ARTICLE 10.—TABULAR VIEW OF MINERALS WHICH DECREPITATE WITH HEAT. *By* CAPTAIN F. H. BADDELEY, *R. E., Member of the Geological Society of France, Hon. Mem. of the Lit. and Hist. Soc. of Quebec, and Corr. Mem. of the Nat. Hist. Soc. of Montreal.*

The grouping together, under important and striking characters, common to them, the various and almost countless subjects in Natural History, has ever been admitted to be the only way in which an extensive knowledge of the Science can be acquired. It not only is the thread by means of which the interminable labyrinths of its study are explored, but it places before the student, those beautiful, instructive, and often curious analogies, contraries and coincidences, all of which it would be impossible to perceive without its assistance; and enables him to form correct and useful generalizations; it allows him, in short, to collect and examine the gems and stalactites—the ores and other mineral productions in the cavern of Natural History—by keeping constantly in sight of the guide and his torch.

Some years ago, with a view to familiarize myself with the characters of minerals, and to discover some of the analogies, &c., alluded to, I made various groups or tests of them, under different characteristic headings; a reference to which, it was likewise supposed, might assist me in determining the nature of a few of those I should meet with. It is not pretended that there is anything novel in this mode of arrangement, as various lists of minerals, bearing particular relation to their specific gravities, hardness, and colour, &c., have been printed. I only propose to offer you other lists, headed by other important and striking characters, common to the minerals in such lists ; and, as there are not any more so than those which the application of heat discloses, it is further proposed to commence with them.

It is well known, that the immediate, or almost immediate effect of an elevated temperature upon some minerals, is to cause them to decrepitate, or fly into particles suddenly, with a crackling report, more or less violent—a phenomenon which may be regarded as the noisy boasting of the enemy, caloric, over his yielding antagonist, cohesion. Some minerals never fail to exhibit this character, before the blow-pipe or in the matrass, while in others it is capricious ; but, as it is one which cannot be mistaken for another, and is, moreover, confined to a few minerals comparatively, a list will be presently introduced of those minerals which are said, by distinguished mineralogists, to decrepitate with heat, while opposite to every member in that list or table, will be affixed other characters, for the very obvious purpose of further distinction ; previously, however, a few observations are introduced upon the cause of decrepitation, and upon the mode of exhibiting, &c. Two causes have been assigned by chemists for the occurence of this phenomenon, viz. :—

First,—The sudden conversion into steam, by caloric, of the water which the minerals previously contained.

Second,—The unequal expansion of the laminæ, of which the minerals are composed, in consequence of their being imperfect conductors of heat.

Professor Ure, who adopts the latter opinion, criticises somewhat severely the former, and observes, that it is notorious, that some of those salts, which when absolutely dry, decrepitate most violently, contain no water whatever, and he instances, Sulphate of Barytes, Sulphate of Potass, and Muriate of Soda. Other mineral substances also, which decrepitate strongly with heat, contain no water; for instance, Fluor Spar, Glauberite, Chromate of Lead, Oxide of Tin, &c., and indeed, the greater portion of those minerals which are described by mineralogists as decrepitatory with heat, have no water set down in their respective analysis.

Although these facts are directly opposed to the opinion, that the presence of water is necessary in all, or even most cases, for the developement of decrepitation, there are cases, it would seem, in which its mechanical suspension in the mineral *is* necessary, before this phenomenon can be elicited. I have, at this moment, before me a mineral (a description of which is given at page 389, vol. II, Transactions Literary and Historical Society of Quebec,) which appears to be a compact variety of either the Hydrate of Magnesia or Hydrate of Allumine, (Dr. Holmes, of Montreal, is of opinion, that it is a variety of Steatite). In a dry state it is slightly translucent on the edges, but being very hydrophanous, it becomes deeply so when absorbing water, in which state, upon being exposed to heat, either in the matrass or on charcoal before the blow-pipe, it decrepitates violently; but, previously to the absorption of water, no such character belongs to it. It is further remarkable and corroborative of the opinion, that water is the cause of decrepitation, in this instance, that this character may be renewed, at pleasure, *in the same assay*, by only moistening it, previously to subjection to heat. This fact, however, is by no means opposed to Dr.

Ure's opinion as to the cause of decrepitation; because, it is highly probable, that the same mineral, which when dry, is a good conductor of heat, becomes the contrary when moist; and I believe, it will be found upon experiment, that other absorbent minerals which decrepitate when moist, lose that character upon becoming dry.

The phenomenon of decrepitation, is in general, best developed by directing the exterior flame of the blow-pipe *suddenly* upon the assay, upon charcoal; but different decrepitating minerals require often different degrees of heat; for, while some exhibit this character, only in the reducing flame of the blow-pipe, others, to do the same, must be submitted to the more moderate temperature of the candle or matrass; whatever the degree of heat be however, it should always be applied suddenly, for, some of those minerals not subject to this law, may be made not to discover it, if they be heated gradually, a mode often adopted, when the fusibility of a mineral is the subject of enquiry, in which case decrepitation is a very inconvenient character. In ascertaining, whether decrepitation be a character belonging to a mineral, several trials, under different circumstances, should be made, for instance: in the candle, in the matrass, in the outer flame, in the reducing flame; and, when the mineral under examination, is absorbent or hydrophanous, it should be tried in both a moist and in a dry state, and in the description the particulars should be stated. It is obviously useless to *continue* the experiment with a fusing heat, or after the assay is red-hot, at which stages all decrepitation ceases.

It must be well understood, that in presenting to the Society the following Tabular View of Minerals which Decrepitate with Heat, it is not meant to assume, that a mineral which does not, *cannot* belong to one of the several species which it embraces, but only, that it *probably* does not; there are cases indeed, in which this probability almost amounts to a certainty; but the above general warning will not be the less necessary on that account. It must also be borne in mind, that the writer is not compiling a System of Mineralogy, but arranging a few minerals, under certain heads, principally as an *aide mémoire*, in doing which his main object, self-improvement, will be realized, whatever opinion may be entertained of the general usefulness of his labours.

