SUPPLEMENTARY INFORMATION

**A dinosaur missing-link? *Chilesaurus* and the early evolution of ornithischian dinosaurs**

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**1. Character scores.** Character scores taken from Baron et al. (2017), with the addition of data taken from Novas et al. (2015).

 *Saltopus* 0??????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????00??0???0?0?????????????????1???????11??1??1?0??0-??10?????????0????????????0?00??????1????????????????01?000221?-?00010?1??02???????????1??????00??????1?0??000??????????????????????????0?????000???0??????10?0??0?????10???????02?10?000?0000000

 *Dromomeron romerii* 0???????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????1111000001110--011-----0-0----0011010000000100-0?010100??011?11000100?01?0????????????????????????????????

 *Dromomeron gregorii* 0???????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????11110100011?0--1101-0000-1000-0011010000000000-0?010?????01??????????1????????????????????????????????????

 *Lagerpeton* 0??????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????00??00??0?00000??????????????????????????????????????????????????????????????????0001000001000000?0000200010100000010-10000111011000---1001-11111000001110--011-----0-1100-0?010100?0000000-0?01?100?00101110001?01010000010011301000002110100000??00??

 *Marasuchus* 0?0????????????????????????????????????????????????????????????????????????????????????0?1?010?0???0?10000?00?????????1?????????????????????????????????????000??0???0?00??0??000?000??00011?00-00?0000010-00-00??010??00000000000000010001?????1??00101?111100100??0011???0????????????????????????100100010100000001000200010110000110-10100011010000---1001-01100010001100--1001-0010-1100-10000100000100010?0000100000100110100000000000011010301?0000210010000000000?

 *Nyasasaurus* 0???????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????11???0?010?1?1?0??20???????1?0?001?010??????????????????????????11111?01??????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????

 *Silesaurus*

0??01?0000000-000-0-101?0-00???10?0000?2?00?????0????????0000010???1??????000???01?01?00111110110100?0?110000?1????010100---1001120001?0?????10100010102????10?1?100-100020?0?200101011000?0100-002000001101110000001?01?010010100?1000-001?????11000-0101111000000?0010-??0????00??????????????????00000001110102100000020100101010011?-10102002010100---0001-001201110011011010020000111100-110001101011000100?011101000100010101000010???????10301001002010200000000000

 *Asilisaurus* 0???????????????????????????????????????????????????????????????????????????0???????????????????????????????????????????0---1000010?0??????????000?10???????1000-100-00??0-???2?010?1??000??000-10?0000011??1?0??00?1010000?000100?0000-?01????????????1011?0000???0?0??????????????????????????????000100?????002110000020100?01????1???1??0????0????0---?0?1-001000?10??1010?1001-0?0111000-?10001?000010?0????0?0?111001?0110100000000??????????????1????????????00000?

 *Lutungutali* 0??????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????0?????????0?00????????????????????????????????????????????????????????????????00000011101020100000201001010?01??0-1??02??10?0???????????0??????????????????????????????????????????????????????????????????????????????????????????????????????????

 *Eucoelophysis* 0?????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????1?????????????????????????????????????????????????????????????????????11???1??????01?010?0?00---???????1200110??2?10010120001111100-01000100100??????????????????????????????????????????????0?????0????????????

 *Lewisuchus*/*Pseudolagosuchus* 00???????????????????????????001011001?2???0???????????10?20003000?0101-0?000000????01101?1110?101?00100100010?1000??0100---0001001???????????????0001??????0000-?00-00001100?000000001000?1?00-100?00001??11101000110?????????????00????????????0001101011???010?0?????????????????????????????????????????????????????????????????????????0????0???00---00????110?0?100???10?1001-00?111100-?1000100000100010??01010??00100110100??0000??????????????1????????????000000

 *Diodorus* 0????????????????????????????????????1????????????????????????????????????????????????????????????????????????????????????????0102?0??????????????0?0???????1100-100-000020?0?2??1020??011??????????????????????????????????????????????????????????????????1011100000????????????????????????????????????????????????????????????????????????????????????????????2010001?1?1001011-001111000-0100????????????????????????????????????????????????????????????????????????

