**Supp. file 3.** Data matrix of 288 morphological characters in NEXUS format for Mesquite with the two parsimonious trees.

<https://doi.org/10.5852/ejt.2021.753.1389.4391>

#NEXUS

BEGIN TAXA;

TITLE Taxa;

DIMENSIONS NTAX=39;

TAXLABELS

Uintaceras\_radinskyi Ronzotherium\_velaunum\_ Ronzotherium\_romani\_FERTE\_ALAIS GAIMERSHEIM RICKENBACH MARSEILLE R\_romani\_merged POILLAT R\_romani\_merged\_final Ronzotherium\_filholi\_QUERCY VILLEBRAMAR R\_filholi\_merged Ronzotherium\_kochi\_CLUJ Ronzotherium\_elongatum\_PERNES KLEINBLAUEN R\_elongatum\_merged AUVERGNE BUMBACH R\_indet VENDEZE LAMOTHE\_CAPDEVILLE R\_sp\_nov Teletaceras\_radinskyi Penetrigonias\_dakotensis Trigonias\_osborni Epiaceratherium\_naduongense Epiaceratherium\_bolcense Epiaceratherium\_magnum Subhyracodon\_occidentalis Epiaceratherium\_delemontense Molassitherium\_albigense Diceratherium\_armatum Mesaceratherium\_gaimersheimense Pleuroceros\_pleuroceros Diaceratherium\_tomerdingense Pleuroceros\_blanfordi Mesaceratherium\_welcommi Protaceratherium\_minutum Mesaceratherium\_paulhiacense

;

END;

BEGIN CHARACTERS;

TITLE Matrix\_Tissier\_et\_al.\_2019;

DIMENSIONS NCHAR=288;

FORMAT DATATYPE = STANDARD RESPECTCASE GAP = - MISSING = ? SYMBOLS = " 0 1 2 3 4 5 6 7 8 9 A B C D E F G H J K M N P Q R S T U V W X Y Z a b c d e f g h j k m n p q r s t u v w x y z";

CHARSTATELABELS

1 'Nasal: lateral apophysis = 0, absent; 1, present ',

2 'Maxillary: foramen infraorbitalis = 0 above P1-2; 1 = above P3; 2 = above P4; 3, above molars ',

3 'Nasal notch = 0, above P1-2; 1 = above P3; 2, above P4-M1',

4 'Nasal septum = 0, never ossi?ed; 1, ossi?ed (even sometimes)',

5 'Nasal septum: ossi?ed = 0, partially; 1, totally',

6 'Nasal/lacrymal: contact = 0, long; 1, punctual or absent ',

7 'Orbit: anterior border = 0, above P4?M2; 1, above M3; 2, behind M3 ',

8 'Lacrymal: processus lacrymalis = 0, present; 1, absent ',

9 'Frontal: processus postorbitalis = 0, present; 1, absent',

10 'Maxillary: anterior base of the processus zygomaticus maxillari = 0, high; 1, low ',

11 'Zygomatic arch = 0, low; 1, high; 2, very high ',

12 'Zygomatic arch: processus postorbitalis = 0, present; 1, absent ',

13 'Zygomatic arch: processus postorbitalis = 0, on jugal; 1, on squamosal ',

14 'Jugal/squamosal: suture = 0, smooth; 1, rough ',

15 'Skull: dorsal profile = 0, flat; 1, concave; 2, very concave',

16 'Sphenoid: foramen sphenorbitale and f. rotundum = 0, distinct; 1, fused ',

17 'Squamosal: area between temporal and nuchal crests = 0, ?at; 1, depression ',

18 'External auditory pseudomeatus = 0, open; 1, partially closed; 2, closed ',

19 'Occipital side = 0, inclined forward; 1, vertical; 2, inclined backward ',

20 'Occipital: nuchal tubercle = 0, little developed; 1, developed; 2, very developed ',

21 'Skull: back of teeth row = 0, in the posterior half; 1, restricted to the anterior half ',

22 'Pterygoid: posterior margin = 0 nearly horizontal; 1, nearly vertical ',

23 'Skull = 0, dolichocephalic; 1, brachycephalic ',

24 'Nasal bones: rostral end = 0, narrow; 1, broad; 2, very broad ',

25 'Nasal bones = 0, totally separated; 1, anteriorly separated; 2, fused ',

26 'Nasal bones = 0, long; 1, short; 2, very long ',

27 'Median nasal horn = 0, absent; 1, present ',

28 'Median nasal horn = 0, small; 1, developed ',

29 'Paired nasal horns = 0, absent; 1, present ',

30 'Paired nasal horns = 0, terminal bumps; 1, lateral crests',

31 'Frontal horn = 0, absent; 1, present ',

32 'Frontal horn = 0, small; 1, huge',

33 'Orbit: lateral projection = 0, absent; 1, present ',

34 'Zygomatic width/frontal width = 0, less than 1.5; 1, more than 1.5 ',

35 'Frontal-parietal = 0, sagittal crest; 1, close frontoparietal crests; 2, distant crests ',

36 'Occipital crest = 0, straight; 1, concave; 2, forked ',

37 'Maxillary: processus zygomaticus maxillari, anterior tip = 0, progressive; 1, brutal ',

38 'Vomer = 0, acute; 1, rounded ',

39 'Squamosal: articular tubercle = 0, smooth; 1 high ',

40 'Squamosal: transversal pro?le of articular tubercle = 0, straight; 1, concave ',

41 'Squamosal: foramen postglenoideum = 0, distant from the processus postglenoidalis; 1, close to it ',

