trail by way of Mentasta bears northeastward somewhat ford, over the high ground of to be a good, cut horse trail River below the mouth of the ute leads along the northwest of the Slana; this trail, how- as the Millard trail.

Klutena at Cranberry Marsh a ey and leads by way of Lake ence down that river to the started chiefly by prospectors ing of 1898, after which the ran led to its disuse. That an Indian trail, and is said to d down the Matanuska and was in use by the Russians in er.

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Valdez up Lowe River, across igh), and down the Tasnuna oration up the Copper would ner of special power.

REPORT OF THE WHITE RIVER-TANANA EXPEDITION.¹

By W. J. PETERS and ALFRED H. BROOKS.

NARRATIVE.

The party on whose work the following report is based was constituted as follows: W. J. Peters, topographer in charge; Alfred H. Brooks, geologist; Charles Ray, H. B. Baker, A. R. Airs, and L. D. Gardiner, camp hands. We desire to express our indebtedness to these four men for services faithfully rendered, under what were frequently very trying conditions.

Our party crossed the White Pass, on the snow, about the middle of April, and made its way on the ice to the head of Marsh Lake. Here we were delayed for several weeks on account of the spring thaw; finally, the ice having broken, we started down the lake in our canoes on the 28th of May. During the first few days we were much hampered by ice floes, which forced us to make several portages and rendered canoe navigation rather perilous. After passing Lake Lebarge we saw no more of the ice, and traveled rapidly down the river. At Fort Selkirk we attempted to obtain information from the Indians in regard to the region we were to explore, but in this we met with a very moderate degree of success and the results were not encouraging. We were assured that it would be impossible to ascend the White River in boats, and the portage to the Tanana was estimated as from 20 to 100 miles in length. According to these stories, if we escaped the perils of navigating the White and Tanana rivers we ran still greater dangers from the Tanana Indians, who were said to guard their country jealously from the intrusion of white men.

On June 5 we reached the mouth of White River, where Mr. Barnard and party, with whom we had traveled thus far, left us to continue their journey to the Fortymile region. On June 8 our party of six made a start up the White River, with provisions for three months and equipment divided among three canoes. The ascent of the river was accomplished under great difficulties; by tracking (cordelling), poling, and much of the time dragging the canoes, we reached the mouth of Snag River by July 10. Through the hardest kind of work, which included almost continuous wading and frequent duckings in the glacial waters of the White River, we had in a month made about 85 miles. We were hampered not only by the swift current but also by the numerous quicksands, as well as the many snags found in the

WHITE RIVER

river, on which our canoes repairs. This month was, for we made several trips in mapping.

After continuing up Snag to Tanana waters which was broad lowland, Mirror Creek source within a few miles completed in a few days, and then we started down a smoothly contrasting strongly with the Creek proved to be about 60 near its great westerly bend of the latter stream. The river and making a hasty survey. At the point near the Menta prospectors and Indians, the months. We reached Weare of September, as had been exhausted. From Weare we and from St. Michael returned

PREVIOUS

The Upper White was explored and Dr. Hayes, who crossed reached the river some 150 miles journey to the source of the by way of the Scolai Pass.¹ 1885 by Lieutenant Allen, who Copper River by the Suslota mouth.² Different parts of by those indefatigable explorers. Unfortunately the information collected rule not easily available.

The White and Tanana part of the drainage basin that great river. A description these two basins will be found Yukon district (p. 85) and Tanana rivers and their

¹ A trip to the Yukon Basin, by C. Wil

² An Exploration of the Copper, Tan. Lieut. Henry T. Allen. U. S. A.

in the higher mountains. One of the chief sources of food supply of the natives are the salmon, which ascend the White probably as far as the Klotassin, and the Tanana to about the foot of Bates Rapids.

CLIMATE.

The climate, like that of most of the Yukon Basin, is semi-arid, with short hot summers and long cold winters. The accompanying table gives a summary of our meteorological observations.

Temperature observations on the White and Tanana rivers in 1898.