Wishing to have, as far as it was possible, an occular proof of the approximate accuracy of these Tables, I have experimentally consulted as many of the minerals mentioned in them as are to be met with in the Cabinet belonging to the Literary and Historical Society; at least, whenever the specimens would admit of it, without injury to them. With reference to these Tables and experiments, I have ventured to mark in the former, with an asterisk, those minerals in which decrepitation may be considered sufficiently striking and constant to be characteristic. This experimental part of my labour would have been more satisfactory had I possessed the opportunity of consulting a larger cabinet, and, I trust, that great allowance will be made for this, or any other attempt which may succeed it, to be useful, while it is considered, that neither minerals, books, nor men, are very readily consulted in a country just commencing its scientific flight.

As they may not be found devoid of interest, although their perfect accuracy I will not guarantee, the experiments alluded to above, are here introduced:—

SULPHATE OF BARYTES.

Of fourteen specimens of this mineral examined, twelve exhibited strong decrepitation. Of the two which failed one consisted of acicular prismatic crystals—the other was a fibrously compact variety, from Monte Paterno, near Bologna, (Bolognian Stone). Those in which this character was most striking were of a distinctly laminar or foliated structure.

CARBONATE OF BARYTES.

One specimen, (the only one tried) slightly.

SULPHATE OF STRONTIAN.

Not one of seven specimens tried (four of them crystallized) can be considered as having decrepitated; the slightest, almost imperceptible motion, in some of them was alone observed. May not the presence of the Sulphate of Barytes give this character to this mineral when it exists?

ARRAGONITE.

Three, of six assays from this mineral, decrepitated strongly. No signs of decrepitation in the others.

HYDRATE OF MAGNESIA AND MARMOLITE.

Two specimens were tried, from the locality of Hoboken, New Jersey, neither of which succeeded; the presence of moisture might alter the case however, as it does with the specimen alluded to in the early part of this paper, and which resembling the Marmolite in appearance, is also found, to hold the same geological position, forming thin layers and thick seams in the serpentine and talcose schist of the Gannanoqui.

BRONZITE AND HYPERSTENE.

Unsuccessful experiments.

FULLERS' EARTH.

Decrepitation remarkably strong but single—one specimen tried.

CRYOLITE AND ALUMSTONE.

No decrepitation in one assay of each—the fusibility, indeed, of the former is so great, that if ever it exhibit that character, and Berzelius stands alone as authority (first-rate however) that it does, it must be at a very low temperature comparatively, as it melts in the flame of a candle.

The Metallic Minerals, submitted to experiment were the following, viz. :—

CARBONATE OF LEAD.

All, of six crystallized specimens, decrepitated strongly.

SULPHURET OF LEAD.

Only five, of ten assays, decrepitated; these did so, however, strongly—one was crystallized in cubes—two granular, and two massive (laminarly) : those deficient in this character were, three, massive—one, granular (argentiferous)—and one, crystallized in octohedra.

MOLYBDATE OF LEAD.

The only two specimens tried decrepitated strongly; they were crystallized in flat octohedra (much flatter than the primary) and in very low right square prisms—Sheperd.

CHROMATE OF LEAD.

Also two specimens—strongly; both crystallized, one in rhombic prisms of 93° 30′ and 86° 30′—Sheperd.

PHOSPHATE OF LEAD.

Three, of four specimens decrepitated, two of them crystallized in six-sided prisms, and one in acicular and radiating crystals—the former strongly—the latter slightly. A brown Phosphate of Lead, in six-sided prisms, apparently corroded, did not decrepitate.

OXIDE OF TIN.

The only specimen tried (under the usual form of crystal) very strong.

SULPHURET OF ZINC.

Five, of six assays, all from crystallized specimens, decrepitated. The specimen in which this character was not observed is a fibrous blende.

ELECTRIC CALAMINE.

No decrepitation in the two specimens tried.

CARBONATE OF IRON.

Four, out of five, strongly; both crystallized and massive—the fifth was "in distinct crystals of the *primitive* form."—Sheperd. Among an equal number of primary and secondary crystals of the same decrepitating mineral would not the character appear more frequently in the latter than the former?

WOLFRAM

Three, out of four—two crystallized (laminarly) and one compact (the last most violently); the fourth was granular.

TUNGSTATE OF LIME.

One specimen (crystallized in octohedra) slightly—the only one tried.

COPPER PYRITES.

Four specimens tried, decrepitated—three of them strongly (two crystallized, one compact); the fourth (botryoidal) slightly.

GREEN CARBONATE OF COPPER.

Of four specimens, the only crystallized one (a circumstance unusual) among them, did not decrepitate.

It will be found in general, that a mineral which decrepitates possesses either a crystallized form or a crystalline structure; and further, that it is either laminar or compact, the former most frequently. Among fibrous minerals the character is somewhat rare, and still more so among such as are of an earthy texture. Fullers' earth is a striking exception to the latter assertion, but it must be remembered, that its texture is quite as compact as it is earthy, and an analogous observation may be made respecting the Green Carbonate of Copper, the structure of which is very compact as well as fibrous. Granular minerals often exhibit decrepitation, but they are obviously, in general, composed of an assemblage of small crystals—from all of which it appears, that in collecting an assay for examination in this particular character, the most crystalline portion of the mineral should be taken, and particularly such portion the structure of which is laminar.

In compiling this paper, all the works on the subject I could meet with have been consulted, viz.: Berzelius, Bakewell, Cleaveland, Griffin, Mohs, Jameson, and Phillips. A few, a very few, of the observations are original, at least, as far as the writer's information extends. Should the whole prove acceptable, his labours will be continued on the same plan. Among the distinguished works on Mineralogy just named, not one holds a higher place than Cleaveland's, at once remarkable for its fulness of detail, and for its perspicuity of style .It is a treatise I have always had recourse to in my mineralogical difficulties, and the student will find it, as I have, the Pharos, which if it do not always conduct to port, will, at least, save him from being wrecked upon the shoals and quicksands of the Science. If he be an American, two additional motives are his to possess it, as it is a work of which he may be justly proud, and the only one which offers him a compendium of the Mineralogy of his country.*

* C. U. Sheperd, Esq., of Yale College, has subsequently, published a useful little Mineralogical Directory, by means of which the names of Minerals under examination may be more readily ascertained.

