

# A new genus and species of 'paramyid' rodent (Rodentia: Ischyromyidae) from the Creechbarrow Limestone Formation (late Middle Eocene) of Dorset, England

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Nine isolated teeth recovered from the Creechbarrow Limestone Formation are here described as a new late Middle Eocene ischyromyid genus and species *Patriarchamys batesi* gen. et sp. nov. Its relationships are discussed with reference to the continental European and North American paramyid faunas. Its closest affinity is with *Pseudoparamys* and possible ancestral relationship with modern sciurids is indicated.

KEY WORDS: Paramyid, Middle Eocene, Creechbarrow, England

## Introduction

During an ongoing research programme at the Harrison Institute on the Robiacian mammal fauna of Creechbarrow (Dorset, S. England), isolated teeth of a small, very rare 'paramyid' rodent have been recovered. Five teeth reported from the site by Hooker (1986, p. 290, pl. 13; figs. 9–13) as ?*Manitshinae* gen. et sp. undet. have been reviewed here in the light of new material and are considered referable to the same taxon.

Hooker (1986) published the first comprehensive list of the mammal fauna known, including 45 taxa at generic or specific level from the site, of which 13 were described as new to science. He outlined the history and geology of the deposit and considered the Creechbarrow Limestone Formation to be Bartonian. The term Robiacian is also widely employed for this biohorizon (MP 16) based on the extensively studied French sites at Robiac, Gard (Savage & Russell, 1983). Creechbarrow is the only known British site with a well-represented mammal fauna of this age. A selected faunal list of seventeen positively identified species from Creechbarrow, including essentially Robiacian taxa was recently provided by Hooker & Weidmann (2000, tab. 23). They estimate (p. 128) that the deposit was formed 37–41.5 million years ago. The first known glirid from Creechbarrow, *Glamys hookeri*, was described by Harrison (2002) and a number of other unreported taxa from the site are currently being researched and will be published later.

The methods employed in this study have previously been described by Harrison (2002, p. 11). Dental terminology employed here generally follows Escarguel (1999, p. 114; fig. 5).

Measurements listed here are CL (Crown length) CW (Crown width) in mm.

Material studied is from the Natural History Museum (London) Collection (M) or the Harrison Zoological Museum Collection (HZM).

## Systematic palaeontology

The taxonomy used here follows Escarguel's (1999) extensive revision of European 'Paramyidae'.

Order Rodentia Bowdich, 1821

Infraorder Protogomorpha von Zittel, 1893

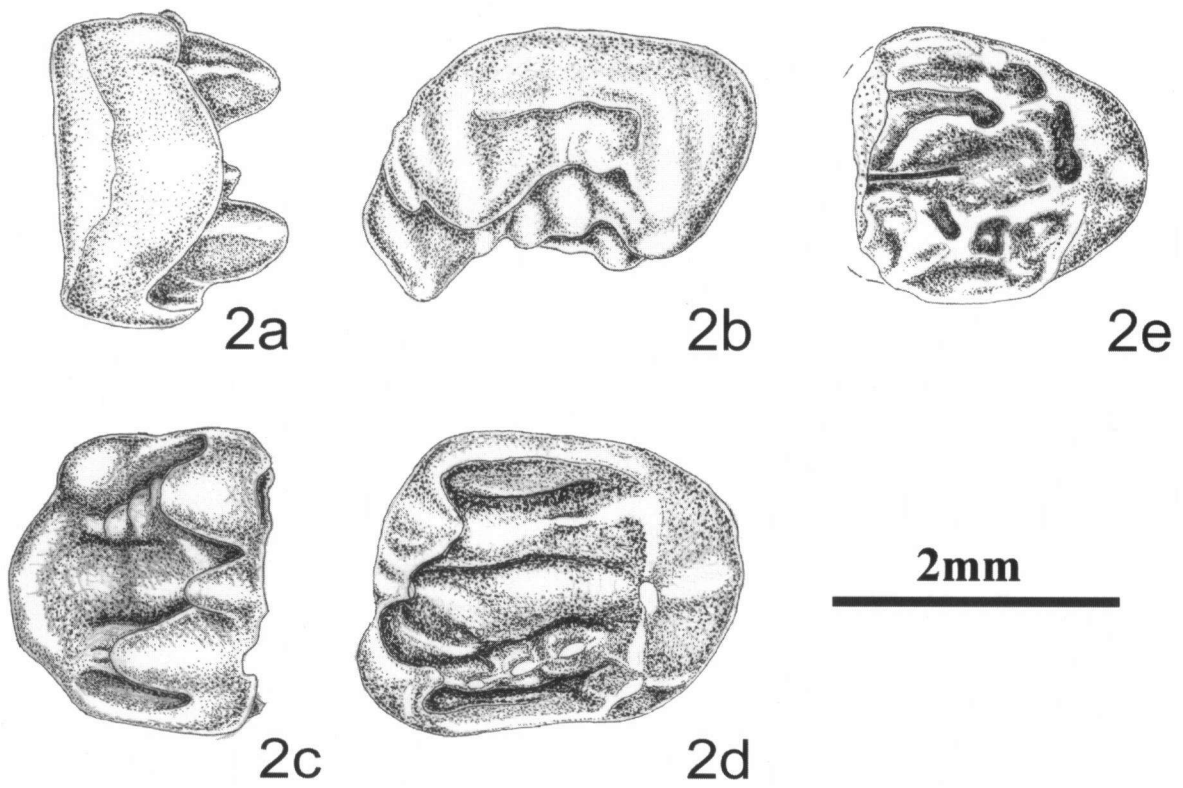
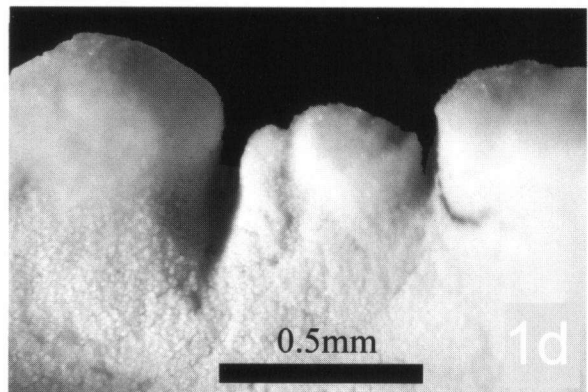
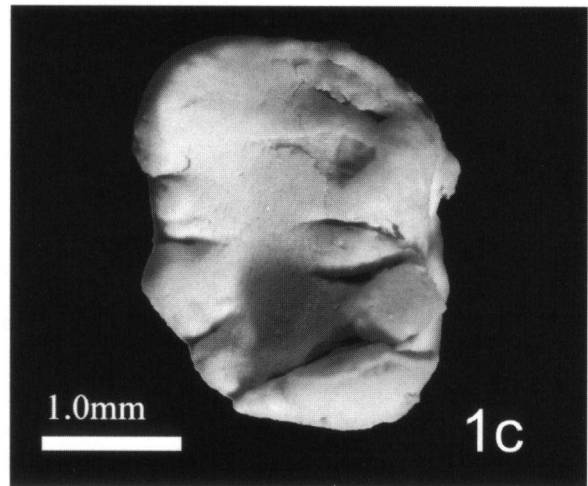
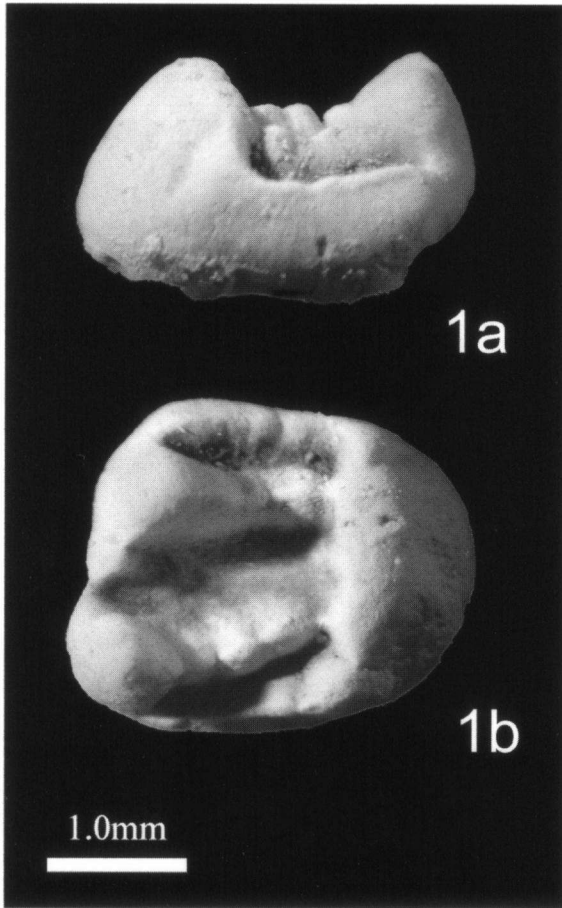
Family Ischyromyidae Alston, 1876 (= Paramyidae Miller & Gidley, 1918)

