

SUPPLEMENTAL DATA 1

FOSSIL SIRENIA OF THE WEST ATLANTIC AND CARIBBEAN REGION. IX.

*METAXYTHERIUM ALBIFONTANUM*, SP. NOV.

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APPENDIX 1. List of characters and states used in the phylogenetic analysis (following Domning, 1994; Domning et al., 1994; Bajpai and Domning, 1997; Domning and Aguilera, 2008; Bajpai et al., 2010; Velez-Juarbe et al., 2012). New or modified characters are denoted by an asterisk (\*). All characters are treated as unordered.

(3) Rostrum: premaxillae do not form an elongated rostrum (0); rostrum elongated but small relative to cranium (length of premaxillary symphysis  $\leq 0.27 \times$  condylobasal skull length) (1); rostrum enlarged (length of premaxillary symphysis  $> 0.27 \times$  condylobasal skull length) (2).

(6) Nasal process of premaxilla: thin and tapering at posterior end, overlapping frontal and/or nasal (0); tapering but thickened at posterior end, with long overlap of frontal and/or nasal (1); broadened and bulbous at posterior end, having more or less vertical joint surface in contact with frontal (2).

(7) Nasal process of premaxilla: long (distance from rear of symphysis to posterior end of premaxilla  $> 1/2$  length of the symphysis) (0); very short (distance from rear of symphysis to posterior end of premaxilla  $\leq 1/2$  length of the symphysis) (1).

(8) External nares: not retracted (0); retracted and enlarged, reaching to or beyond the level of the anterior margin of the orbit (1).

(9) Premaxilla: short, does not contact frontal (0); long, contacts frontal (1); long, contact with frontal reduced, premaxilla abuts mainly against nasals instead (2).

(10) Premaxillary symphysis: not laterally compressed to form a middorsal ridge (0); laterally compressed, bearing a middorsal ridge anteriorly and with its posterior end

upraised to form a boss in lateral view (1); laterally compressed but without a boss, the posterior end being dorsally flattened instead (2).

(11) Zygomatic-orbital bridge of maxilla: nearly level with palate (0); posterior part elevated above palate, ventral surface lying  $> 1$  cm above the alveolar margin (1).

(13) Infraorbital foramen: small (diameters about  $15 \times 10$  mm or less) (0); large (diameters greater than  $15 \times 10$  mm but less than about 30 mm) (1); very large (diameters greater than about 30 mm in adults) (2).

(14) Zygomatic-orbital bridge of maxilla: long anteroposteriorly (vertical thickness  $< 0.40 \times$  minimum length) (0); shortened (thickness  $\geq 0.40 \times$  length) (1); shortened and transformed into transverse vertical wall (2).

(16) Palate: thin or incomplete at level of penultimate cheek tooth (0);  $> 1$  cm thick at level of penultimate tooth (1).

(20) Infraorbital canal: not obstructed (0); partly obstructed by a transverse bony ridge (1).

(21) Paranasal air sinuses\*: present (in any facial bone) (0); absent (1).

(22) Zygomatic-orbital bridge of maxilla: anterior edge thin and sharp, posterior edge thick and more or less rounded (0); both edges thin and sharp (1); both edges thick and rounded (2).

(23) Anterior palate (= palatal gutter; forward of infraorbital foramen)\*: very narrow relative to posterior palate including teeth and to rostral masticating surface (0); almost as wide as posterior palate and rostral masticating surface (1).

(31) Nasals: meet in midline (0); separated in midline by frontals and/or incisure, or separated and fused with frontals (1).

(36) Supraorbital process of frontal: well developed, dorsoventrally thin overall (< 2 cm thick), with prominent, dorsoventrally-flattened posterolateral corner (0); dorsoventrally thickened, with posterolateral corner only moderately or weakly developed (1); reduced, rounded, lacking posterolateral corner (2); dorsoventrally thickened (> 2 cm thick), with dorsal surface inclined strongly ventrolaterad and with posterolateral corner strongly developed and more or less recurved (3).

