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LEGEND

PRECAMBRIAN

8	Undivided granitic rocks; includes 4, 6, and 7
7	Massive granitic rocks; mainly granite but includes some granodiorite and syenite; 7a, local porphyritic varieties
6	Porphyritic granitic rocks; mainly massive, but includes foliated varieties, i.e. porphyritic equivalents of 4 and 7
5	Basic intrusive rocks; gabbro, diorite; minor ultramafic rocks
4	Foliated granitic rocks, chiefly granodiorite; includes some granite and quartz diorite
3	Iron-formation
2	Metasedimentary rocks; derived schists and gneisses; 2a, conglomerate. In part older than 1
1	Chiefly mafic meta-volcanic rocks; minor mafic intrusive and metasedimentary rocks; 1a, volcanic breccia

Heavily drift-covered area

Sand

Geological boundary (approximate)

Bedding (inclined, vertical)

Foliation (inclined, vertical, dip unknown)

Lineament (from air photographs)

Glacial striae

Drumlin, drift ridge

Esker

Small moraine

Mine . . . GOLD

Prospect . . . GOLD

Geology by R. F. Emslie, 1960

See GSC Map 51-1960 for descriptive notes on the geology

Bedding sampling points

Copper concentration of 5 ppm and over are indicated thus . . . 35

Geochemical compilation by R. H. C. Holman, 1960-61

Analyses by M. A. Gilbert

Geological cartography by the Geological Survey of Canada, 1961 and 1964

Approximate magnetic declination, 02° 13' East

Gravel road

Trail or portage

Power line

District boundary

Surveyed line

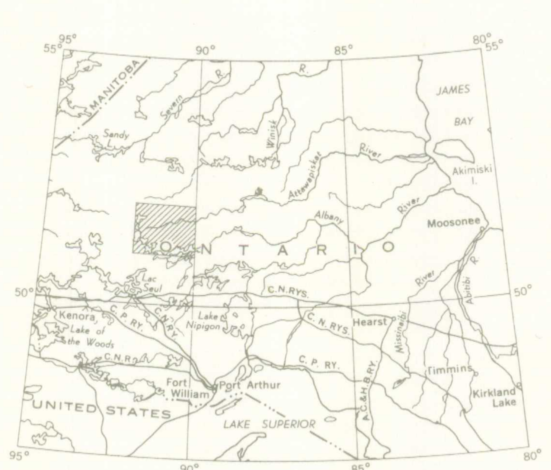
Indian Reserve boundary

Marsh

Rapids

Height in feet above mean sea-level . . . 1218

Base-map prepared by the Surveys and Engineering Branch, 1942



INDEX MAP

EXPLANATORY NOTES

This map is one of a series of seven preliminary geochemical maps, on a scale of 1 inch to 4 miles, presenting the results of a survey of the copper content of bedrock exposed at the surface throughout a 43,000 square mile portion of the Red Lake - Lansdowne House region in northwestern Ontario between longitudes 86 and 94 and latitudes 51 and 53 degrees.

Regional geochemical surveys undertaken for the express purpose of mineral exploration are generally made by sampling stream waters, drainage system detritus, or soils. These techniques have the advantage that secondary dispersion effects, which may be developed in these surficial materials, can often be detected at considerable distances from mineralized zones in bedrock and thus effectively enlarge the exploration target sought. But in this region of low relief and comparatively unweathered bedrock overlain by swamps and glacial deposits, it was thought that the use of these surficial media would introduce especially difficult problems of sampling, chemical analysis and interpretation. Consideration was given, therefore, to the direct sampling of bedrock. This technique has been given little attention previously, probably because of apparent difficulties of sampling and preparing rocks for chemical analysis, together with the fact that certain secondary dispersion effects found in surficial materials may be absent from, or only weakly developed in, bedrock. Apart from these objections, several advantages of working with rocks were apparent: (1) the results would be free from interpretative difficulties arising from the use of surficial materials in a glaciated area; (2) a bedrock study would provide much needed basic data on the regional geochemistry of rocks in this part of the Canadian Shield; and (3) the study would form a sound basis for future work on waters, stream sediments and all other media in this region. For this large scale experimental reconnaissance no special sampling crews were used, and geochemical sampling was restricted to the collection of rock specimens by geological mapping parties without seriously impeding their progress.

Specimens of rock, weighing between 2 and 3 pounds, were taken, where possible, from outcrops at intervals of about a mile along the traverses required for mapping on the scale of 1 inch to 4 miles. At each station a single specimen of the most common rock was taken and its description recorded. The specimens were split and a chip retained for reference. The remainder was passed through a jaw crusher set to deliver about 60 mesh/inch size. After thorough mixing by rolling on paper sheets, a 15 to 20 gram grab sample was taken and ground to finer than 100 mesh/inch size in a ceramic ball mill. This procedure is rapid and contamination is negligible. The finely-ground rock powders were analyzed for copper by fusion with potassium bisulphate followed by colorimetric determination with dithizone using the technique described by Gilbert, GSC Paper 59-3.