42 'Squamosal: processus postglenoidalis = 0, ?at; 1, convex; 2, dihedron ',

43 'Basioccipital: foramen nervi hypoglossi = 0, in the middle of the fossa; 1 shift anteroexternally ',

44 'Basioccipital: sagittal crest on the basilar process = 0, absent; 1, present ',

45 'Squamosal: posterior groove on the processus zygomaticus = 0, absent; 1, present ',

46 'Squamosal-occipital: processus post-tympanicus and processus paraoccipitalis = 0, fused; 1, distant',

47 'Squamosal: processus post-tympanicus = 0, well developed; 1, little developed; 2, huge ',

48 'Occipital: processus paraoccipitalis = 0, well developed; 1, little developed ',

49 'Occipital: foramen magnum = 0, circular; 1, subtriangular ',

50 'Basioccipital: median ridge on the condyle = 0, present 1, absent ',

51 'Basioccipital: medial truncation on the condyle = 0, absent; 1, present ',

52 'Basioccipital: medial truncation on the condyle = 0, present at juvenile stage; 1, still present at adult stage ',

53 'Symphysis = 0, very upraised; 1, upraised; 2, nearly horizontal',

54 'Symphysis = 0, spindly; 1, massive; 2, very massive',

55 'Symphysis: posterior margin = 0, in front of p2; 1, level of p2-4',

56 'Foramen mentale = 0, in front of p2; 1, level of p2-4',

57 'Corpus mandibulae: lingual groove = 0, present; 1, absent',

58 'Corpus mandibulae: lingual groove = 0, still present at adult stage; 1, present at juvenile stage only',

59 'Corpus mandibulae: base = 0, straight; 1, convex; 2, very convex',

60 'Ramus = 0, inclined forward; 1, vertical; 2, inclined backward',

61 'Ramus: processus coronoideus = 0, well developed; 1, little developed',

62 'Foramen mandibulare = 0, below the teeth neck; 1, above the teeth neck',

63 'Compared length of the premolars/molars rows = 0 (100 \* LP3?4/LM1?3) > 50; 1, 42 < (100 \* LP3?4/LM1?3) < 50; 2 (100 \* LP3?4/LM1?3) < 42 ',

64 'Cheek teeth: enamel foldings = 0, absent; 1, weak; 2, developed; 3, intense ',

65 'Cheek teeth: cement = 0, absent; 1, present ',

66 'Cheek teeth: cement = 0, weak or variable; 1, abundant',

67 'Cheek teeth: shape of enamel = 0, wrinkled; 1, wrinkled and corrugated; 2, corrugated and arborescent',

68 'Cheek teeth: crown = 0, low; 1, high ',

69 'Cheek teeth: crown = 0, high; 1, partial hypsodonty; 2, subhypsodonty; 3, hypsodonty ',

70 'Cheek teeth: roots = 0, distinct; 1, joined; 2, fused ',

71 'I1 = 0, present; 1, absent ',

72 'I1: shape of the crown (cross-section) = 0, almond; 1, oval; 2, halfmoon (NA) ',

73 'I2 = 0, present; 1, absent ',

74 'I3 = 0, present; 1, absent ',

75 'C = 0, present; 1, absent ',

76 'i1 = 0, present; 1, absent',

77 'i1: crown = 0, developed, with a pronounced neck; 1, reduced',

78 'i2 = 0, present; 1, absent',

79 'i2: shape = 0, incisor-like; 1, tusk-like',

80 'i2: orientation = 0, parallel; 1, divergent',

81 'i3 = 0, present; 1, absent',

82 'c = 0, present; 1, absent',

83 'Upper premolars: labial cingulum = 0, always present; 1, usually present; 2, usually absent; 3, always absent',

84 'P2?4: crochet = 0, always absent; 1, usually present; 2, always present ',

85 'P2?4: crochet = 0, always simple; 1, usually simple; 2, usually multiple ',

86 'P2?4: hypocone = 0, connected to the ectoloph; 1, disconnected',

87 'P2?4: lingual cingulum = 0, always present; 1, usually present; 2, usually absent; 3, always absent',

88 'P2?4: lingual cingulum = 0, continuous; 1, reduced',

89 'P2?4: postfossette = 0, narrow; 1, wide; 2, posterior wall ',

90 'P2?3: antecrochet = 0, always absent; 1, usually absent; 2, usually present; 3, always present',

91 'P1 (in adults) = 0, always present; 1, usually present; 2, always absent ',

92 'P1: anterolingual cingulum = 0, present; 1, absent ',

93 'P2 = 0, present; 1, absent ',

94 'P2: protocone and hypocone = 0, fused; 1, lingual bridge; 2, separated; 3, lingual wall (NA) ',

95 'P2: metaloph = 0, hypocone posterior to metacone; 1, transverse; 2, hypocone anterior to metacone',

96 'P2: lingual groove = 0, present; 1, absent ',

97 'P2: protocone = 0, equal or stronger than the hypocone; 1, less strong than the hypocone',

98 'P2: protoloph = 0, present; 1, absent ',

99 'P2: protoloph = 0, joined to the ectoloph; 1, interrupted',

100 'P3?4: medifossette = 0, always absent; 1, usually absent; 2, usually present; 3, always present',

101 'P3?4: constriction of the protocone = 0, always absent; 1, usually absent; 2, usually present; 3, always present',

102 'P3?4: protocone and hypocone = 0, fused; 1, lingual bridge; 2, separated; 3, lingual wall (NA) ',

103 'P3?4: metaloph = 0, hypocone anterior to metacone; 1, transverse; 2, hypocone posterior to metacone ',

