

1 ***Vectidromeus insularis*, a new hypsilophodontid dinosaur from the Lower**  
2 **Cretaceous Wessex Formation of the Isle of Wight, England**

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14 ABSTRACT

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17 The Lower Cretaceous Wessex Formation of the Isle of Wight, UK, has produced a diverse  
18 dinosaurian fauna over the past 150 years. Hypsilophodontids are the most common small  
19 dinosaurs in the assemblage. Currently all hypsilophodontids are referred to *Hypsilophodon*  
20 *foxii*, originally described based on skulls and skeletons from the *Hypsilophodon* bed near  
21 Cowleaze Chine, in the uppermost Wessex Formation. We report a new hypsilophodontid,  
22 *Vectidromeus insularis* gen. et sp. nov., from exposures near Sudmoor Point, lying at the base  
23 of the exposed Wessex, ~150 m below the *Hypsilophodon* beds. Associated elements of the  
24 dorsal vertebrae, pelvis, hindlimbs, and tail are preserved. The specimen represents a juvenile,  
25 but differs from adult and juvenile *Hypsilophodon foxii* in the short and deep posterior iliac  
26 blade, short pubic peduncle, laterally exposed brevis fossa, rectangular ischia, and large fourth  
27 trochanter. *Vectidromeus* adds to the diversity of dinosaurs in the Wessex Formation. With  
28 other putative hypsilophodontids now assigned to other families, the Hypsilophodontidae  
29 currently comprises just *Hypsilophodon* and *Vectidromeus*, both from the Wessex Formation  
30 of the Isle of Wight. Hypsilophodontidae appear to be endemic to the Early Cretaceous of  
31 Europe.

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34 Keywords: Dinosauria; Ornithischia; Ornithopoda; Hypsilophodontidae; Wessex Formation

35 Barremian

## 36 1. Introduction

37 The dinosaurs of the Lower Cretaceous Wessex Formation of the Isle of Wight represent one  
38 of the best known dinosaur faunas in Europe (Martill et al., 2001). Outcropping along the south  
39 and east coasts of the Isle, the Wessex Formation exposes terrestrial sands, muds, and paleosols  
40 assigned to the Barremian stage of the Lower Cretaceous. Collecting and initial scientific study  
41 of the dinosaurs began in the 19<sup>th</sup> century when paleontology first emerged as a science, and  
42 played an important role in the history of paleontology. Dinosaurs from the Isle of Wight were  
43 studied by celebrated figures such as paleontologists Gideon Mantell (Mantell, 1854), Richard  
44 Owen (Owen, 1865) and evolutionary biologist Thomas Henry Huxley (Huxley, 1869), and  
45 played a role in debates about the origins of birds and their relationship to dinosaurs (Huxley,  
46 1870). Today, after more than 150 years of collecting and study by amateurs and scientists, the  
47 Wessex Formation represents one of the most diverse known Early Cretaceous dinosaur faunas  
48 (Martill et al., 2001).

49 Dinosaurs of the Isle of Wight include theropods (Naish et al., 2001; Barker et al.,  
50 2017), sauropods (Naish et al., 2004), and ornithischians. The ornithischian fauna includes the  
51 nodosaur *Polacanthus foxii* (Owen, 1865), the iguanodonts *Iguanodon* cf. *bernissartensis*  
52 (Norman, 2013; Lockwood et al., 2021) and *Mantellisaurus atherfeldensis* (Hooley, 1925), the  
53 hadrosauriform *Brighstoneus simmondsi* (Lockwood et al., 2021), and the dryosaurid  
54 *Valdosaurus canaliculatus* (Galton, 1975) (Table 1). One species of hypsilophodontid,  
55 *Hypsilophodon foxii* (Huxley, 1869; Hulke, 1882; Galton, 1974), named by Thomas Henry  
56 Huxley in 1869, has been recognized.

57 *Hypsilophodon* was a small, bipedal herbivore, growing to around 2 meters in length.  
58 *Hypsilophodon* was originally interpreted as a juvenile of *Iguanodon* by Richard Owen, but  
59 Huxley (1869) recognized it as a distinct species, *Hypsilophodon foxii*. Since then, many  
60 specimens of *Hypsilophodon* have emerged from the Wessex Formation (Hulke, 1882; Galton,

61 1974). Many come from the type locality at Cowleaze Chine (Galton, 1974), in the uppermost  
62 Wessex Formation. *Hypsilophodon* is common enough here that the horizon producing these  
63 specimens are known as the ‘*Hypsilophodon* Beds’.

