has shown that the name *Charomeryx silistrensis* should be applied to the specimen from the Gáro Hills figured by Falconer and Cautley, under the name of *Anthracotherium silistrense*, in the "Fauna Antiqua Sivalensis" (pl. lxviii. figs. 22, 22a). At the time of writing that notice no trace of the specimen, which consists of a fragment of the right maxilla,¹ could be found; and judging from the figure, and a cast (which now appears very inexact), he was under the impression that it contained three teeth which were considered as the true molars. The original specimen has recently been found in the British Museum (No. 19040); and it really contains only two teeth, which are respectively the third and fourth milk-molars. A comparison of the fourth milk-molar of this specimen with an upper true molar from Sind which is figured in the "Palæontologia Indica" (*op. cit.* pl. xxiii. fig. 11), under the name of *Sivameryx sindiensis*, shows that the two are certainly generically, and very probably specifically the same; the slight differences between the two being not improbably merely due to difference of serial position. The figure in the F. A. S. does not exhibit very clearly some of the characteristic features of the Gáro Hills specimen; and from this, coupled with the reference of the teeth of this specimen to the permanent instead of the milk-series, the two specimens were referred to distinct genera.

It follows from the above that the genus *Sivameryx* must be abolished. *Charomeryx* has been previously placed in the neighbourhood of *Merycopotamus*, but a recent comparison with specimens in the British Museum renders it probable that its affinities are rather with *Dichodon*.

The occurrence of *Charomeryx* and *Anthracotherium silistrense* in Sind and the Gáro Hills renders it probable that at least a part of the Siwaliks of the latter district correspond to the lower division of that series.

IV.—NOTE ON THE *POSIDONOMYA BECHERI* BEDS OF BUDLE (NORTHUMBERLAND), WITH REMARKS ON THE DISTRIBUTION OF THE SPECIES.

By G. A. LEBOUR, M.A., F.G.S.,

Professor of Geology in the Durham College of Science, Newcastle-upon-Tyne.

BUDLE BAY, on the coast of Northumberland, between Holy Island and Bamburgh, is the estuary of the little river Waren. The rocks of the country belong to the Bernician Series or, in other words, to the alternating grits, limestones, shales, and coals which in northernmost England represent the Carboniferous Limestone Series. The northern shore of the Bay is a broad expanse of sand stretching as far as Fenham Flats and Holy Island, but the southern is rocky though not lofty. The Great Whin Sill (the well-known intrusive sheet of Basalt²) is present here, and the late Mr. G. Tate of Alnwick has more than once described it as it occurs here, associated with the beds which form the subject of this note. In 1872

¹ The figure in the F. A. S. is reversed.

² Or *Diabase*, as Mr. Teall tells me I had better now call it.

he wrote: "At Budle the basalt is nearly connected with an indurated, jointed, red shale (containing *Posidonomya Becheri*, etc.), which overlies a limestone; for the basalt is in the hill a little above the schist, and on the sea-shore to the east; so that the jointed and indurated condition of the schist is probably due to the action of the Basalt."¹

As early as 1853, however, Mr. Tate had called attention to the occurrence of the fossil in question. In his Presidential Address to the Berwickshire Club on the 7th of September of that year, he alluded to the "Budle schists . . . filled with rare and beautiful remains of fossil plants and animals belonging to the Carboniferous era."² In a similar address delivered in 1864, by Mr. Wm. Stevenson of Dunse, the then President of the Club, is the following passage, which I believe was at least inspired by Mr. Tate: "Proceeding onwards to Budle Bay, the well-known Posidonia shales were examined with much interest. These shales of a reddish brown colour, abounding in the shells of the fragile Posidonia, associated with the remains of a few land plants, have evidently been deposited in the still brackish waters of an ancient lagoon or estuary, little disturbed by tidal action."³

The above quotations, which, considering the scarcity of the back volumes of the Berwickshire Transactions, I make no excuse for giving in full, comprise about all that can be said in the way of description as to the Budle Shales. They are red, rather hard, and much jointed; they contain numerous plant remains in the form of drifted narrow ribbon-shaped leaves, showing little or no structure, and not easy to determine; but the most interesting fossil is undoubtedly the *Posidonomya*, which gives its name to the beds in which it occurs. The specimens are abundant; but, owing to the way in which the shale breaks up, it is somewhat difficult to obtain good specimens. With this shell are species of *Lingula*, *Spirifer*, *Chonetes*, *Orthis* and *Euomphalus*; *L. mytiloides*, *Sp. bisulcatus*, *O. Michelinii*, *Eu. pentangulatus* being the commonest. Other fossils occur; among them I have found a *Bellerophon*, a *Phillipsia* (tail only) and some *Polyzoa*, whilst one *Gonatites* (*G. atratus*, Goldf.) is recorded by Mr. Tate; but with the exception of a *Fenestella*, these are all rare. Corals and Crinoids are conspicuous by their absence, and after many searches, I have never seen but one specimen of the otherwise ubiquitous genus *Productus*, and that was *Pr. fimbriatus*, by no means a common Northumbrian form.

Mr. Tate placed the horizon of these shales rather low down in his "Calcareous Group" of the Carboniferous Limestone Series of Northumberland, between the two beds of limestone known locally as the *Stone Close* or *Five-Yard* and the *Hobberlaw* or *Four-Yard*

¹ See G. Tate on "The Basaltic Rocks of Northumberland," Berwickshire Naturalists' Transactions, 1872, p. 200.

² Berwickshire Transactions, vol. iii. 1857.