104 'P3: protoloph = 0, joined to the ectoloph; 1, interrupted',

105 'P3: crista = 0, always absent; 1, usually absent; 2, usually present; 3, always present ',

106 'P3: pseudometaloph = 0, always absent; 1, sometimes present ',

107 'P4: antecrochet = 0, always absent; 1, usually absent; 2, usually present; 3, always present ',

108 'P4: metaloph = 0, continuous; 1, discontinuous',

109 'Upper molars: labial cingulum = 0, always present; 1, usually present; 2, usually absent; 3, always absent ',

110 'Upper molars: antecrochet = 0, always absent; 1, usually absent; 2, usually present; 3, always present',

111 'Upper molars: crochet = 0, always absent; 1, usually absent; 2, usually present; 3, always present',

112 'Upper molars: crista = 0, always absent; 1, usually absent; 2, usually present; 3, always present',

113 'Upper molars: medifossette = 0, always absent; 1, usually absent; 2, usually present',

114 'Upper molars: lingual cingulum = 0, always present; 1, usually present; 2, usually absent; 3, always absent ',

115 'M1-2: constriction of the protocone = 0, always absent; 1, usually absent; 2, usually present; 3, always present ',

116 'M1-2: constriction of the protocone = 0, weak; 1, strong',

117 'M1-2: paracone fold = 0, present; 1, absent ',

118 'M1-2: paracone fold = 0, strong; 1, weak ',

119 'M1-2: metacone fold = 0, present; 1, absent ',

120 'M1-2: metastyle = 0, short; 1, long ',

121 'M1-2: metaloph = 0, long; 1, short ',

122 'M1-2: posterior part of the ectoloph = 0, straight; 1, concave ',

123 'M1-2: cristella = 0, always absent; 1, usually present; 2, always present ',

124 'M1-2: posterior cingulum = 0, continuous; 1, low and reduced ',

125 'M1: metaloph = 0, continuous; 1, hypocone isolated ',

126 'M1: antecrochet-hypocone = 0, always separated; 1, sometimes joined; 2, always joined ',

127 'M1: postfossette = 0, present; 1, usually absent ',

128 'M2: protocone, lingual groove = 0, always absent; 1, usually absent; 2, always present ',

129 'M2: hypocone anterolingual goove = 0, absent; 1, present',

130 'M2: mesostyle = 0, absent; 1, present ',

131 'M2: mesostyle = 0, weak; 1, strong ',

132 'M2: antecrochet and hypocone = 0, separated; 1, joined',

133 'M3: ectoloph and metaloph = 0, distinct; 1, fused (ectometaloph) ',

134 'M3: shape = 0, quadrangular; 1, triangular ',

135 'M3: constriction of the protocone = 0, always absent; 1, usually absent; 2, always present',

136 'M3: protocone = 0, trefoil-shape; 1, indented ',

137 'M3: protoloph = 0, transverse; 1, lingually elongated',

138 'M3: posterior groove on the ectometaloph = 0, present; 1, absent ',

139 'p2-3: vertical external roughnesses = 0, absent; 1, present ',

140 'Lower cheekteeth: external groove = 0, smooth, U-shaped; 1, developed; 2, angular, V-shaped (NA)',

141 'Lower cheekteeth: external groove = 0, vanishing before the neck; 1, developed until the neck',

142 'Lower cheekteeth: trigonid = 0, angular; 1, rounded',

143 'Lower cheekteeth: trigonid = 0, obtuse or right dihedron; 1, acute dihedron',

144 'Lower cheekteeth: metaconid = 0, joined to the metalophid; 1, constricted',

145 'Lower cheekteeth: entoconid = 0, joined to the hypolophid; 1, constricted',

146 'Lower premolars: lingual opening of the posterior valley = 0, U-shape; 1, narrow, V-shape',

147 'Lower premolars: lingual cingulum = 0, always present; 1, usually present; 2, usually absent; 3, always absent',

148 'Lower premolars: lingual cingulum = 0, reduced; 1, continuous',

149 'Lower premolars: labial cingulum = 0, present; 1, absent',

150 'Lower premolars: labial cingulum = 0, continuous; 1, reduced',

151 'd1/p1 in adults = 0, always present; 1, usually present; 2, usually absent; 3, always absent',

152 'd1: 0, always two-rooted; 1, usually two-rooted; 2, always one-rooted',

153 'p2 = 0, always present; 1, usually present; 2, always absent',

154 'p2: paralophid = 0, isolated, spur-like; 1, curved, without constriction',

155 'p2: paraconid = 0, developed; 1, reduced',

156 'p2: posterior valley = 0, lingually open; 1, usually closed; 2, always closed',

157 'Lower molars: lingual cingulum = 0, always present; 1, often absent; 2, always absent',

158 'Lower molars: lingual cingulum = 0, reduced; 1, continuous',

159 'Lower molars: labial cingulum = 0, always present; 1, usually present; 2, usually absent; 3, always absent',

160 'Lower molars: labial cingulum = 0, continuous; 1, reduced',

161 'Lower molars: hypolophid = 0, transverse; 1, oblique; 2, almost sagittal',

162 'm2-3: lingual groove of the entoconid = 0, absent; 1, present',

163 'dI1 = 0, present; 1, absent ',

164 'dI2 = 0, present; 1, absent ',

165 'D2: mesostyle = 0, present; 1, absent ',

166 'D3?4: mesostyle = 0, absent; 1, present ',

167 'D2: lingual wall = 0, absent; 1, present ',

168 'D2: secondary folds = 0, absent; 1, present ',

169 'D2: mesoloph = 0, absent; 1, present ',

170 'di1 = 0, present; 1, absent',

171 'di2 = 0, present; 1, absent',

172 'Lower milk teeth: constriction of the metaconid = 0, present; 1, absent',

173 'Lower milk teeth: constriction of the entoconid = 0, absent; 1, present',

174 'Lower milk teeth: protoconid fold = 0, present; 1, absent',

175 'd1 (in juveniles) = 0, present; 1, absent',

176 'd2-3: vertical external roughnesses = 0, absent; 1, present',

177 'd2-3: ectolophid fold = 0, present; 1, absent',

178 'd2: anterior groove on the ectolophid = 0, absent; 1, present',

179 'd2: paralophid = 0, simple; 1, double',

180 'd2: posterior valley = 0, always open; 1, usually open; 2, usually closed; 3, always closed',