64 Since the original description of *Hypsilophodon*, a number of small, bipedal  
65 neornithischians have been referred to the family Hypsilophodontidae (Gilmore, 1915;  
66 Sternberg, 1940; Rich and Vickers-Rich, 1999; Galton, 2009). Subsequently, it has become  
67 clear that basal neornithischians were highly diverse and that these animals do not form a  
68 monophyletic group (Norman et al., 2004a). Instead they are a paraphyletic assemblage of  
69 lineages that represent successive outgroups to the larger, more specialized Hadrosauriformes  
70 (Boyd et al., 2009; Madzia et al., 2018). The North American Thescelosauridae, including  
71 *Thescelosaurus*, *Parksosaurus*, *Orodromeus* and *Zephyrosaurus*, appear to form a distinct  
72 clade of basally diverging neornithischians (Boyd et al., 2009; Boyd, 2015) that may lie outside  
73 of Ornithopoda (Boyd, 2015; Madzia et al., 2018). South American and Australian ornithopods  
74 form a clade, Elasmaria, that lies closer to Iguanodontia. Meanwhile, the Rhabdodontidae, from  
75 the Late Cretaceous of Europe, lies further up the tree as part of Iguanodontia (Boyd et al.,  
76 2009; Madzia et al., 2018). This creates a curious situation in which *Hypsilophodon foxii* itself  
77 is currently the only species that can be confidently referred to the family Hypsilophodontidae  
78 (Boyd et al., 2009; Ruiz-Omeñaca et al., 2012; Madzia et al., 2018; Andrzejewski et al., 2019).

79 Here, we report a new species of Hypsilophodontidae from Wessex Formation exposures  
80 near Sudmoor Point (Fig. 1), where the lower part of the Wessex Formation is exposed (Fig.  
81 2). The new hypsilophodontid is represented by a juvenile individual (Fig. 3) but differs from  
82 both adults and juveniles of *H. foxii* in the morphology of its pelvic and limb bones, showing  
83 that it represents a distinct genus and species. This new taxon increases the diversity of  
84 hypsilophodontids and dinosaurs in the Early Cretaceous of the Isle of Wight and suggests that

85 the Hypsilophodontidae may represent a clade that was endemic to Europe in the Early  
86 Cretaceous.

87

88 **Institutional Abbreviations.** BMNH, Natural History Museum, London, UK. IWCMS  
89 (formerly MIWG), Isle of Wight Council Museum Service, Sandown, UK.

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## 92 **2. Geologic setting**

93 The Isle of Wight is a diamond-shaped isle with an east-west long axis of approximately  
94 37 km and a north-south axis of 21 km (Fig. 1). A folded ridge of the Chalk Formation forms  
95 the spine of the island from east to west, and separates a northern region of Paleogene strata  
96 from a region of Lower and Upper Cretaceous strata. The strata are gently to intensely folded  
97 along this ridge (monocline) with two en-echelon anticlines to the south of the ridge in which  
98 the core strata are Lower Cretaceous Wealden Group mudstones and sandstones of terrestrial  
99 and lagoonal origin. Both structures are well exposed in the coastal cliffs on the southeast and  
100 southwest coasts of the island.

101 The Lower Cretaceous strata of the Isle comprises two formations. The lower formation,  
102 the Wessex Formation, is dominated by red and variegated fluvial mudstones and fluvial  
103 sandstones, along with thin horizons rich in phyto-debris called Plant Debris Beds, or PDBs  
104 (Sweetman and Insole, 2010). The exposed Wessex Formation spans over 150 meters, and the  
105 top is overlain by lagoonal mudstones, sandstones, and thin lumachels of the Vectis Formation.  
106 The new specimen described here comes from close to the base of the western exposures of  
107 the Wessex Formation, between the entrance to Brook Bay and Sudmoor Point. Together the  
108 Wessex and Vectis formations from the Wealden Group (Fig. 2).

109 Cropping out along the southwest coast of the Island, and at Yaverland on the southeast  
110 coast, the Wessex Formation on the Isle of Wight comprises varicolored mudstones, grey plant  
111 debris beds, and yellow-brown sandstones. The predominantly red-brown-purple mudstones  
112 are interpreted as overbank deposits resulting from seasonal flooding and subsequent  
113 pedogenesis. The plant debris beds, which contain coalified wood including fusain, could be  
114 localized pond infillings or debris flow deposits (Sweetman and Insole, 2010), and are often  
115 rich in dinosaur bones. The sandstones show bedding features such as cross-bedding consistent  
116 with point bar and in-channel deposition. For more detailed reviews see Stewart (1978), and  
117 Insole and Hutt (1994).

