

DISTRIBUTION OF ACID VOLCANIC ROCKS  
IN THE SUPERIOR PROVINCE  
OF THE CANADIAN SHIELD

by

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## INTRODUCTION

Mapping and petrographic studies within the Shield area have been extended to a point where integration of the mass of data included in published reports and maps should provide a much more accurate view of conditions prevailing during the Precambrian time than was heretofore possible. This thesis is a contribution toward that end. The particular task undertaken was a regional study of the character and distribution of acid volcanics within that part of the Southern Shield referred to by Gill (1949) as the "Superior Province".

The method followed was to assemble all published information relating to acid volcanics; to plot on maps such data as can be shown graphically and to summarize the rest.

Five maps have been prepared of various districts in the Province where these rocks occur. Descriptions of occurrences, including Tables of Formations and references have been assembled in an Appendix.



### MAPPING PROCEDURE

The maps show the locations and rock types of the main occurrences of acid volcanic rocks in the Superior Province of the Canadian Shield.

Six maps have been prepared as follows:

|                       |   |       |        |   |           |
|-----------------------|---|-------|--------|---|-----------|
| Chibougamau District  | - | scale | 1 inch | = | 4 miles   |
| Southwestern Quebec   | - | "     | "      | " | "         |
| Northeastern Ontario  | - | scale | 1 inch | = | 8 miles   |
| Lake Nipigon District | - | "     | "      | = | " "       |
| Kenora Lake District  | - | "     | "      | " | " "       |
| Superior Province     | - | scale | 1 inch | = | 60 miles. |

Each occurrence has been mapped under the pattern of the predominant rock type. Where the occurrence consists of more than one rock type, as is often the case, letters indicate the more important ones in the group. Tables of Formations in the Appendix provide a more complete description of the sequence in the area.

Many maps of shield areas show Keewatin Volcanics as a unit, making no distinction between acid and basic rocks. Such areas usually are underlain by a mixed assemblage, in which interlayered acid lavas and pyroclastics comprise a minor part (probably not more than 10 percent) of the whole group. These areas have been shown on the thesis maps by close-spaced cross-hatching.

Basic volcanics have been mapped so that their relative abundance and distribution may be compared with that of the acid volcanics. The areas underlain entirely by basic

volcanics have been shown by wide-spaced crosshatching. X

Unless otherwise noted the volcanics on the thesis maps have all been classed as Keewatin in age. Exceptions are the "Timiskaming" volcanics of Northeastern Ontario; the "Haileyburian", "Pre-Algoman" and "Uchi" Series of Western Ontario.

The following published maps of the Geological Survey of Canada were used as base maps:

| <u>District</u>       | <u>Base Maps</u>                                   |
|-----------------------|----------------------------------------------------|
| Chibougamau District  | - Chibougamau Sheet, West Half<br>G.S.C. Map 398 A |
|                       | Chibougamau Sheet, East Half<br>G.S.C. Map 397 A   |
|                       | Opemisca Sheet, East Half<br>G.S.C. Map 401 A      |
| Southwestern Quebec   | - Rouyn-Harricana Area<br>G.S.C. Map 271 A         |
| Northeastern Ontario  | - Lake Huron Sheet<br>G.S.C. Map 155 A             |
| Lake Nipigon District | - Lake Nipigon Sheet<br>G.S.C. Map 308 A           |
| Kenora Lake District  | - Kenora Lake Sheet<br>G.S.C. Map 266 A            |
| Superior Province     | - Geological Map of Canada<br>G.S.C. Map 820 A.    |

#### Sources of Error in Mapping

1. Not all of the Superior Province has been surveyed in detail and it is probable that many outcrops of acid volcanics have not been mapped; a conservative guess is that about two-thirds of them appear on the thesis maps. It is very probable, however, that most, if not all, of the largest occurrences have been reported in Southwestern Quebec, Chibougamau District and North-

eastern Ontario. The percentages of acid volcanics arrived at for these districts should be good approximations to the true values. There are not so many large scale maps available for the districts of Lake Nipigon and Kenora Lake and if all of the acid volcanics in these areas were reported there would most likely be an increase of 1 or 2 percent over the percentages shown in Table No. 1.

2. Minor amounts of acid volcanics which occur interbedded with the predominantly basic volcanics of the Keewatin assemblage have not been shown on the thesis maps unless they comprise an appreciable part (10 percent or more) of the assemblage. These minor unmapped rocks together with those which occur in areas where no detailed surveys have been carried out probably do not make up more than one third of the total area of acid volcanics in the Province. Considering Southwestern Quebec as an example this third would amount to 130 square miles and would raise the percentage of acid volcanics to 13 instead of 10 percent. The addition of the unmapped third to each of the other districts gives the higher percentage shown in the right hand column of Table No. 1. The writer considers these higher percentages to be maximum values since it is almost certain that at least two thirds of the acid volcanics have been mapped.

3. Interbedded acid lavas and pyroclastics have been shown either as lavas or pyroclastics entirely depending upon which predominates in the group. Where there was no indication as to the relative proportions of each, the group has been shown as being made up of lavas. Letters beside each occurrence show what other rocks occur in the sequence and Tables of Formations

in the Appendix give more detailed information about the rock types in each occurrence. The effect of this procedure has been to exaggerate the extent of some areas of acid lavas since in these instances a considerable part of the group may consist of pyroclastic rocks. This would not change the overall areal extent of acid volcanics shown in the area.

4. In a few areas minor amounts of basic volcanics occur interbedded with the acid lavas and pyroclastics. They have been included as part of the acid assemblage unless some distinction was made on the published maps of the areas so that it was possible to eliminate them. The effect of this error has been to increase slightly the area shown to be underlain by acid rocks; however, this error opposes that due to the omission of minor acid volcanics in a predominantly basic assemblage.

5. Acid flows are not continuous over wide areas. They tend to form thick successions of flows of limited areal extent such as, for example, the 1400 feet thick layer of flows in the Noranda District. If volume and not area were being considered the acid rocks would bulk appreciably larger in the Keewatin assemblage than they appear to do on the surface.

#### AREAL EXTENT OF ACID VOLCANICS

Acid lavas and pyroclastics comprise about 5 percent of that area of the Superior Province which is underlain by volcanic rocks of all types, acidic to basic, and about 0.5 percent of the total area of the Province. These figures are

maximum values. They were obtained from the writer's estimate that two thirds of all of the acid volcanics in the Province appear on the thesis maps. The percentages, therefore, include those areas containing acid rocks, which have not yet been mapped in detail, as well as minor amounts of the acid volcanics which occur with predominantly basic assemblages and could not be mapped separately.

Consideration of all the possible sources of error involved in the calculation of the areal extent of rocks spread over some 200,000 square miles and it becomes apparent that the percentages obtained can be at best, only estimates of the true values. In the writer's estimate, 3 to 5 percent is a fairly close approximation to the actual percentage of acidic volcanics in the volcanic assemblage of the Superior Province.

TABLE NO. 1

AREAL EXTENT OF ACID VOLCANICS IN SUPERIOR PROVINCE

| DISTRICT                | AREA OF<br>ACID LAVAS<br>(SQ. MILES) | AREA OF<br>ACID<br>PYROCLASTICS | AREA INTER-<br>BEDDED BASIC<br>AND ACID VOL-<br>CANICS | AREA VOL-<br>CANICS OF<br>ALL TYPES<br>BASIC TO<br>ACID | TOTAL<br>AREA<br>OF<br>DISTRICT | % OF DIS-<br>TRICT<br>UNDERLAIN<br>BY ACID<br>VOLCANICS | % OF VOLCAN-<br>ICS OF<br>ALL TYPES<br>WHICH ARE<br>ACID |
|-------------------------|--------------------------------------|---------------------------------|--------------------------------------------------------|---------------------------------------------------------|---------------------------------|---------------------------------------------------------|----------------------------------------------------------|
| CHIBOUGAMAU             | 100                                  | 85                              | 40                                                     | 2,600                                                   | 9,250                           | 2%                                                      | 8 - 10%                                                  |
| SOUTHWESTERN<br>QUEBEC  | 240                                  | 100                             | 500                                                    | 4,000                                                   | 9,300                           | 4                                                       | 10 - 13                                                  |
| NORTHEASTERN<br>ONTARIO | 225                                  | 45                              | -                                                      | 6,800                                                   | 31,000                          | 1                                                       | 4 - 5                                                    |
| LAKE NIPIGON            | 100                                  | 15                              | 140                                                    | 4,000                                                   | 65,000                          | 0.2                                                     | 3 - 4                                                    |
| KENORA LAKE             | 100                                  | 15                              | 275                                                    | 6,300                                                   | 65,000                          | 0.2                                                     | 3                                                        |
| SUPERIOR<br>PROVINCE    | 765                                  | 260                             | 955                                                    | 23,700                                                  | 179,550                         | 0.5                                                     | 3 - 5                                                    |

## DISTRIBUTION OF ACID VOLCANICS

### Distribution in Keewatin Time

There is no evidence in the Superior Province to show that the extrusion of acid volcanics was confined to any particular period of Keewatin time. The sequences from all parts of the 200,000 square miles of the Province show that the acid lavas and pyroclastics occur in all possible combinations with the basic volcanics and sediments of the Keewatin assemblage and are distributed throughout the assemblage from top to bottom. It is reasonable to believe that the acid volcanics were similarly distributed throughout the part of the Keewatin sequence that was removed by erosion. Therefore, it is probable that the present erosion surface of the Shield presents a representative sample of the original distribution of these rocks in the Keewatin assemblage.

### Irregular Volcanic Sequences

According to Tyrrell (1929), it often happens in present day volcanic areas that no regularities can be discerned in a sequence, due to masking of significant relations by the overlapping of products of adjacent volcanoes or through other accidental circumstances attending eruptions. However, "a long succession is often punctuated, so to speak, by the appearance of a constant type, especially basalt and rhyolite. As Harker has shown, this may be due to fresh accessions of magma bringing about repetitions of the same sequence. Thus, in the volcanic succession of the Berkeley Hills, near San Francisco, writing a for andesite, b for basalt, r for rhyolite tuff, the sequences are as follows:

Lower Berkeleyan Formation - a, b, r; a, b, r.

Upper Berkeleyan Formation - a, b, r; a, b.

Campan Formation - a, b, r, b, r.

Many successions begin with rhyolite or some other acid or intermediate lava and end with basalt, the intervening members being of somewhat variable acidity.....in the Mount Dore region of Auvergne the sequence from Mid-Pliocene to Recent is as follows: phonolite; rhyolite; basalt; andesite and basalt; acid tuffs; acid andesite and trachyte; augite-andesite and tephrite; phonolite; plateau-basalts; basalt.....it is probable that in the majority of cases the significant order of eruption is obscured by adventitious circumstances". One would expect to find an irregular distribution of acid volcanics in Keewatin time.

#### Acid Volcanics and Marginal Orogenic Belts

With regard to the areal distribution of acid lavas and pyroclastics, it is possible that the vents were strung out along lines of fracture in orogenic belts similar to those of the present day in the Dutch East Indies and other parts of the circum-Pacific belt of volcanoes.

Gill (1948) states "it may be observed that the width of the Superior belt with east-west trends is greater than any later mountain-built belt known unless we include composite belts formed by two or more periods of mountain building such as the western Cordilleran System in North America.....one could imagine an area of block faulting in which lavas were poured out and rapid sedimentation of conglomerates and greywacke occurred in local basins producing the stratigraphic relations cited, but the uniform folding of the whole area in one episode



so as to preserve a series of strips of trough deposits is not a mechanically feasible concept....any satisfactory explanation of the relations described must include a succession of foldings of volcanics and sediments laid in a series of troughs. Presumably downwarping, loading by flows and sediments, folding and intrusion would have followed one another as in later mountain-built belts, and this pattern must have been repeated many times. Under this concept the sequences are similar, but the formations in different folded belts are not contemporaneous".

