

WOODWARD ON STONE ROOFING AND SAND STONE TILES OR "SLATES"

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The calcareous "slates" of the Jurassic system are strictly speaking flagstones or tilestones. The more important of them are fissile calcareous sandstones or sandy limestones, more or less oolitic and micaceous. Organic remains are sometimes abundantly distributed over the surfaces of the rock, and Dr. Sorby has remarked that "the fissility of the Stonesfield Slate is, in great measure, due to minute laminae derived from *Ostrea* and *Brachiopoda*." (*Quart. Journ. Geol. Soc.*, vol. xxxv. p.83 (Proc.)) The rock splits according to the plane of deposition, hence the slates vary in thickness and are not uniform individually; but they are found serviceable for roofing-purposes.

Other stone-slates consist of thin layers of shelly and oolitic limestone that occur interstratified with shaly clays, as in the Forest Marble.

Stone tiles have been in use since Roman times, and they have been obtained from the Inferior Oolite, including the Northampton Sand and Collyweston Slate; as well as from the Great Oolite Series, including the Stonesfield Slate and Forest Marble.

Referring to the roofing-tiles obtained from the Forest Marble of Chavenage, near Tetbury, Lycett remarks that the weight of these flags is fully three times that of ordinary slate; "the tile, however, possesses much advantage in point of comfort compared with slate, as it is a much worse conductor of heat, the upper parts of houses covered with the stone tiles are much less exposed to the vicissitudes of the external temperature." (*Cotteswold Hills*, p. 106.)

NORTHAMPTON SAND

Thin fissile calcareous sandstones have yielded material that has been used for roofing-purposes, under the name of Duston Slates. (See p.182.)

COLLYWESTON SLATES

These slates have been worked for upwards of 350 years at Collyweston and Eaton near Stamford, Duddington, Medbourn, Kirby, and Dene Park, near Rockingham.

Prof. Judd has remarked that the Collyweston Slates have been dug over a considerable area, old pits being traceable from Wothorpe near Stamford to the western side of Collyweston, a distance of more than three miles. He has given the following full account of the method of working, &c to which I have added a few notes. "The valuable fissile character of the beds is merely a local accident; and in some locations the bed of stone has been followed and found to become non-fissile and in consequence worthless for roofing purposes. There is only a single bed of stone (the lowest limestone of the series) which is used for making roofing-slates. This varies greatly in thickness, being often not more than 6 inches thick, but sometimes swelling out to 18 inches, and in rare cases to 3 feet; while, not unfrequently, the bed is altogether absent and its place represented by sand [or sandstone]. Rounded mammillated surfaces, like the "pot-lids" of Stonesfield, abound in these beds."

"The slates are worked either in open quarries or by drifts (locally called "fox-holes") carried for a great distance under ground, in which the men work by the light of candles. The upper beds of rock are removed by means of blasting, but the slate-rock itself cannot be thus worked, for though the blocks of slate-rock when so removed appear to be quite uninjured, yet, when weathered, they are found to be completely shivered and consequently rapidly fall into fragments. The slate-rock is therefore entirely quarried by means of wedges and picks, which, on account of the confined spaces in which they have to be used, are made single sided. The quarrying of the rock is facilitated by the very marked jointing of the beds, a set of master-joints traversing the rocks with a strike 40° W. of N. (magnetic), while another set of joints, less pronounced, intersect the beds nearly at right angles."

"During the spring of the year the water in the pits rises so rapidly that it is impossible to get the slates out. The slates are usually dug during about six or eight weeks in December and January. The blocks of stone are laid out on the grass, preferably in a horizontal position. It is necessary that the water of the quarry shall not evaporate before the blocks are frosted, and they are constantly kept watered, if necessary, until as late as March. The weather most favourable to the production of the slates is a rapid succession of sharp frosts and thaws. If the blocks are once allowed to become dry they lose their fissile qualities, and are said to be "stocked." Such blocks are broken up for road-metal, for which they afford a very good material. The limestone beds above the slate-rock are burnt for lime"

After the blocks are split, the slates are stacked on edge in circular piles or heaps. Subsequently they are shaped, and again stacked on edge according to size.

