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PRAEKOGIA CEDROSENSIS, A NEW GENUS AND SPECIES OF FOSSIL PYGMY SPERM WHALE FROM ISLA CEDROS, BAJA CALIFORNIA, MEXICO

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PRAEKOGIA CEDROSENSIS, A NEW GENUS AND SPECIES OF FOSSIL PYGMY SPERM WHALE FROM ISLA CEDROS, BAJA CALIFORNIA, MEXICO[1, 2]

By LAWRENCE G. BARNES[3]

ABSTRACT: The new genus and species, *Praekogia cedrosensis,* is an extinct fossil pygmy sperm whale. Its known osteology is based upon a cranium without the rostrum, recovered from marine sedimentary rocks identified as the Almejas Formation on Isla Cedros, Baja California, Mexico. The geologic age of *Praekogia cedrosensis* is concluded to be early Pliocene in the broad sense. The base of the Almejas Formation, stratigraphically below the stratum that produced *Praekogia,* rests unconformably upon Temblor-age Miocene rocks, and mollusk-bearing beds of middle to early late Pliocene age overlie the site. *Praekogia* is an ideal antecedent for the living pygmy sperm whale, *Kogia* Gray with a less telescoped braincase and fewer cranial specializations.

INTRODUCTION

During the summers of 1964 and 1965, members of the Department of Geological Sciences at the University of California at Riverside were engaged in extensive collecting in late Tertiary marine sedimentary deposits on Isla Cedros which lies off the western coast of Baja California, Mexico. The existence of vertebrate fossils was brought to the attention of vertebrate paleontologists by Frank H. Kilmer of Humboldt State University, Arcata, California, who has been studying the geology and invertebrate paleontology of Isla Cedros. In 1964 Kilmer, with David P. Whistler and George Jefferson, of the University of California at Riverside, travelled to Isla Cedros and collected the fossil skull of the pygmy sperm whale that forms the basis of this paper. The following year (1965) Kilmer was joined by Whistler and Richard H. Tedford from the University of California at Riverside and Juan Felix from the University of Baja California at Ensenada. They made a large collection of fossil marine vertebrates, including one of the most diverse fossil cetacean assemblages known from the Pacific coast of North America (Barnes, 1972: 114-264).

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Marine sediments of Miocene and Pliocene age are exposed at the southeast end of Isla Cedros, Baja California, and near the middle of the east side of the island (Hanna, 1927). The younger parts of these sediments have been called the Salada Formation (Hertlein, 1925) and the Almejas Formation (Durham and Allison, 1960), both of which are generally regarded as Pliocene in age and have their type sections on the mainland of Baja California. The name Salada Formation was considered not applicable for the younger sediments on the island by Jordan and Hertlein (1926) and the name Almejas Formation is used in this paper.

The fossil vertebrates collected in 1964 and 1965, including the pygmy sperm whale studied herein, were quarried from the exposures in deep canyons and on ridges near the base of the escarpment that forms the northwest wall of Valle Blanca at the southeast end of Isla Cedros. Here, about 800 feet of lightly colored sands and gravels, of Pliocene age, unconformably overlie Miocene strata (Luisian age) of the Tortuga Formation (Hanna, 1927). The geology and invertebrate paleontology of the island have been studied by several writers (Hertlein, 1925; Jordan and Hertlein, 1926; Hanna, 1927; Beal, 1949) and the Pliocene sediments were correlated with mainland exposures of the Almejas Formation at Bahia de las Tortugas (Mina, 1957; Durham and Allison, 1960) and with the San Diego Formation, which has an age of middle Pliocene to early late Pliocene (Jordan and Hertlein, 1926).

From their studies, Jordan and Hertlein concluded that the Almejas invertebrate fauna on Isla Cedros contained a mixture of some cool water species and mostly warm water species, with an ocean water temperature like that prevalent today around Isla Cedros.

The marine vertebrates from the Almejas Formation, however, are not associated with the invertebrates. All the invertebrates occur in algal conglomerate beds stratigraphically above the basal 100 to 120 feet of strata bearing the vertebrates. Kilmer has suggested (in litt. to Charles A. Repenning) that an unconformity may lie above the vertebrate-bearing part of the formation. Therefore the cetaceans must be considered older than the age determination of middle to early late Pliocene based on invertebrates in overlying strata, and younger than the Luisian age placed on the disconformably underlying Miocene beds.

Howard (1971) has recently presented a study of the fossil birds that are part of the marine vertebrate assemblage from the Almejas Formation. She concluded that the birds appear to be early Pliocene in age, and are different from those comprising late Miocene and late Pliocene avifaunas. The present paper is the first to describe a mammal from the formation. The other cetaceans will be described in other studies in preparation.

The pygmy sperm whale described here is an extinct genus and species, represented by a braincase, and is the first fossil pygmy sperm whale cranial material reported in the literature.

Within the descriptive parts of this report I have made extensive com-

parisons with both living species of pygmy sperm whales, *Kogia breviceps* Blainville, 1838 and *Kogia simus* Owen, 1866 (see Handley, 1966). For the purposes of comparison with *Praekogia* the two living species of *Kogia* Gray, 1846 are almost identical. This does not imply the invalidity of either living species, but instead, indicates that the fossil skull differs from those of both living species in the same characters. Morphological comparisons will therefore be made at the generic level.

I have referred extensively to the published articles dealing with the anatomy of modern *Kogia* presented by Schulte (1917), Kernan and Schulte (1918), Raven and Gregory (1933), and Handley (1966), although I have not in all cases used the anatomical terminology used by any one of these writers.

ABBREVIATIONS

The following abbreviations are used in text:

LACM — Natural History Museum of Los Angeles County, Vertebrate Paleontology Section
UCMP — University of California, Museum of Paleontology.
UCR — University of California at Riverside, Department of Geological Sciences
mm — millimeter
cm — centimeter

The following abbreviations are used for bones and anatomical structures in illustrations:

Al — alisphenoid
Bo — basioccipital
Fr — frontal
Ju — jugal
Mx — maxilla
Oc — occipital
Pmx — premaxilla
Pt — pterygoid
Sq — squamosal
Vo — vomer

aon — antorbital notch
cc — carotid canal
eam — external auditory meatus
fhy — hypoglossal foramen
fio — infraorbital foramen
fop — orbital fissure
fp — falcate process of basioccipital
fmx — maxillary foramen
g — glenoid fossa
ji — jugular incisure
n — narial passage
occ — occipital condyle
pp — paroccipital process

ACKNOWLEDGMENTS

For their assistance in recording and interpreting the geologic and geographic source of the specimen I thank Richard H. Tedford, Frank H. Kilmer, and David P. Whistler. The cooperation and generosity of the former director of the Instituto de Geología of the Universidad Nacional Autónoma de México Ing. Guillermo P. Salas, the former acting director Luis Blásquez L., and the Mexican government are hereby acknowledged and recognized as having made possible the expeditions from the University of California at Riverside. Addi-

tionally, the assistance of personnel from the University of Baja California at Ensenada is gratefully acknowledged.

