

A delineation of the strata of Derbyshire, forming the surface from Bolsover in the east to Buxton in the west, by a plate, designed from a tablet, composed of the specimens of each stratum within the above line, with and explanatory account of the same; together with a description of the fossils found in these strata; and also of the nature and quality of the respective soils / By White Watson.

Contributors

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Publication/Creation

Sheffield : Printed by W. Todd, 1811.

Persistent URL

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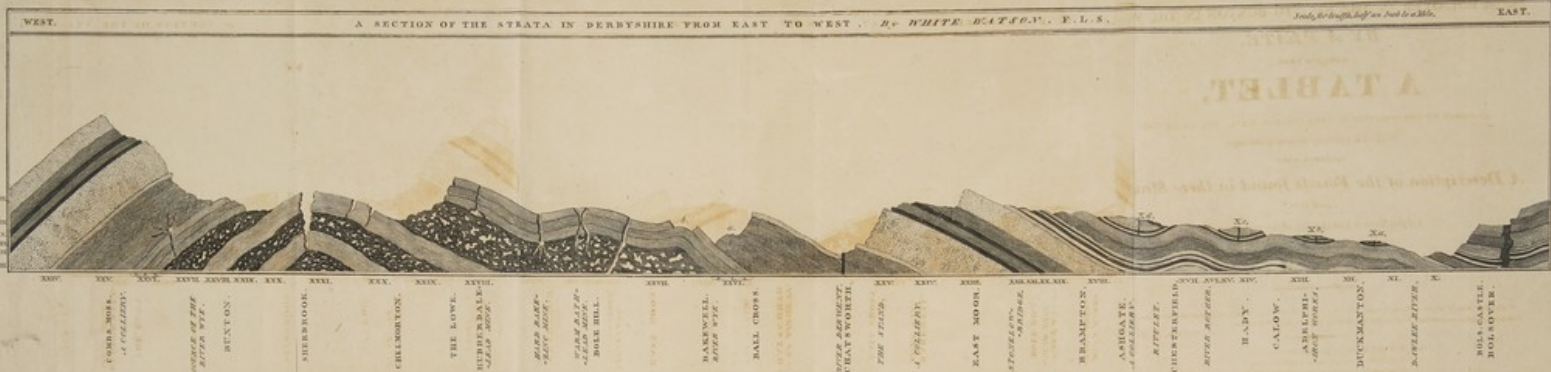
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A DELINEATION
OF THE
STRATA OF DERBYSHIRE,

Forming the Surface

FROM BOLSOVER IN THE EAST TO BUXTON IN THE WEST,

BY A PLATE,

DESIGNED FROM

A TABLET,

COMPOSED OF THE SPECIMENS OF EACH STRATUM WITHIN THE ABOVE LINE,

With an Explanatory Account of the same ;

TOGETHER WITH

A Description of the Fossils found in these Strata ;

AND ALSO

Of the Nature and Quality of the respective Soils.

BY WHITE WATSON, F. L. S.

" God has thought proper to discover to our senses much of his Providence ; and, to encourage our researches, He has endowed us with a most earnest desire to trace Him along the path that He has made.

A. HUNTER, M. D.

*" With how much wisdom are the Strata laid,
" Of different weight and of a different kind,
" Of sundry forms for sundry ends design'd !"*

BLACKMORE.

SHEFFIELD :

PRINTED BY W. TODD, AT THE MERCURY OFFICE, HEAD OF THE MARKET PLACE.

1811.

175 271

A DELINEATION

OF THE

STRATA OF DERBYSHIRE

Containing the Geology

FROM HORSFORD BY THE EAST TO DUXTON IN THE WEST

BY A. PLATE

REGISTERED FROM

A TABLET.

CONTAINED OF THE SPECIMENS OF EACH STRATUM WITHIN THE ABOVE LINE

WITH AN EXPLANATORY ACCOUNT OF THE SAME

VEGETATION WITH

A Description of the Fossils found in these Strata

AND ALSO

Of the Nature and Quality of the rocks

BY JOHN WATSON, F.R.S.

"The following report is drawn up in pursuance of an order of the Council of the Society of Antiquaries, London, passed on the 10th of January 1831, and is intended to be published in the Transactions of the Society."

Printed by J. W. Smith, at the Press of the Society of Antiquaries, London.

1831

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TO THE MOST NOBLE
William Cavendish,
DUKE OF DEVONSHIRE,

LORD LIEUTENANT OF THE COUNTY OF DERBY,

THIS SECTION
Of the Strata of Derbyshire

IS,

BY HIS GRACE'S PERMISSION,

INSCRIBED,

AS A TOKEN OF GRATEFUL RESPECT,

BY HIS GRACE'S

MOST OBEDIENT,

HUMBLE SERVANT,

WHITE WATSON.

THE
WILLIAM CURTIS

DUKE OF DEVONSHIRE

LIEUTENANT OF THE ROYAL ARMY
JAMES S. S. S.

Of the State of Maryland

BY HIS EXCELLENCY
JAMES S. S. S.

BY A JOINT RESOLUTION
OF THE GENERAL ASSEMBLY

IN SENATE

AND IN HOUSE

OF THE GENERAL ASSEMBLY

OF THE STATE OF MARYLAND

IN SENATE

AND IN HOUSE

OF THE GENERAL ASSEMBLY

OF THE STATE OF MARYLAND

IN SENATE

AND IN HOUSE

INTRODUCTION.

A Perfect knowledge of Rocks the celebrated George Agricola found highly necessary towards the attainment of skill in Mining : and Mr. Werner, of the present day, has, through indefatigable exertions, given so scientific a description of Rocks, Earths, and Minerals, that a skilful Mineralogist is able, from the inspection of a rock, to point out immediately what minerals may be expected therein ; a knowledge which prevents the generous researcher from imposition, and enables him to employ his pecuniary assistance where these treasures are most probably to be found.

Rocks are divided into Primary, Secondary and Tertiary ;—

Primary consist of Granite, Gneis, Micaceous-Schistus, Hornblende-Schistus, Argillaceous-Schistus, Kiesel-Schistus, Hone-Schistus, Chlorite-Schistus, Sienite, Porphyry, Quartz, Primitive-Limestone, Serpentine, and Topaz Rock ; which produce Platina, Gold, Silver, Mercury, Tin, Bismuth, Antimony, Nickel, Cobalt, Arsenic, Molybdena, Scheelium, Uranium, &c. with the Precious Stones, accompanied with several Ores of the Metals found in the secondary.

The Secondary consist of Limestones, Grits, Sandstones, Coals, Ironstones, Aluminous-Schistus, Basalt, Basaltic Amygdaloid, &c. which compose the Tablet here described.

The Ironstone and Coal Strata (found laminated in Clay in the concavities on the surface of the Grit Stratum, No. X.) may, by some, be accounted Tertiary : if so, the Lavas compose a fourth formation ; hence the basis of a quaternary division.

The Miner will in vain search for Platina, Native Gold, Silver, Mercury, and the Ores of Tin, within the limits of this Section.

These Strata are subject to Breaks, termed Faults, Mares, Dykes, &c. When thus broken, they are generally raised on one side and depressed on the other, and the fracture filled with clay, containing fragments of the Strata, particles of Lead-ore, &c. When Faults occur in the Coal Districts, they dam up the water, which keeps the Coal moist and consequently preserves it; they are generally narrow at the surface and widen as they descend, (but this depends upon the nature of the Fracture;) whereas the Rake-veins, which are perpendicular Veins in Rocks, are generally wider above, and narrower below, sometimes terminating in strings.

As Plants are peculiar to certain Soils, Botany will doubtless derive great advantage from having the Strata delineated, and Agriculture will, it is presumed, find a surer basis for improvement.

The Botanist and Zoologist may also find great amusement from studying the arrangement of the Strata, as many of them abound with "Monuments of the past felicity of Organized Nature!"

The Chymical World, hitherto divided by the opinions of the Neptunists and Vulcanists respecting the formation of these Strata, can obtain solid arguments to decide the dispute only by correct delineation and observation of their real state. Thus in considering the Strata of Derbyshire, the Neptunist may consult, the various animal and vegetable petrifications, so abundant in many of them; and the Vulcanist, on the other hand, by attentively considering the analogy of the Basalt, Basaltic Amygdaloid, Lava, Whinstone and Mandelstein of this and other Countries, may correct or confirm his ideas respecting their origin and effects.

These considerations induced the author to form a Tablet, consisting of real specimens of the Strata in their relative situations; and encourage him to hope that the delineation of the same, with such additional observations as a long and attentive study of the subject enable him to make, which he now offers to the public, will not be unacceptable to such as are engaged in the above mentioned pursuits.

Early in Life the Author was indefatigably engaged for several years, in making an extensive collection of the Fossils of this County, and particularly of the Petrifications, which he arranged agreeably to their respective Strata; this Collection he has had the honour of exhibiting, with general satisfaction, to many of the virtuosi of this and other nations. In 1790 he offered, in conjunction with Mr. Martin, a Descrip-

tion thereof, in Quarto, to the Public, with coloured plates, to be printed by subscription, but, not meeting with sufficient encouragement, did not proceed. Mr. Martin however having the Drawings, which were intended for their joint publication in his possession, in 1793, published himself the first Number of Derbyshire Petrifications, acknowledging in his Preface his being engaged with Mr. W. at the commencement of the business. Yet now, (1810) the first volume being published entire, Mr. W's name, as proposer of the work, is withdrawn, and, though the whole of the original specimens, from which the figures are taken, nine excepted, are still in his possession; yet Mr. Martin adverts to this circumstance only in one or two instances. The Author most willingly refrains from making any reflections upon this behaviour, however painful to his feelings, since it relates to a person who has already gone to that land* where his ear is equally insensible to the reproaches of injured friendship, as it is to the applause which his abilities so justly merit. Mr. W. thought it proper to mention this fact, as the Petrificata Derbiensia consist principally of specimens, characteristic of several of the Strata mentioned in and referred to throughout this work.

* Mr. Martin died at Macclesfield in June, 1810.



DESCRIPTION

OF THE

TABLET.

1.

Crystallized Granular Limestone.

THIS Stratum which forms the surface from Langwith (where the river Poulter divides this County from Nottinghamshire) to Bolsover, where it bassets out,* is composed of the following seven beds, subject to Faults as shewn in the Tablet.

No. 1. The top bed, of Isabella yellow colour, sparry texture, and small uneven fracture, being formed of minute rhombs in mass.

2. A variety, of straw yellow colour, much used for Building and makes neat Flooring, Staircases, &c. †

* The point where the Stratum terminating appears to the day.

† At Nether Langwith there is a machine for sawing blocks into slabs, erected by Mr. John Stanley.

These beds make lime esteemed for Mortar, but not proper for Agriculture ; the incumbent soil is not accounted productive of good herbage, but the luxuriance of the Spiked Heath Brome-Grass* is characteristic, and the sweet scented violet† both blue and white, is very plentiful. Morels‡ are very abundant in the month of April, at the roots of Ash and Elm trees, but not near the Oak ; and the Mistletoe§ is found on the Crab, Thorn, Willow, Lime, Tacamahaca and Cherry trees ; which it adorns with its parasitic foliage and crystalline berries, during the absence of the deciduous leaves in the winter months. Yellow rose trees with single and double, flowers grow luxuriantly in this soil, as may be noticed in gardens at Shire-oaks near Whitwell ; this soil, in some situations, as Hardwick, is very favourable to the growth of the Oak ; in others, as Pleasley, it flourishes for a few years and then ceases ; the Elm grows well, but the broad-leaved is subject to crack ; the Walnut comes to a large size.

N. B. These beds are void of Petrifications, but on breaking a block in Bolsover Field, in the Year 1795, of a ton and a half weight, a toad was

* *Bromus pinnatus.*

† *Viola odorata.*

‡ *Phallus esculentus.*

§ *Viscum album.* (Not seen here on the Oak.)

discovered alive in the centre, which died immediately ; no crack or joint was perceptible.