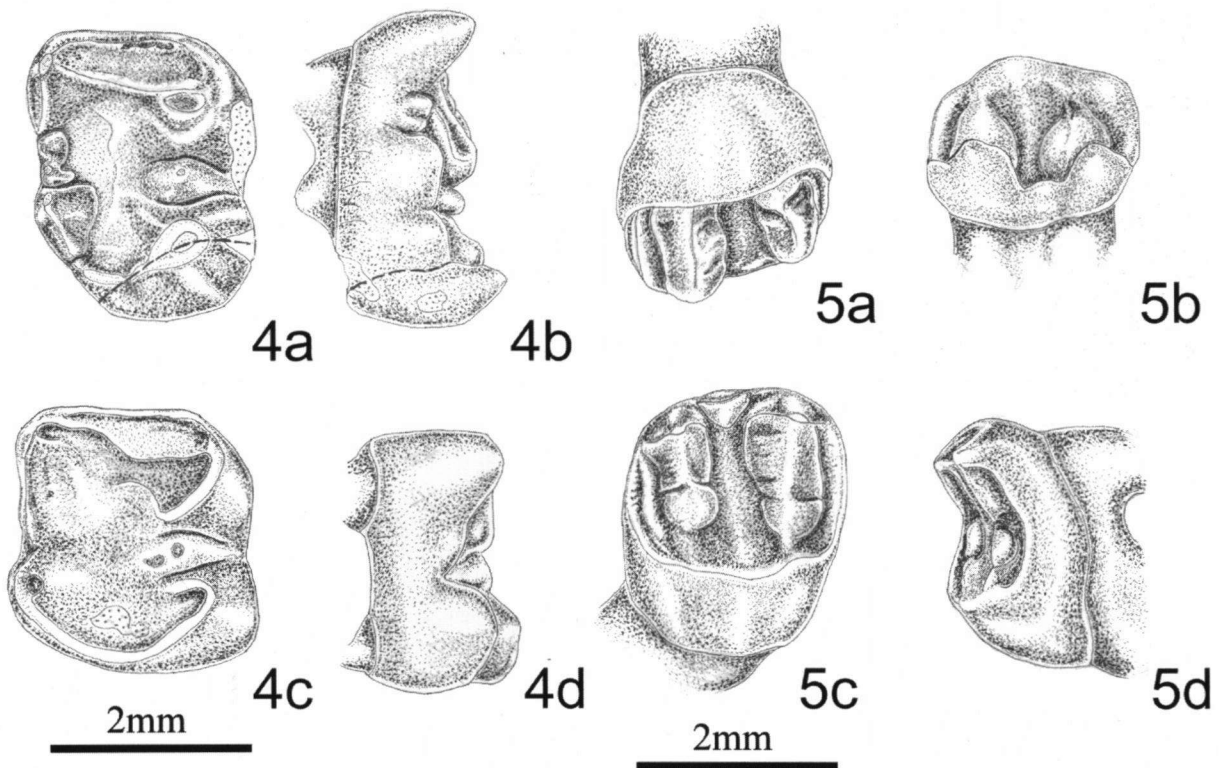
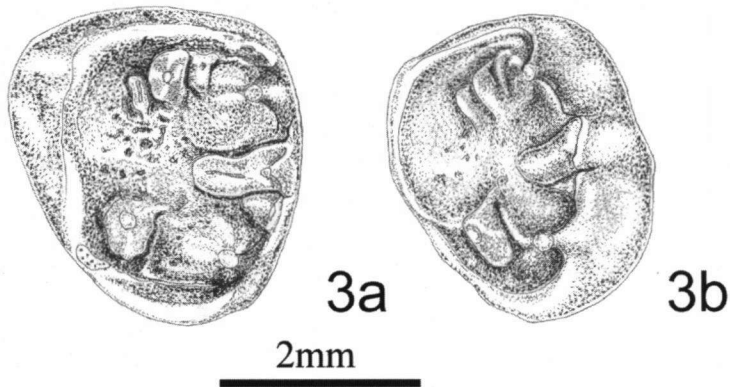
Subfamily Pseudoparamyinae Michaux, 1964

*Included genera* –

*Pseudoparamys* Michaux, 1964 from the Lower Eocene, Europe (MP7–9).

