Ordinary Meeting, May 7th, 1860.

The Rev. T. Wiltshire, M.A., F.G.S., President, in the Chair.

The following gentlemen were elected members of the Association :—Dr. C. T. Richardson, and H. J. Sanders, Esq.

The President announced that the Committee had come to the resolution of conducting an excursion to Maidstone on the 19th of June.

The following donations were announced :—

A stereoscopic photograph of fossil human bones found at Le Puy, Haut Loire, France. By H. Deane, Esq.

It was resolved that the thanks of the Association be given to Mr. Deane for his donation.

The President announced that a member of the Committee had kindly offered to take stereoscopic photographs of remarkable fossils, for the purpose of distribution among the members at the expense of the Association.

The following paper was read :—

“On the Action of Heat on certain Sandstones of Yorkshire.”
By C. Tomlinson, Esq.

In passing along the highways of a country, the geologist can generally tell at a glance what is the mineral character of the district in the kind of metal employed to mend the roads; whether there are iron or other works in the neighbourhood, the slags of which are applied to the same purpose, or whether the traffic is so great, and the neighbourhood so poor in road-making material, as to necessitate the importation of road metal from a distance. Where stone abounds, the picturesque hedgerows are often superseded by stone walls, and where the stone is of lamellar structure and plentiful, it is used to pave the footpaths between distant villages for miles together.

In rambling among the Yorkshire villages in the neighbourhood of Huddersfield, in September, 1859, the abundance of stone was apparent in the boundary walls and paved footpaths of the district, and there was nothing to excite remark, until, approaching a village

called Almondbury, I was struck with the brick red appearance of the roads, which increased on that side of the village nearest Huddersfield. I had no means of accounting for this appearance, for there was no stone in the neighbourhood of that tint, nor any works the secondary products of which at all resembled it. A slight shower of rain brought out the colour more vividly, and it appeared still more to deepen in a bye-road leading out of the main road. Pursuing the bye-road for a short distance, I found myself in a quarry of several hundred feet in length, and what was my astonishment to notice on its vertical walls extensive marks of the action of fire, such as large red patches, brown and purple masses, blisters, and incipient vitrifications; and these signs appeared at intervals, rising from the floor of the quarry to a height of forty or fifty feet. Seeing some men at work at the further end of the quarry, I went up to them, and found them undermining what appeared to be a portion of the quarry in a highly vitrified state. I then learnt from them the cause of these extraordinary phenomena, and was able to explain the red appearance which had excited my attention in the road.

The stone of the neighbourhood not furnishing a very durable road-metal in its natural condition, it has long been the custom to harden it by the action of fire, for which purpose a stone stack is constructed in this quarry two or three times a year, the inferior kinds of stone, and the refuse after the building stone has been got out, being used for the purpose. For the construction of this stack, an area of about sixty feet square is laid out in such a manner that the face of the quarry may furnish one, if not two, vertical sides to the stack, for the sake of shelter. On the present occasion the stack had been constructed at the end of the quarry, so that two vertical walls were thus obtained for its support and shelter. The stack is commenced by spreading a layer of broken stone over the base; upon this a layer of coals, that fuel being very cheap (a coal-pit being within sight), then another and thicker layer of broken stone, care, however, being taken to form suitable channels for the entrance of air, and in this way, with three layers of coal and five layers of stone, a stack is built up to the height of fifty feet and upwards. The fuel is then kindled at the ventilating openings, and the draught being properly

regulated, the combustion quickly spreads, and continues for about three months, varying with the state of the weather, and producing at night a red glow in the sky visible for miles around. As the fuel burns out, the stack diminishes in height, and is left for a couple of months or so to cool. The men then proceed to break it up by means of long crow-bars and picks. This is no easy task, since the mass is very hard, and has the appearance of volcanic slag or scoriæ. The men, however, somewhat abridge their labour by commencing at the base of the stack, driving in their crow-bars, and undermining a considerable portion, until huge fragments of many tons weight crack and fall off. The workmen judge by the cracking sounds as to the proper time for retiring, and they sometimes assist the disruption by pouring water into the crevices above, if the rain does not do it for them. The cold water coming in contact with the vitrified mass, which, from its low conducting power, cools very slowly, produces large cracks, which assist in its mechanical disintegration. The large masses are broken up by means of sledge-hammers into smaller masses, and these are again broken with smaller hammers into pieces about the size of a hen's egg, for placing on the roads. I collected a number of fragments from the stack which I have now the pleasure of laying before the meeting. It will be seen that they are all more or less vitrified, sonorous, and brittle, and one or two of the specimens have the appearance of a rude kind of pottery or stone-ware; the material is probably a crude silicate of alumina and iron.

Observing on the face of the stack which had been exposed to the weather a considerable amount of efflorescence, a portion of which being placed on the tongue, instantly melted with the cool sensation produced by an alkaline salt. The workmen informed me that the stack was a capital guide to the weather, as they always knew of the approach of rain many hours, and even days, before, by the change in its appearance.

