

**Deciduous dentition and dental eruption of Hyainailouroidea (Hyaenodonta, “Creodonta,”
Placentalia, Mammalia)**

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In Palaeontologia Electronica

APPENDIX 3.

List of all the taxa and specimens used in this analysis, along with information on age and
locality data

Appendix 3. Specimens used for phylogenetic analysis

Akhnatenavus leptognathus

Formation: Jebel Qatrani Formation
Locality: Quarry A, lower Sequence
Geological Age: Rupelian, Oligocene
Absolute Age: 33.9–33.7 Ma
Country: Fayum, Egypt
Citation: Seiffert, 2010; Holroyd, 1999
Specimens observed: AMNH 13263 (Holotype), dentary with P₃–M₃

Akhnatenavus nefertiticyon

Formation: Jebel Qatrani Formation
Locality: L-41
Geological Age: late Priabonian, latest Eocene
Absolute Age: 35–33.9 Ma
Country: Egypt
Citation: Holroyd, 1994; Holroyd, 1999; Borths et al., 2016
Specimens observed: CGM 83735 (Holotype), cranium with C, P²–M³; DPC 13518, maxilla with M¹; DPC 18242, cranium with P²–M²; DPC 7765, dentary with P₂–M₃; DPC 15250, dentary with P₂, P₃, M₂

Allopterodon torvidus

Formation: Fissure fill, between Bouxwiler and Lissieu levels zone
Locality: Egerkingen
Geological Age: MP 14, Lutetian
Absolute Age: 42.6–42.8
Country: Switzerland
Citation: Hartenberger, 1970; Lange-Badré, 1984; Polly and Lange-Badré, 1993; Becker, Rauber, & Scherler, 2013
Specimens observed: NMB En 522 (Holotype), rostrum with P³–M³; NMB En 172, dentary with M₂–M₃ (erupting); UCMP 140644 (cast of Egerkingen specimen), dentary with P₁–M₃; NMB En. 167, maxilla with P⁴–M³; NMB Em. 16, partial cranium with P⁴–M³; NMB Bchs 482, palate with P⁴–M³; NMB Eh 557, dentary with P₄–M₃

***Altacreodus magnus* (*Cimolestes magnus*, Lillegraven 1969)**

Formation: Ravenscrag Formation, Frenchman Formation, Hell Creek Formation, Scollard Formation, Lance Formation
Locality: Saskatchewan, Alberta, Montana, Wyoming
Geological Age: Late Cretaceous (?Judithian–“Endmontonian”)
Absolute Age: 70–65 Ma
Country: North America
Citation: Lillegraven, 1969; Kielan-Jaworowska et al., 2004; Moore et al., 2014; Fox, 2015
Specimens from Fox, 2015: UALVP 620 (Holotype), dentary with P₄–M₃; UALVP 3793, maxilla with P⁴–M³; UALVP 3267, left M²; UALVP 3791, dentary with P₃, P₄, M₁–M₃; UALVP 3754, dentary with P₁, P₃, P₄, M₁–M₃;

Specimens from Lillegraven, 1969, Fig. 35 (UALVP 4085b, dP⁴; UALVP 3795, canine; UALVP 2997, P⁴; dP³, dP⁴; UALVP 3736, M³, UALVP 3793, maxilla with P⁴–M³), Fig. 36 (UALVP 3676, lower canine; UALVP 3152, P₁; UALVP 3791, P₁–M₃), Fig. 37 (UALVP 3267, M²; UALVP 3781, P⁴; UALVP 3754, P₁, P₃–M₃)

Anasinopa leakeyi

Anasinopa libyca

Formation: Hiwegi Formation and Kulu Formation

Locality: Rusinga Island, Lake Victoria (Maboko Island, Rousing Site 106, Karugu, Mfwanganu Island)

Geological Age: Burdigalian, Miocene

Absolute Age: 17.8–15 Ma

Country: Kenya

Citation: Savage, 1965; Werdelin, 2010

Specimens observed: BMNH M 19081a (Holotype), maxilla with P⁴, M¹; BMNH M19081b (Holotype), maxilla with M¹–M³; BMNH M 19081c (Holotype), dentary with P₁–M₃; BMNH M 19081d (Holotype), dentary with M₂, M₃; BMNH M19081e, dentary with canine and P₄; KNM-FT 15092, isolated M¹; KNM-WK 17061, dentary with P₂–M₃; KNM-WK 16992, dentary with M₂; KNM-WK 18197, isolated teeth P⁴, M³, M₂, femoral head, long bone shaft; KNM-RU 52250, dentary with I₁–M₃; KNM-RU 2935, dentary with M₁–M₃; KNM-RU 2928, M²; KNM-RU 2929, right M²; KNM-FT 3658, M₁; KNM-RU 2385, dP², dP³, dP⁴ (cast of specimen, location of original specimen unknown, though possibly in BMNH collections after loan to RJG Savage); (*Anasinopa libyca*) BMNH M82378, dentary with dP₃, dP₄

***Apterodon gaudryi* (= *A. flonheimensis*; = *A. intermedius*)**

Formation: Quercy, Mainz Basin, Weisselter Basin

Locality: Espenhain

Geological Age: Late Rupelian (MP22), Early Oligocene

Absolute Age: 32.6–30.9 Ma

Country: Germany

Citation: Lange-Badré and Böhme, 2005; Grohé et al., 2012

Specimens observed: AMNH 12391 (Cast of Holotype), P₄–M₃; BSPG 2008.43 (*Apterodon intermedius* holotype), P₄–M₂; BMNH M55a, maxilla with M¹–M²

Apterodon langebadrae

Formation: Idam Unit, Sarir Tibisti Basin

Locality: 68.19, 69.53, 25, Dur At-Talah

Geological Age: Late Bartonian

Absolute Age: 39 if Late Bartonian (Grohé et al. 2012); Likely 33 and Rupelian (Seiffert, 2010); range used: 37–33 Ma

Country: Libya

Citation: Grohé et al., 2012; Seiffert, 2010

Specimens observed: BMNH M 85297 (Holotype), dentary with C–M₃; BMNH M 85298 (Holotype), dentary with C, P₂–M₃; BMNH M 85300 (Holotype), maxilla with C, P¹, P⁴–M³; BMNH M 85301, maxilla with I²–P²; BMNH M 85303, maxilla with P³; BMNH M 85304, frontal fragment; BMNH M 85307, squamosal fragment; BMNH M 85308, squamosal fragment;

BMNH M 85309, sagittal crest; BMNH M 85310, cranial fragment; BMNH M 85312, occipital fragment; BMNH M 85313, cervical vertebra; BMNH M 85315, femur; BMNH M 85315, distal femur; BMNH M 85317, proximal femur; BMNH M 85318, humerus; BMNH M 85319, proximal tibia; BMNH M 85320, distal tibia; BMNH M 85321, distal radius; BMNH M 85322, ulna; BMNH M 85323, proximal radius; BMNH M 85324, metacarpal IV; BMNH M 85325, distal metacarpal IV; BMNH M 85327, phalanx I; BMNH M 85328, phalanx II; BMNH M 85329, phalanx II, BMNH M 85330, rib; BMNH M 85331, distal fibula; BMNH M 85332, innominate fragment; BMNH M 85333, innominate fragment

Apterodon macrognathus

Formation: Qasr el Sagha Formation, Jebel Qatrani Formation

Locality: Quarry A

Geological Age: Early Rupelian

Absolute Age: 33.9–33.7 Ma

Country: Fayum, Egypt

Citation: Holroyd, 1994; Lewis and Morlo, 2010; Seiffert, 2010

Specimens observed: CGM 8982 (Holotype), dentary with P₂–M₂; AMNH 13236, cranium with I¹–M³; AMNH 13237, cranium with I¹–M³; CGM 29916, dentary with P₂–M₃; DPC 7731, maxilla with canine–M³; UCMP 154454, dentaries with canine–M₃; DPC 7731, maxilla with C–M₃; DPC 0959, humerus; DPC 11347, dentary with M₁–M₂; SMNS 12643, dentary with canine–M₃; SMNS 11950 (Holotype), dentary P₄–M₃; SMNS 47724, palate with canine–M³; SMNS 11267a, dentary with P₄–M₃; SMNS 11267b, dentary with M₃; SMNS 43466, astragalus; SMNS 43467, radius; SMNS 47729, distal humerus, ulnae, tibia; BSPG 1905 XIII 510, dentary with Canine, P₂, P₄–M₃; BSPG 1905 XIII 9, maxilla with P⁴–M³; YPM 18160, dentary with canine, P₄–M₃; AMNH 13240, dentary with canine–M₃; AMNH 13247, tibia; AMNH 92794, calcaneum; AMNH 13241, dentary with P₂–M₃; BMNH M 8441, astragalus; DPC 1143, M¹; DPC 2557, dentary with M₁–M₃; DPC 4126, maxilla fragment with dP³; DPC 8217, left dentary with dP₃, dP₄, M₁.

