Dall." The author describes the specific characters in detail, but fails to point out those which should mark the proposed genus from its nearest allies.

A new species of *Rhynchonella* is founded on specimens showing casts of the interior, and a new species of *Gypidia* is described. Several new species of *Platyceras*, a new genus of corals, *Bucanophyllum*, and new species of *Strombodes* and *Labechia* are introduced and figured. Finally a new genus of Foraminifera named *Moellerina* is based on some minute orbicular bodies with spiral ridges on the outer surface. It seems to have escaped the notice of the author that these bodies have been already described and figured by Professor Dawson, as *Saccammina* (*Calcisphæra*) *Eriana*, and that they were previously mentioned by Prof. Meek as probably the fruits of *Chara*.

REPORTS AND PROCEEDINGS.

Geological Society of London.

I.—June 23, 1886.—Prof. J. W. Judd, F.R.S., President, in the Chair.—The following communications were read:

1. "On some Perched Blocks and associated Phenomena." By Prof. T. McKenny Hughes, M.A., F.G.S.

The author described certain groups of boulders which occurred on pedestals of limestone rising from 3 to 18 inches above the level of the surrounding rock. The surfaces of these pedestals were striated in the direction of the main ice-flow of the district, while the surrounding lower rock in no case bore traces of glaciation, but showed what is known as a weathered surface.

He inferred that the pedestals were portions of the rock protected by the overhanging boulder from the down-pouring rain, which had removed the surrounding exposed parts of the surface. When the pedestals attained a certain height relatively to the surrounding rock, the rain would beat in under the boulder, and thus there was a natural limit to their possible height.

He referred to the action of vegetation in assisting the decomposition of the limestone, and considered that there were so many causes of different rates of waste and so many sources of error, that he distrusted any numerical estimate of the time during which the surrounding limestone had been exposed to denudation.

Considering the mode of transport of the boulders, he thought that they could not have been carried by marine currents and coast-ice, as they had all travelled, in the direction of the furrows on the rock below them, from the parent rock on the north. Moreover, marine currents would have destroyed the glaciation of the rock and filled the hollows with débris.

Furthermore, the boulders and striæ are found in the same district at such very different levels and in such positions as to preclude the possibility of their being due to icebergs.

Nor could the boulders represent the remainder of a mass of drift which had been removed by denudation, for the following reasons:—

1. They were all composed of one rock, and that invariably a rock to be found in place close by.

2. Any denudation which could have removed the clay and smaller stones of the drift would have obliterated the traces of glaciation on the surface of the rock.

3. The boulder which had protected the fine glacial markings below it from the action of the rains would certainly in some cases have preserved a portion of the stiff Boulder-clay.

4. The margin of the Boulder-clay along the flanks of Ingleborough was generally marked by lines of swallow-holes, into which the water ran off the Boulder-clay; and when the impervious beds overlying the limestone had been cut back by denudation, a number of lines of swallow-holes marked the successive stages in the process; but there was not such evidence of the former extension of the drift up to the Norber boulders.

5. The boulders themselves were not rounded and glaciated in the same way as the masses of the same rock in the drift, but resembled the pieces now seen broken out by weathering along the outcrop of the rock close by.

Having thus shown the improbability of these boulders having been let down out of a mass of drift the finer part of which had been removed by denudation, or of their having been masses floated to their present position on shore-ice, he offered an explanation of their peculiar position, which he thought was not inconsistent with the view that they belong to some part of the age of land-ice.

That they were to be referred to some exceptional local circumstances seemed clear from the rarity of such glaciated pedestals, while boulders and other traces of glaciation were universal over that part of the country. He therefore pointed out in explanation, that they occurred always where there was a great obstacle in the path of the ice:—at Cunswick the mass of Kendal Fell curving round at the south and across the path of the ice; at Farleton the great limestone escarpment rising abruptly from Crooklands; at Norber the constriction of the Crummack valley near Wharfe and the great mass of Austwich grit running obliquely across its mouth. In all these cases the ice had to force its way up hill; and there would be a time when it would just surmount the obstacle after a season of greater snowfall, and fall back after warm seasons, until it fell back altogether from that part. During the season of recession, boulders would be detached below the ice-foot; during the seasons of advance they would be pushed forward; and in those exceptional localities of isolated hills from which the drainage from higher ground was cut off, the boulders were left on a clean furrowed surface of limestone, which was then acted upon by rain-water and the vegetation, except where protected by the boulders.

