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JAMES BOYD, DIRECTOR

REPORT OF INVESTIGATIONS

INVESTIGATION OF TOLSTOI MOUNTAIN IRON DEPOSITS  
KASAAN PENINSULA, PRINCE OF WALES ISLAND  
SOUTHEASTERN ALASKA



BY

ANER W. ERICKSON

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By Aner W. Erickson<sup>2/</sup>

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INTRODUCTION

Magnetite iron deposits on Tolstoi Mountain were examined as part of the investigations by the Bureau of Mines of iron and copper ores on Prince of Wales Island. The Tolstoi Mountain project was a part of a program for investigating mineral deposits in Alaska, under the general supervision of R. S. Sanford, acting branch chief.

<sup>1/</sup> The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used, "Reprinted from Bureau of Mines Report of Investigations 4373."

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A preliminary examination was made by S. P. Holt, mining engineer of the Bureau of Mines, in company with John Reed, L. A. Warner, and W. S. Twenhofel of the Federal Geological Survey, on July 14, 1943. Three samples were taken, rough estimates were made, and it was proposed that the area be mapped, topographically and geologically. Dip-needle work was added to the program, and it was decided that, should results warrant, the deposits would be diamond-drilled.

From March 26 to May 28, 1944, the deposits were examined thoroughly by Bureau of Mines personnel under the direction of the author. Thirty-two acres were mapped with contour intervals of 10 feet, grids were established covering the principal outcrops, over 1,500 dip-needle readings were secured, and the magnetite bodies were outlined. Additional information was gathered by trenching and channel-sampling, 600 linear feet of trench being dug and 32 channel samples being cut. Finally, the mapped area was checked for nonoutcropping deposits by taking dip-needle readings at 10-foot intervals along the traverse lines, creeks, trails, and all outstanding topographical features. This reconnaissance work gave sufficient coverage of the 32 acres to eliminate the possibility of further magnetite bodies of any consequence remaining undiscovered.

#### ACKNOWLEDGMENT

Acknowledgment is made to Nils Johannsen, assayer, Territorial Department of Mines, Ketchikan, Alaska, for determination of samples.

#### LOCATION AND ACCESSIBILITY

The deposits are on Prince of Wales Island in Southeastern Alaska near Tolstoi Bay, a deep-water indentation at the northwest end of Kasaan Peninsula. The physical features are shown on figures 1 and 2 and the location of the deposit on figure 3. Old workings were found on the west side of Tolstoi Mountain, between elevations of 650 and 1,150 feet, at distances of 3/4 to 1-1/4 miles from the east shore of Tolstoi Bay.

Access to the area is over a brushed foot trail built by the Bureau of Mines. Topography would permit construction of either surface or aerial tramways at moderate cost but would make road building expensive. Deep-water navigation, permitting inexpensive water transportation, is possible the year around.

#### PHYSICAL FEATURES AND CLIMATE

Kasaan Peninsula is an area of moderate relief, being considerably less rugged than the mainland to the east. Most of the mountains and ridges are less than 2,500 feet in height and show evidence of having been covered by the ice cap of the Pleistocene age. Rock exposures below elevations of 2,000 feet are limited, as extensive overburden 2 to 20 feet deep covers the greater part of the peninsula.

