

Appendix. Description of characters used in the phylogenetic analysis of *Arenysaurus*.

Characters 1-56 have been taken from Godefroit et al. [17]; character 57 from Evans & Reisz [7: #33]).

Appendice. Description des caractères utilisés dans l'analyse phylogénétique d'*Arenysaurus*.

Caractères 1-56 d'après Godefroit et al. [17]; caractère 57 d'après Evans & Reisz [7: #33].

1. Parietal participating in the occipital aspect of the skull (0), or completely excluded from the occiput (1). **2.** Ratio “length/minimal width” of the parietal >2 (0), or <2 (1). **3.** Parietal sagittal crest relatively short, less than $2/3$ the length of the parietal (0), or relatively long, more than $2/3$ the length of the parietal (1). *Contra* Horner et al., 2004. **4.** Midline ridge of parietal straight to slightly downwarped along length (0), or strongly downwarped to below the level of the postorbital-squamosal bar (1). **5.** Frontal participating in the orbital rim (0), or excluded by postorbital-prefrontal joint (1). **6.** Hollow supracranial crest absent (0), or developed (1). **7.** Frontal relatively long, with a “caudal length/maximal width” ratio >0.75 (0), very shortened frontal, with a “caudal length/maximal width” <0.6 (1), or secondary elongation resulting of the backward extension of the frontal platform (2). Character treated as ordered. **8.** Deeply excavated frontal platform absent (0), occupying the rostral part of the frontal in adult (1), or extending above the rostral portion of the supratemporal fenestra (2). Character treated as ordered. **9.** Premaxillae narrow, expanded laterally less than two times width at post-oral constriction, margin oriented nearly vertically (0), or expanded transversely to more than two times postoral constriction, margin flared laterally into a more horizontal orientation (1). **10.** Premaxillary reflected rim absent (0), deflected at anterolateral corner and posteriorly reflected (1), reflected along entire rim and narrow (2), reflected along entire rim, but thickened at anteroventral corner (3). Character treated as ordered. **11.** Premaxillary foramen present (0), or absent (1). **12.** Premaxillary, auxiliary narial fossa absent (0), or present (1). **13.** Posterior premaxillary process short, not meeting the lateral premaxillary process posterior to external naris (0), or posterior premaxillary process long, meeting the lateral premaxillary process behind the external naris to exclude the nasal, nasal passage enclosed ventrally by folded, divided premaxillae (1). **14.** Lateral premaxillary process stopping at the level of the lacrimal (0), or extending further backward above the skull roof (1). **15.** External naris/basal skull length ratio <0.2 (0), or >0.3 (1). **16.** Posteriormost apex of external naris

formed entirely by nasal (0), formed by nasal (dorsally) and premaxilla (ventrally) (1), or formed entirely by premaxilla (2). Character treated as unordered. **17.** Circumnarial depression absent (0), light depression incised into nasal and premaxilla (1), or marked by a well-developed ridge and sometimes invaginated (2). Character treated as ordered. **18.** Nasal restricted to area rostral to braincase, *cavum nasi* small (0), or nasal retracted caudally to lie over braincase in adults resulting in convoluted, complex narial passage, *cavum nasi* enlarged (1). **19.** Nasal does not participate in a hollow crest (0), participates in a small part of the hollow crest and is excluded from the caudodorsal border of the crest (1), participates in half of the crest or more and forms the caudodorsal aspect of the crest (2), or forms the entire crest (3, autapomorphic for *Tsintaosaurus*). Character treated as unordered. **20.** Solid supracranial crest absent (0), present but not excavated by the caudal circumnarial fossa (1), present and excavated laterally by the circumnarial fossa (2). Character treated as unordered. **21.** Supraorbital free (0), or fused to the prefrontal (1). **22.** Caudal portion of the prefrontal oriented horizontally (0), or participating in the lateroventral border of the hollow crest (1). **23.** Median ramus of squamosal lower than paroccipital process (0), or higher than paroccipital process (1). **24.** Squamosal prequadratic process strikingly longer than rostrocaudal width of quadrate cotylus (0), or short, only slightly longer than rostrocaudal width of quadrate cotylus (1). **25.** Posterior surface of supraoccipital nearly vertical (0), or steeply inclined forwardly at an angle of about 45° (1). **26.** Supraoccipital/exoccipital shelf limited (0), or very extended (1) above the foramen magnum. **27.** Postorbital pouch absent (0), or well-developed (1). **28.** Dorsal surface of postorbital flat (0), or thickened to form a dorsal promontorium (1). **29.** Rostral process of the jugal tapering in lateral view to fit between maxilla and lacrimal (0), or dorso-ventrally expanded (1). **30.** Rostral process of the jugal angular and slightly asymmetrical in lateral view (0), rounded and symmetrically very expanded (1), isosceles-triangle-shaped (2), or asymmetrically strongly upturned (3). Character treated as unordered. **31.** Jugal flange slightly developed, dorsoventral depth of jugal from ventral border of infratemporal fenestra to ventral edge of flange approximately equal to minimum dorsoventral depth of rostral segment of jugal between rostral and postorbital process (0), dorsoventral depth of jugal from ventral border of infratemporal fenestra to ventral edge of flange less than twice minimum dorsoventral depth of rostral segment of jugal between rostral and postorbital process (1), or strongly projected ventrally into semicircular boss, dorsoventral depth of jugal from ventral border of infratemporal fenestra to ventral edge of flange twice or nearly twice minimum dorsoventral depth of rostral segment of jugal between rostral and postorbital process (2). Character treated as ordered. **32.** Apex of maxilla caudal to centre (short caudal portion of maxilla) (0), or at or rostral to center (long and robust caudal portion of maxilla) (1). **33.** Maxillary

