places in the different parts of the world just named. Yet the one shown here was not exactly similar to any of them, nor indeed did any two in his collection appear to be alike notwithstanding their general resemblance. It would appear that if they have expressed definite ideas, the language in which they are inscribed has varied as much as the idioms of spoken languages vary at the present day. There are several casts in the museum of the Philosophical Hall at Leeds taken from the markings on Rombalds Moor, one of them, in the arrangement and dimensions of the figures, is not unlike the one we have brought under your notice. The cups are very distinct and about one inch deep, but the peculiar feature is the absence of rings, which are usual in most markings. It is considered that as regards distinctness the marks on this recently exposed stone compare very favourably with others, one reason being the peculiar and most valuable property of the rough rock of hardening with exposure; another being its uneven surface, which has preserved the fine markings from destruction by the ploughshare, which has evidently obliterated some, as a later and more careful examination has enabled traces to be discovered of several others. The cups are half an inch in depth, and the rings a quarter of an inch; two of them have outlets near three inches in length, and what would appear to give them an astronomical significance is they point to the north. I may say that Mr. Holmes did not attach much importance to these two marks, yet we must suppose they had some connection with the meaning of the inscriptions. Although numerous conjectures have been made no satisfactory solution has been arrived at. Their meaning is yet a mystery.

ON THE DRIFT DEPOSITS OF THE VALE OF MOWBRAY.

BY T. CARTER MITCHELL, ESQ.

The district in which my observations have been made may be roughly described as that part of the Vale of Mowbray which lies between Ripon, Thirsk, and Boroughbridge, being bounded on the west by the river Ure, and on the east by the foot of the Hambleton Hills. Through the centre of this district runs the river Swale. This piece of country seems to be very rich both in quantity and variety

of erratic rock fragments. I have not confined my observations to boulders of large size, but extended them to any fragments, however small, which seem interesting as part of the drift. I shall first give a list, though necessarily an imperfect one, from a petrological point of view. I shall then endeavour to refer the boulders to their original stratigraphical position, mentioning the characters of the rocks or of their contained fossils which have guided me in this. Next I shall make some remarks on the local distributions of these erratics, and the direction of the ice or water-currents by which they were brought into the place they occupy.

I shall begin with the Siliceous Rocks as they form a large majority. Fragments of sandstone are present of every size, from great boulders to fine sand, of every degree of hardness, from an almost flinty rock to stone so soft that it perishes after a very short exposure to the weather. In texture they vary from the roughest grits to the finest possible sandstone. In colour there is also great diversity, while the great majority are more or less white or pale yellow, many are red, and more still are red and white, that is to say, consist of white stone mottled with red spots. Some have dark red spots on a pink ground. In some cases the spots which mottle the lighter ground are brown instead of red. A chocolate colour may also be observed, some stones being wholly of a dark chocolate colour. Some of these erratics consist of grit, in which are imbedded numerous rounded pebbles of white quartz. I have found specimens of chert, also of quartzite. In some places there are extensive and thick beds of fine loose red sand ; in other places, a yellow argillacious sand is present, and here and there I have seen white sand turned up. Next in number to the Silicious Rocks are the calcareous masses of Mountain Limestone ; they are very common, as are also pieces of dark limestone from the Yoredale Series. Magnesian Limestone is very plentiful in the gravel of the River Ure. Blue Lias Limestone and Oolitic Limestone are among the rocks of the drift. Crystaline Brown Limestone, full of encrinite stems, and called, I believe, "Yorkshire Marble," is to be found ; and I once met with a large piece of pure white saccharoid marble. Of Argillaceous Rocks we have fragments of blue and green slates, black shale, and large

deposits of brick clay ; also a sandy clay, which seems to contain some lime and iron, and in places forms an impermeable structure, which from its hardness seems to be fast turning into stone. It is called " Moor-pan," because it underlies the peaty soil of some of the moors, and prevents the water draining away. Besides the boulders I have enumerated, there are to be found a great many specimens of schistose and metamorphic rocks. In one part pieces of lignite are plentiful, and some specimens of good jet can be found. Four, at least, different kinds of granite are met with, one of which is grey; another is red, not porphyritic, and without mica or hornblende. The commonest kind, found in many places as good-sized boulders, and in every gravel heap in smaller pieces, is the charcteristic Shap Granite. This is light-red, with large porphyritic crystals of pink felspar, also much mica and hornblende. The fourth kind is a brighter red in colour, also full of masses of felspar, but no mica is seen in it, hornblend is present but rather sparingly. Numerous specimens of Basic Igneous Rocks are met with, differing in colour from black to light-grey, and varying much in texture, some close-grained and comparatively smooth specimens of volcanic tufa occur, while others are ragged and course. I ought also to mention pieces of conglomerate and breccia which I have found at times. Septaria or cement stones are very common in some parts. Having recorded examples of the great variety of rocks which have been brought together in the drift, I shall refer some of them to the systems to which they originally belonged. With regard to the numerous schistose and metamorphic stones I am unable to say more than that probably they belong to some of the oldest sedimentary rocks. I think that we may safely consider that the pieces of green slate have been brought from the neighbourhood of Skiddaw, and are Cambrian. The Silurian system has supplied many of the erratics which can be identified by the fossils they contain, as tentaculites, annulatus, pentamerus, etc. I have found the old red sandstone fossil Parka decipiens, the remains of the spawn of a crustacean. There is an immense number of stones from the Carboniferous system in the drift. Sandstones from the upper coal measures are to be found everywhere with casts of stigmaria on them, sigillaria, calamites,

