

The return journey was made *via* Rails Hatch and then by bridle road through well-wooded country to West Horsley Church, where the main road was taken to the Duke of Wellington Inn at East Horsley for tea. Pole Pit, close by, was pointed out as having yielded plates of *Marsupites*, but it is so dirty and thickly shaded by trees that finding them is a difficult matter.

Both time and rain prevented a visit to Rowbarns Pit, another fossiliferous exposure in the *M. cor. anguinum* zone, about half-a-mile south of East Horsley Church, and the party returned to town by the 7.45 train. Mr. T. W. Reader acted as Secretary of this Excursion.

REFERENCES.

- Geological Survey Map, 1 in., Old Series, Sheet 8, Drift Ed.
 1872. WHITAKER, W., *Geol. Surv. Mem.*, vol. iv.
 1887. FRENCH, H. H.—"Excursion to Gomshall, Netley Heath and Clandon." *Proc. Geol. Assoc.*, vol. x, p. 182.
 1900. STEBBING, W. P. D.—"Excursion to Netley Heath and Newlands Corner." *Ibid.*, vol. xvi, p. 524.
 1907. YOUNG, G. W.—"The Chalk Area of Western Surrey." *Ibid.*, vol. xx, p. 422.

REPORT OF AN EXCURSION TO CHARMOUTH AND LYME REGIS.

MAY 29TH TO JUNE 3RD (WHITSUNTIDE), 1914.

BY THE PRESIDENT (GEORGE W. YOUNG, F.G.S.) AND
W. D. LANG, M.A., F.G.S., *Directors of the Excursion.*

The Headquarters were at the Bow House, Lyme Regis.
Mr. A. H. Williams acted as the Excursion Secretary.

May 30th.—REPORT BY MR. LANG.

A PARTY of twenty assembled on the jetty at the bottom of Broad Street, and, embarking in boats, proceeded to examine from the sea the general geological features of the cliffs east of Lyme. Unfortunately a rainy mist hid the tops of the cliffs, but the lower parts were quite visible, and the whole succession from the *angulatus*-zone to the top of the Belemnite Marls was visible as each bed in turn, owing to the generally easterly dip, descended to the beach.

Church Cliffs were first passed, consisting of limestones with partings of shale, in the *angulatus*- and *bucklandi*-zones, bent into an anticline. Beneath Lyme Church a wall has been built against the cliff in the hope that thus the continual falling of the cliff (aggravated by the destruction and removal in the past of

ledges of limestone on the foreshore for burning for lime) may be arrested, and the church saved. A few groynes also have been built, presumably to collect shingle and so to form a substitute for the protecting ledges that have been removed. Some 15 ft. above the *bucklandi*-limestones Table-ledge was visible as a whitish stripe on the cliff. The fallen remains of the burning cliff were pointed out—a brick-red patch just above beach-level composed of burnt shales.

The Church Cliffs anticline was seen to give way to a slight synclinal at Cock-pits, and, this passed, the whole thickness of the Black Marls came into view in a gentle anticline on Black Ven. The marls occupy the lowest two clay precipices on Black Ven, the lower of which is capped by the *Birchi*-Bed and the next by the *Stellaris*-Beds. The highest clay precipice, formed of Belemnite Marls, was just to be distinguished through the mist.

Passing Charmouth Beach, the party next studied the succession on Stonebarrow Cliff. The general dip was seen to be westerly at first, but undulating near the contorted strata (not visible from a boat, but examined later) of the Char Valley disturbance. Soon, however, the dip was seen again to become easterly at the Stonebarrow anticline. Here the base of the cliff is in the *Brooki*-Shales; the Lower Cement Bed was seen towards the base of the lowest precipice, and above it the Upper Cement Bed, the *Obtus*-Shales, and, finally, capping the precipice, the *Stellaris*-Beds with the conspicuous, ochreous-weathering Limestone-with-Brachiopods at their base. Above the slopes over the *Stellaris*-Beds the Belemnite Marls were seen to form a second precipice. Higher and higher beds appeared coming down to the beach as the party proceeded eastwards, until, at about $1\frac{1}{4}$ miles east of Charmouth beach, the *Armatus*-Limestone at the foot of the Belemnite Marls, generally talus-covered farther west, appeared as a long ledge at the cliff-base.

