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Introductory to Mineralogy

We spoke, in our last Lecture of the mosaic account of the first creation; and we did not hesitate in pronouncing it the most rational, & dignified specimen of Cosmogony that the world has yet been favoured with.

After relating the different systems of cosmogony, we took a cursory view of the surface of this globe, w.c we found to be marked with many irregularities, in some places we find vast plains, intersected with hills, and with vallies; in others long chains of mountains, from whence proceed vast rivers, w.c after fertilizing & beautifying vast tracts of various countries, at last discharge themselves into the sea, whence they originally sprang.

We then took as rapid a view of the contents of the earth, w.c with the surface of it appeared to Buffon a world in disorder a confused heap of rubish, w.c instead of a comfortable habitation for man, where he might enjoy, admire & be grateful seemed to his eye to be a world in ruins. We endeavoured to hold the some object up to your view in a different light. We saw, or thought we saw arrangement & design in all these seeming confusion. We shall shew you hereafter, that even in the subterraneous regions, nay, in the very structure of mountains we could discover evident marks of design.

We told you that beside the metals, there were many things under the surface of the earth highly serviceable to man. Coal, Such sort

testimony, and a thousand other articles, designed as a never fail-
-ing treasure for the service of all succeeding ages, are commodiously
locked up, if we may so speak in a vast store-house under our
feet. We told you that these useful articles were not placed
at such convenient distances below the surface, as to be accessible
to civilized man.

Now Minerals, or Fossils constitute one of the three King-
-doms of nature; And that branch of natural history w.c teaches the
structure, & properties of Ores & minerals is called Mineralogy

All the solid materials of which this globe of ours is composed
have received the name of minerals. We can gather but very
little knowledge of the mineral kingdom from the ancients. They
knew the seven metals, w.c they named after the seven planets;
and they were acquainted with most of the precious stones: but
they were ignorant of their component parts & qualities. It is only
very lately that the ~~component parts of~~ method of ascertaining
the component parts of these minerals has been discovered.
Some go so far as to assert that "the whole Science of Mineralogy
has been created since the year 1770" (Thompson. Vol. 3. p. 413)
New minerals are every day described & analysed; collections
are every where forming, and travels of discovery are succeeding
each other without intermission. The fruit of these labours has
been the discovery of no less than six new earths; and eight new
metals; beside a vast number of useful minerals which had
been formerly unknown or disregarded.

In Sweden & in Germany mineralogy is considered a
science of such importance as to claim the particular attention
of the government. They have colleges in which this science is
regularly taught. The Intendants of the national mines form a

part

a part of the administration. This example has been followed by the French, Spaniards & Russians. The French have within these 20, or 30 years cultivated chemistry & mineralogy with an ardor bordering on enthusiasm.

One reason that we, in this country, have paid so little attention to this useful part of Natural History, is, that we have not been compelled to search the bowels of earth for fuel. No- we send to England for coal, while we probably have more of that article than the whole British navy could carry away in a thousand years! As our woods diminish, we shall, through necessity, search the earth for coals. Rhode Island depends on the continent for fire-wood. This difficulty led the inhabitants to explore the earth, and the consequence has been the discovery of a valuable coal-mine.

It is somewhat less than twenty years since the Science of Mineralogy was attempted to be taught in America. It commenced in this place. And with it grew up the collection preserved in our Cabinet. Mineralogy is, at this time, cultivated in New England more than any other branch of Natl. History, and I believe that this useful Science is destined to flourish among us. I say useful science; for although it be true, that every thing for the support of life is continued with unceasing circulation from the upper stratum, or coat of earth, it is nevertheless as true, that from the bowels of it Labour draws all his tools; Agriculture the chief of her support, Commerce her riches, and the fine-arts their materials.

Is it not a shame that we Americans, who brag so much of our independance, should notwithstanding, be dependent on foreign nations for

riches,

riches w^c. Nature has actually placed under our feet?

I do not encourage you to pursue Mineralogy, in hope that you will find the Ruby, the Topaz, the Emerald, the Saphire, the Onyx or the Diamond. These are useless articles; the mere playthings of Kings & Queens, and of course below the notice of us wise and frugal Republicans. Some of these glittering baubles, viz the Diamond, not bigger y^n. a walnut has been purchased for more money than would be sufficient to put our vast sea coast, in a ~~respectable~~ comfortable state of defence, and to build a navy large enough to make our enemies respect us. A single diamond in the sceptre of the late Empress of Russia is valued at 4,854,728 pounds sterling! And this only to ornament a sceptre, or cap, or neglace, or finger of one of these excrescences of Society called in Emperor, or Empress! Our disgust is encreased when we reflect on the thousands of the human species condemned to die for them in the dark caverns of the earth! Quot manus attenuntur, says Pliny, ut unus niteat articulus!