In a fissure of this Limestone in Scarcliff Park, near Bolsover, rises a strong spring of clear water, which is remarkable for its flowing most rapidly in the hot summer months ; it is called Owlsitch, and its course is lined for a considerable way with the Shave-grass, (*Equisetum hyemale*.)

3. A variety, the ground of hair brown colour, abounding with yellowish white rhombic crystals, and thin laminæ of pipe clay of sea green colour ; where it forms the surface a great variety of plants grow luxuriantly.

4. Limestone of a compact texture, and conchoidal fracture of yellowish white colour, containing very minute specks of a deeper yellow, with shades of faint purple ; makes good lime for various purposes in building.

5. Dendritical Limestone, of granular texture, slaty structure, colour yellowish white, with linear black spots on the edges, which describe its laminæ: on being split asunder beautiful arborescent landscapes appear, (which in one of the laminæ assume the configuration of *Septariæ*) produced

by a colouring formed by metallic solutions deposited between the layers.

Pipe Clay used at the Pipe Manufactories at Bolsover, &c, separates the above five beds, which are included in No. 1, in the Tablet.

6. Limestone of granular texture formed in laminæ, some of which are brownish red, others bluish grey with blotches of brownish red; the soil of this bed is accounted the best for the growth of wheat on which it is generally the most free from smut; * owing to faults, the red beds sometimes form the surface. This bed forms No. 2 in the Tablet.

* The Smut appears to be a disorder arising from a Parasitic-plant, the farina of which, alighting upon the grain whilst in its bloom, (after thrashing) fixes thereon, and vegetates with it; by stirring the grain well in good quick lime, and afterwards steeping it in brine for a few hours previous to sowing, is said to prevent the disorder.

The Mildew is also the effect of a Parasitic-plant, growing on the stems of corn and absorbing the nourishment which should fill the ears; its progress is most rapid on corn that is bent down and matted together in wet sultry seasons; the ancient custom is recommended, in strong crops, of two persons walking up and down the furrows frequently in these seasons, holding a string across the lands, thereby lashing off the wet. Proper management of soils to produce crops of a proper strength to resist their being laid, will, of course, prevent the disease.

The Honey-dew,* on Hop Plants, Currant-trees, &c. appears to be occasioned by Frosts occurring late in the Spring, whilst foliage is expanding; which puts a stop to the regular flowing of the juices and changes their nature, they thereby become of a mucilagenous consistency, and nourishment for Insects as the Aphis, which alight, increase, and feed thereon, and retard vegetation; and, except showers of rain shortly ensue to dissolve the mucilage, the leaves soon decay, and the health of the Plant is frequently much injured.

Reaumur, considering each Aphis as bringing forth ninety young, calculates that in five generations the produce from a single one would be five thousand nine hundred and four millions nine hundred thousand.

Bloodstone, (Hematites Iron-ore) is found in obtuse angled nodules imbedded in this stone and scattered loose on the surface of the under beds, and is collected for burnishing metals, &c. it is very rare that a good one is met with, which makes them valuable.

7. Shell-Limestone, of a more compact texture, of a bluish grey colour, containing petrified Bivalve Shells; this stone is in request for making Lime for Agriculture, and quarries of it are worked at Bolsover, Oxcroft, Barlborough, Palterton and Houghton.

This bed is represented by No. 3, in the Tablet, which is announced on the surface by a variety of good herbage.

The living waters, springing from the bottom of this Stratum, are very clear and good, and proper for irrigation.

II.

Grit. *

A Stratum four yards thick ; the surface of the ground where it bassets is covered with the fragments of the incumbent beds, whose abrupt termination makes it probable to conclude that these fragments have been shook off by some convulsive violence.

III.

Rock-Coal. †

A bed about two feet thick.

* Though Grit and Sand may originally be synonymous terms, and properly only applicable to loose unconnected hard particles ; yet it has been found convenient to use them as distinct terms in the following pages, and to make use of the former without the addition of *Stone* to indicate the compact substance.

By Sandstone we understand those varieties in which the quartzeous or other constituent parts are visible to the naked eye, or which may be reduced to what is called *Sand* by pounding.

Under the name Grit we collect such whose particles are imperceptibly small, and which, instead of turning to Sand, are resolved into dust or impalpable powder.

† Rock-Coal is found stratified with Crystallized Granular Limestone and Sandstone Rocks.—See Tablet III. V. VII. XIV. XX. and XXII.—Pit Coal is of later formation, and lies under beds of Ironstone and Clay, and appears to have been formed from the destruction of Vegetables once growing on the concave surface of undulated Grit.—See Tablet X. a, X. b, X. c, and X. d.

IV.

Grit, Shale, Ironstone and Clay,

In thin beds.

V.

Rock-Coal,

A bed betwixt two and three feet thick.

VI.

Shale, Ironstone, Clay and Grit,

In thin beds.

VII.

Rock-Coal,

A bed eighteen inches thick.

VIII.

Grit.

Ten or twelve yards thick, the ending of this Rock occupies a considerable portion of ground, and makes some of the best land in the valley; in this Stratum are numerous organic remains, having the appearance of large striated Reeds. *Phytolithus sulciculmis* and *striati culmis*. Martin, Tab. 8, 25, 26. Ludij Lithophyl. p. 12, 184, 6. Woodward's Catalogue, Vol. II. p. 104. 9. 2.

IX.

Grit,

A thin bed.

At the termination of this Stratum the Dawlee Rivulet winds through the Valley.

N. B. The dip of all the above described Strata is to the south east, with a declination of not quite three degrees.

Woodhouse Estate (situate on the endings of these Strata from the foot of No. I. to the rivulet) when purchased by the Rev. Edward Otter, in the year 1807, abounded with Bogs, covered

with Rushes, and other sour plants ; but now, (1810) by the spirited management of this Gentleman, is an excellent specimen of good husbandry, being by draining, irrigation and drilling, brought into a high degree of improvement.

X.

Ferruginous Grit,

Of yellowish white colour, of a fine grained texture and slaty structure abounding with ferruginous curves of shaded brown, easily decomposing by the air into Clay. The surface undulated, in the concavities of which are formed beds of Coal and Ironstone, (vide X, a. X, b, X, c. X, d.) The convexities form Conical hills, as at Duckmanton, Calow, Chesterfield, &c.

This stone is hardened by torrifaction in Kilns, which makes it a better material for repairing roads ; a custom about Duckmanton, Staveley, and other places. On being struck after this process, the stones resolve themselves into distinct pentagonal and other sided prisms, the planes of which like those of Basalt, are generally concave ; this circumstance is also frequently observed in the

hearths of old furnaces, and in the torrifaction of some ironstones.*

The Soil is very favourable to the growth of the Holly-tree and Gorset† and Brakes‡ grow very luxuriantly.§

The Author is in possession of a dried Toad, that was taken alive out of this Stratum forty yards from the Surface in the Fire Engine Pit at Eastwood colliery, but died immediately on exposure to the air ;** it was presented to him by Mr. Gervas Bourne of Eastwood, of whose extensive Collection of Vegetable impressions in Ironstone and other choice Fossils of that neighbourhood, &c. it formed a part.

* A pig of Lead being put into a Red Lead Furnace, and precipitated from thence on a cold stone floor, just prior to its state of liquefaction, will, immediately resolve itself into Columns, exhibiting beautiful miniature specimens of the Columns of Staffa, the Giant's Causeway, &c.

† Ulex Europæus.

‡ Pteris Aquilina.

§ Whilst the Soil of the Crystallized Limestone affords in the Month of April its peculiar Esculent Plant the Morel, this Stratum in August supplies us with that delightful Agaric, the Common Mushroom.

** The celebrated Tourist Mr. Saussure, of Geneva, made experiments on Toads by keeping them from the air enveloped in balls of Plaster varnished over, for six weeks, when on opening the balls, they gasped and died immediately, as it is said all have done that have been found in Rocks,

X a, X b, X c, X, d.

Ironstone and Coal Strata.

Formed within the concavities of No. X. termed Troughs, Sancums, &c. imbedded in clay ; the beds of Coal, termed Pit-coal, whose laminæ frequently abound with Charcoal, Carbonate of Iron, Sulphuret of Iron, Crystals of Sulphate of Lime, &c.* lie at the bottom, and are more or less separated by Clay ; the bottom beds of Ironstone are in nodules frequently containing vegetable impressions resembling Ferns, Galiums, Nuts, and a variety of Flowers, Insects, &c,† which are sometimes accompanied with particles of Sulphure of Lead. Above these beds are nodules which contain impressions of larger plants, and incumbent are layers of compact nodules. Above these are compact beds abounding with Petrified Muscle Shells, (*Conchyliolithus Myæ ovalis*, of Martin, Plates 27 and 28,) incrustated with Conic Clay, composed of multifarious concentric ramified Cones ; and nearer the surface are oblate

C

* In one bed which contains a seam of Pyritical Pisolites, the surface of the joints are coloured with a beautiful peacock's tail Tarnish, termed moon-feathered.

† In the nodules of Ironstone found in the bottom beds in the neighbourhood of Heanor, appear impressions of a great variety of Plants, Flowers and Insects, several of which are figured in Martin, as the *Phytolithus Filicites striatus*, T. 10. *Phytolithus Plantites imbricatus* T. 14. *Phytolithus Pseudoregalis* T. 19. *Phytolithus Plantites, stellatus*, T. 20. *Phytolithus acutulinus*, T. 21. *Entomolithus Monoculites. ? lunatus*, T. 45. Fig. 4. &c.

sphéroids, containing Septariæ* of Carbonate of Iron, some of which septa, towards the centre of the nodule, are hollow and lined with crystals of Carbonate of Iron, Sulphuret of Iron, Sulphure of Lead, Sulphate of Zinc, &c. These Strata are subject to Faults which consequently derange their Stratification.

The natural soil in these districts is very favourable to the growth of the Oak, but where the surface is formed of soil brought from a depth by getting Ironstone, it is incapable of producing good herbage or grain ; and, like the soil from Lead Mines, is characterised by the luxuriance of Colts-foot† and Water Pepper‡. The best purpose such soil can be applied to is Planting, for which it answers very well.

At X a, is probably a Sancum, containing beds of Ironstone and Coal, as smuts of coal appear on the surface, but they have not at present been sufficiently examined.

* Ludus Helmontij ; or Waxen Vein of Woodward. Vol. 1. p. 85.

† Tussilago farfara. The essence of this plant is efficacious in the Belland, a complaint peculiar to Miners, owing to inhaling very minute particles of Lead Ore, &c. which lodge in the interstices of the lungs. Cattle pastured near mine-hillocks, are also subject to the belland, owing to the winds blowing these particles upon the Grass.

Lead Smelters (formerly called Ore Burners) are also subject to the Belland, arising from the Effluvia in Smelting ; but it appears they were much more so when Blast Furnaces were only used, the last of which in Derbyshire, was at Rowsley, near Bakewell, and was pulled down in 1788.

‡ Polygonum Hydropiper.

Section of the principal Ironstone and Coal Strata which are found within a Sancum at X b, where are situate the Adelphi Ironworks, belonging to Messrs. Smiths, established in 1799; here true Mechanism appears combined with originality of genius, and the useful Arts have deservedly crowned the promoters with success.

