

probable that it has often been "top dressed," a process which would quickly add to the depth of the soil. It should, however, be mentioned, that some years since, a field, in the north part of the county Tipperary, was broken up, that had a soil fourteen inches deep, and this field a man, seventy years old, knew to be exactly 110 years in grass. As the average depth of soil, in this part of that county, is from ten to twelve inches in depth, it would leave about 2.5 inches of soil to grow in the century, which is very similar to the results found near Caerleon.

V.—NOTE ON THE CAUSE AND NATURE OF THE ENLARGEMENT ON SOME CRINOIDAL COLUMNS.

By JOHN ROFE, F.G.S.

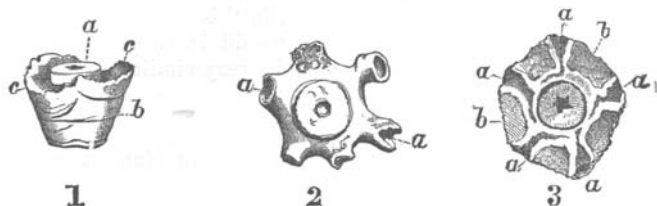
AMONG a great number of specimens of *Crinoidea* from the Mountain Limestone collected by me during several years past, there are many parts of columns which shew an enlargement of the diameter or bulging similar to that described by Miller as representing "the remedial effect of calcareous secretion in repairing an injury of the joints of the stem," and some few portions have occurred having the appearance of a small column rising from the centre of a larger one as shewn in Woodcut *fig. 1*.

These last, for some time, were a puzzle not only to myself but to several friends better able to give an opinion on the subject. The small column a seems to be growing from the centre of the larger one without any appearance of a head or of side arms, and without any apparent cause; but further examination of a large number of specimens, an accidental fracture of one of them, and the subsequent dissection of others, suggest an elucidation of this difficulty, and of the cause and nature of these enlargements generally, and at the same time give a clue to the process of the growth of these Zoophytes.

The column of a Crinoid appears to have been not unfrequently used as a place of attachment for Corals, Bryozoa, or Serpulæ. Phillips (*Geol. of Yorks.*, vol. ii, pl. 1, fig. 61) figures the *Calamopora parasitica* on a stem, and MM. Edwards and Haime (*Monographs Pal. Soc.*) giving it M'Coy's designation Favosites, also figure and describe it as usually adhering to the stem of an Encrinite. Another Coral, with which this note is more particularly connected, is described by McCoy as *Jania crassa*, and subsequently as *Cladochonus crassus*, and he states that "the mode of attachment of the young is most usually by the early branches growing in a circle round a Crinoidal stem." It is over and around the coral thus attached to the Crinoidal column that the enlargement above alluded to is very frequently formed. The coral having fixed itself to and surrounded the column prevents its further natural growth laterally; but the zoophyte when enlarging its column, which it evidently effected by secreting and depositing fresh shelly matter on the outside, encloses the body or cup of the coral with the column, and by so much increases the size. Certainly in most cases, and probably in all, the

divisions of the ossicula of the column are carried round the intruder, and shew on the outside as at *b*, *fig. 1*.

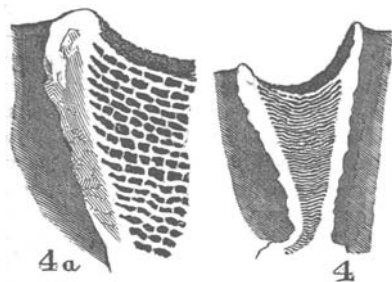
The specimen *fig. 1* is evidently a section of one of these enlarge-



ments broken across, from which the coral has been removed, probably at the time of fracture. In my collection there is nearly half the circle of a *Jania* which has thus been removed from a column to which it does not shew any appearance of having been attached further than by close contact. *Fig. 1 c.c.* indicate moulds left in the enlarged column from the coral having been removed.

Fig. 2 is a small fragment of a column with the *Jania* surrounding it, but not enclosed with shelly matter. Specimens in this state are very rare, and probably may be accounted for by the death of the Crinoid occurring before the enlargement of the column was made. *a.a.* shew the calices of the coral.

Fig. 3 is from a section cut across an enlargement of the column where the coral is surrounded by the Crinoidal matter. It may be here seen, as above stated, that the coral has attached itself to the column, and by gemmation eventually surrounded it; after which the Zoophyte, whilst increasing the size of its column, has enclosed the coral by a sort of exogenous secretion of shelly matter, as indicated in the section at *b.b.*; *a.a.* being the calices of the coral which apparently were left open whilst the coral lived, but in some specimens they are entirely closed in. This specimen also illustrates what is above stated in respect to *fig. 1*, for it will at once be observed, that if the coral is removed there would remain the small central column in the middle of the larger one, as in that figure.



To satisfy myself that this process of growth is common to other Crinoidea and in other geological formations, I have had a similar enlargement in the column of an *Apiocrinite*, from the Bradford Clay, cut both vertically and transversely, and find that here also the enlargement is due to the envelopment of some foreign substance attached to the

column, by a deposition of fresh shelly matter over and around it.

In the specimen *fig. 3*, one of the *Corallites* is well preserved, and shews a structure which fully justifies the doubt of MM. Edwards and Haime as to the affinities of this Coral (*Brit. Fossil Corals*, p. 164). *Fig. 4* is a magnified section of one of the calices, and *fig. 4a.* is a more highly magnified view of part of the same. It appears to be a tabulated coral, and, so far as I know, not yet fully described. I am indebted to Mr. Henry Woodward for calling my attention to the structure of the coral, as I should probably have overlooked its peculiarity, not being myself so familiar with this family as with the *Crinoidea*.

VI.—NOTES ON THE GEOLOGY OF LUDLOW.

By ROBERT LIGHTBODY, F.G.S.

I HAVE long thought that the vallies of the Onny and the Teme, both above and below Ludlow, had once formed an estuary, and that the promontory on which the town stands had been thrown up by some convulsion blocking up the valley, and turning the part above the town into a lake, which (by faults or otherwise) eventually caused an opening for the Teme between the Castle and Whitcliffe.

Lately, in making a drain on the N.E. side of Castle-street, a quantity of rather coarse, and very well rounded gravel was exposed *in situ*, and below it was a bed of fine brown argillaceous sand. The pebbles were Silurian, chiefly Lower Ludlow. One which looks like Wenlock, contained *Stromatopora concentrica*; another mass was composed entirely of *Rhynchonella navicula*, from the band at the top of the Aymestry Limestone.

This appears to confirm most appositely my original opinion, as the gravel is very similar to that found in the bed of the valley, both above and below the town, and appears to have been elevated with the site of the town. It could hardly have been deposited *since* the elevation. The line of fault, which appears to have accompanied the upthrow, runs east and west (about 100 yards north of this gravel), and I believe is crossed by another fault, running between the Castle and Whitcliffe, and giving passage to the Teme.

About half a mile east, at the Gravel Hill, and at 40 feet higher, there is a fine bed of gravel, but of a very different kind, consisting principally of the debris of the Old Red, chiefly Cornstone, and which makes binding and solid-surfaced gravel walks, in consequence of the clay mixed with it, whereas the lower level gravel, as well as the small outlier, which I first mentioned, is perfectly loose, and consists principally of Silurian and Cambrian pebbles, washed down from the upper Onny valley and mixed with sand, which sometimes occurs in thin beds.

In the first instance, when was this Upper Gravel deposited? It must have been formed at the time of the denudation of the thick series of Old Red Beds, that once filled up the interval between the Titterstone, and Brown Clees Hills; the Clees Hills themselves being preserved by the capping of Basalt spread over them.