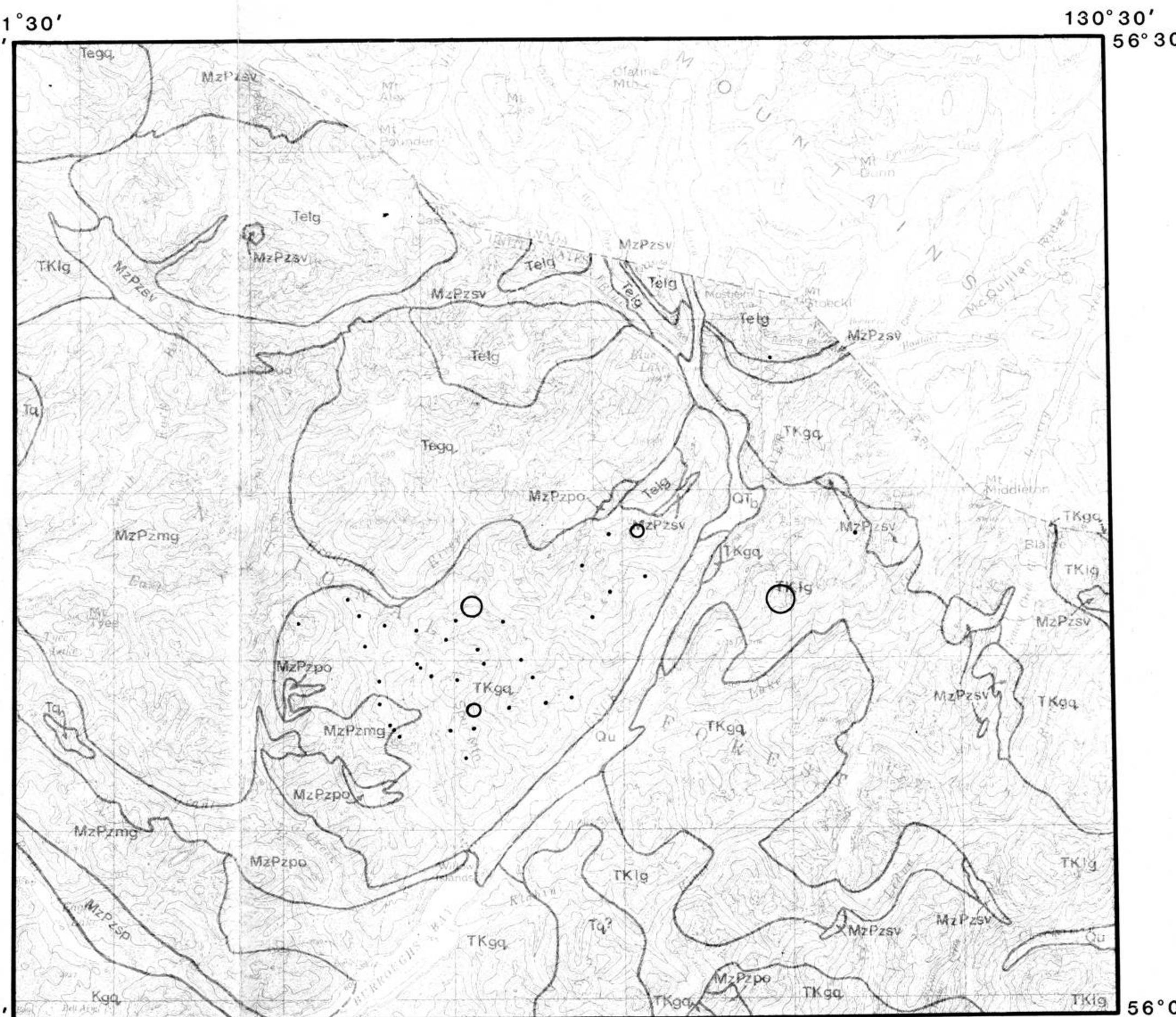
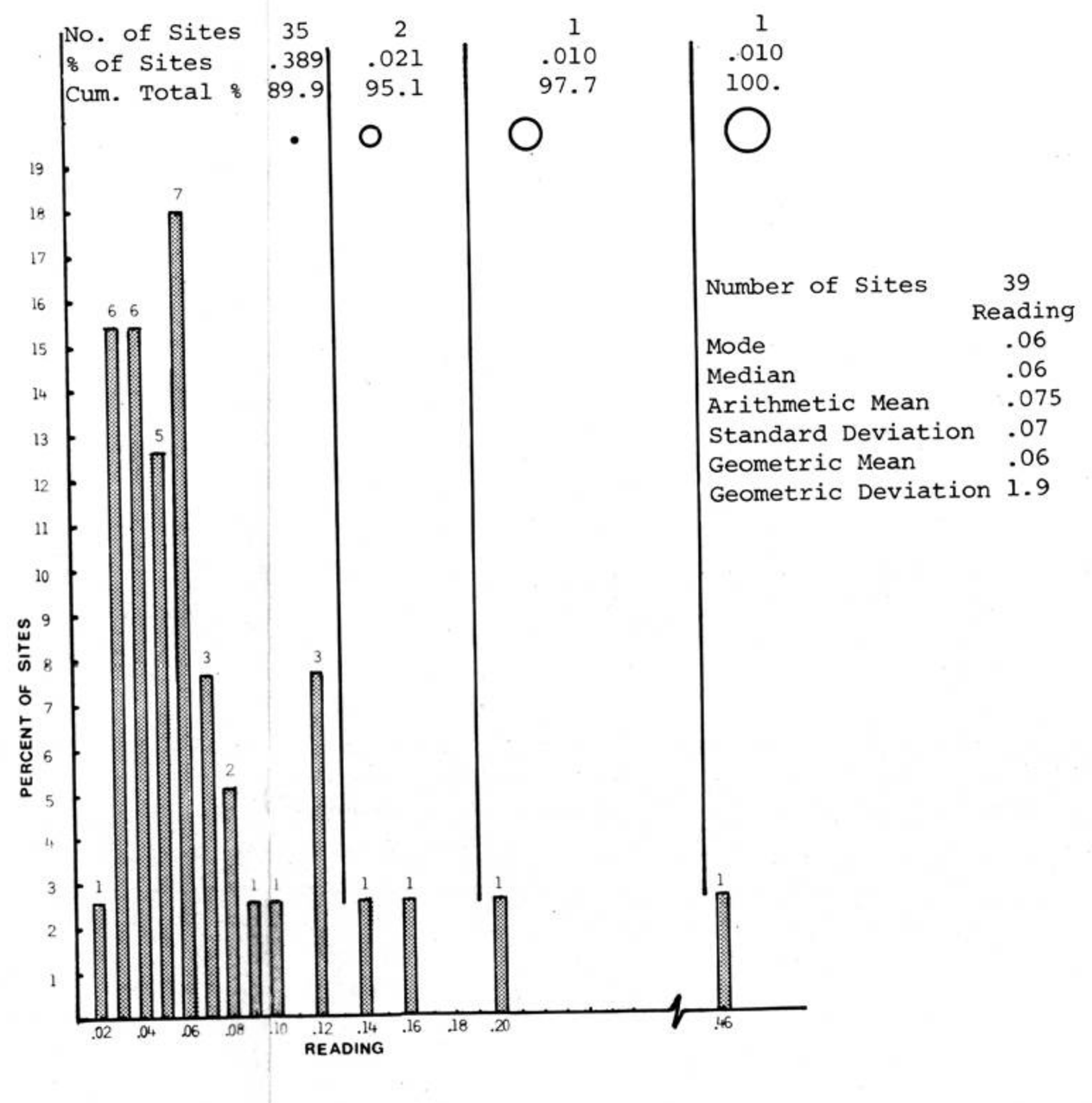
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN-FILE REPORT
81-840
SHEET 2 OF 2