No.	<i>The general inclination about eight Degrees to the East.</i>	<i>Provincial Terms.</i>	<i>Yds.</i>	<i>Ft.</i>	<i>Ins.</i>
1	Clay	Clay .....	....	....	....
2	Ironstone in irregular shaped nodules.....	Scrin .....	....	....	1½
3	Clay	Clay .....	....	....	....
4	Calcareous Clay, composed of multifarious concentric ramified Cones	Bears.....	....	....	6
5	Ironstone, a bed abounding with Petrified Muscle Shells, Conchyliolithus Myæ ovalis of Martin, pl. 27 and 28.....	Dogtooth .....	....	....	5
6	Clay.....	Clay .....	....	....	....
7	Ironstone, in cheese shaped nodules, containing Septariæ of Carbonate of Iron.	Old Man .....	....	....	4
8	Clay.....				
9	Ironstone, in finger shaped nodules, consisting of Concentric Laminæ	Gingerbread .....	....	....	3
10	Clay				
11	Ironstone, a bed	White Measure.....	....	....	2
12	Clay.....				
13	Ironstone, a bed	Bottom Measure .....	....	....	2½
14	Clay	Coal Smut.....	....	....	....
15	Coal	First Coal.....	....	....	....
16	Clay.....				
17	Coal	Old Hobbery .....	....	5	....
18	Clay	Bind	15	....	....
19	Coal,	Third Coal	1	....	....
20	Clay	Bind	40	....	....
21	Coal	Fourth Coal	1	....	....

N. B. The following Beds have a general inclination of about eighteen Degrees.

22	Clay .....		....	....	....
23	Coal	Fifth Coal.....	1	....	....
24	Clay of bluish grey colour	Bind	100	....	....
25	Coal	Sixth Coal.. ..	1	....	....
26	Clay	Clay	10	....	....
27	Coal, which passes out at Calow.....	Seventh Coal.....	1	....	....

Section of the Strata of Ironstone and Coal, at Hady, East of Chesterfield, X c, formed within a Sancum which appears to surround Chesterfield, and following the course of the rivers, the Strata baset towards and from the town, as represented at X d, Ashgate. Subject to faults.

No.	<i>The general inclination about eight Degrees to the West.</i>	<i>Provincial Terms.</i>	<i>Yds.</i>	<i>Ft.</i>	<i>Ins.</i>
1	Clay .....	.....	11	....	....
2	Ironstone, in angular nodules	Serin .....	....	....	1½
	Clay .....	.....	....	1	6
3	Ironstone, in cheese-shaped nodules containing Septariæ of Carbonate of Iron	Cheeses .....	....	....	3
4	Conic Clay, composed of multifarious concentric ramified cones; containing on Analysis, Iron 11 0. Carbonate of Lime 78, 5. Silix 2, 5. Manganese 8 0. in 100 parts.				
5	Ironstone, abounding with petrified Muscle Shells, (Conchylolithus Myæ ovalis of Martin, Plates 27 and 28) contains 25 per cent. of Iron	Bears.....	....	....	3
		Muscle band.....	....	....	3
6	Clay	Clay .....	....	1	6
	Ironstone, in Cheese-shaped nodules, containing Septariæ of Carbonate of Iron..	Old Man .....	....	....	4
7	Clay .....	.....	....	1	3
	Ironstone, in cheese shaped nodules, containing Septariæ of Carbonate of Iron..	Old Woman.....	....	....	4
8	Clay	Clay .....	....	....	9
	Ironstone, in Ovate nodules, containing Vegetable Impressions (Phytolithus Plantites imbricatus of Martin, Pl. 14.)	White Balls .....	....	....	4
	Clay	Clay .....	....	1	6
9	Ironstone in lenticular nodules, containing Septariæ	Dices.....	....	....	1
	Clay	Clay .....	....	1	9
10 & 11	Ironstone in nodules, two beds	Balls .....	....	....	6
	Clay	Clay .....	....	1	6
12	Ironstone in lenticular nodules.....	Smooth Chitters .....	....	....	3
	Clay .....	.....	....	....	6
13	Ironstone in lenticular nodules	Rough Balls .....	....	....	8
	Clay .....	.....	....	2	6
14	Ironstone in beds	Flamper .....	....	....	6

No.	The general inclination about eight Degrees to the West.	Provincial Terms.	Yds.	Ft.	In.
	Clay.....	.....	...	2	2
15	Ironstone in beds, containing Sulphure of Lead in small Fissures.....	Serin black .....	....	...	3
	Clay .....	.....	....	2	...
16	Ironstone, abounding with Petrified Plants, Phytolithus Sulciculmis of Martin. Plate 8, Figure 1.	Black Measures .....	....	...	3
	Clay .....	.....	....	1	6
17	Ironstone in Beds.....	Dunstone .....	....	...	6
	Clay .....	.....	....	1	6
18	Ironstone in nodules, containing petrified bivalve shells, similar to Fig. 3, in T. 27, Martin, with Crystals of Sulphure of Lead, &c. ....	.....	....	...	4
	Clay .....	.....	....	1	6
19	Ironstone in lenticular nodules, containing Pisolites.....	Balls .....	....	...	5
	Clay .....	.....	....	1	6
20	Ironstone, in ovate nodules, containing Vegetable impressions (Phytolithus imbricatus of Martin,) Plate 50	Black Measures .....	....	...	4
	Clay .....	.....	....	1	6
21	Ironstone in angular nodules	Over bottom.....	....	...	4
	Clay .....	.....	....	1	6
22	Ironstone of black colour	Blackstone Lining .....	....	...	6
	Clay .....	.....	....	1	5
23	Ironstone	Lining .....	....	...	3
	Clay .....	.....	....	1	6
24	Ironstone in ovate nodules, containing Impressions of vegetables, (Phytolithus Plantites imbricatus of Martin,) Plate 50	Nether bottom.....	....	...	4
	Clay	Bind .....	....	2	5
25	Coal	Main Coal .....	....	2	2
26	Ferruginous Clay, with oval nodules of Ironstone, containing Vegetable Impressions, as Ferns, &c. ....	.....	11	....	....
	<p>" Hence dusky Iron sleeps in dark abodes, " And ferny foliage nestles in their nodes." DARWIN.</p>				
27	Coal	Underbed.....	....	2	....
	Black Soil.....	Smut.....	....	2	6
28	Soft Coal	Soft Coal .....	....	2	....
Yards			35	2	3½

At X d, A similar Sancum to X c, containing corresponding Strata of Ironstone, Clay and Coal ; with an inclination to the east of about eight degrees.

The mode used by the Saxons and Danes in searching for Ironstone was by pricketing* on their Basset Ends ; which they described by the course of the Sun, according to the hour of the day when his rays first bore upon them, terming it “ such an hour’s Sun ;” and this method of description is used even at this day. It is said, that they sunk no deeper for Ironstone than to the bed, called “ Old Man,” a term applied amongst Lead Miners to Old Works.

Their mode of Smelting Ores was not by Furnaces, but by what they termed Boles,† which were Hearths made of Sandstone, placed on the summits of high Hills, exposed to the action of the Westerly Winds, as being the most prevalent ; and in many places, are hills which, at this day, go by the name of Bole Hill, from the above circumstance ; as at Bakewell, Ashover, &c.

* Probing with sharpened Iron Rods.

† See Watson’s Chemical Essays, Vol. 3, page 269.

XI.

Whetstone Grit,

Of a light hair brown colour, fine grained texture, and conchoidal fracture, forming a stratum three yards thick ; much esteemed for Whetstones, Tombs, Paving, &c. being very neat and durable.

The upper beds are in testaceous laminæ, and used as Slates for covering Buildings.

The soil of this stratum is very conducive to the growth of good Corn, and the Dandelion * flourishes in great abundance.

XII.

Grit,

Of a yellowish white colour, a bed about three yards thick, used for roads.

* *Leontodon Taraxacum.*

XIII.

Grit, commonly called Cankstone ;

Of a yellowish brown colour with shades of brownish red ; of very fine grained texture and splintery fracture ; from its hardness much used for roads, a bed about ten inches thick. Incumbent thereon is a bed of Fire Clay used at the potteries, &c.

XIV.

Rock Coal.

Of a fibrous texture, a bed about one foot thick, frequently divided by Clay into two beds, abounding with Sulphuret of Iron.

XV.

Organic Grit,

Provincially Crowstone, Gannister, Galyard, of very fine grained compact texture, abounding with impressions of a peculiar vegetable, *Phytolithus Plantites (verrucosus)** of Martin Table 11.

* Since this Manuscript went to the press, the author has been presented with a collection of petrified plants consisting of several varieties of *Phytolithus*, and apparently impressions of compressed cones of Pine Trees, which have lately been found in a quarry of Argillaceous

12. 12*. the substance of the plants is entirely decomposed and their place occupied by minute particles of Quartz, Argil, Mica, &c. forming a compact Grit; the impressions are covered with a very slight coating of a black substance, probably the carbonization of the bark.

It forms a Stratum of from six inches to up-
D

Grit, situate on the brow of an hill, in a Coal district facing the north west, rising from the valley of the river Calder, about three miles East of Wakefield in Yorkshire. Part of the quarry appears to have been subjected to a Subterranean Fire, supposed to have been occasioned from the ignition of a bed of Coal which bassetted there; in this part of the quarry there is a Stratum of Shale which contains stratified nodules of Ironstone that have undergone a great degree of heat. These fossil plants lay horizontally in the rock, but a Phytolithus Plantites has lately been discovered in the same quarry in a vertical position, of which plant about twelve feet in length has been taken out, which, towards the top is roundish and about eight inches by six in diameter; but the lower part is more elliptical and measures twenty-six inches one way and eighteen the other; an appearance of pith is described at the centre by an ellipsis of a reddish brown colour; the petrification, which is Argillaceous Grit, is solid and of the same nature throughout, bearing the external character of the original plant, which is in part coated with Coal. This interesting specimen is in the possession of Sir Edward Smith, Bart. of Newland Park, who has favoured the author with a complete round from the same, taken near the top.

At the top were branches somewhat resembling stags' horns, one of which accompanies the main stem.

In the burnt part of the quarry, another vertical plant has since been discovered, which appears to be of a different species, a perfect specimen of which is also in the Author's possession.

These Reliquiæ denote the existence of a tribe of Plants once flourishing on the surface of these Strata which now appear to be extinct; and only their external characters remain, which, like the petrifications in the lower Strata, are enshrined "as Medals deposited by the hand of Nature, in memory of the more remarkable changes on the surface of the earth, and from which the time and order of the work may, in some measure, be judged of, whilst other monuments are silent."

wards of three feet thick, and is much used for Roads. Beneath this Stratum is a thin bed of Coal.

XVI.

Friable Grit.

Of a greyish white colour, containing very thin laminae of Coal, is composed of several beds forming a Stratum of about four yards thick.

XVII.

Bituminous Shale.

Of black colour, earthy texture, and laminated structure; a bed about two yards thick, used by Masons for scoring their lines.

The surface boggy,* situate on the East Moor, the soil very wet and unfavourable to the growth of trees or good herbage. Here large pieces of

* Here the Cotton Grass, *Eriophorum*, is abundant very early in the Spring, and affords at that season, great nourishment to sheep, which are so remarkably fond of it that they have been observed to fasten their teeth to the young shoots, and to draw them up from the roots.

N. B. By attention to the Section, the Strata that occasion these Bogs, as well as their respective thicknesses may be easily ascertained, thereby pointing out to the skilful Agriculturist, a sure mode of draining at a reasonable expense, by which, instead of the surface being clothed in irksome brown, from the inferior herbage of *Schoeni*, *Scirpi*, *Eriophora*, &c. a few years good husbandry would soon make it assume the pleasing verdure afforded by the *Trifoliums* and other sweet grasses.

timber have frequently been found, which circumstance in some measure gives strength to the tradition "That the Town of Leasefen, or Leasefield, formerly stood on this spot," the following being still an old saying in the neighbourhood :

When Chesterfield was Gorse and Broom,
Leasefen was a Market Town ;
Now Leasefen is Gorse and Broom,
And Chesterfield is a Market Town.

XVIII.

Grindstone-Sandstone.

Of a yellowish white colour, composed of small uniform grains of Quartz, with Mica and Argil ; much esteemed for Grindstones, Scythe-stones, Filtering Cisterns, Bakestones, &c. and is an excellent Firestone.

It contains vegetable Petrifications, chiefly Phytolithus Sulculmis and Phytolithus acutulinux of Martin. See Plates, 8, and 21.