118 The exposed Wessex Formation on the Isle of Wight is considered to date to the Barremian  
119 stage (Robinson and Hesselbo, 2004; Gale, 2019). However, these authors also considered that  
120 the Hauterivian- Barremian boundary could lie in the foreshore near to Hanover Point (SZ379  
121 838), approximately one mile to the northwest of where IWCMS.2023.102 was found.  
122 Ongoing research could however, lead to a re-evaluation of the age and position of the  
123 boundary. Thus, the specimen is probably either earliest Barremian or latest Hauterivian in age.  
124 With the base of the Barremian dated to 125.77 Ma (Cohen et al., 2013), the Sudmoor Point  
125 exposures probably date to around 125-126 Ma.

126 The type and most referred specimens of *Hypsilophodon foxii* come from the overlying  
127 *Hypsilophodon* beds (Fig. 2; Galton, 1974), which lie at the top of the Wessex Formation, and  
128 about 150 meters above the new hypsilophodontid, IWCMS.2023.102. The age of the  
129 *Hypsilophodon* beds above is less well-constrained, but with the top of the Barremian occurring  
130 in the overlying Vectis Formation, they can be no younger than 121.4 Ma. Thus, a maximum  
131 of ~4.3 million years separate the Sudmoor Point Sandstone and the *Hypsilophodon* beds that  
132 produced the *Hypsilophodon foxii* holotype (Fig. 2).

133 Sudmoor Point (SZ 392 828) is on the southeast limb of the Brighstone anticline. The  
134 Sudmoor Point Sandstone (SS1), which is over, and underlain by mudstones, dominates the  
135 cliff. The sandstone is capped by plant debris bed L1, above which is the more localized plant  
136 debris bed L2 at Sudmoor Point (Stewart, 1978). The section can therefore be interpreted as  
137 representing a large fluvial channel within the background sequence of overbank flood  
138 deposits.

139

### 140 3. Systematic Palaeontology

141

142 Dinosauria Owen 1842

143 Ornithischia Seeley 1887

144 Ornithopoda Marsh 1881

145 Hypsilophodontidae Dollo 1882

146 *Vectidromeus insularis* gen. et sp. nov.

147

148 *Etymology.* Genus name = *Vectis*, the Roman name for the Isle of Wight + Greek *dromaeus*,  
149 = runner; species name from the Latin *insularis* = insular.

150

151 *Holotype.* IWCMS 2023.102, partial skeleton (Fig. 4) including a dorsal neural arch, five  
152 distal caudal vertebrae, left and right ilia, left pubis, left and right ischia, partial right femur  
153 and right tibia, left femur, left tibia and fibula, distal end of the left pes.

154

155 *Diagnosis.* Neural spines of dorsal vertebrae with a convex dorsal margin; ilium with a short,  
156 ventrally directed pubic peduncle; dorsal margin of ilium strongly arched, posterior ala of ilium  
157 short and deep, brevis fossa broadly exposed laterally. Ischium with a broad, rectangular distal

158 blade, obturator process small and weakly demarcated from ischium. Femur with a large, broad  
159 fourth trochanter.

160

161 *Locality and Horizon.* Sudmoor Point; approximate Ordnance Survey grid reference SZ 391  
162 827: Lat/long 50° 37' 55.4"N 01° 28' 37.3"W, Wessex Formation, Barremian (Fig. 1). The  
163 exposures at Sudmoor Point lie low in the section, near the base of the exposed Wessex  
164 Formation on the island, and over 150 meters below the *Hypsilophodon* bed near the top of the  
165 Wessex Formation that produced the holotype of *Hypsilophodon foxii* (Galton 1974).

166 Four pieces were collected at different times. The largest block contains both ilia,  
167 ischia, the left pubis, a dorsal vertebra, the left femur, and the distal end of the left tibia and  
168 fibula. A second block contains the proximal end of the tibia and fibula, and a string of caudal  
169 vertebrae. A third contains the shaft of the right femur and a limb bone, presumably the right  
170 tibia, and a dorsal neural arch. A small fourth block contains the distal ends of left metatarsals  
171 II, III and IV, and associated phalanges. The first and second blocks are clearly part of the same  
172 animal because they contain different parts of the left tibia and fibula, and though their ends  
173 are broken and so they do not articulate, they are in the proper orientation to do so. The other  
174 elements can be somewhat more tentatively associated as part of the holotype based on (i) their  
175 provenance, (ii) the fact that they belong to a hypsilophodontid ornithopod, (iii) their small  
176 size, (iv) color of the matrix and preservation of the bones, and (v) the fact that no elements  
177 are duplicated between any of the blocks.

