

## EXCURSION TO BRISTOL.

WHITSUNTIDE, 1907.

*Directors* . PROF S. H. REYNOLDS, M.A., F.G.S., A. VAUGHAN, B.A., D.Sc., F.G.S., PROF. W.S BOULTON, B.Sc., A R.C.S., F.G.S., and T. F. SIBLY, B.Sc., F.G.S.

*Excursion Secretary* : GEORGE W. YOUNG.

(*Report by THE DIRECTORS*)

THE headquarters were at the St. Vincent Rocks Hotel, Clifton. Most of the members arrived on Friday, May 17th. They were joined on each of the days by many local visitors, bringing the number on each excursion to above 50.

SATURDAY, MAY 18TH

*Director* . DR VAUGHAN.

The members assembled at the fountain at the top of Bridge Valley Road, where they were joined by the Director at 9.30 a.m. Fine weather fortunately presented the beautiful Avon Gorge in its most charming aspect and permitted the full programme to be carried out.

The great fault at the foot of Bridge Valley Road was seen to separate the highest beds ( $D_2$ )\* of the Carboniferous Limestone, on the north, from the *Seminula* beds on the south. The large heave of the fault was demonstrated by walking southward as far as the base of  $D_1$ , and noting the distance covered, on the return traverse, before the same bed was again met with, in the main sequence, north of the fault.

$D_2$ ,  $D_1$  and upper  $S_2$  were rapidly passed in review.

$S_1$  and the base of  $S_2$  were more carefully examined in the Great Quarry, where the abundance of *Seminula ficoides* and of *Lithostroton martini* immediately arrested the attention. At the top of  $S_1$  the Cyathophylloid *Caninia* (*Caninia cylindrica* mut.  $S_1$ ) and the spinose semireticulate *Productus* were pointed out, from the lowest beds of  $S_2$  a specimen of *Carcinophyllum*  $\theta$  was obtained.

Time did not permit of the examination of the *Syringothyris*-zone (C), but attention was drawn to the importance of this period as one of wide-spread movement, only indicated in the Avon by rocks of shallow-water origin.

The *Zaphrentis*-zone (Z) was seen in the Black Rock Quarry, where the abundance of *Zaphrentis* in the upper part ( $Z_2$ ), and the predominance of Brachiopods in the lower ( $Z_1$ ) were

\* For explanation of terms used see the Table *ante*, p. 73

pointed out. At the top of  $Z_2$  (horizon  $\gamma$ ), the first establishment of the Caninoid *Campophylla* and the acme of *Syringothyris cuspidata* were noted, a little below this level occur the celebrated "Clifton Fish Beds"

The main portion of the *Cleistopora*-zone (Lower Limestone Shales of the Avon Section) was passed by without examination, but some time was spent in studying the base (*Modiola* Phase  $\equiv$  Km) of the zone, in the railway cuttings, near Cook's Folly, on the two Avonmouth lines. Here, attention was especially drawn to the evidences, both faunal and lithological, of extremely shallow water conditions during the deposition of these beds which immediately succeed the Old Red Sandstone of the Avon section

*Modiola* was found plentifully in the shales and *Athyris cf. Roissyi* was collected from the upper cutting. Interest was also shown in the well-known "Bryozoa" and "Palate" beds

The party went by train from Sea Mills to Shirehampton, where they had luncheon, after which they crossed the river by ferry to Pill, and the return walk was made from Pill to the base of the Carboniferous Limestone, on the Leigh Woods side. In the course of this walk, the Dolomitic Conglomerate was seen lying, unconformably, upon the Old Red Sandstone in the cuttings on the Portishead Railway. The party also collected specimens of Celestite (sulphate of strontia) from stacks which had been brought from the surface workings at Leigh Court, Abbot's Leigh, where the mineral occurs in irregular seams in the Keuper Marl

Work was then resumed upon the lowest beds of the Avonian sequence in a low riverside exposure. Specimens of *Strepsodus* were obtained from the top of the Old Red Sandstone, and Brachiopods (*Productus bassus*, *Camarotoechia*, etc.) from the lowest beds of  $K_1$ , immediately above the Bryozoa Beds.

