

Conglomerate. Pebbles. Jaspilyte.]

siderite rather than calcite is shown by its frequently marked absorption,—stronger than calcite commonly shows,—and by the fact that the powdered rock effervesces very freely in hot hydrochloric acid, while there is almost no effervescence in the cold acid.

One section.

*Age.* Keewatin.

U. S. G.

NO. 908. CONGLOMERATE.

North of the Cady house on the South ridge, Tower.

*Ref.* Annual Report, xv, pages 268, 269, 389; Annual Report, xvii, pages 194, 215.

*Meg.* A fine-grained, gray, schistose rock which contains small grains of feldspar, some of quartz and rock fragments. One of the specimens contains a piece of a black, hard, slaty rock. The rock is a rusty weathering one. On fresh fractures very minute, silvery, micaceous scales are abundant.

*Mic.* Angular grains of feldspar and quartz are embedded in a finer-grained groundmass, but there are all variations in size between the feldspars and quartzes visible in the hand sample and the minute ones of the groundmass. The rock is schistose and the groundmass is composed essentially of *quartz, feldspar, muscovite, chlorite, calcite*, dust-like black material, and probably also *kaolinite*. One of the slides shows a fragment of a black rock which consists of a few scattered, lath-shaped feldspars, in a confused dark background.

Two sections.

*Age.* Upper Keewatin.

U. S. G.

NO. 908A. PEBBLES (*from No. 908*).

Same locality as No. 908.

*Ref.* Annual Report, xv, page 389.

*Meg.* There are four of the pebbles, or rather fragments of pebbles. One is a fine-grained, granular, somewhat crumbling, white quartzite or jaspilyte. Another is a fine-grained, hard, black, slaty rock. Another is a very fine-grained, gray rock, with a few small grains of quartz. Another is fine grained, greenish gray and somewhat porous. Another is fine-grained, hard, almost flint greenstone. Another is black, slaty jaspilyte.

*Mic.* The section was evidently made from the first-mentioned pebble, which is seen to be an almost pure, completely crystallized, fine-grained quartzite, or a rather coarse-grained jaspilyte. One section.

*Age.* Pebbles in Upper Keewatin rock.

U. S. G.

NO. 909. JASPILYTE.

A little north of, but near, Tower.

*Ref.* Annual Report, xv, pages 229, 268, 389. This rock is embraced in a clastic green schist similar to No. 910.

*Meg.* Red jaspilyte with some irregular, black laminae which contain small *magnetite* crystals. The rock is in places schistose, and specular *hematite* has been developed along the cleavage planes. The hand specimen is crossed by a white quartz vein, less than an eighth of an inch in thickness, and along this vein are some cavities holding *quartz* crystals, *hematite* and apparently *limonite*. No section.

*Age.* Upper Keewatin.

U. S. G.

NO. 910. CHLORITE SCHIST.

From a narrow band between two jasper masses, near Tower.

*Ref.* Annual Report, xv, page 389.

*Meg.* A fine-grained, soft, schistose, green rock, containing many minute, glistening crystals (*magnetite*). The hand sample also embraces fine siliceous nodules that appear to be jaspilyte.

*Mic.* The section shows a schistose rock, composed essentially of three minerals: (1) *Chlorite* in small flakes, abundant; (2) *Quartz* in fine grains, abundant; (3) Small octahedra of *magnetite*, common. One section.

*Age.* Upper Keewatin.

U. S. G.

NO. 911. CONGLOMERATE. (*Jaspilitic.*)

Sec. 20, T. 62-15 W., near Tower.

*Ref.* Annual Report, xv, pages 316, 389.

*Meg.* There are three hand samples of this number. Two of these are of indistinctly mottled and blotched gray to green jaspilyte; in general in these two specimens the fragments are not distinctly visible. In the other specimen the fragmental character of the rock is evident. There are pieces, usually not more than half an inch in diameter, and partly rounded, of gray, greenish and reddish jaspilyte in a cement of green jaspilyte.

*Mic.* There are two sections, one of which is too thick and shows a little green chloritic material. The other section has a fragmental character, although this is partially obscured owing to the similar nature, at times, of the fragments and the cement, both of which are composed of aggregates of fine-grained *quartz* and granular *siderite*. The fragments are angular in shape and are composed of jaspilyte of finer grain than the matrix and also containing finely divided iron ore. The fragments are also richer in *siderite* than the matrix and in these fragments this mineral is sometimes aggregated in irregular, but approximately spherical masses.

Two sections.

*Age.* Upper Keewatin.

*Remark.* From what is seen in the hand specimens and the slides, one cannot be certain that the rock is a conglomerate; it is possible that it is a breccia.

U. S. G.

Breccia. Quartz-porphry.]

NO. 912. BRECCIA. (*Pyritic.*)

Lee mine, Tower.

Ref. Annual Report, xv, pages 248, 389.

*Meg.* A breccia in which the fragments are rather soft, earthy hematite, and the cement is pyrite and hematite. There is present a small amount of a soft, green, chloritic or earthy substance as a part of the cement.

No section.

*Age.* Keewatin.

U. S. G.

NO. 913. QUARTZ-PORPHYRY. (*Hornblendic.*)

Low hills, southeast of Tower, near the Duluth and Iron Range railroad; sec. 33, T. 62-15 W.

Ref. Annual Report, xv, pages 271, 273, 389.

*Meg.* The rock is gray in color and is apparently somewhat schistose. It shows a very fine-grained groundmass in which are small porphyritic crystals of hornblende and larger ones of feldspar and quartz.

*Mic.* The rock is a quartz-porphry, which has been altered and sheared, and the section is too thick for careful study. The porphyritic crystals are *feldspar*, *quartz* and *hornblende*. The feldspar is considerably kaolinized and clouded; some of it shows no twinning and is perhaps orthoclase, while some of it is twinned according to the albite law and is perhaps near *oligoclase*. The quartz is not abundant; two of the crystals show an approach, though somewhat rounded, to a bipyramidal form. The hornblende varies in color from brownish, to green, to almost colorless; it is frequently fibrous and perhaps none of it is original, although some of the brown crystals may be.

The groundmass of the rock is very fine grained and is composed of quartz, feldspar, flakes of hornblende, of chlorite and of muscovite, and epidote. The last named mineral is sometimes in distinguishable grains, and also, apparently, as very minute grains scattered all through the groundmass.

One section.

*Age.* Keewatin.

U. S. G.

## NO. 914. QUARTZ-PORPHYRY (?)

Southeast of Tower, near the Duluth and Iron Range railroad; sec. 33, T. 62-15 W.

Ref. Annual Report, xv, pages 271, 273, 389.

*Meg.* A fine-grained, gray rock, containing some large porphyritic quartzes and some smaller, less apparent feldspars.

*Mic.* The most noticeable feature of the section is presence of an abundance of *epidote*, which has permeated the whole rock; it is scattered in small grains throughout the groundmass, which is mainly composed of fine-grained *quartz*, and it replaces what appear to have once been porphyritic feldspars. There are

a few areas of fibrous *hornblende* encroached upon by epidote; these seem to represent some original, porphyritic, ferromagnesian constituent. A few larger quartz grains occur, and there is one which shows an approach to a bipyramidal form.

One section.

Age. Keewatin.

U. S. G.

No. 915. CAMPTONYTE (?)

"Greenstone, from dike cutting the graywacke near the railroad, southeast of Tower; sec. 33, T. 62-15."  
Ref. Annual Report, xv, pages 271, 273, 389.

*Meg.* A fine-grained, compact, massive, grayish-green rock. It weathers to a greenish gray.

*Mic.* The section shows a rather fine-grained rock, whose chief component is feldspar. This occurs in irregular grains and forms the background of the rock. The feldspar is sometimes untwinned and sometimes shows albite twinning. Its species was not carefully determined, but equal extinction angles in twinned sections indicate a feldspar near *andesine* or perhaps *andesine-oligoclase*. *Hornblende* is abundant. It is brownish green and pale green to almost colorless. The brownish-green hornblende occurs in elongated prisms, whose size in cross sections is considerably less than that of the feldspars. The prismatic planes on this brownish-green hornblende are often developed, but the terminal planes rarely. Frequently these hornblendes have borders and fibrous elongations of the pale-green hornblende, and the latter occurs in irregular masses and small fibres abundantly throughout the section. *Epidote* is common, and there is a little iron ore. One section.

Age. Keewatin.

U. S. G.

No. 916. BRECCIA. (*Hematitic.*)

Breitung mine, Soudan.

Ref. Annual Report, xv, pages 250, 389; Annual Report, xvii, pages 194, 215.

*Meg.* A rough, heavy rock, brecciated, and composed of small fragments of hematite in a cement of the same. Scattered all through the rock are small, irregularly shaped areas of a soft, white, earthy substance. Some of this substance was examined under the microscope and found to consist of a very finely divided, gray, practically isotropic material. Specimens collected later under this number show a breccia of jaspilyte. No section.

Age. Keewatin.

U. S. G.

No. 917. JASPILYTE.

From the extreme eastern extension of the ridge affording No. 868; sec. 32, T. 62-15 W., Tower.

Ref. Annual Report, xv, pages 268, 389.

*Meg.* Brecciated, somewhat crumbling, white, black, gray and red jaspilyte.

No section.

Age. Keewatin.

U. S. G.

Dioryte. Chlorite schist. Quartz-porphry.]

NO. 918. DIORYTE (*with quartz*).

From a boulder near the railroad, Breitung mine, Soudan.

Ref. Annual Report, xv, pages 275, 336, 389.

*Meg.* A coarse-grained granitic rock, composed largely of hornblende, but with some white to red feldspar and quartz. Some of the hornblendes have compact borders and cores which are granular.

*Mic.* The section shows much green *hornblende* and smaller amounts of *feldspar* and *quartz*. The feldspar is generally much clouded and kaolinized, but in places still retains traces of albite twinning. *Epidote*, *sphene*, *magnetite* and *hematite* are also present.

One section.

*Age.* Boulder, probably from the Archean.

U. S. G.

NO. 919. CHLORITE SCHIST. (*Jaspilitic.*)

Railroad cut south of the Stone mine, Soudan.

Ref. Annual Report, xv, pages 224, 389; Bulletin vi, pages 44, 52, 231, 421.

*Meg.* A fine-grained, grayish-green, schistose rock. It contains considerable white, fine quartz.

*Mic.* The rock is composed essentially of small grains of *quartz*, similar to the quartz of the jaspilytes, and flakes of *chlorite*. These are sometimes intimately mingled together, but quite commonly each is massed in areas largely free from the other. A few *magnetite* crystals are present.

Three sections.

*Age.* Keewatin.

*Remarks.* This is one of the rocks intermediate in composition between jaspilyte and green schist. Compare Nos. 885, 894, 895, 897.

U. S. G.

## NO. 920. QUARTZ-PORPHYRY (?)

S. E.  $\frac{1}{4}$  sec. 6, T. 62-15 W.; east side of bay on south shore of Pine island, Vermilion lake.

Ref. Annual Report, xv, pages 303, 389.

*Meg.* A gray schistose rock of fine grain and holding many small hornblendes.

*Mic.* The groundmass of the section is of fine grain and is composed of *quartz*, *feldspar*, *chlorite*, *muscovite*, pale green *hornblende* and *epidote*. In this groundmass are larger grains of feldspar and quartz. These are without crystal outlines, interlock irregularly with the smaller grains of the groundmass, and in many cases have been fractured and their parts more or less separated. There are also some larger grains of brownish-green hornblende, which often have attached to them growths of pale green hornblende.

One section.

*Age.* Keewatin.

*Remark.* From the field notes and the slide this rock may be regarded as a quartz-porphry which has been sheared, but this origin for the rock is not absolutely certain, as a tuffaceous deposit or a recomposed quartz-porphry might take this form. Compare No. 913, which is a similar rock and seems to be clearly a quartz-porphry.

U. S. G.

NO. 921. SLATE. (*Black.*)

South shore of Pine island, Vermilion lake, at the west line of sec. 6, T. 62-15 W.  
*Ref.* Annual Report, xv, pages 303, 389; Annual Report, xvii, pages 194, 215.

*Meg.* A fine-grained, hard, black slate.

*Mic.* The rock is very fine grained and is composed of *quartz*, probably also *feldspar*, *chlorite*, *muscovite*, *kaolinite*, *epidote* and *pyrite*. There is also much dust-like, black material.

One section.

*Age.* Keewatin.

U. S. G.

## NO. 922. "GREENSTONE."

South shore of Pine island, Vermilion lake; S. W.  $\frac{1}{4}$  sec. 1, T. 62-16 W.  
*Ref.* Annual Report, xv, pages 303, 304, 389.

*Meg.* A fine-grained, grayish-green rock, resembling some of the "greenstones" of the Keewatin. Calcite is present in small seams.

*Mic.* The section shows a fine-grained rock, which is probably an altered, basic, igneous rock, but its original species cannot be told. The constituent minerals form a confused mass composed of *zoisite*, fibrous, almost colorless *hornblende*, *epidote*, *feldspar*, *muscovite*, *quartz* and *calcite*, the minerals being named approximately in the order of their abundance, the most abundant being named first.

One section.

*Age.* Keewatin.

*Remark.* From the field notes one might judge that this specimen was part of a "greenstone" dike.

U. S. G.

NO. 923. GRANITE (*in contact with biotite schist*).

Southwest corner of Avis island, Vermilion lake, near centre of sec. 35, T. 63-17 W.  
*Ref.* Annual Report, xv, pages 291, 389.

*Meg.* The granite is of medium grain and light gray in color. It is composed of *feldspar*, *quartz* and *muscovite*. The *biotite schist* is of medium grain for such a rock and is dark gray in color. The contact between the two rocks is sharp and distinct and runs about parallel with the cleavage of the schist.

*Mic.* The granite is composed of grains which vary considerably in size and which interlock irregularly. The rock seems to have suffered some granulation. The essential minerals are *quartz*, *feldspar* and *muscovite*. The *quartz* frequently

Granite. Hornblende schist.]

shows undulating extinction. The feldspar is apparently largely *orthoclase*, and there is a small amount of plagioclase (probably *oligoclase*) present. Associated with the *muscovite* is some chlorite and with the *chlorite*, and commonly included in it, are a few small grains of *epidote*.

The schist is composed largely of *biotite*, quartz and feldspar. The last named mineral shows no twinning and commonly no cleavage; its species was not determined. *Chlorite*, *muscovite* and *pyrite*, are also present, as well as a little *epidote*.

The sections do not show the contact of the two rocks.

Three sections.

Age. Archean.

U. S. G.

NO. 924. GRANITE. (*Biotitic.*)

S. W.  $\frac{1}{4}$  sec. 35, T. 63-17 W., west side of the channel west of Avis island, Vermilion lake.  
Ref. Annual Report, xv, pages 291, 389.

*Meg.* A rather fine-grained, gray granite, composed of quartz, feldspar and biotite.

*Mic.* The section shows a granite whose essential minerals are *feldspar*, *quartz* and *biotite*. The feldspar is more or less clouded and apparently both *orthoclase* and acid plagioclase (*oligoclase*). *Muscovite*, *chlorite* and iron ore are also present.

One section.

Age. Archean.

U. S. G.

## NO. 925. HORNBLLENDE SCHIST.

Same locality as No. 924.  
Ref. Annual Report, xv, pages 291, 389.

*Meg.* A fine-grained, schistose, greenish-gray rock, having along its cleavages many dark glistening scales.

*Mic.* The section shows a rock composed essentially of feldspar, quartz and green hornblende. The feldspar is much kaolinized. Chlorite, epidote and pyrite are rather common.

A minute vein crosses one end of the hand sample and is included in the section. The vein is composed of a colorless mineral at times somewhat clouded by impurities or alteration products. This mineral has an index of refraction higher than quartz and a double refraction considerably stronger than quartz. It has one pretty good cleavage and sometimes a poorer cleavage or cross fracturing approximately at right angles to the good cleavage. The mineral is biaxial, with a rather small optic angle, and the character of the double refraction is positive. The acute bisectrix is apparently perpendicular to the good cleavage. The hardness is apparently 6 or more. The species of the mineral is not known, but it may be *thomsonite*. One section.

Age. Archean.

U. S. G.

## NO. 926. DIABASE.

N. E.  $\frac{1}{4}$  sec. 31, T. 63-17 W.; Bear narrows, Vermilion lake.  
*Ref.* Annual Report, xv, pages 295, 389.

*Meg.* A fine-grained, dark-gray diabase, with some pyrite.

*Mic.* The section shows a rock consisting essentially of *plagioclase* and *augite*. The former is usually in lath-shaped forms and is considerably altered. The augite is in polysomatic areas and in plates which have an ophitic relation to the feldspars. The augite is also some altered, and secondary minerals have been developed throughout the slide. These secondary minerals are mainly *chlorite*, *hornblende*, *biotite* and *quartz*. *Magnetite* and *pyrite* also occur in the slide.

One section.

*Age.* Probably a dike cutting Archean rocks.

U. S. G.

## NO. 927. GRANITE.

From the point near the centre of sec. 23, T. 63-18 W.; West bay, Vermilion lake.  
*Ref.* Annual Report, xv, pages 295, 389.

*Meg.* A medium-grained granite, composed of quartz, white to pink feldspar and a dark mineral which appears to be largely chlorite.

*Mic.* A granitic rock, composed essentially of feldspar, which is highly altered, isolated *quartz* grains and *chlorite*. *Epidote* and *magnetite* are present.

One section.

*Age.* Archean.

U. S. G.

## NO. 928. CHLORITE SCHIST.

"Graywacke-like rock containing syenite in lenticular patches, southwest corner sec. 9, T. 63-17;" Long bay, Vermilion lake.  
*Ref.* Annual Report, xv, page 390.

*Meg.* The specimens vary from a fine-grained, green, somewhat schistose, chloritic rock, with some feldspathic material, to a rock of a little coarser grain and resembling somewhat a dark graywacke.

*Mic.* The section shows a rock which is composed essentially of three minerals, *quartz*, *feldspar* and *chlorite*. The feldspar is considerably clouded by decay and the texture of the rock is almost granitic.

One section.

*Age.* Archean.

U. S. G.

## NO. 929. BIOTITE SCHIST.

N. E.  $\frac{1}{4}$  sec. 14, T. 63-18 W.; north shore of West bay, Vermilion lake.  
*Ref.* Annual Report, xv, pages 296, 390.

*Meg.* The specimen is a dark-gray, biotite schist of medium grain for such a rock.

Hornblende schist. Granite.]

*Mic.* The section is composed largely of quartz, feldspar (apparently *orthoclase* and some acid *plagioclase*), *biotite* and *chlorite*, with a little *epidote* and *pyrite*.

One section.

*Age.* Archean.

*Remark.* Nos. 929 to 932 were collected to illustrate mica schist and granite and intermediate stages between these two rocks. Compare American Geologist, vol. xx, pp. 41-48.

U. S. G.

NO. 930. HORNBLLENDE SCHIST (*with granite*).

Same locality as No. 929.

*Ref.* Annual Report, xv, pages 296, 297, 390.

*Meg.* There are two samples of this number; one is a uniform, rather fine-grained hornblende schist, rich in feldspar; the other is a dark amphibolyte in contact with a pinkish granite. In the granite the hornblende is sometimes collected in patches.

*Mic.* The section was evidently made from the granite. It consists essentially of quartz, feldspar (apparently *orthoclase* and acid *plagioclase*), and green hornblende, the latter mineral being collected on one edge of the slide.

One section.

*Age.* Archean.

U. S. G.

NO. 931. GRANITE. (*Hornblendic.*)

Same place as No. 929.

*Ref.* Annual Report, xv, pages 296, 390.

*Meg.* A rather fine-grained, pinkish-gray, hornblende granite.

*Mic.* An ordinary granite, the essential minerals being quartz, feldspar (apparently *orthoclase* and acid *plagioclase*) and green hornblende. *Chlorite*, *epidote*, *biotite* and *sphene* are also present.

One section.

*Age.* Archean.

U. S. G.

## NO. 932. GRANITE.

Same place as No. 929.

*Ref.* Annual Report, xv, pages 296, 390.

*Meg.* A rather coarse-grained, pinkish granite composed of quartz, feldspar and a small amount of a dark mineral.

*Mic.* A granite, composed mainly of quartz and feldspar. The latter mineral is in three forms which are apparently *orthoclase*, acid *plagioclase* and *microcline*. Hornblende seems to have been the ferro-magnesian constituent of the rock, but it was in small amount and is now represented by *chlorite*. One section.

*Age.* Archean.

U. S. G.

No. 933. GNEISS. (*Hornblendic.*)

Sec. 14, T. 63-18 W.; north shore of West bay, Vermilion lake.  
 Ref. Annual Report, xv, pages 296, 390.

*Meg.* A rough, schistose, green rock, composed largely of hornblende with some feldspar. There are a few narrow bands, parallel to the schistosity, of feldspathic material. The rock may be called a banded gneiss.

*Mic.* The section was evidently made from the green part of the rock. It consists essentially of green *hornblende* and *feldspar*, which is much kaolinized and sometimes shows albite twinning lamellæ.

One section.

*Age.* Archean.

U. S. G.

## No. 934. GRANITE.

"Intrusive granite, obtained at the mouth of Rice river, so called, N. E.  $\frac{1}{4}$  sec. 15, T. 63-18." North shore of Vermilion lake.

Ref. Annual Report, xv, page 390.

*Meg.* Coarse-grained, reddish granite. The minerals are feldspar, quartz and a dark mineral, in small amount, which is sometimes hornblende or chlorite and sometimes biotite. One of the specimens shows a small band of this rock cutting dark hornblende schist.

*Mic.* A coarse granite, composed mainly of *feldspar* and *quartz*, with a little *chlorite*. The feldspar is more or less kaolinized and appears to be acid *plagioclase* *perthite* and *orthoclase*. One section.

*Age.* Archean.

U. S. G.

No. 935. GRANITE. (*Biotitic.*)

Small island in Partridge lake near the east line of sec. 11, T. 63-18 W., or perhaps from a reef in Vermilion lake in N. W.  $\frac{1}{4}$  sec. 26, T. 63-18 W. There is uncertainty as to which of these localities is the correct one.

Ref. Annual Report, xv, pages 297, 390.

*Meg.* The specimen is a medium-grained, gray, biotite granite. On one side is a layer, probably a vein, of quartz and a little pink feldspar.

*Mic.* The section shows a granite, composed essentially of *feldspar*, *quartz* and *biotite*. The feldspar is apparently *orthoclase* and acid *plagioclase*. Considerable *chlorite* is present, and *epidote*, *sphene*, *muscovite* and iron ore also occur.

One section.

*Age.* Archean.

U. S. G.

No. 936. GRANITE. (*Biotitic.*)

From a small island at the northwest corner of sec. 32, T. 63-17 W., Vermilion lake.

Ref. Annual Report, xv, pages 294, 390.

*Meg.* A medium-grained, light-gray granite, composed of feldspar, quartz and a comparatively small amount of biotite.

Granite. Schist. Chlorite schist.]

*Mic.* The rock is an ordinary granite; the essential minerals are feldspar, quartz and *biotite*. The feldspar is apparently *orthoclase* and *oligoclase*, with a little *microcline*. The quartz often shows undulatory extinction. The following accessory minerals occur in varying amounts: *chlorite*, *muscovite*, *epidote*, *magnetite* and *sphene*.

Two sections.

*Age.* Archean.

U. S. G.

NO. 937. GRANITE. (*Biotitic.*)

From a small island just east of Big island, Vermilion lake; N. W.  $\frac{1}{4}$  sec. 22, T. 63-18 W.  
*Ref.* Annual Report, xv, pages 297, 390.

*Meg.* A medium-grained, light-gray granite, composed of quartz, white feldspar and a comparatively small amount of *biotite*.

*Mic.* An ordinary granite, in general similar to No. 936, the essential minerals being quartz, feldspar (apparently *orthoclase*, *oligoclase* and a little *microcline*) and *biotite*.

One section.

*Age.* Archean.

U. S. G.

NO. 938. SCHIST (*with zoisite*).

West side of Oak island, Vermilion lake; S. W.  $\frac{1}{4}$  sec. 23, T. 63-17 W.  
*Ref.* Annual Report, xv, pages 294, 390.

*Meg.* A hard, gray, compact, fine-grained, but little schistose, rock looking like a graywacke or impure quartzite.

*Mic.* The section is composed mainly of quartz, feldspar (considerably altered) and a mineral of high index of refraction and weak double refraction, which is thought to be *zoisite*; this is very abundant. Other minerals are *hornblende*, *chlorite*, *muscovite*, *magnetite* and *sphene*.

One section.

*Age.* Archean.

U. S. G.

NO. 939. CHLORITE SCHIST.

Small island in S. E.  $\frac{1}{4}$  sec. 31, T. 63-16 W.; Vermilion lake.  
*Ref.* Annual Report, xv, pages 299, 390.

*Meg.* A soft, fine-grained, green schist. The specimen contains part of a lenticular mass of coarse, white vein quartz.

*Mic.* The section is fine grained, and consists essentially of *calcite*, *chlorite*, *epidote* and quartz. One section.

*Age.* Archean.

U. S. G.

NO. 940. PEGMATYTE.

North shore of a bay of Vermilion lake, north of Pine island; S. W.  $\frac{1}{4}$  sec. 23, T. 63-16 W.  
*Ref.* Annual Report, xv, pages 301, 390.

*Meg.* A coarse-grained, granitic rock composed of quartz, feldspar (white and pink in color) and biotite.

*Mic.* Quartz, feldspar and biotite are the chief minerals of the section. The feldspar is considerably clouded, and appears to be *orthoclase* and acid *plagioclase*. The *biotite* is altering to *chlorite*. One section.

*Age.* Archean.

U. S. G.

NO. 941. GRANITE.

Same place as No. 940.

*Ref.* Annual Report, xv, pages 301, 390.

*Meg.* Pinkish, medium-grained granite, composed of quartz, feldspar and a very small amount of a dark micaceous mineral. On one side of the specimen is a contact with a much finer-grained, reddish granite.

*Mic.* The slide shows principally *feldspar* and *quartz*. The former is commonly much clouded and appears to be *orthoclase*, acid *plagioclase* and *perthite*. A little *chlorite* is present. One section.

*Age.* Archean.

U. S. G.

NO. 942. GRANITE.

N. W.  $\frac{1}{4}$  sec. 25, T. 63-16 W., Vermilion lake.

*Ref.* Annual Report, xv, pages 301, 390.