N

Number.	NAME OF MINERAL, *form under which it usually occurs, and authority for decrepitation.*	COLOUR. In Mass.	COLOUR. Streak or Powder.	Lustre.	Structure.
1	*Sulphate of Barytes(violently)—All authorities—Crystallized and massive, crystals rhomboidal prisms.	White, Blue, Yellow, Grey, Red Brown.	Streak White.	Vitreous inclining to resinous.	Laminar fibrous granular compact.
2	Carbonate of Barytes, Witherite (slightly). Jameson, Cleaveland, Griffin, Mohs,—Generally, amorphous, sometimes crystallized in six sided prisms terminated by six sided pyramids, also stalactitic.	White, Yellowish Grey.	Streak White.	Vitreous inclining to resinous.	Fibrous usually.
3	Sulphate of Strontian.—Celestine.—Griffin, Mohs.—Crystallized and massive. Crystals, rhomboidal prisms.	White, Grey, Blue, Reddish, Red.	Do.	Do. and somewhat pearly on the perfect faces	Laminar fibrous.
4	*Fluate of Lime,—Fluor Spar, (usually with violence)-All authorities. Generally crystallized in cubes or octohedrons, also massive.	White, Yellow, Blue, Green, Red.	Streak White.	Vitreous.	Laminar granular compact earthy.
5	Carbonate of Lime,—Calcareous Spar, (some varieties)—Crystallized, forms various, usually rhomboidal.	White, Grey, Red Green, Yellow.	Streak Greyish White.	Vitreous often pearly.	Laminar fibrous compact.
6	Do. Arragonite,—Cleaveland, "a small transparent fragment"—Mohs, "thin fragments of transparent crystals"—Bakewell,—Jameson, Crystallized in six sided prisms.	Do. and Blue.	Do.	Do.	Laminar fibrous compact.
7	Carbonate of Magnesia (*Compact*) Magnesite,-Griffin, "crackles"—Magnesite from Baudessero, crackles on charcoal, Berzelius.	Grey or Yellow.	Streak White and dull.	Dull.	Compact.
8	Hydrate of Magnesia,—Native Magnesia,—"crackles" Griffin. Massive and in regular hexahedral prisms.	White, inclining to Green.	Do. powder pure White.	Pearly upon the perfect faces.	Laminar.
9	*Diaspose (violently)-All authorities.—It decrepitates and is *dispersed* by the heat of a candle, whence its Grecian name,—Massive, rarely in doubly oblique prisms.	Greenish, Grey or Brown.		Vitreous and pearly.	Do.

*Minerals marked with an asterisk have the character of decrepitation constant.

Sp.Gr.	Hardness	Fusibility by the blow-pipe on charcoal	CHEMICAL CONSTITUENTS.	ADDITIONAL REMARKS.
4.2 4.6	4 or 5 Fluor spar or Calc spar.	A white enamel with *difficulty*; of an hepatic flavor.	Baryta.....66–00 } Berthier, Fourcroy, Berzelius. Sulp. acid. 34– 0 }	The enamel, formed by fusion on charcoal, communicates to the palate the flavor of rotten eggs. Varies from opaque to transparent,—when the latter, double refraction may be noticed.
4.2 4.4	4 or 5 Fluor spar or Calc spar.	A white enamel *easily*; transparent while hot.	Baryta. 78 } Klaproth. Carbonic acid 22 }	Effervesces and disolves in the muriatic and nitric acids—opaque translucent to semi.transparent,—brittle, doubly refractive when sufficiently transparent.
3.5 4.0	4 or 5 Fluor spar or Calc spar.	A white enamel somewhat caustic.	Strontia 54 } Vauquelin. Sulp. acid 46 } Strontia 58 } Klaproth. Sulp. acid 42 }	Its powder phosphoresces on red hot iron-translucent to transparent—brittle. Its enamel digested in muriatic acid will give a rose-red colour to flame, but this is no distinctive character because all the carbonates of lime so treated will do the same.*
3.0 3.2	4 Fluor spar.	A greyish white glass.	Lime ... 67–75 } Klaproth. Fluoric acid 32–25 } Lime .... 72–14 } Berzelius. Fluoric acid 27–86 }	When its powder is digested in sulphuric acid and heated it gives out white fumes which corrode glass—phosphoresces on glowing charcoal, translucent to transparent,—brittle.
2.6 2.7	5 Calc spar	No; turns into a caustic lime.	Lime...... 57 } Vauquelin. Carbonic acid 43 }	Burns to a caustic lime,-effervesces entirely dissolves in the muriatic and nitric acids,-translucent to transparent, when the latter doubly refractive.
2.9	4 Fluor.	No; Do. becomes opaque & friable in the flame of a candle	Lime 58-5. Carb. acid 41-5. Vauquelin and Fourcroy. It still forms a subject for conjecture why its chemical composition being so near that of calcareous spar. Aragonite should possess a different crystalline form.	Arragonite with the exception of its specific gravity and hardness, which is somewhat greater, does not differ from calcareous spar in any other respect than as to form, particularly that of the primary crystal.
2.7	5 or 6 Calc spar or Selenite.	No; crackles and shrinks, and becomes hard enough to scratch glass.	Magnesia ....48 } Bucholz. Carb. acid. . 52 } Magnesia ....48 } Klaproth. Carb. acid....49 } Water. ... 3 }	Dissolves in sulphuric acid (sometimes with effervescence at others without) and by evaporation crystals of the sulphate of magnesia (epsom salts) are obtained. Adheres to the tongue—opaque.
2.1	6 and below Selenite or Talc.	No; loses transparency, and becomes friable and opaque.	Magnesia 70–00 } Bruce. Water. 30–00 } Magnesia 69–75 } Fyfe. Water. 30–25 }	Dissolves entirely in the mineral acids without effervescence and affords by evaporation crystals of epsom salts-semi-transparent to transparent,—thin lumina—flexible.
3.4	3 or 4 apatite or Fluor.	No.	Alumina......80–0 } Vauquelin. Protox of iron. 3–0 } Water. .....17–3 } Alumina.....76–06 } Children. Protox of iron 7–78 } Water.. .....4–70 }	Translucent on the edges.

