New Freshwater molluscs from Crete, Greece
(Gastropoda: Hydrobiidae, Bythinellidae, Valvatidae)

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Abstract
The syntype of Pseudamnicola brachia (Westerlund, 1886), the only known Pseudamnicola sp. from Crete, is compared with a recently collected Pseudamnicola sp. which could be identified as a species new to science. Comparisons with data in the literature show us that P. brachia (Westerlund, 1886) has nothing in common with P. brachia sensu Schütt, 1980 as well as P. brachia sensu Szarowska et al., 2015, but both are possibly conspecific with the new species which is described here.

In addition we describe two new Bythinella spp. from Crete which could be found in addition to B. cretensis Schütt, 1980, and a new Valvata (Tropidina) sp. from Lake Kournas.

Key words: Pseudamnicola, Greece, Crete, anatomy, Pseudamnicola brachia, Bythinella, Valvata.

Introduction
Many Pseudamnicola species have been found in the Aegean Islands as reported by Szarowska et al. (2015), Radea et al. (2015) and Glöer et al. (2018). In all cases these species are regional endemics. One part of our study was to identify Pseudamnicola brachia (Westerlund, 1886), the only Pseudamnicola sp. known so far from Crete. We found several populations of Pseudamnicola sp. and compared them with specimens presented in literature.

Formerly only one species of the genus Bythinella, B. cretensis Schütt, 1980, was known from Crete. Benke et al. (2011) sequenced the only sample of a Bythinella sp. from Crete they had, as B. cretensis, but unfortunately they did not collect the species from type locality. Szarowska et al. (2016) could show that there are more than one Bythinella spp. inhabiting Crete, as they found three distinct clades, but they incorrectly used the sampling site of Benke et al. (2011) as the supposed type locality of B. cretensis.

From the holarctic Valvatidae Gray, 1840, five species have been mentioned from Greece: Valvata (Valvata) cristata O.F. Müller, 1774, V. (Cincinna) piscinalis (O.F. Müller, 1774), V. (Tropidina) macrostoma Mörch, 1864 (= V. pulchella Studer, 1820), and the endemic species V. (Cincinna) theotokii Locard, 1889 from Corfu, and V. (Cincinna) klemmi Schütt, 1962 from Lake Trichonis. Bank & Neubert, 2017. Valvata (Tropidina) macrostoma has been mentioned by Bank (2004: 57) and Bank & Neubert (2017) only from mainland Greece. Recently H-JH collected Valvata (Tropidina) sp. from Lake
Kournas, which looks at first glance like *V. macrostoma*. As the width of the umbilicus is suggested to be an important feature to distinguish between *Valvata* spp. (Vinarski et al., 2013), we compared the umbilicus of our material with *V. macrostoma* from Central Europe.

**Material and Methods**

During field trips in 2014, 2015 and 2016 we checked more than twenty springs for the occurrence of freshwater molluscs. If present, living snails were collected by hand by Andrea and Hans-Jürgen Hirschfelder, in part also by Theresia and Klaus Kittel, and fixed in 75% ethanol. Also the biggest freshwater lake of the island, Lake Kournas, was investigated, mainly the outflow at the northern end. Many empty shells of several species were deposited there.

To evaluate the current material we needed to review the historical material. To this end we were able to borrow the syntype of *Pseudamnicola brachia* from Westerlund’s collection (NHMG, Göteborg) and obtain photos of the holotype and paratypes of *Bythinella cretensis* (SMF, Frankfurt a. Main).

The dissections and measurements of the genital organs and the shells were carried out using a stereo microscope (Zeiss). The type material is stored in the Zoological Museum of Hamburg (ZMH), Germany, whilst some paratypes are deposited in the private collections of the authors. The anatomical and shell photos were made with a digital camera system (Leica R8).

**Results**

We collected specimens of the genus *Pseudamnicola* Paulucci, 1878 in six springs and specimens of the genus *Bythinella* Moquin-Tandon, 1856 in ten springs. Recently one species of the genus *Planorbis* O.F. Müller, 1773 was detected and described as a new species (Glöer & Hirschfelder, 2015). At Lake Kournas, we collected several species of molluscs but no living specimens were found. After examination of the material collected we suspected a higher diversity of the freshwater mollusc fauna of Crete than previously thought.

Comparisons between our *Pseudamnicola* material and the syntype showed considerable differentiation. Specimens presented in literature which are very similar to ours were obviously misidentified. Thus we found an additional *Pseudamnicola* sp. and describe this species here as new to science. The holotype and one paratype are depicted in addition to the penis, which is characteristic for the genus.