This concept of a succession of folded belts in connection with which there were enormous outpourings of lava forms a major part of the theory, originally proposed by A. C. Lawson, that North America has steadily grown by the addition of marginal orogenic belts around a nucleus formed early in the earth's history in the Hudson Bay region. A succession of belts would be formed in each of which the acid volcanics would be irregularly distributed; similar sequences of acid rocks should occur in an east-west direction across the Superior Province. If, as Gill states, the mountain built belts were some 40 to 50 miles wide, we should expect to find these sequences a short distance apart in a north-south direction across the Province. Close-folding has complicated the picture somewhat but there is some slight evidence that these similar sequences exist. In the Lake Nipigon and Kenora Lakes Districts three roughly parallel, elongated belts of volcanics some 50 miles wide extend east-west across the region. In the central belt of volcanics of Kenora Lake District an almost continuous occurrence of rhyolite stretches approximately 100 miles across the northeast arm of Lake of the Woods. This is remarkable if one considers the

usual 2 or 3 miles length of a rhyolite flow. These three belts continue into Lake Nipigon District. A widely separated, but similar sequence of rhyolite, agglomerate and tuff extends for 200 miles along the north shore of Lake Superior in the southern most belt. There are few acid volcanics in the northern most belts and few similar sequences; to the east these belts are lost under the Paleozoic rocks south of James Bay. In Northeastern Ontario, Southeastern Quebec and Chibougamau District there is a greater concentration of volcanics but it is difficult to distinguish definite trends. There are, however, fairly well-defined localizations of rock types, such as the rhyolite, tuff, agglomerate of Shiningtree area in Ontario and the great amount of rhyolite in Noranda Area. Dacite is common around Amos; nowhere else in the Superior Province is it found in such great amounts. Long belts of trachyte which occur south of Bourlamaque are the largest occurrences of this rock in the Superior Province.

There are three belts of volcanics in the Chibougamau District; however, these are only ten miles or so wide and are separated by about the same distance so it is unlikely that they have much significance as regards the mountain belt theory. Rhyolite, tuff and agglomerate, together with long belts of feldspathic sediments which are thought to represent tuffs, occupy most of the northern belt of volcanics in this district. The volcanic belt that extends through Northeastern Ontario and Southeastern Quebec to Chibougamau has an average width of some 70 miles and might be considered as a separate belt. There are, however, few similar sequences evident in the belt and if it is

considered as a unit we are left without any northern belts. These belts, theoretically should outcrop east of James Bay if we consider them to be extensions of the volcanics hidden under the Paleozoic rocks.

### 1. Distribution in Chibougamau District

Acid volcanic rocks consisting of rhyolite, trachyte, feldspathic tuffs and coarse fragmentals comprise from 8 to 10 percent of the 2600 square miles of volcanic rocks to be found in the Chibougamau District, and about 2 percent of the total area of 9250 square miles covered by the thesis map.

The most common types of occurrences are (1) interbedded rhyolite, tuff and agglomerate; and (2) feldspathic sediments, probably tuffs. Each is found in greatest abundance in the northeastern part of the district; the lava flows and associated pyroclastics in the area surrounding Opemisca Lake and the tuffs to the northeast, south and west of the same area. Rhyolite also occurs in abundance on the south shore of Opawica Lake and is to be found in scattered patches throughout the western part of the district along with a few scattered remnants of tuff. Tuff is abundant along the shores of Lac aux Loutres.

Coarse fragmental rocks associated with lavas form an important part of the assemblage that extends eastward from Portage Bay to Tache Lake.

Trachyte occurs with rhyolite in the vicinity of Lake Chibougamau and to the south of Lake Waswanipi. Dacite is to be found only in one outcrop, on the shores of Lac la Treve.

### 2. Distribution in Southwestern Quebec

Acidic lavas and pyroclastics comprise from 10 to 13

percent of the 4000 square miles of volcanic rocks in South-western Quebec and 4 percent of the total area of 9300 square miles underlain by rocks of all types.

Acidic lavas occur most frequently in the Noranda Area where rhyolite, trachyte and dacite are plentiful throughout an area of some 1000 square miles. Rhyolite is the dominant volcanic rock in the district. It is found to the northeast, northwest and southeast of Lake Dufault. A large area of predominantly rhyolitic lava occurs to the north of Lake Duparquet.

Dacite and rhyolite together with large areas of associated tuffs, breccias and agglomerates underlie approximately 500 square miles in the Amos Anticline and Duvernay Syncline north of Amos. Dacite is the predominant acidic lava in this district.

Acidic tuff and rhyolite interbedded with breccia and agglomerate occur as scattered outcrops north, east and south of Bourlamaque batholith. Much of the acidic volcanics in this area is interbedded with basic volcanic rocks. Several long narrow bands of trachyte interbedded with andesite and pyroclastics outcrop to the south of Bourlamaque.

Interbedded acidic and basic volcanics underlie Cléricey and La Pause Townships to the east of Lake Dufault.

It will be noticed that the three districts in which acidic volcanics appear to be concentrated, namely Noranda, Amos and Bourlamaque, are also those in which the most detailed mapping has been done. It is probable that more detailed work in the area north of Cléricey - La Pause will eventually show the presence of a considerably greater number of occurrences of these rocks than at present appears on the map. In particular it will be

noted the abrupt termination of the volcanics to the west of Amos and to the northwest of Lake Duparquet. In addition, further work will also show an extension of the Blake River and Malartic Groups with which there are associated considerable areas of acidic volcanics.

### 3. Northeastern Ontario

Of the 31000 square miles of rocks included by the thesis map of Northeastern Ontario approximately 300 square miles, or 1 percent, are composed of acidic volcanics. Acidic volcanics comprise about 5 percent of the total area of 6800 square miles underlain by volcanic rocks of all types, acidic to basic.

Acidic lavas are about 5 times as abundant as pyroclastics and the most common acidic lava in the District is rhyolite. Trachyte is common in Kirkland Lake area, dacite has been reported in notable amounts in Langmuir Township and in the vicinity of the Hollinger Mine.

The greatest concentration of acidic lavas and pyroclastics is in Shiningtree - Bannockburn Gold Area where rhyolite with tuff and agglomerate underlies much of the district. In nearby Tyrrell Township, Timiskaming rhyolite, trachyte and tuff overlies Keewatin rhyolite, tuff and agglomerate. The only other occurrence of Timiskaming volcanic rock is in the vicinity of Kirkland Lake where trachyte, breccia and rhyolite overlies rhyolite of Keewatin age. Occurrences of rhyolite, tuff and agglomerate are plentiful in the Swayze - Rush Lake area. In Porcupine District, scattered outcrops of rhyolite and dacite are present. Long narrow bands of rhyolite extend for several

miles between Harker and Beatty Townships. Rhyolite, with associated pyroclastic rocks, is present along the southern shore of Lake Timagami.

#### 4. Lake Nipigon District

Acidic volcanics comprise from 3 to 4 percent of the total area of 4000 square miles of volcanic rocks in the Lake Nipigon District of Ontario. Of the 65,000 square miles of rocks of all types in the district, approximately 0.2 percent are acid volcanics.

The greatest concentration of these rocks is to the east of Lake Nipigon where scattered outcrops of rhyolite, trachyte, dacite and associated pyroclastics are interbedded with the predominantly basic volcanic rocks. Rhyolite, with associated tuff and agglomerate is relatively abundant in Big Duck - Aquasabon and Schreiber areas. Kowkash - Ogok, contains several large outcrops of rhyolite. Dacite is scarce; it is found in a few outcrops in the vicinity of Keezhik Lake and interbedded with rhyolite and pyroclastic rocks in Gorham Township.

Undifferentiated, mixed acidic and basic rocks form a long band which extends eastward from Lake Nipigon to Long Lake and contains several important mining localities, among them the Little Long Lac District.

More occurrences of acidic volcanic rocks will be reported, probably, in various parts of the Lake Nipigon District which are at present shown to be underlain by undifferentiated volcanics. But it is evident that there is present in this District, a considerably smaller percentage of acidic lavas and

pyroclastics than there is in the region to the east, in Northeastern Ontario and Western Quebec.

#### 5. Kenora Lake District

This district, in which relatively little detailed surveying has been carried out, as compared with the more settled areas to the east, contains the lowest number of reported occurrences of acidic volcanic rocks in the Superior Province.

Approximately 3 percent of the 6,300 square miles of volcanics consist of acidic types. About 0.2 to 0.3 percent of the total area of 65,000 square miles is underlain by acidic volcanics.

Numerous scattered outcrops of rhyolite which extend for some eighty miles along the northeastern shore of Lake of the Woods comprise the greater part of the acid volcanics in the district. Rhyolite is also relatively abundant along the northwestern shore of Birch Lake and occurs with agglomerate and tuff south of Wabigoon Lake. Interbedded tuff, breccia and rhyolite occurs as a long band for some twenty miles along the southern shore of Sturgeon Lake. Scattered occurrences of rhyolite and pyroclastics are numerous in the Steeprock Lake area.

Trachyte is scarce, occurring, in notable amounts, only to the east of Straw Lake where it is found interbedded with rhyolite, agglomerate and tuff.

Dacite has not been reported in the Kenora Lake District in any occurrence worthy of note.

A large area of mixed and interbedded acidic and basic lavas and pyroclastics lying to the northwest of Lake St. Joseph

may contain considerable areas of acidic types. It is probable that more detailed work in the future will reveal acidic volcanics also in the, at present, undifferentiated volcanics which underlie some ten percent of the Kenora Lake District.



CHARACTERISTICS OF ACID VOLCANICS OF THE SUPERIOR PROVINCEPetrography

Acid volcanics occurring in the Superior Province include rhyolite, trachyte, dacite, acid tuffs, explosion breccias, flow breccias and agglomerates. The names in use in the field have about the following meanings, according to Cooke, James and Mawdsley (1935):

"Rhyolite: light coloured, fine-grained lavas with much free quartz, commonly porphyritic. They are hard, brittle, siliceous, little altered, mostly light-grey to white. Quartz phenocrysts average from 1-2 mm in diameter. The feldspar is commonly albite or oligo-albite. Much of the feldspar forms small phenocrysts; in some varieties feldspar forms half the rock. Ferromagnesian minerals are mica and chlorite. In lighter coloured varieties muscovite is present, darker varieties contain varying amounts of chlorite. The alteration of these rocks is less than that of any other type. Where phenocrysts are conspicuous and particularly where there is some suggestion that the rock may not be a lava flow but an intrusive, it is common practice to term the rock a quartz-porphyry, or a feldspar porphyry. The so-called feldspar porphyries may be either trachytes or rhyolites. Rhyolite flows are thick and of limited areal extent.

Trachyte and Dacite: vary from dark-greenish to light grey. The darker varieties of dacite resemble andesites in the field but thin sections show quartz. The lighter varieties of dacite resemble trachyte plus quartz. Most of the trachytes and dacites in the field are light grey, fine grained rocks, grey

lavas. The principal original constituent is a plagioclase feldspar near albite in composition; some orthoclase may be present but the groundmass is commonly so fine that it is difficult to determine its presence."

#### Tuffs, breccias and agglomerates:

The pyroclastic rocks occur most commonly as thin beds separating lava flows. However, in Southwestern Quebec, thicknesses of several thousand feet of these rocks have been recorded.

Acidic varieties are more abundant than the basic. These rocks range from fine grained, cherty tuffs to breccias and agglomerates containing blocks up to twenty feet across.

Beds of tuff may be of wide extent. Waterlain tuff may have a slaty or a silty texture, other types are cherty. Some tuffs are finely laminated, others have a sand-like grain and are commonly highly feldspathic as for example those in the Chibougamau District.

Coarse fragmental volcanics are associated usually with lava flows and in places make up a great proportion of the total thickness of the volcanic assemblage. In general the pyroclastic rocks have the same composition as the lava flows with which they are associated.

#### Structures and Textures

Lava Flows: In general, the lava flows are thick and of limited areal extent. The greatest uninterrupted succession of rhyolite flows recorded in the Superior Province, that in the Noranda District, has a thickness of 14,000 feet (Wilson 1932).

The average length of individual flows probably

averages one to three miles.

Individual members of acid groups with superior resistance to weathering frequently outline the structures of the formations in which they occur. Good examples can be seen near Amos and in the vicinity of Lois Lake in Southwestern Quebec; a series of plunging folds is well shown in the area west of Lake Chibougamau.

Rhyolite dykes are present in several areas probably representing feeders to rhyolite lava flows.

Pillow structures are rare in rhyolite and trachyte. A noteworthy occurrence is to be found in the acidic volcanics of Desvaux and Ogima Lakes in Southwestern Quebec where the rocks are reported to have "pronounced amygdaloidal and pillowed structures, displaying well-defined flow lines and flow contacts"<sup>1</sup>. Most of the rocks in this area are trachyte. Pillow structures occur more frequently in dacite than in rhyolite and trachyte.

Amygdules are of common occurrence and are exceedingly abundant in the rhyolite of Noranda District. Spherulites and micropegmatitic intergrowths are also very commonly found in the acidic lavas; they are abundant in the Noranda District.

Columnar structure is noteworthy in the Amulet belt and throughout a wide area in the Hé'ré Creek rhyolite of North West Rouyn Township. Columns range from 3" to 7" in diameter.