*So indeed would any other mineral if it should happen to contain a little carbonate of lime, even the enamel of a sulphate of barytes containing lime would do the same. See Silliman's Journal, Vol. 18, p. 261.

Number.	NAME OF MINERAL, *form under which it usually occurs, and authority for decrepitation.*	COLOUR. In Mass.	COLOUR. Streak or Powder.	Lustre.	Structure
10	Calaite—Oriental Turquoise—Berzelius. In masses varying from the size of a nut to that of a goose's egg; reniform, botryoidal and mamillary.	Blue or Green.	Streak White.	Resinous.	Compact
11	Bronzite.—Diallage, Metalloide, Schiller Spar. Crackles a little in the matrass,—Berzelius, Griffin. Massive or imbeded.	Green, Brown, Grey.	Streak yellowish or greyish White.	Semi-metallic often like bronze and pearly.	Laminar Fibrous.
12	Hyperstene, do. Labrador Hornblende. Crackles in the matrass—Griffin. Massive or imbeded.	Greyish or Greenish Black.	Greenish Grey Streak.	Do. do. sometimes coppery.	Laminar.
13	Fullers' Earth,—Berzelius,—Griffin. Occurs massive.	Green, Grey, White.	Streak similar shining resinous.	Dull, Glimmering.	Compact earthy.
14	Precious Opal,—Cleaveland,—Phillips. Disseminated in nodules.	Milky, White RF pale orange TF	Streak White.	Vitreous sometimes Resinous.	Compact.
15	Gadolinite,—Griffin,—Cleaveland,—Mohs,—Bakewell. Massive and crystallized.	Velvet blk. Greenish or Brownish black.	Streak greenish Grey.	Vitreous inclining to resinous.	Compact.
16	Flint—Cleaveland.	Various shades of grey, yellow, black	Streak White.	Vitreous but feeble.	Compact rarely laminar.
17	Fluate of Soda and Allumine, Cryolite,—Berzelius says, that from Greenland, decrepitates in the matrass. Massive.	White, Brown, Red.	Do.	Vitreous and slightly pearly.	Perfectly laminar.
18	Alumstone—Griffin,—Massive and crystallized; the crystals are rhomboidal.	White, Red, rarely Grey.	Do.	Do.	Compact or fine-grained.
19	Marmolite,—Nuttall. Prismatic.	Pale Green and Grey.		Pearly inclining to metallic.	Laminar.
20	Somervillite,—Brooke. Pyramidal.	Pale, Dull, Yellow.		Dull.	
21	Mesetine Spar,—Breithaup.	Dark Greyish, Yellowish White.	Streak White.	Vitreous.	Laminar.

Sp. Gr.	Hardness	Fusibility by the blow-pipe on charcoal	Chemical Constituents.	Additional Remarks.
2·6 3·2	2 Felspar.	No; turns brown in R. F. and colours the flame green	Alumina,...... 73·0 Water, ... 18·0 Oxide of Copper 4·5 Oxide of Iron;.. 4·0 } John.	The acids have no action upon it. Feebly translucent on the edges to opaque—Fracture conchoidal—Not crystallized.
3·0 3·4	3 or 4 Apatite or Fluor.	No; assumes a lighter colour.	Silica,....... 0·60 Magnesia,.... 27·50 Oxide of Iron, 10·50 Water,...... 0·50 } Klaproth.	Translucent more or less.
3·3 3·4	2 or 3 Felspar or Apatite.	Greenish grey, opaque, globule.	Silica,.....54·25 | Magnesia,14·00 Alumina,.. 2·25 | Lime,....1·50 Oxide Iron.24·50 | Water, ..1 ·0 Klaproth.	Some mineralogists describe this mineral as infusible mistaking it probably for the foregoing—opaque or nearly so—brittle.
1·7 2·2	6 or below Selenite or Salt.	With difficulty a white blebby glass.	Silica,.....53·0 | Alum,.... 10·0 Water,....24·0 | Magnesia, 1·25 Lime, ... 0·5 | Mur.of Soda0 ·1 Oxide of iron 9·75—Klaproth.	If thrown into water it forms a paste, which is not plastic, *absorbs oil and fat*, perfectly sectile—unctuous—opaque or nearly so, but becomes semi transpt. in water; falls to pieces.
2·1	2 Felspar.	No; turns opaque white.	Silica,.... . 90 Water,....10 } Klaproth.	Highly translucent-hydrophanous and remarkable for the beautiful play of irised colours it exhibits by varying the incidence of light—brittle.
4·2	1 or 2 Quartz or Felspar.	No; except in very small splinters.	Ytria,......... 45·00 Protox of Iron, 11·43 Protox of Cerium, 17·92 Silica,........ 25·10 } Berzelius.	In nitric acid it loses its colour and is converted into a jelly—frequently magnetic—almost opaque.
2·6	1 & above Quartz or scratches Quartz.	No; turns white and opaque.	Silica,. .... 98·00 Lime,.......... 0· 5 Alumina, ... 0·25 Ox. of iron,...... 0·25 Water,..........1 ·0 } Klaproth.	Brittle when first taken from its bed in "upper chalk" of which it is characteristic—translucent on the edges or in thin portions—conchoidal fracture—fragments splintery and sharp.
2·9 3·0	5 or 6 Calc spar or selenite	Easy; even by the flame of a candle.	Alumina, 21· 0 } Klaproth 24·0 } Vauquelin Soda,.. 32· 0 } Klaproth 36 0 } Vauquelin Flu. acid, & Water.. 47· 0 } Klaproth 40·0 } Vauquelin	It dissolves like *ice* before the blowpipe whence its name, and subsequently becomes hard and slaggy—very hydrophanous—semi-transparent to translucent.
2·4 2·7	3 to 6 Apatite to Selenite.	No; emits a slight odor of sulphur.	Sulp. acid,.... 35 495 Alumina,..... 39·654 Potash,........ 10 021 Water and loss, 14·350 } Cordier.	After roasting it imparts to the palate the flavour of alum—translucent to transparent—brittle.
2·47	5 or 6 Calc spar or selenite	No; hardens and splits into laminæ.	Magnesia, 46·0 | Silica,..36·0 Lime,.... 2·0 | Water, . 15·0 Ox. of iron and Chrome... 0·5 } Nuttall	Resembles chlorite. It forms with nitric acid a thick partly gelatinous mass—brittle—occurs in serpentine.
	Below Garnet.	Grey, globule.	Not analysed.	
3·34 3·37	Fluor.	No ?	It contains probably Magnesia, Lime, Protox. of iron and Oxide of Manganese.	In muriatic and nitric acid a feeble effervescence takes place but it is entirely soluble.

