TERRITORY OF ALASKA
DEPARTMENT OF MINES
JUNEAU, ALASKA

Memorandum Report to Leo H. Saarela,
Commissioner of Mines, on the Snettisham
Iron Deposit, Snettisham, Alaska

The Snettisham Iron Deposit was visited on August 17 - 19, 1950 by Howard M. Fowler, Associate Mining Engineer for the Territory of Alaska, Department of Mines. The visit was made for the purpose of conducting a preliminary examination of a known large magnetic anomaly in the area. The disturbance from this anomaly as determined by the U. S. Coast and Geodetic Survey is felt over a 20 square mile area of land and water, 8 square miles of which is considered strong. (See accompanying sketch of anomaly from U. S. C. & G. S. Chart No. 8227)

A reconnaissance was made along the Snettisham beach from Fache Cove east to Sentinel Point and south from Sentinel Point for a distance of nearly one mile. From Fache Cove to a point approximately 200 yards west of the old Post Office at Snettisham, the beach exposures were nearly entirely of diorite or of closely related dioritic phases. The amount of visible magnetite was very small, and there was virtually no noticeable reaction with a hand magnet or a dip needle. However, at a point about 200 yards west of the Post Office the diorite contacted a hornblendite which contained noticeable amounts of magnetite. The general strike of the diorite-hornblendite contact was approximately normal to the beach line. Small segregations of magnetite, sometimes appearing to form narrow, irregular stringers of less than 1/2 inch in width, were noted between the hornblende crystals. Through the hornblendite were noted pegmatitic phases consisting of biotite, hornblende crystals, chlorite, pyroxene, and of magnetite. Some small narrow vein dikes of anorthosite, stringers of epidote, and one quartz vein of approximately 2 foot width were noted.

Along the beach at the foot of the mill excavation were noted several dozen pieces of float magnetite of various sizes up to six inches in diameter. It is probable that this

magnetite came from the ore bin footings at the head of the mill. Similar material is found in place there. At that point it appears to be local segregations of magnetite that are part of the pegmatitic phase of the diorite-hornblendite. Average pull on a Short and Mason Mining Dip Needle (Norwegian Type) in this area was about 10 degrees above the pull caused by terrestrial magnetism.

A reconnaissance along the beach to the east of the mill also disclosed a continuation of the hornblendite with accessory magnetite. This condition exists for approximately one and one-fourth miles along the beach front.

A search was made to the east of the abandoned Post Office at Snettisham for a 6 foot vein of practically solid titaniferous magnetite as reported in U. S. G. S. Bulletin 773, "Mineral Resources of Alaska, 1923#n", pages 133 and 134. It was reported that 4 or 5 tons of the magnetite was shipped to the Treadwell Mines in 1918, and was found to carry 4 or 5 percent titanium. The search was conducted both along the beach and in the timbered area back from the beach. No evidence of a magnetite vein could be found either by dip needle or visual observation. No evidence of an abandoned caved-in out was seen; however, it is probable that such a vein does exist in the area as it was reported as having actually been seen by the Geological Survey.

The hornblendite-magnetite zone extends to about one-fourth mile from Sentinel Point. There, it is contacted on the east by a series of slates and phyllites. These slates and phyllites extend in a southerly direction along the shore of Gilbert Bay, and observations made along the beach for about one mile disclosed no evidence of either hornblende or magnetite exposures in that area.

A further reconnaissance was made up the Crystal Mine trail to an elevation of approximately 1,000 feet, thence east for about one-half mile, then return to the beach at a point about 200 yards from the town of Snettisham. The area traversed is one of flat muskegs and steep hillsides. Considerable overburden is present over most of the area, and comparatively few outcrops are evident. The dip needle showed little reaction in the area between the beach and the Crystal Mine. The same condition was present above the Crystal Mine, and for the half mile traversed to the east. Much of the country rock was of a dioritic or gabbroid nature. No magnetite was observed; however, at a point about midway on the final leg of the traverse, the dip needle again indicated a magnetic pull of about 10 degrees.

The ore at the Friday Mine, a gold property now abandoned, and located about midway between the Crystal Mine and Shettisham is reported to have been rich in magnetite. The property has not been worked since 1904, and its workings were not located.

Four samples were cut of the various magnetic occurrences observed, with the following results:

<u>Sample No.</u>	<u>% Fe</u>	<u>% S</u>	<u>% P₂O₅</u>	<u>% TiO₂</u>	<u>Remarks</u>
HMF - 146	67.85	0.12	0.013	9.94	Grab sample taken from near area in which 6" vein reported. Not representative.
HMF - 147	52.00	0.14	Nil	8.84	Hi-Grade sample taken from under mill footings.
HMF - 150	15.12	0.79	0.95	2.65	Sample over 200' @ 1' intervals from mill to the west.
HMF - 155	18.33	0.66	1.35	3.10	Sample over 50' @ 5' intervals from mill to the east.

Inasmuch as samples 150 and 155 were representative samples taken over 250 feet of the most apparently promising area, it is probable that the hornblendite will not average over 15 percent to 20 percent iron. While very low percentages of TiO₂ are indicated, the grade increases considerably in the concentrated or higher grade material and approaches the minimum desired by industry. The hornblendite is crushed without difficulty, and a ready magnetic separation made. However, the grade of material at present exposed is too low grade for economic mining.

There has been insufficient prospecting done in the area, and bearing in mind that the magnetic anomaly present is unusually strong over approximately four square miles, it is possible that thorough investigation will disclose minable ore bodies of magnetite. Further, inasmuch as known iron ore supplies on the Pacific Coast will undoubtedly prove insufficient for future industrial needs on the coast, a more complete program of prospecting and examination is fully warranted.

