

Appendix S3

Appendix S3. Age and clade rank data for therocephalian and cynodont subclades. Basal skull length measurements (BSL) are in mm.

| Eutheriodontia | CR [†] | AR [‡] | MaxBSL | lnBSL | Voucher specimen/Source |
|----------------------------|-----------------|-----------------|--------|-------|---------------------------------|
| Therocephalia | | | | | |
| <i>Lycosuchus</i> (CR1) | 1 | 2 | 340 | 5.828 | SAM-PK-9084 |
| Scylacosauridae (CR2) | | | | | |
| <i>Ictidosaurus</i> | 2 | 1 | 168* | 5.123 | Abdala et al. [72] (NMQR 2910) |
| <i>Glanosuchus</i> | 2 | 2 | 330 | 5.799 | UCMP 42669 |
| <i>Pristerognathus</i> | 2 | 2 | 262 | 5.568 | SAM-PK-11492 |
| <i>Scylacosuchus</i> (CR3) | 3 | 3 | 250* | 5.521 | Ivakhnenko [73] (PIN 2628/1) |
| Akidnognathidae (CR4) | | | | | |
| <i>Annatherapsidus</i> | 4 | 5 | 250* | 5.521 | Ivakhnenko [73] (PIN 2005/1993) |
| Akidnognathidae, n. sp. | 4 | 5 | 218 | 5.384 | USNM 412421 |
| <i>Akidnognathus</i> | 4 | 5 | 150 | 5.010 | BP/1/499 |
| <i>Promoschorhynchus</i> | 4 | 6 | 125 | 4.828 | RC 116 |
| <i>Olivierosuchus</i> | 4 | 7 | 122 | 4.804 | NMQR 3605 |
| <i>Euchambersia</i> | 4 | 5 | 115 | 4.744 | NHMUK R5696 |
| <i>Cerdosuchooides</i> | 4 | 6 | 134 | 4.897 | RC 58 |
| <i>Moschorhinus</i> | 4 | 6 | 260 | 5.560 | BP/1/3983 |
| Unnamed clade (CR5) | | | | | |
| Hofmeyriidae, new sp. | 5 | 5 | 60 | 4.094 | SAM-PK-K8516 |
| <i>Hofmeyria</i> | 5 | 3 | 89 | 4.488 | SAM-PK-10525 |
| <i>Mirotenthes</i> | 5 | 5 | 110 | 4.700 | UCMP 40467 |
| <i>Ictidostoma</i> | 5 | 3 | 74 | 4.304 | CGS CM86-258 |
| <i>Ictidochampsia</i> | 5 | 6 | 115 | 4.744 | RC 69 |
| <i>Viatkosuchus</i> | 5 | 4 | 170 | 5.135 | Tatarinov [74] (PIN 2212/13) |
| <i>Moschowhaisia</i> | 5 | 6 | 250* | 5.521 | Ivakhnenko [73] (PIN 1100/20) |
| <i>Theriognathus</i> | 5 | 5 | 336 | 5.817 | BP/1/4008 |
| Ictidosuchidae (CR6) | | | | | |
| <i>Ictidosuchus</i> | 6 | 4 | 150 | 5.010 | SAM-PK-K10650 |
| <i>Ictidosuchooides</i> | 6 | 3 | 146 | 4.983 | SAM-PK-K6886 |
| <i>Regisaurus</i> (CR7) | 7 | 7 | 123 | 4.812 | CGS AK86/7 |
| Unnamed clade (CR8) | | | | | |
| <i>Karenites</i> | 8 | 4 | 100* | 4.605 | Ivakhnenko [73] (PIN 2212/93) |
| Zambian karenitid | 8 | 5 | 77 | 4.343 | NHCC LB44 |
| <i>Lycideops</i> | 8 | 6 | 210 | 5.347 | NHMUK R5695 |
| <i>Choerosaurus</i> | 8 | 4 | 89 | 4.488 | SAM-PK-8797 |
| <i>Tetracynodon tenuis</i> | 8 | 6 | 63 | 4.143 | RC 89 |
| <i>Tetracynodon darti</i> | 8 | 7 | 75 | 4.317 | UCMP 42869 |
| <i>Scaloposaurus</i> (CR9) | 9 | 7 | 67 | 4.204 | NMQR 3323 |
| Ericiolacertidae (CR10) | | | | | |
| <i>Ericiolacerta</i> | 10 | 7 | 59 | 4.077 | BP/1/4794 |
| <i>Silphedosuchus</i> | 10 | 7 | 35* | 3.555 | Ivakhnenko [73] (PIN 951/100) |
| Ordosiidae (CR11) | | | | | |
| <i>Ordosiodon</i> | 11 | 9 | 101 | 4.615 | Hou [75] (IVPP V4786) |
| <i>Hazhenia</i> | 11 | 8 | 157 | 5.056 | Sun and Hou [76] (IVPP V5866) |
| Bauriidae (CR12) | | | | | |
| <i>Bauria</i> | 12 | 9 | 130 | 4.867 | AMNH FR 5622 |
| <i>Microgomphodon</i> | 12 | 8 | 87 | 4.465 | SAM-PK-K10160 |