On mentioning the above particulars to friends in the neighbourhood, I was surprised to find that the information was as new to them as it was to me. They had, indeed, observed the red glow in the sky on winter nights, but were satisfied with the general information that it proceeded from some iron or other works, and had inquired no further. On referring to books descriptive of Yorkshire,

including Phillips's well-known work, and Mr. Hobkirk's recently published "History and Natural History of Huddersfield and the Neighbourhood," which contains a chapter headed "Geological," I could find no mention of the circumstance. As an old man in the quarry informed me that the plan was in operation when he was a boy, and that his father spoke about it as a thing of course known in that place, and in one or two other parts of Yorkshire, where they had the right sort of stone, or "stone with plenty of fat in it," I was induced to refer to that old but admirable authority, Camden, in whose interesting folio I did not find what I sought, but met with information which led me to a result of so curious a character that, although it is antiquarian rather than geological, I trust the meeting will excuse me if I take the liberty of submitting it to them.

Camden says, "Six miles from Halifax, not far from the right side of the river Calder, and near Almondbury, a little village, there is a very steep hill, only accessible by one way from the plain, where the marks of an old rampire and some ruins of a wall and of a castle well guarded with a triple fortification are plainly visible." He then goes on to say that these are really the remains of the *Cambodunum* of the Romans; that in early Saxon history there was a royal seat here, and a cathedral built by Paulinus, the apostle of these parts, and dedicated to St. Alban, whence the village of *Albanbury*, now called *Almondbury*. "But," continues Camden, "in those cruel wars that Ceadwall, the Britain, and Penda, the Mercian, made upon Edwin, the prince of these territories, it was burnt down, which in some measure appears in the colour of the stones to this day."

The event here recorded by Camden took place in the eighth or ninth century. Eight centuries had elapsed before Camden wrote his description, and yet the marks of fire remained unobliterated during that long period. No cause, as far as I knew, had intervened since Camden's time to obliterate those marks of fire, why should they not therefore still be visible? "For this simple reason," was the reply, "that the whole of the ruin has long since been cleared away to make room for a public-house and tea-gardens, where our Yorkshire bands are fond of assembling for practice, and where parties of pleasure go to listen to them."

"That is not a sufficient reason," I rejoined. "Stone is so abundant in this district, that no one would think of carrying it from the top of the hill to the valley below, still less of carrying it below upwards, where the ruin would furnish abundant material for constructing the musical hostelry, and I dare say enclosing it in a stone fence; and in addition to all this I have no doubt there is plenty of stone scattered about, bearing the marks of the Mercian fire to this day."

It was therefore agreed that we should ascend the Castle Hill next day; but as I did not expect to find marks of fire so decided as on the stone of the stack in the quarry, but only the effects of a moderate heat, such as the higher oxidation of the iron, producing the well known reddish tint, I placed a piece of ordinary micaceous sandstone of the neighbourhood in the fire for an hour or two, and beg to call the attention of the members to the two specimens, when it will be seen at once which of the two has been acted on by the fire.

The next day we climbed the hill, and had no sooner arrived at the wall which surrounds the grounds of the public-house, than we were struck with the red appearance of many of the stones of which it is built, and which left no doubt that although a thousand years had elapsed since "Ceadwall the Britain and Penda the Mercian" in those cruel wars burnt down the castle and cathedral of St. Alban, there was still before us evidence of the fact, rendered if possible still more striking on breaking open some of the stones, where the action of the fire had in some cases penetrated only a short distance, and in others completely through, presenting to the eye the reddish tint as bright and fresh as that on the piece of stone which I had passed through the fire on the preceding night.

There are six specimens of stone from the Castle Hill now on the table, which I leave for the inspection of the members, with many apologies for having thus far intruded on their time.

A discussion followed, in which the President, Professor Tennant, Mr. Cresy, and others took part.

Specimens of London Clay fossils, which had been collected from the excavations now being made for the purpose of the main drainage at Kentish Town, were exhibited by Mr. Pickering.

Mr. Atkinson exhibited a striated specimen of chalk, found in

the neighbourhood of Rochester, at a depth of eighty feet below the surface, which had the appearance of a tusk. Professor Tennant thought that its peculiar appearance was due to the same cause as that which produces slickensides.

Ordinary Meeting, June 4th, 1860.

Professor Tennant, F.G.S., Vice-President, in the Chair.

The following gentlemen were elected members of the Association:—The Rev. James Stanley Perceval; Walter H. Bartlett, Esq.; Thomas Brain, Esq.; Lieut. F. W. Hutton; Benjamin Pollard, Esq.

A donation of fossil bones from the Inferior Oolite at Sherborne, by J. W. Butler, Esq., was announced.

The following paper was read:—

“On the Flint Implements lately found in the Drift.” By S. J. Mackie, Esq., F.G.S.

The author first pointed out the evidences that the fossil flint-implements had been actually worked by the hand of man, and alluded to the uniform characteristics observable in the manner in which the flints have been trimmed wherever they have been found. This trimming is peculiar and very evident in the undulating lines of fracture of the chips split off, always running from the outer edge towards the centre of the object. Such a constant method could not be imitated by Nature in the natural breakage of stones and pebbles by collision with each other, for the blows in such cases would be various in their directions, and not uniform. He then dwelt upon the point that they are really fossil, or belonging to a true geological age, giving details of the sections at Abbeville, Hoxne, and other places in which the superposition of the Drift-beds was known, and in which the particular layers from which the flint-implements had been met with had been authenticated.

The author then exhibited specimens of the various kinds of worked flints which had been extracted from the gravel and Drift-beds, such as flake arrow-heads, flake knives, the little perforated sponges, probably used as beads, and the great pointed flints hitherto commonly called “celts;” but to the continued use of which term