Flow contacts are infrequently found in rhyolite. Lamination is common in the rhyolite of Noranda District, the laminae ranging from 1/100 inch to 1/20 inch and extending for

1. Auger, P.E., Q.B.M. Geol. Report No. 27 - 1947.

distances up to 600 feet or more over widths of 1 to 7 feet.

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APPENDIX

Descriptions of occurrences of acid volcanic rocks in the Superior Province of the Shield together with references and, where available, tables of formations, are included in this Appendix. Most of the descriptions are in the words of the individual authors of the reports listed above each description.

Five main districts corresponding to the five maps prepared for this thesis are described. Each district has been subdivided into smaller areas, which in turn may include a number of published map sheets and reports.

For Ontario the descriptions for the most part are of individual townships since most of the published maps and reports of the Ontario Department of Mines are of one Township.

Numbers beside each area are the same as those on the thesis maps, for the corresponding area.

CHIBOUGAMAU DISTRICT(1) Chibougamau Lake Map Area

G.S.C. Memoir 185, 1935, J.B. Mawdsley and G. W. Norman

G.S.C. Map 304A, Chibougamau Sheet, 1935

G.S.C. Map 397A, Chibougamau Sheet (East Half) 1938.

Keewatin  
Type

Feldspathic sediments, breccia and acidic volcanics,  
black slate.

Volcanic flows mostly of intermediate composition,  
some basic and acid types; some pyroclastics and  
sediments, and intrusives related to the flows.

The extrusives shortly after their formation were, undoubtedly continuous over most, if not all, of the territory mapped, but they now occur as narrow bands and shred-like remnants invaded by various intrusives and occupy not more than 25 percent of the map area, north of David, Doré and Chibougamau Lakes. Light-coloured acid flows, of rhyolitic and trachytic composition are in places important, but highly altered lava flows of intermediate composition, probably andesites, predominate in the volcanic assemblage. The volcanics are usually massive, but locally are much sheared, particularly where intrusions are numerous. The massive varieties show various structures such as flow bands, ropy, scoriaceous and fragmental tops, and amygdules.

The acid types have a very fine grained quartz-feldspar groundmass; they contain well-formed phenocrysts of acid plagioclase and, in some cases, quartz; they usually contain considerable white mica, and lesser amounts of carbonates, epidote-zoisite minerals and other secondary products.

Coarse fragmentals associated with acidic volcanics form an important part of the volcanic assemblage that extends eastward from Portage Bay to Tache Lake. They consist of sub-angular to rounded fragments of light grey, acidic volcanic material in a fine grained green matrix. The fragments average a few inches in size although some range up to 18 inches.

The largest area underlain by the feldspathic group is a belt about 3500 feet wide which extends from the east end of Bourbeau Lake to Blondeau Lake. The feldspathic group is a well-bedded assemblage with a typical sedimentary appearance. The assemblage is composed of acid volcanic materials and has a high content of altered feldspar and a much smaller content of quartz. This peculiar feature of their composition, coupled with their extreme alteration makes the determination of their original character difficult. It is uncertain to what extent true clastic sediments are included in this group although some of the rocks are clearly, in part, waterlain. They are probably for the most part waterlain tuffs and pyroclastics with interbedded acid flows.

(2-5) OPEMISCA, EAST HALF

Opemisca, East Half

G.S.C. Map 401A

G.S.C. Preliminary Report 38-10, G.W. Norman

G.S.C. Map 397A, Chibougamau Sheet, East Half, 1938.

Keewatin  
Type

Feldspar-rich tuff or sediments; felsitic agglomerate or conglomerate, grit and black slate; rhyolitic and andesitic flows.



Keewatin  
Type

Rhyolitic lavas; agglomerate; tuff, minor andesite;  
rhyolitic and andesitic lavas and pyroclastics.  
Andesitic and basaltic lavas; minor rhyolitic lavas  
and pyroclastics; minor basic intrusives.

The oldest lavas are green-coloured andesites; pillow structures are common. Towards the top they include lens-like bodies of rhyolite, rhyolitic agglomerate and felsitic tuffs, and they are overlain by an upper, thick group of tuffaceous sediments.

(6-7) Opemisca, West Half

G.S.C. Paper 38-11, 1938, G.W. Norman

G.S.C. Map 398A, Chibougamau Sheet, West Half, 1938.

Southern Belt: The oldest rocks, a thick group of basic lavas, are overlain by a mixed group of acid and basic lavas and tuffs, 5000 feet thick in the northern limb but narrow and much sheared in the south limb. Acid volcanics are overlain by a thick group of sedimentary rocks 7,500 - 10,000 feet wide along the centre of a syncline.

Northern Belt: The succession and lithology closely resemble those in the Southern belt:

Keewatin  
Type

Conglomerate  
Banded cherty sediments  
Interbedded acidic lavas, tuffs and some andesite.  
Basic to intermediate lavas, pillowed.

The overlying group of acid lavas, tuff and andesite is best exposed east of Opemisca River.

(9) Buteaux Area

Q.B.M. Geological Report No. 15, 1943, B.C. Freeman.

Minor rhyolite flows occur interbedded with predominantly andesitic lavas.

(10) Barry Lake Area

Q.B.M. Geological Report No. 14, 1942, R.L. Milner.

Acid flows occur along the shores of Lac aux Loutres, small outcrops were observed between Lac aux Loutres and Barry Lake.

(11) Wetetnagami River Area

Q.B.M. Geological Report No. 28, 1946, H.W. Fairbairn

Acid tuffs and agglomerate outcrops in the vicinity of Penaché River and Wilson Lake.

(12) Wetetnagami Lake Area

Q.B.M. Geological Report No. 29, 1947, R.B. Graham.

Acid tuffs and agglomerate, outcrops on the south shore of Labrie Lake.

(13, 14) Grevet Map Area

Q.B.M. Annual Report, 1936, Pt. B, W. W. Longley.

The rocks are composed chiefly of highly-altered Keewatin volcanics. In the southern part of Grevet Township and the northern parts of Quévillon and Verneuil Townships the volcanics are mainly andesite and rhyolite. Banded rhyolite tuffs occur in many places as narrow zones between flows of different composition; the best exposures were seen north of Wedding River, in East Franquet Township and Western Grevet.

(15) Currie Map Area

Q.B.M. Annual Report, 1935, Part B, G.S. MacKenzie.

Rhyolites and trachytes occur in several places in the

country eastward from Cameron Lake to Esther Lake and at the northern end of Wedding Lake. On the Cameron property the tuffs are acid, very fine grained and brittle due to silicification. The beds are up to 2" thick and were deposited in water.

#### (16) Pustikamika Map Area

Q.B.M. Annual Report, 1934, G.S. Mackenzie.

Keewatin volcanics, in large part andesite, are the predominant rock type; interbedded flows of diverse composition were observed in places. The metamorphosed equivalents of rhyolite and basalt occur throughout the area. A few outcrops of banded siliceous tuff were noted on the islands and mainland around the northeastern end of Pustikamika Lake.

#### (17) Iserhoff River Area

Q.B.M. Geological Report No. 49, 1950, Jacques Claveau.

A medium-grey lava, found in restricted occurrences among the andesites of the volcanic band parallel to the Iserhoff River, has the composition of rhyolite.

#### (18) Lake Goéland Area

Q.B.M. Preliminary Report No. 218, 1949, P.E. Imbault.

Rhyolite is the more abundant rock type along the Waswanipi River. Elsewhere it is found sparsely interbedded with andesite.

#### (19) Lac La Tréve Area

Q.B.M. Preliminary Report No. 230, 1949, J.E. Gilbert.

|              |                                                                             |
|--------------|-----------------------------------------------------------------------------|
| Pre-Opemisca | Altered gabbro and diorite                                                  |
|              | Feldspathic sediments and tuffs, slate, argillite, conglomerate, greywacke. |

|              |                                                                     |
|--------------|---------------------------------------------------------------------|
| Pre-Opemisca | Altered and schistose, basaltic to andesitic lava, a little dacite. |
|--------------|---------------------------------------------------------------------|

Dacite outcrops with andesite along the northwestern shore of La Treve Lake east of the entrance to Gilbert Bay.

(20) Opawica Lake Area

G.S.C. Preliminary Report No. 39-2, 1940, G.N. Shaw.

G.S.C. Map 556A, 1940, G.N. Shaw.

Rhyolite flows occur along the south shore of Opawica Lake as part of the Keewatin volcanic assemblage.

(21) Bachelor Lake Area

Q.B.M. Geological Report No. 47, 1950, W.W. Longley.

Exposures of fragmental lavas with a little interbedded sedimentary rock are widely scattered, chiefly in the southern part of the area. The fragments are dark greyish in colour, cherty in texture and are assumed to be rhyolite. Most of them are irregular and sharply angular in shape. One exposure occurs 2 miles south of Bachelor Lake; scattered outcrops of similar rock extend north for 1000 feet to a contact with amygdaloidal lava. Other exposures of fragmental lava were seen west, north and north-east of Bachelor Lake. Massive, silicic rock, very fine grained, light green cherty, the author believes to be of sedimentary origin.

Q.B.M. Preliminary Report 243, the Southwest Part of LeSueur Township, 1950, R.B. Graham:

|                  |                                                                                                                                                                                                                                                                                   |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Keewatin<br>Type | <p>Andesite, minor beds of agglomerate and tuff;<br/>minor flows of basalt and trachyte.</p> <p>Basalt, minor beds agglomerate and tuff; minor<br/>flows of basalt and trachyte.</p> <p>Agglomerate and tuff with minor flows of basalt,<br/>andesite, trachyte and rhyolite.</p> |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Very little trachyte was found in the area; the occurrences were not shown on the map accompanying the report.

DISTRICT OF SOUTHWESTERN QUEBEC(1) DASSERAT AND BEAUCHASTEL TOWNSHIPSSoutheastern Dasserat

G.S.C. P.R. 49-25, 1949, C.H. Stockwell.

Keewatin

Agglomerate tuff

Trachyte, rhyolite, acid flow breccia

Andesite, andesite flow breccia

Porphyritic andesite

Desvaux Lake Area

Q.B.M. G.R. 27, 1947, P.E. Auger

Keewatin

Agglomerate

Acidic volcanics, fragmental rocks, tuffs

Basic fragmentals

Trachyte

Rhyolite - pillowed, porphyritic and amygdaloidal  
 sericite schist, andesite, diorite, basalt,  
 chlorite schist.

Rhyolite underlies the southeastern shore of Dasserat Lake. In the vicinity of Desvaux and Ogima Lakes are acidic volcanics with pronounced amygdaloidal and pillowed structures, displaying well-defined flow lines and flow contacts. These are believed to be a continuation of the band of similar acidic volcanics that crosses the Fortune map area. On the southeastern shore of Lake Ogima most of the outcrops are trachyte. Coarse acidic fragmental volcanic rocks and tuffs are associated with the acidic flows along the southeastern shore of Lake Dasserat.

Fortune Lake and Wasa Lake Map Areas

Q.B.M. G.R. No. 5, 1940, G.S. Mackenzie

Keewatin

Basic and acid flows

Tuffs and agglomerates

The main band of acid lavas with some interbedded basic volcanics persists across the northern part of the Alder-mac-Arntfield district. Most of the lavas are massive; occasionally they show small pillow or ellipsoidal structures. Vesicles, in many places filled with quartz are up to 2 inches long.

Halliwell Mine Map Area, Beauchastel Township

Q.B.M. G.R. 7, 1941, G.S. Mackenzie

Keewatin

Volcanic rocks

Tuffs, agglomerates

Acid to basic flows

Rhyolites outcrop in southeastern Beauchastel Township in Range VI. They are massive, porphyritic, fresh, white, and contain quartz phenocrysts.

Northeastern Beauchastel Township

G.S.C. Paper 41-7, E.D. Kindle

G.S.C. Map 453A

Early

Andesite and andesite flow breccia

Precambrian

Rhyolite, rhyolite and dacite flow breccia,  
rhyolite breccia

A great mass of rhyolites overlies the andesites in the eastern part of the map area. In the northern part of Range 9 several hundred feet of rhyolite lies between alaskite and andesite. In the southwestern part of the area a band of rhyolitic rocks ranging from 1000 to 2000 feet thick runs east-west, separating andesite bands. The rhyolites include por-

phyritic and amygdaloidal flows, rhyolite flow breccias and some rhyolite pyroclastic breccia. The most acidic rhyolite flows in the area lie south of the Horne Creek fault. The rhyolite grades into rhyolite flow breccia in the vicinity of tops and bottoms of individual flows.

Part of Northwest Quarter of Beauchastel Township

Q.B.M. G.R. No. 30, 1948, W.G. Robinson.

Rhyolite, agglomerate and acid tuff occur in the area covered by this report.