*Plesiarctomys* Bravard, 1850 from the Eocene, Europe (MP 8/9–19).





**Figure 1.** *Patriarchamys batesi* gen. et sp. nov. HZM 1.34326 M1-2 dex. (holotype): a – mesial view; b – occlusal view. HZM 2.34481 m3 dex.: c – occlusal view; d – mesostylid, lingual view. Light macrographs, specimens coated with ammonium chloride.  
**Figure 2.** *Patriarchamys batesi* gen. et sp. nov. HZM 1.34326 M1-2 dex. (holotype): a – lingual view; b – oblique mesial view; c – buccal view; d – occlusal view; e – M 35452 part P4 dex. occlusal view.  
**Figure 3.** *Patriarchamys batesi* gen. et sp. nov. M35536 M3 sin: a – occlusal view; b – oblique buccal view.  
**Figure 4.** *Patriarchamys batesi* gen. et sp. nov. HZM 2.34481 m3 dex. --- = Fracture line of restored distobuccal fragment: a – occlusal view; b – lingual view. HZM 3.34730 m1-2 dex.: c – occlusal view; d – lingual view.  
**Figure 5.** *Pseudoparamys teilhardi* (Wood, 1962). M 29660 M1-2 dex. Mutigny, France. Lignites de Soissonais, Early Eocene: a – oblique lingual view; b – oblique buccal view; c – occlusal view; d – oblique mesial view.

*Franimys* Wood, 1962 from the Paleocene, North America (Clarkforkian – Wasatchian).  
*Patriarchamys* gen. nov. described here.

*Patriarchamys batesi* gen. et sp. nov.  
 Figures 1-4

1986 ?*Manitshinae* gen. et sp. undet. Hooker p. 290; pl. 13; figs. 9 – 13; text-fig. 29.

*Type material* – Holotype: HZM 1.34326 Isolated M1-2 dex. CL 2.40 CW 2.88 mm. (Figures 1a, b; 2a-d). Paratypes: M 35452 Part P4 dex. CL 2.11 mm. (e). (Figure 2e);

M 35767 Part M1-2 dex. CL 2.24 mm. (e); M 35536 M3 sin. CL 3.07 CW 2.82 mm (Figure 3); M 35768 dp4 dex CL 1.79 CW 1.54 mm; M 37189 p4 dex. CL 2.24 CW 1.86 mm; HZM 3.34730 m1-2 dex. CL 2.50 CW 2.24 mm. (Figure 4c, d); HZM 2.34481 m3 dex. CL 2.88 CW 2.21 mm. (Figures 1c, d; 4a, b). (e = estimated measurement).

*Referred material* – HZM 4.34731 Mesio-buccal fragment M3 dex. CL 3.14 CW 2.94 mm. (e).

*Type locality* – Creechbarrow, Dorset SY 8240 9215, Southern England.

*Stratigraphy* – Creechbarrow Limestone Formation (Bed 12, Hooker, 1986), late Middle Eocene, Robiacian ELMA MP 16.

*Etymology* – ‘Patriarchal’ (venerable) mouse. Specific name after Dr Paul J.J. Bates of the Harrison Institute in recognition of his many contributions to mammalogy and to the palaeontological researches of the Institute.

*Diagnosis* – The genus is monospecific so that the diagnosis given here applies to the genus and species. Medium-small pseudoparamyine, M1-2 CL 2.40 mm. Crests of maxillary molars prominent, continuous (M1-2) or incomplete (M3); protoloph and metaloph nearly parallel, originating wide apart from protocone so that the trigon basin is almost rectangular lingually. M1-2 with the paracone distinctly lingual to the metacone. The protoconule is reduced, with a narrow crestiform cusp, not extruding mesially or distally from the complete protoloph. Metaconule tripartite, with weak crestiform cusps not extruding from the metaloph. M3 is elongate, with prominent conules. The protoconule is triple, the single metaconule prominent and rounded. Lower molars m1-3 with mesoconid massive, isolated from metaconid and hypoconid by deep fissures, m3 mesostylid double.

*Description* – **P4:** M 35452 described by Hooker (1986, p. 290; pl. 13; fig. 9) is a P4 dex. lacking the buccal wall. Although no accurate measurements can be taken it appears compatible in size and morphology with the present taxon and allowing for the incomplete buccal wall it does not appear greatly reduced in size relative to the intact holotype M1-2 dex. The outline is triangular and strong anterior and posterior cingula resemble the holotype M1-2. The crests and conules are worn, the latter reduced to pits, which do not extrude from the crests, the former arising wide apart from the protocone and nearly parallel with each other. The detailed structure of the conules cannot be discerned, but a pronounced mesial indentation in the metaloph may represent a constriction between original divisions of the metaconule. Hooker (1986) noted the absence of a hypocone and presence of a fissure between the paracone and metacone.

**M1-2** The holotype M1-2 (HZM 1.34326) is well preserved. Essential features have been given in the diagnosis above. The buccal cusps are high, the paracone slightly