SNOW AND ICE SITES



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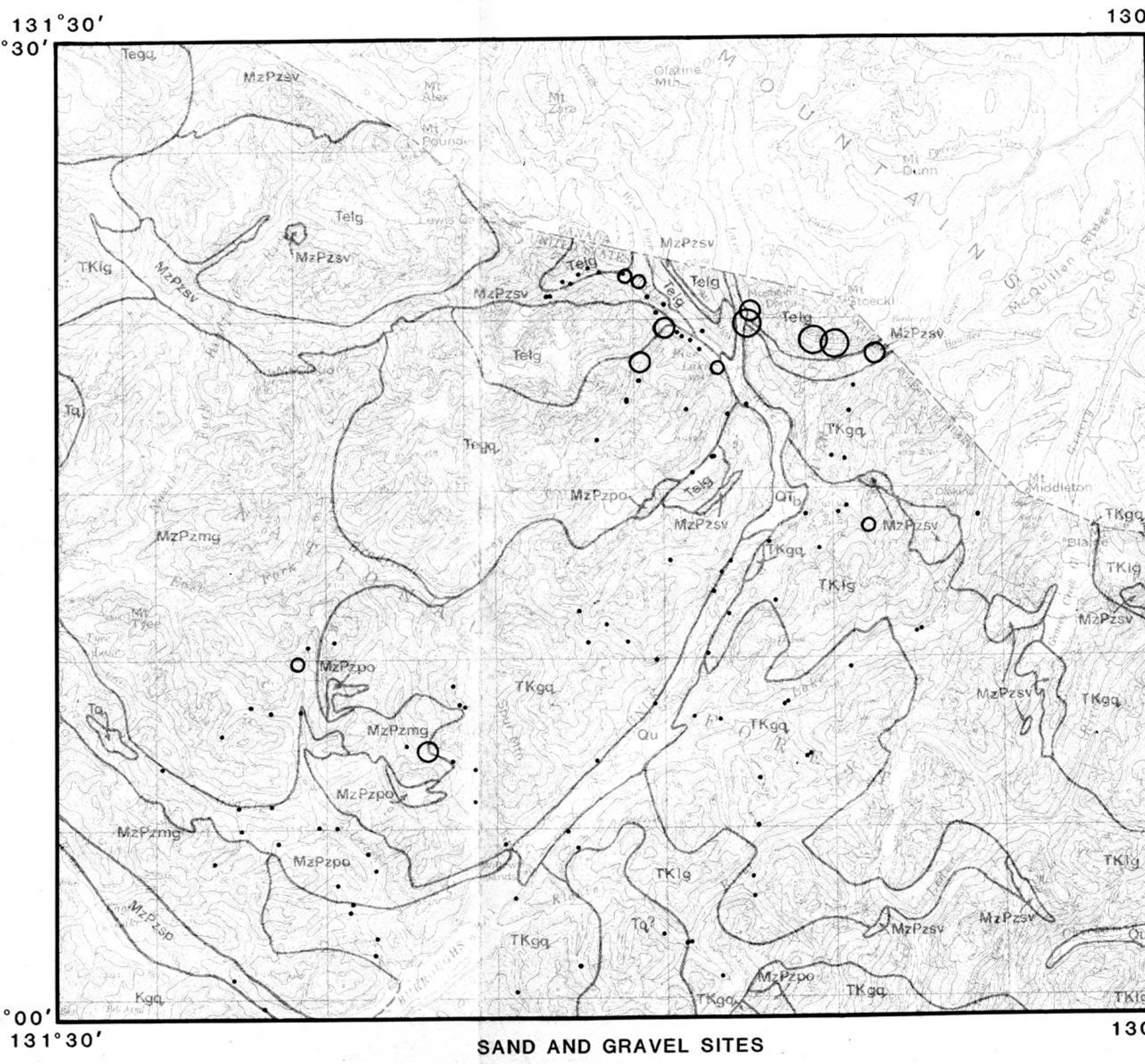