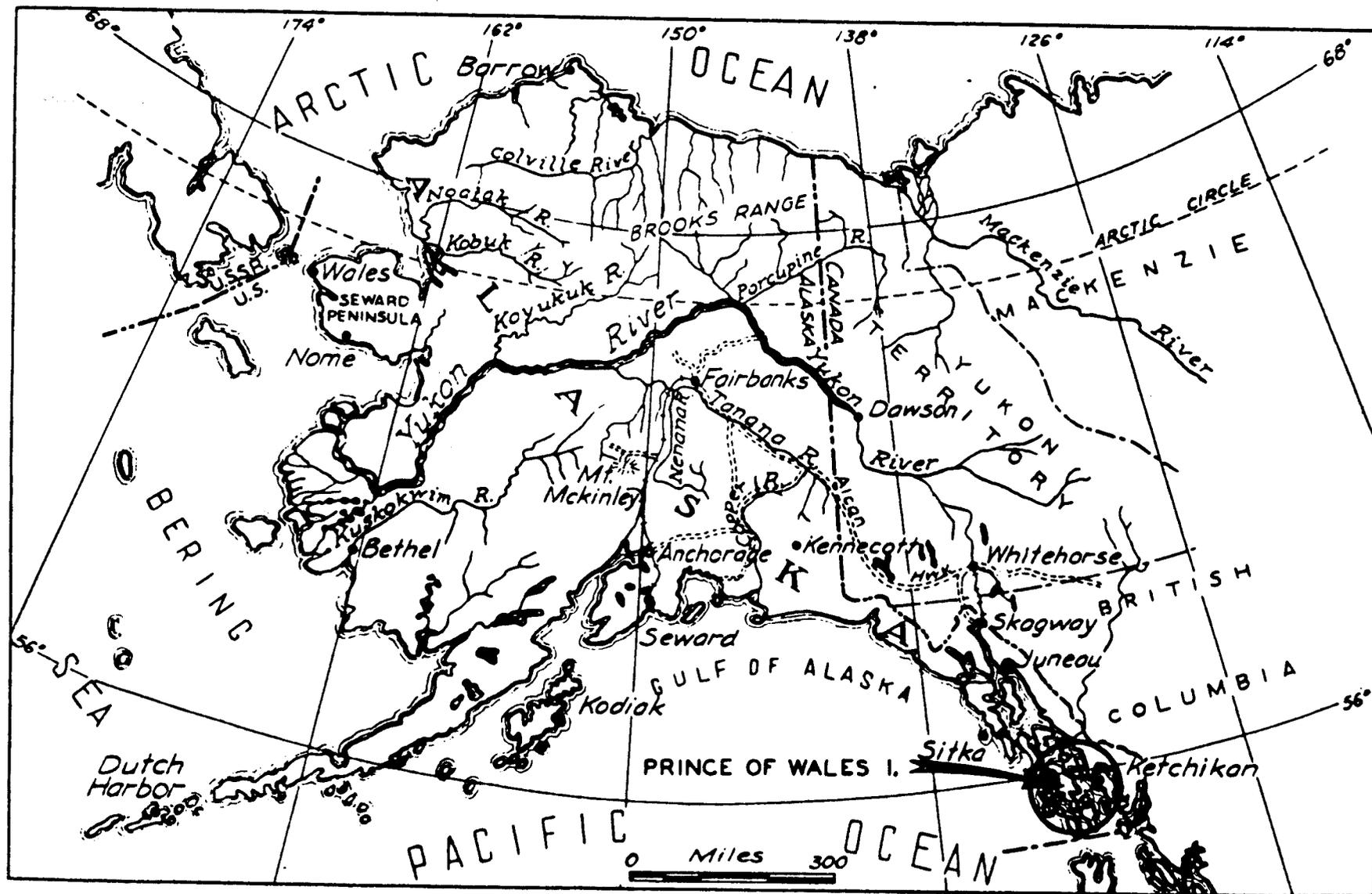


Figure 1. - Index map of Alaska showing location of Prince of Wales Island.