2. "On some Derived Fragments in the Longmynd and Newer Archæan Rocks of Shropshire." By Dr. Charles Callaway, F.G.S.

Further evidence was added to that given in the author's previous paper (Q.J.G.S. 1879, p. 661), to show that the Longmynd rocks of Shropshire were chiefly composed of materials derived from the

Uriconian series, and that the Uriconian series itself (Newer Archæan) was partly formed from the waste of pre-existing rocks. This evidence consisted of (1) the presence, throughout the greatly developed Longmynd conglomerates and grits, of purple rhyolite fragments, recognized by microscopical characters as identical with the Uriconian rhyolites of the Wrekin, and the occurrence of grains, probably derived from the same rhyolites, in the typical green slates of the Longmynd; and (2) the existence of conglomerate beds containing rounded fragments of granitoid rock in the core of the Wrekin itself, whilst the Uriconian beds of other localities, and especially those of Charlton Hill, contained waterworn pebbles, chiefly metamorphic. These pebbles appeared to have been derived from metamorphic rocks of three distinct types. The views put forward were founded on microscopical evidence, of which some details were given in the paper, and were supported by the views of Professor Bonney, who had furnished notes on the microscopical characters of the rocks.

3. "Notes on the Relations of the Lincolnshire Carstone." By A. Strahan, Esq., M.A., F.G.S.

The Lincolnshire Carstone has hitherto been supposed to be correlative with the upper part of the Speeton series, and to be quite unconformably overlain by the Red Chalk (Quart. Journ. Geol. Soc. vol. xxvi. p. 326–347). But the overlap of the Carstone by the Red Chalk, which seemed to favour this view, is due to the northerly attenuation, which is shared by nearly all the Secondary rocks of Lincolnshire. Moreover, the Carstone rests on different members of the Tealby group, and presents a strong contrast to them in lithological character, and in being, except for the derived fauna, entirely unfossiliferous. It is composed of such materials as would result from the "washing" of the Tealby beds.

In general it is a reddish-brown grit, made up of small quartz-grains, flakes and spherical grains of iron-oxide, with rolled phosphatic nodules. Towards the south, where it is thick, the nodules are small and sporadic. Northwards, as the Carstone loses in thickness, they increase in size and abundance, so as to form a "coprolite-bed," and have yielded specimens of *Ammonites speetonensis*, *A. plicomphalus*, *Lucina*, etc. When the Carstone finally thins out, the conglomerate character invades the Red Chalk, similar nodules being then found in this rock.

The presence of these nodules, with Neocomian species, taken in connexion with the character of the materials of the Carstone, points to considerable erosion of the Tealby beds. On the other hand, there is a passage from the Carstone up into the Red Chalk. It would seem, then, that the Carstone should be regarded as a "basement-bed" of the Upper Cretaceous rocks.

The Lincolnshire Carstone is probably equivalent to the whole of the Hunstanton Neocomian, the impersistent clay of the latter being a very improbable representative of the Tealby Clay. It therefore follows that the whole Speeton series is absent in Norfolk, and also in Bedfordshire. The unconformity at the base of the Carstone

becomes greater southwards, and the nodules have been derived from older rocks. Similarly north of Lincolnshire, where the Speeton series is overlapped, the nodules in the Red Chalk, marking the horizon of the Carstone, have been derived from Oolitic rocks.

In the South of England it would seem that equivalents of the Speeton series reappear. The Atherfield clay contains an indigenous Upper Speeton fauna, while a pebble-bed near the base of the Folkestone beds is described by Mr. Meÿer as containing derived Oolitic pebbles, and being probably the representative of the Upware deposit, and presumably, therefore, also of the Lincolnshire Carstone.

4. "The Geology of Cape-Breton Island, Nova Scotia." By Edwin Gilpin, Esq., Jun., A.M., F.R.S.C., Inspector H.M.'s Mines.

After referring to previously published descriptions of Cape Breton geology, the author stated that the various formations found in the island had been thus classified by the officers of the Geological Survey :—

Pre-Cambrian (Laurentian) including		The Felsite series. The Crystalline Limestone series.
Lower Silurian, Devonian. Carboniferous, including		Lower Coal-formation. Gypsiferous series. Limestones, etc. Millstone-Grit. Middle Coal-formation.

