VI.—*Preliminary Notice of Substances which may prove to be New Minerals.*

By Professor Heddle.

Paper First.

At Mr. Collins's request I submit to the members of the Mineralogical Society the following preliminary notice of substances which I have collected during my somewhat extensive wanderings about Scotland.

In the case of several of the substances described, it will be seen that I do not by any means bring them forward as being without doubt *new minerals*; of that, I have not satisfied myself, and still less can I hope to satisfy others, until specimens more fitted for absolute determination are obtained, and that in a quantity larger than what I have as yet had to operate upon.

The noting and describing these substances now, will enable others to lend their aid in the work.

It may be convenient to begin with such as occur in the northern counties, and in the present paper I confine myself to those found in the shires of Sutherland and Ross.

The names are of course to be held as being provisional.

Bhreckite (Vreckite.)

On the western slopes of the hill of Ben Bhreck, near Tongue in Sutherland, there lie, imbedded in till, two boulders of syenitic granite, which probably were derived from the neighbouring mountain of Ben Loyal, the rock of which is identical with that of the boulders.

One of these boulders was crossed by a granitic vein; this vein yielded in itself as many minerals as are frequently to be found in a whole county.

Being an exfiltration-vein the ingredients had crystallised in regular sequence from the sides, leaving here and there very small vacuous spaces in the centre; and the substance, to which I have attached the name of the hill, was one of the last, if not the very last to be deposited in these cavities.

It occurred in such very small quantity that nearly the whole had to be employed for the analysis.

The substance was deposited upon the surface of crystals of brown quartz, and its immediate associates were specular-iron and a calcareous strontianite.

In appearance it resembled a very fine-grained dense aphrosiderite; but its colour, being a light apple-green, was nearer to that of celadonite.

It was minutely granular or scaly; it was soft and friable.

What was analysed was to all appearance uniform and pure.

The analysis, executed on ·484 grammes, yielded,—

Silica	34·917
Alumina	7·158
Ferric Oxide	12·715
Ferrous Oxide	2·105
Manganous Oxide	·414
Lime	16·082
Magnesia	8·264
Water	17·768
	99·421

Of the above water 1·033 was lost at 212°.

There were traces of alkalies, but there was not enough material to determine them upon, separate quantities having to be used for the determination of the ferrous oxide, and of the water.

The mineral was freely soluble in chlorhydric acid.

By this feature it may be distinguished from all the so-called "chlorites," with the exception of glauconite; it likewise serves to distinguish it from celadonite.

From Delessite and the scaly varieties of saponite (which are soluble in chlorhydric acid), it differs in virtue of its large content of silica—a feature of its constitution which also serves to distinguish it from glauconite and the chlorites alike.

The calculation of its atomic constitution is as follows:

		Atoms.			
Silica	34·92	1·164		8	36·28
Alumina	7·16	·14	·3	2	7·78
Ferric Oxide	12·71	·16			12·1
Lime	16·08	·574	1·04	7	17·69
Magnesia	8·26	·413			8·46
Water	17·77	1·974		13	17·69

Atoms.

$$\dot{R}\ 7,\quad \ddot{R}_2\ 2,\quad \ddot{S}i\ 8,\quad \dot{H}_2\ 13$$

which give the percentages of the last column.

This is the only chlorite-like mineral which contains lime in quantity; if established as a species, it will stand next to chonicrite, and in composition it is not far removed from the metaxoite of Asp.

Xantholite.

Chondrodite is stated in several works to occur "near Loch Ness."

Loch Ness, being twenty-four miles in length, must certainly have fifty miles of shore, so that "near" is not very precise. The sentence is, however, not more deficient in precision than are many others in mineralogical directories.

It is true that the adjunct "in limestone" would appear to convey in the present case all the necessary information,—limestone being of very exceptional occurrence in the district in question, and only being found in quantity at one spot,—the Milltown of Glen Urquhart.

Neither Professor Maskelyne nor the writer could satisfy themselves that the one known specimen of "chondrodite from Loch Ness"—that in the British Museum—was that mineral. To the writer it appeared to be yellow serpentine; and, had it not been for the concomitant presence of arsenical-iron, he would without hesitation have said that the limestone matrix was that of Glen Elg.

