A new species of Miocene terrestrial gastropod *Gastrocopta* from Poland and the validity of "*Pupa* (*Vertigo*) *suevica*"

EWA STWORZEWICZ and VALENTIN A. PRISYAZHNYUK

Stworzewicz, E. and Prisyazhnyuk, V.A. 2006. A new species of Miocene terrestrial gastropod *Gastrocopta* from Poland and the validity of "*Pupa* (*Vertigo*) *suevica*". *Acta Palaeontologica Polonica* 51 (1): 165–170.

We describe *Gastrocopta sandbergeri* sp. nov. from the Miocene brown coal deposits of the open-cast mine Bełchatów (central Poland) and identify it as conspecific with *Pupa* (*Vertigo*) *suevica* Sandberger, 1875 (*nomen nudum*) from the Miocene of Steinheim. The new name "*sandbergeri*" has been introduced in substitution because Sandberger's name "*suevica*" has been later proposed again for a valid species *Gastrocopta* (*Albinula*) *suevica* by Boettger (1889). We could not use the name "*minor"* proposed by Miller (1900) as form of *Pupa* (*Leucochilus*) *suevica* because it is preoccupied by another *Gastrocopta* species: *Bifidaria ashmuni* f. *minor* Sterki, 1898 [= *Gastrocopta ashmuni* (Sterki, 1898)]. In consequence Sandberger's *Pupa* (*Vertigo*) *suevica* is recognized as the senior synonym of *Gastrocopta sandbergeri* sp. nov. The new species is most similar to *Gastrocopta nouletiana* (Dupuy, 1850) but differs in having smaller and always slender shell, less convex whorls, much weaker crest on the body whorl (or even absent) and generally rather weakly developed teeth (6–7) in the aperture.

Key words: Gastropoda, Pupilloidea, *Pupa*, *Gastrocopta*, Neogene, Miocene, Bełchatów, Poland.

Ewa Stworzewicz [stworzewicz@isez.pan.krakow.pl], Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, ul. Sławkowska 17, PL 31-016 Kraków;
Valentin A. Prisyazhnyuk [prysval@mail.ru], Institute of Geological Sciences, Ukrainian Academy of Sciences, 55b Gončara, UK 01030 Kiev.

Introduction

In Steinheim am Albuch, Sandberger (1875: 654) found a specimen similar but "not identical" ("… ist aber keinenfalls identisch.") to those he described in the same paper as *Pupa gracilidens* (p. 600) and named it *Pupa* (*Vertigo*) *suevica*. Since the new name was accompanied neither by any description nor a figure so according to the rules of the International Code of Zoological Nomenclature (1999) it has to be regarded as a *nomen nudum*. However, in some museum collections the name "*Pupa suevica*" (= *Gastrocopta suevica*) is applied to two different forms: one of them representing *Sinalbinula*, the other the *Albinula* group. The name was validated for a species of *Gastrocopta* (*Albinula*), contrary to Sandberger's original concept. Finding a series of specimens in the Miocene (MN5) deposits of Bełchatów (Central Poland), in our opinion conspecific with Sandberger's "*Pupa* (*Vertigo*) *suevica*", prompted us to discuss the previous opinions on the matter and recognize the latter name as the senior synonym of *Gastrocopta sandbergeri* sp. nov.

Institutional abbreviations.—IGS, Institute of Geological Sciences, National Academy of Sciences, Kiev, Ukraine; ISEA, Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Cracow, Poland; MNHN, Muséum national d'Histoire naturelle, Paris, France; MWNH, Museum Wiesbaden, Germany; SMF, Senckenberg Museum, Frankfurt a. M., Germany.

Other abbreviations.—MN, mammal zones; H, height of shell; h, height of aperture; W, width of shell; w, width of aperture.

Historical background

We attempted to locate Sandberger's type of *Pupa* (*Vertigo*) *suevica* and were only partially successful. One specimen labelled "*Pupa suevica*" was traced in Sandberger's collection at the Museum Wiesbaden by Michael Apel, the curator of the Naturwissenschaftliche Sammlung of the Museum (Fig. 1), but there is no evidence that it is original specimen mentioned by Sandberger (1875: 654).

