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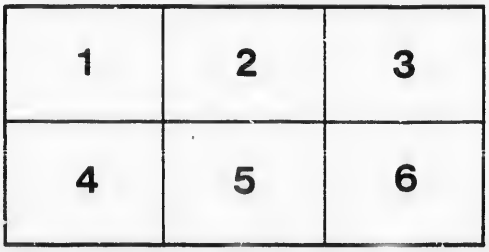

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MINERALS OF NEW BRUNSWICK.

WITH DESCRIPTIONS, AND SIMPLE TESTS FOR DETERMINING THE SPECIES.

BY G. F. MATTHEW, M. A.

INTRODUCTION.

As we look around us on the objects of nature we soon learn to distinguish three classes—the *animals*, the *plants*, and the *rocks, earth* and *water* which compose the visible substance of the earth. These three classes of objects constitute the three Kingdoms of Nature.

If we take an object belonging to one of these classes, as for instance, a stone, and compare it with other stones, we soon notice that all stones are not alike; there will be differences of color, of hardness, of size, &c., in the particles of which the several stones are composed. Perhaps the stone we are examining will be found to consist of grains of three different kinds; one of which, of a dark color, has shining or pearly surfaces; another kind is flesh-colored or white, with bright reflections from cert in sides of the grains; and the third kind seems like grains of dirty grey glass: on inquiry we ascertain that this stone is called *granite*. Armed with the foregoing observations on its character, we arrive at the conclusion that granite is not a simple mineral substance, but an aggregate of three different kinds, each of which has unvarying characters peculiar to itself. It is the province of mineralogy to describe the appearance and properties of the different simple mineral substances, of which granite and other rocks are composed, so as to make their determination easy and certain. Each of the substances of which this science treats, having properties peculiar to itself, and, within certain limits unvarying, is called a species; and it is to give an elementary knowledge of such of these species as are found in New Brunswick, that the following pages are prepared.

The plan followed in the arrangement of the following list of species is Prof. J. D. Dana's adaptation of the systems of Berzelius and Rose. Thus the elements occurring uncombined and the more simple mineral species are described first, and then those of a more complex composition. A description of its more prominent characteristics follows the name of each species, and simple tests are given, by the use of which it is believed that most of the minerals met with in New Brunswick can be determined. The characters of the species are arranged in the following order:—

1. The *Crystalline form*. Each mineral species has a fundamental type of crystal to which all its varying forms (in some cases quite numerous) can be referred. These types are six in number.

I. *Monometric*, including the *cube* (1), and derivative forms such as the *regular octohedron* (2), and the *rhombic dodecahedron* (3).

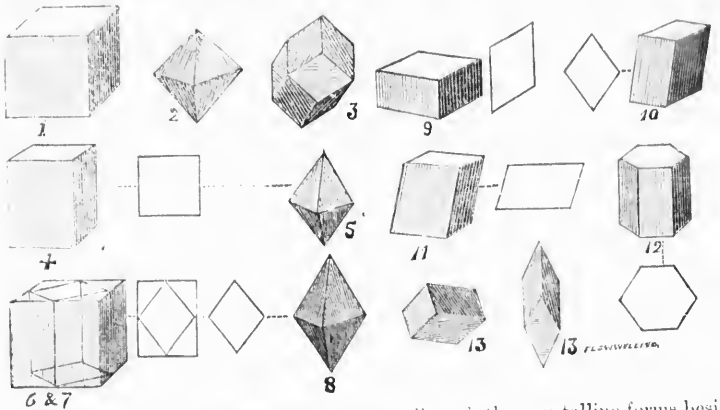
II. *Dimetric*, such crystals as have the *right square* prism (4), or the *square octohedron* (5), for their primary form.

III. *Trimetric*, such as are derived from the *right rectangular* (6), and the *right rhombic* prisms (7), or the *rhombic octohedron* (8).

IV. *Monoclinic* forms derived from the *right rhomboidal* (9), and *oblique rhombic* prisms (10).

V. *Triclinic* includes crystals which have the *oblique rhomboidal* (11) prism for their primary form.

VI. *Rhombohedral* includes the *hexagonal* prism (12) and the *rhombohedron* (13).



The skeleton figures represent the basal outline of the crystalline forms besides which they are placed.

One or other of these six different types is indicated by its Roman numeral after the name of each species in the Descriptive Catalogue.

2. The *hardness*. This property is indicated by the letter "H" following the numeral which stands for the crystalline form, and the degree of hardness is marked by the number following "H." The standards of hardness to which the numbers following "H" refer, are:- 1 Tale, 2 Gypsum, 3 Calcite, 4 Fluor Spar, 5 Apatite, 6 Feldspar, 7 Quartz, 8 Topaz, 9 Sapphire, 10 Diamond. Hardness is determined by drawing a file alternately two or three times across the mineral being examined, and across the standards of hardness, and thus deciding to which of these it comes nearest. The standards above Quartz, (7) are seldom required in testing the more common minerals.

As the minerals of the Standard scale of hardness are not always to be had, Chapman's scale of hardness which corresponds in the numbers to the standard scale is given:—

1 Yields easily to the nail.
2 Does not yield to the nail. Does not scratch a copper coin (cent).
3 Scratches a copper coin, but is also scratched by one.
4 Not scratched by a copper coin. Does not scratch glass.
5 Scratches glass feebly. Yields easily to the knife.
6 Scratches glass easily. Yields with difficulty to the knife.
7 Does not yield to the knife. Yields with difficulty to the edge of a file.
8, 9, 10, Harder than flint or rock crystal (No. 7).

3. *Specific gravity*. Indicated under each species by a "G," with numbers following. The specific gravity of a mineral is its weight compared with water which is assumed to be 1. The "gravity" is obtained by weighing the mineral in air and

then in water, and dividing the weight in air by the difference between the weight in water and that in air.

Synonyms and chemical composition of each species is given on the line beneath that on which the above characters are indicated; and then

4. *Other physical properties.* As Lustre, Color, Streak, Refraction, Phosphorescence, Magnetism, &c. "Streak" is the color of a mineral where it is scratched. Phosphorescence is observed in the dark in certain minerals when they are placed on a red-hot iron. Magnetism is observable in some compounds of iron, and the assays of others when calcined. To test this quality a small magnet is required.