I thank Richard H. Tedford and Michael O. Woodburne for the privilege of studying the cetacean fossils from Isla Cedros that are housed at the University of California, Riverside. For their special assistance in obtaining materials I thank George Jefferson, Jacquelin Schoenwald, Robert T. Orr, and Robert E. Jones.

The line drawings were prepared by J. Patricia Lufkin (Figs. 1, 3, 5), staff artist in UCMP and by myself (Figs. 2, 4, 6). The photographic plates (Figs. 7-10) were prepared by Lawrence Reynolds of LACM. The Spanish summary was prepared by Alvaro Mones of the Museo Nacional de Historia Natural in Montevideo, Uruguay.

SYSTEMATICS

Family Physeteridae Gray, 1821

Subfamily Kogiinae Gill, 1871

Praekogia, new genus

Diagnosis of genus.–Kogiinae with small skull, slightly more than one-half the size of that of adult *Kogia breviceps* Blainville, 1838, cranium not foreshortened (telescoped) as in *Kogia* Gray, 1846, lateral maxillary crests high and with sharp margins, not rounded and inflated, forming nearly straight lateral margins of the supracranial basin, left premaxilla wraps around posterior side of left naris and joins in formation of sagittal facial crest in supracranial basin, left margin of this crest less developed than in *Kogia,* right margin of right premaxilla not forming a crest as in *Kogia* with deep fossa in its position, temporal fossa large with anteroposterior dimension greater than vertical dimension, lateral surface exposure of jugal between maxilla and supraorbital process of frontal very slender, bone texture of skull not inflated and porous as in *Kogia.*

Type species.–Praekogia cedrosensis

Praekogia cedrosensis, new species

Figures 1-10

Diagnosis of species.–Same as that for the genus until further species of *Praekogia* are described.

Holotype.–UCR 15229, an incomplete cranium lacking the rostrum, occipital crest, pterygoids, and with the left zygomatic process of the squamosal separated from the braincase.

Type locality.–UCR RV–7315, on the ridge west of "Arroyo Delphin," the first prominent drainage system to reach the shoreline north of the point where Valle Blanca reaches the shoreline, south of the cannery village, Isla Cedros, Baja California, Mexico.

Formation and age.–Almejas Formation, probably early Pliocene in the sense of Weaver et al., (1943). The holotype of *Praekogia cedrosensis* was collected from an ochre-yellow sand designated as unit O in Richard H. Tedford's field notes of 1965. The horizon is about 6 feet stratigraphically below the first and lowest prominent pebble conglomerate in the Almejas Formation as exposed at locality UCR RV-7315. This pebble conglomerate forms a prominent break in slope above the arroyo below. The site is also located approximately 120 feet stratigraphically above the base of the Almejas Formation (Tedford's field notes, 1965).

Below the base of the Almejas Formation unconformably lies the Miocene Tortuga Formation of Luisian age (Hanna, 1927). Molluscan fossils have been collected higher stratigraphically in the Almejas Formation than the type locality of *Praekogia cedrosensis.* They have been favorably compared with Mollusca from the San Diego Formation which is traditionally considered to be middle Pliocene to early late Pliocene in age (Jordan and Hertlein, 1926). Kilmer (in litt. to C.A. Repenning) has suggested that an unconformity may exist between the vertebrate-bearing strata and the overlying mollusk-bearing conglomeratic beds. A time gap may be indicated by this. The age of *Praekogia cedrosensis* must lie somewhere between Luisian age and middle Pliocene age, and may provisionally be placed at early Pliocene.

Rocks traditionally cited as being of early Pliocene age on the Pacific coast of North America (Weaver et al., 1943) may currently best be called late Miocene in age in light of recent interpretations of the Miocene-Pliocene boundary (Berggren, 1969: Table 1).

Collectors.–David P. Whistler and George Jefferson, 15 to 16 July 1964.

OSTEOLOGY

Skull.–The holotype consists of a cranium lacking the rostrum anterior to the nares. It is typically kogiine in being brachycephalic, and having a steeply ascending supracranial basin with a sagittal crest posterior to the nares, small supraorbital processes of the frontals, and broad basioccipital with large descending falcate processes. Unlike modern *Kogia,* the skull bones are not porous and inflated. Only the posterior walls of the narial passages remain intact, and the left passage is much larger and located more posteriorly than is the right (Fig. 2). The right narial opening appears larger, relative to the overall skull size, than in *Kogia breviceps.* As in *Kogia* and members of the sperm whale subfamily Physeterinae, the right premaxilla extends posteriorly into the supracranial basin, bends around and partly encompasses the right naris, expands laterally in the center of the basin behind both nares, and reaches the occipital crest.

Praekogia resembles the Miocene sperm whale *Aulophyseter* Kellogg, 1927 in that the left premaxilla extends around the left naris, forms its posterior wall, then meets the right premaxilla to which it is closely appressed in

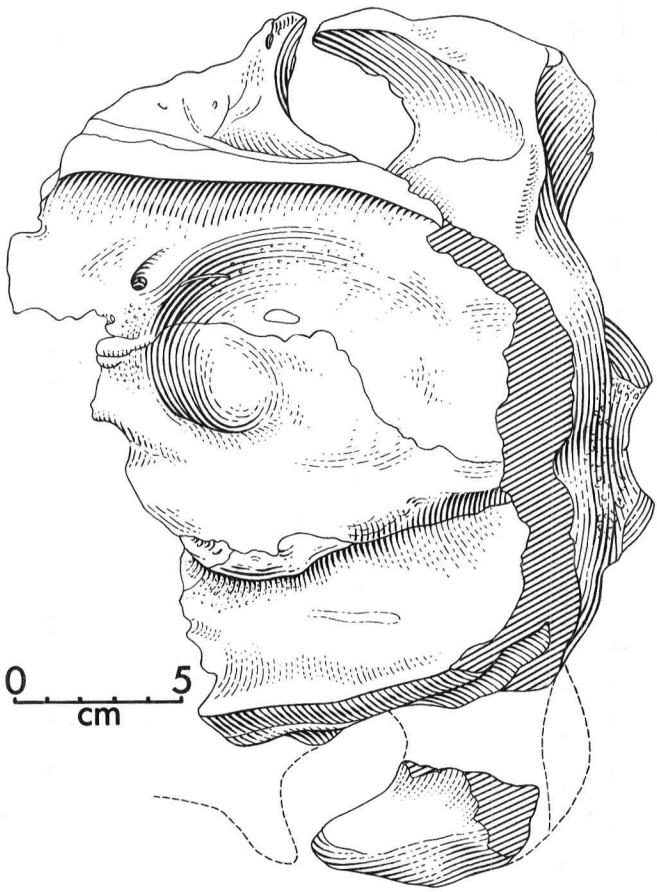

FIGURE 1. *Praekogia cedrosensis,* new genus and species, holotype, skull, UCR 5229, locality UCR RV-7315, dorsal view.