Respectfully submitted,

HOWARD M. FOWLER
Associate Mining Engineer

David W. Mitchell
Hear Mining Building
University of California
Berkeley 4, California
January 3, 1951

Mr. W. A. Kettlewell, Vice President
Guy F. Atkinson Company
Russ Building
San Francisco, California

My dear Mr. Kettlewell:

The following describes, as far as possible without assay, the testing of your samples of Snettisham Peninsula, Alaska, titaniferous magnetite ore.

Microscopic examination of the polished sections of ore from samples number HMF 160 and 162 revealed the presence of ilmenite crystals of very small size, down to a fraction of a micron in at least one dimension and only a micron or two in the other directions. To liberate any substantial amount of this very fine ilmenite by grinding would be out of the question because of the extreme cost of such grinding and because it would probably be impossible to separate commercially the ilmenite from the magnetite once it was liberated by any known method of mineral dressing. The accompanying photo-micrographs show these fine ilmenite crystals in the magnetite at 1000 diameters (1 mm. in photograph = 1 micron in the ore sample). This manner of occurrence, along crystallographic planes of the magnetite, is typical of titaniferous magnetite ores.

In addition to the very small crystals of ilmenite described above, there occur larger grains of ilmenite which might be liberated by reasonable grinding.

In view of the occurrence of the ilmenite in this ore and in accordance with my understanding with Mr. Stines and yourself, I decided the best method of quickly checking the possibility of removing a significant amount of titanium from the magnetite would be to make two parallel series of tests (one pair of tests on each of the five -100 mesh samples) with the David Tube, a wet magnetic assayer designed to test finely-ground magnetic ores. One series of tests was run with a magnetic field sufficiently strong to remove practically all magnetic material from the samples and the other with the magnetic field adjusted to barely remove most of the magnetite. Since magnetite has a relative magnetic attractability of about one and one-half times that of ilmenite it might be possible to separate some of the free ilmenite from the magnetic concentrate. The weights of the magnetic and non-magnetic fractions from each test are given in the table below. Sample numbers followed by the letter, A, indicate testing with the weak magnetic field.

<u>Sample No.</u>	<u>Wt. Magnetic Product - grams</u>	<u>Wt. Non-Magnetic Product - grams</u>
HMF 160	21.77	3.20
HMF 161	22.71	5.22
HMF 162	16.55	5.14
HMF 163	11.68	4.04
HMF 164	16.92	4.86
HMF 160A	12.39	1.69
HMF 161A	13.31	3.19
HMF 162A	13.98	3.17
HMF 163A	5.95	3.36
HMF 164A	7.35	1.81

It is not to be expected that accurate recovery calculations can be made from these data because the individual products were not filtered but were dewatered by decantation in order to save time. The only significance that can be attached to these tests lies in a comparison of the Fe-Ti ratio in the products of the two series of tests. This is certainly a measure of the best results to be expected from magnetic separation.

The possibility of removing a relatively high grade titanium product from this ore by flotation should be investigated. Such a separation is being done commercially at the present time. Whether or not sufficient titanium can be removed by flotation to make this ore commercial, depends upon the fraction of the total ilmenite that is liberated by reasonable grinding and what titanium content prospective purchasers of the iron minerals would accept. The first of these questions can be settled by further test work that I could perform for you if a little time can be allowed. In connection with the second, I am enclosing herewith a copy of USBM Report of Investigations No. 3679, "Smelting of Vanadium-Bearing Titaniferous Sinter in an Experimental Blast Furnace" by C. E. Wood, T. L. Joseph and S. S. Cole, January 1943. You will note on page 23 of this report that the writers believe a slag containing 15 to 20% of TiO_2 could be handled successfully in commercial furnace practice. A very rough calculation indicates that this ore smelted as is (assuming iron and titania contents of sample number HMF 160) would yield a slag containing under 20% TiO_2 . Removal of some titanium by mineral dressing would probably reduce this considerably--although this will depend upon the silica and alumina contents and the amounts and compositions of coke and fluxes used.

If there are any questions concerning these tests please call on me for clarification.

Very truly yours,

(Signed) L. W. MITCHELL
Metallurgical Engineer

DWM:M

(1,8,2.3,17.0-17.5)
133.47 W
57°57'N
TERRITORY OF ALASKA
DEPARTMENT OF MINES
JUNEAU, ALASKA

February 26, 1953

MEMORANDUM REPORT

TO: Phil R. Holdsworth, Territorial Commissioner of Mines, and
J. A. Herdlick, Chief of Mining Division, Bureau of Mines

FROM: James A. Williams, Associate Mining Engineer, Territorial
Department of Mines

SUBJECT: Magnetic exploration work at the Snettisham magnetite deposit,
February 11, 1953.

KX 115-10
115-19

By request of the Bureau of Mines, the writer made a field trip to Port Snettisham in company with Robert L. Thorne, Mining Engineer for the Bureau of Mines, for the purpose of making a joint magnetic survey over a portion of the Snettisham magnetite deposit. Travel was accomplished aboard the MV SWAN II, and the trip was over a three-day period with the actual field work being done on February 11, 1953.

In July of 1951, the writer performed a preliminary magnetic survey in this vicinity and wrote a report entitled "A Magnetic Survey in the Vicinity of Snettisham, Alaska" dated February 19, 1952 on this earlier work. The present report may be considered a supplement to the earlier report.

