Figures and figure supplements

A non-archaeopterygid avialan theropod from the Late Jurassic of southern Germany

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Figure 1. Geographic and stratigraphic provenance of the new avialan specimen. (A) Map of the southern Franconian Alb with the palaeogeographic settings indicated and showing the localities of theropod specimens from the Solnhofen Archipelago (modified from Foth and Rauhut, 2017). (B) Figure 1 continued on next page.
Stratigraphic position of the new specimen, SNSB-BSPG 2017 I 133, within the ‘Solnhofen limestones’ and in comparison to known specimens of Archaeopteryx (modified from Rauhut et al., 2012).
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Figure 2. Overview photograph of holotype specimen of Alcmonavis poeschli gen. et sp. nov., SNSB-BSPG 2017 I 133. Abbreviations: hu, humerus; mc, metacarpus; r, radius; sl, semilunate carpal; ul, ulna; Roman numerals indicate digits and Arabic numerals indicate phalanges of digits. Scale bar is 5 cm. DOI: https://doi.org/10.7554/eLife.43789.004
Figure 3. Right humerus of Alcmonavis poeschli in (A) normal and (B) ultraviolet light. Abbreviations: dpc, deltopectoral crest; fmb, fossa musculus brachialis; it, internal tuberosity; mp, attachment facet for m. pectoralis; rc, radial condyle. Scale bar is 3 cm.
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Figure 4. Antebrachium and manus of Alcmonavis poeschli. Abbreviations as in Figure 1, and: pi, pisiforme; ra, radiale. Scale bar is 5 cm.
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Figure 5. Proximal end of ulna of Alcmonavis poeschli in (A) normal and (B) ultraviolet light. Abbreviations: ha, humeral articulation; ib, impressio brachialis; ri, ridge bordering the impressio brachialis; rt, radial tubercle (cotylus dorsalis). Scale bar is 5 mm.

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Figure 6. Distal end of ulna and proximal carpals of Alcmonavis poeschli in (A) normal and (B) ultraviolet light. Abbreviations as in Figures 2 and 4 and: amr, anteromedial ridge. Scale bar is 5 mm.
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Figure 7. Radius of Alcmonavis poeschli. (A) Proximal end as exposed in medial view. (B) Proximal end in oblique posteromedial view. (C) Mid-shaft in medial view. Abbreviations: fu, longitudinal furrow; tbr, tuberculum bicipitale radii. Scale bars are 5 mm.

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Figure 8. Manus of Alcmonavis poeschli in (A) normal and (B) ultraviolet light. Abbreviations as in Figures 2 and 4, and: dc, distal carpal. Scale bar is 10 mm.

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Figure 9. Distal carpals and bases of metacarpals of *Alcmonavis poeschli* in (A) normal and (B) ultraviolet light. Abbreviations as in Figures 2, 4 and 8, and: patr, palmar trochlear ridge; pltr, plantar trochlear ridge. Scale bar is 5 mm.

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Figure 10. Manual phalanges of Alcmonavis poeschli. (A) and (B) Distal ends of metacarpals II and III and proximal phalanges of digits II and III in normal (A) and ultraviolet (B) light. (C) First phalanx of first digit in medial view. (D) Ungual phalanx of digit I in medial view under ultraviolet light. (E) Ungual phalanx of digit II in medial view under ultraviolet light. (F) Ungual phalanx of digit III in lateral view under ultraviolet light. Abbreviations as in Figure 2, and: ft, flexor tubercle; gr, groove; ks, keratinous sheath; lpf, lateropalmar flange; pl, proximal lip. Scale bars are 1 cm.
Figure 11. Comparison of humeral shape in some Mesozoic birds. (A, E) Alcmonavis. (B–D) Archaeopteryx with humeral shape of Alcmonavis shown in grey. (B) Berlin specimen. (C) Solnhofen specimen. (D) Daiting specimen. (F) Jeholornis. (G) Sapeornis. (H) Confuciusornis. (B, C) modified after Wellnhofer, 2008. (F–H) modified after Wang et al., 2016.