West Half Beauchastel Township

Acidic lavas underlie most of the west half of the township. Large exposures occur southwest and northeast of Wasa Lake. It is difficult to distinguish individual flows; pillows are extremely rare.

Some of the acidic rocks can be distinguished as intrusions presumably nearly contemporaneous with adjacent flows.

Subdivision of pyroclastic rocks in the area present troublesome problems. Pyroclastic rocks are present which contain light-coloured acidic fragments in a dark green chloritic matrix. The question is, are they acidic breccias in which the matrix has been chloritized or are they basic rocks with extraneous fragments or injections of acidic material.

(2) NORANDA - ROUYN

Noranda Area

G.S.C. Memoir 229, 1932, M.E. Wilson.

|          |                                                                      |
|----------|----------------------------------------------------------------------|
| Keewatin | Siliceous rhyolite                                                   |
|          | Rhyolite, rhyolite flow breccia, rhyolite tuff and explosion breccia |
|          |                                                                      |



|          |                                                                                   |
|----------|-----------------------------------------------------------------------------------|
| Keewatin | Andesite, andesite flow breccia, andesite tuff<br>and explosion breccia<br>Chert. |
|----------|-----------------------------------------------------------------------------------|

The Keewatin surficial rocks are wholly volcanic and consist of a conformable succession of lava flows, stratified tuff, pyroclastic breccia and chert, having a total average thickness of 25,000 feet of which rhyolite comprises 14,000 feet.

Varieties of acidic volcanic rocks are: massive rhyolite; mesh-weathering rhyolite; spherulitic rhyolite; bluish-grey weathering rhyolite; rhyolite flow breccia; dacite and trachyte; rhyolite explosion breccia and tuff.

The lava flows consisting of siliceous rhyolite; normal rhyolite; rhyolite flow breccia and andesite were poured out in successive alternating belts ranging from a few hundred feet to 11,000 feet in thickness. The greatest length of flow, that in andesite, is 6 miles. The lava flows followed each other with very little lapse of time as shown by the presence of original lamination and breccia at the tops of both flow belts and individual flows within the belts. Much explosion breccia and tuff is interbedded with the lavas in the area south of Rouyn suggesting that craters were present in the southern part of the district. However, throughout most of the district there is an entire absence of pyroclastic rocks and no craters or crater-like structures have been found. The abundance of rhyolite and andesite dykes in the district suggests that some of these intrusions occupy channels along which the lavas made their ascent; the lavas being extruded quietly through fissures.

Lake Dufault

G.S.C. Map 626A

|          |                                   |
|----------|-----------------------------------|
| Keewatin | Acidic pyroclastics               |
|          | Rhyolite and rhyolite breccia     |
|          | Andesite and related pyroclastics |

Lake Routhier

G.S.C. Map 625A

Formations are the same as on G.S.C. Map 626A

East Rouyn

Q.B.M. Map 262, 1933

Rhyolite and trachyte flows are shown.

Rouyn-Beauchastel

G.S.C. Paper 43-7 (3 maps), 1946, M.E. Wilson

|                      |                                                                                                                     |
|----------------------|---------------------------------------------------------------------------------------------------------------------|
| Blake River<br>Group | Rhyolite, rhyolite porphyry, rhyolite flow breccia,<br>rhyolite tuff and explosion breccia, dacite and<br>trachyte. |
|                      | Andesite and andesite flow breccia.                                                                                 |

Noranda Mine

G.S.C. Memoir 229, 1932, M. E. Wilson

In the vicinity of the Horne Mine the Keewatin lavas, tuffs and breccias have undergone extensive alteration forming a wide variety of rock types that grade into one another and make it almost impossible to map individual rock units. The principal Keewatin rocks are termed rhyolite and dacite for easy reference. The rhyolites are light coloured, massive or brecciated, highly siliceous rocks; the dacites contain more chlorite and less quartz and are darker in colour. Both rhyo-

lite and dacites pass gradually from massive into brecciated varieties.

Kinojévis Sheet

G.S.C. Map 306A, 1935.

Altered rhyolite and rhyolite breccia occurs south of Lake Rouyn and between Lake Routhier and Davidson Creek.

Duparquet Sheet

Includes the townships of Montbray, Duprat, Dufresnoy, Duparquet, Hébécourt, North Beauchastel.

The lavas are mainly andesites; acid types of volcanics are least abundant.

(3) LAKE DUPRAT AREA

Northeastern Duprat Township

Q.B.M. P.R. 241, 1950, R.L. L'Esperance.

Keewatin

Gabbros, diabase, diorite

Andesite, rhyolite dykes

Chert

Rhyolite, trachyte, dacite

Andesite, tuff, agglomerate, flow breccia

Rhyolite flows are abundant and comprise one-half of the map area. In the central part of the township they are interbedded with andesite. Acid breccias are common and form a considerable part, if not the major proportion, of the rhyolite belts. Fragments up to 5 feet in length occur in the breccia. Some trachyte flows are included in the rhyolite and dacitic belts.

Rocks mapped as dacite outcrop in a belt less than

1/4 mile wide, 2 miles northeast of Nora Lake. A few horizons of pillows are present and in the north central part of the township spherulitic dacite occurs.

#### Flavrian Lake

Q.B.M. Geological Report No. 13, 1939, W.G. Robinson

Southwest of Flavrian Lake is a complex of rhyolite intrusives and flows. By far the greater part of the complex consists of intrusives.

#### (4) HÉBÉCOURT - PALMAROLLE AREA

#### Palmarolle Sheet

G.S.C. Map 293A, 1934

Minor altered trachyte and dacite rocks are shown in Hébécourt and Roquemaure townships.

#### Hébécourt Lake

G.S.C. P.R. 216, 1948, R. B. Graham

#### Part of West Half of Hébécourt Township

Q.B.M. P.R. 232, 1949, R.B. Graham

|          |                                                                                                                                                                                  |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Keewatin | Diabase, diorite, gabbro<br>Trachyte, dacite, andesite, basalt, flow breccia,<br>tuff, agglomerate, rhyolite, related hornblende<br>schist, chlorite schist and sericite schist. |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

The volcanic rocks of the area are mainly trachyte, dacite, andesite and basalt.

A prominent band of rhyolite 2-1/2 miles long and 1600 feet wide outcrops southwest of Hébécourt Lake.

Three main horizons of trachyte are exposed within the map area north of Lake Hébécourt. Flows of dacite and andesite are widely distributed and occur closely intermingled

with flows of basaltic composition; they occur most abundantly in the southern part of the area. Dacite is distinguished from andesite only by the presence of minute quartz eyes. The two rocks were grouped together for mapping purposes.

Parts of Duparquet, Hébécourt, Palmarolle and Roquemaure Townships

Q.B.M. P.R. 248, 1950, B. Lee

|                  |                                     |
|------------------|-------------------------------------|
| Keewatin<br>Type | Andesite: massive, pillowed massive |
|                  | Fragmentals, agglomerate            |
|                  | Rhyolite                            |
|                  | Andesite                            |

A belt of rhyolite extends N72°W across the eastern and central parts of the area. The rhyolite has a maximum thickness of 15,000 feet within the area. Certain sections of the rhyolite show high percentages of rhyolitic and tuffaceous fragments which give the rock the appearance of an agglomerate. Bands of highly siliceous tuff are present within the andesites; in all cases the tuff occurs in narrow, discontinuous bands.

West Part of Duparquet Township

Q.B.M. P.R. 206, 1947, R.B. Graham

|          |                                                                                           |
|----------|-------------------------------------------------------------------------------------------|
| Keewatin | Gabbro                                                                                    |
|          | Rhyolite, trachyte, dacite, andesite, basalt, tuff agglomerate, breccia, related schists. |
|          | Greywacke and slate with some interbedded lavas.                                          |

Along the north margin of the map-sheet is the continuation of the body of rhyolite and associated pyroclastics mapped in Lamorandiere. The rhyolite is schistose and locally porphyritic. Bands of interbedded tuff and agglomerate are

common, in places becoming the predominant rock type. Dacite and trachyte predominate in ranges 7 and 8. After a distance of approximately 2 miles to the south, they again predominate toward the southern boundary of the area. The flows frequently have a well developed pillow structure.

East Part of Duparquet Township

Q.B.M. P.R. 193, 1945

|          |                                                                                    |
|----------|------------------------------------------------------------------------------------|
| Keewatin | Gabbro                                                                             |
|          | Diabase                                                                            |
|          | Andesite, trachyte, dacite, tuff, agglomerate, breccia, rhyolite, related schists. |

Rhyolite occurs along the north edge of the map sheet.

Lavas termed dacite and trachyte predominate from within a quarter mile of the north boundary southward to the Beattie road. After a distance of two miles they reappear to extend to the southern boundary of the area. As far as can be determined they represent the oldest rocks in the map area. Pillow structure is well developed. A few bands of flow breccia are associated with pillow lavas; siliceous tuff and agglomerate form only a small part of the exposed formations. Along the southern border of the area there are scattered, widely spaced outcrops in which tuffaceous agglomerate predominates over the dacite and trachyte. This zone has a maximum width of 1000 feet.

West Part of Destor Township

Q.B.M. P.R. 189, 1945, R.B. Graham.

|          |                       |
|----------|-----------------------|
| Keewatin | Gabbro                |
|          | Ultrabasic intrusives |

|          |                                |
|----------|--------------------------------|
| Keewatin | Andesite, dacite, gabbro, tuff |
|          | Agglomerate                    |
|          | Greywacke, argillite           |

Dacitic lavas predominate from the northern boundary of the map area to within half a mile of Beattie road. These are the oldest rocks in the map area.

#### (5) LOIS LAKE AREA

G.S.C. Map 285A, Taschereau Sheet.

|          |                                                    |
|----------|----------------------------------------------------|
| Keewatin | Chiefly altered tuff                               |
|          | Altered andesite, some rhyolite dacite and basalt. |

There are minor rhyolite flows in the Lois Lake District. A rhyolite flow in West Privat township has been traced in a more or less continuous outcrop around the nose of a plunging syncline.

#### (6) CLÉRICY - LA PAUSE AREA

##### Cléricy

G.S.C. Map 635A

|                      |                                                                       |
|----------------------|-----------------------------------------------------------------------|
| Blake River<br>Group | Andesite, dacite and rhyolite; related pyroclastics.                  |
|                      | (a) agglomerate, mostly of basic lavas; minor bedded rhyolite tuff;   |
|                      | (b) mainly andesite and dacite; related pyroclastics, minor rhyolite; |
|                      | (c) mainly rhyolite and related pyroclastics;                         |
|                      | (d) mainly acidic pyroclastics; massive rhyolite.                     |
| Kewagama<br>Group    | Greywacke; conglomerate; slate; andesite and dacite.                  |
| Malartic<br>Group    | Andesite and dacite; pyroclastics.                                    |

LaPause Township

G.S.C. Map 634A

|                   |                                                                                                                     |
|-------------------|---------------------------------------------------------------------------------------------------------------------|
|                   | Andesite; dacite; minor rhyolite; related pyroclastics.                                                             |
| Blake River Group | (a) andesite, dacite, pyroclastics;<br>(b) rhyolite, pyroclastics;<br>(c) acidic pyroclastics; massive acidic lava. |
| Kewagama Group    | Greywacke and conglomerate                                                                                          |
|                   | Andesite and dacite; pyroclastics.                                                                                  |
| Malartic Group    | (a) andesite and dacite;<br>(b) rhyolite tuffs and siliceous sediments.                                             |

Lepine Lake

Q.B.M. G.R. No. 4, 1940, H.M. Bannerman

|          |                                                   |
|----------|---------------------------------------------------|
|          | Andesite, dacite and basalt flows.                |
|          | Porphyritic andesite                              |
| Keewatin | Rhyolite and rhyolite porphyry; tuff; agglomerate |
|          | Chlorite, talc, sericite schists                  |
|          | Greywacke, argillite, conglomerate                |

Bands of rhyolite and tuff occur at a number of places between more basic flows but their total distribution within the area is relatively small. In general the rhyolite bands are very erratic in thickness, pinching and swelling along their strike and their margins are in places brecciated. Commonly the bands are traceable for one to two miles, then wedge out. Usually the rhyolite is accompanied by well-bedded tuff, often agglomeratic, having a thickness of a few feet only. The tuffs are schistose in contrast to the massive blocky rhyolite.



(7) DESMELOIZES AREA

G.S.C. Map 284A, 1933

This map includes the townships of Desmeloizes, Clermond, La Seine, and La Sarre. Cream-coloured to dark grey rhyolites are present, mainly confined to northeastern Desmeloizes and southern Clermont. The acid flows are greatly sheared.