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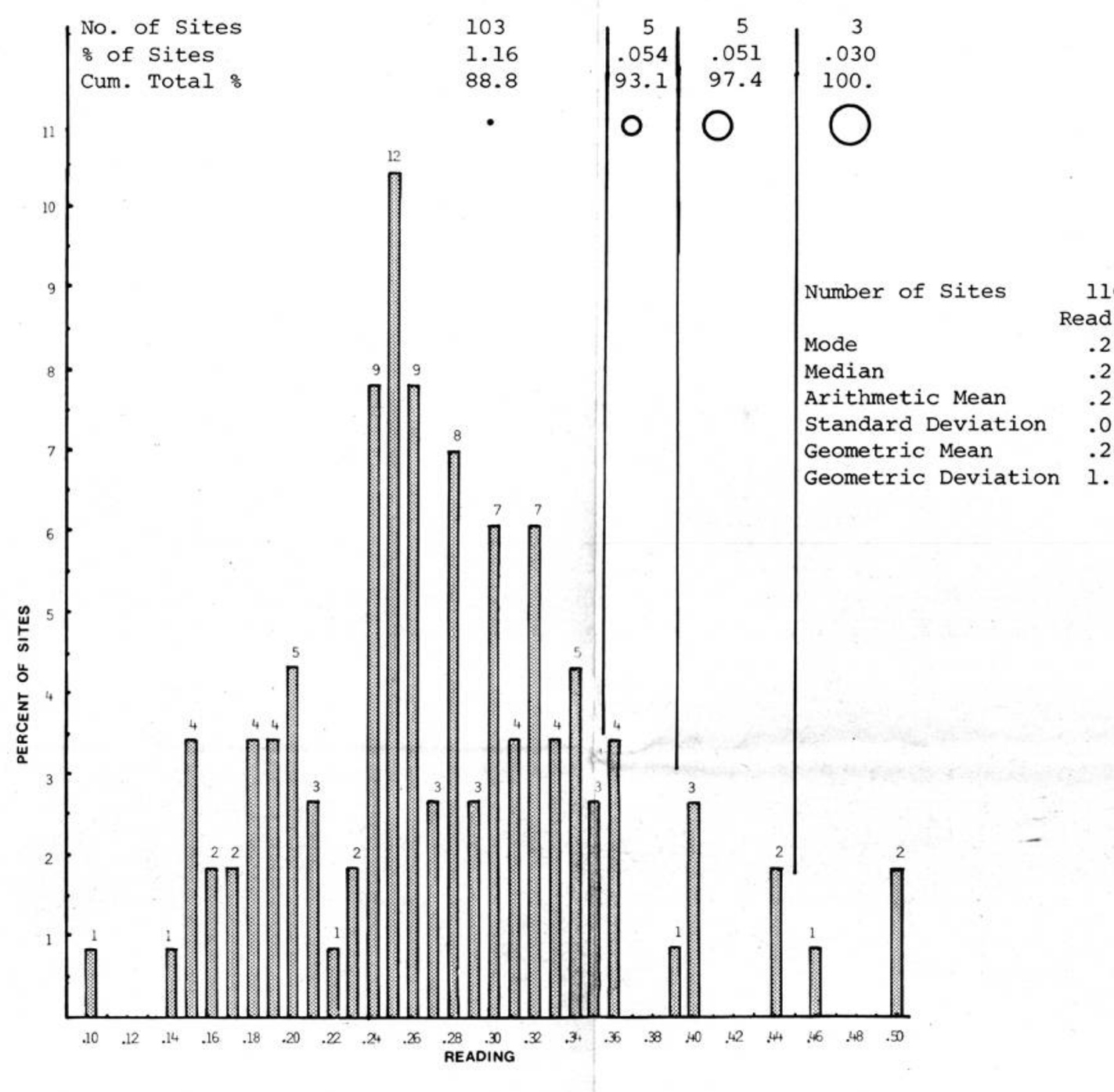