Number.	NAME OF MINERAL, *form under which it usually occurs, and authority for decrepitation.*	COLOURS.		Lustre.	Structure	Sp. Gr.
		In Mass.	Streak or Powder.			
1	*Sulphuretted antimonial silver, Red silver. Cleaveland, Mohs, Phillips, Griffin, Bakewell.—Crystallized, dendritic, massive, micaceous.	Red, LeadGrey IronBlack	Always Red.	High sometimes Semi Metallic.	Laminar imperfect.	5·2 5·8
2	Argento Antimonial Sulphuret of Lead,—White silver.—Weissgaltegerty, Berzelius. Occurs massive and disseminated.	LeadGrey inclining to black sometimes light coloured.	Streak Similar.	Metallic.	Fibrous.	5·3 5.6
3	*Sulphate of Lead,—Griffin, Mohs, Phillips, Jameson. Occurs crystallized commonly in rhombic prisms with dihedral terminations; also in octohedrons.	White, Yellowish Greyish, Greenish.	Streak White.	N. M. but adamantine passing into vitreous or resinous.	Perfectly Laminar.	6·2 6·3
4	*Carbonate of Lead.—All authorities. Occurs in tabular crystals, in six sided prisms variously terminated and in macled crystals of different forms.	White, Grey, Brown, Black.	Streak White.	N.M. but adamantine passing into resinous.	Laminar more or less distinctly.	5·7 7·2
5	*Sulphate of Lead.—Galena. (violently).—Cleaveland, Griffin, Phillips, Jameson. Crystallized in cubes or octohedrons; also amorphous.	Lead Grey.	Streak Similar.	Metallic.	Laminar granular compact fibrous.	7·0 7·6
6	*Molybdate of Lead, (briskly). All authorities. Crystallized in flattish acute octohedrons; rarely massive.	Yellow, Yellowish Grey, Greenish and Greyish White.	Streak White.	Non Metallic, Waxy.	Perfectly Laminar.	5·1 6·8
7	*Chromate of Lead,—Berzelius, Griffin, Mohs, Phillips, Jameson. Crystallized and massive.	Red and Yellow.	Streak Orange Yellow.	Non Metallic, adamantine.	Laminar.	5·7 6·1
8	*Aluminous oxide of Lead. Plomb-gomme, (violently.)—Cleveland, Mohs, Phillips, Berzelius. In mamillary small masses.	Yellowish Reddish, Brown.	Yellow?	Non Metallic.	Laminar concentrically.	Heavy.
9	*Triple Sulphate of Lead—Bournonite,—Griffin, Phillips, Bakewell, crystallized in rectangular prisms variously modified.	SteelGrey Lead Grey, Iron Grey.	Streak Similar.	Metallic.	Perfectly Laminar.	5·5 5·8

Fusibility by the blow-pipe on charcoal.	Hardness	CHEMICAL CONSTITUENTS.	ADDITIONAL CHARACTERS.
Melts into a bead of silver exhaling sulphureous, and antimonial vapours.	6 Selenite.	Silver,..........58·949; Antimony,.......22·846; Sulphur,.........16·609; Earthy substances, 0·299 } Bonsdorf	Frequently burns with a bluish flame—soluble in dilute nitric acid. Opaque to semi-transparent—sectile.
Melts into a scoria of impure silver exhaling copious white vapours of a sulphureous odor	6 Selenite.	Silver 20·40, Lead 48·06, Antimony 7·83, Iron 2·25, Sulphur 12·25, Alum 7·0, Silex 0·25; again a dark coloured variety, Lead 41·0, Ant 21·5, Sil. 9·25, Sulp. 22·0, Iron 1·75, Al. & Silex 1·75.—Klaproth.	Soluble in dilute nitric acid.—brittle—sectile.
Easy into a white slag.	5 or 6 Calc spar or Selenite.	Ox. of Lead .... 72·47; Sulp. acid.... ....26·09; Water,................0·12; Hydrous oxide of Iron.....0·09; Oxide of Manganese,....0·06; Silica, &c............0·51 } Stromeyer.	In O. F. on charcoal fuses into a transparent glass which becomes opaque on cooling—in R. F. effervesces and a particle of lead is obtained. --brittle,—translucent to transparent, usually in crystals.
Fuses into a bead of lead but previously becomes yellow or red.	4 to 6 Fluor spar to Selenite.	Oxide of Lead, 82·0; Carbonic Acid, 16·0; Water, ... 2·0 } Klaproth.	Soluble with effervescence in the nitric and muriatic acids—translucent to transparent when the latter doubly refractive in a high degree—brittle—powder phosphosescent on ignited charcoal.
Fuses easily into a bead of lead at the same time exhaling the odor of sulphur.	5 or 6 Calc spar or Selenite.	Lead,.....85·13; Sulphur,..13·02; Iron,...... 0·50 } Thomsom.	Brittle in the laminar varieties readily breaking into little cubes or cuboidal fragments. Partly soluble in nitric acid and leaves a white residue.
Into a dark greyish mass which sinks into the charcoal leaving particles of reduced lead.	5 or 6 Calc spar or Selenite.	Ox. of Lead,.64·42..58·40; Molybdic acid34·25..38·00; Ox. of Iron..00·00.. 2·08; Silica,......00·00.. 0·28 } Klaproth and Hatchett.	Soluble in hot nitric acid without effervescence.—Translucent on the edges to semi-transparent,—brittle.
Blackens and fuses into a dark slag containing globules of lead.	5 or 6 Calc spar or Selenite.	Oxide of Lead,....68·00; Chromic Acid,....32·00 } Peaff.	Communicates in the course of a few hours a green tinge to muriatic acid.—To borax it also gives a green tinge—translucent to transparent sectile—soluble in nitric acid with effervescence.
No: becomes white and opaque.	Fluor spar or Calc spar.	Oxide of Lead,........40·14; Alumina,... ....37·00; Water,...............18·80; Sulphurous acid,........ 0·20; Lime & the oxide of Iron and manganese,...... 1·80; Silica,................0·60 } Berzelius.	Melts with borax into a colourless transparent glass; the presence of nitre is necessary to reduce the lead—translucent—resembles hyalite or mullers glass.
Melts with sulphureous vapours into a crust of lead containing copper	Calcareous spar or Selenite.	Antimony,....28·50....19·75; Lead,..... ..39·00....42·50; Copper,......13·50....11·75; Iron,......... 1·00.... 5·00; Sulphur,......16.00. ..18·00	Easily soluble in heated nitric acid—very brittle—soils—sectile—bluish phosphorescence on ignited charcoal.

