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LIV. *A brief Account of the Mineral Productions of Shropshire.* By JOSEPH PLYMLEY, A. M. Archdeacon of Salop, and Honorary Member of the Board of Agriculture.

[Continued from p. 208.]

DR. TOWNSON, in his Tracts, p. 166, has given the strata of two other pits in this district, and has added to the colliers' names for the different measures his own definition of each. He observes, that "annually about 260,000 tons of coal are raised in this district;" a very large proportion of which are consumed in the adjacent iron-works, I presume; for I have understood, that in the Ketley iron-works they use at least six ton of coal out of every seven they raise. What I have called the collieries of the eastern district, comprehend pits on both sides the river Severn. The veins of coal in this district are equal in thickness, I believe, to most in this county, but very inferior to those of the Staffordshire works, from 15 to 20 miles east of these, where, I have been told, there is a bed of coal measuring 13 yards, or more. The next coal-works to be mentioned are those of the Clee Hill, from 20 to 30 miles south of those we have been describing*. Collieries, indeed, are now working at Billingsley, connecting them, in some measure, by their situation: and again, west of the eastern coal district, pits have been lately sunk with success. I am indebted to Dr. Townson's Tracts, before quoted, for the following lists of the strata in two of the Clee Hill collieries.

Strata found in sinking the deep Pit in the Southern Part of the Hill.

	Yds.	Ft.
Earth and sandstone rock	10	1½
Basalt, called here Jewstone	64	1½
Sandstone rock, bind, clunch, and coal roof; dry clays	23	0
The great coal	2	0
Coal bottom and ironstone roof: these are dry clays	1	1
Ironstone measure, a dry clay	1	0½
Three-quarter coal	0	1½
Clumper, hard dry clay	2	0
Smith's coal	1	2
The smith coal bottom; dry clay down to the four feet coal rock	0	2
	107	1

* A coal pit is now (1802) worked on the summit of the Brown Clee Hill, within the encampment.

The

The strata in the water pit, which is about a quarter of a mile to the north-east of the preceding, are :

	Yds.	Ft.
Basalt, here called Jewstone	48	0
Brown and white clunch, dry clay	6	0
Red rock, a yellowish sandstone	9	0
Bind and clunch, dry clays	9	0
Pinny ironstone measure, dry clay	1	0
Clunch, dry clay	3	0
Brown rock, a yellowish sandstone	6	0
Tuff (plastic clay) and sand	1	0
Black bind, a dry clay	4	0
Rock, very coarse sandstone	5	0
Strong clay	1	0
Horse-flesh earth, a variegated red and white marl	6	0
Gray rock, sandstone	6	0
Bind, a dry clay	2	0
Great coal rock, whitish sandstone	6	0
Coal roof, dry clay	3	0
The great coal	2	0
Coal bottom pounsin*, a dry clay	1	0
Ironstone roof and measure, a dry clay	1	1
Three-quarter coal, and bass	0	2
Clumper, a hard dry clay	3	1
Smith coal, and clod in it	1	2
Strong clunch, dry clay	2	0
Flan and bass, hard dry clay	0	2
Strong clunch, dry clay	3	0
Four-foot coal, and bass	1	0
Strong brown clunch, dry clay	1	0
Sunk into the four-foot coal rock	3	1
	137	0

In the first of these Clee Hill pits, then, we find the first strata of coal 98 yards below the surface ; that the thickest vein is 6 feet ; and that the aggregate of coal in 107 yards 1 foot, is 12 feet 6 inches. In the second pit they must sink 116 yards before coal is found, the vein of which is also 6 feet thick ; and the other veins, which are not pure coal, measure in the aggregate 10 feet ; so that in 137 yards there are only 16 feet of coals, and of these only six that are unmixed. Of the collieries in the west and north-west extremity of the county, the most considerable were those of

* " Poundstone is probably meant by this word, as it is the earth or stone lying immediately under the coal, and which, when it is a rock, occasions the colliers to pound or break their tools."—*Mr. William Reynolds.*