It is not clear whether the Sandberger's specimen was examined by Boettger (1877, 1889) who mentioned three specimens of *Pupa suevica* from Steinheim at his disposal. Initially Boettger (1877: 194–195) regarded this nominal taxon as an intermediate one between *Pupa* (*Leucochila*) *gracilidens* Sandberger, 1875 and *P. (L.) didymodus* Sandberger, 1858, or even being more similar to *P.* (*L.*) *didymodus* and recognized it as a member of *Leucochila* instead of *Vertigo*. Later Boettger (1889: 279) described this nominal taxon and

thus validated it according to ICZN rules, but classified it as one of the varieties of *Leucochilus quadriplicatum* (Braun, 1851). Specimens designated as *Leucochilus quadriplicatum* mut. *suevica* Boettger, 1889 are kept at the Senckenberg Museum in Frankfurt am Main. In fact, this sample (SMF 152387) contains specimens of two different species, representing two subgenera: *Albinula* (two specimens) and *Sinalbinula* (one specimen) (personal examination of ES, 1994; Manganelli and Giusti 2000).

Miller (1900) examined Sandberger's specimen of *P. suevica* and mentioned that further forty specimens were present in the collection of Naturalien Kabinet (nowadays Staatliches Museum für Naturkunde in Stuttgart). The author (Miller 1900: 398–399, pl. 7: 16) supplied the first figure of this species supplemented by detailed description including variation of its apertural barriers and described a new form *Pupa suevica* var. *minor*. According to Michael Rasser (personal communication 2005), the curator of the invertebrate paleontological collections in the Museum, material preserved there possibly belongs to the collection mentioned by Miller (1900), and consists of *P. suevica* var. *minor* specimens only. Later Wenz (1923) proposed the latter taxon to be a synonym of *Pupa suevica* sensu Sandberger (1875). Miller (1900: 399, pl. 7: 17) also examined the specimens of *Pupa (L.) quadridentata* Klein, 1853 stating that Boettger's *Pupa* (*L.*) *quadriplicatum* mut. *suevica* lies within the variability range of *Pupa* (*L.*) *quadridentata* Klein, 1853 [= *Gastrocopta acuminata* (Klein, 1846)]. Moreover Miller (1900) pointed out that the *P. quadriplicatum* mut. *suevica* of Boettger (1889) is not conspecific with *P. suevica* of Sandberger (1875).

Gottschick and Wenz (1916: 65), disregarded Miller's (1900) paper and interpreted *Leucochila suevica* sensu Sandberger as a species of the *L. obstructa* (Sandberger, 1874) group. In the subsequent papers Gottschick, Wenz, and Edlauer (Gottschick and Wenz 1919: 13; Wenz and Edlauer 1942: 92) noted that shells of *L. suevica* varied in size and shape, being elongated to a different degree.

Schütt (1967: 208, fig. 13) identified *Gastrocopta suevica* (Sandberger, 1875) as an elongate, turreted shell with a forked parietoangular tooth though it appears to be *G. fissidens* (Sandberger, 1858), and later he repeated this misinterpretation (Schütt, 1985: 190, fig. 1). Papp (1974: 385, pl. 17: 9) followed Schütt (1967), hence his *G. suevica* (Sandberger, 1875) is similar to that recorded by Schütt from Hollabrunn. Schlickum (1979: 408, pl. 23: 5) presented a specimen of S*inalbinula* from Öcs as *G. suevica* sensu Boettger, 1889, and said it was similar to *G. fissidens infrapontica* Wenz, 1927. Lueger (1981: 27, pl. 2: 23, 24) synonymized *G. suevica* sensu Sandberger with *G. serotina* Ložek, 1964.

Zilch (1984: 159, pl.1: 2) designated one of the Boettger's specimens of *Albinula* as the lectotype of *G. suevica* (Boettger, 1889) (see Manganelli and Giusti 2000).

Finally, Finger (1998: 19, pl. 8: D–F) quite rightly classified elongate, large specimens (judging from his figures D, E, F and scale bars H = 2.7, 2.0 and 2.2 mm, respectively) from "der *kleini*-Schichten des Steinheimer Beckens"—type locality of Sandberger's "*Pupa* (*Vertigo*) *suevica*"—under the name *G. suevica* (Sandberger, 1874[sic!]). Finger (1998), like the other authors until review by Manganelli and Giusti (2000), was apparently unaware that *G. suevica* (Sandberger, 1875) is a *nomen nudum* and did not address the problem of its taxonomical status.