He then proceeded to give an account of each system and its subdivisions in order, commencing with the most ancient and adding a few detailed sections of the rocks belonging to some of the principal series. He described the distribution and relations of the several divisions.

The paper concluded with a few notes on the superficial geology of the island. There is a general absence of moraines and of the fossiliferous Post-Pliocene marine clays of the Lower St. Lawrence. The older beds are generally exposed, but deeper soils and deposits with erratic boulders are found overlying the Carboniferous beds. Marks of recent ice-action are found on the shores of some of the lakes, and are due to the ice being driven by the wind.

5. "On the Decapod Crustaceans of the Oxford Clay." By James Carter, Esq., F.G.S., etc.

The author commented on the paucity of these fossils as indicated in British lists, only three or four species having hitherto been recorded.

The discovery of considerable numbers of Decapod Crustaceans in the Oxford Clay of St. Ives has enabled the author to increase the list materially. Many have been collected by Mr. George, of Northampton. These fossils occur in the clay immediately beneath the St. Ives rock, and therefore presumably in the uppermost zone of the Oxford Clay. Many of the specimens are more or less mutilated, but some fifteen or sixteen distinct species have been made out. None of these have been recorded as British except *Eryma Babeaui*, mentioned by Mr. Etheridge as having been found in

the Kimmeridge Clay. Seven species are identified as foreign forms, and seven are new to science. They are distributed as follows:—

Eryon	1	species.
Eryma	5 or 6	,,
Glyphea	2	,,
Magila	2 or 3	,,
Mecochirus	2	,,
Goniochorus	1	,,
Undetermined	3	,,

Nearly all the forms belong to the type of the Macrura, the Brachyura being doubtfully, if at all, represented.

6. "Some Well-sections in Middlesex." By W. Whitaker, Esq., B.A. Lond., F.G.S.

Accounts of many well-sections and borings having been received since the publication of vol. iv. of the Geol. Survey Memoirs, the author now gave more or less detailed descriptions of fifty-six of these, all in the Metropolitan county, and all either unfinished or, in a few cases, with further information as to published sections. The depths range from 59 to 700 feet, more than half being 300 feet or more deep. Nearly all pass through the Tertiary beds into the Chalk, and most have been carried some way into the latter. Papers descriptive of like sections in Essex, Herts, and Surrey have been sent to Societies in these counties.

7. "On some Cupriferous Shales in the Province of Houpeh, China." By H. M. Becher, Esq., F.G.S.

This communication contained some geological observations made during a visit to a locality on the Yangtse river, near I-chang, about 1000 miles from the sea, for the purpose of examining a spot whence copper-ore (impure oxide with some carbonate and sulphide) had been procured.

The principal formations in the neighbourhood of I-chang were said to be Palæozoic (probably Carboniferous) limestones of great thickness, overlain by brecciated calcareous conglomerate and reddish sandstones, which form low hills in the immediate vicinity of the city. About fifty miles further west the limestones pass under a great shale-series with beds of coal, the relations of which to the sandstones are not clearly ascertained.

The copper-ore examined by the writer came from the shales, which contained films and specks of malachite and chrysocolla, and in places a siliceous band containing cuprite, besides the oxydized minerals, was interstratified in the beds. Occasionally larger masses of pure copper-ore are found imbedded in the strata. The ground had not been sufficiently explored for the value of the deposits to be ascertained.

8. "The Cascade Anthracitic Coal-fields of the Rocky Mountains, Canada." By W. Hamilton Merritt, Esq., F.G.S.

The coal-field named occurs in the most eastern valley of the Rocky Mountains, that of the Bow river, and, like other coal-fields of the country, consists of Cretaceous rocks, which lie in a synclinal trough at an elevation of about 4300 feet above the sea. The underlying beds, of Lower Carboniferous or, possibly, Devonian age, rise into ranges 3000 feet higher.