Llwyn y Main and Trevor Claudd, which appear to be nearly exhausted; but other collieries have been lately opened between Oswestry and Chirk Bridge. The colliers describe these veins as diverging rays from an ideal centre, marked here by the part of the horizon where the sun appears from eight to ten o'clock in the morning. To this ideal centre the Ruabon collieries dip from north-west to east on the north side the Dee. The Chirk collieries, from west to east on the south side the Dee, and between that river and the Ceiriog; and again, the Pen y bryn collieries, lately begun to be worked, and the only work of the three in Shropshire, dips from west to east on the south side the Ceiriog. These veins range up against a ridge of lime rocks that run from north to south-west. Those near Ruabon, as well as those on the south side the Ceiriog, are a strong bituminous coal, with the baking quality of the Newcastle coal, yielding a strong heat, but no bad smell, except the top coal. The veins between the Dee and Ceiriog are a lighter coal, burning more quickly, and the ashes are white. This difference is supposed, by the colliers, to arise from the less weight of water that is over these veins. Mr. Arthur Davies, of Oswestry, has favoured me with the following list of the strata in the engine-pit at Chirk Bank coal-work, and which is the deepest pit he has sunk.

	Yds.	Ft.	In.
Gravel	-	-	-
Red clay	-	-	-
Delph	-	-	-
Fine sandstone	-	-	-
Tender coal	-	-	-
Clunch	-	-	-
Blue bind	-	-	-
Freestone rock	-	-	-
Coal	-	-	-
Clunch and ironstone	-	-	-
Blue bind, with ironstone	-	-	-
Black shale	-	-	-
Coal	-	-	-
Gray rock and clunch	-	-	-
Coal	-	-	-
Clunch	-	-	-
Dark gray rock	-	-	-
Blue bind	-	-	-
Gray stone mixed with ironstone	-	-	-
Coal	-	-	-
	102	0	3

We

We find then, in this pit, a vein of 7 feet thick, 1 foot thicker than any mentioned in the other Shropshire coal-works; and that in little more than 102 yards, 7 yards and 3 inches of coal are met with. Having given these specimens of the strata in the collieries on the east, south, and north-west borders of the county, I shall conclude with those in one of the deepest pits at Welbatch, the works there being the most considerable of what may be called the central collieries of this county.

					Yds.	Fr.	In.
Clay	-	-	-	-	2	0	0
Blue clod	-	-	-	-	10	0	0
Brown rock	-	-	-	-	3	0	0
Red measures	-	-	-	-	9	0	0
Gray rock	-	-	-	-	1	0	0
Red measures	-	-	-	-	2	0	0
Red clod	-	-	-	-	2	0	0
Coal	-	-	-	-	0	0	9
Blue clunch	-	-	-	-	2	0	0
Dark brown rock	-	-	-	-	2	0	0
Gray rock	-	-	-	-	2	0	0
Light blue clod	-	-	-	-	4	0	0
Coal	-	-	-	-	0	1	0
Blue clunch	-	-	-	-	2	0	0
Gray rock	-	-	-	-	1	1	6
Blue clod	-	-	-	-	9	0	0
Coal	-	-	-	-	0	2	0
					52	2	3

We see, then, that in near 53 yards there is only 1 yard 9 inches of coal, and no vein thicker than 2 feet; but probably there are veins of more substance, whenever it shall be thought expedient to sink these pits deeper.

This county is also well supplied with lime, and in general the limestone is at no great distance from coal. It differs in colour, and in the quantity of flour or powder that it yields when slacked. The lime-works at Lilleshal are very considerable. There is plenty of limestone near the Wrekin and Coalbrook Dale; and it extends from Benthall Edge, (on the opposite side the Severn to Coalbrook Dale,) near to Wenlock, called there Wenlock Edge; and so, south-west, pointing towards Ludlow, it forms a ridge of rock, somewhat perpendicular on the north-west side. It is worked in various parts, and yields a large quantity of white powder, though these properties degenerate as it extends