The collected material of the genus *Bythinella* was compared with the original description of *Bythinella cretensis* Schütt 1980. We found three different species. We describe herein two *Bythinella* spp. new to science. The comparison with Szarowska et al. (2016) showed that two of these species correspond very well with two of their proposed clades, the third species is totally new, and from the third clade in Szarowska et al. (2016) we had no material.

The comparison with *Valvata macrostoma* from Central Europe revealed that the *Valvata* sp. from Lake Kournas is a species new to science which is described herein.

In summary, at least two species of *Pseudamnicola*, four species of *Bythinella* and one species of *Valvata* live on the island of Crete.

**Taxonomic part**

Family **Hydrobiidae** Stimpson, 1865

Genus **Pseudamnicola** Paulucci, 1878

Type species: *Bithynia lucensis* Issel, 1866
**Pseudamnicola brachia** (Westerlund, 1886) (Fig. 1, 3)

Type locality: *Creta*.

**Remarks:** The original description (Fig. 1) corresponds with the syntype of Westerlund’s collection (Fig. 3). Unfortunately Westerlund did not mention the exact type locality on Crete in his description. On the label only the town of Candia is noted which is the older name of the capital Iráklio.

The specimens collected by H-JH do not correspond with the original description nor with the picture of the syntype of *Pseudamnicola brachia* of Westerlund’s collection: “Gew. dick u. kurz, eifg., stumpf; Umg. 4, schnell zunehmend, die oberen ziemlich, der vorletzte stark gewölbt, der letzte gross u. bauchig, gleich hoch wie das Gew., an der tief eingeschnürten Naht quer abgesetzt; Münd. eifg., Aussenrand stark bogig, Spindelrand unten gerade u. frei, oben umgeschlagen u. kurz angeheftet. G. 21½ : 2 mm. (*Creta.*)”

The specimens collected by H-JH do not correspond with the original description nor with the picture of the syntype of *Pseudamnicola brachia* of Westerlund’s collection: “Gew. dick u. kurz, eifg., stumpf ...”. This translates to: “spire broad, short ovate, obtuse ...”. And the difference becomes particularly visible if we compare the type with a subadult specimen of *Pseudamnicola occulta* n. sp. of the same size (Figs. 3, 4).

**Figure 1.** Faksimile of the original description and the label of the syntype (fig. 3) of Westerlund’s collection.

**Figure 2.** The sampling sites of the studied material of *Pseudamnicola* spp. on Crete, Greece. Black dot: Iráklio (= Kandia), syntype of *Pseudamnicola brachia* (Westerlund, 1886) in coll. Westerlund; 1: Topólia, type locality of *Pseudamnicola occulta* n. sp.; green dot: Spíli, paratype locality of *Pseudamnicola occulta* n. sp.; red dots: additional material of *Pseudamnicola occulta* n. sp.; 2 = Myrthios, 3 = Amári Valley between Méronas and Amári, 4 = Zou, 5 = Zákros; blue dot: Almyros spring in Georgióupoli, sampling site of *Pseudamnicola* sp. in Szarowska et al. (2015), see Figs. 5, 6; yellow dot: Almira spring near Chaniá, sampling site of *Pseudamnicola* sp. in Schütt (1980, Fig. 29).
Figures 3-6. The Pseudamnicola spp. from Crete. 3: Syntype of *P. brachia*, 4: subadult shell of *Pseudamnicola occulta* n. sp. of same size as *P. brachia*, 5: *Pseudamnicola* sp. from the publication of Szarowska *et al.* (2015, Fig. 7 C) and 6: as well as a penis (Fig. 10 L).

Schütt (1980: 133) listed *Pseudamnicola brachia* from many sampling sites on Crete, also from Spíli but not from Topólia. If we compare his photos with *P. occulta* n. sp. we see that Schütt had possibly the new species in hand, but not *P. brachia*. Also the photos presented in Szarowska *et al.* (2015) correspond very well with *P. occulta* n. sp. (see Figs. 7-10).

*Pseudamnicola occulta* n. sp. (Figs. 4-10)

**Type material:** Holotype (ZMH 140042): Shell height 3.4 mm, shell width 2.4 mm. Paratypes: from the type locality Topólia: ZMH (140043), coll. Hirschfelder (3 in ethanol, 4 dried), coll Glöer (2 in ethanol); from sampling site 2 Spíli: ZMH (140044), shell height 2.7 mm, shell width 2.1 mm (dried, Fig. 4), coll. Hirschfelder (14 in ethanol, 14 dried), coll. Kittel (4).