 *Sacisaurus*

0????????????????????????????0?0-1000002???1?????????????????????????0?????????????????????????????????????????1????????0---10011000???????????????101??????1100-101?11000-10?20010?0??000?????????????????????????????????????????000110????????100111???1?????????????????????????????????????????0000000??10?0200?0000211??1010100??0-???0?0010????0---?????0110010100?101001011-000111000-?10001?01011000100?011?????????????????????????????????????????????0??00000?

 *Pisanosaurus* 0???????????????????????????????????11???????????????????????????????????????????????????????????????????????????????????????????010111???0??0000200????????11?0-000-11???????211112???000??0????0???0001??1??01??001???????????????????????????????????????????????????????????????????????????????????????????????????????????1????2???????????0?????????????0?10?0020101?1??10?20?1111?????1?000?0000??0?0100?0101011001110101?1000011???????1??????1?????0??00????0000

 *Fruitadens* 0????11???????1?11???????????0?????210????????????????????????????????????????????????????????????????????????????????????????0102?0???????????????0010311111100-000-0121201002011011??000???1???1?0000?????0??01????0?3?1???121?1001?100????????????????????1?1111000???????????????????????????????????????????????????????????????????????????????????????????100012010?0???101201010-12011100002000?110?0??11111101111?110111?10111111?????????????????????0??????0000

 *Manidens*

0??????????????????????????0?0?0-0?21002??????????????110??0202001?020011001111021??00??0?0???1?????1????????????????????????????210011?1-002101020?01??????1001101100?2120?1?201111???000???1?1???????????0??0????01??3?111?12??1????????????????????01011?????????????????????????????????????????11121100?01?0?2111000?0?0?0?10?022??-1??11?0101??01?0??????0??????????????????????????????????????????????????????????????????????????????????????????????????????????

 *Abrictosaurus* 0000??1000?110?011100000010?100??00211020??011?10100001????????????????????????????????????????????????????????????????011010101?010?11?0?0????0??000103011010?1100??0122201?02011111??000???00-????????????????????????0?????1??1??????????????0?001?????1111?11??0001?????00???1100?001?0??001???011120100000201211101--000?0????????????????????????????????01??????0?0?????1?020111??1201???????0????1??????1111???1101?????????1???1???????10?11????????01000001?0000

 *Tianyulong*

000010110001?0?0111000000?0?1000-??111?2000011110??????00???0????????????0??????2???????????????????????????????????????11??010??000011?010??00???00010401?210?0-00??0121200?02001020??000???????????????????????????????1????1???001010?10?????????11????1?1???1????????????0???11??1??10000??11??0??????????????????????????011010????-?0?111?????????????????1???0??0?????????????????12011?0?0011???11???????11????111??????????11???10??0??101?1??0?????110?000110001

 *Heterodontosaurus* 000010110001101011100000010110111001110200001110010000100?00200010112001100010002001010001001110?0101100110000??00???0?011010101001011100010000002000003011210110011001212?110200111111100?001?10010000010-00-001?211?030100012001?0??10?01010-1010011?1?11111?1111?001110-100002110010010000001111011120100000201211101--00010010100210-1111100101??0100?11-??01?0??120?0??101100201110-12110?000021000110????1?11110111111??1?1?1?11?11100100110?010110????1100000100000

 *Eocursor* 0????????????????????????????????????1????????????????????????????????????????????0?????????????????01001?00????????????????00110000101?00001100020?????????10?0-0??0?1??20?0?20110????000???????0?00000?0-00-00???????2?????11?01??????????????010111????101101101001???????????????1??1???????????1112?1000012012?110001000?00101002?1-20011?0101?20100?11-??0110001202010101100201010-120111100020?001201011??11110?100??????????????????????1????0???????0?0????1?0000

 *Laquintasaura*

0???101?????????????????????1000-??10??2???????????????10?000??00????0?????0????11????000?????????????????0???????????????????????????????????????????000???10010000-11??20?0?10?10?????00?0???????????????????????11????????????????????0???????000?1????1?????????????????????????????????????????11?2????00??????0??00?0????0?01202?10??111?0?????01?0??????0???00?2?2??0???1?120101??1201?0???1??????2010110??11??????1?1????????11??????????????????????????0????????

