

218
OS. 218
1/3
(1)
18
GOVERNMENT GEOLOGIST

ON CERTAIN CALCAREOUS NODULES.

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[Two photos.]

THE nodules described in the following paper occur in certain bands in the upper members of the strata disclosed at Duff's quarry, in Forster-street, New Town. The nodule-bearing bands appear to be unfossiliferous, but both above and below them are other bands carrying numerous fossil impressions, including *Alethopteris australis*, *Thinnfeldia obtusifolia*, *Phyllothea*, &c. The whole series of bands is just below the horizon of the New Town Coal Measures. The beds in which the nodules are found are grey and blue-grey in colour, traversed by thin layers of darker hue, thus giving rise to a banded structure; they may be described as a calcareous sandstone of fine texture, fairly tough, and showing little or no tendency to split along the planes of banding.

In general the nodules have the shape of double-convex lenses, giving in the most perfect forms a circle in plan and two intersecting circular arcs of different curvatures in elevation. The equatorial planes of the nodules were almost invariably parallel to the bedding planes; in the case of those nodules having bounding surfaces of different curvature the surface of greatest curvature was generally found to be the one lying uppermost. The larger nodules have an equatorial diameter about four inches long, and the lens at its thickest part is about half an inch through; on fracturing, the interior shows a crystalline structure, the surfaces exposed having a steel-blue sub-metallic lustre.

An analysis of the crystalline part of one of these nodules, kindly made for me by Mr. Ward, A.R.S.M., Government Analyst, gave the following result:—

Carbonate of Lime	44·0	per cent.
Silica, &c., insoluble in acid	50·6	„
Total Iron, taken as Peroxide...	4·7	„
Carbonate of Magnesia and loss.	0·7	„
	100·0	

The specific gravity is 2·5.

2/3

Mr. Ward writes—"The nodule appears to consist of a fine sand cemented by crystalline carbonate of lime."

Slides of the nodules were prepared parallel to and cutting transversely the equatorial plane. In natural light the slide shows a confused micro-granular structure, the component grains being transparent, opaque, and grey; on rotating the slide, a slight change of tint, due to variation of absorption, is noticed. With crossed nicols, large areas of the slide extinguish simultaneously, and it is seen that adjacent crystalline aggregates appear to grow into each other, there being no trace whatever of anything like a definite crystal boundary, or of the twinning characteristic of tabular calcite crystals. Minute angular grains of quartz and opaque matter are irregularly dispersed through the calcite aggregate.

The nodules in which the most perfect geometrical form is developed show little or no crystalline structure on fracture; bands running parallel to the equatorial plane of the nodule are seen to traverse the broken face, and occasionally the area between two consecutive bands, presents a crystalline appearance very similar to that shown in the larger nodules. The nodules of perfect form are rather less than two inches in diameter, and they pass by stages into smaller ones of roughly spherical shape. These smaller ones show a banded structure, but exhibit when broken no traces of crystallisation.

When the containing rock is broken the nodules are separated from the cavities in which they repose without the slightest difficulty. After the rock has been blasted, the nodules may be found lying in all directions, with scarcely a trace of the bed-rock adhering to them. The cavities and the exterior of the nodules, especially those of larger size, are frequently stained red. The nodules appear to occur most numerous along the bedding planes; in one slab, the largest dimension of which was about fourteen inches, seven cavities were counted.

The bed-rock is in places traversed by narrow irregular fissures containing calcite.

(3)

3/3

