

relate, it owes its recognition as such to two rami of the mandible!

We were at first puzzled by the numbers applied to certain premolars in the author's description of the dentition of some fossil species belonging to still existing genera, until the following paragraph in the Introduction was noticed:—"In enumerating the teeth of the typical heterodont Eutherian mammals, each tooth of the cheek series is referred to its proper position in the complete series, the first premolar always meaning the first tooth in the typical series of four, and so with the succeeding teeth." Mr. Lydekker has therefore resuscitated what we had thought was long defunct—namely, the Owenian system of expressing the homology of the teeth by imagining a fixed mode of reduction for a typical number of 44, of which the premolars, for instance, when reduced in number, are supposed to become so by symmetrical loss from before backwards; so that when, for example, two upper premolars alone remain, these must be considered to be the third and fourth. It is, however, an incontrovertible fact that in many species of mammals it is the third premolar in the upper jaw that is wanting, that further reduction is accomplished by the loss of the second, and, lastly, of the first premolar, the fourth premolar of the original series alone remaining, this tooth very rarely disappearing also. In the lower jaw of certain species with three premolars the second premolar is the first to disappear, so that here the same difficulty exists. Were the mandible of such a species to become fossil, the two remaining premolars would, by the Owenian system, be recognised as the third and fourth, whereas they would really be either the second and fourth or the first and fourth. Indeed Prof. Owen himself notices ("Anat. Vertebr.," iii. p. 374) that "in some instances the first premolar remains of small size when p. 2 and p. 3 are lost;" and Prof. Flower, commenting on the theory of reduction advanced by Prof. Owen, remarks ("Encycl. Brit.," xv. p. 353) that "if this were invariably so, the labours of those who describe teeth would be greatly simplified; but there are unfortunately so many exceptions that a close scrutiny into the situation, relations, and development of a tooth may be required before its nature can be determined, and in some cases the evidence at our disposal is scarcely sufficient for the purpose."

Space will not admit of entering upon a criticism of the geological horizons adopted, which, so far as the Tertiaries of Europe are concerned, have been slightly modified by the author from the tables given by Gaudry, Boyd Dawkins, and Max Schlosser. We note, however, with satisfaction that he has rejected the prevalent notions as to the position of the Siwalik and Pikermi beds, referring the ossiferous strata of the former to the Upper and that of the latter to the Lower Pliocene—a view, if we mistake not, urged for some time past by Mr. W. T. Blanford. We could wish for a special note on the position of the Caylux and Quercy phosphorites of Central France, referred to the Upper Eocene; for the highly specialised character of the mammalian remains from these deposits appear to throw much doubt on their supposed age.

Where there is much to blame there is also much to praise: the descriptions appear to be in most cases excellent and carefully worked out, the subjects chosen for

illustration well selected, and the woodcuts (thirty-three) well executed. We hope that this volume and the next (which will probably include the remaining species of fossil Mammalia represented in the collection) will together form but a "Prodromus" to a catalogue of fossil Mammalia by the same author, which, while equalling in comprehensiveness the best of the hitherto published catalogues issued by the Trustees of the British Museum, shall, however, surpass all of them in accuracy of description and in the number and excellence of its illustrations.

THE SELF-INSTRUCTOR IN NAVIGATION

The Self-Instructor in Navigation and Nautical Astronomy for the Local Marine Board Examinations and for Use at Sea. With numerous Examples, Illustrations, Diagrams, and Charts. By W. H. Rosser. New and Thoroughly Revised Edition. (London: Imray and Sons, 1885.)