Arfia gingerichi

Formation: Tienen Formation

Locality: Dormaal

Geological Age: MP7, very close to PETM

Absolute Age: 55.6–55.4 Ma

Country: Belgium

Citation: Smith and Smith, 2001; Smith, Rose & Gingerich, 2006

Specimens observed: IRSNB M1275 Holotype, M₃; IRSNB M1301, P₃; IRSNB M1302, DP₄; IRSNB M1303, P₄; IRSNB M1304, M₁; IRSNB M1305, M₂; IRSNB M1306, M₃; IRSNB M1307, P³; IRSNB M1358, DP⁴; IRSNB M1308, P⁴; IRSNB M1309, M¹; IRSNB M1310, M²; IRSNB M1311, M³

Arfia opisthotoma

Formation: Willwood Formation

Locality: Clarks Fork Basin, Bighorn Basin, Powder River Basin, Piceance Creek Basin

Geological Age: Early Eocene, early to middle Wasatchian (Sandcouleean Wa2 to late Graybullian Wa5)

Absolute Age: 55–53 Ma

Country: USA

Citation: Matthew, 1901; Ivy, 1993; Gunnell, 1998

Specimens observed: AMNH 99, UM 78996, dentary with M_1 – M_3 ; UM 69949, dentary with canine, P_2 – M_3

Specimens from literature: UA 8271, rostrum with canine– M^2 (Gingerich and Deutsch, 1989)

Arfia shoshoniensis

Formation: Willwood Formation

Locality: Clarks Fork Basin, Bighorn Basin, Powder River Basin

Geological Age: Early Eocene, early to middle Wasatchian (early Sandcouleean Wa1 to early Graybullian Wa3)

Absolute Age: 55–53 Ma

Country: USA

Citation: Matthew, 1915; Ivy, 1993; Gunnell, 1998

Specimens observed: AMNH 16158 (Holotype), UM 85935, rostrum with P^1 – M^3 ; UM 75186, dentaries with canine, P_2 – M_3 ; UM 80487, dentary with P_1 – M_3 ; UM 69474, partial skeleton with humeri, vertebral elements, tibia, femora, astragali, calcaneum, metapodials, innominate; UM 75383, radius

Specimens from literature: UM 65502, M^1 – M^2 , M_2 – M_3 (Gingerich and Deutsch, 1989)

Boritia duffaudi

Formation: ?

Locality: La Borie

Geological Age: Early Eocene, MP8 and MP9

Absolute Age: 54–51 Ma

Country: France

Citation: Solé et al., 2014a

Specimen from literature: MHNT.PAL.2010.19.1 (Holotype), P_3 , P_4 , M_1 – M_3

Boualitomus marocanensis

Formation: Sidi Daoui and Recette 4 quarries, lowermost bed I

Locality: Grand Daoui, Ouled Abdoun Basin

Geological Age: earliest Ypresian

Absolute Age: 55.8–54 Ma

Country: Morocco

Citation: Gheerbrant et al., 2006; Seiffert, 2010

Specimens observed from a cast of the holotype: OCP DEK/GE 306 (Holotype), dentary with canine, P_2 – M_3 (thanks to E. Gheerbrant for creating the cast)

Brychotherium ephalmos

Formation: Jebel Qatrani Formation

Locality: L-41

Geological Age: late Priabonian, latest Eocene

Absolute Age: 35–33.9 Ma

Country: Egypt

Citation: Holroyd, 1994; Seiffert, 2010; Present study

Specimens studied: CGM 83750 (Holotype), dentary with C–M₃; DPC 17627, dentary with P₄–M₃; DPC 11990, rostrum with P⁴M³; DPC 11569A, dentary with C, P₂–M₃; DPC 11569B, dentary with P₂, P₃, M₁–M₃; DPC 11474, dentary with dP₃, dP₄, M₁, M₂

Buhakia moghraensis

Formation: Moghra Formation

Locality: Wadi Moghra

Geological Age: early Miocene

Absolute Age: MN 4, 18–17 Ma

Country: Egypt

Citation: Morlo et al., 2007

Specimens observed: DPC 8994, dentary fragment with dP₄, M₁, M₂

Cynohyaenodon trux

Formation: Wittenberg Formation (among others)

Locality: Geiseltal (Lutetian, MP11; Germany), Egerkingen (Lutetian, ?MP13–Mp14; Switzerland)

Geological Age: Lutetian, MP11–MP14

Absolute Age: 48.6–40.4 Ma

Country: Germany, France, Switzerland

Citation: Solé et al., 2014; Van Valen, 1965; Lange-Badré and Haubold, 1990

Specimens observed: NMB Em 17, dentary with P₂, P₃, P₄, M₁, M₂, M₃; NMB En 187, dentary with M₁, M₂, M₃; NMB En. 111, maxilla fragment with M¹, M²; GMH 10831, dentary with M₂, M₃; GMH 3986, dentary with M₁, M₂, M₃; GMH 3984, dentary with P₃, P₄, M₁, M₂, M₃; GMH 3985, dentary with dentary P₃, P₄, M₁, M₃; GMH 3987, dentary with P₂, dP₃, dP₄, M₂

Cynohyaenodon cayluxi

Formation: Quercy, Egerkingen

Locality: Quercy, Egerkingen

Geological Age: MP14, MP18–MP20, Priabonian, Late Eocene

Absolute Age: 48–34 Ma

Country: France

Citation: Solé, 2013; Solé et al., 2014b

Specimens observed: MCZ 8901, cranium with P³–M³; MCZ 8902, dentary with P₃–M₃; UCMP 140651, dentary with P₂–M₃ (cast); UCMP 140652, dentary with P₂–M₂ (cast); UCMP 140653, dentary with P₂–M₃; MNHM Qu 8562, cranium with P²–M³; MNHM Qu 8566, dentary with P₄–M₃; MNHM Qu 8564, dentary with canine–M₂; MNHM Qu unnumbered, maxilla with P⁴–M³; BMNH M 9612, dentary P₂–M₃

Dissopsalis pyroclasticus

Formation: Ngorora Formation (Locality 2/56) and Kaboor

Locality: Tentatively in (Lewis and Morlo discussion) Kaboor, Fort Ternan, Maboko, Moroto, Napak

Geological Age: Middle Miocene

Absolute Age: 15–9 Ma

Country: Kenya

Citation: Savage, 1965; Barry, 1988; Lewis and Morlo, 2010; Werdelin, 2010

Specimens observed: BMNH M. 19082, dentary with P₄–M₁ (Holotype); KNM-MB 25305, maxilla fragment with M²; KNM-MJ 13, maxilla fragment with P⁴–M²; KNM-FT 13770, M₃; KNM-MB 8432, M²; KNM-FT 15092, M¹; KNM-BN 1191, M²; KNM-FT 3562, dentary with P₂–P₄, M₁–M₂; KNM-FT 3357, maxilla with dP³–dP⁴

Eomaia scansoria

Formation: Yixian Formation

Locality: Liaoning Province

Geological Age: Early Cretaceous, middle Barremian

Absolute Age: 129.7–122.1 Ma

Country: China

Citation: Kielan-Jaworowska et al., 2004; Chang et al., 2009; Beck and Lee, 2014

Specimen scored from Kielan-Jaworowska et al., 2004

Eoproviverra eisenmanni

Formation: Rians

Locality: Rians

Geological Age: earliest Eocene, MP7

Absolute Age: 55.8–48.6 Ma

Country: France

Citation: Godinot, 1981; Solé et al., 2014a

Specimen scored from Literature: From Godinot, 1981: MNHN.F.RI 400, M₂; MNHN.F.RI 203, M₃; MNHN.F.RI 401, M¹; MNHN.F.RI 362, M²; MNHN.F.RI 2014, dentary with M₁–M₂

Eurotherium matthesi

Formation: Wittenberg Formation (among others)

Locality: Geiseltal (Lutetian, MP11; Germany), Egerkingen y, a+B (Lutetian, ?MP13–Mp14; Switzerland), La Défense (Lutetian, MP13; France), Issel (Lutetian, MP14; France), Aigues-Vives 2 (Lutetian, ?MP13; France)