Month.	Mini- mum.	Maxi- mum.	Rainy days.
June.....	42°	70°	3
July.....	42°	75°	10
August.....	41°	63°	8

AGRICULTURE.

The agricultural possibilities of the Yukon district have been treated elsewhere in this report; and what has been said there applies equally well to the Tanana region. The Tanana Valley has a rather more luxuriant vegetation than the White River Valley. Some of the hardier grains, potatoes, and vegetables could probably be grown there. The native grasses of the Tanana Flats are said to furnish excellent pasturage by those who have used pack horses in the region.

ROUTES AND MEANS OF TRANSPORTATION.

In the past, traveling in this region has been limited chiefly to the large waterways, on which boats and canoes were used in summer and sleds in winter. The development of the district will be rapidly advanced by the introduction of steamboat navigation on the Tanana and the use of pack animals throughout the entire region. Grass for stock will be found from about the 1st of June to the middle of September.

White River.—Navigation of the White River may be said to be almost entirely impracticable. It is possible, however, that the mouth of Ladue Creek might be reached in a shallow-draft boat with a powerful engine. The experience of our party last summer shows that the small boats or canoes can reach the mouth of Snag River, but it is doubtful whether this is an economical method of arriving at that point. Sledging up the White River on the ice has been done and is entirely feasible. This stream, on account of its swift current, is said

to remain open a month later in the spring than the Yukon.

Trails to White River.—It is said to be reached by pack train in fact, it is said to have had a route across the mountains which was used by them for many years. It is reported that a party of men crossed the White last summer. The route from Chilkat Inlet to the Tanana has not been published, but he who has made it. The route from the Copper River to the Tanana is recommended itself, because it is the shortest. The Schwatka and the Tanana on the White is entirely feasible for the routes farther south.

Sixtymile River by crossing Tanana River.—There are several routes from the Tanana River up to the point of the Cantwell, a distance of about 30 miles where the Fortymile-Susitna River joins only by a steamer especially adapted for the purpose must be capable of making the ascent. Some of the tributaries of the Tanana should have facilities for wintering. The boats on the Tanana should have facilities for wintering. The boats on the Tanana should have facilities for wintering.

Of the tributaries of the Tanana, the Chackat, Chena, and Toclak are some distance by small steamers.

Trails to the Tanana.—The Tanana is reached from the White by the trail from the Tanana. There are said to be several routes to the Tanana from the White. There are said to be several routes to the Tanana from the White. There are said to be several routes to the Tanana from the White.

Katrina River, to tributaries of the Tanana brought to the Tanana from the Mentasta passes, and from the Sushitna the Tanana is reached by the trail from Fortymile. It runs from the Tanana to the Cantwell river valleys. It runs from the Tanana to the Cantwell river valleys. It runs from the Tanana to the Cantwell river valleys.

by the trail from Fortymile. It runs from the Tanana to the Cantwell river valleys. It runs from the Tanana to the Cantwell river valleys. It runs from the Tanana to the Cantwell river valleys.

River over a low rolling

chief sources of food supply of the White probably as far as the foot of Bates Rapids.

The Yukon Basin, is semi-arid, winters. The accompanying geological observations.

and Tanana rivers in 1898.

	Minimum.	Maximum.	Rainy days.
.....	42°	70°	3
.....	42°	75°	10
.....	41°	63°	8

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The Yukon district have been and what has been said there on. The Tanana Valley has a the White River Valley. Some vegetables could probably be the Tanana Flats are said to fur-have used pack horses in the

TRANSPORTATION.

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The White River may be said to be as possible, however, that the used in a shallow-draft boat with our party last summer shows at the mouth of Snag River, but the usual method of arriving at that on the ice has been done and is amount of its swift current, is said

to remain open a month later in the fall and to break a month earlier in the spring than the Yukon near the mouth of the White River.