In conclusion: the lectotype of *Gastrocopta suevica* designated by Zilch (SMF 152387) is not conspecific with the specimen named by Sandberger (1875: 654) "*Pupa* (*Vertigo*) *suevica*", and examined by Miller (1900). Boettger (1889: 279) most probably misinterpreted *P. suevica* as a mutation of *Leucochilus quadriplicatum* (Braun, 1851), as argued by Miller (1900), and subsequent authors repeated this mistake. Finally, Manganelli and Giusti (2000: 78, pl. 6: 17) separated from among three Boettger's specimens housed at the Senckenberg Museum (SMF 152387/3) one paralectotype as *Gastrocopta* sp. which in our opinion is conspecific with Sandberger's "*Pupa* (*Vertigo*) *suevica*" as closely corresponding to the specimen from Sandberger's collection (Fig. 1, MWNH-22-2) and description by Miller (1900). Another specimen (MNHN 10815) of "*Pupa suevica*" sensu Sandberger, 1875 from Steinheim was discovered and examined by the senior author at the Museum National d'Histoire Naturelle (Paris), in Cossmann's collection. We failed to find out if that specimen was published or illustrated by Cossmann.

The name *Gastrocopta* (*Albinula*) *suevica* (Boettger, 1889) is supported by a sufficient description to fulfil the requirements of Art. 12 of the International Code of Zoological Nomenclature (1999), albeit the description concerns a form quite different from "*Pupa suevica*" Sandberger, 1875 *nomen nudum*. In such a situation the Sandberger's "*Pupa suevica*" should obtain a new name. We decided to erect a new species, which in our opinion is conspecific with "*Pupa* (*Vertigo*) *suevica*" sensu Sandberger (1875), basing on the specimens found in the Miocene deposits of Bełchatów (Stworzewicz 1999) as the repository of the Sandberger's type is unknown. The new specimens from Bełchatów are described here as *Gastrocopta sandbergeri* sp. nov. making Sandberger's "*Pupa* (*Vertigo*) *suevica*" a senior synonym of this new species.

Systematic paleontology

Superfamily Pupilloidea Turton, 1831
Family Chondrinidae Steenberg, 1925
Subfamily Gastrocoptinae Pilsbry, 1916
Genus *Gastrocopta* Wollaston, 1878

Diagnosis (after Pilsbry 1916).—The shell is rimate or perforate, cylindric or ovate-conic, having angular and parietal lamellae more or less completely united into one biramose, bifid, lobed or sinuous lamella (or rarely the angular lamella

is wanting). Columellar lamella present; palatal folds developed (except in *B. corticaria*). Lip well expanded.

Subgenus *Sinalbinula* Pilsbry, 1916

Diagnosis (after Pilsbry 1916).—Whitish, with plicae on a palatal callus. Parietal lamella straight inside, or curving towards the columella, its anterior end usually free, but sometimes the angular and parietal lamellae are concrescent into a single sinuous lamella. Columellar lamella horizontal, or with the inner end curved downward.

Remarks.—Although the subgeneric division of *Gastrocopta* is questioned by Solem (1988) and Pokryszko (1996), it is currently accepted by most authors (cf. Manganelli and Giusti 2000).

Gastrocopta (*Sinalbinula*) *sandbergeri* sp. nov.

Figs. 1, 2A–E.

1875 *Pupa* (*Vertigo*) *suevica* sp. nov.; Sandberger 1875: 654 (*nomen nudum*).

1877 *Pupa suevica* Sandberger; Boettger 1877: 194, 195 (*nomen nudum*); non *Leucochilus quadriplicatum* mut. *suevica* Sandberger; Boettger 1889: 279 [= *Gastrocopta suevica* (Boettger, 1889)].

1900 *Pupa* (*Leucochilus*) *suevica* Sandberger, 1875; Miller 1900: 398, pl. 7: 16.