N. B. In Sandstone districts, Turf and Peat occur in swamps, the former composes the surface, and consists of the roots and stalks of various morassy vegetables with a mixture of Peat, the latter

is composed of vegetable matter impregnated with Petroleum, and is constantly forming by the growth and decay of a peculiar vegetable. On penetration, Petroleum is more and more abundant, and the deeper the Peat is procured, the better its quality.

XIX.

Fatiscent Grit,

Of a blue grey colour, forming a Stratum of twenty-nine yards.

XX.

Rock Coal,

Abounding with sulphuret of Iron in its laminæ, a bed about twenty two inches thick.

XXI.

Clay. Coal Bind.

A bed about eight Yards thick.

XXII.

Rock Coal,

Abounding with nodules of Sulphuret of Iron, termed Basses, Bats, &c. used in making Sulphate of Iron* and Carbonate of Iron in thin laminæ, crystallized in rhombs. In this stratum at Thatch-marsh near Buxton, veins of Sulphure of Lead are found in Faults having Coal attached on both sides, accompanied with Sulphuret of Iron.

XXIII.

Millstone-Sandstone†, or Sandstone,

Of a reddish white colour, composed of Quartz in grains of various sizes with Feltspar in a state of decomposition, and Mica; used for Millstones, Cisterns, &c. and is very durable in Buildings.

It contains Vegetable Impressions (*Phytolithus sulciculmis* of Martin, Plate 8, and *Phytolithus verrucosus*, Plate 11.) and at Ashover, branches of

* Copperas.

† Mr. Samuel Watson, of Baslow, the Author's Father, obtained a Patent in 1774, for making a Hand-mill of Millstone-Sandstone and Derbyshire Burr, for grinding Wheat and other Grain into Flour; and also for crushing Malt, Oates, Beans, Drugs, &c.

trees somewhat resembling the Stag's horn Sumach with the surface covered with a thin coating of Coal.

Sulphure of Lead and other Minerals sometimes are found in Faults.*

Bilberries†, Cowberries‡, Cranberries§, Crowberries||, &c. flourish well on and are characteristic of this stratum, and on Axe Edge near Buxton Cloudberrries** are found.

In Sandstone districts, insulated blocks of various sizes are diffused over the surface, some having cavities on their tops, containing water, called rock-basins; at Rowtor, a place worthy of notice, near Winsters, many of them are formed together in mass, amongst which are some that may easily be rocked to and fro by the hand, in one place several may be moved together, in others, detached ones, one calculated to weigh fifty tons; these rocking-stones are called by Antiqua-

* In Yorkshire and The Isle of Man, rich Rake Veins of Lead Ore are in work in a similar Sandstone Stratum.

† *Vaccinium Myrtillus*.

‡ *Vaccinium Vitis Idæa*.

§ *Vaccinium Oxycoccus*.

|| *Empetrum nigrum*.

** *Rubus Chamæmorus*.

ries Druidical Temples, to which the following lines allude ;

Thither, Youths,
Turn your astonish'd eyes ; behold yon huge
And unhewn sphere of living adamant,
Which, pois'd by magic, rests its central weight
On yonder pointed rock : firm as it seems,
Such is its strange and virtuous property,
It moves obsequious to the gentlest touch
Of him, whose breast is pure ; but to a traitor,
Tho, ev'n a giant's prowess nerv'd his arm,
It stands as fix'd as Snowden.

MASON'S CARACTACUS.

In the neighbourhood of Hathersage, where this stratum forms a chain of Mountains, and where the best Peak Millstones are procured, the Sheep*, that are pastured thereon, produce Wool the most esteemed in the County ; which is the case with those Sheep in Spain, whose summer Station is on the Mountain Arandilla, which is a similar Sandstone Stratum. The coincidence therefore of Sheep being pastured on this Stratum, producing Wool

* Mr. Robert Bakewell, Author of " Observations on the Influence of Soil and Climate on Wool" recommends on all the dry Uplands of Derbyshire, a mixture of the Merino with the South Down, or Nottinghamshire Forest Sheep, if they were sheltered from the inclemency of the weather in the Winter Months and from long continued Rains : but on no account a mixture of the Merino with any of the Derbyshire flocks ; the wool of the latter being much too coarse ; such a mixture would require a long time and a great number of crosses, to attain a tolerable degree of perfection in comparison with pure Merino.

of a superior quality in countries so very remote, fully confirms its superiority, and will, no doubt, be particularly attended to by the intelligent Farmer, attentive to the goodness of his Wool; who will consequently avoid turning his Sheep from this Stratum upon that of Limestone.

On the decomposition of the Sandstones XVIII. and XXIII. the particles are conveyed by rains into small reservoirs where they form beds of the most proper sand for mixing with Lime in the making of good Mortar for pointing and stucco work; the Lime recommended as most firm and durable is obtained from the Crystallized granular Limestone, No. I. And the mode of mixture is by incorporating with a riddle in a dry state one pound of Quicklime to four pounds of Sand, which ought to be kept dry and to be well worked up with water as it is wanted for use.

Lime from the Shell Limestones, No. XXVI, will answer well, but requires great attention.

XXIV.

Argillaceous, or Shale Grit,

Of a straw yellow colour, forming an undulating surface, subject to Faults, from its com-

mencement at Chatsworth to its bassetting at Bakewell Edge. Is of a light straw yellow colour and earthy texture, composed of an argillaceous basis, in which are disseminated minute grains of Quartz and Mica, and concentric ferruginous circles of shaded brown, proceeding from nuclei, which have a beautiful effect in ornamental buildings. It is formed in beds separated by clay; the upper ones are disposed in thin flat laminæ, the surfaces of which abound with Mica, and are used as slates for covering Roofs; the bottom beds, which appear to have been shattered into blocks, are used in building, when care must be taken that the stones are placed in the same position as when they lay in the Quarry; if otherwise, the laminæ are liable to separate, and the stone perishes in a few years.*

It contains petrified Plants. (Phytol. cancellicaudex, Phytol. sulculmis, & Phyt. verrucosus, of Martin, Plates 13, 8, and 11.)

Bakewell Church is built of this stone from Bakewell Edge, from whence the Fronts of Chats-

E

* The Author is happy in announcing to the Public, that he has, by experience of several years, discovered a mode of preventing Buildings and ornaments of this stone from decaying, without producing any perceptible change in the appearance.

worth* were built, and the principal part of the Crescent at Buxton; though the same Stratum bassets out on the spot, a circumstance at that time not known.

Springs of soft water issue from between the beds and a variety of aquatic plants adorn their courses.

The Foxglove†, Maiden Pink,‡ and small Trefoil§, are characteristics of this Stratum; Hindberries|| are abundant. It is the best soil for Potatoes; and here the Oak delights to grow.

When now, become the Father of the wood,
By the stout rustic's gleaming axe it falls,
And in a ship, upon the watery flood,
It forms, O Glorious fate! our wooden walls.
High o'er the deck th' Imperial flag's unfurl'd,
And Britain sends her Oak to rule the World.

RODD'S BATTLE OF COPENHAGEN.

* The Author's Grandfather, Mr. Samuel Watson, of Heanor, was a principal Carver at Chatsworth at the time of its building: he executed the Carving in the West and other Fronts, the Trophies and other Ornaments in the inner Court, at the Cascade, &c. and assisted Mr. Gibbons in the Chapel, "Who gave to wood the loose and airy lightness of Flowers, and chained together the various productions of the elements, with a free disorder natural to each species."—Mr. WALPOLE, Vol. 3, p. 344.

† Digitalis Purpurea.

‡ Dianthus Deltoides.

§ Trifolium filiforme; an handful of which being well bruised, and its juice put into a pint of Skimmilk, made lukewarm, and given to a Beast afflicted with the Red Water, is esteemed an excellent remedy.

|| Rubus Idæus.

A general Inclosure* taking place at this period, Ball Cross, situate on the Basset of this Stratum and Shale, heretofore clothed with Brakes and Gorse, is now enriching with fine plantations,

Whose rising forests, not for pride or shew,
But future buildings, future navies grow.

POPE.

And the Commons of Bakewell and Over Haddon, which were lately one continued dreary waste, are now a scene of complete enclosures gracefully ornamented with extensive plantations.

“ And here behold a smiling change of Scene,
“ Where earth-born Russet turns to lively green;
“ Rich pastures rise where deserts spread before,
“ And barren Wastes recruit the less’ning store.”

N. B. The River Derwent rises near to a Gritstone Village of the same name, situate in the Woodlands, at the northern extremity of the High Peak Hundred, and continues its course southwardly through vallies of Gritstone and Shale by Chatsworth to Rowsley, where it receives the united

* The Duke of Rutland's Precedent by enclosing with Quicksets in lieu of Stone Walls, will remove the dreary aspect of the Country, and yield a richer prospect to the Traveller, and be of service by affording Timber useful for various purposes and a warmer shelter for Cattle.

“ There Birds resort, and in their kind thy praise

“ Among the branches chant in warbling lays.”

WORT.

streams of the Wye and Lathkill, and passing through vallies of Limestone, &c. continues its course to Derby, a few Miles below which town it forms a junction with the Trent, the length of its course being about fifty miles ; its water is of an Umber brown colour, and, generally speaking, its stream is rapid, especially in its course through the High Peak. This river abounds with Trout*, seldom exceeding two pounds and a half, Laxbrood or Samlets, Grayling or Umber, esteemed of a superior flavour, Barbel, Chub, Dace Dare or Dart, Gudgeon, Roach, Silver Eel, Crawfish, and in some parts Perch.

XXV.

Aluminous Shale, or Slate†.

Of a brownish black colour, earthy texture, and lamellar structure ; which freely cleaving when

* On the 3d of August, 1806, a Trout was taken out of a Pond situate on Shale Grit, belonging to His Grace the Duke of Devonshire in Chatsworth Park, that was one foot ten inches long, by one foot seven inches in girth, weighing eleven pounds and a half, of a fine Salmon colour and very good flavour, which weighed only two pounds when put therein four years before.

† On this Stratum, within a Fault Chatsworth is situate,

Which like the Sun in an hazy air,

Adds Lustre to its dusky Mountains. LEIGH.

Here the Weymouth Pine, Horse Chesnut, Beech, Oak, &c. grow remarkably luxuriant.

The quantity of rain fallen at Chatsworth within the last fifty years, is 1420 inches.

At Chatsworth, is an excellent Collection of Fossils, which were collected by the late Duchess of Devonshire and arranged into two Cabinets ; one containing the various productions of Derbyshire ; amongst the nodules of Ironstone containing Petrifications, &c. No. 56, contains a perfect

exposed to the air, decomposes to Clay, in which state it is used for making Building Bricks. Thin beds of Grit and Ironstone frequently occur in this Stratum, a perfect knowledge of which is highly necessary in draining bogs.*

It is also productive of Alum, and cavities are frequently found herein, heretofore made by the Miners in sinking through for veins of Lead Ore in the Limestone below; these cavities are lined with Plumose Vitriol of Iron, and needle like crystals of Plumose Alum.

Nodules of Ironstone, called Shale Binds, also occur stratified, some of which contain Septariæ of Carbonate of Iron, which are hollow, and contain liquid Petroleum† and Asphaltum, with crystals of Sulphate of Baryte, Carbonate of Lime,

Compound radiated Flower, resembling a small Sunflower; and in No. 60, is the appearance of an insect, resembling an Apis.

The other Cabinet contains choice specimens from Cornwall and other counties in this Kingdom, a select Collection from Scotland, and a specimen of Shell-Limestone from Schlappenstadt in the Duchy of Brunswick, containing the head of an Encrynus,** of the fragments of which species of Petrification the Entrochal Marble of this County is formed.

** Vide plate of a recent Encrynus, taken on the Coast of Barbadoes, in Whitehurst's "Enquiry into the original state and formation of the Earth," 2d Edition, and Parkinson's Organic Remains.

* To Mr. Joseph Gould, of Pilsbury, the public are much indebted for his Precedent in draining bogs in this Stratum, as well as for several other agricultural Improvements.