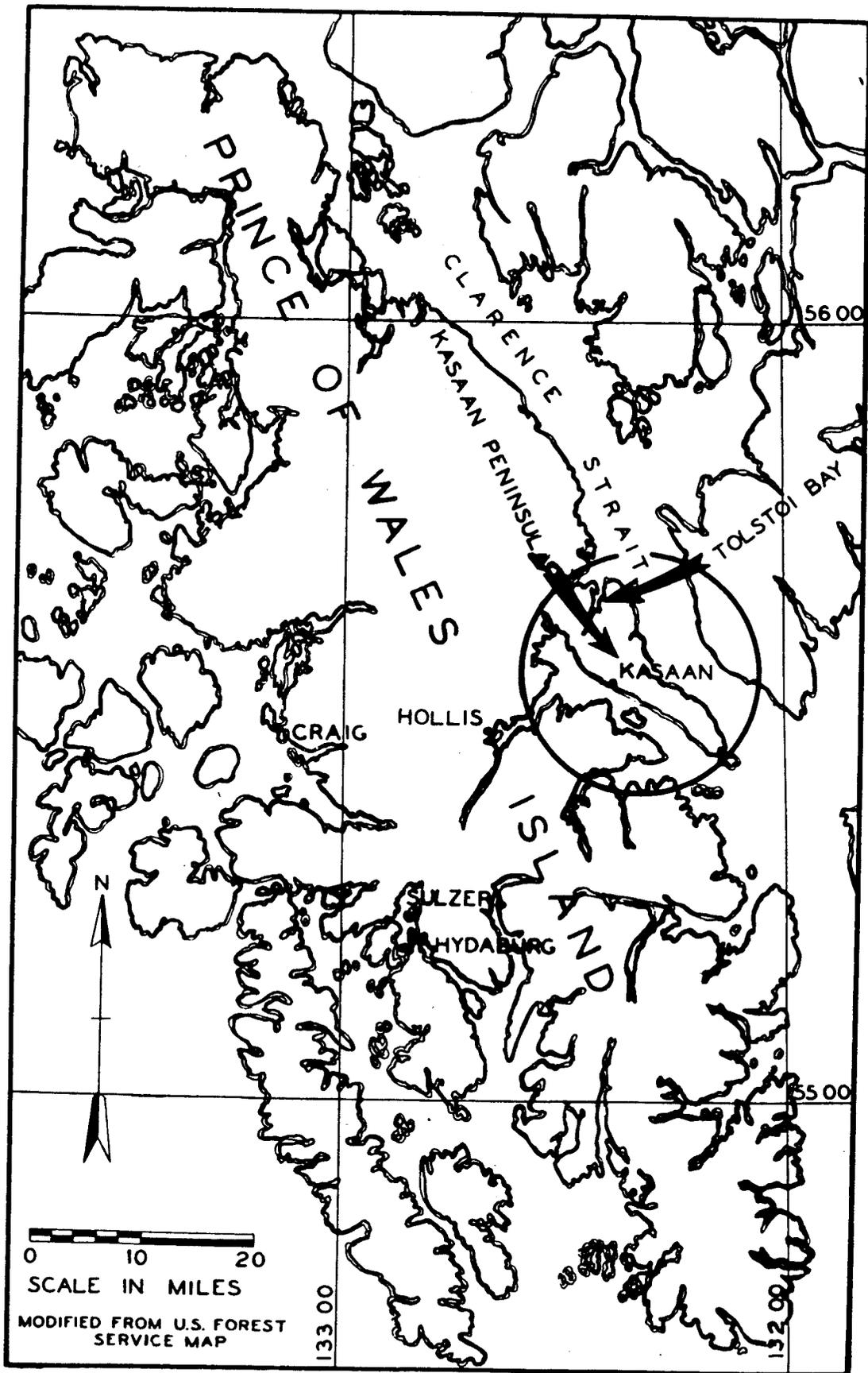


Figure 2. - Vicinity map - Prince of Wales Island.