181 'd3: paralophid = 0, double; 1, simple',

182 'd3: lingual groove on the entoconid = 0, always absent; 1, usually absent; 2, always present',

183 'Atlas: outline of the rachidian canal = 0, bulb; 1, mushroom',

184 'Atlas: alar notch = 0, absent; 1, present',

185 'Atlas: foramen vertebrale lateralis = 0, absent; 1, present',

186 'Atlas: condyle-facets = 0, comma-like; 1, kidney-like',

187 'Atlas: axis-facets = 0, straight; 1, sigmoid; 2, transversally concave NA',

188 'Atlas: foramen transversarium = 0, present; 1, absent',

189 'Atlas: foramen transversarium = beside the axis-facet; 1, hidden by the axis-facet',

190 'Scapula = 0, elongated (1.5<H/APD<2); 1, very elongated (H/APD>2); 2, spatula-shaped (H/APD<1.5)',

191 'Scapula: glenoid fossa = 0, oval; 1, medial border straight',

192 'Humerus: greater trochiter = 0, high; 1, low',

193 'Humerus: fossa olecrani = 0, high; 1, low',

194 'Humerus: distal articulation = 0, egg cup (shallow median constriction); 1, diabolo (deep median constriction)',

195 'Humerus: scar on the trochlea = 0, absent; 1, present',

196 'Humerus: distal gutter on the epicondyle = 0, absent; 1, present',

197 'Radius: anterior border of the proximal articulation = 0, straight; 1, M-shaped',

198 'Radius: medial border of the diaphysis = 0, straight; 1, concave',

199 'Radius: proximal ulna-facets = 0, always separated; 1, usually separated; 2, usually fused; 3, always fused',

200 'Radius: insertion of the m. biceps brachii = 0, shallow; 1, deep',

201 'Radius/ulna = 0, independent; 1, in contact or fused',

202 'Radius: gutter for the m. extensor carpi = 0, deep and wide; 1, weak',

203 'Radius/ulna: second distal articulation = 0, absent; 1, present',

204 'Radius: posterior expansion of the scaphoid-facet = 0, low; 1, high',

205 'Ulna: angle between diaphysis and olecranon = 0, open; 1, closed',

206 'Ulna: anterior tubercle on the distal end = 0, absent; 1, present',

207 'Scaphoid: postero-proximal facet with semilunate = 0, present; 1, absent or contact',

208 'Scaphoid: trapezium-facet = 0, large; 1, small',

209 'Scaphoid: magnum-facet in lateral view = 0, concave; 1, straight',

210 'Scaphoid: comparison between anterior and posterior heights = 0, equal; 1, Hant < H post',

211 'Semilunate: ulna-facet = 0, absent; 1, present',

212 'Semilunate: distal border of anterior side = 0, acute; 1, rounded',

213 'Semilunate: anterior side = 0, keeled; 1, smooth',

214 'Pyramidal: distal facet for semilunate = 0, symmetric; 1, asymmetric; 2, Lshaped',

215 'Pyramidal: distal side = 0, triangular; 1, elliptic',

216 'Trapezoid: proximal border in anterior view = 0, symmetric; 1, asymmetric',

217 'Magnum: proximal border of the anterior side = 0, nearly straight; 1, concave',

218 'Magnum: indentation on the medial side = 0, absent; 1, present',

219 'Magnum: indentation on the medial side = 0, always shallow; 1, usually shallow; 2, always deep',

220 'Magnum: posterior tuberosity = 0, short; 1, long',

221 'Magnum: posterior tuberosity = 0, curved; 1, straight',

222 'Unciform: pyramidal-facet and McV-facet = 0, always separate; 1, usually separate; 2, always in contact',

223 'Unciform: posterior expansion of the pyramidal-facet = 0, always absent; 1, usually absent; 2, usually present; 3, always present',

224 'McII: magnum-facet = 0, curved; 1, straight',

225 'McII: anterior McIII-facet = 0, present; 1, sometimes absent',

226 'McII: posterior McIII-facet = 0, always absent; 1, usually absent; 2, always present',

227 'McII: anterior and posterior McIII-facets = 0, separated; 1, fused',

228 'McII: trapezium-facet = 0, always present; 1, usually present; 2, always absent',

229 'McIII: magnum-facet in anterior view = 0, visible; 1, invisible',

230 'McIV: proximal facet, outline = 0, trapezoid; 1, pentagonal; 2, triangular',

231 'McV: 0, functional; 1, vestigial',

232 'Metacarpals: insertion of the m. extensor carpalis = 0, flat; 1, salient',

233 'Coxal: acetabulum = 0, oval or circular; 1, subtriangular',

234 'Femur: trochanter major = 0, high; 1, low',

235 'Femur: head = 0, hemispheric; 1, medially stiff',

236 'Femur: surface of epiphysis of the head = 0, flat; 1, crescent-shaped',

237 'Femur: fovea capitis = 0, present; 1, absent',

238 'Femur: fovea capitis = 0, high and narrow; 1, low and wide',

239 'Femur: third trochanter = 0, developed; 1, very developed',

240 'Femur: relations between the medial lip of the trochlea and the diaphysis = 0, rupture; 1, ramp',