In vain has he on several occasions sought long and diligently for chondrodite, both at Loch Ness, and in other limestone localities, but last summer when he in company with Dr. Aitken found the substance to which the above name is given, he believed that it had at last been found.

The mineral occurs a little to the east of the Free Church of Milltown, in a singular rock composed of large crystals of smaragditic edenite and a matted mass of interwoven plates of a highly calcareous Biotite, which much resembles talc.

Accessory minerals are fibrous Wollastonite, hydrous anthophyllite, currant-red garnet with minute imbedded zircons, and the mineral in question.

This occurs in rough crystals of the size of beans, so wrapped up in the Biotite as to appear to be nodular. When broken, the colour is seen to be intermediate between that of rosin and of cinnamonstone; when the mineral is bruised it has still more of a yellow tint. It is fissured throughout, but there is one very evident cleavage; the fracture is conchoidal, and the lustre of the fracture vitreous, but that of the cleavage

face is slightly pearly. The hardness is greater than that of the knife; but, from a minute amount of the Biotite lying in the fractures, it seems to be cut with the knife. It is reduced to powder with an amount of ease which, when its extreme hardness is considered, is singular.

No sound portion large enough for the determination of its specific gravity could be found.

The mineral was picked with extreme care, but the portion analysed might still have contained an inseparable trace of the Biotite.

Two analyses were made of the same quantity picked,—the first on 1·25, the second on 1· gramme.

There was obtained—

Silica	27·04	27·2
Alumina	45·858	45·965
Ferric Oxide	8·671	8·607
Ferrous Oxide	6·904	6·91
Manganous Oxide	·56	·5
Lime	3·808	3·528
Magnesia	4·32	4·5
Fluorine	·087	n.d.
Water	2·88	2·874
	100·128	100·084

It lost at 212° 0·64 of the water.

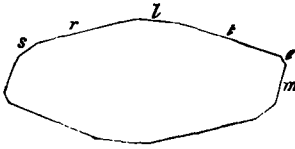
The only decided difference between the above and *grenatite* lies in the presence of lime and magnesia, and seeing that it is only lately that the presence of *both* oxides of iron has been noticed in grenatite, and that the formula of that mineral is hence still doubtful, it cannot be said that *this* might not, so far as composition is concerned, fall under the same formula.

What I have been able to make out of its crystalline form, however, points to its being distinct.

I have said that the nodular masses are rough crystals; such as I have been able to separate from the investing Biotite, seemed to indicate an oblique form.

The larger crystals are sometimes penetrated by smaller ones, which I at first took for zoizite—a mineral which occurs within a mile of the locality. Several of these penetrating crystals, however, having the same colour as the larger masses, I was inclined to think them pseudomorphs, until upon breaking them out I found that they had a perfect cleavage, with well-defined conchoidal fractures with a vitreous lustre.

These crystals, which occur of a resinous and also of a dark-green colour, are very minute. Examined by the microscope they have in section the form drawn. This, if not that of epidote, is very close to it; *l* sometimes instead of being a plane is a series of oscillations between *t* and *r*. The letters are appended conjecturally merely to show the position of *m*, which has a very perfect cleavage with a pearly lustre. There also appears to be a cleavage parallel to *l*, and the general lustre of these minute crystals is resinous.



On account of their want of size, I have not been able either to try the hardness of these crystals, or to attach them to the goniometer; their being the same substance as that analysed rests therefore only on extreme probability.

If they be the same, the material of *grenatite* is dimorphous, and calls for a second characterising name; the *colour* being here the most characteristic distinction, I have named the substance therefrom.

Dr. Aitken has lately found this substance of a somewhat redder tint at a locality about half a mile from that at which we first found it; this is in the cliffs of a small stream, north of the village of Milltown. Here the mineral was only in nodules, these were much fissured; the cracks were filled with a soft white steatite-like substance; this remained with a reticulated structure when the fissured mineral was dislodged from its grasp. A little Wollastonite was also here present.

ABRIACHANITE.

This substance, which I name from one of the localities in which it occurs, was forwarded to me for examination by Mr. John Horne, of H.M. Geological Survey. The portion sent was, I understand, found by the members of the Inverness Field Club, during one of their excursions.

