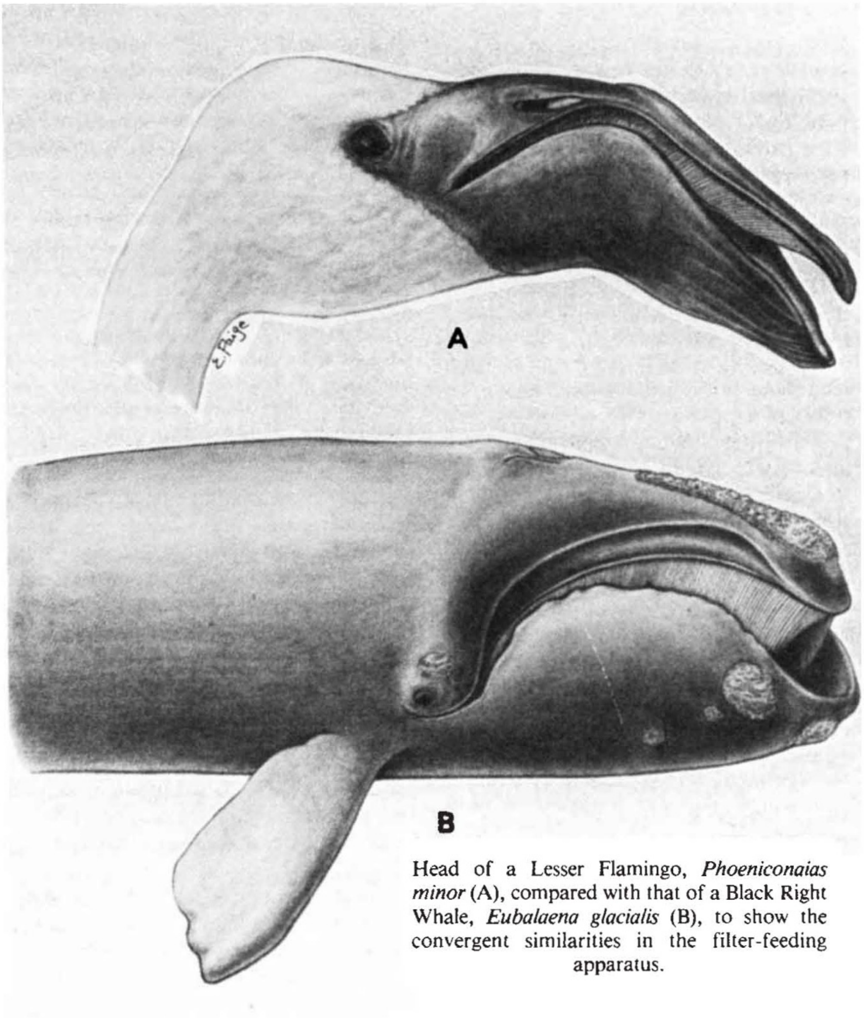
Flamingos, stilts and whales

from Andrew Milner

THE phylogenetic position of the flamingos (family Phoenicopteridae) has long been the subject of controversy among avian systematists with some workers supporting relationship with the Anseriformes (ducks and geese) whilst others favour association with the Ciconiiformes (storks, herons and ibis).

The evidence has been reviewed recently by Olson and Feduccia (*Relationships and Evolution of Flamingos (Aves: Phoenicopteridae)* Smithsonian Contributions to Zoology **316**, Smithsonian Institution Press; 1980) who have developed an earlier proposal by Feduccia that the flamingos fall within the Charadriiformes (waders, gulls and auks). Characteristics of the musculature, the skeleton, the natal down and the endoparasitic cestodes all lead to the conclusion that the closest living relatives of the flamingos are the Recurvirostridae (stilts and avocets) and, more specifically, the Australian Banded Stilt (*Cladorhynchus*). This remarkable bird lives in colonies frequenting temporary salt lakes in southern Australia and its behaviour, pattern of breeding and life history all bear specific similarities to those of flamingos. The earliest certain fossil flamingo from the Eocene of Wyoming is described by Olson and Feduccia and supports their hypothesis by being morphologically intermediate between recurvirostrids and flamingos. One phylogenetic anomaly, the presence of anseriform-type feather lice in flamingos but not in *Cladorhynchus*, is attributed to the presumed common lifestyle and physical proximity of early flamingos and the early colonial Anseriformes such as *Presbyornis*.

The filter-feeding mechanism of flamingos is structurally and mechanically different from that of ducks but is remarkably convergent with that of the baleen whales, particularly the Right Whale! Despite the differences in scale and orientation during feeding, the two filter feeders share structures such as a large fleshy tongue accommodated in a deep-sided lower jaw and a recurved rostrum permitting the presence of a row of elongate filtering devices suspended from each upper jaw. The similarity in structure and function of the feeding apparatus of whale and wader suggests to the authors that the 'crooked beak' of the flamingo may have been a fundamental adaptation to filter-feeding which preceded the 'inverted-head' feeding posture rather than following it as has generally been assumed.



Head of a Lesser Flamingo, *Phoeniconaias minor* (A), compared with that of a Black Right Whale, *Eubalaena glacialis* (B), to show the convergent similarities in the filter-feeding apparatus.

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and geological dating leaves little doubt that each pair was formed simultaneously. In addition, in neither is there a structural basis for assuming a highly oblique impact angle. It seems that both pairs may indeed be the product of the impact of double meteorites.

The idea is in fact not new having been examined by R. W. Tanner in 1963 (*J. R. astr. Soc. Can.* **57**, 109). Recently it has been considered in greater detail by P. D. Noerdlinger (*Icarus* in the press) who, after an exhaustive study of tidal disruption mechanics, confirms that Tanner's analysis is essentially correct. In the general case of tidal rupture at a distance of several Earth radii the separation that fragments achieve approximates only the initial radius of the parent body. Overlapping or nested craters will result. It is conceivable that the separation found at the terrestrial crater pairs might be achieved by tidal or atmospheric rupture of a body of low strength which, entering at an oblique angle, became a satellite for several orbits. Clearly such an event has an extremely low probability, but the Ries-Steinheim and Clearwater pairs are two occurrences in a total population of approximately two dozen large ($\sim$ 20 km) craters (Grieve & Robertson *Icarus* **38**, 212; 1979). Once again the existing crater statistics argue that multiple cratering events, even in this size range, are not of great rarity.

On the other hand Noerdlinger contends that the population of meteoroid doubles is also probably small. Rupturing an asteroid so that the pieces remain in close association requires a delicate balance between the energy of fragmentation, gravity and angular momentum. The association may also be difficult to maintain for any appreciable time. The entire life cycle of double meteoroids and asteroids is in need of a careful, quantitative evaluation of the circumstance under which they can form and their subsequent stability before final capture, separation or disintegration. Such a study would be relevant to another important issue — the formation and lifetime of ring systems as now revealed in spectacular detail by the Voyager images of Jupiter and Saturn.

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