arch transversely; and the valleys or hollows by which this ridge is now traversed, or trenched (M, the valley of Monnetier; A, the hollow called Petite Gorge; B, that called Grande Gorge; and C, the descent towards the Valley of Croisette), owe their origin to denudation, guided by curvilinear fissures, which affect and partly shape the summits of all the inner lateral limestone-ranges, as far as the Aiguille de Varens.

It is this guidance of the torrent-action by the fissures; the relation of the longitudinal fault to the great precipice; and the altered condition, not only of the beds on the cliff-side, but of the Molasse conglomerates on the eastern slope, to which I wish presently to direct attention: but I must give more drawings to explain the direction of these fissures than I have room for in this number of the Magazine; and also, before entering on the subject of the angular excavation of the valley at M, and curvilinear excavations at A and B, I want some answer to this question—one which has long embarrassed me:—The streams of the Alps are broadly divisible into three classes: 1st, those which fall over precipices in which they have cut no ravine whatever (as the Staubbach); 2nd, those which fall over precipices in which they have cut ravines a certain distance back (as the torrent descending from the Tournette to the Lake of Annecy); and, 3rd, those which have completed for themselves a sloping course through the entire mass of the beds they traverse (as the Eau Noire, and the stream of the Aletsch Glacier). The latter class—those which have completed their work—have often conquered the hardest rocks; the Eau Noire at Trient traverses as tough a gneiss as any in the Alps; while the Staubbach has not so much as cut back through the overhanging brow of its own cliff, though only of limestone! Are these three stages of work in anywise indicative of relative periods of time?—or do they mark different modes of the torrents' action on the rocks? I shall be very grateful for some definiteness of answer on this matter.

II. ON THE FOSSIL NECK-BONES OF A WHALE (*PALÆOCETUS SEDGWICKI*), FROM THE NEIGHBOURHOOD OF ELY.*

By HARRY SEELEY, F.G.S., Woodwardian Museum, Cambridge.

[Plate II.]

THOUGH the oldest English Whales yet named are found in the Crag, Prof. Sedgwick, a quarter of a century since, obtained from Ely some anchylosed cervical vertebræ evidently

* This paper was read before the Phil. Soc. Cambridge, May 2, 1864.

Cetacean. The fossil was found at Roswell Pit in the Boulder-clay, but the Professor writes, 'I have not the shadow of a doubt that it was washed out of the Kimmeridge (or the Oxford) Clay, for both clays are near at hand. In condition it is exactly like the bones from those clays; and is utterly unlike the true Gravel bones, whether in the dry Gravel, or the Till.'* This is unmistakeable, for the specimen is mineralised with phosphate of lime; and so could have been derived from no deposit newer than the Crag. It is partly coated with stalagmite; but that condition was probably acquired while the fossil was embedded in the Drift; and when the thin crust is stripped off, the bone is quite like other bones from the Kimmeridge Clay. The Boulder-clay itself is largely made of nodules of Chalk and Kimmeridge Clay, with, if we may judge from fossils, a sprinkling from most of the older rocks; so, although an Upper Greensand fossil would have the same aspect, Prof. Sedgwick's determination of its age is legitimate, and probably true.

Professor Owen has examined the specimen, and in the 'Brit. Assoc. Reports' classed it as a species of *Delphinus*. In the 'British Fossil Mammals,' p. 520, it is spoken of as one of the *Delphinidæ*; and in the 'Palæontology,' p. 355, as an animal as large as a *Grampus*.

The fossil consists of the axis, third and fourth cervical vertebræ, and the neural arch of the fifth. The centra of the second and third are anchylosed. In outline they form a broad depressed triangle, $6\frac{3}{4}$ inches long by about 4 inches high; and from the odontoid process to the fourth vertebra they measure 3 inches: the odontoid process projects three-quarters of an inch; half the remaining thickness is made up of the axis, and the other half equally by the third and fourth vertebræ, with their interspace of an eighth of an inch. The third vertebra has a slight hypapophysis; the fourth is broken underneath: posteriorly, it shows the characteristic Cetacean unossified epiphysial surface.

In front the neural canal is a circular hole, $1\frac{1}{8}$ inches across; but behind it is half an inch wider, the floor has become flat, and it is scarcely so high as in front, where it is made circular by sloping down to the odontoid process.

The articular surface of the axis is a little concave; it extends from the base as high as the middle of the neural canal, and is 5 inches wide, being nearly double the width of the fourth vertebra, which measures $2\frac{3}{4}$ inches wide, by $2\frac{1}{4}$ inches high. The odontoid process is in the middle of the centrum, concave above, convex below, and in a line with circular foramina at the sides of the articular surface. These are passages for the vertebral arteries; they

* Letter in 'British Fossil Mammals,' p. 520.

measure but $\frac{3}{8}$ of an inch across in front, yet each expands behind like a funnel into an oval form, which is at the third vertebra 2 inches high, by $1\frac{1}{4}$ inches wide. In the axis it is but a perforation and excavation in a posterior bony expansion of the sides, but the arcs to the third and fourth vertebræ are slender bony rings: that of the fourth is most slender, and more contracted than in the other. They rise at the base of the neural arches, and terminate in the same plane as the bases of the centra, being there a little compressed laterally.