Geological Age: Lutetian, MP11–MP14

Absolute Age: 48.6–40.4 Ma

Country: Germany, France, Switzerland

Citation: Polly and Lange-Badré, 1993; Solé, Falconnet, and Yves, 2014

Specimens observed: UCMP 140638, dentary with P₁–M₃ (Cast, original specimen number not recorded); UCMP 140639, maxilla with P²–M³ (Cast, original specimen number not recorded); UCMP 140635, astragalus (cast of GMH XIV 3614); UCMP 140634, calcaneum (cast of GMH XIV 2364); GMH XIV 224, P₁–M₃; GMH XI-1-1954 (Holotype), dentary with P₂–M₃; GMH XIV-3419-1956, cranium with P²–M³; GMH XIV-1357-1955, cranium with P²–M³; GMH XIV-3332-1956, dentary with P₃–M₃; GMH XIV-3614-1956, astragalus; GMH XIV-2364-1954, calcaneum

Eurotherium theriodis

Formation: unnamed karst infillings

Locality: Egerkingen y, a+B (Lutetian, ?MP13–Mp14; Switzerland), Aigues-Vives 2 (Lutetian, ?MP13; France)

Geological Age: Lutetian, MP13

Absolute Age: 48.6–40.4 Ma

Country: France, Switzerland

Citation: Polly and Lange-Badré, 1993; Solé, Falconnet, & Yves, 2014

Specimens observed: UCMP 140647, dentary with P₂–M₃ (Cast, original specimen number not noted); NMB Em. 12, cranium with P¹–M¹ (Holotype), NMB Em. 14a, cranium with P³–P⁴, humerus (Egerkingen, 1915 on card); NMB Em. 14b (Paratype), dentary with M₂–M₃; NMB Em. 193 (Paratype), M²; NMB En. 247, M²; NMB En. 120, dentary with P₃–M₃; NMB En. 106, P⁴; NMB En. 140, M¹; NMB Eh. 536, dentary with M₂–M₃

Observed in Solé et al. (2015): MNHN.F.ERH427, right dentary with canine–M₃;

MNHN.F.ERH428, dentary with P₁, P₂, P₄

Furodon crocheti

Formation: Glib Zegdou Formation

Locality: HGL 50 and HGL 50 bis, Gour Lazib, Tindouf Province

Geological Age: late Ypresian or middle Lutetian

Absolute Age: 49.3–45.7 Ma

Country: Algeria

Citation: Solé et al., 2014b; Coster et al., 2012

Observed casts of material at MNHM thanks to F. Solé: HGL 50bis-56 (Holotype), dentary with canine base, P₁–P₃ alveoli and P₄–M₃; HGL 50-410, M₁; HGL 50-404, M¹; HGL 50-405, M¹; HGL 50-407, M¹

Galecyon chronius

Formation: Willwood Formation

Locality: Bighorn Basin, Clarks Fork Basin

Geological Age: Wa-6

Absolute Age: 53–50.3 Ma

Country: USA

Citation: Zack, 2011

Observed from Zack (2011): USNM 487920 (Holotype), petrosal, P³ (left), P⁴–M¹; USNM 511004, dentary with P₂, P₄–M₃; YPM 23341, dentary with P₂–P₄; USNM 51190, P₄; USGS 8769, dentary with M₁–M₂; USGS 10284, M₂; USNM 487920, dentary with C, P₂–P₃, M₁–M₃; USGS 15956, M²

Observed from Zack and Rose (2015): USNM 511004, humerus, ulna, scaphoid, lunate, tibia, astragalus, calcaneum, cuboid

Galecyon mordax

Formation: Willwood Formation

Locality: Bighorn Basin, Clarks Fork Basin

Geological Age: Wa-5, Wa-1/2 to Wa-3

Absolute Age: 55.4–53 Ma

Country: USA

Synonym: *Prolimnocyon robustus*

Citation: Zack, 2011

Specimens observed: UM 85887, dentary with canine, P₂–M₂; AMNH 16157 (Holotype), canine, P₂–M₃

Observed from Zack (2011): USNM 490637, dentary with canine, P₁–M₁

Observed from Gingerich and Deutsch (1989): UM 76227, dentary with M₁–M₃

Observed from Zack and Rose (2015): USNM 1125, glenoid of left scapula; USNM 1125, innominate; USNM 1125, femur, fibula

Galecyon morloi

Formation: Tienen Formation

Locality: Dormaal

Geological Age: MP7, very close to PETM

Absolute Age: 55.6–55.4 Ma

Country: Belgium

Citation: Smith and Smith, 2001; Smith, Rose & Gingerich, 2006

Specimens observed: IRSNB M1314, M₁; IRSNB M1312, DP₄; IRSNB M1313, P₄; IRSNB M1315, M₂; IRSNB M916, M₃; IRSNB M1316, P₄; IRSNB M1317, M¹ or M²

Galecyon peregrinus

Formation: Willwood Formation

Locality: Bighorn Basin, Clarks Fork Basin, Powder River Basin

Geological Age: early Wasatchian (Sandcouleean), Wa-0 to Wa-1/2

Absolute Age: 55.4–53 Ma

Country: USA

Citation: Zack, 2011

Observed from Zack (2011): USNM 509676 (Holotype), dentary with P₃–M₃; UCMP 217129, M₂; UCMP 217128, M₁

Gazinocyon whitiae

Formation: Green River Basin, Bighorn Basin, Wind River Basin

Locality: Green River Basin, Bighorn Basin, Wind River Basin

Geological Age: Lostcabanian subage, Wasatchian NALMA, early Eocene

Absolute Age: 53–50.3 Ma

Country: Wyoming, USA

Synonym: *Sinopa vulpecula*, *Prototomus vulpeculus*, *Gazinocyon vulpecula*

Citation: Matthew, 1915; Gingerich and Deutsch, 1989; Polly, 1996; Rana et al., 2014

Specimens observed: UCMP 137216, dentary with M₃, calcaneum, radius, atlas, axis dens, innominate, ulna, humerus, femur, astragalus, M²; AMNH 15606, dentary with P₂–M₃

Observed from Gingerich and Deutsch (1989): USNM 19347, maxilla with P²–M³

Glibzegdouia tabelbalaensis

Formation: Glib Zegdou Formation

Locality: HGL 10 and HGL 50, Gour Lazib, Tindouf Province

Geological Age: late Ypresian or middle Lutetian

Absolute Age: 49.3–45.7 Ma

Country: Algeria

Citation: Solé et al., 2014b; Coster et al., 2012

Observed casts of material at MNHM thanks to F. Solé: GZC 35 (Holotype), M₂; HGL 10-15, M²; HGL 50-411, M₁; HGL 50-406, P³; HGL 50-408, P³

Hemipsalodon grandis

Formation: Cypress Hills Formation, Clarno Formation, ?Chadron Formation

Locality: Saskatchewan, Oregon, Wyoming, Texas

Geological Age: Late Duchesnean, Bartonian (“late Eocene–early Oligocene” in Mellett)

Absolute Age: 41.2–37.8 Ma

Country: USA

Citation: Mellet, 1969; Solé et al., 2015

Specimens observed: AMNH 95735 (cast of OMSI 619), cranium with I²–M³ and dentary with canine, P₃–M₃; AMNH 95736, maxilla with canine, P³–M³; AMNH 10636 (cast of NMC 6497, Holotype), dentary with M₃; AMNH 95780 (cast of SDSM 6333), dentary with P₃–M₁

Hyaenodon horridus

Formation: White River Formation, South Dakota (many, see Mellet, 1977)

