

The Centenary of William Smith, LL.D., the Father of English Geology.

BY E. CHISHOLM BATTEN.

AT the Annual Meeting of the British Association, at Edinburgh, on the 3rd of August, 1892, the President, Sir Archibald Geikie, in his opening address, called attention to the peculiar appropriateness in the time of this visit of the Association to Edinburgh.

“A hundred years ago a remarkable group of men was discussing here the great problem of the history of the earth. James Hutton, after many years of travel and reflection, had communicated to the Royal Society of this city, in the year 1785, the first outlines of his famous ‘Theory of the earth.’” Then naming Hutton’s friends and associates, the President said, “The centenary of Hutton’s ‘Theory of the earth’ is an event in the annals of science, which seems most fittingly celebrated by a meeting of the British Association in Edinburgh.”

Sir Archibald explained, clearly and vividly, the views of the school of geology founded by Hutton, and illustrated and extended by the writings and experiments of Playfair and Hale. He remarked that this school was necessarily limited in their vision on the field of geology by the comparatively narrow range of ascertained fact which up to their time had been established, and added, “It was by the memorable observations and generalizations of William Smith that a vast extension of our knowledge of the past history of the earth became possible.”

“While the Scottish philosophers were building up their theory here, Smith was quietly ascertaining by extended journeys that the stratified rocks of the West of England occur in a definite sequence; and that each well marked group of them can be discriminated from the others, and identified across the country by means of its enclosed organic remains. It is nearly a hundred years since he made known his views, so that by a curious coincidence we may fitly celebrate on this occasion the centenary of William Smith, as well as that of James Hutton. No single discovery has ever had a more momentous and far-reaching influence than that law of organic succession which Smith established. At first it served merely to determine the order of the stratified rocks of England. But it soon proved to possess a world-wide value, for it was found to furnish the key to the structure of the whole stratified crust of the earth. It showed that within that crust lie the chronicles of a long history of plant and animal life upon this planet; it supplied the means of arranging the materials for this history in true chronological sequence; and it thus opened out a magnificent vista through a vast series of ages, each marked by its own distinctive types of organic life, which, in proportion to their antiquity, departed more and more from ‘the aspect of the living world.’”

It seems not unbecoming in me, having attended the Association meeting as the delegate of this society, to call your attention to the connection of Somersetshire with William Smith and those discoveries which have justly earned for him, with the consent of all, the proud title of “the Father of English Geology.”

William Smith came to Somerset in 1791. His first published statement of his discovery is dated in 1801. It was during these ten years, and while residing in Somerset, that he made those discoveries which established the principles upon which is founded the science of geology. The first suggestion of these principles arose in his mind after he had settled in this

county, and from the observations he made in this county. We shall see the truth of this from a very short sketch of his early life.

William Smith was born at Churchill, in Oxfordshire, in 1769. His father died when he was eight years of age; irregularly educated—mostly self-taught—William, at eighteen, in 1787, became pupil to Mr. Webb, a land surveyor, at Stow-on-the-Wold, in Gloucestershire. He assisted Mr. Webb, lived in his house, and acquired his confidence; and attaining twenty-one in 1790, would naturally become desirous of working on his own account, if he had an opportunity. That opportunity arrived in 1791, when Mr. Webb transferred to his young friend the survey of an estate at Stowey, in this county of Somerset. Smith walked from Stow to Stowey, entered upon his work, and took up his residence at High Littleton, near Stowey.

The first indication of any attention on Smith's part to the order of succession in the strata is in his subsequent account of his earliest observations at High Littleton. It is as follows:—“Coal was worked at High Littleton beneath the red earth, and I was desired to investigate the collieries and state the particulars to my employer. My subterraneous survey of these coal veins, with the sections that I drew of the strata sunk through in the pits, confirmed my notions of some regularity in their formation; but the colliers would not allow of any regularity in the matter of the hills above the ‘red earth,’ which they were in the habit of sinking through; but on this subject I began to think for myself.”