| | CR | AR | MaxBSL | lnBSL | Voucher specimen/Source |
|-------------------------------|-----|----|--------|-------|---|
| Cynodontia | | | | | |
| Basal cynodont, n. sp. | n/a | 6 | 185 | 5.220 | SAM-PK-K10702 |
| <i>Charassognathus</i> (CR1) | 1 | 4 | 63 | 4.143 | SAM-PK-K10369 |
| <i>Dvinia</i> (CR2) | 2 | 6 | 88 | 4.477 | PIN 2005/2469 |
| <i>Procynosuchus</i> (CR3) | 3 | 4 | 60 | 4.094 | SAM-PK-K10138 |
| Galesauridae (CR4) | | | | | |
| <i>Cynosaurus</i> | 4 | 5 | 48 | 3.871 | BP/1/1563 |
| <i>Galesaurus</i> | 4 | 7 | 120 | 4.787 | NMQR 860 |
| <i>Progalesaurus</i> | 4 | 7 | 93 | 4.532 | SAM-PK-K9954 |
| <i>Thrinaxodon</i> (CR5) | 5 | 7 | 100 | 4.605 | SAM-PK-K1461 |
| <i>Platycraniellus</i> (CR6) | 6 | 7 | 84 | 4.430 | Abdala [77] (TM 25) |
| Cynognathia (CR7) | | | | | |
| <i>Cynognathus</i> | 7 | 8 | 330 | 5.799 | SAM-PK-11484 |
| <i>Diademodon</i> | 7 | 9 | 265 | 5.579 | BP/1/3754 |
| <i>Sinognathus</i> | 7 | 9 | 121 | 4.795 | Abdala et al. [78] (IVPP V2339) |
| <i>Beishanodon</i> | 7 | 8 | 232* | 5.446 | Gao et al. [79] (PKUP V3007) |
| <i>Trirachodon</i> | 7 | 8 | 105 | 4.653 | SAM-PK-K10762 |
| <i>Langbergia</i> | 7 | 8 | 115 | 4.744 | BP/1/5362 |
| <i>Cricodon</i> | 7 | 9 | 160 | 5.075 | Abdala et al. [78] (BP/1/5540) |
| <i>Luangwa</i> | 7 | 9 | 142 | 4.955 | BP/1/3731 |
| <i>Dadadon</i> | 7 | 10 | 143 | 4.962 | Ranivoharimanana et al. [60] (FMNH PR2232) |
| <i>Massetognathus</i> | 7 | 10 | 204 | 5.318 | Abdala and Giannini [80] (PULR11) |
| <i>Protuberum</i> | 7 | 10 | 200 | 5.298 | Reichel et al. [81] (MGB 368-100) |
| <i>Exaeretodon</i> | 7 | 11 | 400 | 5.991 | Abdala et al. [82] (MCZ 4486) |
| <i>Lumkuia</i> (CR8) | 8 | 9 | 58 | 4.060 | BP/1/2669 |
| Unnamed clade (CR9) | | | | | |
| <i>Ecteninion</i> | 9 | 11 | 98 | 4.584 | Martinez et al. [83] (PVSJ 422) |
| <i>Trucidocynodon</i> | 9 | 11 | 187 | 5.231 | Oliveira et al. [58] (UFRGS PV1051T) |
| Chiniquodontidae (CR10) | | | | | |
| <i>Chiniquodon</i> | 10 | 10 | 310 | 5.736 | Abdala and Giannini [84] (UFRGS PV0122T) |
| <i>Aleodon</i> | 10 | 9 | 156 | 5.049 | Abdala and Smith [85] (GSN EN3) |
| <i>Probainognathus</i> (CR11) | 11 | 10 | 83 | 4.418 | Romer [86]; Sidor [52] (MCZ 4277) |
| <i>Therioherpeton</i> (CR12) | 12 | 11 | 33* | 3.496 | Oliveira [87] (MVP05.22.04) |
| Ictidosauria (CR13) | | | | | |
| <i>Riograndia</i> | 13 | 12 | 35 | 3.555 | Bonaparte et al. [88]; Soares et al. [89] (MCN PV2264; UFRGS PV0569T) |
| <i>Chalimimia</i> | 13 | 13 | 48 | 3.871 | Martinelli and Rougier [90] (PVL 3257) |
| <i>Elliotherium</i> | 13 | 13 | 58 | 4.060 | BP/1/6106 |
| Brasilodontidae (CR14) | | | | | |
| <i>Brasilodon</i> | 14 | 12 | 26 | 3.258 | Bonaparte et al. [91] (UFRGS PV0628T) |
| <i>Brasilitherium</i> | 14 | 12 | 27 | 3.295 | Bonaparte et al. [92] (UFRGS PV0929T) |
| Mammaliaformes (CR15) | | | | | |
| <i>Sinoconodon</i> | 15 | 13 | 37 | 3.610 | Patterson and Olson [93]; Crompton and Sun [94] (IVPP 4727; IVPP 8683; IVPP 8692) |
| <i>Morganucodon</i> | 15 | 13 | 26* | 3.258 | Kermack et al. [95] |

CR, clade rank; AR, age rank;

Asterisk (*) denotes estimated measurement from literature source;

† CR values correspond to side branches designated in Figure 3;

‡ AR values correspond to: 1, Wordian (Middle Permian) *Eodicynodon* AZ; 2, Capitanian (Middle Permian) *Tapinocephalus* AZ; 3, Capitanian-Wuchiapingian (Middle-Late Permian) *Pristerognathus* AZ; 4, Wuchiapingian (early Late Permian) *Tropidostoma* AZ; 5, Wuchiapingian (Late Permian) *Cistecephalus* AZ; 6, Wuchiapingian-Changxingian (Late Permian) *Dicynodon* AZ; 7, Induan-Olenekian (Early Triassic) *Lystrosaurus* AZ; 8, Olenekian (late Early Triassic) *Cynognathus* subzone A; 9, Anisian (early Middle Triassic) *Cynognathus* subzones B-C; 10, Ladinian (late Middle Triassic); 11, Carnian (early Late Triassic); 12, Norian (Late Triassic); 13, Rhaetian (latest Triassic).

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