XI. Notice respecting the Geological Structure of the Vicinity of Dublin; with an Account of some rare Minerals found in Ireland.

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Communicated by L. Horner, Esq. Sec. to the Geological Society.

The following observations are to be ascribed principally to the late Rev. Walter Stephens. I present them to the Geological Society in their present imperfect form, with the hope that they may attract the attention of mineralogists to the country in the vicinity of Dublin; for they are sufficient to shew that very interesting information may be expected from a correct examination of that district; which from its situation is easy of access, and presents many advantages to the observer. I shall subjoin to a brief statement respecting the geological structure of that country, an account of some minerals of not very common occurrence, recently found in Ireland.

The city of Dublin is placed in a flat limestone country, at the distance of about five miles to the northward of a range of mountains, which form the verge of a mountainous district, extending from thence for more than thirty miles to the southward. Through this tract there passes in a south-western direction from the shore on the south side of Dublin bay, a broad body of granite, bounded on
its eastern and western sides by incumbent rocks of great variety; the structure and relations of which, as well as of the granitic mass, are in many places very distinctly exhibited.

Within this mountainous district, distinguished by the interesting and beautiful scenery which it presents, are found the copper mines of Cronebane and Ballymurtagh;* and the lead mines of Glenmalur; the veins of lead ore at Dalkey, and that near the Scalp also belong to it. The stream works commonly called the Gold mine, at the mountain Crogban Kinsbela are on the southern range of this district and of the County of Wicklow; and gold has been found within it, at another mountain also named Crogban, about seven miles to the northward of that place.†

The occurrence of tinstone at the "Gold-mine," where it has been obtained in fragments,‡ is a fact which deserves attention; for from the great extent of primitive country in the Wicklow mountains, the probability of finding veins of tinstone there, appears considerable. Porcelain earth in purity equal to the "China clay" of Cornwall, has been found in the lands of Kilranelagh, on the south-western side of this county; and granite in a state of decomposition is found so extensively in other parts of it, that this valuable production may very probably be obtained there in considerable quantity.

The country around the village of Bray, at the distance of ten miles from Dublin, presents within a small space an instructive series of rocks; and the appearances observable at Killiney, first noticed I believe by Dr. Blake of Dublin, particularly deserve attention. Schis-

* An account of the metalliferous waters of these mines was published in the Philosophical Transactions so far back as the year 1752, vols. lxxvii. and lxxviii.
† Gold is said to have been found also in the King's River, near the village of Holywood, in the County of Wicklow.
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These beds are to be seen at that place to a considerable extent reposing upon granite; and the line of junction, which begins here at the sea-side, may be traced by the eye for some miles across the country. The regularity of this junction is remarkable on the top of Rochestown hill, adjoining that of Killiney; where ledges of granite, against the foot of which the incumbent rocks incline, present in several places, a rectilinear course for many fathoms together.

On the shore at the base of Killiney-hill, the granite is traversed by numerous veins, many of which themselves consist of granite; and in some instances, two granite veins, differing from each other and from the mass, in fineness of grain and in proportion of their ingredients, are seen to intersect; one vein often deranging the continuity of the other's direction. The substance of these veins is perfectly continuous with that of the mass through which they run, and the surface of the fracture passes through both without interruption.

The conical masses of the Sugar-loaf mountains, with the summits of Brayhead, and Shankhill, resembling them in structure, are composed of quartz; and it may be remarked, that the conical form appears to be in some measure characteristic of mountains composed of that substance; for Mr. Jameson informs me, that he has seen in Lusatia detached conical summits composed of it; and that the well-known Paps of Jura, and the conical summits in the mountains separating Caithness from Sutherland, are of the same material; as also is, according to Dr. Berger, the mountain Durnhill, near the town of Portsoy.*

The actual contact of granite with incumbent rocks, has been ob-

* Humboldt states, that in South America, quartz constitutes, exclusively, a mass of more than nine thousand five hundred feet in thickness, which he considers as of a "formation" peculiar to the Andes. He has not mentioned the form of the summits. Tableau Phys. p. 128.
served at the following places in the counties of Dublin and Wicklow. On the western side of the granite, in a streamlet joining the Dodder, west of the glen above Ballinascomey; at Golden-bill, near the granite quarries; and at Kilranelagh: on the eastern side, at Killiney; at the southern extremity of the Scalp; at Tinelagee; near Agbavanagh to the eastward; and at the south-western side of Croghan Kinshela. On the shore of Dublin bay, between Bootser-town and Blackrock, a mass of compact limestone is visible within a few fathoms of the granite, but in the interval the rock is concealed.