(37) Nasal incisure at posterior end of mesorostral fossa: absent or small (does not extend posterior to supraorbital process) (0); deep and narrow (extends posterior to the supraorbital process) (1); comparably deep but broad, with the anterior frontal margin displaying a median convexity (2).

(42) Frontal roof: convex, more or less flat, or moderately concave between temporal crests (if present) (0); deeply concave or depressed overall (with or without a small median convexity) between temporal crests, but not sloping ventrad anteriorly (1); deeply concave or depressed, and sloping steadily ventrad to anterior margin (2).

(44) Supraorbital process of frontal: not divided (0); divided by one or more distinct, deep dorsoventral grooves indenting its lateral margin (1).

(45) Frontal roof: bears no knoblike bosses (0); bears a bilateral pair of knoblike bosses, more or less cylindrical in shape and directed anterad; or at least a distinct longitudinal ridge or swelling medial and parallel to, and distinct from, each temporal crest (1).

(51) Sagittal crest: present (0); absent (1).

(64) Supraoccipital: wider in dorsal half than at ventral extremities of lateral borders (i.e. dorsal portion of lateral border overhangs) (0); wider ventrally than dorsally, or equally wide throughout (1).

(66) Exoccipitals: meet in a suture dorsal to foramen magnum (0); do not meet in a suture (1).

(67) Supracondylar fossa of exoccipital: absent (0); distinct, but shallow, directly dorsal to condyle (1); deep and extending across entire width of occipital condyle (2); reduced and located dorsomedial to condyle, or lost (3).

(70) Dorsolateral border of exoccipital: rounded and more or less smooth, not flangelike (0); thick and overhanging posteriorly as a flange (1); greatly thickened, forming rugose overhanging flange (2).

(72) Hypoglossal (= condyloid) foramen: surrounded by bone (0); open (forming a notch) or absent (1).

(73) Posttympanic process of squamosal\*: distinctly projects anteroventrally (with a facet for insertion of sternomastoid m.) from the ventral squamosal border (0); absent (i.e., no facet projecting for sternomastoid muscle) (1); less salient, ends nearly in line with the ventral squamosal border (2); elongated directly downwards (3).

(74) Sigmoid ridge of squamosal\*: absent (no ridge extends above bottom of mastoid foramen) (0); present and prominent (1); reduced or absent (2).

(76) Cranial portion of squamosal\*: does not extend to temporal crest (0); extends to temporal crest (1).

(77) Processus retroversus of squamosal: absent (0); present, moderately inflected (1); present, not inflected (2); present, strongly inflected (3).

(81) Outline of zygomatic process of squamosal\*: gradually tapered and pointed anteriorly, with triangular cross section (0); regularly or irregularly rounded anteriorly, with non-triangular, sometimes inflated cross-section (1).

(82) External auditory meatus of squamosal: narrow and slitlike (anteroposterior breadth less than dorsoventral) (0); about as wide (anterodorsal-posteroventrally) as high (posterodorsal-anteroventrally) (1); very broad and shallow, wider anteroposteriorly than high (2).

(84) Zygomatic process of squamosal: medial side not swollen, appears relatively flat or concave and inclined inward dorsally (0); medial side markedly swollen, inclined inward ventrally or forming a vertical wall (1).

(85) Ventral extremity of jugal: lies posterior to orbit (0); lies approximately under posterior edge of orbit, but forward of jugal's postorbital process (if present) (1); lies ventral to orbit (2).

(87) Preorbital process of jugal: does not contact premaxilla (0); contacts premaxilla (1).

(88) Preorbital process of jugal: relatively flat and thin (posteromedial-anterolateral breadth of portion lateral to maxillojugal suture > anteromedial-posterolateral thickness) (0); thick and robust (breadth  $\leq$  thickness) (1).

(89) Posterior (zygomatic) process of jugal: as long as or longer than diameter of orbit (0); shorter than diameter of orbit (1).

(90) Ventral rim of orbit: does not distinctly overhang lateral surface of jugal, where such a surface is present below the orbit (0); does distinctly overhang (1).