We never have, nor ever shall recommend any thing in these Lectures, that has not the public utility for its end & object. Iron, Copper, Lead & Tin will be of more service to us, as a Nation, or as individuals, y^n. if we found Silver, Gold or Diamonds. Our country abounds with the most useful of the metals; but these receptes of wealth & independence have not yet been entered. It behoves us to prepare the way for those who come after us. They may be benefited by even the faint and glimmering light that we carry before them into these dark caverns of the earth.

The science of Mineralogy includes under it three different topics: 1st the method of describing minerals with so much accuracy and precision, that they may easily be distinguished from each other. 2d. A Systematic arrangement of minerals. 3. The art of analysing them.

The antients have left us scarcely any thing worth reading on the science of mineralogy; but about 900 years ago the famous Arabian physician Avicenna wrote a treatise on the congelation & conglutination of Stones; in which he divides minerals into four clases, viz, 1st. Stones; 2d. Salts; 3d Inflammable bodies; and 4th. metals; and it is to the honour of Avicenna that this division is adopted by some of the best Chemists & mineralogists of the present time. The first systematic mineralogist, of modern times was George Agricola, a celebrated Saxon miner. His division of minerals was into. 1st. Terra. 2d. Succus Concretus. 3d. Lapis - 4th. Metallum. Then Alonzo Barba a Mexican Priest wrote on metals; and was the first who treated on Amalgamation. Then that wonderfully laborious compiler Aldrovandus published his Museum Metallicum; and in 1678 Athanasius Kircher, a learned Jesuit, published his Mundus Subterraneus. About 20 years after Woodward published his catalogue of minerals; and he may be considered as the first English mineralogist of note. In 1708 Becher published at Leipsic, his Physica Subterranea. In 1739 Cramer gave a system of mineralogy containg seven clases. 1st. metals 2. Semmetals. 3. Salts. 4th. Calxfiers. Inflammable. 5th. Stones. 6th. Earths 7th. Waters. But three years prior to Cramer the illustrious Linnaeus published the first sketch of his Mineral System; and although he did not very much contribute very much to the increase the knowledge of minerals,

yet his system bears the mark of his masterly hand. He was, indeed the first of the moderns [Aristotle of the antients] who established right ideas of system. He shewed that the principle object was to assist the memory, & to enable naturalists to distinguish one body from another, and to ascertain if what they were investigating had been previously described by others. Linnæus taught that no system could be of that use that did not posess an uniformity in the basis of its classification & nomenclature, and a fixed & generally received language. In 1768 he published a 2d. edition of his system of mineralogy in wc. the ordees & genera are encreased [See Preface to Jameson p. IV & V.]

About this time Pott & Henkel encreased, what maybe called metallurgic chemistry, & paved the way for some of the celebrated chemical systems of the present day.

In 1747 Waller [or Wallerius] who was Prof. of mineralogy at Upsal published his system of mineralogy; and ten years after the celebrated Cronsted of Sweden favored the world with his system. This is an excellent work, and the foundation on which Kirwan, and Werner have built their high reputation. Cronsted divides his system, as usual, into four classes viz. 1. Terræ. 2d. Salia. 3d Phlogistica, and 4th. metallia. The 1st. class, terræ has 9 ordes 1st. calcareæ 2d. Silicææ, 3d. Granatinæ, 4th. Argillaceæ, 5th. Micaceæ. 6. Fluores 7th. Asbestinæ, 8th. Zeolithicæ, and 9th. Magnesiæ. It is observed, [preface to Jameson p VI.] that one of the most striking excellencies of this system is the strict adherence to a fixed principle, as the basis of classification; and that it is throughout chemical. Kirwan, Magellan and Werner have published translations of this valuable book. Its modest

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and excellent author was lost to the world before he had quite at-
-tained the meridian of life.

In 1772 that singular character, D^r Hill, or Sir John Hill, who aimed to shine in every thing, published a System of mineralogy, w^c I think, is not without considerable merit. But Werner of Freyberge* has surpased all that we have mentioned for system, apt terms, and for accurate external characters of minerals.