178

179 *Description.* The animal's small size, the striated bone texture (Tumarkin-Deratzian et al.,  
180 2006) and lack of fusion between dorsal vertebrae and neural arches (Brochu, 1996) all suggest  
181 that the animal was still actively growing at the time of death, and that IWCMS 2023.102  
182 represents a juvenile. Elements lie in association but are disarticulated (Fig. 4), except for a



183 string of five caudal vertebrae, and the left tibia and fibula, which articulate distally. Some  
184 crushing is visible, especially of the femur and distal tibia. There is also some post-mortem  
185 breakage of bones and displacement of fragments, such as the ischium, and damage to the bone  
186 surface that may represent insect feeding traces. However, the bones are largely three-  
187 dimensional, and well-preserved (Fig. 4). Bones are preserved in a fine grey sandstone. The  
188 fossil has been prepared to reveal the diagnostic features of the animal, but further preparation  
189 was not attempted as it would have risked damage to the delicate bones while providing little  
190 additional anatomical information.

191

192 *Dorsal vertebrae.* A disarticulated dorsal neural arch lies on the main block (Fig. 5), and a  
193 second neural arch is preserved with the right femur and tibia. The neural arch is short, broad,  
194 and fan-shaped, with a wide end that bears a convex dorsal margin; that of *Hypsilophodon* is  
195 more rectangular in outline and has a straight dorsal margin (Galton, 1974). Transverse  
196 processes are short and narrow. Ossified tendons are preserved lateral to the neural spine. Four  
197 of these form a sort of bundle, but three or four others are preserved at various angles to the  
198 others. Similar ossified tendons occur in *Hypsilophodon*, in other small neornithischians such  
199 as Thescelosauridae (Gilmore, 1915), *Haya griva* (Makovicky et al., 2011), and *Convolosaurus*  
200 *marri* (Andrzejewski et al., 2019) and in Iguanodontia (Norman et al., 2004b).

201

202 *Caudal vertebrae.* Five distal caudal vertebrae lie in articulation (Fig. 6). Centra are elongate,  
203 as in *Hypsilophodon foxii* (Galton, 1974). Prezygapophyses are long, and postzygapophyses  
204 bear small spurs that project caudally past the prezygapophyses. A few very fine ossified  
205 tendons are preserved alongside the caudal vertebrae, as in *Hypsilophodon* (Galton, 1974) and  
206 other basal ornithischians (Gilmore, 1915; Andrzejewski et al., 2019).

207

208 *Ilium*. The ilia (Figs. 7, 8) broadly resemble those of *Hypsilophodon foxii* (Galton, 1974) and  
209 other small ornithischians such as *Haya griva* (Makovicky et al., 2011) and *Gideonmantellia*  
210 *amosanjuanae* (Ruiz-Omeñaca et al., 2012) but differs in key details. The preacetabular blades  
211 of the ilia are broken and only the base of the ala remains on the right side, but it suggests a  
212 long and slender anterior ala as in *Hypsilophodon*. The anterior ala would have extended  
213 anteriorly and slightly ventrally, as in BMNH R196; that of BMNH R193 extends straight  
214 forward (Galton, 1974). The dorsal margin of the ilium is broadly arched and convex in lateral  
215 view, again this resembles the condition in BMNH R196 but not R193.

216         The posterior wing of the ilium is proportionately short and deep compared to  
217 *Hypsilophodon* (Fig. 9). Other basal neornithischians also have a long posterior wing, for  
218 example *Haya griva* (Makovicky et al., 2011), *Jeholosaurus shangyuanensis* (Han et al., 2012)  
219 and *Gideonmantellia amosanjuanae*, which suggests the short ilium represents a derived  
220 character. The posterior wing is somewhat shorter in a juvenile *Hypsilophodon* from Chilton  
221 Chine, MIWG.6877b, but still longer than in IWCMS 2023.102, suggesting that the ilium may  
222 exhibit change in shape over the course of ontogeny, but that such changes do not explain the  
223 different shape of the ilium in *Vectidromeus*.

224         In dorsal view, the iliac blade gently curves outwards. In *Hypsilophodon*, the ilium  
225 projects straight posteriorly and has a straight dorsal margin in dorsal view (Galton, 1974). In  
226 lateral view, the posterior margin of the blade has a distinctly trapezoidal shape, with the dorsal  
227 and posterodorsal margins of the ilium meeting to form a corner. This resembles the condition  
228 in *Gideonmantellia* (Ruiz-Omeñaca et al., 2012), but contrasts with the more rounded shape of  
229 the posterior margin in *Hypsilophodon* (Fig. 9). The medial surface of the ilium bears a well-  
230 developed shelf that forms the medial part of the brevis fossa. In posterior view, it forms an  
231 inverted Y where the medial shelf of the ilium diverges from the posterior ala. This shelf hangs  
232 down to define a deep brevis fossa, while that of *Hypsilophodon* is much shallower;

233 furthermore, in *Vectidromeus* it extends anteriorly towards the ischiadic peduncle so that the  
234 brevis fossa is broadly exposed in lateral view. This contrasts with the brevis fossa in  
235 *Hypsilophodon*, which is barely visible in lateral view (Fig. 9). The brevis fossa has a stronger  
236 lateral exposure in *Gideonmantellia*, however (Ruiz-Omeñaca et al., 2012).