 *Lesothosaurus*

00??10101?0011100-1000?0?10?1001?001011200001110010000100?000??0011?100210001000000111000?0??11000?01100100000?001??10?01000001100100010000021100200??0010?01100-000-1110200002011110110?0?001?00???000010-00-0???011??20111011101?01111?0??????01001101?11111111010001110-100??100??00?0100?0001?1?11120100001101220100020001001012020111011100101020100011-1-0110000202020100101201010-120110000020000120101100111??110010101110100?111?0?100100?1101101-??010?0?0100000

 *Scelidosaurus*

000?1??0100?????????0?0?0??01000-0??1101100?101?011?2?010?0010310010100100000000100110000??????????1??????01?10????????1??????????10111?1-0??100021???0110??1000-000-101020000201111???0?0???1???00??????0-???????111?220??1???0???0?????011-0-??00011????1?1111001?10??????????????????????????????1112011000110111010002001?0010100200-?011100101021100011-1-0?1000?00212010010120101??1201?0?00020????2???110?112??11001?1?1??????01???0???0?00101???002110000100101110

 *Emausaurus*

00??1??00??0??100-?000000?0?1000-00010020??0111001010001??0000300010100?00?0?000?00110?????????????0??????00???????????1?0??00110100111?000021000200??0110101100-000-1100200012011000??000???????????????????????????????????????????10-00???????????????????????????????????0???03??????10??0??1?????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????11?0

 *Agilisaurus*

00011000000010100-1000000?011000-001110200001110010111100?000030001010??10?01000100?011?0??0??1?00?0??????0??0?0??1????010?001110010111?1-0??0000200010110101000-000-111220000201111011000?0?????11???????????0???????1201?10120?0?0?????0?1-0-?10001101??1000?1101000?0-100????????????????????????1112010100110121010002100?001012020111001100101020101011-1-0110???10?0??1011??20101??1201?100101?????20?01??01?110?100101011??????1???0???00003110?00021100000?0100000

 *Hexinlusaurus*

0?0?1??0???????????????????11000-??11?0200001110010000100?0000?0001010??10?01000?00?1110???????????????????????????????0??????1??00??11???????????0?????????10010000-11??2000?201101???000???0???01????????????0??????120????11??1?0?????0?1-0-?1??01??????1???0?0???????????????00??0??01??????????111201010012?1210101--100?0010122210110111001010?0111111-1-0110????0???????1??2010???1201????00?????????????????????0???1?????????1???????1?????????????1?1?00?0100000

 *Jeholosaurus*

00?01011000010110-10000001011000-00010?200001101010000100?0010300010101-10001111010?11100?02??1000?01????000???????????011100011?01011101-0020?012000?00101011?11000-111?200002011?101100000?1??001000001??0110010211??300010121211001110011-???11?101????1111111?1?00???0-?????????????????????????11120101000201201101--100?0011120211120011001?????1???11-??011?001202020101101211110-1201110000211?1?201011001111011001010110010001?110???11003110000021101000001?0000

 *Dracoraptor*

00??100011??1??1??100?00?10?000??11?0?12????1011?0----?00?1001300??0??????????????????????????1001????????????????????????????????????????????????????030???0000-000-0???10?0000000????0?0???????1???1?0???1?1???0????????????????0??????010111????????????????????????110-??0???????????00??1?????????????????????????????????0102112???????2?010?0??0---?01010?200002?201011010?201011?1?0????????????????????????10110?????????????????0??????0????01002110?0?0???00000

 *Massospondylus carinatus*

0001010011200-010-1111111-11?000-01000021010011100----10100000010011000001000???111110001010?0100???1101?01010??1?1??2?00---01010110110?000001000200110211200000-000-002021001210100111010???11??01?00011100112??0?11?01?00001?0100?0???001??10?0010110?011012111011001100-103?1100??000001111211?0010010001001?012101000?000?001?20????-???0?001010200---???0100???0??00010?????????????1101-?0????0????1???10000?0??0000111?111?????0???0?????00100?0010?1100?0000000000

 *Massospondylus kaalae*

0????10011100-?10-1111111-1??00??01000020?00111100----1???0000??0011?0???????????1?1???????01?1?????1??1??110??????????00---01010110111?00001?000200?00210200000-000-??2021001100100?11010????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????

