In Britain, the genus *Girvanella* has, so far, only been recognized as occurring in the Ordovician limestones of Ayrshire. I have, however, found some of the Carboniferous limestones of the North of England to contain largely an ill-preserved organism which will, I think, prove to be referable to *Girvanella*. As previously pointed out, the genus occurs in the Ordovician rocks of North America. This is shown by the fact that certain of the specimens from the Cincinnati Group of Indiana sent to me by Mr. E. O. Ulrich as belonging to the *Stromatocerium richmondense* of Mr. S. A. Miller, prove on examination to belong to a species of *Girvanella*, specifically distinct, I think, from our British species, as shown by the greater minuteness of its tubes. I see, also, no reason to doubt that the fossils from the Chazy Limestone of North America, for which Prof. Henry M. Seeley has proposed (Amer. Journ. Sci. and Arts, 1885, vol. xxx. p. 355, 1885) the new generic name of *Strephochetus*, are in reality referable to the genus *Girvanella*. It is probable that the Chazy form (*Strephochetus ocellatus*, Seeley) is specifically distinct from *Girvanella problematica*, but its generic identity appears to be indubitable.¹ Prof. Seeley seems disposed to think that the curious fossil described by Prof. James Hall, from the Calcareous Limestone, under the name of *Cryptozoon proliferum* (Thirty-sixth Ann. Rep. of the State Cabinet, pl. vi. 1884), may be related to *Girvanella*; but I cannot think that such a relationship—supposing it to exist—can be one of generic affinity. The fossil for which Prof. Hall has proposed this name is not only comparatively gigantic in point of size, but its internal structure, so far as may be judged from the incomplete provisional diagnosis given by its author, is altogether different, since it is stated to consist of branching and anastomosing canaliculi. Lastly, with regard to Prof. H. M. Seeley's reference of *Girvanella* (= *Strephochetus*) to the calcareous sponges, it need only be said that the structure of the genus, so far as recognized, shows nothing which would warrant such a reference, and that it would be essential to the establishment of this view, according to our modern lights, that the organism should be proved to possess definite spicules.

IV.—HERTFORDSHIRE SUBSIDENCES.

By A. C. G. CAMERON.

SUBSIDENCES are by no means unusual amongst the arable lands in the Chalk districts of this county. No one, who has travelled in these parts, can have failed to notice the numerous holes and dells dotted about the fields in all directions, many of which have fallen in, or will do so, in course of time. Nearly all of them mark spots where the Chalk has been dug up for chalking the land, which is then said to work better.²

On the crown of some hill or ridge, it is no uncommon sight to

¹ Dr. Hinde has already pointed out that *Strephochetus*, H. M. Seeley, is identical with the previously described *Girvanella*, and has further shown that the *Siphonema* of Dr. Bornemann, supposed by its describer to be a calcareous Alga, is likewise a synonym of *Girvanella* (Geol. Mag. 1887, Dec. III. Vol. IV. p. 227).

² Gravel soils, such as fringe the modern alluvium of rivers and streams, are chalked as well as the stronger soils.

find a windlass and bucket erected over a circular hole or shaft sunk deep in the Chalk, while a man at the bottom, working right and left of him, sends bucketfuls of dazzling, white chalk to the surface, which is wheeled away in barrows, and deposited in heaps close to one another, in the field where the shaft has been sunk, to be afterwards broken up, and lain about the place.

When all the chalk that is required has been dug up, the windlass disappears, and the hole is filled up to the original surface level, in order that no unnecessary unevenness should occur to mar the ploughing. Gradually however, a subsidence takes place, as the material, with which the hole was filled, settles down in the cavity prepared for it, and then for a time, a basin-shaped hollow marks the site of the shaft. Suddenly a deep ring-like orifice, the sides of which show a clear section of the earth and stones, with which the hole was filled, appears at the bottom of the pit, and a veritable swallow-hole is formed on the spot.

If it is only a subsiding hole, that is, one that may go down at any moment, a short funnel or pipe is seen, without the ring-like orifice and clean cut sides.