The results of the chemical analyses, together with petrological classifications and other data describing each specimen were recorded on electronic data processing cards for statistical treatment. Standard statistical parameters were calculated that describe the distribution of copper between and within the different map-units, and are given in a table and diagrams on the map margin. The arithmetic mean ($\overline{X}$), geometric mean (G), and median (M) are measures of central tendency and indicate how the copper is distributed between the different rocks occurring in the region. The ranges (W) and standard deviations (S_L) show the degree of scatter or spread of the concentrations within each of the map-units. Ranges given in the table refer to the data used in the computations. Higher concentrations were found in a few specimens containing abundant visible sulphide minerals, these are shown on the map but were excluded from the calculations. Cumulative frequency curves were generally found to approximate more closely to straight lines when plotted logarithmically and suggest, therefore, that the copper is usually distributed approximately lognormally in the rocks. For this reason the means ($\overline{X}_L$) and standard deviations (S_L) were calculated on the logarithms of the copper concentrations. ($\overline{X}_L + S_L$), $\overline{X}_L + 2S_L$), and ($\overline{X}_L + 3S_L$) are three levels above which 15.9, 2.3 and 0.13 per cent, respectively, of the individual concentrations will lie (assuming a lognormal distribution) and may be used to investigate local deviations from the means.

Regional variations in the concentrations of copper in rocks are likely to follow patterns resulting from a complex history of lithological, metamorphic and structural events. The importance of lithology as a control is evident from the considerable difference between the means of the copper concentrations for some of the map-units. This strong lithological control is likely to obscure smaller and more subtle variations in the distribution of copper induced by other causes. Recognition of this fact is important for a proper interpretation of the data. No satisfactory way could be found of presenting the geochemical data on a single map suitable for preliminary publication so that the influences of different controls over the distribution of copper were clearly shown. For this reason the results are given as simple plots of the copper concentrations determined from each specimen.

MAP 50-1963

GEOCHEMISTRY
(COPPER IN BEDROCK)

LAKE ST. JOSEPH

KENORA AND THUNDER BAY DISTRICTS

ONTARIO

Scale: One Inch to Four Miles = $\frac{1}{253,440}$

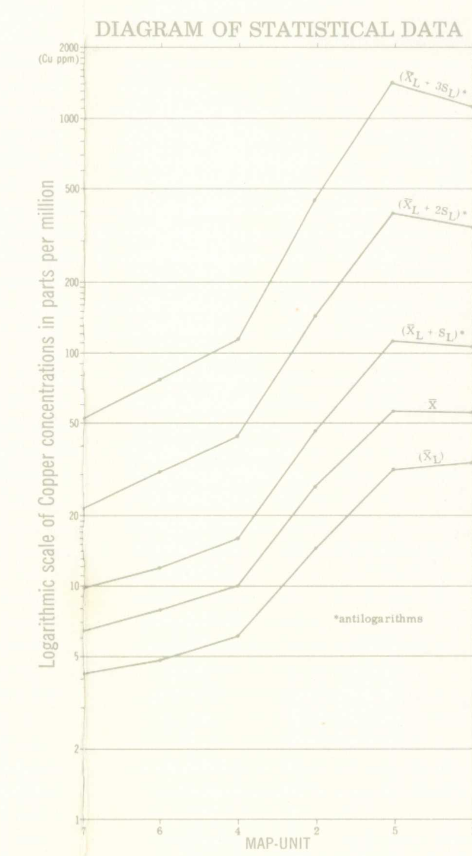
Miles
4 2 0 4 8 12

TABLE OF STATISTICAL DATA

Map Unit (a)	Area of Outcrop: sq. miles A (b)	Area of Outcrop: per cent (c)	Number of Specimens n	Area per Specimen A/n sq. miles	Copper in parts per million (Cu ppm): Range W (d)	Median M (d)	Arithmetic mean $\overline{X}$ (e)	Logarithmic mean $\overline{X}_L$ (f)	Logarithmic mean G	Standard deviation S_L (g)	$\overline{X}_L + S_L$	$\overline{X}_L + 2S_L$	$\overline{X}_L + 3S_L$
8	341	6	41	8.3	<5 to 160	-	13	-		-	-	-	-
7	1567	29	662	2.4	<5[d] to 145	<5	6	0.6268	4*	0.3651	0.9919 10*	1.3570 23*	1.7221 53*
6	1142	21	364	3.1	<5 to 85	<5	8	0.6852	5*	0.4021	1.0873 12*	1.4894 31*	1.8915 78*
5	10	<1	40	0.25	<5 to 370	50	57	1.5013	32*	0.5515	2.0528 113*	2.6043 402*	3.1558 1430*
4	1388	26	390	3.6	<5 to 120	5	10	0.7928	6*	0.4231	1.2159 16*	1.6390 44*	2.0621 115*
2	160	3	81	2.0	<5 to 500	20	27	1.1688	15*	0.4990	1.6678 47*	2.1668 147*	2.6658 463*
1	782	15	234	3.3	<5 to 700	50	56	1.5285	34*	0.5080	2.0365 109*	2.5445 350*	3.0525 1130*
Total	5390	100	1812	3.0	<5 to 700						*Antilogarithms		

(a) - For explanation of Map-units see legend
(b) - Rough estimates that include the areas of all lakes. Total area of map is approximately 6000 sq miles, thus about 10 per cent of the area is obscured by cover other than water
(c) - Expressed as percentages of 5390 sq miles
(d) - <5 = less than 5 ppm Cu (detection limit of analytical method); arbitrarily assigned a value of 2 ppm for all computations
(e) - $\overline{X} = \Sigma \overline{X}/n$ where $\overline{X}$ = concentration of copper (ppm) in each specimen
(f) - $\overline{X}_L = \frac{\Sigma \log \overline{X}}{n}$ (logarithms to base 10 used throughout)
antilog $\overline{X}_L$ = G (geometric mean)
(g) - S_L = standard deviation calculated on logarithmically transformed data

DIAGRAM OF STATISTICAL DATA



CUMULATIVE DISTRIBUTION CURVES FOR MAP-UNITS DESCRIBED IN LEGEND