 *Leyesaurus*

00??0??011?010?10-111??1?11??00??0100?02???0111100----?0?0000??00?0100??01?000001111???????????????????????01??000?????00---000??010110?0?0011000?00?1021?200000-000-002021?0021010??110?0?0?1101??000021??01?20?0???????????????????1???0?????????????1??1?????????????????????????????????????????????????????????????????????1???22?????????0???????????0??????????????????????????????????????????????????????????????????????????????0110?0???????010?110?0????00????

 *Antetonitrus* 0????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????0???001?10???????201??????????????001??00??????001001????121111101000110111?3????????????1??11?????1?01010?0000012201100???000?1???????????00001010200---0010100100001121200--1011-001101111-0000010000010001000000101000??????????????????????0?1?110??0?1?0?1?00000000?

 *Guaibasaurus* 0????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????10?????????1??1????000??1?00????01??????100???0011?????????????????????????????????????????1??????1?0121?2?00000???0?00122002?0-200000020?01?0---00?1-0???????0101?1001?11-001??1101-??0001?????1???100?000???00010101111???00?0?0???0000?01?00102110000000000000

 *Panphagia*

0??????????????????????????0?????????0???1??????00----?????????????????????000011111??????????1011?????????????????????00---000??111110000001100010011??????0000-010100132000?0101001??010???1?0?0?0001011000-00?0011????0?00???1????????????????00011????1?????????????????????????????????????????000?0001?00201100000010000001221?11???2?00001??0??????0001-0????????????????????????????????????0110011001000000?????0?01?1??1?1?0??????????0?????0??????0???0?00?????

 *Plateosaurus*

0000000011100-000-1000111-110010-11011021110111100----00100000301010100000100???0111101010?011?011?001001000000000?012?00---010101100101000011000100110110100000-01000010200002111011110000001101020000111?11100?00111110000010010000110?01?????1000010001101111101?101110-10201201??00010101111110010110001001001221110020101001021221102??00001010200---00001001000?2020101001011-00?111111-100002?000011?0100?010101000111011111100010?01001000101?01101100000000000000

 *Unaysaurus*

00??00?0111010?00-100011101?0020-1111102?110111?00----0?1???00301010100001101??????111???????????1?0010010000??????????00---01???110010?0000?1001100110210100000-000-001020000211100???000?0????????????????????????1?????????????????10?010????00000100011?11111010101100-1?2???????????010?11?1????????????????????????????????????????????????????????????????????????????????????????????????????????11001000?11???????11011111100???????????????001?0?1?0?0?000000000

 *Saturnalia* 0??1????????????????????????????????????????1??1????????????????????????????????????1?0?????????????????0??0????????????????????????????0???????????????????10???0?????132????????0?????10????1??02?000011?00-0010011001?00000001100??10?0??????00001100011011110010101120-1????????????????????????000????1??01012?00000?0001001221?2?00?200200101?200---?0?0101100102000101001001-000111101-1000020000111001000000101000110011?1?100010?011000103010011020?0?000?000000?

 *Efraasia*

00??100011100-?00-1111111-10?010-01001021000?1?100----0???????????1??0????1100001101?0111?????1?0????10?1??????????????00---000??010110?0001-?00120011021020000??000-??102?000210100???000??????0?1???01???0??1?1?10101?10??0000??001???10101???0?0001?0??111111001010?10??1010?200??000?01111111100100100100012012101000?000?001?10011?-11100?01010200---00?1-0010000201010???1011-000??1101-?0000???0001?0?10?????10?0001??110????00????0110?00?10100??02110?00010000000

 *Aardonyx*

00?101?010200-??0-1010101-1??0?0-0100002???0?????0----0??0000??00??1?0???????????00110?????????????????????????????????00---010??110?10?0??0100???00??011???100??0?????1????0121010????0?0???1?0?0??00011110112??0??1??1???0??1??0?0011??01??1????????????1???????????11011??2???????????01??12?????????????????????????????????122???????2?000?10??2?0---000010?10?00201120???1011-000??1111-00000??????1??01??????????00???????????????????????0??1??0?????0???01?00000?

