volcanic matter, and also veins of quartz, intersect the beds, and the surfaces of rents are frequently baked by heat ejected from the interior. Faults also occur, and cause displacements of the beds by upheaval or down­throw of one or other side of a rent.

Several varieties of clay slate are met with, and are char­acterized by the mineral that chiefly prevails. The colour —varying shades of blue, green, and purple being the most common—depends mainly on the presence of iron and the form in which it exists. The common roofing slate of com­merce is generally fine-grained, and combines great strength and durability with moderate weight. It is also very dense, 1 cubic foot weighing over 170 lb, while according to Mr Wilkinson it takes on an average 20,000 lb) to crush 1 cubic inch.

Certain varieties of slate, however, are soft and perish­able, particularly the black carbonaceous kinds. Cubes of iron pyrites frequently occur in slate rock, and are generally deleterious owing to their tendency to decompose and fall out, but this is not always the case, as some of the most durable slates are sprinkled with pyrites without detriment.

The following percentage analysis of an average sample of Welsh roofing slate is given by Prof. Hull:@@1—

|  |  |
| --- | --- |
| Silica 60∙50 | Magnesia 2∙20 |
| Alumina 19∙70 | Potash 3∙18 |
| Iron (protoxide) 7 ∙83 | Soda 2∙20 |
| Lime 1∙12 | Water 3∙30 |

Slate has been used for roofing during many centuries, and it is said that some of the old castles of North Wales—such as Carnarvon and Conway—were covered with this material. And no doubt the better class of houses, situated in the neighbourhood of slate beds, would be roofed with slates obtained by rough surface digging, or from blocks exposed by mountain streams and split by the action of the weather, long before regular quarrying operations commenced. The Delabole quarries of Cornwall had acquired considerable importance as far back as the 16th century, and some of the Welsh slate quarries are very old, as are those of Angers in France. But the slate industry belongs mainly to the present century and latter part of the 18th; and since the open­ing up of the country by sea and land communications the progress and development of slate quarries have been great and rapid. The largest and most valuable quarries of North Wales are worked in the Cambrian and Lower Silurian beds, those of Llanberis and Penrhyn being worked in the former, and the Festiniog quarries in the latter. Important quarries are worked in Cumberland (Lower Silurian), Westmoreland, and Lancashire (Upper Silurian), and also in Devon and Cornwall (Devonian and Carboni­ferous), the lake districts being specially noted for their rich green slates. Some of the western and midland districts of Scotland—mainly Argyleshire, Dumbartonshire, and Perthshire—produce very strong and durable slates (Lower Silurian and Cambrian), the largest and most important quarries being at Ballachulish in Argyllshire, where 15,000 tons are annually made. The Scotch slates are chiefly blue in colour, but thin beds of green are found in some of the central districts.

Slate is now almost universally used for roofing houses and buildings of every description, and for such purposes it is unequalled, the better sorts possessing all the qualities necessary for protection against wind, rain, and storm. The finer varieties are made into writing slates, and in districts where cross cleavage exists slate pencils are made. Slabs are also manufactured, and, being readily cut, planed, dressed, and enamelled, are used for chimney pieces, billiard tables, wall linings, cisterns, paving, tomb­

stones, ridge rolls, and various other architectural and industrial purposes.

Slate rocks are quarried both above ground and below ground, according as they lie near to or distant from the surface. When they are near the surface, and their dip corresponds with the slope of the ground, they are in the most favourable position, and are worked in terraces or galleries formed along the strike of the beds and having a height of about 50 feet. The galleries are generally carried on in sections of 10 yards, worked across the beds, and may rise to any height or be sunk below the surrounding level by excavations. When the rock is much removed from the surface, or inconveniently situated for open workings, it is quarried in under­ground chambers reached by levels driven through the intervening mass and across or along the beds. Or it may be necessary to sink shafts as in coal-pits before the rock is arrived at, but the cost of doing so forms a serious drawback. Inclines, waggons, tramways, and other machinery are employed in slate quarries as in other quarries, to suit the special circumstances and position of the opera­tions, and need not be detailed.