The purpose of the present survey was to enable the Bureau of Mines to determine the most advantageous location and direction for a diamond drilling project with which they wished to sample the deposit. For accuracy in locating the magnetic survey, a physical survey by transit and chain was made beforehand by a Bureau of Mines crew under the direction of R. S. Warfield, Mining Engineer for the Bureau of Mines. The transit survey was made so as to cover an area favorable toward ease in moving and setting up the drill as well as toward the probability of striking a high grade portion of the magnetite deposit. A base line and five section lines at intervals of 500 feet were laid out. Transit stations and 100-foot stations were carefully marked by large stakes clearly lettered, and the crew deserves credit for having done an excellent job.

At the time of this writing, the exact location of the survey with respect to points on the nearby beach has not been established, but its approximate location is such that the baseline, bearing $N46^{\circ}10'E$, is about 200 feet from the beach at the nearest point and Line E coincides in the same area as Traverse C ~~as shown~~ of the earlier work as shown on the aerial photo in the report of February 19, 1952. The section lines bear $S59^{\circ}E$. The base and section lines can be easily seen in Figures 1, 2, and 3 where the readings indicated were taken at the 100-foot stations. In Figure 4, the stations shown are the transit stations, some of which coincide with the 100-foot stations. Elevations have not yet been obtained.

It is intended to plot the work covered in this report on the aerial photo of the earlier report in profiles similar to those of the earlier traverses. This is in order to have all magnetic work thus far accomplished plotted together for a more comprehensive interpretation of the probable extent of the higher grade portion of the magnetite body. However, since the exact location of the survey is not known at present, and the writer hopes to do some more magnetic work there, the further plotting on the aerial photo will be done later. It will be appended to this report when done, or included in another report.

In the current work, four sets of magnetic data were obtained over the surveyed traverses. They are shown in the four figures included with the report. Isomagnetic contour maps were plotted instead of traverse profiles from the data obtained, in an effort to better outline areas of high and low magnetic attractions. The writer points out, though, that extrapolation of isomagnetic contours between lines which are 500 feet apart is partly guess work, and the contours in some cases may actually trend in different directions between lines than shown.

The purpose in obtaining the several sets of data was largely one of research: to compare the results obtained with two different systems of using the dip needle and with the horizontal variations of magnetic declination as indicated by the compass; and

to determine, if possible, which system gives the best results. A preliminary comparison of the results can be made here, but the writer will not attempt to draw any conclusions on the relative value of the methods before the results of the core drilling are made known. Further magnetic work, over an extended area, if possible, will also help in the final conclusions.

The two methods of using the dip needle were as follows: orienting the instrument so that the needle swings in a plane parallel with the magnetic meridian, and orienting it so that the needle swings in a plane perpendicular to the magnetic meridian. The latter system, as outlined in the writer's earlier report on Snettisham, is the same orientation as used with the Schmidt-type vertical magnetometer, and the needle is attracted only by the vertical component of the magnetic field. Thus the dip needle will register the greatest dip when directly over the point of highest magnetic attractions. With the needle parallel to the magnetic meridian, both the horizontal and vertical components act on the needle, making the results more complex and difficult to interpret. In this system, the location of the greatest reading of the dip needle will not necessarily coincide with the highest grade portion of the magnetic body because of the conflicting attractions between the two components. The instrument used by the writer was a Sharpe Instruments, Ltd. dip needle, Serial No. 4, and Thorne's dip needle was a Short and Mason, double suspension type, manufactured in England.

The four illustrations included with this report are magnetic maps of the surveyed area constructed from the observations obtained. The dots on the maps are the locations of the stations or points where the readings were taken. In the first three figures, the numbers adjacent to the points are the actual dip needle readings taken at the points in degrees of dip below horizontal. In Figure 4, the numbers are the actual local magnetic declinations at that point computed from transit compass readings taken by R. S. Warfield at the transit stations in the course of his transit survey. The contour lines, of course, indicate probable trends of areas of varying degrees of intensity of the magnetic field, and in Figure 4, areas of varying magnetic declination.

Figure 1 is the map of readings taken by the writer indicating the relative vertical intensities, and Figures 2 and 3 are maps constructed from readings taken by the writer and R. L. Thorne, respectively, using different instruments in the same manner: parallel to the local magnetic meridian. These three maps show that the results of the two systems are generally similar over the area in question, regardless of the foregoing mentioned theoretical differences. They each show a highly magnetic area to exist at the east end of Line 42, the lowest area to be to the southwest of the high area at the end of Line A, and another low area to be at the east end of Line E. The parallel maps show more low areas along the base line than the vertical intensity map, and the vertical map shows a very promising high area at the east end of Line B that the others show as perhaps only a little above average. The three maps show a moderately low area in the southwest

portion of the area, but the vertical map does not show the low areas along Line F that Figures 2 and 3 indicate. All strong anomalies at Snettisham have thus far been positive. The writer sees no evidence that the deposit is polarized.

In Figure 4, the greatest magnetic disturbance is also shown at the east portion of Line 42, with the magnetic declination at the next to last station showing a high of 112° from normal in a clockwise direction. It should be remembered that with this set of data, the figures have somewhat of a directional function as well as indicating intensity. The east end of Line A is high in magnetic declination, rather than the lowest point in the other maps, and this high area seems to continue on through Line B. It will be noticed that there are two small areas in the northern part of the area where the declination is slightly to the west of normal. All data except Mr. Thorne's is recorded in Field Book No. W-2.