As Mr. Horne was not able to put in my hands a sufficiency of material for a complete examination, he referred me to our fellow-member, Dr. Thomas Aitken.

Dr. Aitken sent me a further supply, but inasmuch as from the nature of the specimens as ordinarily collected, they were not fitted for analysis, I found it necessary to visit several of the localities, under Dr. Aitken's guidance; I there collected the varieties of the mineral with my own hands, and was thus enabled to obtain it in as great a state of purity as was possible.

Dr. Aitken having undertaken to supply the history of the mineral as regards its localities I need say little on that head.

To myself the modes of its occurrence appear so unusual and inexplicable, when considered as a whole,—that a few words on the geology of the district are desiderated.

So far as I know it is confined to a geographical limit of about six miles square, this square lying to the west of the town of Inverness, at a distance of about six or seven miles.

The chief rock of this district is a gneiss, which has been assigned to Silurian age.

It is a rock altogether ill-defined as a gneiss, is very argillaceous, and one which for a north-country rock has suffered but little metamorphism.

Overlying this gneiss, in about the centre of the district in which the mineral is found, there occurs a bossy outlier of the Old Red Sandstone conglomerate. Outwardly, it rises in craggy knolls; inwardly, it consists of much-rounded and marvellously diversified nodules of rocks, which had been markedly more highly metamorphosed than the underlying gneiss.

A few miles westward of the flanks of this mass of conglomerate there occurs a very circumscribed hill of red granite of a fine grain; this granite is somewhat hornblendic in composition, it is different from any other granite which I have seen in Scotland.

Between the granitic hill and that part of the gneiss which is overlaid by the conglomerate, the gneiss is considerably brecciated, and it is occasionally riddled by granite veins, these being however of a nature totally dissimilar to the red granite of the western hill.

Where the gneiss approaches the conglomerate the breccia is quite loose, hardly coherent in its parts, being quite open in its structure, and undergoing rapid ærial decomposition.

The arrangement of its parts does not in any way convey the impression that it is a fundamental breccia of the Old Red formation.

In the northern portion of the space indicated, there are bands of a poor limestone, with interbedded Steatite and Saponite.

It may be almost said that the gneiss, the rotting breccia, the granite veins, and the vein-stone of the lime, are alike saturated and pervaded with the mineral described; this, from its colour, has for a year of speculation as to its nature, been called "the blue mineral."

The specimens furnished me by Mr. Horne were of two sorts.

The first consisted of shattery and sharp-angled fragments of the dull brown and muddy looking gneiss, on the surfaces of and filling the many rents of which there were thin films of a pale to a deep blue coating, which had a somewhat glossy lustre.

The second consisted of putty-like lumps of a blue clay, which showed the impression of the fingers which had lifted it while soft; this clay contained imbedded fragments of lycopodia and mosses, with patches of a red-coloured substance.

The finer and purer bits of the first variety showed under a magnifier a fine fibrous structure, the fibres of which were transverse to the thickness of the veins,—they thus somewhat resemble crocidolite: the second somewhat resembled the earthy variety of Vivianite, though the structure was not loose enough or granular enough to make the resemblance complete.

The first of the localities to which I (in company with Mr. Horne) was conducted by Dr. Aitkin, was a road cutting in process of construction near Dochfour; this was being carried through the loose breccia. Both of the above varieties were to be seen here in abundance; and it was sufficiently evident that the second was merely an enlarged development of the first, in a less pure form.

Every rent—and the rock was pervaded with innumerable rents—was plugged with the mineral, from seams more delicate than tissue paper to vein-structure of over an inch in width.

Out of the larger veins the pulpy clay could be dug with the blade of a knife; and it was held in suspension as a blue cream in the ditches at the foot of the cutting.

The appearance and mode of occurrence were such as to induce a confident assertion that it was merely kaolin stained of a peculiar tint.

The breaking into the rock to a depth of little more than a foot, however enabled us to get rid of surface moisture, and sufficed to show the fallacy of the above opinion, for the mineral was then seen to fill the vein, not as a kaolinic powder, but as a solid, though much fissured schistose stone.