higher than the metacone and recessed lingually, so that the metacone is buccally prominent. The trigon basin is deep, with a fissure between the mesostyle and metacone. The anteroloph and posteroloph are strong and nearly rectilinear. The trigon basin is almost rectangular lingually, between the prominent and continuous crests. The protoconule is reduced, with a narrow crestiform cusp, not extruding mesially or distally from the protoloph. The metaconule is tripartite, with weak crestiform cusps not extruding from the metaloph. The anteroloph 2 of Escarguel (1999, p. 185) is absent. The mesostyle is distinct, attached to the paracone, a low mesoloph extending from it towards the central metaconule, not attaining half the width of the crown basin. The enamel of the crown basin is smooth. The hypocone is small, but distinct, the endoloph high and slightly oblique. The lingual sinus is poorly differentiated. M 35767 is a broken right M1-2 with a large buccal part missing (Hooker, 1986, p. 290; pl. 13; fig. 10). Its general shape and size and preserved prominent parastyle indicate that it is referable here. It is unfortunately too heavily worn to discern any detailed morphology. **M3** M 35536 is an intact and well-preserved M3 sin. described by Hooker (1986, p. 290; pl. 13; fig. 11). Essential features have been given in the diagnosis above. It is shaped as an elongate right-angled triangle of which the mesial border is the shortest. A fissure separates the mesostyle from a small accessory mesostylar cusp attached to the metacone. The anterior and posterior cingula are strong, the posterior one ridged. The enamel is finely rugose throughout the concave crown basin. No lingual sinus or hypocone are present. The strong mesostyle has a short, straight mesoloph extending less than halfway across the crown. HZM 4.34731 is a mesio-buccal fragment of M3 dex. with the protocone and lingual border of the crown missing. It is rather heavily worn and corroded. The parallel crests are, however, clearly visible, the protoloph complete and the deeply concave crown basin closely resembles the intact M35536. The conules are worn away so that no detail can be distinguished. The mesostyle is long, but too worn to determine if it was originally double. Scarcely any trace of a mesoloph remains, but the strong anterior cingulum is preserved. It is marginally larger than M 35536, but clearly too small to be referable to *Plesiarctomys*.

**dp4:** M 35768 is a dp4 dex. described by Hooker (1986, p. 290; pl. 13; fig. 12), with wrinkled enamel in the talonid basin. Its small size and comparison with the p4 described below indicate that it is referable here. Hooker noted the presence of a nearly complete hypolophulid. **p4:** M 37189 is a right p4 corroded and disto-buccally broken. Hooker, (1986, pl. 13; fig. 13.) noted the distinct protoconid, smaller than the metaconid. There is a deep talonid notch and wrinkled enamel in the talonid basin, but no mesostylid is present. **m1-2:** HZM 3.34481 m1-2 dex. is the only known m1-2 at present. Essential details have been given in the diagnosis above. It is well preserved except for a small area of enamel erosion in the distal talonid basin. The outline is subrectangular, with the talonid and trigonid subequal, but the talonid distinctly wider. The straight anterolophid is at right angles to the median axis of the tooth.

The entoconid is lower than the protoconid and forms a notch with its postcrisid; there is no mesostylid. The ectolophid and hypolophid are absent and no hypoconulid is apparent, with the distal crown margin evenly convex. The enamel of the talonid basin is smooth. The metaconid and hypoconid are more worn than the protoconid and entoconid. The postmetacristid is slightly convex. **m3**: HZM 2.34481 m3 dex. is the only known third lower molar at present. Essential details have been given in the diagnosis above. It is well preserved except for a detached fragment from the distal hypoconid found separately in the sample and restored leaving a small deficit disto-buccally. An area of eroded enamel is present on the buccal aspect of the protoconid. The talonid is elongated, longer than and as broad as the trigonid, which is compressed mesio-distally. The mesostylid is prominent and doubled, separated from the metaconid and entoconid by deep fissures. The entoconid is situated anterior to the larger hypoconid; the hypoconulid is low, but individualised, the hypoconid separated from it by a distinct notch; the enamel of the talonid basin is smooth. The protoconid and hypoconid are more worn than the metaconid and entoconid. This suggests an occlusal relationship similar to that between the upper and lower molars of *Ps. teilhardi* illustrated by Escarguel (1999, p. 162; fig. 9), in the form of a gutter, which is shallow and subhorizontal, leading to more advanced wear of the external cusps of the lingually tilted lower molar crown.

#### Comparative notes on the subfamily Pseudoparamyinae Michaux, 1964

*Pseudoparamys teilhardi* (Wood, 1962).

For synonymy see Escarguel (1999, p. 158). This is the European ischyromyid most closely approaching *Patriarchamys batesi* gen. et sp. nov. the M1-2 (Figure 5) sharing the widely separated almost parallel crests, high oblique endoloph, reduced hypocone and protoconule, but well developed metaconule, sometimes double, but not triple. The conules extrude from the crests in *Ps. teilhardi* and the paracone is level with or slightly buccal to the metacone in M1-2 and no mesoloph is present. The enamel usually exhibits wrinkling, becoming more evident towards the distal end of the maxillary tooth row (Escarguel, 1999: p. 160). The M3 in this genus has the conules feeble or absent (Escarguel, 1999: p. 162; pl. 12; fig. j). The m1-2 rather closely resembles *Patriarchamys* gen. nov. (Escarguel, 1999: p. 162; pl. 12, figs n,o,p) although the trigonid basin is usually more completely closed off from the talonid basin, a detail rather obscured by wear, however, in the only m1-2 of *Patriarchamys* gen. nov. The m3 shows some strong resemblances to *Patriarchamys batesi* gen. et sp. nov. including the relatively large talonid (Escarguel, 1999: p. 163; pl. 12; fig. q). In *Ps. teilhardi* the trigonid is open posteriorly in the majority (75%) of the specimens. The mesostylid is much less prominent and not doubled, so that there is only a narrow gap between the metaconid and entoconid. *Pseudoparamys teilhardi* is a smaller species, (M1 CL 1.98 – 2.31mm. m 2.10 n = 43. See Escarguel, 1999, p.

302). *Pseudoparamys cezannei* Hartenberger, 1987 is essentially similar, but smaller. *Pseudoparamys* sp. is known in Britain (Hooker, 1996, p. 147), see Conclusions (below). *Plesiarctomys* Bravard, 1850 Ischyromyids of this genus are generally large, with globose cheekteeth and increasingly prominent crests; a pericingulum frequently joins the mesostyle to the posterior cingulum in the region of the metacone; the enamel is usually wrinkled. Two species occur at Creechbarrow, *P. curranti* Hooker, 1986 and *P. hurzeleri* Wood, 1970. Both are readily distinguished from *Patriarchamys batesi* gen. et sp. nov. by their large cheekteeth and prominent crests.