*Meg.* A rather fine-grained granite, composed of feldspar and quartz, with very little of a dark mineral.

*Mic.* The section shows a granite, composed largely of *quartz* and *feldspar*, which seems to be *orthoclase* and *oligoclase*, with a small amount of *microcline*. A little *chlorite*, probably an alteration product of biotite, is present.

*Age.* Archean.

U. S. G.

NO. 943. GRANITE.

Locality uncertain, but north of Pine island; either the same as No. 940 or from N. E.  $\frac{1}{4}$  sec. 27, T. 63-16 W., Vermilion lake.

*Ref.* Annual Report, xv, pages 301, 390.

*Meg.* A rather fine-grained, pinkish granite.

*Mic.* An ordinary granite, with the feldspar much clouded by alteration. The dark mineral is not abundant and is *chlorite*. One section.

U. S. G.

NO. 944. GRANITE. (*Biotitic.*)

Near centre of sec. 27, T. 63-16 W., Vermilion lake.

*Ref.* Annual Report, xv, pages 301, 390.

*Meg.* A fine-grained, gray to pinkish granite.

*Mic.* An ordinary biotite granite, with the feldspar much clouded by alteration and the biotite altering to *chlorite*. Some muscovite is present. One section.

*Age.* Archean.

U. S. G.

Gneiss. Graywacke. Chlorite schist.]

No. 945. GNEISS. (*Dioritic.*)

S. W.  $\frac{1}{4}$  sec. 23, T. 63-16 W.; north shore of Vermilion lake.  
*Ref.* Annual Report, xv, pages 301, 390.

*Meg.* A medium-grained, dark-gray rock, composed mainly of hornblende and feldspar. The specimen is somewhat banded by bands in which the relative proportion and size of the grains of the two constituents vary.

*Mic.* The section shows a granitoid rock, composed almost entirely of green hornblende (in great abundance), *feldspar* (common and usually much kaolinized) and *quartz* (in small amount).

One section.

*Age.* Archean.

U. S. G.

No. 946. GNEISS. (*Granitic.*)

N. E.  $\frac{1}{4}$  sec. 27, T. 63-16 W.; north shore of Vermilion lake.  
*Ref.* Annual Report, xv, pages 301, 390.

*Meg.* Fine grained, red, and composed of *feldspar*, *quartz* and a dark micaceous mineral, whose flakes are arranged with their cleavage planes nearly parallel, thus giving a gneissic structure to the rock.

*Mic.* An ordinary granitic rock, composed essentially of *feldspar* (commonly clouded, and in part acid *plagioclase*), *quartz* and *chlorite*.

One section.

*Age.* Archean.

U. S. G.

No. 947. GRAYWACKE (?)

N. E.  $\frac{1}{4}$  sec. 3, T. 62-15 W.; northeast shore of Vermilion lake.  
*Ref.* Annual Report, xv, pages 301, 390.

*Meg.* A greenish-gray rock of fine grain. There are small hornblendes and feldspars scattered through the rock.

*Mic.* This section is quite similar to No. 920.

One section.

*Age.* Keewatin.

U. S. G.

No. 948. CHLORITE SCHIST.

"On the N. W.  $\frac{1}{4}$  sec. 28, T. 63-11 [Garden lake], a diabasic green rock (No. 949) cuts a greenish, hard, finely schistose rock (No. 948), the contact being well exposed on the south side for a distance of a few feet."  
*Ref.* Annual Report, xv, pages 329, 390.

*Meg.* A soft, green, fine-grained schist.

*Mic.* The section shows *chlorite*, *calcite*, *quartz* (and perhaps also feldspar) and *epidote*. There is much fine, granular material which is perhaps *epidote*.

One section.

*Age.* Keewatin.

U. S. G.

## No. 949. "GREENSTONE."

See under No. 948.

Ref. Annual Report, xv, pages 329, 390.

*Meg.* A fine-grained, soft, much decayed greenstone.

*Mic.* The section is a poor one. It shows irregular grains of *feldspar* and *quartz*, also some *hornblende* and much chloritic indistinct secondary material. The *feldspar* is much altered, *zoisite* and *kaolinite* having been developed in the alteration, and some of it still shows albite twinning lamellæ.

One section.

*Age.* Keewatin.

U. S. G.

## No. 950. CUMMINGTONITE SCHIST.

"At the lower end of the rapids which are formed where White Iron lake descends to Garden lake, N. E.  $\frac{1}{4}$  sec. 32, T. 63-11, are two short, small tunnels, running in opposite directions, into a siliceous schist or bedded quartzite, which disturbs the compass needle by magnetic attraction. It dips N. N. E. 80° to 85°. It is somewhat brecciated, and recemented by chemical silica and pyrites. In some places this bedded quartzite is black, and in others blue, sonorous and brittle, recalling the Animikie quartzites. It is represented by No. 950. The quartz in which the tunnels were excavated is represented by No. 951. This locality is known locally as *Silver City*, so named by the proprietor of the tunneling."

Ref. Annual Report, xv, pages 329, 390; Annual Report, xvii, pages 194, 208; Bulletin vi, pages 8, 421.

*Meg.* A fine-grained, hard, gray, siliceous schist.

*Mic.* The rock is composed of three minerals, *quartz*, *cummingtonite* and *magnetite*. The main part of the rock is of quartz, and the other minerals vary considerably in amount. The quartz is in interlocking grains of nearly uniform size. The *cummingtonite* is in small flakes scattered through the rock, the elongation being usually in a common direction. This mineral at times shows twinning lamellæ parallel with the elongation and the cleavage, and an extinction angle as high as 15°. These characters agree with *grünerite*, but on account of the double refraction of this mineral, which is approximately .02, it is referred to *cummingtonite* rather than to *grünerite*, whose double refraction is much stronger (.056). The *magnetite* is scattered through the rock and is often included in the quartz; the *magnetite* is in grains and crystals (octahedrons) of varying size.

Three sections.

*Age.* Keewatin.

U. S. G.

## No. 951. QUARTZ.

Same locality as No. 950.

Ref. Annual Report, xv, pages 329, 390; Bulletin vi, pages 8, 421.

*Meg.* Gray, vitreous, rusty-weathering, vein quartz.

*Mic.* The section shows quartz grains of various sizes interlocking by very irregular sutures. Considerable of a dark, earthy material is scattered through the rock in small masses. One section.

*Age.* Vein in Keewatin rocks.

U. S. G.

Syenite. Granite. Gabbro.]

No. 952. SYENYTE. (*Hornblendic.*)

West side of White Iron lake; sec. 6, T. 62-11 W.  
 Ref. Annual Report, xv, pages 329, 390.

*Meg.* A medium-grained, pinkish-gray, hornblende syenite.

*Mic.* The section is composed essentially of feldspar and green, more or less fibrous *hornblende*. The feldspar is *orthoclase* and acid *plagioclase* and perhaps also *anorthoclase*. Other minerals present in small amount, are: *chlorite*, *magnetite*, *epidote*, *sphene* and *quartz*. A microchemical test, with hydrofluosilicic acid, of a grain of feldspar showed the presence of soda and lime, but practically no potash.

One section.

*Age.* Archean.

U. S. G.

No. 953. GRANITE. (*Porphyritic.*)

Sec. 19, T. 62-11 W.; river bank on the portage from White Iron lake to Birch river.  
 Ref. Annual Report, xv, pages 329, 334, 336, 390.

*Meg.* A medium-grained, pinkish, hornblende granite, with porphyritic crystals of flesh-colored feldspar.

*Mic.* The rock is quite similar to No. 952, except for the presence of more *quartz* and some *microcline*. A microchemical test, with hydrofluosilicic acid, of one of the porphyritic feldspars gave much soda and potash and almost no lime, thus indicating *anorthoclase*. A test of a grain of feldspar from the groundmass gave the same result.

One section.

*Age.* Archean.

U. S. G.

No. 954. GABBRO. (*Olivinitic.*)

Near the N. W.  $\frac{1}{4}$  sec. 17, T. 61-11 W.; east side of Birch lake.  
 Ref. Annual Report, xv, pages 332, 333, 390; Annual Report, xvii, pages 194, 207.

*Meg.* A rather coarse-grained, gray gabbro. Feldspar is the most abundant mineral and occurs in grains and plates which frequently show the striation due to polysynthetic twinning. Biotite is quite noticeable, and pyroxene, olivine and magnetite also occur. The mass is in laminae due to the linear arrangement of the olivine grains.

*Mic.* The sections show a fresh gabbro. The minerals are feldspar (probably *labradorite*), *olivine*, *pyroxene* (*augite* and some pleochroic pyroxene which is probably *hypersthene*), *biotite*, *magnetite*, *pyrite* and greenish and brownish alteration products of the olivine. The rock exhibits many interesting features and would make a good subject for detailed study.

Three sections.

*Age.* Cabotian.

U. S. G.

No. 955. GNEISS. (*Granitoid.*)

From boulders in N. W.  $\frac{1}{4}$  sec. 26, T. 61-12 W.; north shore of Birch lake.  
*Ref.* Annual Report, xv, pages 333, 334, 391.

*Meg.* A medium-grained, dark-gray, granitic gneiss.

*Mic.* A schistose rock appearing like a sheared granite, the grains being broken and apparently granulated around the edges. The chief minerals are *quartz*, *feldspar* and dark brown *biotite*.

One section.

*Age.* Boulders of Archean rocks.

U. S. G.

No. 956. GNEISS. (*Hornblendic muscovadite?*)

From boulders in N. W.  $\frac{1}{4}$  sec. 26, T. 61-12 W.; north shore of Birch lake.  
*Ref.* Annual Report, xv, pages 333, 391.

*Meg.* A dark-gray gneiss of medium grain.

*Mic.* The section shows a somewhat confused aggregate composed essentially of the following minerals: *feldspar*, *biotite*, *hornblende*, *chlorite*, *magnetite* and *quartz*. The feldspar is in irregularly interlocking grains and commonly forms the background of the rock, this mineral holding the other minerals poikilitically.

One section.

*Age.* Boulders of Archean (?) rock.

U. S. G.

## No. 957. CUMMINGTONITE SCHIST.

From boulders in N. W.  $\frac{1}{4}$  sec. 26, T. 61-12 W.; north shore of Birch lake.  
*Ref.* Annual Report, xv, pages 333, 391.

*Meg.* Similar to No. 950.

*Mic.* This rock appears similar to No. 950, except that it (No. 957) is coarser grained and the *cummingtonite* is of a greenish tint, is slightly pleochroic and is often colored brownish, due to staining or alteration.

Two sections.

*Age.* Boulders of Archean rock.

U. S. G.

No. 958. GRANITE. (*Breccia.*)

N. E.  $\frac{1}{4}$  S. E.  $\frac{1}{4}$  sec. 21, T. 61-12 W.; point on the north side of Birch lake.  
*Ref.* Annual Report, xv, pages 333, 391; Annual Report, xvii, pages 195, 207.

*Meg.* Irregular masses of dark-gray, fine-grained rock, inclosed in a cement of rather fine-grained, light-gray to pinkish granite.

*Mic.* The dark masses are composed of a granitic aggregate of *hornblende*, *feldspar*, much of which is clearly *plagioclase*, and *quartz*. The cementing rock is an ordinary biotite granite. The sections do not show the junction of the two kinds of rock.

Two sections.

*Age.* Archean.

U. S. G.

Granite. Iron Ore.]

## NO. 958A. GRANITE.

Same place as No. 958.

Ref. Annual Report, xv, pages 333, 391.

*Meg.* A fine-grained, dark-gray, granitic rock. This sample represents the dark masses included in No. 958, and is spoken of in the field notes as a mica schist. The hand specimen is too small to show the schistose character of the rock.

*Mic.* A granitic aggregate of *feldspar*, *quartz*, *hornblende* and *biotite*. Some micropegmatyte is present. The rock may be a quartz diorite rather than a granite; the feldspar was not determined, but considerable of it is plagioclase.

One section.

*Age.* Archean.

U. S. G.

NO. 958B. GRANITE. (*Vein.*)

Same place as No. 958.

Ref. Annual Report, xv, pages 333, 391.

*Meg.* From a small vein or dike in No. 958A. The component minerals are quartz and feldspar.

No section.

*Age.* Archean.

U. S. G.

NO. 959. GRANITE. (*Biotitic.*)

Sec. 23, T. 61-12 W.; north shore of Birch lake.

Ref. Annual Report, xv, pages 334, 336, 391.

*Meg.* A fine-grained, gray granite.

*Mic.* A granite whose essential components are *quartz*, *feldspar* and *biotite*. Magnetite and chlorite are also common.

One section.

*Age.* Archean.

U. S. G.

NO. 960. IRON ORE (*with olivine, etc.*).S. E.  $\frac{1}{4}$  S. W.  $\frac{1}{4}$  sec. 24, T. 61-12 W.; near north shore of Birch lake.

Ref. Annual Report, xv, pages 335, 339, 391; Annual Report, xvii, page 195.

*Meg.* A heavy, crystalline rock, composed largely of magnetite and with another mineral which is in large plates. Compare Nos. 976, 1138.

*Mic.* The rock is one of the "olivinitic iron ores," which are found in a number of places along the north side of the gabbro. There are several sections of this number, showing varying conditions. The essential minerals present are *magnetite*, *pyroxene*, *olivine*, *quartz* and amphibole (perhaps *grünerite*). The pyroxene is both monoclinic (*diallage*) and orthorhombic (*enstatite* or *hypersthene*) and the two are sometimes intergrown. Five sections.

*Age.* Keewatin or Animikie.

U. S. G.

NO. 961. GRANITE. (*Contact.*)

"Rock No. 961 shows the contact between the coarse syenyte like No. 953, as it occurs near the southwest corner of sec. 24, T. 61-12, and the granite Nos. 955 and 959."

*Ref.* Annual Report, xv, pages 334, 391.

*Meg.* A coarse-grained, sub-porphyrific, hornblende biotite granite, in sharp contact with a fine-grained biotite granite.

*Mic.* The slide was evidently made from the coarse-grained part of the hand sample. The rock is a granite, the essential minerals being *feldspar*, *quartz* and *biotite*. Chlorite, magnetite and sphene also occur. One section.

*Age.* Archean.

U. S. G.

## NO. 962. GABBRO (?)

About one-fourth mile west of No. 961.

*Ref.* Annual Report, xv, pages 336, 391.

*Meg.* The hand specimens vary some in grain and in general appearance. Some look like fine-grained, magnetic rocks, recrystallized by the gabbro, and others seem to be fine-grained gabbros.

*Mic.* The rock has a granitic texture and consists of *pyroxene* (at least some of which appears to be orthorhombic), brownish *hornblende*, *magnetite*, *feldspar* and *quartz*. One of the sections shows light colored areas in a dark background. These areas are composed mainly of feldspar and pyroxene, the latter sometimes in poikilitic plates, while the background consists largely of hornblende.

Two sections.

*Age.* Cabotian(?)

U. S. G.

*Remark.* This rock is apparently allied to No. 960. One specimen, of which no section was made, is a fine-grained heavy iron ore.

N. H. W.

NO. 963. SYENYTE. (*Biotitic.*)

S. W.  $\frac{1}{4}$  S. W.  $\frac{1}{4}$  sec. 24, T. 61-12 W., just east of the line between sections 23 and 24; near the north shore of Birch lake.

*Ref.* Annual Report, xv, pages 336, 391; Annual Report, xvii, pages 195, 207.

*Meg.* Fine-grained, reddish syenyte, with some porphyritic reddish feldspars.

*Mic.* The rock is a granitic one, composed largely of feldspar, which seems to be mostly *orthoclase*. *Biotite* is common, and *magnetite* and *chlorite* occur.

Two sections.

*Age.* Archean.

U. S. G.

NO. 964. GRANITE. (*Hornblendic.*)

"Rock No. 964 shows a coarse syenyte, lying on No. 965, apparently conformably; No. 964A is from a vein (or dike) of fine granular granite, six inches wide, running across the bedding of No. 964 and blending with No. 965. No. 964B is mica schist, a condition of No. 964A, in small patches." S. E.  $\frac{1}{4}$  sec. 22, T. 61-12 W.; point on north shore of Birch lake.

*Ref.* Annual Report, xv, pages 334, 335, 391.

Granite. Mica schist. Pegmatyte.]

*Meg.* A medium-grained, reddish, hornblende granite.*Mic.* A granite, composed essentially of feldspar, quartz and hornblende, which last is largely replaced by biotite and chlorite.

One section.

*Age.* Archean.

U. S. G.

NO. 964A. GRANITE. (*Biotitic.*)

See under No. 964.

*Ref.* Annual Report, xv, pages 334, 335, 391.*Meg.* A rather fine-grained, pinkish, biotite granite.*Mic.* An ordinary granite, the essential minerals being quartz, feldspar and biotite.

One section.

*Age.* Archean.

U. S. G.

## NO. 964B. MICA SCHIST.

See under No. 964.

*Ref.* Annual Report, xv, pages 334, 391.*Meg.* Hand specimen not found. No section.*Age.* Archean.

U. S. G.

NO. 965. GRANITE. (*Biotitic.*)

"Rock No. 965 is fine-grained granite, in bedded regular dip E. 30°. No. 965A is from a vein (or dike) of coarse syenite running zigzag in No. 965." Same place as No. 964.

*Ref.* Annual Report, xv, pages 334, 335, 391.*Meg.* A fine-grained, gray, biotite granite.*Mic.* A granitic aggregate essentially of feldspar (considerably clouded), quartz and biotite. One section.*Age.* Archean.

U. S. G.

## NO. 965A. PEGMATYTE.

See under No. 965.

*Ref.* Annual Report, xv, pages 335, 391.*Meg.* A coarse-grained aggregate of quartz and pinkish feldspar.*Mic.* Quartz and feldspar, the latter commonly showing fine albite twinnings.

One section.

*Age.* Archean.

U. S. G.

## NO. 966. GRANITE.

Same place as No. 964.

*Ref.* Annual Report, xv, pages 335, 391.*Meg.* Rather coarse-grained granite composed of quartz, white, pinkish and red feldspar and apparently both hornblende and biotite.

*Mic.* Quartz and feldspar make up most of the rock. The latter mineral is usually clouded by alteration and is sometimes reddened. Magnetite is present, and there are alteration products, chief among which is chlorite.

One section.

*Age.* Archean.

U. S. G.

No. 967. GRANITE. (*Epidotic.*)

North side of sec. 21, T. 61-12 W.; bay on the north side of Birch lake. Occurs in the form of a dike cutting coarse granitic rock.

*Ref.* Annual Report, xv, pages 336, 391.

*Meg.* A medium-grained, reddish granite.

*Mic.* The section shows much feldspar, considerably clouded, and some epidote, hornblende, chlorite, magnetite and quartz.

One section.

*Age.* Archean.

U. S. G.

No. 968. GRANITE. (*Hornblendic.*)

Near the same place as No. 967.

*Ref.* Annual Report, xv, pages 336, 337, 391.

*Meg.* A rather coarse-grained, gray granite. The specimen is crossed by a band of lighter color and finer grain.

*Mic.* The essential minerals of this granite are feldspar, quartz, hornblende and biotite. Chlorite, epidote, sphene and magnetite also occur.

One section.

*Age.* Archean.

U. S. G.

No. 969. DIORYTE.

From a dike, eighteen inches wide, in the S. E.  $\frac{1}{4}$  sec. 29, T. 61-12 W.; Birch lake.

*Ref.* Annual Report, xv, pages 337, 391; vol. iv, page 261.

*Meg.* A medium-grained, greenish rock, composed largely of hornblende. It is crossed by a vein-like form of rusty, porous, feldspar rock.

*Mic.* The dark portion of the rock is composed very largely of green hornblende, while the vein of feldspar rock is made up of much clouded feldspar.

One section.

*Age.* Archean.

U. S. G.

No. 970. DIORYTE.

Schistose part of same dike as No. 969.

*Ref.* Annual Report, xv, pages 337, 391.

*Meg.* A fine-grained, dark-gray rock, with coarser feldspars.

*Mic.* The section shows a rock composed essentially of green hornblende and more or less altered feldspar. Sphene is common. One section.

*Age.* Archean.

U. S. G.

Dioryte. Gneiss.]

## NO. 971. DIORYTE.

Schistose part of the same dike as No. 969.

*Ref.* Annual Report, xv, pages 337, 391.\*

*Meg.* Rock similar to No. 970, in sharp contact with a coarse-grained, gray, hornblende syenite.

*Mic.* The section was made from the syenite. It is composed essentially of feldspar, commonly clouded, and hornblende.

One section.

*Age.* Archean.

U. S. G.

NO. 972. GNEISS. (*Granitoid.*)

From a point a little north of No. 969.

*Ref.* Annual Report, xv, pages 337, 392.

*Meg.* A fine-grained, gray, biotite granite or granitoid gneiss. The hand sample does not show the gneissic structure of the rock very markedly.

*Mic.* The section shows an ordinary granite, the essential minerals being feldspar, quartz and biotite.

One section.

*Age.* Archean.

U. S. G.

NO. 973. GNEISS. (*Dioritic.*)

"Hornblende gneiss, a phase of No. 972, from the northwest corner of sec. 30, T. 61-12." Birch lake.

*Ref.* Annual Report, xv, pages 338, 392.

*Meg.* Medium-grained, dark-gray, dioritic rock. Parts of the specimens are light colored, but the gneissic structure is not well shown in the hand samples.

*Mic.* The section shows a granitoid rock the essential minerals of which are hornblende and feldspar. The latter mineral is usually much clouded by kaolinization.

One section.

*Age.* Archean.

U. S. G.

NO. 974. GNEISS. (*Dioritic.*)

"Shows the same rock (No. 972) undergoing a change toward mica schist; from the same locality."

*Ref.* Annual Report, xv, pages 338, 392.*Meg.* A dark-gray, rather fine-grained, roughly schistose rock.*Mic.* The section is in general similar to that of No. 973. One section.*Age.* Archean.

U. S. G.

NO. 975. GNEISS. (*Dioritic.*)

"Two other samples of No. 972, here a mottled schist, from the extreme west end of Birch lake, south of the mouth of Birch river."

*Ref.* Annual Report, xv, pages 339, 392.

*Meg.* A gneissic rock, varying in color, composed mainly of feldspar and hornblende.

*Mic.* The section is similar to those of Nos. 973 and 974, but in this rock (No. 975) the feldspar is more abundant than in the other two.

One section.

*Age.* Archean.

U. S. G.

NO. 976. MAGNETITE, OLIVINE, QUARTZ. (*Ferruginous muscovadyte.*)

From a boulder a quarter of a mile south of the second trail-crossing of Dunka river; S. W.  $\frac{1}{4}$  sec. 10, T. 62-12. (Compare Nos. 960 and 1138.)

*Ref.* Annual Report, xv, pages 341, 392; Annual Report, xix, pages 121, 127.

*Meg.* Black, magnetic, with quartz and olivine apparent.

*Mic.* Quartz, olivine, magnetite and grünerite (?) make up this rock, magnetite being most abundant and olivine next, all being of secondary generation from the jaspilyte lodes of the Keewatin when impure with intermingling of basic sedimentary material, the recrystallization having resulted from the action of the gabbro. In the olivine of this section is a good illustration of a fact which is not uncommon in the generation of secondary minerals, viz.: The larger olivines often embrace a number of fine globular grains of the same mineral, as illustrated by figure 6, plate II.

*Age.* In the annual report this ore was placed as the bottom of the Animikie, but is now believed to be a modified condition of the Keewatin ores, always accompanied by muscovadyte.

*Remark.* Although the specimen was obtained from a boulder, the rock is *in situ* in the immediate vicinity.

According to Hintze the grünerite, determined by Lane and Sharpless, should have been called cummingtonite (Handbuch der Mineralogie, Bd. II, page 1230). Examined by Prof. Dodge this ore gave no titanium. The structure of this rock is illustrated by figure 5, plate II.

N. H. W.

NO. 977. GABBRO. (*Olivinitic.*)

S. W.  $\frac{1}{4}$  sec. 10, T. 62-12 W.; at the second crossing of the river by the trail which runs from Birch lake southward along Dunka river.

*Ref.* Annual Report, xv, pages 341, 392.

*Meg.* A fine-grained, yellowish-gray, granular rock.

*Mic.* The section shows a granitoid rock consisting chiefly of *plagioclase*, *pyroxene* and *olivine*. At least some of the *pyroxene* is orthorhombic, apparently *hypersthene*. *Magnetite* and *biotite* are common.

One section.

*Age.* Cabotian.

U. S. G.

NO. 978. DIORYTE.

S. E.  $\frac{1}{4}$  sec. 28, T. 61-12 W.; Birch lake.

*Ref.* Annual Report, xv, pages 340, 392.

*Meg.* A medium-grained, dark-gray rock,

Granite. Greenstone. Gneiss. Gabbro.]

*Mic.* The section shows a granitoid rock, whose essential minerals are *feldspar* and *hornblende*. The former is largely *plagioclase*. Some magnetite and quartz are present.

One section.

*Age.* Archean.

U. S. G.

NO. 979. GRANITE.

From "the palisades" on the east shore of the Kawishiwi river; N. W.  $\frac{1}{4}$  S. W.  $\frac{1}{4}$  sec. 4, T. 62-10 W.  
*Ref.* Annual Report, xv, pages 343, 344, 392; Annual Report, xvii, pages 195, 207.

*Meg.* Fine-grained, gray to reddish granite.

*Mic.* The section shows a granite, composed essentially of feldspar and quartz. The latter is much clouded and is sometimes reddened.

One section.

*Age.* Archean.

U. S. G.

NO. 980. "GREENSTONE" (?) (*Flinty.*)

Small island near the north shore of the Kawishiwi river; S. E.  $\frac{1}{4}$  N. W.  $\frac{1}{4}$  sec. 19, T. 63-9 W.  
*Ref.* Annual Report, xv, pages 346-348, 392.

*Meg.* The specimens show a rock which seems to be banded. Parts of the rock are very fine grained, flinty and green or greenish gray in color, while others are of a somewhat coarser grain and are almost black in color.

*Mic.* In thin section the rock appears of fine, but varying grain, composed of quartz, feldspar, biotite, chlorite, hornblende, epidote and magnetite.

One section.

*Age.* Keewatin.

*Remark.* This rock probably represents a crystallized elastic.

U. S. G.

NO. 981. GNEISS. (*Biotitic.*)

From a small island a short distance southeast of the island from which No. 980 was obtained.  
*Ref.* Annual Report, xv, pages 346, 347, 392.