The whole succession of the Belemnite Marls could now be seen in detail, and their divisions (described by the Director, *Geol. Mag.*, 1913, dec. v, vol. x, pp. 408-412) were pointed out. The Belemnite Stone, capping the Marls, could be distinguished; and, in places, the lower divisions of the Green Ammonite Beds topped the precipice. As Westhay Water was approached the easterly dip brought higher and higher horizons down to the beach, until at the waterfall itself only the top few feet of the Lower Belemnite Marls were visible. Farther east (at Ridge Water) the dip could be seen to be reversed until the Ridge fault temporarily ended the cliff and no more detail was visible from this point.

The party now landed and examined at close-quarters, in the gully of Westhay Water, the subdivisions of the Belemnite Marls and of the Green Ammonite Beds as high as the Red





Band, and collected from the different horizons. Body-chambers of ammonites of the *latecosta* group and fragments of *Crenatula ventricosa*, J. de C. Sowerby, were found on the slopes of the Green Ammonite Beds; and in the bed of the stream an involute form of the "*striatus*"* group of ammonites, evidently fallen from the Red Band. The Belemnite Stone yielded *Amberleya* sp.; and the Pyritic Marl immediately beneath it several forms, including one specimen of *Acanthopleuroceras ellipticum* (James Sowerby). Lower horizons of the Belemnite Marls were disappointing for yielding little in place, but associated *Ichthyosaurus* vertebræ and crushed specimens of the brachiopod *Cincta* sp. were found fallen from the Marls, and, farther west, fallen blocks of the Marls yielded *Inoceramus falgeri*, E. v. d. Linth, and crushed ammonite remains, including two specimens of *Acanthopleuroceras valdani* (d'Orbigny).

The party then turned westward as far as where the *Armatus*-Limestone descends to the beach. The long ledge formed on the beach by this rock, and often well exposed, was, unfortunately, almost entirely covered with shingle. The *Armatus*-Limestone yielded a small *pettos*-like *Deroceras*. Blocks of the Lowest Tier, from above the Green Ammonite Beds, lay about near here, and one, on being split open, was found to contain *Amaltheus*.

From this point the return to Charmouth was made in boats, and at Charmouth the boats were dismissed.

As soon as the tide was low enough the Char Valley disturbance at Mouth Rocks was examined, shown in the repetition here of the *Birchi*-Bed in three anticlines and one highly-dipping reef, and in the vertical tilting of the shales above and below it.

The beds were then followed along the coast back to Lyme, and the nature and distribution of "beef" (fibrous calcium carbonate) in the Shales-with-Beef observed. The strings of "beef" vary in thickness from about $\frac{1}{16}$ inch up to a few inches. The thickest seams show very marked cone-in-cone structure. The thinner the seam the less obvious the cone-in-cone structure. The thicker the seam the longer it persists. A seam is nearly always split longitudinally into two layers; those that are not so split are, as a rule, less than $\frac{1}{4}$ inch thick. Generally the upper layer is much thicker than the lower. When non-fibrous calcium carbonate appears, it generally occurs as a lenticle or nodule lying between the two layers of a seam of "beef." Occasionally, however, a nodule occurs not so

* Mr. L. F. Spath, who has kindly examined for me this and other Charmouth Ammonites, thinks it probable that the *striatus*-like forms from the Red Band are involute *Androgynoceras* related to the earlier *A. latecosta* (as Buckman has suggested for *A. bechei* and *A. henleyi*, Yorks Type. Ammonites, 1911, Vol. I, p. iii) and not to *Liparoceras* (to which genus *A. striatus* belongs), which occurs lower, and probably includes the few *striatus*-like Ammonites that have been found in the upper part of the Belemnite Marls and in the Belemnite Stone. *Striatulus*-like forms apparently are absent between the Belemnite Stone and the Red Band.

surrounded. Impersistent tabular limestones or indurated marls also occur without layers of "beef" above or below them.

