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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

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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 fromation 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 1¼ miles southwest of Sentinel Point. The geographical coordinates are 133° 46' W Longitude and 57° 59' N Latitude.

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

HISTORY OF THE 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 revels 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 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.

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.

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 distrubances 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 graducated 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 1/60,000 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 $\frac{2.6248\, na^2 I}{(a^2+h^2)\sqrt{2a^2+h^2}}$ where "n" is the number fo 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 coil in

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

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 vent 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 plan 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 affect 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 Snettisham, 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. 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 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

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.

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

midway between the Friday Mine and the upper-most 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 typicalof the while 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 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 LHS-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, appoximately 10%.

The Crystal Mine is in a difference 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°, andthe 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. 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 263A 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.[11/]

8/ Ibid., p. 197.

9/ Buddington, op. cit., p. 133.

10/ Buddington and Chapin, op. cit., p. 197.

11/ Fowler, op. cit., p. 3.

Anoљther 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 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 Snettisham area. Whether it exists in economically important deposits or concentrations is yet to be determined.

Study of the magnetic profiles in Figure 4 revals 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 unil 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 rightto 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 noted 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 highes. 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.

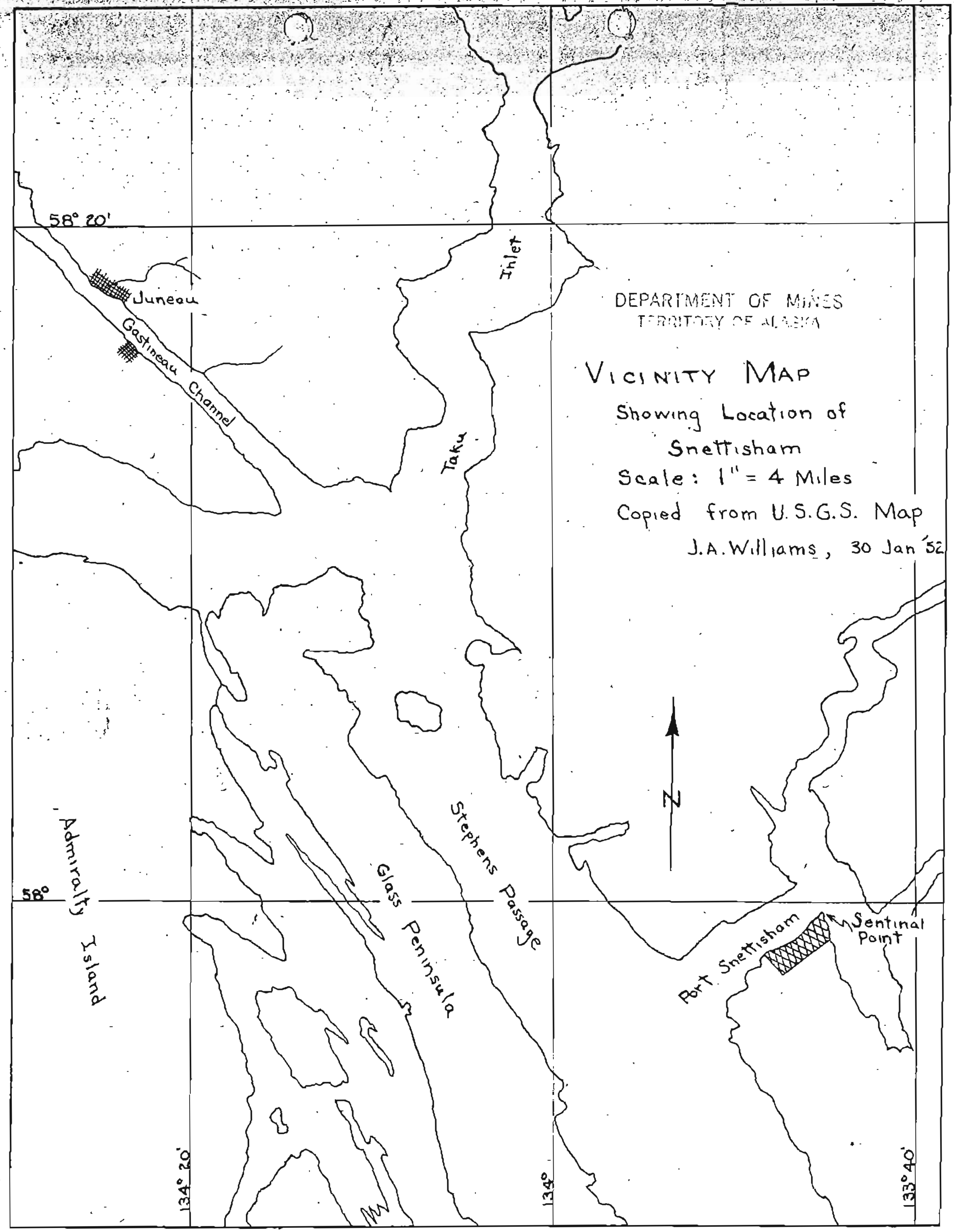
All anomalies above two or three thousand gammas are magnetic intensities that are definitely above normal.

