Art. V.—*Desultory Observations on a few of the Rocks and Minerals of Upper Canada, by Captain Bonnycastle, R. E.*

In the very desirable step which the Historical Society has at length adopted to commence the march of geological science in Canada, every reason is afforded for belief that a new and important opening will be made towards clearing away the incumbrances which have long overshadowed so fair a field for research, and that, not only will the country be ultimately benefitted and enriched, but that a new light may be spread over the science itself from the unveiling of those peculiar doubts and difficulties with which its study in this singular country is beset.

Among some of these hitherto unsolved questions which so naturally present themselves to an enquiring mind, is that of the manner in which the vast masses of foreign rocks, in the shape of water worn boulders, have been transported to their present situations and whence they came. The boulders of the Jura and of Germany, are of small import and of limited extent when compared to those of Canada. I have travelled by land or along the shores from Prescott to Lake Erie, and every where these singular strangers present themselves to view, thickly spread over rocks and soils to which they have not the slightest analogy, and at an immeasurable distance from any beds to which they might, in a few instances, be supposed to have originally belonged, I have observed them equally strewing the shores of the lakes and of the St. Lawrence, and covering the mountains and the hills, and that too as in Pelham township at a very considerable elevation. Here (at Kingston,) they line the low limestone shores of the lake, and consist of hard schists, of granites, of gneiss, of quartz,

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of black basaltic looking masses, and of nearly pure felspar. The granites on the higher plateaus of the limestone of Frontenac, are so numerous and varied, that I am confident in a few hours, above a hundred specimens of different kinds might be procured, but there are no *data* either from their form or their position, on which a theory of a plausible nature, as to the route they have travelled, could be drawn. The diluvian dressings, as they are rather affectedly termed, have been so variously rolled about, that the side on which these boulders have received the most severe chastisement is undoubtedly not recognizable. I have fancied that I could perceive there was a kind of regularity in their general position, but I cannot as yet speak with certainty. I conjecture that they are in nearly parallel lines on the flat tables which this part of the country affords, but I shall not hazard a statement until I have opportunity to enquire more largely. Altogether, the subject of the Canadian boulders appears to me, one of the deepest interest.

At Kingston, the mineralogical contents of the transported rocky masses are very interesting. Prase, schorl, varieties of mica, beautiful large crystals of felspar, garnets, and the other concomitants of gniess, granite and sandstones may be readily found, whilst large blocks of quartz from the transparent limpid species, through almost all the shades to dark brown, exist ; I have a piece of quartz from a rock which is under ground and is of course a boulder, nearly as pure as the Brazilian kind, having but a slight milkiness about it.

There are some amygdaloidal boulders here also, containing imperfect jasper, agate, &c., but they are merely curious from their present situation, and are very rare and much worn and disintegrated.

Although secondary rocks visibly prevail in the neighbourhood it is well known that Kingston is the great point where the pure granite range, which forms the Thousand Islands,

lands, and the country of the United States down to Lake George, again rises. Here a deposit of immense extent of beautiful red granite rears its head above the limestone range and forms Cedar Island, and the shores of Hamilton's Cove, while in the former place is observed, the unusual and unexpected circumstance of the granite, and the limestone mingling with each other, and that so intimately as to appear, even in a small specimen, the result of contemporaneous fusion; primitive limestone, therefore, exists here.*

Kalm, the Swedish traveller, has noticed similar calcareous granites in this country, and one near the St. Lawrence, he particularly describes as being composed of red felspar, black mica, white limestone with grains of purple or red quartz. Of another rock he says, that the absence of felspar is supplied by grey primitive limestone which, together with purple or garnet coloured quartz, and black mica it is composed of.

It was supposed that the granitic range from the United States, and Thousand Islands terminated at Kingston, but I feel inclined to think otherwise, and that this granite spreads onwards towards the immense primitive range, which divides the waters flowing into Hudson's Bay and the upper lakes from those which pay tribute to the mighty St. Lawrence.

The limestone of Kingston, contains in most instances but few shells and those mostly of one kind, a sort of scallop. I should not be at all surprized at some discoveries being ultimately effected here with respect to animal remains, as Hamilton's

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* Captain Bonnycastle appears to allude to this rock in the following extract from another communication of his: "Here is the most singular junction of the granite, with I think a talcose limestone; these rocks actually intermix so, that the quartz and felspar of the granite may be seen separately in the lime, and the lime separately in the granite, far beyond the line where the two masses have actually been soldered together as it were. This is all made evident by having a surface smoothed and polished. There is not much schorl here but I have seen a little in the granite *in situ*."

milton's Cove on its north shore is cavernous to a very great degree, the limestone quarter of Cedar Island is the same, and there are some tokens of vast caverns under Point Henry, as a stream, which is of some volume in spring, loses itself suddenly there in a chasm.

Orthoceratites and other organics are found here, the bivalves are, however, not very common, and the orthoceratites seem to belong to large slabs which have been transported, rather than to any rock *in situ*.