The lowest beds of the *Zaphrentis*-zone (Horizon  $\beta$ ), were searched in Quarry 1 and yielded the Brachiopod assemblage characteristic of that level (*Spirifer clathratus*, *Productus burlingtonensis*, *Spiriferina cf. octoplicata*, *Syringothyris aff. cuspidata*, etc.).

In Quarry 2, the base of  $Z_2$  yielded the early form of *Schizophoria resupinata*, associated with the small progenitors of the papilionaceous *Chonetes*. The uppermost beds of this quarry displayed *Zaphrentis aff. cornucopiae* at its maximum

In Quarry 3, the *Camunia*-Oolite is finely displayed, resting upon a fossiliferous band in which *Syringothyris laminosa* is a characteristic form. The ill-developed bedding of the oolite indicates continuity of deposition and the purity of the oolite-structure points to conditions of clear but shallow water.

In Quarry 4 ( $S_1$  and  $S_2$ ), the same fossils were observed as in

the Great Quarry at the corresponding level on the Clifton side. Especial interest was shown in the prevalence of a peculiar calcareous breccia which exhibits pisolitic structure on a large scale.

No further stop was made until the base of  $D_1$  was reached, where the abundance of *Productus giganteus*, *Cyathophyllum murchisoni* and *Dibunophyllum*  $\theta$  was immediately remarked.

After re-passing the Great Fault, the repetition of the sequence along the side of the towing-path was hurriedly reviewed and the river section finally left at the foot of Rownham Hill, where tea was obtained.

Halfway up this hill a visit was paid to Rownham Quarry where  $D_2$  beds are worked. (This is the level from which the Clifton Corals, so widely-distributed in museums, have almost all been obtained.) The quarry was in a bad state for examination, but most of the characteristic fossils were obtained (*Lonsdalia*, *Lithostrotion portlocki*, *L. ensifer*, *Productus cf. latissimus*, etc.). Attention was directed to the recurrent beds of patchy limestone which weather into rubbly beds.

The Director pointed out that, although these are the highest beds which contain Avonian fossils in the Bristol area, yet they were laid down at an earlier date than the Lower Limestone of Scotland, and that the Millstone Grit of Bristol, at least in its lower part, is the equivalent of the highest subzone of the Avonian ( $D_3$ ) in the Midlands and north of England.

After recrossing the river by the Suspension Bridge, a brief visit was paid to the uppermost *Seminula*-beds of Observatory Hill. A thick limestone bed, crowded with weathered specimens of *Seminula ficoides*, was examined in order to demonstrate the internal spiral arms. Finally, the party was shown a good example of the peculiar concietionary beds which characterise the top of  $S_2$  in the Bristol district.

The thanks of the Association are heartily rendered to Mr E. Newton, district superintendent of the Midland Railway, for permission to visit the cuttings on the Avonmouth lines, and to Prof. Wertheimer, Principal of the Merchant Venturers' Technical College, for kindly allowing the party to examine the beds in the Great Quarry.

MONDAY, MAY 20TH, 1907

EXCURSION TO THE SILURIAN INLIER OF THE EASTERN MENDIPS

Director - PROF. REYNOLDS.

Leaving Bristol at 9.30 the party, numbering about 50, reached Shepton Mallet at 11.20. There they were joined by Mr H. B. Woodward, and after some delay, due to insufficient carriage accommodation, started for Beacon Hill, where the coarse, ashy



conglomerate is exposed at the Rifle Butts. Firing, however, was going on and rendered a visit to the exposure impossible. The party then proceeded to Sunnyhill Quarry, where the finest section of the Silurian igneous series occurs. The exposure shows a very varied series of tuffs about 100 ft thick in all, underlying a thick mass of pyroxene andesite. A considerable number of fossils were found in the lower part of the tuff section. Crossing the road to the large and well-known Moon's Hill quarry good specimens of the lava, which here as everywhere else in the district is a pyroxene andesite, were collected. Mr H. B. Woodward took this opportunity of congratulating the Director on having added the Silurian to the map of Somerset. In the small quarry south of the tunnel a block of tuff was found which may possibly have fallen from an exposure on the quarry face. No tuff has yet been found *in situ* at Moon's Hill. The party then walked across the fields to the quarry in coarse, ashy conglomerate to the east of Moon's Hill. The Director explained the various suggestions which have been made to account for this curious deposit. The general opinion appeared to be that the rounding of the blocks could only have been accomplished by water action, and certain indications of bedding which were detected in the finer grained material were held to support this view.