237 The pubic peduncle is short and projects anteroventrally. This contrasts with  
238 *Hypsilophodon*, where the pubic peduncle is long and projects anteriorly (Fig. 9); similarly  
239 there is a long, anteriorly projecting pubic peduncle in *Thescelosaurus neglectus* (Gilmore,  
240 1915), *Haya griva* (Makovicky et al., 2011) and *Jeholosaurus shangyuanensis* (Han et al.,  
241 2012). The ilium's acetabular margin is deep and almost semicircular. The ischiadic peduncle  
242 and antitrochanter project strongly ventrally and laterally. The ischiadic peduncle is much  
243 narrower in lateral view than in *Hypsilophodon*, and in this respect is more similar to *Haya*  
244 *griva* (Makovicky et al., 2011) and *Jeholosaurus shangyuanensis* (Han et al., 2012).

245

246 *Pubis*. The left pubis is preserved but missing its proximal end (Fig. 10). The shaft is a long  
247 and slender rod, bowed outwards along its length. It does not differ appreciably from  
248 *Hypsilophodon foxii* (Galton, 1974) or other basal neornithischians.

249

250 *Ischium*. The ischium (Fig. 10) is a long, slender bone contacting the ilium dorsally, and the  
251 pubis anteriorly and distally. Overall, it resembles that of *Hypsilophodon* in outline (Fig. 9) but  
252 with several key differences.

253 The pubic peduncle is mediolaterally compressed and rectangular in lateral view. It has  
254 a concave, triangular facet where it contacts the pubis. Just below this articulation, the anterior  
255 margin bears a small tab. A similar but larger tab occur in *Hypsilophodon* (Galton, 1974) ,  
256 which apparently contacted the rodlike body of the pubis; this tab appears to be absent however

257 in *Thescelosaurus neglectus* (Gilmore, 1915), *Haya griva* (Makovicky et al., 2011) and  
258 *Jeholosaurus shangyuanensis* (Han et al., 2012).

259 The ischiadic peduncle is mediolaterally expanded. The articulation with the ilium is  
260 deeply concave, and kidney-shaped, with a concave anterior margin and a convex posterior  
261 margin; the articular surface is broader medially than laterally. The articular surface in  
262 *Hypsilophodon* is more ovoid in shape, and much broader anteroposteriorly (Galton, 1974),  
263 corresponding to the broader ischiadic peduncle of the ilium.

264 The acetabular rim of the ischium is narrow where it meets the pubic peduncle, and  
265 much broader posteriorly where it meets the iliac peduncle.

266 Below the acetabulum, the ischium forms a slender bar of bone, with a triangular cross  
267 section. The proximal end of the ischium has a distinctly concave anterior margin, versus a  
268 straight margin in *Hypsilophodon* (Galton, 1974). Distally the ischium expands to become a  
269 broad, flat, rectangular blade. The ischium twists such that it is compressed mediolaterally just  
270 below the acetabulum, then expanded mediolaterally further down the blade. This large  
271 ischiadic blade is shared with *Hypsilophodon* (Galton, 1974), but absent in other basal  
272 neornithischians such as *Thescelosaurus neglectus* (Gilmore, 1915), *Haya griva* (Makovicky  
273 et al., 2011) and *Jeholosaurus shangyuanensis* (Han et al., 2012). The blade in *Vectidromeus*  
274 has straight medial and lateral margins, providing a simple rectangular or plank-shaped outline  
275 with straight, roughly parallel margins. The ischium of *Hypsilophodon* has a distinct outline  
276 (Fig. 9), being narrow proximally, then expanded distally, with a strongly convex lateral  
277 margin of the blade.

278 The obturator process is a small tab, weakly differentiated from the ischiadic blade, and  
279 hooked forward around the pubis. The obturator process of *Hypsilophodon* is much larger  
280 (Galton, 1974), and more well-differentiated from the blade of the ischium. Distally, the

281 ischium forms a long, thin plate with a slightly convex anterior surface and a flat posterior  
282 surface, as in *Hypsilophodon*.