"The slates are cleaved at any time after they are frosted. Three kinds of tools are used by the Collyweston slaters. The 'cliving hammer,' a heavy hammer with broad chisel-edge for splitting up the frosted blocks. The 'batting hammer' or 'dressing-hammer,' a lighter tool for trimming the surfaces of the slates and chipping them to the required form and size. The 'bill and helve,' the former consisting of an old file sharpened and inserted into the latter in a very primitive manner. This tool is 'used for making the holes in the slates for the passage of the wooden pegs, by means of which the slates are fastened to the rafters of the roof. These holes are made by resting the slate on the batting hammer and cutting the hole with the bill."

"The slates are sold by the 'thousand,' which is a stack usually containing about 700 slates of various sizes, the larger ones being usually placed on the outside of the stack. The slates when sold on the spot fetch from 23s. to 45s. per thousand. Many of the Collyweston slaters accept contracts for slating, and go to various parts of England for the purpose of executing their contracts."

"The land at Collyweston is generally held by slaters by copyhold, the slaters paying 6s. 8d. per pit' to the lord of the manor (a 'pit' is 16 square yards) with an extra charge of 1s. 6d. per pit to the measurer. A few workings are rented of the lord of the manor, the slaters paying 30s. per pit with an, additional 1s. 6d. for the measurer. These payments are made every year at the annual 'slaters' feast' held in January."

"The manner in which the slates are placed on the roof is as follows - The largest are laid on nearest the wall plate, and the size of the slates is made gradually to diminish in approaching the ridge. The ridge itself is covered by tiles of a yellowish white tint, made at Whittlesea, and harmonising well in colour with the slates themselves. The larger slates are, in the ordinary way, fixed to the rafters of the roof by means of wooden pegs driven through a hole in the upper part of each slate. But roofs are often covered with small slates which are fixed by mortar."

"On the ground floor of the Museum of Practical Geology at Jernyn Street, London, specimens of the 'slates' made at Collyweston, and of the various tools employed by the workmen are exhibited." (Geol. Rutland, 1875, pp.182, 183)

The slates of Collyweston are worked with more or less vigour at the present time (1889), although in many new houses built in the neighbourhood of the quarries, and at Stamford, brick and Welsh slates or red clay-tiles are employed, in place of the freestone and Collyweston slate.

In colour the rock is a buff and blue-hearted stone, so that some of the slates are blue, others yellow, and many are parti-coloured. The pale coloured slates when put up, are said to darken on exposure. The slates are usually cemented as well as pegged on to the roofs, hence they do not fall away if cracked. The blocks that are raised from the open quarries and galleries are of irregular shape.

The slate-pits at Kirby are now almost entirely abandoned, and they are only occasionally worked near Dane Lodge.

The slabs known as Whittering Pendle, were obtained from beds of the age of the Collyweston Slate; but the material was used mainly for paving. (See p. 195.)

INFERIOR OOLITE

Thick and heavy "slates", have been obtained from the Inferior Oolite in the northern portion of the Cotteswold Hills near Snowhill, Condicote, and Lower Swell. (Hull, Geol. Cheltenham, p.89) The principal workings were at a spot known as Hyatt's Pits (see p.140).

STONESFIELD SLATES

At the base of the Great Oolite there are thin bands of sandy and oolitic limestone that have been long worked for "slates." The principal quarries and mines are at Stonesfield, near Woodstock, in Oxfordshire; but beds on, or about, the same horizon have been worked in many parts of Gloucestershire at Througham near Bisley, Nettlecomb, near Birdlip, Miserden, Rendcomb, Chedworth, Pewdown west of Hasleton, Sevenhampton, Kynetton, Eyeford, Naunton, Hampton Field, Ablington near Bibury, &c. Occasionally in Somersetshire, as on Lansdown, north of Bath, fissile limestones at the base of the Great

Oolite have been employed for roofing-purposes. [Under modern usage, the name Stonesfield Slate would not be applied to the slates from most of these localities.]

At Stonesfield the slate is now mostly obtained by means of shafts, there being one mine worked on the level. The shafts are from 20 to 70 feet deep.