Chain coral (tubipora catenulata) madrepores and the honeycomb fossil (favoisite) are found on the islands in the vicinity, but not very perfect; and amongst other things a small slab was picked up lately, on which is the perfect appearance of a large plant in *alto relievo*, with some leaves beside it.

2. About fifteen miles from Kingston, in the township of Loughborough, galena and broad plates of mica, as well as carburet of iron, exist as I am informed. Pipe clay very pure is found near the forty mile creek in the Niagara district, and there is also a large bed of sulphur. Lead is found at Mud Creek, in the county, or rather township joining Pelham, and fine granular gypsum at the Grand River, in such quantities as to be common on all the farms in the Niagara district.

Selenite (crystallized gypsum) is found at Fort George, and at Beckett's Mills. At the Short Hills there is a singular declivity in the woods, which bears every appearance of having been an ancient waterfall; some water still oozes out of the rock at its base, and here are strewed masses of agatized wood and hornstone, apparently formed by the petrifying qualities of the ancient stream.

There is an extensive bed of iron pyrites in the woods at the Short Hills, and thereabouts occur crater like hollows, which may probably have been formed by the combustion of that mineral; the lips of the cups, however, are not high, and it is equally probable that these hollows may have been caused by the sinking of the sand.

In all probability there is a great deposit of magnetic iron near Kingston, as well as of other ores of iron; large masses are occasionally seen, and I have met with very pure ores in lumps as large as a man's head.

I propose to close these observations upon a few of the rocks and minerals of Upper Canada, by adding a mineralogical annalysis of the Marmora ores of iron, together, with that of a Kingston mineral which, I believe, has hitherto been considered erroneously to be tremolite.

I *Magnetic oxide of Iron, Marmora, Upper Canada.*

This mineral is composed of large and small crystals in the mass, (sometimes though not frequently exhibiting the form of the octahedron,) generally strongly bevelled on all their edges. Colour externally iron black; on a fresh fracture, iron grey in spots. Fracture, uneven with cavities. Lustre, weakly metallic. Powder, under the hammer black; under the file also black; streak, metallic. Alone on charcoal very difficult to fuse. With borax, on platina wire, it first becomes red, then bottle green, and when cool it forms a transparent and colourless glass. With salt of phosphorus the same is observed. It strongly attracts the insulated needle.

This is the *granular* magnetic ore and exists in immense quantities on the Crow Lake, forming mountain masses. It is very valuable, and although it contains much sulphur, from the quantity of carburet of iron and argillacious ores found near it, its fusion is accomplished without great expenses.

N°. II,—*Red oxide of Iron and fibrous hornblende, Marmora.*

This mass has a laminar structure in the direction of the longitudinal fracture, but is very compact. The hornblende covers both faces of the flattish surfaces, and appears sometimes penetrating the mass. It has the peculiar odour of hornblende, a fibrous structure, resinous lustre and bituminous appearance; the fibrous structure when filed across its length

length is very distinct, resembling the grain of bamboo or cane. Its streak greenish gray. Insoluble in nitric acid. The ore itself has but little of the metallic look; and does not move the needle. External colour, dark brownish dirty red; streak, dark fine red; powder, the same, very fine and rather smooth.

The streak and powder are uncertain, being sometimes as above, at others the streak is brown grey, as well as powder, the hornblende being so intimately mixed with the mass. The results of fusion also vary. Alone it does not fuse on charcoal, but blackens with borax; the dark powder gives a dull red opaque glass; in the oxidating flame, wine yellow; in the reducing flame fine dark (green ?) colour, which becomes more green on cooling.

This variety does not appear to be very common, it is a curious specimen.

N°. III.—*Mountain ore (called also lake ore,) from the mountain it almost composes being near the lake, Marmora.*

This ore is a very massive looking variety with an even fracture and argillaceous appearance. In *nitric acid* insoluble. Colour of fracture, iron black or steel gray; it is generally coated by a light crust of brown oxide. Powder by file black; streak, metallic. Moves the needle, and is evidently *earthy* magnetic oxide of iron.

This ore is very abundant at Marmora, and is used for making the best bar iron there. It is probably inexhaustible.

N°. IV.—*Red ore, or ochrey red oxide of iron, Marmora.*

This has an earthy aspect; strongly soils the fingers of a deeper indian red than its own external colour, which is dull brick red, but when cut fine indian red. *Fracture* earthy. *Powder* dark red. *Streak* red and shines a little. Easily cut and broken. Nitric acid changes the colour of the mass, or appears to discharge it. No other effect from dropping the powder into nitric acid than a metallic scum arising and floating on the surface.

This is a variety of the *ochrey red oxide of iron*, and might be made use of as a pigment, for which purpose it is indeed sometimes sold at Marmora, at the rate of 25s. a ton. It may perhaps be rendered useful in the arts as its qualities are much the same as that brought from the gulf of Ormus. At Marmora it is abundant, and is used as a strong flux for the best ores. Its effects, in this way are represented as very great.