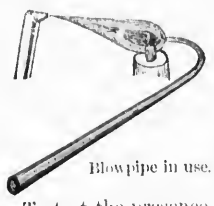
Cleavage is the property which many minerals have of splitting in certain directions. The planes along which they split are called cleavage planes.

Sectile.—A mineral is sectile when it may be cut by a knife without crumbling.

Weathering is the change which takes place by the decomposition of the surface of a rock or mineral from long exposure to the atmosphere and rains.

Malleable.—A mineral is so described when it may be beaten out with a hammer without breaking.

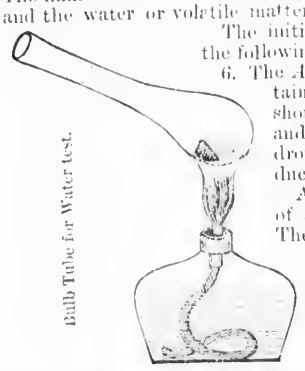
5. *Behaviour before the Blowpipe.* This is one of the most valuable tests and involves the use of certain accessories. Besides the blowpipe itself, which may be of very simple construction, an oil or spirit lamp (not paraffine), charcoal and platinum forceps are required. And a few inches of fine platinum wire is desirable for testing with fluxes, such as borax and soda (carbonate). The end of the wire should be formed into a small ring or loop which is to be filled with the broken or powdered flux, and this melted to a clear bead before the blowpipe. When the mineral is powdered the heated borax-bead will if applied to the powder, pick up as much of it as may be required. Two other fluxes may occasionally be required—salt of phosphorus, for trying chlorids and fluorids, and silica to use with soda in testing sulphates.



Blowpipe in use.

The cone of flame produced by the blowpipe in blowing through the flame of a lamp or candle consists of two parts, the inner cone or *reducing* flame of a blue color, and the outer or oxydating flame of a yellow color. The hottest part of the cone is just at the tip of the blue flame.

To test the presence of water or volatile matter, the mineral should be heated in a glass tube or vial about three or four inches long and as large as a goose quill. The flame should be directed against the outside of the tube beneath the assay, and the water or volatile matter will condense in the upper part of the tube.



Bulb Tube for Water test.

The initials "B B." used in the description of species in the following list signifies "Before the Blowpipe":—

6. The *Action of Acids.* Acids are used to distinguish certain minerals, as *carbonates.* The acid for testing should be diluted with an equal quantity of water, and the mineral should be coarsely powdered and dropped into it, when bubbles of gas will arise, producing an effect called *effervescence.*

Another effect of the action of acids is the formation of a *jelly.* In this experiment *strong* acid is used. The powdered mineral is dropped into a small quantity of the acid placed in a glass tube and after a while a jelly-like mass is formed. Most minerals of the *Zeolite family* (No. 38-47) undergo this change (gelatinize) in acid. The acids used are nitric, muriatic and sulphuric.

7. *Chapman's Table for determining Minerals—applied to this Catalogue.*

ASPECT METALLIC.—*Hard enough to scratch glass* (common window glass):

Color—Light brass yellow. 12. (See number preceding name of species in the following catalogue or list).

Color—Tin white or silver white. 13.

Color—Steel grey, black, or brown. 19*, 20, *a* & *b* & *c*, 22, 23*a*.

* Varieties of the same mineral will be found in different parts of the Table.

ASPECT METALLIC.—*Not hard enough to scratch glass:*

Malleable or ductile. 1, 2.
Yielding to the nail. 4, 6, 14, 21, 30.
Not yielding to the nail. 5, 7, 8, 9, 10, 11, 15, 22.

ASPECT NON-METALLIC (stony, glassy, &c.)—*Hard enough to scratch glass:*

Infusible, very hard, not yielding to the knife. 19, 24, 25, 31, 32, 33, 34.
Fusible, not yielding water in the bulb tube. 26, 27, 28, 29, 31, 32, 34.
Fusible, yielding water in the bulb tube. 40, 41, 42, 43, 44, 47.

ASPECT NON-METALLIC (stony, glassy, &c.)—*Not hard enough to scratch glass:*

Soluble, having a saline taste. 16.
Take fire when held in thin splinters in the flame of a candle. 3, 58.
Does not take fire, but burns with a red glow when heated. 3*a*.
Incombustible, streak colored. 18, 20, 21*a*, 23*b* & *c*, 52, 57.

Incombustible, streak white.—*Not yielding water in the tube:*

Yielding to the nail. 27*c*, 30, 35.
Effervescing strongly in cold acids. 53.
Effervescing feebly in cold, but sensibly in hot acids. 54, 55.
Fusible. 7, 49.
Infusible, 9, 49, 50, 56.

Incombustible, Streak white.—*Yielding water in the bulb tube:*

Yielding traces only, or a very small amount of water, 26*a*, 30, 35.
Yielding a considerable amount of water.

B.B. Fuses on the edges with difficulty. 36, 37.
F.B. Exfoliates and crumbles. 51.
B.B. Fuses easily. 38, 39, 45, 46.
B.B. Infusible. 48.

NATIVE ELEMENTS.

1. GOLD.—I. H = 2·5 – 3 ; G = 15·6 – 19·5.—Color golden yellow. Sectile. Malleable. Not affected by any single acid, but soluble in a mixture of nitric and muriatic acids. Has been found in streams in the northern part of New Brunswick, and sparingly by analysis in ores of iron, zinc, &c., in Charlotte County. Used in jewelry, coinage, &c.

2. COPPER.—I. H = 2·5 – 3 ; G = 8 – 9·4.—Color copper red. Sectile. Malleable. Dissolves in nitric acid, and when metallic iron or steel is immersed in the solution it becomes coated with copper. Found sparingly at Little Salmon River, St. John County, and at Clark's Point and Grand Manan, Charlotte County. This was the only metal used by the North American Indians of this region before the discovery of America, and was brought by them from Lake Superior, where there are very large deposits.