The beds worked, are from 2 ft. 6 in. to 3 feet thick, and they yield brown sandy slates, hard grey and slightly oolitic slates, and blue and grey or brown oolitic slates. In size they are obtained 1 ft. 6 in. square and less. The blocks of fissile oolite, fine-grained calcareous sandstone with courses of oolite, and calcareous sandstone, when dug out, must be kept damp, and then exposed to a winter's frost. After that they can be split up evenly at any subsequent time. If they have been allowed to dry before the frost comes, so that the "sap " is dried up, no frost will move the layers, and the rock is then "bound." Formerly it was the custom to begin digging the stone about Michaelmas time or before; now the men commence about the end of October, and work till the end of January. When dug and raised, the stone is banked up and covered with earth, to keep the moisture in, 'until a frost comes. In dry seasons, the quarrymen even water the blocks to keep them moist. It requires three or four good frosts to act upon the stone; hence a mild winter is disastrous to these toilers. Sometimes the stone is put out and then covered up, again and again, until a sufficiently long frost is experienced. As a rule a week's frost is needed.

The stone can be split up any time after it has been "frosted," and of course it can be dressed any time after it has been split. Splitting is usually commenced about the middle of February.

The only qualities in the slates are the first and second, the former being thinner and the latter thicker, though both may be composed of the same kind of stone. The more oolitic slates as a rule are a trifle thicker than the sandy slates, but no particular difference in quality and durability is recognized.

It is thought that the slates do not last well in cities. Mr. Barrett informed me that Exeter College Chapel at Oxford was roofed with Stonesfield slates, but after 20 years had elapsed the stone had become so "bent, broken, and perished," that it had to be removed.

Deal pegs are used for fixing the slates. Oak pegs were formerly used, but it is found that deal forms a better head when driven in than oak, and not so many slates are broken. Copper and iron nails have also been used. In the district around Stonesfield, not only the houses but the porches are roofed with the stone-tiles.

At Througham Field, where Stonesfield Slate is worked, the blocks are improved by lying out all the winter - the second or third frost breaks them up. Slabs 6 feet square or even more are obtained. They furnish material for cow-sheds, mangers, bordering for gardens, and pitching for stables. There is not more than 18 inches of good tile-stone at this locality, but it occurs at slightly different horizons. I obtained some examples of the tools used at Througham Field, and these are placed in the Museum of Practical Geology.

FOREST MARBLE

Over a large area of Wiltshire, Gloucestershire, and Oxfordshire, where the Forest Marble is exposed, the beds have been worked for "slates." Some of the pits are known as "Slate and plank quarries"; and the material is obtained at or near the surface.

These stone-tiles do not require to be split hence no exposure to frost is necessary. They occur as thin flags or leaves of limestone (or occasionally calcareous sandstone), often ranged in oblique bands separated by horizontal layers of clay and shale. All that is necessary is to dress them to the required shape. They resist frost and are considered to be more durable than the Stonesfield Slate, but they are heavier and coarser. (See Lycett, Quart. Journ. Geol. Soc., vol. iv. p.185.)

They have been obtained at Atford, in Wiltshire; and many of the old buildings at Bradford-on-Avon are roofed with them. J. Woodward mentions "Plates, or thin Strata of Stone, used as Slate for covering the Houses at and about Bath. These were taken out of the Slate-Quarries, in Cherlwood, in the Parish of Box, about five miles from Bath and about a Mile from London Road." This slate, as in other cases, often has " a thin Crust of reddish Spar on its Surface." (J. Woodward, Nat. Hist. Foss. Eng., Tome II., 1729, p.101.) (See p. 355)

Other localities for these Forest Marble slates, are Beverstone and Charlton near Tetbury, Avening, Chavenage, Cirencester, Aldsworth, (See Hull, Geol. Cheltenham, p.70.) Burford, between Holwell and Shilton, Poulton, and Fairford. (See p.369.)

In addition to slates, large slabs 5 x 3 or 4 feet are obtained from the Forest Marble for piggeries, garden-edgings, planks, pitching, &c.