(8) LAUNAY AREALaunay Township

Q.B.M. G.R. No. 1, 1939, S.H. Ross

The acidic rocks in the area are agglomerate, tuff and acidic flows. In the agglomerate there are blocks up to 4 feet long in a matrix of volcanic ash. Bands of fine-grained tuff occur in the northern part of the township, associated in places with rhyolite and trachyte. Typically the tuffs are now micaceous schists and phyllites. There are minor outcrops of dacite, rhyolite and trachyte in the township.

(9) DESBOUES AREA

G.S.C. Map 352A, Desboues Sheet

Altered andesite with minor amounts of tuff breccia and acid flows.

(10) DALQUIER-FIGUERY AREAAmos Area

G.S.C. Map 327A, 1935, Amos Sheet

|          |  |                                           |
|----------|--|-------------------------------------------|
| Keewatin |  | Greywacke, conglomerate, argillite, chert |
|          |  | Breccia, tuff, acidic extrusives          |
|          |  | Basic extrusives, largely andesites       |

Acidic extrusives, chiefly rhyolite together with breccia and tuff form three bands traversing the area. Flows

and flow breccias are minor constituents of these bands but are widely distributed among them. Tuffs, now altered to sericite schists are exposed over large parts of the bands, particularly in southeastern Dalquier township.

Dalquier, Figuery and Landrienne Townships

Q.B.M. P.R. 257, 1951, W. W. Weber

Duverny Syncline Sequence:

Keewatin  
Type  
Volcanic  
Rocks

Upper Division: Siliceous lavas and pyroclastics, minor tuffs, overlain by a mixed assemblage of intermediate and basic volcanics.

Lower Division: Predominantly dacitic lavas, agglomerate, flow breccia with interfingering bands of basic volcanics.

Amos Anticline Sequence

Upper Division: Predominantly basaltic lavas, minor flow breccia, cherty tuffs and agglomerate pillow lavas.

Lower Division: Metagabbro, metadiabase with minor fine grained massive and pillowed basic lavas, prominent basic agglomerate bands, grading near the top of the division into a tuff band with siliceous to intermediate lavas interbedded with pyroclastics and iron formation.

### Duverny Synclinal Sequence

Upper Division: These are the youngest rocks exposed in the area. This division is entirely siliceous with interbedded breccia and agglomeratic bands. The base of this division is marked by a rhyolite band which has been traced across the limbs of the syncline. It is overlain by a band of basic lavas 1/2 mile thick; this sequence of massive and pillowed basic lavas encloses a series of pillow lavas, mainly dacitic, in the core of the syncline.

Lower Division: This sequence of lavas of mixed affinities is a heterogeneous assemblage of dominantly dacitic lava with considerable amounts of tuff and pyroclastics in the basal zone. This sequence is overlain by "rhyolite" at the base of the upper division and underlain by rocks of the Amos Anticline Sequence. On the southern limb of the syncline the lower division consists mainly of dacite. The lower division appears on the northern limb of the Duverny syncline underlying a well exposed rhyolite band; here the lava assemblage is mainly dacitic pillowed and massive fine grained flows, to a lesser degree porphyritic and variolitic zones are encountered.

### Amos Anticline Sequence

Lower Division: Siliceous tuffs and interbedded fine grained rhyodacite and dacitic lavas, minor rhyolite and agglomerate are exposed on the north limb of the anticline. An overlying member consisting of dacite, grading upward into fine grained rhyodacite and rhyolite, interbedded with minor andesite, pillowed and massive dacite and siliceous fragmental lavas is well-exposed in north Figuery Township.

(11) LAMORANDIERE - DUVERNYLaMorandiere and Parts of Duverny, Landrienne and Barraute Townships

Q.B.M. P.R. 255, 1951, W.W. Weber

|           |                                                                                                                                                                               |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | Duverny Syncline Sequence                                                                                                                                                     |
|           | Siliceous volcanic rocks, largely brecciated rhyolite, trachyte, siliceous tuffs and agglomerate with minor basic beds.                                                       |
|           | Basic lavas.                                                                                                                                                                  |
| Keewatin  | Heterogeneous assemblage of siliceous to intermediate interbedded volcanics.                                                                                                  |
| Type      |                                                                                                                                                                               |
| Volcanics | Amos and Soma Anticline Sequence                                                                                                                                              |
|           | Basic volcanic rocks with numerous coarse-grained sill-like bodies.                                                                                                           |
|           | Siliceous volcanic rocks largely tuff breccia and agglomerate with minor interbedded intermediate lavas occur within these basic lavas on either flank of the Amos anticline. |

The Keewatin-type volcanic rocks in the district occur as (1) dominantly basic lavas and pyroclastics flanking the Soma anticline; (2) the heterogeneous bands of siliceous, intermediate and sub-siliceous rocks outlining the Duverny synclinal structure and (3) the basic flows interbedded with a prominent band of siliceous pyroclastic and sedimentary volcanic rocks on either limb of the Amos anticline. The rocks in the core of the Duverny syncline are considered to be the youngest of the exposed Keewatin rocks.

### Duvernay Synclinal Sequence

Exposures of these siliceous rocks occur across a width of a half-mile on either limb of the fold. The average thickness is about 3000 feet. Rhyolite and trachyte lavas, largely brecciated are the main rock type about the margin of the Duvernay granite at the western end of the map sheet. In general, throughout the syncline, pillowed and porphyritic dacites predominate. Minor rhyodacite, rhyolite and andesite are interbedded with these flows. Fragmental lavas in the exposed areas are mainly of flow breccia and are of minor significance. In the eastern part of Duvernay Township, variolitic and massive porphyritic dacites occupy an area of equal extent to the pillowed dacite.

### Amos Anticline Sequence

The rocks are considered to be equivalent to those of the Soma anticline. There is one striking dissimilarity in the volcanic bands adjacent to the Amos anticline in comparison with those adjacent to the Soma. On either flank of the Amos anticline there is a band of siliceous volcanic rocks some 3000 to 4000 feet thick. This band is intercalated with the basic lavas in the southern sector but is not exposed adjacent to the Soma anticline in the northern sector.

### Soma Anticline Sequence

A band of siliceous volcanic rocks with an apparent thickness of about 3000 feet is assumed to cross the northeast quarter of the area. This band consists mainly of brecciated rhyolites and dacites, dacite agglomerate and porphyritic siliceous lavas.

(12) MALARTIC AREAMalartic Area

G.S.C. Map No. 574A, Sheet 3.

|                   |                                                                                                    |
|-------------------|----------------------------------------------------------------------------------------------------|
| Malartic<br>Group | Greywacke, minor conglomerate<br>Andesite and dacite; rhyolite, trachyte, basalt,<br>tuff, breccia |
|-------------------|----------------------------------------------------------------------------------------------------|

G.S.C. Map No. 574A, Sheet 4

|                      |                                                                                                      |
|----------------------|------------------------------------------------------------------------------------------------------|
| Blake River<br>Group | Andesite and dacite; rhyolite; trachyte; basalt,<br>tuff, breccia, agglomerate.                      |
| Malartic<br>Group    | Greywacke, minor conglomerate.<br>Andesite and dacite; rhyolite, trachyte, basalt,<br>tuff, breccia. |

(13) BOURLAMAQUE AREA

The oldest rocks of the area are volcanics varying in composition from andesite to rhyolite. Some basic and acidic tuffs and agglomerates are found interbedded with flows. Younger dacite flows with visible quartz, exceptionally well pillowed, are interbedded with spherulitic members, andesite, rhyolite flows and some acidic tuffs. Tuff and agglomerate overlies the dacite flows.

Dubuisson, Bourlamaque, Louvicourt Townships

G.S.C. Preliminary Map 47-20

|  |                                                                                                                                              |
|--|----------------------------------------------------------------------------------------------------------------------------------------------|
|  | Agglomerate, rhyolitic tuff, trachyte and spheru-<br>litic lavas<br>Andesitic to trachytic lavas, some agglomerate and<br>tuff.<br>Andesite. |
|--|----------------------------------------------------------------------------------------------------------------------------------------------|

Northwest Bourlamaque

G.S.C. Preliminary Report 46-15, 1945, G.W. Norman

|          |                                                             |
|----------|-------------------------------------------------------------|
|          | Slaty tuff, andesite, trachyte, agglomerate, some rhyolite. |
|          | Coarse agglomerate, minor tuff.                             |
|          | Trachyte: massive, pillowed and fragmental.                 |
| Keewatin | Tuff, bedded, fine agglomerate.                             |
| Type     | Pale green andesite, tuffs and flow breccia.                |
|          | Trachyte, porphyritic trachyte.                             |
|          | Andesite                                                    |

Southeast Bourlamaque

G.S.C. Preliminary Report 46-15, 1945, G.W. Norman

|          |                                                                                                     |
|----------|-----------------------------------------------------------------------------------------------------|
|          | Greywacke                                                                                           |
| Keewatin | Andesite, diorite, tuff, rhyolite, rhyolite tuff.                                                   |
| Type     | Pillowed and fragmental trachyte and andesite, agglomeratic tuff, intermediate lava minor rhyolite. |

Cadillac-Bourlamaque

G.S.C. Paper 43-6, 1943, G.W. Norman

|          |                                                      |
|----------|------------------------------------------------------|
|          | Andesite, rhyolite, tuff, breccia.                   |
| Keewatin | Andesite, rhyolite, intermediate flow breccia;       |
| Type     | dacite breccia and rhyolite, agglomerate, tuff, etc. |

These rocks occur as long, narrow bands extending in an east-west direction through the area.

Vassan-Dubuisson Townships

G.S.C. Preliminary Report 42-12, 1940, G.W. Norman

Minor rhyolite flows occur in the Blake River Group together with dark green andesite, dacite and tuff.

Cadillac Township

G.S.C. Map 399A, 1934, H.C. Gunning

Blake River Volcanics

|                  |                                                                   |
|------------------|-------------------------------------------------------------------|
| Keewatin<br>Type | Greenstone, altered andesite and basalt.                          |
|                  | Minor acidic flows, tuff, agglomerate.                            |
|                  | Chiefly altered rhyolite, some tuff, agglomerate and basic flows. |
|                  | Chiefly agglomerate and tuff, some flows.                         |

Lamaque-Sigma Mine

G.S.C. Map 224A, 1929, Dubuisson Sheet

|                  |                                                                                                                      |
|------------------|----------------------------------------------------------------------------------------------------------------------|
| Keewatin<br>Type | Breccia or agglomerate with tuff                                                                                     |
|                  | Acidic flows, trachyte, rhyolite, sericite schists                                                                   |
|                  | Basic and intermediate flows, pillow and amygdaloidal lavas, andesite, basalt, serpentinized lavas, chlorite schist. |
|                  |                                                                                                                      |

On the southern boundary of the Bourlamaque Batholith are basic lavas becoming more acidic toward the south, succeeded in turn by a zone of finely interbanded breccias and tuffs and by a band of trachyte 1200 feet wide in which the Sigma deposits occur. The trachyte is followed by the central band of volcanic breccia 3000 feet wide. South of the breccia are acid lavas. Following is a second horizon of volcanic breccia succeeded by acid lavas, these by basic lavas. In the southeastern part of the area there are extensive outcrops of rhyolite. The structure might be interpreted as a central band of breccia succeeded on



either side by a repetition of like beds as components of the limbs of a fold.

(14) SENNETERRE-BARRAUTE AREA

Senneterre Map Area

G.S.C. Map 997A, 1949, compiled by A.S. McLaren. The map includes the district bounded by Long.  $77^{\circ}$ - $78^{\circ}$ W, Lat.  $48^{\circ}$ - $48^{\circ}30'$ N.

|                  |                                                                                                                                                                                                                     |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Keewatin<br>Type | Agglomerate, some tuff; partly amphibolitized<br>rhyolite, agglomerate and tuff; andesite trachyte<br>and spherulitic andesite; rhyolite and tuff; tuff,<br>rhyolitic tuff with andesite.                           |
|                  | Mainly andesite to trachyte and dacite; some<br>agglomerate and tuff; spherulitic and porphyritic<br>trachyte; coarsely porphyritic andesite; andesite<br>breccia; rhyolite, tuff, agglomerate and flow<br>breccia. |

All consolidated rocks of the area are of Precambrian age. The oldest are mainly of volcanic origin fresh to altered in appearance and vary in composition from andesite to trachyte and rhyolite. Some basic and acidic tuffs and agglomerates are found interbedded with the flows. Thick flows of dark to light green andesite showing well developed pillow structures occur. Younger flows of dacite are exceptionally well pillowed; they are interbedded with spherulitic members, andesite, rhyolite flows and some acid tuffs. Tuff and agglomerate overlies the dacite.