*Franimys* Wood, 1962 occurs in the Paleocene (Clark-forkian – Wasatchian) of North America (see Wood, 1962, p. 139 and Escarguel, 1999, p. 156 for diagnosis of *Franimys*). Originally considered to be Reithroparamyine by Wood (1962), but transferred to the Pseudoparamyines by Korth (1984, 1994). It is distinguished from the two previously known European genera of Pseudoparamyinae by the hypocone, which originates from the cingulum (pseudo-hypocone); a large P3 is present and non-molariform P4; a small protoconid is present on the p4. The skull has a small postorbital process of the frontal and a large auditory bulla may have been present. The hind feet are elongated with very developed metatarsals suggesting saltatorial adaptation. The cranial and postcranial structures of *Patriarchamys* gen. et sp. nov. are unknown at present. Further comparison of the dentition is however, facilitated by a cast of the holotype of *Franimys buccatus* Cope, 1877 located in the Natural History Museum, London original USNM 1129. Right maxilla with P4 – M2 *in situ*. San Juan Basin, New Mexico, 'Wasatch.' (Wood, 1962, fig. 49 C). The P4 has no hypocone and is broader than the M1. This specimen (USNM 1129) however, reveals distinctive dental differences in the maxillary dentition from *Patriarchamys* gen. nov., as well as some significant similarities. The absence of a hypocone in P4 of *Patriarchamys* gen. nov. is a primitive feature, resembling *Franimys*, which Wood (1962 p. 139) considered to be one of the most primitive rodent genera known in respect of its premolar structure. The p4 in *Franimys amherstensis* Wood, 1962 (the type species) has a very small protoconid (Wood, 1962, p. 143; fig. 49 A), also resembling *Patriarchamys* gen. nov. The paracone is slightly more prominent than the metacone in both M1 and M2, not recessed lingually as in *Patriarchamys* gen. nov. The crests are similarly complete in both teeth and have the typical Pseudoparamyine parallel origin, wide apart from each other on the protocone. The conules are, however quite different, the protoconule very reduced and without any crestiform cusp; the metaconule single, larger in M2, in which it extrudes mesially from the metaloph. The mesostyle in both teeth is lower and less prominent, but more elongated mesio-distally. The mesoloph is short, resembling *Patriarchamys* gen. nov. The hypocone of M1 and M2 is distinctly more robust. M3 is elongate in the holotype of *Franimys amherstensis* (ACM 10524), but with a slight concavity in its disto-buccal margin. The metaloph is incomplete, the metacone united with the protocone

through the posterior cingulum. The hypocone is probably absent, but obscured by a wear facet (Wood, 1962, p. 142; fig. 48 E). No conules are evident in Wood's figure of M3, although a metaconule is clearly indicated in M2. A third species of this genus is known, *Franimys ambos* Korth, 1984. This author transferred the genus *Franimys* to the Pseudoparamyini. The holotype of *F. ambos* (CM 37091, right maxilla with P4 – M2 *in situ*) was described by Korth (1984, p. 46; fig. 22) from the Wind River Formation (Lysite Member), Wyoming. The structure of the M1 and M2 is essentially similar to *F. buccatus*, with complete crests and the paracones slightly more prominent than the metacones. The protoconule is absent, the metaconule single and prominent, the mesostyle similarly elongated and low. P4 lacks a hypocone, but is otherwise quite molarised, with a double metaconule. The dental differences described above in all three species leave no doubt that *Patriarchamys* gen. nov. represents a different genus. Michaux (1968, p. 154) gave reasons for his earlier (1964) separation of the European Pseudoparamyinae from the North American Manitshinae.

Subfamily Reithroparamyinae Wood, 1962

Tribe Microparamyini Wood, 1962.

Escarguel (1999, p. 182) recognised five genera in this tribe of small European ischyromyids, diagnosed by Wood (1962, p. 157) as having upper cheek teeth which are complex to very complex, well developed hypocones and having a tendency to develop an anterocone at the lingual end of the anteroloph as large as the hypocone. The metaloph tends to unite more often with the hypocone than with the protocone.

Genus *Sparnacomys* Hartenberger, 1971; (Escarguel, 1999, p. 183, new rank).

*Sparnacomys chandoni* Hartenberger, 1971 is the only known species in this genus. For a revised diagnosis see Escarguel 1999, p. 183. It has a number of strong similarities of the M1-2 to *Patriarchamys* gen. nov. (see Hartenberger, 1971: pl. 3; figs. 1, 3, 5; Escarguel, 1999: pl. 17; figs. h & i). The protoloph and metaloph are prominent and continuous, the anterior and posterior cingula rectilinear; the hypocone is small but distinct, the protoconule reduced or absent, the metaconule massive, sometimes double, the parastyle strong. Differences from the M1-2 of *Patriarchamys* gen. nov. are, however, striking. It is much smaller (M1 and M2 CL 0.91 – 1.02 mm  $m = 1.03$ , Hartenberger, 1971 p. 106). The protoconule is present in *P. batesi*, with a crestiform cusp and the metaconule is tripartite, also with crestiform cusps and the conules do not extrude mesially or distally to any extent from the crests. The short cuspidate 'anteroloph 2' of Escarguel (1999, p. 185) present in *S. chandoni* is absent in *Patriarchamys* gen. nov. The paracone of M1-2 in *S. chandoni* is level with or buccal in relation to the metacone, whereas in *Patriarchamys* gen. nov. it is distinctly lingual in position. The mesostyle is generally less prominent and enamel wrinkling is often present in *S. chandoni*. A low mesoloph is variably present. The crests originate much closer together from the protocone so that

the trigon forms a V rather than a rectangle lingually. In *S. chandoni* M3 has a non-cuspidate anteroloph 2; the conules are poorly developed, the mesostyle and mesoloph absent (Escarguel, 1999, p. 185). m1 and m2 of *S. chandoni* have the mesoconid situated internally with a complete ectolophid (Escarguel, 1999, p. 186; pl. 17; figs. m, n). The m3 of *S. chandoni* is characteristically trapezoidal in shape (Escarguel, 1999, p. 186; pl. 18; fig. o). The basin of the trigonid is open to the talonid; the mesoconid is prominent, but the mesostylid scarcely developed.

Genus *Pantrogna* Hartenberger, 1971 (Escarguel, 1999, p. 189, new rank).

These are medium to large microparamyines with massive, globose and bunodont maxillary teeth. The crests are variably developed in M1-2, with the conules large and spreading mesially and distally from them and lacking the regular and rectangular appearance of *Patriarchamys* gen. nov. A large anterocone is developed in *Pantrogna russelli* (Michaux, 1964) as large as the hypocone, less prominent in *Pantrogna marandati* Escarguel (1999). The lingual sinus is quite deep and well developed.

The m3 of *Pantrogna russelli* (Escarguel, 1999, p. 192; pl. 18; fig. o) is globose and rounded; it shows some morphological similarities to *Patriarchamys*, but the mesostylid is little developed. By contrast the hypoconulid is often doubled.