283

284 *Femur*. The femur (Figs. 11, 12) is long and slender, similar to *Hypsilophodon* (Galton, 1974)  
285 and *Jeholosaurus shangyuanensis* (Han et al., 2012), and unlike the more robust femora of  
286 *Haya griva* (Makovicky et al., 2011) and *Thescelosaurus* (Brown et al., 2011). The proximal  
287 end is not preserved in either femur. There is a prominent fourth trochanter at midshaft. The  
288 fourth trochanter is very large, with a broad, crescentic proximal margin and a wide, triangular  
289 tip that projects ventrally in lateral view, and hooks inwards in caudal view. By contrast, the  
290 fourth trochanter of *Hypsilophodon* is narrow and spur-like (Hulke, 1882; Galton, 1974).

291 As in *Hypsilophodon*, the femur's distal end forms a broad 'C' shaped articular surface  
292 in distal view, and lacks the extensor groove seen in more derived ornithopods such as  
293 *Burianosaurus* (Madzia et al., 2018) or *Valdosaurus* (Galton and Taquet, 1982). This articular  
294 surface is much wider than in *Hypsilophodon* although the distal end of the femur is heavily  
295 crushed, and so this wider shape could result from distortion. There is a broad medial condyle  
296 and a narrower lateral condyle, which curves outward in ventral view.

297

298 *Tibia*. The tibia (Figs. 11, 12) is long and slender, as in *Hypsilophodon* (Galton, 1974). The  
299 proximal end is mediolaterally compressed, and more anteroposteriorly expanded than in  
300 *Hypsilophodon*; again, this may be exaggerated by crushing, but the cnemial crest nevertheless  
301 seems much larger than in *Hypsilophodon*. Distally, the tibia narrows and becomes rodlike,  
302 with a subcircular section. It then expands towards the end, becoming mediolaterally expanded,  
303 with a broad, rectangular lateral flange that contacts the fibula. A similar but smaller and more  
304 triangular flange occurs in *Hypsilophodon* (Galton, 1974); this flange is absent in *Jeholosaurus*  
305 *shangyuanensis* (Han et al., 2012) and *Thescelosaurus* (Brown et al., 2011).

306

307 *Fibula*. The fibula is long and slender. It is robust proximally, becoming more slender and  
308 mediolaterally compressed distally. Below this, the fibula bows inwards and becomes  
309 anteroposteriorly compressed where it forms a broad contact with the tibia.

310

311 *Pes*. A fragment of the distal end of the left pes is preserved (Fig. 13). Metatarsals II, III and  
312 IV are preserved in articulation. Metatarsal III is longer and more robust than II and IV, and  
313 metatarsal IV is lightly longer than metatarsal III, as in *Hypsilophodon foxii* (Galton, 1974).  
314 Phalanges III-1 and IV-1 are preserved in articulation, and on the ventral surface, there is a  
315 short phalanx and ungual, presumably IV-4 and IV-5. Overall, the pes is more gracile than in  
316 *Hypsilophodon*, but this may simply reflect the small size and immaturity of the animal.

317

#### 318 **4. Discussion**

319

##### 320 *4.1. Relationships.*

321 The Hypsilophodontidae has traditionally been used as a waste basket taxon including  
322 *Hypsilophodon* and a range of small- to medium-sized basal neornithischians such as  
323 *Thescelosaurus*, *Parksosaurus*, and *Orodromeus* (Galton, 1973; Weishampel and Heinrich,  
324 1992). Most recent analyses recover *Hypsilophodon* as a distinct lineage of basal ornithopods  
325 (Boyd et al., 2009; Huh, 2010; Ruiz-Omeñaca et al., 2012) and recover the North American  
326 *Thescelosaurus*, *Parksosaurus* and *Orodromeus* as part of a distinct clade, Thescelosauridae  
327 (Boyd et al., 2009; Madzia et al., 2018), which may lie outside of Ornithopoda, near the base  
328 of Neornithischia (Boyd, 2015).

329 *Vectidromeus* possesses several characters that are unusual among basal ornithopods  
330 but shared with *Hypsilophodon foxii*. These include (1) a broad and plate-like distal end of the

331 ischium, (2) a process of the ischium contacting the pubis below the pubic peduncle, and (3) a  
332 broad flange of the tibia contacting the distal end of the fibula. These and the overall  
333 resemblance of the skeletons suggest a close relationship between the two within  
334 Hypsilophodontidae.

335         Despite the similarities to *Hypsilophodon*, *Vectidromeus* displays many differences.  
336 The shape of the pubic peduncle, posterior blade of the ilium, brevis fossa, ischia, femur, and  
337 tibia all show that the animal is distinct. Some of these characters appear to be derived, which  
338 suggests it was a distinct lineage, rather than directly ancestral to the later *Hypsilophodon foxii*.

