

A new, unusual therian mammal from the Upper Cretaceous of Saskatchewan, Canada

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Abstract

An incomplete lower jaw with teeth documents the presence of a new genus and species of placental mammal from the Upper Cretaceous (Lancian; late Maastrichtian) Frenchman Formation, Saskatchewan, Canada. This new mammal is characterized by highly compressed lower molars that decrease in size from m1 to m3 and superficially resemble the molars of Tertiary Mesonychia. These resemblances, however, are interpreted as convergent, and the new mammal is classified in its own family and incertae sedis at the ordinal level. This new mammal thus joins other recent discoveries in western Canada of mammals of Tertiary aspect (Condylarthra; Taeniodonta) occurring in the Late Cretaceous.

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1. Introduction

The known fossil record of Late Cretaceous marsupial and placental mammals consists of species having primitive tribosphenic molar teeth in which a neomorphic lingual apical cusp on the upper molars occluded within a newly evolved basined talonid or heel on the lowers, and a tricuspid trigonid of the lower molars fitted within the triangular embrasures between the uppers (Simpson, 1936; Butler, 1961; Crompton, 1971; Kielan-Jaworowska et al., 2004: fig. 11.1C). It is now well established that the adaptively diverse molar morphologies of all Cenozoic marsupial and placental mammals—from opossums to kangaroos and armadillos to elephants—were evolutionary modifications of this relatively simple ancestral pattern. Moreover, until now this pattern has been the only one known to occur in Late Cretaceous marsupials and placentals: the molar differences that allow recognition and

classification of these taxa down to species level have not erased this pattern nor even transformed it in any substantial way (see Kielan-Jaworowska et al., 2004, and references therein for specimen illustrations).

In this paper, we describe an incomplete lower jaw (dentary) with teeth that is an exception to this generalization; it is from a late Mesozoic therian mammal that has departed significantly from the ancestral tribosphenic molar pattern. This specimen is from a locality (Fig. 1) in the Upper Cretaceous Frenchman Formation, Saskatchewan, Canada, and unexpectedly exhibits a more advanced molar morphology than previously discovered in any Mesozoic therian, from North America or elsewhere. In some features, the teeth of this specimen resemble those of certain mesonychian mammals: mesonychians are Paleocene and Eocene archaic placentals (= Eutheria in this paper) mostly known from Asia and North America that evolved a highly specialized flesh-eating dentition (Szalay, 1969a,b). It is concluded, however, that these dental resemblances with mesonychians are convergent and that the specimen represents a new placental lineage that presently lacks known ancestors or descendants.

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Fig. 1. Map of Saskatchewan, Canada, showing location of type locality of *Nanocuris improvida* gen. et sp. nov.

Institutional abbreviations.—RSM P, Palaeontological Collections of the Royal Saskatchewan Museum, Regina, Saskatchewan; UALVP, Laboratory for Vertebrate Paleontology, University of Alberta, Edmonton, Alberta. All measurements are in millimeters (mm).

2. Systematic palaeontology

Class: Mammalia Linnaeus, 1758

Subclass: Theria Parker and Haswell, 1897

Infraclass: Eutheria Gill, 1872 (emended Huxley, 1880)

Order: incertae sedis

Family: Nanocuridae fam. nov.

Genus: *Nanocuris* gen. nov.

Derivation of name. From *nanos*, Greek, “dwarf”, and *kouris*, Greek, “razor”; in reference to the small, blade-like lower molars of this species

Type species. *Nanocuris improvida* sp. nov.

Generic diagnosis. As for the type and only species.

Nanocuris improvida sp. nov.

Figs. 2, 3

Derivation of name. From *improvidus*, Latin, “not anticipating”, in regards the unexpectedly early stratigraphic occurrence of this dentally specialized placental.

Holotype. RSM P2523.260, incomplete right dentary containing the canine, p1, m3, and the broken roots of other teeth.