Further to the eastward the Jurassic and Cretaceous coal contains a large percentage of hygroscopic water and volatile combustible matter, and has the mineral composition of lignite. The average composition is :—

Fixed carbon	42 per cent.
Volatile combustible matter...	34 ,,
Hygroscopic water...	16 ,,
Ash...	8 ,,
	—100

As the mountains are approached, the amount of hygroscopic water is found to diminish by about one per cent. for every ten miles, and fifteen miles from the range the percentage is about five. In the foot-hills the lignites pass into a true coal, with 1·63 to 6·12 per cent. of hygroscopic water, and 50 to 63 per cent. of fixed carbon. In the Cascade-river Coal-field the average character of the coal is that of a semianthracite, with the following composition :—

Fixed carbon	80·93 per cent.
Volatile combustible matter	10·79 ,,
Hygroscopic water	·71 ,,
Ash	7·57 ,,
	100·00

The coal-seams have been subjected to great pressure, and the change in the quality of the coal appears to be due to metamorphic influence.

9. "On a new Emydine Chelonian from the Pliocene of India." By R. Lydekker, Esq., B.A., F.G.S.

The author described the shell of an Emydine Tortoise from the Siwaliks of Perim Island, Gulf of Cambay, which he regarded as decidedly distinct from any of the previously-described Siwalik species, and proposed to refer to the genus *Clemmys*, with the name of *C. Watsoni*, in compliment to the donor of the specimen.

10. "On certain Eocene Formations of Western Servia." By Dr. A. B. Griffiths, F.R.S.E., F.C.S. Communicated by the President.

A great thickness of paper-shales containing paraffin occurs near the river Golabara; these extend over 30 square miles of country. Small beds of clay with rock-salt are also found: the whole is said to resemble the paraffin and salt districts of Galicia. The paraffin shale is free from bituminous impurities. It contains :—

Paraffin wax	1·75 per cent.
Water of combination	3·02 ,,
Ammonia	1·18 ,,

The mineral constituents of the shale are :—

Alumina	32·86 per cent.
Iron oxide	5·20 ,,
Magnesia...	1·26 ,,
Lime...	1·21 ,,
Potash	2·17 ,,
Soda...	0·41 ,,
Silica	56·85 ,,
Loss...	0·04 ,,
	100·00

The brown coal of the neighbourhood, whose natural distillation has most probably yielded the hydrocarbon in the shales, contains :—

Carbon	49·2 per cent.
Hydrogen	1·1 ,,
Water, combined	30·2 ,,
Water, hygroscopic	19·5 ,,
	100·00

The beds containing these coals have been invaded by eruptive porphyry and trachytic rocks, of which the former contains 75½ and the latter 61 per cent. of silica.

The clays from which the shales were originally formed contain abundance of marine Diatomaceæ and Foraminifera (chiefly Nummulites), as also species of *Ostrea*, *Cyrena*, *Cerithium*, *Voluta*, and *Nautilus*, together with the remains of Placoid and Teleostean fishes.

CORRESPONDENCE.

WATER-BEARING NODULES IN THE LOWER GREENSANDS.

Sir,—The brilliant and varied colouring of the Lower Greensands at the Great Northern Railway at Sandy Junction, and at Flitwick Station on the Midland line, must be familar to every one who has travelled those districts. At Sandy, the cutting is a deep one and nearly all in clean sand, varying through shades of green, grey and yellow, the yellow predominating, to almost pure white. At Flitwick, the colouring is still more varied; beautifully tinted bands of a fleshy pink or salmon tint, merging into violet, appear near the bottom of the pit from which Mr. Franklin, of Bedford, obtains his sand. The parti-coloured bands are more numerous at this place than I recollect seeing elsewhere in Bedfordshire, although the white and yellow sand at Heath and Reach, makes very picturesque openings amongst the woods and ferns. The sands at Flitwick remind one of the assemblage of colours met with in the sands,[1] from which the well-known sand pictures are made in the Isle of Wight.

But besides the varied colouring, ironstone nodules, associated with hard lumps of ferruginous rock, like the carstone quarried at Snettisham in Norfolk, are very general in the Greensand. Being of all shapes and sizes and in every stage of growth, they are curious to look upon, and still more interesting to crack for the fossils and sparry crystals that are sometimes found inside them. An abundance of these concretions occurs both at Sandy and Flitwick, some spherical, others tabular, and many other forms.

With Rhodes, the fossil collector, I have lately obtained a number of these nodules from Flitwick,[2] some of which, for description sake, and from the fact of their having water in them, I have designated water-bearing nodules. These are readily distinguished from others inclosing phosphatized fossils (principally the internal casts of some

[1] Bagshot Sands.

[2] From the peat at Flitwick I picked out, last year, a small flint implement.