tends south, till it becomes too argillaceous to be very valuable. Lime is found also in the Clee hills; in a small degree in the south-west district; in many places south of Shrewsbury, but of a brown colour, and less pulverizing quality. West of Shrewsbury, it is gotten in considerable quantities in the parishes of Cardiston and Alberbury; and at Porth y wain and Llanymynach, on the west confines, is a hill of limestone of an excellent quality. At the east end of the Wrekin, and at some other lime-works, is a red lime that will set very hard in water. Mr. Smeaton discovered that lime, with a certain proportion of clay and iron, did best under water. And the colour of the lime here spoken of indicates its having these component parts. Much of the limestone of this county is near the surface; but near Leebotwood, about nine miles south of Shrewsbury, it "is covered by 20 yards of argillaceous strata*." "Limestone is also found near Caughley, under 20 yards of argillaceous and sandstone strata. It is a yard thick, but not worked†." Ironstone is found in the neighbourhood of Wellington, Coalbrook Dale, and Broseley. In and near the Clee hills it is also met with; and Dr. Townson has taken notice of a species of ironstone in the Llwyn y main colliery, near Oswestry, which he ascertained to be a mixture of spatous iron ore and the common argillaceous ironstone. He observes, that the best iron and steel, viz. those of Styria, are made of spatous iron ore; and therefore he judges that this may be found very valuable. Mr. William Reynolds informs me there is a very good stratum of spatous iron ore found at Billingsley, but that it is not worked.

This county is also well supplied with building stone; and its north district, which could be but little noticed for the subterraneous treasures we have been speaking of, stands pre-eminent for its quarry at Grinsell, seven miles north of Shrewsbury, where is a white sandstone, superior, perhaps, to any in the kingdom: the top rock lies in thin strata; the bed is 20 yards thick. There is plenty, also, of good red sandstone in the neighbourhood. The same may be said of the east side of the county; and near Bridgnorth beds of red sandstone are found under white sandstone; and again, beds of white sandstone under the red. This appears a singular division and alteration of the cements. Iron particles give their colour to the red stone; and it is on this account, probably, that the weather has more in-

* Dr. Townson's Essays, p. 187.

† Mr. William Reynolds.

fluence on it than on the white stone, the iron absorbing so much air as to lose its tenacious quality.

Further south, sandstone prevails; and Dr. Townson found at Orton Bank a stratum of the Bath and Portland stone between strata of common limestone.

In the west district is a siliceous grit, hard to work, but very good to build with; but the general stone is argillaceous. That nearest the surface is but in part indurated, and becomes friable, under a slight pressure, when exposed to the vicissitudes of weather. Very good stone slates, for covering roofs, are met with in the parish of Bettus, on the south-west confines of the county. And there is very good flag-stone in Corndon Hill, west of Bishop's Castle. In Swinny Mountain, near Oswestry, is a superior white sandstone, which works very well. Bowden quarry, in the hundred of Munslow, contains also very good white sandstone; and at Soudley, in the parish of Eaton, and franchises of Wenlock, is a very good stone-flag for floors. This brings us near some hills which have not hitherto been much mentioned, viz. the Lawley, and Caerdoc, or Caer Caradoc.

South of the Lawley is a ridge of useful coarse grit, or sandstone, of a yellowish white. But the Lawley is in part formed of a kind of granite, probably what mineralogists call secondary granite; but a greater part of the hill is composed of what forms the basis of what has been lately called toadstone, which, though wanting no explanation to a mineralogist, it may be well to give some popular idea to, by saying, it is entirely distinct from sandstone, limestone, or slate, and approaches the nearest, in outward appearance, to a basaltic rock, though probably very different in reality. The stone of the Caerdoc is chert and granulated quartz; and in some places the toadstone appears, which having, in part, lost its glands, becomes cellular, and which may have given rise to the opinion of its being lava. The Ponsert Hill partakes of the nature of the Caerdoc and Lawley. I am indebted to a conversation with Dr. Townson for whatever is scientific in the account of these two hills; and a more minute account of them, and of other hills in this county, will be found in his volume of Tracts, before quoted. Mr. William Reynolds informs me, that a part of the Caerdoc, towards the north-west end, contains the pistachio green actinolite of Dr. Townson, imbedded in what he calls a gray whack, and which actinolite, on examination, has been found to contain so much iron as to become strongly magnetic on exposure to heat, and the containing

bed forms a black glass. Mr. Aikin, in his *Tour*, p. 201, mentions the Longmount to be composed, so far as his observations extended, of a very shivery kind of schistus. It certainly presents that appearance on its east side, near the Strettons. But Dr. Townson says, the nature of the rock, in general, is "compound sandstone, *i. e.* a stone which, instead of being formed of grains of quartz, is formed of grains, or very minute fragments, of other kinds of stone. These, here, seem to be of an argillaceous and jaspideous nature, mixed with a few grains of feldspar*."