Genus *Microparamys* Wood, 1959

'*Microparamys*' *nanus* (Teilhard de Chardin, 1927).

This is the oldest species of the group, from the Lower Eocene (MP7) of Dormaal, Belgium. It is smaller (M1-2 CL - 1.18 – 1.22; CW -1.35 – 1.41 mm. (Hartenberger 1971, p. 103). The maxillary molars are of primitive aspect, with the cusps of the trigon predominant, the hypocone very low and well separated from the protocone. The paracone and metacone of M1-2 are level with each other (Teilhard de Chardin, 1927; pl. 6; figs. 2, 4); the protoconule and metaconule are always well individualised and a mesostyle is only present exceptionally. (Hartenberger, 1971, p. 104). Escarguel (1999, p. 182) considers this form most probably referable to *Pantrogna*.

Genus *Hartenbergeromys* Escarguel, 1999, p. 201.

This genus of medium-sized Microparamyine presents a mosaic of characters between *Pantrogna* and the Theridomyidae, which it presages (Escarguel, 1999, p. 201). M1-3 are primitive, the protoconule is present in M1-2, extended antero-posteriorly and situated in front of the protoloph; the metaconule is globular and massive (Escarguel, 1999, p. 201; pls. 21, 22; figs. k, l). The m3 of *Hartenbergeromys hautefeulleri* has the anterolophid very reduced (Escarguel, 1999, p. 207; pl. 22; fig. h). The protoconid is strongly joined to the mesoconid and the junction of the hypoconid – hypoconulid is strong.

Genus *Masillamys* Tobien, 1954

This is a large Microparamyine with low-crowned maxillary teeth; M1-2 lacking the high-crowned buccal cusps of

*Patriarchamys* gen. nov. The conules and mesostyle are massive, the former spreading mesially and distally, the metaconule hardly or not at all joined to the protocone, hypocone or lingual margin. The metacone is more lingual than the paracone (Escarguel, 1999, p. 216; pl. 23; figs. e, l, m). The m3 of *Masillamys mattaui* (Escarguel, 1999, p. 221; pl. 24; fig. d) is relatively short, with low, broad cusps. The anterolophid is low, the metaconid greatly reduced, the mesostylid small. The enamel is strongly wrinkled.

'*Paramys*' *woodi* Michaux, 1964.

This is a 'paramyid' of large size and rather uncertain affinity. The enamel surface is often irregular in the maxillary teeth, very finely rugose and the crown is brachyodont, with the cusps massive, low and rounded, the crests little marked (Escarguel, 1999, p. 235; pl. 25). Its m3 (Escarguel, 1999, p. 232; pl. 25; figs. j, s) has a strong globular mesoconid and hypoconulid and rather resembles *Patriarchamys* gen. nov. in having the talonid longer than the trigonid and the gap between the protoconid and entoconid quite long, but the mesostylid is not prominent and doubled in m3 (Michaux, 1968, pl. 3; figs. 1-3).

*Undetermined genera* A and B of Michaux, 1968

Hooker (1986, p. 291) noted that the small assemblage of teeth here referred to this new taxon that he was able to study from Creechbarrow probably belonged to an undescribed genus showing some similarities to *Plesiarctomys*, but not fitting its diagnosis. He also noted some similarities to undetermined genus B from the early Eocene of Avenay and Condé-en-Brie, France (Michaux, 1968, pl. 10; figs. 7-9). He noted specially the large isolated intermediate conules, strong encircling lingual loph, with indistinct cusps and finely wrinkled, deeply basined trigon as features in common, suggesting they may be congeneric. It is now clear however, that the M1-2 of undetermined genus B (Michaux, 1968, pl. 10; fig. 7) has the paracone level with the metacone, as well as a rounded contour and undifferentiated hypocone, all unlike *Patriarchamys* gen. nov. Furthermore the protoconule is relatively massive, not crestiform and extrudes from the continuous protoloph, while the metaconule is not tripartite and extrudes. Undetermined genus B cannot therefore belong to the same taxon as *Patriarchamys* gen. nov. Michaux's (1968; pl. 10; figs. 1-6) undetermined genus A of Avenay is equally incompatible since the M1-2 paracone is strongly buccal to the metacone and the conules are also different, the protoconule transversely extended, the metaconule single and extruding. The crests and crown outline are both more triangular than in *Patriarchamys* gen. nov.

#### Remarks on Asiatic ischyromyids

Genus *Anatoparamys* Dawson & Wang, 2001

The recently described *Anatoparamys crepaturus* and other allied taxa from the Middle Eocene fissure fillings of Shanghuang, China, show some affinities with Manitshine

ischyromyids. Dawson & Wang, (2001, p. 225; fig 1) consider them clearly endemic forms with bunodont cheek teeth, which are nearly non-lophate. The protoloph is complete, but narrow, the protoconule absent, the single metaconule prominent and rounded. The lower molars are rhomboidal, with very small entoconids and no hypolophids. Other described Asiatic ischyromyid genera, including the Early Eocene *Taishanomys* and ?*Acritoparamys*, *Asiomys* and *Eoischyromys* of the Middle Eocene, as well as *Hulgana* from the Late Eocene do not show affinities with the Manitshine ischyromyids of Wood, 1962 and Korth, 1984. (Escarguel, 1999 p. 155), *Eoischyromys* has a long complete hypolophid (Dawson & Wang, 2001, p. 225), thus differing from *Patriarchamys* gen. nov. in this respect. Although showing some affinities with the Pseudoparamyinae as currently recognised, *Anatoparamys* clearly differs from *Patriarchamys* as noted above, as well as in other morphological details, such as the absence of prominent, transversely elongated mesoconids.