Type locality and horizon. RSM P2523.260 was recovered from a quarry in the Upper Cretaceous Frenchman Formation. The quarry was excavated beginning in 1994 by the Royal Saskatchewan Museum to collect an incomplete skeleton of the large theropod dinosaur *Tyrannosaurus rex* (see Tokaryk and Bryant, 2004). RSM P2523.260 was found *in situ* in the

quarry while trenching around part of the dinosaur skeleton. The quarry is located in Chambrey Coulee, southeast of Eastend, Saskatchewan (Fig. 1), on the north bank of the Frenchman River (precise locality data are on file at the Earth Sciences Unit, Royal Saskatchewan Museum, and are available for qualified investigators).

The Frenchman Formation is widely distributed in southwestern Saskatchewan and consists of continental, flat-lying fluvial sandstones and siltstones deposited on an aggrading coastal plain adjacent to the Western Interior Seaway, then undergoing its final retreat. The formation has yielded a rich vertebrate fauna diagnostic of latest Cretaceous time (Lancian North American Land Mammal Age, approximately equivalent to the late Maastrichtian age of marine stratigraphy and ending at the end of the Cretaceous [contra Cifelli et al., 2004]), including, in addition to *Tyrannosaurus rex*, several species of lizards (Gao and Fox, 1996), the dinosaurs *Edmontosaurus saskatchewanensis* (Hadrosauridae), *Torosaurus latus* and *Triceratops horridus* (Neoceratopsia) (Weishampel, 1990), and multituberculate and therian mammals (Johnston, 1980; Johnston and Fox, 1984; Fox, 1989, 1997; Storer, 1991). The Frenchman Formation is conformably overlain by the Ferris (= Number 1) Coal Seam, a regional field marker of the K/T boundary, as documented by an associated boundary clay, iridium anomaly, diagnostic palynofloral change, magnetostratigraphy (the boundary is contained in chron 29R), and radioisotopic dates, all recorded from the vicinity of the type locality (e.g., Lerbekmo, 1985). The *Tyrannosaurus* quarry is 28.3 m below this boundary (McIver, 2002; Tokaryk, 2002; Tokaryk and Bryant, 2004); hence, *Nanocuris improvida* lived in Lancian time, but well prior to the end of the Lancian and, hence, the end of the Cretaceous.

Diagnosis. A placental mammal that is diagnosed by the following unique combination of characters: large relative to most of its North American contemporaries; lower canine slightly procumbent; p1 small, two-rooted, separated from the canine by a short diastema; p2 substantially larger than p1; p4 with well-developed talonid; lower molars decreasing in size from m1 to m3; m1-3 labiolingually compressed, with narrow, posteriorly elongate talonid; m3 with obtuse trigonid angle, of nearly 180°; m3 talonid trenchant, lacking a basin; large neurovascular(?) channel and foramen opening medial to canine.

3. Anatomical description

RSM P2523.260 (Figs. 2, 3) is an incomplete right dentary that was recovered in two pieces, an anterior fragment containing a canine tooth and the remnant of an anterior-most premolar, and a posterior fragment that contains parts of the four posterior-most teeth and the base of the coronoid process. The bone between these two fragments is missing, having been lost before the specimen was recovered. From resemblance in size, colour, condition of the fragments, and proximity to each other when discovered, there can be no doubt that they pertain to a mandibular ramus from a single individual. In comparison to the dentary of most other North American