the anterior part of the sagittal facial crest posterior to the left naris. In *Kogia* and *Physeter* the left premaxilla does not extend as far posteriorly and usually only extends as far posteriorly as the middle of the lateral wall of the left naris. In those genera, the left maxilla then forms the bony surface of the posterior wall of the left naris (Schulte, 1917:371).

On its medial (left) margin, the right premaxilla meets the left premaxilla and the left maxilla to produce an elevated sagittal facial crest with a steep left side, but there is no great upward flare and overhang dorsal to the left maxillary fossa as is developed in the homologous structure of Recent *Kogia.* The right premaxillary posterior apex is situated left of the midline, and continues

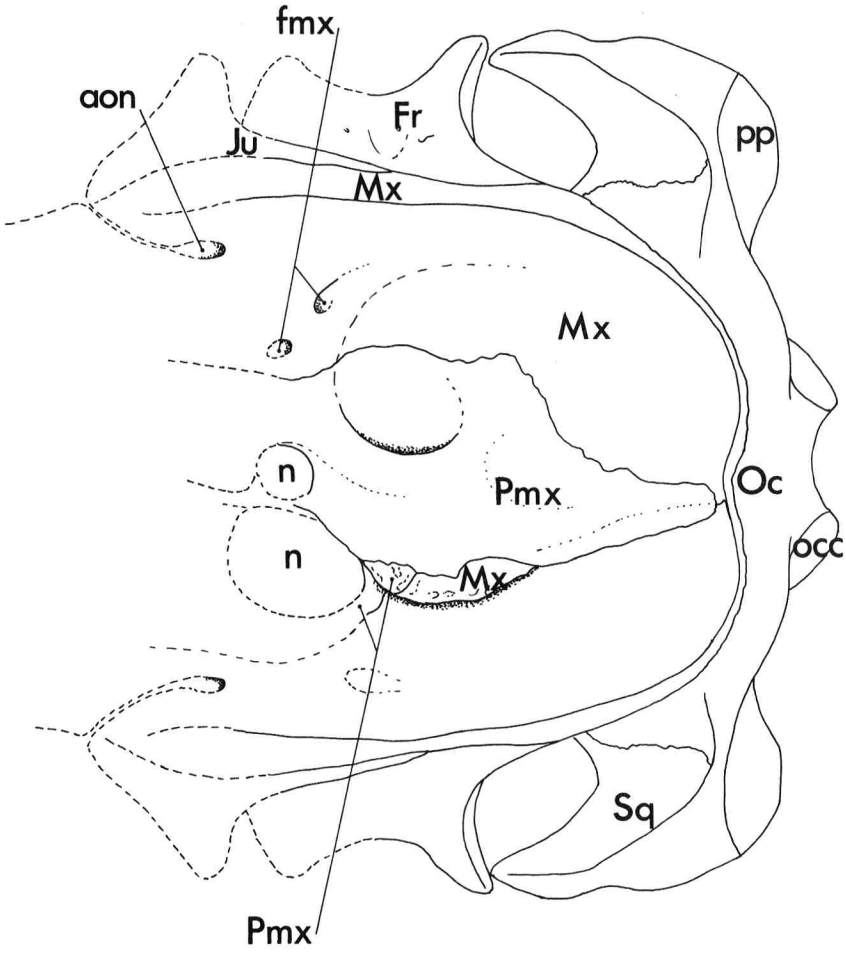

FIGURE 2. *Praekogia cedrosensis,* new genus and species, restoration of skull based on holotype, UCR 15229, and Recent *Kogia,* dorsal view.

toward the occipital crest in a low posterior extension of the sagittal facial crest between the right and left maxillae. This part of the crest consists only of the right premaxilla and is not contributed to by the maxillae, nor formed into a tuberosity as in *Kogia* (Schulte, 1917:372).

Slightly to the right of the center of the supracranial basin, behind the right naris, is a large premaxillary fossa (Fig. 1), with its deepest portion located near the center of the skull in the right side of the right premaxilla. The same fossa also extends shallowly onto the medial portion of the adjacent right

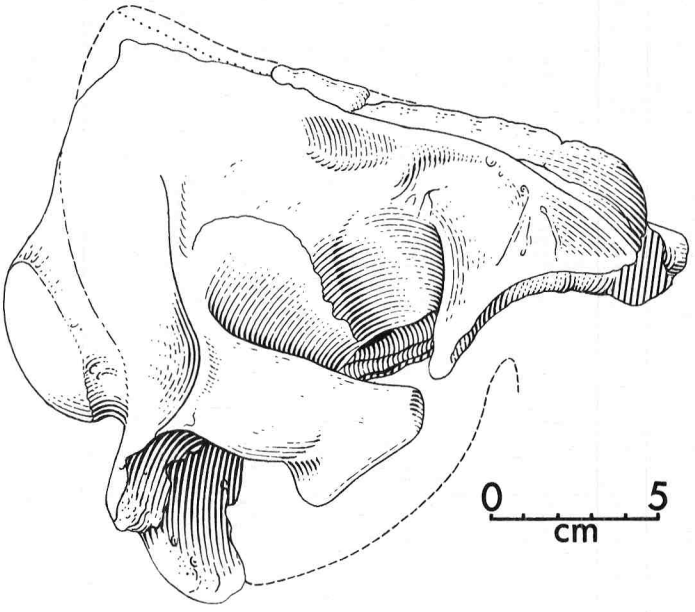

FIGURE 3. *Praekogia cedrosensis,* new genus and species, holotype, skull, UCR 15229, locality UCR RV-7315, right lateral view.

TABLE I.
Measurements (in cm) of the holotype skull of *Praekogia cedrosensis,* UCR 15229. Parentheses indicate estimated measurements.