#### Conclusions

Although the teeth of this new taxon are unfortunately very rare at Creechbarrow, it is now possible to provide at least a provisional description of what is clearly a new genus and species. Table 1 compares and contrasts the principal dental characteristics (M1-2, M3 and m3) of *Patriarchamys batesi*, gen. et sp. nov. *Pseudoparamys teilhardi* and *Sparnacomyx chandoni*, which reveal clear differences between the three taxa. It is clear from the comparisons above that *Patriarchamys batesi* gen. et sp. nov. is a derived pseudoparamyine, possibly descended from a species of *Pseudoparamys* of the Early Eocene. A possible, although at present very speculative scenario is outlined in Fig. 6. This is based on the possibility that *Patriarchamys* evolved from *Pseudoparamys* in isolation on the British Eocene Island, which seems quite feasible, as the genus is unknown from the Early Eocene of Continental Europe. It is, however also possible that it could have been an immigrant from N. America, derived from the Paleocene *Franimys*. More evidence is required to form the basis of a full phylogenetic analysis. Hooker (1996, p. 147, fig. 7) recorded a lingual fragment of left M1-2 of *Pseudoparamys* sp. (M 34596 Natural History museum, London) from Peel Common, near Stubbington, Hampshire, Wittering Formation (?MP 10). Its mesiodistal length of 2.16 mm. suggests this specimen is distinctly smaller than *Patriarchamys* nov. gen. and the preserved lingual end of the anteroloph is separated from the protocone by a distinct notch. Hooker (1996, p. 148) suggests that this fragmentary tooth could be referable to *Pseudoparamys teilhardi*. Some derived characters distinguish *Patriarchamys* gen. nov. from the related, possibly ancestral *Pseudoparamys*. Especially noteworthy are the tripartite metaconule of M1-2 and protoconule of M3, the short mesoloph of the upper molars, elongated double mesostylid of m3 and mesostyle of M3 and the recessed paracone of M1-2.



<b>Dental Character</b>	<b><i>Patriarchamys batesi</i></b> <i>gen. et sp. nov.</i>	<b><i>Pseudoparamys teilhardi</i></b>	<b><i>Sparnacomys chandoni</i></b>
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**M1-2**

<b>1. Size</b>	Medium-small, CL 2.40 mm.	Smaller, CL 1.98 - 2.31 mm	Smallest, CL 0.91 - 1.02 mm.
<b>2. Crests</b> Parallel subrectangular trigon (+) Divergent subtriangular trigon (-)	(+)	(+)	(-)
<b>3. Anteroloph 2</b> Present (+); Absent (-)	(-)	(-)	(+)
<b>4. Protoconule</b> Reduced/absent (+); Large, extruding (-)	(+)	(-)	(+)
<b>5. Metaconule</b> Tripartite, not extruding (+); Single/double, extrudes (-)	(+)	(-)	(-)
<b>6. Mesostyle</b> Strong, prominent (+); Weak, low (-)	(+)	(-)	(-)
<b>7. Mesoloph</b> Present (+); Absent (-)	(+)	(-)	(+)/(-)
<b>8. Paracone</b> Lingual to metacone (+) Paracone - metacone level (-)	(+)	(-)	(-)

**M3**

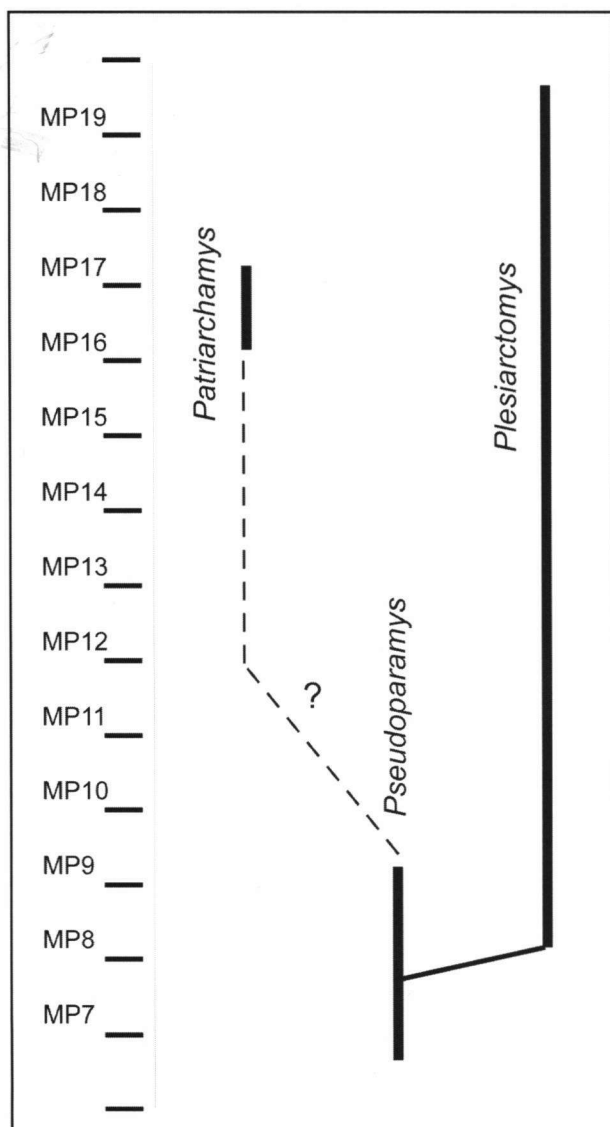
<b>1. Crests</b> Incomplete (+); Complete (-)	(+)	(+)	(+)/(-)
<b>2. Anteroloph 2</b> Present (+); Absent (-)	(-)	(-)	(+)
<b>3. Protoconule</b> Tripartite (+); Feeble/absent(-)	(+)	(-)	(-)
<b>4. Metaconule</b> Single, large (+); Feeble/absent(-)	(+)	(-)	(-)
<b>5. Mesostyle</b> Strong, with accessory cusp (+) Weak, absent (-)	(+)	(-)	(-)
<b>6. Mesoloph</b> Present (+); Absent (-)	(+)	(-)	(-)
<b>7. Metacone</b> Reduced (+); Not reduced (-)	(-)	(-)	(+)



m3

<b>1. Crown</b> Trapezoidal (+); Not trapezoidal (-)	(-)	(-)	(+)
<b>2. Mesostylid</b> Elongated, double (+); Weak (-)	(+)	(-)	(-)
<b>3. Hypoconulid</b> Individualised (+); Reduced(-)	(+)	(+)/(-)	(-)
<b>4. Metalophid 1</b> Complete (+); Incomplete(-)	(+)	(+)/(-)	(-)
<b>5. Mesoconid</b> Massive isolated (+); Less prominent (-)	(+)	(-)	(-)

**Table 1.** Principal dental characteristics (M1-2, M3, m3) of *Patriarchamys batesi* gen. et sp. nov. *Pseudoparamys teilhardi* and *Sparnacomyx chandoni*.