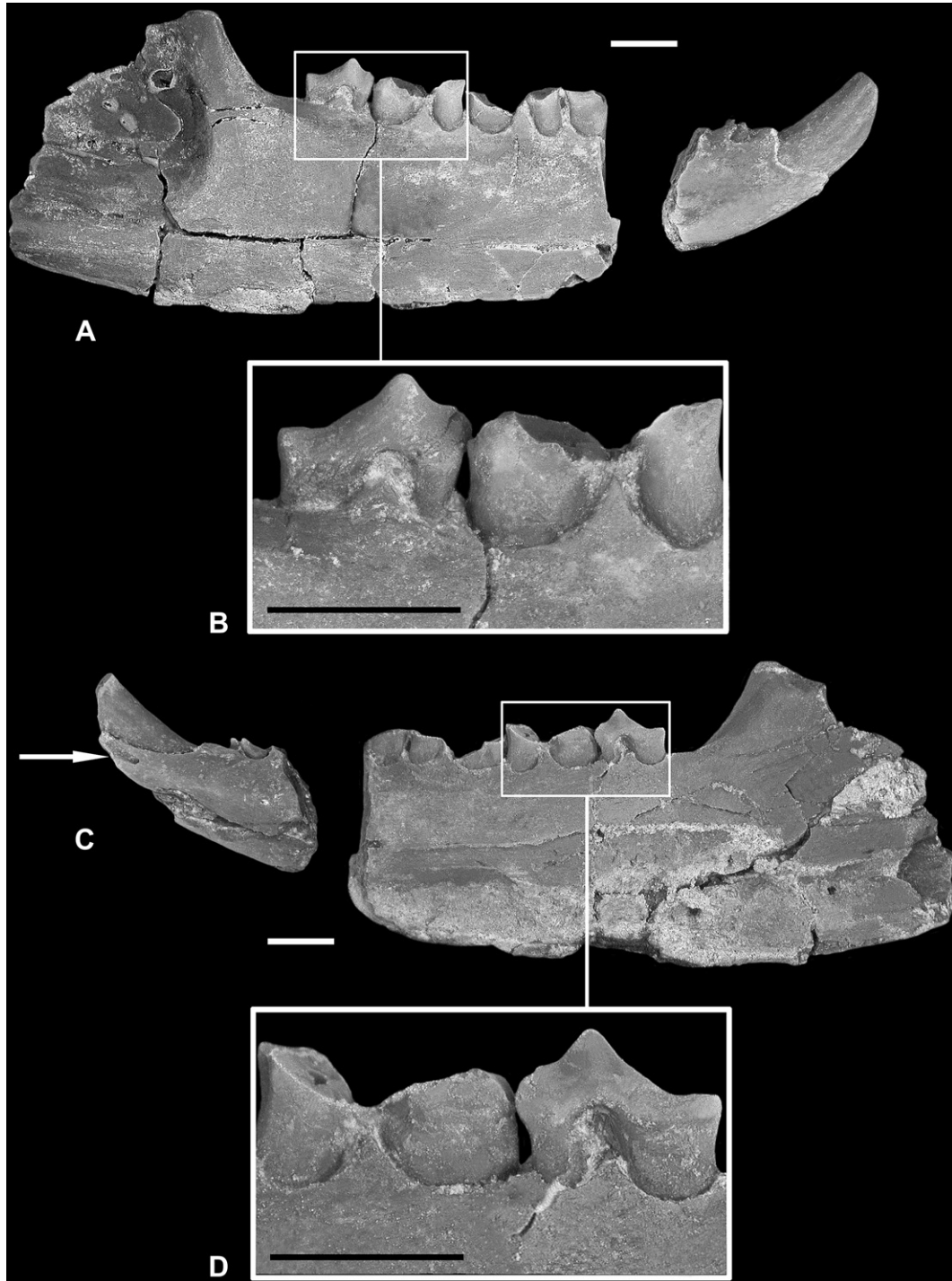


Fig. 2. *Nanocuris improvida* gen. et sp. nov. RSM P2523.260 (holotype), incomplete right dentary containing the canine, p1, m3, and the broken roots of other teeth in (A, B) labial, (C, D) lingual views. Arrow indicates neurovascular channel and foramen medial to canine. Scale bar = 3 mm.

Lancian mammals, RSM P2523.260 is relatively large, approaching the size of that of the didelphodontan *Cimolestes magnus* Clemens and Russell, 1965 or of the taeniodont *Schwalteria clemensi* Fox and Naylor, 2003, species that appear to have been among the largest North American Late Cretaceous mammals known (e.g., Weil, 2005). The dentition of RSM P2523.260 is poorly preserved: several teeth are broken and the unbroken teeth show evidence of diagenetic dissolution

of the enamel. Nonetheless, enough of the dentition is intact to characterize this unusual genus and species as new.

