

The book is a veritable mine of information and is almost encyclopaedic. The author says that in this field, during the 1930-decade, there were published some 20 papers, in the 1940-decade 70 and in the 1950-decade 600. He seems to have included them all. Certainly I could think of scarcely any significant ones that he had left out. Moreover, the applications are multitudinous—to charge distributions, bond orders, polarizabilities, electrode potentials, and particularly chemical reactivity, where he has provided easily the best and most comprehensive account yet published. The text is liberally scattered with excellent diagrams and graphs to show the measure of agreement with experiment.

This is a book which should be accessible to every theoretical organic chemist, and to most experimentalists also. For the story is not too difficult, and the whole pattern of π -electron chemistry is changed because of the work here described. There will be those who shudder occasionally at what will seem hard treatment for their beloved English language ("the hydrogen molecule cannot be solved exactly"; "this function peaks at the nuclei"; "The reader will recall from his algebra days"). But there seem to be very few actual mistakes, despite the inevitable over-simplifications. If there are still any organic chemists who wonder what good has come out of wave mechanics let them read this volume; they will do well if they avoid being converted by the range of the ground covered, and the author's enthusiasm as a guide.

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THE MIOCENE TRANSGRESSION

Fundamentals of Mid-Tertiary Stratigraphical Correlation

By Dr. F. E. Eames, Dr. F. T. Banner, Dr. W. H. Blow and Dr. W. J. Clarke. With a contribution by Dr. L. R. Cox. Pp. viii + 163 + 17 plates. (Cambridge: At the University Press, 1962.) 50s. net; 9.50 dollars.

THE correlation of the Mid-Tertiary marine sediments has frequently been based on uncritical, even dogmatic statements in the past, so that some peculiar conclusions have been reached, notably those relating to the fauna ascribed to the Oligocene in America. The authors of the present work have briefly made known in the past decade some of their reasons for rejecting some of the old correlations. Using their wide knowledge of the stratigraphical palaeontology of both the Old and New Worlds, they now give their correlation of the Mid-Tertiary marine successions throughout the world, and produce their arguments for lowering the base of the Miocene to include much formerly referred to the Oligocene. They lay considerable emphasis on the Foraminifera, both the larger forms and the assemblages of planktonic forms, especially the Globigerinaceae, but (a basic principle) they also take into account the evidence of the other phyla. The authors point out that assessments so made are liable to error if certain factors are disregarded, such as the influence of facies on the local ranges of a species in different localities, the changed time-values of some fossils owing to modern, more refined evaluation of their characters, and the recognition of widespread disconformities and unconformities. The last, in particular, have sometimes been overlooked in the past, so that re-worked Eocene fossils, often

beautifully preserved and incorporated into post-Eocene sediments, have led to false conclusions, especially in America.

Another fundamental principle of the authors is that "the type region for a stage or series of stages must be regarded as constituting the fundamental basic standard". Any discussion of the Miocene in its relation to the Oligocene should, therefore, be based on a clear understanding of the faunas of the European Oligocene and Aquitanian; and the contribution of Dr. L. R. Cox in Part I on their marine molluscan faunas is thus of much importance.

Part I consists of a review of the criteria for correlating the Mid-Tertiary deposits and a critical revision of the correlations made. The Aquitanian is taken as the base of the Miocene, and naturally much of the evidence for the authors' conclusions concerns the recognition of the Lower Miocene (Aquitanian and Burdigalian) and its relationship to the Oligocene. As their revision moves on from Europe, through the Tethyan area, to Indonesia and beyond, the authors argue cogently for several new interpretations, for example, in Indonesia. It is in the Central American area, however, where they make their most profound changes, lowering the base of the marine Miocene everywhere in the United States, Caribbean region and northern South America, to include nearly all that was formerly designated as Oligocene. The Antigua Limestone is of key importance, for in addition to a fauna of *Lepidocyclina* species of Lower Miocene age, it yields corals (and other macrofossils) which enable correlations to be effected with other Central American areas. Thus the coral-bearing formations previously referred to the Oligocene are shown to be Miocene. The biggest changes affect the Vicksburgian, which had come to be regarded as typical of the American Oligocene, but which the authors argue belongs to the Miocene, and the successions in Venezuela and Trinidad, where anomalies can be explained by the re-working and derivation of Eocene fossils.

Part 2 deals with the Globigerinaceae. A series of biozones, based on the planktonic Foraminifera, and founded on the succession in Tanganyika and on a revision of the species occurring there, is proposed for the Upper Eocene, Oligocene and Lower Aquitanian. The distribution of the assemblages so recognized confirms the results reached in Part 1, and particularly the absence of the Upper Bartonian and the whole of the Oligocene from the Central American region.

A reconsideration of Mid-Tertiary palaeogeography follows from the establishment of such a major unconformity (or disconformity), and the authors suggest that, while the Oligocene orogeny was occurring in the archipelagic Caribbean area, "the whole of the southern portion of the United States was uplifted *without* orogeny as a gigantic coastal plain". The widespread Aquitanian transgression that succeeded was in accord with the geological history of the rest of the American region and of the Tethys as a whole.

The arguments put forward by the authors are so logical and well thought out that they carry conviction, and it seems that, in general, only slight adjustments will be necessary to the stratigraphical conclusions at which they arrive. Their correlation-tables are clear and easy to interpret, and the text-figures and plates are excellent. The whole volume is well produced and typographical errors are very few.

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