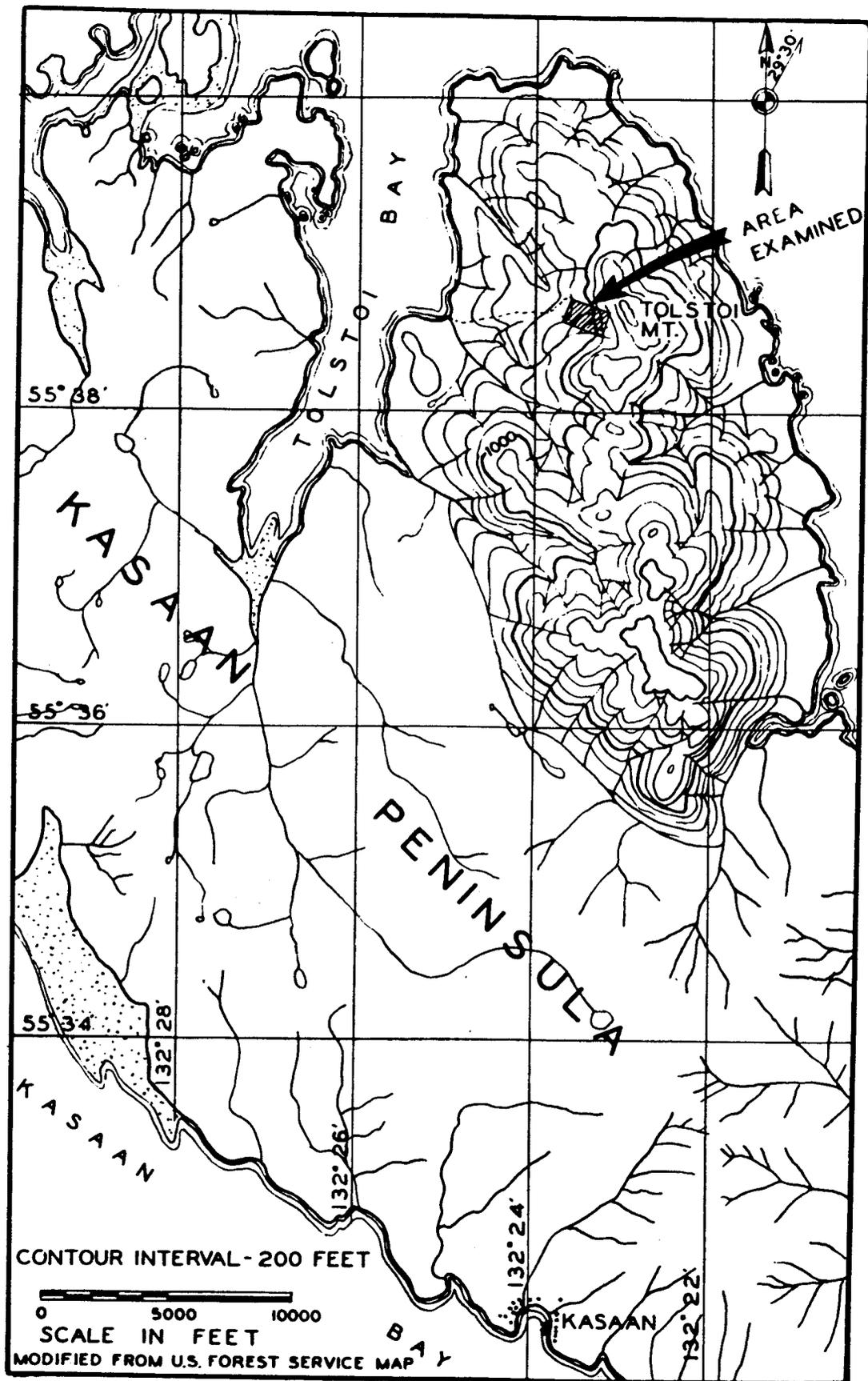


Figure 3. - Vicinity map - Kasaan Peninsula.

Timber and vegetation are abundant throughout the lower flanks of the area, and hinder exploration of prospects. Ample mine timber is available, mostly western and black hemlock and Sitka spruce. The underbrush consists mainly of huckleberry, salmonberry, and cranberry bushes, intermingled with considerable devil's-club, a shrub covered with sharp thorns.

The climate is characterized by moderate temperatures throughout the year. Precipitation is heavy and, although disagreeable, is an asset in that it makes available many potential sources of water power.

Snowfall is moderate at the lower elevation, there seldom being more than a foot or two on the ground at any time. Appreciable snowfall rarely occurs before December, and usually all snow has melted by April.

Weather records kept for 14 years at Ketchikan, 40 miles southeast of the prospect, show an average annual precipitation of 156.51 inches and an average annual temperature of 43.8° F.

#### HISTORY

It is reported<sup>3/</sup> that this area was prospected to a considerable extent by trenching and diamond drilling in 1901 and that some work was done each year up to 1908. No records have been found of work done since that time. There is no history of production of ore from Tolstoi Mountain, and the appearance of cuts and dumps and the absence of docks or tramways indicate that no ore has been shipped from the prospect.

#### PROPERTY AND OWNERSHIP

The deposits investigated appear to be part of what was known as the Iron Cap group. A few old claim posts were located but the writing on them was illegible. No signs of recent assessment or location work were noted nor do records show any patented claims in the vicinity; therefore it is assumed that the claims examined have reverted to the public domain.

#### GEOLOGY<sup>4/</sup>

Tolstoi Mountain is composed largely of diorite intrusive masses, probably of Jurassic age, which have invaded Devonian sediments and associated volcanics. The contact zone, with the diorite occupying the northerly side, strikes about N. 60° W. and dips southwest.

Rocks comprising the sedimentary group are graywackes, conglomerates, slates, and limestones; the volcanics consist of andesitic lavas, breccias,

<sup>3/</sup> Wright, Charles Will, Geology and Ore Deposits of the Copper Mountain, and Kasaan Peninsula, Alaska: Geological Survey Prof. Paper 87, 1915, p. 101.

<sup>4/</sup> Buddington, A. F., and Chapin, Theodore, Geology and Mineral Deposits of Southeastern Alaska: Geol. Survey Bull. 800, 1929, pp. 94-96, 242.

and tuffs. Of these rocks, only the tuffs were noted in the immediate vicinity of the deposit.

The ore bodies, like most of the contact replacement deposits on Kasaan Peninsula, occur in and along a wide zone of alteration. No sharp line of demarcation was noted between the tuffs and diorite, the tuffs gradually giving way to the diorite in both physical and chemical characteristics.

#### OCCURRENCE OF DEPOSITS

The deposits occur as pods, kidneys, and lenses scattered through a zone striking about N. 60° W., 2,000 feet long and 200 to 500 feet wide. These are shown on figure 4. Fifteen separate magnetite bodies are shown on the map, all of which, when surveyed by dip-needle methods,<sup>2/</sup> gave corrected vertical magnetic anomalies of plus 30° or higher. Of these, deposits 1, 2, and 3 showed the greatest intensities and were further examined by trenching, sampling, and detailed mapping. These are shown on figures 5, 6, and 7 respectively.

Deposit 1 is a flat-lying body, about 4 feet thick where exposed. Replacement appears to have taken place along a more clastic member of a series of greenstone tuffs. The magnetite mineralization is poorly developed. Topography indicates the body to be cut off by erosion on the north and west sides. The south and east sides are delimited by the magnetic survey, from which it is inferred that replacement processes diminished gradually in those directions.