**Type locality:** Crete, Nómos Chaniá, Topólia, 9 km south of Kissamos, captured spring in village, 35°25′46.4″ N, 23°41′07.1″ E, alt. 260 m asl., 16.10.2014 Andrea and Hans-Jürgen Hirschfelder leg. (Figs. 11, 12). This spring is also type locality of *Planorbis cretensis* Glöer & Hirschfelder, 2015.

**Sampling site 2 (Paratypes):** Crete, Nómos Réthymnon, Spíli (17 km south of Réthymnon), spring-fed brook next to the Venetian Fountain (Lion Fountain), 23°13′04.8″ N, 24°32′10.7″ E, alt. 417 m asl., 13.10.2014 Andrea and Hans-Jürgen Hirschfelder leg. (Fig. 13); together with *Bythinella magdalenae* n. sp. and *Theodoxus saulcyi* (Bourguignat, 1852).

Figures 7-10. *Pseudamnicola occulta* n. sp. from Crete. 7: adult shell from Topólia (holotype) and 8: penis in situ (*s* = snout), 9: adult shell from Spíli (paratype) and 10: penis in situ.
Etymology: The new species is named *P. occulta* which means “hidden”. It has already been found by several authors but erroneously recognized as *P. brachia*. So the new species was “hidden” behind a wrong name for a long time.

**Description**

*Shell:* The brownish shell is glossy, conical to elongated conical with 4.5 convex whorls and a deep suture. The aperture is ovate, slightly oblique, with a sharp peristome which is thickened at the columella. The apex is pointed. The umbilicus is open. The shell is 2.7-3.4 mm high and 2.0-2.3 mm broad.

*Animal:* The animal is dark brown pigmented, with greyish tentacles. The penis is cylindrical with a broad basis and an obtuse penis tip.

**Differentiating characters:** The spire in *Pseudamnicola occulta* n. sp. is higher than in *P. brachia*, the whorls are more convex and the suture is deeper. In addition *P. occulta* n. sp. is much larger than *P. brachia*.

Figures 11-13. 11, 12: The captured spring in Topólía, type locality of *Pseudamnicola occulta* n. sp. 13: Andrea Hirschfelder collecting paratypes of *Pseudamnicola occulta* n. sp. at sampling site 2 in Spíli.

**Additional material:** In the following springs *P. occulta* n. sp. probably lives as well. The collected specimens correspond with the type series but are not treated as paratypes because only dry material could be examined and no anatomical investigation was made:

Sampling site 3: Crete, Nómos Réthymnon, Myrthios, 1 km north of Plakiás, spring below the wash house, 22.10.2014 Andrea and Hans-Jürgen Hirschfelder, Klaus Kittel leg.; together with *Melanopsis buccinoidea* (Olivier, 1801);

Sampling site 4: Crete, Nómos Réthymnon, Amári valley, 8.4 km east of Spíli, spring along the road 1.6 km from Mémonas towards Amári, 19.04.2016 Andrea and Hans-Jürgen Hirschfelder leg.;
Sampling site 5: Crete, Nómos Lasíthi, fountain in Zou, 6 km south of Sitía, 29.04.2015 Andrea and Hans-Jürgen Hirschfelder, Klaus Kittel leg. (Fig. 35); together with *Bythinella sitiensis* n. sp. (type locality), *Melanopsis buccinoidea* and *Theodoxus saulcyi*;

Sampling site 6: Crete, Nómos Lasíthi, Zákros, Zákros Spring at the western edge of the village, small gutter beside the big source, 29.04.2015 Andrea and Hans-Jürgen Hirschfelder, Klaus Kittel leg. (Fig. 36); together with *Bythinella sitiensis* n. sp. and *Theodoxus saulcyi*.

**Distribution:** *P. occulta* n. sp. is known from several springs in western, central and eastern Crete and is probably widely distributed in the island.

**Remarks:** During our visit on Crete we found no *Pseudamnicola* in springs in the vicinity of Iráklio, i.e. in the big source of Almyros river 8 km west of the town center of Iráklio. Therefore the exact type locality and the distribution of the “true” *P. brachia* (Westerlund, 1886) remains further unknown.