Locality: Saskatchewan, Wyoming, Montana, Colorado, North Dakota, South Dakota

Geological Age: late Chadronian to late Orellan

Absolute Age: 38–33.3 Ma

Country: USA, Canada

Synonym: *Neohyaenodon horridus*, *Hyaenodon cruentus*

Citation: Mellet, 1977

Specimens observed: AMNH 39438, cranium with I¹–M²; AMNH 39439, cranium with I², I³, dC, P¹, P² (erupting), dP³, dP⁴, M¹, M² (erupting), dentary with canine, P₂, dP₃, dP₄, M₁, M₂; UM 6792, humerus; UM 6786, humerus; AMNH 75704, I¹–M², dentary with I₁–M₃; AMNH 1488, cranium with I²–M²; AMNH 9809, innominate, sacrum, lumbar vertebrae, femur, tibia, fibula, metapodials, astragalus, ; AMNH 1381, humerus, astragalus, calcaneum; AMNH 75701, humerus, scapula; AMNH 1381, humerus, ulna; AMNH 1175, ulna; MCZ 17395, cranium with I¹–M², mandible with I₁–M₃ (dentary occluded to cranium); MCZ 4739, cranium with I¹–M² and mandible (occluded) with I₁–M₃; UCMP 22788, cranium with P¹–M²; UCMP 158793, cranium with I³–M²; AMNH unnumbered specimen, cranium, dentaries, skeleton; AMNH 8775, cranium and dentaries (occluded), cervical vertebrae, thoracic vertebrae (T1–T4); YPM 10010, cranium with canine, P²–M², mandible with I₂–M₃; YPM 10916, articulated pes; YPM 10996, humerus; YPM 11035, ulna; YPM 12656 (*Hyaenodon* (*Neohyaenodon*) holotype), cranium with I²–M² and mandible (occluded) with I₂–M₃; AMNH 75725, dentary with dP₃, dP₄, M₁, M₂; AMNH 97780, dentary with P₂, dP₃, dP₄, M₁, M₂

Ergiliyn Dzo *Hyaenodon*

Formation: Ergiliyn Dzo Formation

Locality: Khoer Dzan and Ergiliyn Dzo localities (?)

Geological Age: early Oligocene

Absolute Age: 34–32 Ma

Country: Mongolia

Citation: Lavrov, 1999; Morlo and Nagel, 2006

Specimens observed: PIN 3110-5785, dentary with I_1 – M_3 ; PIN 3109-283, maxilla with P^2 – P^3 ; PIN 3110-578a, cranium with I^1 – M^2 , humerus, tibia, femur, radius; PIN 3109-83, maxilla with P^2 – P^3

Hyaenodon exiguus

Formation: Euzet-les-Bains (Gard): lower Ludien

Locality: Quercy

Geological Age: late Eocene, Euzet Level Zone, Priabonian

Absolute Age: 37.2–33.9 Ma

Country: France

Citation: Lange-Badré, 1979

Specimens observed: MNHM Qu 8364, dentary with canine, P_4 – M_3 ; MNHM Qu 8593, basicranial fragment with auditory bulla; MNHM Qu 8425, P_4 – M_3 ; MNHM Qu 8647, maxilla fragment with P^3 – M^2 ; MNHM Qu 17662, cranium with erupting teeth exposed dP^2 , dP^3 , dP^4 , P^2 , P^3 , P^4 , M_1 , M^2 ; NHMUK M 2353, dentary with P_1 , dP_3 , dP_4 , M_1 ; NHMUK M 2353A, dentary with dP_3 , dP_4 ; NHMUK M 4498, P_2 , dP_4

Hyaenodon minor

Formation: Euzet-les-Bains (Gard): lower Ludien

Locality: Fons 4 (Gard); Quercy; Roc de Santa, Spain; Hordle, lower and upper Headon Beds, England; Gosgen Kanal, Switzerland

Geological Age: late Eocene, Euzet Level Zone, Priabonian

Absolute Age: 37.2–33.9 Ma

Country: France, Spain, England, Switzerland

Citation: Lange-Badré, 1979

Specimens observed: MNHM Qu 8649, cranium with P^1 – M^2 ; MNHM Qu 8461, maxilla fragment with P^1 ; MNHM Qu 8470, maxilla with P^4 – M^2 ; MNHM Qu 8407, M^2 ; MNHM Qu 8406, M^1 ; MNHM Qu 8471, dentary with P_3 – M_3 ; MNHM Qu 8429, dentary with P_3 – M_3 ; MNHM Qu 8557, dentary with canine– P_3 ; MNHM Qu 8450, dentary with P_2 – P_4 ; MNHM Qu 8419, dentary with M_1 – M_3 ; MNHM Qu 8329, rostrum with P^2 – M^2 ; MNHN Qu 9981, astragalus

Hyaenodon neimongoliensis

Formation: Ulanatal Formation

Locality: Ulanatal, Alxa Zuoqi, Nei Mongol

Geological Age: early Oligocene, Hsandagolian

Absolute Age: 33.9–23.03 Ma

Country: China

Citation: Huang et al., 2002; Rodrigues et al., 2014

Specimens observed: IVPP V12438 (Holotype), dentary with canine, P_2 – M_3 ; IVPP V12439, maxilla with P^4 – M^2 ; IVPP V12440, dentary with canine, P_2 , P_3 ; IVPP V12441, P_2

Hyainialouros sulzeri

Formation:

Locality:

Geological Age: MN 3–MN5

Absolute Age: 18–15 Ma

Country: France, Switzerland, Germany

Citation: Ginsburg, 1980; Morlo, Miller & El-Barkooky, 2007; Solé et al., 2015

Specimens observed: SMNS 1926 I 12, P⁴–M¹ (Cast of Holotype); BMNH M14000, P⁴ (Cast of specimen from Mösskirsch, Baden); BMNH M13999, M² (Cast of specimen from Mösskirsch, Baden)

Specimens scored from literature: Illustrated in Ginsburg, 1980

Indohyaenodon raoi

Formation: Cambay Shale Formation

Locality: Vastan open-cast lignite mine

Geological Age: lower Eocene, Ypresian, Bumbanian Asian Land Mammal Age

Absolute Age: 54.5 Ma

Country: India

Citation: Rose et al., 2014; Rana et al., 2015

Observed from figures in Rana et al., 2015: GU 1680, rostrum with P²–M³; GU 767, dentary with P₄–M₃ (canine–P₃); GU 1721, M¹ or M²; GU 321, M₁; GU 1631, M₁; GU 652, dentary with P₄, M₂, alveoli for canine, P₂, P₃; GU 1630, dentary with alveoli for canine, P₂, P₄–M₁; GU 740, ulna; GU 741, tibia; GU 273, tibia; GU 807, calcaneus

Isohyaenodon pilgrimi

Formation: Hiwegi Formation, Kulu Formation

Locality: Rusinga Island (Kavirondo Gulf), Napak

Geological Age: Burdigalian, early Miocene

Absolute Age: 20–15 Ma

Country: Kenya, Uganda

Citation: Savage, 1965; Lewis and Morlo, 2010; Werdelin, 2010

Specimens observed: BMNH M. 19100a (Holotype), dentary with P₂–M₃; BMNH M. 19100b (Holotype), dentary with P₃–M₃; BMNH M. 19100c (Holotype), cervical vertebrae; KNM-RU 259, dentary with P₄–M₃; KNM-RU 2945, dentary with P₂, P₄, M₁; KNM-RU 2943, P₄, M₂, M₃; KNM-RU 5415, astragalus; KNM-RU 8404, rostrum; KNM-SO 1105, dentary with M₂; KNM-SO 1668, maxilla fragment with P⁴–M¹; KNM-SO 5395, M₂; KNM-SO 5671, dentary with M₁–M₃; KNM-SO 8420, dentary with P₄

Kerberos langebadrae

Formation: ?

Locality: Lautrec, Montespieu

Geological Age: MP16, middle Eocene, Bartonian

Absolute Age: 40.4–37.2 Ma

Country: France

Citation: Solé et al., 2015

Specimens observed: MNHN.F.EBA 517 (Holotype), cranium with I²–I³, P¹–M³; MNHN.F.EBA 518a, dentary with canine, M₂–M₃; MNHN.F.EBA 518b, dentary with P₂–M₃; MNHN.F.EBA 520, fibula; MNHN.F.EBA 521, astragalus; MNHN.F.EBA 522, calcaneus; MNHN.F.EBA 523, metatarsal I; MNHN.F.EBA 524, metatarsal II; MNHN.F.EBA 525, metatarsal III; MNHN.F.EBA 526, metatarsal II; MNHN.F.EBA 527, middle phalanx; MNHN.F.EBA 528, middle phalanx

Koholia atlasense

Formation: ?