Deposit 2 is thought to be a westerly dipping continuation of the flat-lying bed described as deposit 1, erosion dividing into two bodies a domelike strata of mineralization. Replacement is more intense in this body, giving a deposition of higher iron content. Several of the more clastic members of the greenstone tuffs have been affected, as is shown in trenches 2-1, 2-4, 2-5, and 2-6, where beds of impure magnetite are stratigraphically separated by unaltered country rock.

The adit under the north end of the deposit cuts, near the face, a few thin bands of partly replaced tuff, none of which are thicker than 6 inches.

Deposit 3 does not appear to be directly connected to the previously described bodies. Bedding of the greenstone tuffs dips 20° to 30° in a westerly direction as in deposit 2. Replacement, however, has been localized along a series of westerly trending joint planes occurring in a zone striking N. 45° E. Several members of the tuffs show partial replacement.

It is inferred that the mineralizing solutions ascended along the jointing planes, replacing the more clastic beds a few feet outward from these cracks. The extent of replacement in the zone making up deposit 3 was not determined, as heavy overburden makes it impracticable. It is estimated from available data that not over 35 percent of the greenstone tuff has been affected.

<sup>2/</sup> As described by A. A. Brant, Interpretation of Dip Needle Surveys: Trans., Canadian Inst. Min. and Met., vol. 41, 1938, pp. 501-516.

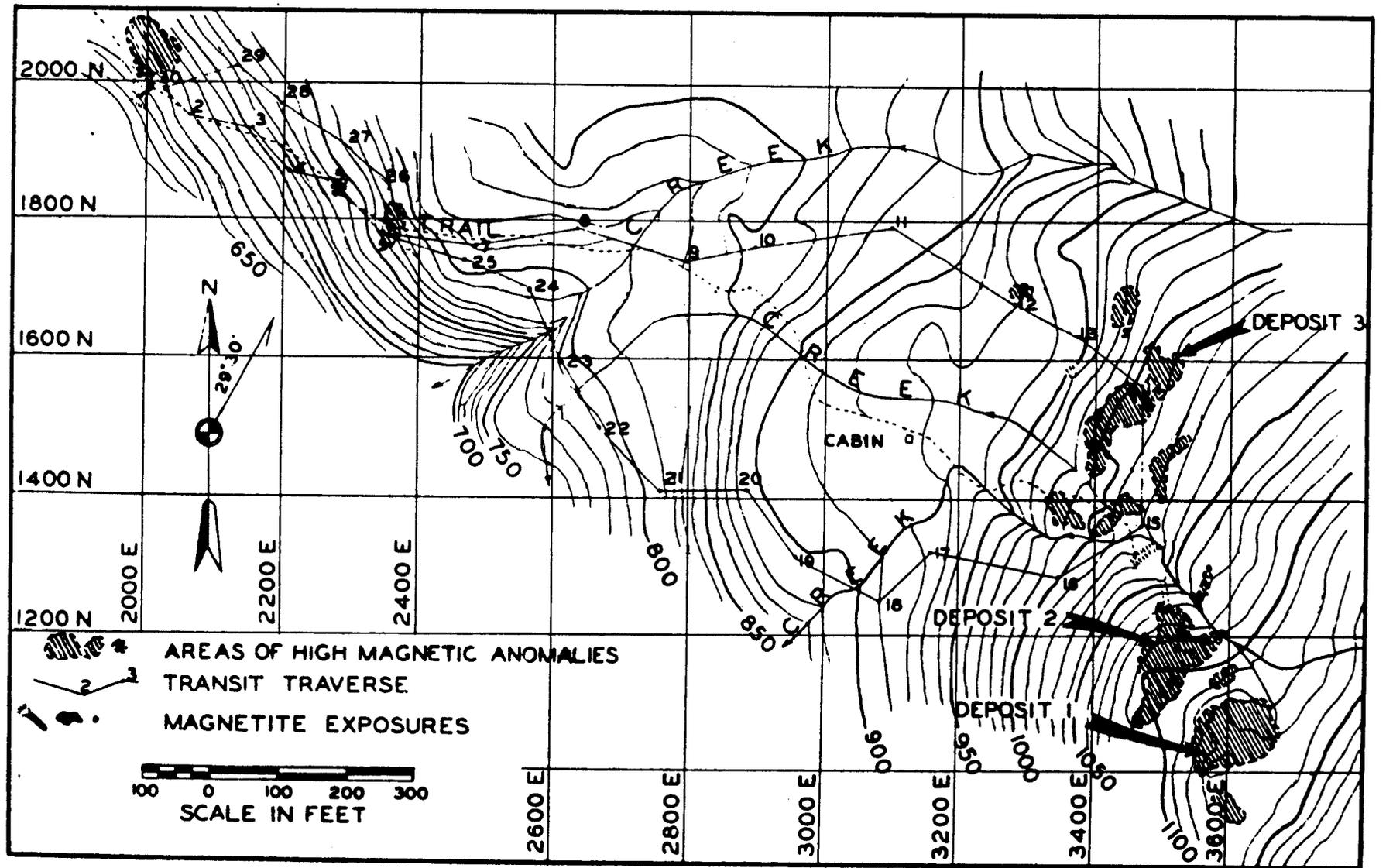


Figure 4. - Index map of area investigated on Tolstoi Mountain.