1900 *Pupa* (*Leucochilus*) *suevica* var. *minor*; Miller 1900: 398.

1919 *Leucochila suevica* (Sandberger, 1875); Gottschick and Wenz 1919: 13, pl. 1: 24–25.

1998 *Gastrocopta suevica* (Sandberger, 1874); Finger 1998: 19, pl. 8: D?, E, F.

1999 *Gastrocopta suevica* (Sandberger, 1875); Stworzewicz 1999: 164, fig. 62.

2000 *Gastrocopta* sp.; Manganelli and Giusti 2000: pl. 6: 17.

Fig. 1. *Pupa suevica* sensu Sandberger (= *Gastrocopta sandbergeri* sp. nov.) from the Sandberger's collection (MWNH-22-2), Miocene (Astaracian, MN7), Steinheim. Photograph by Fritz Geller-Grimm.

Type material: Holotype: ISEA Ml/1033/98a and 19 paratypes ISEA Ml/1033/98b.

Type locality: The brown coal mine in Bełchatów (51°15´N, 19°20´E).

Type horizon: Beł-B horizon, Miocene, MN5.

Derivation of name: The species is named in honour of C.L. Fridolin Sandberger.

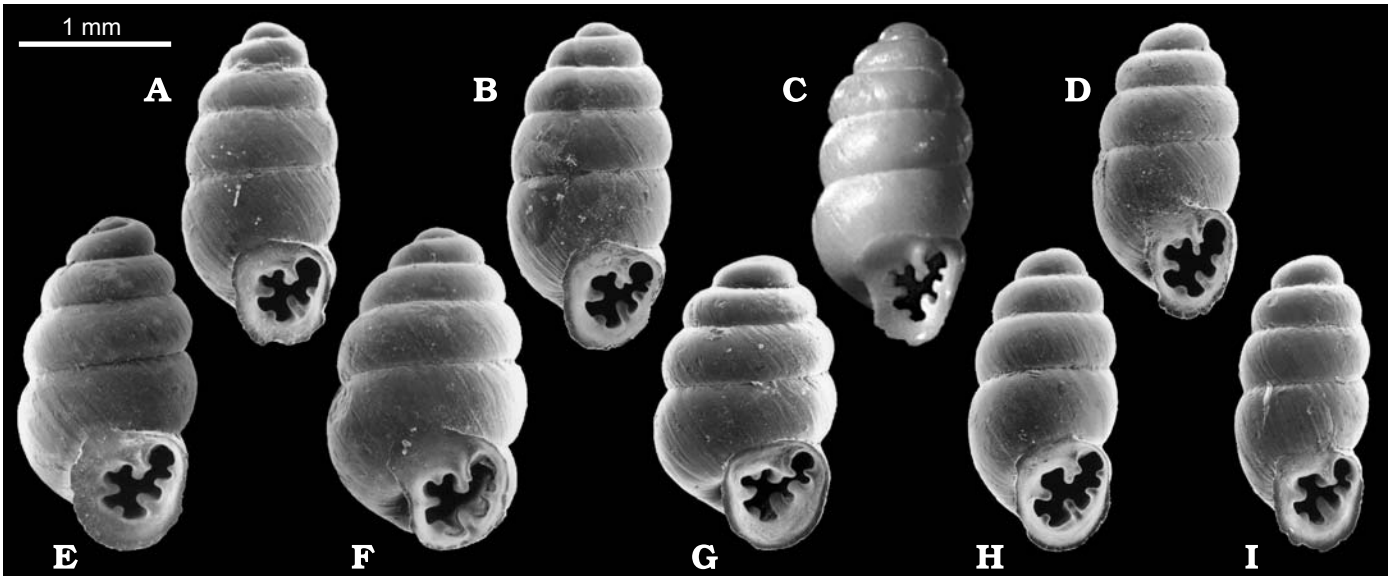

Fig. 2. **A**, **B**. *Pupa suevica* sensu Sandberger (= *Gastrocopta sandbergeri* sp. nov.) from Steinheim, Germany, Miocene, H = 2.06 (**A**) and 2.11 mm (**B**); IGS. **C**. *Pupa suevica* sensu Sandberger 1875, *nomen nudum* (= *Gastrocopta sandbergeri* sp. nov.) from Steinheim, Germany, Miocene, H = 2.05 mm; MNHN. **D**, **E**. *Gastrocopta sandbergeri* sp. nov. from Bełchatów, Miocene, H = 1.90 (D, Ml/1033/98b) and 2.14 (E, holotype, Ml/1033/98a); ISEA. **F**. *Gastrocopta nouletiana* (Dupuy, 1850) from Bełchatów, Miocene, Ml/1031/98, H = 2.23 mm; ISEA. **G**. *Gastrocopta serotina* Ložek, 1964 from Ctiněves-Hýkovina, Czech Republic, Early Pleistocene, ML/567/75, H = 2.00 mm; ISEA ex coll. Ložek. **H**. *Gastrocopta theeli* (Westerlund, 1877) from Northern Caucasus, Recent, H = 1.92 mm; IGS. **I**. *Gastrocopta pseudotheeli* Steklov, 1966 from Fars, Northern Caucasus, Miocene, 3842/50, H = 1.85 mm; IGS.

Additional material.—Steinheim, Miocene (MN7+8), 1 specimen MW, ex coll. Sandberger; 6 specimens IGS, Steklov's material ex coll. Schlickum; 1 specimen SMF 152387/3 ex coll. Boettger; 1 specimen MNHN 10815 ex coll. Cossmann.

Diagnosis.—The new species differs from all the remaining species of the subgenus *Sinalbinula* in having ovate-conical but always slender shell, a weak crest on the body whorl (with tendency to reduce) and generally weak apertural barriers. Specimens with somewhat larger apertural barriers show some similarity to *G. nouletiana* (Dupuy, 1850), but the elongate shell shape, smaller size, less convex whorls and distinctly weaker crest on the body whorl in *G. sandbergeri* easily separate the two species. The new species differs from