³ Berwickshire Transactions, vol. v. p. 104. See also Baker and Tate's "New Flora of Northumberland and Durham," 1868, p. 10; and Tate's "History of Alnwick," vol. ii. 1869, pp. 454, 455, and 457.

limestone. This is a point of much difficulty, owing to the faulted condition of the series in the Bamburgh and Budle district, and more especially to the presence of that disturbing element the Great Whin Sill, which there runs in and out among the sedimentary deposits in a very bewildering manner. In 1878, I hazarded the following statement on the subject:—"The interesting fossil *Posidonomya Becheri* occurs at Budle and in the neighbourhood of Alnwick, and appears to be confined to the Upper Bernician Series. Its exact horizon is doubtful."¹ I am not in a position to add anything to this statement; but the *exact horizon* is *certainly* within the limits of the Bernician, *probably* in its upper portion, and will be known as soon as the results of my friend Mr. W. Gunn's work on the Government Geological Survey of the district are published. At any rate the beds under discussion are some thousands of feet above the Tuedian.

The other localities in the North for *Posidonomya Becheri* are the Cawledge Burn near Alnwick, where it was found by Mr. Tate; a small quarry near Denwick (also in the neighbourhood of Alnwick) where Mr. Topley, I believe, first saw it, and where I have myself gathered it; and lastly at Lowick, where the late Rev. Mr. Jenkinson collected it. All these localities are in the Upper Bernician.

The range of *Posidonomya Becheri* is a subject of great interest. Wherever the Carboniferous Limestone series puts on a shaly facies, there it seems to be present. Many years ago I had the pleasure of seeing specimens of that and another species of the same genus from the shales of Lower Carboniferous age of Western Scotland in the collections of Messrs. James Thomson and Armstrong in Glasgow. Then come the Northumbrian Bernician shales, and next the Devonshire Culm shales with *Posidonomya* as described by Dr. Woodward and Mr. J. E. Lee, to the latter of whom I am indebted for beautiful specimens in a shale wonderfully similar in aspect to that of Budle. On the Continent wherever the *Bergkalk* gives place to the *Kulm*—in other words, wherever the Lower Carboniferous sea was shallow and had a muddy instead of a limy bottom, there *Posidonomya Becheri* invariably appears, as Dr. Ferd. Roemer and others have so well shown. I have lying before me a little collection of *Posidonomya* from Silesia, Nassau, and Portugal due chiefly to Dr. Roemer's kindness and including a beautiful specimen quite recently brought from the slaty beds in Southern Spain in which the great Rio Tinto mines are situated, and presented to this College by Mr. David Tyzack. All these specimens, altogether from some fifty places representing a vast extent of country, are absolutely indistinguishable except as to the degree of alteration which the shales containing them have undergone; and the occasional fossils of other kinds which are visible on the slabs are likewise very similar, the presence of long ribbon-like leaves of plants being remarkably general.

It is perhaps not possible to dogmatize yet as to the limits of the vertical range of *Posidonomya Becheri*. I have paid a good deal of

¹ Lebour's "Outlines of the Geology of Northumberland," (1878), p. 68.

attention to the subject, and cannot find any limits (taking all Europe into consideration) to its range within the Lower Carboniferous rocks. In England, however, it has never yet been recorded from beds of Tuedian age, nor, taking into account the nature of the Tuedian deposits, is it very likely that it may ever be found in them.

V.—ON THE OCCURRENCE OF A MINERAL ALLIED TO ENSTATITE IN THE ANCIENT LAVAS OF EYCOTT HILL, CUMBERLAND.

By Professor T. G. BONNEY, D.Sc. LL.D., F.R.S., Pres. G.S.

THIS interesting series of ancient volcanic rocks is described by the late Mr. Clifton Ward in a paper on the Microscopic Structure of Ancient and Modern Volcanic Rocks, read before the Geological Society,¹ in a Memoir of the Geological Survey on the Lake District, and, in greater detail, in a communication to the Royal Microscopical Society.² All these are illustrated by figures (in no case very good) and some chemical analyses are given in the last-named paper. I went to the hill in the autumn of 1874 and collected a few specimens, but my visit was cut short by heavy rain. A few weeks since Mr. J. Postlethwaite of Keswick, to whose kindness I have been more than once indebted for additions to my collection, forwarded to me three specimens from Eycott Hill, thinking that I might not have any rocks therefrom, and called my attention to the peculiar reddish tint of the felspar in one of them, which, as he remarked, "resembled the colour of a garnet." These were varieties of the well-known porphyritic lava of Eycott Hill, which is described by Mr. Ward as the second lava bed in ascending order, and as being above 100 feet thick. This specimen was obtained from a boulder on the hill. On examining it and comparing it with my own (at which I had not looked for some years), I was struck with the appearance of the ground-mass, which seemed to me unusually compact and more like that of an augite-andesite, than of a dolerite or diabase, as the rock is named by Mr. Ward. I had a slide prepared by Mr. Cuttall from Mr. Postlethwaite's specimen, in which I first discovered the mineral which is described in this note, and have since had some more cut from my own specimens from Eycott and others subsequently sent by him, and (for comparison) from the lavas of Falcon Crag near Derwentwater.

The Eycott rock is described by Mr. Ward as having "a compact greenish-blue base, containing dark green spots of a soft mineral and large porphyritically imbedded felspar crystals, many of them an inch long. . . . The top of this lava is beautifully vesicular in parts, the vesicles being drawn out along the line of flow and filled with chlorite, chalcedony, and calcite." The "dark green spots" I may add generally do not exceed .1 inch in diameter, and I should be disposed to call the base a dark "slate" colour, commonly with a greenish tinge (slightly purplish in Mr. Postlethwaite's specimen), rather than a "greenish-blue"; the felspar crystals are in the normal specimens a greyish olive-green.

¹ Q. J. G. S. vol. xxxi. p. 406.

² Monthly Microsc. Journal, 1877, p. 239.