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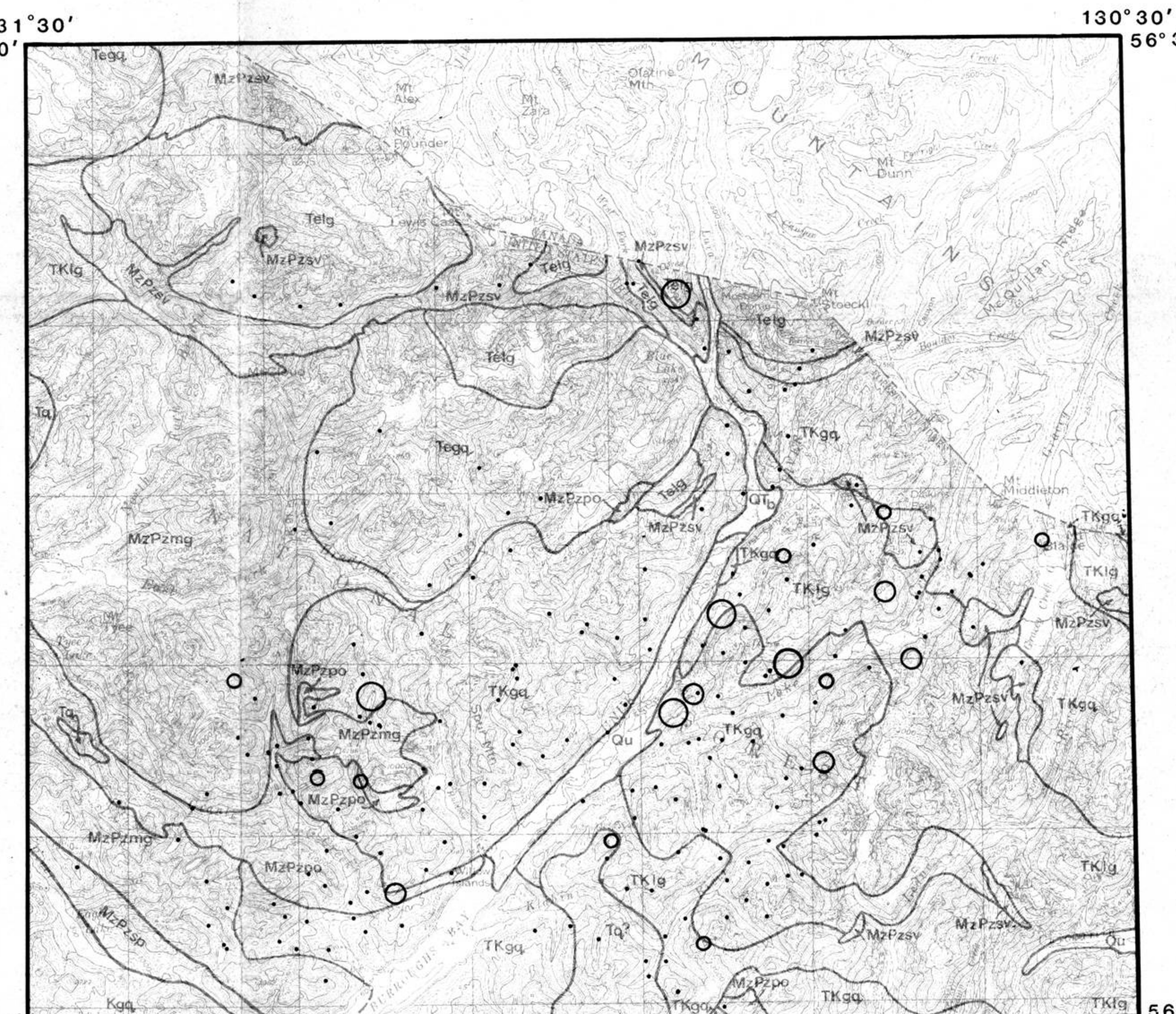
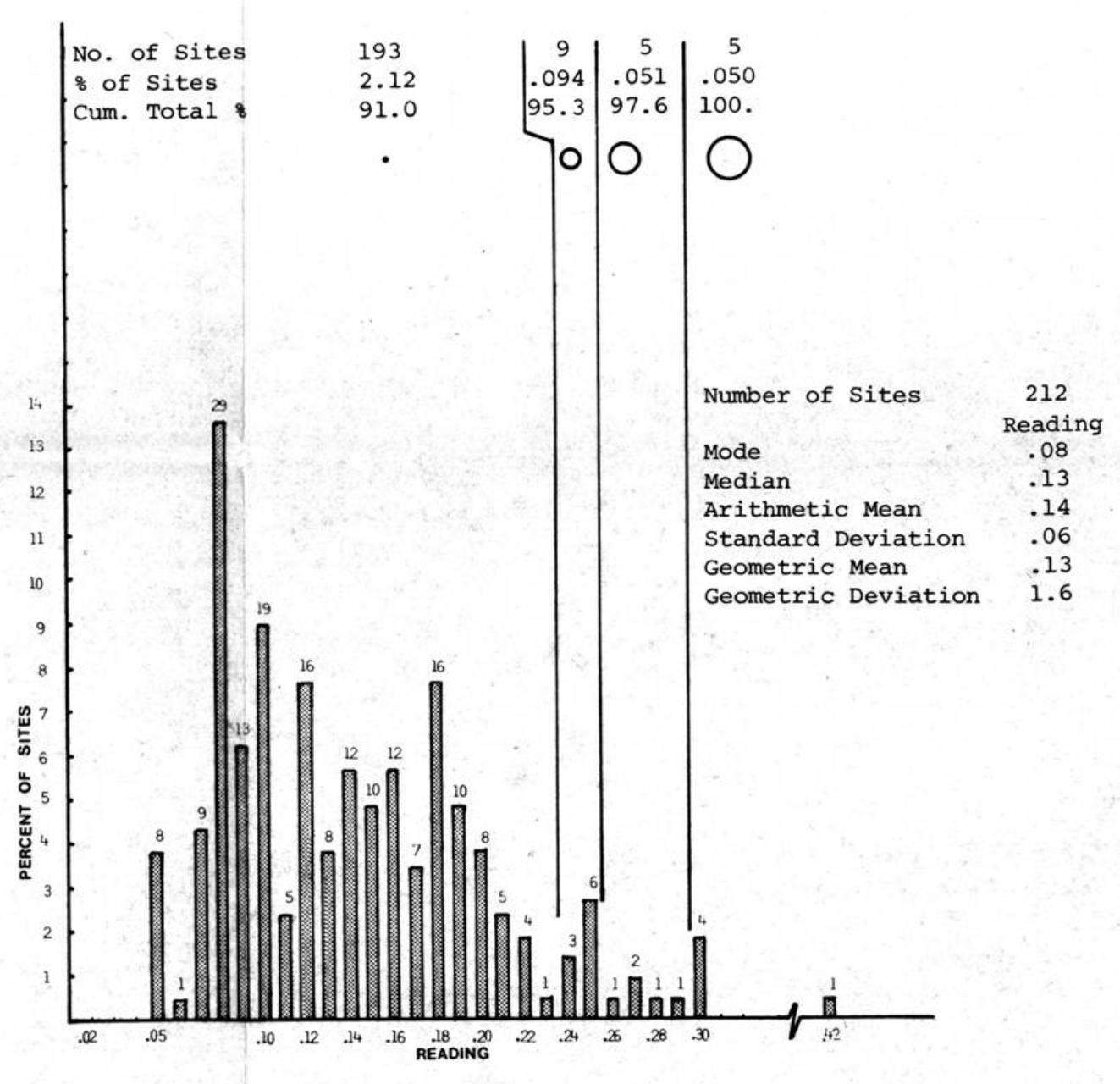