Barraute

G.S.C. Preliminary Map 47-9.

Kinojévis Group

|               |                                                                              |
|---------------|------------------------------------------------------------------------------|
|               | Basaltic and andesitic lavas; minor bands of rhyolite, tuff and agglomerate. |
| Keewatin Type | Highly altered basic volcanics; rhyolite; agglomerate and tuffs.             |
|               | Agglomerates and acid tuffs; minor rhyolite.                                 |
|               | Rhyolite, rhyolite breccia; trachyte.                                        |

The Kinojévis Group is probably the same as the Malartic Group to the west.

(15) PASCALIS AREASouthwestern Part of Pascalis Township

Q.B.M. P.R. 258, 1951, D.J. McDougall.

|               |                                        |
|---------------|----------------------------------------|
| Keewatin Type | Greywacke                              |
|               | Tuff and agglomerate; volcanic breccia |
|               | Dacite; andesite and tuff; agglomerate |

The rocks classified as dacite are siliceous rocks of a lighter shade of green than the andesite. The principal occurrence is a band in the central part of Block A with some small outcrops farther south. The composition of the pyroclastics is essentially andesite, but in some outcrops it may be trachyte or dacite.

(16) VAUQUELIN-PERSHING AREAVauquelin, Pershing, Haig Townships

G.S.C. Paper 47-12, 1947, G.W. Norman

The Keewatin-type rocks are composed, at the top of:

- (a) interbedded andesite, tuff and agglomerate, followed by,

Keewatin  
Type

(b) an interbedded, interfingering group of flows ranging from andesite or dacite to trachyte with tuffs and agglomerate of the same composition.

Many of the flows show peculiar features such as variolitic, spherulitic structures, abnormally large quartz filled amygdules, coarsely porphyritic phases abnormally wide or prominently selvaged pillows in places with felsite cores. Members of these distinct types can be traced for miles. Finally, at the bottom is:

(c) a thick group of normal andesite flows with little, if any, tuff.

#### Vauquelin Township, West Part

Q.B.M. Geological Report 6, 1940, C. Tolman.

Keewatin  
Type

Acid to basic lava flows and associated tuffs, agglomerates and intrusives.

The complex of diorite and igneous fragmentals is the most distinctive feature of the Keewatin assemblage. It is represented by a band 4000 feet wide characterized by exceptional development of igneous fragmentals, largely dioritic in appearance. Most of the fragmental rocks in the Vauquelin area are composed of basic rock.

#### Pershing Township

G.S.C. Paper 47-7, 1947, G.W. Norman, M. Tiphane.

Intermediate to trachytic flows occur in the northern part of the township.

DISTRICT OF NORTHEASTERN ONTARIO(1) Gauthier Township

O.D.M. Vol. L, Pt. 8, 1941, J.E. Thomson.

|             |                                                                                              |
|-------------|----------------------------------------------------------------------------------------------|
| Timiskaming | Basic volcanics                                                                              |
|             | Acidic volcanics: trachyte, trachyte breccia and<br>agglomerate, bedded tuff                 |
|             | Fine-grained sediments: greywacke and arkose                                                 |
|             | Conglomerate                                                                                 |
| Keewatin    | Basic volcanics, andesite, basalt                                                            |
|             | Acidic volcanics: rhyolite, trachyte, fragmental<br>lava, agglomerate and tuff, bedded tuff. |

Timiskaming acid volcanics are separated from Keewatin acid volcanics by a conglomerate band. Most of the acid rocks are breccias, agglomerates and tuffs. Rhyolite and trachyte flows occur in the northern part of Gauthier Township.

(2) McVittie Township

|             |                                                                          |
|-------------|--------------------------------------------------------------------------|
| Timiskaming | Basic lava                                                               |
|             | Trachyte, porphyritic trachyte, trachyte breccia<br>and agglomerate tuff |
|             | Greywacke, arkose                                                        |
|             | Conglomerate                                                             |
| Keewatin    | Basic volcanics                                                          |
|             | Acidic volcanics: rhyolite, trachyte, fragmental<br>lava.                |

In the western part of McVittie is an area of acidic lavas, rhyolite and trachyte, and fragmental rocks including agglomerate.

(3) McGarry Township

O.D.M. Vol. L, Pt. 7, 1941, J. E. Thomson

|             |                                                                                           |
|-------------|-------------------------------------------------------------------------------------------|
| Timiskaming | Basic volcanics                                                                           |
|             | Acid volcanics: trachyte, porphyritic trachyte,<br>trachyte breccia and agglomerate, tuff |
|             | Greywacke, arkose                                                                         |
|             | Conglomerate                                                                              |
| Keewatin    | Iron formation                                                                            |
|             | Basic volcanics                                                                           |
|             | Acidic volcanics: rhyolite; rhyolite breccia                                              |

Irregular areas of rhyolite and rhyolite breccia occur in the northern part of McGarry Township.

The trachyte and associated rocks consist of a heterogeneous assemblage of rocks that have a common volcanic origin and are interbedded with the Timiskaming sediments. The principal flow rock type is trachyte. The trachyte flows are subordinate in areal extent to the pyroclastic members of the group. Pillow structures have been recognized and flow breccias are common.

The presence of large amounts of lavas and pyroclastics in the Timiskaming Series indicates that sedimentation was accompanied or followed at intervals by vulcanism. The lavas and pyroclastics would accumulate on the flood plains and in the seas along with the sediments.

(4) Lebel Township

O.D.M. Vol. LIII, Pt. 2, 1944, A. MacLean.

|             |                              |
|-------------|------------------------------|
| Timiskaming | Tuffs and greywackes         |
|             | Trachyte sills               |
|             | Trachyte flows, amygdaloidal |
|             | Trachyte flows, massive      |
|             | Tuffaceous conglomerate      |
|             | Tuffs and breccias           |
|             | Greywacke                    |
|             | Conglomerate                 |
| Keewatin    | Iron formation               |
|             | Volcanic breccia             |
|             | Andesites                    |

(5) Skead Township

O.D.M. Map No. 1949-3, D.F. Hewitt.

|          |                                                                                                     |
|----------|-----------------------------------------------------------------------------------------------------|
| Keewatin | Early intrusives                                                                                    |
|          | Basic and intermediate volcanics                                                                    |
|          | Acidic volcanics: rhyolite, rhyolite tuff,<br>tuffaceous agglomerate, fragmental lava,<br>trachyte. |

The basic and intermediate volcanic division make up by far the greatest percentage of rock in the township and includes all the volcanics ranging from andesite to dacite. Trachyte flows are rare in the sequence. Rhyolite flows occur as interbeds in the basic and intermediate sequence; associated with the rhyolite are acid agglomerates, breccias and tuffs. A center of volcanic activity was in lots 6 and 7, Concession 3, where a large plug of quartz porphyry occurs. Caught up in this

plug are numerous large blocks of rhyolite and rhyolite agglomerate. In places the rhyolites are porphyritic.

(6) Bryce-Robillard Townships

O.D.M. Vol. L, Pt. 4, 1941, W. W. Moorhouse.

|          |                                                 |
|----------|-------------------------------------------------|
| Keewatin | Gabbro sill                                     |
|          | Intermediate and acid flows and agglomerates;   |
|          | andesite; dacite; light weathering basic lavas, |
|          | tuff, agglomerate, rhyolite                     |
|          | Basic lavas                                     |

The succession of intermediate to acid flows interbedded with breccias and tuffs is at least two miles thick.

In southwestern Bryce the dominant flow rock is quartz-albite porphyry. Rhyolite flows are of small size in the area, comprising sheets, lenses, and narrow bands a few feet wide. Agglomerates reach thicknesses of 1/2 mile; the composition of the fragments is quartz-feldspar porphyry.

(7) Harker Township

O.D.M. Map No. 1951-4, J. Satterly

|           |                                                 |
|-----------|-------------------------------------------------|
| Volcanics | Rhyolite, fragmental lava, porphyritic rhyolite |
|           | Andesite, basalt, pillow lava                   |
| Sediments | Greywacke, arkose, iron formation               |

(8) Michaud Township

O.D.M. Vol. LVII, Pt. 4, 1948, J. Satterly

|          |                                          |
|----------|------------------------------------------|
| Keewatin | Rhyolite; spherulitic rhyolite           |
|          | Basalt; pillow lava; tuff; chert; schist |
|          | Greywacke arkose                         |
|          | Carbonate rock                           |

Acid volcanics outcrop in the northwest quarter of Michaud Township.

(9) Beatty Township

O.D.M. Vol. LVI, Pt. 7, 1947, J. Satterly.

|          |                                               |
|----------|-----------------------------------------------|
| Keewatin | Rhyolite; fragmental lava                     |
|          | Andesite, basalt; pillow lava; dioritic lava; |
|          | spherulitic lava; fragmental lava.            |
|          | Greywacke, arkose quartzite; argillite        |

A band of acid volcanics 1000 feet thick overlies basic volcanics. In the area south of Sabrie Lake the acid volcanics interfinger with the basic and intermediate volcanics.

(10) Northeast Portion of Timagami Lake Area

O.D.M. Vol LI, Pt. 6, 1942, W. W. Moorhouse.

|          |                                                                 |
|----------|-----------------------------------------------------------------|
| Keewatin | Basic and intermediate volcanics                                |
|          | Acid volcanics, rhyolite, porphyries, acid tuffs, agglomerates. |
|          | Iron formation                                                  |

In southwest Chambers township occur rhyolite outcrops up to 1 mile in diameter. Mixed acidic volcanics extend from Iron Lake northeast along the north shore of Vermilion Lake, as well as along the south shore of Lake Timagami's northeast arm.

(11) Tyrell-Knight Townships

O.D.M. Vol. XLI, Pt. 2, 1932, A.R. Graham.

|             |                                    |
|-------------|------------------------------------|
| Timiskaming | Greywacke, arkose, conglomerate    |
|             | Rhyolite, trachyte, breccias, tuff |
| Keewatin    | Banded iron formation              |
|             | Greenstone, pillow lava, etc.      |



The oldest rocks in the district belong to the Keewatin period of prolonged vulcanism, during which time a thick series of basic and acidic flows were deposited upon an unknown primordial floor.

Small isolated areas of rhyolite indicated on the map as Timiskaming may belong to the Keewatin. The Timiskaming rocks, consisting of rhyolite and trachyte flows, tuff, volcanic breccia and sediments, were placed in the Keewatin by earlier geologists; these rocks are, however, not metamorphosed or folded as greatly as the older Keewatin.

Rhyolite, exposed in the eastern part of the area grades westward into trachyte, which is exposed through Natal Township.

A thick series of sediments and volcanics extends into the southern part of Tyrell Township. In the southern part of Tyrell the succession is: initial beds of volcanic breccia and tuff overlain by rhyolite flows which in turn are followed by another series of breccia and tuff grading upwards into sediments.

(12) Porcupine-Shiningtree Area

O.D.M. Map No. 1931A

|          |                                                                                        |
|----------|----------------------------------------------------------------------------------------|
|          | Banded iron formation                                                                  |
| Keewatin | Rhyolite; agglomerate; tuff; greywacke; slate-like<br>sediments of pyroclastic origin. |

The oldest rocks are of Keewatin age and include lavas, tuffs, breccias, agglomerate and iron formation.

On the map a distinction has been made between the basic and acid lavas where such has been shown on the maps from

which the compilation has been made. Otherwise, the Keewatin rocks are grouped together.

(13) Bannockburn Gold Area

O.D.M. Vol. XLI, Pt. 2, 1932, H. C. Rickaby.

Keewatin

Basic volcanics: basalt, andesite, tuff, agglomerate

Acid volcanics: rhyolite, dacite, tuff, agglomerate

Iron formation: banded silica, carbonates

Rhyolite is prominent east and west of the boundary line between Montrose and Bannockburn Townships. The attitude of flows indicates that rhyolite is low down in the Keewatin series. There is considerable interbedding between the rhyolite and the andesite. Rhyolite occurs also in the southwestern part of Montrose Township.

(14) Langmuir-Sheraton Area

O.D.M. Vol. XLIX, Pt. 4, 1940, H.C. Rickaby.

Keewatin

Agglomerates; tuffs, massive dacite and rhyolite; greenstone; hornblende schists.

In the northwestern part of Langmuir Township the lavas are mostly dacite, with rhyolite in a few localities.