The canine (Figs. 2A, C; 3B) is in place in the anterior fragment of RSM P2523.260; its tip has been broken off postmortem, but the crown is stout, recurved, becomes more slender apically, and was probably pointed. In cross section, it is nearly flat on its medial side, but is convex laterally. It is deeper than wide; as it exits from the dentary, it occupies



Fig. 3. *Nanocuris improvida* gen. et sp. nov. RSM P2523.260 (holotype), incomplete right dentary containing the canine, p1, m3, and the broken roots of other teeth. (A, C) posterior fragment, (B) anterior fragment; occlusal views, in stereophotographic pairs. Scale bar = 3 mm.

nearly the entire depth of the bone, and is single-rooted. The ventral border of the canine turns sharply dorsally about two-thirds along the preserved length of the crown from the alveolar rim; there is no corresponding change in the curvature of the dorsal border of the tooth. The canine also appears to have been somewhat procumbent. After leaving the alveolus, its crown does not rise as steeply as does that of the lower canine of the Virginia opossum, *Didelphis virginiana*, for example, or of the grey wolf, *Canis lupus*, but leans somewhat more anteriorly. The dentary is not preserved anterior to the canine, so the number, position, and configuration of the lower incisors cannot be determined, but from the shallowness of the anterior-most extremity of the dentary as preserved medial to the canine (Fig. 2C), the incisors were probably small, possibly procumbent, and reduced in number. From a break in the medial side of the dentary, it can be seen that the root of the canine extends at least as far posteriorly as beneath the first premolar.

Posterior to the canine and separated from it by a short diastema is a small two-rooted tooth (Figs. 2A, C; 3B). Its crown has nearly been eroded away, but a basal remnant is still in place, forming a slender bridge between the two roots, which have also been deeply eroded in the exposed parts external to their alveoli. As the roots enter the dentary, however, they expand to nearly fill the alveoli and hence, must be at, or close to, their original cross-dimensions there. The posterior root is somewhat the larger in diameter and is offset posterolingually from the anterior root. Both roots are subcircular in cross section; they enter the dentary obliquely posteroventrally, with the anterior root the more nearly vertical. From its position relative to the canine and in the absence of evidence to the contrary, we identify this tooth as p1.

The anterior fragment of the dentary is broken immediately posterior to p1. The broken surface is fresh, implying that the damage occurred during excavation of the *Tyrannosaurus* quarry or sometime thereafter, before the specimen was recognized and its pieces salvaged. The anterior wall of a large alveolus is exposed along the broken surface. This alveolus was vertical and penetrated to about two-thirds of the depth of the dentary and contains a remnant of the root in its deepest part. From the parts of the alveolar wall that remain, this alveolus, when complete, was substantially larger in diameter than either of the alveoli for p1, implying that a substantially larger tooth, which we identify as p2, occupied this locus. There is no diastema between p1 and p2. The anterior alveolus of p2 is directly in line with the canine and the anterior alveolus of p1 (Fig. 3B). The posterior root of p1 is lingual to this line, further corroborating the oblique orientation of p1.

The posterior fragment of RSM P2523.260 is about 2.5 times the length of the anterior fragment. Its anterior edge is also freshly broken but does not fit on to the anterior fragment, implying, as noted above, that a middle section of the dentary is missing. The posterior fragment contains the remains of four teeth, which, for reasons that we discuss below, are probably m1-3 plus the posterior part of the next anterior-most tooth, which we identify as p4. If so, p2-3 and the anterior part of p4 have been lost. The p4 is represented by its talonid, which is incomplete, and by the talonid root (Figs. 2A, 3A).