† Liquid Petroleum, Barbadoes Tar, is used by the Miners for fresh wounds, and as a substitute for Candles.

Sulphate of Lime, Sulphuret of Iron, &c. other nodules are formed in concentric laminae and called Geodes*, and others are botryoidal balls of Calciform Iron Ore. Black Asphaltum sometimes occurs of a very compact texture and shining fracture, in thin beds,

In mining, this Stratum is generally a cover for veins of Ores in the Limestone beneath, and accounted a good criterion ; small veins sometimes occur which appear to proceed from the Rake-veins in the adjacent Limestone.

A singular Rake-vein was worked in this Stratum at Haybrook Gate Mine, near Warslow, in Staffordshire, situate on the Western borders of this County ; composed of Sulphure of Lead, accompanied with Sulphate of Zinc, remarkably fine crystals of Topazine Fluuate of Lime, Carbonate of Baryte, Sulphate of Baryte, &c. the vein thirty inches wide, was very productive in 1804.

Where this Stratum forms the surface, and there is a good cover of soil upon it, being of a very retentive nature, its pasturage is remarkably good

* See Woodward, Vol. 1. p. 235.

and highly esteemed, as at Bakewell, Ashford, Haddon, &c. but where it forms a dry eminence, and there is little or no soil upon it, the surface is barren ; in these situations it loses its tenacity and bursting into thin laminae, called Penny-shale, moulders into steril soil.

The Soil on this Stratum is very conducive to the growth of Forest Trees in general, but Fruit Trees do not succeed, they are subject to canker, and their fruit is small and of bad flavour ; experiments have been made by taking out the Soil for a considerable depth and replacing it with good Mould, which answers well for a time, but when the roots penetrate through to the Shale the Fruit becomes very indifferent. As Seedling Trees, never removed, have few, but longer roots than transplanted ones and reach deeper soil, it probably would be adviseable to remove those frequently, which are intended for Shale Soils, previous to planting them where they are to remain.

The following experiment, made by an eminent Chemist, may probably assist in making a proper compost in Shale Districts, intended to be planted with Fruit Trees, when that rock shall be analyzed and its nature and decompositions thoroughly known :

He set Hyacinth Roots in four different glasses,

The 1st was filled with distilled water,

2d. with Hydrocarbonate,

3d. with Solution of Charcoal, and

the 4th. with Carbonic Acid Gas ;

The result was, that in the 4th, the plant vegetated with greater energy than in the distilled water ;

In the 2d, there was little root, but the leaves were larger as was also its flower ;

In the 3d, the Solution of Charcoal, the plant was almost all root, and the roots extended as quick again to the bottom of the glass.

At the Bassetting of this Stratum, there are small hills, formed of tilted pieces slipped from it at distant periods ; and against some of them are pieces of Granite, Limestone, Basalt, Basaltic Amygdaloid, &c. with their angles rounded off, having been carried and deposited by Floods, forming Alluvial grounds. On one of these

these Tilted pieces* in a field near Bakewell, called Castle-Hill, is evidently seen the Site of the Dungeon of a Castle, said to have been built by Edward the Elder, in 924,† who, on finding the fine tepid Springs in the Valley, came and built the Town, and here was a Bath of very great repute, which was uncovered till the year 1705, when an elegant semi-circular Ashlar Arch was erected over it thirty feet long, twenty feet wide, and seventeen feet six inches high ; which being too spacious to retain its heat whilst filling the Bath went out of repute, and now makes part of a dwelling house, the residence of the Author.

The following lines, written by a Gentleman of Bakewell, are descriptive of a Fount in Mr. White Watson's Garden, the spring at which the Company used to drink when the Bath adjoining was resorted to :

Castalia's Fount each tuneful lyre has strung,
 Why should White Watson's then remain unsung ?
 That Fount from whence, so legends old proclaim,
 The Town derives its origin and name :
 Hail Age recorded Fount, Hygæia's seat !
 Ere Britons sought in Gallia safe retreat ;

F

* Represented at **a** in the Section.

† See Bray's Sketch of a tour into Derbyshire and Yorkshire. 2d Edition, page 156.

The Elder Edward, lur'd by thy renown,
 To "Peaklonde" journeying came and built the town;
 BADDECANWELLAN, called in Saxon tongue,
 But smother now in Bakewell flows along;
 Where Auster sheds his balm from mildest skies
 By Watson grac'd the Fount is seen to rise;
 From latent dark retreat, obscur'd from sight,
 In stony limits bound there greets the light;
 An Antique pile of stones adorns its head,
 By Scient hand in rude disorder laid;
 Here Stalactites, their spiral heads above
 Shoot up and form a pyramidic grove,
 And moss grown stones lie rudely at their base
 Adding a cell-like semblance to the place:
 While flow'ry tendrils, jutting from between,
 Give a wild grace and beauty to the Scene:
 And Cupid too recumbent on a wing,
 Peeps o'er the margin of the silver spring;
 Presiding Genius of this flowing Fount!
 By Watson plac'd to guard the mossy mount!
 Quick rising from beneath, the eye may trace
 The crystal bubbles in their limpid chace;
 Which in a streamlet gently glide along
 His Garden* blazon'd in Botanic song.

**Bakewell abounds with fine springs of water,
 which rise from the shale and at the feather-
 edge of its Basset, in a line from South to North,
 near the road passing through the Town leading**

* In this Garden, which is formed of black mould, Trees and Plants grow very luxuriantly, and it is remarkable that variegated ones frequently return to their native green.

from Matlock to Buxton† ; some of those that rise in boggy earth in vallies formed in shale are sometimes fetid like those at Harrogate ; those that rise a short distance before the termination of the shale as the Bath springs, are tepid, being of the temperature of 58° . Farenheit, and are chalybeate, and those that rise at the commencement of the Limestone are cold, being only of the temperature of 48° , as Cap-well, which is 35 yards West of the Bath Spring.

The ancient custom of adorning Springs with Flowers, called Wellbounding or Dressing, was celebrated at these Springs with great ceremony and festivity on Midsummer day annually, till about the year 1752, when it was laid aside ; but this custom still prevails at Tissington on Holy Thursdays, where Springs of fine cool water issue from the beds of Shell-Limestone.

Owing to the undulating surface of the Shell-Limestone, the Basset of the shale frequently extends a considerable way in the concavities of the Limestone before it feathers out,‡ which occasions it to be found at a considerable distance from its general Basset ; as may be seen in a Section by

† At the return of the Basset at Buxton the warm springs rise at the temperature of 82° . Farenheit.

‡ Terminating with a featheredge.

the Author taken in a line from South to North, seven miles distant each way from Bakewell.

Note. As the Shale approaches the Limestone it becomes calcareous, and the laminæ abound with petrified Pecten-shells, and those of small anomia, which are nearly in a recent state.

In the Valley, formed by the termination of the Shale and commencement of the Limestone, the River Wye,* abounding with Trout and Grayling, glides in soft meanders through a beautiful open meadow of considerable extent, where

The patient Fisher takes his silent stand,
Intent his angle trembling in his hand,
With looks unmov'd, he hopes the spotted breed;
And eyes the springing Drake and bending reed.

POPE.

* The Wye is a clear rapid River which rises near Buxton, in fissures of Shell-Limestone, and, running in a south eastward direction, meanders through picturesque Vallies formed in breaks of Limestone, Basalt and Basaltic Amygdaloid, and joins the Lathkill, at Rowsley, at the distance of about sixteen miles, where they fall into the Derwent.

The Wye affords excellent Trout, which seldom exceed three pounds in weight, but have been taken as large as six, its colour frequently red and of fine flavour; Grayling, which seldom exceeds two pounds, Laxbrood or Samlets, which, though abundant a few years ago, are now become scarce, and rarely weigh six ounces; the Silver Eel and Crawfish.

The Lathkill is a remarkably clear cold River, which rises from under the Shell-Limestone, near One Ash, and is supplied with Springs from different Vallies of the same Rock, which joins its course; it affords Trout equal in size, and superior in colour and flavour to those in the Wye; Grayling has not been observed higher up this River than at Alport; Silver Eels are frequently met with, but no Crawfish.

To Bakewell great numbers of Gentlemen resort in the Angling Season for diversion, where they meet with the best of accommodations at a large and excellent Inn, lately built by His Grace the Duke of Rutland, called the Rutland Arms.

XXVI.

Compact Shell-Limestone,

Forming an undulating surface from Bakewell to Chelmorton Low, is composed of fourteen laminae of different colours and textures, all of them abounding more or less with marine Petrifications.

No. 1. Chert, Hornstone, or Petrosilex, forms the uppermost bed, of a greyish white colour, compact texture, and splintery fracture, containing cells, which are lined with minute crystals of Quartz, and contain Asphaltum and sometimes clear water : Sulphure of Lead is found in small lumps in pipe veins : It is much used at the Potteries,* and some sorts have been used with great

* Gnomes ! as ye now dissect with hammers fine,
The Granic Rock—the noduled flint calcine ;
Grind with strong arm, the circling Chertz betwixt,
Your pure Ka-o-lins, and Pe-tun-tses mixt.

advantage for Millstones, as a substitute for the French Burrs ;* nodules and beds of Chert pervade the following beds, in which a similar petrification to that found in XV. (The verrucose Plantite) has lately been found, which is in the author's possession.

2. Of a yellowish brown colour and compact texture, abounding with petrified Bivalves, chiefly Anomites, as the Striated†, Fist-like‡, and Acuminate§ which are characteristics and often accompanied with other Anomites, yet, in some districts it is known by the Naked Pinnite||.

3. Of a dark hair brown colour and compact texture, containing petrified shells, which are chiefly Univalves ; its characteristics are The Dish-like Helicite,** The Great Ammonite,†† Liste-

* In 1759, Mr. Henry Watson received a Premium from the Society for Encouragement of Arts, &c. for the second best pair of Millstones made of English Burrs, which were made of Chert.

† Anomitæ striatus	of Martin,	-	-	-	Tab. 23. fig. 1. 2.
‡ Anomitæ Pugnus	do	-	-	-	Tab. 22. fig. 4. 5.
§ Anomitæ acuminatus	do	-	-	-	Tab. 33. fig. 5. 6.
|| Pinnitæ nudus	do	-	-	-	Tab. 6. fig. 1. 2.
** Helicitæ Catillus	do	-	-	-	Tab. 7. fig. 1. 2.
†† Ammonitæ ingens	do	-	-	-	Tab. 41. fig. 5.

rian Ammonite*, Woodwardian Ammonite†, and The Constricted Turbinite‡.

4. Entrochal Limestone, abounding with Petrifications, chiefly Entrochites, as the Even jointed§, Convex jointed||, Warted**, and the Ring jointed††, which are accompanied with Anomites, as the Semireticulated‡‡, Trigonal§§, and prickly,|||| with various Corals, as the Flower-like Madreporite,††† Cespitose Madreporite,‡‡‡ linked Tubiporite,§§§ and several others.

N. B. On the cheeks of open fissures, and on the surface of the Rock, these Petrifications are frequently left raised, (see Martin, Tab. 24.) the

* Ammonitæ Listeri	of Martin	-	-	-	Tab. 35. fig. 3.
† Ammonitæ Woodwardii	do	-	-	-	Tab. 35. fig. 4. 5.
‡ Turbinitæ constrictus	do	-	-	-	Tab. 38. fig. 3.
§ Stylostrophia Entrochitæ lævis	do	-	-	-	Tab. 2. fig. 3. Tab. 24.
|| Styl. Ent. prominens	do	-	-	-	Tab. 4. fig. 9.
** Styl. Ent. verrucosus	do	-	-	-	Tab. 4. fig. 10.
†† Styl. Ent. annulatus	do	-	-	-	Tab. 4. fig. 11.
‡‡ Anomitæ semireticulatus	do	-	-	-	Tab. 32. fig. 1. 2.
§§ Anomitæ trigonalis	do	-	-	-	Tab. 36. fig. 1.
|||| Anomitæ aculeatus	do	-	-	-	Tab. 37. fig. 10.
††† Madreporitæ floriformis	do	-	-	-	Tab. 43. fig. 3. 4. Tab. 44. fig. 5.
‡‡‡ Madreporæ cespitosæ	do	-	-	-	Tab. 17. fig. 1.
§§§ Tubiporitæ catenatus.	do	-	-	-	Tab. 42. fig. 1. 2.

matrix being destroyed ; the Entrochi are sometimes detached, and much disjointed, when they are by some called Fairy, or Cuthbert's Beads, they are frequently found with the outer parts destroyed, and only the central ones remaining, which are become Siliceous, and somewhat in the form of screws, (termed Screwstones,) see Martin, Tab. 2, fig. 4, and Tab. 3, fig. 5, 6, 8.