*Meg.* A fine-grained, gray, biotite gneiss.

*Mic.* The section shows a granitoid rock, whose chief constituents are feldspar, quartz and biotite, the latter in part altering to chlorite.

One section.

*Age.* Archean.

U. S. G.

NO. 982. GABBRO (?) (*Granulitic.*)

"Northeast ends of the little northeast and southwest lakes, secs. 15 and 16, T. 63-9." Kawishiwi river.  
*Ref.* Annual Report, xv, pages 351, 392; Annual Report, xxi, page 145.

*Meg.* The specimens vary, but in general consist of a fine-grained, yellowish-gray, granular rock, in which biotite scales are noticeable.

*Mic.* The section is a poor one. The rock is granular in texture and many of the grains of the ferromagnesian minerals have rounded outlines. The minerals appear to be *feldspar*, *quartz*, *pyroxene*, *hornblende* and *magnetite*. The magnetite of this rock was tested for titanium, but none was found.

One section.

*Age.* Probably Keewatin metamorphosed by Cabotian gabbro.

*Remark.* This rock is in general similar to No. 983.

U. S. G.

NO. 983. NORYTE (?) (*Granulitic.*)

Same place as No. 982.

*Ref.* Annual Report, xv, pages 351, 352, 392; Annual Report, xxi, pages 144-146.

*Meg.* A grayish rock of rather fine grain. The hand specimen is homogeneous throughout and shows no gneissic or other parallel structures. It is compact and not crumbling. Numerous glistening scales of biotite are easily seen, and under the lens the rock appears granular, but the constituent minerals cannot be made out, although one would judge that quartz formed a large part of the rock. Rock appears fresh. Does not effervesce with cold hydrochloric acid.

*Mic.* The section shows a closely-compact, fine-grained granular mixture of quartz, feldspar, biotite, iron ore, and a mineral referred to pyroxene. The grain is so fine that under crossed nicols the different grains are not all distinctly separated, nor do some of them extinguish completely; this, however, is due to the overlapping of the grains; there is no "amorphous" or "chalcedonic" silica present (compare section of jaspilite in Bulletin vi, plate VIII, figure 1). The rock is thus completely crystalline, and is quite fresh.

The *biotite* is the most noticeable mineral; it occurs in large flakes which often hold many pieces of quartz, some magnetite, and occasionally pyroxene.

The *pyroxene* is in small rounded grains and elongated ones which, however, never show any crystal faces. It has quite a high index of refraction. It contains enclosures of magnetite and numerous transparent areas which seem to be liquid cavities. A slight cleavage is often developed parallel to the long axes of the grains. The extinction is almost always parallel to this cleavage and the mineral often is slightly pleochroic; from these two facts it is referred to the group of orthorhombic pyroxenes—probably it is *enstatite* or *bronzite*. On account of the smallness of the grain and the difficulty of obtaining a good interference figure with the instrument in use, the optical properties were not further studied. This mineral is greenish in color. In the pleochroic individuals the ray vibrating parallel to the cleavage is colorless or greenish and the other of a very light pinkish or reddish shade. This corresponds to the pleochroism of orthorhombic pyroxenes. Monoclinic pyroxene is probably present in small amount.

Noryte. Gabbro.]

The *iron ore* is undoubtedly magnetite; it is in small grains with more or less distinct faces, but with the angles rounded.

The pyroxene and iron ore are probably older than the mass of the rock, which is composed of quartz and feldspar, and the biotite encloses all.

The *feldspar* is abundant; it frequently shows polysynthetic twinning, and is thus plagioclase; but the kind of plagioclase is uncertain. There is also considerable feldspar which is not twinned and which may be orthoclase, or untwinned plagioclase.

The *quartz* is in fine grains, even finer than most of the feldspar. There are many grains, which show no cleavage, or twinning, whose nature it is not easy to determine. Many of such grains, supposed to be quartz, give a biaxial interference figure; and others give no distinct figure. I examined about twenty sections which I thought might be basal sections of quartz; only one out of these twenty gave a distinct uniaxial interference figure; this was tested and found to be +. Four or five gave biaxial figures, and the others gave no definite figures. The feldspar is unaltered, and so is hard to distinguish from quartz, when twinning, cleavage or interference figures are not to be seen. It is my opinion that there is much less quartz in the rock than I had supposed. Thus, so far, I am sure of but one grain; there are, however, undoubtedly more, but I should guess that quartz makes up less than one-tenth of the rock, and I feel certain that it does not make up one-fifth of the rock.

The magnetite of Nos. 982 and 983, was tested for titanium, but none was found.

*Age.* Probably Keewatin metamorphosed by Cabotian gabbro.

*Remarks.* This rock is one of those to which the term "muscovado" has been applied. This specimen now shows nothing that can be taken as proof of an original clastic nature. It is lithologically a fine-grained quartz biotite noryte. It may be a recrystallized sediment or an original eruptive; but from its field relations and from general considerations, it is thought probably not to be in its present condition a true eruptive. It seems to represent a Keewatin rock modified by the gabbro, although originally it may have been of igneous origin. Compare rocks Nos. 1089-1092.

U. S. G.

## NO. 984. GABBRO (?)

Same place as No. 982.

*Ref.* Annual Report, xv, pages 351, 392.

*Meg.* A fine-grained, gray, granular rock with biotite.

*Mic.* This rock is in general similar to Nos. 982 and 983. The section shows apparently *quartz*, feldspar (usually kaolinized), *biotite*, *hornblende*, *pyroxene* and *magnetite*.

One section.

*Age.* Probably Keewatin metamorphosed by Cabotian gabbro.

U. S. G.

## NO. 985. GABBRO.

S. W.  $\frac{1}{4}$  sec. 16, T. 63-9 W.; near the Kawishiwi river.

Ref. Annual Report, xv, pages 352, 392.

*Meg.* A fine-grained, yellowish-gray, granitoid rock.

*Mic.* The section is too thick for study, but it shows a fine-grained gabbro whose chief minerals are plagioclase, diallage and magnetite.

One section.

*Age.* Cabotian.

U. S. G.

## NO. 986. GNEISS.

N. W.  $\frac{1}{4}$  sec. 20, T. 63-9 W.; north side of the Kawishiwi river.

Ref. Annual Report, xv, pages 352, 392.

*Meg.* A fine-grained, gray, granular rock.

*Mic.* The section is of fine grain and the chief minerals are *quartz, feldspar, hornblende* and *biotite*.

One section.

*Age.* Probably Keewatin metamorphosed by Cabotian gabbro.

U. S. G.

## NO. 987. GREENSTONE.

From the hill in sec. 18, T. 63-9 W.; north of the Kawishiwi river.

Ref. Annual Report, xv, pages 346, 347, 354, 392.

*Meg.* One of the fine-grained, non-schistose greenstones.

*Mic.* The section shows a greenstone composed largely of green hornblende with some feldspathic material. In places there are indications that the feldspar in part existed in small, scattered, lath-shaped forms.

One section.

*Age.* Keewatin.

U. S. G.

## NO. 988. AMPHYBOLYTE.

From the summit of a small ridge between No. 987 and the shore of the Kawishiwi river.

Ref. Annual Report, xv, pages 346, 347, 392.

*Meg.* A rather coarse-grained, dark-gray rock composed mainly of hornblende.

*Mic.* The section shows large amounts of green, commonly fibrous hornblende, with smaller amounts of fine-grained feldspar and perhaps also quartz. Biotite and magnetite are also present. One section.

*Age.* Keewatin.

U. S. G.

## NO. 989. GNEISS.

N. W.  $\frac{1}{4}$  N. W.  $\frac{1}{4}$  sec. 27, T. 63-10 W.; south shore of the Kawishiwi river.

Ref. Annual Report, xv, pages 352, 392; Annual Report, xvii, pages 195, 206.

*Meg.* A fine-grained, gray rock varying somewhat, but in general gneissic and feldspathic.

Gneiss.]

*Mic.* The section shows a granitoid rock in which the chief mineral is *feldspar*; this is considerably kaolinized, and sometimes shows albite twinnings, but much of it is too far altered to exhibit these twinnings, even if they originally existed. In addition to the feldspar, *quartz*, *chlorite* and *epidote* are seen.

One section.

*Age.* Archean.

U. S. G.

## NO. 990. GNEISS.

N. W.  $\frac{1}{4}$  sec. 27, T. 63-10 W.; shore of the Kawishiwi river north of No. 989.

*Ref.* Annual Report, xv, pages 352, 392; Bulletin vi, pages 68, 421.

*Meg.* A hard, fine-grained, creamy-white rock.

*Mic.* The section shows a granitoid rock composed essentially of the following minerals: *quartz*, *feldspar*, much clouded by kaolinization, and *epidote*.

One section.

*Age.* Archean.

U. S. G.

## NO. 991. GNEISS.

N. W.  $\frac{1}{4}$  N. W.  $\frac{1}{4}$  sec. 27, T. 63-10 W.; island in the Kawishiwi river.

*Ref.* Annual Report, xv, pages 352, 353, 392; Annual Report, xvii, pages 195, 206; Bulletin vi, pages 68, 421.

*Meg.* A gray, red-weathering, fine-grained, lightly feldspathic gneiss.

*Mic.* The sections show a granitoid rock in which feldspar is the chief constituent, and quartz is less abundant. The *feldspar* is usually considerably clouded by kaolinization and is plagioclase and apparently *orthoclase*. *Epidote*, *green hornblende* and *chlorite* are the chief accessory minerals. There is one small crystal, perhaps *zircon*, surrounded by hornblende. Two sections.

*Age.* Archean.

U. S. G.

*Remark.* The decayed feldspars of Nos. 989, 990 and 991 are in remarkable contrast with the other minerals. *They never interlock*, although in contact. They are surrounded, more or less, and sometimes reconstructed, by secondary granular quartz and feldspar. Occasionally the green hornblende also surrounds small grains of decayed feldspar, and otherwise shows its date of origin was later than the feldspars; but other hornblendes were coeval with or earlier than the feldspars. In several respects these rocks resemble the granites of Kekequabic lake. One hornblende (which surrounds a small zircon) is bounded by the prism faces and is twinned. It is nearly a perfect crystal and must date (as augite) from the earliest condition of the rock. A little of the feldspar, some of the hornblende, all of the epidote and all of the quartz are secondary. The earliest condition of these rocks probably embraced feldspar and quartz chiefly, with a little augite and zircon, and perhaps hornblende, constituting a graywacke. The fine, fragmental, weathered surface of this rock (No. 991) is shown by photograph in plate II, figure 7.

N. H. W.

NO. 992. SYENYTE. (*Epidotic.*)

N. W.  $\frac{1}{4}$  sec. 27, T. 63-10 W.; north shore of the Kawishiwi river and a little east of No. 990.  
*Ref.* Annual Report, xv, pages 352, 392; Bulletin vi, pages 68, 421.

*Meg.* A medium-grained, reddish, decayed syenite.

*Mic.* The section shows two chief minerals, *feldspar* and *epidote*. There is also some *chlorite* and some quartz. The rock is considerably altered.

One section.

*Age.* Archean.

U. S. G.

## NO. 993. SYENYTE.

N. W.  $\frac{1}{4}$  sec. 27, T. 63-10 W.; near No. 992.  
*Ref.* Annual Report, xv, pages 353, 354, 392, 393; Bulletin vi, pages 68, 421.

*Meg.* A rather coarse-grained, reddish syenite.

*Mic.* The section is composed largely of considerably altered feldspar. Other minerals are *chlorite*, *quartz*, *magnetite*, *muscovite* and *tourmaline*.

One section.

*Age.* Archean.

U. S. G.

*Remark.* The section was taken from a slickensided and crushed mass, and, although the grains may have had an interlocking structure originally, they are now so crushed and decayed, though re-cemented by quartz, that they do not show it.

N. H. W.

## NO. 994. GRANITE.

N. E.  $\frac{1}{4}$  N. W.  $\frac{1}{4}$  sec. 26, T. 63-10 W.; south shore of the Kawishiwi river.  
*Ref.* Annual Report, xv, pages 353, 393; Annual Report, xvii, pages 195, 207; Bulletin vi, pages 68, 421.

*Meg.* A fine-grained, reddish granite.

*Mic.* A granitoid rock whose chief minerals are feldspar (often considerably altered), quartz, epidote, chlorite, magnetite and pyrite. Two sections.

*Age.* Archean.

U. S. G.

NO. 995. GNEISS. (*Hornblendic.*)

Rapids in the Kawishiwi river; north part of sec. 8, T. 63-10 W.  
*Ref.* Annual Report, xv, pages 353, 393; Bulletin vi, pages 68, 421.

*Meg.* A rather fine-grained, gray, granitoid rock.

*Mic.* A granitoid rock composed chiefly of feldspar (often considerably altered), quartz and hornblende. Epidote, chlorite, magnetite and apatite are present.

One section.

*Age.* Archean.

U. S. G.

## NO. 996. GREENSTONE.

N. W.  $\frac{1}{4}$  sec. 21, T. 63-10 W.; from a hill range just north of the foot of a portage along the Kawishiwi river.  
*Ref.* Annual Report, xv, pages 346, 393.

Greenstone.]

*Meg.* A fine-grained, dark-green, soft, much fractured rock.

No section.

*Age.* Keewatin.

U. S. G.

## NO. 997. GREENSTONE.

Kawasachong falls.

*Ref.* Annual Report, xv, pages 319, 320, 346, 393; Bulletin vi, pages 39, 421. (Compare No. 356.)

*Meg.* Soft, fine-grained, roughly schistose greenstone. There are two specimens, one finer grained than the other.

*Mic.* The finer-grained section is composed largely of chlorite and altered feldspar. There is some *hornblende*, *quartz* and *magnetite*. In places, the feldspar takes a lath-shaped form, suggesting that the original rock may have been a diabase. The other section consists mainly of hornblende and altered feldspar. Chlorite, quartz and a gray opaque substance, are present; the last is perhaps an alteration product of ilmenite.

Two sections.

*Age.* Lower Keewatin.

U. S. G.

## NO. 998. GREENSTONE.

Rapids above Kawasachong falls.

*Ref.* Annual Report, xv, pages 319, 320, 393; Bulletin vi, pages 37, 39, 40, 421, plate V, figure 5. (Compare No. 356.)

*Meg.* A medium-grained, green rock, composed largely of hornblende.

*Mic.* Dr. H. Hensoldt's description of this section is as follows:\*

"A hornblende-dioryte of similar structure and composition as No. 999, but containing a perceptible admixture of quartz. The hornblende scales are much larger than in No. 999, but their feeble dichroism indicates a more advanced chloritization. The feldspar is exceedingly turbid and has lost its optical properties, no twinning lamellation being perceptible in any of the crystals, but the forms of the original prisms are still preserved. The quartz grains have a fragmental appearance and do but seldom show rounded forms; they are small and easily distinguished by their transparency and brilliant polarization. This dioryte contains little if any magnetite, but we observe in the section numerous crystals of titaniferous iron, surrounded by a peculiar grayish-white alteration product."

One section.

*Age.* Lower Keewatin.

U. S. G.

## NO. 999. GREENSTONE.

Above No. 998 and near Garden lake.

*Ref.* Annual Report, xv, pages 319, 320; Annual Report, xvi, page 111; Bulletin vi, pages 37, 39, 40, 421, plate V, figure 4.

\*Bulletin vi, p. 40.

*Meg.* A medium-grained, dark-gray, massive rock, with much hornblende. Compare No. 356.

*Mic.* Dr. H. Hensoldt's description of this section is as follows:\*

"The principal constituents of this rock are *plagioclase*, *hornblende* and a greenish alteration product, which may be termed *viridite*. If we examine a section under a magnification of, say, sixty diameters, we observe a grayish feldspathic matrix or groundmass, in which numerous crystals of hornblende of a dark-green color lie embedded. These crystals vary considerably in size; some exceed one millimeter in actual diameter while others are barely distinguishable on account of their minuteness; their shape is mostly that of elongated scales or prisms, though rhombohedral outlines are by no means uncommon. These hornblende crystals have been rendered more or less turbid by decomposition and have become clouded by ferric hydroxide or dust-like magnetite, as alteration products, but in the main their characteristics are preserved.

"In addition to the hornblende crystals, large, irregular, colorless patches, surrounded by a pale, greenish fringe, are noticeable in the feldspathic matrix, and in many instances these colorless masses present distinct hexagonal outlines. It is extremely probable that these are pseudomorphs after biotite, the latter having been completely changed into calcite and greenish fibrous epidote.†

"In the original condition of the rock, the grayish matrix was doubtless a colorless triclinic feldspar (possibly labradorite) which has been rendered turbid by partial kaolinization. Its optical properties are now almost completely destroyed, no twin lamellation and only a very faint chromatic display being noticeable. A few small colorless hexagonal sections indicate the presence of *apatite*.

"Dust-like grains of *magnetite* are scattered all over the field and a number of larger crystals with distinct cubical and octahedral outlines are likewise observable."

One section.

*Age.* Lower Keewatin.

U. S. G.

NO. 1000. QUARTZ SCHIST. (*Magnetic.*)

From the upper end of the rapids from Garden lake to Fall lake.

*Ref.* Annual Report, xv, pages 319, 320, 393.

*Meg.* Very fine-grained, dark, and heavy with magnetite.

*Mic.* In the midst of the interlocking fine quartzes and the grains of magnetite, are acicular sections of a rather highly polarizing mineral with no apparent pleochroism, and constant multiple twinning, which is probably *grünerite*. One section.

*Age.* Lower Keewatin.

N. H. W.

\**Bulletin vi*, pp. 39, 40.

†All the smaller biotite scales have been transformed into chlorite or epidote, without a trace of calcite.

Iron ore. Greenstone.]

## NO. 1001. IRON ORE.

Harvey test pits, S. E.  $\frac{1}{4}$  sec. 27, T. 63-12.

Ref. Annual Report, xv, page 393.

*Meg.* Compact, fine-grained magnetite.*Mic.* This iron ore is crossed by veins of microscopic size of secondary quartz, but in general the section is opaque. One section.*Age.* Lower Keewatin.

N. H. W.

NO. 1002. GREENSTONE. (*Tuff?*)

South shore of Long lake; sec. 28, T. 63-12.

Ref. Annual Report, xv, pages 325, 326, 393; Annual Report, xxiii, pages 204, 213.

*Meg.* Fine-grained, gray, siliceous, almost aphanitic.*Mic.* The large amount of *calcite* in this rock is the most striking peculiarity. The masses are not large, but scattered widely, and frequently. The rock has a rather firm frame-work, apparently of secondary *quartz* and feldspar, the latter clouded principally by chlorite and *zoisite*. The rock darkens sometimes over small areas in which are embraced numerous crowded grains of all the other substances, most of which are undeterminable, but in the main it is finely granular. There are evident feldspars, some being twinned on the albite plan. Fine grains of *leucoxene* were probably derived from ilmenite.

In general, the rock is a congeries of secondary minerals that have arisen from the decay of evidently eruptive matter, but, from this specimen alone, it is impossible to say whether originally massive or fragmental. Its structural relations, however, and its complete alteration indicate that it is one of the basic tuffs of Keewatin so common in the vicinity.

*Age.* Lower Keewatin.

N. H. W.

NO. 1003. GREENSTONE. (*Tuff?*)

From about half way from the shore of Long lake to Patterson's trenches; sec. 28, T. 63-12.

Ref. Annual Report, xv, pages 325, 326, 393.

*Meg.* Slaty or schistose, more green than the last, fine grained.*Mic.* With an equal amount of chlorite and *calcite*, and less *quartz*, this rock differs from the last also in having a large amount of green *hornblende*. It also shows the outlines of the old feldspars which are crowded with *chlorite*, *calcite* and minute hornblendes. In some parts of the slide are many tabular microlitic feldspars which extinguish nearly or quite parallel with their longer sections, although the included calcite does not allow perfect extinction. These may indicate an original diabasic nature for the whole rock, or they may appertain to fragments of diabase included in the debris. One section.*Age.* Archean (Lower Keewatin).

N. H. W.

## No. 1004. TUFF.

From the bluff, centre of sec. 19, T. 63-11; west from Kawasachong falls.  
*Ref.* Annual Report, xv, pages 320-322, 325, 393.

*Meg.* Fissile schist, lenticularly disintegrating, confused, near the water, underlying the next.

*Mic.* Rather fine-grained, in general consisting largely of *chlorite* in elongated patches and fine mesh-work. Through this fine mass are distributed numerous coarse angular grains of *quartz*, *leucoxene* and of striated *feldspar*, and indistinct rounded pieces of rock of differing granular aspect and slightly differing composition; the last, however, being uniformly fine grained and allied in general to the main rock itself.

*Age.* Archean (Lower Keewatin).

*Remark.* This rock, although its coarser grains are sharply angular, was probably accumulated beneath the ocean, and it would correctly be styled submarine tuff.

N. H. W.

## No. 1005. TUFF.

Same place as the last but overlying it.  
*Ref.* Annual Report, xv, pages 320, 322, 325, 393.

*Meg.* Resembling the rock of Kawasachong falls.

*Mic.* Finely granular, rather homogeneous, containing much *quartz* in minute angular grains and crossed by small veins of *quartz* and *calcite*. Evidently a finer-grained condition of rock like the last.

*Age.* Archean (Lower Keewatin).

N. H. W.

## No. 1006. "GREENSTONE."

South shore of Fall lake; N. E.  $\frac{1}{4}$  sec. 19, T. 63-11 W. Schist near the dike No. 1009.  
*Ref.* Annual Report, xv, pages 322, 323, 393.

*Meg.* One of the fine-grained, roughly schistose "greenstones." This specimen contains some pyrite. No section.

*Age.* Archean (Lower Keewatin).

U. S. G.

## No. 1007. CALCITE AND PYRITE.

Same locality as No. 1006. In contact with No. 1006.  
*Ref.* Annual Report, xv, pages 322, 323, 393.

*Meg.* A small mass of fine-grained, granular calcite, with considerable disseminated pyrite. No section.

*Age.* Archean (Lower Keewatin).

U. S. G.

## No. 1008. "GREENSTONE."

Same locality as No. 1006. Obtained two feet from the dike, on the south side.  
*Ref.* Annual Report, xv, pages 322, 323, 393.

*Meg.* Very similar to No. 1006. No section.

*Age.* Archean (Keewatin).

U. S. G.

Amphibolyte. Greenstone.]

## NO. 1009. AMPHIBOLYTE.

From a dike that rises in the midst of the rocks Nos. 1004-1008; spreads and extends widely toward the east.  
*Ref.* Annual Report, xv, pages 322, 323, 393.

*Meg.* Greenstone of medium grain.

*Mic.* *Green hornblende* and *chlorite* make up a large part of this rock, probably more than one-half. They are so cut by the *feldspars* that it is evident that they have taken the place of an ophitic *pyroxene*. The feldspars are twinned microliths, much better preserved than those in rocks Nos. 1004 and 1005. There are occasional areas of *calcite* and of *pyrite*, and numerous patches of *leucoxene*. There is no olivine visible. A few *apatite* spicules pierce the feldspar. One section.

*Age.* Archean (dike in Lower Keewatin).

N. H. W.

NO. 1010. GREENSTONE (*at contact with a dike*).

Contact between the fragmental rocks represented by Nos. 1002-1008 and the dike No. 1009.  
*Ref.* Annual Report, xv, pages 323, 393.

*Meg.* In the hand sample the two rocks are quite similar, the dike rock, however, not being schistose.

*Mic.* The slide contains a portion of the granular rock and a portion of the igneous, but the latter is more altered than in No. 1009, and the feldspars are broken by rock movements, and their fragments are dislodged. There is so much alteration that no ophitic structure remains. The hornblende in general is not in distinct crystals, but is broken into myriads of scattered grains, which, mingled with chlorite and with *leucoxene*, give a confused and dirty aspect to the whole slide. One section.

*Age.* Archean (Lower Keewatin).

N. H. W.

## NO. 1011. GREENSTONE.

At various places between the lake shore (Fall lake) and the hill in S. E.  $\frac{1}{4}$  sec. 19, T. 63-11.  
*Ref.* Annual Report, x, pages 324, 393.

*Meg.* Green, medium grained, and ambiguous in character, structurally appears to be in range of the rock that forms Kawasachong falls.

*Mic.* The rock is essentially made up of *green hornblende* and tabular *feldspars*, the latter having such relation to the former as to suggest, though not prove, a former ophitic structure in this rock, in that respect resembling rock No. 1009. There is also *pennine*, filling some large cavities. *Epidote* and *leucoxene* are common. These indicate an alteration of a basic igneous rock, and taken in connection with the partial ophitic structure, rather favor that interpretation. Still, owing to the uncertainty, the term greenstone is applied to this rock, a term which accommodates either interpretation. Notwithstanding the great alteration there is no quartz.

*Age.* Archean (Lower Keewatin).

N. H. W.

NO. 1012. QUARTZ SCHIST. (*Magnetic.*)

From boulders, which are angular, evidently from the rock near. Top of hill S. E.  $\frac{1}{4}$  sec. 19, T. 63-11, south of Fall lake.

*Ref.* Annual Report, xv, pages 324, 393. Compare Nos. 2111, 2112.

*Meg.* Black, banded, magnetic, fine grained.

*Mic.* In the *quartz*, which composes the most of the rock, is a powder of *magnetite*. The latter is in grains of ultra-microscopic size, which by aggregation form larger masses of irregular shape. The quartz is pierced also by the same spicules as mentioned under No. 1000, supposed to be *grünerite* from its twinning and its high double refraction.

*Age.* Archean (Lower Keewatin).

N. H. W.

NO. 1013. QUARTZ. (*Chalcedonic.*)

From a vein in quartz schist, top of the hill, S. E.  $\frac{1}{4}$  sec. 19, T. 63-11.

*Ref.* Annual Report, xv, pages 245, 393; Annual Report, xviii, page 11; Annual Report, xxii, page 6; Bulletin vi, page 69.

*Meg.* Apparently the same kind of fine granular quartz as that of the quartz schist, frequently called "chalcedonic quartz," but incorrectly, because the quartz has not the fibrous structure characteristic of chalcedony, nor its negative, optical character.

*Mic.* The quartz is wholly recrystallized, whatever its original condition, in interlocking grains which vary in size, being coarser along the centre of the vein. Along the edges of the vein the quartz grains have about the same size as in the rock in general. One section.

*Age.* Archean (Lower Keewatin).

N. H. W.

## NO. 1014. GREENWACKE.

Just south of the section line between sections 19 and 30, west of the trail; T. 63-11, south of Fall lake.

