

## CURSORY REMARKS

ON THE

MINERAL SUBSTANCE

Called, in Derbyshire,

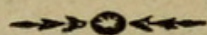
## ROTTEN-STONE.\*

BY

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MR. KIRWAN in his “Elements of Mineralogy,” (vol. i. p. 203.) states, that Tripoli is often of pseudo-volcanic and sometimes, perhaps, of genuine volcanic origin;—he adds, however, that “it also frequently arises from the decomposition or disintegration of other stones.” The latter observation appears to apply strictly to our Derbyshire *Rotten-stone*, which is usually considered by mineralogists as a *variety* of Tripoli, originating from some unknown decomposed stone of the argillaceous kind. That the substance producing *Rotten-stone* is, however, in its

\* *Cariosus Anglorum*. Gmel. Linn. Syst. Nat. p. 146.—  
*Tripoli*. Kirwan. El. Miner. p. 202.



primary state, a *calcareous* and not an *argillaceous* stone, can only be doubted, I think, by those, who have not had an opportunity of examining this fossil in its native repository. Indeed, I feel little hesitation in affirming, that the phenomena, attendant on the substance in question, strongly support the original idea of the late ingenious Mr. Whitehurst, who, from personal and extensive observation, was led to conclude, that the parent rock of the Derbyshire Rotten-stone was *black marble*,\* or some other variety of our dark-coloured lime-stones.

It is some years back, since I availed myself of a favourable opportunity, that occurred, of examining the Rotten-stone pits on Bakewell Moor;† and which, I understand, are only opened at particular periods—that is, every third or fourth year, according to the demand, which may then prevail for the fossil as an article of traffic. On looking over the *memoranda*, made at the time of visiting these pits, I find they differ, in some trifling respects,

\* Vide Whitehurst's "Inquiry into the original state and formation of the Earth."

† Rotten-stone also occurs at Wardlow Mire; and, as I am informed, at Ashford and some other parts of the county: but I am not acquainted with the local circumstances with which it is attended in those places.



from Mr. Whitehurst's account of the mode, in which Rotten-stone is procured, the appearances it exhibits as a mineral deposit, &c. and, as no late author that I am acquainted with has entered into any detail on these subjects, the following brief statement may not be unacceptable to those, who are interested in geological inquiries.

1. The Rotten-stone, found on Bakewell Moor, is deposited on a limestone, which seemingly belongs to the *first* or *uppermost* stratum.\*

2. It occurs in different parts of the moor; frequently on the surface of the limestone, immediately under the vegetable mould; but is procured in the greatest quantity in a long, or somewhat trough-shaped hollow, intersected by several broad irregular fissures, which are filled up with small fragments of limestone—the gravel-like *debris* (rubble) of the traversed stratum.†

3. In these fissures the Rotten-stone occurs at the depth of a few inches below the surface, and from that to ten or fifteen feet.‡

4. It is procured in two distinct states.—In one, the Rotten-stone when dry has an indurated, and sometimes even a stony consist-

\* Vide Note A.

† Vide Note B.

‡ Vide Note C.



ence; texture, earthy; fracture, sometimes imperfectly conchoidal; at other times slaty; hardness, from that of chalk to that, which does but just yield to the scraping of the knife (3—6. Kirwan.); feels smooth, sometimes *rather* greasy—never so meagre as the foreign tripoli; does not crumble soon in water; effervesces *slightly* with acids; sp. gr. 2,3. Its colour is usually between a brownish grey and isabella-yellow.—The other variety occurs in a loose or pulverulent form; feels meagre; rarely effervesces with acids; sp. gr. 2,2; its colour light yellowish-grey.

5. The *hard* Rotten-stone (as the indurated kind is called by the Rotten-stone *getters*) occurs in detached, nodular lumps, dispersed through the *rubble* above noticed;—the soft,\* as a spongy earth or mud, either *coating* the more indurated variety, or deposited, in considerable quantities, under the *debris*, on the surface of the limestone rock.

6. Water, from the upper part of the moor, is constantly draining through the loose materials, which fill the hollows and fissures of the rotten-stone tract.