The occlusal surfaces of the p4 talonid have been split off, but from what can still be seen, the talonid was originally robustly developed. It was anteroposteriorly elongate and juts posteriorly beyond the posterior root (Fig. 2A), with its long axis slightly skewed labially. Its posterior margin is smoothly rounded and abuts against the anterior side of m1. If there was an interlock between these two teeth, the present broken surface of the talonid is ventral to it and the cuspules and/or grooves forming the interlock have been lost. In its exposed part between the talonid and the alveolar rim, the posterior root is transversely narrow. In cross section, it is nearly twice as long anteroposteriorly as it is wide and extends ventrally to just above the mandibular canal.

The crowns of m1-2 are broken and incomplete, while that of m3 is unbroken but eroded (Figs. 2, 3). In spite of the severe damage that these teeth have sustained, enough remains of them to suggest two features of paramount importance in documenting the distinctiveness of *Nanocuris improvida*: 1) m1-3 are strongly compressed labiolingually, and 2) they decrease in length posteriorly along the row. The m1 is represented by only its roots, which were broken off between the alveoli and the base of the crown. The anterior root is ovate in cross section, being slightly longer anteroposteriorly than wide, and descends anteroventrally into its alveolus. The posterior root is labiolingually compressed, is nearly 2.5 times as long anteroposteriorly as wide and in cross section is about twice as long anteroposteriorly as the anterior root; from what little of the root is exposed, it appears to be vertical. The unusual proportions of the root cross sections imply that the crown of m1 was labiolingually compressed (Fig. 3A); moreover, these proportions suggest that the trigonid may have been slightly wider than the talonid, and that the talonid was narrow and posteriorly elongate. Its remnant projects posteriorly beyond the posterior root (Fig. 2A). From the size of the posterior root, the talonid of m1 was substantially longer than that of p4.

As indicated by the cross dimensions and spacing of its roots, m2 was anteroposteriorly shorter than m1 but was labiolingually compressed, as well (Fig. 3A). Virtually all of the crown is missing, having been broken away between excavation and discovery of the fossil, but part of its base remains anteriorly. It and the root immediately beneath are marked by a broad, shallow anterior groove. Overall, however, the anterior root is subcircular in cross section and like that of m1, descends ventrally and slightly anteriorly. The posterior root is labiolingually compressed and anteroposteriorly elongate, but is shorter in cross section than that of m1. It is narrower than the anterior root, implying that the talonid of m2 was narrower than the trigonid, and in its exposed parts is nearly vertical, but angles slightly posteriorly.

The m3 (length = 3.2 mm; Figs. 2, 3) is the shortest of the lower molars and was probably lowest as well: it is only slightly taller than the lowermost parts of the base of the crown of m2 that remain (Fig. 2B, D). From the size and spacing of its roots, m3 is smaller relative to m2, than m2 is to m1. The crown of m3 is not broken away but its enamel has been eroded diagenetically, undoubtedly erasing fine morphological details, although its major features still appear to be intact. As

preserved, m3 exhibits evidence of four cusps (Figs. 2B, 3C). Anteriorly, a low swelling arises slightly lingual to the midline of the crown; this swelling must be the paraconid although no distinctive features of the cusp itself can be determined (part of the cusp has been chipped, during excavation of the specimen or thereafter). The protoconid, the dominant trigonid cusp, is high, pointed, labiolingually compressed, and triangular in side view. It is positioned nearly directly posterior to the paraconid and is erect, i.e., it does not lean posteriorly. A long sloping, steep-sided paracristid descends from the apex of the protoconid to the paraconid. As it nears the paraconid, it turns slightly lingually but is anteroposteriorly oriented through most of its length. A second narrow crest, the protocristid, descends posteriorly from the protoconid apex. It is longer than the paracristid and its angle of descent is slightly shallower (less steep). At its posteroventral extremity, the walls of the protocristid are faintly swollen (Fig. 2B); we interpret this swelling to be a small metaconid, located well posterior and only slightly lingual to the level of the protoconid. As a consequence of the extreme labial positions of the paraconid and metaconid relative to the protoconid, the trigonid is transversely narrow and broadly open lingually, with a trigonid angle of nearly 180°, i.e., the trigonid cusps are arranged in a nearly straight anteroposterior line (Fig. 3C). This pattern is in marked contrast to the disposition of these cusps on the lower molars of all previously known Mesozoic tribosphenic therians, in which the trigonid angle of the ultimate lower molar is less than 90°, often substantially so (see figures in Kielan-Jaworowska et al., 2004).