*Ref.* Annual Report, xv, pages 324-326, 393.

*Meg.* An indefinite green rock or graywacke.

*Mic.* There is much *chlorite*, *hornblende*, *calcite* and *leucoxene*, also considerable *quartz* in scattered small grains of secondary origin, in this rock. There are forms of some original *feldspars*, indicated by the greater transparency in areas, which are crowded with calcite and other impurities, but the distribution of the elements is so promiscuous that no ophitic structure is discernible.

*Age.* Archean (Lower Keewatin).

N. H. W.

## NO. 1015. GREENSTONE.

N. E.  $\frac{1}{4}$  sec. 30, T. 63-11; south of Fall lake, near Garden lake.

*Ref.* Annual Report, xv, pages 325, 394.

*Meg.* Appearing like a fine, brecciated graywacke, rough and angular in general outward aspect.

Jaspilyte. Greenwacke. Greenstone.]

*Mic.* The forms of sections of microlitic *feldspars* are common in the section, but these are dimmed by alteration products, appearing greenish and grayish in natural light. Between them is a confused gray matrix, somewhat coarser grained and so pierced by the feldspars, which lie in all directions, as to allow the suggestion that the rock was once a fine-grained, ophitic diabase, but this matrix has no trace of pyroxene, consisting rather of *calcite*, probably some *leucoxene* and irregular forms of what is apparently a secondary *feldspar*. The green coloring matter is apparently chloritic. Probably a clastic rock. One section.

*Age.* Archean (Lower Keewatin).

N. H. W.

NO. 1016. JASPILYTE (*with magnetite*).

Centre of sec. 30, T. 63-11.

*Ref.* Annual Report, xv, pages 325, 368, 394. Compare Nos. 2111, 2112.

*Meg.* The usual banded iron ore of the Keewatin.

*Mic.* The section is black in reflected light, like *magnetite*. The *quartz*, which occupies angular openings in the magnetite, is crossed by intersecting fine bands of black powder which is doubtless *magnetite*. One section.

*Age.* Archean (Lower Keewatin).

N. H. W.

## NO. 1017. GREENWACKE.

N. W.  $\frac{1}{4}$  sec. 28, T. 63-11, Garden lake.*Ref.* Annual Report, xv, pages 327, 328, 394.

*Meg.* Green schist, with megascopic crystals of white calcite and some granular quartz like that of the jaspilyte.

*Mic.* The slide shows none of the white masses and only a small amount of fine, granular *quartz*, *calcite* and *chloritic* debris. The rock is evidently from a debris of eruptive material. One poor section.

*Age.* Archean (Lower Keewatin).

N. H. W.

## NO. 1018. GREENSTONE.

N. W.  $\frac{1}{4}$  sec. 28, T. 63-16; same rock surface as the last.*Ref.* Annual Report, xv, pages 327, 328, 394.

*Meg.* Similar green schist as the last, but without evident calcite.

*Mic.* Many microlitic *feldspars*, much decayed, originally twinned in twos, are promiscuously disseminated in this rock. Much *calcite* is seen, not only within the areas of the feldspars, but also in isolated grouped masses. There are clusters of minute grains of a yellowish-gray, nearly opaque mineral, which in its thinnest edges and projecting points is seen to be highly doubly refracting when highly magnified, and is probably a form of *leucoxene* more dark than is usual. The distribution of the feldspars in the mass hardly suggests a possible original diabase. There are a few grains of *pyrite*. The green coloring mineral is the same as seen in most of these

rocks, but it is difficult to say whether it is hornblendic or chloritic. It composes the most of the matrix of the feldspars, but is not entirely wanting in them. Quartz is wanting or scarce. One section.

*Age.* Archean (Lower Keewatin).

N. H. W.

NO. 1019. GREENSTONE.

Same place; same rock surface as the last.  
*Ref.* Annual Report, xv, pages 327, 394.

*Meg.* Similar schist, schistose.

*Mic.* Rock is very like the last, a little coarser grained, with less frequent feldspar microliths, but with a large area in which either a rock fragment was enclosed of a different sort, or a different alteration has progressed. In this area are numerous angular *quartzes*. The *leucoxene* is lighter colored than in the last. One section.

*Age.* Archean (Lower Keewatin).

N. H. W.

NO. 1020. GREENSTONE.

Same place; same rock surface as the last.  
*Ref.* Annual Report, xv, pages 327, 394.

*Meg.* Coarsely schistose, but similar to the last.

*Mic.* A little coarser grained, but essentially the same as the last. There is, however, a stronger suggestion of an original ophitic structure in the disposition of the feldspars, and especially as in two or three instances one is seen to cross another at a considerable angle without change of orientation by either. Brown *leucoxene* is common. One section.

*Age.* Archean (Lower Keewatin).

N. H. W.

NO. 1021. GREENSTONE. (*Granular.*)

Same place as the last; same exposed surface.  
*Ref.* Annual Report, xv, pages 327, 394.

*Meg.* Similar to the last, but evidently changed from an igneous debris.

*Mic.* There is much *epidote*, which is yellowish and granulated and bunched, but the granules retain their polarizing power, characteristic of epidote. The feldspars are also deprived of their microlitic shapes, and are scarce, scattered in isolated fragments, there being no ophitic structure preserved. There is much dark *leucoxene*, and much of the same coloring green chloritic substance, which last is almost monorefringent between the nicols, and a very little of *quartz* and of *magnetite*. One section.

*Age.* Archean (Lower Keewatin).

N. H. W.

Greenstone. Magnetite schist.]

No. 1022. GREENSTONE. (*Granular.*)

Same place; same exposed surface.

Ref. Annual Report, xv, pages 327, 394.

*Meg.* Similar to the last.

*Mic.* *Epidote* is here common. The feldspar is but little more common than in the last, and is fragmental; that is, it is in scattered rounded pieces, not in angular, and is sufficiently preserved to show its albite twinning. The green coloring matter is *chloritic*, in general, and sometimes hornblentic, in the latter case strongly pleochroic and faintly doubly refracting, the changing colors of pleochroism being very light yellow and pale green. *Leucoxene* is abundant, and scattered in small grains throughout the slide. A very little *quartz* in fine grains is seen. One section.

*Age.* Archean (Lower Keewatin).

N. H. W.

No. 1023. GREENSTONE. (*Dense, fine.*)

Same place and exposed rock surface.

Ref. Annual Report, xv, pages 328, 394.

*Meg.* More firm, fine-grained, schistose in the same direction. Taken in the midst of the schists above.

*Mic.* This is an average rock of the series above described. It has scattered, chloritized, fine feldspars rather scarce, distributed in a dark-green, structureless matrix, containing chlorite, calcite, quartz, a little epidote, leucoxene and finer feldspars. One section.

*Remark.* This series of greenstones was collected for the purpose of studying the minute transitions between a fine green schist (No. 1017), presumed to be of clastic origin, and a coarser greenstone (Nos. 1022 and 1023), which, in the field, was assumed to be of igneous origin. The conclusion arrived at was that they were all derived from originally massive igneous rock, and that the fine schist (No. 1017) was formed by shearing of a rock like a diabase. It is evident now, however, that one of these assumptions must be erroneous. A subsequent microscopic examination of the slides, followed by a review of their characters in the light of long study and comparison with known altered diabases, leads to the conclusion that they are all of clastic origin, and of the nature, primarily, of basic debris which was perhaps tuffaceous, the supposed igneous rock (Nos. 1022 and 1023) being simply coarser debris of the same sort as No. 1017.

*Age.* Archean (Lower Keewatin).

N. H. W.

## No. 1024. MAGNETITE SCHIST.

S. W.  $\frac{1}{4}$  sec. 23, T. 63-11. Julian Bausman's, east of Farm lake.

Ref. Annual Report, xv, pages 328, 394; Annual Report, xix, pages 121, 127.

*Meg.* The rock is fibrous, but dark with magnetite, blue black in color.

*Mic.* The cementing background is a long fibrous mineral, having a low double refraction and parallel extinction. Its highest color rotated between nicols is bluish gray in the first order. There is not enough of this mineral visible in the section to allow of its specific determination. The magnetite, which, on analysis, gave a trace of titanium, is in form of a fine powder, distributed through this matrix. One poor section.

*Age.* Archean (Lower Keewatin).

N. H. W.

No. 1025. IRON ORE. (*Magnetic.*)

Near the same locality as the last.

*Ref.* Annual Report, xv, pages 328, 394.

*Meg.* Similar to the last, but not schistose; also lacking the bluish color of the last.

*Mic.* About one-half of this rock is of magnetite, the rest being apparently the same fibrous mineral as seen in the last, but here showing more favorably and having a colored double refraction, which, with other characters, denotes *actinolite*. One section.

*Age.* Archean (Lower Keewatin).

N. H. W.

No. 1025A. QUARTZ-PORPHYRY.

Apparently overlying the last.

*Ref.* Annual Report, xv, page 394.

*Meg.* Coarsely granular, with feldspar and quartz.

*Mic.* The large *feldspar* crystals and the rounded *quartz* grains lie in the midst of a fine, granular, secondary matrix. The feldspars are clouded with impurities, but show their coarse twinning (albite and pericline). The quartz is broken and also streaked by bands of impurities. The enclosing matrix has some *hornblendes* which are large, distinct and idiomorphic, and some that are partly changed to *chlorite*, much interlocking fine *quartz*, *leucoxene*, of which some larger grains are straw-yellow, but the most are white, passing to sub-opaque, a little fine epidote and muscovite and a single grain of *apatite*. One section.

*Age.* Archean (Keewatin).

*Remark.* This rock resembles the quartz-porphry of Kekequabic lake.

N. H. W.

No. 1026. AMPHIBOLYTE.

From the northern island crossed by the section line between secs. 11 and 12, T. 64-11. Basswood lake.

*Ref.* Annual Report, xv, pages 357, 394.

*Meg.* A fine-grained, fibrous, green rock.

*Mic.* The *hornblende*, broken by considerable secondary *quartz*, is mostly in a fibrous condition, but sometimes over the area of a crystal it shows not only its

[Granite. Mica schist. Gneiss.]

cleavages, but its polarization colors. Mixed with the hornblende is a considerable amount of a highly refractive and highly doubly refractive mineral, in fine detached grains which are sometimes grouped round black, opaque particles as centres, which are probably *epidote*. A few black, metallic particles are surrounded by a hematitic stain. One section.

*Age.* Archean (Keewatin).

N. H. W.

## NO. 1027. GRANITE.

From an island in the lake, in sec. 1, T. 64-11, cut by an apparent dike of mica schist. Bassimenan lake.  
*Ref.* Annual Report, xv, pages 357, 358, 394.

*Meg.* A fine-grained, pinkish, granitic rock.

*Mic.* *Quartz* constitutes most of this rock, but it also has *microcline* and *andesine-oligoclase*, the latter shown by an extinction angle of  $72^\circ$  on the bisectrix  $n_p$ . The feldspar is sometimes clouded by a gray substance, which gives it the appearance of the sub-opaque leucoxene, whose nature is unknown, but which may be of the nature of *kaolin*. These, with a little *hornblende* are the essentials of this rock. The large microcline crystals sometimes embrace poikilitically both quartz and andesine-oligoclase. One section.

*Age.* Archean (granite).

N. H. W.

## NO. 1028. MICA SCHIST.

Same locality as No. 1027.

*Ref.* Annual Report, xv, pages 358, 394.

*Meg.* A fine-grained, micaceous (biotitic) schist with hornblende and apparently quartz and feldspar. The hand sample is crossed by a vein, one-fourth to one-half inch wide, of pegmatyte which is composed mainly of pink feldspar. No section.

*Age.* Archean.

U. S. G.

## NO. 1029. GNEISS.

Same locality as No. 1027.

*Ref.* Annual Report, xv, pages 358, 394.

*Meg.* A medium-grained, dark-colored rock, gneissic in structure, composed of biotite, hornblende, pinkish feldspar and quartz. No section.

*Age.* Archean.

U. S. G.

## NO. 1030. GRANITE.

From the same place as No. 1027, at three feet from the left of the contact on No. 1028.

*Ref.* Annual Report, xv, pages 358, 394.

*Meg.* A fine-grained, flesh-colored, granitic rock.

*Mic.* Essentially the same rock as No. 1027, but finer grained and having more *hornblende*. There are also small amounts of *biotite* and of *sphene*, as well as of *pyrite*. One section.

*Age.* Archean (granite).

N. H. W.

## NO. 1031. GRANITE.

Same place as the last, at fifteen feet from the contact on No. 1028.  
*Ref.* Annual Report, xv, pages 358, 394.

*Meg.* A medium-grained, dark-gray, granitic rock.

*Mic.* Similar to the last, but with more *hornblende* and biotite. Large feldspars (microcline) englobe many small hornblendes, as well as smaller feldspars, and *apatite*. One section.

*Age.* Archean (granite).

N. H. W.

## NO. 1032. GRANITE.

Sec. 23, T. 65-10; northeast cape, Bassimenan lake.  
*Ref.* Annual Report, xv, pages 358, 394.

*Meg.* Red weathering, gneissic and jointed, gray within.

*Mic.* *Quartz*, *orthoclase*, *microcline*, the feldspars clouded by decay; *hornblende*, *biotite*, *apatite*. One section.

*Age.* Archean (granite).

N. H. W.

## NO. 1033. GNEISS.

From bands cutting the rock No. 1032 in a direction about east and west.  
*Ref.* Annual Report, xv, pages 358, 394.

*Meg.* Dark gneiss.

*Mic.* *Orthoclase*, *hornblende*, *quartz*, the first frequently blurred by alteration, and a few grains of *plagioclase*, with many minute crystals of *apatite*. One section.

*Age.* Archean (gneiss).

N. H. W.

## NO. 1034. GRANITE.

Vein rock, sec 23, T. 65-10.  
*Ref.* Annual Report, xv, pages 358, 394.

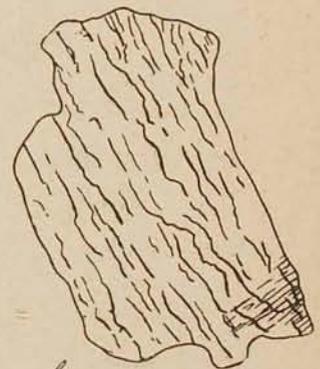
*Meg.* Coarse grained, and apparently containing the same minerals as No. 1032, in form of a segregation in coarse veinings in No. 1032.

*Mic.* *Quartz*, *orthoclase*, *microperthite*, *plagioclase* and *micropegmatyte*.

Figure 36 represents the microperthite, apparently running parallel with the cleavage 001. Compare the description of No. 1051. One section.

*Age.* Archean.

N. H. W.



*Microperthite in 1034.*  
 FIG. 36.

## NO. 1035. BIOTITE SCHIST.

East end of the portage from Ensign to Illusion lake, sec. 13, T. 64-8.  
*Ref.* Annual Report, xv, pages 359, 394.

*Meg.* Fine grained, dark gray, in some places apparently schistose.

Biotite schist. Gabbro.]

*Mic.* There are a few small *plagioclases* (?) which still are so much larger than the rest of the grain of the rock that microscopically they appear like porphyritic crystals, though they are not idiomorphic, and they may be *cordierite* instead. The most of the rock is micro-crystalline interlocking *quartz*, with bands and clusters of *biotite* scales. One section.

*Age.* Keewatin metamorphosed by the gabbro revolution. N. H. W.

NO. 1036. BIOTITE SCHIST (*with hornblende*).

From Illusion lake, sec. 13, T. 64-8.

*Ref.* Annual Report, xv, pages 359, 394.

*Meg.* Fine grained. Similar to the last, evidently arenaceous, at least siliceous.

*Mic.* *Quartz* grains, as in the last, are the most abundant element of this rock. *Hornblende*, *biotite* and *magnetite* are scattered amongst them. One (thick) section.

*Age.* Keewatin metamorphosed by the gabbro revolution. N. H. W.

NO. 1037. GABBRO. (*Muscovadyte*.)

East side of Illusion lake, sec. 13, T. 64-8.

*Ref.* Annual Report, xv, pages 359, 395; Annual Report, xxi, page 152.

*Meg.* Finely granular, gray or yellowish.

*Mic.* The rock is finely granular, with a tendency to globular outlines for all the minerals. There is no evidence of difference of date in the generation of the various minerals, except that the *plagioclase* in some cases was apparently the last to take form. These are *plagioclase*, *hypersthene*, *augite*, the *hypersthene* being most abundant and frequently embracing minute globules of the same mineral. One (thick) section.

*Age.* Cabotian; modification of the Keewatin.

*Remark.* The slightly rusty condition of the *hypersthene* and the thickness of the slide gives an appearance of *olivine* to much of the *hypersthene*, but, as no jelly was formed in HCl, it is presumed that no *olivine* is in the rock. N. H. W.

NO. 1038. GABBRO.

South shore of Illusion lake, sec. 13, T. 64-8, south shore, and on a small island.

*Ref.* Annual Report, xv, pages 359, 395.

*Meg.* Coarse gabbro.

*Mic.* The most of the slide is occupied by a single plate of *feldspar*, but it surrounds several small areas of altered *augite* and *olivine*. This plate is cut nearly perpendicular to  $n_x$  as acute bisectrix, and has extinction at  $24^\circ$  from cleavage, indicating *labradorite*. The *augite* shows an alteration resembling the lamellation of *diallage*, but it is to be considered *uralitic*. One section.

*Age.* Cabotian. N. H. W.

No. 1039. BIOTITE SCHIST (*with cordierite*).

First island south of the last, in Illusion lake; sec. 13, T. 64-8.

Ref. Annual Report, xv, pages 360, 395; Annual Report, xxi, page 146.

*Meg.* Biotite gneiss, showing a contorted structure.

*Mic.* Besides the *biotite*, which is idiomorphic, there is considerable *quartz* and scattered fine *magnetite*. But most of the slide is abundantly strewn with *cordierite*. The quartz embraces all the other minerals poikilitically, forming large plages as in the aporhyolytes. It is rather difficult to distinguish the cordierite from the quartz in numerous instances, the most available optic character being the Becke line, which always moves toward the mineral having the higher refractive index when the objective is slightly raised by the fine adjustment screw. There is a little *oligoclase-andesine* which forms, with *albite*, a *microperthite*. The crystals of this plagioclase are larger than the cordierite grains and enclose them, and are also broadly zoned. They were later to form than the biotite phenocrysts which pierce them.

The fortunate juxtaposition of these white minerals whose general aspects are so similar affords occasion and fine opportunity for the application of some of the nicer microscopical methods. The photographic illustration of this slide (plate II, figure 8) shows an oligoclase-andesine, somewhat zoned, containing the microperthitic albite, also quartz surrounding it and embracing numerous cordierite grains. The order of the minerals in date of generation seems to have been cordierite (not much earlier than biotite), biotite, oligoclase-andesine, quartz. One section.

*Age.* Keewatin modified by the gabbro revolution.

N. H. W.

No. 1040. MAGNETITE (*with hypersthene*).

A little west of the meander corner of sections 28 and 29. N. E.  $\frac{1}{4}$  sec. 29, T. 64-7, Thomas lake.

Ref. Annual Report, xv, pages 360, 395.

*Mac.* Appearing like an iron ore.

*Mic.* The iron ore embraces masses of *hypersthene*, but between the ore and the hypersthene is usually an olivine rim. One (thick) section.

*Age.* Cabotian modification of Keewatin iron ore.

N. H. W.

No. 1041. PERIDOTYTE. (*Cumberlandyte*.)

The old mining place on Fraser lake, near the section line between secs. 23 and 24, T. 64-7.

Ref. Annual Report, xv, pages 360, 395.

*Meg.* A dark, heavy rock, apparently containing magnetite. A part of the banded muscovadyte accompanying the iron ore of the locality.

*Mic.* The slide consists almost entirely of olivine, which, having evident cleavages at right angles, and  $n_p$  in the acute optic angle, is *fayalite*. There are many dark bands of inclusions in this mineral, running parallel with the cleavage

Cordierite gneiss. Amphibolyte.]

100, and perpendicular to the optic plane. This mineral might be mistaken for hypersthene, owing to its good cleavage and parallel extinction; but it forms a stiff jelly quickly with hydrochloric acid. One section.

*Age.* Modified Keewatin, an appendage of the gabbro.

*Remark.* Magnetite is plentiful in some parts of this rock. It is quite probable that, on extended examination, very much of the olivine which accompanies the "olivinitic iron ore," would be found to be fayalite.

N. H. W.

NO. 1042. CORDIERITE GNEISS (*with hypersthene*).

From the lake through which the river flows; sec. II, T. 64-7.

*Ref.* Annual Report, xv, pages 361, 395. Compare No. 1039.

*Meg.* Gneissic, biotitic, quartzose.

*Mic.* Through a background of granular *cordierite* and quartz, the latter being secondary to the former, and both together occupying visibly more than half the total area, are *biotite* in large flakes which inclose *cordierite* and *magnetite* grains in a poikilitic manner, *hypersthene* which in the same manner surrounds *cordierite* and *magnetite*, and occasionally a grain of twinned *plagioclase* which is fresh and glassy. This feldspar, like all the other minerals, is of secondary origin. As to the relative dates of generation of the hypersthene and the biotite, they generally do not interfere, but on close examination it is easy to see that a few detached hypersthene grains of small size are surrounded by the biotite, which, therefore, excepting the quartz, was the latest of the secondary generations. One section.

*Age.* Modified condition of the Keewatin, due to the gabbro revolution.

## NO. 1043. AMPHIBOLYTE.

From the ridge which separates the above lake in the river from Kekequabic lake.

*Ref.* Annual Report, xv, pages 362, 395.

*Meg.* Dark greenish, finely granular.

*Mic.* The rock consists almost wholly of a faintly pleochloric green or colorless hornblende, or *pargasite*, whose maximum extinction angle is  $18^{\circ}$  to  $21^{\circ}$ , and whose acute bisectrix is  $n_z$ , with positive elongation. Sections perpendicular to  $n_p$  show little longitudinal cleavage, but a distant transverse cleavage. Hence, the mineral, while having a faint prismatic cleavage, has also an imperfect basal cleavage (001). Sections that show the highest coloration (010), also have very evident coarse longitudinal cleavage, which therefore must be parallel to 100. The pleochroism is so faint that in sections of normal thinness (.003 millimeter or less), it is hardly apparent.

There is also a notable amount of *biotite* and of *cordierite*, an occasional grain of *magnetite*, and also a little *feldspar*. Two sections.

*Age.* Probably Upper Keewatin.

N. H. W. □

## NO. 1044. GRANITE.

Southeast shore of the little gulf at the southeast side of Kekequabic lake; sec. 11, T. 64-7.  
*Ref.* Annual Report, xv, pages 361, 395; Annual Report, xvii, pages 196, 205.

*Meg.* Apparently a massive granitic rock, with visible feldspars larger, almost porphyritic, in a fine matrix.

*Mic.* The *feldspars* are conspicuous, but they are in various parts mechanically sometimes out of orientation, so that extinction comes over them by patches. At the same time the margins are somewhat extended by later hooked small increments into the surrounding matrix. Occasionally, but rarely, while the original outline of the feldspar is distinctly set off from the matrix by a marginal increase of impurities, there is a sympathetic partial darkening in a small portion of the adjoining matrix, indicating the continuation of the feldspar growth into the surrounding materials by little hooked tongues. Very frequently, also, the large feldspars embrace numerous new growths of feldspars, these lying in independent orientations, each of all the others. They are few and scattered, or they are numerous and crowded. In one instance they occupy the central area of a large crystal, about one-half of the whole, the old crystal being intact only in a marginal band which still exactly outlines the original shape. The appearance of this central area is much like that of the surrounding matrix, but is less sprinkled with mica needles. For the most part these large crystals appear to be simple Carlsbad twins, but are sometimes nearly lost by the secondary micro-granulation.

The matrix is made up of fine secondary feldspars, of *quartz*, *muscovite*, *calcite*, *magnetite*, with a sprinkling of green due to shreds of *actinolite* and of *chlorite*, and a few grains of *sphene*, the whole of it, except the last, of secondary generation, quartz being the latest. One section.

*Age.* Archean.

*Remark.* This rock appears in the midst of a lot of green schists, referable to the rock No. 1043, to which its relation is not definitely known. It appears to be a regenerated condition of granitic debris. The feldspars resemble those of the porphyry on the north side of Kekequabic lake.

N. H. W.

## NO. 1045. GRANITE.

South shore of Kekequabic lake, near the meander corner of section line between secs. 2 and 3, T. 64-7.  
*Ref.* Annual Report, xv, pages 361, 395.

*Meg.* Thin-bedded, or gneissic, similar to No. 1044, but weathering red.

*Mic.* While this rock is similar, in general, to the last, the *feldspar* is stained with hematite, and appears not to be twinned, and the hornblendic ingredient is almost entirely wanting. The coarser grains make up a larger portion relative to the fine matrix. One (thick) section.

*Age.* Archean.

N. H. W.

## NO. 1046. GRANITE.

From a small island in Kekequabic lake, near the centre of sec. 3, T. 64-7.  
*Ref.* Annual Report, xv, pages 361, 364, 395.

*Meg.* Purplish red, sub-crystalline in aspect.

*Mic.* Similar to the last, but with a little more of the *hornblendic* mineral. In general, this is coarser than the rock described above (No. 1044), but the same fine matrix lies between all the grains. The original larger grains do not interlock as if crystallized from a magma, but seem to be simply compacted with much secondary deposition. One of the grains of *feldspar* is nearly surrounded by a clear rim, the central portion being clouded with *hematite* and alteration, but in general this relation is not noticeable. One (thick) section.

*Age.* Archean.

N. H. W.

NO. 1047. TUFF. (*Modified.*)

Southwest corner of Kekequabic lake; S. W.  $\frac{1}{4}$  sec. 3, T. 64-7.  
*Ref.* Annual Report, xv, pages 364, 395.

*Meg.* Fine grained, gray, much like No. 1035.

*Mic.* There is a fine, granular background, which serves as a matrix for the larger hornblende crystals. This fine matrix consists apparently wholly of a single glass-clear, limpid mineral whose refractive index is higher than that of Canada balsam (dipyré?), but the section examined is too thick to allow of further determination. In this matrix are myriads of *actinolite* spicules, whose cross parting perpendicular to their elongation gives them the appearance of apatite, an impression which is corrected at once on noting their colors of double refraction.