Fragments of this dry solid stone when placed suddenly in water, fell to pieces like bole, swelled up considerably, rapidly tinged the water blue, could almost immediately be worked up by the fingers into a slimy clay, and from which there could be separated a few unaltered fragments, both of quartz and of a red and gritty powder.

A sufficiency of the substance in its *three* varieties was here collected.

So far from being inexplicable, there could not be anything more normal than the occurrence, in circumstances such as the above, of any mineral which was manifestly a product of decomposition.

There is to me at least something altogether inexplicable in the mode of occurrence of such a substance, at the second of the localities to which we were guided by Dr. Aitken.

This was the deep water-cut bed of the torrent called Dochfour Burn.

The smooth water-worn floor of this cañon-like gorge has been cut down to a depth of some 40 feet at its embouchure, and to a much greater depth a short way up its course. The gneiss of its bed has here suffered from no apparent change, for the rock is firm and unshattered, and the deep trench has exposed it, and is ever re-exposing it, so that only recent change can possibly affect it.

The gneiss itself shows here but little trace of the mineral; but in granitic veins which ramify throughout it in the very bed of the stream, and on the lip of a cascade, the mineral occurs in veins which are not the fillings up of opened shatterings, but which are firmly coherent, as are the other parts of the granite.

These granitic veins were broken into until our tools gave way. They were everywhere perfectly fresh and unchanged, the felspar bright and lustrous, and firmly coherent to the quartz: yet there, break it in what direction we pleased, was the blue mineral, occurring in veins from the thickness of an eighth of an inch to the thinnest of films.

The third locality at which Dr. Aitken and I observed the mineral was at the limestone quarry of Reelig. Here it filled thin fissures of the gneiss as at the first locality, and was also seen in a coarse crumbling granitic belt of the same rock.

In describing the mineral itself we have to note it in its three appearances.

First, as it occurs in thin veins with a transversely fibrous structure.

The material of these veins when they are exposed by the removal of one part of the rock which had enclosed them, is frequently seen to be in a singularly shattered condition, different portions of the little vein lying apart, and sometimes being adherent to the rock in an evidently false position. The fibres are somewhat paler in colour than is the surface formed by their terminations,—they have a high silky lustre. The colour is a pale blue to nearly white. They are easily crushed between the fingers.

The schistose variety was very splintery, the cleavages or rents forming the splinters lay somewhat parallel to the sides of the vein which contained them. This variety was harder than the last and had a specific gravity of 3·326.

The last variety,—the "clay,"—was formed by the saturation of that just mentioned, by water. It was very soft, smeared the fingers and clothes on contact, and when stirred up with water went almost entirely into suspension.

Upon decanting the suspended particles from the impure sediment, the whole mass of liquid was seen to have a silky appearance, resembling, upon agitation, the twisted interwoven structure of mother-of-pearl, or *moire metallique*.

A drop examined by the microscope was seen to be filled with minute fractured fibres; so that this clay-like variety is nothing more than a coherent mass formed of the interlacing fibres of the first variety.

Being unable to obtain anything like a sufficiency of the fibrous mineral, my first analysis was made on the chips which I picked out of a vertical vein at Dochfour.

The specific gravity taken on a piece of 17·8 grains was 3·326.

The chips were cut down with the pliars to about the size of small shot, some little amount of red gritty matter being removed in the so doing. After purification as far as removal of all impurity visible to a lens, they were crushed in the diamond mortar, and pounded. During the pounding, however, red streaks appeared, and gritty matter was felt under the pestle; this was as far as possible removed, and after fusion with Fresenius flux, there was obtained from 1·001 gramme.

Silica	51·148
Ferric Oxide	14·921
Ferrous Oxide	9·803
Manganous Oxide	·299
Lime	1·118
Magnesia..	10·803
Potash	·63
Soda	6·518
Water	4·772
Sulphur	not det.
	100·012

Of the above water ·948 were lost at 212°. As the red matter could not have been absolutely removed, this can be no more than a close approximation to the true composition,—the quantity of ferric oxide being doubtless too high.

B. B.—the mineral imparts to the flame a strong sodium reaction. With fluxes it gives the iron reactions. It fuses with difficulty into a blebby black glass, which is strongly magnetic. Its powder is insoluble in all acids.