As a result of the magnetic work, Mr. Thorne decided to have the first hole started at a point about midway between the west end of Line E and the east end of Line 42 and directed toward the east end of Line 42 at a negative slope of 30° . This should cut the highly magnetic area at a fair depth if drilled for a distance of at least 500 feet. The drawback in this particular area is that low intensities are indicated both to the south and north, but it may be the edge of a good ore body extending eastward, and at least the drilling should reveal the nature of the material causing the high anomalies.

The area of highs on Line B is particularly interesting because it appears that this could be caused by the same body which gave the succession of high anomalies at the upper end of Traverse B as shown in the aerial photo in the writer's earlier report. The distance between these two areas of high anomalies is in the neighborhood of 1500 feet, and if they are caused by the same relatively high grade body, it would be quite large. Further magnetic surveying over two more section lines to the south of Line B at the same interval and bearing should show whether or not the anomalous areas in question are connected. It is recommended, therefore, that two more lines be surveyed as described above, for the purpose of further magnetic determinations. It is also recommended that, if convenient, Line 42 be extended further eastward to enable observations to be made to determine the probable extent of that highly magnetic area to the east. The writer believes that the magnetic work should be continued to further outline the promising areas, depending partly, of course, on the nature of the material recovered by the core drilling.

James A. Williams
Associate Mining Engineer

12-27-50 2:15 PM

Figure 1.

Figure 2.

Figure 3.

Figure 1.

W. E. MAJOR & CO.
#244 California Street
San Francisco 11, California

Telephone
Douglas 2-1123

Mar. 31, 1953

Air Mail

COPY

Robert E. Coughlin
Juneau, Alaska.

Dear Sir:

The present is to inform you that as of to-day the U.S.G.S. office in San Francisco received a report from the Territory Office in Juneau, to the effect that the Core Drilling had reached a depth of 850 Feet and that the last 300' had indicated about 25% Fe. as Magnetic.

This is of course not very promising but too early to start making any definite conclusions.

The U.S. Bureau of Mines in S.F. was contacted and we were informed the San Francisco office could not help as the Juneau Area was in another District.

It is possible that you do not know that the Core drilling now being conducted at Snettersham is not a joint venture with the Territorial Bureau of Mines in Juneau and this entire venture seems to me to be important enough to require the Bureau of Mines to work along with the U.S.G.S.

You can readily see that the Engineer that is sent on the Core job must be an excellent man or the entire investigation might be of no value. In this regard may we suggest that you make it a point to discuss this matter with Mr. S.H. Lorain, Bureau of Mines, Juneau.

Please allow me to also give you one more suggestion that a diplomatic suggestion might be offered to both Departments that several holes might be drilled if the Engineer in charge thinks they are in Iron Ore, but keeping in mind that the only chance of any interest in a large movement is when the ore can be mined from Surface operations.

It is quite possible to bring some pressure on Washington in case you meet any amount of resistance.

Arch was in S.F. yesterday and I reviewed all the matters we have had correspondence on during the last week or so and asked him to make contact with you as soon as possible to give you some first hand information on what we were attempting to bring about.

Regards,

Yours Very Truly,

/s/ W. E. Major

Pekovich samples.

1 - Float picked up along the talus piles at the base of the cliff and above high water mark assayed in iron	34.97%
2 - Chip sample taken over several hundred feet of cliff to the east of 1 assayed	18.15%
3 - Chip sample from the right hand point looking up the inlet went	36.86%
4 - Chip sample over a space of about 20' with no wall on either limit, at a point about 600 feet above the beach assayed	40.48%
5 - Chip sample north of creek above tide water over a long face gave	32.11%
6 - Chip sample apparently across the strike and up the exposures along the creek for a long distance to an elevation of approximately 1,500 feet returned	19.85%
7 - Chip sample taken angling across the deposit from the beach to an elevation of about 1,000 feet ran	29.29%
8 - Chip sample along 1,000 feet of cliff southwesterly gave	36.20%
9 - Sample of solid magnetite from one of the segregations of that mineral into which someone had at some past time driven a short cut. This sample came from the dump and went	61.28%
1a - About 600 feet NE. from the mill on the shore Discovery #3. A new place. About where the open cut was reported to be. Seems to be extensive. More than 15 feet uncovered. Cliff like.	54.2%
2a - From the mill site. Blasted out and found in place. 2 veins, about 2 and 1 feet each, and 6 or 7 feet apart. Back of ore bin.	48.5%
3a - Brownish material on the beach near No. 2. Different color. Cliff hanging in deep water and cannot be walked on the shore for more than 500 feet. Taken on both sides of it. Finer mineral	48.2
4a - About 1,000 feet from the beach, elevation about 600 feet, large body. Seems to be near contact diorite. On center line No. 1. Brownish looking, and does not seem to be massive.	38.5%
5a - Near the mill N. about 300 feet on the beach. Near the creek to the N. where the old work was done and levelled off as though discovery was made before all the brown loose material soil like highly magnetic	46.1%

Territory of Alaska
DEPARTMENT OF MINES
Assay Office

Ketchikan, Alaska, June 28, 1950, 19.....

REPORT OF ASSAY

W. S. Pekovich

On samples received from.....

Junesau, Alaska

Assay No.	Sample Marked	OUNCES PER TON		Value per Ton	Percentage of		
		GOLD	SILVER		<u>Iron</u>	S	P ₂ O ₅
9310	3902				18.15		
9311	3903				36.86		
9312	3904				40.43		
9313	3905				32.11		
9314	3906				19.85		
9315	3907				29.29		
9316	3908				36.20		
9317	HMF 114				61.24		
9318	3901				34.97		
9354	Composite <u>3901-08</u>				35.91	0.28	0.68

Copy

Art Glover

Assayer.