Near Ballinascomey, on the western verge of the granitic mountains nearest to Dublin, rocks of the trap family occur; and from thence to the south-westward, along the borders of the counties of Wicklow and Kildare, various intermediate rocks between the granitic tract above mentioned, and the limestone of the flat country to the westward will be found. At Arklow-rock, on the south-eastern extremity of the county of Wicklow, columnar rocks of the trap family have been observed by Dr. Wollaston and the Rev. Dr. Brinkley.

The quarries in the more immediate neighbourhood of the city, afford many varieties of calcareous productions. The Calp of Mr. Kirwan, a variety of limestone, of which an excellent description and analysis have been published by Mr. Knox, * is the prevailing rock. Brown-spar (Jameson) is found in veins at the quarries near Dolphinsbarn; and beds of magnesian limestone were observed by Mr. Stephens in the bed of the river Dodder, at Miltown, and at Classons-bridge, above that place. The petrifactions, which abound in many parts of this limestone country, the Calp, and the beds of magnesian

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Limestone afford some of the features which may assist in deciding on the "formation" of Werner, to which it is to be referred; a point of considerable interest, from the great extent which the limestone occupies in the Counties of Dublin, Kildare, and Carlow.

In the peninsula of Howth, which forms the northern side of Dublin bay, grey ore of manganese with brown iron-stone, and brown iron-ore (Museum of Dublin College, Nos. 1067-8, 887.) have been obtained in considerable quantity: and a variety of the earthy black cobalt ore of Werner has been found by Mr. Stephens and Dr. Stokes on the southern side of the hill, forming a crust of a rich blue colour lining the fissures of a rock of slate clay nearly approaching to whet slate, (Mus. T. C. D. No. 267): Mr. Tennant has in this substance ascertained the presence of the oxides of cobalt and of manganese; and the discovery of it is important, as it indicates the probability of the existence of other more valuable ores of cobalt in that neighbourhood. Lugnaquilla, which is supposed to be the highest of the Wicklow mountains, is situated to the south-westward of the centre of the mountainous district: I have found it, by the barometer, to be 2455.1 feet above the house of Mr. Greene at Kilranelagh, which is itself considerably elevated above the sea. Cadeen, a hill detached from the body of the mountains, and forming a striking object from the adjacent flat country, is 1558.9 feet; Baltinglass-bill, 681.8 feet; Eadestown, 749.4 feet; Brussels-town, 740.1 feet; Kilranelagh-bill, 705.5 feet above the same place.*

Of the mountains nearest to Dublin, one of the highest, Garry-

* The first three heights above mentioned, are each the mean of three observations; the rest are from single observations, with two excellent barometers. Mr. Greene's house is (by a single observation) 95.08 feet above the level of the cross roads at the bridge of Tuckmill, a little village on the river Slaney; the elevation of which above the sea will be very well supplied when the line of the grand canal shall be extended in this direction, as is now intended.
Dr. Fitton on the Geology of the castle, is 1531.7 feet above the level of the road at Ballinteer; and the Three Rock mountain is 1247.9 feet above the same place, the elevation of which is considerable. The highest point of Howth is 567 feet above high-water mark.

Account of Minerals, &c.

I. Vesuvian.—(Idocrase, Haiiy). This substance was observed by Mr. Stephens in specimens found by me at Kilranelagh, where it occurs in irregular crystalline masses, in a rock composed of common garnet of a reddish-brown colour, of quartz for the most part greenish, apparently from the admixture of a lamellar fossil of that colour, and a small quantity of felspar. The crystalline form of the garnet is here often very distinct, but in the specimens hitherto found, that of the Vesuvian is not well exhibited, although some indistinct prisms are to be observed. In general, its particles assume a scapiform aggregation, sometimes approaching to stellular, a form which I have not observed in specimens of this substance from other places; but its fusibility, lustre, colour, and other characters leave no doubt as to its nature.

The blocks of this compound at Kilranelagh were not in their natural place, but their size, their great weight and angular form, render it probable that they were not far removed from it. Garnet rock is described as occurring in beds in primitive mountains, and the country at Kilranelagh is of that description.

It is remarkable, that a compound much resembling that which I have described, occurs also in the County of Donegal, from whence specimens now in the cabinet of the Dublin Society, and that of Dublin College (No. 30.), were obtained. The garnet and vesuvian in these specimens, are scarcely to be distinguished from those of
Kilranelagh; and, as at that place, are accompanied by quartz, often of a similar greenish colour; with the addition however of bluish grey granular limestone, and a fibrous substance, not improbably tremolite, mixed with carbonate of lime. I have not seen any felspar in the specimens from Donegal.