Trails to White River.—The head of the White River could probably be reached by pack train from Lynn Canal. The Chilkat Indians are said to have had a route across the head of the White to the Tanana, which was used by them for trading with the Indians of the interior. It is reported that a party of miners crossed from Yakutat Bay to the White last summer. Last season Mr. J. B. Tyrrell traversed the region from Chilkat Inlet to the mouth of the Nisling. His report has not been published, but he tells us that the route is not a difficult one. The route from the Copper River over the Scolai Pass is not likely to recommend itself, because of the difficulty of ascending the Chittyna River. The Schwatka and Hayes route from Fort Selkirk to the White is entirely feasible for pack animals, but is not so favorable as the routes farther south. The Lower White can be reached from Sixtymile River by crossing the divide and coming down Ladue Creek.

Tanana River.—There are no serious difficulties in navigating the Tanana River up to the point where it broadens out above the mouth of the Cantwell, a distance of about 170 miles. From this point to where the Fortymile-Suslota trail crosses, the river can be ascended only by a steamer especially adapted for the purpose. Such a steamer must be capable of making progress against an 8-mile current and should have facilities for warping where it is necessary. In this portion of the river are usually many channels, and by carefully picking the route much of the swifter water can be avoided. A slough some 30 miles in length which is suitable for steamboat navigation is said to extend from below the mouth of the Chena River to the Salchacket, close to the north bank of the Tanana. From the Fortymile trail to Gardiner Creek the current of the Tanana is very moderate, and a flat-bottomed steam launch drawing not over 18 inches of water could easily navigate this part of the river.

Of the tributaries of the Tanana, the Goodpaster, Volkmar, Salchacket, Chena, and Toelat rivers could probably be ascended for some distance by small steamers.

Trails to the Tanana.—The upper part of the Tanana can easily be reached from the White by the route which our party took last summer. There are said to be other portages, from Ladue Creek and Katrina River, to tributaries of the Tanana. Pack trains have been brought to the Tanana from the Copper River by both the Suslota and the Mentasta passes, and neither route offers any serious difficulties. From the Sushitna the Tanana can be reached by both the Delta and the Cantwell river valleys. The best-known route to the Tanana is by the trail from Fortymile Creek, which has long been used by the Indians. It runs from the Ketchumstock Indian village to Tanana River over a low rolling country, and the distance is estimated at

40 miles. Several routes have been followed by pack trains from this part of the Tanana to Dawson and to the Fortymile district. A pack-train route was also established last summer from Circle City to the Tanana by way of Birch Creek; this trail reaches the Tanana near the Salchacket River, and is indicated on the accompanying map (No. 9). An old Indian portage extends from the Toclat River to the Kusko-kwim, a route said to have been used by traders many years ago.

Railway routes.—A railroad crossing from Chilkat Inlet to the mouth of the Nissling could easily be extended to the mouth of the White or across to the Tanana Valley. A railroad from the Copper River could cross the Mentasta Pass and from the Tanana be extended to the Fortymile district by following the route of the well-known trail. It is probable, also, that a railroad could be built at no great cost up the valley of the Chena or of the Salchacket River and, crossing into the Birch Creek district, reach the Yukon near Circle City. Of the latter route we have less definite information.

INHABITANTS.

Whites.—There were last summer possibly 50 prospectors in the entire Tanana district, and there may have been a few in the White River region, but if so we saw nothing of them. Of those on the Tanana, a few spent the winter, but many came out in the fall.

Indians.—The Indians of the White and Tanana basins, like the others of the interior of Alaska, are of Athapascan stock. Those of the White River live entirely on its southeastern tributaries, and Dr. Hayes has given some account of them in the report already cited. The Indians of the Tanana may be divided into three geographic groups: first, those living near the Tok and Tetling rivers; second, those of the Middle Tanana, living near the Volkmar and Delta rivers; and lastly, those of the lower river, whose scattered settlements extend about 170 miles up the river, to where swift water begins. The Indians of the Tanana compare very favorably with the other Indians of the interior. They are kindly, peaceful people, whose skill at certain crude handicrafts has long been known, and so far as our information goes they are trustworthy and reliable.

MARKS AND MONUMENTS ALONG THE ROUTE OF TRAVEL.