7. In this mineral depot are found, with the Rotten-stone, fragments of chert; fragments of a calcareous stone in every possible state,

\* Vide Note D.



intermediate between Rotten-stone and perfect limestone; *Rotten-stone with nuclei of solid black limestone*; &c. &c.

8. The calcareous stone, which forms, in these instances, the central parts of the nodular lumps of Rotten-stone, has the *external* characters of the black limestone or marble, found at Ashford-in-the-waters, &c. but differs, somewhat, in its *internal* properties, from any stratum of limestone yet discovered in Derbyshire.

9. Marine reliquia are sometimes found in the hard Rotten-stone; and these are generally such as have been observed to be most frequent in the black marble; viz. *Entomolithus Derbiensis*, *Conchyliolithus Breynii*, &c. (v. Pet. Derby. t. 45, 39, &c.)

Such are the principal phenomena, which were noted during my examination of the depot of Rotten-stone near Bakewell.—The conclusions, to which this examination led, have been already alluded to; namely, *that Rotten-stone is produced by the disintegration of a particular variety of limestone, probably a black marble*; and that, consequently, authors are incorrect in considering the original substance of this fossil to have been an argillaceous stone.

It will here, however, be asked—how is



the production of this particular substance from another, chemically as well as externally distinct, to be accounted for? and, if Rottenstone be actually the result of a certain change in black marble or limestone, why is it not found in every situation, where such rock occurs? To answer these questions satisfactorily will perhaps be impossible;—to answer them, however, in any way, without having recourse to the reciprocal transmutation of what have hitherto been considered, as simple, elementary parts in mineral compositions,\* we must first recur, it is evident, to the nature of the constituent matter of the original rock, as well as of the substance, which the disintegration of such rock has been presumed to produce.

Limestones, it is well known, are composed principally of an indurated calcareous carbonate;—Rottenstone, according to the following analyses, of alumine in a loose or earthy form, and with its constituent particles in a very minute state of division—But we must remem-

\* The transmutation of silex into lime, or that of lime into silex or alumine, however strongly contended for by some modern Geologists, most assuredly ought not to be assumed in any attempt to account for the phenomena of the mineral kingdom, till supported by stronger facts than those on which it rests at present.



ber, that many other principles enter into the composition of most limestones besides carbonate of lime; as alumine, silex, bitumen, and sometimes magnesia;—and that Rotten-stone contains, besides alumine, silex, bitumen or carbon, and frequently iron and calcareous earth;—and that the comparative proportions of these component parts differ greatly in the different varieties both of Limestone and Rottenstone.

Our analysis of Rotten-stone has afforded the following results.

1 *Very hard Rotten-stone, approaching Black Limestone in external appearance.*

Alumine .....	74
Silex .....	3
Carbonate of Lime.....	14
Oxide of Iron .....	2
Inflammable matter and loss .....	7
	<hr/> 100

3. *Hard Rotten-stone, but less indurated than specimen 2, colour nearly similar.*

Alumine .....	84
Silex .....	3
Carbonate of Lime.....	5
Oxide of Iron.....	0
Inflammable matter and loss .....	8
	<hr/> 100

2. *Another specimen of the hard variety, but of a light brown colour.*

Alumine .....	80
Silex .....	2
Carbonate of Lime.....	10
Oxide of Iron.....	1
Inflammable matter and loss .....	7
	<hr/> 100

4. *Soft Rotten-stone, i. e. with a texture much more loose or earthy than in the other specimens.*

Alumine .....	87
Silex .....	4
Carbonate of Lime.....	0
Oxide of Iron.....	0
Inflammable matter and loss .....	9*
	<hr/> 100

\* It should be observed that the "loss," in these ana-



If we compare the foregoing analysis with those, which mineralogists have given us of limestones, we shall find, that the chief difference (in a chemical point of view) between Rotten-stone and certain varieties of limestone, exists in the larger proportion of alumine, which the former of these substances contains, and its comparative, or, in some instances, its total want of the carbonate of lime. The particular varieties of limestone now alluded to are those, which Mr. Kirwan has denominated *argilliferous marlites*, on account of their holding a large proportion of *argill* (*alumine*) in their composition. (v. E. Min. v. 1. p. 99.)—Some of these stones, though