RECOMMENDATIONS

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

/s/ JAMES A. WILLIAMS, Associate
Mining Engineer



DEPARTMENT OF MINES
TERRITORY OF ALASKA
VICINITY MAP
Showing Location of
Snettisham
Scale: 1" = 4 Miles
Copied from U.S.G.S. Map
J.A. Williams, 30 Jan '52
58° 20'
58°
134° 20'
134°
133° 40'
Juneau
Gastineau Channel
Taku Inlet
Admiralty Island
Glass Peninsula
Stephens Passage
Port Snettisham
Sentinal Point
N

FIGURE 1

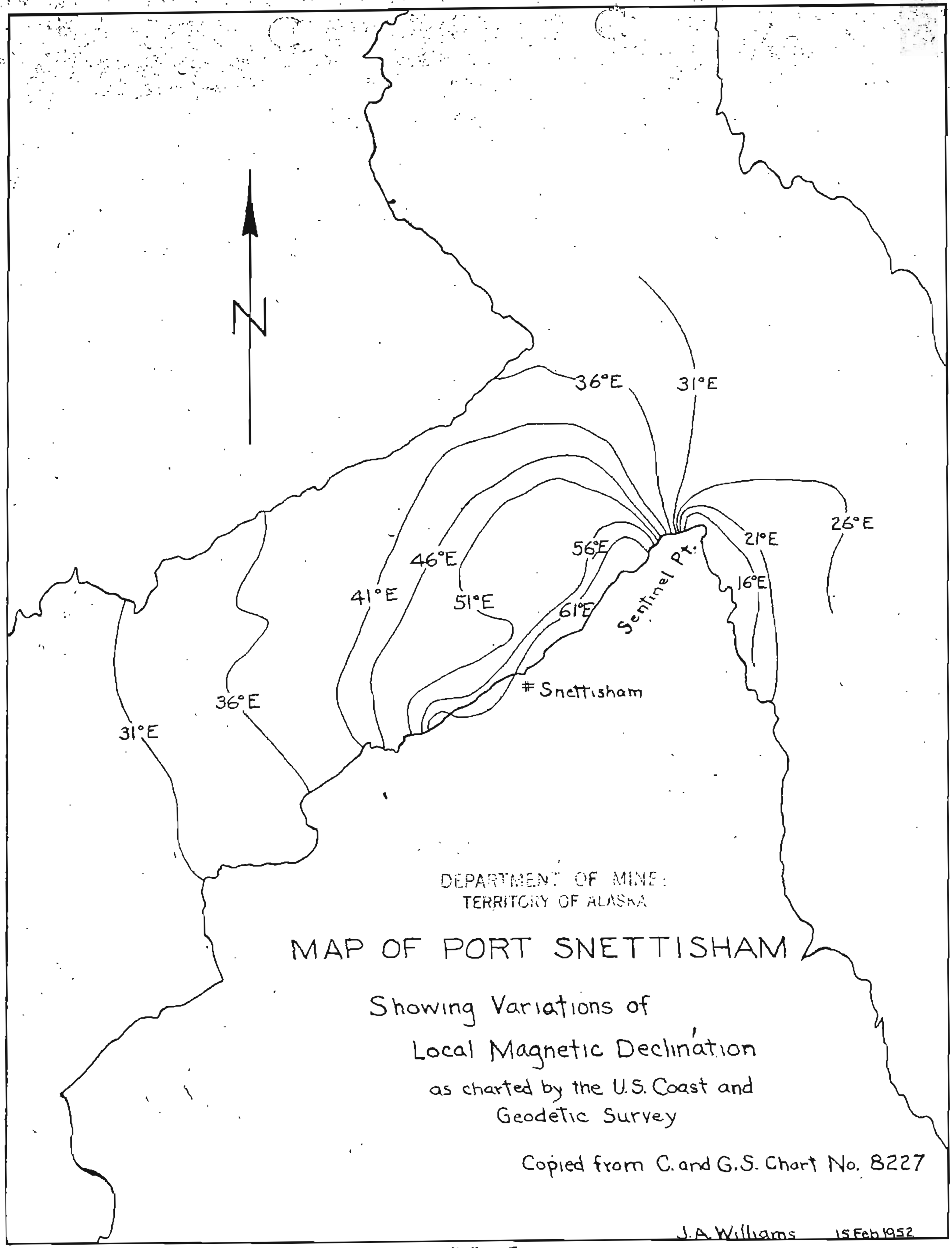

N
36°E
31°E
26°E
21°E
16°E
56°E
46°E
41°E
51°E
61°E
Sentinel Pt.
Snettisham
36°E
31°E
DEPARTMENT OF MINE
TERRITORY OF ALASKA
MAP OF PORT SNETTISHAM
Showing Variations of
Local Magnetic Declination
as charted by the U.S. Coast and
Geodetic Survey
Copied from C. and G.S. Chart No. 8227
J.A. Williams 15 Feb 1952

