

**New toxodontid (Notoungulata) from the Early Miocene of Mendoza, Argentina**

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**Online Supplementary Information 2**

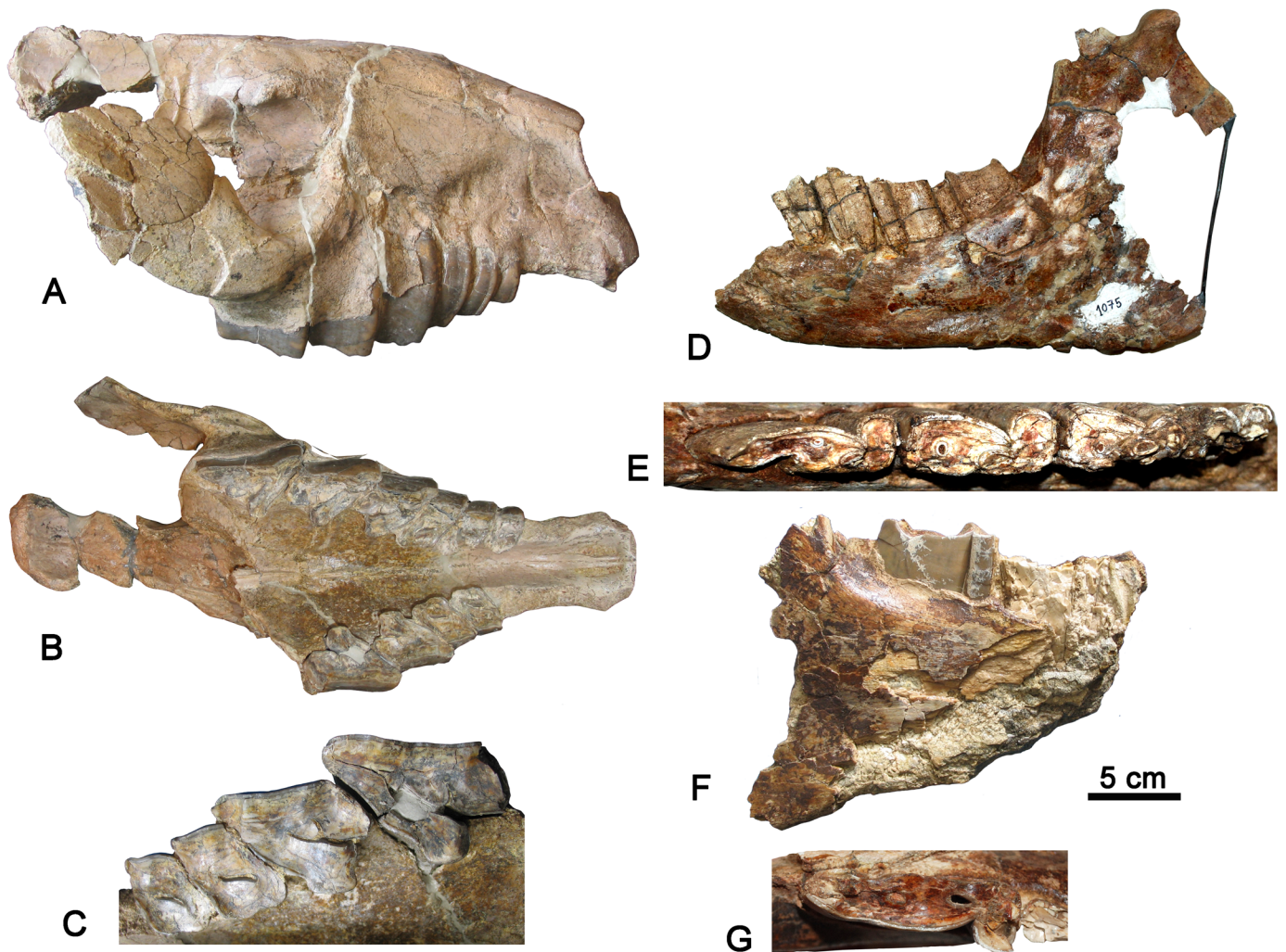
**Appendix 1.** Selected equations to estimate the body mass of *Nesodon taweretus* sp. nov. from Janis (1990) and Mendoza et al. (2006), following Cassini et al. (2012). Weighted mean \* after formula of Christiansen & Harris (2005).