Nor was it long before he discovered not only the regularity of order in the strata above the “red earth” overlying the coal he had suspected to exist, but he found out also about 1791-2 in the Lias quarries, in the neighbourhood of the coal-fields, the same regularity of order he had observed in the coal-fields themselves. Writing in February, 1798, of the regularity of order in strata of building stone he says, “This regularity is nowhere more conspicuous than in the Lias

quarries of Somersetshire, from whence these observations first took their rise about seven years ago.”

The first written memorandum by him, relating to the order of succession in strata, and dated June 15th, 1793, refers to the strata of earth and stone in the coal measures, and is headed, “Proposals towards making a model of the strata of earth, etc., in a coal country.”

In 1793 he was engaged in executing surveys and complete systems of levelling for the line of a proposed canal (ultimately the Somerset Coal Canal). In the course of the operations which he performed in the summer and autumn of 1793, a speculation which had come into his mind regarding another general law affecting the strata of the district was submitted to proof and confirmed. The supposition was that the strata lying above the coal were not laid horizontally, but inclined; that they were all inclined in one direction, viz., to the eastward, so as to successively terminate at the surface, “and thus,” as he expressed himself, “to resemble on a large scale, the ordinary appearance of superposed slices of bread and butter.”

The Act of Parliament authorizing the construction of the Somerset Coal Canal was passed in the spring of 1794. Mr. Smith as the Engineer of the Committee of Management of the Canal, was sent in the summer of that year with Mr. Samborn Palmer and Dr. Perkins, two of the committee, to inquire into the condition of other canals; the tour extended altogether 900 miles, and occupied between one and two months; by one route the party reached Newcastle, and by another returned through Shropshire and Wales to Bath.

His companions were ignorant of the supposition he had formed of the existence of a general law of succession of strata in a definite order of superposition; and he was only able by making use of his eyes in the post chaise, without appearing to his companions to observe anything but the mode in which existing canals were formed, to try to find out

whether the mode of stratification in the coal district of Bath extended to other than coal districts. He was careful not to mention his suppositions until he had found them justified by actual observation.

He continued his work as engineer to the canal, and availed himself of every opportunity which his labours gave him of expanding his theory. What he found true in connection with coal districts, he found applicable to all stone strata. In the passage already referred to, of February, 1798, he says, "It will be readily admitted by all classes of men, from the most accurate observer of nature to the simplest peasant, that there is some degree of regularity in the strata from which our general building materials are generally collected. Masons, miners and quarry men can identify particular beds of stone dug many miles apart; indeed, every cliff and quarry presents a true section of a great many beds of stone, which may be found of the same quality and in the same position in all or most of the neighbouring cliffs and quarries."

In 1795 Smith left High Littleton and went to reside in Bath, continuing his observations on anything which could confirm the theory he had formed of the order of position of strata, whilst fulfilling faithfully his engagement as engineer of the canal.

One more advance he made in his theory. He had found particular fossil plants in "the cliff above the coal;" particular shells in the Lias and Oolites, but none in the "red ground;" and he had combined these simple facts, so far as to consider, to use his own words, "that each stratum had been successively the bed of the sea, and contained in it the mineralogical monuments of the races of beings then in existence." Now at Bath he had access to collections of fossils, and made, and assisted in making, new collections from the strata cut through by the canal, and the result was an addition to his theory and the conviction that each stratum contained organized fossils peculiar to itself, and might, in cases otherwise doubtful, be recognized

and discriminated from other strata like it, but in a different part of the series, by examination of the fossils.

After he came to Bath his engagement with the coal canal continued to 1799, and he became more and more impressed with a conviction of the truth of the three general propositions: 1st, that one general order of succession of strata could be traced throughout England; 2nd, that there was a general inclination or dip of the strata to the east or south east; 3rd, that each stratum had its own peculiar species of fossils whenever it occurred, and could thus be identified when in detached masses and in distant localities.

He was in the habit of labouring to convince his friends, particularly Mr. Richardson and Mr. Townsend, of the correctness of his theory and his discovery of the order of strata to the number of twenty-three; all occurring in Somersetshire. Having determined his engagement, in 1799, with the coal company, he, at the urgent solicitation of these two friends, dictated to them a paper headed—"The Tabular view of the order, as marked, examined, and proved, prior to 1799."