 *Pantydraco*

00??1?00???00-????101????-10?01????000?21000110100----00?0000??00010?0????0?0???2101100110001?1011?001???0000??0??1????00---000??100?10?0??1-0000200000210100000-000-??12200?0100?011??010???111102?01?0?1000-0110???????????????????010101????????????0??1???01??1?????????????????????????????????10010??100100?200100?2000?00?2202?01-11????????????????????0???????01????????????????11?1-??000200?0?1??01000000??0000???????????????????????0101000102110000010000000

 *Thecodontosaurus* 0????????????????????????????????????1??????????0?????????????????????????????????????0010?0?11001?1?10000000????????1??0---000??110??????????????0011??????0000-010100??2000?210100???000??0????0??0000?1000-?0????????0??0?0?01???10101010????000001000?1?011110110010-0-??00?0001-001?010112111001???????????????????????0????????????????2????????????00???0?10?00201020????0????????1101-1000010000011001000000?????0?00011???100????????????????0??????0???01000000?

 *Herrerasaurus*

000000000000??000-1110000?110010-00000020000110100----000?000030001000000000000010010100101??11001?10100000000?0010????00---000??010010?010010000000000200100000-000-00001001000000011100010?11110?0000011011100??211010000000001010011100???????00111????1??1010110?011110?0000?101-101100010101211100000011000012101000100011012110210022010001010200---0000000101002000101101001-000101101-1010020010010001000000101000110010110100010?01100010301001101100000010000000

 *Chindesaurus* 0????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????0????0????????????????????00???1????1??????????????????????????????????????????????????????????????1???????????????0??0?1???1????????????????????1??????????????100002000101101001-0000?1101-10?001001?01000110?010?????0?10?1?11???0????????????????????????????????????

 *Staurikosaurus* 0???????????????????????????????????????????????????????????????????????????????????????????????????????????????????????0---00?00010010?000????000000???????000???????0001????00000????0?0???1???0??0000???1???0??00101000000000100?00110??????????1????????????????????????????????????????????????101000?1?0?0012?0100010001111?1??21???1?000010?02?0---0000001?000020001011?1001-0001?1101-10?0?20010010001000000101000??????????????????????????????????????????00????

 *Sanjuansaurus* 0?????????????????????????1??0???0000??????0????????????????????????0???????????????????????????????????????????????????????????????????????????????????????0000-000-00??10???00000????000???11110100000?10111001?11101000?0000010100???0????????1011100011???????????11110??????????????0??????????1??????????????????0????????????????????00?01010100---???000010000200010?????0?????101101-1010011010010001000000??10001??01111000?000?????????????0?????????????00????

 *Eodromaeus* 0?????0????0??????????????0??0?1010?0?02??01????0?????1???100?????10???????01??????????????????????01??11?000??????????00---00???01?0?0?0??????01200000201000000-00??0?101000000000000?000?001111021010111010?10???01?01?????01??00???10?0101???010011010?101??11?????1110-10000?100110?1000010112?01??????????1?????1?002????0?1???????????02?02010210---00001?1???0?200010???1?01-?00????????00002?11??????1???0????1000101?1??0?0?0001????0?????????0???????0????000000

 *Coelophysis*

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 *Syntarsus*

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 *Eoraptor*

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 *Procompsognathus*

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 *Tawa*

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 *Euparkeria*

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 *Postosuchus*

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 *Dilophosaurus*

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 *Tazoudasaurus* 0????????????????????????????????????0???????????????????????????????0?????00???0?0?????????????????????????????????????0---01010110?10?0????0000?0010??????00010000-00??21?0?210110???000??0????0??000?1???11????201?????????????1000???0??????????????????????????????????????????????????????????????????????????????????????1???????????00?1?010100---001??0???????121?????1??????1????????????1??????????????????1?00?11111?1?0?0????????????????0??????0?0?11100????

 *Yunnanosaurus*

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 *Riojasaurus*

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 *Vulcanodon* 0????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????1?????????????0?????????1??0??0????1????0????????????????????11??????11011?????????????????????????1???????????????1101--001??010?012?1-1?000?11010000---001000?100002121201?01011-001101111-?????10000?????10?????1010001111110?00100?011----?0000110010?10001?01000000?