<b>Variable</b>	<b>%PE</b> (percent prediction error)	<b>Body mass (kg)</b>
TSL	30.5	350.97
OCH	28.1	657.46
SLML	31.9	1140.75
PSL	33.4	342.56
TJL	33.4	343.85
Average		<b>567.12</b>
Weighted mean		<b>573.93*</b>
Algorithm 4.1	13.5–17.5	603.65
Algorithm 4.2	13.5–17.5	627.03
Algorithm 4.3	13.5–17.5	522.17
Algorithm 5.1	17.5–21.5	330.3 kg
Average		<b>520.79</b>
Total average		<b>543.955</b>

The equations by Janis (1990) include:  $\text{Log}_{10}(\text{BM}) = 2.975 * \text{log}_{10}(\text{TSL}) - 2.344$ ;  $\text{Log}_{10}(\text{BM}) = 2.873 * \text{Log}_{10}(\text{OCH}) - 0.457$ ;  $\text{Log}_{10}(\text{BM}) = 3.201 * \text{Log}_{10}(\text{SLML}) + 1.130$ ;  $\text{Log}_{10}(\text{BM}) = 2.758 * \text{Log}_{10}(\text{PSL}) - 0.973$ ;  $\text{Log}_{10}(\text{BM}) = 2.884 * \text{Log}_{10}(\text{TJL}) - 1.952$ ; in which BM, body mass in kg, OCH, occipital height; PSL, posterior skull length; SLML, second lower molar length; TJL, total jaw length; TSL, total skull length.

The equations by Mendoza et al. (2006) include: Ln Algorithm 4.1 =  $0.736 * \text{Ln}(\text{SUML}) + 0.606 * \text{Ln}(\text{SUMW}) + 0.530 * \text{Ln}(\text{MZW}) + 0.621 * \text{Ln}(\text{PAW}) + 0.741 * \text{Ln}(\text{SC}) - 0.157 * \text{Ln}(\text{SD}) + 0.603$ ; Ln Algorithm 4.2 =  $0.593 * \text{Ln}(\text{SUML}) + 0.700 * \text{Ln}(\text{SUMW}) + 0.532 * \text{Ln}(\text{MZW}) + 0.612 * \text{Ln}(\text{PAW}) + 0.635 * \text{Ln}(\text{SC}) - 0.168 * \text{Ln}(\text{SD}) + 0.157 * \text{Ln}(\text{SE}) + 0.751$ ; Ln Algorithm 4.3 =  $0.603 * \text{Ln}(\text{SUML}) + 0.580 * \text{Ln}(\text{SUMW}) + 0.536 * \text{Ln}(\text{MZW}) + 0.532 * \text{Ln}(\text{PAW}) + 0.567 * \text{Ln}(\text{SC}) - 0.200 * \text{Ln}(\text{SD}) + 0.175 * \text{Ln}(\text{SE}) + 0.276 * \text{Ln}(\text{SA}) + 0.408$ ; Ln Algorithm 5.1 =  $0.593 * \text{Ln}(\text{MZW}) + 0.515 * \text{Ln}(\text{PAW}) + 0.996 * \text{Ln}(\text{SA}) + 0.601 * \text{Ln}(\text{SB}) + 0.384 * \text{Ln}(\text{BL}) - 0.266 * \text{Ln}(\text{SD}) + 0.313 * \text{Ln}(\text{SE}) - 1.55$ , in which BL, basicranial length; JMA, posterior jaw length; MZW, muzzle width; PAW, palatal width; SA, length of the ridge for the origin of masseter; SB, occipital height; SD, depth of the face under the orbit; SE, length of the paraoccipital process; SLML, second lower molar length; SUML, second upper molar length; SUMW, second upper molar width.

**Appendix 2** Specimens assigned to *Palyeidodon* cf. *P. obtusum* from the Aisol Formation (Miocene). MHNSR-PV 1021, skull in lateral (A) and ventral (B) views, and detail of the upper dentition in occlusal view (not to scale) (C). MHNSR-PV 1075, left mandible in lateral view (D) and detail of the lower dentition in occlusal view (not to scale) (E). MHNSR-PV 1001, fragment of right mandible in lateral view (F) and detail of the m3 in occlusal view (not to scale) (G)



### Appendix 3

List of characters used in the cladistic analysis (based on Nasif et al., 2000)

Character 0. General shape of the skull

- (0), long and narrow
- (1), pear-shaped or triangular

Character 1. Frontal bones

- (0), flat or depressed
- (1), slightly vaulted
- (2), very vaulted, with a horn base

Character 2. Nasal bones

- (0), long
- (1), short

Character 3. Sagittal crest

- (0), long
- (1), short
- (2), no mid-cranial crest (parietal crests are separated)

Character 4. Premaxilla

- (0), not expanded laterally
- (1), expanded laterally

Character 5. Infraorbital foramen

- (0), close to the zygomatic apophysis of the maxilla
- (1), separated from the zygomatic apophysis of the maxilla