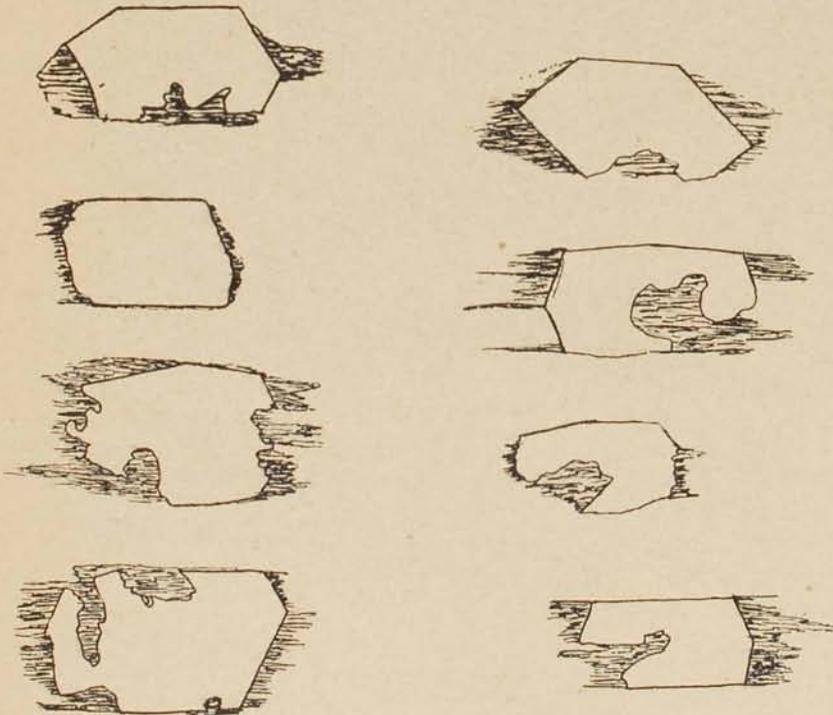


FIG. 37. SECONDARY GROWTH OF HORNBLLENDE ON AUGITE FORMS.  
 Rock No. 1047.

These *hornblendes* are distinctly of two conditions of growth, like those seen in the dike on Stuntz island (No. 872), and in a similar manner they polarize in two colors. The central portion of these hornblendes is dichroic and sometimes still consists of *augite*, but the transparent second growths do not perceptibly show this quality (see figure 37). The non-dichroic growths are fibrous and spreading at the ends of the longitudinal sections, and also are scattered as slender threads through the matrix, the fine, thread-like sections swimming off separately in the fine matrix, but without much divergence. There are, besides, indistinct, non-polarizing, yellowish and dirty spots which appear to be the residue of some original crystal forms which cannot now be determined. One section.

*Age.* Archean.

*Remark.* This rock is very peculiar, and can only be said to be one of the products of the contact of the gabbro of the immediate vicinity on the clastics. N. H. W.

No. 1048. AMPHIBOLYTE. (*Tuff, modified.*)

Same place as No. 1047. Occurs as rounded and subangular masses in No. 1047, into which it apparently shades.

*Ref.* Annual Report, xv, pages 364, 395.

*Meg.* Fine grained, dark gray.

*Mic.* The rock (consisting almost entirely of hornblende) is essentially the same as No. 1047, but much finer grained. The minute spicules and grains of *hornblende* appear between crossed nicols, much like muscovite scales, but when one is cut favorably it can be seen to be of hornblende, with the same secondary enlargements and without parallel extinction. One section.

*Age.* Archean (Keewatin).

*Remark.* The hornblendic element here also must have been derived from a fine debris of *augite*.\* N. H. W.

No. 1049. TUFF. (*Modified.*)

East side of sec. 4, T. 64-7. Six feet above the water at the shore of Kekequabic lake.

*Ref.* Annual Report, xv, pages 364, 365, 395; Annual Report, xvii, pages 196, 205.

*Meg.* Apparently a biotite gabbro, as judged in the field, but somewhat pebbly.

*Mic.* This rock is porphyritic with hornblende in the same manner as No. 1047, but the secondary growths are not so noticeable, but are visible in sections sufficiently thin. There are in the matrix with the hornblende crystals, some old triclinic feldspars in small grains and fragments, which have the altered aspect in the main of the feldspars described in No. 1044. The actinolite spicules penetrate only their margins. Two sections.

*Age.* Archean.

*Remark.* This rock seems in its matrix to be allied to No. 1044, and in its hornblendic porphyroidal aspect to the hornblendic porphyry of Mallmann's peak, No. 751,

\*The sample preserved is apparently not exactly the same as that from which the slide was made.

Tuff.]

while it is structurally and petrographically a part of the same series as Nos. 1047 and 1048. Another mineralogic link connecting this rock (No. 1049) with No. 1043, lies in the nature of the hornblende which has the characteristic which optically distinguishes *pargasite* from all the other hornblendes, viz.: it has the axis  $n_c$  in the acute optic angle.

N. H. W.

No. 1050. TUFF. (*Modified.*)

From the same bluff, near the top.

Ref. Annual Report, xv, pages 364, 365, 395; Annual Report, xvii, pages 196, 206.

*Meg.* Grayish green, rather compact.

*Mic.* Essentially the same rock as the foregoing from this bluff. The fine matrix is not so abundant and the porphyritic aspect of the hornblendes is not so marked. They are also smaller, bringing the rock into greater homogeneity, still characteristically the same rock with the addition of a few small grains of quartz (or cordierite?) and a greater proportionate amount of hornblende. Two sections.

*Age.* Archean.

N. H. W.

No. 1051. TUFF. (*Modified, granitic.*)

West shore of Kekequabic lake; sec. 3, T. 64-7.

Ref. Annual Report, xv, pages 364, 395.

*Meg.* Aspect of an orthoclastic rock; in the field was styled orthoclase gabbro. from the top of the bluff which at the bottom is a pebbly green schist.

*Mic.* This rock seems to unite the characters of Nos. 1044, 1045 and 1046 with those of Nos. 1047 and 1050. The matrix material, however, is coarser, composed of a biaxial mineral of low refraction and low double refraction, having  $n_c$  in the small optic angle without cleavage and without twinning, which embraces all the other minerals poikilitically. The most of the rest of the rock is *hornblende* in small crystals and spicules which pierce the translucent mineral mentioned in all directions and with great freedom. This poikilitic translucent mineral, which in the hand sample is sometimes reddish, gives a fine granitic aspect to the rock.

In one large grain there appear to be two growths, one (the later) surrounding and penetrating the other, the two extinguishing in common in a somewhat spherulitic succession, as shown by the accompanying figure. The later growth has slightly higher refraction, as indicated by the Becke line, and higher double refraction. But these differences may be due to different positions of the same mineral. The sketch herewith (figure 38) outlines roughly the manner in which the older feldspar(?) grains are related to the later growths. The later growths cross the older in fissures and in irregular lamellæ. They are of markedly different color, of double refraction, being



FIG. 38. INTERGROWN ORTHOCLASE (a) AND DEFORMED ORTHOCLASE (b) IN PSEUDO-SPHERULITIC OR LAMELLAR STRUCTURE. THE FORMER SHOWS  $n_c$  VERY OBLIQUE, THE LATTER  $n_m$ .

light yellow (in the section examined), while the older grain is of the dark tint of the first order. The extinction occurs in a shadowy manner, and in fan-shaped patches, showing different orientations, somewhat in the manner of broad spherulitic groups having always positive elongation, but without any other visible spherulitic structure, the later feldspar (*b* in figure 38) having the same extinction as the earlier. The name of this poikilitic mineral was not determined, but is supposed to be orthoclase in two conditions, viz.: ordinary and deformed orthoclase, cut in the zone (001) (010), the pseudo-spherulitic or lamellar structure being parallel to the axis *b*, constituting a coarse microperthite. Compare No. 1034.

*Age.* Archean (probably Upper Keewatin).

N. H. W.

NO. 1052. GRANITE.

W.  $\frac{1}{2}$  sec. 3, T. 64-7. Kekequabic lake, from near the contact with No. 1051.  
*Ref.* Annual Report, xv, pages 364, 395.

*Meg.* Red rock, same as No. 1046.

*Mic.* Though much finer grained, this is a rock like Nos. 1044-1046. The hornblende is in small, irregular areas, not in spicules. There is the same distinction between the old and the new feldspars, the latter being clear and glassy, and the former cloudy. The new growths form the cementing band, as they constitute interlocking arms and hooks, sometimes originating from the older grains and sometimes being apparently entirely free from them. The rock has the appearance of having quartz in the new material, but owing to the fineness of the grain none can be detected in convergent light. The feldspars are twinned on the albite and Carlsband plans and apparently on the microcline, and the larger ones are occasionally zoned. One section.

*Age.* Archean (igneous).

*Remark.* Were it not that this rock is so intimately connected in the field relations with rocks Nos. 1044-1046, and those through No. 1051 with rocks Nos. 1047-1050, it might be difficult to affirm its original fragmental character. But the microscopic characters entirely agree with the field relations and indicate that both groups are recrystallized debris.

N. H. W.

NO. 1053. GRAYWACKE AND SLATE.

N. W.  $\frac{1}{4}$  sec. 3, T. 64-7 W. West side of Kekequabic lake.  
*Ref.* Annual Report, xv, pages 365, 395.

*Meg.* There are two small hand samples of this number. One is a rather fine-grained, gray, gritty rock. The other is a fine-grained, dark argillyte. Both hold pyrite. No section.

*Age.* Archean (Keewatin).

U. S. G.

Graywacke. Green schist. Vein rock.]

No. 1054. GRAYWACKE.

Same locality as No. 1053.

Ref. Annual Report, xv, pages 365, 395.

*Meg.* Very similar to the first sample mentioned under No. 1053. No section.

*Age.* Archean (Keewatin).

U. S. G.

No. 1055. GREEN SCHIST. (*Tuff.*)

Kekequabic lake, northwest end of the bay projecting northward into sec. 34, T. 65-7.

Ref. Annual Report, xv, pages 365, 395, 396.

*Meg.* Lenticularly and coarsely schistose; the northwest extension of rocks Nos. 1049 and 1050.

*Mic.* A mass of fine debris of the kind represented by rocks Nos. 1049 and 1050, largely *hornblende*, but cemented by *calcite* and by secondary deposition. Carlsbad and albite twinned fragments of *feldspar* are visible and a little *quartz* in independent grains, evidently a part of the original debris. The section is remarkable for the amount of contained *calcite*. One (thick) section.

*Age.* Archean (Upper Keewatin).

N. H. W.

No. 1056. VEIN ROCK.

Same locality as No. 1055.

Ref. Annual Report, xv, pages 365, 395.

*Meg.* From veins in No. 1055. The hand sample consists largely of milky white quartz and pinkish *calcite*. No section.

*Age.* Archean.

U. S. G.

No. 1057. GREEN SCHIST. (*Tuff.*)

Near the meander corner between secs. 35 and 36, T. 65-7.

Ref. Annual Report, xv, pages 365, 395.

*Meg.* Variety of No. 1055, non-schistose nor pebbly.

*Mic.* This is like No. 1055 in composition, but the *hornblendes* are coarse and more like those of Nos. 1049, 1050, etc., with a little *feldspar* debris. One section.

*Age.* Archean.

N. H. W.

No. 1058. GREEN SCHIST. (*Tuff.*)

From the hill in N. W.  $\frac{1}{4}$  sec. 36, T. 65-7; Kekequabic lake.

Ref. Annual Report, xv, pages 366, 368, 395.

*Meg.* Sometimes conglomeratic, but in general resembling the last. Two specimens were obtained, one showing the conglomeratic structure and the other a hard, coarse-jointed, sometimes schistose, rock.

*Mic.* The section is made up of a debris like the last, but composed largely of *hornblendes*, which were probably originally augite fragments. They are short and angular without fibrous enlargements. The fine-grained matrix is composed of the same materials. One section.

*Age.* Archean (Upper Keewatin).

N. H. W.

No. 1059. GREEN SCHIST. (*Tuff.*)

N. E.  $\frac{1}{4}$  sec. 36, T. 65-7; Kekequabic lake.

Ref. Annual Report, xv, pages 367, 372, 396; Annual Report, xvii, pages 196, 206.

*Meg.* Another phase of the same rock, non-schistose and coarse jointed. (Compare No. 751.) Rises perpendicular from the water nearly 100 feet.

*Mic.* Very fine grained, colored everywhere with a prevailing chloritic and *hornblendic* ingredient, but showing a few of the larger fragments of crystals, apparently of *feldspar*, but now permeated by decay. These do not show secondary growths. There is also distributed through this another coloring material, which is in fine, roundish grains, either isolated or grouped, highly polarizing and highly refractive, appearing like detached intercleavage pieces of *epidote*, and when elongated sufficiently to allow the test (which is rare) they are seen to have parallel extinction. As these highly-polarizing, angular grains are sometimes embraced in a network of hornblende fibres, whose nature is evident, and still maintain their identity, it is evident that they cannot be augite, to which, in some respects, they have a resemblance.

In the fine matrix are also scattered a few ragged remnants of old feldspars of large size. Three sections.

*Age.* Archean (Upper Keewatin).

N. H. W.

No. 1060. GREEN SCHIST. (*Tuff.*)

N. W.  $\frac{1}{4}$  sec. 31, T. 65-6; apparently an extension of No. 1055.

Ref. Annual Report, xv, pages 368, 396, 398.

*Meg.* Gneissic, apparently a mica schist.

*Mic.* This rock is the same in general character as the last, but is more largely hornblendic, and with secondary growths both in the feldspathic and in the hornblendic grains. Occasionally, in the centres of the *hornblendes*, or somewhat eccentric, are seen several rounded grains resembling *augite* remnants (figure 39). There are also a few grains that appear to be of *epidote*, and numerous patches of *calcite*. The sketch connected with the description of rock No. 1047 shows the manner of development from augite to *hornblende*. There are in this slide a great many grains whose original nature cannot now be determined. They may be wholly altered feldspars, or they may be remnants of a volcanic glass. They do not transmit light freely, but afford a cloudy, dirty aspect, and between nicols are wholly dark.

These compose perhaps a fourth part of the slide. One section.

*Age.* Archean (Upper Keewatin).

N. H. W.

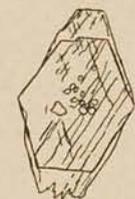


FIG. 39. HORN-  
BLENDE DE-  
VELOPED  
FROM AU-  
GITE WITH  
REMNANTS  
OF AUGITE.

## No. 1061. ESTERELLYTE.

East end of the narrows of Kekequabic lake; N. W.  $\frac{1}{4}$  sec. 31, T. 65-6. (Compare No. 1094.)

Ref. Annual Report, xv, pages 367, 369, 396; see, also, Annual Report, xxi, pages 39-42.

*Meg.* "Porphyry."

Esterellyte.]

*Mic.* In a fine-grained, transparent matrix, consisting mostly of interlocking fresh, glassy *feldspars*, with a very few *quartzes*, some *biotite*, *apatite* and *calcite*, frequent cubic grains apparently of *magnetite*, and some shreds of *hornblende* and fragments of *augite*, lie large crystals of other feldspar, of augite and of hornblende.

The feldspar crystals are much twinned on the Carlsbad, the albite and the pericline plans, and are rarely also surrounded by a zone, generally narrow, of a later growth. These feldspars are not fresh, but are dimmed by kaolinic disintegration. The zonal additions are dimmed also by the same disintegration, but far less than the central areas. They are worthy of very careful investigation. They are very interesting in their forms and especially in their twinning. But as the object of this examination is to throw light on the origin and relations of the rock masses principally, and as that purpose can be secured without further description, these are left for future research. Further, Dr. Grant, in one of the annual reports, has reported on this rock and has investigated the feldspar as well as the augite (Annual Report, xxi, page 43). From chemical analysis he determined it to be *anorthoclase*.

In this rock the feldspars are larger than seen elsewhere, and, with the augites, are better preserved. Many of the augites are uralitized (*i. e.*, converted to hornblende) and many of them are mere fragments, comparable with the fragments already noted in the green schists (Nos. 1058, 1059 and 1060). It is but rare that the form of a full crystal can be found in the three slides examined, while fragments of all dimensions are scattered everywhere, and in one slide it has furnished much hornblendic dust, which dims the matrix.

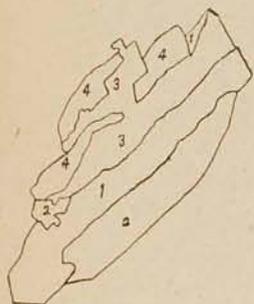


FIG. 40.

The feldspars in No. 1061 are rather compounded than twinned, and the rock might be described as glomeroporphyritic. The outline and compound structure of one of these crystals are shown in figure 40, magnified about twenty-five diameters. Three sections.

*Age.* Archean (cutting Upper Keewatin).

*Remark.* The name *esterellyte* was given by Michel Lévy in 1897 to a rock almost identical which occurs as laccoliths in the Mesozoic in southern France. (*Mémoire sur la porphyre bleu de l'Esterel*, Bulletin 57, Carte géologique de France, 1897.)

According to the determination of Michel Lévy, based on chemical as well as optical examination, the feldspar of esterellyte is of at least two kinds. The central cores are of *labradorite* and the zonal increments are of *andesine*, which is in accord with the optical specification of the feldspars in the porphyry of Kekequabic lake. (Compare No. 1094.)

N. H. W.

## NO. 1061A. INCLUSIONS OR PEBBLES FROM NO. 1061.

Same locality as No. 1061.

Ref. Annual Report, xv, pages 367, 396; see, also, Annual Report, xxi, page 51.

*Meg.* A few dark, sub-angular pieces of completely crystallized rock, made up almost entirely of hornblende or of hornblende and augite. No section.

*Age.* Archean.

U. S. G.

## NO. 1061B. ESTERELLYTE.

Same locality as No. 1061.

Ref. Annual Report, xv, pages 367, 396.

*Meg.* Similar to No. 1061, but showing a white weathered surface in which are a few large grains of quartz. No section.

*Age.* Archean.

U. S. G.

## NO. 1062. CONGLOMERATE.

Near the narrows in lake No. 6, or Zeta lake, sec. 28, T. 65-6, east of Kekequabic lake.

Ref. Annual Report, xv, pages 368, 369, 396.

*Meg.* Coarse conglomerate, with many evident large crystals of feldspar, with occasional visible quartz. Forms hills fifty to seventy-five feet high.

*Mic.* This consists of the same elements in evidently fragmental state as seen in the foregoing described porphyry (No. 1061) from Kekequabic lake. The augite is changed to *hornblende* and the *feldspars* are clouded by decay, containing *kaolin*. They are much twinned, often in remarkable combinations, as in rock No. 1061. These elements, though large and conspicuous in numerous large grains, are also of all smaller sizes, descending to the size of the grains of the matrix. They rarely, or never, are ingrown or interlock, except where twinned originally, but are separated uniformly by spaces filled with the fine elements. They are palpably all fragmental grains, and did not have their birth in the places in which they now lie except where they are embraced in some of the pebbles. The fine matrix is composed largely of secondary feldspars, but it is evidently more nearly in its original fragmental state than about Kekequabic lake, a fact that can be attributed to the non-action of great metamorphism at this point. This difference is also observable in the non-zoned condition of the large feldspars, and the absence of fibrous secondary enlargements on the hornblendes, which simply show, occasionally, the old augite outlines.

As to the species of the feldspar, extinction in two instances on the axis  $n_1$ , indicate *andesine* or *andesine-oligoclase*, and one test on  $n_2$  gave  $20^\circ$ , which is near *albite*. Allowing for error and for some obliquity in the section, it can only be said that these observations show a feldspar of medium basicity. The remarkable twinning, in which the albite bands vary in width rather suddenly along their greater extension, and are confusedly intersected by pericline bands, and are interrupted by

Feldspar. Graywacke. Conglomerate.]

interferences amongst themselves, is a feature which is more like albite, but is not probably a reliable character as diagnostic, but is a marked feature of the feldspar (andesine) of esterellyte, as described by Michel Lévy. Two sections.

*Age.* Archean (Upper Keewatin).

*Remark.* This conglomerate is made up of pebbles of various grain, as to size, and of the above debris. Microscopically the sections of No. 1061, from Kekequabic lake are indistinguishable from this. This is supposed to be the conglomerate which spreads widely eastward, under the name Ogishke conglomerate, and, according to Dr. Grant, it extends also westward to the south shore of Kekequabic lake. (Annual Report xxi, page 27.)

N. H. W.

## NO. 1062A. FELDSPAR.

Same locality as No. 1062.

*Ref.* Annual Report, xv, page 396.

*Meg.* Part of No. 1062, coated with a thin layer of small, pinkish crystals, probably orthoclase. No section.

*Age.* Archean.

U. S. G.

NO. 1063. GRAYWACKE. (*Conglomeratic.*)

N. W.  $\frac{1}{4}$  sec. 27, T. 65-6; northwest shore of the long bay from Ogishke Muncie lake.

*Ref.* Annual Report, xv, pages 369, 396.

*Meg.* Appearing conglomeratic and quartzose.

*Mic.* The greater part, by far, of the slide, consists of clouded *feldspars*, in which kaolinic and chloritic substances combine. There are some sub-rounded grains of *quartz*, some *calcite*, a little distinct *hornblende* and apparently considerable *leucoxene*. One section.

*Age.* Archean (Upper Keewatin).

*Remark.* This is a compact debris, rather coarser in average than the foregoing, and perhaps is more dependent on oceanic assortment, but in general it is a very similar rock, though the elements were more decayed prior to consolidation into the present rock mass. It is probable that much of the debris of this rock was of volcanic origin primarily. The feldspars rarely come into contact, at least they never interfere.

N. H. W.

## NO. 1064. CONGLOMERATE.

Shore of the bay last mentioned; taken so as to represent the average character of the rock about this bay.

*Ref.* Annual Report, xv, pages 370, 396.

*Meg.* Conglomerate, showing among the enclosed pebbles some of red jasper and of quartz.

*Mic.* Identical with the last in general character, but showing a few well-preserved *hornblendes*, though the most of the debris of the ferro-magnesian minerals

is chloritized. In the slide are a few rounded *quartz* grains, some *sphene* and one pebble of *red jasper*. The feldspathic ingredient, which was originally the most abundant, presents an aspect of general decay. One section.

*Age.* Archean (Upper Keewatin).

N. H. W.

NO. 1065. CONGLOMERATE.

Same locality as No. 1064.

*Ref.* Annual Report, xv, pages 370, 396.

*Meg.* Appearing porphyritic by the presence of idiomorphic crystals of feldspar, as in No. 1062.

*Mic.* Rounded and subangular *quartzes*, *feldspar* fragments, *red jasper*, *leucoxene*, *epidote*, *calcite*.

This slide differs from all the preceding in having pebbles of *different sorts of rock* besides of jasper. These rocks are: fine diabase, wholly altered to a greenstone, but in which the manner of distribution of the feldspathic microliths shows that it was probably an ophitic diabase; and volcanic tuff and porphyry, containing fragments of augite, now changed to hornblende, and of feldspar identical with that seen at Kekequabic lake (Nos. 1061, etc.). One section.

*Age.* Archean (Upper Keewatin).

*Remark.* The discovery of pebbles of rock in this conglomerate, like the porphyritic rock of Kekequabic lake, and like the porphyry of Zeta lake, seems at first view to indicate a later date for the Ogishke conglomerate; but that is not a necessary inference, since similar porphyritic pebbles are found in both those other rocks, rather indicating, instead, an identity of origin and age for all of them. N. H. W.

NO. 1066. GRAYWACKE.

Same locality as No. 1063; N. W.  $\frac{1}{4}$  sec. 27, T. 65-6; Ogishke Muncie lake.

*Ref.* Annual Report, xv, page 396.

*Meg.* Rather quartzose, sometimes pebbly, generally with no signs of bedding.

*Mic.* *Feldspar* and *quartz* grains compose this rock essentially. They are frequently angular, the cement consists of the same in a finer state of comminution, of *calcite* and *kaolinic* debris. One section.

*Age.* Archean (Upper Keewatin).

N. H. W.

NO. 1067. GREEN SCHIST.

East side of the second narrows of Ogishke Muncie lake; N. W.  $\frac{1}{4}$  sec. 24, T. 65-6.

*Ref.* Annual Report, xv, pages 371, 396.

*Meg.* Schistose, almost fissile, a part of the conglomerate of the region.

*Mic.* There is a banding, evidently due to the occurrence of finer and coarser elements in bedding, which is seen to cross the slide. These bands are also characterized by greater or less amounts of a brightly polarizing mineral the nature of

Greenstone. Marble. Conglomerate.]

which, owing to the extreme fineness of the rock and the thickness of the section, cannot be determined, but which appears to be *calcite*, or muscovite. There are numerous feldspar fragments in the coarser bands, and one nearly entire crystal lying with its greatest dimension parallel with the banding. One section.

*Age.* Archean (Upper Keewatin).

N. H. W.

NO. 1068. GREENSTONE.

From the hill a little north of the second narrows of Ogishke Muncie lake, east side of sec. 24, T. 65-6.

*Ref.* Annual Report, xv, pages 371, 372, 396; Annual Report, xvi, page 96; Annual Report, xvii, pages 196, 205.

*Meg.* Collected under the name doleryte.

*Mic.* The whole slide is composed of a very fine, green element, like some species of *chlorite*, with scattering remnants of feldspar (and secondary feldspar) and *calcite*. There were sundry small geodic cavities which have become filled with the same chloritic substance. Separating this chlorite from the walls of the original cavity is a coating of a transparent mineral of very low double refraction, uniaxial and probably *quartz*. One section.

*Age.* Archean (Keewatin).

*Remark.* In this rock there is no trace of ophitic structure. *Calcite* constitutes nearly one-half. There are a few *magnetite* grains, with accompanying *leucoxene*.

N. H. W.

NO. 1069. MARBLE (*with greenstone inclusions*).

Hill just northwest of the last: sec. 24, T. 65-6.

*Ref.* Annual Report, xv, pages 371, 396; Annual Report, xvi, page 95; Annual Report, xvii, page 199.

*Meg.* Rusty, calcareous, fine grained. (Compare No. 746.) Rises about ten feet.

*Mic.* What remains of the slide, which is accidentally much wasted in the preparation, shows a rock like the last, but containing more *calcite*. One section.

*Age.* Archean (Keewatin).

*Remark.* As this rock was collected under the same "irony conglomerate," it is probable that the slide does not fairly represent it.