This Bed affords the Grey Entrochal Marble,* which varies in colour and figures in different districts, and from the variety of figures presented by the Entrochi being cut in different directions, (see Martin, Tab. 3, fig. 7,) is universally admired in Chimney Pieces, Tables, &c.

This Bed, when burned, produces the best lime for Agriculture.

Analysis of 100 parts.

Calx. 55. Carbonic Acid, 30. Water, 15.

5. Compact Limestone, of a reddish brown colour, containing a few small shells, its fracture

* Though the Author has been constantly in the habit of seeing blocks and slabs of this marble for upwards of thirty years, only two heads of this Petrification have come under his inspection ; one, apparently of the smooth jointed, is in a polished slab, in Mr. G. Platt's possession at the Marble Works, Ashford ; the other, which is in part raised from the matrix, is in Mr. Stevens' Collection at Chatsworth, and given in Parkinson's "Organic Remains," Vol. 2.

uneven, which gives it the preference of the incumbent beds for the use of the Roads.* It forms a thicker bed than any of those above.

No. 6, 7, 8 & 9. These four beds are very similar, being very compact, of a reddish brown colour, containing a few small shells.

10. Compact Limestone, forming a larger bed than any of the four preceding ones, but nearly of the same texture and colour; and, like No. 5, breaks with an uneven fracture, and is equally serviceable for roads.

N. B. No. 1 to 5 are included in No. 1, No. 5 to 11, in No. 2,^{an} No. 11 and 14,^{in No 3} in the Tablet.

11. Bituminous Fetid Limestone, colour black, of conchoidal fracture, and compact texture; containing peculiar Petrifications, as the Gesnerian†

G

* Though various methods have been pursued in forming the surface of Roads, that lately introduced into the Neighbourhood of Bakewell has by much the preference, for ease of Horse and Carriage, for durability and the least expense. These roads are made of Limestone, which is broken at the Quarries to a circular, Iron gage, of $2\frac{1}{2}$ inches diameter within; and there is a forfeiture for each stone that will not pass the ring; in this state it is applied to the roads which are made with an horizontal surface, at a certain price per ton.

† The Gesnerian Orthoceratite, mentioned and explained in Martin, Tab. 38. fig. 1. has

and Breynian Orthoceratites*. The Derbyshire Oniscite,† Great Ammonite,‡ Smooth Anomite,§ and Lengthened Anomite,|| which are frequently accompanied with other Anomites, minute Entrochites, &c.

N. B. The Workmen employed some years ago in getting this Marble from the Quarry, on Cowden, near Ashford, on breaking a solid block, found in the midst thereof two Toads alive, at the distance of about six inches from each other, which died immediately on exposure to the air.

The colour is owing to Petroleum, with which it abounds, and which is found in cells that are lined with crystals of Carbonate of Lime, &c. This Limestone is subject to de-

been considered as the tail of a Crocodile, to which it bears some resemblance, but that animal does not appear to have been found in this stratum of Limestone; but is probably peculiar to the Pouzzalanic Limestone found at Bath, &c. A very fine petrified Skeleton, five feet nine inches in length, of the Gangetic Crocodile, imbedded in this species of Limestone, is now in the possession of Mr. Wright, Surgeon, Lichfield; found thirty feet below the surface at Wilmcote, near Stratford upon Avon, in the year 1810.

* Orthoceratitæ Gesneri and Breynii of Martin,	-	-	Tab. 38. fig. 1. 2. Tab. 39. fig. 4.	
† Onicitæ Derbiensis	-	do	-	Tab. 45. fig. 1. 2.
‡ Ammonitæ ingens	-	do	-	Tab. 41. fig. 5.
§ Anomitæ Glaber	-	do	-	Tab. 48. fig. 9. 10.
|| Anomitæ productus	-	do	-	Tab. 22. fig. 1. 2. 3.

compose, in which operation the calcareous particles are disengaged and escape, and their interstices are occupied by water, the stone still occupying the same space, bulk for bulk as before; but on being squeezed, the water comes out as from a sponge. On being exposed to the air (by laying it on the grass which it destroys, and sweeter herbage springs up in its place) till perfectly dry, the water evaporating leaves a very light impalpable substance called Rottenstone; much esteemed for polishing metals, &c. This Stone varying in the proportion of its ingredients, affords a variety of the Rottenstone, useful for various purposes; it is found very near the surface and to the depth of eighteen and twenty feet, in nodules which are sometimes only decomposed on the surface. These are scraped, and the stone, called the heart, cast into the pit again; it frequently is found in Rake veins, called Runs, which in the centre contain Carbonate of Lime, Sulphure of Lead and Sulphate of Baryte, which substances are not at all changed by the decomposition of the Matrix which forms the cheeks of the vein for three or four inches on each side. This is the best Rottenstone.*

* The finest Rottenstone is got on Dirlow-Moor, near Bakewell, where the surface is very wet, apparently owing to a fault.

Analysis of 100 parts of

BLACK LIMESTONE.	FINE ROTTENSTONE.	HARD ROTTENSTONE.
Calx & Carbonic Acid 82	Silex 75	Silex 98
Silex 16	Alumine 25	Alumine 1
Water 2		Iron..... 1
100	100	100

The decomposition of Black Marble into Rottenstone is very perceptible in a Pilaster intended for a Monument that was worked and polished under the Author's direction in 1787, which has since been exposed to the air in his marble yard, and is now become white, being coated with rottenstone; this coating may be observed in the walls built of this stone from the Quarries at Ashford, &c. he has also Amulets of Rottenstone found in his Garden and other places, which doubtless were Black Marble when made. Petrified Corals and Anomia shells, frequent in Black Marble, occur also in Rottenstone, where they are much more delicate, being only the shells themselves, their moulds being decomposed.

The Luxuriancy of the Annual Meadow Grass*

* *Poa Annua*. Abundant on Green Cowden, formerly a noted Sheep Pasture on the Black Limestone.

N. B. Cheese made of Milk from Cows that graze on the herbage of this Soil, are subject to heave, but are prevented by the fresh young shoots of Hawthorn being put into the Rennet, an handful to a quart.

is characteristic of the black beds which afford the Black Marble so much esteemed for Chimney Pieces, Monuments, Tables, &c.*

Lime of this stone appears to be Pouzzalanic.

12. Shell Limestone, of a reddish grey colour, abounding with Petrifications, which are chiefly the Gigantic and thick beaked Anomites of Martin, Plates 15 and 16, that are for the most part Siliceous: on Analysis this Stratum contains

Calx and Carbonic Acid 93½

Silex 6½

In 100 parts.

13. A variety of ditto of a darker colour, abounding with similar Petrifications.

14. Compact Limestone, Colour blackish grey, containing minute Entrochi, and particles of Sulphuret of Iron are dispersed therein: lime from this bed is of a dark ash grey colour, and said to be Pouzzalanic.

* Machines for Sawing, Levelling and Polishing by Water this Marble and the Entrochal, got near Monyash, were established at Ashford, by Mr. Henry Watson, in 1751, for which he then obtained His Majesty's Letters Patent.

Obs. These Limestones are generally calcined indiscriminately to lime for agricultural purposes, being principally wanted to destroy Heath and other sour plants; the best stone for which purpose is the fourth bed, which is the most abundant in petrified shells. (See the Author's Pamphlet on the various Limestones.)

Lime greedily absorbs acids; Heath, Moss, and other sour plants, contain a large portion of Acetous principle; Lime coming in contact with such plants, absorbs the acid they contain and deprives them of life; Trefoil* and other sweet Grasses, having none, or but a small portion of acetous principle, are not at all injured by the effects of this Lime, but feed upon the manures formed by it and the mixture of the destroyed acetous plants.

The upper beds of this Stratum are frequently much broken by the convexity of the under ones, as at (b) in the Section, which in that case conse-

* *Trifolium repens*, which constitutes the best herbage, appears indigenous to most of the Soils of Derbyshire, all of them appearing replete with its seeds did not the sour plants obstruct its growth; but as there are several methods of removing them, good husbandry only appears wanting to secure its presence.

Moors, which have been covered with Heath for ages, Bogs with Rushes, and Pastures with Moss, and other sour Plants, are on their destruction by the application of this Lime, Trampling, Rolling in of Stones, Covering with House Ashes, Bones, &c. soon clothed with its delightful Foliage.

quently form the highest ground ; these convexities and breaks may perhaps be occasioned by the expansive force of the Basaltic Amygdaloid beneath. The different beds forming the surface afford various soils and great variety of Herbage.

Hence, in fine streams, diffusive acids flow,
Or, wing'd with fire, o'er earth's fair bosom blow.

DARWIN.

This Stratum, being very much broken and dislocated, abounds with fissures, which are many of them filled with Spars, &c. when they contain minerals, and are under four inches wide, they are termed Scrins, and Veins when thicker ; which when perpendicular are called Rake Veins ; and when the dislocation is very extensive, and one side of the vein sunk considerably below the other, they are termed Faults.

The Minerals in these veins are formed alternately on their cheeks*, and when there was not a sufficiency of matter to fill the vein, the last deposited substances crystallized†, hence the forma-

* Sides of the vein.

† The most ancient name for crystallized Carbonate of Lime and Fluor appears to be Croyl-stone.

tion of the beautiful Crystals which adorn the Cabinets of the Curious, which varying in their figure in different districts of the same stratum, and peculiar Mines being unworked, occasions some Crystals to be very scarce ; Crystals of the same substance sometimes vary in the figure in the same specimen, and frequently assume different figures in different parts of the same Mine. Scrins often descend to what are termed Pipe Veins, when they are termed leaders, where the Minerals are formed between the bedding of the rock in concentric laminæ, resembling oblate Spheroids, sometimes the minerals are formed in hemispheric cups, consisting of alternate layers, found detached in mineral soils with their mouths upwards and reversed. The oblate Spheroids are often conjoined, when the places of union are called twitchings, and often stratified over each other, having their leaders passing through the Centre of the whole, when they are termed feeders, which generally terminate below the Pipes in small strings. When the minerals are formed in horizontal laminæ between the beds of the Rock, they are termed Flat-works.

These Veins* are productive of various Ores of

* The Rake Veins frequently cross each other in various directions, when at right angles the centre of Union is termed the Pee. The points of rock which separate the veins at the Pee are termed Rither Points.

Lead, as the Sulphure of leafy lamellar fracture, compact and spread over, which last is termed Slickensides. The Carbonate, Phosphate, Muriate and Brown. The ores of Zinc, as the native Oxyde and the Sulphate*, (which, when accompanying the crystals of Carbonate of Lime, sometimes decomposes them, and in the action, by attacking, supplants them, forming after-crystals.) Also Ores of Copper ; Iron ; Manganese ; very rarely Antimony ; (the grey Ore of Antimony in convergent needle-like crystals, have been found though very rarely, in Gregory Mine, Ashover ;) a variety of Clays and Ochres, &c. accompanied with various Earths of Lime, as Carbonate, Fluuate and Sulphate ; varieties of Sulphate of Baryte ; Quartz†, &c. Native Sulphur is found compact, mixed with Sulphure of Lead, and in a friable State within balls of Sulphate of Baryte, accompanied with crystallized sulphuret of Iron‡.