the group of very slender species, such as *G. didymodus* (Sandberger, 1858), *G. fissidens* (Sandberger, 1858), and *G. obstructa* (Sandberger, 1874), in that the parietal and angular portion of parietoangular tooth are partly fused (three latter species have a cylindrical shells with angular more or less distinctly separated from parietal). Compared to *G. pseudotheeli* Steklov, 1966 the new species has somewhat similar parietoangular tooth but the former species is distinguished immediately in having a solid crest on the body whorl.

Description.—Shell ovate-conical, usually slender, of 4.8–5.5 moderately convex or somewhat flattened whorls. Surface irregularly, weakly striated or nearly smooth; striae sometimes more regular and more visible on the body whorl. Suture rather shallow. Body whorl equal to or slightly exceeding half shell height; last part of body whorl slightly ascending just before aperture, at the base somewhat narrowed, provided with a weak ridge situated a short distance behind the peristome (crest), rarely vestigial to absent. Umbilicus narrow, deep, open or partly covered with the body whorl. Aperture rounded triangular to almost circular, lip reflected. Parietal callus usually thinner than the rest of the lip. In aperture 7 teeth (rarely 6): parietoangular, infraparietal, columellar, basal and 3 (rarely 2) palatal. Parietoangular tooth: parietal portion short lamellate, subvertical, sometimes with thickened edge; angular portion somewhat shorter than parietal, thin and low, its inner end with slightly thickened tip, in front view bent palatalwards. Most specimens have a slight convexity situated on the left side of the middle part of parietoangular to make the angular portion triangular in outline. Infraparietal tooth as an elongate tubercle, situated half way between the parietoangular and parietal/columellar corners. Columellar tooth well developed, short lamellate, subhorizontal in front view, relatively deep-situated. Basal tooth knob-shaped, in basal or columellar/basal position. Among palatal teeth the lower is the biggest; upper very short; suprapalatal vestigial or absent. Callus at the base of palatal teeth developed to varying degrees; from nearly invisible in specimens from Steinheim to more or less distinct in specimens from Bełchatów.

Dimensions.—Measurements (see Table 1 for individual measurements and those of comparative material) of 20 specimens from Bełchatów (in mm); shell: H = 1.90–2.17, W = 1.02–1.09; aperture: h = 0.71–0.80, w = 0.66–0.77; H of body whorl = 1.08–1.25; number of whorls: 4.8–5.5.