VEGETATED SITES



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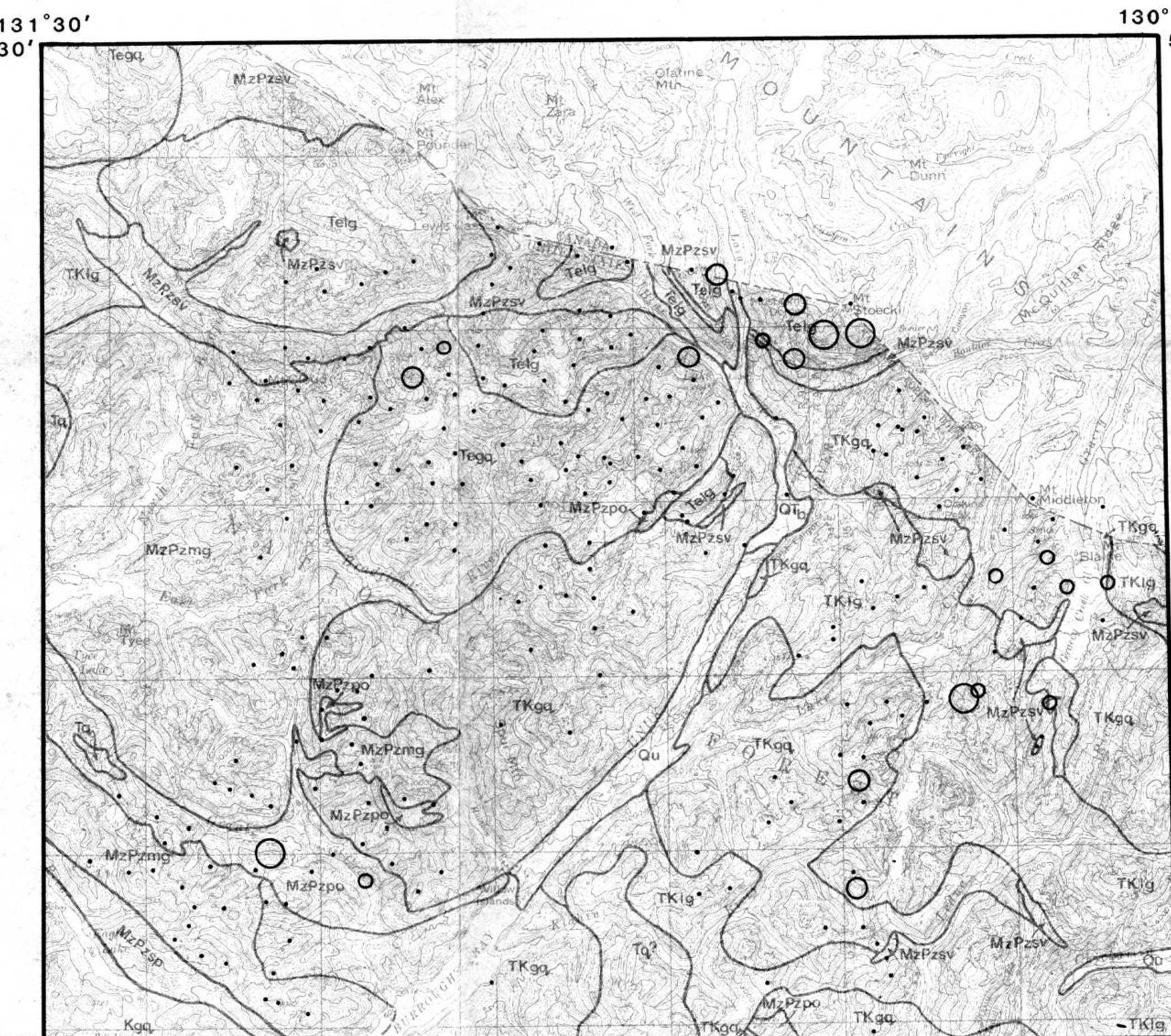
