

NOTICES OF MEMOIRS.

Papers read before Section C (Geology), British Association, Manchester, September, 1915.

I. THE CLASSIFICATION OF THE TERTIARY STRATA BY MEANS OF THE EUTHERIAN MAMMALS. By HON. PROFESSOR W. BOYD DAWKINS, M.A., D.Sc., F.R.S.

THE classification of the Tertiary strata by means of the higher mammalia outlined in my paper before the Geological Society in 1880¹ has been tested by the many discoveries all over the world since that time, and not found wanting. The details have been filled in, and the principle adopted has been proved to be of worldwide application to North and South America and to Southern Asia and Africa as well as Europe, the living mammalian species in each geographical province being taken as the standard. It has been accepted by Osborne and others, and is now being used for the grouping of the Tertiary strata of America. It has been used in the organization of the Manchester Museum. It is therefore fitting that it should be brought up to the knowledge of to-day.

The classification is based on the evolution of the mammalia, the only group in the animal kingdom that was, as Gaudry writes, "en pleine évolution" in the Tertiary Period, all the lower forms having already undergone their principal changes and none changing fast enough to be of service in defining the stages. The scheme is as follows:—

TABLE OF THE DIVISIONS OF THE TERTIARY PERIOD.

<i>Descriptions.</i>	<i>Characteristics.</i>
Historic, in which the events are recorded in history.	Modern types of man. Man the master of nature.
Prehistoric, in which man has multiplied exceedingly and domesticated both animals and plants. Wild Eutheria on the land of existing species, with the exception of the Irish elk.	Modern types of man. Cultivated plants. Domestic animals—dog, sheep, goat, ox, horse, pig, etc. Wild Eutheria of living species.
Pleistocene, in which living species of Eutheria are more abundant than the extinct species. Man appears.	Extinct types of mankind. (Modern types?) Living Eutherian species dominant. Man.
Pliocene, in which living Eutherian species occur in a fauna mainly of extinct species.	Living Eutherian species present. Extinct species dominant.
Miocene, in which the alliance between living and extinct Eutheria is more close than in the preceding stage.	No living Eutherian species. Living Eutherian genera appear. Anthropoid apes. Extinct genera dominant.
Oligocene, in which the alliance between extinct and living Eutheria is more close than in the Eocene.	No living Eutherian genera. Living families and orders. Extinct families and orders numerous.
Eocene, in which the Eutheria are represented by living, as well as by extinct, families and orders.	No living Eutherian genera. Living families and orders. Lemuroids. Extinct families and orders dominant.

The most important break in the succession of life-forms occurs at the close of the Oligocene age in Europe and America. From this

¹ Q.J.G.S., pp. 379-404.

break down to the present day the continuity is so marked that we may conclude that the present face of the earth is merely the last in a long succession in the Tertiary Period.

II. THE CARBONIFEROUS LIMESTONE ZONES OF N.E. LANCASHIRE. By ALBERT WILMORE, D.Sc.

THE sequence is well seen in the neighbourhood of Clitheroe, where numerous quarries have been opened up. The lowest beds exposed are near Chatburn Mill, and are dark, thinly-bedded limestones with calcareous shale partings. Fossils are very scarce. There is a great thickness of these almost unfossiliferous beds, the top parts of which are dolomitic.

Bold Venture Quarry, Horrocksford Quarry, and several other exposures show beds in probably lower zone C, with numerous small Zaphrentids (chiefly *Zaphrentis omalusi*, with the variety *ambigua* of Mr. R. G. Carruthers very common). Higher parts of these beds contain *Caninia cylindrica*, which has been found at Brungerley Bridge, in Bold Venture Quarry, at Pimlico, and at Downham. This species is not so common or well developed as in beds farther east, towards Hellifield and district. Among the Brachiopods are *Chonetes comoides*, *Orthotetes crenistria*, etc. Large Gasteropods such as *Euomphalus pentangulatus* and *Bellerophon cornuarietis* are common. *Conocardium hibernicum* is a characteristic Lamellibranch.

Above these beds come the lowest beds with *Productus sub-lavis*, and the Knoll beds of Coplaw, lower part of Worsaw, etc. Here are the typical zone C, knolls with numerous Brachiopods, the Gasteropods mentioned above, but few Corals. *Amplexus coralloides* is, however, common and *Michelinia* sp.

Above these are well-bedded crinoidal limestones leading up to the knolls of Salt Hill, Bellman Park, Worsaw, etc., which are probably in the upper C or lower S of Dr. Vaughan's zonal scheme. These beds contain a rich Brachiopod fauna, quite distinct, however, from that of Elbolton. Whilst *Productus pustulosus*, *Pr. semireticularis*, *Spirifer striatus*, etc., are quite common, one never finds *Pr. striatus*, *Pr. martini*, and other *D.* forms so common in those eastern knolls.

A fairly rich coral fauna has lately been discovered in these higher Clitheroe knolls; it has not yet been worked out, however. There is probably an unconformity at this level, and then there succeeds a great thickness of shales with limestones, with few fossils. These would appear to be on the same horizon as the richly fossiliferous beds of Elbolton. Above these shales with limestones come the Pendleside limestones, black limestones with cherts, and with irregular bands of more fossiliferous limestone. The Ravensholme limestone appears to be similar and to contain some of the same fauna as the highest limestone at Cracoe and the limestone of the railway quarry at Rylstone described by the writer.

The Bowland shales succeed these beds, and lead up to the Millstone Grit series. A map was exhibited on which some of these generalizations were shown.