FIGURE 2

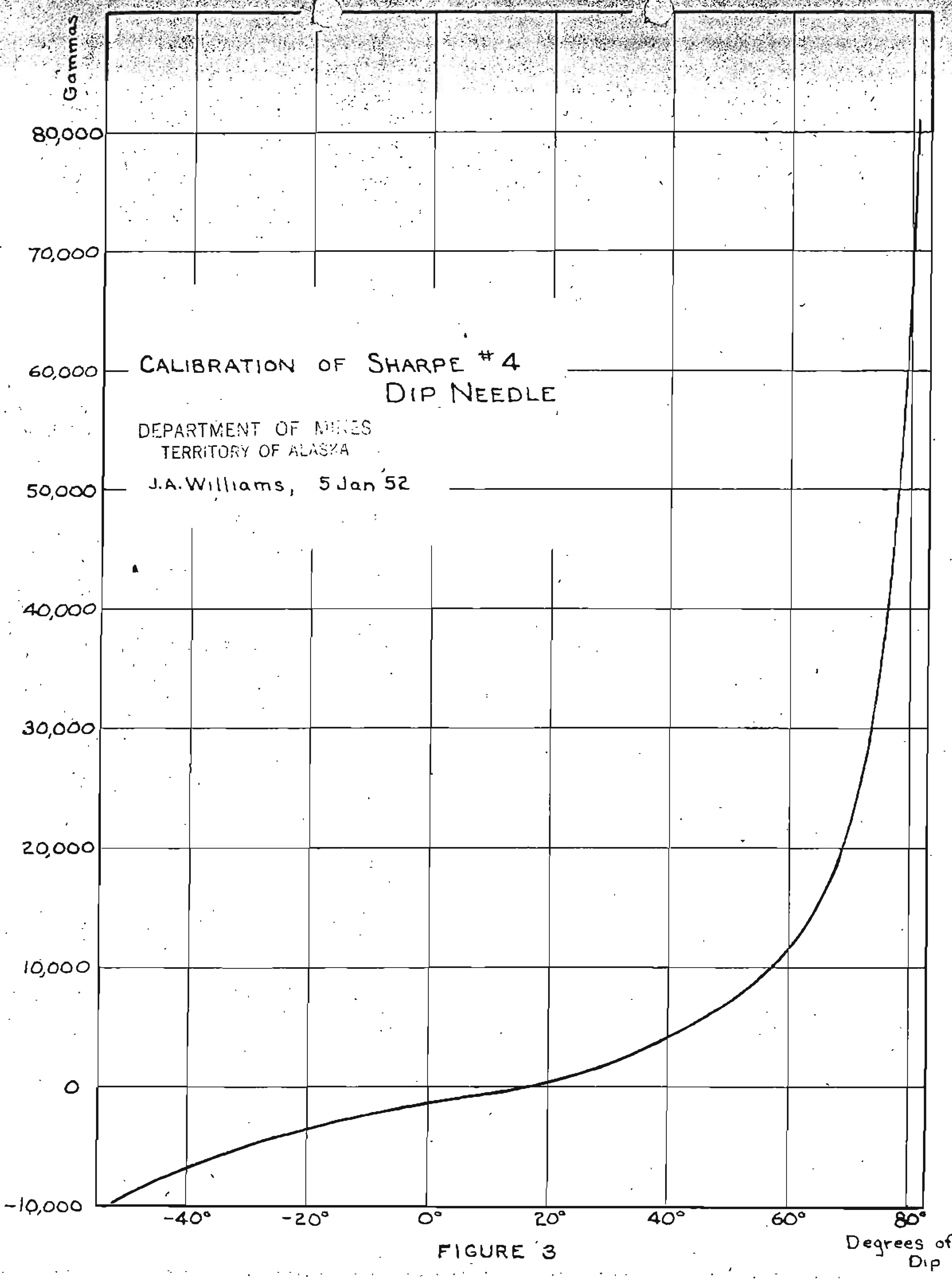

Gammas
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
-10,000
CALIBRATION OF SHARPE #4
DIP NEEDLE
DEPARTMENT OF
TERRITORY OF ALASKA
J.A. Williams, 5 Jan 52
-40°
-20°
0°
20°
40°
60°
80°
Degrees of
Dip

FIGURE 3

FIGURE 4

J.A.Williams 29 Jan 1952