ALASKA JUNEAU GOLD MINING COMPANY
Juneau, Alaska

COPY

ASSAY REPORT

W. S. Pekovich

August 17, 1950

Sample Description	Sample Number	Ti	Sol. Fe	Insol Fe	S	P
Snettesham Iron Samples	1	4.9	54.2	3.5		
" " "	2	4.8	48.5			
" " "	3	4.8	48.2		tr.	
" " "	4	3.4	38.5		tr.	
" " "	5	4.1	46.1		tr.	
Composite Sample					tr.	.07

Territory of Alaska
DEPARTMENT OF MINES
Assay Office

Ketchikan, Alaska,July 15, 1950....., 19.....

REPORT OF ASSAY

On samples received from.....Sam Pekovich.....

Address.....Juneau, Alaska.....

Assay No.	Sample Marked	OUNCES PER TON		Value per Ton	Percentage of		
		GOLD	SILVER		Iron	Sulfur	P ₂ O ₅
	Panned concentrate from composite 3901 to 3908						
9400					46.30	0.06	0.69

Note: The ratio of concentration was 10 : 3.45. No effort was made to make a closely graded concentrate; rather, the slimes were washed off and the remainder was only briefly concentrated by further panning. The tailings were noted to contain rather abundant, fine, magnetite and, in our opinion, gravity concentration is not applicable to this material. A magnetic separation would probably prove far more satisfactory.

Copy

.....
Art Glover

.....
Assayer.

**Territory of Alaska
DEPARTMENT OF MINES
Assay Office**

Ketchikan, Alaska, December 27, 1950, 19.....
October 9, 1950

REPORT OF ASSAY

On samples received from Howard M. Fowler

Address Terr. Dept. of Mines, Juneau

Assay No.	Sample Marked	OUNCES PER TON		Value per Ton	Percentage of		
		GOLD	SILVER		Iron	P ₂ O ₅	TiO ₂
9575	HMF 160				53.49	0.01	8.06
9576	161				48.94	Tr.	6.22
9577	162				44.80	3.09	7.42
9578	163				36.58	2.45	5.04
9579	164				44.40	0.07	6.74

Note: This is a corrected copy and should replace the one issued Oct. 9, 1950.

Copy

Art Glover

Assayer.

**Territory of Alaska
DEPARTMENT OF MINES
Assay Office**

Ketchikan, Alaska, August 11, 1950, 19.....

REPORT OF ASSAY

On samples received from Sam Pekovich

Address Juneau, Alaska

Assay No.	Sample Marked	OUNCES PER TON		Value per Ton	Percentage of
		GOLD	SILVER		
	(Supplementing 9400)				Titanium
9490	Panned concentrate 3901-8				12.02%

Copy

/s/ A. E. Glover
Art Glover Assayer.

ABBOT A. HANKS, INC.
Engineers, Assayers, Chemists, Metallurgists
Consulting-Testing-Inspecting

634 Sacramento Street
San Francisco 11, California

December 5, 1950

COPY

Guy F. Atkinson Co.
622 Russ Building
San Francisco, California

Attention: Norman C. Stines

Gentlemen:

At your request we have analysed some samples which you left
with us, and have to advise you as follows:

Mark Lab. No.	160 <u>24542</u>	161 <u>24543</u>	162 <u>24544</u>	163 <u>24545</u>	164 <u>24546</u>	Composite <u>24590</u>
Iron	52.04%	46.96%	45.96%	37.89%	44.96%	45.51%
Silica	7.52	7.29	12.20	15.71	11.79	10.87
Titanium Oxide	6.98	6.70	6.97	5.88	6.20	6.52
Phosphorus	0.002	0.003	3.178	2.383	0.092	1.132
Sulphur	0.010	0.007	0.003	0.008	0.024	0.011
				Alumina		4.39
				Calcium Oxide		6.03
				Magnesium Oxide		6.11
				Manganous Oxide		0.47
				Chromic Oxide		0.04

Respectfully submitted,

ABBOT A. HANKS, INC.

Original Signed by
By P. T. BEE

PTB:pf

TERRITORY OF ALASKA
DEPARTMENT OF MINES

MEMORANDUM REPORT

on

A MAGNETIC SURVEY IN THE VICINITY OF SNETTISHAM, ALASKA

to

LEO H. SAARELA
Commissioner of Mines

by

JAMES A. WILLIAMS
Associate Mining Engineer

February 19, 1952

TABLE OF CONTENTS

	Page
INTRODUCTION	1
SUMMARY AND RECOMMENDATIONS	1
LOCATION	2
HISTORY OF AREA	2
OWNERSHIP	3
TOPOGRAPHY	3
TIMBER AND VEGETATION	4
BUILDINGS AND EQUIPMENT	4
MAGNETIC METHODS USED	5
GEOLOGY	7
MINERALOGY	10
CONCLUSIONS	11
RECOMMENDATIONS	12

ILLUSTRATIONS

Figure 1	Vicinity Map showing Location of Snettisham
Figure 2	Map showing Variations of Magnetic Declination
Figure 3	Calibration Curve of Dip Needle
Figure 4	Magnetic Traverse Profiles plotted on Aerial Photograph

MEMORANDUM REPORT

on

A MAGNETIC SURVEY IN THE VICINITY OF SNETTISHAM, ALASKA

INTRODUCTION

Upon request of W. S. Pekovich to the Department of Mines, and by direction of Commissioner of Mines Leo H. Saarela, a magnetic survey was made by the writer during July 1, 2, and 3, 1951 of the area at Snettisham reported to contain deposits of magnetite. The instrument used was a Sharpe dip needle, employed in the manner of a vertical magnetometer so that only the vertical components of the magnetic anomalies were measured. Over 24,000 feet of traverses were surveyed, with measurements taken at approximate 100-foot intervals.