Locality: El Kohol, Saharan Atlases

Geological Age: Ypresian, late early Eocene

Absolute Age: 51.8–51 Ma

Country: Algeria

Citation: Crochet, 1988; Solé et al., 2009; Coster et al., 2012

Observed from Fig. 1 and Fig. 2 in Crochet, 1988

Kyawdawia lupina

Formation: ‘Upper Member’ of the Pondaung Formation

Locality: Kdw7, Pondaung area

Geological Age: latest middle Eocene

Absolute Age: 40.1–36.7 Ma

Country: Myanmar

Citation: Egi et al., 2005, Zaw et al., 2014

Specimens observed as casts: AMNH 133542 (cast of holotype NMMP-KU 0042), rostrum with I²–I³, canine, P¹, P⁴–M³; NMMP-KU 0042 (cast at UCMP), canine cast; NMMP-KU 0784, P₄; NMMP-KU 0043, M₃; KMMP-KU 1288, I³, canines, P₁, P₄, M₁, M₃, P², P³, M², dentary fragments

Specimens observed from Egi et al., (2005): NMMP-KU 0042, cranium with zygomatic arch fragments; NMMP-KU 0044, I²–I³; NMMP-KU 1661, I³, dentary with P₃, P₄, M₂–M₃; NMMP-KU 0785, humerus, femoral head, tibia, vertebra, jugal (all fragmentary); NMMP-KU 1288, pisiform, phalanx

Lahimia selloumi

Formation: local Thanetian bed IIa, Sidi Chennane quarries

Locality: Ouled Abdoun Basin

Geological Age: ?middle Paleocene–late Paleocene, Selandian

Absolute Age: 61.6–59.2 Ma

Country: Morocco

Citation: Solé et al., 2009; Kocsis et al., 2014

Specimens observed from casts created by E. Gheerbrant for E. Seiffert of OCP DEK/GE 443 (Holotype), dentary with alveoli for canine, P₂–P₄, M₁–M₃; MNHN PM 56, dentary with M₂–M₃; MNHN PM 57, dentary with P₃ roots, M₁–M₃; OCP DEK/GE 442, dentary with M₂–M₃ and alveoli of P₂–M₁

Leakitherium hiwegi

Formation: Hiwegi Formation, Kulu Formation

Locality: Rusinga Island (Kavirondo Gulf), Napak

Geological Age: Burdigalian, early Miocene

Absolute Age: 17.8–15 Ma

Country: Kenya, Uganda

Citation: Savage, 1965; Werdelin, 2010

Specimens observed: BMNH M. 19083 (Holotype), maxilla with M^1 – M^2 ; KNM-RU 3119, dentary with P_4 – M_3 , isolated M^1 , M^2 , P_1 – P_4 , canines, cranial fragments including the sagittal crest, occipital region, and zygomatic arches; KNM-RU 2949, maxilla with dP^3 , dP^4 ; KNM-RU 17244, astragalus; KNM-RU 4389, P^4 ; KNM-RU 8390, P_4 ; KNM-RU 17243, M_3 ; KNM-RU 17343, humerus; KNM-RU 15182, maxilla with dP^3 , dP^4

Leonhardtina gracilis

Formation: Geiseltal

Locality: Geiseltal

Geological Age: MP12–MP13

Absolute Age: 48.6–40.4 Ma

Country: Germany

Citation: Solé et al., 2014a

Specimens observed: GMH VI-42-1949 (10237) Holotype, dentary with P_2 – M_3 ; GMH VI-712-1951, dentary with I_1 –canine, P_1 alveoli, P_2 – P_4 , M_2 – M_3 , palate with P^3 – M^3 , astragalus; GMH I-786-1949 (10038), cranium with P^2 – M^3 and petrosal; GMH 2802, calcaneum; GMH VI-343, dentary with P_3 – M_3 ; GMH I-78a-10038, dentary with P_3 , P_4 , M_3 ; GMH LVIII-23-1982, dentary with P_2 – P_4 , M_2 – M_3 ; GMH XXXV-15-1962, maxilla with P^2 – P^4

Lesmesodon behnkeae

Lesmesodon edingeri

Formation: Messel

Locality: Messel (Hessen, Germany)

Geological Age: early middle Eocene (MP 11)

Absolute Age: 48.6–40.4 Ma

Country: Germany

Citation: Morlo and Habersetzer, 1999

Specimens observed: SMF-ME 3843, skeleton with P^3 , dP^4 , M^1 , M^2 exposed; SMF-ME 1465a, upper skeleton with canine– P_3 , dP_4 , M_1 – M_2

Specimens also scored from observations made in Morlo and Habersetzer (1999)

Limnocyon verus

Formation: Bridger Formation

Locality: Bighorn Basin, Bridger Basin, Uinta Basin

Geological Age: Br1, Br2, Br3, middle Eocene, early to late Bridgerian

Absolute Age: 50.3–46.2 Ma

Country: USA

Citation: Ivy, 1993; Morlo and Gunnell, 2003

Specimens observed from observation: YPM 13095 (Holotype), I^1 – I^3 , P^1 , P^4 – M^2 ; YPM 11796, cranium with P^3 – M^2 ; AMNH 12155, cranium with I^1 – I^3 (alveoli), canine, P^1 – M^2 , dentary with canine– M_2 , ulna, radius, humerus, femur, tibia, fibula, astragalus, calcaneum, metapodials

Maelestes gobiensis

Formation: Djadokhta Formation

Locality: Ukhaa Tolgod, Mongolia

Geological Age: Campanian, Late Cretaceous

Absolute Age: 75–71 Ma

Country: Mongolia

Citation: Wible et al., 2007; Wible et al., 2009

Specimens observed from literature in Wible et al., 2007 and Wible et al., 2009

Masrasector aegypticum

Formation: Jebel Qatrani Formation

Locality: Quarry G

Geological Age: Rupelian

Absolute Age: 31–30.6 Ma

Country: Egypt

Citation: Simons and Gingerich, 1974; Seiffert, 2010

Specimens observed: CGM 30978, dentary with P₃, M₁–M₃ (casts of holotype also observed at UCMP 66312, YPM 20943, AMNH 129736); YPM 30030, maxilla with P³–P⁴; YPM 20944, dentary with dP₄–M₁

Masrasector ligabuei

Formation: Ashawq Formation

Locality: Taqah, Dhofar Province, Sultanate of Oman

Geological Age: Priabonian, latest Eocene; Rupelian, early Oligocene

Absolute Age: 33–30.6 Ma

Country: Oman, Egypt

Citation: Crochet et al., 1990; Seiffert, 2006

Specimens observed in Crochet et al., 1990: TQ 13 (Holotype), M¹; TQ 14, M₃

Masrasector nananubis

Formation: Jebel Qatrani Formation

Locality: L-41

Geological Age: late Priabonian, latest Eocene

Absolute Age: 35–33.9 Ma

Country: Egypt

Citation: Borths and Seiffert, 2017

Specimens observed: CGM 83736 (Holotype), right dentary with canine, P₂–M₃; CGM field number 96-161, rostrum fragment with P³–M²; CGM field number 95-281, dentary with P₄–M₁; CGM field number 95-109, isolated M²; DPC 7704, left dentary with P₂–M₃; DPC 8276, rostrum and palate with P³–M³; DPC 9274, right dentary with canine, P₁, alveoli for P₂, P₃–P₄, alveoli for M₁, M_{2,3}; DPC 10358, left dentary with dP₃, dP₄, M_{1,2,3}; DPC 11383, right dentary with C, alveoli for P₁, P₂–M₃; DPC 11359, right dentary with canine, P₁₋₄, M₃; DPC 11990, cranium with P²–M³; DPC 12157, cranium with alveoli for P^{1,2}, P³–M³; DPC 12330, right dentary with P₃–M_{1,2}; DPC 12524A, right dentary with alveoli for P_{2,3}, P₄–M₃; DPC 13285, rostral fragment with P²–M³; DPC 15211, left dentary with C, P₁–M₃; DPC 15742, right dentary with canine, P₂–M₃; DPC 10831, left distal humerus; DPC 15436, left distal humerus; DPC 11670, left distal humerus; DPC 13837, right maxilla dP³, dP⁴, M¹; DPC 20882, maxilla with dP³–dP⁴

Matthodon tritens

Formation: Geiseltal

Locality: Geiseltal

Geological Age: MP11

Absolute Age: 48.6–40.4 Ma

Country: Germany

Citation: Solé et al., 2014a

Specimens observed: GMH XIV-1-Franzke 6, dentary with canine, P_2 – M_3 , GMH XIV-739-1957, dentary with P_1 – M_3 ; GMH XIV 5107-Franzke 9, maxilla with P^2 – P^4 ; GMH XIU-3820, humerus; GMH XIV-2832-1956, dorsal cranium fragment

***Megistotherium osteothlastes* Savage 1973**

Formation:

Locality: Gebel Zeltan, Wadi Moghra

Geological Age: Burdigalian, middle Miocene

Absolute Age: 19–14 Ma

Country: Libya, Egypt

Citation: Savage, 1973; Werdelin, 2010

Specimens observed: BMNH M26173 (Holotype), cranium with alveoli for I^1 – M^2 with partial crowns of P^2 , M^2 , M^3 ; BMNH 9117, astragalus; DPC 6611, dentary with P_4 – M_3 ; BMNH M26518, maxilla with alveoli for M^1 – M^3 ; BMNH UB 20580, Metatarsal IV; BMNH L17, metatarsal III; BMNH X87, metatarsal III; BMNH UB 20576, distal humerus; BMNH M26516, premaxilla fragment with I^1 alveoli; BMNH M21902, atlas; BMNH M26515, cranial fragment with parietals, occipital condyles, basicranium; BMNH M92922, maxilla with roots of P^2 – P^3

Metapterodon kaiseri

Formation: Elisabethfeld

Locality: Elisabethfeld, Rusinga Island

Geological Age: early Miocene, middle Burdigalian

Absolute Age: 20–15 Ma

Country: Namibia, Kenya

Citation: Holroyd, 1999; Werdelin, 2010

Specimens observed: BSPG 1926-X-1 (Holotype), maxilla with P^3 – M^2 ; KNM-RU 2951, mandibular symphysis with P_1 , P_2 ; KNM-KA 77, maxilla fragment with P^3 – M^3 ; KNM-RU 8369, M^2 ; KNM-RU 29509, maxilla fragment with P^4 – M^2

***Metasinopa* spp.**

Formation: Jebel Qatrani Formation

Locality: Type locality unknown beyond “upper sequence of Jebel Qatrani”

Geological Age: Rupelian, Fayum A? (V is Where *M. osborni* comes from)

Absolute Age: 33–30 Ma

Country: Egypt

Citation: Holroyd, 1994; Lewis and Morlo, 2010; Seiffert, 2010

Specimens observed: AMNH 14453 (Holotype), dentary with canine, P_2 – M_3 ; DPC 10199, maxilla with dP^3 , dP^4 , M^1 ; DPC 4544, dentary with P_2 , dP_4 , M_1 , M_2 , M_3 .

Mlanyama sugu

Formation: Unnamed

Locality: Nakwai

Geological Age: latest Oligocene to early Miocene

Absolute Age: 24–20 Ma

Country: Kenya

Citation: Rasmussen and Gutierrez, 2009

Note: Rasmussen and Gutierrez (2009) originally described the holotype as retaining P_1 – M_1 with P_4 retained as a highly modified molariform tooth. For the purposes of this study, the tooth position identified by Rasmussen and Gutierrez (2009) as P_4 is considered dP_4 .

Specimens observed: KNM-NW 46832 (Holotype), dentary with canine alveolus P_2 – M_1 ; KNM-NW 46828, P_4 ; KNM-NW 46824, P^4 ; KNM-NW 46829, P_3 ; KNM-NW 46830, P_3 ; KNM-NW 46831, M^1 ; KNM-NW 46909, M_3 ; KNM-NW 46913, M_1 ; KNM-NW 46914, M_3

Morlodon vellerei

Formation: ?

Locality: MP8+9, Saint Agnan (Paris Basin, France), MP8+9, Avenay, Condé-en-Brie (France)

Geological Age: Early Eocene, MP8+9, Wasatchian

Absolute Age: 55.8–48.6 Ma

Country: France

Citation: Solé, 2013

Specimens observed: StA 741-L (Holotype), dentary with P_2 – M_2 ; StA 326, M^2 trigonid

Specimens observe from Solé, 2013: MNHN Condé 65, maxilla fragment with P^4 – M^3

Orienspterodon dahkoensis

Formation: Rencun Member, lower part of Heti Formation in China, Upper member of Pondaung Formation in Myanmar

Locality: Lunan Basin, Yunnan Province, southern China; Eastern side of Pondaung Range, central Myanmar

Geological Age: late middle Eocene

Absolute Age: 42–39 Ma

Country: China, Myanmar

Citation: Egi et al., 2007

Specimens observed: PGM V1297, dentary with P_2 – M_3 ; AMNH 122028 (cast of IVPP specimen), M_3 ; NMMP-KU 0261 (cast observed at UCMP), dentary with P_2 – M_1 ; NMMP-KU 0262, M_1 and M_2 trigonids; NMMP-KU 0304 (cast observe at UCMP), maxilla with roots of P^3 – P^4 , M^1

Specimens observed in Egi et al., 2007: NMMP-KU 1628, proximal metacarpal II, metatarsal III, metatarsal IV

Oxyaenoides bicuspidens

Formation: Geiseltal

Locality: Geiseltal

Geological Age: MP11

Absolute Age: 48.6–40.4 Ma

Country: Germany

Citation: Solé et al., 2014a; Solé, 2015

Specimens observed: GMH XIV-2848-1955 (Holotype, cast also available as UCMP 140637), dentary with P₂–M₃; GMH XV-1143-1957, calcaneum; GMH XIV-2944-Franzke 9, maxilla with alveoli for P¹–P⁴, crowns of M¹–M²; GMH XIV-2909-1954, dentary with M₁–M₃; GMH XIV-2910-Franzke 12, premaxilla fragment and maxilla fragment with M¹–M²; GMH XIV-291, P₄; GMH XXXVII-174-1970, femur; GMH XIV-2810-1954, humerus; GMH XIV-456-1956, femur

Oxyaenoides lindgreni

Formation: Cuis, Mancy

Locality: Cuis, Mancy

Geological Age: MP10

Absolute Age: 51–48.6 Ma

Country: France

Citation: Solé et al., 2014a; Solé, 2015

Specimens observed: MNHN.F.L-49-MA (Holotype), dentary with P₄, M₂, M₃ (casts at MCZ 21254, UCMP 107092); MNHN MA 14826, dentary with P₃–P₄; MNHN.F.L-23-Cuis, M¹;

MNHN.F.MA.14833, M₁

Observed in Solé et al., 2014a

Paratritemnodon indicus

Formation: Subathu Formation, upper part

Locality: Outer Himalaya, near Village Fiji on the Metka-Mohgala Road, Rajauri District

Geological Age: Late Early to early Middle Eocene

Absolute Age: 49–44.5 Ma

Country: India

Citation: Kumar, 1992; Rana et al., 2015

Observed from Fig. 2 (WIF/A 1103, palate with canine–M³) and Fig. 3 (WIF/A 1102, dentary with P₃–M₃) in Kumar (1992)

Paroxyaena galliae

Formation: Quercy

Locality: Quercy, France

Geological Age: middle Eocene, Bartonian

Absolute Age: 41.2–37.8 Ma

Country: France

Citation: Lange-Badré, 1979; Solé et al., 2015

Specimens observed: MNHM Qu 8735, dentary with P₄–M₃; BSPG 1879-XV-33, maxilla with M¹, M²

Specimens observed observed from Lange-Badré, 1979

Paroxyaena pavlovi

Formation: Specific locality unknown

Locality: Quercy, France

Geological Age: late Eocene, Priabonian, MP16

Absolute Age: 40.4–37.2 Ma

Country: France

Citation: Lavrov, 2007; Solé et al., 2015

Observed from cast of GGM Ca-300 courtesy of A. Lavrov

Observed from literature in Figs. 1–4, GGM Ca-300, cranium with dP^3 , dP^4 , M^1

Parvagula palulae

Formation: ?