An interesting bed in the Shales-with-Beef at the cliff-foot, about 360 yards west of the end of Lower Sea Lane, corresponding in horizon to reef 17* on the foreshore, and crowded with *Arnioceras*, was opened up and collected from. A fallen block, probably of *Planicosta*-Limestone, caused a good deal of interest, containing, besides ammonites, many minute gastropods and fish-scales. In a fallen block, probably of the impersistent limestone lying immediately upon the *Birchi*-Bed, an ammonite of the *turneri-brooki* group was found.

In the evening, Mrs. Lister, of High Cliff, kindly entertained the Association at her house, where Miss G. Lister, assisted by Mr. Harding and Mr. Cameron, of Lyme, and by Dr. Wyatt Wingrave, had got together a collection of local fossils, arranged, as far as possible, in their exact stratigraphical order; and Mr. L. F. Spath discoursed on the ammonites exhibited.

May 31st.—REPORT BY THE PRESIDENT.

In the afternoon the President led a small party to see the fault at Pinhay Bay, going by the Warren and returning by the shore. This part of the coast was visited on the excursion of Easter, 1906, and a full account will be found in the Report (*Proc. Geol. Assoc.*, vol. xix, pp. 334-338). On a smooth reef on the foreshore near Devonshire Point, a stem of a *Calamite*-like plant was noticed, 26½ ft. in length and only 2 in. in diameter. The destruction of the West Cliff by quarrying is still going on, and apparently more rapidly than that wrought by the sea.

June 1st.—REPORT BY MR. LANG.

The object of Monday's excursion was the detailed examination of the Green Ammonite Beds on a part of Stonebarrow Cliff, and of the Gault at the western end of Fairy Dell. But, first, from the top of Stonebarrow Lane, whence an excellent view is obtained of the Vale of Marshwood, the Director pointed out the topography, and mentioned the views of Jukes-Brown (1897, *Proc. Dorset Nat. Hist. Club*, vol. xviii, pp. 174-184) on the shape of the base-line of the Cretaceous beds that formerly covered the vale, and on the manner of denudation that left the vale in its peculiar form, that of a wide, basin-shaped clay hollow surrounded by sand-topped hills, and opening to the sea by a narrow gap at Charmouth. Mr. Whitaker gave an interesting discourse on the drift of the surrounding hill-tops, and reviewed the present opinions held as to the amount (if any) of gravels of Eocene age present among the Clay-with-flints of the drift.

* *Proc. Geol. Assoc.*, 1914, vol. xxv, Part 5, p. 314, Part VI, map 2.

A move was then made to the edge of the cliff above a big fall that took place between June, 1908, and June, 1909, and exposed a fine section of the Foxmould passing into the "Gault," and this, in turn, resting on the Three Tiers. These beds and the sub-divisions of the "Gault" were pointed out. The base of the section was then reached by a less precipitous way, and the Lowest Tier examined in place. Some deviators from the programme, examining the "Gault" in this section, found *Lima* (*Mantellum*) *gaultina*, Woods, probably from Bed 3. Meanwhile *Amaltheus* and *Tragophylloceras loscombi* (James Sowerby) were found in the Lowest Tier, of which scattered blocks lay around as well as a large mass in place. The foot of sand below the Lowest Tier also was examined, and the clay immediately below this yielded *Amaltheus* (never before recorded from below the Three Tiers) and *Straparollus*. A small pyritised specimen of *Tragophylloceras loscombi* (James Sowerby), and *Oistoceras* sp., was found on slopes of the Upper Clays. The Upper Limestone was next examined (yielding *Oistoceras omisum*, Simpson sp.*), also the Upper Red-band Clay, the Red-band and the Lower Red-band Clay. An ammonite of the "*striatus*" group, and *Tragophylloceras loscombi* (James Sowerby) was found in the Red Band. The Lower Limestone was covered with some recently-fallen material and could not be seen.