N°. V.—*Irregular mass; apparently epidote and decomposing Felspar, Marmora.*

A green substance in distinct crystallizations intersecting. Fracture crystalline and laminated longitudinally; cross fracture uneven. *Powder*, greenish gray, and harsh to the touch. Does not yield easily to the knife, and has a greenish gray streak. Opaque, or feebly translucent at the edges in thin laminæ. Fresh fracture has a lustre almost metallic, shining and vitreous, or slightly resinous. Does not fuse easily, or scarcely at all, on charcoal, but in forceps in a thin scale, it fuses with difficulty on the edges into a round black, dull, enamel, here and there. With borax, on platina wire, intumesces, and yields a glass of a yellowish colour. Crystalline cleavage in two directions, longitudinal and diagonal.

There is also I think some hornblende and much iron in this specimen. Rocks of this nature appear abundant in the porphyritic sienite of Marmora.

N°. VI.—*Argillaceous carbonate of iron, Marmora.*

Yellowish brown, sparry looking masses, with an uneven fracture, and crystalline structure which is lamellar, and resembles calcspar, having a shining pearly lustre when turned to the light. *Streak* very easily effected, and of a light brownish yellow or yellowish white colour. *Powder*, rough and very red. The powder when fine on the finger moves the needle faintly. Effervesces in powder strongly; when thrown into nitric acid a bright red heavy powder subsides, and a metallic scum rises. Decrepitates on charcoal, and falls into a metallic dull red powder.

I should call this an argillaceous carbonate of iron, or argillaceous sparry iron ore. I believe they think it is yellow ochre at the Marmora works.

N°. VII.—*Clayey iron ore, Marmora.*

Earthy, uneven, irregular masses resembling some kinds of graphic clay. *Colour* green grey, slightly glimmering. *Streak*, greenish grey. *Powder*, darker greenish gray. *Alone* on *charcoal*, it becomes powdery, and rising up a little turns reddish brown and crumbles into dust, parts of which look metallic, but does not readily fuse. *With borax* on platena wire, it is very difficult to fuse, but turns at last into a beautiful light green glass which on cooling fades. During the process the essay becomes bright red hot in points. *With salt of phosphorus* it is also difficult of fusion; at first it forms a red globule which turns gradually a dark bottle green, then a fine light green and becomes a colourless glass on cooling. *Not effervescent in acids*, nitric, muriatic nor sulphuric. I should call this specimen (which is very common at Marmora, and is called a coarse *black lead* by the workmen,) green argillaceous oxide of iron, from the peculiar bottle green colour it developes. Perhaps there is some chrome in its composition which gives it its slightly green hue in mass.

It resembles in its qualities the indurated green iron earth of Jameson, Hauy's fer oxide terreux. supposed by some, according to Cleaveland, a phosphuret of iron, and of rare occurrence.

It affords a greenish black trace on paper with pressure, but none on white porcelain, and feels very slightly greasy. When moistened by breathing on it, it gives out a strong argillaceous odour.

N°. VIII.—*White and light blue radiated and bladed sulphate of barytes, Kingston.*

This mineral exists at Kingston, in the upper beds of a compact dark limestone with very few, or rather scarcely any, shells. These upper beds appear to have been subjected to some

some convulsion as they are much broken and irregular, differing also in their aspect from those on which they repose, and passing by exposure to the oxygen of the air, or some other operating cause, into a dull whitish (argillaceous) grey looking substance.

Calcspar commonly is in conjunction with the barytes, and is sometimes red or of a pale flesh colour, but the whole specimen is very frequently much decomposed. Nodular masses of this barytes, coated by argillaceous lime of a dirty light brown colour, and of the size of a cocoa nut, are also sometimes found on the surface of the exposed beds.

I have been particular in the examination of this mineral, because I suppose that it is the substance which has long passed at Kingston under the designation of tremolite. Its obvious great specific gravity might have prevented this mistake.

Structure bladed & radiated; the plates or blades very long and intersecting in broad rays, leaving interstices. *Fracture* crystalline, and, in the direction of the rays, lamellar and shining; across them uneven, powdery and dull. *Lustre*, fine white and shining, rather vitreous. *Powder*, white, & harsh, and also breaks into little long spangles on slight trituration. *Streak*, white. Scratched by fluor spar and in some places, by the nail. *Not affected by the acids* nitric, muriatic nor sulphuric, neither in mass, powder nor spangle. Alone on charcoal it is very difficult of fusion; in a thin lamina it turns white, and transparent on cooling, at the first blast; on the next turns again lime white, and gives out an intense and beautiful white light, after which it separates, swells a little, and fuses into an irregular dull, but fine white, enamel, which when cold and placed on the tongue, gives the peculiar disagreeable taste of sulphuretted hydrogen and after a few hours becomes soft and powdery.