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Figure 12. Mani of several paravian theropods for comparison with Alcmonavis. (A) Right manus of Velociraptor mongoliensis (IGM 100/982) in plantar view. (B) Left manus of Microraptor gui (IVPP V 13352) in plantar view. (C) Right manus of the Thermopolis specimen of Archaeopteryx in planto-medial view. (D) Left manus of Confuciusornis sanctus (JME 2005/1) in palmar view. (E) Right manus of Alcmonavis poeschli in palmar view. Abbreviations as in Figure 2. Scale bars are 20 mm (A) and 10 mm (B–E).

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Figure 13. Proximal part of the humerus of specimens of Archaeopteryx in anteromedial view, showing the lack of a pronounced facet for the pectoralis muscle in this taxon. (A) London specimen. (B) Thermopolis specimen.

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Figure 14. Shoulder region and proximal ends of both humeri of *Sapeornis* (JZT-DB 0047), showing the enlarged and medially inclined facet for the insertion of *m. pectoralis* (arrows).

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Figure 15. Phylogenetic position of Alcmonavis poeschli. Time-calibrated, simplified reduced consensus tree resulting from an analysis of 136 taxa scored for 565 characters under equally-weighted parsimony (see text and supplementary material for details). Nodes with circuit numbers: 1, Maniraptora; 2, Pennaraptora; 3, Paraves; 4, Deinonychosauria; 5, Avialae; 6, Anchiornithidae; 7, Pygostylia; 8, Ornithothoraces. Bremer supports are shown for the clade Avialae. 
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Figure 15—figure supplement 1. Full strict consensus tree of the unweighted analysis with Bremer support and Bootstrap values for clades with a support of 50% or more indicated.
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Figure 15—figure supplement 2. Full reduced consensus tree of the unweighted analysis. Named nodes: 1, Coelurosauria; 2, Tyrannosauroidea; 3, Compsognathidae; 4, Maniraptoriformes; 5, Ornithomimosauria; 6, Maniraptora; 7, Alvarezsauridae; 8, Pennaraptora; 9, Therizinosauroidea; 10,
Oviraptorosauria; 11, Oviraptoridae; 12, Paraves; 13, Deinonychosauria; 14, Troodontidae; 15, Dromaeosauridae; 16, Unenlagiinae; 17, Microraptorinae; 18, Velociraptorinae; 19, Dromaeosaurinae; 20, Avialae; 21, Anchiornithidae; 22, Pygostylia; 23, Ornithothoraces; 24, Enantiornithes; 25, Ornithuromorpha; 26, Ornithurae; 27, Neornithes.

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Figure 15—figure supplement 3. Strict consensus tree of the analysis using implied weights with Bremer support and Bootstrap values for clades with a support of 50% or more indicated.
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Figure 16. Development of the deltopectoral crest and the facet for the pectoralis muscle in several theropods. (A) Right humerus of the basal maniraptoriform Ornitholestes hermani (AMNH 619). (B) Left humerus (reversed for comparison) of the dromaeosaurid Unenlagia comahuensis (MCP PVPH 78). (C) Right humerus of Alcmonavis poeschli (under ultraviolet light; SNSB-BSPG 2017 I 133). (D) Right humerus of Bucorvus abyssinicus (northern ground hornbill; SNSB-BSPG unnumbered).

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Figure 17. Development of the tuberculum bicipitale radii in basal avialan theropods. (A) Right elbow joint of Archaeopteryx (Munich specimen). (B) Right elbow joint of the Ottmann and Steil specimen (probably Archaeopteryx). (C) Left elbow joint of Confuciusornis sanctus (SNSB-BSPG 1999 I 15). Abbreviations: hu, humerus; r, radius; tbr, tuberculum bicipitale radii; ul, ulna.

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Figure 18. Proximal end of theropod ulnae, demonstrating character states for character 563. (A) Left ulna of Coelurus fragilis (YPM 2010). (B) Left ulna of Confuciusornis sanctus (JME 1997/1) Scale bar is 10 mm in (A) and in mm in (B).

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