SANDSTONES AND SAND

Irregular concretions of sandstone, and huge spheroidal masses known as "Doggers." or Sand Burrs', are found in the sandy strata. These are cemented by carbonate of lime; and they occur in the Midford Sand, in the Northampton Sand, and in the Hinton Sands that belong to the Forest Marble.

Sometimes irregular flaggy beds are formed, and these pass into spheroidal or mammillated masses that retain the marks of bedding or false-bedding, while sometimes the upper or under layers when split off resemble "Pot-lids" (lids of saucepans).

Such "Pot-lids" are found in the fissile calcareous sandstones of the Collyweston Slate, Stonesfield Slate, and Forest Marble: and they sometimes may be split up into slabs suitable for roofing-purposes. Examples occur in the Forest Marble near Cirencester, where they have been used to support Bee-hives.

Of the smaller concretions, examples have been noted in the sands belonging to the Inferior Oolite, at Snowhill on the Cotteswold Hills, and associated with the Collyweston Slate near Stamford. Prof. Judd mentions that " On the surfaces of the flags obtained from these pits, which can sometimes be raised of considerable size and are used for rustic-bridges, peculiarly shaped concretionary masses are sometimes found. One concretion of this character, found on a slab near King's Cliffe, has attracted much attention in the neighbourhood from the popular belief that it is a 'fossil carrot.' Small recesses or caverns are sometimes formed by the weathering out of the sands from beneath the hard rock; one of these is known in the district as 'the Robber's Cave.' (Geol. Rutland, &c., p.170.)

The layers and concretions of calcareous sandstone, called "sand-hats" or "sand-burrs," are occasionally employed for building-purposes. They have been thus used at Yeovil junction and Burton Bradstock, as they furnish larger blocks than the Oolite above.

Dr. Wright has stated that the Cotteswold sands are well adapted for foundry purposes, as they receive sharp impressions of bodies pressed upon them"; in most cases however they would be too calcareous for the purpose, though such sands, as noted by Dr. Percy, may be useful for the bottoms of copper-furnaces.

Above the Horsepools, west of Painswick, the beds comprise very fine mealy sand that has been used for polishing purposes (cleaning silver, &c.). (Lycett, Cotteswold Hills, p.17. : Judd, Geol. Rutland, p.179.) In some places as at Snowhill, the sand is used for making mortar.

Soft fissile sandy beds, belonging to the Stonesfield Series at Througham Field, Bisley, were formerly used for sharpening shears for shearing cloth. The material was obtained every winter for the purpose.

Sands, belonging to the Northampton Sand, as at Kingsthorpe (p.184), have been used for mortar-making; (Judd, Geol Rutland, p179) also for foundry and scouring purposes; while indurated beds have been employed for lining ovens, &c. The white siliceous sands, such as occur at Epwell, and other localities in Oxfordshire, might be serviceable for glass-making, but I am not aware that they have been employed for the purpose. They have been used at Wansford, Apethorpe, Blatherwycke, and Burghley Park. (Hunt, Mineral Statistics, Part 2, 1858, p.375.)

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The use of the name Stonesfield Slates for all of the locations listed is misleading. At the time this document was written the name had a much wider meaning than today. Under modern usage, it should only be used for slate from the vicinity of Stonesfield where pendle (or frost split) stone was worked.

The Stonesfield Slate is found in three beds within the Taynton Limestone which also contains other pendle beds: in the south at Trougham (Trougham Tilestone) and Bisley (Bisley Flats) - these are the same slates

under different names; west of Miserden at 'The Camp' (Miserden itself is too far east) and to the west from Burford to Enstone (Fulwell Slates). Additionally, where the Taynton Stone overlies the Fuller's Earth at Soundborough and Naunton it is sometimes encountered as pendle.

Therefore, those locations listed which primarily worked the Eyford Member of the Fuller's Earth - Pewtdown west of Hasleton, Sevenhampton, Kyneton, Eyeford and Naunton - will generally have been presents quarries although the possibility of pendle occurring from time to time in the overlying Taynton Stone cannot be ruled out. On the other hand, Rendcomb, Chedworth, Hampton Field and Ablington near Bibury which are Forest Marble locations are unlikely to have produced pendle. Back