3. COAL.—H = 1· – 2·5 ; G 1·2 – 1·75.—Color black to dark brown. Combustible. B.B. entirely consumed except the mineral impurities called "Ash."—The varieties are:—

3*a*. *Anthracite* or Hard Coal. This consists of carbon with 4 to 7 per cent. of water and more or less ash.—There are small seams of this mineral in the grey sandstones near Saint John, and an important bed of granular anthracite with a heavy ash (specific gravity 1·84) occurs with similar sandstones at Lepreau Basin, Charlotte County, where it is mined.

Bituminous Coal. Carbon with 10 to 60 per cent. of bitumen and 3 to 20 per cent. of "Ash."—Of this there are several kinds, viz.:—

3*b*. *Pitch or Caking Coal*, which needs to be stirred to help combustion. Suitable for grate-fires and forges.—Mined at Newcastle and Coal Creek, Queens County.

3*c*. *Cherry or Dry Coal.* Burns more rapidly than the last and without caking. The best soft coal for close stoves and furnaces.—Mined at Springhill, N. S., &c.

3*d*. *Cannal Coal.* Compact in texture, glimmering lustre, conchoidal fracture, and receives a good polish. Used for making gas (and formerly for oil.) Occurs at Caledonia, Albert County.

3*e*. *Albertite*, or Albert Coal. Has many of the properties of bitumen or mineral pitch. It is very pure, with only 2 per cent. of ash, and is used in the manufacture of gas. Mined at Hillsborough, Albert County. This mine is more than 1000 feet deep, and has lately been closed.

3*f*. *Peat*, Is a combustible mineral in which the process of conversion into coal has begun by the decay of vegetable matter. It is found in many localities in mossy bogs and low marshy land, Torryburn, Simonds, &c.

4. GRAPHITE.—VI. H = 1 - 2 ; G = 2·1.—"Black Lead," "Plumbago," Carbon, with usually some iron (which however is not essential). Color black, lustre metallic, laminated (*i. e.* leaf-like plates) or granular. Leaves a metallic streak on paper. Not attacked by acids. Occurs in irregular beds and pockets in limestone and slate from Pisarinco, Lancaster, to Hammond River, Kings County, also at Dumbarton Ridge, Charlotte County.

The St. John mineral has been mined at several places and used for stove polish, and for lubricating purposes. A finer quality, not as yet found in New Brunswick, is used for making lead pencils.

SULPHURETS AND ARSENIURETS.

[Sulphurets when heated give readily the stifling fumes of sulphur. Arseniurets give off a white vapor with a garlic-like odor. The ores of this section may be recognized by their behaviour before the blowpipe, &c. *Antimony* gives white fumes. *Lead* yields a bead of metallic lead. *Zinc*, with soda on charcoal exhibits the peculiar bluish flame of burning zinc. *Copper*, with borax or soda, affords metallic copper. *Manganese*, with borax, gives an amethystine globule. *Iron*, with the same flux, gives a pale green glass. *Bismuthine* melts in the flame of a candle. All the minerals of this section except Blende have a metallic lustre. For method of using the blowpipe and application of fluxes, borax, soda, &c., (See Sec. 5 of the Introduction).]

5. BISMUTHINE.—III. H = 2 - 2·5; G = 6·4 - 6·55.—Sulphuret of Bismuth. Color and streak lead gray. B.B. gives off white inodorous fumes, with a yellow deposit on the charcoal and is finally volatilized. Occurs with other ores in a vein at the head of La Tête Harbor, Charlotte County. Bismuth is used in type metal, plumbers' solder, mosaic gold, and fusible metal; and in the toilet preparation called "pearl powder."

6. STIBNITE.—III. H = 2 ; G = 4·5.—"Antimony Glance," or Sulphuret of Antimony. Color and streak lead gray; often in bladed crystallizations (*i. e.* long columnar plates). B.B. fuses easily, giving off copious white fumes, with a white deposit on the charcoal and is at last volatilized. Important veins exist at Lake George, York County, where there are several mines; and the mineral has been found at other localities. Antimony is used in making printing type, Britannia metal, and in medicine.

7. ERUBESCITE.—I. H = 3 ; G = 4·4 - 5.—"Purple Copper," Sulphuret of Copper and Iron. Color between copper red and pinchbeck brown. Tarnishes quickly. B.B. fusible to a globule, attractable by the magnet. In veins at Adam's Island and La Tête, Charlotte County, and Martin's Hd., Goose Creek and Pt. Wolf, St. John County. A useful ore of copper.

8. GALENA.—I. H = 2·5 - 2·75 ; G = 7·25 - 7·7. "Blue Lead," Sulphuret of Lead. Color and streak lead gray. Cleavage cubic perfect, also granular. B.B. on charcoal decrepitates (*i. e.* snaps or crackles) and finally yields a globule of lead. Occurs at Campobello Island, La Tête, and Frye's Island, Charlotte County; Norton and Upham, Kings County; and Tobique River, Victoria County. This is the principal ore of lead and not infrequently contains a considerable proportion of silver.

9. BLENDE.—I. H = 3·5 – 4 ; G = 3·9 – 4·2.—"Black Jack," Sulphuret of Zinc. Color from yellow through brown to black. Has a resinous look. B.B. infusible alone and with borax. Dissolves in nitric acid. Found at La Tête and Campobello and Frye's Island, Charlotte County, Quispamsis Station, &c. This is one of the most abundant ores of zinc.

10. CHALCOCITE.—III. H = 2·5 – 3 ; G = 5·5 – 5·8.—"Copper Glance," "Vitreous Copper," Sulphuret of Copper. Color and streak blackish lead gray. B.B. fuses easily, boils and finally yields a globule of copper. Occurs at Grand Manan, Simpson's Island and Crow Harbor, Charlotte County ; Upper Salmon River, Albert County ; and Dorchester, Westmoreland County. It is one of the principal ores of copper.

11. PYRRHOTINE.—I. H = 3·5 – 4·5 ; G = 4·4 – 4·7.—"Magnetic Pyrites," Sulphuret of Iron. Color between bronze-yellow and copper-red. Speedily tarnishes. Slightly attracted by the magnet. B.B. fuses, glows, and affords a black magnetic globule. Found with copper ores at La Tête, and with galena at Campobello. Same uses as the next species.