2. *Grenatite* (Staurotide, Hauy). This was detected by Mr. Stephens in crystals in a micaceous compound of which I found a specimen at the Glenmalur lead mines in the County of Wicklow; the crystals are small, but their colour, form, and characteristic crossing are very distinct, and they are infusible before the blowpipe.

3. *Beryl* (Var. of Emerald, Hauy). The precious beryl has been found by Mr. Stephens and myself imbedded in granite, near Lough Bray in the County of Wicklow. (Museum of Dublin College, No. 39.) Mr. Weaver has discovered it in blocks of granite, near Cronebane in the same county; and I have found in the Dublin mountains above Dundrum, specimens probably belonging to the same species.

4. *Andalusite* (Feldspath apyre, Hauy). This has been found by Mr. Stephens and myself, in very distinct specimens, on the north-east side of Douce mountain in the County of Wicklow, apparently imbedded in the mica slate of which that mountain is composed, and accompanied by quartz, mica, and a remarkable crystallized substance hereafter to be mentioned. It differs from the Andalusite of Spain and of Scotland, chiefly by inferior hardness; for although some pieces scratch window-glass, others yield easily to the knife; but the Count de Bournon has observed an equal variation in the hardness of specimens of this substance found by him at Forez,* and I have found that of the Scottish stone to vary very much.

*Since this paper was written, I have found that this compound from Donegal has been described by Mr. Sowerby. British Mineralogy, August, 1810. p. 133.
This fossil seems to have been first taken notice of under the name of Wurflicher (cubic) Feldspath by Karsten, who took his description from specimens in the Leskean cabinet now in Dublin (No. 907 b, &c.); and from a comparison of these with the specimens from Douce, the identity of Karsten’s fossil, with Andalusite is ascertained. I have not found however, that his claim to the first detection of it has been mentioned by subsequent writers; although his opinion with respect to its affinity to felspar, accords with that which Hauy is disposed to adopt. Tableau comparatif, &c. p. 217.

To this species is also to be referred a mineral which occurs in great abundance at Killiney in the County of Dublin, first observed there by Dr. Blake, and for some time considered as belonging to a non-descript species. It is most remarkable on the shore at the southern extremity of the cliff under the obelisk hill, where it appears thickly on the surface of beds of mica slate; and it seems to abound also imbedded in the substance of that rock, although less distinctly visible until it has been exposed to decomposition, being less affected by exposure than the rock in which it is contained.

The Andalusite, when thus brought to view, appears generally in slender prismatic crystalline pieces rounded at the angles, seldom sharp, promiscuously aggregated, sometimes in a stellular form, and of a greyish-black colour, remarkably contrasted with the lustre and light colour of the micaceous substance in which they appear. But in fresher pieces, the form, colour, cleavage, and other characters of this mineral are distinct; and I have observed an approach to the peculiar appearances which it presents at this place, in some Spanish specimens, where the crystalline shoots had assumed a scapiform arrangement.

* Journal de Physique, xxxiv. p. 453. 1789.
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5. The Andalusite of Douce mountain is accompanied, as has been mentioned, by a crystallized mineral, the characters of which have much affinity to those of indurated talc; and which is placed under that denomination in the collection of Dublin College (Nos. 405, 406, 407); and a specimen of the same kind, stated to be from Glendalagh in the County of Wicklow, was found in the same collection (No. 404.)

The crystals are rhomboidal prisms, of which the length is in some instances more than twice the breadth, but no acumination is observable. They are easily cut by the knife, faintly translucent, their colour yellowish-grey. Small fragments before the blowpipe appear to swell a little from the separation of the folia on the first application of the heat; they become white, and give with some difficulty a solid white enamel. The specimens to which I have access at present do not enable me to give any detail of the remaining characters.

The connection of this substance with the Andalusite of Douce is remarkable; the latter often forming the nucleus of crystals externally of four sides, sometimes filling nearly the whole of the interior, but in other specimens, forming little more than an axis, with rounded edges, and of irregular form, from which the folia of the investing talc-like substance appear to radiate.

The occurrence of indurated talc in crystals has hitherto been very rare: it is not mentioned by Jameson; and Brochant, though he quotes from Emmerling the rhomboidal prism as one of its forms, expresses doubt as to the correctness of the statement; I therefore do not give that name to the crystals found at Douce, without some uncertainty.