BOOKS of this character have presumably their use; and this particular one is neither worse nor better than many others which owe their being to the necessities of the examination room rather than to the wants of the practical navigator. Its table of contents is framed according to the schedule of the Board of Trade; and though it is spoken of in the preface as "adapted for use at sea," Mr. Rosser has proved in other books that he knows it can be so considered only as an indirect compliment to the Board of Trade Examinations, which have been carefully devised so as to call for the greatest possible amount of cram and the smallest possible amount of real knowledge. The "Self-Instructor" has run through many editions, and no doubt answers the purpose of the author sufficiently well: it is, he says, essentially practical and not theoretical; though he omits to say that practical is to be understood as referring to what is wanted for the examination, and that theoretical refers to any reasoning or intelligent mode of working. It is not Mr. Rosser's fault that the examination is laid down on such clumsy and really unpractical lines; and what he has professed to do he has done fairly well: though it would be as well to expunge from future editions the symbol given on p. 2, for the "observed distance between the sun's near limb and the moon's far limb"; more especially if the symbol is to be used, as on p. 304, for a distance observed to the moon's near limb.

As a little matter of history, it may be remarked that the statement on p. 364, that the method of determining the latitude by the altitudes of two stars on the same hour-circle was originally given by Mr. Bolt in the *Nautical Magazine* for 1874, is not quite accurate. Mr. Bolt, in the article referred to, makes no claim of originality, but merely says that the problem may be new to many even expert calculators. In point of fact, the method suggested itself to, and was taught and practised by, the writer of this notice in 1859, and was introduced by him into the examination papers of the Royal Naval College in 1866; since which time it has been repeatedly set as a theoretical question. In reality, it ought only to be so considered; for though it gives very good results, and the observation is by no means a delicate one, a rough approximation to the interval of time being quite

sufficient, still the method is only available on a comparatively clear night; and though the same sights may possibly be also used for the determination of longitude, it will more commonly happen that the complete position may be satisfactorily determined by Sumner's method applied to two stars having a considerable difference in azimuth.

The pages in which Mr. Rosser treats of Sumner's method are of themselves sufficient to establish what has been already said as to the practical nature of the book. In an admirable monograph published two years ago, under the title of "Stellar Navigation," Mr. Rosser has shown himself alive to the very great value of this method of determining a ship's position, and to the necessity of shortening the calculation by the use of Sir William Thomson's special tables, or by Burdwood's and Davis's azimuth tables. But no remark in the "Self-Instructor" calls attention to this, and the problem is left, in its native clumsiness, in the form suitable to the questions of the examination room. The same might indeed be said of almost all other problems, which are given without any hint of the little artifices which, in practice on ship-board, render the computation quicker and easier. In saying this, however, we attach no blame to Mr. Rosser, unless it is for calling his book "practical," or "adapted for use at sea." The book is meant to meet the demands of the examinations; and for this, at least, it appears sufficiently well adapted.

J. K. L.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

On the Cause of the Dissimilarity between the Faunas of the Mediterranean and Red Seas

THE republication by Mr. A. H. Cooke of the list of Testaceous Mollusca obtained by the late Mr. Robert MacAndrew during a dredging excursion (in 1869) in the Gulf of Suez,¹ affords data for comparison with that of the Mediterranean over its eastern part, and of which the late Mr. J. Gwyn Jeffreys has, amongst other writers, given an account.² The extreme dissimilarity in reference to the species will, upon such a comparison, impress the mind.³ I propose briefly to sketch out the process by which this dissimilarity may be supposed to have been brought about.

Going back to the Eocene period, we know that the whole of the region bordering the Levant, and including large portions of the three continents, formed the bed of the ocean, and we may presume that a community of genera and species existed over the whole tract represented by those of the Nummulite limestone of the Middle Eocene period.

During the Upper Eocene period there was a shallowing of the sea-bed in many places, and corresponding deepening in others, and thus the first division of the submerged area into deep and shallow basins would have been brought about with a certain influence on the animal and plant life; but the general result may not have been considerable.