Among the French Romé de Lisle published a very valuable work in 1783 on Crystallization, w^c he divides into three classes 1. Saline crystals; 2^d Stoney crystals, and 3^d metallic & semi-metallic crys-
-tals. This French writer was the first, after Werner, who par-
-ticularly directed the attention of mineralogists to the primitive form of crystals, of which he enumerates the following species 1^st Tetraedron 2 Cube. 3^d Octaedron. 4^th Parallelepipedon. 5. Rhomboidal oc-
-taedron, and 6^th Dodecaedron, with triangular planes.

The next French mineralogist of note is the Abbé Hauy. His System seems, in a great measure, founded on the measurement or the degrees of the angles of each crystal, and may therefore be called a crystallometrical System. It is certainly a very pretty (French) System; and so geometrically exact that it is enough to make a mathematician endure the name of mineralogy; but I am doubtful if you can make every son of Euclid believe in this subter-
-ranean mathematics.

The ingenious Abbé Hauy determines the species of simple minerals from one character, w^c is styled the "integral molecule" and he defines the mineral species to be a collection of the bodies

* Germ^y or Sir Isaac Newton?

This

This integral molleeule, or kernel is dectected, either by mechanical dirssion, or by measurement combined with calculation; and when found, is asserted by the Abbé to afford an essential, and invariable character for the species. Now the fact is the greater number of minerals are not crystallised, and therefore have no discoverable "integral molleeule". It is found that many of the Abbé's species have the same molleeules, or integral parts, while the individuals of the same species have different molleeules. It appears that the integral molleeule, or kernel cannot, in any instance, be considered as the type of the species. But when you cannot clearly destinguish them by their component molleeule, then must you have recourse to their che-
-mical analysis.

Classification of Earths & Stones —

[See Kirwan V. 1st. Sect. IV. 45.]

On viewing a heap of stones, they appear all so much alike as to induce us to call it a heap of stones & not of bricks, or oyster-shells. On viewing the heap more more closely, we readily perceive that some have an homogeneous aspect, that is they appear to be alike. Others on the contrary visibly contain two or more heterogeneous, or dissimilar substances, either adhering to, or inhering one in the other. These are called Aggregates. Others again participate of the nature of two or more heterogeneous fossils, without however any visible separation of one from the other: Some call the Derivatives.

Thus have we three primary divisions of Earths or Stones.

The classification of Earths & Stones consists in their arrangement in a certain order relatively to each other.

Order, when not arbitrary, necessarily supposes both distinction, and resemblance. Without distinction all the bodies to be arranged would be equally entitled to the same place in the series. Without resemblance no reason could be assigned why a body should occupy one particular place rather than another, there being no relation to connect it with the preceding. Hence it follows, that those bodies which resemble each other most, should be grouped together; and consequently, that there should be as many heads of general division as there are general grounds of resemblance.

If it be asked whence this resemblance should be taken; whether from the external marks, or internal qualities? We answer, that it should be taken from both. The joint consideration of external character & chemical analysis stamps the mineral.

Now upon examining the totality of homogeneous earths & stones it will be found that those resemble each other ~~best~~ most that contain

contain the largest proportion of the same simple earth; or most of the characterizing properties of the ~~same simple~~ simple earth; and, as there are but Nine simple earths, it follows that there must be nine kinds or Genera, or primary divisions of homogeneous earths & stones.

To simplify the business we may say that there are but six primitive Earths viz

1st Terra Ponderosa —— Byretic earth.
2d Calx —— —— or Calcareous earth.
3d Magnesia —— or Magnesian earth.
4th Argilla —— or Argillacious earth
5th Terra Silicia —— or Silicious earth. —
6th Adamantine earth. —

By primitive earths we mean those that cannot be farther decomposed. The calcareous earth is the most universal; it is common to all the three kingdoms of nature; for it is found in the bones & shells of all animals; as well as in the ashes of burnt vegetables: it must consequently have existed before any living being or vegetable substance existed; and is distributed throughout the globe in a quantity adequate to its universal use. (Cronst.)

From these facts it follows that there must be nine, or for simplicity sake six genera, or kinds, or primary di-
-visions of earths + stones.

Now we may consider under each head or genus, those substances as specifically different that resemble each other least. Hence 1st the generic earths, combined with an acid, are specifically different from those that are not. 2. The same generic earth, combined with different acids, forms different species. 3d. The same generic earth, combined with a notable proportion of one or more of the other earths, forms a different species from the same generic, either un-
-combined, or combined with a less important proportion of other earths. Kirwan calls a proportion notable, or important when it introduces a considerable alteration in the external or internal characters of the compound.

If you live to be an
old man, amuse yourself
in teaching even these
Lectures do not answer
them into the fire
unexamined L M —.

To Jas S— M Crae —