and lepidodendron remains are often found. I have one specimen of the latter from a large tree. Great boulders of millstone grit are to be met with. The Yoredale series is plentifully represented, while the mountain limestone erratics are very common. These are fossiliferous, containing encrinites, corals, and large producti. The Permian system is easily detected by pieces of magnesian limestone from the upper beds, and by a red breccia, called in some places brockram, which belongs to the lower part of the system. The lower New Red Sandstone is doubtless present, but this is not easily distinguished from that of the Trias. Permian fossils are scarce, but I have found Productus horridus. With regard to the Trias there is any amount of bunter sandstone, and I have found the typical fossil Ceratites nodosus. The Lias supplies many water rolled stones in which are fossil Gryphæas, etc.; also jet, lignite, and septaria. Pieces of Oolitic limestone are sometimes found, but not often. Thus the stones of the drift in the district which I have defined, are derived from every system from the Jurasic to the Cambrian inclusive, and probably from some earlier formations as well. I am unable to fix the age of the granites and trap rocks present, but the eruption which poured out the Shap granite, which is only to be found *in situ*, at Wastdale Crag and Wastdale Pyke in Westmoreland, occurred after the formation of the green slates, and before the deposition of the old red sandstones. Although all these different rocks are to be met with in a district ten miles square, some are found more plentifully in one part than in another. The Ure gravel on the west side contains more of the magnesian limestone, while the long ridge of rather elevated land which forms the water parting between the Ure and the Swale, and along which the old Roman Watling Street runs, has on both sides of it a tract of land which, though for the most part very fertile, contains great quantities of erratics, interspersed in the soil for a considerable depth. Many of these are very large, and for the most part consist of sandstones, though many other rocks are to be found among them. Most of these are rounded, others are angular. Parallel to this ridge, but a few miles further east, a long range of sand and gravel hills follows the course of the Swale, sometimes on

one side of the river sometimes on the other. The gravel in these, the lowest part of the brick clay, is laminated, being interstratified with fine sand. There is no doubt that the chief agent by which the drift, which I have described, was brought into this valley was an enormous sheet of ice which advanced from the north-west, but I also think that there must have been a later and smaller ice-drift which came round the north end of the Hambleton Hills, and kept to the east side of the valley. This glacier would, no doubt, have its origin in the Scandinavian Mountains. But water, as well as ice, has done a great deal towards bringing about the existing state of things. The whole tract of land from the estuary of the Tees through the vales of Mowbray and York to Holderness, is not much elevated, and a very moderate depression would convert it into an arm of the sea. Besides this the thawing of such piled-up accumulations of ice as had gathered through ages of frost, when every atom of vapour was retained as ice in the frozen north, the thawing of these accumulations must have produced torrents of water rushing southward to find again its level in the ocean. By these currents from the north this valley must have been swept again and again, and by them denuded, to what extent the resulting alluvial deposits of Holderness bear witness. The stones of the drift in this part testify in several ways to having been subject to submergence and the action of water; they are, even in the case of very large ones, considerably rounded. Ice markings, though very evident in some cases, are decidedly rare among them ; this, I think, is due to their having been so rubbed and rounded by water action that their surface marks have been obliterated. When these "cobble" stones, as they are called, are used in building, the walls made of them turn wet in damp weather, I believe that this is due to the same cause which makes seaweed turn damp under similar circumstances, that is to say, that they still contain some of the salt which penetrated into them when they were covered by the sea, salt having the power of attracting moisture from the air. I have here very strong evidence of one of these stones having been under the sea ; it is a piece of sandstone which, from its colour, has laid long in the soil. It contains several cells, which have been made in it by some rock-boring shell-fish.

The holes have been nearly globular, but have a short neck through which the tenant communicated with the outside. The cavity is almost exactly like that of a mould for casting a round bullet, the hole by which the hot head enters corresponding to the narrow neck in the stone. I consider that these borings were made by a Pleistocene Saxicava, and the size of the cavities appear to indicate that they were formed by S. artica. This is the more likely, as the few fossils of the drift were for the most part of a northern type.

NOTES ON SOME SINGULAR CAVITIES IN THE MAGNESIAN LIMESTONE.

BY REV. J. STANLEY TUTE, B.A.

PLATE VI.

The cavities or burrows in the Permian Limestone near Wormald Green Station, to which I wish to draw your attention, are of such obscure origin that at one time one is inclined to refer them to the excavations of some early form of Gastrochæna ; at another to an annelid ; then to one of the algæ. Without attempting to say what they really are, I venture only to describe their forms and their position in the limestone, and what I have been able to gather from the observations of others, hoping that the members here present may be able to throw so much light upon the matter that we may come to some probable conclusion as to their origin.

An old quarry, about a quarter of a mile west of Wormald Green, which had been for a long time disused, was opened again a few months ago. In the old and new section about 60 or 70 feet of the middle beds of the Lower Magnesian Limestone have been exposed. Throughout 30 feet of the upper portion of the new part there occur innumerable grooves and cavities of a singular character, agreeing with certain fossil remains which are mentioned by Mr. J. W. Kirkby in a paper read before the Geological Society in 1861,* as occurring in the Lower Permian Limestone of South Yorkshire, at Hampole Stubbs. He says, "the occurrence of another Fossil, of somewhat obscure affinities, though possibly an annelid, may here be noticed. It is the cast of a laterally compressed tube three inches long (neither

* Quart. Journ. Geological Society 1861, vol. xvii., p. 309.