After lunch the descent into Fairy Dell was made, and sections *h*† and *i*† of the Gault examined. Since last year a fall has opened up the section between sections *h* and *i*, revealing the full thickness of the sandy Bed 2 of the Gault. In section *h*, Bed 3 was opened up and several common species extracted. *Pecten* (*Syncyclonema*) *orbicularis*, James Sowerby, *Lima* (*Mantellum*) *gaultina*, H. Woods; *Inoceramus concentricus*, Parkinson, *Pinna robinaldina*, d'Orbigny, *Grammatodon carinatum* (James Sowerby), *Turritella vibrayeana*, d'Orbigny, etc., but not very plentifully; when the President, who was examining blocks fallen from the new exposure in Bed 2 between sections *h* and *i*, came upon a piece rich in fossils, and for the rest of the time the party broke up these fragments and collected specimens. Bed 2 (being very sandy) hitherto has yielded but one fossil—a specimen of *Cucullæa glabra*, Parkinson, found by the Director in 1909 in section *m*. Here were casts in sand of numerous species of lamellibranchs, *Panopæa mandibula* (James Sowerby), *P. gurgitis*, (Brongniart), *Tellina* (*Palaemæra*) *inæqualis*, J. de C. Sowerby, *Leptosolen dupineanus* (d'Orbigny), *Inoceramus concentricus*, Parkinson, etc., as well as several specimens of the zonal fossil *Hoplites interruptus* (Bruguière). On the last occasion of the Association's excursion to Lyme (Easter, 1906), *Hoplites inter-*

* It is of interest that this species, hitherto known from Yorkshire, has now been found in place in Dorset. It was found and identified by Mr. L. F. Spath.

† These and similar letters refer to the sections so named and marked on the maps, *Proc. Geol. Assoc.*, 1914, vol. xxv, parts v and vi, map 3.

ruptus was found for the first time in this district (in Bed 3 of the "Gault" of Black Ven; (see *Proc. Geol. Assoc.*, 1906, vol. xix, p. 323). Since then it has been found once (in 1909, in Bed 1 in Section *m*) by the Director. So its occurrence in some abundance on this occasion gave great satisfaction.

A few members returned to Charmouth down the gully mentioned in the programme, but the majority of the party (numbering on this day twenty-four) returned by the way they came.

June 2nd.—REPORT BY THE PRESIDENT.

The party proceeded in brakes to Dowlands Farm, near Rousdon, and then walked across the fields to the edge of the inland cliffs overlooking the Great Landslip of 1839. At this spot chalk of the *Terebratulina gracilis*-zone is well displayed, and the name fossil was found in abundance. They then walked westward along the top of the cliff, descending into the landslip at its western end, and returning through the chasm to Landslip Cottage, near which lunch was taken. Charton Bay was next visited. A halt was made at the "Engineer's Cottage," shown on the 6-in. map close to the pumping house of Rousdon estate. In 1911 a small landslip occurred which completely demolished this cottage, and its ruins afforded an impressive proof of the destruction which is continually going on along this strip of coast. The Blue Lias Limestone Beds were seen, and numerous fossils obtained in a road which descends from here to Humble Point, a little west of which the Grey Marls (passage beds between Keuper and Rhætic) were examined. Rapidly traversing the broken ground past the Landslip Pool we reached the "Great Cleft" * which appeared noticeably wider and deeper than at our previous visit. Finally we made a somewhat hurried inspection of the Chapel Rock in the grounds of Pinhay, and Lyme Regis was reached by the footpath through the Warren. Thanks are due to Sir Wilfrid Peek and Mr. W. Allhusen, both of whom had granted the members full permission to traverse their estates.

June 3rd.—REPORT BY MR. LANG.

Wednesday began with so much rain that many members were deterred from the excursion arranged for the morning. A small party (twelve in number) assembled on the summit of Stonebarrow Hill, whence the Director pointed out the position of the "Gault" sections at the eastern end of Fairy Dell, which it was intended to visit. These sections had never yet been described, though examined and mapped by the Director as long ago as 1909. In that year section *m* yielded a

* Rowe, A. W., "Zones of the White Chalk of the English Coast. III. Devon *Proc. Geol. Soc.*, vol. xviii, p. 1, *et seq.*

single fossil from the base of Bed 2, and three specimens—*Hoplites interruptus* (Bruguière), *Natica gentii* (James Sowerby), and *Grammatodon carinatum* (James Sowerby), from the top of Bed 1.