1. Straight line trail blazed by party from Snag River to head waters of Mirror Creek. Legend on tree at Snag River.
2. Spruce tree peeled and marked "U. S. G. S." on left bank at crossing of Fortymile-Mentasta trail.
3. Spruce tree on right bank 30 feet above the river at mouth of Johnson River, blazed and marked "U. S. G. S."
4. Mound of stone and blazed tree on right bank, marked "U. S. G. S.," mouth of Delta River.
5. Cairn of stone on right bank of Tanana at foot of Bates Rapids, 200 feet

above river. Aluminum table 1898, William J. Peters, Alfred B. Baker, A. R. Airs. End of above the mouth of Cantwell

Table of approximate

White River:
 Mouth of White River
 Mouth of White River
 Portage Snag River to
 Tanana River:
 Mouth of Tanana Riv
 Mouth of Tanana Riv
 Mouth of Tanana Riv
 Mouth of Tanana Riv
 Mouth of Tanana Riv
 Mouth of Tanana Riv

Magnetic declinatio

Lat. (N.)	Long. (W.)	
63 18	139 35	Mouth
63 14	140 23	Mouth
62 52	140 13	Foot C
62 37	141 13	Mirror
62 40	141 27	Mouth
63 11	142 36	Foot C
63 25	143 27	Fortyn
64 42	148 48	U. S. C

REPORT OF THE FORTY MILE EXPEDITION.¹

By E. C. BARNARD.

ITINERARY.

The party left Seattle on April 4, on the U. S. S. *Wheeling*, and arrived in Skagway on April 11. It was found that the reindeer which were originally intended for the party were too weak to travel, so other means of transportation had to be looked for. It was also decided that the Dalton trail was impracticable at this time of year, which left a choice of two routes, one by way of Dyea and the Chilkoot Pass, and the other by way of Skagway and the White Pass. After a careful examination the White Pass route was decided on, as being less congested and not so liable to such severe snowstorms as frequently rage on the summit of the Chilkoot Pass, delaying travel for days at a time.

A contract was made for the transportation of the whole outfit to Lake Bennett at 10½ cents a pound, and the members of the party walked to this point, a distance of 40 miles, carrying only their blankets. At Lake Bennett another contract was made, and the heavy freight was forwarded to the head of Marsh Lake, a distance of 50 miles, by horse sleds, our party following with hand sleds and camping outfit. The ice was hard only in places, and on Tagish Lake sails were used on the sleds to good advantage. On April 28 we went into camp at the head of Marsh Lake, it being deemed inadvisable to attempt to proceed farther, since the ice was fast becoming dangerous.

While we were waiting for the ice to break, a large boat was built, the six Peterboro canoes which we had brought being of insufficient capacity to carry all our supplies, and sails were made for the boat and canoes. A map of Marsh Lake and vicinity was made, and a reconnaissance survey was run over to Lake Aklen and the Teslin drainage. By the 1st of May crocuses and other wild flowers were in bloom, and mosquitoes had made their appearance.

On May 27, as there was an apparently clear channel near the west bank of the lake, we loaded our boats and set sail. The next night we had been joined by over one hundred boats. The following day we narrowly escaped having our boats crushed by a jam of ice which the wind drove on the shore, but many who were camped along the lake were not so fortunate.

As there was no indication of a channel opening for the big boat, she was left with four men to follow us; and by portaging the canoes

¹ See map No. 10, in accompanying envelope.

and their contents for a number of hours of wading and got past the ice field, and, s River by nightfall.

At Miles Canyon we for made a business of running \$50, according to size. So day. As a rule two pilot bow and stern, while two two horse tramways were rapids, and, deeming it dan our heavily loaded canoes. thing, and the outfit was o'clock the next morning.