Family *Bythinellidae* Locard, 1893

Genus *Bythinella* Moquin-Tandon, 1856
Type species by designation: *Bulimus viridis* Poiret, 1801

*Bythinella cretensis* Schütz, 1980 (Figs. 14-18)
**Type locality:** “Insel Kreta: Quellbach in Mesa Potami, 25°31’ N, 35°13’ E, 900 m NN, 11.2-14.1 °C.
[Remark: Schütz confused the coordinates N/E]

**Figures 14-18. Bythinella cretensis.** 14: Holotype, 15: specimen from Exo Potami, 16: specimen from Meso Potami (topotype), 17: penis in situ, 18: penis with tubular gland. Abbreviations: e = eye, p = penis, pa = penial appendix, t = tentacle, tg = tubular gland.

**Description:**

*Shell:* The shell is cylindrical with a small apex. The 4-4.5 whorls are slightly convex with a deep suture. The body whorl is prominent, especially in height. The aperture is ovate, narrowed at the top, with a peristome thickened at the columella. The umbilicus is slit-like to closed. The shell is up to 3.3 mm high and 1.5-2.0 mm broad.

*Animal:* The penis is shorter than the penial appendix. The tubular gland has the same width over the full length.

**Sampling sites** (numbers refer to the map in Fig. 19):
4: Crete, Nómos Lasíthi, Meso Potámi (type locality), spring 500 m W of the village, 05.05.2015 Andrea and Hans-Jürgen Hirschfelder, Klaus Kittel leg.; together with *Ancylus fluviatilis* (O.F. Müller 1774) (Figs. 29, 30).
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5. Crete, Nómos Lasíthi, Exo Potámi (2.4 km E of Meso Potámi), fountain (two pipes) and outflow into a small water basin, 05.05.2015 Andrea and Hans-Jürgen Hirschfelder, Klaus Kittel leg. (Fig. 31). This spring is identical to sampling site K07 in Szarowska et al. (2016).

6: Crete, Nómos Lasíthi, Sarakina spring 800 m W of Males (8.8 km N of Mýrtos), 23.04.2015 Andrea and Hans-Jürgen Hirschfelder, Klaus Kittel leg. (Fig. 31).

A very small Bythinella population was also found 5 km W of Meso Potámi in a seeping spring at the monastery Kardiotisa, but the sample was too small for anatomical investigation. So the status of this population remains unknown.

**Distribution:** Lasíthi highlands and east central Crete.

**Remarks:** For discussion see under Bythinella sitiensis n. sp.

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**Figure 19.** The sampling sites of the studied material of Bythinella spp. on Crete. 1-3: Bythinella magdalenae n. sp.; 1: Argiroúpoli (type locality), 2: Ano Méros, 3: Axós; 4-6: Bythinella cretensis: 4: Meso Potámi, 5: Exo Potámi, 6: Sarakina spring; Bythinella sitiensis n. sp.: 7: Zou, 8: Zákros.

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**Bythinella magdalenae n. sp.** (Figs. 20-24)

**Type material:** Holotype (ZMH 140045): Shell height 2.7 mm, shell width 1.7 mm. Paratypes: from type locality Argiroúpoli (ZMH 140046, 3 in ethanol), coll. Glöer (2 in ethanol), coll. Hirschfelder (8 in ethanol, 8 dried); from sampling site 2 Ano Méros ZMH (140047, 1 dried, 2 in ethanol), coll. Hirschfelder (6 in ethanol, 1 dried); from sampling site 3 Axós (ZMH 140048, 1 penis, 1 dry), coll. Hirschfelder (4 in ethanol, 2 dried), coll. Kittel (11 dried).

**Type locality:** Crete, Nómos Réthymnon, Argiroúpoli (14 km SW of Réthymnon), captured spring below the “Church of the Holy Five Virgins”, 35°17’35.2" N, 24°20’33.0" E, alt. 195 m asl., 12.10.2014 Andrea and Hans-Jürgen Hirschfelder, Klaus Kittel leg. (Fig. 32); B. sitiensis n. sp. feeds on fallen leaves of Platanus orientalis.

**Etymology:** The new species is named in honour of Magdalena Szarowska (Kraków, Poland). She was the first who recognized a greater diversity in the genus Bythinella on Crete.

**Sampling site 2 (Paratypes):** Crete, Nómos Réthymnon, Ano Méros (25 km SW of Réthymnon), captured spring 2.9 km NW of Ano Méros along the road to Gerakári, 19.04.2016 Andrea and Hans-Jürgen Hirschfelder. B. magdalenae lives only in a small outflow beside the main source (Fig. 33).
Sampling site 3 (Paratypes): Crete, Nómos Réthymnon, Axós (33 km E of Réthymno), spring 500 m W of the village along the road to Enagron Ecotourism Village, 35°18’37.4” N, 24°50’14.0” E, alt. 430 m asl., 03.05.2016 Hans-Jürgen Hirschfelder, Theresia Kittel leg. (Fig. 34); together with *Melanopsis buccinoidea*.