241 'Femur: proximal border of the patellar trochlea = 0, curved; 1, straight',

242 'Tibia: antero-distal groove = 0, present; 1, absent',

243 'Tibia: medio-distal gutter (tendon m. tibialis posterior) = 0, always present; 1, usually present; 2, always absent',

244 'Tibia: medio-distal gutter = 0, shallow; 1, deep',

245 'Tibia-fibula = 0, independent; 1, in contact or fused',

246 'Tibia: posterior apophysis = 0, high; 1, low',

247 'Tibia: posterior apophysis = 0, acute; 1, rounded',

248 'Fibula: proximal articulation = 0, low; 1, high',

249 'Fibula: distal end = 0, slender; 1, robust',

250 'Fibula: latero-distal gutter (tendon peronaeus muscles) = 0, shallow; 1, deep',

251 'Fibula: position of the latero-distal gutter = 0, posterior; 1, median',

252 'Astragalus: (Transverse Diameter/Height) ratio = 0, TD/H < 1; 1, 1 < TD/H < 1.2; 2, 1.2 < TD/H',

253 'Astragalus: (Antero-Posterior Diameter/Height) ratio = 0, APD/H < 0.65; 1, 0.65 < APD/H',

254 'Astragalus: orientation of the fibula-facet = 0, subvertical; 1, oblique',

255 'Astragalus: fibula-facet = 0, flat; 1, concave',

256 'Astragalus: collum tali = 0, high; 1, low',

257 'Astragalus: posterior stop on the cuboid-facet = 0, present; 1, absent',

258 'Astragalus: caudal border of the trochlea, in proximal view = 0, sinuous; 1, nearly straight',

259 'Astragalus: orientation trochlea/distal articulation = 0, very oblique; 1, same axis',

260 'Astragalus: expansion of the calcaneus-facet 1 = 0, always present; 1, usually absent',

261 'Astragalus: expansion of the calcaneus-facet 1 = 0, always wide and low; 1, usually wide and low; 2, always high and narrow',

262 'Astragalus: calcaneus-facet 1 = 0, very concave; 1, nearly flat',

263 'Astragalus: calcaneus-facets 2 and 3 = 0, always independent; 1, usually independent; 2, usually fused; 3, always fused',

264 'Calcaneus: fibula-facet = 0, always absent; 1, usually absent; 2, usually present; 3, always present',

265 'Calcaneus: tibia-facet = 0, always absent; 1, usually absent; 2, always present',

266 'Calcaneus: tuber calcanei = 0, massive; 1, slender',

267 'Calcaneus: insertion of the m. fibularis longus = 0, salient; 1, invisible',

268 'Navicular: cross section = 0, lozenge; 1, rectangle',

269 'Cuboid: proximal side = 0, oval; 1, triangular',

270 'Ectocuneiform: postero-lateral process = 0, weak; 1, developed',

271 'MtIII: proximal border of the anterior side = 0, straight; 1, concave; 2, sigmoid',

272 'MtIII: posterior MtII-facet = 0, present; 1, absent',

273 'MtIII: MtIV-facets = 0, distinct; 1, sometimes joined ',

274 'MtIII: distal widening of the diaphysis (in adults) = 0, absent; 1, present',

275 'MtIII: cuboid-facet = 0, absent; 1, present',

276 'MtIII: cuboid-facet = 0, small; 1, large',

277 'MtIV: postero-proximal tuberosity = 0, isolated; 1, pad-shaped and continuous',

278 'Phalanx I for MtIII: symmetric insertions = 0, lateral; 1, nearly anterior',

279 'Limbs = 0, slender; 1, robust (brachypod)',

280 'Metapodials: intermediate relief = 0, high and acute; 1, low and smooth',

281 'Central metapodials: postero-distal tubercle on the diaphysis = 0, absent; 1, present',

282 'Lateral metapodials: insertion of the m. interossei = 0, long; 1, short (does not reach distal half of the shaft)',

283 'p3: lingual branch of paralophid = 0, developped; 1, reduced',

284 'p3-4 : Anterolingual cingulum = 0, stopping at metaconid or absent: 1, joining metaconid',

285 'P2: Metacone fold = 0, strong; 1, weak or absent',

286 'P3-4: Metacone fold = 0, strong; 1, weak or absent',

287 'M1-2 : Parastyle = 0, long; 1, short',

288 'I1: Shape = 0, spatulate; 1, conical, pointed; 2, chisel' ;

MATRIX

Uintaceras\_radinskyi ?010-?0001000?0?00200?0???????0-000?0?0??????011????10?0??000?10???0-00?000000000010-10010000011-000031000003000000-00000000000000-0000-0-?10010013-010?00022-3-00?????????????????????????????000?1?0?000??00?????01??10?????????????00?0????010???000????1?101?000000020????0??00-??01?01?001{0 1}

Ronzotherium\_velaunum\_ ????????????????????????????????????????????????????{1 2}1011-010?1??????0???????01?11{2 3}???{0 1}0???????????0?32??0??{2 3}????{0 1}0-000??0????????????????011000000001{2 3}?00102-2100???????0?01110001{0 1}00??????????000???????????10000??00?00-00?0????????0???????00???0??1???1?100??0?????????10????????01??00?0??

Ronzotherium\_romani\_FERTE\_ALAIS ???????????????????????????????????????????????????????????????00-?0-????????01???10-10000??011-0010002???010220020-00110000000000-0100-01111000003-01??01102-2110????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????00001?