The Wrekin is chiefly composed, I believe, of a reddish chert. Mr. William Reynolds informs me, that prodigious masses of granulated quartz are imbedded in it, and much feldspar, and that a quantity of red mica is also found at the south-west end of the hill. The Stiper stones are a granulated quartz; and they are perhaps the highest ground in Shropshire, except the hills near Oswestry, and those are a coarse grained sandstone. Near the Cardington hills Mr. William Reynolds found a quartz † that he thought as good, or better, than the Carreg china of Caernarvonshire, which is exported for the use of the English potteries. He has since found a granulated quartz, in the Wrekin and Arcall hills, which seems likely to answer the same purpose for the pottery, and which has the convenience of being near established potteries, and a navigable river. With the same advantages, that near Cardington would be very valuable, as there is a steatitic clay there, which was long used in the Caughley china-works, at a considerable expense of land carriage. Pitchford, about seven miles south-east of Shrewsbury, is a red sandstone, approaching the surface in many places, and from which exudes a mineral pitch. The same substance is gathered from a well in the neighbourhood, and in some quantity in warm weather; but in winter very little is seen floating on the water. From the rock is extracted an oil called Betton's British oil. The experiment was first tried at Brosely (at a place still called the Pitchyard), about fourscore years ago, or more, and an account of which was published in No. 228 of the *Philosophical Transactions*: from near that period the Pitchford rock has been gotten for that purpose, and sometimes 20 ton, or more, used in a year, for which the manufacturer paid 5s. per ton. It was carried from thence to Shrewsbury, where the oil was procured by distillation; but the process is kept

* Tracts, &c. p. 186.

† The first species, second family of the siliceous genus of Kirwan.
secret :

secret: a patent was obtained for the discovery by the late Mr. Betton; but his right to a patent was disallowed, by the decision of a court of law, some time after. The oil was used only medicinally, and has probably many of the properties of what is called Friar's balsam, and in quality and appearance has a near resemblance to oil of amber, and is often sold as such. When the manufacture was carried on in its greatest extent, I have understood that a considerable quantity of the oil was exported, and principally to Germany. It is still to be bought in Shrewsbury, from the preparer. It is also from a rock of red sandstone that the fossil tar spring, near Coalbrook Dale, issues. Mr. Aikin relates in his book, before quoted, p. 194, that this "spring was cut into by driving a level in search of coal; that the quantity that issued at first was to the amount of three or four barrels per day; but that, at present (1797), there seldom flowed more than half a barrel in the same period." And in 1799 Dr. Townson states the produce at only 30 gallons per week (now, 1802, it is about half that quantity), though, he imagines, other fissures, filled with the same substance, may be found, if there were a greater demand for it. The oil distilled from this tar exactly resembles Betton's British oil, and is used as a solvent for *caoutchouc*, (commonly known by the name of elastic gum, or Indian rubber,) which is now used as a varnish for cloth, and is particularly applicable to balloons. Near Jackfield, on the south side the river Severn, is carried on the manufacture of coal tar, for which lord Dundonald formerly obtained a patent. In coaking the coal, which is here done in close vessels, they obtain the volatile products which are raised in vapour by the heat of the operation of coaking, and condensed in a chamber covered with lead plates, over which water is constantly running. These products are a water and an oil; the former of which contains a portion of volatile alkali, and the latter is boiled down to the consistence of tar or pitch. The oil which is caught during the boiling down is used as a solvent for resin, and forms an excellent varnish for ships, or any wood-work exposed to weather. The MS. account of Bradford North mentions a salt spring at Smeithmore, in the lordship of Longford; and Dr. Townson states several springs of salt water to have been found in the neighbourhood of the tar spring; and that in the parish of Broseley, on the opposite side of the Severn, salt is said to have been made formerly from water taken out of pits still called the Salt-house Pits. At the Lyth, in the parish of Cundover, is a field the soil of which is impreg-