A short stop was made River. This is one termi was more used during th Nordenskiold River above. party at the mouth of central camp of the Klond frontier town, with one ma Here we were joined by ot canyon and rapids, and th mouth of Fortymile Cree. dropped down the Yukon where the United States determined an astronomic j eral summits. From this American territory. Field two weeks were spent in n within the limits of the area and in extending the trian; ascended the Yukon again work had been delayed by e timber during the last sum

On June 29 we started supplies for six weeks. T took us three days to make manent cache was made i made into the country to was also made of Fortymil on the special map No. 10 trip, traveling about 150 n

On August 8, having e started down the Fortymi

rocks, we found descending; but we reached Fortymile or remaining supplies, floated American territory on the west boundary line.

I went in different directions, by September 1, when all work on mountain peak was completed. I had to ascend this peak five times. On September 15 we started and we arrived September 25, and see, of the U. S. S. *Wheeling*, at our disposal, we were enabled to *Conemore*, and two hours after reaching south. We arrived in

WORK.

ed in mapping, as the country is almost all of the bare summits. The on River and Fortymile Creek, and American territory, located points. Fortymile, Mission, and American territory. The ridges were followed and the more important points, from the forks of streams were determined, giving a fairly accurate map. The dip angles, the map Davidson, estimated by the level to be 575 feet above mean sea level in continuous contours on a scale of 1 inch to 1 mile; but the indicated by sketch contours, and in the office.

PHY.

ing topographic features of this area are comparatively flat ridges whose gaps are at a general mean level of 3,200 feet, the domes and ridges flat, gently sloping with a rather sharp fall-off at the edge. The rocks are chiefly of granite, though some are of limestone; they are from a generally flat top from 100 yards to 1 mile to the top a sharp descent of 50 to

100 feet reaches the surrounding plateau. In the northwest corner of the mapped area some ridges reach an elevation of 6,000 feet; these have been called the Glacier Mountains, on account of the beautiful examples of local (annual) glaciation here.

Fortymile Creek has cut its course deeply through an older valley, leaving benches a quarter of a mile to a mile wide, which preserve a mean elevation of about 500 feet above the present stream bed. The stream has an average fall of 8 feet to the mile, with numerous riffles. This fall permits of water being easily diverted for sluicing on the bars. Most of the smaller tributaries have some water flowing all summer. Seventymile and Mission creeks do not have the ancient benches so well marked, and the fall is somewhat greater than on Fortymile.

ROUTES.

In the Fortymile quadrangle there are three principal valleys or drainage areas, and as all the mining is carried on in these valleys and those of the tributary streams, a description of the routes followed in reaching the same may be interesting. The valleys are those of Fortymile, Seventymile, and Mission creeks.

That portion of Fortymile Creek which lies in American territory may be reached either by trail or by boat. If pack animals are not to be had, which was the case last year, and a long trip is to be made, a considerable amount of supplies must be taken and Fortymile Creek ascended by boat or canoes from its mouth. It is 23 miles to American territory, and the stream may be ascended by tracking or poling to the forks, and at times of high water up both forks as far as the map extends.

If but a short trip is to be made the ridges may be followed to advantage; and if the start is made from Fortymile Post the old Indian trail leading over to the Tanana is the best. This trail leaves the Fortymile at the mouth of Clinton Creek, 4 miles from the Yukon, which point is usually reached by boat. Then following along the ridges, it finally crosses the south fork of the Fortymile at the mouth of Franklin Creek, and, going up Franklin Creek, crosses to the Mosquito Fork and continues up it to the Tanana.

Should Eagle City be the starting point, there is a good trail which crosses the flat to American Creek about 3 miles from its mouth, and then ascends the ridge between Mission and American creeks; and once on top of the ridges, one can travel with ease in any direction. Mission and American creeks are not of sufficient size to permit of ascending in boats, and the head waters are best reached by following the ridges.

Seventymile Creek may be ascended a short distance in boats, but the head waters are more accessible from Eagle City by going up

Mission Creek and crossing through a low gap to the Seventymile drainage, or by following the ridges.

METHODS OF TRAVEL.

In regard to travel in general, Eagle City is a good center for making trips from the Yukon to the interior, and is especially well located for the distribution of supplies to the valleys, if pack animals are obtainable.

