

## A REVIEW OF CRETACEOUS MAMMALS

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ABSTRACT—Notwithstanding their rarity, there is sufficient fossil evidence recording the rise of mammals from therapsid reptiles in the Trias and of their subsequent ascendancy in the early Tertiary. Lower Cretaceous mammals have been reported from the Wealden of England and Spain. Albian mammals from Texas include Wealden types and therians of eutherian-metatherian grade. In the Cenomanian, the Djadochta beds of Mongolia form the principal source of information. In the Maestrichtian, the Lance mammalian fauna is very similar to the older Campanian fauna. However, the fauna occurring at the top of the Maestrichtian is comparable in aspect to Palaeocene faunas rather than the older fauna, and includes the earliest record of primates and condylarths.

The discovery of a Mesozoic mammal locality has always been a momentous event, and justifiably so, considering the rarity of mammalian remains. The ascendancy of the mammals took place during the 167 million years spanning the Mesozoic era. Originating from the therapsid reptiles, the mammals came into their own in the Jurassic, and by the end of the Cretaceous, they had become differentiated into six Orders. Becoming established in the Mesozoic, their diversification and radiation at the start of the Tertiary was in no small measure the result of their competitive superiority over contemporary dinosaurs and their effective utilization of ecological niches provided by the radiation of the angiosperms in mid-Cretaceous times.

The first Mesozoic mammal discovered, was from the Jurassic in 1764 (Van Valen 1967). The first Cretaceous mammal was collected

nearly a century later in 1854, but its mammalian affinities were only recognized 39 years later by Lydekker (1893). The first Cretaceous mammal to be identified as such, was found by Jacob Wortman in 1882 from Harding County, South Dakota, U.S.A. and was described in the same year as a multituberculate, *Meniscoessus coquistus* by Cope (1882).

The distribution of Cretaceous mammalian Orders in various parts of the world is shown in Table 1. The earliest Cretaceous mammalian remains are from the Wealden of England. Of the five specimens originally recovered (Woodward 1891, 1911, Lydekker 1893) only two are now believed to be mammalian, both having been identified as plagiulacid multituberculates by Clemens (1963). Recent work has resulted in the recovery of more specimens including a dryolestid *cf. Melanodon* closely resembling an American form from the

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TABLE 1

STAGES	COUNTRIES					
	ENGLAND	U. S. A.	CANADA	SPAIN	FRANCE	MONGOLIA
MAESTRICHTIAN		P. C.				
		M. MI. I. D.	M. MI. I. D.			
CAMPANIAN		M. MI. I.	M. MI. I.		Th.	
SANTONIAN						
CONIACIAN						
TURONIAN						
CENOMANIAN						M. I. D.
		? M.				
ALBIAN		M.T.S. Me-Euth.				
APTIAN						
NEOCOMIAN	M. T. S. Th.			? Th.		

Stratigraphic and regional distribution of Cretaceous mammalian Orders.

C—Condylartha, D—Deltatheridia, I—Insectivora, M—Multituberculata. Me-Euth—Therians undifferentiated into eutherians and metatherians, MI—Marsupials, P—Primates, S—Symmetrodonta, T—Triconodonta, Th—Theria.

Morrison formation of Wyoming, U.S.A., a symmetrodont, *cf. Spalacotherium* and a possible therian premolar. Of greater significance is *Aegialodon dawsoni* (Kermack *et al*, 1965), a species based on a single "trituberculosectarial" lower tooth. The wear surfaces of this molari-form specimen, indicate the presence of a definite protocone in the upper molars—the first such record. The tooth is derivable from the dryolestid *Peramus* of Purbeckian age. Crusafont and Andover (1966) record the presence of a mammal from the Wealden of Spain. The only other problematical therian, is *Endotherium* from the Husin coal bearing beds of southern Manchuria. Shikama (1947) originally described the form as upper Jurassic, or less probably from the lower Cretaceous. It is now believed that the less likely alternative is the correct one (Kermack

*et al*, 1965).