Table 1. Measurements of some specimens from Bełchatów and Steinheim (in mm, holotype in bold).

Locality and institutional abbreviation	Shell		Aperture		H/W ratio
	height	width	height	width	
Bełchatów sample Beł-B	1.90	1.02	0.71	0.66	1.86
	1.99	1.05	0.75	0.70	1.89
	2.05	1.06	0.75	0.72	1.93
	2.11	1.08	0.74	0.67	1.95
	2.14	**1.09**	**0.80**	**0.77**	**1.96**
	2.17	1.09	0.71	0.68	1.99
Steinheim, IGS	1.87	0.98	0.70	0.63	1.90
	2.05	1.05	0.65	0.67	1.95
	2.06	1.08	0.72	0.68	1.90
	2.11	1.07	0.64	0.60	1.97
	2.15	1.04	0.68	0.63	2.06
	2.17	1.13	0.75	0.72	1.92
Steinheim, MNHN	2.05	1.10	0.70	0.66	1.86
Steinheim, according to Finger (1998)	2.70	1.25	–	–	2.16
	2.00	1.00	–	–	2.00
	2.20	1.05	–	–	2.09
Steinheim, after Giusti and Manganelli (2000)	2.35	1.30	0.85	0.80	1.80

Variability and comparative remarks.—Shell measurements indicate that *Gastrocopta sandbergeri* is rather variable in shell height, but the shell is always elongate. A weak crest is always visible in specimens from Steinheim but rarely in specimens from Bełchatów. Shells from Bełchatów have more convex whorls and somewhat more robust apertural barriers than those from Steinheim. Only one of the 20 specimens from Bełchatów lacks an infraparietal tooth. By contrast, in specimens from Steinheim it is the suprapalatal tooth that tends to get reduced. The Bełchatów specimens also have a distinct callus at the base of palatal teeth, particularly of the upper one.

Gastrocopta sandbergeri differs from *G. nouletiana* (Dupuy, 1850)—even from small specimens and also those previously regarded as a slimmer form *gracilidens*—in the following characters: (1) more slender shell (H/W ratio in 20 *nouletiana* specimens = 1.55–1.88, mean 1.73; in 20 *sandbergeri* specimens = 1.80–2.16, mean 1.95); (2) distinctly weaker crest on the body whorl; (3) apertural barriers generally weaker developed. In some specimens of *G. nouletiana* from various localities the parietoangular tooth may be rather weakly developed, as in *G. sandbergeri*, but the shell shape and size easily separate the two species (Fig. 2F). The new species can not also be confused with *Gastrocopta serotina* Ložek, 1964 (Fig. 2G) as the latter species is most similar to *G. nouletiana*.

Compared to the group of species with very slender and cylindrical shells, such as *G. didymodus* (Sandberger, 1858), *G. fissidens* (Sandberger, 1858) and *G. pseudotheeli* Steklov, 1966 (Fig. 2I), as well as *G. theeli* (Westerlund, 1877) (Fig. 2H) – *G. sandbergeri* differs rather clearly in having a less slender, ovate shell, less convex whorls, a distinctly shallow suture and an infraparietal tooth present (cf. Prisyazhnyuk 1977). In addition, *G. fissidens* and *G. pseudotheeli* both have a very distinct crest. The parietal and angular portions of the parietoangular tooth in *G. fissidens* are partly separated, with the angular portion distinctly bent towards the palatal wall.

Another very slender species—*G. obstructa* (Sandberger, 1874)—differs from *G. sandbergeri* for the slender shell, the whorls which are fairly convex and distinctly oblique, and for the reduced apertural barriers (suprapalatal and infraparietal teeth absent). The columellar wall in *G. obstructa* is distinctly oblique, so that its upper section is deflected from the shell axis towards the parietoangular tooth, resulting in a very much narrowed parietal margin between the tooth and the columellar/parietal junction; the space is too narrow for an infraparietal tooth.

Gastrocopta sandbergeri sp. nov. is a rare species in Miocene deposits. It was hitherto known only from Steinheim am Albuch (as *Pupa suevica* Sandberger, 1875) dated from the Mid Miocene (Astaracian, MN7+8), hence its occurrence in Bełchatów (Beł-B horizon, Orleanian, MN5) shifted its stratigraphic range to the Lower/Mid Miocene limit.