The next halt was made at Tadhil, the spot where Silurian fossils were first met with in the Mendips. The rock here is a fine-grained felspathic tuff, and though the trench which afforded a good section of the material had been filled in, many fossils were collected from the loose *débris*. Most of the party then walked across the fields to Downhead, where there is a third large quarry in pyroxene andesite, not differing materially from the rock exposed at Moon's Hill and Sunnyhill. Joint planes in this quarry were lined by a peculiar pale, flexible material, which proved on examination to be nearly pure magnesium silicate.

Rejoining the brakes at Downhead, the party drove through the beautiful village of Mells to Frome, where tea was obtained at the Wallbridge Hotel, and returned to Bristol by the 5.50 train. It was hoped that time would have permitted a visit to the Vallis quarries, where the upper beds of the Inferior Oolite rest with strong unconformity on the Carboniferous Limestone, but this was impossible, though a distant view of the quarries was obtained from the carriages.

TUESDAY, MAY 21ST.

Director Mr. T. F. SIBLY

The party left Bristol by the 9.30 train, and, alighting at Burrington Station, walked to Burrington Combe, where the day's work began. The basal beds of the *Dibunophyllum*-zone,

exposed in a quarry at the mouth of the Combe, were first examined. Ascending the Combe, the *Seminula*-zone, which is not well exposed, was passed over, and the next halt was made to examine the upper beds of the *Syringothyris*-zone. The strongly oolitic nature of these beds was noted, and several specimens of *Cyathophyllum*  $\phi$ , a characteristic fossil, were obtained. After a brief examination of the lower *Syringothyris*-beds, some time was devoted to collecting from the highly fossiliferous limestones of Horizon  $\gamma$ . Numerous fossils were obtained, including many specimens of *Caninia cylindrica*, the great abundance of which coral characterises this level.

Continuing the walk up the Combe, the fine escarpment of  $Z_2$  limestones on the south side of the road was noticed. Some members of the party accompanied the Director up a tributary ravine to examine the shales of the lower *Cleistopora*-zone (*Modiola*-phase), and the uppermost beds of the Old Red Sandstone, exposed in the stream-section. Others stayed to collect fossils from the *Zaphrentis*-beds. The attention of members was drawn to the disappearance of the stream in a swallet beside the road.

Joining the brakes, the party drove over the Mendips and down the magnificent Carboniferous Limestone gorge of Cheddar. Time did not permit of an examination of the fossiliferous beds at the base of the *Seminula* zone, but a halt was made at the quarry lower down the gorge, and fossils were collected from the upper beds of  $S_1$ , there exposed. The abundance of *Lithostrotion martin* in these beds was noted.

Arriving at the stalactite caves the party divided into two sections, one of which visited Gough's Cavern and the other Cox's Cavern. A few energetic members found time to see both.

After tea at the Cliff Hotel the party returned to Bristol by the 5.21 train.

WEDNESDAY, MAY 22ND.

*Directors* PROF. W. S. BOULTON and PROF. REYNOLDS

Leaving Bristol at 9.5, the party, strengthened by a contingent from Clevedon, reached Weston at 9.46, finding brakes awaiting them. They then drove round the eastern end of Worle Hill, where a halt was made at the quarries, and Mr Sibly drew attention to the overfold in the *Seminula* beds due to the reversed fault traversing the hill. Rejoining the brakes, the party drove to Woodspring Priory, whence they walked along the ridge to the most westerly of the four sections of igneous rocks which here occur interbedded in the Carboniferous Limestone series. The section is given in detail on p. 63 of the current volume of the PROCEEDINGS. Some members of the party devoted their attention

to the underlying limestone (hor.  $Z_2$ ), which is one of the richest collecting grounds in the Bristol district. The second and third exposures of the igneous series which lie about half a mile to the east of the first were then visited, and here, though the lava is absent, the tuff is rather thicker than in the western exposure. Much attention was paid to certain sandy bands with peculiar vertical bodies which occur at the top of the igneous series.