It was during the succeeding Miocene period that the differentiation of the fauna and flora of the two seas really began. Recent observations on the geology of Northern Africa, Arabia, and Palestine by Zittel, Lartet, and others, leave little doubt

that the Miocene period was one during which the main lines of the future lands and seas were marked out; and the absence of deposits belonging to this epoch (except a few scattered tracts formed of shallow-water and littoral beds) over the region referred to, leads to the conclusion that land-conditions prevailed very much where we now find them, and that the submerged areas of the Mediterranean and Red Seas were dis severed by the Isthmus of Suez. It was during this period of elevation that the differentiation proceeded; the original forms of the Eocene period developing in each basin independently of one another, and becoming more divergent as time went on. The process seems to have been continued well into the Pliocene epoch, but at a time which may be indicated perhaps as "Newer Pliocene" there occurred a re-submergence of the land to the extent of 220 to 250 feet below the present level of the sea, marked by the occurrence of raised sea-beds containing shells, &c., of species still living in the adjoining waters, and of old coast-cliffs perforated by Pholas borings, like that discovered by Oscar Fraas in the cliffs of Jebel Mokattam, near Cairo, at an elevation of 220 feet above the surface of the Mediterranean, and recently described by Dr. Schweinfurth (*Zeitsch. d. deutschen geolog. Gesellschaft*, 1883). During this depression Africa became an island, and the waters of the two seas were united.

With this union of the Mediterranean and Red Seas there must have been brought about a certain commingling of the forms inhabiting their waters respectively, and hence it is somewhat surprising that there should at the present day be found such an almost entire dissimilarity as that already stated. The explanation, it seems to me, is to be found in the fact that the strait was, in its shallower portion, very shallow; and that consequently, except for the purely littoral and shallow forms of marine life, a commingling really did not take place to any great extent. To the north of Lake Timsah there occurs a ridge of ground called *El Guisr*, which rises 70 feet above the present sea-level, and another called *Tunum*, which rises 25 feet. These ridges would have caused a shallowing of the strait to the extent of their elevation, so that over the former ridge the depth of the strait would only have amounted to 180 feet or less during the greatest submergence. It is impossible to say whether these ridges are higher, or the contrary, than they were at that period; but it is a remarkable fact that the sub-fossil shells in the gravels to the south of Tunum are those of the Red Sea, and to the north those of the Mediterranean; other ridges, like that of Tel-el-Kebir, produced similar shallows. As a general result it is clear that the submergence of the isthmus during the later Pliocene period did not produce a general commingling of the forms of the two seas; and when ultimately the seas were again separated by the re-elevation of their beds, and the present isthmus established, those forms which may have passed across from sea to sea would succumb to the altered conditions of their environment. It can scarcely be doubted that the temperature of the water of the Red Sea differs considerably from that of the Mediterranean by several degrees, and the forms which belong to the former would perish in the latter, and *vice versa*. It would be interesting to ascertain which of the two faunas more closely resembles that of the original Eocene stock.

Here, then, we have the remarkable zoological phenomenon of two perfectly distinct sets of marine forms originating in one stock only as far back as the Middle Eocene period, independently developing to such an extent that, at the present day, there are scarcely more than eighteen species (according to Prof. Issel) common to both. Now, if the beds of these two seas (the Levant and Red Sea) were to be elevated into land and their fossil contents studied by a geologist of the future, he would probably assert on the palæontological evidence that they belonged to two distinct periods of geological time! This is subject matter for reflection, at least for geologists of the present day. I may add that I have been induced to try and solve to my own satisfaction the problem here presented while engaged on a work containing the scientific observations and conclusions made during the recent expedition to Arabia Petrea in connection with the "Palestine Exploration Fund."

EDWARD HULL

Hybridization among Salmonidæ

I PERCEIVE in NATURE (vol. xxxi. p. 563) that the "National Fish Culture Association" propose cross-breeding land-locked salmon and trout as proposed by Prof. Brown Goode in "Forest and Stream," August 7, 1884. Before doing so I would venture to direct their attention to a few points.

¹ *Annals and Magazine of Natural History*, vol. xv. p. 322 (fifth series).

² *Ibid.*, vol. vi. p. 65 (fourth series).

³ This fact has been recognised by Prof. Haeckel in his "Visit to Ceylon" and his "Arabische Korallen," &c.