**Figures 20-24.** *Bythinella magdalenae* n. sp. from Crete. 20: Holotype, 21: Ano Méros (paratype), 22: penis in situ of no. 21, 23: Argiroúpoli (paratype), 24: male copulatory organ of no. 23. Abbreviations: p = penis, pa = penial appendix, tg = tubular gland.

Description:

*Shell:* The shell is cylindrical with a small apex. The 4-4.5 whorls are slightly convex with a deep suture. The aperture is ovate, narrowed at the top, with a sharp peristome. The umbilicus is slit-like. The shell is 2.7-2.9 mm high, 1.7-1.8 mm broad.

*Animal:* The penis is as long as the penial appendix. The tubular gland has the same width over the full length.

Additional material: *B. magdalenae* n. sp. probably also lives in the spring of Spíli (see above under *Pseudamnicola occulta* n. sp.). The collected specimens correspond with the type series but are not treated as paratypes because only dry material could be collected and no anatomical investigation was made.

Distribution: Central part of Crete.

Remarks: For discussion see under *Bythinella sitiensis* n. sp.

*Bythinella sitiensis* n. sp. (Figs. 25-28)

**Type material:** Holotype (ZMH 140049): Shell height 2.5 mm, shell width 1.6 mm. Paratypes from the type locality Zou: coll. Hirschfelder (2 in ethanol, 1 dried); from sampling site 8 Zakros ZMH (140050, 1 dried, 1 penis), coll. Glöer (2 in ethanol), coll. Hirschfelder (3 in alcohol, 1 dried), coll. Kittel (3 dried).

**Type locality:** Crete, Nómos Lasíthi, fountain in Zou, 6 km south of Sitía, 35°09’15.7” N, 26°06’31.5” E, alt. 181 m asl., 29.04.2015 Andrea and Hans-Jürgen Hirschfelder, Klaus Kittel leg. (Figs. 35); together with *Pseudamnicola occulta* n. sp.

**Sampling site 8 (Paratypes):** Crete, Nómos Lasíthi, Zákros, Zákros Spring at the western edge of the village, small gutter beside the big source, 35°06’50.1” N, 26°12’49.0” E, alt. 282 m asl., 29.04.2015 Andrea and Hans-Jürgen Hirschfelder, Klaus Kittel leg. (Figs. 36); together with *Pseudamnicola occulta* n. sp.

Etymology: *Bythinella sitiensis* n. sp. is named after Sitía in eastern Crete, in whose municipality (Dimos Sitías) the new species was found in two springs.
Figures 25-28. *Bythinella sitiensis* n. sp. from Crete. 25: Holotype, 26: male copulatory organ of no. 25, 27, 28: Zákros (paratypes). Abbreviations: p = penis, pa = penial appendix, tg = tubular gland.

Description:

*Shell:* The shell is cylindrical with a small apex. The 4-4.5 whorls are slightly convex with a deep suture. The aperture is ovate, narrowed at the top, with a thickened peristome at the columella. The umbilicus is closed. The shell is 2.5 mm high, 1.5-1.7 mm broad.

*Animal:* The penis is as long as the penial appendix. The tubular gland becomes thicker at the distal end.

Distribution: Far eastern part of Crete.

Remarks: The distribution map of our three *Bythinella* species (Fig. 19), we could determine by anatomical features, fits very well with two proposed clades in Szarowska et al. (2016). Clade “CR1” *sensu* Szarowska et al. (2016) is the true *B. cretensis* (their sampling site K07 is identical with our site 5), Clade “CR2” *sensu* Szarowska et al. (2016) should be *B. magdalenae* n. sp. The sampling site “Epis” (collected by Benke et al. 2011 as “*B. cretensis*”) is 1100 m away from the type locality of *B. magdalenae* n. sp. In the region of clade “CR3” *sensu* Szarowska et al. (2016) we did not collect, and the region of East Crete, where we found *B. sitiensis* n. sp., was not included in the work of Szarowska et al. (2016). Anatomical and shell differences between the studied species are given in the key below.