N. H. W.

NO. 1070. CONGLOMERATE. (*Rusty.*)

Rapids of the stream connecting Ogishke Muncie and Town Line lakes; sec. 13, T. 65-4.

*Ref.* Annual Report, xv, pages 372, 396.

*Meg.* Pebbly, schistose conglomerate.

*Mic.* There is a little quartz amongst the pebbles of this conglomerate, but generally the pebbles are of some greenstone, either very fine grained and with much *calcite* or thickly porphyritic with microlitic *feldspars*, in both cases so altered that the hornblende ingredient is chloritized. In the finer matrix embracing these is

*pyrite* and *siderite*, the latter frequently surrounded by a rustiness due to its oxidation. In one case the pebble contains old feldspars of larger size, recalling the rocks of Kekequabic lake, but as the pebble has no porphyritic hornblendes nor secondary growths, but much scattered chlorite and calcite, it is hardly to be referred to that origin, but may be considered a case parallel with that mentioned under No. 1065. One section.

*Age.* Archean (Upper Keewatin).

N. H. W.

No. 1071. TUFF (?)

Northward projecting point south shore of Frog Rock lake; sec. 18, T. 65-5.  
*Ref.* Annual Report, xv, pages 372, 396.

*Meg.* Porphyritic, apparently, with some pyroxene, but generally a green, amorphous rock. Contains pyrite.

*Mic.* Throughout the matrix, which is fine and chloritized and nearly dark between crossed nicols, are disseminated many fragments of uralitized *augite* and of *feldspar*. There are but few *hornblendes* that show secondary growths of *actinolite*. Epidote also is conspicuous. There are areas in the slide that are darker and of different grain from the rest, indicating a pebbly or tuffaceous accumulation. One section.

*Age.* Archean (Keewatin).

*Remark.* This rock seems to be allied in origin and age to the Kekequabic Lake fragmental green schists.

N. H. W.

No. 1072. TUFF. (*Basic.*)

East end of Frog Rock lake; sec. 17, T. 65-5.  
*Ref.* Annual Report, xv, page 372.

*Meg.* Greenstone-like rock. Contains pyrite.

*Mic.* Rounded and sub-angular quartzes and feldspars are disseminated as clastic debris in a green calciferous matrix, in which are also *leucoxene* and *pyrite*. In this slide is seen also a pebble of diabase which shows yet its ophitic structure. In this pebble the pyroxenic element is altered entirely to a chloritic green mineral of low double refraction in which is much fine-grained *calcite*. One section.

*Age.* Archean (Keewatin).

N. H. W.

No. 1073. GRAYWACKE.

Mouth of Ogishkie Muncie creek; sec. 26, T. 65-6.  
*Ref.* Annual Report, xv, pages 372, 376, 396, 397; Annual Report, xvii, pages 197, 205.

*Meg.* Coarse jointed, massive.

*Mic.* Rather quartzose, fragmental, containing also fragments of *microcline*, *plagioclase*, *zircon*, *calcite*. Two sections.

*Age.* Archean (Keewatin).

Graywacke. Greenwacke.]  
Diabase. Greenstone.

*Remark.* Judging from the fact that two slides bear this number but differ considerably, this rock varies from the above character to a more green, less siliceous one, in which the matrix is very chloritic and calcareous and contains but few quartz grains.

N. H. W.

NO. 1074. GRAYWACKE.

Near the same place as No. 1073.

*Ref.* Annual Report, xv, pages 372, 396; Annual Report, xvii, pages 197, 204.

*Meg.* Irregular stratum of No. 1073, holding fragments of *fissile*, closely jointed slate.

*Mic.* Only a finer grained condition of rock resembling No. 1073. One section.

*Age.* Archean (Keewatin).

*Remark.* The section was probably made from one of fragments of slate.

N. H. W.

NO. 1075. GREENWACKE.

Near the same place as No. 1073.

*Ref.* Annual Report, xv, pages 372, 396.

*Meg.* Collected with the purpose of showing a blending of the characters of Nos. 1073 and 1074.

*Mic.* The sections are so similar and so thick and the rock so fine that no differences can be stated to exist between these rocks. Two sections.

*Age.* Archean (Keewatin).

N. H. W.

NO. 1076. DIABASE.

From hills in the southern part of sec. 35, T. 65-6; south of Ogishke Muncie lake.

*Ref.* Annual Report, xv, pages 373, 374, 376, 397.

*Meg.* Tough, massive, coarse jointed.

*Mic.* The ophitic structure is evident, but the most of the pyroxene is altered to *hornblende*. A section of the feldspar cut so as to show  $n_x$  nearly perpendicular, and in the acute angle of the optic axes, has an extinction on cleavage of  $9^\circ$ , indicating *andesine*, according to the determinations of Fouqué. As this grain of feldspar holds minute *apatites* it appears to be one of the original generation, but it is not, as it lies, ophitic in respect to the surrounding ferro-magnesian minerals. There is also considerable *quartz* in the rock. One section.

*Age.* Archean (Keewatin).

N. H. W.

NO. 1077. GREENSTONE. ("Pebbly.")

Same place as No. 1076.

*Ref.* Annual Report, xv, pages 373, 374, 397; Annual Report, xvi, page 97.

*Meg.* In the field apparently graduating into No. 1076.

*Mic.* This slide has a varied composition. One part is made up of loosely set imperfect green spheruliths though without marked radial structure, lying in a matrix which is sub-translucent, or nearly isotropic. Amongst these spheruliths are a few scattering idiomorphic crystals of *feldspar*, each crystal about as large in cross section as 8 to 12 of the spheruliths. Another portion consists of *actinolite* and *chlorite*, with more or less of *feldspar*, being in general much more transparent than the last, though containing also some of the same spherulitic forms and some *magnetite*. A third portion, not well separated from either of these, is fine grained, but consists of about the same elements.

The porphyritic aspect, the fine and almost isotropic nature of the substance embracing the little spheruliths, the varied nature of the structure connected with the essential unity of the composition, conspire to indicate that this rock was originally a basic basalt, somewhat porphyritic, a diabase porphyryte. One (thick) section.

*Age.* Archean (Keewatin).

N. H. W.

NO. 1078. GREENSTONE.

Near the same place as Nos. 1076 and 1077; hills in sec. 35, T. 65-6; south of Ogishke Muncie lake.  
*Ref.* Annual Report, xv, pages 368, 372, 373, 397.

*Meg.* Coarse jointed, massive, porphyritic.

*Mic.* The much decayed feldspars are crowded with *zoisite*, *calcite* and other impurities. The pyroxene element is changed to *hornblende*, about which are gathered *hematite* and more or less *leucoxene*, the latter also being in other parts of the slide. Two crystals of *apatite* of the first generation also are conspicuous. One section.

*Age.* Archean (Keewatin).

*Remark.* This rock was probably originally a massive diabase with ophitic structure.

N. H. W.

NO. 1079. CONGLOMERATE. (*Matrix of the pebbles.*)

Southern portion of sec. 23, T. 65-6; one-third of a mile north of the shore of Ogishke Muncie lake.  
*Ref.* Annual Report, xv, pages 374, 397.

*Meg.* Matrix of the Ogishke conglomerate.

*Mic.* The rock consists, besides the finest matrix, of the following pebbles: *quartz*; diabase, both fine and coarser, particularly the former; *hornblende* crystals; *feldspar* crystals, which have the striking multiple twinning of those in rock No. 1061, at Kekequabic lake and in the porphyrel of Zeta lake; fine-grained rock like the matrix of the crystals of the Kekequabic Lake rocks, numerous; quartzite, in which several orientations are in one pebble. One section.

*Age.* Archean (Upper Keewatin).

N. H. W.

Pebble. Conglomerate. Flint. Tuff.]

NO. 1079A. PEBBLE (*from No. 1079*).

Same place as No. 1079, *i. e.*, one-third of a mile north of Ogishke Muncie lake, sec. 23, T. 65-6.  
*Ref.* Annual Report, xv, pages 375, 397.

*Meg.* Gray, fine-grained pebble.

*Mic.* The section shows a rock in all respects like the porphyry at the narrows of Kekequabic lake, and like the pebbles in that porphyry, having along with crystals of *feldspar* and altered *augite*, some large *quartzes*. These lie isolated in a very fine matrix of feldspar and quartz, in which still are seen some finer fragments of the same kind of crystals.

A section of another pebble from the same shows essentially the same kind of rock, but in this the matrix is considerably coarser, and more *calcite* is disseminated. The feldspars show their original zoning, but the *hornblendes* are not apparently of two periods of growth, but are much chloritized. Two sections.

*Age.* Archean (Upper Keewatin).

N. H. W.

NO. 1080. CONGLOMERATE. (*"Porphyritic."*)

Northeast corner of S. E.  $\frac{1}{4}$  sec. 22, T. 65-6, north of Ogishke Muncie lake.  
*Ref.* Annual Report, xv, pages 375, 397.

*Meg.* Evidently a fragmental rock with scattered crystals of large size of some feldspar.

*Mic.* There is *jasper*, *quartz*, *hornblende*, *feldspar*, *diabase*, and many pebbles like the matrix of the Kekequabic lake porphyroids. These constitute the coarser elements, but they graduate in size downward into the matrix. The whole rock might be considered a product of destructive friction on rocks of the Kekequabic lake series (No. 1061), or a non-metamorphic conglomerate of the same kind and age. One section.

*Age.* Archean (Upper Keewatin).

N. H. W.

NO. 1081. FLINT. (*Black.*)

N. E.  $\frac{1}{4}$  sec. 22, T. 65-6, north of Ogishke Muncie lake.  
*Ref.* Annual Report, xv, pages 375, 397.

*Meg.* Black slate.

*Mic.* Very fine-grained mixture of angular *quartz* and *feldspar* and probably debris of ferromagnesian elements, with secondary generation of *quartz*, sometimes in small veins. In convergent light, and on lowering the lower nicol there come to sight many isolated fine granules of what appear to be *zoisite* or *epidote* and a network of what appears to be fine spicules and fragments of *actinolite*. One section.

*Age.* Archean (Upper Keewatin).

N. H. W.

NO. 1082. TUFF. (*Hard, dense, dark.*)

Eighty rods northwest of the last.  
*Ref.* Annual Report, xv, pages 375, 376, 397.

*Meg.* Thicker bedded and arenaceous, sometimes greenish.

*Mic.* There are but few grains of *quartz* in the slide, but there are many fragments of *hornblende* and of *feldspar*, as well as some pebbles of rocks in which these crystals appear. The whole rock appears to be a volcanic tuff or a debris from quartz-porphry and other Lower Keewatin rocks. It is similar to the rock No. 1080, but finer grained. One section.

*Age.* Archean (Upper Keewatin).

N. H. W.

NO. 1083. SLATE. (*Green-black, flinty.*)

From the hill, same locality.

*Ref.* Annual Report, xv, pages 375, 397.

*Meg.* Resembles a fine, flinty basalt, intersecting No. 1082.

*Mic.* The slide consists largely of *chlorite*, spicules of *actinolite*, *feldspar*, and roundish scattered grains, apparently of *epidote*, which are sometimes grouped into grains of larger size. These larger grains have a high single and also double refraction. There is a small amount of fine *quartz* in angular grains. One section.

*Age.* Archean (Upper Keewatin).

*Remark.* This rock is evidently a clastic one.

N. H. W.

NO. 1084. CONGLOMERATE. (*Fine.*)

Sec. 22, T. 65-6. Same locality as No. 1082.

*Ref.* Annual Report, xv, pages 375, 397.

*Meg.* Fragmental rock from the dark-green beds represented by No. 1082.

*Mic.* Highly angular, gritty, with *quartz* and *feldspar*. The rock is a fair sample of the finer portions of the Ogishke conglomerate. There are many fine-grained fragments, apparently of the matrix of a quartz-porphry and of *feldspar* and of *hornblende*. Some parts appear to be wholly micro-granulitized feldspars. It is apparent that the elements of this rock were much decayed before they entered into the constitution of a rock mass, but were not long exposed to sedimentary attrition. One section.

*Age.* Archean (Upper Keewatin).

N. H. W.

NO. 1085. CONGLOMERATE.

West end of Little Reynard lake, near the water; sec. 26, T. 65-6.

*Ref.* Annual Report, xv, pages 375, 397.

*Meg.* Evidently a coarse fragmental.

*Mic.* The slide is quite varied in its aspects. With conspicuous angular and subrounded *quartz* grains are many pebbles of a very fine-grained earlier fragmental rock, of old, now much decayed, twinned *feldspars*, and apparently of an older diabasic rock (judging from a suggestion of the ophitic structure still remaining). These are embraced in a greenish, finer matrix which is debris probably from some basic rock, the whole liberally sprinkled with *calcite* and a little *pyrite*. One section.

*Age.* Archean (Upper Keewatin).

N. H. W.

Slate. Breccia. Biotite schist.]  
Biotite gneiss.

NO. 1086. SLATE. (*Black.*)

Near the same locality as No. 1085.

Ref. Annual Report, xv, pages 376, 397.

*Meg.* A very fine-grained, siliceous, black slate. No section.

*Age.* Archean (Keewatin).

U. S. G.

NO. 1087. BRECCIA.

Portage from Fox to Ash lake. The specimen came from near the southwest corner of sec. 25, T. 65-6 W.

Ref. Annual Report, xv, pages 377, 397.

*Meg.* A breccia of fine-grained, gray, siliceous slate and a coarser, gritty rock, the latter including fragments of the former. No section.

*Age.* Archean (Keewatin).

U. S. G.

NO. 1088. BIOTITE SCHIST (*with quartz*).

North shore of Gabemichigama lake. From an island at the entrance to the bay running northeast; S. W.  $\frac{1}{4}$  sec. 29, T. 65-5.

Ref. Annual Report, xv, pages 379, 397; Annual Report, xxi, page 147.

*Meg.* Quartzitic slate, having a columnar aspect.

*Mic.* Biotite is very conspicuous, also angular *quartzes*. These lie in a finer matrix of quartz grains which also has some of striated *feldspar*. The quartz is secondary to the biotite, and partially incloses it poikilitically, having been entirely recrystallized. One section.

*Age.* Archean (Keewatin).

N. H. W.

NO. 1089. BIOTITE SCHIST (*with actinolite*).

North side of the long point, S. W.  $\frac{1}{4}$  sec. 32, T. 65-5, Gabemichigama lake.

Ref. Annual Report, xv, pages 379, 380, 397; Annual Report, xxi, page 147.

*Meg.* Siliceous, fine grained, rather dark, in heavy layers.

*Mic.* In a fine background of secondary granular *quartz* are numerous *biotite* leaves, and a debris from basic rock consisting now in part of *actinolite* in fibres and occasionally in bundles of fibres, but most abundantly of scattered granular or globular particles, which are also embraced in the enlargements of the quartz. In the form of grains and minute particles this element mingles widely with the quartzose matrix and is evidently some form of *pyroxene*. One (thick) section.

*Age.* Archean (Keewatin).

N. H. W.

NO. 1090. BIOTITE GNEISS (*or schist, with cordierite*).

South shore of the same long point, Gabemichigama lake.

Ref. Annual Report, xv, pages 379, 380, 397; Annual Report, xxi, page 148.

*Meg.* Siliceous, gneissic, with evident biotite.

*Mic.* This rock is like the last, but is coarser and has a monoclinic *pyroxene*. The secondary *quartzes* form large crystals that embrace the earlier grains of *cordierite* and this regenerated ferro-magnesian debris poikilitically. Many of the glassy grains thus embraced are apparently of *oligoclase-andesine*. They not only show a fine

albite twinning, but in a favorable section showing  $n_p$  perpendicular the extinction on the twinning trace was  $70^\circ$ . This is not conclusive, but by making the Becke test for comparative refraction it is found that these earlier glassy grains are uniformly less refractive than the quartz; many of them are certainly of cordierite. Compare Nos. 1350 and 1351. One section.

*Age.* Archean (Keewatin).

*Remark.* In another section of this rock the recrystallization is more advanced, the grains are larger and interlocking more like the structure of a crystalline massif. But as the rocks of this point are known to be clastics affected by the gabbro, this furnishes an instructive instance of the manner of formation of gneiss from elastic rock.

The rocks of this point received detailed examination in the field, and are referred to again under Nos. 1350 and 1351. See also rocks Nos. 767, 768, 983.

N. H. W.

NO. 1091. BIOTITE GNEISS.

Same locality. Northwest portion of the S. W.  $\frac{1}{4}$  sec. 32, T. 65-5, Gabemichigama lake.  
*Ref.* Annual Report, xv, pages 380, 397; Annual Report, xxi, page 148.

*Meg.* The same kind of rock, but without apparent bedding or gneissic structure.

*Mic.* The same interlocking fine secondary quartz and feldspar as ground-mass, is thickly and uniformly sprinkled with biotite.

N. H. W.

NO. 1092. BIOTITE GNEISS (*with cordierite*).

Near the same place as the last, northwest corner S. W.  $\frac{1}{4}$  sec. 32, T. 65-5.  
*Ref.* Annual Report, xv, pages 380, 397.

*Meg.* Stratified gneissic rock. Compare No. 1350.

*Mic.* The rock, consisting entirely of secondary products, is still entirely crystalline. The most abundant element is perhaps the cordierite. This *cordierite* sometimes wholly surrounds small *pyroxene* grains which are nearly round. *Quartz* is less common, but still there are some large grains, and these are spread amongst the other minerals so as to involve them poikilitically, *i. e.*, the small *cordierites*, the pyroxenes, the biotite, the last also embracing the small pyroxenes.

The pyroxenes present a singular feature; they embrace sometimes a number of smaller globular pyroxenes, of differing orientation, and when these are numerous the general extinction is imperfect, and the whole grain appears to be made up of a grouping of smaller individuals. The consequence is that there is no complete extinction, and at the same time the cleavages are not evident. This phenomenon has to be explained in the same manner as *quartz-globulaire* has been explained by Fouqué, and similarly to the *siderite-globulaire* already noted in this work, *viz.*: that these infant globules represent the commencement of aggregation into crystals, but never acquired definite crystal outlines. One section.

*Age.* Archean (Keewatin).

N. H. W.

Tuff. Esterellyte.]

No. 1093. TUFF. (*Green schist.*)

Southeast side of sec. 29, T. 65-6. Point in Kekequabic lake.  
 Ref. Annual Report, xv, pages 369, 397.

*Meg.* Greenish gray, nearly homogeneous, basaltiform.

*Mic.* Fragmental debris, consisting very largely of *hornblende* and *feldspar*, with a little angular *quartz* in a matrix of finer materials of the same, with a few grains and groups of *epidote*. The last is also quite abundant in the form a finer powder in the matrix, but rarely being coarse enough to show its polarization colors. There is a large amount of very fine isotropic substance, apparently of *chlorite*. One section.

*Age.* Archean (Keewatin).

*Remark.* The hornblendes do not show secondary growths.

N. H. W.

No. 1094. ESTERELLYTE (?) (*or Dacyte.*)

At the corner of secs. 29, 30, 31, 32, T. 65-6, Kekequabic lake.

*Ref.* Annual Report, xv, pages 368, 397; Annual Report, xvi, page 100; Annual Report, xvii, pages 197, 205; Bulletin vi, pages 41, 422; see, also, Annual Report, xxi, pages 41-49.

*Meg.* A hard, gray, porphyroidal rock, not evidently bedded or banded. Compare Nos. 1061, 1399.

*Mic.* Similar to some already described at Kekequabic lake. Extinction on feldspar  $28^\circ$  on  $n_g$ , acute bisectrix, indicates *labradorite*. On another grain extinction on  $n_g$  is  $22^\circ$ , indicating *labradorite* and on another  $29^\circ$ , indicating the same. There is also some *microcline*, at least a microcline twinning.

The larger crystals of the labradorite are zoned and composed of different species. Sometimes the fresh central area extinguishes with the external zone, the acute bisectrix being  $n_g$ , at an angle of  $9^\circ$ , indicating *andesine*. Sometimes two feldspars are minutely interleaved like *micropertthite*, the interstructure being parallel with the exterior of the crystal, as shown by the adjoining sketch, which shows a section nearly parallel to the brachypinacoid. These feldspars are also twinned in a complex manner. They sometimes include little crystals of *augite*, which are also more abundant in the surrounding rock, and are of considerable size, occasionally breaking the boundaries of the feldspars. These are fresh and idiomorphic or fragments of idiomorphic crystals. Scattered through the finer matrix are also

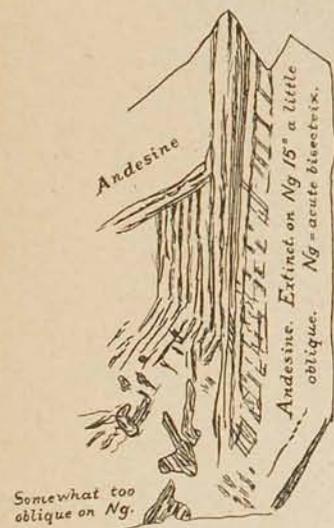


FIG. 41. TWINNED AND ZONED FELDSPAR IN ROCK NO. 1094.

numerous *actinolite* spicules, but these have no apparent connection with the augites. In this rock is also some secondary *quartz*, some *sphene* and some *apatite*. Two sections.

*Remark.* That these augites and labradorites did not grow up together in the place where they are now found, is evident from the fact that their boundaries

rarely interlock. Yet, that they grew together in the same rock, in same place, is evident from the inclusion of minute augites occasionally in the feldspars. That they are both out of their native places is further evident from the nature of the surrounding matrix, which consists of debris of actinolite and of secondary quartz, combined with fragmental stuff largely made up of feldspathic and augite grains. Such feldspars, holding augite in the same manner, are seen also in the porphyry of Zeta lake, which is plainly composed of clastic materials, and is believed to be a less metamorphic analogue of this rock.

The following account by Dr. Grant, of the augite of this rock, No. 1094, which is the same as No. 86G, is taken from the Twenty-First Annual Report, pages 45-48.

"The *augite* occurs in short, stout prisms, whose length is half a millimeter or less; rarely, larger crystals, one to three millimeters in length, are seen. The crystals are generally completely idiomorphic, but occasionally the terminal planes are lacking, or are very poorly developed. The prismatic planes are the unit prism, the orthopinacoid and the clinopinacoid. The terminal faces, which are usually present, are the basal plane and the orthodome  $P_{\infty}$  while the unit pyramid and a clinodome can sometimes be recognized, but usually there is a tendency to a rounding off of the edges of the basal plane and the orthodome  $P_{\infty}$ . The cleavage is well developed in thin sections and parting is usually not seen, but in one case (see figure 43) it is quite noticeable. An attempt was made to measure the angles on some of the larger augite crystals detached from the rock, but the faces gave such imperfect reflections that no satisfactory results were obtained.

"In transmitted light the augite is of a bottle green color, but there are parts of

some crystals which are colorless and entire colorless individuals are sometimes seen. A slight pleochroism is to be noticed in many sections, *a* and *b* being bottle green and not distinguishable from each other, while *c* is a yellowish green. The absorption is  $a=b>c$ .

"Zonal structure is rather common; in such cases the core of the crystal is usually colorless, or of a lighter green than the outer rim. The colorless centres occasionally pass gradually into the colored rims, but generally the two are separated by a pretty distinct line. The outlines of these colorless cores are irregular and are seldom parallel to any crystallographic planes. The cleavage lines run uninterruptedly from one part of the crystal to another, and in sections cut parallel to the zone of the ortho-axis the extinction directions of both parts of the crystal are parallel, but in sections which are inclined to the

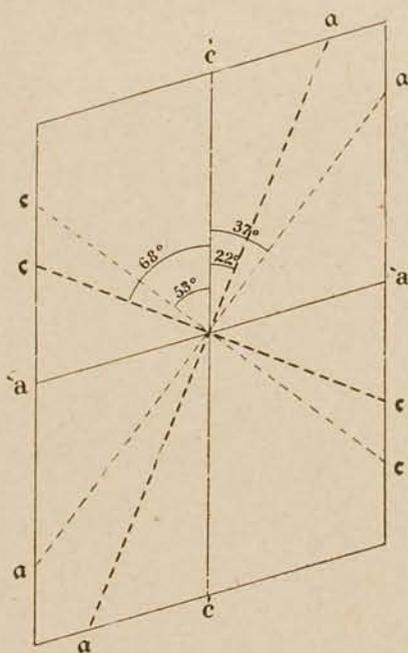


FIG. 42. DIAGRAM SHOWING THE RELATIVE POSITIONS OF THE CRYSTALLOGRAPHIC AND OPTICAL AXES IN THE GREEN AND COLORLESS AUGITE.

Esterellyte.]

ortho-axis, the extinction directions are different in the two parts of the crystal. Moreover, in one section, cut parallel to the clinopinacoid, parting parallel to the basal plane is seen, and this runs straight through the colored rim and the colorless core. From these facts it is seen that the two parts of the crystal have the same crystallographic axes, *i. e.*, are parallel growths, but that the axes of optical elasticity, excepting the one coincident in direction with the ortho-axis, do not have the same directions in the two parts of the crystal.

“The green crystals and rims have a lower index of refraction, lower double refraction and a smaller extinction angle than the colorless augite (the extinction angle measured being that between *a* and *c* in acute angle *b*). The dark green crystals are more pleochroic than the lighter ones, and the colorless ones show no pleochroism. These facts indicate that the green crystals and rims contain more of the acmite molecule than the colorless parts. (That the augite contains a considerable amount of the acmite molecule is shown by the analysis given below.)

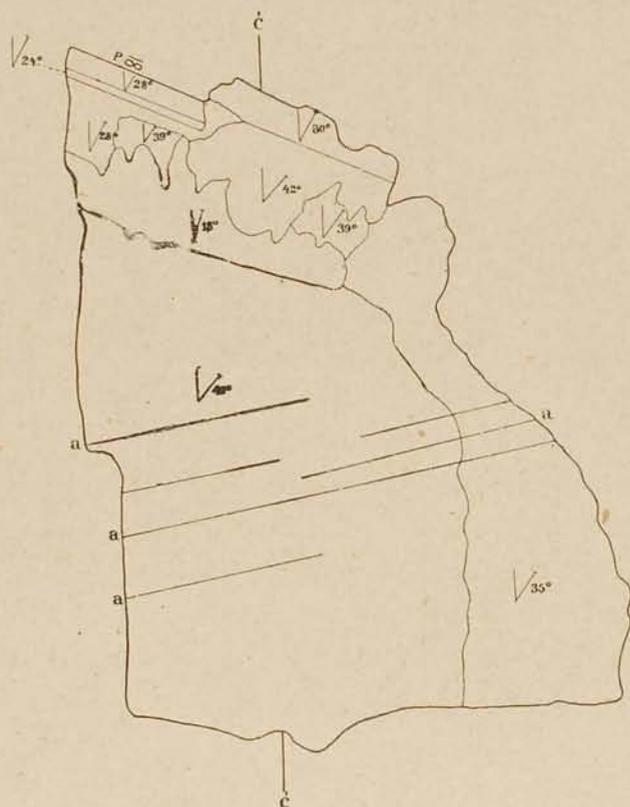


FIG. 43. SECTION OF AUGITE CRYSTAL SHOWING AREAS OF DIFFERENT OPTICAL ORIENTATION.