12. PYRITES.—I. H = 6 – 6·5 ; G = 4·83 – 5.—"Mundic," Persulphuret of Iron. Color pale yellow. Strikes fire with steel (hence the name). B.B. affords a magnetic globule. This ore is very widely distributed and of frequent occurrence both in veins and disseminated through the rocks. In company with calcite and actinolite it forms regular beds in the schists at Moore's Mills, Charlotte County. It is used for the manufacture of sulphuric acid, green vitriol, alum and sulphur.

13. MISPICKLE.—III. H = 5·5 – 6 ; G = 6 – 6·4. "Arsenical Pyrites, Arseni-Sulphuret of Iron. Color silver white, streak dark greyish black. B.B. affords arsenical fumes and then a globule which is magnetic. Has been found at Wawig River, near St. Stephen, and Sand Brook in Clarendon, Charlotte County.

14. MOLYBDENITE.—VI. H = 1 – 1·5 ; G = 4·4 – 4.8.—Sulphuret of Molybdenum. Color lead-gray. Laminated : thin scales, very flexible, not elastic. B.B. infusible. Dissolves in nitric acid. Found in loose boulders near St. Stephen ; also on Nepisiguit River,

15. CHALCOPYRITE.—II. H = 3·5 – 4 ; G = 4·1 – 4·3.—"Copper Pyrites," Sulphuret of Copper and Iron. Color brass-yellow, streak greenish-black. B.B. fuses to a globule which is magnetic. Distinguished from gold by crumbling under the knife, and from pyrites by its softness and deeper color. Found at many localities along the coast of Charlotte County and the eastern part of St. John County. Mined at La Tête. This is the most abundant copper ore.

FLUORIDS AND CHLORIDS.

[When *fluorids* are heated with salt of phosphorus previously melted in an open glass tube, the *glass is corroded*. A dull green bead, made by dissolving a little oxyd of copper in salt of phosphorus, becomes surrounded by a *fine blue* or *purple flame* if a *chlorid* be added.]

16. COMMON SALT.—I. H = 2·5 ; G = 2·1 – 2·3.—Chlorid of Sodium. Color white or grayish. Soluble. Taste saline. Snaps and crackles when heated. Obtained from brine springs at Sussex and "Salt Springs," Kings County.

17. FLUOR SPAR.—I. H = 4 ; G = 3·14 – 3·2.—"Blue John," Fluorid of Calcium. Color white, purple or green. Phosphoresces on hot iron. B.B. decrepitates and ultimately fuses. This mineral occurs on N. E. Branch of Magaguadavic River, at Frye's Island, Charlotte County ; Upham, Kings County, and (Beach Hill) Dorchester, Westmoreland County. Used for the manufacture of hydrofluoric acid.

OXYDS OF THE METALS.

[Behaviour of the various metals before the blowpipe is described above under the head of "Sulphurets and Arseniurets."]

18. CUPRITE.—I. H = 3·5 – 4 ; G = 5·85 – 6·15.—"Red Copper," Oxyd of Copper. Color dull red, streak brownish red. B.B. yields a bead of copper on charcoal. Dissolves in nitric acid. Found at Vernon Mine, St. John County, and Upper Salmon River, Albert County.

19. MAGNETITE.—I. H=5·5–6·5; G=4·9–5·2.—"Magnetic Iron Ore," Protoxyd of Iron. Color and streak black. Strongly attracted by the magnet. B.B. infusible. Found at Scotch Settlement and Springfield, Kings County, ; Dolin's, Loch Lomond, St. John County; New River and Deer Island, Charlotte County. A valuable ore of iron, and one widely diffused.

20. HEMATITE.—VI. H=5·5–6·5; G=4·5–5·3.—Peroxide of Iron. Color steel-gray to ochre-red. Streak dark brownish red to ochre-red. B.B. infusible. The varieties are:—

20*a*. *Specular Iron.* Specimens having a perfect metallic lustre. Found at Musquash and West Beach, St. John County, &c.

20*b*. *Micaceous Iron.* Specular Iron with a foliated structure. Found at La Tête, Campobello, West Beach, &c.

20*c*. *Red Hematite.* A dull earthy looking compact variety. At Woodstock, New Bandon, Dorchester; and Black River in St. John County, &c.

20*d*. *Red Ochre.* Soft and of a brighter color, contains clay. At Brighton, Harvey, Blissville, Sussex, &c.

20*e*. *Jaspery Clay iron.* A flinty variety of hematite. West Beach.

20*f*. *Clay iron stone.* Similar to the last in appearance but not jaspery.

Hematite is one of the principal ores of iron.

21. PYROLUSITE.—III. H=2–2·5; G=4·8–5. "Grey Manganese ore," Anhydrous binoxyd of Manganese. Color and streak black. B.B. alone infusible; on charcoal loses oxygen. This and the next species differ from magnetite (magnetic iron ore) in being softer; these are frequently fibrous, magnetite is not. Occurs at Markhamville, Kings County; Quaco, St. John County; Bathurst, Gloucester County.

21*a*. *Wad* or Bog manganese an earthy variety found at Richibucto, Lincoln, Fredericton, Woodstock, &c.

22. MANGANITE.—III. H=4; G=4·2–4·4. "Grey manganese ore," Hydrous peroxyd of manganese. Color steel grey. Streak brownish black. B.B. [illegible] fusible. Found at Markhamville and Tête-a-gouche River.

Manganese ores are used in bleaching, glassmaking, steel manufacture,

23. LIMONITE.—H=5–5·5; G=3·6–4. "Brown Hematite," Hydrous of Iron. Color dark brown to ochre-yellow. Streak yellowish brown yellow. Often fibrous with a mammillated surface, or massive, or earthy water in a tube. B.B. Blackens and becomes magnetic and the yellow va. turn red. The varieties are:—

23*a*. *Brown Hematite.* Massive and compact or fibrous. Salmon River, Queens County.

23*b*. *Bog iron ore.* Massive, more or less cellular. Found at Campobello, St. Stephen, Richibucto, Lincoln, &c.