The Dell was then entered, and section *m* reached. An opening was made in Beds 3 and 2, and fossils (including *Pecten* (*Syncyclonema*) *orbicularis*, James Sowerby, and *Lima* (*Mantellum*) *gaultina*, Woods, from Bed 3, and *Inoceramus concentricus*, Parkinson, from Bed 2) extracted. The Pebble Bed at the base of the Gault, here about a foot thick, and consisting of small pebbles in a sandy and clayey matrix, was easily found by digging just below the wettest patches.

The Lias slopes below, showing the two highest Tiers, were also examined, but, except for some minute fossils from a hard band about 1 ft. below the Middle Tier, proved very barren.

As there was still some time available, the President invited discussion on the origin of the Lias limestones of the district, since the members had had plenty of opportunity of examining these from the base up to the Three Tiers. The Director advocated a segregationary origin for them all. So long ago as 1865 Day (*Geol. Mag.*, Dec. I, vol ii, p. 519) had maintained this, but later writers either stated or implied their belief in a segregationary origin for those that obviously were nodular, and a sedimentary origin for the tabular ones. But there was no line to be drawn between the one form and the other, or, if any line could be drawn, there were several lines between several forms of limestone, some more or less concretionary, some more or less tabular; and it was more rational to account for their formation by modifications of one process, if it were capable of producing them, than to call in two processes, one to explain each extreme form, and which you will to explain the intermediate forms. Surely it was more likely that, if segregation accounted for certain of the nodular limestones, the tabular limestones could similarly have been segregated along the bedding planes. And the deposit in that case would have been a more or less homogeneous marl (instead of an alternating calcareous and argillaceous deposit), derived by the denudation of pre-existing (Carboniferous and Devonian) limestones and shales of the neighbouring lands, probably the country round Dartmoor and the Mendip Hills. The Belemnite Marls most nearly resemble the original deposit, and their pale, more or less indurated bands show a small degree of segregation. An indurated marl like Table Ledge is a gradation between these and a tabular limestone. The impersistent tabular limestone above the *Birchi*-Bed shows a gradation between a normal tabular limestone and a nodular limestone like the *Birchi*-Bed, which itself is not so typically segregationary as the *Stellaris*-Nodules.

Further, in some cases, it seems as if the lamination of paper-

shales might be caused by the segregation of minute selenite crystals along bedding planes.

Mr. Whitaker remarked that the conclusions inevitably arrived at depended upon which side the subject was approached from. Starting from an undoubtedly segregated limestone, the gradation was so gradual that all the limestones were claimed as segregations, until the impossible situation was reached when the advocate for the segregationary origin was face to face with a limestone such as occurred in the Welsh Lias in which there were no clay partings. On the other hand, one holding that the limestones were deposited as such would have to admit that sooner or later he was dealing with a septarian structure, so gradually does the one type pass into the other. For his part, he found it difficult to believe that a continuous limestone, spreading over many miles, could originate as a segregation.

After this the party walked back to Lyme in time to catch the afternoon train to London.*

REPORT OF A MOTOR EXCURSION IN SURREY.

SATURDAY, JUNE 6TH, 1914.

BY THE PRESIDENT (G. W. YOUNG, F.G.S.) AND DOUGLAS LEIGHTON, F.G.S., *Directors of the Excursion.*

THIS excursion was planned to afford members an opportunity of seeing in a single day a large tract of country with which they were fairly familiar, but which had been previously visited on different occasions at widely separated intervals.

The party, 36 in number, started at 10 a.m. from Trafalgar Square, and crossing the river at Putney, reached the first open ground at Wimbledon Common where the extensive high-level gravel flat was noted. The road soon dips down into the valley of the Beverly Brook, which has cut down into the London Clay and separates the Wimbledon Common gravel from that of Kingston Hill and Richmond Park, which once formed one sheet. Descending Kingston Hill, level ground over the low-level gravel and alluvium of the Thames was traversed through Kingston, Surbiton and Ditton, to the foot of Esher Hill, just before reaching which the large pits in London Clay near Claygate could be seen in the distance.

Leaving the Portsmouth Road at Esher the margin of the Bagshot Sands was skirted to Oxshott, a halt being made to examine the large sand pit on Oxshott Heath. Proceeding to Leatherhead over London Clay we then turned sharply to the

* For references see *Proc. Geol. Assoc.*, vol. xxv, pp. 354-359.