The clay-like mass was picked as free as possible from all visible or tangible impurity under a lens; it was then rubbed up into a cream in a mortar with water, and the suspended portion decanted into a large jar of water. It was decanted several times from the heavier and coarser portions, and then set aside to subside from a large quantity of liquid. It settled with such extreme slowness that seven weeks elapsed before a sufficiency had subsided. This was obtained by the decantation of what was still in suspension, and drying the residue first in a water bath, and ultimately, when approaching dryness, in dry air. The colour of the material thus obtained was very fine and pure,—being like a pale ultramarine.

1· gramme of this sediment afforded—

		Atoms.	
Silica ..	52·4 ..	1·75	1·75
Ferric Oxide	9·339 ..	·117	·117
Ferrous Oxide	15·171 ..	·421	
Manganous Oxide	·4		
Lime.. ..	1·176 ..	·063	
Magnesia ..	10·5 ..	·521	1·581
Potash ..	·614 ..	·013	
Soda.. ..	7·106 ..	·229	
Water ..	2·968 ..	·33	
Sulphur ..	1· ..	·063	
	100·674		

Of the above water ·57 were lost at 212°. No alumina was found. As a check on this point the total iron was determined by potash precipitation,—by ammonia,—and by titration;

There was got

By Potash ..	26·25	Ferric Oxide
Ammonia ..	26·25	
Titration ..	26·1	

Sediment which has settled after four months suspension is hardly any finer in colour than what was examined; so that the sedimented clay

may be regarded as being next in purity to the fibrous variety of the mineral.

Of the above analysis it may be said in the first place that there can be little doubt that the colour is due, as in ultramarine, to a ferruginous sulphuret of sodium.

The atomic ratios, as calculated out, hardly enable us to conjecture the true manner in which the ingredients are arranged; the atoms of the bases nearly balance those of the silica, so that probably it is a normal silicate.

It has been supposed that this substance was at one time utilised as a pigment in Inverness:—the ease with which it can be purified by washing, and decantation, and the delicacy of its colour—a kind of lively neutral tint—give very considerable countenance to this conjecture.

It will doubtless appear that, (while no more care and trouble has been taken in the determination of the nature of this substance than is called for in any and every case,) there has been much prolixity in the detail of the process employed for securing purity of material—as also of the modes of occurrence of the substance; the reason of this is *the absolute inability of the writer to account for its formation*, not to say for its almost universal distribution in the district in which it is found, and its entire absence from the same class of rocks beyond that district.

It did at first appear—from the open and decayed condition of the rock at Dochfour, and the occurrence of vegetable matter in its proximity,—as if it might be the product of an action of vegetable acids on the felspathic ingredient of the rock; but any such view must be absolutely set aside in presence of the following facts.

It was obtained by the writer from a portion of the rock at Dochfour, which, while it might have suffered from ordinary decay or alteration, was in no way exposed to the influence of the products of vegetable decay.

It is to be found in the interior of perfectly unaltered granitic veins, which are in no proximity whatever to vegetable matter.

The composition not only is not of the nature of kaolin, but from the absence of alumina is altogether different from it.

The composition in no way gives countenance to the view that the substance is the product of a change resulting from the action or influence of vegetable matter.

But the difficulty does not end here. While its occurrence in the shattered and changing rock at Dochfour,—the transverse arrangement of its fibres,—and the feeble grasp with which it holds together the fissured

portions of the rock indicate, that it is at Dochfour and Reelig *a product of change*, its composition as such is very singular, for the rock does not visibly show the presence of any pyrites, or mineral capable of yielding the sulphur. While apparently (it must be borne in mind that the identity has not been proved by analysis) the same substance occurs in granitic veins in circumstances which give no countenance to our regarding it as *the product of a change of any kind*.*

The attaining to any conception of the mode of formation of this Scottish ultramarine, is to the writer as difficult as was the attaining to the actual formation of true ultramarine to the chemists of a former generation, and probably can only be arrived at by an analysis of the unaltered, and also of the much altered rock-matrix.

* The granite veins in the Dochfour Burn which carry the mineral show rarely minute specks of pyrite,—these are apparently quite unaltered; the mineral here is paler in colour than is usual.