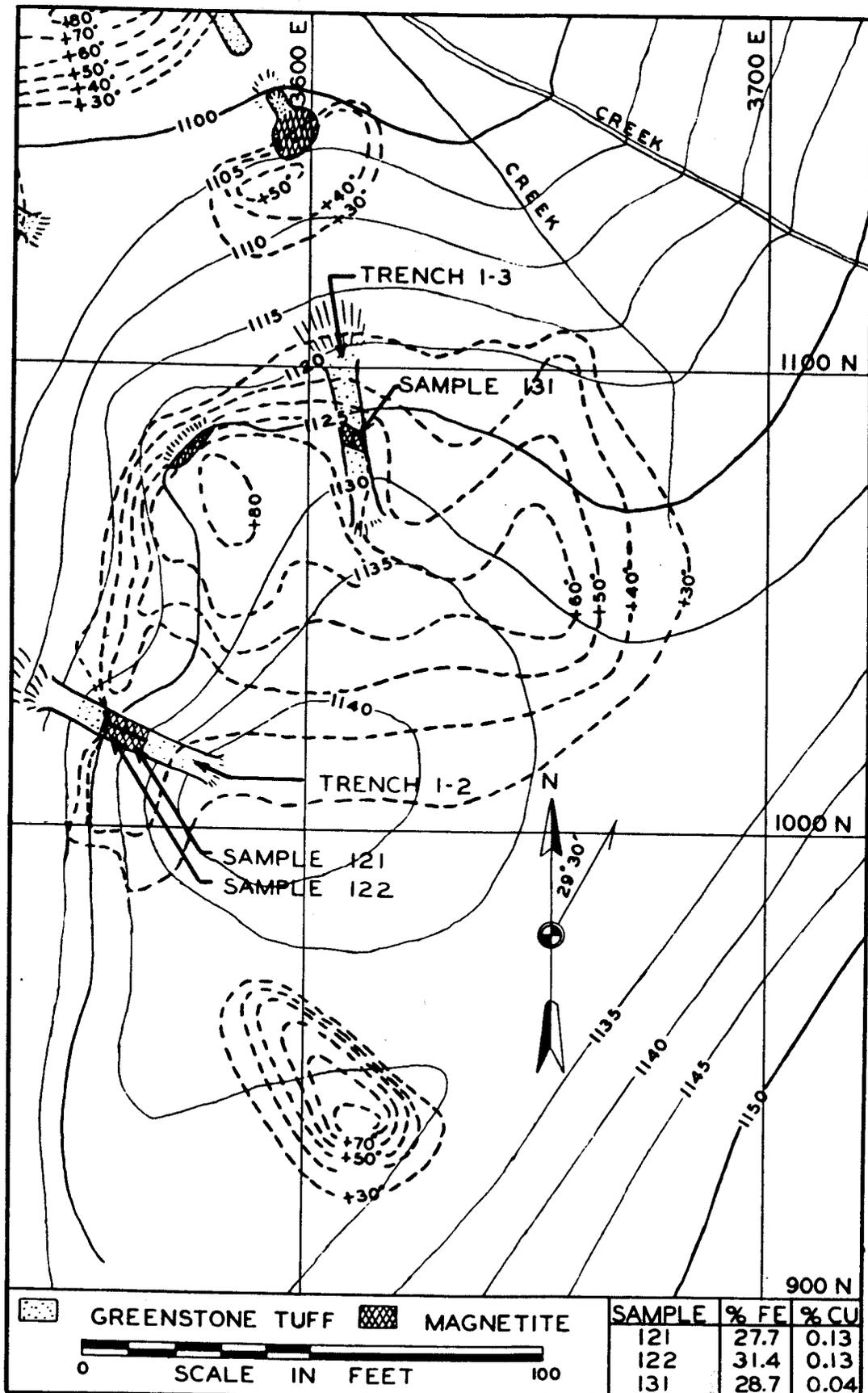


Figure 5. - Magnetic surveying, sampling - deposit I.

