



XII. On certain points connected with the super-position of the strata of England

David Mushet Esq.

To cite this article: David Mushet Esq. (1812) XII. On certain points connected with the super-position of the strata of England , Philosophical Magazine Series 1, 40:171, 49-55, DOI: [10.1080/14786441208638184](https://doi.org/10.1080/14786441208638184)

To link to this article: <http://dx.doi.org/10.1080/14786441208638184>



Published online: 27 Jul 2009.



Submit your article to this journal [↗](#)



Article views: 3



View related articles [↗](#)

lime, and some more (but blackened) is sublimed into the neck of the retort; but, upon the whole, there is a considerable loss of weight of the arsenic. But the more minute details of the experiment, with some other phenomena connected with it, I must reserve till I can bring before the public the memoir of which it forms a part.

I must here observe, that for the success of this experiment, it is essential that it be performed in close vessels. It will not succeed in an open crucible. Three times I have failed when using glass retorts. Some carbonic acid was expelled from the tube as before, but mixed with a large proportion of insoluble gas; and little or no carbonate of lime was found; but a new compound, with the nature of which I am not at present perfectly acquainted. In each these experiments, it appeared that a hole had been formed in the retort, and the difference of the result must be attributed, therefore, to the admission of atmospheric air.

When I used common lime, which was very caustic, I found the production of carbonic acid, apparently, much more abundant. From three ounces of this lime, and an equal weight of white arsenic, I procured 90 cubic inches of carbonic acid, and the lime was likewise converted into carbonate of lime.

Finally, I have once used lime which had been exposed to so intense a heat that the crucible was partly melted. This lime put into an acid did not emit the smallest bubble of gas. Heated, in close vessels, with its weight of white oxide of arsenic, some carbonic acid was produced: but the matter in the retort did not prove to be carbonate of lime; but another compound with the nature of which I am at present no further acquainted, than that it dissolves in muriatic acid, without effervescence, and forms a crystallizable salt.

XII. On certain Points connected with the Super-position of the Strata of England. By DAVID MUSHET, Esq.

To Mr. Tillock.

SIR, THE subject of stratification has lately been so ably treated in your valuable Magazine by Mr. John Farey, that it cannot fail to excite a very great interest among those interested in the success of geological and philosophical pursuits. With a patriotism truly laudable, Mr. Farey invites his countrymen to the study of the subject at home,

Vol. 40. No. 171. July 1812.

D

23

as sufficiently rich in itself to afford ample compensation to the most unwearied investigation. I am induced to trouble you with this letter; in consequence of a call made on your readers by Mr. John Farey, in your Number for February, for information on some particular points connected with the super-position of the strata, as well as from some remarks said to have been made on a similar subject by Mr. Robert Bakewell in your Number for March.

Mr. Farey, I am afraid, must have mislaid his notes, made along with me in the Forest of Dean eighteen months ago, when I detailed to him the regular succession of the upper coal series from the upper red down to the yellow lime; at the same time offering to show him in several places the yellow limestone emerging from under its massy incumbent, associated in situations where the thickness of the covering stratum could have been nearly ascertained, or even subjected to accurate measurement. Mr. Farey however says, in page 103, that he has never been able, satisfactorily, to ascertain which was the incumbent measure or stratum to the yellow, or, as it has been termed by some since the able analysis of Mr. Smithson Tennant, the magnesian lime. In an arrangement I have made for my own use, I term it the second limestone, reckoning upwards and beginning with the Derbyshire series.

It may be proper to observe, that I conceive the superstratum to the yellow lime to be that which is denominated by Jameson the old red formation, and in my arrangement, the *great red*, in contradistinction particularly to the *marly red*, which surmounts the upper coal series. The thickness of this stratum is variable. Where its immense beds are allowed without the intervention of faults or waves to stretch themselves out in regular succession, I have not estimated it at less than 1600 yards, and in some places, particularly from the high grounds to the south of Ross in Herefordshire to its termination or regular ending at Berristone Hill between Ross and Ledbury, not less than 2000 yards.

This vast stratum is composed of alternations of parti-coloured stone, in which the red colour predominates; breccia, regularly stratified clay, clay more friable and in a marly state. The joints of the rocks afford gypsum. The beds of clay, rock salt, or salt springs, as at Droitwich, Nantwich, &c. : the marl, sometimes stratified gypsum. It appears to me extremely probable, that the gypsum pits described by Mr. Farey, page 104, had been worked in a lower bed of the great red, and immediately over the yellow lime. This, however, ought not to be admitted as proof, unless
the

the fact were established by other circumstances, since the whole of the great red, and frequently the third limestone series above it, forms deep red soil, in which gypsum is frequently found.