The neural arches are very simple; flattened above, they are concave at the sides, project slightly in front and behind, and are from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch thick. There has been a slight neural spine to the axis, but it is rubbed away.

The sum of the features here described indicate, not a Cetacean of the Dolphin family, but a true Whale. The characters which more especially mark this are—the size and position of the passages for the vertebral arteries; the absence of neural spines, though in *Phocæna* they are no more developed; the relative depth of the vertebræ, and the position of the ‘dentata.’ There are some points of resemblance to Dolphins; but with *Balænoptera* the affinity is singularly close; and it is chiefly from the funnel-shaped artery-passages opening on the axis by a minute perforation that it is distinguished. Other distinctive characters are that in *Balænoptera* the ‘dentata’ is at the base of the spinal cord; that the vertebræ do not so rapidly decrease in size; that the processes are relatively larger; that only the neural arches of the second and third are anchylosed, and that the vertebral arcs do not form rings. None of these characters are very important, but the sum of them will justify a separation of the old Oolitic fossil from its living ally; and, as an old true Whale, I have named it *Palæocetus*.*

EXPLANATION OF PLATE II.

- Fig. 1. Front view of the ‘axis’ of *Palæocetus Sedgwicki*; half natural size.
2. Under view of 2nd, 3rd, and 4th cervical vertebræ of *P. Sedgwicki*; half natural size.

(The figures are from Photographs by W. Farren, Cambridge.)

NOTE.—In Mr. Woodward’s paper on *Plicatula sigillina*, GEOLOGICAL MAGAZINE, vol. i. p. 114, there is an error relating to this Whale. The fossil figured by Professor Owen in the ‘British Fossil

* While this was printing, I have been indebted to Dr. Gray for his memoir on British Cetacea; and am able to add that it also resembles *Physalus*, being nearest to *Ph. Sibbaldii* (Gray): in which the lateral processes of the axis resemble those of the fossil more closely than those in *Balænoptera* do; but after the second, they do not form rings, in that species, while *Physalus* has all the vertebræ free. *Palæocetus* appears to connect these two genera.

G. West, del.

H. & N. Bartholomew, lith.

CERVICAL VERTEBRÆ OF PALEOCETUS SEDGWICKII. *Sedg.*

Mammals,' p. 520, is not the Woodwardian fossil here represented, but a true Delphinoid—*Phocæna crassidens*. Further, the evidence (in connection with *Plicatula sigillina*) on which our fossil was referred in Mr. Woodward's paper to the Upper Greensand is this;—the paint in the Woodwardian Museum is extremely bad; and, as the convex surfaces of the bone rested on it unmoved for years, it came off on the fossil, making little crescentic white patches which I at first mistook for worn remnants of the little fossil above mentioned.

I gladly annex the following letter:—

MY DEAR SIR,—I thought the following observations on the Genus *Palæocetus* might be interesting to you, and you are quite welcome to make any use of them you like.

The Bones have great interest to me, as I think I have an Australian Whale that illustrates them.

They agree with *Balæna* in the cervical vertebræ being anchylosed. They differ from all the known *Balæna* in the Atlas, being free and separate from the other cervicals;—now in these characters they agree with a Genus of Whales which I have just described under the name *Macleayius*, from a specimen in the Australian Museum in Sydney.

The Genus *Palæocetus* differs, however, from *Balæna* and *Macleayius* in the form of the lateral processes of the cervical vertebræ. In *Balæna* and *Macleayius* the upper lateral processes of the second and following cervical vertebræ are small and rudimentary, and the lower lateral processes of the second and third cervical vertebræ are large, produced, enlarged and united at the end. They are all anchylosed together. But in *Palæocetus* the upper and lower lateral processes of the two vertebræ appear, by the Photographs you have sent me, to be short, united together, forming a rounded lobe in the middle of the side of the vertebræ, somewhat like (though much smaller and less developed) the ring-like lateral processes of the second cervical vertebræ of the true Finner-Whale (*Physalus*), showing that *Palæocetus* has many affinities, and decided characters for a genus. Indeed, I feel assured that it will form a Family, which may be called *Palæocetidae*, perhaps the forerunner of a number of fossil species. Yours, very truly,

JOHN EDW. GRAY.

BRITISH MUSEUM: Dec. 20, 1864.

III. NOTE ON *XIPHOTEUTHIS ELONGATA*.

By Professor JOHN PHILLIPS, F.R.S., &c.

THE very important addition to our knowledge of the *Belemnitidae* contained in Professor Huxley's Memoir on *Xiphoteuthis* encourages the hope that, by following the steps of Mr. Day, we may clear up some other perplexities among the Cephalopoda of the Lias. One of the singular forms which presents itself for more complete inquiry is the fossil called by Mr. J. Sowerby *Belemnites pistilliformis*, found at Lyme-Regis. It is not the species so named