23*c*. *Yellow Ochre.* Earthy, of a bright yellow, contains clay. Found at Brighton, Enniskillen in Petersville, &c.

QUARTZ.—(SILICIC ACID.)

24. QUARTZ.—VI. H=7; G=2·6–2·7. [This mineral varies greatly in color and outward appearance. It is always present in granite and many other rocks, and forms the principal part of the sand, gravel and boulders on the sea-shore. It may be recognized by its hardness, for it will scratch glass and turn the edge of a file. It cannot be split, and it does not melt before the blowpipe. It is not affected by acids. The hardness and absence of cleavage will serve to distinguish it in almost all its varieties. Some of these are the following]:—

I. VITREOUS VARIETIES.—(Lustre of broken surfaces like that of glass, *i. e.* vitreous.)

24*a*. *Rock Crystal.* "White stone" of the jewellers, or pure crystals of quartz. Transparent like glass. Found at Diamond Hill, Musquash; Mispec Barrens and West Beach, Simonds, &c. At West Beach are large green crystals coated and penetrated by chlorite. (37).

24*b*. *Milky Quartz.* Of a milk-white color. Massive and with the lustre of glass on broken surfaces. Very common.

24*c*. *Ferruginous Quartz.* Similar to the last, but colored or stained by iron, opaque or nearly so. Red, brownish or ochre-yellow. Also very common.

II. CHALCEDONIC VARIETIES.—(Lustre glimmering like that of wax.)

24*d*. *Chalcedony.* Has the subdued lustre of wax, is either translucent or subtranslucent (though it includes milk white opaque varieties.) Found loose at Darling's Lake (Hampton) and Bellisle Bay, and *in situ* (*i. e.* in ledges of rock) on S. shore of Washdemoak Lake.

24*e*. *Carnelian.* A red variety of chalcedony, generally of a bright tint. Occurs with the last in the localities named and at Campbelltown.

24*f*. *Agate.* A variegated chalcedony, the colors in clouds, spots or bands. Found with the two former varieties.

24*g*. *Hornstone.* Allied to chalcedony, but with dull colors and more opaque. Seams are found at Crescent Lake, Portland, in red conglomerate and it also occurs with the chalcedonies of Kings County.

III. JASPERY VARIETIES.—(Lustre dull or earthy.)

24*h*. *Jasper.* Red, yellow, brown or green, compact, nearly or quite opaque, and possessing little beauty until polished. Common in veins of the hard green rocks of Musquash, Loch Lomond and Quaco in St. John County.

24*i*. *Lydian stone* or Touch stone. A black variety used for trying the purity of the precious metals. Found at Saint John, Black River, &c.

Rocks, composed chiefly of Quartz, are:

24*j*. *Granular Quartz.* A massive compact rock of a granular texture, colors various and dull. Portland, N. B., Grand Manan, Brighton in Carleton County, &c.

24*k*. *Sandstone* consists of quartz sand cemented into a rock. A variety much used by stonecutters is *Freestone.*

24*l*. *Silicified wood* is wood petrified by silica or quartz: it usually retains the original structure of the wood. Found at Saint John, Grand Lake, Chatham, &c.

Quartz is an essential constituent of granite, gneiss, mica schist and other allied rocks. The chalcedonic varieties are mostly found in vesicular cavities and veins in basalt and other trap rocks.

Rock crystal and the chalcedonic varieties are used in jewelry, jasper in ornamental work, and the commoner varieties for glassmaking, ornamental stonework, &c.

25. OPAL.—H = 5·5 – 6·5; G = 1·9 – 2·3. Silica, in its gelatenizing state (See Sec. 6 of the Introduction). Colors, white, grey, brown, &c. No cleavage or crystalline structure. B.B. infusible. Two varieties have been observed in New Brunswick:

25*a*. *Chrysolony.* Porcelain white, adheres to the tongue.

25*b*. *Siliceous Sinter.* Porous, stalactitic, (see 53*c*).

Both found in trap rocks at Grand Manan.

SILICATES.—(I. ANHYDROUS.)

[Silicates along with quartz are the principal constituents of all rocks except limestone. Those which are most common are Nos. 26, 27, 30, 31, 36 and 37. These minerals are not so easily recognized as those previously described, but the characters given for the different species will, it is believed, make their determination sufficiently sure. Anhydrous silicates do not yield water in a glass tube when heated.]

26. PYROXINE.—IV. H=5-6; G=3·23-3·5.—Silicate of Lime, Magnesia and Iron. Color various shades of green to brown and black, streak white to gray. Brittle. (For other characters see Hornblende). Several varieties occur:

26*a*. *Diallage*. Brown laminated, pearly. In serpentine at St. Stephen.

26*b*. *Hypersthene*. Greenish black, cleavable, with the lustre of bronze. At Dolan's Lake, Simonds, St. John County.

26*c*. *Green Earth*. Dark olive green, lining cavities of trap at Grand Manan.

26*d*. *Augite* or Pyroxine is an important constituent of the trap rocks (dolerites), &c., of Grand Manan, and also of those along the borders of the coal measures in Central New Brunswick.

27. HORNBLENDE.—IV. H=5-6; G=2·9-3·4.—Silicate of Lime, Magnesia and Iron. This mineral very much resembles Pyroxine in appearance and composition, but has a different form of crystal. Hornblende is often in six-sided prisms, with angles approaching 120°, or rhombic prisms of 124½°; while Pyroxine crystals are commonly four-sided prisms near 90° in the angles, or eight-sided prisms near 135° at each angle. Both species are fusible before the blowpipe and have an uncolored streak. In color they range from white to black through grass-green and olive-green shades, and are distinctly cleavable; prisms, when broken lengthwise, often show a cleavage plane, or have a splintery look. The varities of Hornblende are:

27*a*. *Tremolite* (Silicate of Lime and Magnesia). White or greyish crystals, often in long slender blades, or grouped in columnar or radiated masses. In the limestone rocks of Portland, &c.