nated with salt; and there is no doubt but this commodity could be gotten in this county, though its proximity to the extensive and established salt-works of Cheshire may prevent any profit from an adventure of this kind. At Kingley Wick, about two miles west of Lilleshall Hill, is a "spring of salt water that yields 4 or 5000 gallons in the 24 hours. It is an impure brine, but was formerly used: the salt pans and buildings are still remaining. It flows out of a reddish sandstone rock, which rests upon a reddish chert, like that of the Wrekin*. And at Admaston, near Wellington, only two miles from Kingley Wick, there is a salt medical spring, chalybeate and hepatic. There are two springs: the one containing carbonated iron and lime, selenite and sea salt; the other, hepatic air, aerated lime, selenite, and sea salt†. The MS. history of Bradford hundred, before quoted, says, "at Moreton Say is a mineral water that purges those who drink it." There is also a well, not far from the parsonage-house, that I am pleased to record, as it was fenced in under the directions of the late archdeacon Clive, and which continued to partake of the care and consideration he had for the things, as well as the persons around him. Dr. Darwin informs me that this spring is valuable as a strong chalybeate, but that it has no other peculiar qualities. There is a spring near Ludlow that contains a very little fixed air, some magnesia, a little lime, and a good deal of sea salt. Its strength is irregular as a medicine; it is sometimes about as active as sea water, I am told, but frequently weaker.

* This brine is now used for the making of soda at a work established at Wormbridge, on the banks of the canal there, as will be seen by the following note, which is one of many favours I have received from Mr. Dugard, of the Salop Infirmary.

"At Wormbridge, near Wellington, as well as at several other collieries in the neighbourhood, martial pyrites are found in considerable quantities. After being cleared from the coal (sulphureous coal) in which they are found, the lumps, which are perhaps from twelve to fourteen pounds weight each, are disposed in loose heaps, upon a bed, or large area, paved with bricks, and inclining from the circumference to the centre, to allow the water, with which the whole is repeatedly sprinkled, ultimately to flow into a large reservoir which is constructed at this place. The pyrites are thus exposed to the action of the air, as well as frequent waterings; the decomposition of them, produced by this process, forms sulphate of iron (martial vitriol) in considerable quantities, and was a few years ago evaporated and crystallized, and allowed to be, by the consumers, as pure a salt of iron as any ever made in Great Britain. The demand for it was greater than the work, in its infant state, could supply. It is now no longer carried on as a vitriol manufactory, but the acid obtained from the pyrites is wholly consumed in getting the soda from rock salt and the brine of Kingley Wick.

† Townson's Tracts, p. 179.

A pint

A pint is a usual dose ; but very large quantities have been drunk without any fatal effects.

Between Welbatch and Pulley Common are two wells, called Hanley or Boothby Spa. The water of both is weak : the one contains sea salt, muriated lime, magnesia, and selenite ; the other has, with these ingredients, a chalybeate. Near Sherlot Common, in the neighbourhood of Wenlock, is a strong chalybeate water. On Prolley Moor, near the western side of the Longmynd, is a spring that contains a small proportion of selenite and of sea salt ; but muriated lime is the principal ingredient. It shows no appearance of iron with the usual test. I shall conclude this section with an account of Sutton Spa, near Shrewsbury ; for the whole of which I am indebted to Dr. Evans ; and if an obligation becomes lighter by being divided, I doubt not but the readers of the article will readily join in sharing its weight.

[To be continued.]

LV. *Extract from a Work, published by Professor PROUST, entitled Researches on the Tinning of Copper, on Tin Vessels, and glazed Pottery ; published at Madrid 1803*.*

THE author, in the introduction, says, that the motives which induced him to undertake this labour were the doubts spread abroad, two years before, among the public in regard to the salubrity of tinned copper, and the accounts of the disagreeable accidents arising from vessels badly glazed. Government, always attentive to every thing that can tend to calm the public mind, had recourse on this subject to sound chemistry ; the only tribunal competent to banish doubts of this kind. Two problems were presented to the author to be resolved :

1st, Is the use of zinc advantageous or not, for tinning and for tin vessels ?

2d, Can tinning, in consequence of the lead it contains, and sometimes in large quantities, expose the health of the public to the same dangers as glazing of a bad quality ?

The author divides his work into three chapters, and each chapter into several paragraphs.

The first part, which may be considered as historical, is divided into four paragraphs.

In the first the author mentions the project which was

* From the *Journal de Physique*, Frimaire, an 13.