Number.	NAME OF MINERAL, *form under which it usually occurs, and authority for decrepitation.*	COLOUR. In Mass.	COLOUR. Streak or Powder.	Lustre.	Structure	Sp.
10	*Phospate of Lead, (usually)—Phillips, Griffin, Jameson. Crystallized in six sided prisms generally modified in the edges; also botroyidal reniform and massive.	Green, Yellow, Grey, Brown.	Streak White, sometimes pale Brown, powder greyish White.	Non Metallic, Resinous.	Laminar.	6·2 7·2
11	*Oxide of Tin,—Tin Stone.—Cleaveland, Griffin, Phillips, Jameson.—Crystallized in quadrangular prisms terminated by four sided pyramids, rarely massive.	White, Grey, Yellow, Red, Brown, Black.	Streak White, powder Greenish White,	Non Metallic, Adamantine.	Laminar?	6·3 7·0
12	*Sulphuret of Zinc,—Blende,--Berzelius, Cleaveland, Griffin, Phillips, Jameson.—Crystallized and amorphous or massive; the forms of its crystals are very numerous,—tetrahedral, rhomboidal, octohedral, dodecahedral.	Green, Red, Yellow, Brown, Black, Hone bright.	Streak White, powdow Grey.	N. M. Splendent Adamantine, vitreous, resinous, S. M.	Laminar.	3·7 4·2
13	Siliceous oxide of Zinc.—Electric Calamine,—Berzelius, Griffin, Phillips, Mohs, (slightly.) Occurs crystallized stalactic mamillated, botryoidal and massive, the forms of its crystals are various among the common are a six sided prism, a four sided table, the octohedron is also met with.	White, Blue, Green, Yellow, Brown.	Streak White.	Non Metallic, Vitreous inclining to pearly.	Laminar. Compact.	3·3 3·5
14	Carbonate of Manganese.—Berzelius, Griffin, Mohs, (violently.)—Occurs massive.	Rose Red, inclining to Brown.	Streak White.	Non Metallic, Vitreous inclining to pearly.	Laminar.	2·8 3·5
15	Oxide of Antimony.—White Antimony,—Cleaveland, (sometimes.) Crystallized in tabular and acicular crystals, in diverging groups; more rarely massive.	White, Red, Grey.	Streak White.	Non Metallic, Admantine pearly.	Laminar.	5·0 5·6
16	*Carbonate of Iron.—Sparry iron ore.—Berzelius, Griffin,—some species violently. Crystallized in obtuse and acute rhomboids, iu six sided prisms, in octohedrons, in lenticular crystals, also massive.	White, Yellow, Brown, Black.	Streak White.	Non Metallic, Vitreous inclining to pearly.	Laminar compact fibrous.	3·6 4·0

ardness	Fusibility by the Blow-pipe on Charcoal.	Chemical Constituents.	Additional Characters.
Fluor spar r Calc spar.	Into a dark globule of a poly hedral form.	Ox. of Lead,..78·58..78·40 / Phosp. acid,..19·73..18·37 / Muriatic acid,. 1·65.. 1·70 / Ox. of Iron,... 0·00.. 0·10 } Klaproth	Dissolves in acids without effervescence. Reduced to the metallic state with borax—translucent on the edges to semi transparent—brittle.
artz or elspar.	Nearly infusible.	Klaproth. Desatils. / Ox. of Tin, 99 00.......95·00 / Ox. of Iron, 0·25...... 5·00 / Silica,.... 0·75...... 0·00	Insoluble in acids—usually crystallized—semi transparent to opaque and transparent.
patite o Calc spar.	No ; exhales a slight odor of sulphur but does not fuse even with borax.	Thompson. Gueniveau. / Zinc,....59 09... ..62 00 / Iron, ...12·05.... .. 1·50 / Sulphur,..23·36......34 00	Its powder in nitric acid exhales the odor of sulphuretted hydrogen and dissolves—translucent to transparent—brittle.
elspar or patite.	No ; loses transparency and whitens emiting a green phosphorescent light.	Berthier. Berzelius. / Ox. of Zinc,...66·00......66·37 / Silica,. .....25·00 .. ..26·23 / Water,...... 9·00....... 7·40	Forms with borax a globule clear and glassy which becomes opaque in cooling. Its powder gelatinized in heated sulphuric or muriatic acid—phosphorescent by friction—brittle—translucent to transparent.
Fluor spar to lenite.	No ; blackens.	Ox. of Manganese, 54 60 / Carbonic acid,.... 33·75 / Ox. of Iron,...... 1·87 / Silica,. .... 4·37 / Lime,............ 2·50 } DuMenil.	Effervesces with the mineral acids and communicates to borax an amethystine tinge—brittle—translucent more or less.
lc spar to lenite.	Entirely volatalized, leaving a white coating.	Ox. of Antimony, 86·00 / Do. Iron,.... 3 30 / Silica,......... 8·00 } Vauquelin	It melts in the flame of a candle, sectile brittle—translucent to semitransparent soluble in nitro-muriatic acid.
lc spar to patite.	No ; blackens and becomes magnetic.	Protox of Iron, 63·75. 57·50 / Carbonic aciid, 34 00..36·00 / Ox. of Mangan. 0 75.. 3·30 / Lime,...... . 0·00.. 1·25 / Magensia,...... 0·52.. ·000 } Klaproth.	Dissolves slowly in nitric acid with slight effervescence—brittle more or less translucent, suffers spontaneous decomposition its surface bleachening in the atmosphere—colours borax green.