Rostral width	(12.)
Interorbital width	(20.)
Zygomatic width	(24.)
Exoccipital width	(23.)
Condyle width	7.2
Length, antorbital notch to occipital condyle	14.9
Height of temporal fossa	6.1
Length of temporal fossa	7.7

maxilla and there is no distinct right maxillary fossa as is present in *Kogia.* The left margin of the premaxillary fossa of *Praekogia* is formed by a steeply overhanging ridge in the center of the right premaxilla which runs obliquely posteriorly and to the left from the external margin of the right naris (Figs. 1-2). A suture between the right premaxilla and right maxilla runs generally through the right part of this premaxillary fossa, then curves medially to meet the apex of the premaxilla. In its center, the fossa is floored by a smooth bone surface, but toward its right side the bone surface is rugose, pitted, and a faint, curving, medially concave ridge in the middle of the right maxilla marks the right margin of the fossa.

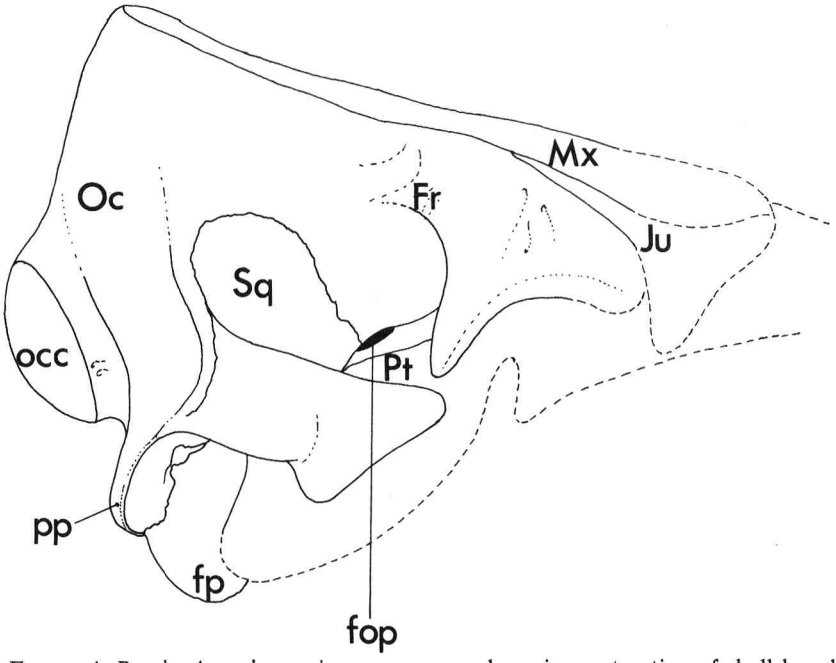

FIGURE 4. *Praekogia cedrosensis,* new genus and species, restoration of skull based on holotype, UCR 15229, and Recent *Kogia,* right lateral view.

This central premaxillary fossa in *Praekogia* does not appear to be homologous with the large, shallow fossa in the elevated right premaxilla of *Kogia,* but instead is probably homologous with a small depression in *Kogia* present in some animals (especially in adults) around the medial side of the right posterior maxillary foramen. The above-mentioned steeply overhanging ridge in the center of the right premaxilla of *Praekogia* seems homologous with a similarly positioned ridge in Recent *Kogia* that extends posteriorly and to the left from the lateral side of the right naris to the anterior part of the premaxillary basin. The more shallow, lateral part of the fossa on the right maxilla of *Praekogia* therefore probably corresponds with the large fossa in the center of the facial part of the right maxilla of *Kogia.*

In modern *Kogia,* the posterior part of the right premaxilla not involved in the premaxillary fossa of *Praekogia,* is elevated, with upturned margins, inclined dorsally to the left side, and shallowly excavated into a depression. No such depression is present in *Praekogia,* in which the premaxillary margins are not upturned, and the premaxillary surface while inclined dorsally to the left side is neither elevated nor excavated to the extent seen in *Kogia.*

On each side of the supracranial basin, the lateral maxillary crests are upturned into sharp-topped ridges with slight medial overhang and flat external surfaces. These crests are much more inflated, rounded, and curved in *Kogia.*

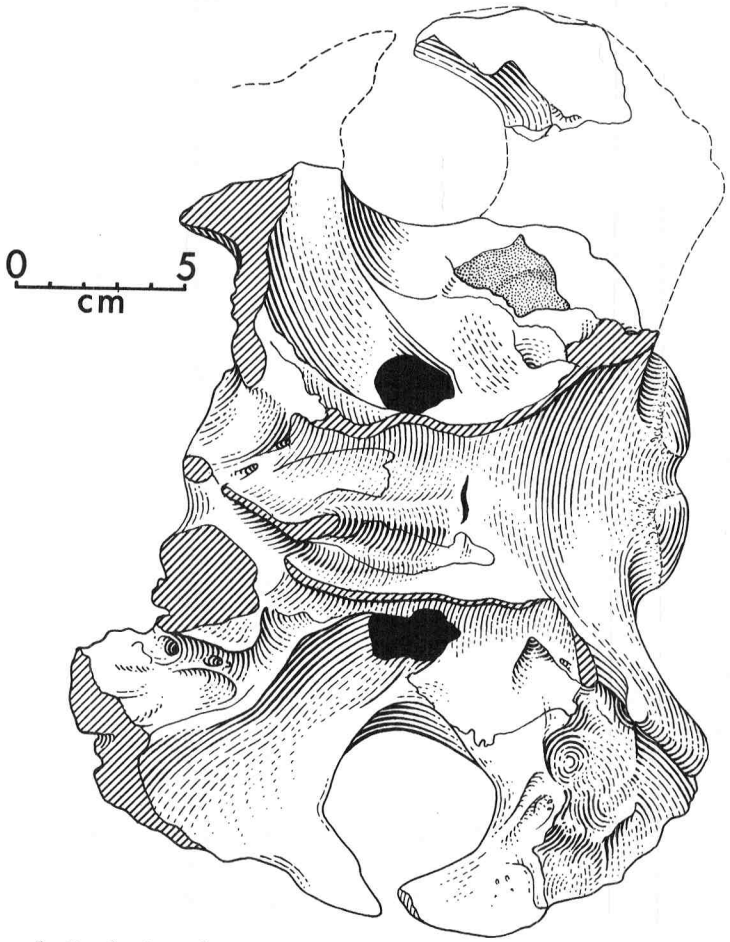

FIGURE 5. *Praekogia cedrosensis,* new genus and species, holotype, skull, UCR 15229, locality UCR RV-7315, ventral view.