Ascending the series, the great red may universally be considered as the next stratum in the order; and one of its most distinguishing characters is the plum-pudding-stone, or breccia, which occupies a superior situation in the mass, forming bold edges, and stretching into table land, where the stratification has become more horizontal. It is an opinion not unfrequently advanced by geologists, that fragments of breccia are a certain indication of an approach to a primitive country. I should rather infer, that such fragments betokened an approach to the upper beds of the great red. What gives considerable strength to the former opinion is the fact of the most mountainous districts, hitherto considered primitive, being contained in the superficies occupied by this grand boundary to our two great coal series. How different is the fact where elevation of surface continues! On these extensive plains of breccia, where the measures are fairly extended, rests the third, or great limestone series. This is the limestone which underlays the Staffordshire, Shropshire, South Wales, and Forest of Dean coals. It is also the same as the Bristol limestone, which is seen on the banks of the Avon, rising rapidly from under the coal measures. This rock is also various in its thickness: in the Forest of Dean I estimate it at 200 yards, and from the enlarged dimensions of its beds on the west side of the great Welsh basin, its thickness must be from 250 to 300 yards.

Immediately upon this rock rests from forty to sixty yards of what by many would be termed alluvial sandstone. It is easily distinguishable from every other sandstone by its pure siliceous base. It also contains from 15 to 20 yards of breccia in solid stratified blocks, and several veins of the same, in a more disintegrated state, which open and shut in the same way as metallic veins. How irreconcilable to these facts are the opinions of those who determine the class of the stratum, whether it be alluvial or not, by the absence or presence of a single pebble! These regularly stratified beds of breccia, and veins of the same, rest under more than 50 veins of coal, and nearly two perpendicular miles of higher strata. The upper bed of this peculiar sandstone series partakes in some places of the nature of limestone, and abounds with vegetable impressions. In Wales it is called the Farewell Rock, because it terminates the coal

and iron stone measures, reckoning downwards, in some places, as in the Forest of Dean, the lowest coal is only separated from it by a few inches of clay.

The measures which rest upon the third limestone I denominate the upper coal series: the boldest feature in this assemblage is a gray greenish micaceous sandstone, measuring in thickness fully 200 yards; this forms uncommonly bold high land, from Myrthr Tidvil to Caerphilly, along a considerable extent of the South Wales coast, and in the Forest of Dean, fine plains with rounded edges, from 7 to 800 feet above the level of the sea. In Wales it is called the Gray Rocks, and the Pennard Rock in the neighbourhood of Bristol.

Between this and the Farewell Rock are contained the iron-making coals and ironstone of the South Wales Basin, the former of which, according to Mr. Martin, amounts to 95 feet of workable coal. I have not seen any statement, nor have I heard of any coal being worked in South Wales at any great height in this series above the Gray Rock. Should this prove the case, the Forest of Dean supplies the void that would otherwise have been occasioned in the general section, as it contains from 3 to 400 yards of coal measures, occupying a higher range in the series, and immediately above the great Gray or Pennard Rock. These measures are composed of twelve seams of coal, and are surmounted by a considerable thickness of a straw-coloured sandstone, containing occasionally beds of red marl. From this circumstance, and from the absence of red ground upon the surface of the coal measures in the Forest of Dean, and in South Wales, as far as I have seen, I am induced to think that this sandstone, containing the red marl, where there is cover, is overlaid by the upper Somersetshire coals, and these again, by cliffe or shale, on which rest the upper red, which I conceive to be a species of red calcareous marl. Subject to this arrangement, we find that the upper series is formed into three distinct divisions with red marl above, and the great red (from under the third limestone below); the whole thickness of which series may be estimated at 1200 yards.

Having thus, according to my observation, supplied the chasm complained of by my friend Mr. Farey, I shall shortly subjoin an outline of what I believe to be the general order of the British strata.

London clays and sands reaching to the chalk:

Measures from the chalk to the third or great oolite, comprising the green sand, Bedford sand, 1st oolite or Portland

Portland stone, clunch, or Oxford clay; 2nd oelite, fuller's-earth, &c. &c. &c.

Measures from the great oelite to the upper or marly red, containing a great thickness of blue clay, the blue lias, and white lias limestone, &c.

First division of the great upper coal series, comprising 5 or 6 small coals which have been sunk to, and got under the lias limestone at Duncarton, Camberton, Timsborough, &c. &c. Somersetshire.

Second division of the upper series, as now worked to a considerable extent in the Forest of Dean, above the Great Gray or Pennard Rock.

Third division of the upper coal series, between the Great Gray Rock and the third limestone series; comprising the coals worked for iron making, and for other purposes, along the great Welsh coal basin. Those worked at Kingswood and Ashton, Nailsea and Bakewell, near Bristol, and in the neighbourhood of Coleford in Dean Forest.

The third limestone series:

Great red.

Yellow, or magnesian limestone.

Derbyshire and Yorkshire coal series:

The four great sandstones, containing the stinking coals, and forming very high land and precipitate terminations along a considerable extent of Derbyshire and Yorkshire.

The great or limestone shale.