GAIMERSHEIM ????????????????????????????????????????????????????1111000??1100-00-1?????1-0111100-00010000{1 2}1-00100(0 3)2000000{0 1}20020-00110000000001101?0-0?100000003-0(0 1)1201102-2110??01000??10100110300??????????????00{2 3}11111??1100??????00-?????????02?0???????????????????21000110001????????10010-???10?10000?

RICKENBACH ????????????????????????????????????????????????????2{1 2}11??0???100-?0?0???????01?11{0 1}0-00(0 1)00??011-00100020?0002{2 3}2102{2 3}000110000000000-0100-011100010020013-01102-0100??????????????????????????????????????????????????????????????????0?????????????????????????????????????????10000-0?0?0010101?

MARSEILLE ?????????0??????????????????????????0???????????????211????101000-?0-?010????01?1110-0000000021-0010032000001{1 2}00031000110000000000--100-00010000013-013-00102-0110???0?????10?00?10000???????????10?0001?1????0100?????1?????????????2?????????0???????????????????????????010??????1??1?0?0001?

R\_romani\_merged ?????????0??????????????????????????0???????????????(1 2){1 2}11000101(0 1)00?00?(0 1)010??1?0111110?(0 1)0(0 1)(0 1)0000{1 2}1?00100(0 3)20000(0 1)121102100011000000000(0 1)10100?0(0 1)(0 1)(0 1)(0 1)00(0 1)0(0 1)200(0 1)220(0 1)102?11(0 1)0??0(0 1)000??10100110{1 2}00???????????10?00{1 2}11111??(0 1)100?????100??????????02?0???????0???????????21000110001?????010100(0 1)0?(0 1)?0100(0 1)0(0 1)0(0 1)?

POILLAT ????????????????????????????????????????????????????1???1-0100000-?0-00?0????01???1???000?00010-00100?(1 2)000??1????2{0 1}0000?00?????0?0-0100-01?100100???01?2????2-{1 2 3}?0??????????0000111100??????????????????????????????????????????????????????????????????????????????????????????????????????0001?

R\_romani\_merged\_final ?????????0??????????????????????????0???????????????(1 2){1 2}11(0 1)0010(0 1)(0 1)00?00?(0 1)010??1?0111110?(0 1)0(0 1)(0 1)0000{1 2}(0 1)?00100(0 3)(1 2)0000(0 1)1211021000(0 1)1000000000(0 1)10100?0(0 1)(0 1)(0 1)(0 1)0(0 1)(0 1)0(0 1)200(0 1)220(0 1)102?{1 2}1(0 1)0??0(0 1)000??(0 1)0(0 1)0(0 1)11(0 1)100???????????10?00{1 2}11111??(0 1)100?????100??????????02?0???????0???????????21000110001?????010100(0 1)0?(0 1)?0100(0 1)0(0 1)0(0 1)?

Ronzotherium\_filholi\_QUERCY ?2????0?????????????????????????????????????????????0111000??0000-?0-0???????01??100-10000??010-0000002000012100000-00110000000000-0100-00011000000000??????001000????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????01000?

VILLEBRAMAR ?20???0?0011-?11?0110?1???????0-001010???101?0100???1?001-011(0 1)100-?0-?000110101?1100-1000000010-00000{0 1 3}2020011100010-0011000000000??0100-0(0 1)011000000100{0 1}10100000000??00000??00000111000?????????001?1000100001?000100?001?0-????100-20??0000???0?0???0000?0?1??00???020{1 2}0???0?000010-??000?010001

R\_filholi\_merged ?20???0?0011??11?0110?1???????0?001010???101?0100???(0 1)1(0 1)(0 1)(0 1)0011(0 1)(0 1)00??0?0000110101?1100?1000000010?00000{0 1 3}201001{1 2}100010?00110000000000?0100?0(0 1)011000000(0 1)00{0 1}10100001000??00000??00000111000?????????001?1000100001?000100?001?0?????100?20??0000???0?0???0000?0?1??00???020{1 2}0???0?000010???000?010001

Ronzotherium\_kochi\_CLUJ ??????????????????????????????????????????????????????????????00?0?0-?????????????00-10000??020-00000(0 3)1000010{1 2 3}000{0 1}0-001100000-000??-100-00??????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????000?

Ronzotherium\_elongatum\_PERNES ?{1 2}?0-?0000{0 1}00?1?00?1??????0-0-0-0?010?00?1010001010-??????????100-?0-?????????????{0 1}1000000??011-0000132000001300002000110000000000-0100-00??????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????0?0?

KLEINBLAUEN ??????0??0??????????????????????????0??????????????????????????00-?0-1??0?????????010?0000?????????0132000010200002000110000000000-0101000?110000???????????2-0000???????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????00?

R\_elongatum\_merged ?{1 2}?0??0000{0 1}00?1?00?1??????0?0?0?0?010?00?1010001010???????????100??0?1??0?????????{0 1}1000000??011?00001320000(0 1)1200002000110000000000?0101000?110000???????????2?0000??????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????000?

AUVERGNE ????????????????????????????????????????????????????????????????0-?0-??????????????0-100?0??02?-101000??????0{1 2}00020-00110000???000-0100-00??????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????1?0?