339         The immature nature of the specimen raises the issue of whether some of the differences  
340 seen could reflect ontogenetic changes rather than species-level differences. Some dinosaur  
341 taxa identified as distinct species have since been revealed to represent juveniles or even  
342 different sexes of previously described species. For example, the hadrosaurid *Edmontosaurus*  
343 *saskatchewanensis* was later shown to be a juvenile of *Edmontosaurus annectens* (Campione  
344 and Evans, 2011), and the pachycephalosaur *Homalocephale* may be a juvenile or even a  
345 female of *Prenocephale* (Longrich et al., 2010). For this reason, caution is required in naming  
346 species based on juveniles. Nevertheless, the nature and extent of ontogenetic change in  
347 dinosaurs has perhaps been exaggerated at times (Longrich and Field, 2012), and juveniles do  
348 exhibit diagnostic features, e.g. young *Triceratops* exhibit the distinct parietal morphology seen  
349 in adults (Goodwin et al., 2006). The problem is being able to distinguish which characters are  
350 associated with ontogeny or dimorphism, and which are consistent between juveniles and  
351 adults, and therefore of diagnostic utility in juveniles. In the case of *Vectidromeus*, juvenile  
352 *Hypsilophodon* are known, making it possible to see whether the unusual features here are  
353 associated with immaturity. Examination of a small *Hypsilophodon* (MIWG.6877b) argues that  
354 this is not the case; small *Hypsilophodon* differ from *Vectidromeus* in the shape of the ilium  
355 and ischium.

356

357 4.2. *Diversity.*

358 *Vectidromeus* adds to the diversity of small herbivorous dinosaurs in the Wealden Group and  
359 the diversity of Hypsilophodontidae (Fig. 14). However, *Vectidromeus* does not appear to have  
360 been a contemporary of *Hypsilophodon foxii*. Instead, it lies well below the *Hypsilophodon* bed  
361 that produced the original *Hypsilophodon*, suggesting turnover between the two levels. Over  
362 millions of years, selective pressures—competition, predation, and environmental change—  
363 would be expected to cause the fauna to evolve, with species found lower down either evolving  
364 into new species, or going extinct and being replaced by immigrants. It is therefore perhaps to  
365 be expected that different species would occur at different levels of the Wealden.

366 It is still possible that more than one taxon of hypsilophodontid existed simultaneously  
367 during Wessex Formation times. For example, the shapes of the ilia are distinctly different in  
368 different specimens. In BMNH R193 and BMNH R195, the anterior blade of the ilium is  
369 weakly downturned. In BMNH R196 and R2477a, the anterior blade is strongly hooked down.  
370 These differences could reflect individual variation, ontogeny, dimorphism or deformation of  
371 the fossils, but it is also possible that more than one species is represented here. Since the  
372 holotype of *H. foxii* is a skull, it is unclear which of these animals is referable to *H. foxii*, if  
373 they were to prove distinct. Further study and more fossils will probably be needed to resolve  
374 these problems.

375

376 4.3. *Biogeography.*

377 Over the years, a diversity of small ornithischians have been referred to the family  
378 Hypsilophodontidae. More recently, following additional work on ornithischian phylogenetics,  
379 they have been removed, leaving *Hypsilophodon* as the sole member of Hypsilophodontidae,  
380 and Hypsilophodontidae restricted to the Early Cretaceous of Europe. The recognition of



381 *Vectidromeus* as a distinct taxon adds to the diversity of Hypsilophodontidae but underscores  
382 the limited geographic distribution for the group. Hypsilophodontidae are currently known only  
383 from the Early Cretaceous of the UK, suggesting that the group was endemic to Europe.

384

## 385 **5. Conclusions**

386 A new hypsilophodontid, *Vectidromeus insularis*, is recognized based on a partial skeleton of  
387 a juvenile from the lower part of the Wessex Formation at Sudmoor Point. It is distinguished  
388 from the younger *Hypsilophodon foxii* by features of the ilium, ischium, and femur, and adds  
389 to the diversity of the Isle of Wight ornithopods. Hypsilophodontidae appear to be a distinct  
390 lineage of basal ornithopods endemic to Europe.

391

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395 anonymous reviewer for a constructive review.

396

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512

513

## Tables

514

515 **Table 1.** Ornithischian fauna of the Isle of Wight. See text for references.

516

### 517 **Nodosauridae**

518 *Polacanthus foxii* Owen 1865

519

### 520 **Iguanodontidae**

521 *Iguanodon bernissartensis* Boulenger 1881

522 *Mantellisaurus atherfeldensis* Hooley, 1925

523

### 524 **Hadrosauriformes**

525 *Brighstoneus simmondsi* Lockwood et al. 2021

526

### 527 **Dryosauridae**

528 *Valdosaurus canaliculatus* Galton, 1975

529

### 530 **Hypsilophodontidae**

531 *Hypsilophodon foxii* Huxley, 1869

532 *Vectidromeus insularis* n. tax.