**Figure 6.** MP Reference levels of European Pseudoparamyinae, with speculative origin of *Patriarchamys* gen. et sp. nov. from *Pseudoparamys* (Modified from Escarguel, 1999, 259). Note that the Reference levels are biohorizons and do not in fact represent defined divisions of time.

Some of these features are also derived in comparison with the primitive Paleocene *Franimys* of North America. Escarguel (1999, p. 259) indicated a possible North American origin for the *Pseudoparamyinae*. Some of the dental similarities between *Franimys* and *Patriarchamys* nov. gen. may support this origin. Certain features of the molar teeth of *Patriarchamys* gen. nov. are very reminiscent of modern Sciuridae, particularly the prominent complete crests of the M1-2. The recessed paracone, shorter protoloph and distally curved metaloph as well as the elongated, bifid mesostylid of m3 are also very sciurid. It is interesting to note that Wood (1962: 140) commented on some distinctly sciurid features in the skull and skeleton of *Franimys*. In the absence of cranial and postcranial remains, however, it is impossible to be sure whether these sciurid features are an indication of true relationship or merely the result of evolutionary convergence.

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## References

- Alston, E.R. 1876. – On the classification of the order Glires. *Proceedings of the Zoological Society of London*. 1876, 61 – 98, pl. 4.
- Bowdich, T.E. 1821. *An analysis of the natural classification of Mammalia for the use of Students and Travellers*. 115 pp., 15 pls. Paris.
- Bravard, A. 1850. Notes sur les ossements fossiles de Débruge. *In: Gervais, P., Zoologie et paléontologie Françaises (Animaux vertébrés) ou nouvelles recherches sur les Animaux vivants et fossiles de la France. Deuxième édition.* (Explications des planches et divers mémoires) expl. Pls. 46 – 48: 2-3. Paris, 1859.
- Cope, E.D. 1877. Report upon the extinct Vertebrata obtained in New Mexico by parties of the expedition of 1874. XI. Fossils of the Mesozoic periods and geology of Mesozoic and Tertiary beds. XII. Fossils of the Loup Fork epoch. *Report of the United States Geographical Survey West of 100<sup>th</sup> Meridian (First Lt. Geo. M. Wheeler)*. Washington Engineer Department U.S. Army 4 (2): iv ; 370 p. 61 pls.
- Dawson, M.R. & Wang, B. 2001. Middle Eocene Ischyromyidae (Mammalia, Rodentia) from the Shanghuang fissures, South-eastern China. *Annals of Carnegie Museum* 70, 221-230.
- Escarguel, G. 1999. Les rongeurs de l'Eocène inférieur moyen d'Europe occidentale. Systématique, phylogénie, biochronologie et paléobiogéographie des niveaux – repères MP7 à MP 14. *Palaeovertebrata*, 28, 89 – 351, 26 pls.
- Harrison, D.L. 2002. A new species of Dormouse (Rodentia: Gliridae) from the Creechbarrow Limestone Formation (Late Middle Eocene) of Dorset, England. *Tertiary Research* 21, 11 – 18.
- Hartenberger, J.L. 1971. Contribution à l'étude des genres *Gliravus* et *Microparamys* (Rodentia de l'Eocène d'Europe). *Palaeovertebrata* 4, 97 – 135, 5 pls.
- Hartenberger, J.L. 1987. *In: Godinot, M. et al.* Nouvelles données sur les mammifères de Palette (Eocène inférieur, Provence). *Münchner geowissenschaftliche Abhandlungen A* 10, 273 – 288, 2 pls.
- Hooker, J.J. 1986. Mammals from the Bartonian (middle / late Eocene) of the Hampshire Basin, southern England. *Bulletin of the British Museum (Natural History) (Geology)* 39,1 – 478, 34 pls.
- Hooker, J.J. 1996. Mammals from the Early (Late Ypresian) to Middle (Lutetian) Eocene Bracklesham Group, Southern England. *Tertiary Research*, 16, 141 – 174.
- Hooker, J.J. & Weidmann, M. 2000. The Eocene mammal faunas of Mormont, Switzerland. *Schweizerische Paläontologische Abhandlungen*, 120, 1 – 141.
- Korth, W.W. 1984. Earliest Tertiary evolution and radiation of rodents in North America. *Bulletin of the Carnegie Museum of Natural History* 24, 1 – 71.
- Korth, W.W. 1994. The Tertiary Record of Rodents in North America. *In: Topics in Geobiology*. Stehl, F.G. & Jones, D.S. (Eds.). Plenum Press Publication. 12, 1 – 319.
- Michaux, J. 1964. Diagnoses de quelques Paramyidés de l'Eocène inférieur de France. *Comptes Rendus sommaires des Séances de la Société Géologique de France*, Paris 1964 (4), 153 – 154.
- Michaux, J. 1968. Les Paramyidae (Rodentia) de l'Eocène inférieur du bassin de Paris. *Palaeovertebrata* 1, 135 – 193, 10 pls.
- Miller, G.S. & Gidley, J.W. 1918. Synopsis of the supergeneric Groups of Rodents. *Journal of the Washington Academy of Sciences* 8, 431 – 448.
- Savage, D.E. & Russell, D.E. 1983. *Mammalian Palaeofaunas of the World*. Addison Wesley Pub. i – xviii; 1 – 432.
- Teilhard de Chardin, P. 1927. Les mammifères de l'Eocène inférieur de la Belgique. *Mémoires du Musée royal d'Histoire Naturelle de Belgique* 36, 1 – 33, 6 pls.
- Tobien, H. 1954. Nagerreste aus dem Mitteleozän von Messel bei Darmstadt. *Notizblatt des Hessischen Landesamtes für Bodenforschung*, 82, 13 – 29, 2 pls.
- Wood, A.E. 1959. Rodentia. *In: McGraw, P.O.* The geology and paleontology of the Elk Mountain and Tabernacle Butte area, Wyoming. *Bulletin of the American Museum of Natural History* 117, 157 – 169.
- Wood, A.E. 1962. The Early Tertiary Rodents of the family Paramyidae. *Transactions of the American Philosophical Society (N.S.)*, 52, 1 – 261.
- Wood, A.E. 1970. The European Eocene Paramyid Rodent, *Plesiarctomys*. *Verhandlungen der Naturforschenden Gesellschaft in Basel*, 80, 237 – 278.
- Zittel, K.A. von 1893. *Handbuch der Paläontologie*, 4. 799 pp. Munich, Germany.