SUMMARY AND RECOMMENDATIONS

The country rock is a mass of ultrabasic intrusive hornblendite in which a large amount of magnetite is indicated. Whether there are concentrations that can be economically mined can only be determined by future physical prospecting. The magnetic survey shows four promising areas, the best of which is located around the upper half of Traverse B. (See Figure 4.) A fairly consistent formation is indicated there, but its magnetite percentage is not known.

It is recommended that further magnetic surveys be run to better outline the more favorable areas, and that trenching be done to expose cross sections of these areas. If results from this work are favorable, diamond drilling could be considered. A transit survey should be made to precisely locate future work.

LOCATION

Snettisham is located in southeast Alaska about 35 miles southeast of Juneau as indicated in Figure 1. The location of the community of Snettisham was very close to the old mill site and is represented by the light spots in the aerial photograph (Figure 4) near the northeast end of Traverse A. The old mill site is at the lower end of Traverse B, and is located $1\frac{1}{4}$ miles southwest of Sentinel Point. The geographical coordinates are $133^{\circ} 46'$ W Longitude and $57^{\circ} 59'$ N Latitude.

Access to this district is by boat and float plane only. No roads or flight strips are in existence.

HISTORY OF AREA

The only mineral that has been mined in significant quantities in the near vicinity of Snettisham is gold. The Crystal Mine was discovered in 1895 and was in production from 1901 to 1905.¹ Mike Kelly, Nome, Alaska, is at present holding the property. The Friday Mine began operations in 1899 and ceased in 1904 because of low grade ore. Apparently no one is interested in the Friday Mine now. A search of the records reveals the only remaining production from the area to be four or five tons of iron ore from an open cut on a six-foot magnetite vein in 1918.² A former Associate Mining Engineer for the Department of Mines searched for this vein in 1950, but did not find it.³ H. S. Lorain and

1. Arthur C. Spencer, The Juneau Gold Belt: U. S. Geological Survey Bull. 287, 1906, p. 47.

2. A. F. Buddington, Mineral Resources of Alaska, 1923-B: U.S. Geol. Survey Bull. 773-B, 1925, p. 133.

3. Howard M. Fowler, "Memorandum Report to Leo H. Saarela, Commissioner of Mines, on the Snettisham Iron Deposit, Snettisham, Alaska": Territorial Department of Mines unpublished report, undated, p. 2.

Robert Thorne of the Bureau of Mines have also visited Snettisham recently. Other activities through the years have consisted of sporadic prospecting and assessment work on the various properties.

Even prior to 1918, it was known that the area contained a large amount of magnetic material because of the extreme deviations of magnetic compasses when brought into the vicinity. (See Figure 2.) These disturbances are reported to be felt over an area of 20 square miles and are strong over an area of 8 square miles.

The present locator, Mr. Pekovich, staked a portion of the ground in the expectation of developing an iron-mining enterprise.

OWNERSHIP

Mr. W. S. Pekovich is holding a number of unpatented claims in the area, but much of the ground traversed is not under location at present.

Snettisham is in the Juneau Precinct, and all claims, titles, affidavits, etc. concerning the district are recorded in the Juneau Recording Office.

TOPOGRAPHY

The topography of the Snettisham area is rugged, and a large share of the slopes are precipitous. There are no large-scale contour maps of the district available at present. Referring to Figure 4, the upper end of Traverse B is at an elevation of 735 feet, and Traverse C goes to 1110 feet. The Crystal and Friday Mines are at 700 and 350 feet, respectively. They are shown in the photograph near Traverse A and in the upper right hand corner.

TIMBER AND VEGETATION

The timber and undergrowth are typical of most of southeastern Alaska. The whole area is heavily timbered with fairly large evergreens with the exception of a few relatively small open muskeg areas. These can be easily seen in Figure 4. The undergrowth varies from heavy to light in different places, but considerable axe work would be necessary to open lines sufficient for a transit survey.

BUILDINGS AND EQUIPMENT

There are no existing buildings or equipment that could be utilized for future mining operations, though some of the timbers in the collapsed mill building could probably be put to use in future construction.

MAGNETIC METHODS USED

The dip needle used in the magnetic survey is a Model D-2, Serial No. 4, manufactured by the Sharpe Instrument Co., Toronto, Canada. It is graduated in degrees in a manner so that when the instrument is properly levelled and the needle is horizontal, a dip of zero degrees is indicated by the N end of the needle. When the N end is drawn downward by an increasing magnetic intensity, the dip is recorded as positive, and when the N end rises above the zero as a result of a lesser intensity, the dip is recorded as negative. A dip of 90° would be indicated if the needle were in a vertical position.