The sections of a gallery are generally worked by crews of six men, who undertake to perform all operations of quarrying, split­ting, and dressing at fixed rates. The rock is bored by jumper drills directed and turned by the hand and driven by hammers. When the bore is short and of small diameter one man can do the work, holding the jumper with one hand and using the hammer with the other. But when a large mass of rock has to be thrown down a bore 4 to 6 feet deep and a diameter of 2 to 3 inches is required and three men are employed,—one to guide and turn the jumper and two to drive it with heavy hammers. Bores of inter­mediate size are made by two men, one holding and the other driving the drill. When the boring has to be done on a steep face a staging is fixed to the rock or suspended from the top by means of ropes. The explosive generally used is rock-blasting powder, being the most suitable for the heaving force required to throw out or detach masses of rock without much splintering, which would destroy the blocks for slate making. Advantage is taken of the natural cuts or joints in blasting, as the rock is readily thrown or worked off these. From the mass thrown out by the blast, or loosened so as readily to come away by the use of crowbars, the men carefully select and sort all good blocks and send them in waggons to the slate huts to be split and dressed into slates. Two men are employed at this operation—one splitting and the other dressing, performing their work in a sitting posture. The splitter places a block on end between his knees, and with chisel and mallet splits it into as many plates as possible of the usual thickness for roofing purposes—namely, quarter of an inch more or less according to the size and strength required. These plates are then placed horizontally by the dresser on a vertical iron “ stand,” and cut with a sharp knife into slates of various sizes suitable for the market (from 30 in. × 16 in. to 10 in. × 6 in.). Certain sizes are designated by names from the peerage, such as princesses (24 in. × 14 ins.), duchesses (24 × 12), marchionesses (22 × 11), countesses (20 × 10), viscountesses (18 × 9), ladies (16 × 10), &c. In every slate rock there is a large amount of waste or bad rock, which is thrown away as rubbish—the proportion of good to bad varying from one in twelve to one in thirty. Attempts are being made at present to have this waste material manufactured into some article of indus­trial value ; and, as it consists chiefly of silica and alumina, these attempts should prove successful.

The slate industry of the British Isles is now of very considerable importance, that of North Wales in particular being immense. According to the census of 1881 the number of slate quarriers in the United Kingdom amounted to 15,765, while over half a million tons of slates and slabs are produced annually, the value of which may be estimated at or over £1,250,000. The number of slates exported in 1884 exceeded 49 millions, the declared value being £251,824, of which over 35 millions went to Germany, valued at £163,321, over 53/4 millions to Australasia, valued at £37,474, and over 3 millions to Denmark, valued at £34,304.

Good slate beds are also worked in the south of Ireland, par­ticularly in the counties of Wicklow, Tipperary, Cork, and Kerry (Lower Silurian, Devonian, and Carboniferous). On the continent of Europe slate rock is worked in Devonian and other formations —in France (Lower Silurian and Devonian), Belgium, Sweden, Norway, Germany, Austria, and Italy (Oolitic). In North America immense slate beds extend from Newfoundland westwards to the Great Lakes and south westwards to Arkansas (U.S.); and slate quarries are successfully worked in Newfoundland, Canada, and in the States of Maine, Vermont, Massachusetts, New York, Penn­sylvania, &c. Writing and roofing slates and slabs of every variety of size and colour are manufactured in these ; but none of the quarries have hitherto reached the immense developments of the principal ones in North Wales, and yet, with characteristic enter­prise, roofing slates have been within recent years imported to Great Britain from Newfoundland and the United States. (D. C.)

SLAUGHTER HOUSE. See Abattoir.

@@@1 *Building and Ornamental Stones of Great Britain and Foreign Countries,* 1872.