The original manuscript, now in the possession of the Geological Society, has in the corner, in Smith's own handwriting,—"This table of the strata, dictated by myself, is in the hand writing of the Rev. Benjamin Richardson, and was first reduced into writing at the house of the Rev. Joseph Townsend, Pulteney Street, Bath, 1799.—William Smith."

MS. copies of this tabular view were freely distributed by and among his friends, until, in 1801, he printed a proposal to publish a Geological map of England; the date of this proposal, which was the first printed statement of his discoveries, is, "Midford, near Bath, June 1, 1801."

Mr. Smith did not issue his "Map of the Strata of England and Wales," till 1815. He felt bound to publish the name he had given to each stratum, and by that time he had distinguished, by names first given by himself, twenty-two strata above the coal measures. He introduced the terms, "Oolite"

and "Pisolite," probably helped by Richardson and Townsend. but his Greek did not carry him any further. Sir Charles Lyell* says, "Smith adopted for the most part English provincial terms, often of barbarous sound, such as Gault, Cornbrash,† Clunch clay, and affixed them to sub-divisions of the British series. Many of them still retain their place in our scientific classifications, and attest his priority of arrangement." Sedgwick, on presenting Smith with the Wollaston Medal, in February, 1831, said, "With his maps in my hand I first learned the sub-divisions of our oolitic series, and apprehended the meaning of those arbitrary and somewhat uncouth terms, which we derive from him as our master, which have long become engrafted into the conventional language of English geologists."

I hope I have now established the fact that we may claim as our own—William Smith, "the Father of English Geology." Here in this county did he first learn the lesson of observation; here for ten years did he practise that lesson; and here he laid down the principles of the science which such observations revealed to him.

When he quitted the service of the coal canal, and entered upon the calling of a land and mineral surveyor, it was his efficiency in that capacity which attracted the attention of landed gentry and their stewards. To them his geological speculations were only interesting so far as they appeared to have immediate practical results in agriculture. The very discriminating steward of Lord Bath's estate, Mr. Thomas Davis, a personal friend of William Smith, first pointed out to him the obvious light his discoveries shed on the improvement of agriculture, and encouraged him to continue his researches by saying, "that is the only way to know the true value of land."

* Principles of Geology, 9th edition, p. 58.

† Brash is given in the Somerset Glossary, 18th vol. of Trans., p. 6.

He soon acquired an eminence in his calling as a land surveyor, for in addition to the discoveries he made in geology, which we have mentioned, he had for some time laid down the proposition that "the locality of plants, insects, birds, etc. arises from the nature of the strata."

We have a MS. memorandum of his, dated in August, 1797, which under this heading proceeds as follows:

"Where art has not diverted the order of things, a considerable locality may be observed in many animals and vegetables, as in mineral productions, by which they are evidently attached to particular soils to such a degree that if this subject was studied with attention it would form one of the principal characteristics of the strata underneath. Though it seems mysterious to some that brute beasts, insects, etc., which have the liberty of roving at pleasure, should feel any particular attachment to this or that soil; yet the wonder ceases 'when we consider how the chain of natural things is linked together, and how these creatures are taught to cull their food from insects that are lodged in, or seeds that are produced from, particular plants that grow upon particular soils.'"

A pregnant observation. It is recorded of William Smith, says his personal friend, Mr. Baker, the historian of Scarborough,* "that whatever he saw he remembered ever after;" and doubtless the observation of living animals and vegetables in particular localities, as he passed along on his professional journeys, helped him to identify strata, as well as the slower and more laborious examination of sections and fossil remains, which would take much time.

Another qualification for the profession of a land surveyor was the acuteness of his geological vision. Though the road along which he passed, from York to Newcastle, with the two Somerset Coal Canal Directors, in the post chaise, was from five to fifteen miles distant from the hills of Chalk and Oolite, he was satisfied as to their nature by their contour and relative

* Baker's "History of Scarborough," p. 451.

position and their ranges on the surface, in relation to the Lias and "red ground" occasionally seen on the road.