In geophysical magnetic exploration, the magnetic anomalies are measured in units called "gammas". One gamma is equal to about $1/80,000$ of the earth's total average magnetic field in the United States.^{4/} Before the survey, the dip needle was adjusted and calibrated until it was determined that its sensitivity was roughly 90 gammas per degree dip in the vicinity of zero degrees. After the survey, a calibration was very carefully carried out that resulted in the sensitivity curve for the instrument shown in Figure 3. Varying known magnetic fields were obtained in the calibrations by means of a square coil of wire with measured amounts of electrical energy flowing through it. The induced magnetic field in terms of gammas is equal to $\frac{2.6248 \text{ na}^2 \text{I}}{(a^2+h^2) \sqrt{2a^2+h^2}}$ where "n" is the number of turns in the coil, "a" is one-half the length of one side of the coil in feet, "I" is the current flowing through the

^{4/} J. J. Jakosky, Exploration Geophysics, (First Edition: Los Angeles: Times-Mirror Press, 1940), p. 55.

coil in milliamperes, and "h" is the height of the instrument above the center of the coil in feet.^{5/}

In addition to the fact that magnetic intensities should be measured in units of gammas in the event that future magnetic work might be done in the area, it is also preferable to merely reporting the angle of dip because the angle of dip of a dip needle is far from proportional to the actual anomalies. This can be readily ascertained from the calibration curve in Figure 3.

In performing the survey and the calibrations, only the vertical component of the magnetic anomalies was measured. This is accomplished by orienting the instrument so that the plane of revolution of the needle is perpendicular to the magnetic meridian, (magnetic north-south direction). In this manner the horizontal component of the earth's field has no effect on the needle,^{6/} and the results can be more intelligently interpreted. Two readings were taken at each station, one with the N end of the needle pointing W and one with it pointing E. When the two readings differed, an average was taken. A Brunton compass was used for the orientation, and a Brunton tripod proved very useful for supporting the dip needle while readings were being taken.

Four traverses were surveyed at Shettisham, as indicated in Figure 4. They are Traverses A, B, C, and the Beach Traverse. Readings were taken and recorded at intervals of a hundred feet (as nearly as possible by pacing), and the intensities were calculated from the calibration curve and plotted on the aerial photo as near the exact location of the anomalies as possible. The actual locations of the traverses, except the Beach Traverse, are indicated by the heavy dashed lines.

^{5/}J. H. Swartz, "Determination of the Sensitivity of a Vertical Magnetometer By Means of a Coil Laid on the Ground". (U.S. Bureau of Mines, 1942), p. 7.

^{6/}C. A. Heiland, Geophysical Exploration, (New York: Prentice-Hall, Inc., 1940), pp. 320, 346

The upper ends of Traverses B and C may not be indicated in precisely the correct positions because of the difficulty of accurate pacing and orientation. This was because of the very steep and brushy terrain and the deviations of the compass. Traverse A follows the remains of corduroy roads that were built at the time the mines in the vicinity were in operation.

The lighter, straight lines are reference lines for scaling the various anomalies and for making it easier to determine at a glance the relative magnitudes of the anomalies. The reference lines should be considered as being at a level of zero gammas, and all anomalies should be considered as positive quantities. Small arrows are employed in the photograph to show the correct locations of some of the higher anomalies. The others can be worked out with little difficulty. A good base for future magnetic operations would be on a small outcropping of diorite about 300 feet west on the beach from the old postoffice site, where a reading of zero is indicated on the profile. The lowest anomaly of the survey was found there.

The Snettisham survey and second calibration are recorded in Field Book No. W-2.

GEOLOGY

The area under consideration is a large ultrabasic mass of hornblendite with occasional small intrusions of diorite. It is a portion of the Upper Jurassic or Lower Cretaceous intrusive rocks which form the dominant geologic feature of southeastern Alaska.^{7/} The contacts

^{7/}A. F. Buddington and Theodore Chapin, Geology and Mineral Deposits of Southeastern Alaska: U. S. Geol. Survey Bull. 800, 1929. p. 173.

of the hornblendite are with diorite to the west and phyllites to the east, and appear to run about perpendicularly to the beach where traversed. They can be quickly located in Figure 4 by noting where the beach traverse magnetic profile flattens out at each end. The eastern contact appears not to reach the beach to the south of Sentinel Point, and it probably passes near the upper end of Traverse C. The western contact apparently goes up the hill from the beach and crosses Traverse A at a point about midway between the Friday Mine and the uppermost right-angle turn in the traverse. The Crystal Mine is definitely outside of the zone of hornblendite, and the Friday Mine is driven in hornblendite that is typical of the whole mass, although perhaps a little lower in magnetite content at that point.

The hornblendite grades from fine to very coarse grained,, the coarser rock having large crystals of biotite that are particularly noticeable where the rock is not weathered. Small aplite dikes were observed. The chief accessory minerals are magnetite, apatite, and plagioclase.^{8/} The magnetite runs throughout the hornblendite, and grades from finely disseminated to concentrations of an unknown size. As noted earlier, a six-foot vein of magnetite is reported to be in existence, but it was not observed by the writer. The best magnetite exposures seen personally are at the old mill site where the rock has been excavated for footings. The hornblendite here is mixed indiscriminately with aplite and quartz material, and the magnetite is segregated into small stringers or lenses up to an inch thick. There were also a few

^{8/}Ibid., p. 197.

one-inch stringers of magnetite seen on the beach at a jutting point about 1500 feet northeast from the mill. The writer believes that this point is probably in the vicinity of the above-mentioned vein, but it is not the point of the highest anomalies. The highest anomalies were found on the next outstanding point to the northeast, approximately another 1500 feet away from the mill site at the lower end of Traverse C. Except for the two places mentioned, very little actual segregation of the magnetite was observed. The rock in general, however, is magnetic.