 *Coloradisaurus*

00??010011201-?10-11011110?01000-01001?2???0????00----??10?0003??011?00001000010110110111010?11001?011?100120????????0?00---010??10011010?001000110011??????00010000-002?21?0?210100???0?0???1?0?0?00001???011201?0111?????????????00???0???????1000110101101111101100???????????0??????????????????1???????????012?010001000000122102???22000001010200---0010000???002020101?01011-001??1101-0000020000111001000010??1??0?111111?0100????0????00030110010110000000000000?

 *Lufengosaurus*

0001?????????????????1??1??2?00???100?020??011??00----1?10?????01001101-01000???11011000?0???11001?01??1?0000??0011????0??????????1?010?0??????0010?????????0000-000-00??20?0?21010?1110?00??10010200001???011101?01110100000100101001100010?0-100000101001011111011001100-1?2111001-00??01011111?001001000100020?211101--00000?12200201-22000001010200---0000000100002020101??10?1-000??1101-1000020000?11001000010101000111111?111?0110?0101101010110010111000000000000?

 *Dracovenator* 0????000102211?11111?101100??0?1001200?2????1???1??????????????????????????????????????????????????????????????????????????????0????????0??????002?0??020?000000-000-000?10?00000001???0?0????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????

 *Cryolophosaurus*

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 *Sinosaurus*

0010100011201??0111111011000000??00?0002??01100110----0???0000100011110201100????011101??1?2?11000?0101110000????????0?00---0001000?010?000??0000200??0101000000-000-0010100000000001??000???????1??11?????1??0??0??1?12?1??0?????0?0????01??1??10001101011111111?1?00111??1????????????????????????11030001?0121120011001010?001?20020?-1?10?00201020????01-???020?0??010???1?1??2010???1100-0?1?021111???101?0?01?1000001???1?????1101110?????103????0?0211?201?0?000000

 *Ignotosaurus* 0???????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????000100011101120000000201001????????????????????????????????0??????????????????????????????????????????????????????????????????????????????????????????????????????????

 *Lophostropheus* 0???????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????00???????????10???00?????????????1???0??1111111010?????????2??1?010??1??1???????????????????????????????????????????????????????????????11?0?0?1???21?2?0110?2010?0???????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????

 *Panguraptor*

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 *Sarcosaurus* 0????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????10?????????????????????????????????????????????????????????????????????????????????????????110300010002012011101201010?1???????????02?0??00?00---?????0???????010??11?1001-?00??1101-????????????????????????????????????????????????????????????????????????????

 *Pulanesaura* 0???????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????00010000-00??21???21?10??????0??0100???00002?1001111??101??????????????101??00???10???????????????11???????1011??????0??????????????????????????????????????????0??0122002?1-??????????????????????0???????????????????????????????????100?001??0100?000?????????????????????????????????????????????01?00000?

 *Pampadromaeus*

00?010001120?0?00-1??1011?1?0010-1100002000?110100----0?0?0000300010?0????000????0??10?????????????????????????????????00---000??000010?0??0?0?00100100210100000-000-0?1320000100100101010???????????????1???????0????????????????????????????????0001????1?????????1????????????????????????????????001?00000?10?2?010002000?0????????????????????????????????0???0???0001?1001?01-00?111101-?????1??0?????????????????????????????????????????????????????????????0?0000

 *Liliensternus* 0??????????????????????????????100?1?0?2???????????????????00?30?0??10010?00????????01?????????????????????????0????????0---00???011???????????????0?0??????000??0?????????0??000100???000????11???1?1?1?1?1??0?????1?????????????????????????????00???1??1?0111111?011110-?????????????????????????110000?1?011??2011?012010?000?20?21?-???0?002010?00---???010????0??020?010?1??201001?1101-10000?01??1????11????????000???????????????????????0?????10????0?000?00?????

 *Gongxianosaurus* 0?????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????0?????0?01?0???00??0-????1?????????????????????????????????1?0?????1?????????00110?010???100?00-01??11111110????10-??1??????????????????????????????????????????????0?0????????????????0????????????00???00??00?0121?0???00?-----??????????????????1???100???0???100111?1??????00???0?????00101?0??0?1000100000000??

 *Zupaysaurus*

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 *Dromomeron gigas* 0????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????111010???110--1111-0000?0----?01?0???????????????????????????????????????????????????????????????????????

 *Agnosphitys* holotype 0???????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????100000?11?0101?000000200010????????????????????????????????0??????????????????????????????????????????????????????????????????????????????????????????????????????????