Number.	NAME OF MINERAL, *form under which it usually occurs, and authority for decrepitation.*	COLOUR. In Mass.	COLOUR. Streak or Powder.	Lustre.	Structure	Sp. (
17	Phosphate of Iron. Vivianite, Mohs. Crystallized in right oblique angled prisms often small aggregated and divergent, also earthy.	Blue, Green, Grey.	Streak Bluish White, changing to indigo blue, dry powder, liver Brown.	Non Metallic, pearly almost Metallic.	Laminar earthy powdery.	2·6 3·0
18	*Tungstate of Iron—Ferruginous oxide of Tungsten.—Wolfram,—all authorities. In prismatic or tabular crystals also in octohedrons and massive.	Dark Greyish or Brownish Black.	Streak dark Reddish Brown.	Non Metallic, adamantine or imperfect Metallic.	Laminar	6·4 7·4
19	Tungstate of Lime —Calcareous oxide of Tungsten,—Griffin, Phillips, Jameson,—"crackles." In octohedral crystals, also amorphous.	White, Yellowish, Grey, Reddish, Brown.	Streak White.	Non Metallic, Vitreous inclining to adamantine.	Laminar. or often imperfectly.	5·5 6·1
20	*Pyritous Copper,—Cleaveland. Copper Pyrites,—Phillips, Cleaveland, Jameson. In tetrahedral crystals, also stalactitic, botryoidal, mamillated and amorphous.	Brass Yellow.	Streak Greenish Black, a little Shining.	Metallic.	Laminar granular.	4·2 4·3
21	Grey Copper,—Cleaveland. Fahlerz,—Philips, Cleaveland, Griffin, Jameson. In tetrahedral crystals; also massive and disseminated.	Steelgrey Iron Black.	Streak similar sometimes Brownish.	Do.	?	4·4 5·4
22	*Green Carbonate of Copper, Green Malachite,—Cleaveland, Griffin, Mohs, Jameson. In prismatic macled crystals but usually massive botryoidal, reniform stalactitic and cellular.	Green.	Streak similar and paler.	Non Metallic, shining silky or pearly.	Compact, fibrous passing into each other.	3·5 4·0

Hardness	Fusibility by the Blow-pipe on Charcoal.	Chemical Constituents.	Additional Remarks.
Calc spar to Talc.	Becomes yellowish and melts into a magnetic globule of metallic lustre with intumescence.	Klaproth. Bogel. Protox of Iron, .47·50 41·00 Phos. acid,....32·00 26·40 Water,........20·00 31·00 Friable. Crystallized	Soluble in dilute sulphuric and nitric acids—translucent to transparent. In thin laminar perfectly flexible—sectile.
Felspar or Apatite.	Melts in a strong heat into a scoriaceous globule of metallic lustre which does not affect the needle.	Tungstic acid,....... 78·77 Protox of Manganese,.. 6·22 Do of Iron,.......18·32 Silica,............... 1·25 } Berzelius	In the nitric and muriatic acids its powder becomes yellow—opaque.
Fluor spar or Calc spar.	No ; becomes opaque.	Tungstic acid, 80·42 } or Oxide of Scheelium. Lime,...... 19·40 Berzelius.	Turns yellow in nitric acid with borax forms a colourless glass translucent to semi transparent—brittle.
Do.	Melts into a globule which after much roasting becomes magnetic.	Copper,. ......30·00 Iron,...........32·20 Sulphur,........35·16 Earthy matter.... 0·50 Lead arsenic & loss2·14 } R. Phillips	Before fusion it becomes black which changes to red upon cooling. Partly dissolves in dilute nitric acid to which it communicates a green colour.
Apatite to Fluor.	Melts into a greyish metallic globule.	In this species, Klaproth found Copper from 48·0 to 25 5, Iron 27 to 3·25, Sulphur 28 to 10, Arsenic 24 to 0, Silver 14·77 to 0, Antimony 1·5 to 0 besides a little zinc and mercury in some of the specimens.	Rather brittle.
Fluor to Calc spar	Nearly infusible blackens.	Perox of Copper,..72·2 Carbonic acid,....18·5 Water,.......... 9 3 } R. Phillips	Yields to borax a green colour and a bead of copper, soluble without residue and with effervescence in nitric acid to which it gives a green colour—translucent more or less—brittle—it gives a green tinge to the flame of burning bodies.

Number.	NAME OF MINERAL, *form under which it usually occurs, and authority for decrepitation.*	COLOURS. In Mass.	Streak or Powder.	Lustre.	Structure	Sp. Gr.
23	Dioptase—Emerald Copper—Cleaveland, Mohs. This mineral is rare and has not been observed under any other form than that of six sided prisms terminated by a three sided pyramid or elongated rhombic dodecahedron.	Green.	Streak Similar.	Non Metallic, Vitreous inclining to Resinous.	Laminar.	3·2 3·3
24	*Arseniate of Copper, (foliated) Copper Mica,—Cleaveland; Griffin, Mohs, Phillips, Jameson. In six sided tabular crystals of which the lateral planes are trapeziums.	Green.	Streak Similar.	Non Metallic, often Semi Metallic.	Laminar.	2·5
25	Tennantite, (slight)—Mohs, Phillips, Griffin, Jameson. In crystals having the form of the rhombic dodecahedron, the cube and octohedron; rarely massive.	Blackish, LeadGrey TinWhite externally.	Streak Reddish, Grey, Powder do.	Metallic.	Do. imperfectly.	4·3 4·4
26	*Green Oxide of Uranium—Uranite,-Cleaveland, Griffin, Phillips, Bakewell, Jameson. Crystallized in quadrangular prisms, in four, six and eight sided tables, rarely in acute and obtuse octohedrons.	Yellow, Brown, Green.	Streak Similar.	Non Metallic, Shining.	Laminar.	3·1 3·3
27	Yttrious Oxide of Columbium,—Phillips, Mohs, Jameson. In rhombic prisms and in angular pieces sometimes as large as a hazle nut.	Green, Black, Brown.	Streak and powder Grey.	Somewhat Metallic occasionally.	Compact.	5·1 5·8
28	Arsenical Bismuth,—Mohs. In globular forms.	Dark hair Brown.		Non Metallic, resinous.		Heavy