Typically in *Kogia,* the thickened external margin of the maxilla has a wide exposure over the supraorbital process of the frontal, and is much thicker and more elevated on the left side than on the right. In *Praekogia,* however, the maxilla is not widely exposed on the external surface of the lateral maxillary crest (Figs. 3-4), has a straight ventral sutural margin, does not thicken over the supraorbital process of the frontal, and the right and left sides are equally developed. The lateral maxillary crests are straighter, and the supracranial basin is correspondingly more anteroposteriorly elongate and not as rounded as in *Kogia.*

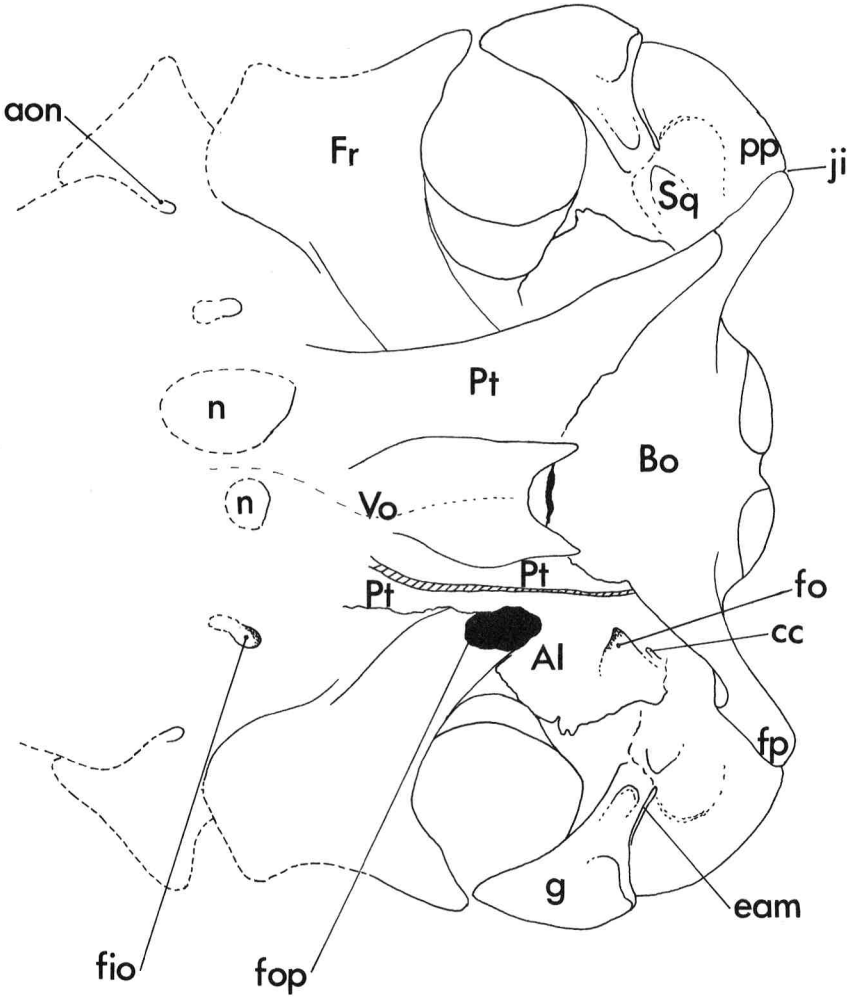

FIGURE 6. *Praekogia cedrosensis,* new genus and species, restoration of skull based on holotype, UCR 15229, and Recent *Kogia,* ventral view.

In the relative positions of the posterior maxillary foramina only the left one of *Praekogia* resembles that of *Kogia.* The right maxillary foramen of *Praekogia* is placed farther laterally than in *Kogia.* A vestige of the broken left posterior maxillary foramen lies to the left of the posterior margin of the left naris. On the right maxilla two connecting apertures of the posterior maxillary foramen lie lateral to the posterior margin of the right naris. The anterior one of these is not located as close to the premaxilla as is common in *Kogia.* The

antorbital notch appears not to be as deeply incised into the dorsal surface of the maxilla as in *Kogia*.

In *Kogia*, the jugal is large and a considerable portion of the bone is visible laterally as a wedge extending posteriorly between the maxilla and the antorbital process of the frontal (Schulte, 1917:pl. 35). In *Praekogia*, a very slender section of the jugal extends as a wedge (Fig. 3) farther posteriorly between the maxilla and frontal than in *Kogia*. The supraorbital processes of the frontals of *Praekogia* and *Kogia* are almost identical in shape but the ventrolateral margin dorsal to the orbit is turned laterally and is thinner in *Praekogia* than in *Kogia*, and the lateral bone surface is concave and rugose rather than inflated and smooth. The temporal fossa of *Praekogia* is relatively and absolutely larger, more rounded, and not as roofed over by the frontal as in *Kogia*.

The difference between the temporal fossae of *Praekogia* and *Kogia* is associated with a relatively more posterior position of the orbit in the latter. Compared with *Praekogia*, the bony orbit of *Kogia* is located more over the anterior end of the zygomatic process of the squamosal and encroaches on the anterior part of the temporal fossa. The fossa, which in *Praekogia* is entirely open in lateral view (Fig. 3), is partly hidden in a lateral view of *Kogia*. Concommitantly, the posterior margin of the temporal fossa extends more posteriorly into the occipital shield in *Kogia* than in *Praekogia*. The fossa is higher than wide in *Kogia* and more anteroposteriorly expanded in *Praekogia*, further emphasizing the different positions of the orbit.

Praekogia resembles *Kogia* when viewed posteriorly (Fig. 10b) in possessing large, ventrolaterally flaring exoccipitals, large falcate processes of the basioccipital, and occipital condyles which are not distinctly set off from the occipital shield. In *Praekogia*, though, the zygomatic processes of the squamosals flare farther laterally, the paroccipital processes of the exoccipitals extend farther posteriorly, and the occipitals bear rugose fossae just lateral to the occipital condyles.

Praekogia differs from *Kogia* by having the occipital condyles more set off from the occipital shield and the foramen magnum and condyles nearly circular, not transversely compressed as in *Kogia* (Schulte, 1917: plate 37; Handley, 1966: Fig. 1).

Much of the ventral surface of the cranium is badly damaged (Fig. 5) and most of the pterygoids are missing. The proportions and relationships of the preserved parts resemble those of *Kogia*. Subtle differences are that the pterygoid-basioccipital descending processes do not diverge as widely posteriorly and the orbits are positioned more anteriorly so that the tract of the optic nerve enters the braincase directed posteromedially and not so nearly perpendicular to the long axis as in *Kogia*.

The ventral part of the internarial septum, formed by the presphenoid and vomer, is relatively thick compared with *Kogia* and appears to have been entirely sheathed ventrally by the posterior part of the vomer which extends across, and farther posterior than, the open basisphenoid-presphenoid fissure.