Once past the metaconid of m3, the posterior crest becomes horizontal and continues along the length of the talonid as a trenchant ridge having steep labial and lingual sides. At its posterior-most extent, the talonid crest is somewhat inflated, presumably representing the ancestral posterior-most talonid cusp, the hypoconulid. Lingually, a low ridge extends along the side of the talonid, but this is probably an erosional feature and not original. The morphology of the talonid of m3 provides no evidence that a talonid basin was developed: the talonid is a narrow and elongate structure and was undoubtedly so before erosion of its enamel cover, and it is narrower than the trigonid. There is no trace of a hypoconid or entocoid. On functional grounds, these cusps would not be expected to have been developed in the absence of a talonid basin, making their absence on the m3 virtually certain to be original and not an artifact of preservation. No carnassial notches are evident at the junctions between crests and cusps, i.e., between the paraconid and paracristid, along the protocristid, or between the talonid crest and the metaconid. The anterior root appears to be subcircular in cross section and is vertically emplaced, unlike the anterior root of m1 and m2. The posterior root, which slopes slightly posteriorly, is labiolingually compressed and in cross section is anteroposteriorly elongate beneath the elongate talonid. These proportions give substance to the conclusion that the talonid of m1 and m2 was narrow and elongate, as well. On m3, a faint anterior groove extends from the base of the crown down the anterior root partway to the alveolar rim; whether it continues along the root within the alveolus cannot be determined.

The mandibular corpus of RSM P2523.260 (Fig. 2A, C) also displays features that seem no less peculiar than those of the dentition. Through much of its length, the corpus is unusually deep relative to the height of the teeth (even taking into account their poor preservation). It is deepest posteriorly, behind the level of the posterior-most molar, and becomes gradually shallower anteriorly, and at its anterior-most extremity, it is little deeper than the canine itself; moreover, its ventral border is relatively straight. Usually, the dentary of Late Cretaceous tribosphenic therians is deepest beneath the molars and its lower border is ventrally convex, lending the mandibular corpus a shallowly “boat-shaped” outline in lateral view. Medial to the canine and dorsal to the mandibular symphysis in RSM P2523.260, a conspicuous foramen opens into a channel that runs anteriorly and progressively widens as it approaches the broken anterior edge of the bone; this presumably is a neurovascular channel, but has no counterpart on the dentary of other mammals known to us. On the anterior fragment, a large mental foramen opens laterally beneath p2. On the posterior fragment, the masseteric fossa is incomplete (Fig. 2A), but enough remains to show that it is unusually deep, and its borders are sharply defined in comparison to the same parts in, for example, *Didelphis virginiana*. There is no evidence of a labial mandibular foramen inside the masseteric fossa as occurs in many early therians. The raised crest delimiting the masseteric fossa anteriorly does not extend anteroventrally down on to the side of the mandibular corpus as in *Schowalteria clemensi*, *Cimolestes cerberoides* Lillegraven, 1969 (UALVP 2255), or *D. virginiana*, leaving the fossa to terminate ventrally well above the ventral edge of the dentary, an unusual configuration. In contrast, the pterygoid fossa appears to have been only shallowly developed, but the medial side of the dentary is crushed and otherwise poorly preserved, making a definitive interpretation of the original features of this surface impossible. A broad, anteroposteriorly discontinuous horizontal groove along the medial side of the dentary is almost certainly an artifact of the crushing that the specimen has sustained and is not a Meckelian groove or other original feature. At the broken posterior end of the dentary, a part of the dorsal rim of the mandibular foramen is preserved beneath the pterygoid fossa (Fig. 2C). From the curvature of this remnant, the complete foramen appears to have been relatively large.