“The extinction angle of the colorless augite in sections parallel to the clinopinacoid runs as low as 37°, although usually higher than this; this is an angle of 53° as the extinction of augite is usually measured, *i. e.*, *c* to *c* in obtuse angle *b*. In the green crystals and rims *a* is inclined about 22° to *c*, but in one section it is as low as 18°. The positions of the axes of elasticity with reference to the crystallographic

axes are shown in the accompanying figure (figure 42); the axes of elasticity of the colorless variety being represented by the lighter dotted lines.

"While in the zonal crystals there are usually only two parts, which are of different optical orientation, in a few there are more than two such areas. To illustrate parallel growths of this kind, the above figure is introduced. It shows part of a large crystal of augite cut parallel to the clinopinacoid. The extinction and outlines of the different parts are represented rather diagrammatically, as the different zones are not always separated by a sharp line. The lines *aa* represent the parting parallel to the basal plane. The extinction angles given are those of *a* against *c*. The large central part of the crystal is colorless and the rest is greenish; the small irregular area with an extinction of  $18^\circ$  is yellowish green and distinctly pleochroic.

"A typical fresh specimen of the porphyritic granite (No. 86G) was powdered and the augite separated and analyzed. This augite is fresh and unaltered and the powder used (which has a higher specific gravity than 3) is quite pure, as in this specimen of the granite the only other minerals present were feldspar and quartz with a few minute fibres of secondary hornblende. The analysis is here given:

*Analysis of augite.*

SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	FeO	CaO	MgO	K <sub>2</sub> O	Na <sub>2</sub> O	H <sub>2</sub> O	Total
53.19	2.38	9.25	5.15	17.81	9.43	0.38	2.63	0.01	100.23

"Assuming that this represents an isomorphous mixture of the diopside, heddenbergite, acmite and fassaite molecules and calculating their relative proportions, we get approximately the following result:

Diopside, Mg Ca Si <sub>2</sub> O <sub>6</sub>	47 per cent.
Heddenbergite, Ca Fe Si <sub>2</sub> O <sub>6</sub>	27 " "
Acmite, Na Fe Si <sub>2</sub> O <sub>6</sub>	21 " "
Fassaite, Mg Al <sub>2</sub> SiO <sub>6</sub>	5 " "

"In the considerable percentage of the acmite molecule this augite approaches in composition the pyroxene of the more alkaline rocks, the eleolite syenytes.\* This analysis very probably represents quite well the usual composition of the green augite, as the proportion of zonal crystals, with colorless centres and entire colorless crystals is small. The colorless augite is very similar to that of the well known augite granite from Laveline in the Voges."

An analysis of the whole rock gave the following results:

SiO <sub>2</sub>	67.42
Al <sub>2</sub> O <sub>3</sub>	15.88
Fe <sub>2</sub> O <sub>3</sub>	1.37
FeO	1.14
MnO	trace
CaO	3.49
MgO	1.43
K <sub>2</sub> O	2.65
Na <sub>2</sub> O	6.42
P <sub>2</sub> O <sub>5</sub>	0.07
H <sub>2</sub> O	0.05
Total,	99.92

\* Cf. A. MERIAN. *Studien an gesteinsbildenden Pyroxenen*; *Neues Jahrbuch f. Min., Pet. u. Pal.*, B.B. III, pp. 252-315, 1885.

Tuff. Diabase. Green schist.]

*Age.* Intrusion in the Upper Keewatin.

*Remark.* The name of this rock was given by M. A. Michel Lévy to the blue porphyry of Esterel in 1897,\* a laccolitic and intrusive rock of southern France penetrating Permian strata, which he shows is perfectly analogous to the laccoliths of the Henry mountains. The chief chemical difference between this rock and that of Esterel consists in the somewhat greater percentages of silica and of soda in this. This high percentage of soda is in harmony with the aegirite nature of the pyroxene.

N. H. W.

NO. 1095. TUFF. (*Porodyte?*)

Mallmann's peak, S. E.  $\frac{1}{4}$  sec. 30, T. 65-6; Kekequabic lake.

*Ref.* Annual Report, xv, pages 368, 397.

*Meg.* Banded graywacke and slate.

*Mic.* The grains are angular, consisting of *quartz* and *feldspar*, embraced in an abundant matrix of prevailing green elements. There are also pebbles which were probably originally glassy (*zirkelyte*), but now are dark constantly between the nicols or are sprinkled sparsely with polarizing specks. This substance, in finer condition, also constitutes much of the surrounding matrix. Some of these pebbles are black, with fine dust of *magnetite*. A little *pyrite* is scattered through the slide. One section.

*Age.* Archean (Keewatin).

N. H. W.

## NO. 1096. DIABASE.

From a dike making a couple of islands in Kekequabic lake, south of Mallmann's peak, N. E.  $\frac{1}{4}$  sec. 31, T. 65-6.

*Ref.* Annual Report, xv, pages 368, 398; Annual Report, xxi, page 29.

*Meg.* Dark, diabasic rock, of medium grain.

*Mic.* An ordinary diabase, which, however, has been subjected to some dynamic stress, as the pyroxenic element, which appears in the main to be still *augite* and is ophitic toward the feldspars, is broken into several fragments (each crystal) which cause a shifting extinction to pass over the crystal. The feldspars are all more or less clouded by *zoisite* and by *mica*. The rock has also some original crystals of *magnetite* and some secondary *actinolite* and *pennine*. One section.

*Age.* Dike cutting the Archean.

N. H. W.

## NO. 1097. GREEN SCHIST.

S. E.  $\frac{1}{4}$  sec. 30, T. 65-6 W. South shore of Kekequabic lake.

*Ref.* Annual Report, xv, pages 368, 398.

*Meg.* A rather soft, green schist, similar to many others in the vicinity. Evidently consisting largely of hornblende. In the field this rock shows contorted sedimentary structure. No section.

*Age.* Archean (Keewatin).

U. S. G.

\* Mémoire sur le porphyre bleu de l'Esterel. *Bull. Ser. Carte Geol. France No. 57*, tome ix, 1897-1898, Paris.

## NO. 1098. GREEN SCHIST.

N. W.  $\frac{1}{4}$  sec. 31, T. 65-6, Kekequabic lake.

Ref. Annual Report, xv, pages 367, 368, 398; Annual Report, xvii, pages 197, 206.

*Meg.* "Conglomeratic, chloritic schist; phase of No. 1060."

*Mic.* There are fine fragments of *actinolite* and a few of *feldspar* distributed in a very fine pulpy matrix whose constituents cannot easily be differentiated, but which is partly actinolitic, but largely consists of a dirty, yellowish, fine mesh, which is almost wholly dark between the nicols, but which is probably in part chloritic and partly actinolitic, and at first zirkelyte. One section.

*Age.* Archean (Upper Keewatin).

N. H. W.

## NO. 1099. TUFF.

Portage trail from Kekequabic lake northward. Sec. 34, T. 65-7.

Ref. Annual Report, xv, pages 366, 398.

*Meg.* Hornblendic and conglomeratic, sometimes gneissic.

*Mic.* The fragmental hornblendes are generally free from secondary enlargements, which, in the form of spicules of *actinolite* have been disseminated throughout the matrix, but in some cases these secondary attachments are still in their native places. Some of the feldspars are also zoned. These lie in the usual fine fragmental matrix. In one section the elements are all much finer, and much calcite has been generated. Two sections.

*Age.* Archean (Upper Keewatin).

N. H. W.

## NO. 1100. GRANITE.

Most westerly island in Kekequabic lake, sec. 3, T. 64-7.

Ref. Annual Report, xv, pages 361, 362, 398.

*Meg.* Reddish syenitic rock.

*Mic.* This rock is like those already mentioned (Nos. 1044 and 1045), made up largely of a recomposed debris of coarse, much twinned and zoned *feldspars*, lying in a matrix, now recrystallized, composed of secondary *feldspars*, *quartz*, *calcite* and *actinolite*, with scattering *magnetite* powder. One section.

*Age.* Archean (Keewatin).

*Remark.* This rock is a special condition of the prevailing tuffs of the region, due to greater effect of a regional metamorphism probably earlier than the advent of the gabbro. It differs from the tuffs in having a coarser interlocked matrix of quartz and feldspar, and in the manner in which the old feldspars are interlocked about their margins with the surrounding matrix by secondary enlargements.

N. H. W.

## NO. 1101. GRANITE.

From the north side of the same island, Kekequabic lake.

Ref. Annual Report, xv, pages 361, 362, 398.

Granite. Tuff. Esterellyte.]

*Meg.* Similar to the last, but greenish.

*Mic.* This rock, like the last, contains numerous old *feldspars* much twinned, with ragged edges, eaten into by a secondary micro-granulitic development of fresh *quartz* and *feldspars*. Some of the old *feldspars* are almost entirely replaced by this new generation. The *hornblende* is somewhat brown in pleochroism, parallel to  $n_m$ , and bluish parallel to  $n_e$ . The rock also has a few grains of *sphene* and scattered *magnetite*, and also *pyroxene* and *calcite*. One section.

*Age.* Archean (Keewatin).

N. H. W.

## NO. 1102. GRANITE.

West end of Animikie island in Kekequabic lake. S. W.  $\frac{1}{4}$  N. E.  $\frac{1}{4}$  sec. 3, T. 64-7 W.  
*Ref.* Annual Report, xv, pages 362, 398.

*Meg.* "Greenish syenite identical with No. 1101." No specimen found. No section.

*Age.* Archean (Keewatin).

U. S. G.

## NO. 1103. GRANITE.

Northwest corner of Animikie island in Kekequabic lake. S. W.  $\frac{1}{4}$  S. W.  $\frac{1}{4}$  sec. 3, T. 64-7 W.  
*Ref.* Annual Report, xv, pages 362, 398.

*Meg.* A reddish and a gray specimen, the former quite similar to Nos. 1101 and 1102. In one place a breccia is apparent, the gray holding fragments of the red. No section.

*Age.* Archean (Keewatin).

U. S. G.

NO. 1104. TUFF. (*Subgranitic.*)

East end of the largest or Animikie island, Kekequabic lake.  
*Ref.* Annual Report, xv, pages 362, 398.

*Meg.* Green and diabasic in aspect, rather fine grained.

*Mic.* This fine-grained rock contains numerous fragments of *feldspar*, most of them very small and apparently of secondary date, but some of them old; *hornblende* in subordinate amount, also in mesh-like arrangement, and *biotite*. The last occurs both in the fine interlocked groundmass and in the body of the larger grains of *feldspar*. The slide also contains patches of rock, which varies from the rock of the slide, by being finer grained, or free from *hornblende*, but micro-granulitic with *feldspar*. *Sphene* and *magnetite* as in No. 1101. One section.

*Age.* Archean (Keewatin).

N. H. W.

NO. 1105. ESTERELLYTE (*or Dacyte.*)

From the north side of the little island northeast of Animikie island, sec. 2, T. 64-7, Kekequabic lake.  
*Ref.* Annual Report, xv, pages 363, 398; Annual Report, xvi, page 104.

*Meg.* Apparently porphyritic, siliceous.

*Mic.* This rock consists very largely of secondary *quartz* in interlocking growths which surround the old *feldspars*, which are much twinned and also much altered. In this interlocking growth are also irregular, apparently fragmental masses of *augite* and a few of *sphene*, as well as a few spicules of green *hornblende*. The feldspars are strikingly zoned, and are intergrown, apparently along the easy cleavages, in the manner of a micropertthite, by another feldspar of later date, this later growth being somewhat interlocked about the margins in the secondary quartz. In this rock some of the small augite crystals are entirely included in the old feldspars. The same is true of some of the sphenes. One section.

*Age.* Archean (Keewatin).

N. H. W.

*Remark.* This rock is closely similar to No. 551G, which is a part of this same granite mass. No. 551G is from the south shore of Kekequabic lake in S. W.  $\frac{1}{4}$  S. W.  $\frac{1}{4}$  sec. 3, T. 64-7 W.

An analysis of the whole rock is as follows:

SiO <sub>2</sub>	66.84
Al <sub>2</sub> O <sub>3</sub>	18.22
Fe <sub>2</sub> O <sub>3</sub>	2.27
FeO	0.20
CaO	3.31
MgO	0.81
K <sub>2</sub> O	2.80
Na <sub>2</sub> O	5.14
P <sub>2</sub> O <sub>5</sub>	trace
H <sub>2</sub> O	0.46
Total	100.05

On separating the powder of a fresh specimen of the normal granite (No. 551G) by means of Thoulet's solution the larger proportion of the feldspar fell between a specific gravity of 2.58 and 2.62, which would indicate that the mineral was a mixture of the orthoclase and albite molecules; and the analysis, as here given, shows that it belongs to the anorthoclase series:

*Analysis of feldspar.*

SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	CaO	MgO	K <sub>2</sub> O	Na <sub>2</sub> O	H <sub>2</sub> O	Total
67.99	19.27	0.82	0.75	0.02	3.05	6.23	0.90	99.03

It is to be noticed that the silica percentage is larger than is required by the amount of soda, potash and lime present. This is probably due to the fact that a small amount of quartz was so intimately intergrown with the feldspar that certain grains of the feldspar powder contained some quartz. From the analysis it is calculated that this feldspar is an *anorthoclase* with approximately the composition Or<sub>5</sub> Ab<sub>14</sub> An<sub>1</sub>.

U. S. G.

No. 1106. SYENYTE. (*Augitic, Esterellyte.*)

From the same little island as the last, north side.

*Ref.* Annual Report, xv, pages 363, 398. Compare No. 574G.

*Meg.* Porphyritic, similar to the last.

syenite.]

*Mic.* Has a great abundance of *augite*, considerable *biotite*, *sphene*, and large *apatites*. In this slide, where the augites are numerous, not only are some of the small ones entirely enclosed in the old feldspars, but several of the larger augites are seen to break the feldspar boundaries in a poikilitic manner, and the biotite does the same, while the biotites are pierced by spicules of *actinolite*, and broken by the augite. One section.

*Age.* Archean (Keewatin).

N. H. W.

*Remark.* This rock represents the "poikilitic phase" of the granite as described by Grant in the Twenty-first Annual Report, page 50 (compare No. 574G). While the rocks Nos. 1105 and 1106 have certain characters that show them closely related petrographically, they are seen in the field to be one intrusive in the other, as thus described in the Twentieth Annual Report, page 74:

There is an island in the N. W.  $\frac{1}{4}$  N. W.  $\frac{1}{4}$  sec. 2, T. 64-7, which is made up mostly of the pyroxene granite (No. 573G); this varies somewhat in grain, but none was seen as fine as No. 571G; it is noticeably porphyritic with reddish feldspars. On the west side of the island near the north end is a rock with a green aphanitic groundmass in which are numerous glistening biotite scales (No. 574G). This rock is seen in contact with the granite; the contact line is sharp and distinct. The green rock is cut by many vein-like forms of a purple rock which is seen to be part of the granite, but they were not actually traced into the granite. No. 575G shows this rock in contact with the green rock. On a microscopic examination No. 575G is seen to be part of the granite. The two rocks were not apparently changed near the contact. Many angular and rounded fragments of the green rock are seen in the granite and a few fragments, or what appear to be such, of the latter are seen in the green rock. The evidence of this exposure points to the more recent age of the granite.

The rocks about Kekequabic lake can be divided petrographically into three groups, as follows: Group I, Nos. 1061, 1094, 1105, which are distinctly porphyritic with augite (and hornblende) and feldspar. These are at the narrows of the lake and on the little island northeast of Animikie island. There is reason to believe, contrary to the opinion of the writer when the field observations were made, that this is an igneous rock in its present structural relations, and that it originally existed in other regions adjacent. It is probably a phase of the granite represented by the first numbers of group II, below, both being intrusive in the green schists of Kekequabic lake, and into the crystalline conditions of that green schist.

The second group includes Nos. 1044, 1045, 1046, 1051, 1052, 1100, 1101, 1104, 1106. These are rather granitic in texture, and, judging from their geographic distribution, which is nearest the strike of the gabbro, as well as from their petrographic features, they may be referred to a recrystallization of older clastics more or less mingled with volcanic detritus, perhaps at the time of the gabbro revolution. These may again be separated into two sub-groups by excluding Nos. 1101, 1104 and 1106, which are green with much hornblende.

The third group is non-crystalline debris, or less crystalline than the last, and includes the following: Nos. 1047, 1048, 1049, 1050, 1055, 1057, 1058, 1059, 1060, 1093, 1098 and 1099.

The third group becomes more and more coarse and even conglomeratic toward the east, and cannot be distinguished petrographically from the Ogishke(?) conglomerate, as represented by the following numbers: 1062, 1063, 1064, 1065, 1066, 1080, 1095.

N. H. W.

## NO. 1107. FLINT.

West side of sec. 27, T. 65-7, on Knife lake, north from the portage landing from Kekequabic lake.  
*Ref.* Annual Report, xv, pages 381, 398.

*Meg.* Purplish to black, weathering light colored.

*Mic.* This is apparently a finer debris of the same kind as the tuffs about Kekequabic lake, but probably of older date. One section.

*Age.* Archean (Lower Keewatin).

N. H. W.

## NO. 1108. MICA SCHIST AND GRANITE.

Basswood lake, at the west end of the portage near the centre of sec. 6, T. 64-10 W.  
*Ref.* Annual Report, xv, pages 356, 398.

*Meg.* A fine-grained, dark, compact, biotite schist cut by a vein about an inch in width, of medium-grained, pinkish, muscovite granite. No section.

*Age.* Archean.

U. S. G.

## NO. 1109. QUARTZ-FELDSPAR SCHIST.

At the portage from Newton lake to Fall lake.  
*Ref.* Annual Report, xv, pages 356, 398; Annual Report, xvii, pages 198, 206.

*Meg.* "Sericitic" schist.

*Mic.* There is but little *sericite* in the slide, but there is a very finely granular background of secondary *quartz* and *feldspar*, in which are very sparsely distributed larger grains of *quartz*, *actinolite* and areas of *calcite*. One section.

*Age.* Archean (Keewatin).

N. H. W.

## NO. 1110. GRANITE.

From the island in White Iron lake, lying in sec. 33, T. 63-11, and sec. 5, T. 62-11.  
*Ref.* Annual Report, xv, pages 330, 398.

*Meg.* Quartzose granite, rather coarse.

*Mic.* A finely striated feldspar has an extinction on  $n_p$  of  $81^\circ$ , a feldspar between andesine oligoclase and *oligoclase*, some have no twinning, *orthoclase*, and some have the quadrillage of *microcline*. The ferromagnesian mineral is *hornblende*. There are a few grains of *sphene*. In some of the feldspars is much *zoisite* in rather coarse crystalline grains. One section.

*Age.* Archean granite.

N. H. W.

## NO. 1115. ACTINOLITE SCHIST.

Near the north end of White Iron lake.  
*Ref.* Annual Report, xv, pages 330, 398; Bulletin vi, page 8.

Granite. Schist.]

*Meg.* Schistose.*Mic.* The section consists almost wholly of a fine interlocking background of quartz, or quartz and *feldspar*, in which are many *actinolite* fibres arranged mainly in one direction, some *magnetite* with a very little *garnet*. One section.*Age.* Archean (Keewatin).*Remark.* The foregoing schists stand nearly vertical, forming a bluff at the outlet of the lake which rises about 100 feet, and has been explored for iron. N. H. W.

## NO. 1116. GRANITE.

East shore of White Iron lake at a distance from contact with the schists.  
*Ref.* Annual Report, xv, pages 330, 398.*Meg.* Granite.*Mic.* The feldspar (a fresh grain) cut perpendicular to  $n_p$  in the acute axial angle has extinction on a twinning striation at  $88^\circ$ , indicating *oligoclase*. Another section, having  $n_e$  in the acute angle of the optic axes has extinction on  $n_e$  of  $15^\circ$ , which falls between *albite* and *oligoclase-albite*. Some grains show the peculiar striation of *microcline*. There is also in the rock a series of older, much decayed feldspars which are frequently zoned. The *hornblende* of the rock is almost converted to *chlorite*. There is comparatively little *quartz*. One section.*Age.* Archean granite.

N. H. W.

## NO. 1117. GRANITE.

North end of White Iron lake, near junction with the schists.  
*Ref.* Annual Report, xv, pages 331, 399.*Meg.* Rather quartzose and fine grained.*Mic.* The rock has much secondary quartz and secondary feldspars, the latter both as zoning about an older feldspar and as separate small grains, which latter are in part of *microcline*. There is a scant sprinkling of *biotite*, a little rusted *garnet* and a few crystals of *apatite*. One section.*Age.* Archean granite.

N. H. W.

NO. 1118. GRANITE AND SCHIST. (*Contact.*)North end of White Iron lake; junction specimen.  
*Ref.* Annual Report, xv, pages 331, 399.*Meg.* Granite in immediate contact on the schists.*Mic.* In the granite part of the slide is very much *quartz* in its usual secondary form, with a slight tendency to micropegmatitic intergrowth in the *feldspar*, of which some of the larger grains are of *microcline*, in which the peculiar and characteristic quadrillage is seen frequently in only a portion of the section, as if it were due to some secondary cause. There is also a little *biotite* and apparently of *garnet*,

but it is remarkably free from the dark minerals. The schist side of the slide is marked by the presence of much *actinolite*, with secondary feldspar and quartz. There are also scattered grains of a highly polarizing monoclinic mineral, with frequent parallel extinction, colorless in common light, in prevailing sub-quadratic sections, which is more fully described under No. 1123, and is probably *epidote*. One section.

*Age.* Archean granite.

N. H. W.

No. 1123. SCHIST. (*Epidotic.*)

The same schist, more indurated, from a point lower down the cliff.

*Ref.* Annual Report, xv, pages 331, 399; Bulletin vi, page 8.

*Meg.* Actinolitic.

*Mic.* *Andesine-oligoclase* shows a section perpendicular to  $n_p$  in the broader bands, and has an extinction of  $72^\circ$ , and an angle between the macles of albite and of percline(?) in the same section of  $72^\circ 30'$ . This may be, however, due to a microperthitic growth, parallel to 001. The rock has some secondary *quartz* which embraces the other minerals and occasionally surrounds *cordierite*. There is a light green *actinolite* in considerable amount.

*Epidote* is rather abundant, shown by its high refraction and double refraction, and the position of the optic plane perpendicular to the easy cleavage in sections in the zone of symmetry. Many of the cross sections also have a parti-colored polarization, but a light yellow color in natural light. The mineral has a higher double refraction than actinolite, and also higher single refraction. It occurs in small scattered globular and angular grains which are fresh, evidently of secondary origin. This mineral serves a leading rôle in giving green color to the rock. It frequently shows its own crystal boundaries about a half or more of the individual grains, and it has numerous globular inclusions which give it a strong resemblance to the diopside in the metamorphic schists and gneiss of the long point in the northeastern part of Gabemichigama lake. One section.

*Age.* Archean (Keewatin).

*Remark.* If, as supposed when the specimens were gathered, this is a part of the prevalent green schists of the region, this greater crystallization is to be attributed to the action of the great granitic mass which is intrusive in the immediate vicinity.

N. H. W.

No. 1124. ACTINOLITE SCHIST.

Same place as the last.

*Ref.* Annual Report, xv, pages 331, 399; Bulletin vi, page 8.

*Meg.* Somewhat more schistose than No. 1123.

*Mic.* This is similar to No. 1123, but contains more *actinolite*, with apparently one or two grains of *sphene*, and considerable *biotite*. One section.

*Age.* Archean (Keewatin).

N. H. W.

Schist. Granite. Amphibolyte.]

NO. 1128. GREEN SCHIST. (*Regenerated.*)

East shore of White Iron lake, N. W.  $\frac{1}{4}$  S. E.  $\frac{1}{4}$  sec. 6, T. 62-11. Cut by intrusive granite.  
*Ref.* Annual Report, xv, pages 331, 399; Annual Report, xvii, pages 198, 208.

*Meg.* Coarse-grained, crystalline, fresh rock, of dark color.

*Mic.* The rock is wholly crystalline, in a secondary sense, appearing like a massive rock, and furnishes a fine instance of the effect of metamorphism on the green schists when carried to the extreme. It consists of *hornblende*, *biotite*, *microcline* and a triclinic finely twinned feldspar which is probably *oligoclase*, and the same yellow mineral as mentioned in No. 1123, *i. e.*, *epidote*. Scattered throughout the slide, and sometimes clustered, are also numerous globular grains of some pyroxene, perhaps *diopside*. These minerals, excepting the epidote and pyroxene, are interlocked in a truly massive or granitic manner. The diopside(?) is more isolated, yet is sometimes developed into larger crystals. The fresh feldspars are so glassy that they appear like quartz, but so far as tested they all give a biaxial figure in convergent light. The biotite and hornblende are also conspicuously ingrown in a micropegmatitic manner, and in other places the hornblende embraces the biotite poikilitically. One section.

*Age.* Archean (Keewatin recrystallized).

*Remark.* It seems impossible to give a current name to this rock. It perhaps could be called amphibolyte, but is too nearly a massive rock, and it has too much of other minerals for that. Still, it has the same origin as many amphibolytes. It might be designated a biotite-hornblende-pyroxene-plagioclase gneiss, but such would hardly be a name. It is rather a description; and, further, the rock is not distinctly gneissic. Perhaps the term tonalyte is appropriate, or mica-dioryte.

N. H. W.

## NO. 1129. GRANITE.

Same place as No. 1128, and cutting No. 1128.  
*Ref.* Annual Report, xv, pages 331, 399; Annual Report, xvii, pages 198, 208.

*Meg.* Granitic.

*Mic.* Quartz, *microcline*, *oligoclase*, *hornblende* make the bulk of this rock, but there are scattering grains of *sphene*, the last being included in the hornblendes and in the feldspars. Many of the large feldspars are much altered at their centres with interpositions of *muscovite* and of *kaolin*(?) and some are wholly changed. In others there is a micro-intergrowth of another feldspar in the manner of *microperthite*. One section.