In the holotype of *Praekogia,* the right side of the internarial part of the presphenoid is covered by vomer at least to the midline, and appears to be incompletely covered to the left side only because parts of the vomer are broken away. In *Kogia,* the vomer is applied to either side of the internarial septum, but the ventral keel is exposed (Schulte, 1917:386).

The transverse dimension of the lateral border of the orbit, the tract of the optic nerve, and the orbital fissure are all relatively larger than those in *Kogia,* indicating that the eye of *Praekogia* was larger. Schulte (1917:373) has noted that the lateral process of the pterygoid underlies the medial part of the frontal and forms a shelf in the wall of the orbit. This is similar to the structure in *Praekogia.* Ventral to this shelf and directly anterior to the orbital fissure in *Praekogia,* there is a small (10 mm diameter) recess or sinus in the lateral surface of the pterygoid that does not exist in *Kogia.*

In *Kogia* there exists a fossa marking the position of a sinus in the medial part of the alisphenoid and the pterygoid, medial to the foramen ovale. There is an indication of a smaller sinus in the same position in *Praekogia,* but the pterygoid is broken away and impairs discernment of a fossa.

A small canal for the carotid artery lies posterior to the foramen ovale and is larger and closer to the latter than in *Kogia.* The aperture of the posterior lacerate foramen of *Praekogia* is situated more medially and is more recessed dorsal to the falcate process of the basioccipital than in *Kogia.* With this, the aperture is farther from the lateral margin of the recess for the mastoid process and there is more space in the roof of the auditory region formed by the squamosal than in *Kogia.* The posterior process, or what Schulte (1917: 394) called the tympano-mastoid, of the auditory bulla must have been relatively much larger than in *Kogia* for the excavation in the lateral part of the squamosal and exoccipital for its attachment is much wider than in *Kogia.* The posterior wall of this excavation, which is formed by the paroccipital process of the exoccipital is much thinner than, and not inflated as in *Kogia.*

At the ventral extremity of a descending transverse strut in the squamosal is a vestigial groove marking the passage of the external auditory meatus. The groove is slightly larger (2.5 mm across) than in most specimens of *Kogia,* and is directed anterolaterally posterior to the postglenoid process, but is broken and incomplete. Unlike the condition in *Kogia,* there is a bony fossa marking the position of a middle ear air sinus developed in the squamosal on the posteromedial part of the postglenoid process. The sinus is well marked because the posteroventral part of the articular surface of the glenoid fossa is set off from the squamosal and the sinus runs around it posteriorly and medially.

RELATIONSHIPS

Praekogia cedrosensis is a kogiine physeterid or pygmy sperm whale that is more generalized than either of the two living species, *Kogia breviceps* and *K. simus,* and may be ancestral to the genus *Kogia. Praekogia* exhibits nearly

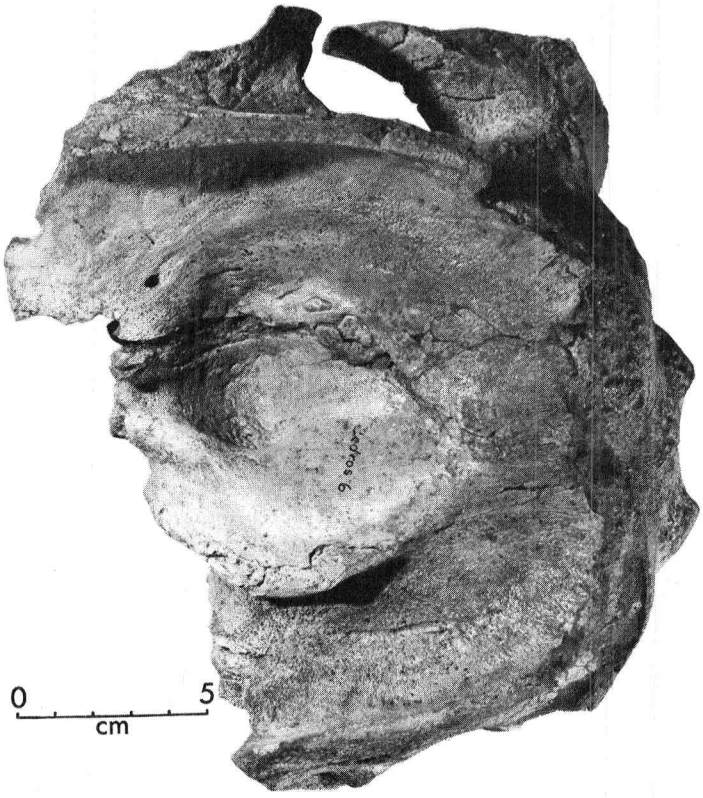

FIGURE 7. *Praekogia cedrosensis,* new genus and species, holotype, skull, UCR 15229, locality UCR RV-7315, dorsal view.

all of the structural peculiarities in the skull of Recent *Kogia* except that the bone is not porous and inflated, and the skull is less telescoped or foreshortened (see Miller, 1923). Concomitant with this lesser degree of telescoping, and in contrast with *Kogia,* the supracranial basin is longer with straighter sides, the supraorbital process of the frontal and the optic nerve tract are directed more anterolaterally, the orbit is more anteriorly located, the squamosal is relatively longer, the temporal fossa is larger, the sagittal facial crest is lower, and the narial openings are not located as far posteriorly. In the retention of the more primitive proportions and structures the skull of *Praekogia* resembles certain extinct Miocene sperm wales (for example *Orycterocetus* Leidy, 1853; *Aulophyseter* Kellogg, 1927).

Two previous publications allude to fossil Kogiinae. Kellogg (1929) based a new genus and species, *Kogiopsis floridanus,* upon the symphyseal portion of a fossil mandible from the Bone Valley Gravels of Polk County, Flor-

