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A re-evaluation of *Pliophoca etrusca* (Pinnipedia, Phocidae) from the Pliocene of
Italy: phylogenetic and biogeographic implications

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APPENDIX S1. Characters and character-states used in phylogenetic analysis.

- (1) Premaxilla-maxilla suture: external to nasal aperture (0); internal to nasal aperture (1) (Wyss, 1988; modified from Berta and Wyss, 1994 #2).
- (2) Premaxillary-nasal contact: extensive (0); reduced (1); absent (2) (modified from Berta and Wyss, 1994 #1).
- (3) Premaxillary, medial tuberosity: reduced-absent (0); well developed (1) (see Muizon, 1981:24, Fig. 5).
- (4) Mastoid lip: does not cover the external cochlear foramen (0); covers external cochlear foramen (1) (Wyss, 1988; Berta and Wyss, 1994 #36).
- (5) Maxilla, antorbital tuberosity: absent or reduced (0); well developed (1) (Sorbi, 2004b).
- (6) Petrosal, dorsal region: unexpanded (0); expanded (1) (Berta and Wyss, 1994 #29).
- (7) Tympanic bulla does not cover the petrosal posteriorly (0); tympanic bulla covered by petrosal posteriorly (1).
- (8) Premaxillary, lateral triangular extension: absent-reduced (0); well developed (1).
- (9) Diastema between P4 and M1: large (0); reduced (1) (Sorbi, 2004a).
- (10) Mandibular condyle: at or slightly above level of toothrow (0); well elevated above toothrow (1) (Berta and Wyss, 1994 #53).
- (11) Mandibular symphysis: terminates at p2 (0); terminates at p3 (1); terminates at p4 (2) (Koretsky and Grigorescu, 2002 #10).

- (12) Incisors: 3/2 (0); 2/2 (1); 2/1 (2) (Koretsky and Grigorescu, 2002 #18).
- (13) Upper incisors: in straight line (0); in a curved line (slanted) (1) (Koretsky and Grigorescu, 2002 #26).
- (14) Upper incisors, shape in cross-section: round (0); laterally compressed (1) (Wyss, 1988; Bininda-Emonds and Russell, 1996 #130).
- (15) Upper incisors, relative size: outermost incisor equal in size to remaining incisors (0); outermost incisor relatively larger than others (1) (Wyss, 1988; Bininda-Emonds and Russell, 1996 #131).
- (16) Procumbent upper incisors: absent (0); present (1) (Bininda-Emonds and Russell, 1996 #134).
- (17) Basal cingulum of postcanines (P, p1-M, m1): well developed (0); not developed (1) (Koretsky and Grigorescu, 2002 #23).
- (18) Crowns of postcanines: labiolingually compressed (0); labiolingually broad (1) (Cozzuol, 2001 #42).
- (19) p4-m1 alveoli: similar in size (0); p4 alveolus smaller than m1 alveolus (1); p4 alveolus larger than m1 alveolus (2) (Koretsky and Grigorescu, 2002 #16).
- (20) Postcanine accessory cusps: (0) absent; 2 (1); 3 or more (2) (modified from Koretsky and Grigorescu, 2002 #24).
- (21) M1: equal in size to P4 (0); smaller than P4 (1) (this study).
- (22) Premolars: parallel to toothrow axis (0); obliquely oriented in toothrow (1) (Koretsky and Grigorescu, 2002 #25).
- (23) Postcanine teeth, carinae: absent (0); present (1) (this study).
- (24) Postcanine teeth, overlapping: no (0); yes (1) (this study).

(25) Humerus, lesser tubercle and head: equal in height or tubercle insignificantly higher than head (0), tubercle much higher than head (1) (Koretsky and Grigorescu, 2002 #30).

(26) Humerus, deltoid crest: shorter than one-half the length of the bone, confined to the proximal half of bone (0); longer than one-half the length of the bone (1) (modified from Koretsky and Grigorescu, 2002 #34).

(27) Humerus, olecranon fossa: deep (0); shallow (1) (Berta and Wyss, 1994 #92).

(28) Humerus, supracondylar (=entepicondylar) foramen: present (0); absent (1) (Berta and Wyss, 1994 #91).

(29) Humerus, bicipital groove: absent or shallow (0); present (deep) (1).

(30) Humerus, distal portion of shaft: more developed transversely relative to proximal portion (0); less developed transversely relative to proximal portion (1) (Sorbi, 2004a).