Character 6. Zygomatic arch

- (0), more or less rectilinear
- (1), sigmoid

Character 7. Occipital condyles

- (0), not projecting backward
- (1), projecting backward

Character 8. Dentary horizontal ramus

(0), without ventral extension

(1), with ventral extension

Character 9. Coronoid process

(0), low, close to the level of the condyle

(1), high, clearly over the level of the condyle

Character 10. Coronoid process and condyle

(0), parallel

(1), convergent

Character 11. Postero-ventral border of the vertical ramus

(0), rounded

(1), angled

Character 12. Anterior symphysis

(0), narrow, with little divergent borders

(1), very widened, with very divergent borders

Character 13. Alveolar border of the symphysis

(0), lingually U-shaped

(1), straight

Character 14. Symphysis

(0), without median labial keel

(1), with median labial keel

Character 15. Symphysis

(0), without a well-differentiated chin angle

(1), with differentiated but smooth angle

(2), strongly marked angle, S-shaped

Character 16. Symphysis

(0), posterior edge at the level of p2–p4

(1), at the level of p4–m1 (anterior part)

(2), at the level of m1 (posterior part)–m2

Character 17. Symphysis and incisors

(0), procumbent, at the level of the cheek tooth series

(1), procumbent, well below the cheek tooth series

(2), upraised

Character 18. Cheek teeth (upper/lower)

(0), brachyodont

(1), subhypsodont, with roots

(2), hypsodont, without roots

Character 19. I1 cross section:

(0), caniniform

(1), triangular

(2), trapezoidal

(3), kidney-shaped, with a median lingual groove

(4), triangular buccolingually flattened

Character 20. I2

(0), not developed as a tusk

(1), developed as a tusk

Character 21. I3

(0), present

(1), absent

Character 22. Upper canine

(0), present

(1), absent

Character 23. P1

(0), with enamel

(1), without it

(2), absent

Character 24. P2

(0), with median lingual groove or median fossette

(1), without groove or fossette

Character 25. P2

(0), with lingual enamel

(1), without lingual enamel

Character 26. P3–P4

(0), with median lingual groove or median fossette

(1), without groove or fossette

Character 27. P3–P4

(0), with lingual enamel

(1), without lingual enamel

Character 28. Molars

(0), with inner enamel fossettes

(1), without fossettes

Character 29. Molars

(0), with median crista and incipient Y-shaped median valley

(1), with median crista and well-developed Y-shaped median valley

(2), without crista, with simple groove

Character 30. M1–M2

(0), with posterior groove F3–F4 or fossette well marked

(1), smooth groove or absent

Character 31. M3

(0), with posterior groove F3–F4 or fossette well marked

(1), smooth groove or absent

Character 32. Lingual enamel on M3

(0), complete

(1), surpassing the posterior groove

(2), only reaching the posterior groove

Character 33. Ectoloph of the molars

(0), concave-convex or straight

(1), very concave

Character 34. Protocone column

(0), without being detached from the protoloph

(1), well-detached, limited by grooves

Character 35. i1 section

(0), espatulated

(1), triangular

(2), oval buccolingually

Character 36. i2 section

(0), espatulated

(1), triangular

Character 37. i3

(0), caniniform

(1), developed as a tusk

Character 38. Lingual enamel of i1–i2

(0), wide

(1), reduced to a narrow band

(2), absent

Character 39. Lingual enamel of i3

(0), continuous

(1), wider than labial enamel

(2), as wide as the labial enamel

(3), narrower than the labial enamel

Character 40. Lower canine

(0), present

(1), absent

Character 41. Diastema behind i3

(0), absent

(1), present

Character 42. p1

(0), with enamel

(1), without enamel

(2), absent

Character 43. Lingual enamel of p2–p4

(0), complete

(1), reduced

(2), absent

Character 44. Labial groove of p2–p4



marked (0),

smooth or absent (1)

Character 45. Premolars-molars

(0), with fossettids

(1), without fossettids

Character 46. Accessory fossettid of m2–m3

(0), present

(1), absent

Character 47. Anterior fold (paraconid-metaconid) of m1–m2

(0), well-developed

(1), smooth

(2), absent

Character 48. Anterior fold (paraconid-metaconid) of m1–m2

(0), anterior to the level of the buccal fold

(1), at the same level of the buccal fold

(2), posterior to the level of the buccal fold

(3), absent

Character 49. Meta-entoconid fold of m1–m2

(0), marked

(1), smooth or absent

Character 50. Ento-hypoconid fold of m1–m2

(0), marked and directed forward

(1), marked and approximately straight

(2), smooth or absent

Character 51. Meta-entoconid fold of m3

(0), marked

(1), smooth or absent

Character 52. Ento-hypoconid fold of m3

(0), marked

(1), smooth or absent

Character 53. Labial groove of the molars

(0), smooth and wide

(1), deep and wide

(2), deep and narrow

Character 54. Lingual enamel of m1

(0), complete

(1), between the anterior fold and the hypoconulid, without covering it totally

(2), between the metaentoconid fold and the hypoconulid, without covering it totally