27*b*. *Actinolite*. Bright green bladed crystals, or columnar forms. The fibrous or radiated crystallizations are named *Asbestiform Actinolite*. In veins of trap rock at Sheldon Point and Manawagonis Island, near St. John, Norton, Kings County, Martin's Head, &c.

27*c*. *Asbestus*. Similar to the last but more finely fibrous. From the same localities.

27*d*. *Hornblende*. This name is confined to the dark green and black varieties, and it may be in crystals or massive. At Indiantown in Portland, near Bald Mt. in Petersville, in Springfield, &c. Hornblende is always present in the rocks called Syenite and Diorite. The variety asbestus is used for making fire-proof roofing and for lining fire-proof safes. The ancients made cloth of it, and also wicks for their temple lamps.

28. GARNET.—I. H=6·5-7·5; G=3·15-4·3.—Silicate of Alumina and Iron. Color red, brown, &c., streak white. Transparent to opaque. Brittle. B.B. fuses to a dark vitreous (*i. e.* glassy) globule. Small red crystals are found in mica schist at Moore's Lake, Charlotte County. Used in jewelry.

29. EPIDOTE.—VI. H=6-7; G=3·25-3·5.—Silicate of Alumina, Lime and Iron. Two varieties are known in New Brunswick:

29*a*. *Pistacite* (Silicate of Alumina, Lime and Iron), "Lime and Iron Epidote." This resembles some varieties of Pyroxine and Hornblende, but may be distinguished by its peculiar yellowish green color; the crystals and columnar forms differ from those two minerals in having no very distinct cleavage, and in the absence of a splintery appearance in the fracture. B.B. fuses on thin edges and swells up. Found in diorite rocks at Beaver Harbor and New River, Charlotte County; Clifton, Kings County, and various points in St. John County.

29*b*. *Zoisite*, "Lime Epidote" (Silicate of Alumina and Lime). Fibrous flesh-red masses are found with pistacite in a vein at Sheldon Point, Lancaster.

30. MUSCOVITE.—V. H=2-2·5; G=2·75-3·0.—"Common Mica," Silicate of Alumina, Iron and Potash. Color white, grey, yellow, brown, &c. Cleavage parallel to the base of the prism very distinct, dividing it into thin shining laminæ or plates, which are flexible and *elastic*. B.B. fuses on thin edges only. Occurs at Moore's Mills, Charlotte County; Land's End in Westfield, Brookville Station, Simonds, &c. Mica is used for doors of stoves and lanterns, and for preserving

objects for the microscope. It is a constituent of granite, mica schist, gneiss and other rocks.

31. ORTHOCLASE.—IV. H=6; G=2·4 – 2·6.—"Potash Feldspar," Silicate of Alumina and Potash. Color white, grey, flesh-red, &c. Occurs either in tabular crystals or cleavable masses, never fibrous, but sometimes granular. Lustre vitreous, inclined to pearly. There is one perfect cleavage giving a smooth surface, and another less perfect at right angles to it. B.B. fuses on the edges. Crystals of orthoclase are to be had at Nerepis Station, Land's End and Clifton in Kings County. This mineral is a constituent of granite, syenite, mica schist, felsite and other rocks. It is used for the manufacture of porcelain, artificial teeth, &c.

31*a*. *Kaolin* is the name applied to a clay that results from the decomposition of feldspar. It is used for making porcelain and china ware. Found in the eastern part of St. John County, &c.

31*b*. *Clay* is mostly derived from the decay of feldspar rocks, and is usually composed of one part of alumina and two of silica; when iron is present the clay burns red.

32. LABRADORITE.—V. H=6; G=2·67 – 2·76.—"Labrador Feldspar," Silicate of Alumina, Lime and Soda. Color gray, brown and dark greyish green; worn and exposed surfaces weather (See Sec. 4 of the Introduction) chalky white. There is usually a play of colors, blue, green, &c., from the interior of translucent crystals. Cleavage like orthoclase, except that the planes are inclined (not at right angles, but) at angles of 86 or 114°. B.B. more fusible than orthoclase. Occurs with hypersthene at Dolin's Lake, Simonds, and elsewhere. This mineral is a constituent of labradorite-rock, dolerite, and other rocks. The translucent varieties are cut for ornamental purposes.

33. ANDALUSITE.—III. H=7·5; G=3·1 – 3·2.—Silicate of Alumina. Color flesh-red or pearl-gray. Tough. Nearly opaque. B.B. infusible. Long rhombic prisms, imbedded in mica-slate, are met with at Moore's Lake, Charlotte County.

34. TOURMALINE.—VI. H=7 – 7·5; G=2·94 – 3·3.—"Schorl," Silicate of Alumina and Iron, with boracic acid. Color black, &c., streak uncolored. Brittle. B.B. fuses with difficulty to a black slag. Differs from the black varieties of Pyroxine and Hornblende in having no cleavage or splintery look when broken. Occurs in a vein of feldspar, mica and quartz, at Brookville Station, St. John County, also in granite at Clarendon Station, Queens County, and in quartz veins at Moore's Mills, Charlotte County.

SILICATES.—(V. HYDROUS.)

[Most hydrous silicates when heated in a tube yield water. For other characters see note on silicates under Anhydrous silicates.]

35. TALC.—III? H=1 – 1·5; G=2·56 – 2·8.—"Soapstone," Silicate of Magnesia. Color white, apple green to dark green. Laminated, laminæ flexible, *not* elastic. Lustre pearly. Also compact. Greasy to the touch. B.B. loses color but does not melt; with borax forms a clear glass. The variety:

35*a*. *Steatite* or Compact Tale has been found at the Narrows of St. John River, and at Lily Lake, Portland; also at Woodstock. Steatite or Soapstone is used for fire-stones in stoves and furnaces and for sinks, hot-air, registers, &c. One variety is called *Tailor's* or *French Chalk*.

36. SERPENTINE.—III? H=3 – 4; G=2·5 – 2·6. Silicate of Magnesia (with more water than Tale). Color oil green to blackish green. Massive and fibrous. Lustre resinous. Streak white. Sectile. Gives water when heated in a tube. B.B. on charcoal scarcely fuses on the edges. Dissolves readily in borax. The following are varieties:

36*a*. *Precious Serpentine*. Translucent and of a rich oil green color. In limestones of Lancaster, Portland and Rothesay.