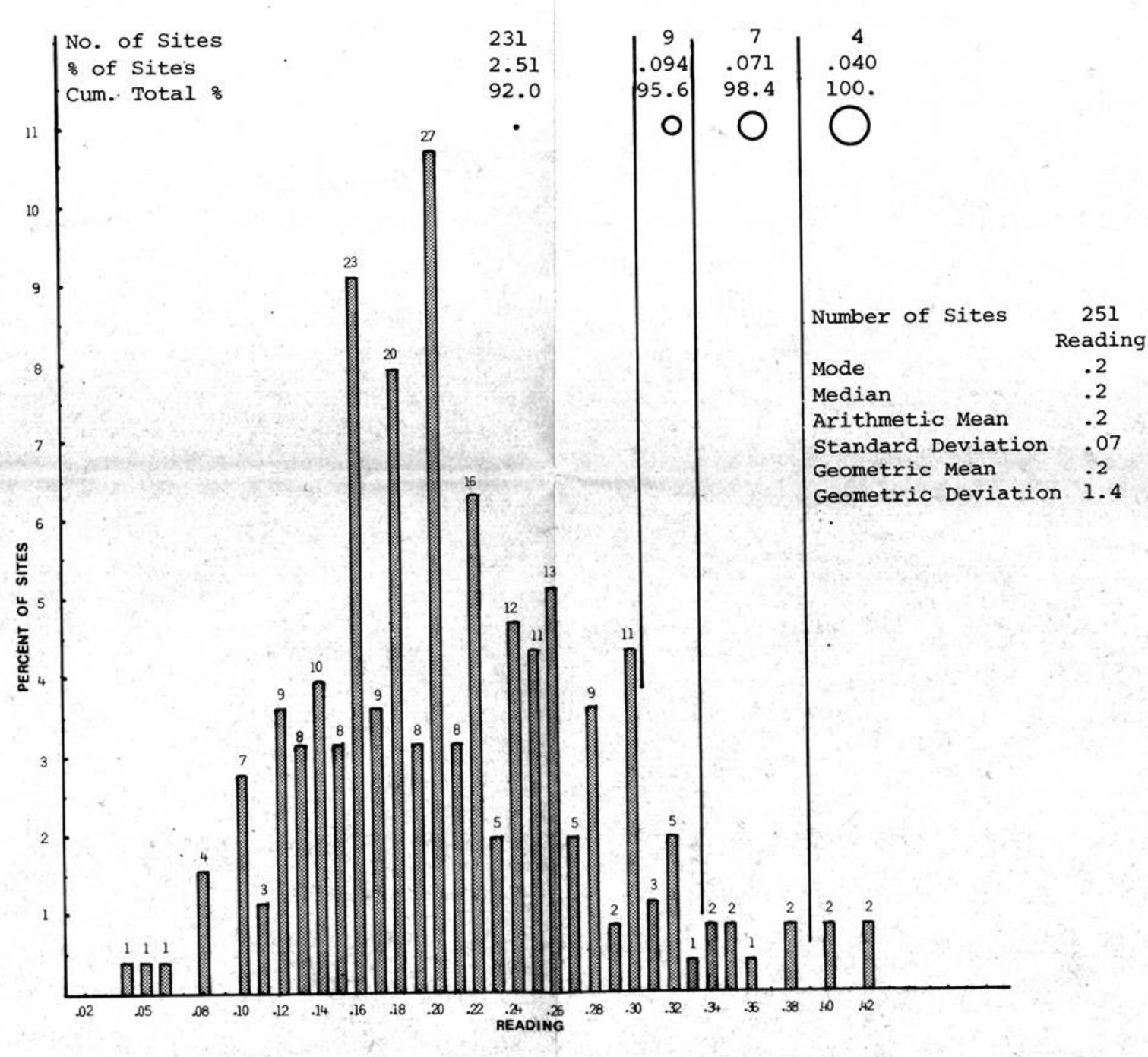
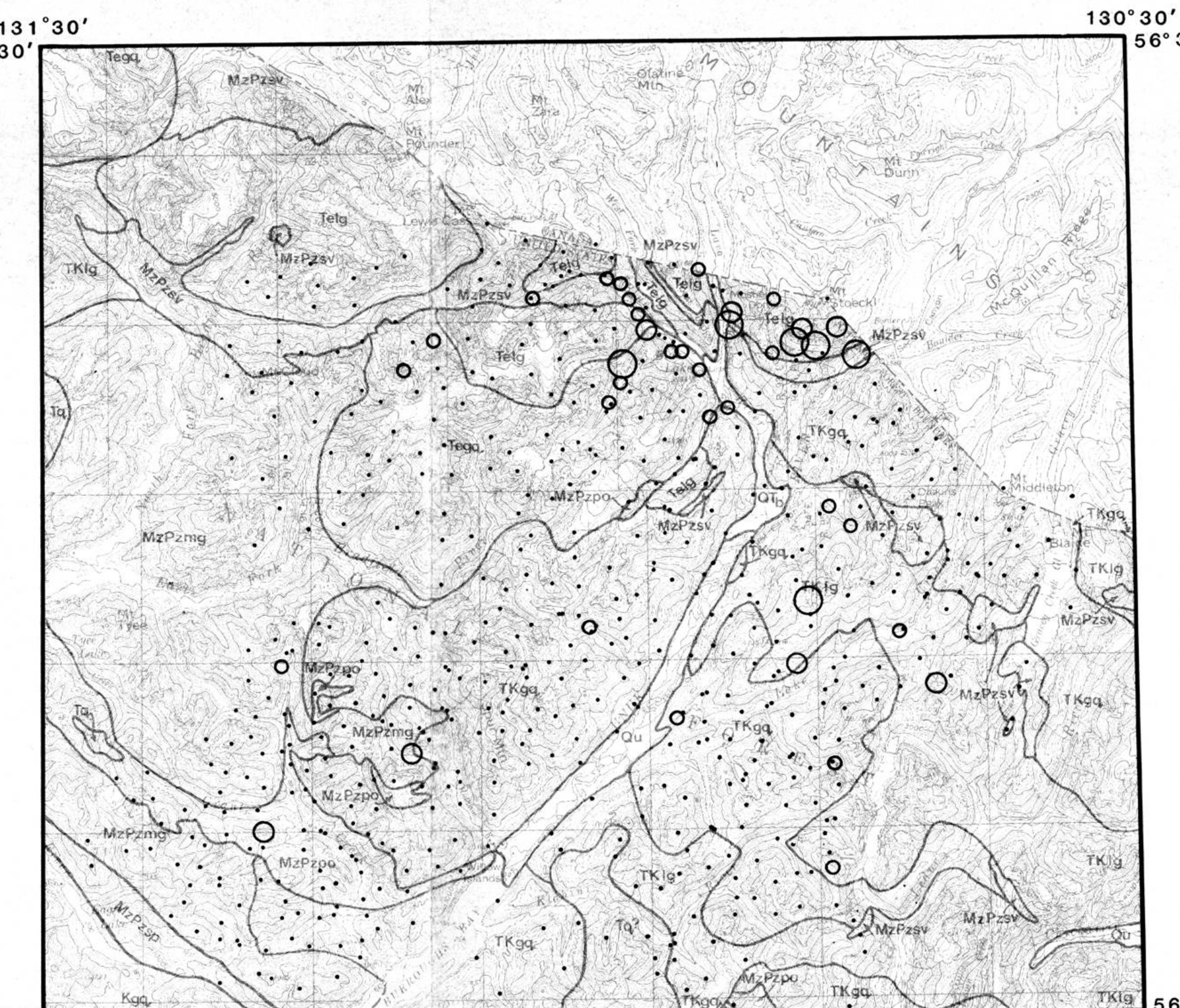