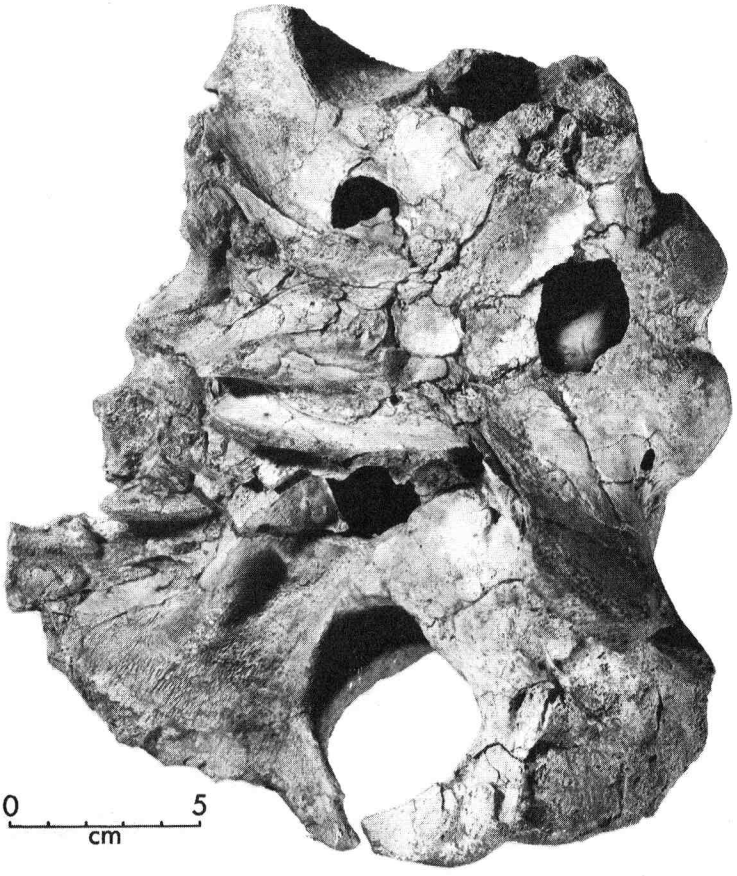

FIGURE 8. *Praekogia cedrosensis,* new genus and species, holotype, skull, UCR 15229, locality UCR RV-7315, ventral view.

ida. In his description Kellogg stressed the similarity between *Kogiopsis* and fossil physeterines and hoplocetines with which it compares favorably also in its large size. The large size of *Kogiopsis* alone precludes synonymy, and possibly close relationship, between *Kogiopsis floridanus* and *Praekogia cedrosensis.*

Kogia prisca is a name applied by Matsumoto (1936) to isolated teeth, apparently of Miocene age, from Japan. These teeth are large (50 to 90 mm long) and bear enamel. The teeth of *K. prisca* are too large to belong to *Praekogia cedrosensis,* and like Recent *Kogia,* to which it is obviously closely related, *Praekogia* probably had no enamel on the teeth. In light of present meager knowledge of North Pacific Miocene cetaceans, I would withhold any

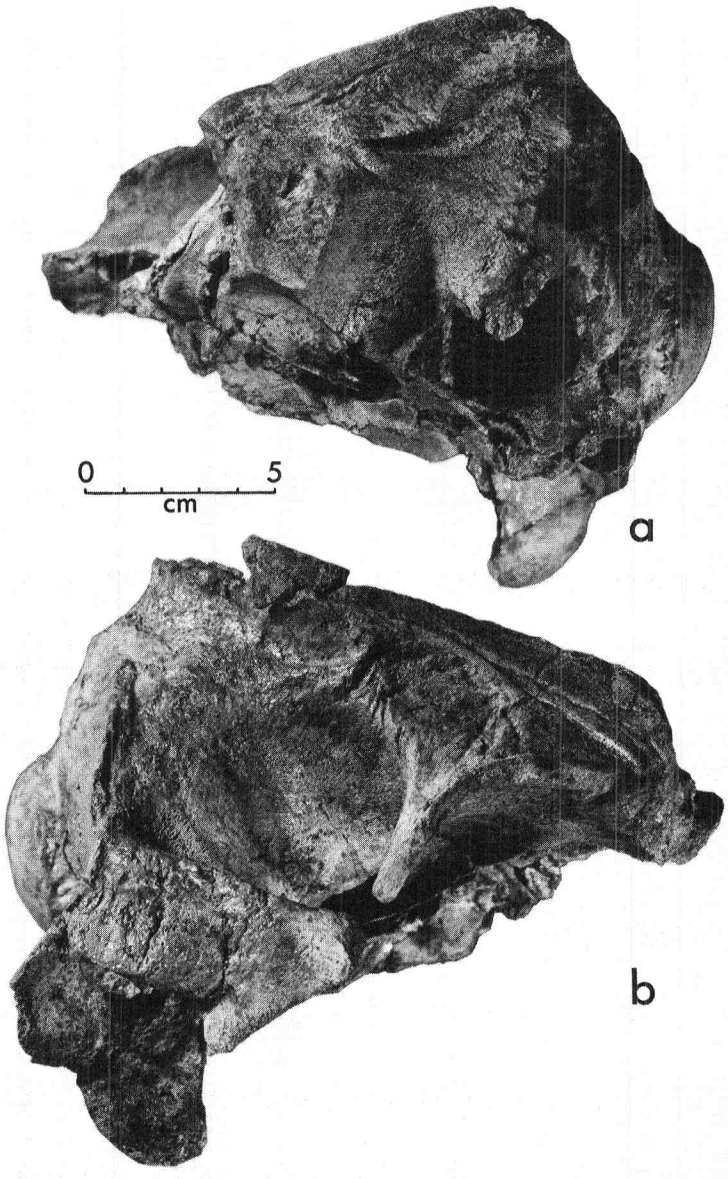

FIGURE 9. *Praekogia cedrosensis,* new genus and species, holotype, skull, UCR 15229, locality UCR RV-7315; *a,* left lateral view; *b,* right lateral view.