lysis, never exceeded 1,5;—hence the proportion of “*inflammable matter*” may be stated as varying from 5,5. to 7,5. At the time of making my experiments on Rotten-stone, the principal object in view was to ascertain the predominating earth in its composition, and not determining the nature of the inflammable matter, it was placed with the loss;—there can be little doubt, however, of its being *carbon*. *Silex* was found in all the specimens examined. Carbonate of Lime only in the harder varieties, and not constantly in those. Two or three specimens analysed, in all external respects similar to No. 3, were without it. Oxide of Iron was only present in the harder Rotten-stones.—The actual constituents, therefore, of genuine or perfect Rotten-stone (that is, Rotten-stone in which the disintegration of the original substance is complete) may be stated to be *alumine*, *silex* and *inflammable matter* (*carbon?*)



affording lime, contain 30 per ct. of alumine, together with small quantities of silex, iron, &c :—and our Derbyshire black marble, or limestone, undoubtedly belongs to this class.—The greatest quantity of this stone is quarried at Ashford-in-the-waters; and, as the quarry is situated at no great distance from the *depot* of Rotten-stone, and affords an excellent example of this formation, I shall here describe the state, in which it is found, and some of its principal varieties. It occurs in beds, which vary in thickness, from a few inches to two or three feet, with interposed seams (*semistrata*) of black, bituminous shale and clay. The substance of these beds, though throughout of the same general aspect, and constantly *burning to lime*, more or less pure, differs greatly in the proportion of its constituent parts, as well as somewhat in its external characters. The limestone of those beds, immediately worked as marble, is of a deep greyish-black, which, on the stones being polished, becomes perfect, or dark-black \* :—

\* Its colour must be ascribed to the bitumen or carbon, which it contains, as it becomes perfectly white, when calcined, and also acquires a white, or ash-coloured, crust, on exposure to the weather. In many instances I have found the crust of a considerable thickness and become perfect Rotten-stone. And there is no doubt but in walls,



texture close, fine-earthly : fracture slaty, passing into the imperfectly conchoidal \* : hardness from 6 to 7 (Kirwan. p. 38.) : emits a fetid or rather urinous smell when scraped, but in a much less degree than the following varieties : contains, according to the specimen examined, about 18 per ct. of alumine, with small proportions † of silex, iron, and inflammable matter.

The next variety of limestone, it will be proper to notice, is one rejected by the work-

which are sometimes built of black marble, and in other exposed situations, this would frequently be the case, if a further decay of the stones were not prevented by a timely and friendly covering of lichens and mosses. I have observed, however, that pieces of polished marble, though equally exposed with those in the unpolished state, do not so soon acquire a white crust—Polishing, by filling up the minute interstices, induces a greater degree of external hardness of the stone and prevents for a longer time the decomposition of the surface.

\* By *fracture*, is here meant the *general appearance*, or form, which the broken surface of the fossil presents : by *texture*, the grain, or form and disposition of the particles, observable throughout the surface of the *fracture*.

† In no instance did the proportion of silex exceed 4 per ct. or that of the iron  $1\frac{1}{2}$ . As the experiments, however, which gave these results, were not repeated on each variety of stone, we do not give these proportions as those, which analysis hereafter may find to be correct.—The proportion of alumine, in each instance, we believe, will be found to be near the truth.



men at Ashford, as being less fit for their purpose than that I have just described—It appears to be too soft to receive a lasting polish, and its colour, though black, is much less deep than in the foregoing variety, frequently verging on brownish-black:—texture earthy: fracture slaty: hardness 6: gives out a very fetid smell on being scraped. One specimen of this stone contained, according to the experiments made on it, 66 carbonate of lime; 24 alumine; 1,2 oxide of iron; 1,5 silex; and 7 inflammable matter. Another specimen of this stone, however, *from the same bed*, yielded only 19 alumine.

A third strongly marked variety of limestone, found with the foregoing, has the following characters: colour black, or brownish-black: texture splintery, with disseminated, shining, spar-like particles; these frequently exhibit the minute parts of organic remains: fracture slaty: hardness 7: emits a very fetid odour, when scraped or rubbed. The specimen analyzed gave 8 per ct. alumine, and 4 silex, with 7 inflammable matter, but little or no trace of iron.