Locality: Palette, Provence, Bouches-du-Rhone; Fornes, Minervois, Hérault

Geological Age: Early Eocene (not more specific in Solé et al., 2015, Ypresian age used here)

Absolute Age: 56–47.8 Ma

Country: France

Citation: Godinot et al., 1987; Solé et al., 2015

Specimens observed: UM/PAT 4 (Holotype, cast observed at MNHM), dentary with P_2 – M_1

Specimens observed in Solé et al., 2015: UM/FNR 52, trigonid of M_1 ; UM/FNR 53, dentary fragment with P_4 ; UM/FDN 153, trigonid of M_1

Preregidens langebadrae

Formation: Argiles rutilantes d'Issel et de Saint-Papoul Formation

Locality: Saint-Papoul, Aude, Languedoc-Roussillon

Geological Age: early Eocene, Ypresian, MP8 and MP9

Absolute Age: 55.8–48.6 Ma

Country: France

Citation: Solé et al., 2015

Specimens observed in Solé et al. (2015): MNHN.F.SPPXX1, dentary with P_1 , P_2 , P_3 alveoli, P_4 , M_1 – M_3

Prolimnocyon atavus

Formation: Willwood Formation

Locality: Clark's Fork Basin, Bighorn Basin, Powder River Basin, Piceance Creek Basin, San Juan Basin, Washakie Basin

Geological Age: early Eocene, Wasatchian, Wa3 to Wa6

Absolute Age: 53–50 Ma

Country: USA

Citation: Gebo and Rose, 1993; Gunnell, 1998

Specimens observed: DPC 5364, maxilla with P^4 – M^3 , dentary with P_1 – M_3 , scapula fragment, humerus, radius, ulna, ungula phalanx, innominate, femur, tibia, fibula fragment, calcaneum, astragalus, cuboid, metatarsals, vertebrae

Also referenced illustrations in Gebo and Rose (1993)

Prolimnocyon chowi

Formation: Nomogen Formation

Locality: Bayan Ulan, Inner Mongolia

Geological Age: late Paleocene

Absolute Age: 57–55.3 Ma

Country: China

Citation: Meng et al., 1998

Specimens observed from figures in Meng et al. (1998)

Propterodon morrisi

Formation: Irdin Manha Beds, Iren Dabasu Basin

Locality: “23 miles south of Iren Dabasu”

Geological Age: middle middle Eocene, Irdinmanhan Age

Absolute Age: 46–43 Ma

Country: Mongolia

Citation: Matthew and Granger, 1924

Specimens observed: 19160 (Holotype), dentary with P₂, dP₄, M₂; AMNH 21553, dentary with P₂, M₁–M₃; AMNH 95776, dentary with canine, P₂–M₂; AMNH 96384, dentary with P₂, roots of P₃, P₄–M₂; AMNH 95777, dentary with P₂–M₃ PIN 71-73, P₃, M₂, M₃ trigonid, dP₄, M²

Propterodon tongi

Formation: Hedi Formation, Yuli member

Locality: Huoshipo, Guojia Village, Wangmao Town, Yuanqu, Shanxi

Geological Age: middle middle Eocene, Irdinmanhan Age

Absolute Age: 46–43 Ma

Country: China

Citation: Liu et al., 2002

Specimens observed: IVPP V12612 (Holotype), dentary with P₁–M₃

Prototomus minimus

Formation: Tienen Formation

Locality: Dormaal

Geological Age: MP7

Absolute Age: 55.8–48.6 Ma

Country: Belgium

Citation: Smith and Smith, 2001

Specimens observed: IRSNB M1287 (Holotype), M₁; IRSNB M 1286, P₄; IRSNB M 1288, M₂; IRSNB M 1289, M₃; IRSNB M 1290, P₄; IRSNB M 1291, M¹; IRSNB M 1292, M²; IRSNB M 1293, M³; IRSNB M 1294, edentulous dentary; IRSNB M 1295, edentulous dentary; IRSNB M 1285, dP₄

Prototomus phobos

Formation: Many (Willwood Formation, Bridger Formation etc.)

Locality: Clarks Fork Basin, Bighorn Basin, Powder River Basin

Geological Age: Early to Middle Eocene, earliest Wasatchian Wa0 to earliest Bridgerian BR0

Absolute Age: 55–46 Ma

Country: USA, Europe

Citation: Gingerich and Deutsch, 1989; Ivy, 1993; Zack, 2011; Solé et al., 2014a

Specimens observed: YPM-PU 13019 (Holotype), cranium with I¹–I², P¹–P², P⁴–M³ and dentaries with C–M₃; UM 68075, dentary with C, P₃, and portions of M₁–M₃; UM 74134, maxilla with M¹–M³, astragalus, calcaneum, humerus

Proviverra typica

Formation: Geiseltal level XXXVI

Locality: Geiseltal, Germany

Geological Age: Geiseltalian, Lutetian, Middle Eocene

Absolute Age: 46–41 Ma

Country: Germany

Citation: Solé et al., 2014a

Specimens observed: NMB Em 18 (Holotype), cranium with alveoli of canine, roots of P^1 , P^4 , M^1 , M^2 (protocone), M^3 ; NMB Ek 30 (cast also viewed: UCMP 140643), maxilla with P^4 – M^3 ; NMB Eh 561 (cast also viewed: UCMP 140642), dentary with P_4 , M_2 – M_3 ; GMH XXXVI-519 (cast also viewed: UCMP 140641), dentary with P_4 – M_2 ; GMH XXXVII-136-1964, dentary with P_2 – P_3 , fragments of P_4 , M_1 , fragments of M_2 – M_3 ; GMH XXXVI-20-1962, dentary with P_3 – P_4 , M_2 (taloid)– M_3 ; GMH XLI-309-1968, dentary with P_4 – M_1 ; NMB 162, maxilla with P^4 – M^2 ; NMB Eh. 191, P_3 , M_1 – M_3

***“Pterodon” africanus* Andrews 1903**

Formation: Jebel Qatrani Formation

Locality: Quarry A, lower sequence, Fayum Depression

Geological Age: early Oligocene

Absolute Age: 33.9–33.7 Ma

Country: Egypt

Citation: Holroyd, 1994; Holroyd, 1999; Seiffert, 2010

Specimens observed: BSPG 1905-XIII-8 (Holotype), dentary with canine– M_3 ; AMNH 13251, maxilla with P^2 – P^3 , fragmentary P^4 – M^2 ; CGM 8897 (cast at BMNH M8887), femur; CGM 8898, humerus; UCMP 41475, maxilla with M^2 ; SMNS 43470, calcaneum; SMNS 11575, cranium with incisor alveoli, canine, P^2 – M^3 , posterior portion of cranium very heavily reconstructed; SMNS 43471, tibia; BMNH M8503, dentary with P_2 – M_3 ; BMNH 21897, palate with P^2 – M^2 ; BMNH M8445, proximal femur; BMNH M9475, astragalus; BMNH M9473, axis fragment; BMNH M9472, axis; BMNH 9472, atlas; BMNH 9472, cervical vertebra; BMNH 8446, vertebra

***Pterodon dasyuroides* de Blainville 1839**

Formation: Quercy

Locality: Paris Basin

Geological Age: MP18–MP20, Priabonian, Late Eocene

Absolute Age: 37.2–33.9 Ma

Country: Paris

Citation: Lange-Badré, 1979; Solé et al., 2014a; Solé et al. 2015

Specimens observed: MNHM 1903-20.Qu.8652 (Holotype), cranium with Canine– M^3 ; MNHM 1893-11.Qu 8301, dentary with I_3 , P_1 – M_3 and cranium with I^2 , canine, P^2 – M^3 ; MNHM 1893-11.Qu 8304, cranium with P^2 – M^3 ; MNHM 1882-18.Qu 8803, dentary with P_4 – M_3 ; MNHM 1903-80.Qu 8669, rostrum with I^1 – I^2 , canine, P^2 – M^3 ; MNHM 1903-20.Qu 8631, basicranium; MNHM 1893-11.Qu 8736, dentary with canines, P_2 – M_3 ; MNHM Qu 8734, maxilla with canine– M^3 ; MNHM 1875-931.Qu 8787, maxilla with P^3 – M^3 ; MNHM 1903-20.Qu 10071, calcaneum; MCZ 8912, dentary with P_2 – M_3 ; MCZ 8911, maxilla with P^3 – M^2 ; BSPG 1879 1879-XV-32, maxilla with P^4 – M^3 ; BSPG 1961-XVII-19, maxilla fragment with M^2 ; BSPG 1959-IX-4, maxilla with M^1 – M^2 ; BMNH M27578, maxilla with P^2 , P^4 , M^1 – M^2 ; BMNH 26757, maxilla with P^4 – M^3 ; BSPG 1879 XV 642, dP^3

***“Pterodon” phiomensis* Osborn 1909**

Formation: Jebel Qatrani Formation
Locality: Quarry A, Fayum Depression
Geological Age: early Oligocene
Absolute Age: 33.9–33.7 Ma
Country: Egypt
Citation: Holroyd, 1994; Holroyd, 1999; Seiffert, 2010
Specimens observed: AMNH 13253 (Holotype), P₂–M₃; AMNH 13254, dentary with P₂–M₃

Pyrocyon strenuus Gingerich and Deutsch 1989

Formation: San Jose Formation
Locality: San Jose Basin, Bighorn Basin, Wind River, Green River
Geological Age: Early to Middle Eocene, middle Wasatchian (Graybullian) Wa3 through Bridgerian (Br1) (*P. multicuspis* is early Eocene, middle to late Wasatchian (late Graybullian Wa5) to Lostcabinian (Wa7)
Absolute Age: 55.8–50.3 Ma
Country: USA
Citation: Ivy, 1993; Gingerich and Deutsch, 1989
Specimens observed: USNM 1023 (Holotype), dentary with canine, P₂–M₃; AMNH 15234, maxilla with canine–M³ and dentary with canine–M₃; UM 21186, dentary with P₂, P₄–M₃