 *Dimorphodon*

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 *Chilesaurus* 0?????1?1????????????????????0???????0???????????????????????????????0???????????1??????????????????1??1????????????????0---0101?1?0???????????????0??0?????00?0-000-00??11???21?00?1???10???????0??0110???00-1???0??????????????????????01?????0101010000111111101?101110-0?0???????0??101011111???111300?1?01201211101--1100001020100?-10011000010?00---10-1-01???0?0020?01111?120111??1101-??0??2010001?????0011?10?100111011?0?1???1?????????0??10?00????000?000000000

**2. Strict Consensus Tree – full version**



**3. Bremer support**

|  |  |  |
| --- | --- | --- |
|  | No *Chilesaurus* | With *Chilesaurus* |
| Clade | All taxa (74) | All taxa (76) | Without *Pisano*. | Without *Agnos*. and *Salto*. | Without both |
| Dinosauria | 1 | 1 | 1 | 2 | 2 |
| Herrerasauridae | 1 | 4 | 4 | 4 | 4 |
| Sauropodomorpha | 1 | 1 | 1 | 1 | 2 |
| Saurischia | 2 | 1 | 1 | 1 | 1 |
| Ornithischia | 4 | 1 | 3 | 1 | 3 |
| Theropoda | 3 | 1 | 2 | 2 | 2 |
| Ornithoscelida | 4 | 1 | 2 | 1 | 3 |
| Hetero.+ Gena. | 2 | 1 | >5 | 1 | >5 |

**4. Constrained analyses**

Several constrained analyses were carried out to assess how many additional steps it would take to place *Chilesaurus* in alternative positions in the tree.

The first constrained analysis forced the inclusion of *Chilesaurus* within a monophyletic Theropoda (the command force = (a,b,c,…n) was used, with all taxa that were recovered within Theropoda in the analysis by Baron et al. [2017] listed within the bracket); in this analysis Herrerasauridae was allowed to fall within or our outside of Theropoda as a ‘free-floating’ clade. With constraints enforced, we employed both of the search protocols implemented in the main analysis using TNT 1.5-beta (Goloboff et al. 2008). Using a simple New Technology Search 90 MPTs were produced, each of length 1832 steps (13 steps longer than the unconstrained analyses), and all resolution within Theropoda was lost. Using a Driven Search and TBR branch swapping to explore additional tree space, we recovered 716 MPTs of the same length and same fundamental tree topology as the New Technology Search.

The second constrained analysis forced the inclusion of *Chilesaurus* within Neotheropoda (sensu Sereno 1998). This was done using the same force = (a,b,c,…n) command as the first analysis, but with *Eoraptor lunensis*, *Eodromaeus murphi* and *Tawa hallae* removed from the list of taxa forced within the monophyletic clade with *Chilesaurus*. These taxa, along with Herrerasauridae, were allowed to be ‘free-floating’. Using a simple New Technology Search 93 MPTs were produced, each of length 1825 steps (6 steps longer than the unconstrained analyses). In this result *Chilesaurus* was found to nest within a clade containing *Dilophosaurus wetherilli*, *Dracovenator regenti* and *Dracoraptor hanigani*. Using a Driven Search and TBR branch swapping to explore additional tree space, we recovered 625 MPTs of the same length.

The third constrained analysis forced the inclusion of *Chilesaurus* in a small clade of derived theropods, in a position most similar to that which was originally proposed by Novas et al. (2015). In this analysis, the force command only listed *Cryolophosaurus ellioti*, *Dilophosaurus*, *Dracovenator* and *Sinosaurus triassicus* as taxa to be constrained in to a monophyletic group with *Chilesaurus*, as these taxa represent the most derived theropod taxa in this dataset. Using a simple New Technology Search 93 MPTs were produced, each of length 1829 steps (10 steps longer than the unconstrained analyses). Using a Driven Search and TBR branch swapping to explore additional tree space, we recovered 689 MPTs of the same length.