*Age.* Archean granite.

N. H. W.

## NO. 1132. AMPHIBOLYTE.

South of the meander line between secs. 6 and 7, T. 62-11, White Iron lake.  
*Ref.* Annual Report, xv, pages 331, 399; Annual Report, xvii, pages 198, 208.

*Meg.* Hornblendic and gneissic.

*Mic.* This rock, microscopically, is like No. 1128. It is wholly crystalline and granitic in structure. *Hornblende* constitutes somewhat more than one-half of the mass. One section.

*Age.* Archean (changed Keewatin).

N. H. W.

NO. 1133. MICRO-GRANITE. (*Aplyte.*)

Meander line between secs. 6 and 7, T. 62-11, White Iron lake.

*Ref.* Annual Report, xv, pages 331, 399.

*Meg.* Fine grained, granitic. From dikes cutting granite.

*Mic.* *Quartz, microcline, oligoclase* in rather fine, interlocking allotriomorphic grains make up the bulk of this rock, but there is also a little *hornblende, sphene* and *epidote*. One section.

*Age.* Archean.

N. H. W.

NO. 1134. AMPHIBOLYTE. (*Micaceous.*)

Lake shore in sec. 12, T. 62-12, White Iron lake.

*Ref.* Annual Report, xv, pages 331, 338, 399; Annual Report, xvii, pages 198, 207.

*Meg.* Granitic, dark colored, cut by veins of granite.

*Mic.* *Hornblende* is the most conspicuous element, but shares the rock liberally with *biotite*. These constitute perhaps one-half of the rock, the rest being mainly of *feldspar*, but yet with a little *quartz* and a few scattered *sphenes*. One section.

*Age.* Archean (changed Keewatin).

*Remark.* This rock is petrographically like Nos. 1128 and 1132, and probably has the same origin.

N. H. W.

NO. 1135. AMPHIBOLYTE. (*Changed Keewatin.*)

From small dikes cutting the granite vein above mentioned.

*Ref.* Annual Report, xv, pages 331, 399.

*Meg.* Dark, hornblendic.

*Mic.* Similar to the last, but has no *biotite* and less *hornblende*, with evident *epidote*. One section.

*Age.* Archean (changed Keewatin).

N. H. W.

NO. 1136. GABBRO.

From a point about half a mile west of the line between sec. 31, T. 62-11, and sec. 6, T. 61-11, in town 61, Birch lake.

*Ref.* Annual Report, xv, pages 332, 399.

*Meg.* Gray, granitic in structure, with much *feldspar*.

*Mic.* *Feldspar* has extinction angle of  $62^\circ$  on  $n_p$ , and is hence *labradorite*. The *augite* is sometimes crowded with interlamellar inclusions. The *magnetite* is not unfrequently bordered by *biotite*. The *diallagic augite* was about cotemporary with

Gabbro. Diabase.]

some of the labradorites, cutting their borders, but being cut by others. *Olivine* is quite plentiful. One section.

*Age.* Cabotian.

N. H. W.

## NO. 1137. GABBRO.

From a point a short distance west of the meander stakes between secs. 24 and 25, T. 61-12, Birch lake.  
*Ref.* Annual Report, xv, pages 332, 399; Annual Report, xvii, pages 198, 207.

*Meg.* Fine-grained gabbro.

*Mic.* The *augite* is *diallagic*, and is also sometimes crowded with coarser inter-lamellar impurities, which, as in the last, do not coincide with the direction of the diallagic structure. *Olivine* is quite abundant. It was cotemporary with, or later than, either feldspar or augite. *Magnetite* is accompanied by *biotite*. The olivine is sometimes changed peripherally to *bowlingite*(?) and in the immediate vicinity is developed a finely radiated, rather highly doubly refracting lamello-fibrous mineral, which, with positive elongation, colorlessness in common light, seems to be a form of *tremolite*, but this is closely mingled with a light greenish fibrous mineral which has about the same structure, arranged frequently along the borders of the *tremolite* areas as if intimately related to the *tremolite*, and sometimes they intertwine or mingle. This is pleochroic and is evidently the remains of a green hornblende (*actinolite*) from which the other is derived. One section.

*Age.* Cabotian.

N. H. W.

[NOTE. Nos. 1141 to 1263, inclusive, were collected outside the state of Minnesota and are not here described, excepting Nos. 1173, 1200 and 1203, which are described below. The field relations and preliminary designations of Nos. 1141 to 1263 are given in the Sixteenth Annual Report, pages 13-60, 114-119.]

## NO. 1173. DIABASE.

Thessalon point, Canada. Original Huronian area.  
*Ref.* Annual Report, xvi, page 18.

*Meg.* Schistose and slaty diabasic rock. Logan's "green chlorite slate."

*Mic.* The rock is composed of microlitic *feldspars*, lying in a matrix of alteration products, chief among which is *actinolite*, but in which also is *leucoxene*, *zoisite* and apparently *epidote*. One section.

*Age.* Keweenawan(?)

*Remark.* This is a part of the great greenstone or diabase seen a few miles further north and west, which is there later in date than the great basal quartzite on which it lies, the quartzite being considered of the age of the Potsdam at Potsdam, New York.

N. H. W.

## No. 1200. GABBRO.

Near Otter Tail P. O. (original Huronian region), Canada.  
*Ref.* Annual Report, xvi, page 29.

*Meg.* Gray, medium grained, indefinite.

*Mic.* The rock has been much broken by dynamic movements, and the alteration of all the minerals is considerable. Particularly has *zoisite* been developed, indicated by its high refractive index, its parallel extinction and its blue color between the nicols. Much *pyroxene* is evident, but no olivine, while the feldspar is unidentifiable. There are small blades that appear to be of *actinolite*. One poor section.

*Age.* Cabotian.

N. H. W.

## No. 1203. GABBRO.

About N. E.  $\frac{1}{4}$  sec. 23, Plummer (original Huronian area), Canada.  
*Ref.* Annual Report, xvi, page 29.

*Meg.* Similar to No. 1200.

*Mic.* Less broken than No. 1200. There is in this rock much *magnetite*, some *sphene*, *hornblende*, *chlorite* and spicular *apatite*. The green areas which seem to be determined in outline by some earlier generation of a mineral now wholly changed, show probably old *olivines*, and others *augite*. One (thick) section.

*Age.* Cabotian.

N. H. W.

## No. 1264. BASALT.

Rove Lake road, north of Grand Marais, near the south foot of Pine mountain.  
*Ref.* Annual Report, xvi, pages 61, 119.

*Mic.* The rock is porphyritic with fine *feldspars* that lie numerous in an ophitic relation in the *augite*. There is developed considerable fine *actinolite*. The *augite* is fresh, while the *feldspars* are much rotted. In crystallizing, the *augites* apparently enclosed much of the magma glass in places, and this is now marked by the sprinkling of *magnetite* grains in the *augite* crystals, but in other cases much of the zirkelyte of the rock resulted simply from the condensation of the magma without crystallization, and such portions are now thickly sprinkled with fine *magnetite* particles. Between the nicols the rock in general is also much darkened, apparently by the prevalence of fine *zoisite* particles with their high refractive index, and by the generation of *chloritic* substance. Two sections.

*Age.* Keweenawan.

*Remark.* There seems to have been a long time (or a short period of great activity) between the formation of the *feldspars* and the final consolidation of the rock, the latter being but shortly after or contemporary with the formation of the *augites*. During this intervening period not only were the *olivines* wholly lost by resorption, but the *feldspars* were much affected by the introduction of many microlitic impurities.

N. H. W.

NO. 1265. GRANITE. (*Red.*)

Brulé mountains, north from Pine mountain.

*Ref.* Annual Report, xv, pages 62, 119.

*Meg.* "Red rock."

*Mic.* Consists chiefly of reddened feldspars, dimmed by much impurity and by general decay. Some can be seen, however, to be twinned on the albite plan. In some small angular spaces *quartz* is generated. There is a little *magnetite*, some *hornblende* and apparently *pyroxene*, and some red crystals of *hematite*(?) Two sections.

*Age.* Cabotian.

*Remark.* It is evident, in one slide, that the extinction in the quartz grains governs that in the surrounding feldspars, which are permeated by it, and which give place to it sometimes in the manner of a micro-pegmatyte.

N. H. W.

## NO. 1265A. PORPHYRYTE(?)

On the Grand Marais and Rove Lake wagon road; probably near the crossing of the North Brulé river, which is in the N. W.  $\frac{1}{4}$  sec. 32, T. 64-1 E. From a boulder.

*Ref.* Annual Report, xvi, page 63.

*Meg.* The rock has a very fine-grained, brownish-gray groundmass, in which are numerous large, tabular, red, porphyritic crystals of feldspar, some of which are an inch across. There are also areas, apparently amygdaloidal, which are filled with a yellow mineral, probably epidote; also similar areas filled with a soft, dark-green mineral, probably chlorite. No section.

*Age.* Cabotian.

U. S. G.

NO. 1269. GABBRO. (*Weathered.*)

North side of sec. 19, T. 64-1 E.

*Ref.* Annual Report, xvi, pages 64, 66, 119.

*Meg.* Dark, coarse grained.

*Mic.* The ophitic structure is still evident, although the *augite* is now transformed largely into a dull-gray substance which in the centres and other parts of the augite masses extinguishes in alternation with the rest. The rock contains, along with the evident plagioclases, considerable amounts of *magnetite*, of *apatite* and of a dull yellowish chloritic substance, the result of alteration, probably of *olivine* and of the augite. One section.

*Age.* Cabotian.

N. H. W.

## NO. 1273. DIABASE.

Just west of the rapids going out of North lake.

*Ref.* Annual Report, xvi, pages 65, 119.

*Meg.* Dense, trap-like rock.

*Mic.* Ophitic, and finely holocrystalline, with secondary *calcite*. The rock contains a few spots, occupied by a greenish-yellow felted substance, which are not areas of magma glass, but amygdules or pseudamygdules filled subsequent to the consolidation. The *augite* is in rather fine particles, but sometimes is cut by the *feldspars* which are wholly microlitic. One section.

*Age.* One of the Logan sills of the Animikie.

N. H. W.

NO. 1275. GABBRO.

A mile west of the entrance of the river to Gunflint lake, north shore.  
*Ref.* Annual Report, xvi, pages 65, 66, 119.

*Meg.* Rather medium-grained gabbro.

*Mic.* The striking feature in this rock is that the formation of the *feldspars* preceded that of the *olivine*, there being an ophitic relation between them like that characteristic of augite and feldspar in diabase. The feldspar is *labradorite-bytownite* as shown by extinction of  $28^\circ$  on a section exactly perpendicular to  $n_g$  as the acute bisectrix. The *augite*, which is purplish, is also ophitic toward the feldspars. While this is the general rule, there are still instances in which all three of these minerals appear to have formed nearly cotemporaneously, since these relations are reversed, and augite and olivine crowd upon the boundaries of the labradorite-bytownite. One section.

*Age.* Cabotian.

*Remark.* It is but rare that this ophitic relation between the olivine and the feldspars in the gabbro is met with. Compare Nos. 757 and 1842, where it is also mentioned.

N. H. W.

NO. 1276. TACONYTE.

North shore of Gunflint lake.  
*Ref.* Annual Report, xvi, pages 66, 119.

*Meg.* Immediately overlain by gabbro (No. 1275).

*Mic.* The green glauconitic grains are rounded and at their centres are crystallized into minute *actinolites*, which also is somewhat distributed elsewhere. These green bodies lie in the midst of interlocking fresh secondary grains of *quartz*, which also permeates the green masses in still finer granules. Sometimes a little *magnetite* in fine powder is scattered through the green substance, but generally not. So far as can be determined the green substance is perfectly amorphous. One section.

*Age.* Animikie.

N. H. W.

NO. 1277. FLINT.

North shore of Gunflint lake (Canada).  
*Ref.* Annual Report, xvi, pages 66, 119; Annual Report, xviii, pages 34, 62; Bulletin vi, pages 114, 123, 422.

Flint. Feldspar schist.]

*Meg.* "Composed of pieces and granules of a dark-gray, aphanitic rock, varying in size from that of a pinhead to peas or larger, closely compacted together; \* \* \* the general aspect being that of a dark, basic, dense diabase, specked with minute white spots."

*Mic.* Consists essentially of excessively fine, interlocking grains of *quartz*, as in the last, with a slightly schistose distribution of a scant, dirty, green substance, which gives opacity to the rock, as well as a slightly gray color. Occasionally this green substance shows a sprinkling of *actinolite* fibres, and in other places it is stained by *hematite*. One section.

*Age.* Animikie.

*Remark.* Another section shows a non-schistose, even distribution of the finely globular green substance, with areas of *calcite*. This rock is apparently produced by a finer association of the elements found in No. 1276.

N. H. W.

## No. 1278. FELDSPAR SCHIST.

Mouth of the creek, east end of the long bay, north side of Gunfint lake (Canada).

*Ref.* Annual Report, xvi, pages 67, 119; Annual Report, xvii, pages 199, 202.

*Meg.* Schist, light green, fine grained, with pyrite.

*Mic.* The rock consists essentially of very fine angular grains of feldspar, lying in an abundant mesh of the well-known translucent, but nearly isotropic, chloritic substance, which results from alteration of ferro-magnesian minerals, whether in the massive rocks or in their detritus. This mesh has a prevalent elongation and structure in one direction. It has a few fibres that polarize distinctly, which may be of *actinolite* or *muscovite*, and much *calcite*, the latter being not infrequently aggregated in masses of considerable (microscopic) size.

The feldspar grains are in two conditions—whether two species it is impossible from this slide to determine. One sort is clear and fresh, though not glassy, giving the low gray colors of the first order in a section of the normal thinness, without visible impurities. The other sort is so crowded with minute grains and crystalliths that they are nearly as dark between the rotating nicols as the chloritic mesh. It is possible to explain this difference by assuming that the clouded feldspars are original fragmental grains lying still in the detritus in which they were deposited, and that the fresh feldspars are of secondary growth *in situ* under the action of metamorphic forces. As to shapes and sizes, these grains do not differ notably, and they are both slightly elongated, prevailing with the schistosity. They all have a shadowy extinction, and this is noticeable in the fresh grains, because in the clouded grains the indefiniteness of extinction prevents observation on this point. As to relations of orientation, they do not seem to have any dependence, one on the other, as might be expected if the fresh grains were secondary developments in the vicinity of older

grains. They are usually not in contact, but occasionally they are. It is to be inferred, hence, that if the fresh grains are of later date they are of a different species from the clouded grains. The fresh grains are themselves frequently in contact, but their orientations are different.

There is no quartz, but there are a few fine, black, opaque particles which are indeterminable, but which are not magnetite. One section.

*Age.* Archean (Keewatin).

*Remark.* This schist may consist of one feldspar and a lot of micro-granulated debris. This debris may have been originally largely feldspathic, or it may have been a volcanic glass.

N. H. W.

NO. 1279. QUARTZ-PORPHYRY. (*Sheared debris.*)

Associated with No. 1278. Compare No. 311.

*Ref.* Annual Report, xvi, pages 67, 119.

*Meg.* Coarser grained, sub-porphyrific, with pinkish feldspars.

*Mic.* In a fine, granular matrix of fresh feldspar and of quartz, lie many large crystals of *feldspar* and grains of *quartz*. This matrix is more angular than in the last, and, while belts of chloritic matter (*pennine*) cross it, yet the grains are not uniformly elongated. The quartzes have occasionally a hooked or serrated border and the hooks and teeth extinguish with the grain, but the common orientation does not extend beyond the ends of the hooks. Occasionally, but not commonly, these quartzes are broken, the parts still lying adjacent, with slightly differing orientations, and sometimes many small fragments are strung off one side of the principal mass. These large quartzes are not of vein formation, but have come from a quartz-porphyry, if not now in their native places, for they occasionally show the marginal embayments peculiar to such quartz. The feldspars are much twinned and much altered, being charged with micaceous scales, *calcite*, *epidote*, and with kaolinic impurities. They occasionally are also broken and deranged in orientation in a manner similar to that of the quartzes. They are also occasionally bordered by narrow rims of secondary growths, which are not clouded by the impurities seen in the body of the crystal. Extinction on  $n_p$  indicates *oligoclase* for the body of the crystal,\* and there is no observable difference in extinction between it and that of the rims.

In the slide are several phenocrysts of *apatite* and spots that appear to be *leucoxene*. A considerable amount of the coloring matter, scant as it is, is of *biotite*, and a few small *sphenes* are scattered in the fine matrix. There is one grain in the slide which appears to have the form of a basal section of *augite*, and a portion of the grain polarizes like *augite*, the rest of the area being dark. One section.

\*The actual extinction angle read on an albite twinning line on  $n_p$  is  $4^\circ$ , but as Fouqué does not give so small an angle on  $n_p$  in any feldspar, this is taken to be the supplement of the true angle given by him, which would therefore be  $86^\circ$ .

Basalt. Graywacke. Quartz-porphyrty.]

*Age.* Archean (Keewatin).

*Remark.* This rock has a petrographic relationship with the porphyritic rock at Kekequabic lake (Nos. 1061, 1094 and 1106), except that the augite, if it ever existed in considerable quantity, has been destroyed by the exigencies through which the rock has passed; and in that respect the relation seems to be nearer some of the conglomeratic debris less metamorphosed, seen east from Kekequabic lake. N. H. W.

## NO. 1280. BASALT.

North shore of Gunflint lake, interstratified with the schists (Canada).

*Ref.* Annual Report, xvi, pages 67, 119.*Meg.* Having the appearance of a massive greenstone.

*Mic.* In an originally glassy matrix lie microlitic *feldspars* and spicules of *magnetite* of about cotemporary generation, the feldspars being generally a little earlier, but occasionally cut by the magnetites. The zirkelyte is now devitrified. It is filled with granular magnetite and pleochroic *biotite* and apparently globular *augite*. One section.

*Age.* Archean (Keewatin).

N. H. W.

## NO. 1281. GRAYWACKE (?)

North shore of Gunflint lake (Canada).

*Ref.* Annual Report, xvi, pages 67, 69, 120.*Meg.* Gray, compact, weathering reddish, with sedimentary bands.

*Mic.* This is a rock similar to the fine-grained matrix of No. 1279, but finer and less easily analyzed. There are fine mica scales everywhere in the rock, and these scales are also gathered abundantly in spots, giving a spotted aspect to the slide between crossed nicols. In some of the larger scales a pleochroism is visible. Hence the mica is probably *biotite*. Some particles of *sphene* and groups of dark *leucoxene* are identifiable. But the greater portion of the rock consists of fine angular feldspars, which are fresh, and equally fine quartzes. One section.

*Age.* Archean (Keewatin).

N. H. W.

NO. 1282. GRAYWACKE. (*Sheared.*)

North side of Gunflint lake (Canada).

*Ref.* Annual Report, xvi, pages 68, 120; Annual Report, xvii, pages 199, 202.*Meg.* Gray, gneissoid, slightly porphyritic.

*Mic.* Like the last, excepting the presence of gneissoid structure and much *calcite*, with some *quartz*. One section.

*Age.* Archean (Keewatin).

N. H. W.

NO. 1283. QUARTZ-PORPHYRY. (*Schistose debris.*)

Bluff, north shore of Gunflint lake (Canada).

*Ref.* Annual Report, xvi, pages 68, 120; Annual Report, xvii, pages 199, 202.

*Meg.* Porphyritic aspect, with a little pyrite. Compare No. 311.

*Mic.* This rock is quite like No. 1279, but coarser, and the full description need not be repeated. The slide, however, shows no large quartzes, and the mica scales are more abundant. One section.

*Age.* Archean (Keewatin).

*Remark.* On the weathered surface the white porphyritic feldspars stand out prominently and are larger and more numerous than the quartzes. N. H. W.

NO. 1284. SLATE. (*Micaceous.*)

Interbedded with No. 1283; north shore of Gunflint lake (Canada).

*Ref.* Annual Report, xvi, pages 68, 120.

*Meg.* Fine, grayish, slaty.

*Mic.* Mica scales are distributed parallel with the slatiness. Hence the slide darkens noticeably four times in one revolution, like a zeolitic mineral. It contains, however, *calcite* and angular grains of *feldspar*, which do not usually darken parallel with the threads and the slatiness. N. H. W.

NO. 1285. ARGILLYTE.

Interbedded with No. 1283.

*Ref.* Annual Report, xvi, pages 68, 120.

*Meg.* No specimen found. No section.

*Age.* Archean (Keewatin). U. S. G.

NO. 1286. GRAYWACKE. (*Sheared.*)

Same rock as No. 1282 (Canada).

*Ref.* Annual Report, xvi, page 120.

*Meg.* Evident quartzes are visible in this rock, which is schistose.

*Mic.* While this is much like No. 1283, it differs from it in having much more general decay and less evidently a gneissic structure. Quartz is quite abundant in rounded and sub-angular grains. One section.

*Age.* Archean (Keewatin).

*Remark.* This is quite evidently a clastic rock, and its relations with No. 1283, as described in the field, so closely ally it with that rock that it is reasonable to call attention to the petrographic alliance of Nos. 1279 and 1283 with the pebbly and "porphyritic" portion of the Ogishke conglomerate seen intermediate between Ogishke, Muncie and Kekequabic lakes, in which the "porphyritic" feldspars are evidently derived as detritus from some earlier quartz-porphry.

NO. 1287. MUSCOVADYTE.

Mayhew iron location, Mayhew lake. Compare Nos. 694-700.

*Ref.* Annual Report, xvi, pages 78, 120.

*Meg.* The gray rock "on which the gabbro lies unconformably."

Muscovadyte. Gabbro. Siderite.]

*Mic.* *Feldspar* and *diallage* practically compose this rock, rather evenly and finely granular, and cotemporary in origin. It is but rarely that can be seen a feldspar encroaching on the boundary of a diallage. Yet occasionally a very small round feldspar is wholly embraced in a diallage, and, *vice versa*, small diallages are in the feldspars. The diallage shows an interesting instance of basal twinning. Several lamellæ are visible crossing the grain. Generally the diallagic lamination parallel to 100 and this twinning are visible only in separate grains, giving, on first view, the impression of separate and distinct minerals, but on careful search it can be seen occasionally that they both occur in the same grain. They stand nearly at right angles to each other. The lamellation parallel to 100 is also affected by the interposition of some polarizing mineral, which renders the separation planes quite light when the lamellæ themselves are dark.

The last mineral to form was *magnetite*, which is scattered in round small grains sparsely, and in one instance in form of a large mass, which embraces small grains both of feldspar and of the pyroxene. One section.

*Age.* Cabotian (modified Keewatin).

*Remark.* This is evidently petrographically a portion of the gabbro, but has a bedding and dip resembling that of sedimentation. The reader may compare the chapter on structural geology for a discussion of the origin of the gabbro and of muscovadyte.

N. H. W.

NO. 1288. GABBRO. (*Iron-bearing.*)

Near the same place as the last, but further west; Mayhew lake.

*Ref.* Annual Report, xvi, page 120.

*Meg.* Dark and heavy with iron ore.

*Mic.* *Olivine*, *magnetite*, *plagioclase* essentially compose this rock. But there is frequently a rim of *brown hornblende* between the magnetite and the plagioclase. There seems to have been a powerful corrosion of the olivines and plagioclases, leaving only remnants of their former sizes, sharp and angular, crescent shaped or excavated in curvilinear contours, and the spaces filled by later *magnetite*. One section.

*Remark.* This is another instance of the later date of the iron ore in the gabbro rocks of the state. This subject is mentioned in connection with the description of the rocks at Duluth (No. 1, etc.).

N. H. W.

NO. 1289. SIDERITE (*in glassy matrix*).

Boulder of the gray rock belonging near the bottom of the Animikie.

*Ref.* Annual Report, xvi, page 120.

*Meg.* Gray, massive, finely crystalline, coated on weathered surfaces with a film of limonite, on the fractured surfaces with glistening cleavages.

*Mic.* The rock consists almost entirely of highly doubly refracting grains, which are seldom so crowded that they do not show a tendency to idiomorphic rhombic outlines, and which, in form and cleavage, as well as in comparative refractive index, are

to be considered nearer *siderite* than calcite; and taken in connection with the rusty film that coats all weathered surfaces, there is no escape from calling them siderite. In all parts of the slide, and more abundantly in some than in others, the substance in which these rhombs lie is seen to be isotropic, though transparent, resembling *glass*. In high power of magnification and with strong light, there appear between crossed nicols dim, minute crystalliths whose forms cannot be made out any further than to determine that usually they show some elongation. They do not polarize in colors, but show only the lowest grays of the first order. One section.

*Age.* Bottom layers of the Animikie.

N. H. W.

NO. 1292. GABBRO. (*Iron-bearing.*)

Same as No. 1288.

*Meg.* With olivine.

*Mic.* *Brown hornblende* in considerable quantity separates the *magnetite* from the other minerals, whether *olivine* or *plagioclase*, and is sometimes surrounded by the magnetite. A little *augite* is in the slide. One section.

*Age.* Cabotian.

N. H. W.

NO. 1293. DIORYTE(?)

North shore of Iron lake. From a boulder.

*Ref.* Annual Report, xvi, pages 78, 120.

*Meg.* A dark crystalline rock composed mainly of hornblende and feldspar, with some biotite. The following description is from the Sixteenth Annual Report, page 78:

"Rock No. 1293 is from a boulder, north shore of Iron lake. The interesting feature in this boulder, which was rounded, and evidently far transported by drift agents, is that *it is made up of boulders*. Originally the mass measured three feet by two and one-half feet by four feet, and by the action of fire large slabs have been made to drop off. Otherwise no samples could have been obtained with any means which we could control. This is not only made up of boulders, but it is from the mica-hornblende schist or Vermilion group [Coutchiching], and shows that conglomerates there have been converted into crystalline rock. The small boulders are of greenstone, mica schist and changed greenstone. The matrix is granulyte or granite." No section.

*Age.* Archean.

U. S. G.

NO. 1294. TACONYTE.

On the town line (if extended into Canada) between T. 65-1 and T. 65-2 W., about half a mile from Gunflint lake.

*Ref.* Annual Report, xvi, pages 69, 120.

*Meg.* Appearing like a conglomerate, or breccia, ferruginous and somewhat crumbling.

*Mic.* The section consists of interlocking *quartz* grains of secondary origin, serving as matrix for rather large, pebbly and concretionary grains, which are stained