Quasiapterodon minutus

Formation: Jebel Qatrani Formation, Quarry M
Locality: Fayum Depression
Geological Age: Rupelian, Younger than G and V (in turn older than A and B)
Absolute Age: 30–29.2 Ma
Country: Egypt
Citation: Lavrov, 1999; Grohé et al., 2012
Specimens observed: SMNS with no number (Holotype, cast of type also available at UCMP 140656), dentary with part of P₄, M₁–M₃; DPC 2948, maxilla with P³–M³; DPC 8288, maxilla with P⁴–M¹; DPC 7314, maxilla with P³–M¹; DPC 21473, dentary with P₄–M₃; DPC 3154, dentary with canine, P₂–M₃; DPC 201431, dentary with canine, P₃–M₃; DPC 5022, dentary with M₁–M₂; DPC 2949, dentary with P₄–M₃;

Quercytherium simplicidens

Formation: Quercy phosphorites
Locality: Quercy phosphorites
Geological Age: early late Eocene
Absolute Age: 37.2–33.9 Ma
Country: France
Citation: Lange-Badré, 1979; Solé, et al., 2014a
Specimens observed: MNHN unnumbered right dentary with P₂–M₃; MNHN.F.Qu8559, dentary with P₄, portions of M₁–M₃; MNHN.1962-35, dentary with M₂–M₃; MNHN.1893-11, left dentary with P₂–P₄, M₃; MNHN.F.Qu8645, dentary with M₂–M₃; MNHN.F.Qu8649, cranium with P², P⁴, M², M³

Quercytherium tenebrosum

Formation: See localities

Locality: Euzet-les-Bains (Gard), Quercy phosphorites

Geological Age: early late Eocene

Absolute Age: 40–33.9 Ma

Country: France

Citation: Lange-Badré, 1979; Solé, et al., 2014

Specimens observed: MNHN.F.Qu8644 (Holotype), dentary with P₂–M₃; MNHN.F.Qu8643, dentary with P₂–M₃; MNHN.F.Qu8646, maxilla with P¹–M³

Rukwa Rift hyaenodont

Formation: Nsungwe Formation

Locality: Nsungwe 2

Geological Age: late Oligocene

Absolute Age: 24.95 Ma

Country: Tanzania

Citation: Stevens et al., 2013

Specimen observed: RRBP 09088, maxilla fragment with dP³ crown, dP⁴–M¹ alveoli

Sinopa grangeri

Formation: lower Bridger (B3?) Formation

Locality: Uinta County, Wyoming, Bridger Basin, Uinta Basin

Geological Age: Middle Eocene, Early to late Bridgerian (Br1 to Br3)

Absolute Age: 50.3–46.2 Ma

Country: USA

Citation: Matthew, 1906; Ivy, 1993

Specimens observed: USNM 5341 (Holotype), cranium with Canine–P², P⁴–M³, dentaries with canines–M₃, cervical, thoracic, lumbar, caudal vertebral series, scapula, humerus, ulna, radius, carpals, metacarpals, innominate, femur, tibia, fibula, astragalus, calcaneum, metatarsals (mounted at USNM making it difficult to observe morphology so observations were supplemented by figures in Matthew, 1906)

Sinopa jilinia

Formation: Member III, Huadian Formation

Locality: Huadian basin, Huadian County, Jilin Province

Geological Age: middle Eocene, Yuanquan (Uintan)

Absolute Age: 46.2–40.4 Ma

Country: China

Citation: Morlo et al., 2014

Specimen observed from Morlo et al. (2014): RCPS-CAMHD06-001, dentary with P₂–P₃, roots of P₄, M₁–M₃ (cast available at SMF)

Teratodon spekei

Teratodon enigmae

Formation: ?

Locality: Koru, Songhor (*T. enigmae* from Songhor only), and Rusinga

Geological Age: Burdigalian, Early Miocene

Absolute Age: 20–15 Ma

Country: Kenya

Citation: Savage, 1965; Werdelin, 2010

Specimens observed: AMNH 56429 (cast of *T. enigmae* holotype BMNH M19089, cast also available as UCMP 77538), dentary with roots of P_2 – P_4 , alveoli of M_1 – M_3 ; AMNH 56428 (cast of *T. enigmae* holotype, cast also at UCMP 77535), maxilla with P^2 – M^3 ; AMNH 56425 (original BMNH M14310, cast of *T. spekei* holotype), maxilla with canine, P^2 ; AMNH 56427 (cast of *T. spekei* paratype, also UCMP 77543), dentary with P^2 – P^3 ; AMNH 56426 (cast of BMNH M14216, also available at UCMP 77541), dentary with M_2 – M_3 ; AMNH 56424 (cast of *T. spekei* holotype BMNH M14307, also available at UCMP 77542), maxilla with P^4 – M^2 ; UCMP 77544 (cast of BMNH M14308), dentary with P_2 – P_3 ; KNM-SO 85, M_2 ; KNM-SO 1110, dentary with P_2 – P_3 , M_1 – M_3 ; KNM-SO 1109, dentary with M_1 – M_3 ; KNM-SO 1111, mandibular condyles, P_1 – P_2 ; KNM-SO 5118, P^4 ; KNM-CA 311, P_3 ; KNM-CA 1915, dentary with P_3 – P_4 ; KNM-RU 14769, maxilla with canine– P^4 , dentary with P_2 – P_4 , roots of M_1 – M_3 ; KNM-ME 29, dentary with P_2 – M_2 ; KNM-LG 679, maxilla with P^4 – M^2

Thinocyoon velox

Formation: Grizzly Buttes, Blacks Fork Member, Bridger Formation (Type)

Locality: Bridgerian biochrons Br-1b, Br-2 northern and southern Green River Basin, Br-3 Washakie Basin, Wyoming

Geological Age: middle Eocene, Br1–Br3

Absolute Age: 50.3–46.2 Ma

Country: USA

Citation: Morlo and Gunnell, 2003

Specimens observed: YPM 11797, dentary with canine, P_1 , fragmentary P_2 – P_3 , P_4 , partial M_1 – M_2 ; AMNH 13081, cranium with P^1 – M^2 , dentary with P_2 – M_2 , ulna, radius, metacarpals, sacrum; AMNH 140007, cranium and dentary (occluded) with I^1 – M^2 and I_1 – M_2 ; AMNH 11524, femur, tibia; AMNH 12154, atlas, axis, cervical, thoracic, and lumbar vertebrae, humerus, radius, ulna, carpals, femur, tibia, metapodials, astragalus, calcaneum

Specimens observed from Morlo and Gunnell (2003): GMUW 3059, humerus, astragalus, calcaneum

Tinerhodon disputatum

Formation: Adrar Mgorn 1 and Ihadjamene

Locality: Ouarzazate Basin

Geological Age: Thanetian, Late Paleocene

Absolute Age: 56.5–55.8 Ma

Country: Morocco

Citation: Gheerbrant, et al., 2006; Seiffert, 2010

Specimens from literature (Gheerbrant et al., 2006): THR 192 (Holotype), M_3 ; THR 294, P_2 ; THR 292, P_4 ; THR 193, M_2 ; THR 192, M_3 ; THR 313, P_3 ; IDJ 1, M_1 or M_2 ; THR 111, M_1 or M_2

Tritemnodon agilis

Formation: Bridger Formation

Locality: Type from Grizzly Buttes, Uinta County; Bighorn basin, Bridger basin, Uinta basin

Geological Age: middle Eocene, early to middle Bridgerian (Br1 to Br2)

Absolute Age: 50.3–46.2 Ma

Country: USA

Citation: Matthew, 1909; Ivy, 1993

Specimens observed: AMNH 11536, calcaneum, astragalus, femur, tibia, fibula, atlas, innominate, sacrum, vertebrae, metapodials, metatarsals, phalanges, maxilla with canines–M³, dentaries with canines–M₃; AMNH 12636, cranium with canines–M³; dentaries with canine–M₃; complete cervical, thoracic, lumbar and partial caudal vertebral series, scapulae, humerus, ulna, radius, metapodials, carpals, phalanges, innominate, femur, tibia, fibula, metatarsals, astragalus, calcaneum, metapodials, phalanges

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