

Supplementary Materials for **Mid-Cretaceous amber fossils illuminate the past diversity of tropical lizards**

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Published 4 March 2016, *Sci. Adv.* **2**, e1501080 (2016)

DOI: 10.1126/sciadv.1501080

This PDF file includes:

Character scores for amber specimens
Synapomorphies of amber specimens with squamates, gekkotans, and chameleons
Fig. S1. Results from the analysis of the large morphological data set using parsimony.
Fig. S2. Results from the analysis of the large morphological data set using Bayesian inference.
Legend for movie S1
Reference (48)

Other Supplementary Material for this manuscript includes the following:
(available at advances.sciencemag.org/cgi/content/full/2/3/e1501080/DC1)

Movie S1 (.mp4 format). 3D volume-rendered movies of the burmite lizards.

Character scores for amber specimens

Small morphological data set (10):

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Large morphological data set (11,12):

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JZC_Bu267 shared synapomorphies with squamates

Small morphological data set (10):

- 26-1. Frontals, lateral orbital margin deeply concave
- 40-2. Parietal table and jaw adductor muscles, parietal table very wide, jaw adductors restricted entirely to ventral surface of parietal.
- 112-1. Interpterygoid vacuity, open and wide.

129-1. Anterolateral process of coronoid, present, overlapping lateral surface of dentary.

137-0. Posterior mylohyoid foramen (on medial surface of angular), present.

162-1. Vomerine teeth, absent.

163-1. Palatine teeth, absent.

165-1. Pterygoid teeth, absent.

Large morphological data set (11,12):

114-3. Maxilla facial process length/maxilla length, 38-55%.

120-0. Maxilla suborbital ramus extends posteriorly, to roughly midorbit (or anterior).

250-2. Palatine choanal fossa development, extending about half way back on palatine.

258-1. Pterygoid separation on midline, broad at base, narrow anteriorly.

369-0. Dentary posterior termination on lateral face of mandible, below (or anterior to) level of coronoid apex.

393-1. Coronoid, posteromedial process, present.

JCZ_Bu1802 shared synapomorphies with gekkotans

Small morphological data set (10)

24-0. Frontals, single median element.

35-2. Posterior margin of orbit, very incomplete, less than 50% of posterior orbital margin bordered by bone.

45-1. Upper temporal arch, incomplete, upper and lower temporal fenestra confluent.

86-1. Vidian canal, posterior opening located at basisphenoid-prootic suture.

117-2. Meckel's canal, enclosed tube within dentary, upper and lower borders completely fused together.

227-1. Scleral ossicles, square in shape.

Large morphological data set (11,12):

39-2. Frontal subolfactory process depth: 58–68%.

70-1. Postfrontal broad and flat, often very broad, always anteroposteriorly extensive and flat.

88-0. Parietal fusion, paired, not fused.

90-2. Parietal temporal muscles originate ventrally on parietal table and supratemporal process.

135-1. Prefrontal-maxilla articulation, prefrontal broadly contacts maxilla supradental shelf lateral to palatine.

137-1. Lacrimal, absent.

141-1. Lacrimal duct position, enclosed in prefrontal.

149-1. Jugal lateral exposure below orbit, partly exposed above orbital margin of maxilla.

152-2. Jugal postorbital ramus development, postorbital bar absent.

158-1. Jugal cross-section at level of ectopterygoid, depressed.

161-1. Squamosal temporal ramus-parietal contact, temporal ramus broadly contacts parietal supratemporal process.

178-2. Quadrate head suspension, quadrate head broadly contacts braincase anteriorly.

185-2. Quadrate height to braincase depth ratio (braincase depth measured from near the quadrate head, 60–69%.

187-1. Quadrate foramen size, small.

208-0. Nervus ethmoidalis medialis, (0) above septomaxilla.

234-1. Palatine, vomerine process dorsally on vomer, narrow slender tip of palatine loosely attached to vomer.

- 283-2. Ectopterygoid posterior process absent.
- 315-0. Posterior auditory foramen, bordered by opisthotic.
- 347-1. Medial aperture of the recessus scalae tympani (MARST) subdivided, IX cranial nerve exits posteriorly, large oval MARST undivided, with IX cranial nerve exiting at posterodorsal end.
- 372-3. Dentary restricts Meckel's canal, Meckel's canal closed and fused anterior to splenial.
- 375-0. Splenial anterior extension, around one-third (or less) length relative to dentary tooth row.
- 388-0. Coronoid anteromedial process fits into sulcus beneath tooth-bearing border of dentary (at or behind end of tooth row), absent.
- 394-1. Coronoid, anterolateral dentary process, present.
- 420-3. Maxillary tooth count, 16–27.
- 434-0. Cusps on posterior teeth, unicuspid.
- 489-1. Scapula, elongate and thin.
- 514-1. Pectineal (pubic) tubercle, closer to symphysis than to acetabulum.
- 521-1. Ilium, tubercle, absent.