H

* Provincially Black Jack, Mock-Ore

† Crystals of Quartz of clove-brown colour, are found at the foot of Mamtor, near Castleton, containing Nodules of Asphaltum, by which they appear to be coloured.

‡ Amongst the instances of animal and Vegetable Remains in a state of Conservata occurring in Mineral Veins, a very remarkable one of a Tree is mentioned in Martin's " Outlines of an attempt to establish a knowledge of Extraneous Fossils," Page 14. But a more explicit account, accompanied with specimens, having been presented to the Author by the same respectable communication, and as the circumstance occurred in the fissure of a similar Limestone Stratum to the one now in consideration, he takes the liberty of inserting it here.

In sinking a shaft on a Lead Vein in Rellen Mine, near Holywell in Flintshire, in or about the year

This Section includes, as represented in the Tablet, several rich veins ; particularly the Warm-Bath Vein, which is a Rake and passes by Mandale, a Rake also, composed of Sulphure of Lead,* accompanied with Carbonate of Lime†, Sulphate of Baryte‡, &c. This is a very ancient Mine though not at present worked ; owing to its being overflowed with water ; but, was formerly remarkably rich, as appears by an Inquisition taken in the 16th year of Edward I. Anno 1288.

Hard Rake, which contains excellent Oxyde of Zinc§, mixed with Sulphure of Lead.

And Hubberdale, which is a Pipe Vein about three feet thick in the Centre, where Basaltic Amygdaloid forms the Sole|| ; about the year 1768 when this Mine was most productive, one lump

1792, a Fir-tree was discovered at a considerable depth in an upright position, which, from the cones found thereon, appears to be a species of the Larch, the wood of which appears unchanged except in being strongly impregnated with imperceptible particles of Lead Ore, which on being lighted at a candle, by blowing upon it, Lead issues therefrom in minute globules ; a piece of the wood was entirely surrounded and incrustated with the Sulphure of Lead in a manner similar to that in which the Sulphuret of Iron is frequently found attached to sticks in the Cliffs of the Island of Sheppy in Kent.

* Galena, when of leafy lamellar fracture ; Provincially Throstle-breast, or Dice Ore.

† When crystallized, provincially Dogtooth. The Fluor is called cubic Spar.

‡ Provincially Cawk, Kevil, Tush, and when crystallized Oatstone.

§ Calamine.

|| The Bottom.

of Sulphure of Lead was taken out, which (at four loads to a ton) weighed ten ton ; Sulphuret of Iron* in cuneiform crystals were very abundant there at that period, which being cast upon the hillocks have nearly lost their portion of Sulphur, and became (without losing their bulk) a brown Oxyde of Iron ; Carbonate of Lead† was also plentiful.

N. B. Lead Mines are of great Antiquity in this County, and were much worked by the Romans, as appears by legends on pieces of Lead which have been taken out of the old Mine Hillocks, three of which were deposited a few years ago in the British Museum. The first was found on Cromford Moor in 1776, which was made in the reign of the Emperor Adrian ; the second was found near Matlock Bank, in 1783, which appears to have been the property of Lucius Aruconius Verecundus, Lead Merchant of London ; and the third was found near Matlock in 1787, belonging to Tiberius Claudius, of Chesterfield, Triumvir, “ drawn from a Silver Mine.”

The most ancient method of working these

* Provincially Brazil, Firestone, Mundic and Pyrites.

† Provincially Lead Spar and White Lead Ore.

mines appears to have been by making fires upon the veins to crack the cheeks and loosen the Vein materials, for which, they had fixed hours on forfeiture ; See Hardy's Miners' Guide, 2d Ed. p. 22, and 45. When Gunpowder was introduced, a hole was bored in the rock of several inches deep, with an iron chissel termed an Auger, of about a foot long, which was worked with an iron hammer, afterwards a quantity of Gunpowder was put at the bottom, upon which was placed a *Slug* and *Clippet* ; the Slug was a round piece of iron about six inches long, with a Conic plane on one side, in the centre of which was a groove for Gunpowder to be placed in so as to communicate with that at the bottom ; against the plane a piece of Iron called the Clippet, was fitted to complete the circle of the Slug, which was drove down to fasten it ; in this operation, sparks were frequently struck, which often injured the Workmen, and made the business dangerous ; to remedy this evil, the *Gun* or *Jumper*, was invented, which was a Rod of Iron about eight inches in length and nearly an inch in diameter with a similar Conic Plane on one side, and a Wedge of Iron, termed a *Quinnet*, fitted thereto to fasten it ; through the centre of the Gun a hole was made for Gunpowder to communicate with the bottom as in the Slug and Clippet ; when the Gun was applied the Quinnet was drove down to fasten it, and sparks still ensued though much seldomer.

About the end of the seventeenth century, some miners were invited from Saxony, who introduced the *Skewer* and *Fuse*, the practice to this day. The *Skewer** is a piece of strong Iron Wire about eighteen inches long tapered to a point at one end and a ring formed at the other to draw it up by ; the *Fuse* is a tube formed of a Raspberry Stalk, &c. After the Gunpowder is put at the bottom of the Auger-hole, the *Skewer* is placed therein and fragments of Rock, Clay, &c. are rammed hard around by an Iron Bar called the *Rammer*, which has a small groove at the bottom fitted to the *Skewer* ; as the hole is filling the *Skewer* is gradually drawn up by a piece of Iron put through the ring ; and when perfectly filled, the *Skewer* is taken out and the *Fuse*, (previously filled with Gunpowder) is introduced in its stead, which communicates with the Gunpowder below, and on being fired at the top by touch paper, a blast ensues.

In upright blasting, as at Limeworks and tree roots, a Straw Fuse is recommended to be placed diagonally and the hole to be filled around it with clean white Calais Sand in preference to ramming.

* The *Skewer* is recommended to be made of Copper instead of Iron to prevent sparks.

When Lead Ore is got from the mine it is separated from its mixtures termed Deads, by knocking with different shaped Iron hammers into three assortments called Bing, Peasy and Smytham ; all produced from the first by pounding. Bing is the largest size ; Peasy is of the size of Peas, and Smytham small grains ; they are washed well, in which process the very minute particles are carried away into reservoirs and afterwards collected by the name of Belland, and measured by the Dish, a standard measure ; in the Low Peak is a measure of Brass called the Weapontake Dish or Measure, which was wrought in the Reign of Henry VIII. and contains fourteen pints ; it is placed in the Barmoot Court Hall at Wirksworth. (See Pilkington's View of Derbyshire, Vol. 1. p. 101.) This measure being liable to great imposition, by refuse being mixed with the Ore, a Dish has lately been introduced by which the Ore is sold by weight at the same time that it is measured, which gives great satisfaction both to the buyer and seller ; it was introduced for the first time the 10th of September, 1803, at Gregory Mine, near Ashover.

The most ancient method of obtaining Lead from its Ores recorded in this County appears to have been by fires made upon blocks of Sandstone, termed Boles, (see page 16) which were improved

upon by the Blast Furnace*, and in 1698, the Cupola was introduced from Holywell in North Wales; soon after which period Blast Furnaces went out of use for smelting the Ore, the last of which was taken down at Rowsley near Bakewell, (see page 16); but they are still used for obtaining Lead from the Cupola Slags, and called Slag Hearths. In 1777 an horizontal chimney was placed to the Cupola in Middleton Dale, to collect the sublimed particles, and an improvement with respect to the fire was made in a Cupola at Stanage, near Ashover, in 1802.

Rake Veins of Basaltic Amygdaloid (Toadstone) have been found in this Stratum on Bonsal Moor, &c. See Whitehurst, p. 194.

This Stratum contains large Caverns, which are adorned with Calcareous Stalactites, Crystallizations, Petrifications, &c. as at Castleton, Buxton, Middleton Dale and Bradwell, which are much frequented by the Curious.

The Carbonic Acid, termed Sweet Damp, Choak, or Chalk Damp, sometimes occurs in Caverns, Mines, &c. It extinguishes Flame and kills ani-

* Agricola de Re Metal, published in 1550, pages 165, 338.

mals ; but Quicklime, by absorbing this Acid, soon renders the air pure again and fit for respiration.

Hydrogen Gas, Inflammable Air or Fire Damp of the Miners, often floats in the roofs of Caverns and Mines, which on being lit by a candle, explodes with great violence ; and has too often proved fatal to Miners. Doctor Clanny is said to have constructed a lamp which prevents this explosion ; a most valuable and useful discovery.

About the year 1663, a large Cavern was discovered in sinking for Lead Ore upon a Hill at Ball-eye, within two miles of Wirksworth ; in which a large Skeleton was found, which, in the original account of its discovery, is said to be “ that of a Man, that his brain-pan would have held two bushels of Corn, and that it was so big they could not get it out of the mine without breaking it.” Several of its teeth were distributed in the Neighbourhood, one of which (with the original account of the discovery) is in the Author’s possession*. The Tooth is Ivory, and, when compared with the Dentes Molares of an Elephant, no difference can be found ; from this circumstance,

* Presented to him 24th of August, 1803, by Robert Mower, Esq. of Barlow Woodseats, whose Great Grandfather being a Proprietor of the Mine at the time of the discovery, was presented with it.

it is evident that the Skeleton found could not have been that of a man, or Giant, so called by the Miners, who are ever prone to the marvellous, but must be indisputably that of an Elephant, and its capacious Brainpan is a corresponding proof; for, after the Miners had conferred on it the appellation of the Giant's tooth, the Brainpan must naturally follow the proportions of its bulky owner. The fangs, though perhaps perfect at the time of the discovery, are now broken, and no change appears to have taken place from its original substance. Several of these teeth were brought out, but the Skeleton left behind; which, it is to be lamented, cannot now be viewed, that part of the mine having run in, rendering it impracticable without much trouble and expense.

The Sulphure of Lead procured at Balleye, or Bawlee Mine, about the year 1749, appears to have been rich in Silver, containing twenty ounces per ton, (See Dr. Short on Mineral Waters, p. 74.) Several vessels were made of this Silver, of which a Tankard, Salver and two small tumbler Cups are in the possession of Mr. Milnes of Ashover, with a specimen of the ore.

Petroleum is found in this Stratum in various stages of fluidity, in the Mineral Veins, and at Castleton in a water course on the surface; the

most rare is in an elastic state resembling the Cahout-chou, or Indian Rubber, which is found mixed with Minerals in the Veins, and within petrified Shells.* Asphaltum is also found of various sorts; the most rare is of a fine hair brown colour, very brittle, of conchoidal fracture with strong lustre; found imbedded in a species of the elastic sort. It is probable that this is the substance which gave the fine brown shades in the much admired Paintings of the celebrated Titian.

Those beautiful Vallies called Monsal Dale, Millers Dale, &c. through which gently winds the Wye from its source at Buxton, are evidently formed by the breaking of this Stratum, under which the Basalt and its Amygdaloid appear, where the convexities of the undulations will admit. Tophus, incrustated concrete carbonate of Lime, (formed by water upon Vegetables, &c. abounding with cavities lined with Stalactites, very ornamental in Grotesque Architecture) is also found in these vallies, which are enriched with fine clear springs of water, rising between the Limestone and Basalt, and their courses abound with Water-cresses and other Aquatic Plants.

* See Mr. Hatchett's observations on Bituminous substances in the Linn. Trans. Vol. 4, Page 129.

Streams never flow in vain ; where streams abound,
How laughs the land, with various plenty crown'd !

COWPER.

At Alport, a similar Valley near Youlgreave, the Tophus abounds, which, by its formation, appears to have obstructed and diverted the course of the River Lathkill, whence the shells of Snails and horns of Stags, of very large size, completely enveloped in Tophus, have been taken. A pair of the latter were in the possession of the late Rev. Robert Barker, B. D. Vicar of Youlgreave.