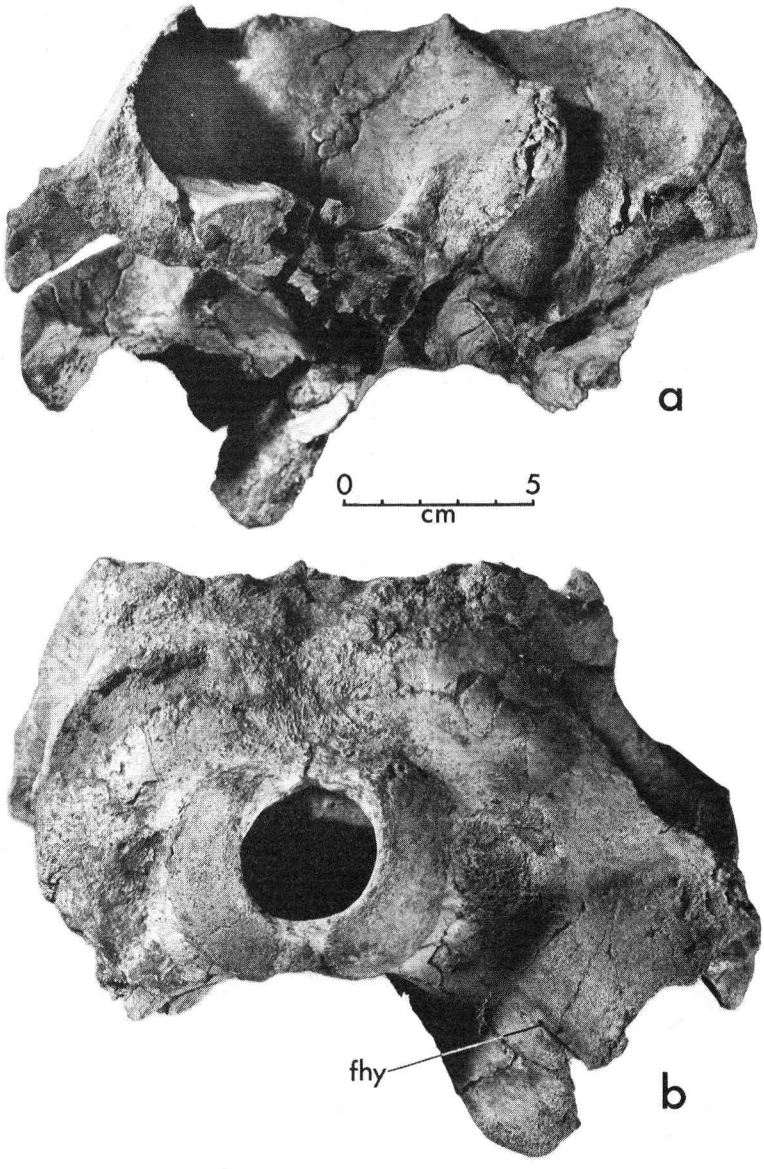

FIGURE 10. *Praekogia cedrosensis,* new genus and species, holotype, skull, UCR 15229, locality UCR RV-7315, *a,* anterior view; *b,* posterior view.

positive statement regarding the identity of the teeth figured by Matsumoto, and the name is here declared a *nomen vanum.*

Praekogia, therefore, is the first described fossil to show positive close phylogenetic relationships with living pygmy sperm whales of the genus *Kogia.* All the structural peculiarities of the skull are present in both genera, and *Praekogia* differs by being less highly modified from a primitive condition. The major structural modifications required in the evolution of a skull like that of *Kogia* would be accomplished by further telescoping of the skull of *Praekogia* and by the inflation and increase in the porosity of the bone. Miller (1923) has convincingly postulated, using the fossil record, the manner in which members of various cetacean groups appear to have evolved highly modified skulls through telescoping. The process of telescoping involves the extension of bones over and under one another to reach positions on the skull where they do not exist in more generalized and less highly evolved animals. Telescoping also involves the posterior movement on the skull of the dorsal narial apertures and of the orbit with a resulting shortened braincase. The skull of *Praekogia* had telescoped to the point where the cranial bones were roughly in the same position and had the same sutural relationships as in Recent *Kogia,* but further foreshortening of the skull was still possible to bring the eye and narial apertures farther posterior upon the braincase. This is well displayed by the fact that the orbit of *Kogia* is in a position dorsal to the anterior part of the zygomatic process of the squamosal. This is an unusual situation, because in most fossil and Recent cetaceans (including *Praekogia*), the anterior tip of the zygomatic process articulates with or is very close to the ventral extremity of the postorbital process of the frontal. If telescoping of the skull of *Kogia* progresses further, it is possible that the orbit may proceed even farther posteriorly into the temporal fossa.

Other cranial features possessed by *Praekogia,* that differ from *Kogia,* serve to point out the relatively more primitive nature of *Praekogia.* These include the less elevated sagittal facial crest, more prominent occipital condyles, relatively larger zygomatic process of the squamosal, more expansive vomer on the ventral surface of the internarial septum, and uninflated nature of the bone surface.

I believe that the pygmy sperm whales are best included as a subfamily Kogiinae within the Physeteridae as was done by Simpson (1945: 102) and Handley (1966: 64). This contrasts with some authors (Miller, 1923; Kellogg, 1928, 1929; Miller and Kellogg, 1955) who recognized a family Kogiidae.

CONCLUSIONS

1. *Praekogia cedrosensis,* a new genus and species of extinct pygmy sperm whale, is based on the first cranial remains of a pygmy sperm whale documented in the fossil record. *Kogiopsis floridanus* Kellogg, 1929, described from mandibular sections found in Florida's Bone Valley Gravel, is an animal

much larger than, and probably distantly related to, *Praekogia. Kogia prisca* Matsumoto, 1936, known only by isolated teeth from probable Miocene rocks in Japan is herein designated a *nomen vanum.*

2. *Praekogia cedrosensis* is known only from one site in the Pliocene Almejas Formation on Isla Cedros, Baja California, Mexico. The strata bearing the holotype are unconformably underlain by Luisian age (Miocene) rocks of the Tortuga Formation, and overlain (possibly unconformably) by mollusk-bearing beds correlated with the middle Pliocene to early late Pliocene-age San Diego Formation of California. The geologic age of *Praekogia cedrosensis* is therefore estimated to be early Pliocene.

3. The braincase of Praekogia indicates possible morphological ancestry to both of the living species of pygmy sperm whale *Kogia breviceps* and *K. simus.* The osteological changes that would be necessary for the skull of *Praekogia* to come to resemble one of a Recent *Kogia* are an overall telescoping (foreshortening) of the braincase, enlargement of the maxillary crests around the supracranial basin, elevation of the sagittal facial crest formed by the maxillae and premaxillae posterior to the nares, and inflation and general increase in porosity of the bone tissue of the cranium.

4. Both *Kogia* and *Praekogia* are included in the Subfamily Kogiinae of the Family Physeteridae. Cranial morphology of the Kogiinae is sufficiently similar to the true sperm whales (Physeterinae, Hoplocetinae) to argue against the use of a family solely for the pygmy sperm whales.

RESUMEN

El nuevo género y especie *Praekogia cedrosensis* es un cachalote pigmeo extincto, conocido por una porción de cráneo sin el rostro, descubierto en depósitos marinos sedimentarios identificados como Formación Almejas, en la isla Cedros, Baja California, México. La antigüedad geológica de *Praekogia cedrosensis* es considerada como Plioceno Inferior en sentido amplio. La base de la Formación Almejas, estratigráficamente 36 metros por debajo de horizonte que proporcionó *Praekogia,* descansa discordantemente sobre rocas Miocenas de edad Temblor. Por encima del mencionado horizonte existen depósitos con moluscos marinos de edad Pliocena Media-Superior. *Praekogia* es un antecesor ideal para el cachalote pigmeo actual, *Kogia* Gray, con una caja craneana menos telescópica y una menor especialización craneana.

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