The fourth constrained analysis forced the inclusion of *Chilesaurus* within a monophyletic Sauropodomorpha, with all taxa recovered as sauropodomorphs by Baron et al. (2017) included in the constraint command; *Nyasasaurus parringtoni* was then allowed to be ‘free-floating’ in a second analysis, due to uncertainties regarding its phylogenetic affinities. Using a simple New Technology Search, with *Nyasasaurus* included, 596 MPTs of length 1832 steps were produced (13 steps longer than the MPTs of the main analyses). With *Nyasasaurus* allowed to fall outside of a monophyletic Sauropodomorpha + *Chilesaurus* clade, 60 MPTs were produced, each of length 1825 steps (6 steps longer than the unconstrained analyses). In this result *Chilesaurus* was found close to taxa such as *Thecodontosaurus antiquus* and *Panphagia protos*. Using a Driven Search and TBR branch swapping to explore additional tree space, we recovered 544 MPTs of the same length as the New Technology Search; *Chilesaurus* is recovered in a polytomy along with many of the most basal sauropodomorphs in this analysis.

 A fifth and final set of constrained analyses tested whether *Chilesaurus* could be recovered in a more derived position within Ornithischia; first by excluding *Pisanosaurus mertii* from the forced monophyletic group containing *Chilesaurus* and other ornithischians, second by excluding *Pisanosaurus* and all heterodontosaurids (in effect forcing *Chilesaurus* within ‘Genasauria’), and lastly by excluding *Pisanosaurus* and ‘genasaurians’. As with the previous analyses, the members of these clades were chosen based upon the results of Baron et al. (2017) and the main analyses of this study. With *Chilesaurus* forced into a more derived position within Ornithischia than *Pisanosaurus* 86 MPTs of length 1821 steps (i.e. 3 steps longer) were found. Forcing *Chilesaurus* within Heterodontosauridae, we recovered 86 MPTs of length 1828 steps (i.e. 9 steps longer); forcing *Chilesaurus* within ‘Genasauria’, we recovered 90 MPTs of length 1825 steps (i.e. 6 steps longer).

**5. Optimised ornithischian synapomorphies**

In the text we list a set of synapomorphies for the clade Ornithischia that are also found in *Chilesaurus*, and therefore unite the two taxa in our analyses. Here we list those synapomorphies of Ornithischia *sensu stricto* that also appear convergently in some derived theropod taxa. *Chilesaurus* was originally thought to belong to Tetanurae (Novas et al. 2015), and this result may have been generated, in part, as a result of the presence of such convergent morphologies.

Below is a list of the ornithischian characteristics observed in *Chilesaurus* that also appear convergently in some derived theropods:

1) an anterior iliac process that is at least subequal in anteroposterior length to the posterior iliac process – also present in most theropods, although it must be noted that the dorsoventral depth of the elongated process varies greatly between taxa;

2) a distinct brevis fossa that is not visible in lateral view, but is restricted to the ventral margin of the postacetabular process – also observed in some tetanuran theropods;

3) a postacetabular process that is 25–35% of the total anteroposterior length of the ilium – also present in some derived theropods;

4) a pubic symphysis that is restricted to the distal end of the pubis – also observed in some tetanuran theropods;

5) a femur that is straightened in anterior view (no sigmoidal profile or medial bowing present) – also present in some theropods and in many large-bodied sauropodomorphs;

6) a fibula that is less than half of the width of the tibia in midshaft diameter – also present in some theropods, including many ‘basal’ members of Theropoda.

**6. References**

Baron MG, Norman DB, Barrett PM. 2017. A new hypothesis of dinosaur relationships and early dinosaur evolution. *Nature* **543**, 501–506. (doi:10.1038/nature21700)

Goloboff PA, Farris JS, Nixon K. 2008. TNT, a free program for phylogenetic analysis. *Cladistics* **24**, 774–786. (doi:10.1111/j.1096-0031.2008.00217.x)

Novas FE, Salgado L, Suárez M, Agnolín FL, Ezcurra MD, Chimento NR, de la Cruz R, Isasi MP, Vargas AO, Rubilar-Rogers D. 2015. An enigmatic plant-eating theropod from the Late Jurassic period of Chile. *Nature* **522**, 331–4. (doi:10.1038/nature14307)

Sereno PC. 1998. A rationale for phylogenetic definitions, with application to the higher-level taxonomy of Dinosauria. *Neues Jahrbuch Geol. Paläontol. Abh*. **210**, 41–83.