Character 55. Lingual enamel of m2

(0), complete

(1), between the anterior fold and the hypoconulid, without covering it totally

Character 56. Lingual enamel of m3

(0), complete

(1), reaching the level of the hypoconulid

(2), without surpassing the ento-hypoconid fold

Character 57. Ectolophid of the molars

(0), convex-straight

(1), concave-convex

Character 58. Length of p2–p4

(0), equal or greater than 50% of the molar length

(1), less than 50%

Data matrix

Abbreviations: a, 0 and 1; b, 0 and 2; c, 1 and 2; d, 1 and 3; e, 1, 2, and 3.

*Pampahippus arenalesi*

0?000??000 ?1000?0?0? 0000000002 0000000000 0000000000 1000000000

*Leontinia gaudri*

0010010001 0100010201 1000000000 0000000000 0000000000 100100000

*Scarritia canquelensis*

0010010001 0100010200 0000000000 0000000000 0000000000 0000000000

*Rhynchippus pumilus, R. equinus*

000001000? ??00010001 0000000000 0100000000 000a000000 000101200

*Proadinotherium leptognathum*

?????????0? ????????01 ?0??0a0001 00?001????3 0?????00??0 ?00000?0?

*Adinotherium ovinum, A. robustum*

1b00011100 ?100001013 1000000001 000001?10d 0a00000100 0001000a1

*Nesodon imbricatus*

1b00011100 ?000101012 1000000001 0000010103 000000a100 000100000

*Nesodon taweretus*

000101110? ?00010101? ?00?????01 ?0?00????? ??????00230 00010000?

*Xotodon major, X. cristatus,*

11a0001100 010012a222 1100101012 11010111c2 0000111000 a0a111100

*Hyperoxotodon speciosus*

?????????0? ?100?1?221 1?00000012 1120011100 0100011110 a00111100

*Nonotherium henningi*

10010111?? ????????24 1100101012 11210????? ??????????? ??????????

*Posnanskytherium desaguaderoi*

1001000001 1100011024 011010a012 1121001123 0121a11100 201011100

*Trigodon gaudri*

1202000100 ?100012021 1002111112 1110121123 1111111121 010111111

*Paratrigodon euguii*

120?0011?? ????????24 ?112111110 1110111121 111c011??1 11011?1??

*Palyeidodon obtusum*

1201010000	?000010021	1000000011	1110010101	000100a230	000111101
<i>Hoffstetterius imperator</i>					
1200110111	0101002022	1112101010	1120011121	0122111110	111121101
<i>Ocnerotherium intermedium</i>					
??0???????	????????24	??01010101	11200?????	???2011110	0??1?1?0?
<i>Toxodon platensis</i>					
1001110000	?011001124	11a0100010	112011112e	012ba11010	0001aaa00
<i>Andinotoxodon boliviariensis</i>					
??0?????00	?001?1002?	1???????12	???00111c?	0?210a1110	100111100
<i>Pisanodon nazari</i>					
1???0???0?	??0?????2?	?0?1??0?10	11200?????	?????110a0	a0011110?
<i>Gyrinodon quassus</i>					
1002?1011?	??????1?2?	1???000a12	11201?????	???2011110	a0121110?
<i>Pericotoxodon platignathus</i>					
1101001111	?100?0021	1001111011	11c0111111	01210a1100	100111100
<i>Dinotoxodon paranensis</i>					
????????a?	??????1?2?	??????0010	01201?????	???2011010	00011110?
<i>Mixotoxodon larensis</i>					
??0?????00	?00000102?	???????????	?????11113	101201101a	00122110?
<i>Calchaquitherium mixtum</i>					
??0?????01	1100111223	??????????2	?120011111	1012111010	011111101

Phylogenetic tree indicating the position of *Nesodon taweretus* sp. nov.

Consensus tree of the 16 most parsimonious trees obtained after the heuristic search with equally weighted characters. Length of 183 steps, consistency index (CI) of 0.46 and retention index (RI) of 0.65. The Bremer support is indicated for each node.