BUMBACH ?10???0100????1??{0 1}????????0-??0-0?111???????????????1111??0???100-?0-?00011010101100-0000001020-10000{0 1 3}1000??2{2 3}??020-00110000??0000-0??????0200100??0013-01102-1100?????????100?00??0????????????01?100?1000100?????00??110-00??000-2???1??0?00??????????????????????????????0?????????????001101

R\_indet ?10???0100????1??{0 1}????????0???0?0?111???????????????1111??0???100??0??00011010101100?(0 1)000001020?10(0 1)00{0 1 3}1000??1200020?00110000??0000?0100?000200100??0013?01102?1100?????????100?00??0????????????01?100?1000100?????00??110?00??000?2???1??0?00??????????????????????????????0?????????????001101

VENDEZE ?100-?010011-?1??1010?1???????0-010?0?00?2??0010010-1111000000100-?0-?000111-0101100-000002?020-0000032000000{1 2}00030-001101000??000-0100-00021010013-1-3-01102-2100????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????000011

LAMOTHE\_CAPDEVILLE ????????????????????????????????????????????????????111???0???100-?0-??????1-01111{0 1}0-000?0??020-100003200000?????{2 3}{0 1}?0?1?00?????0?0-0100-001210000?3-013-0??0??0100????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????00011?

R\_sp\_nov ?100??010011??1??{0 1}010?1???0???0?01(0 1)1(0 1)?00?2??0010010?1111000000100??0??00011(0 1)101(0 1)11{0 1}0?(0 1)000011020?(0 1)0(0 1)00{0 1 3}(1 2)00000120002{0 1}?00110(0 1)000?0000?0100?00(0 1)2(0 1)0(0 1)00130(0 1)13?01102?1100?????????100?00??0????????????01?100?1000100?????00??110?00??000?2???1??0?00??????????????????????????????0?????????????00(0 1)(0 1)(0 1)1

Teletaceras\_radinskyi 1000-00001100001?0110000000-0-0-00010???010?0100????11?1??020?1010?0-?0?0000?01?00310102100003010020331100013110020-00000001000000-0000-0-?1001111002-0200002-3-00??1?000?????????????????????????????????????????????????????????????10???????????????????0?000??0???????0??????0????01?00?0002

Penetrigonias\_dakotensis 0010-?000010000?00??00?0000-0-0-0?0?0?00?1?00101????11?1??120?1010?0-?0?01000010113221000000021-0000021000003120000-00111100000000-0110-01?1010001??2-0?0??0??3-00????????????????????????????????????????????????????????????????????0???????????????????????????????????????????????0???0?0{0 1}?2

Trigonias\_osborni 1010-1000010000?01020010000-0-0-00010?0000010010100-20?100010?100-00-?0?000000100100-0000000020-0020021000010100000-01000000000000-0000-0001000100202-0000002-2-00??000000000100?0??00110?0000?0?0000000000?0001000001000101001000-00?00000???00101-000?000110000000000??1?00?0000????00010?00?2

Epiaceratherium\_naduongense 0010-?0??01??0???1?001?00?0-0-??00010?00?1?1001??10-1111??0100001010-001000000101130-100100003100000031000012310022000000000000010-0000-0-110010013-110000022-2100????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????100001

Epiaceratherium\_bolcense 011??????0??????????0?10010-0-0-??011100?{1 2}?1??1??????1?1??01??0010?0-?0?0000001?1120-1011000?310?0000{0 3}?000013300023-000100000{1 2}00011000{1 2}-0-11?011003-1-{0 1}001002-3-1?????????????????????011???????00??1???????0?000101????10-??00?????0??1010?00???0????1????11000000???0?00000?1?010-00000?000001

Epiaceratherium\_magnum ????????????????????????????????????????????????????211(0 1)00010000???0-?0?000000111130?00010?00{1 2}1??0(0 1)00320{1 2}00033110{1 2}3-001101000000110010{1 2}000(0 1)21010013?1??200022?(2 3)110????????????????????????????????????????????????01110110???0?00200?2?1???????????????????10???0100000????000100?0???0???101001

Subhyracodon\_occidentalis 1010-0000010000110110?00000-0-0-01110??0??010110????1111??010?100-?0-?00011000101100-1001000021-0000031000010210001000110100000000-0110-00010010010100320001010010000000000???0000100?01110000?00001?03010??1001100100000??10???????0?10000???000???0??10??1?0010?11-03001000?2??00-100??1?11102

Epiaceratherium\_delemontense 0{1 2}2???0000100?0??{0 1}2???0?010-??0-00021110?{1 2}??0?????????????????000-?0-?????????????30-001??0?021?-0?0?310?0?0330?023-00110100??001100102000??????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????????00??

Molassitherium\_albigense 01(0 1)???000010??0??1?10?10010?0?0?00020110?{1 2}?10?10???????1??01??00???0-?0??11???????00?000??0?020??0000{1 3}20?0?0(0 1){2 3}0?0{1 2}{1 2}000110100?100(0 1)10(0 1)100?000{1 2}1010010100{2 3}?000010{1 2}(0 1)10????????????????????????????????????????????00?0???{1 2}0?10?10??110?002?1???????????????????000000101?00????0??????????00??11110?