Harvest is the time, I am told, when these pits most frequently fall in; but as the subsidences also occur during rainy seasons, when water wells up or accumulates at the bottom, I am inclined to think the reported falling in at harvest time is greatly accounted for by reason of more people being in the fields then to observe them than at any other time. Holes are being re-filled this autumn about here, that have required filling several times before.

In some parts of the county "doming" is resorted to for covering the holes, thereby obviating the periodical filling up, which may require doing yearly. A pit to be domed, is first nearly filled up to the original surface-level, at least presumably so—and then arched over with brickwork and covered with earth. This plan is said to cost no more than the other, but the latter is the safer of the two.

A labourer informed me that somewhere in the Baldock country, a domed hole once caved in when a ploughman and lad with three horses were crossing it. The two attendants had a narrow escape for their lives, the three horses were killed. Poles are sometimes put up to show the sites of these pits.

The foregoing brings to my recollection much that is in common with the 'natural pits' at Ripon,¹ where it will be remembered a haystack disappeared down a cavity² that suddenly opened in the limestone, during the time the haymakers had adjourned for dinner. Doubtless some Hertfordshire subsidences³ are as natural as those at Ripon—due to the dissolution of the strata by acidulated waters.

Semicircular holes in the chalk filled with brickearth, often seen

¹ See Natural Pits at Ripon, by Rev. Stanley Tute, Proc. Yorks. Geol. and Polyt. Soc. 1869. Also 'Subsidences over Permian Limestone,' A. C. G. Cameron, Rep. Brit. Assoc. York, 1881, and Proc. Yorks. Geol. and Polyt. Soc. vol. vii. pt. iv.

² Locally named "shoots" and "earthquakes."

³ See "Nature," vol. xxxvii. Dec. 8, 1887, On an Earthquake in England, by Worthington G. Smith.

where any considerable section of Chalk is exposed, as in a rail or road cutting, indicates natural subsidences whose origin may be traced to causes similar to those at Ripon.

If it were possible to see the surface of the Chalk, bared of its superficial covering of clay, loam, etc., it would, I imagine, be singularly convex and concave. In digging pits, the chalk is is sometimes found close to the surface at one side of the shaft, but cannot be found at twenty or even thirty feet on the other side.

V.—EFFECTS OF ALTERNATIONS OF TEMPERATURE ON TERRA COTTA COPINGS SET IN CEMENT AS AN ILLUSTRATION OF A THEORY OF MOUNTAIN BUILDING.

T. MELLARD READE, C.E., F.G.S., F.R.I.B.A.

ELSEWHERE I have shown that metals under certain conditions when subjected to changes of temperature undergo permanent deformation. Thus sheets of lead ridge up and fold even under the influence of atmospheric changes, as may be seen by the examination of any old lead flats or gutters. The cumulative effect of small but repeated changes of temperature is very striking, and I have used it in illustration of what I conceive to be the true explanation of the ridgings up of the earth's crust called mountain ranges. The examples given¹ of the effects of alternations of temperature are mostly in metals, but I have also shown that other materials not ductile are affected in the same way, in a lesser degree.

A very remarkable example has lately come under my notice² of the lengthening of a terra cotta coping, which it appears to me can only be explained on the same principle.

The coping in question which, is freely exposed to the direct rays of the sun, consists of two courses of red Ruabon terra cotta bricks set in cement upon a fence wall, built with common bricks in mortar a brick and a half thick. The courses are level, but, in consequence of the inclination of the road, the coping is stepped down at intervals, so that the under-course of bricks of one length is just gripped and held in position by the top course of the next length of coping. It will thus be seen that it must constitute by liability to lifting a more delicate test than ordinary of any increase of length that might take place in the coping.

When I examined the coping—and I have looked at it over and over again—the end portion of one length abutting against the next length at the drop in the level was thrown up into an anticlinal of about 6 ft. span; the coping bricks being lifted in the highest part one inch from their bed. There was a fracture at the crown of the anticlinal, and another at the foot or springing, but for a distance of 30 feet the coping was practically one solid continuous bar. A careful examination showed that the coping had “grown” about a quarter of an inch longer than when it was first set, and that this

¹ Origin of Mountain Ranges, chap. iii. and iv.

² I am indebted to Mr. F. Archer for first calling my attention to it.