JCZ_Bu154 shared synapomorphies with chameleons

Small morphological data set (10):

- 26-0. Frontals, lateral orbital margin straight or only very slightly concave.
- 57-1. Quadrate. Tympanic crest (outer conch), tympanic crest a low ridge.
- 115-2. Epipterygoid, absent (absence inferred from the lack of fossa columellae).

Large morphological data set (11,12):

- 130-2. Prefrontal boss, in projecting canthal crest.
- 179-0. Quadrate suprastapedial process, absent
- 290-1. Epipterygoid, absent (absence inferred from the lack of fossa columellae).
- 404-1. Retroarticular process, very short or absent.
- 454-2. Presacral vertebrae number reduction, fewer than 23 presacrals.

Comparative material

Codes for Institutional Collections: AMNH: American Museum of Natural History, New York, USA. AND: Personal collection of Scott Anderson. B–V: Personal collection of George Poinar, Jr. CAS: California Academy of Sciences, San Francisco, CA, USA. FMNH: The Field Museum, Chicago, IL, USA. GAM: Deutsches Bernstein-Museum in Ribnitz-Damgarten, Germany. I, II, III: Private specimens (48). JZC: Personal collection of James Zigras. M: Personal collection of Ettore Morone. MCZ: Museum of Comparative Zoology, Harvard University, Cambridge, MA, USA. MNHN Entomology: Museum national d'Histoire naturelle, Paris, France. NMBA: Naturhistorisches Museum, Basel Switzerland. OAAAA: Private specimens (48). PIN: Paleontological Institute, Russian Academy of Sciences, Moscow, Russia. SMNS: Staatliches Museum für Naturkunde Stuttgart, Germany. SMU: Shuler Museum of Paleontology, South Methodist University, Dallas, TX, USA. UCMP: Museum of Paleontology, University of California, Berkeley, CA, USA. USNM: National Museum of Natural History, Smithsonian Institution, Washington DC, USA. UMMZ: Museum of Zoology, University of Michigan, Ann Arbor, MI, USA.

YPM: Yale Peabody Museum of Natural History, New Haven, CT, USA. ZFMK: Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany. ZPAL: Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland.

Agamidae: *Acanthocercus atricollis* AMNH-R 67815; *Acanthosaura nataliae* AMNH-R 154611; *Agama aculeata* AMNH-R 31647; *Agama agama* FMNH 47531; *Agama anchietae* AMNH-R 116267; *Amphibolurus muricatus* AMNH-R 82236; *Bronchocela cristatella* AMNH-R 21123, AMNH-R 111835; *Calotes ceylonensis* AMNH-R 94516; *Calotes emma* AMNH-R 147066, FMNH 252264; *Ceratophora stoddartii* AMNH-R 94536; *Chlamydosaurus kingii* AMNH-R 99843; *Ctenophorus adelaidensis* AMNH-R 99788; *Ctenophorus caudicinctus* AMNH-R 104309; *Diporiphora bilineata* AMNH-R 120264; *Draco beccarii* AMNH-R 63395; *Draco blanfordii* AMNH-R 110126; *Draco maculatus* AMNH-R 30956; *Gonocephalus grandis* AMNH-R 119565; *Hypsilurus auritus* AMNH-R 98876; *Japalura polygonata* AMNH-R 21194; *Leiolepis guttata* AMNH-R 99297; *Lophognathus gilberti* AMNH-R 120266; *Lophognathus temporalis* AMNH-R 62103; *Lyriocephalus scutatus* AMNH-R 94448; *Moloch horridus* AMNH-R 24913; *Otocryptis wiegmanni* AMNH-R 94457; *Paralaudakia caucasia* AMNH-R 160947; *Phoxophrys nigrilabris* AMNH-R 111875; *Phrynocephalus helioscopus* AMNH-R 902222; *Phrynocephalus versicolor* AMNH-R 31286; *Physignathus cocincinus* AMNH-R 13658; *Pogona minima* AMNH-R 99792; *Sitana ponticeriana* AMNH-R 110801; *Trapelus megalonyx* AMNH-R 96141; *Uromastyx acanthinura* AMNH-R 71836; *Uromastyx ocellata* AMNH-R 173509; *Xenagama batillifera* AMNH-R 20085.

Amphisbaenidae: *Amphisbaena fuliginosa* FMNH 22847. **Anguidae:** *Elgaria multicarinata* FMNH 23601.