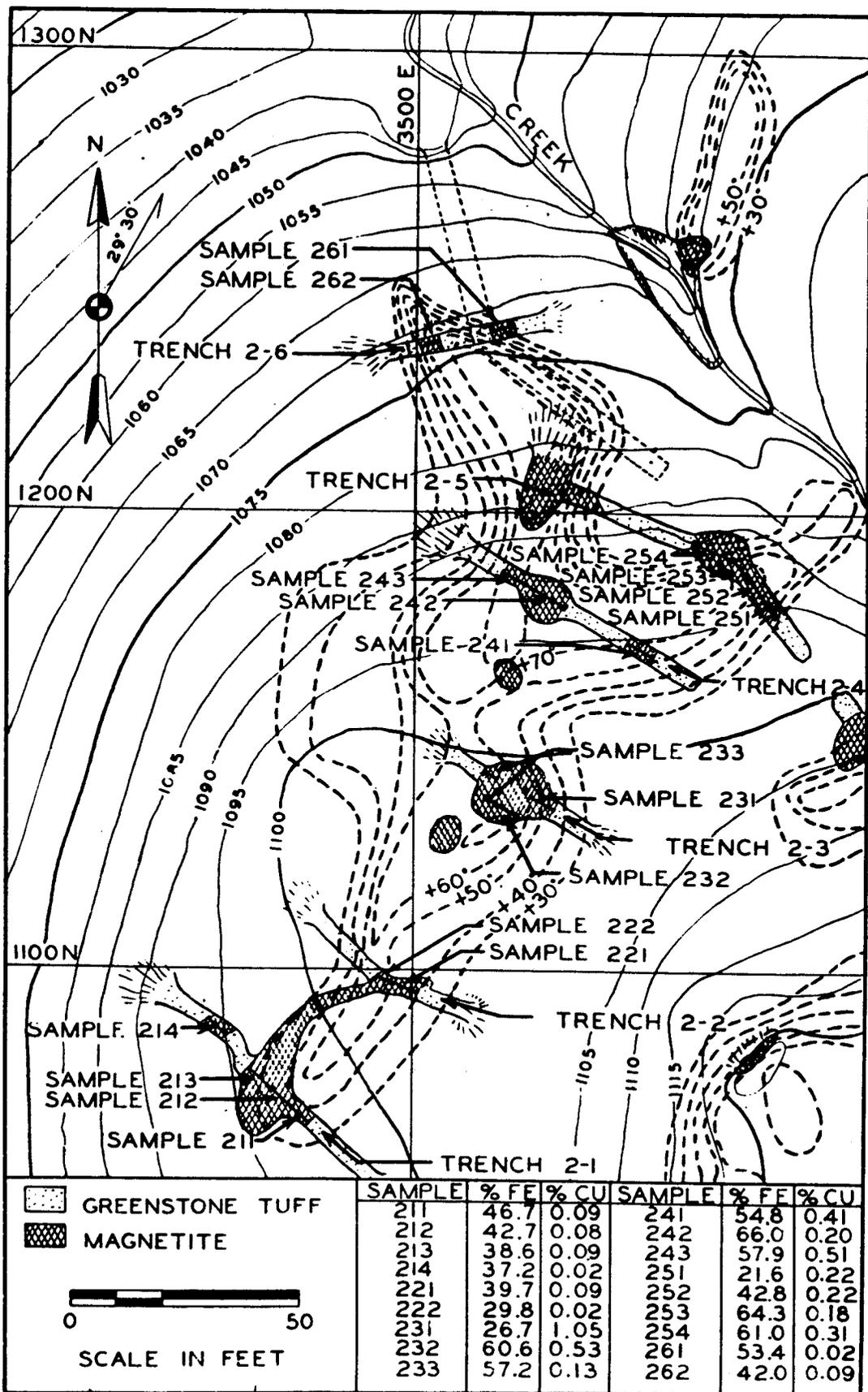


Figure 6. - Magnetic surveying, sampling - deposit 2.