4. Comparisons and taxonomic discussion

Among presently known late Mesozoic mammals, marked labiolingual compression of the lower molars is a distinctive feature of only the Eutriconodonta, an archaic lineage of non-therians from the Jurassic and Cretaceous in which the major cusps on the molars are arranged serially, more or less in an anteroposterior line (Kielan-Jaworowska et al., 2004). The Saskatchewan specimen, however, is clearly not from a eutriconodontan: as described above, the ultimate molar of RSM P2523.260 has an elongate, robust talonid, a morphology radically different from that in eutriconodontans, in which no

talonid is developed on any of the lower molars (Kielan-Jaworowska et al., 2004).

The morphology of m3, the only molar of RSM P2523.260 in which the crown remains, provides the most useful evidence as to the broad relationships of *Nanocuris*. We interpret this tooth as being of specialized tribosphenic construction, i.e., modified from an ancestor in which the m3 trigonid had three well-developed cusps arranged in a triangle and the trigonid angle was less than 90°, the talonid was tricuspid and basined, and the upper molar protocone occluded within the basin of the talonid (Simpson, 1936; Bown and Kraus, 1979; Kielan-Jaworowska et al., 2004). Whether the talonid of m1-2 was basined and tricuspid in RSM P2523.260 cannot be determined, although the proportions of the posterior root of these teeth (Fig. 3) at least suggest that the talonid was elongate and narrow, as on m3. Hence, if a talonid basin was developed on these teeth, it must have been narrow, as well. Nonetheless, we assume that m1-2, just as m3, of *Nanocuris* had been modified from ancestors having generalized tribosphenic crowns at these loci. Although the lower molars of pretribosphenic Jurassic/Cretaceous peramuran “eupantotheres” have a narrow talonid, it is significantly shorter than that in *Nanocuris*. There is no upper molar protocone in peramurans, although some have an incipient talonid basin (see, for example, Clemens and Mills, 1971; Kielan-Jaworowska et al., 2004), a feature that is absent from at least m3 in *Nanocuris*. Although a latest Cretaceous occurrence of peramurans is not impossible (their present youngest record is from the Early Cretaceous [Kielan-Jaworowska et al., 2004]), lacking unambiguous evidence to the contrary we find it an unlikely alternative.

From what can be determined of lower molar morphology in RSM P2523.260, we infer that the upper molars were anteroposteriorly elongate, the protocone was little expanded lingually, and the embrasures between the upper molars were transversely shallow and anteroposteriorly elongate — all modifications emphasizing specialized anteroposterior molar shear, with little or no capacity for crushing and little capacity for transverse movement of the lower molars across the uppers as the lower jaw was elevated. In respect to M3, at least, the protocone would have occluded against the labial side of the talonid crest of m3, and hence was unable to function as a mortar and pestle in interaction with a talonid basin. If our inferences about coronal morphology of m1-2 as based on m3 are correct, then we anticipate that the stylocone and conules were weakly developed on the upper molars. Indeed, these cusps may well have been lacking altogether in *Nanocuris*, lost as a correlate of the evolution of a specialized anteroposterior molar shearing function in transversely narrow crowns that consisted mostly of a blade-like paracone and metacone.

We know of no Mesozoic tribosphenic therians other than *Nanocuris* in which the lower molars are strongly compressed labiolingually and decrease in size posteriorly. Among mammals of Tertiary age of possible relevance, advanced South American borhyaenoid marsupials have bilaterally compressed lower molars, but these increase in size from anterior to posterior, not decrease, and the talonids are anteroposteriorly short to absent altogether (Thenius, 1989). Similar