The hornblendite in the Friday Mine is generally quite coarse-grained, and is sparingly mineralized with pyrite and a negligible amount of gold. The rock is very hard, (as it is everywhere in the vicinity), and where it is fractured, it is filled with aplite dikes. The fillings apparently came in so rapidly and cooled so quickly that the country rock that was trapped in the cooling material was not assimilated, so that the dikes have many inclusions of unaltered hornblendite. In checking the main tunnel and other locations for magnetite, it was discovered that the strongest zones of magnetite were about a foot away from the walls on either side of the aplite fillings. The upper tunnel was found to be 400 feet long, and the lower one, which had less magnetite than the upper, was about 150 feet long. It is at an elevation of 350 feet. Sample IHS-1951-12 was taken of some typical country rock in the upper tunnel for a nickel, platinum, and magnetite assay. The results were Ni, trace; Pt, nil; and magnetite, approximately 10%.

The Crystal Mine is in a different country rock, as already mentioned, and at an elevation of 700 feet. The rock here is an elongated

dark flow with elongated light crystals of feldspar, which places it in the classification of a gneiss. The rock is well jointed in one direction, dipping about 30° , and the mineralization is in the filling of the joints. The principal mineral is quartz, which carries the gold and pyrites. Many well-formed crystals of both pyrite and quartz are in the mine. Sample LHS-1951-11 was taken of some concentrate found below the mine. Fire assay results show that it contains 1.32 ounces of gold and 2.68 ounces of silver to the ton.

The two mines and the mill site were checked for radioactivity with a Victoreen Model 283A Geiger Counter. No abnormal radiation was detected.

MINERALOGY

In U. S. Geological Survey Bulletin 773, Buddington refers to the six-foot vein as titaniferous magnetite,^{9/} and in Bulletin 800 he states that the vein is ilmenitic magnetite.^{10/} He goes on to say in the latter reference that the country rock near the vein contains 14% ilmenitic magnetite, 56% pyroxene, 26% hornblende, and 4% apatite. Samples taken by Fowler were found to contain from 2.65% to 9.94% TiO_2 and from 15.12% to 67.85% Fe_2O_3 .^{11/}

Another group of samples from the area were tested by David W. Mitchell, Metallurgical Engineer at the University of California. He reported in a letter to Mr. Kettlewell of the Guy F. Atkinson Co., San Francisco, dated January 3, 1951, that the samples contained ilmenite

^{9/}Buddington, op. cit., p. 133.

^{10/} Buddington and Chapin, op. cit., p. 197.

^{11/} Fowler, op. cit., p. 3.

crystals of such a small size that they could not be economically liberated by grinding. He also reported larger grains of ilmenite that might be liberated by reasonable grinding. Mitchell experimented with magnetic separation using weak and strong magnetic fields, but came to no conclusions. Comparison of the Fe-Ti ratios in the products of the tests was not done. He recommended investigation of the possibility of removing a relatively high grade titanium product from the ore by flotation.

U. S. Bureau of Mines R. I. No. 3679, "Smelting of Vanadium-Bearing Titaniferous Sinter in an Experimental Blast Furnace" by C. E. Wood, T. L. Joseph, and S. L. Cole gives further information on removal of TiO_2 .

CONCLUSIONS

It is obvious from all evidence that a large amount of magnetic material is present in the Shattisham area. Whether it exists in economically important deposits or concentrations is yet to be determined.

Study of the magnetic profiles in Figure 4 reveals that the highest magnetic intensity found in the survey is located on the point at the lower end of Traverse C. An anomaly of nearly 60,000 gammas was measured there. The attraction drops off sharply in three directions from this point, but generally maintains the highest average along the beach toward Sentinel Point until the phyllite contact is reached. In the other direction on the beach, the anomalies drop to a lower average but as far as the next outstanding point where a high anomaly of about 35,000 gammas exists, the low values do not drop below 10,000 gammas.

In Traverse A there is nothing of particular interest concerning the possibilities of large magnetite bodies, but it will be noted that going from right to left, the diorite-hornblendite contact is apparently defined by local high values, after which the profile drops again.

The most promising area from the results shown is the upper half of Traverse B. The highest anomaly is not the highest of the survey, but for a distance of about 1300 feet, the intensities are consistently higher than for any other portion of traverse of equal length. It will be noticed here that no long drops to low values occur. This indicates a more consistent concentration of magnetite than elsewhere.

A shorter segment in the center of Traverse C is also high with the exception of one low point in the center of the highs. It is possible that this area of high intensities is caused by the same body or formation that causes the high anomalies of Traverse B.

From the above, it can be seen that the most promising areas for future prospecting work found in this survey are (1) the upper half of Traverse B and (2) along the beach from the lower end of Traverse C to the phyllite contact. The next most promising areas are the middle portion of Traverse C and the beach from the lower end of Traverse C to the next jutting point about 1500 feet to the southeast.

All anomalies above two or three thousand gammas are magnetic intensities that are definitely above normal.

RECOMMENDATIONS

It is recommended that additional magnetic surveying be done in traverses at right angles to the existing traverses in the favorable

areas that are outlined in CONCLUSIONS in order to better determine the extent of these areas. It is further recommended that physical prospecting in the form of trenching be carried out to expose cross sections of the more highly magnetic areas, particularly the area of upper Traverse B where a consistent formation is indicated. If results from this work are favorable, diamond drilling could be considered. To precisely locate future work, it is recommended that lines be brushed out and a transit survey be made.

Respectfully submitted,

JAMES A. WILLIAMS
Associate Mining Engineer

FIGURE 1

FIGURE 2