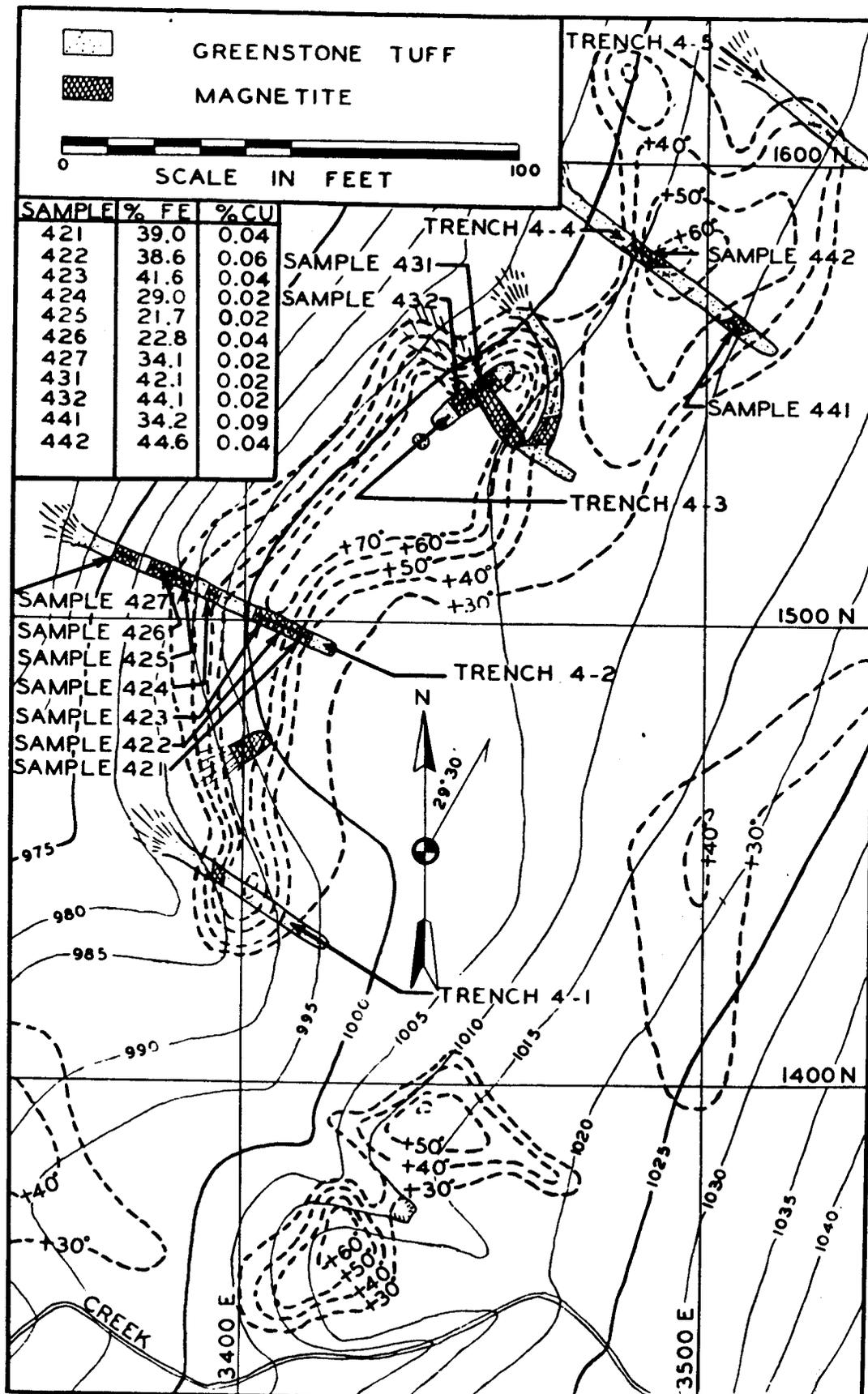


Figure 7. - Magnetic surveying, sampling - deposit 3.

A number of other scattered deposits giving high magnetic anomalies are shown on figure 4. As intensities were lower and areas were smaller than deposits 1, 2, and 3, they were not investigated in detail.

#### CHARACTER OF MINERALIZATION

Mineralization is typical of the contact iron deposits of Kasaan Peninsula. The ore mineral is magnetite, carrying small quantities of chalcopyrite and pyrite. Gangue minerals noted were garnet, epidote, calcite, and quartz.

#### SAMPLING AND ANALYSIS

Thirty-two channel samples were cut from deposits 1, 2, and 3. Grooves were 4 inches wide by 2 inches deep. Locations and analyses are shown on figures 5, 6, and 7.

All analysis work was performed by the Territorial Department of Mines<sup>6/</sup> at Ketchikan. Samples were tested for iron and copper only, the sulfur and phosphorus having been determined to be within allowable limits on the preliminary samples as follows:

Sample No.	Location and length of sample cut	Assay					
		Au, oz.	Ag, oz.	Percent			
				Cu	Fe	S	P
T-1 .....	14' chip sample along east wall of open-cut, 200' SE. of and 50' above tunnel.	Tr.	0.60	0.24	63.9	2.32	0.02
T-2 .....	17' chip sample along north wall of open-cut in creek bed, 25' above and 100' SE. of tunnel.	Nil	0.60	1.88	61.6	2.39	0.02
T-3 .....	15' chip sample along east wall of tunnel, to face. Includes some altered greenstone and pyrite.	Tr.	0.40	0.87	39.9	0.63	0.02

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<sup>6/</sup> Nils Johannsen, assayer.