Chamaeleonidae: *Brookesia brygooi* FMNH 260015; *Chamaeleo calypttratus* NHC 62768; *Chamaeleo laevigatus* FMNH 47572. **Cordylidae:** *Smaug mossambicus* YPM 12670. **Dactyloidae:** *Anolis carolinensis* FMNH 242298, *Anolis* sp. SMU 74976. **Diploglossidae:** *Celestus enneagrammus* FMNH 108860. **Gekkota:** *Hoburogekko*

suchanovi PIN 3334-500, *Gobekko cretacicus* ZPAL MgR-II/4, ZPAL MgRII/43, ZPAL MgR-II/47, *Carphodactylus laevis* MCZ R-35114, *Nephrurus asper* CAS 74733, *Nephrurus levis* YPM 12868, *Saltuarius salebrosus* CAS 74742, *Saltuarius cornutus* FMNH 57503, *Underwoodisaurus milii* CAS 74744 *Aprasia repens* CAS 104382, *Delma borea* USNM 128679, *Lialis burtonis* FMNH 166958, *Paradelma orientalis* CAS 77652, *Pletholax gracilis* MCZ R-187676, *Pygopus lepidopodus* CAS 135450, *Amalosia rhombifer* CAS 100919, *Crenadactylus ocellatus* CAS 95287, *Dactylocnemis pacificus* CAS 47979, *Diplodactylus pulcher* CAS 75182, *Eurydactylodes vieillardii* CAS 231986, *Hoplodactylus duvaucelii* UMMZ 129351, *Lucasium steindachneri* CAS 75185, *Mokopirirakau granulatus* CAS 47982, *Naultinus elegans* CAS 47976, *Oedura tryoni* CAS 75669, *Pseudothecadactylus australis* MCZ R-35162, *Rhacodactylus auriculatus* CAS 205486, *Rhynchoedura ornata* UMMZ 124484, *Strophrurus ciliaris* FMNH 215488, *Toropuku stephensi* CAS 47986, *Aeluroscalabotes felinus* FMNH 146141, *Goniurosaurus kuroiwaie* CAS 198810, *Hemitheconyx caudicinctus* CAS 165588, *Holodactylus africanus* CAS 198932, *Aristelliger georgeensis* CAS 176485, *Coleodactylus brachystoma* UMMZ 103051, *Euleptes europaea* MCZ R-4463, *Lepidoblepharis xanthostigma* CAS 178104, *Pristurus carteri* CAS 225349, *Pseudogonatodes barbouri* MCZR14385, *Afroedura karroica* CAS 198274, *Dixonius siamensis* CAS 95254, *Luperosaurus corfieldi* CAS 182570, *Rhoptropella ocellata* CAS 186351, *Uroplatus fimbriatus* CAS-SU 13469, *Asaccus elisae* 218137A, *Phyllodactylus baurii* CAS 09501, *Thecadactylus rapicauda* CAS 95146.

Gerrhosauridae: *Cordylosaurus subtessellatus* FMNH 74082. **Gymnophthalmidae:** *Colobosaura modesta* USNM 341978. **Lacertidae:** *Gallotia stehlini* AMNH-R 102163; *Lacerta viridis* AMNH-R 01124; *Takydromus septentrionalis* AMNH-R 20445. **Leiocephalidae:** *Leiocephalus inaguae* AMNH-R 45610. **Opluridae:** *Chalarodon madagascariensis* AMNH-R 71456. **Scincidae:** *Amphiglossus splendidus* FMNH 72807; *Brachymeles gracilis* FMNH 52642; *Chalcides ocellatus* YPM 12690; *Egernia striolata* YPM 12865. **Teiidae:** *Callopistes maculatus* FMNH 53726. **Xantusiidae:** *Cricosaura typica* USNM 547842.