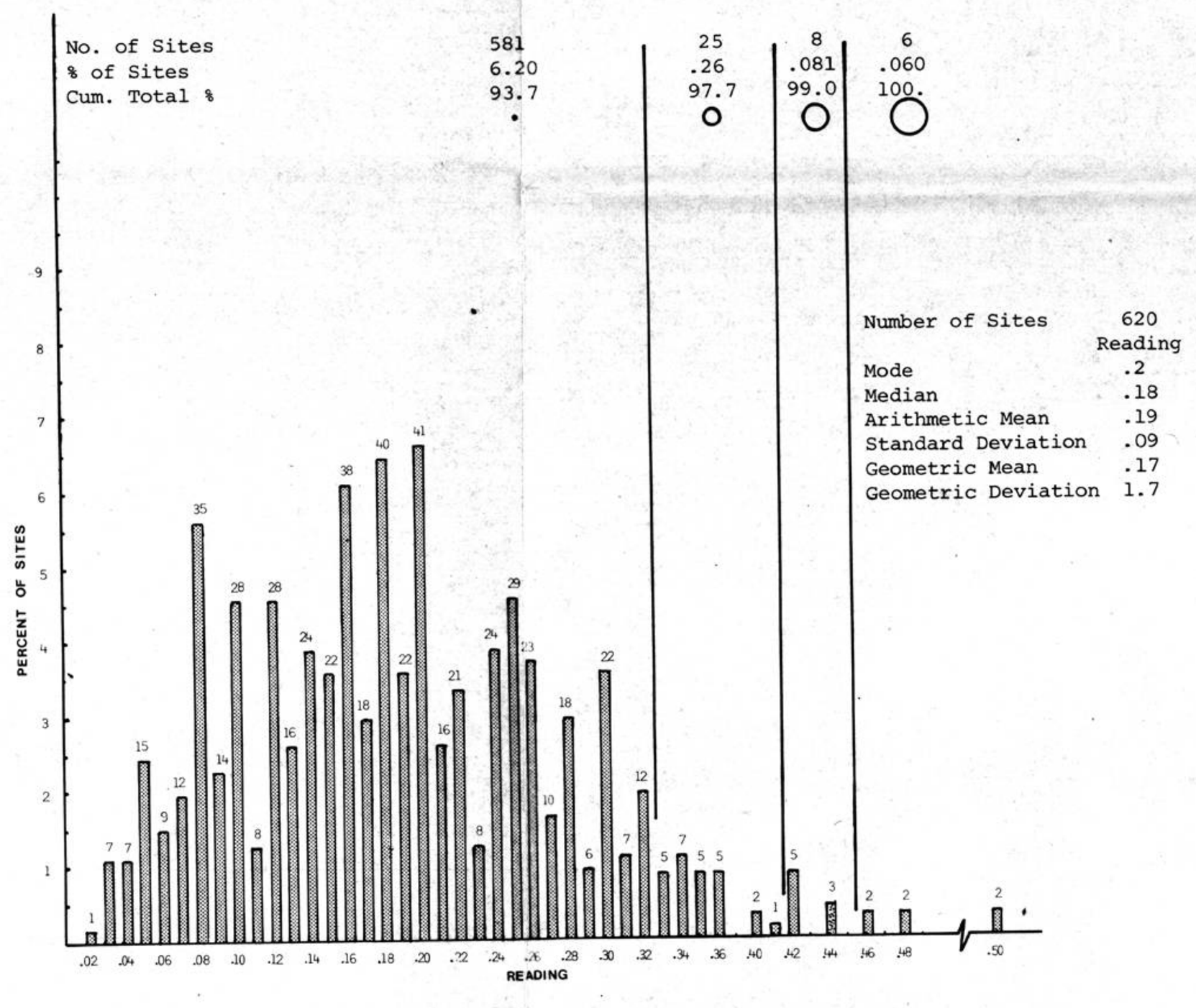
ROCK SITES



ROCK SITES



ALL SITES



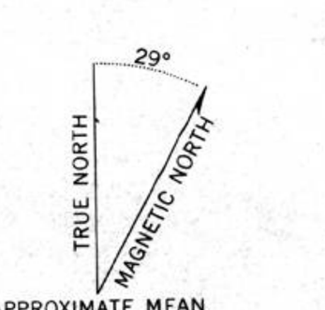
ALL SITES

SCALE 1:250 000

5 0 5 10 15 20 25 MILES

5 0 5 10 15 20 25 KILOMETERS

CONTOUR INTERVAL 200 FEET
DATUM IS MEAN SEA LEVEL



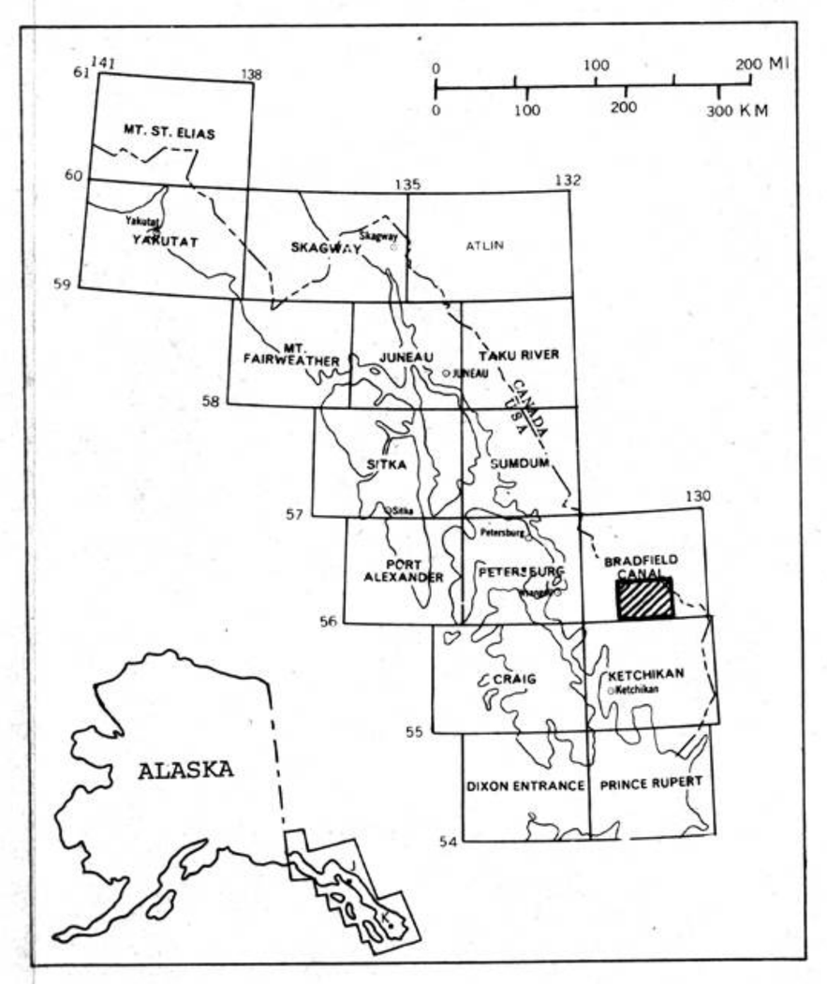
APPROXIMATE MEAN DECLINATION, 1955

Base from USGS 1:250,000 topo series:
Bradfield Canal, 1955, ALASKA-CANADA.

Geology by: H. C. Berg, D. A. Brew, J. E. Decker, M. F. Diggles, R. L. Elliott, J. D. Gallinatti, S. M. Karl, R. D. Koch, M. L. Miller-Hoare, R. P. Morrell, J. G. Smith, and R. A. Sonnevil, 1972-1979.

Unit Descriptions

Qu	UNCONSOLIDATED DEPOSITS, UNDIVIDED (Quaternary)
QTb	BASALT (Quaternary and Tertiary?)
Telg	LEUCOCRATIC QUARTZ MONZONITE AND GRANODIORITE (Eocene)
Tegq	GRANODIORITE AND QUARTZ DIORITE (Eocene)
Tq	QUARTZ DIORITE (Eocene or Paleocene)
TKlg	LEUCOCRATIC QUARTZ MONZONITE AND GRANODIORITE (Tertiary and/or Cretaceous)
TKgq	GRANODIORITE AND QUARTZ DIORITE (Tertiary and/or Cretaceous)
Kgq	BIOTITE-HORNBLENDE QUARTZ DIORITE, PLAGIOCLASE-PORPHYRITIC BIOTITE GRANODIORITE/QUARTZ DIORITE, BOTH LOCALLY CONTAIN GARNET AND/OR EPIDOTE (Cretaceous)
MzPzmg	MIGMATITE AND ORTHOGNEISS, WITH LESSER PARAGNEISS (Mesozoic and/or Paleozoic)
MzPzpo	PARAGNEISS AND ORTHOGNEISS, WITH LESSER AMPHIBOLITE AND MARBLE (Mesozoic and/or Paleozoic)
MzPzsp	SCHIST AND PARAGNEISS, WITH LESSER AMPHIBOLITE AND MARBLE (Mesozoic and/or Paleozoic)
MzPzsv	METASEDIMENTARY AND LESSER METAVOLCANIC ROCKS, WITH LOCAL MARBLE (Mesozoic and/or Paleozoic)



Discussion

Four maps on this sheet show the distribution of sites where gamma-ray measurements were made for each of the four site types: sand and gravel, rock, vegetation, and snow or ice. A fifth map shows sites for all measurements made. Sites with the highest values on each map are represented by three sizes of circles, with larger circles indicating higher values. Other site locations are shown by dots. The range of values associated with each symbol is indicated on the corresponding histogram.