The way to travel with pack animals is to follow the ridges, which are bare and hard, affording good passage for both men and animals. The valleys, as a rule, are hard to travel, owing to the frequent occurrence of "niggerhead" marshes, and the hillsides are steep and rather brushy. The gaps in the ridges are not very low, and the descents into them are, as a rule, gradual. There is an abundance of feed for animals all over this area during the months of June, July, August, and September, and good water is readily found.

POPULATION.

Eagle City is the important town of the Upper Yukon in American territory to-day; it is finely located, just above the mouth of Mission Creek, on a flat sufficiently high to be above the flood plain of the Yukon. It now has 500 or more cabins, with a population of about 1,700. There is a post-office, and the three important companies on the Yukon—Alaska Commercial Company, North American Transportation and Trading Company, and Alaska Exploration Company—have stores there. There is also a sawmill of considerable capacity.

Seventymile City and Star City are small towns about a mile apart at the mouth of Seventymile Creek, having a total population of about 500.

On Fortymile Creek and its tributaries there are probably 300 miners; on Mission and American creeks, including Eagle City and adjacent creeks, 2,000; on Seventymile Creek and its tributaries, 700; making a total of 3,000 people in the area covered by the map.

MINING ACTIVITY.

GOLD.

Gold was discovered on Fortymile Creek in 1886, and work has been continued there ever since. Early work was done on Canyon and Nugget gulches and at Walkers Fork. During the last year mining has been successfully carried on on Napoleon, Chicken, and Franklin creeks.

American Creek produced considerable gold last year. Over the entire area numerous claims are staked, and much prospecting has

been done the last winter. are at work are Canyon Creel O'Brien Creek), Walkers Fo covery Fork), Marion and creeks, Cuban Gulch, and all

Lignitic coal is found on A City. I am informed that Following is an analysis of a

Analysis of lignit

Moisture in vacuo.....	
Volatile combustible.....	
Fixed combustible (non-cohe	
Ash (reddish).....	
Total.....	
Sulphur.....	

S

Soda springs exist at the j taries of Canyon Creek, and fork of Fortymile, also on 1 the Seventymile. These spr ture reaches 30° or 40° be Creek is said not to freeze at

The following temperatur the Canadian Government, a Creek, give some idea of the

Temperature observations at F

Month.	Lowest Temperature.	
	Day.	Degrees.
Nov., 1896..	17	-36.4
Dec., 1896..	24	-55.5
Jan., 1897..	26	-68.5
Feb., 1897..	-31.5
Mar., 1897..	20	-37.2

NS OF ALASKA.

the middle of Kadiak Island occur. Dr. Becker and Mr. near the beach at Red River, report coal of good quality but occurring at Sitkinak Island. older series, apparently very e axis of the Kenai Peninsula, old properties have been located Kadiak Island, in these rocks. l carbonaceous slates, and the average probably 1 to 2 feet in ssociated with the gold are the e gold is easily panned from the rmination of values has been Kadiak Island, at Portage and ave been washed for the light rrying this gold are probably iles back from the beach; they n inch in thickness and a few is as yet unimportant and does ocess, such as cyaniding, which used in its extraction. By the f this flour gold is lost.

THE ALASKA PENINSULA AND THE ALEUTIAN ISLANDS.

By W. C. MENDENHALL.

Geography.—The Alaska Peninsula and the Aleutian Islands from Lake Iliamna to the island of Attu, and including the westernmost possessions of the United States, are geographically a unit and will be treated as such. This region is the southwestern extension of the volcanic chain west of Cook Inlet, and as the mountains are more or less completely submerged they appear as isolated islands or a continuous land mass. From Kamishak Bay the group extends southwest, gradually curving to the west and northwest, and with the Commander Islands, off the Kamchatkan coast, which belong to the Russians, it constitutes the southern boundary of Bering Sea. Topographically two types are represented—the rough volcanic backbone, lying close to the southern shore line of the peninsula, and the low tundra apron, flat and lake-covered, stretching northward from this backbone to Bristol Bay and the adjacent parts of Bering Sea. Of these two types, all of the Aleutian Islands and the southern edge of the peninsula belong to the first, while only the remainder of the peninsula is included under the second. All of the islands are mountainous, heights of more than 8,000 feet being reached. These elevations and the abundance of precipitation give conditions favorable for the production of glaciers, many of which flow down from the higher summits.