increase in size posteriorly is seen in the lower molars of certain hyaenodontid and oxyaenid creodonts, archaic carnivorous placentals first known from the Paleocene, but while the lower molars of creodonts can be as narrow as those of RSM P2523.260 and the trigonid angle as obtuse, the paraconid is enlarged and bladelike in these species, and the talonid is reduced or even absent (Thenius, 1989; Gunnell, 1998). Among known Tertiary terrestrial mammals, the Mesonychia (=Acreodi of McKenna and Bell, 1997) are most like RSM P2523.260 in the configuration of the lower molars: for example, in advanced mesonychians (Mesonychidae; Hapalodectidae), the lower molars are bilaterally compressed, the talonid single-crested and trenchant, and in some species, a re-entrant groove is developed on the anterior face of the anterior root of the molars (Ting and Li, 1987). RSM P2523.260, however, probably does not pertain to a mesonychian: on the mesonychian m3, the metaconid is located lingual to the protoconid or, in some species, even slightly in advance of it, not well posterior to it (Matthew, 1937; Szalay, 1969a,b; Ting and Li, 1987; Lopatin, 2001), as in RSM P2523.260. Moreover, in mesonychians, the talonid on m3 tends to be reduced, not elongated (Zhou, 1995), and in the premolariform lower molars of typical mesonychians, deep notches are developed between the paraconid and protoconid, and protoconid and talonid (Zhou, 1995), but no notches are evident on m3 of RSM P2523.260. In the advanced mesonychian family Hapalodectidae, the taxon having blade-like lower molars most like m3 of RSM P2523.260, the lower molars increase in length posteriorly (Szalay, 1969a; Lopatin, 2001), not decrease. These differences reflect fundamental incongruities in lower molar morphology, leading us to conclude that the bilateral compression and trenchant talonid as preserved in RSM P2523.260 are convergent on similar features in advanced mesonychians and, hence, are not evidence of relationship.

Although *Nanocuris* is not a mesonychian, it is concluded that it is a placental not a marsupial, based on our identification of p4 as the first tooth in the posterior fragment of RSM P2523.260. If this tooth were p3, as would be the case if RSM P2523.260 were from a marsupial, only three lower molars were presumably present in this specimen, but four is the primitive number of molars in marsupials and the number of molars in each jaw quadrant in all Cretaceous marsupials for which the articulated dentition is now known (Kielan-Jaworowska et al., 2004). Moreover, the talonid on p3 of primitive marsupials is small in contrast to the talonid of this tooth, which although damaged, was clearly originally robust and more placental-like in that regard. If this tooth were the first of four molars, as in a marsupial, the largest lower molar on the specimen would then be m2, as in the Lancian bunodont marsupial *Glasbius intricatus* (see Clemens, 1966: 25), but in all other Cretaceous marsupials known to us, the lower molars increase in size from m1 to m3, or even to m4 as in Stagodontidae (Clemens, 1966; Fox, 1981). In contrast, decrease in size of the lower molars from m1 to m3 is not uncommon in early placentals, having evolved independently in, for example, Late Cretaceous Zalambdalestidae (Wible et al., 2004), Paleocene erinaceids (Krishtalka, 1976), picrodontids

(Scott and Fox, 2005), the pentacodontids *Pentacodon* and *Aphronorus* and the early Tertiary Plagiomenidae (RCF: pers. obs.), and the mesonychid *Harpagolestes* (Szalay, 1969b). Primitively, m2 appears to have been the largest lower molar in placentals; in its departure from this primitive pattern, *Nanocuris* thus parallels a number of early placental species and on that account is more probably a placental.

From the evidence furnished by its surprisingly derived dentition, we are unable to refer *Nanocuris* to a currently recognized order of placental mammals and so classify it incertae sedis at the ordinal level. To express the distinctiveness of *Nanocuris* relative to all other known mammals (regardless of what its relationships may finally prove to be), we erect a monotypic family for its reception, finding this to be a utilitarian, informative function of suprageneric classification even if the containing family is monotypic, as is Nanocuridae at present. Whereas it seems likely that *Nanocuris* is also a member of a previously unknown order of placental mammals, we have concluded that it would be premature to name a new order for its reception until more extensive evidence concerning its morphology becomes available. In any case, *Nanocuris* joins Condylarthra and Taeniodonta as a placental mammal of progressive, Tertiary, aspect from the Late Cretaceous, all uniquely documented at present by the fossil record of western Canada (Johnston, 1980; Johnston and Fox, 1984; Fox, 1989, 1997; Fox and Naylor, 2003).

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