Data from both rock and sand-and-gravel sites form relatively uniform distributions with only very slight asymmetry. Data from vegetated sites are slightly less uniform and less symmetrical. None of the populations is bimodal, nor do any have a strongly extended high-end tail, with the exception of the highest snow-and-ice site value.

Gravel Sites

Gamma-ray readings were made at 116 sand- or gravel-covered sites scattered sparsely across the study area. The highest 11 percent of values are indicated by circles on the map. With three isolated exceptions, all of the highest values for this site type cluster near Blue River and unit Telg near boundary peak Mt. Stoeckl. Most of the Telg rock in this area consists of coarsely potassium feldspar-porphyritic leucocratic quartz monzonite.

Rock Sites

The range of gamma-ray intensities at rock sites is slightly broader, and the population of values somewhat lower, than for the values measured at sand and gravel sites. The apparent shift could result from a combination of factors. The geometry of some landing sites may produce mass effects, with rock sites tending to be flat to convex and gravel sites commonly being flat to slightly concave, often with boulders nearby. Probably the most significant factor is that sand and gravel sites usually have completely exposed rock material, while many sites classified as dominantly rock exposure actually have some partial covering of wet moss, other plant material, or snow.

The highest 8 percent of the rock site values are marked with circles on the map. The only strong clustering appears to be associated with unit Telg near Mt. Stoeckl. Other high values are scattered or show weak groupings.

Vegetated Sites

The range of gamma-ray values recorded at vegetated sites is essentially identical to the range for rock sites; however, the bulk of the values from vegetated sites is shifted toward the lower end of the distribution. This probably results from the effects of gamma-ray absorption produced by the surface covering. This absorption varies from site to site and from time to time in response to different thicknesses (and possibly types) of plant cover, and different amounts of water (which absorbs radiation) and radiation-emitting soil components contained in the plant-rich layers. The bulk of vegetated sites are in the south-central part of the study area, generally at lower elevations, while rock sites are concentrated more to the north. Despite the geographic shift in site density, the difference in population levels is probably due to gamma-ray absorption.

The upper 9 percent of values for vegetated sites are shown by circles on the map. They do not form a recognizable pattern, but seem to be scattered across the area.

Snow and Ice Sites

Only 41 readings were made on snow or ice. With one exception, the values are conspicuously lower than those for any other site type, reflecting significant gamma-ray absorption by water. Since snow or ice depth was not measured but varied greatly at different sites, the amount of absorption of bedrock generated gamma rays probably varied greatly as well. Absorption was essentially complete at many sites where snow depth may have been tens of meters. The low-end snow and ice site values, ranging from 0.02 to perhaps about 0.08, probably indicate the level of gamma ray contribution from atmospheric and cosmic sources.

The upper 10 percent of snow and ice sites are marked on the maps with circles but these four sites are scattered and are too few to allow conclusions. The only reading with a level comparable to those in the high end of other site type distributions occurs in unit TKlg east of the Unuk River. It is not supported by values at nearby rock or vegetated sites.

All Sites Combined

The last map on this sheet shows the distribution of the upper six percent of values for all gamma-ray readings combined. The data were not adjusted to compensate for the different levels of the bulk of readings in each site-type group. As a result, the circles on this map correspond mainly to sand and gravel sites (25) and rock sites (12).

Two thirds of the highest values from the combined data set form a significant cluster in the area south and west of Mt. Stoeckl. The other high values are scattered across the central part of the study area.

An attempt was made to adjust the values of each site type group so that all groups had the same arithmetic or geometric means. This resulted in the high values for the combined data being scattered sparsely in a vague east-west belt across the middle of the study area, and a concentration south and west of Mt. Stoeckl which was less dense than that on the map shown here. This kind of adjustment or "normalizing" of the data is not rigorously valid since the amount of absorption, the effect which the adjustment is intended to counteract, varies greatly from site to site, as well as between site types. As a result, the amount of compensation is usually either too high, resulting in spurious "anomalies", or too low, excessively depressing some values. Adjusting the snow and ice site data in this manner elevates readings which may represent mainly atmospheric and cosmic radiation, to levels comparable with readings representing bedrock radiation from other sites. This "normalized" data is misleading and is not presented here.

Uranium Analyses of Selected Rock Samples

Preliminary determinations of uranium content have been made on granitic rock samples from 32 of the sites in the eastern two-thirds of the area of this gamma-ray survey. Three samples from each major granitic body and nine samples of Telg near Mt. Stoeckl were analyzed. Though small in number, these samples are probably representative of the granitic bodies from which they were collected. Scintillometer readings were not considered when selecting the samples for U analysis and values tend to have the same level within each body; except for Telg near Mt. Stoeckl which has a broad range of values. The values average 2.7 ppm U and only four samples have 5 ppm U or more. All four of these samples (5, 5, 20, and 26 ppm U) are from unit Telg near Mt. Stoeckl.

Conclusion

The most significant concentration of high gamma-ray readings is clustered in the area near Blue River and in unit Telg near Mt. Stoeckl along the Canadian border. This latter area also produced the four highest values of uranium in rock samples. Most high gamma-ray values elsewhere occur singly or in small groups scattered throughout the study area.

This simple type of gamma-ray survey can be a useful adjunct to helicopter-supported fieldwork. It can be accomplished with minimal effort from the field crew and for essentially no additional cost. Recording the readings took only seconds after each landing and no extra flying or landing was done beyond that required for the main project objectives. Readings are significantly affected by the type of ground surface at each site and this factor must be taken into account. The data from rock sites and gravel sites provide the most reliable and useful information. The results can outline areas which may warrant detailed investigation with 4-channel spectrographic equipment, field examination, and chemical analyses.

TOTAL GAMMA-RAY INTENSITIES AT GROUND STATIONS IN THE BRADFIELD CANAL QUADRANGLE, SOUTHEASTERN ALASKA

by
R. D. KOCH, R. L. ELLIOTT, AND RICHARD ROSSITER

1981

This report is preliminary and has not been reviewed for conformity with Geological Survey editorial standards and stratigraphic nomenclature.