## Figure Captions

533

534

535 **Fig. 1.** Locality map; A, Isle of Wight; B, Sudmoor Point, the locality of the holotype of  
536 *Vectidromeus insularis*, approximately Lat/long 50° 37' 55.4" N 01° 28' 37.3"W.

537

538 **Fig. 2.** Stratigraphic column showing correlation of the Early Cretaceous strata at the Isle of  
539 Wight and stratigraphic section of the Wessex Formation exposures along the south coast of  
540 the Isle of Wight; after Sweetman (Sweetman, 2007). The type of *Hypsilophodon foxii* comes  
541 from the *Hypsilophodon* bed in the uppermost Wessex Formation; IWCMS 2023.102, the  
542 holotype of *Vectidromeus insularis*, was collected from the Sudmoor Point Sandstone in the  
543 lower part of the exposed Wessex Formation about 150 meters below.

544

545 **Fig. 3.** Relative sizes of the juvenile holotype of *Vectidromeus insularis* and a mature  
546 *Hypsilophodon foxii*. Reconstructions after G. S. Paul and M. Python.

547

548 **Fig. 4.** IWCMS 2023.102, *Vectidromeus insularis* holotype in **A**, left lateral view; **B**, right  
549 lateral view. Abbreviations: fem, femur; fib, fibula; il, ilium; isch, ischium. tib, tibia. Scale =  
550 50 mm.

551

552 **Fig. 5.** IWCMS 2023.102, *Vectidromeus insularis* holotype. Abbreviations: fos, lateral fossa  
553 of neural arch; na, neural arch; nsp, neural spine; prz, prezygapophyses; ten, tendons, tp,  
554 transverse process. Scale = 10 mm.

555

556 **Fig. 6.** IWCMS 2023.102, *Vectidromeus insularis* holotype; **A**, articulated distal caudal  
557 vertebrae; **B**, closeup of caudal vertebrae. Abbreviations: pos, postzygapophyses; pre,  
558 prezygapophyses; ten, tendons. Scale = 10 mm.

559

560 **Fig. 7.** IWCMS 2023.102, *Vectidromeus insularis* holotype, left ilium in **A**, lateral, **B**, dorsal,  
561 **C**, ventral views. Abbreviations: ace, acetabulum; ant, antitrochanter; bre, brevis fossa; med,  
562 medial wing of brevis fossa; pos, postacetabular blade; pp, pubic peduncle; pre, preacetabular  
563 blade. Scale = 10 mm.

564

565 **Fig 8.** IWCMS 2023.102, *Vectidromeus insularis* holotype, partial right ilium in **A**, lateral view  
566 and **B**, ventral view. Abbreviations: ace, acetabulum; ant, antitrochanter; isc, ischiadic  
567 peduncle; pos, postacetabular blade. Scale = 10 mm.

568

569 **Fig. 9.** (A,B), ilia of *Vectidromeus insularis* IWCMS 2023.102 compared to *Hypsilophodon*  
570 *foxii* BMNH R196 (after Galton, 1974); (C,D) ischia of *Vectidromeus insularis* IWCMS  
571 2023.102 compared to *Hypsilophodon foxii*. Scale = 50 mm.

572

573 **Fig. 10.** IWCMS 2023.102, *Vectidromeus insularis* holotype, ischia and pubis in **A**, anterior  
574 view; **B**, lateral view. Abbreviations: ib, ischial blade; isc, ischium, ob, obturator process; pub,  
575 pubis. Scale = 1 cm.

576

577 **Fig. 11.** IWCMS 2023.102, *Vectidromeus insularis* holotype, left hindlimb. Left femur in (A)  
578 anterior and (B) distal views; left tibia and fibula (C) in anterior view. Abbreviations: cc,  
579 cnemial crest; fg, flexor groove; fib, fibula; lc, lateral condyle, lf, lateral flange; mc, medial  
580 condyle, tib, tibia. Scale = 10 mm.

581

582 **Fig. 12.** IWCMS 2023.102, *Vectidromeus insularis* holotype, partial right femur and ?tibia in  
583 (A) lateral view and (B) posterior view. Abbreviations: fe, femur; na, neural arch; ?tib, tibia;  
584 tr4, fourth trochanter. Scale = 10 mm.

585

586 **Fig. 13.** IWCMS 2023.102, *Vectidromeus insularis* holotype, distal end of left pes.  
587 Abbreviations: MT II, metatarsal II, MT III, metatarsal III, MT IV, metatarsal IV; IV-1,  
588 phalanx IV-1; III-1, phalanx III-1. Scale = 10 mm.

589

590 **Fig. 14.** Ornithischian fauna of the Isle of Wight. Silhouettes redrawn after G.S. Paul.