Derbyshire limestone series, comprising 1st, 2nd, 3rd, 4th limestone alternating with toadstone.

I shall now beg leave to remark what is said to be stated by Mr. R. Bakewell, in his Lectures; namely, that the Derbyshire fourth limestone is seen in Yorkshire, resting on slate. Could this fact be established, it would be interesting in the extreme. But when this gentleman appeals to similar instances in Shropshire and in Wales, I am afraid he refers to one of those numerous formations in the great red, commonly denominated primitive. Examples of this sort are to be found in the neighbourhood of Charnwood Forest, Mount Sorrel, the Malvern hills, &c. I agree with him as to the fact of limestone covering slate, and this slate resting upon granite; but I differ from him by assigning to the granite a different place in the strata. I am not yet satisfied that the granite is the foundation of the series, but in many cases only an accidental formation in the great red, sometimes stratified and sometimes assuming the form of an ir-

regular crystallization : so that, in my estimation, the fourth Derbyshire limestone is not that which is generally found resting upon slate ; but more probably the yellow lime : this being the concomitant stratum to the great red, is frequently subjected to those mighty derangements peculiar to this immense mass. In proof of this I refer your readers to an examination of the country in this neighbourhood, from Flanly Abbey, where the yellow lime just emerges from under the great red, not as a regular ending or basset, but in consequence of a powerful lift or swell in the measures along Blassden and May Hills, passing behind Newent to the west, sometimes wheeling, sometimes advancing, forming gentle helmet-topped hills covered with brushwood, till acquiring a more uniform and contiguous ridge, it makes directly to Ledbury, and subsequently the angle of its rise becoming much elevated it overlays the western side of the Malvern hills to a considerable height.

This limestone, as it is seen in the neighbourhood of Ledbury and Malvern hills, has been accurately described by Mr. Horner in the Geological Transactions. That part of the limestone series which he denominates argillaceous slate, I conceive to be an inferior sort of limestone, as there are few of the beds but what yield nodules of limestone. In Kirkby in Derbyshire it wears exactly the same appearance when exposed to the weather. In some districts it is called mudstone, and is soluble in water, so as to make sinking through it difficult. As a proof that the limestone now described is the same with the yellow or magnesian, which forms the coping stratum of the Derbyshire and Yorkshire coal fields, I have to state the fact of the Derbyshire thick first coal having been worked many years ago, from under the crop of the yellow lime, near the town of Newent in Gloucestershire. Appearances had been so favourable in the crop as to induce the proprietors about ten or twelve years ago to sink a shaft, between 80 and 90 yards deep, and put up a powerful engine. This pit was sunk in the lower beds or mudstone of the yellow lime. The coal was found six feet thick, but of an inferior quality ; the roof also, from the numerous joints in the mudstone, was so heavy as to break timber two feet in diameter. Before abandoning the work, those concerned had, by cutting a drift across the rising plane of the measures, ascertained the existence of the lower coals, which, upon comparing with the Derbyshire section, I found exactly to correspond with the small coals found under the Greasley Sheanich and Alfretton coals. This curious circumstance was further corroborated to me

at

at the time, by finding fragments of well-known argillaceous ironstone amongst the spoil at the pit ground.

I remain, &c.

Coleford, Gloucestershire,
20th April, 1812.

DAVID MUSHET.

XIII. *On the Elements for reducing the Polar Distances of the principal fixed Stars which pass near the Zenith of the Royal Observatory at Greenwich. Taken from Dr. BRADLEY'S Catalogue, by Mr. FIRMINGER.*

Charles-street, Somers Town,
July 25, 1812.

SINCE the time that the reductions of the latitude and longitude of the stations used in carrying on the trigonometrical survey of this country have been in part published, many gentlemen engaged in the pursuit of practical astronomy have either made use of them in settling the position of their observatories, or have employed themselves in the verification of these results with a series of astronomical observations made at the different stations or objects that have been given in the survey. Some of these verifications were attempted with sextants; but as the sextant itself cannot be depended on generally, to an accuracy nearer than 20 or 30 seconds, this combined with the errors arising from the artificial horizon used with it render such observations, in deductions where an uncertainty of only a few seconds is to be looked for, of little or no value, even though a mean, from a great number of repetitions, should be taken. The usual method which astronomers have adopted to determine the difference in latitude between two places, not very distant from each other, has been by observing the zenith distances at the two places of a number of stars which pass near the zenith of each place; these, when properly reduced, give the difference of latitude between the two places, or the number of degrees in the contained arc. The instruments generally employed in such operations have been those denoted by the name of Zenith Sectors, and they are the best instruments when well constructed for this purpose, admitting of a more accurate measure, from being divided on an arc of a much larger radius than can be used in the construction of instruments for other astronomical observations. The zenith sector in the Royal Observatory at Greenwich is divided upon an arc of twelve feet radius; its principal use there is for determining the error in collimation of the two mural quadrants; and this has been done from a series of observations upon the