36*b*. *Common Serpentine*. Of a dull greenish black color. Near the town of St. Stephen.

36*c*. *Chrysotile*. A fine asbestiform variety of an olive-green color and silky lustre is found at Pisarinco, Lancaster and Portland in precious serpentine.

36*d*. *Verd Antique Marble* is a mixture of carbonate of lime and serpentine.

37. CHLORITE.—VI. H = 2 – 2·5; G = 2·65 – 2·85.—"Pipe Stone." Silicate of Alumina, Magnesia and Iron. Granular and laminated, laminæ *not* elastic. Color dark green to nearly black. Sectile. Gives water when heated in a tube. B.B. on charcoal fuses to a globule, or on thin edges. A glass made with borax is colored green (by iron) when chlorite is added. Chlorite is found at Clifton, Kings Co., at New River, Beaver Harbor and Grand Manan, Charlotte Co., and at various points in St. John Co. It was formerly used by the "Indians" of New Brunswick for making pipe bowls.

ZEOLITES.—(BOILINGSTONES).

[These are hydrous Silicates of alumina and some alkali—as potash, soda, lime, &c., (magnesia is always absent). They are not disseminated through the body of a rock, but are implanted on the sides of fissures, or fill cavities in the rock. They boil or swell up when placed in the blow-pipe flame.]

Three species have a pearly cleavage.

38. HEULANDITE.—IV. H = 3·5 – 4; G = 2·2. In flat six-sided or rhomboidal prisms. Color white, red, &c.

39. STILBITE. IV. H = 3·5 – 4; G = 2 – 2·2 In flat tabular pointed crystals and sheaf-like groups. Color white, yellow, brown, &c.

40. APOPHYLLITE.—II. H = 4·5 – 5; G = 2·34. In flat rectangular prisms. Color white to pale apple-green.

Three species have slender prismatic forms.

41. THOMPSONITE.—III. H = 5 – 5·5; G = 2·35 – 2·4. In radiating crystals. Color white. B.B. bubbles and becomes white and opaque. When powdered gelatinizes in nitric acid.

42. NATROLITE.—III. H = 5 – 5·5; G = 2·17 – 2·24. In needle-like, usually separate, crystals. Translucent. B.B. fuses quietly to a glassy globule. Forms a thick jelly with acids.

43. SCOLESITE.—IV. H = 5 – 5·5; G = 2·2 – 2·7. In acicular, usually imbedded, crystals. Translucent. White. B.B. curls like a worm and melts to a shining slag.

Two species are granular when massive.

44. ANALCIME.—I. H = 5 – 5·5; G = 2·07 – 2·27. The crystals are trapezohedrons (a 24-sided solid of which each face is a trapezoid). Color white or brownish. Gelatinizes in muriatic acid with difficulty.

45. CHABAZITE.—VI. H = 4 – 4·5; G = 2·08 – 2·17. The crystals are rhombohedrons (a 6-sided solid of which each face is a rhomb) nearly cubic in form. Color white, grey, red.

One species whitens and crumbles after lengthened exposure to dry air. This is

46. LAUMONITE.—IV. H = 3·5 – 4; G = 2·3. The crystals are oblique rhombic prisms. Color white to gray. Gelatinizes in nitric acid.

All these zeolites are found in the trap rocks (hard rocks similar to the lava of volcanoes) of Grand Manan. Heulandite also occurs in trap at Newcastle and Hampstead in Queens Co. and at Chamcook Lake, Charlotte County. Laumonite is met with in a vein at Quispamsis Station, Kings County.

47. PREHNITE.—III. H = 6 – 6·5; G = 2·8 – 2·95. Crystallized and massive. Color pale green. This species is distinguished from the other Zeolites by its hardness. Found in veins in diorite (a hard dark green crystalline rock) at Clifton, Kings County.

48. CHRYSOCOLLA.—II. H = 2 – 3; G = 2 – 2·3. Hydrous silicate of copper (not a zeolite) usually an incrustation on other copper ores. Color pale to bluish green. Translucent to opaque. Streak white. Brittle. B.B. Blackens on charcoal without melting. Gives a green bead with borax. Found at Upper Salmon River, Albert County.

SULPHATES.

[A glass made of soda and silica becomes red or orange-yellow when sulphur is present (by the addition of a mineral containing it). All the sulphurets except Blende have a metallic lustre. Hence with this exception any *unmetallic species* in this list *containing much sulphur, must be a sulphate*. Blende may be distinguished by the test for zinc (See Sulphurets).]

49. Barytes.—III. H=2·5–3·5; G=4·3–4·7.—"Heavy Spar." Sulphate of Baryta. Color white inclining to yellow, red, &c. Streak white. Transparent to opaque. B.B. Decrepitates and fuses with difficulty. Occurs at Swallow Tail, Grand Manan, Frye's Island, Charlotte Co., and with Manganese at Markhamville and Shepody Mountain. This mineral is largely used in the manufacture of paint.

50. Anhydrite.—III. H=3·–3·5; G=2·9–2·96.—Anhydrous sulphate of Lime. Color white, grey, bluish and reddish. Streak greyish white. B.B. Whitens but does not exfoliate, (*i. e.* open out into leaf-like layers) and finally is covered with a friable enamel. In beds with gypsum at Hillsborough, Albert Co. Same uses as gypsum.

51. Gypsum.—IV. H=1·5–2; G=2·3.—Sulphate of lime. In crystals; also granular, fibrous and compact. Color usually white; also grey, brown, &c. Lustre on some faces (of crystals) pearly; when massive the lustre is glistening to dull. Streak white. B.B. becomes opaque white, opens out into leaf-like layers and falls to a powder which, if moistened, soon becomes solid and hard. The varieties are:

- 51*a*. *Selenite*. Transparent crystals. In the mud of a spring at Sussex.
- 51*b*. *Alabaster*. The massive varieties of fine grain and pure color. Of excellent quality at Hillsborough, Albert Co.
- 51*c*. *Satin Spar*. Translucent fibrous variety. Albert and Westmorland Co's.
- 51*d*. *Fibrous Gypsum*. White fibrous variety. Albert and Westmorland Co's.
- 51*e*. *Common Gypsum*. The massive and impure varieties of a dull color. Extensive beds of gypsum are found in Albert, Westmorland and Victoria Counties. *Plaster of Paris* is gypsum rock, calcined and ground, and has various uses in the arts. The uncalcined plaster is extensively used for improving soils. *Alabaster* is cut into vases and ornaments, and *Selenite* is used for optical instruments.

