

5. *THE CELLULAR MAGNESIAN LIMESTONE OF DURHAM.* By GEORGE ABBOTT, Esq., M.R.C.S., F.G.S. (Read December 3rd, 1902.)

[Abstract.]

THE Permian Limestone covers about $1\frac{1}{2}$ square miles near Sunderland; it alternates with beds of marl containing concretionary limestone-balls, and attains a thickness of 65 feet or so. The cellular limestones frequently contain more than 97 per cent. of calcium-carbonate. Magnesium-carbonate occupies the interspaces or 'cells' of this limestone, and also the spaces between the balls. The hundred or more patterns met with in it can be arranged into two chief classes, conveniently termed honeycomb and coralloid, each with two varieties; and each class has four distinct stages, both classes having begun with either parallel or divergent systems of rods. The second stage is the development of nodes at regular distances on neighbouring rods; and these in the third stage, by lateral growth, become bands. Finally, in the fourth stage the interspaces become filled up. The upper beds are usually the most nearly solid. In the coralloid class the nodes and bands are smaller and more numerous than in the honeycomb class. In both classes tubes are frequently formed. The rods have generally grown downwards, but upward and lateral growth is common. A section of Fulwell Quarry is given..

DISCUSSION.

Dr. HENRY WOODWARD complimented the Author, not only upon his fine display of lantern-slides and photographs, but also upon having liberally presented to the Natural History Museum the very beautiful series of specimens which he had collected during many years. The Author had referred to the 'puzzle,' which, since the days of Sedgwick, still remained, as to how these structures came about. Surely, the giving of names to the varied forms which these remarkable inorganic bodies took on, did not advance us much. He (the speaker) thought that we should look at them, and at the flints in the Chalk, the clay-ironstone nodules of the Coal-Measures, the septaria of the London Clay, and the concretions in other clayey and shaly beds, as all due to the same set of causes. Water in the Chalk, charged with silica in solution, deposited that silica as flint-nodules or bands of flint along lines of stratification in the Chalk or in joints. So in other beds the iron was deposited, often around organisms; but not so much so at Sunderland, although Prof. Garwood had shown that fossil shells did occur in these calcareous concretionary beds. Prof. Rainey, as far back as 1857, had pointed out that, by introducing gum in solution into a fluid magma ready to crystallize out, the tendency to crystallize remained, but was frustrated or arrested by the gum-solution, and

the mineral matter formed into a concretion instead. He thought that this would, in a measure, account for the Author's specimens from Sunderland; but how all these varied forms of pseudo-crystalline bodies came about was a puzzle still, and the right persons to solve it were chemists and mineralogists.

Mr. A. P. YOUNG remarked that, in trying to explain these structures, we were not bound to confine our attention to the present chemical constituents of the rock. The possible removal of gypsum and soluble salts so frequently associated with dolomite in the Zechstein formation must be taken into consideration. Instances were furnished by the Stassfurt beds and the Rauchwacke. Some of the Author's specimens showed druses which recalled similar cavities in the Rauchwacke containing the so-called 'asche,' a powder consisting chiefly of dolomite and calcium-sulphate.

Prof. GARWOOD congratulated the Author on the splendid series of photographs and specimens which he had exhibited and described. But he confessed that he had been disappointed in the slight allusions made to the mode of formation, among which he could not discover anything that was new, or that was contrary to what he, the speaker, had set forth in a paper in the 'Geological Magazine' for 1891, p. 433. He thought that the cause of the origin of the concretions was as obscure as of yore, and that the best that we could do at present was to put them down as 'organized accidents.' With regard to the suggestion of one of the speakers that a bulk-analysis should be made of the beds containing concretions and the non-concretionary beds interstratified with them, he would like to point out that he had made and published such analyses in the paper already mentioned, and that his results showed a remarkable correspondence in the percentage of magnesium-carbonate in the two beds, the relative amount of magnesium to calcium-carbonate in the one case being 40 to every 100 parts, and in the other 43. For fuller details he would refer the Author to the paper which he had quoted.

The AUTHOR expressed his thanks for the reception accorded to his paper.