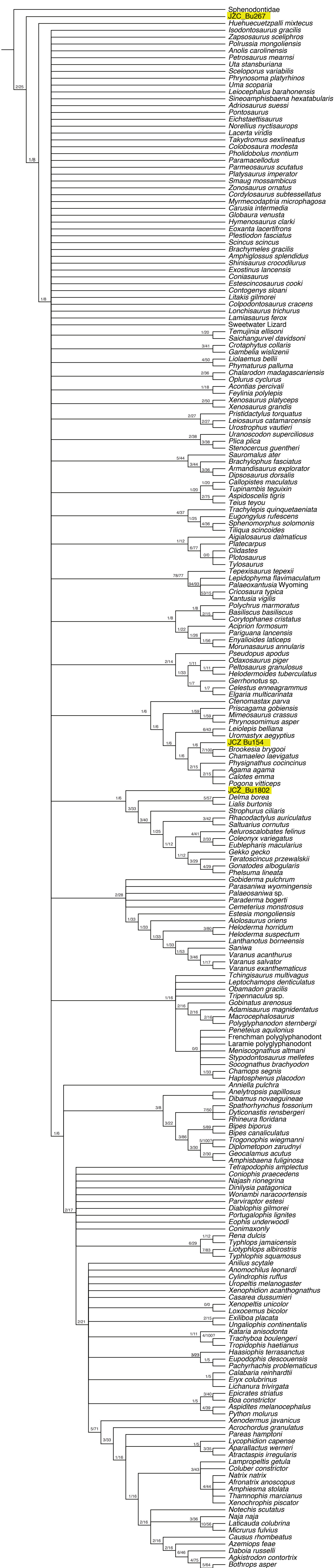


Fig. S1. Results from the analysis of the large morphological data set (11,12) using Parsimony. Strict consensus of 1000 trees, showing the position of three burmite lizards, basal squamate (JZC BU267), stem gekkotan (JZC BU1802), and stem-chamaeleonidae (JCZ BU154). Values at the nodes correspond to Bremer and Relative Bremer support.

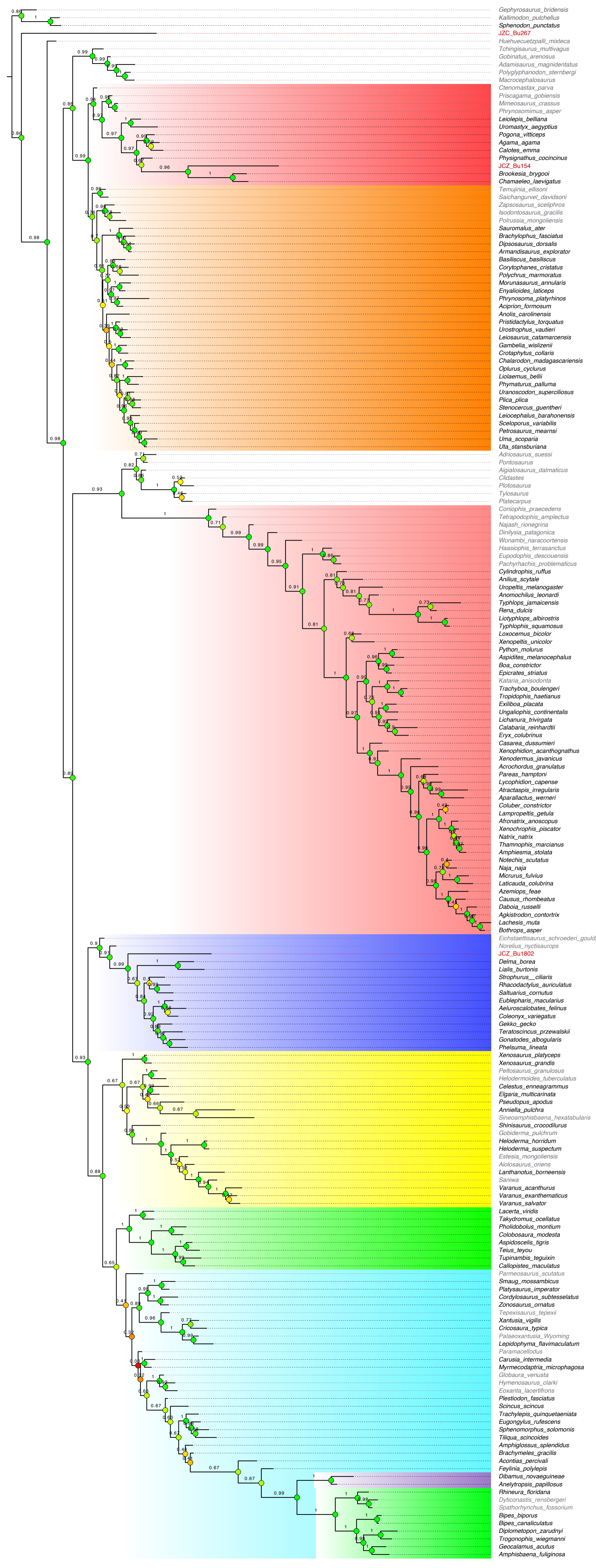


Fig. S2. Results from the analysis of the large morphological data set (11,12) using Bayesian Inference. Tree shows the position of three burmite lizards, basal squamate (JZC BU267), stem gekkotan (JZC BU1802), and stem-chamaeleonidae (JCZ BU154). Values at the nodes correspond to posterior probabilities.

Movie S1: 3D volume rendered movies of the burmite lizards, gekkotan (JZC BU1802), lacertoid (JZC BU1803), basal squamate (JZC BU267), stem-chameleon (JCZ BU154), and agamid (JCZ BU266).