Under these circumstances it is instructive to see how he exercised his business as a surveyor, and I think it will be interesting to the Society to have the report made on an estate by Mr. Smith in November, 1802, which I have among my muniments It begins:—

"Sir, When I surveyed your estate at ——— my attention was chiefly directed to the following improvements, which appear to be applicable to that situation." After alluding to the bad state of the buildings, fields, and fences, which, he says, "is too often the case at the expiration of leases for lives,"* he proceeds as follows:—"The Number of Pollard Trees in the Hedgerows indicates that the growth of timber trees has been much injured, and the cutting of Hedges and cleaning of Ditches has been sadly neglected, to the great injury of the Fences and Damage of the Lands, and particularly to such parts as are too retentive of moisture, or otherwise inclinable to be wet.

But the quantity of Wet Land is not great, and the Streams of water are inadequate to the purposes of Irrigation; therefore, there is not much to be made either by Draining or Floating, except a few little meadows and the wet ends of some Arable Fields, which lie by the side of them in a line from the stone Quarry to the boggy place called the Witheybed.

These fields may be materially improved by one Drain which shall take off all the Springs issuing out of the Sandstone Rock, which you have begun to Quarry.

And the boggy Flat called the Witheybed may be made into

* Fifty years after, Sir Thomas Acland writes in his Report on Somerset:—"Some years ago many estates in the hills were let on leases for lives. It is needless to point out here how that kind of tenure works ill both for landlord and tenant, and is a barrier to improvements in various ways. It is now fast coming to an end." And in a note to Sir Thomas Acland's statement, the late Viscount Portman says—"The life-lease system is expiring, but is manifesting all the evils of the end that can have been foretold."—Rep. on Som., p. 8.

a pond for little more expence than will be necessary to Drain and clean it for Cultivation. If this was done the large Pasture ground adjoining to the said Witheybed on one side, and the young Orchard on the other, would then become the most eligible spot upon the Estate for building a good Farm House, which might possess all the comforts and convenience attached to modern Buildings of this description, and upon which the value of Landed Property is much more dependant than is generally immagined.

It is a dry healthy spot, contiguous to, but not too near to the Road, adjoining to a fine young Orchard, and well supplied with Water, open to all the business of the Farm, and likely to make an Improvement in all the adjoining Land which will soon pay for the buildings; whereas by the present situation of the Farmyard and bad state of the Roads but little manure can be carted to that part of the Estate which is most in want of it. It is also much nearer to the Stone Quarries, therefore the Buildings may be put up at much less expence than in the Village, and the proposed Pond may be made subservient to the purpose of working a Thrashing Machine in case it shall be wanted.

The other end of the Estate, where Mr. Dyer's Son-in-law now lives, seems also to possess the same advantages for building, being well supplied with Water, Stone and Lime, and well calculated for collecting the Corn, and carrying out the manure upon any of the adjoining Lands.

This disposition of the Farm Buildings renders the long Drain for conveying water to the proposed plan of Building in the village quite unnecessary.

It appears by some old Pits in the Fields which I examined that the Red Marl has been dug and used on the Lands which I understand has not been productive of so much good as in many other places which I am acquainted with, and the stiffness farther induces me to believe that little or no improvement is to be expected from it.

But the Limestone on the upper part of the Estate seems to be worthy of much more attention for the purposes of improving the Land, as well as for Sale : the present Quarries being wrought with considerable expense, and said to be nearly exhausted. I am inclined to think that the same Stone may be found and worked (perhaps to greater advantage) in some of the adjoining Fields.

The White Sandstone (if quarried in a proper manner) appears to be a valuable acquisition to the Property for the purpose of building thereon, and also for Sale ; there being no doubt about the Quantity of Stone, as we have traced the Stratum from one extremity of the Estate to the other, and I am perfectly satisfied, from the many observations that I have made, on the Coal Veins and their accompanyments, that it would be attended with no extraordinary difficulty or Expence to find that valuable Article on or near to your Estate, and am,

Sir,

Your humble Servant,

Wm. Smith.

Trim Bridge, Bath,

November, 1802."