Geology.—No systematic study of the geology of this peninsular and island belt has thus far been made, although many observers have contributed limited notes on portions of the region. Chief among these is Dr. W. H. Dall, from whose publications most of the notes for this summary have been taken.

The sedimentary rocks, where found, are generally of Tertiary age, sandstones and conglomerates prevailing, with some beds of associated shale; in these Tertiary rocks occur the coal and lignite seams which have been exploited with indifferent success in many localities. The sediments are sometimes undisturbed, but are more usually folded, faulted, intruded, metamorphosed, or buried under flows—phenomena of vulcanism of later date than the sediments and continuing in fact down to the present. There seem to be fragments of an earlier sedimentary record than the Tertiary in places; e. g., on the Island of Attu, the westernmost of the Aleutians, metamorphic slates and quartzites are known, and in the middle members of the

ies is reported. Jurassic rocks knek Lake and at many other

of the belt are much the most and of Bogoslof rose from the called Grewingk, appeared in elevation and outline since its active and is regarded by Dr. her volcano in the chain. The alaska, Unimak, Atka, Great ds are the sites of historical

cker, are andesites and dacites, Unga Island near the Apollo the interior of this island. he peninsula and on the islands, leanic phenomena.

the Island of Unga, one of the Kadiak which has yielded any posit, according to Dr. Becker, shear zone, and stands nearly e country rocks are andesites ediments. Besides sulphurets, rthoclase occur as gargue min- e ton. There are other deposits rently along the strike of the pollo. Except this deposit, we either the peninsula or the

Russians. coal has been known l adjacent islands, one of the most rendeen Bay, on the northern bed was opened here in 1890 eral were taken out; but after the coal was cut off by a fault it. Two or three hundred tons whose engineer reported very s. At Amalik Harbor, east of al, each about 18 inches thick, are reported on the Ugashik same name. On the west shore as furnished fuel for a near-by atisfactory steaming qualities. her west, coal is also reported. on in a small way at several

localities in the Shumagin Islands, but the coal here is in thin beds and proves to be of poor quality. On the Aleutian Islands proper there have been no developments, but coal is reported on Unalaska and on one or two of the other islands. Tertiary rocks, which may carry lignite, occur at many points throughout the group.

Routes across the peninsula.—Three routes long in use by Russian traders and Indians converge at Katmai; two cross the peninsula by way of Naknek River and Lake, and one by way of Igagik River and Lake. Farther west Herendeen Bay, an arm of Port Moller on the Bering Sea side, is connected by easy portages with Pavlof Bay and Portage Bay on the south.

Inhabitants and industries.—The inhabitants of the region are mostly Aleuts, probably belonging to the Eskimo race. They live in small villages scattered among the islands and hidden in the numerous bays. With them are a few white traders and miners who have married native women in order to avoid the law prohibiting all except natives or white men with native wives from hunting the sea otter. Twenty years ago many an Aleut hunter lived in affluence on the income derived from the sale of sea-otter pelts; now the animal is very scarce and the industry has about disappeared; but in recent years cod and salmon fisheries have become more important and bid fair to restore in a measure the vanished prosperity. Bears, foxes, and land otters, and in places on the peninsula caribou, are important sources of food and income.

A few Russian priests still preside in their districts, and the little churches are a source of much pride to the natives.

Villages.—The village of Unalaska, on the island of the same name, is the most important town in the islands, and the westernmost post-office in the United States has been established here. Belkovsky, on the peninsula, was formerly of much importance as the center of the sea-otter trade, but has declined with the disappearance of this animal. Unga, Atka, and Attu all have populations of 100 or more.