It must now be observed, that, along with these three described varieties of limestone, several others occur, which, in their external characters, exhibit various gradations between



the black-marble and the bituminous shale, that separates the calcareous beds; and that the whole formation of these limestone *stratula* appears to graduate, or to pass by an almost insensible transition, into the great *stratum* of shale, under which the limestone of Derbyshire, for the most part, dips.

It is evident, from the above remarks on the black-limestone formation, that among its numerous beds the original of *Rotten-stone* probably exists; and, though the result of my own experiments and observations certainly does not warrant the conclusion, that it has yet been detected as a native rock or stratum, there seems little doubt, but that a more careful examination, than what my leisure when at Ashford permitted *me* to make, may hereafter determine the stone in this state. The variety of black limestone already described, as holding, sometimes, 24 per ct. of alumine, undoubtedly comes near in external characters to the central nodules of marble, which, it has been observed, occur frequently as *nuclei* to the fragments of *hard* Rotten-stone, (v. p. 317.) and which, there is every reason to conclude, are remaining portions of the original calcareous rock. Still, however, this rock appears to have differed essentially from the limestone, with which we are now com-



paring it:—1st. in being a somewhat softer stone. 2d. in containing a much larger proportion of inflammable matter—and, lastly, in holding, at least, 30 per ct. of alumine.\* It may here, perhaps, be objected, that a stone, holding even 30 per ct. of alumine, can never be presumed to give by its decomposition a substance, containing more than double such proportion of the material—especially as this substance is evidently *not* composed (in certain instances at least) of the *travelled*, and at length deposited, particles of the original stone; but actually exhibits the matter (in part) of the original stone itself under its primitive structure, and merely deprived of one of the constituent principles.—For this really seems to be the state, in which the greater part of the indurated Rotten-stone occurs. To this objection, I can only, at present, oppose, as probable, the supposition, that, during the formation of *hard* Rotten-stone, while losing the calcareous particles, a gradual and considerable contraction took place in the remaining matter; and that this was effected without destroying the slaty structure, where it previously existed, in the primary stone.† By

\* All the specimens I have examined have given something more than the proportion of alumine here stated.

† A nearer approximation of the aluminous particles to



this assumed contraction in the substance of Rotten-stone, it is evident, we may readily account for the greater proportion of alumine it exhibits, on comparing a given quantity of it, with an equal one of limestone.—But it will probably be advanced, that the hypothesis eventually supports more than we wish to prove; as, admitting the contraction of the matter forming Rotten-stone, any limestone holding a *small* quantity of alumine may be

each other may easily be supposed, as a natural consequence of the removal of the calcareous matter; but, that the structure of the original stone should remain, after this loss of matter, will not, perhaps, be as easily supposed or admitted.—However, as the ingredients of black limestones, &c. exist (it is probable) merely in the state of *mixture*, the extraction of any one of these constituent parts will certainly be less liable to destroy the general structure of the stone, than if the process had to act on principles *chemically* united.

We have here considered the structure, or fracture of hard Rotten-stone to be immediately derived, generally speaking, from that of the original limestone; but in some instances, particularly where the slaty structure is present, it is rather, perhaps, the consequence of the *contraction* contended for, than the remains of any particular disposition of particles, which existed in the primary fossil.—We have, not unfrequently, observed the slaty structure in hard Rotten-stone, where no vestige of it appeared in the enclosed *nuclei* of limestone; though it must be observed, that these *nuclei*, in every other respect, were perfectly similar to those, in which such structure was very evident.



the original stone.—The local circumstances, however, attendant on Rotten-stone must prevent such a supposition from being adopted.—All limestones, it is true, are liable to decomposition ; and the black seem to be more subject to this process \* than the lighter.

N. B. *It is to be regretted that this paper was left in an unfinished state, owing to the death of the ingenious author, and that several of the notes, referred to, have not been discovered amongst his manuscripts, though these have been examined with very great care and attention.*

\* Vide Note.





Martin, William. 1813. "Cursory Remarks on the Minerals Substance, called in Derbyshire, ROTTEN- STONE." *Memoirs of the Literary and Philosophical Society of Manchester* 2, 313–327.

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