(15) Porcupine Area

O.D.M. Map No. 47A, 1938, M.E. Hurst

Keewatin

Greywacke, slate, tuffs

Acidic flows and pyroclastics (Composed chiefly of rhyolitic and highly feldspathic lavas)

Iron formation, pillow lavas

Massive basic lavas

Massive andesite, dacite

Pillow lava

Fragmental lava, tuffs, sediments

(16) Robb-Jamieson Area

O.D.M. Vol. LIII, Pt. 4, 1944, L.G. Berry.

|          |                                                                                   |
|----------|-----------------------------------------------------------------------------------|
| Keewatin | Transition zone; indeterminate rocks, between<br>normal Keewatin types and gabbro |
|          | Rhyolite                                                                          |
|          | Greenstone; pillow lava; volcanic fragmentals                                     |

Rhyolite outcrops at numerous points throughout the area, the most prominent exposure is Mount Jamieson. Acidic tuffs occur interbedded with rhyolite northeast of Kamiskotia Lake.

(17) Rush Lake Area

O.D.M. Map No. 290A, 1933.

|                   |                                                                   |
|-------------------|-------------------------------------------------------------------|
| Schist<br>Complex | Rhyolite pyroclastics locally grading into rhyo-<br>lite porphyry |
|                   | Iron formation                                                    |
|                   | Intermediate to basic lavas                                       |
|                   |                                                                   |

Rhyolite porphyry occurs in Newton and Heenan Townships. In Marion Township are, for the most part, rhyolite tuffs and flow breccia.

(18) Swayze Gold Area

O.D.M. Vol. XLIII, Pt. 3, 1934, H.C. Rickaby.

|             |                                                                                                       |
|-------------|-------------------------------------------------------------------------------------------------------|
| Timiskaming | Conglomerate, greywacke, trachytic to rhyolitic<br>tuffs and agglomerates                             |
|             | Hornblende and chlorite schists                                                                       |
|             | Iron formation                                                                                        |
| Keewatin    | Acidic to basic lavas: basalt, andesite, gabbro,<br>diabase, rhyolite dacite, tuffs and agglomerates. |

Rhyolites are of local occurrence, being found mostly in Coppel and Swayze Townships; they occur most frequently in the upper horizons of Keewatin rocks.

The geologic history starts with a period of intense volcanic activity followed by a period of alternating vulcanism and local sedimentation. The first period of volcanic activity resulted in the laying down of flows of considerable thickness, essentially of basic to intermediate composition. Towards the end of the period the flows tended to become more acidic. The second period is a transitional one; the volcanic activity continued but was largely explosive and resulted in the deposition of a thick series of acid pyroclastic rocks including trachyte and rhyolite tuffs, agglomerates and flow breccias. These are well represented in the area north of Cree Lake in Swayze Township.

LAKE NIPIGON DISTRICT(1) Keezhik-Miminiska Lakes Area

O.D.M. Annual Report, 1939, Vol. 43, Pt. 6, V.K. Prest

|          |                                                                       |
|----------|-----------------------------------------------------------------------|
|          | Basic sill-like intrusives                                            |
|          | Andesitic to basaltic volcanics                                       |
|          | Conglomerate                                                          |
| Keewatin | Acid to basic light-coloured volcanics, bedded<br>tuffs and sediments |
|          | Andesitic to basaltic volcanics and sediments                         |

The acid volcanics of the Keezhik Lake section present a striking contrast in colour and character to all the other volcanic rocks. Dacite is the most prevalent type but rhyolite also occurs.

(2) Kowkash-Ogoki Area

O.D.M. Annual report, 1931, Vol. 40, Pt. 4, L.F. Kindle.

|              |                                                                           |
|--------------|---------------------------------------------------------------------------|
|              | Iron formation                                                            |
|              | Rhyolitic tuff, agglomerate, slate, conglomerate                          |
| Keewatin     | Rhyolite                                                                  |
|              | Diabase, gabbro                                                           |
|              | Pillow lava, basalt                                                       |
| Coutchiching | Massive and schistose whitish quartzose rocks;<br>iron formation, breccia |

(3) South Onaman Area

O.D.M. Vol. XLVII, Pt. 8, 1938, W. W. Moorhouse.

|          |                                                |
|----------|------------------------------------------------|
|          | Iron formation                                 |
|          | Diorite, diabase                               |
| Keewatin | Lavas, acid to intermediate; agglomerate; tuff |
|          | Lavas, mainly basic; agglomerate; tuff         |

Acid lavas are most abundant in a large section surrounding Castlewood Lake; they are also widespread in the eastern part of the area north of La Pierre Township. The acid lavas grade into intermediate; true acid lavas are of rare occurrence in the area.

(4) Western Part of Sturgeon River Area (Sturgeon River-Beardmore Section)

O.D.M. Vol. XLV, Pt. 2, 1932, H.C. Laird

|          |                                                                                                                                                                                                                                      |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Keewatin | <p>Tuffs and agglomerates</p> <p>Rhyolite, dacite, andesite flows and their associated pillowed, amygdaloidal and porphyritic varieties; flow breccias; carbonate, sericite and chlorite schists derived from the various flows.</p> |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

In the vicinity of Crooked Green Creek the lavas range in composition from rhyolite to hornblende dacite. Between the Jackpine-Sturgeon workings and Macjoe Landing on the Sturgeon River, the lavas show a gradual transition from dacite to typical rhyolite. Thick flows of rhyolite porphyry occur on the Macjoe Sturgeon property.

Intercalated with the lava flows in many places are narrow bands of volcanic tuff and agglomerate. These fragmental types vary greatly in appearance and composition but, in the main correspond closely to the contemporaneous flows with which they are associated. The tuffs are usually fine-grained but show all gradations into coarse agglomerates, with fragments up to 8 inches in length. For the most part they appear to have been subaerial accumulations with the result that bedding is not a common feature; locally, they are banded and were sorted under water.

LITTLE LONG LAC AREA(5) Eastern Part of Sturgeon River Area (Jellicoe-Sturgeon River Section)

O.D.M. Vol. XLV, Pt. 2, 1936, E.L. Bruce.

|          |                                                                                                                                                                                                                   |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Keewatin | <p>Iron formation</p> <p>Lavas, mainly intermediate to acid in composition; agglomerate and tuff; schists derived from these</p> <p>Lavas; mainly basic; ellipsoidal weathering greenstones; derived schists.</p> |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

White dense, tuffaceous rocks, which occur in places interbanded with the typical ellipsoidal-weathering greenstones, have commonly a faint, fine banding. In thin sections they show a fragmental texture with angular grains of plagioclase and quartz in a matrix of calcite, sericite and fine particles of plagioclase and quartz. These bands are apparently rhyolite tuff.

Most of the more acidic lavas are rhyolite but certain bands are low in quartz and probably are trachytes; others may be dacites. Those that are quite certainly rhyolites are porphyritic with conspicuous rounded phenocrysts of quartz visible in the hand specimens. Most of the acidic rocks occur in the northern part of the area.

Two kinds of breccia are associated with the Keewatin lava: explosive and volcanic breccia. The volcanic breccia is a pyroclastic type differing from agglomerate mainly in the angular nature of its fragments. It consists of numerous angular and blocky fragments of greenish materials showing considerable variety and ranging in size from mere particles to four-sided

blocks two or more feet in width. The fragments are generally crowded together and show no special orientation. The interstitial material is a dark chlorite substance.

Flow breccias are less common, but excellent outcrops of this material were observed in the southern part of Irwin Township. They resemble the volcanic breccias on account of their fragmental character, but may be distinguished by the more uniform nature of the matrix.

#### (6) Big Duck-Aguasabon Lakes Area

O.D.M. Map 49K

O.D.M. Annual Report, 1940, M.W. Bartley

|          |                                                                                                  |
|----------|--------------------------------------------------------------------------------------------------|
| Keewatin | Acid lava, agglomerate, tuff<br>Basic to intermediate lava, pyroclastics<br>Schists and gneisses |
|----------|--------------------------------------------------------------------------------------------------|

Acid lavas are relatively scarce; they appear as scattered patches in the basic lavas in the vicinity of Aguasabon Lake.

#### (7) Schreiber Area

O.D.M. May 47 J

O.D.M. Annual Report, 1938, Vol. 47, Pt. 9, G.A.

Harcourt.

|          |                                                                                                                                                                              |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Keewatin | Iron formation<br>Conglomerate, quartzite; limestone<br>Acid to intermediate flows, tuff, agglomerate;<br>acid pillow lavas<br>Intermediate to basic flows and pyroclastics. |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Rhyolites make up a considerable part of the Keewatin



formation but they are not as widespread as the andesite flows. They are more or less segregated from the andesites but inter-finger with them. Rhyolite flows within the andesite areas are rare; they are seldom very thick.

Pyroclastics are associated with rhyolite flows and are composed of rhyolite fragments and cement. Agglomerates made up of round rhyolite fragments one inch to one foot in diameter are common.

#### (8) Heron Bay-White Lake Area

O.D.M. Map 41J, 1932, J.E. Thomson.

O.D.M. Annual Report Vol. 41, Pt. 6, 1932.

|          |                                       |
|----------|---------------------------------------|
| Keewatin | Rhyolite, agglomerate, volcanic tuff  |
|          | Iron formation                        |
|          | Basic volcanics, amphibolite; schists |

#### (9) Gorham Township and Vicinity

O.D.M. Vol. XLVIII, Pt. 1, 1939, K.D. MacDonald

|              |                                                                                                   |
|--------------|---------------------------------------------------------------------------------------------------|
| Keewatin     | Acid volcanics: rhyolite and rhyolite porphyry;<br>dacite; pyroclastics; basic volcanics; schists |
| Coutchiching | Mica schists and gneisses                                                                         |

The acid volcanics consist of rhyolite and rhyolite porphyry; they are the common rock type in southwestern Gorham Township. The rhyolites are usually massive and have a dense siliceous appearance.

#### Goudreau-Lochalsh Area

O.D.M. Map 49G

O.D.M. Annual Report, 1940, Vol. 49, Pt. 3, C.L. Bruce.

|          |                             |
|----------|-----------------------------|
| Keewatin | Mainly basic lavas          |
|          | Iron formation              |
|          | Sediments                   |
|          | Mainly acid lavas and tuffs |

Lochalsh-Missinabi Area

O.D.M. Annual Report, 1935, E.M. Burwash.

|                  |                                      |
|------------------|--------------------------------------|
| Haileyburian (?) | Upper volcanics, mainly basic        |
| also called      | Iron formation                       |
| Upper Keewatin,  | Lower volcanics, mainly acid, partly |
| Post-Dorean, or  | basic.                               |
| Wawa tuffs       |                                      |

The acid area in Rennie and Stover Townships is of rhyolitic character, characterized by flow structure and is, in places, pyroclastic.

KENORA LAKE DISTRICT(1) Shonia Lake Area

O.D.M. Annual Report 1930, Vol. 39, Pt. 3, H.C. Laird.

|          |                                                                         |
|----------|-------------------------------------------------------------------------|
| Keewatin | Altered basic lavas, acid lavas, iron formation<br>conglomerate, slate. |
|----------|-------------------------------------------------------------------------|

The acid volcanics are chiefly rhyolites and rhyolite fragmentals. The latter occur at the southeast corner of Long Lake. The principal belt of rhyolite extends from Andy Lake westward to Shonia Lake.

(2) Cat River - Kawinogans Lake Area

O.D.M. Annual Report 1935, Vol. 44, Pt. 6, W.D. Harding.

|          |                                                                                                                                                |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Keewatin | Conglomerate<br>Iron formation<br>Quartzite, greywacke, slate, some lavas.<br>Basic and acid flows, intrusives, pyroclastics<br>and sediments. |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------|

(3) Birch - Springpole Lakes Area

O.D.M. Annual Report 1936, Vol. 45, Pt. 4, W.D. Harding.

|          |                                                               |
|----------|---------------------------------------------------------------|
| Keewatin | Acid volcanics<br>Basic volcanics and interlayered sediments. |
|----------|---------------------------------------------------------------|

(4) Uchi - Slate Lakes Area

O.D.M. Annual Report 1939, Vol. 48, Pt. 8, J.D. Bateman.

|                                         |                                                                                                                                              |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Uchi Series<br>(dominantly<br>volcanic) | Rhyolite and silicic tuff<br>Quartzite, slate<br>Volcanic tuff, breccia, intermediate lavas<br>Greenstone, schists, amphibolite<br>Sediments |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|

The Uchi Series west of Fly Lake consist mostly of rhyolite and altered andesite tuffs. In the southern part of the Uchi Lake Area the rocks consist mainly of amphibolites interbedded with narrow beds of silicic tuff and rhyolite flows.