Acknowledgements

We thank Beata M. Pokryszko (Museum of Natural History, Wrocław University, Poland) and Professor Robert A.D. Cameroon (University of Sheffield, United Kingdom) for critical reading of the earlier version of the manuscript and revising the English, Maria Nowogrodzka-Zagórska (Jagiellonian University, Kraków, Poland) for preparing the SEM photos, Agnès Lauriat-Rage (Muséum national d'Histoire naturelle, Paris, France) for the loan of the specimen from Cossmann's collection, Michael Apel (Museum Wiesbaden, Germany) and Michael Rasser (Staatliches Museum für Naturkunde, Stuttgart, Germany) for help in search of Sandberger's *Pupa suevica* material, and Fritz Geller-Grimm (Museum Wiesbaden, Germany) for taking the photographs of Sandberger's specimen. We are sincerely grateful to two reviewers, Folco Giusti (Università di Siena, Italy) and Jonathan Todd (Natural History Museum, London, England) for their constructive comments on the manuscript.

References

Boettger, O. 1877. Ueber die Fauna der Corbicula-Schichten im Mainzer Becken. *Palaeontographica* 24: 185–219.

Boettger, O. 1889. Die Entwicklung der Pupa-Arten des Mittelrheingebietes in Zeit und Raum. *Jahrbücher des Nassauischen vereins für Naturkunde* 42: 225–327.

Braun, A. 1851. Darstellung der geognostischen Verhältnisse des Mainzer Beckens und seiner fossilen Fauna und Flora. *In*: F.A. Walchner (ed.), *Handbuch der Geognosie zum Gebrauche bei seinen Vorlesungen und zum Selbststudium mit besonderer Berücksichtigung der geognostischen Verhältnisse des Grossherzogthums Baden*, 1121–1169. Christian Theodor Gross, Karlsruhe.

Dupuy, D. 1850. Description de quelques espèces de coquilles terrestres fossils de Sansan. *Journal de Conchyliologie* 1: 300–313.

Finger, I. 1998. Gastropoden der *kleini*-Schichten des Steinheimer Beckens (Miozän, Süddeutschland). *Stuttgarter Beiträge zur Naturkunde Ser. B* 259: 1–51.

Gottschick, F. and Wenz, W. 1916. Die Sylvanaschichten von Hohenmemmingen und ihre Fauna. *Nachrichtsblatt der Deutschen Malakozoologischen Gesellschaft* 48: 55–74.

Gottschick, F. and Wenz, W. 1919. Die Land- und Süsswassermollusken des Tertiärbeckens von Steinheim am Aalbuch. I. Die Vertiginiden. *Nachrichtsblatt der Deutschen Malakozoologischen Gesellschaft* 51: 1–23.

Klein, A. von. 1846. Conchylien der Süsswasserkalkformation Württembergs. *Jahreshefte des Vereins für vaterländische Naturkunde in Württemberg* 2: 60–116.

Klein, A. von 1853. Conchylien der Süsswasserkalkformation Württembergs. *Jahreshefte des Vereins für vaterländische Naturkunde in Württemberg* 9: 203–223.

Ložek, V. 1964. Neue Mollusken aus dem Altpleistozän Mitteleuropas. *Archiv für Molluskenkunde* 93: 193–199.

Lueger, J.P. 1981. Die Landschnecken im Pannon und Pont des Wiener Beckens. *Österreichische Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Klasse, Denkschriften* 120: 1–124.

Manganelli, G. and Giusti, F. 2000. The gastrocoptids of the Fossil Forest of Dunarobba (Central Italy) and a preliminary revision of the European Tertiary nominal species of *Albinula* and *Vertigopsis* (Gastropoda Pulmonata: Gastrocoptidae). *Bolletino della Societa Paleontologica Italiana* 39: 55–82.

Miller, K. 1900. Die Schneckenfauna des Steinheimer Obermiocäns. *Jahreshefte des Vereins für vaterländische Naturkunde in Württemberg* 56: 385-406.

