Book Reviews

Summary of Chandler's Lower Tertiary Floras

The Lower Tertiary Floras of Southern England. vol. 4. A summary and survey of findings in the light of recent botanical observations. M. E. J. Chandler. British Museum (Natural History), London, 1964. xii + 151 pp. Illus. £7 10s.

Three important monographs on the Lower Tertiary floras of southern England have been published by the British Museum (Natural History) since 1961: vol. 1, *Palaeocene Floras, London Clay Flora* (Supplement) [reviewed in *Science* **134**, 45 (1961)]; vol. 2, *Flora of the Pipe-Clay Series of Dorset (Lower Bagshot)* [*Science* **140**, 632 (1963)]; and vol. 3, *Flora of the Bournemouth Beds; The Boscombe, and the Highcliff Sands* [*Science* **144**, 719 (1964)].

In its preface volume 3 was designated as the final volume of the series, but, within a few months of its review in scientific journals, volume 4 has been published. For paleobotanists not specializing in the study of Tertiary fruits and seeds, and for botanists interested in paleoecology and paleophytogeography, volume 4 alone provides much valuable information. It completes the series on the Lower Tertiary fruit and seed floras of southern England with a synthesis of the taxonomic, floristic, and ecological data that is presented in the preceding volumes.

An earlier statement in volume 1 with regard to the alternative correlations between the British Tertiary section and the corresponding European stages is revised. A complete and revised list that indicates the stratigraphic distribution of all described and figured megafossils (in volumes 1–3) is included (pp. 16 to 34). Corrections and additions in systematics are detailed in a 42-page appendix, with four accompanying plates of photographs of specimens. New material includes lists (from Ma Khin Sein and Jane Pallot) of genera based on pollen and spores from the London Clay (Eocene) and Bembridge Beds (Oligocene).

The first three volumes consist largely of formal taxonomic descriptions and photographs of specimens from successive floras; volume 4, in Chandler's words, "aims at showing the relationship which exists between these separate floras." The London Clay flora, as the largest and most completely known from southern England, is the common denominator by which Chandler attempts to tie all of the sometimes scanty "sample floras" to the same vegetation and climate. The factor of chance, as it plays a part in the transport of fruiting organs by water and to a lesser extent by wind and animals, in the mode of accumulation and composition of seed deposits, and in the subsequent recovery of specimens by the paleobotanist, is called upon repeatedly to account for all discrepancies—the presence of certain genera in some floras and their absence in others and the admixture of presumably temperate montane and tropical lowland strand elements whose "thermo-ecology" as extinct species or genera must remain to some extent a guess. The theme of volume 4 is that the available evidence indicates no significant floristic or climatic change during the period of deposition of any of the sedimentary strata examined. Chandler believes that the nine seed assemblages were derived from a stable, long-lived forest that persisted in England at least from the earliest Eocene "until the onset of alpine mountain building movements of the Miocene." Paleobotanical data thus provides no help in resolving the difficult stratigraphic problem of the position of the Eocene-Oligocene boundary in southern England.

Drawing together information for contemporaneous Tertiary floras from the Old and the New Worlds, Chandler reasons that the London Clay flora is not "unique" as Reid and Chandler emphasized in 1933, since the expansion of the tropical zone in the early Tertiary, though unsatisfactorily explained climatologically, was nevertheless, a global phenomenon. The phytogeographic connection of southern England with Southeast Asia remains as clear as it was 30 years ago, but the problem is no longer to explain how a single tropical flora reached a latitude in the vicinity of 50°N during a relatively brief, hottest phase of the Eocene. An earlier view of the importance of the ancient Tethys Sea as the main migrational pathway to England for Indomalayan plants is no longer stressed, for London Clay type floras and even fossil *Nipa* (a mangrove genus of palms) are known to predate the northern connection of the Tethys with the Anglo-Franco-Belgian Basin, now presumed to have occurred in the middle of the London Clay epoch.

Armed with such evidence and by emphasizing that tropical assemblages of the London Clay type (albeit lacking the shore genera—for example, *Nipa* and *Ochrosoidea*—of the marine beds) are to be found in southern England in continental beds (and must therefore closely reflect the indigenous lowland vegetation), Chandler attempts to counter arguments raised by C. G. G. J. van Steenis, who claims much as did J. S. Bowerbank more than 120 years ago that all the truly tropical components of the London Clay came from allochthonous drift material carried north by the Tethyan equatorial current. Despite such an improbability, van Steenis, in company with some other paleobotanists and climatologists, strongly rejects the possibility that climates in latitude 45° to 50°N were ever more than warm temperate to subtropical.

In an effort to make full use of all data, even when it is insufficient to warrant speculation, Chandler has conveniently swept some inconsistencies in her floras under the rug. Still one cannot help being greatly impressed by the single-mindedness of this "indefatigable authoress" and by the convincing manner in which she marshalls her arguments. Single-handed, Miss Chandler has largely erased J. S. Gardner's rebuke to British paleobotanists when he urged that they cease neglecting the rich storehouse of Tertiary plant material with which their country is endowed.

JANE GRAY
Paleoecology Laboratory, Museum of Natural History, University of Oregon