#### (5) Sturgeon Lake Area

O.D.M. Annual Report 1930, Vol. 39, Pt. 2, A.R.Graham.

|          |                                                                    |
|----------|--------------------------------------------------------------------|
| Keewatin | Rhyolite, volcanic tuff and breccia, agglomerate, schists, basalt. |
|----------|--------------------------------------------------------------------|

A belt of acid flow and clastic rocks outcrop throughout the Northeast arm of Sturgeon Lake. Fine grained tuffs are interbedded with the rhyolites.

#### (6) Dryden - Wabigoon Area

O.D.M. Annual Report 1941, Vol. 50, Pt. 2, J. Satterly.

|          |                                       |
|----------|---------------------------------------|
| Keewatin | Intermediate to basic volcanics       |
|          | Quartzite, greywacke, schists         |
|          | Intermediate to basic volcanics       |
|          | Quartzite, greywacke, schists, arkose |
|          | Acid lavas, acid pyroclastics         |
|          | Quartzite, greywacke, schists         |

Acid lavas and agglomerates occur at a large number of scattered localities. These acid rocks are interbedded with intermediate to basic flows and agglomerates. An extensive occurrence is found in the vicinity of Butler Lake.

#### (7) Steeprock Lake Area

O.D.M. Annual Report 1939, Vol. 48, Pt. 2, M.W. Bartley.

|          |                                                             |
|----------|-------------------------------------------------------------|
| Keewatin | Iron formation                                              |
|          | Acid lava, pillow lava, tuff, agglomerate                   |
|          | Intermediate to basic lava, pillow lava, tuff, agglomerate. |

A band of well bedded acid to intermediate tuff up to 200 feet thick follows the south shore of the Lake.

(8) Straw - Manitou Lakes Area

O.D.M. Annual Report 1934, Vol. 43, Pt. 4, J.E.Thomson.

|          |                                                                                           |
|----------|-------------------------------------------------------------------------------------------|
| Keewatin | Rhyolite, trachyte, agglomerate and tuff<br>Andesite, basalt, basic agglomerate and tuff. |
|----------|-------------------------------------------------------------------------------------------|

The largest belt of acid lavas and associated pyroclastics is found between Mister and Straw Lakes. Most of them have the composition of rhyolite, less commonly trachyte. Acid agglomerates and tuffs are occasionally associated with the flows. Well developed pillows were observed in acid flows on Straw Lake. Towards the boundaries of the large areas of acid lavas, there is considerable interbedding of basic and acid flows.

(9) Kakagi Lake Area

O.D.M. Annual Report 1933, Vol. 42, Pt. 4, E.M.Burwash.

|             |                                                                                                                                                      |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Keewatin    | Fragmental volcanics of great thickness without stratification<br>Banded tuff<br>Iron formation<br>Felsite, rhyolite<br>Basic lavas, mainly andesite |
| Couchiching | Gneisses, schists<br>Rhyolite at Berry Lake.                                                                                                         |

(10) Bigstone Bay Area

O.D.M. Annual Report 1930, Vol. 33, Pt. 3 G.G.Suffel.

|          |                                                                  |
|----------|------------------------------------------------------------------|
| Keewatin | Coarse diorite<br>Basic quartz porphyry, fine grained intrusives |
|----------|------------------------------------------------------------------|

|                         |                                                                         |
|-------------------------|-------------------------------------------------------------------------|
| Keewatin<br>(continued) | Basic volcanics, schists                                                |
|                         | Gneissoid biotite schists                                               |
|                         | Rhyolite, quartz and feldspar porphyry agglomerate,<br>sericite schist. |

The rhyolitic rocks occur along the south shore of Witch Bay and on the south side of Pipestone Peninsula and of Andrew Bay.

(11) North-Central Part, Lake of the Woods Area

O.D.M. Annual Report 1936, Vol. 45, Pt. 3, J.E. Thomson.

|          |                                                                                         |
|----------|-----------------------------------------------------------------------------------------|
| Keewatin | Rhyolite and rhyolite porphyry                                                          |
|          | Sediments, inberbanded with lavas, agglomerates,<br>greywacke and slate, iron formation |
|          | Andesite and basalt.                                                                    |
|          |                                                                                         |

Rhyolite and rhyolite porphyry are widespread over the area, generally occurring as small bands interlayered with other members of the assemblage. The largest areas of these acid lavas are on Rat Portage, Corkscrew Island and Indian Reserve No. 38A.

Rhyolite throughout the area is often brecciated and associated with acidic phases of the agglomerate.





- L E G E N D**
- acid lavas: rhyolite, trachyte, dacite
  - ▨ mixed acidic to basic volcanics
  - ▧ basic and undifferentiated volcanics
  - ▩ acidic tuff, breccia & agglomerate
  - r rhyolite
  - t trachyte
  - p tuff
  - b breccia
  - a agglomerate

DISTRIBUTION OF ACIDIC VOLCANIC ROCKS IN THE  
**KENORA DISTRICT**

SCALE: 1 inch to 8 miles

0 8 16 24 32

- INDEX OF LOCALITIES**
- ① Shonia Lake Area
  - ② Cat River-Kawinagans Lake Area
  - ③ Birch-Springpole Lakes Area
  - ④ Uchi-Slate Lakes Area
  - ⑤ Sturgeon Lake Area
  - ⑥ Dryden-Wabigoon Area
  - ⑦ Steeprock Lake Area
  - ⑧ Straw-Manitou Lakes Area
  - ⑨ Kakagi Lake Area
  - ⑩ Bigstone Bay Area
  - ⑪ North-central Lake of the Woods Area



MAIN REPORTED OCCURRENCES OF ACIDIC VOLCANIC ROCKS IN THE  
SUPERIOR PROVINCE  
OF THE CANADIAN SHIELD

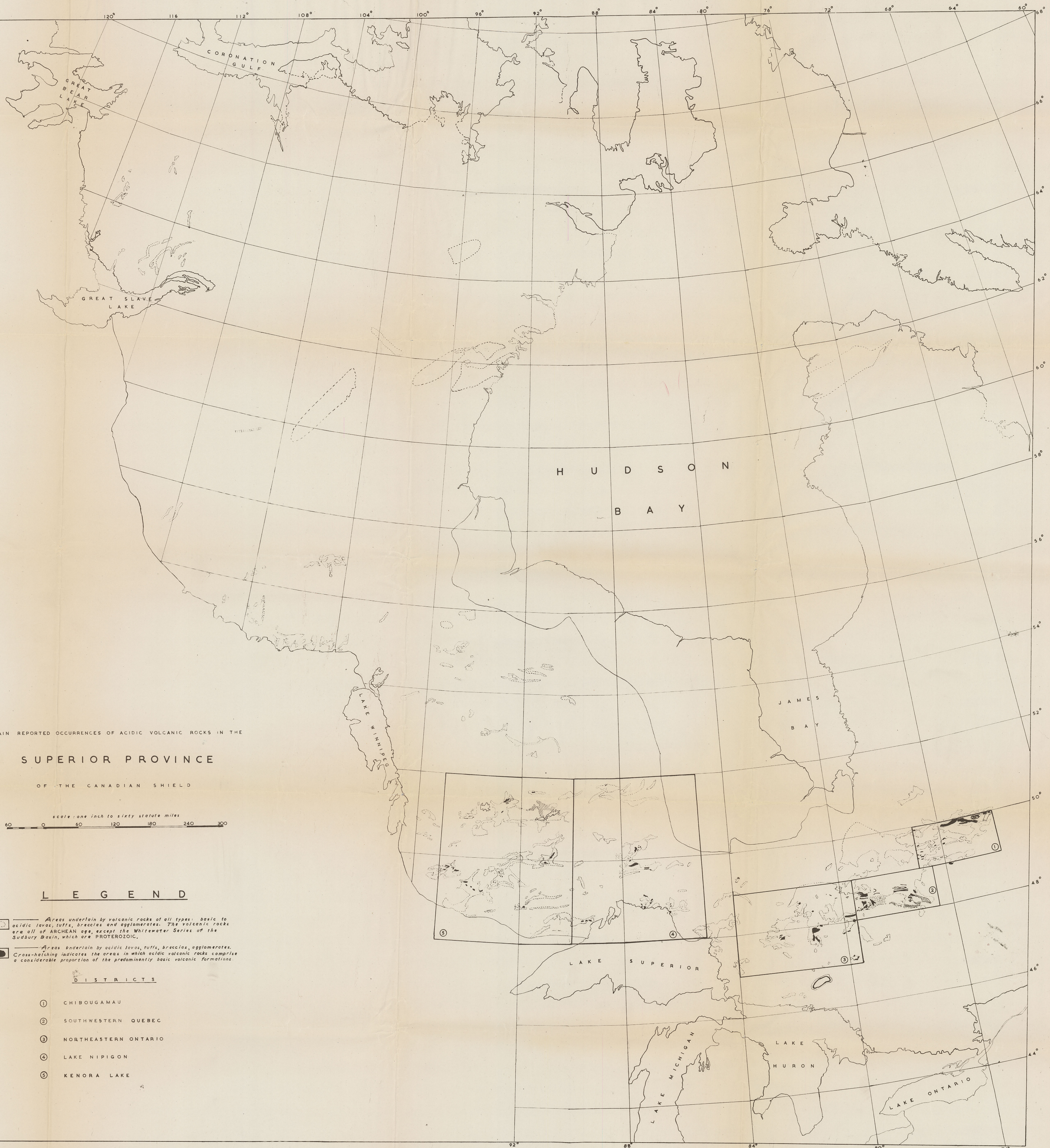
scale: one inch to sixty statute miles

LEGEND

- Areas underlain by volcanic rocks of all types: basic to acidic lavas, tuffs, breccias and agglomerates. The volcanic rocks are all of ARCHEAN age, except the Whitewater Series of the Sudbury Basin, which are PROTEROZOIC.
- Areas underlain by acidic lavas, tuffs, breccias, agglomerates. Cross-hatching indicates the areas in which acidic volcanic rocks comprise a considerable proportion of the predominantly basic volcanic formations.

DISTRICTS

- ① CHIBOUGAMAU
- ② SOUTHWESTERN QUEBEC
- ③ NORTHEASTERN ONTARIO
- ④ LAKE NIPIGON
- ⑤ KENORA LAKE











# LEGEND

- Acid lava flows
- Acid pyroclastics
- Keewatin basic volcanics

## TIMISKAMING

- 2r rhyolite
- 2t trachyte
- 2d dacite
- 2b breccia
- 2p tuff
- 2a agglomerate

## KEEWATIN

- 1r rhyolite
- 1t trachyte
- 1d dacite
- 1b breccia
- 1p tuff
- 1a agglomerate

## INDEX TO LOCALITIES

- ① Gauthier Township
- ② McVittie Township
- ③ McGarry Township
- ④ Lebel Township
- ⑤ Skead Township
- ⑥ Bryce-Robillard Area
- ⑦ Harker Township
- ⑧ Michaud Township
- ⑨ Beatty Township
- ⑩ N.E. Timagami Lake Area
- ⑪ Tyrell-Knight Area
- ⑫ Porcupine-Shiningtree Area
- ⑬ Bannockburn Gold Area
- ⑭ Langmuir-Sheraton Area
- ⑮ Porcupine Area
- ⑯ Robb-Jamieson Area
- ⑰ Rush Lake Area
- ⑱ Swayze Area

## DISTRIBUTION OF ACID VOLCANIC ROCKS IN NORTHEASTERN ONTARIO

SCALE  $\frac{1}{506880}$  = 1 inch to 8 miles









# LEGEND

- Acid lavas; rhyolite, trachyte, dacite.
  - Acid tuffs, breccias, agglomerates.
  - Interbedded acidic and basic lavas.
  - Basic and undifferentiated volcanics.
- a) Rhyolite  
 b) Trachyte  
 c) Dacite  
 d) Tuffs  
 e) Breccias  
 f) Agglomerates
- (1) Reference number of district

## INDEX TO LOCALITIES

- ① DASSERAT - BEAUCHASTEL
- ② NORANDA - ROUYN
- ③ LAKE DUPRAT
- ④ HÉBÉCOURT - DUPARQUET
- ⑤ LOIS LAKE
- ⑥ CLÉRICY - LAPAUSE
- ⑦ DESMELOIZES
- ⑧ LAUNAY
- ⑨ DESBOUES
- ⑩ DALQUIER - FIGUERY
- ⑪ LAMORANDIERE - DUVERNY
- ⑫ MALARTIC AREA
- ⑬ BOURLAMAQUE AREA
- ⑭ SENNETERRE - BARRAUTE
- ⑮ PASCALIS
- ⑯ VAUQUELIN - PERSHING

DISTRIBUTION OF ACIDIC VOLCANIC ROCKS  
 IN  
 SOUTHWESTERN QUEBEC

SCALE: 1 inch to 4 miles