(91) Lacrimal: with foramen (nasolacrimal canal) (0); without foramen, but still large (1); vestigial or absent (2).

(93) Lacrimal: does not contact premaxilla (0); contacts premaxilla (1).

(97) Posterior border of palatine: not incised, merely shallowly concave (0); incised or deeply indented (1); very deeply incised, to as far forward as level of M<sup>1</sup> (2).

- (99) Palatines: extend anteriorly beyond posterior edge of zygomatic-orbital bridge (0); do not extend so far forward (1).
- (101) Alisphenoid canal: present (0); absent (1).
- (102) Pterygoid fossa: absent (0); present, extending above level of roof of internal nares (1); reduced, confined to below roof of internal nares or at level of basisphenoid (2).
- (103) Foramen ovale: enclosed by bone (0); opened to form a notch or incisure (1).
- (105) Sphenopalatine region: long, with pterygoid process not enlarged (0); short, with pterygoid process enlarged, thickened, and downwardly projecting (1).
- (115) Periotic\*: fused to alisphenoid (0); not fused with any other skull bone, set in closely-fitting socket in squamosal, but contacting alisphenoid (1); not in contact with alisphenoid (2).
- (118) Mastoid portion of periotic\*: not exposed on outside of skull (0); exposed only via fenestra in dorsal occiput (1).
- (122) Ventral border of horizontal mandibular ramus: straight or only slightly concave (0); moderately concave, sharply downturned anteriorly (1); moderately and evenly concave (2); strongly concave (3).
- (123) Accessory mental foramina: present, in addition to and usually posterior to the large principal foramen (0); absent (1).
- (125) Posterior border of mandible: descends ventrally or posteroventrally from condyle without marked interruption or abrupt change in direction (0); bears a steplike process (processus angularis superior) below condyle (1); has no distinct processus angularis superior but does have broadly convex outline beginning well below condyle (2).

- (126) Anterior border of coronoid process: approximately vertical (0); extends slightly anterior to base of process (1); extends very far anteriorly to base (2).
- (127) Mandibular dental capsule: completely enclosed by bone of mandible (0); exposed posteroventrally (1); absent (2).
- (128) Horizontal ramus of mandible: slender (minimum dorsoventral height  $< 0.25 \times$  length of mandible) (0); broad dorsoventrally (height  $\geq 0.25 \times$  length of mandible) (1).
- (129) Ventral border of horizontal ramus of mandible: tangent to angle (0); not tangent to angle (1).
- (137) First upper incisor: enamel crown distinct from root (0); enamel extends entire length of tusk (1).
- (139) First upper incisor: present (0); vestigial or absent (1).
- (140) Depth of I1 alveolus: much less than half the length of the premaxillary symphysis (0); about half the length of the symphysis (1); much greater than half the length of the symphysis (2).
- (141) Cross section of I1 crown: suboval or subelliptical (0); lens-shaped, with sharp anterior and posterior edges (1); lozenge- or kite-shaped (2); broad and extremely flattened mediolaterally (3).
- (142) First upper incisor: with enamel on all sides, forming complete enamel crown (0); with enamel mainly on medial side (1).
- (143) Second and third upper incisors, first through third lower incisors: present, at least in part (0); all absent (1).
- (144) Canines: double-rooted (0); single-rooted (1); absent (2).
- (145) Premolars 1-4: all present (0); some absent (anterior ones) (1); all absent (2).



(146) Permanent premolar 5/5: present (0); absent; i.e., no replacement occurs at P5 and p5 loci (1).

(147) *Molar 3/\**: with crown longer than or equal to that of M2 (0); smaller than M2 (1); with reduced, circular crown (2).

(150) Supernumerary molars: absent (0); present and replenished indefinitely by horizontal replacement (1).

(151) Functional cheek teeth: present in adult (0); present in juvenile only (1); absent (2).

(155) Postcanine dental formula: P1-4, M1-3 (0); P1-5, M1-3, or secondarily reduced from this condition by loss of anterior premolars (1).

(157) Permanent premolars: some double- or triple-rooted (0); all single-rooted (1); all absent (2).