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BIOSTRATIGRAPHY, CHRONOLOGY, AND THE CONTINENTAL MAMMAL RECORD OF AUSTRALIA AND NEW GUINEA

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Pleistocene fossils of Australian mammals have long been recognized from the pioneer works of Owen, Krefft, DeVis, etc., and although others have carried on these researches (Tedford, Stirton, Marcus, Woods, Ride, Bartholomai) in the mid 1900's, information on the earlier, Tertiary, record has been nonexistant.

Interest in the Tertiary mammal evolution of Australia increased dramatically over the last 20 years. Except for scattered publications, the most notable of which was the description of Wynyardia (Spencer, 1900), a presumable phalangeroid of uncertain affinities, few recognized discoveries were made before this period.

In contrast to most other continent-sized areas, development of the pre-Pleistocene record in Australia and New Guinea has had the advantage of being guided by modern principles of paleontology wherein close attention has been paid to not only the fossils themselves, but also to the depositional framework in which they occur. This work has taken place during a period of increased refinement of both marine and nonmarine biostratigraphic and chronostratigraphic data and procedures.

Increased refinement and precision in invertebrate biostratigraphy and radiometric geochronology has been coupled with general acceptance of the concept of continental mobility and the result has been a re-awakened curiosity as to world wide patterns of geological and organic evolution, dispersal of organisms, climatic change, and the like.

To what extent do these factors and conditions affect the Tertiary record of Australia and New Guinea? It is possible to argue from general principles that the Australian land mass was contiguous

with Antarctica until about 50 million years ago and that since then it has drifted northward toward its present position. This allows a rational basis for the presumed Tertiary isolation of the continent, in which the proto- and metatherian mammal fauna evolved to its present state, and suggests that biogeographic phenomena such as Wallace's Line are of relatively recent origin and hence still relatively sharp, at least for mammals. The Tertiary continental positions of Australia also suggest that it is more likely that the colonizing marsupials (?and monotremes) were of southern (Antarctic and South American) origin rather than Asian, and that Australia is one of the few continent-sized areas to have moved across the presumed Tertiary latitudes. Thus, the Tertiary climatic history of Australia may prove to have been different from that which appears to have generally affected most of the other continents.

The Australian fossil mammal record is almost exclusively Neogene. Of this, the Tertiary record consists of less than a dozen taxonomically useful assemblages; geographic representation is strongly skewed toward the eastern half of the continent and the incidence of contemporaneous faunas from more than one area is almost nil. The problem of limited data is further augmented by the isolation of the continent from the rest of the world during most of the Tertiary. Thus, with the possible exception of Pleistocene, recognition of the fossil mammal criteria for precise use of words such as Pliocene, Miocene, or perhaps even Neogene, is entirely non-existant in Australia. Applying such concepts to the land mammal history of Australia is achieved only secondarily, by means of local stratigraphic sections in which mammals are interbedded with marine invertebrates, or with deposits amenable to isotopic dating.

The preceding all adds up to the fact that fossil mammal paleontology and chronostratigraphy is a developing discipline in Australia. There is no choice but to investigate and develop local geologic sections, demonstrate local physical, biostratigraphic, and chronostratigraphic correlations and extend these outward within Australia and New Guinea, to achieve an increasingly stable and refined series of local and, potentially, eventual continental correlations unique to the region.

TABLE 1. Chronologic relationships, Neogene mammal faunas, Australia and New Guinea.

Tasmania	So. Australia	Victoria	North Terr.	Queensland	New Guinea
		various			
	Malkuni (a)				
2					
	Kanunka (a)			Chinchilla	
	Palankarinna (a)	Hamilton[1]			Awe[2]
		Lake Tyers[3]			
5		Forsyth's Bank[4]			
		Beaumaris[5]			
10					
			Alcoota		
			Bullock Ck.		
	Kutjamarpu (a)				
			Kangaroo Well	Riversleigh	
	Ngapakaldi (a, 6)				
15	Callitris Lake (6)				
Wynyard[7]					

Explanatory notes for correlation chart. Approximate position of fossil faunas to radiometric chronology shown at left (not to scale).

(a). Superposed sequence in northern South Australia; Malkuni and Kanunka faunas in Katipiri Sands unconformably overlies barren Tirari Fm., which unconformably overlies Mampuwordu Sands (Palankarinna fauna). Mampuwordu and Wipajiri Fms. (Kutjamarpu fauna) also unconformably overlie Etadunna; Kutjamarpu and Palankarinna faunas separated by stage of evolution of taxa.

1. In fossil soil developed on marine Grange Burn Fm., of Kalimnan age. Overlain by and deposited shortly before basalt dated at 4.35 m.y.

2. Potassium-argon dates in Otibanda Fm. (Awe fauna) range in age from 3.1 - 7.6 m.y. Some or all may be contaminated; the problem requires resolution from geochemical/geological as well as from faunal grounds.

3. Fossils occur in marine Jemmy's Point Fm., of upper part of Kalimnan megafossil invertebrate Stage.

4. Single macropod jaw in Grange Burn Fm. of Kalimnan age, stratigraphically below the Hamilton fauna.

5. Diprotodontid and marine vertebrates in Black Rock mbr. of Sandringham Sands, type locality of Cheltenhamian megafossil invertebrate Stage.

6. Etadunna Fm. (Ngapakaldi) and possibly equivalent rocks (Callitris Lk.) in Frome Embayment. Spores and pollen from both areas apparently correlative with those in marine rocks of Balcombian age on southern coast and indicate a younger age for these faunas than previously thought.

7. Enigmatic phalangeroid Wynyardia known from Freestone Cove Ss. of Table Cape Group; Longfordian megafossil invertebrate Stage.