In a Cavern of Shell Limestone in Ricklow-Dale, near Bakewell, a Cat's head was found some years ago in part incrustated over with Tophus, (given in Martin, Plate 5,) accompanied with the vertebræ of the same animal, and bones of small birds.

In the old Road leading from Haddon Field to Youlgreave, a very large Fault appears, where, on the left, the Limestone is sunk many yards, with a thick cover of Shale upon it ; whereas on the right, the Limestone is the surface and forms an eminence. In the Valley through which the river Lathkill descends, in sinking a shaft for a Lead Mine, on the left side of the Fault, a few years

ago, an hedge, formed of Hazle Trees with leaves and nuts thereon accompanied with large pieces of Oak*, was discovered eleven feet from the surface ; specimens of which the Author collected at the time which are now in his possession.

The first Ornament, made of Derbyshire Spar, was a Vase† of massive Fibrous carbonate of Lime, commonly called Watricle, (constantly forming in Limestone Caverns,) by Mr. Henry Watson, Statuary, of Bakewell, Uncle to the Author, in the year 1743, at the request of Lord Duncannon ; from the accidental circumstance of his Lordship's Horse (when riding down Middleton Dale) striking against this Spar lying in the road, which, his Lordship examining, he so much admired, that he expressed a wish that an ornament should be made of it, and, sending Mr. Watson a design, this Vase was accordingly made, from whence arose the Manufactory of the Amethystine Fluate of Lime,

* A piece of Oak-like Woodstone was found some years ago in Lathkill-dale supporting a block of Limestone, a slab off which is given in Martin, Plate 1. being a transverse section consisting of siliceous concentric layers and lines intersecting those layers as the medullary prolongations from the centre to the bark, is in the Author's possession : the bulk of it was sent by Mr. Henry Watson, of Bakewell, to the Empress of Russia. Similar specimens have been found by ploughing in a field near Foolow, which are supposed to have come from Deep Ditch Mine, which is adjoining, out of which mine similar pieces have been taken.

† Given as the Frontispiece which was taken from the original design in the Author's possession.



THE FIRST VASE

Made of

DERBYSHIRE SPAR

See Page 62.

commonly called Blue John, and other Fossils in this County so universally admired.

Fluate of Lime frequently occupies the Fissures of this Stratum, and each district produces its peculiar Colour. Thus at Castleton

His Cubic forms Phosphoric Fluor prints,

Or rays, in spheres, his Amethystine tints. DARWIN.

whilst at Bradwell

With light's own smile the Topaz Fluor burns.

THOMSON.

XXVII.

Spheroidal Basalt, with Basaltic Amygdaloid,

Provincially Toadstone, Blackstone, Dunstone, Channel, &c.

Is not in beds, but is an undulating Stratum of irregular thickness, composed of irregular shaped Nodules of various sizes, of different colours and textures, totally void of Petrifications, and easily decomposing on exposure to the air; some being Basalt, often in concentric laminæ, containing Hornblende and Olivin, others Amygdaloid, having the vesicles filled with Carbonate of Lime, Calcedony and Jasper of various colours, in concen-

tric circles which frequently interrupt each other, forming beautiful zoned Agates* like those in Whinstone from Scotland, Ireland, &c. others contain quartz, compact and radiated, and others, Green-earth, Steatite, Raystone, or Actynolite, &c. some of the vesicles are hollow and lined with beautiful crystals of Quartz, Carbonate of Lime, Sulphate of Baryte, Needle-like and globular crystals of Magnetic Iron-ore, with Sulphuret of Iron, &c. obtuse angular Nodules of Shell Limesone of very compact texture are found imbedded in the Basaltic Amygdaloid, having their surfaces jasperized and coated with a thin crust of fibrous Carbonate of Lime; Mountain Leather is rarely seen in thin Rake-veins. This Stratum is separated from the Limestone by beds of Blue Clay, called Wayboard, which abounds plentifully with Sulphuret of Iron, crystallized in cubes and in balls composed of cubes in mass.

This is evidently the Stone called Whinstone in Scotland and Ireland, Ferrilite, Rowley Ragg, and Variolite by some authors, and Mandelstein by

* Which were nicely imitated by Electrical concentric circles of different colours on resinous plates by the late celebrated Electrician, the Rev. Abraham Bennett, of Wirksworth, F. R. S.

Soft Cobweb Clouds transparent Onyx spreads,
And playful Agates weave their colour'd threads.

DARWIN.

the Germans, all of which have very much the appearance of the Lavas from Vesuvius, Hecla, &c. as may be seen in a Tablet by the Author, composed of Specimens of Basalt and Basaltic Amygdaloids, Lavas, Whinstones, Mandelsteins, &c. to shew their affinity with each other.

The Rake Veins containing the Ores of Lead, &c. in the Incumbent Limestone Stratum, generally descend through this Stratum, but they seldom contain much Ore, though instances occur at Calvestone Mine on Tideswell Moor, Wheelsrake near Alport, Dickeye near Matlock, &c. which have been very productive. The Veins, when in the Amygdaloid, are generally very small and chiefly composed of Carbonate of Lime, (which being fibrous is characteristic) containing Asphaltum, in which are rarely imbedded Bead-like Globules of pellucid Carbonate of Lime, resembling Pearls; when they descend into the Limestone below, they become stronger again, and sometimes as rich in Ores as in the incumbent Limestone.

Tools, as the Heads of Hammers and Axes*, have been found made of Basalt, used by the ancient Inhabitants of the County, of a form similar to those of Otaheite, some of which are in the possession of the Author.

* Similar to the German Hatchets given in Møntfaucon's Antiquities, Vol. 5, page 135.

Chelmorton is remarkable for a spring, which rises under a high Hill called the Lowe, (see Tablet) where the Limestone and Basaltic Amygdaloid Basset, and being received there into Stone Troughs, from thence continues its course through the village, and at the bottom sinks into a Swallow in the Limestone below, and goes a long way under the surface before it appears to the day again ; from which circumstance it has obtained the appellation of “ The Ill Willy Water of Chelmorton that serves no Town but its own.”

The Rivers Wye, Lathkill and Bradford, which have their Source in the High Peak Hundred, issue from this Stratum, and uniting with the Derwent, which also rises in the same Hundred, but, from the Grit Stratum, fall into the Trent.

Hence Rills and Rivers owe their secret birth,
And Ocean's hundred arms embrace the Earth.

DARWIN.

XXVIII.

Compact Scaly Limestone,

Forming the surface from Chelmorton to near Sherbrook.

Not in distinct laminæ as XXVI. though it is

slightly laminated, abounding with small entrochi of scaly texture ; its colour yellowish white, the bottom beds of bluish grey, containing a few anomiae shells. When applied to Roads its soil is white and tenacious. There are several open fissures where it forms the surface, but as no mine hillocks appear, it probably is not rich in Mineral Veins, though in the Vicinity of Winster, where Limestone and Basalt alternate to the fourth Limestone, all of them have been productive, more or less, of Ores.

Calciform Oxyde of Manganese, called Black Wad, is found in Pipeworks, of blackish brown and yellow colours.

Bloodstone, Hematites Iron Ore, is rarely found in obtuse angled nodules, interspersed in this Stratum*, and arborescent configurations of brown hematites occur adorning the cheeks of small fissures.

When this Stratum forms the surface, it is generally covered with a bed of reddish soil, called Foxearth, of about three inches thick, on which

K

* In a decomposed state it is used to mark Sheep with a red colour, and called Rud or Raddle.

is a black Soil of the same thickness. These Soils are very steril, are injurious to Fruit Trees and require good husbandry to make them productive. At Counter's Cliff, near Buxton, on a hill called Diamond Hill, Crystals of Quartz, called Buxton Diamonds, are disseminated in the Foxearth of flesh red colour, in hexagonal prisms terminating with an hexagonal pyramid at each end, sometimes in macles by two crystals crossing each other, and sometimes in clusters. With these crystals are found detached cubes of Fluuate of Lime, frequently much corroded, and Tuberous balls of Sulphate of Baryte crystallized in mass into cuneiform crystals*; and in the incumbent black soil, colourless Quartz crystals are also disseminated; these crystals are most discernable after heavy showers of rain which wash the soil from them. It is probable, from similar crystals being found attached to the Cheeks of Veins, that these crystals were formed in Fissures of the Limestone.

N. B. Large Blocks of this Stratum are procured at Hopton, where it forms the Surface, which are sawn into slabs and make neat Staircases, Floors, &c.

* These balls have frequently the crystals of Quartz and Fluuate of Lime imbedded in them.

XXIX.

Basalt and Basaltic Amygdaloid,

In every appearance similar to XXVII, and is separated from the Limestones by a similar Way-board.

XXX.

Compact Sugar-Limestone,

Much more compact than the incumbent ones ; more or less of the texture of Sugar, much less abundant with Petrifications, and its colour whiter ; it consists of three laminæ nearly of the same colour and texture, which are separated by irregular beds of very fine Porcelain Clay of different colours, as milk white, containing hydrophanous Steatite of the same colour as its matrix, of compact texture and conchoidal fracture ; reddish white, and of various shades of yellow, brown and black.

It is said that lime from this stone is very hard, therefore it is seldom burnt.

N. B. At Peak Forest, a few miles North of

Sherbrook, this Stratum is of a blueish grey colour of a much stronger sugar texture, and the Petrifications it contains have the same texture as their matrix ; when struck it has a fetid smell.

XXXI.

Basalt and Basaltic Amygdaloid,

Similar to XXVII and XXIX, and is also separated from the Limestone by a Wayboard, which concludes for the present the Section's depth.



It is said that time from this stone is very hard. Therefore it is seldom burnt. N. B. At Peak Forest, a few miles North of

The Reader is now requested to pay particular attention to the Section, as here the effect of some powerful agency is very visible ; for he will perceive that at this place (Sherbrook) the Strata, here, described, have been burst abruptly asunder*, and after having bassetted successively Westward from Bolsover Castle to this place, (a distance of about thirty miles) suddenly change their bassets to the East, and then descend in succession with a rapid Westward inclination to the summit of Combs-moss, a distance only of five miles, which terminates the Tablet, as well as the County†, where the same Stratum, as at XVIII (viz. Grindstone-Sandstone) appears again but bassetting to the East, as if desirous to effect its union with its former adjunct, viz. the Stratum XVIII.

These Strata, bassetting towards each other, but

* “ By his Knowledge the depths were broken up, and with the blast of his nostrils the waters were gathered together ; the floods stood upright as an heap, and the depths were congealed in the heart of the Sea.”

† Buxton, celebrated for its warm Medicinal Springs and Baths, is situate, as represented in the Section on the Basset of the Limestone and Shale ; the springs rise between these Strata of a temperature of 80°. Farenheit, over which are the Baths, and adjoining is the Crescent, which is built on the Basset of the Shale.

Old men's numb'd joints new vigour here acquire,
In frozen nerves, this water kindleth Fire.
Hither the Cripples halt, some help to find,
Run hence, their Crutches unthaukt left behind.

HOBBS.

separated by a distance of twenty-one miles, indubitably shew that some extraordinary power must have been the Agent to effect their separation at Sherbrook, where the bottom of the fracture so evidently appears ; and there can be no doubt but that this shock was produced by the effect of Heat in some grand convulsion of Nature though beyond the Annals of recorded Time.

○ Lord ! how manyfold are thy works ! in wisdom hast thou made them all : the Earth is full of thy riches.

PSALM CIV. v. 24.

FINIS.



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W. Watson begs leave to inform his Friends and the Public, that he undertakes to make Mineralogical Surveys of Estates, under which employment he engages to point out the various Strata of each District ; their uses in Agriculture, the Arts and Manufactories, the nature of their respective Soils, proper methods of Draining, and the Minerals they may be expected to contain.

OF WHOM MAY BE HAD,

Not only this Tablet, but also those of the Strata, taken North and South of Bakewell, in Ashover Parish, the Ironstone Districts, and of various Limestones ; Also, Collections of Specimens of these Strata, with their various Productions.

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