6. Hollowspar, Jameson. (Macle, Hatry). Very distinct specimens of this mineral have been found by Mr. Davy at Aghavanagh
in the County of Wicklow: and I have observed it at Baltinglass hill, within a few miles of that place. I may mention here, that from the appearances of many specimens found in the neighbourhood of Killiney, Mr. Stephens was inclined to suppose that a connection existed between this singular species and Andalusite.

7. Pitchstone. This substance is found in a vein traversing granite, in the vicinity of Newry in the County of Down. I am indebted to Mr. Jameson of Edinburgh, for much of the following description of its external characters, as it appears there.

Its colour is intermediate between mountain and leek green. It is massive. Fracture small and not very perfect conchoidal.

Internal lustre, resino-vitreous and shining. It exhibits lamellar distinct concretions; the plates are from one-fourth to one-tenth of an inch in thickness, and are further divisible into pieces of the rhomboidal form of various angles.

The surface of the concretions is smooth, and strongly glistening. Slightly translucent on the edges. It scratches window-glass, but is easily scratched by quartz. Easily broken. Specific gravity, 2.29.

Before the blowpipe without addition it yields a greyish-white frothy enamel.

It is in some places porphyritic, containing imbedded, minute crystals of feldspar and of quartz.

A letter from a very intelligent observer, who has examined this substance in its native place, states the following particulars respecting its position.

"The vein is first observable in the townland of Newry, at the bottom of a bank of granite, about half a mile from the northern end of the town, on the right of the road leading to Down-Patrick. It crosses the road, and runs due westward, ending on
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The side of the great road from Newry to Belfast. Its length, so far as hitherto observed, is half a mile.

The rock, which is covered with mould to the depth of about a foot, consists of a grey granite. The vein is about two feet and a half, or two and a quarter in width; at the places of contact both the granite and pitchstone are disintegrated, the latter being almost as soft as clay, but becoming gradually harder, as it approaches the center of the vein. The structure of the vein is foliated, the folia being perpendicular to the horizon, and also to the walls; and besides these, there are seams, that run longitudinally, parallel to the horizon, and nearly perpendicular to the folia.

Although this substance presents some peculiarity, in being divisible into rhomboidal fragments, it approaches in this respect to the pitchstone of Arran (in lamellar concretions) which holds as it were a middle place between it, and that possessing the more usual characters.

Mr. Jameson has described a vein of pitchstone "running in granite," observed by himself in Arran,* and he states that "lamellar distinct concretions have been hitherto observed in the pitchstone of that island only."†

8. The granular sulphate of barytes, hitherto very rare, has been found, as the Rev. Mr. Hincks of Cork informs me, by Dr. Wood of that city, on the sea shore, near Clonakilty, from whence a specimen in the Museum of Dublin College, (No. 653) has probably been obtained: it is accompanied by iron pyrites.

9. Wavellite: This remarkable mineral has recently been found in the county of Cork, at Springhill near Tracton-abbey, about ten miles south-eastward from the city. The Rev. Mr. Hincks of the

Cork Institution, from whom the specimens that I have seen were obtained, informs me, that it was found at a small distance from the surface, near the base of a hill composed of flinty slate, and that he has seen it adhering to a piece of rock of that description. But it has occurred principally detached in the form of globular nodules, irregularly grouped together, and of various sizes, the largest about an inch in diameter, externally coated with a yellowish brown earthy crust, and within composed of radiating crystalline spiculae, the characters of which agree very nearly with those of the wavellite from Devonshire, described by Mr. Davy; indeed some of the specimens from the county of Cork, are scarcely to be distinguished from some of those obtained at that place.

The most distinct specimen that I have seen was a nodule about three-fourths of an inch in diameter, in part affected by decomposition and containing some small spongy cavities. On its external surface indistinct dihedral terminations of the crystalline shoots are discernible; and internally, where it is not decomposed, its lustre is higher and more glossy than is common in the Devonshire fossil. The specific gravity of that part of it, which was very pure and nearly transparent, was 2.34.

The nodules are in some instances decomposed throughout; the spiculae having lost their lustre, acquire a dull grey or brownish colour, and become much softer than when unchanged; and Mr. Hincks has seen some of them altogether in the state of clay, apparently from the effect of decomposition.

It would appear that the fluoric acid, of which Mr. Davy has ascertained the presence in the wavellite from Devonshire, exists also in that from Cork; for glass is corroded by heating upon it, in a drop of sulphuric acid, a fragment of the mineral from either of those places.