Papp, A. 1974. Landschnecken im Sarmatien der Zentralen Paratethys. *Chronostratigraphie und Neostratotypen. Miozän der Zentralen Parathetys* 4: 377–395.

Pilsbry, H.A. 1916–1918. *Manual of Conchology, Second Series: Pulmonata.* 24. 380 pp. Conchological Department, Academy of Natural Sciences of Philadelphia, Philadelphia.

Pokryszko, B.M. 1996. The Gastrocoptinae of Australia (Gastropoda: Pulmonata: Pupilloidea): systematics, distribution and origin. *Invertebrate Taxonomy* 10: 1085–1150.

Prisyazhnyuk, V.A. [Prisâžnûk, V.A.] 1977. Miocenovi gastrocopti Ukraini. *In*: *Materiali do paleontologiï kajnozoû Ukraïni,* 36–46. Naukova Dumka, Kiïv.

Sandberger, C.L.F. 1858–1863. *Die Conchylien des Mainzer Tertiärbeckens.* 458 pp. C.W. Kreidel's Verlag, Wiesbaden.

Sandberger, C.L.F. 1870–1875. *Die Land- und Süsswasser-conchylien der Vorwelt.* 1000 pp. C.W. Kreidel's Verlag, Wiesbaden.

Schlickum, W.R. 1979. Zur oberpannonen Molluskenfauna von Öcs, II. *Archiv für Molluskenkunde* 109: 407–415.

Schütt, H. 1967. Die Landschnecken der untersarmatischen Rissoenschichten von Hollabrunn, N.-Ö. *Archiv für Molluskenkunde* 96: 199–222.

Schütt, H. 1985. Känozoische Landschnecken der Türkei (Känozoikum und Braunkohlen der Türkei, Nr. 25). *Archiv für Molluskenkunde* 115: 179–223.

Solem, A. 1988. Non-camaenid land snails of the Kimberley and Northern Territory, Australia I. Systematics, affinities and ranges. *Invertebrate Taxonomy* 4: 455–604.

Steenberg, C.M. 1925. Études sur l'anatomie et la systématique des maillots

(Fam. Pupillidae s.lat.). *Videnskabelige Meddelelser fra Dansk naturhistorisk Forening i Kjøbenhavn* 80: 1–211.

Steklov, A.A. 1966. *Nazemnye mollûski neogena Predkavkaz'â i ih stratigrafičeskoe značenie*. 262 pp. Nauka, Moskva.

Stworzewicz, E. 1999. Miocene land snails from Bełchatów (Central Poland), IV: Pupilloidea (Gastropoda Pulmonata). Systematic, biostratigraphic and palaeoecological studies. *Folia Malacologica* 7: 133–170.

Turton, W. 1831. *A manual of the land and fresh-water shells of British Islands, arranged according to the more modern systems of classification and described from perfect specimens in the author's cabinet with coloured plates of every species.* 150 pp. Longman, London.

Wenz, W. 1923. Gastropoda extramarina tertiaria. *In*: C. Diener (ed.), *Fossilium Catalogus I: Animalia* 23: 1735–1862. W. Junk, Berlin.

Wenz, W. 1927. Weitere Beiträge zur Fauna der pontischen Schichten von Leobersdorf. *Senckenbergiana* 9: 41–48.

Wenz, W. and Edlauer, A. 1942. Die Molluskenfauna der oberpontischen Süsswassermergel vom Eichkogel bei Mödling, Wien. *Archiv für Molluskenkunde* 74: 82–98.

Westerlund, C.A. 1877. Sibiriens Land- och Sötvatten-Mollusker. *Kongliga Svenska Vetenskaps-Akademiens Handlingar (ser. II)* 14: 1–111.

Wollaston, T.V. 1878. *Testacea Atlantica or the land and freshwater shells of the Azores, Madeiras, Salvages, Canaries, Cape Verdes and Saint Helena.* 588 pp. Reeve & Co., London.

Zilch, A. 1984. Die Typen und Typoide des Natur-Museums Senckenberg, 74: Mollusca: Pupillacea (4): Chondrinidae: Gastrocoptinae, Hypselostomatinae, Aulacospirinae. *Archiv für Molluskenkunde* 115: 151–177.