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Function of Pointed Premolars in *Phenacolemur* and Other Mammals

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Phenacolemur pagei is an archaic Paleocene fossil primate about the size of a small squirrel. Its mandibular dentition is highly reduced; it consists only of an elongated narrow procumbent incisor that is followed by a single, greatly enlarged pointed premolar (fourth premolar) and then the normal complement of three molars. Figure 1 shows that the living Australian marsupial gliders (genus *Petaurus*) are about the same size as *Phenacolemur;* they have a similar mandibular dentition, with an enlarged procumbent incisor and a large pointed cheek tooth followed by three molars. *Petaurus* feeds on insects, buds and blossoms, fruit, eggs, mice, and possibly small birds (WINTER, *J Mammal* 47: 530, 1966). Because its dentition is so similar to that of *Petaurus,* we can infer that *Phenacolemur* was equally omnivorous. Why have these animals, particularly *Phenacolemur,* evolved a greatly enlarged, pointed tooth at the front of the molar series? This question can be answered partially by determining the tooth's function.

Dental function in the living opossum (*Didelphis*) has been studied by cineradiography (CROMPTON and HIIEMAE, *Zool J Linnean Soc* 49: 21, 1970). In extinct mammals cineradiography is impossible, but much can be learned from detailed study of the minute striations on wear facets produced on the teeth during mastication (GINGERICH, *Am J Phys Anthropol* 36: 359, 1972). Most wear facets in *Phenacolemur* indicate upward, forward, and medial buccal-phase, or grinding lingual-phase movements of the mandible during mastication (Fig 1,*B*).

A number of specimens of *Phenacolemur* (Princeton University [PU] numbers 13277, 14528, 16218, and so on) have a wear facet on the anterolateral side of the apex of the pointed mandibular premolar and a matching facet on the posteromedial side of the apex of the principal cusp of the maxillary third premolar. Striations on these facets indicate an upward and backward orthal retraction movement of the mandible during function (Figs 1*B,* 2). Since the facets are at the apexes of the cusps, they indicate point-to-point occlusion. The function of this mode of occlusion is undoubtedly to puncture food during early stages of mastication. Other cheek teeth in *Phenacolemur* and in *Petaurus* have flat crowns, and in each, the puncturing function of the dentition as a whole is concentrated in a single anterior cheek tooth. The most powerful biting in generalized mammals such as *Phenacolemur* occurs as the mandible is drawn upward and backward, chiefly by the temporal muscles (GINGERICH, *Postilla* 152: 1, 1971). Puncturing is the first step in breaking down a tough bolus of food; thus, it is not surprising that puncturing is correlated with powerful orthal retraction mandibular movements in *Phenacolemur.* More detailed observation of feeding in living marsupials with specialized puncturing teeth is needed to determine the circumstances and types of food requiring such a remarkably developed puncturing tooth.

Orthal retraction wear facets have not been detected on the specialized puncturing teeth of *Petaurus,* but they are well developed on these teeth in the related Australian genus *Phalanger* (Peabody Museum no. 6372). The dental adaptations of living phalangeroid marsupials parallel closely those of the known Paleocene primates, and with further study promise to provide additional insight into the paleobiology of these extinct forms.

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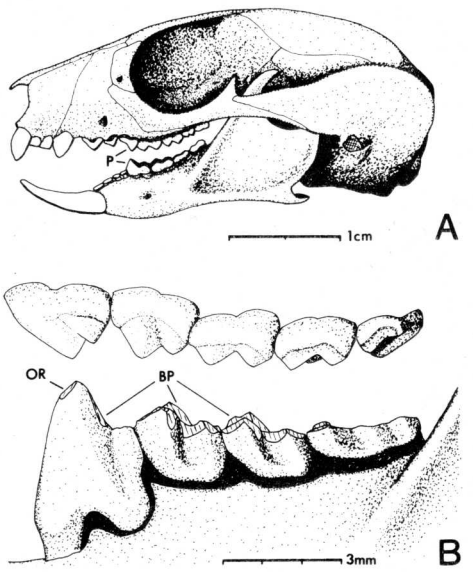

FIG 1.—*A,* skull of *Petaurus; P* identifies puncturing teeth. *B,* left upper and lower cheek teeth of *Phenacolemur pagei* (PU no. 14528, 16218) in lateral view; *BP* indicates buccal-phase facets; *OR* indicates apical orthal retraction facet.

FIG 2.—Left fourth premolar and first molar of *Phenacolemur* (PU no. 13277); arrow points to striated apical facet (mag approximately × 10).