foramen on rostromedial maxilla (0), or on dorsal maxilla along maxilla-premaxilla suture (1). **34.** Ectopterygoid ridge faintly developed and inclined caudally (0), or strongly developed and nearly horizontal (1). **35.** Rostromedial process developed on the maxilla (0), or wide sloping maxillary shelf (1). **36.** Paraquadratic foramen present (0), or absent (1). **37.** Distal head of quadrate transversely expanded (0), or dominated by a large hemispheric lateral condyle (1). **38.** Diastema between first dentary tooth and prementary short, no more than width of 4 or 5 teeth (0), moderate, equal to approximately 1/5 to 1/4 of tooth row (1), long, more than 1/3 of tooth row, but less than 1/2 (2), or extremely long, more than 2 of tooth row (3). Character treated as ordered. **39.** Coronoid process subvertical (0), or inclined rostrally (1). **40.** Rostral mediolateral width of prementary less than or equal to rostrocaudal length of lateral process (0), rostral mediolateral width greater than or equal to rostrocaudal length of lateral process (1), or rostral mediolateral width greater twice rostrocaudal length of lateral process (2). Character treated as ordered. **41.** Number of tooth positions in dentary tooth row (adult specimens): 30 or less (0), 34-40 (1), 42-45 (2), 47 or more (3). Character treated as ordered. **42.** Dentary crowns broad with a dominant ridge and secondary ridges (0), or miniaturised with or without faint secondary ridges (1). **43.** Median carina of dentary teeth straight, (0) or sinuous (1). **44.** A maximum of 7 (0), or a minimum of 8 (1) sacral vertebrae. **45.** Posterior dorsal and sacral neural spines relatively short, less than 3 times centrum height (0), or elongate, more than three times centrum height (1). **46.** Coracoid hook small and pointed ventrally (0), or prominent and pointed cranioventrally (1). **47.** Biceps tubercle on coracoid small (0), or large and laterally projecting (1). **48.** Proximal plate of sternal shorter than distal "handle" (0), or proximal plate longer than distal "handle" (1). **49.** Deltpectoral crest of the humerus moderately (0), or strongly developed, extending down below midshaft (1). **50.** Antitrochanter of ilium absent or poorly developed (0), or prominent (1). **51.** Ischial peduncle of ilium as a single large knob (0), or formed by two small protrusions separated by a shallow depression (1). **52.** Postacetabular process of ilium tapers caudally to nearly a point, wide brevis shelf (0), or postacetabular process subrectangular, no brevis shelf (1). **53.** Distal end of ischium forming a moderately expanded knob (0), hypertrophied and footed (1), or tapering distally (2). Character treated as unordered. **54.** Distal head of fibula moderately expanded into the shape of a ball (0), or greatly expanded and club-shaped (1). **55.** Cranial ascending process of astragalus laterally skewed (0), or equilateral in shape (1). **56.** Plantar keels on unguals absent (0), or present (1). **57.** Prefrontal, medial flange extends caudally over the dorsal surface of the frontal and above the prefrontal-postorbital joint in lateral view (in adults): absent (0); present (1).