Mr. Sibly contributes the following note as to the position of the igneous rocks at Woodspring

"The horizon of the igneous rocks in the Woodspring ridge can be determined with considerable accuracy, and the following facts are worthy of special mention. In the westernmost exposure, where the volcanic series attains its maximum development, the igneous rocks occur immediately *under* horizon  $\gamma$ . In the easternmost exposure, however, where the igneous series is represented only by a few feet of tuff, this tuff occurs at the *top* of horizon  $\gamma$ , and is immediately overlain by the unproductive "*Laminosa-dolomites*," the basal beds of the *Syringothyris*-zone. The tuff seen in the easternmost exposure must, therefore, be of later date than any part of the volcanic series seen in the westernmost exposure."

From Woodspring the party drove through Kew Stoke to Spring Cove, near the Old Pier, Weston. Professor Boulton described the main features of the basalt lava-flow in the limestone, which is here exposed from the cliffs across the fore-shore to low-water, a distance of about 150 yards. The special features noted were

(a) The complex character of the flow—the coarse, pillowy structure at the cliff end, with the tuff-like character of the basalt between the spheroids.

(b) The lumps and masses of oolitic limestone (see Plate IV, Fig. 1), now largely converted into dolomite, and in many cases apparently picked up as calcareous mud by the lava and squeezed into spaces between the spheroids of basalt.

(c) The agglomeratic character of the middle portion of the flow, with lumps of scoriaceous basalt (see Plate IV, Fig. 2), as well as limestone embedded in a coarse ash, all showing signs of successive outpourings along the calcareous floor of the sea, and not, as at Middle Hope, the deposition of ash to form stratified layers in the limestone.

(d) The contact-phenomena at the junction of the limestone below the lava, and the discoloration and dolomitization of the underlying beds.

After tea at Huntly's Restaurant the 6.30 p.m. train was taken for Bristol, and the excursion brought to a close, most of the members returning to London by the 7.24 train from Bristol.



## EXCURSION TO PORTISHEAD

*(Report by PROF. REYNOLDS)*

During their stay at Bristol some of the members made an unofficial excursion to Portishead. The first spot visited was Fore Hill, where the relation of the Carboniferous Limestone to the Old Red Sandstone is difficult to understand, and several varying interpretations based on faulting have been suggested. The party then proceeded to Battery Point, which is formed of limestone (hor.  $\beta$ ). A short distance to the south the *Cleistopora* beds (K), which are finely exposed and very fossiliferous, are thrown into a series of small flexures probably owing to a reversed fault which brings lower beds (hor.  $\alpha$ ) over them. At this point the party divided, some proceeding *via* the limestone quarries of the Portishead and Clevedon road, the others by the coast path which displays a splendid series of unconformities between the Old Red Sandstone and Dolomitic Conglomerate. The two sections reunited at Walton Castle, near Clevedon, and after a visit to Coles' Quarry, where the superficial deposits are of much interest, and a small cave has yielded many bones,\* drove back to Bristol.

The President during the course of the excursion took the opportunity of thanking in turn the various Directors for the great interest that the excursion had afforded to the members.

## EXPLANATION OF PLATE IV

FIG 1 —Mass of oolitic limestone embedded in basalt. The margin of the limestone has been baked by the hot lava. The basalt also shows veins and strings of infiltrated calcareous matter.

FIG 2 —Spheroids of amygdaloidal basalt embedded in Tuff. The latter has flowed out in a fragmental condition, carrying lumps of basalt with it.

EXCURSION TO THE CUCKMERE VALLEY,  
SEAFORD AND NEWHAVEN.

SATURDAY, JUNE 1ST, 1907

*Director:* J. VINCENT ELSDEN, B.Sc., F.G.S.*Excursion Secretary:* MARK WILKS,*(Report by THE DIRECTOR)*

IN spite of threatening weather, a party of ten met the Excursion Secretary at London Bridge Station and travelled by the 9.45 a.m. train to Berwick Station on the L. B. & S. C. Railway. Here attention was drawn to a section in the railway cutting near the

\* Some of these bones were exhibited by Dr. H. C. Male at the conversazione in November last.