PHOSPHATES.

52. Vivianite.—IV. H=1·5–2; G=2·66.—Color blue. Streak bluish. B.B. fuses to a dark brown scoria or slag that effects the magnetic needle. Affords water in a glass tube. Dissolves in nitric acid. Occurs in clay at Quisabis River, Madawaska County.

CARBONATES.

[Carbonates effervesce with dilute muriatic acid and more briskly with strong acids].

53. Calcite.—VI. H=2·5–3·5; G=2·5–2·8. "Cale Spar." Carbonate of Lime. This mineral is next in abundance to quartz and as varied in its aspect. A knife easily scratches it, and a drop of dilute nitric or muriatic acid produces an immediate frothing on its surface. B.B. gives an intense white light and burns to quicklime. The sparry varieties are—

- 53*a*. *Iceland Spar*. Transparent crystals. These exhibit the property of double refraction, which calcite possesses in an eminent degree. Objects seen through a crystal of this spar, held in a certain position, seem double. Large crystals have been found at Belledune, Gloucester County. Iceland spar is used in optical instruments.
- 53*b*. *Calcareous Spar* or cale spar has a variety of crystalline forms such as "nail-head spar," "dog's-tooth spar" and the hexagonal prism found at Fort Howe Hill, Portland, and Lawlor's Lake, Simonds; and simple and modified rhombohedrons found at Markhamville, Kings County, and Goose Creek, Saint John County.
- 53*c*. *Stalactite* and *Stalagmite*. Icicle forms produced by the dripping of calcareous water from the roofs to the floors of caverns. Dipper Harbor and the caves of Portland, St. John County, are localities for these varieties. Used for ornamental work.

53*d*. *Granular Limestone* or Marble. A massive crystalline rock. Found in Lancaster, Portland, Canterbury, Brighton, &c. Statuary and other crystalline marbles are included here.

The earthy varieties are:

53*e*. *Compact Limestone*. Of dull grey, bluish, brown and black colors and dull lustre. It is of common occurrence. Extensively used in the manufacture of lime.

53*f*. *Hydraulic limestone* is largely composed of silicia and alumina (clay) and magnesia. Occurs in beds in Albert County and elsewhere. Used for the manufacture of hydraulic cement.

53*g*. *Agaric Mineral*. A loose friable variety deposited from the water of caverns. Caves in Portland, St. John County.

53*h*. *Marl*. A mixture of carbonate-of-lime and clay, found in lakes and marshy land, and due to the decomposition of the shells of fresh water moluscs, (water snails, &c.) Found at Lawlor's Lake, St. John County, at Bathurst, &c. Used as a fertilizer.

54. MAGNESITE.—VI. H = 3·5 – 4·5; G = 2·8 – 3·.—Carbonate of Magnesia. Color white, yellowish or greyish. B.B. infusible. Dissolves slowly with little effervescence in nitric acid. Occurs with serpentine in Portland and in magnesian schist at West Beach, Simond's. Used in the manufacture of Epsom Salts.

55. DOLOMITE.—VI. H = 3·5 – 4; G = 2·85 – 2·9.—Carbonate of Lime and Magnesia. When in crystals the faces of the crystals are usually curved. Color as in calcite. Brittle. B.B. acts like calcite. Soluble in acids, but more slowly than calcite.

The varieties are:

55*a*. *Dolomite*. White crystals and massive granular kinds. Found at Portland, Frye's Island, Kars, Kings County, and Grand Manan.

55*b*. *Pearl Spar*. Crystals with curved faces and pearly lustre. Musquash Harbor and Markhamville.

55*c*. *Brown Spar*. Contains 5 to 10 per cent. of oxyd of iron and has a rusty look when exposed to the weather. Found at Taylor's Island, Lancaster, and Lepreau Basin.

55*d*. *Magnesian Limestone*. Is a name for the earthy varieties of dolomite. Lime from dolomite makes a more durable cement than that from common limestone.

56. CHALYBITE.—VI. H = 3·5 – 4·5; G = 3·7 – 3·9. "Spathic or sparry iron ore." Carbonate of Iron. Color ash grey to brown, faces of crystals often curved. Streak white. Brittle. B.B. blackens and at last yields an oxyd of iron attractable by the magnet. Colors borax pale green. Dissolves with difficulty in nitric acid, and scarcely effervesces unless previously pulverized. Occurs at Petersville, Queens County and Grand Manan, Charlotte County.

56*a*. *Clay iron stone* is an earthy variety occurring in nodules and seams in coal measures. Found at Dorchester, Newcastle, Grand Lake, &c. Both this and the sparry variety are used for the production of iron.

57. MALACHITE.—VI. H = 3·5 – 4; G = 3·7 – 4. Green carbonate of copper. Color bright green, streak paler green. B.B. yields water and blackens. On charcoal fuses, giving a globule of copper. Dissolves without effervesence in acids. Found at Simpson's Island, Charlotte County, and at Martin's Head and Goose Creek, St. John County, and at Bathurst in Gloucester County. Smelted with other copper ores, and some varieties are used for ornamental work.

ORGANIC COMPOUNDS.

58. BITUMEN—(A hydrocarbon). Liquid to solid. Dark brown to black in color. Inflammable. Three varieties are found in New Brunswick.

58*a*. *Asphaltum*, or mineral pitch. At Ayer's farm, Petitcodiac.

58*b*. *Maltha*, or mineral tar. At Godie's farm, Petitcodiac.

58*c*. *Petroleum*, or mineral oil. At Ayer's farm, Petitcodiac.

Used for making burning and lubricating oils, varnish, &c.

REFERENCE SUMMARY.