Albian mammals were first reported from the Trinity sandstone at Forestburg, Texas in great detail by Patterson (1951, 1955, 1956). Slaughter's contribution (1965) on the fauna from the area, throws considerable light on the diversification of placentals and marsupials from mammals at a eutherian-metatherian grade. Though the bulk of the Albian mammals are plagiaulacid multituberculates, the triconodonts and symmetrodonts are also present. Tribosphenic molars described by Patterson (1956) are critical in the context of later therian evolutionary history. These upper molars possess a wide styler area, a well developed stylocone, and a ridge connecting the stylocone to the paracone; in the majority of cases the paracone is larger than the metacone. The trigonid of the lower molars is relatively much

wider than that of the talonid, the protoconid is usually the largest trigonid cusp and the hypoconulid is well separated from the entoconid and hypoconid. Slaughter (1965) believes that *Pappotherium* collected from the Butler Farm locality of Texas is close to the ancestral form of all later therians. That eutherians had differentiated from metatherians is suggested by the presence of a submolariform premolar, a condition found in placentals but not in marsupials.

During the 20 million odd years spanning the Cenomanian, the only record of a mammal, in America, is a solitary tooth, believed to be a multituberculate from Texas, U. S. A., (Slaughter pers. comm.). The famous Djadochta beds of Mongolia, formerly considered to be upper Cretaceous are now believed to be Turonian—Cenomanian (Z. Kielan Jaworowska, Sloan pers. comm.). Sloan came to this conclusion after a study of the Mongolian forms in the light of the evolutionary history of the multituberculata. He believes that the Djadochta forms are pre-Campanian and post-Albian. Associated with the multituberculates are Deltatheridians (*sensu* Van Valen 1966) and the Insectivore *Zalambdalestes*.

The Campanian mammals were studied in some detail by the author (Sahni 1968). The principal locality is Clambank Hollow, from the Judith River Formation, Chouteau Co., Montana. The mammals are distinctly more advanced than the pre-Campanian forms. The multituberculates are closely allied to those from the Maestrichtian and are generically similar though specifically different. Marsupials are represented by the genera *Alphadon*, *Pedimys*, and *Boreodon*; a fourth genus *Eodelphis* may also be present but the inadequate and fragmentary nature of the material makes separation of this genus

extremely speculative. The teeth of *Alphadon* resemble those of eutherian-metatherian grade from the Trinity sandstone of Texas (Albian). The placentals are represented by a single genus, *Gypsonictops*, which can be derived from *Zalambdalestes*. The Canadian Campanian fauna from the Belly River formation is allied to that from the adjacent Judith River formation of Montana. Deltatheridians have yet to be reported from the Campanian, though further work is likely to result in their discovery. A therian lower molar from France is the only other report of a Campanian mammal. (Ledoux *et al.*, 1966).

There are two mammalian faunas in the Maestrichtian differing in composition and diversity. The Lance fauna is stratigraphically lower and has been described in great detail by Clemens (1964, 1966). The Lance fauna is similar to that of the Campanian except for size changes in various species of the multituberculates, greater specific diversification of marsupials and the addition of at least two new placental genera. The other fauna is known from a series of localities at the very top of the Maestrichtian, where the mammals are found in association with the last evidence of dinosaurian remains. The mammals are closer to Palaeocene forms than those from the Lance Formation. Two orders and 4 families have been extended from the Palaeocene into the Cretaceous, (Sloan and Van Valen 1965, Van Valen and Sloan 1965). The two Orders, the Condylartha and the Primates are represented each by a single genus *Protungulatum* (Arctocyoniidae) and *Purgatorius* (Paromomyidae). *Purgatorius ceratops* from the late Cretaceous is the earliest record of primates, the species is believed to be ancestral to *P. unio* from the late Early Palaeocene. The other families that range down into the Cretaceous are Eucosmodontidae, and

Taeniolabididae (Multituberculata).

The rise of the mammals from the therapsid reptiles and their ascendancy in the Tertiary was brought about by their greater competitive superiority resulting from their capacity for maintaining a constant body temperature, greater activity, greater intelligence and a diet that was mostly herbivorous or insectivorous. The rise of angiosperms in the mid-Cretaceous is generally thought to have been detrimental to the already well established dinosaurian groups and beneficial to the small rodent-like multituberculates and insectivorous placentals and metatherians. The Palaeocene saw the initiation of a great mammalian radiation with the introduction of a number of new placental orders. The Early Tertiary was a period of experimentation for the newly evolving groups, some lineages being shortlived while others persist to this day.

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