(31) Humerus, supinator ridge (= epicondylar crest): well developed (0); absent or poorly developed (1) (Cozzuol, 2001 #6).

(32) Ulna, anconeal tuberosity: well developed and posteriorly positioned on olecranon (0); well developed and anteriorly positioned on olecranon (1); poorly developed (2) (Muizon, 1981).

(33) Ulna, articular facet for cuneiform (=pyramidal): transversely oriented (0); slightly inclined anteroposteriorly (1); nearly perpendicular relative to main axis of ulna (2) (Sorbi, 2004a).

(34) Metacarpal I and metacarpal II: approximately the same length (0); metacarpal I longer than metacarpal II (1) (Cozzuol, 2001; see Wyss, 1988).

- (35) Manus, phalanges: rounded (0); flattened (1) (see Wyss, 1988).
- (36) Manus, intermediate phalanx digit V: unreduced (0); reduced (1) (Wyss, 1988:fig. 5; Berta and Wyss, 1994: #104).
- (37) Manus, ungual phalanges unreduced; shaft longer than 1/3 of the entire length (0); reduced (1); shaft not more 1/3 of the entire length (2) (Sorbi, 2004a; see Wyss, 1988 #22).
- (38) Manus, metacarpophalangeal and interphalangeal articulations: well developed and trochleated (0); reduced, broad and flattened (1) (Wyss, 1988).
- (39) Femur, condyles: different in size (0); similar in size (1) (Koretsky and Grigorescu, 2002 #38).
- (40) Femur epiphyses: distal epiphysis one-fourth to one-fifth wider than proximal (0); widths of proximal and distal epiphyses about equal (1); proximal epiphyses wider than distal (medial) one (2) (Koretsky and Grigorescu, 2002 #39).
- (41) Femur, intercondylar region: narrow and deep (0); wide and flattened (1) (Koretsky and Grigorescu, 2002 #44).
- (42) Femur, head and greater trochanter: same level (0); greater trochanter slightly higher than head (1) (see King, 1966, Muizon, 1982; Bininda-Emonds and Russell 1996).
- (43) Femur, neck: long, slender (0); short, wide (1) (Koretsky and Grigorescu, 2002 #47).
- (44) Femur, trochlea: slightly higher than wide (0); slightly wider than high (1).
- (45) Femur, trochanteric fossa: relatively deep (0); reduced or absent (1) (Berta and Wyss, 1994 #119).

(46) Femur, epicondylar crests: absent or poorly developed (0); well developed (1) (Cozzuol, 2001 #26).

(47) Tibia and fibula: not fused (0); fused proximally (1) (Berta and Wyss, 1994 #122).

(48) Tibia, posterotibial fossa: shallow (0); deep (1) (Cozzuol, 2001 #31).

(49) Astragalus, calcaneal facet (= sustentacular facet): relatively long (0); short (1) (Sorbi, 2004a; see Wyss, 1988 #20).

(50) Astragalus, facet for articulation with tibia: not elevated (0); elevated and forming a calcaneal process (1) (Sorbi, 2004a).

(51) Calcaneum, length: slightly longer than astragalus (0); approximately same length as astragalus (1); shorter than astragalus (2) (Sorbi, 2004a, see Muizon, 1981:68).

(52) Calcaneum, calcaneoastragalar (=proximal astragalar) facet: fibular portion small and forms a right angle with astragalar portion (0); fibular part large and forms a right angle with astragalar portion (1); fibular part large forms an obtuse angle with astragalar portion (2) (Sorbi, 2004a; Muizon, 1981 68).

(53) Calcaneum, calcaneoastragalar facet: forms an oblique angle with the main axis of the bone (0); forms a right angle with main axis of bone (1) (Sorbi, 2004b).

(54) Calcaneum, medial (=greater tuberosity) and lateral calcaneal tubercles: lateral tubercle lower than medial tubercle (0); same elevation (1) (Sorbi, 2004b).

(55) Calcaneum, sulcus for m. peroneus longus with anterior tuberosity: absent-reduced (0); present (1) (Sorbi, 2004b).

(56) Cuboid, contact between posterolateral process and metatarsal V: present (0); reduced-absent (1) (Sorbi, 2004a; see Muizon, 1981:68).

(57) Metatarsal III: approximately equal to the others (0); much shorter (1) (Berta and Wyss, 1994: 106).

(58) Hindflipper, ungual phalanges: unreduced (0); reduced (1) (Berta and Wyss, 1994#107).

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