Hardness	Fusibility by the blow-pipe on charcoal.	CHEMICAL CONSTITUENTS.	ADDITIONAL CHARACTERS.
Apatite or Fluor spar.	No; Blackens in Outward Flame, reddens in Reducing Flame.	Lowitz. Vauquelin. Ox. of Copper,.. .55·00....25·57 Carbonate of Lime,. 0·00....42·85 Silver,............33·00....28·57 Water, ...12·00.... 0·00	Gives a green colour to the flame of the blow-pipe, and to borax, in the latter of which it readily dissolves. Soluble without effervescence in muriatic acid,—translucent to transparent.
Calc spar or Selenite.	Melts first into a black spongy scoria and afterwards into a black globule, during which process it exhales the odor of arsenic	Vauquelin. Chenevix. Oxide of Copper,..39·00..58·00 Arsenic acid,......43·00..21·00 Water,.. ....17·00..21·00	Dissolves in nitric acid, without effervescence affording a greenish solution,—translucent to transparent, sectile.
Felspar or Apatite.	Burning with a blue flame and emitting copious arsenic vapours, it melts into a black magnetic scoria.	Copper,....45·32 Iron,....... 9·26 Sulphur,....28.74 Arsenic,....11·84 Silica,.... . 5·00 } R. Phillips.	Brittle.
Calc spar.	No; acquires a brassy colour; gives a yellowish green colour to borax.	Oxide of Uranium,..... 60·00 Oxide of Copper,...... 9·00 Phos. acid, ...15·30 Water,... .. ..13·80 Silex,..... .... 0· 5 Loss,....... .... 1· 4	Soluble without effervescence in nitric acid, (Phillips says with) affording a solution of a yellow colour —Translucent on the edges to transparent,—sectile, brittle its laminæ not flexible like mica which it resembles.
Felspar.	It melts but not easily into a greenish yellow slag. Phillips.	Black. Yellow. Ox. of Tantalium, 57.00 59.50 60. 1 Yttria,........ 20·25 24·90 29· 8 Lime,.. ..... 6·25 3·29 0· 5 Ox. of Uranium,. 0 50 8·23 6· 6 Tun.acid with tin,8·25pure1·25 1·04 Ox of Iron,..... 3·50 2·72 1·15 Berzelius.	Griffin, Cleaveland and Mohs, consider this mineral infusible, but describe it as acquiring a lighter colour before the blow-pipe.
Calc spar.	Emitting the odor of arsenic, it melts into a glass	Nothing is known of the chemical analysis of this Mineral; and we are even deficient in information as to its physical characters??	

Number.	NAME OF MINERAL, *form under which it usually occurs, and authority for decrepitation.*	COLOURS.		Lustre.	Structure	Sp. G
		In Mass.	Streak or Powder.			
1	•Glanberite, Brithyne Salt,—Griffin, Mohs, Phillips. All authorities—Crystallized in oblique flat rhomboidal prisms; also massive.	Yellowish or Greenish White.	Streak White.	Vitreous.	Laminar.	2·7 2·8
2	•Muriate of Soda, common Salt†. All authorities. Occurs massive and crystallized in the form of the cube and octohedron.	White, Yellow, Red, Ash Grey	Streak White.	Do.	Do. obscurely.	2·2 2·5

Combustible Materials which

1	Dysodile "a crackling noise,"—Griffin, Phillips. Occurs massive.	Yellow, Grey, Greenish.		Glimmering and Resinous.	Lamellar Compact.	1·1 1·5
2	Candle Coal, Cannel Coal, Parrot Coal,—Griffin, Cleaveland, Phillips. Occurs massive.	Greyish Black.			Slaty in the large, compact in the small.	1·2 1·3

†See Silliman's Journal, Vol. 19, p. 198, for a curious instance of decrepitation.

N. B.—The Nitrate of Potash, (saltpetre,) detonates on charcoal with heat, but does not decrepitate; the phenomena cannot be mistaken

Hardness	Fusibility by the Blow-pipe on Charcoal.	Chemical Constituents.	Additional Characters.
Calc spar or Selenite.	Melts into a white enamel.	Sulphate of Lime,49·0 / Do. of Soda,.51·0 } Brongniart.	If immersed in water it loses its transparency and is partly dissolved, the same even occurs in a moist atmosphere—translucent to transparent—brittle—taste saline and astringent.
Selenite.	Melts disengages fumes and is absorbed.	Muriate of Soda,...983·25 / Sulphate of Lime,... 6·50 / Muriate of Mag.... 0·19 / Muriate of Lime,... 0·06 / Undissolved Matter,. 10·00 } Henry.	Deliquesces in the atmosphere and entirely dissolves in water—taste well known.

decrepitate with Heat.

Selenite ?	No; burns with a considerable flame, and smoke leaving a residue of nearly half its weight.	Not analyzed ?	While burning it exhales a fœtor insupportably disagreeable—macerated in water it becomes translucent and flexible—brittle—exhales an argillaceous odor when moistened.
Calc spar	No; burns with a bright flame.	Carbon.... ....64·7 / Hydrogen.......21·6 / Nitrogen........13·7 } Thompson.	Its odor while burning is not unpleasant—brittle.

*** The preceding Tables were intended to be the first of a Series, embracing the leading characteristics of Minerals, arranged in a similar manner ;—the value of such a Guide to the Student of Mineralogy has already been touched upon. Unfortunately, however, CAPTAIN BADDELEY was called from Quebec, before he could carry his intentions fully into execution—and the increasing claims of duty, consequent on the distracted state of the Province, during some years, and his subsequent departure, for India, put it out of his power to resume his work. The SOCIETY have, however, deemed it right to give these Tables a place in their TRANSACTIONS, both from their intrinsic value, as far as they go, and as the latest Work of one, who, while in the Province, laboured long and zealously in the field of Canadian Geology and Mineralogy, as the preceding Volumes of their " Transactions" amply testify.