Diceratherium\_armatum 0010-?010110001?12020100000-110-0001011001010???000?20?0000100001010-10?011000101130-0000000010-0020012000000310002001000100000010-0100-010100100001003?0000010010??000?0??10000001200010?01-??00000003010000020000101000101000000-00210?000010000000011000100001000003120010020010-000001??1102

Mesaceratherium\_gaimersheimense ????????????????????????????????????????????????????0110??0???000-00-00??11000101120-000000?011-0020012000000310003001110100100010-0101-01?20000011001020000102100?????????0010?????????????????00??00?0??0?1?0001010101010110?0????02?0??0?0?0???01?00????1000001003000000000110?0-0?01??001102

Pleuroceros\_pleuroceros 0010-?000010001?01110?00100-110-00010???????0100?1??21?1000100000-00-?0?1110?01011010122000002010000022000312330023000110100000010-010200110000?010100??0???00011??????????101????????????????????????????????0101???100010??0?002000?11???????????????????110000?00?003?1?000000?0-??0001??1102

Diaceratherium\_tomerdingense 1??0-??????????????????000100-???????????????????1?????????????00-?0-?00?????01???3220001000020-0000022000003{1 2}3002100001110000000100??????000000113-1-3-0002003-10??010100?00010101000????????0?000???0??0011?????011001?????23100-2?1000?????001???0???010???????????????????????????10?1101102

Pleuroceros\_blanfordi ?01???????1??0?????1???????????????1??1??2??1???010?21111-0???10110101?????0?01011212002000?011-100121200030233101310101010110001100102001100001010100020000000110?????????00?00110000??????????01100??00001??0101011??0010??01000-?0?11?????????101001?110110000100200001000010010-0?0001?1011?

Mesaceratherium\_welcommi ????????????????????????????????????????????????????11111?0100101000-0???????0101030-000000?010-1000312000000330003101110100100010-0102001120100113-1-120???10210???????????????????????????????????????0000?00001000?0?010??0000200??00?????????101100????110000100303300000?1201????00?0??111?

Protaceratherium\_minutum 0020-?0??01???0??0100?10000-0-0-0???0?0???????0?0????0?0??110?000-10-10?11101010113220000000020-0021022020202230003000011100000010-0100-01020001010000020000001110??00000??0000000??000100000?00?000?0?0?????02101011100011??0?000-?00?0?1????0?00??000????11001001000110000002??10-?10000111112

Mesaceratherium\_paulhiacense ????????????????????????????????????????????????????111?00010000???0-?0????0001????0-000??00021?0000022000003330003001110100100?110010??0??101000100013-0112100100????????????0???????????????????????????????000101?101010110?10210010????????????????????110000?003000?0?00022-00-??00?0??111?

;

END;

BEGIN ASSUMPTIONS;

TYPESET \* UNTITLED = unord: 72 94 102- 103 140 187-190\3, ord: 1- 71 73- 93 95- 101 104- 139 141- 186 188- 189 191- 288;

END;

Outgroup 1;

Delete 3-8 10-11 14-15 17-21;

Hsearch Addseq = random nreps = 1000 hold = 100 allswap = yes swap = tbr multrees = yes reconlimit = infinity;

END;

BEGIN MESQUITECHARMODELS;

ProbModelSet \* UNTITLED = 'Mk1 (est.)': 1- 288;

END;

BEGIN TREES;

Title Trees;

ID 0171cf2ac7175;

LINK Taxa = Taxa;

TRANSLATE

[0] 1 Uintaceras\_radinskyi,

[1] 2 Ronzotherium\_velaunum\_,

[2] 3 Ronzotherium\_romani\_FERTE\_ALAIS,

[3] 4 GAIMERSHEIM,

[4] 5 RICKENBACH,

[5] 6 MARSEILLE,

[6] 7 R\_romani\_merged,

[7] 8 POILLAT,

[8] 9 R\_romani\_merged\_final,

[9] 10 Ronzotherium\_filholi\_QUERCY,

[10] 11 VILLEBRAMAR,

[11] 12 R\_filholi\_merged,

[12] 13 Ronzotherium\_kochi\_CLUJ,

[13] 14 Ronzotherium\_elongatum\_PERNES,

[14] 15 KLEINBLAUEN,

[15] 16 R\_elongatum\_merged,

[16] 17 AUVERGNE,

[17] 18 BUMBACH,

[18] 19 R\_indet,

[19] 20 VENDEZE,

[20] 21 LAMOTHE\_CAPDEVILLE,

[21] 22 R\_sp\_nov,

[22] 23 Teletaceras\_radinskyi,

[23] 24 Penetrigonias\_dakotensis,

[24] 25 Trigonias\_osborni,

[25] 26 Epiaceratherium\_naduongense,

[26] 27 Epiaceratherium\_bolcense,

[27] 28 Epiaceratherium\_magnum,

[28] 29 Subhyracodon\_occidentalis,

[29] 30 Epiaceratherium\_delemontense,

[30] 31 Molassitherium\_albigense,

[31] 32 Diceratherium\_armatum,

[32] 33 Mesaceratherium\_gaimersheimense,

[33] 34 Pleuroceros\_pleuroceros,

[34] 35 Diaceratherium\_tomerdingense,

[35] 36 Pleuroceros\_blanfordi,

[36] 37 Mesaceratherium\_welcommi,

[37] 38 Protaceratherium\_minutum,

[38] 39 Mesaceratherium\_paulhiacense;

TREE 'PAUP\_1+' = (1:20,((26:3,(27:10,(28:4,30:0.0):18):12):27,(25:28,(23:21,(24:7,((2:9,(16:8,((9:7,22:10):17,(12:2,13:2):22):7):9):29,((39:11,(33:12,37:22):11):18,((31:14,29:35,32:41):23,(35:33,(38:24,(34:18,36:19):26):12):19):17):15):17):16):14):18):5):0.0;

TREE 'PAUP\_2+' = ((((27:11,(28:4,30:0.0):17):12,26:3):27,((((((((31:18,29:15):22,32:27):23,(((34:18,36:19):25,38:25):12,35:33):18):17,((33:13,37:21):11,39:11):19):15,(2:9,(((9:7,22:10):17,(12:2,13:2):22):7,16:8):9):29):17,24:7):16,23:20):15,25:29):18):4,1:19):0.0;

END;