Identification key for the *Bythinella* ssp. from Crete

1. Penis shorter than penial appendix, shell larger than 3 mm.......................................................... *Bythinella cretensis*
   - Penis as long as the penial appendix, shell smaller than 3 mm.......................................................... 2

2. Peristome sharp, tubular gland regular broad (constant width) ........................................ *Bythinella magdalenae* n. sp.
   - Peristome thickened at the columella, tubular gland thicker at the distal end .................... *Bythinella sitiensis* n. sp.

Family Valvatidae J.E. Gray 1840

Genus *Valvata* O.F. Müller 1773
Type species by designation: *Valvata cristata* O.F. Müller 1774

*Valvata kournasi* n. sp. (Figs. 37-42)

Type material: Holotype (ZMH 140040): Shell height 2.6 mm, shell width 5.0 mm. Paratypes: (ZMH 140041), coll. Hirschfelder (9 + 1 juv.).

Type locality: Greece, Nómos Chaniá, outflow of Lake Kournas, 3 km southeast of Georgioupoli, alt. 19 m asl., 11.10.2014 Andrea and Hans-Jürgen Hirschfelder leg. (Figs. 44-46).
Figs. 29-36. Habitats of Bythinella spp. from Crete. 29: Meso Potámi (type locality of B. cretensis), 30: Meso Potámi (B. cretensis together with Ancylus fluviatilis), 31: Exo Potámi (B. cretensis), 32: Argiroúpoli (type locality of B. magdalenae n. sp.), 33: Ano Méros (B. magdalenae n. sp.), 34: Axós (B. magdalenae n. sp.), 35: Zou (type locality of B. sitiensis n. sp.), 36: Zákros (B. sitiensis n. sp.)
Etymology: *V. kournasi* n. sp. is named after the type locality (Lake Kournas).

![Images of Valvata species](image1)

**Figures 37-42.** Comparison of two similar *Valvata* spp. 37-39: *Valvata macrostoma* (Hamburg). 40-42: *Valvata kournasi* n.sp. (Crete, Lake Kournas).

Description:

*Shell:* The horn-colored shell has 3.5 circular whorls with a low spire and a blunt apex. The surface is densely covered by regular-silky ribs. The umbilicus is wide, shell diameter to diameter of umbilicus about 4 : 1. The aperture is circular and slightly angulated at the top. Shell height up to 2.6 mm, diameter 5.0 mm.

*Animal:* unknown.

**Differentiating characters:** From the most similar *Valvata macrostoma* the new species differs in the narrower umbilicus and the slight angle at the top of the aperture which is missing in *V. macrostoma*.

Distribution: *V. kournasi* n. sp. is probably endemic to Lake Kournas.

![Distribution map](image2)

**Figure 43.** Distribution map of *Valvata kournasi* n. sp. on Crete (red dot).
Remarks: Only empty shells could be found in the overflow of the lake. The overflow area was totally dry during sampling time in autumn. Other mollusc species found with *V. kournasi* n. sp. were *Heleobia maltzani* (Westerlund, 1886), *Planorbis atticus* Bourguignat, 1852, *Radix labiata* (Rossmässler, 1835) and *Theodoxus sauleyi* (Bourguignat, 1852) (Fig. 46). *V. kournasi* n. sp. was the rarest one.

Figures 44-46. Lake Kournas, type locality of *Valvata kournasi* n. sp., 45: Overflow of Lake Kournas which was completely dry during sampling time, 46: deposit of shells at the overflow where *Valvata kournasi* n. sp. was also found.

Discussion

Seven *Pseudamnicola* spp. have been described from the Aegean islands (Bank, 2004, Delicado *et al*., 2014, Bank & Neubert, 2017, Göler *et al*., 2018), most of them endemic to just one island. Only on Rhodes two distinct *Pseudamnicola* spp. could be found (*P. exilis* (Frauenfeld, 1863) and *P. ianthè* Radea & Parmakelis, 2015), and now also on Crete (*P. brachia* and *P. occulta* n. sp.). Thus eight *Pseudamnicola* spp. are currently known from the Aegean islands.

Szarowska *et al*. (2016) stated that the differences between the *Bythinella*-clades form Crete are small and thus the morphology of the shells and the penis alone are not suitable to distinguish between *Bythinella* spp. We can confirm their results and in case of doubt the *Bythinella* spp. from Crete can be identified geographically and/or in combination with molecular data.

*Valvata kournasi* n. sp. is probably endemic to Lake Kournas because this is Crete’s only freshwater lake of natural origin. In contrast to *V. macrostoma* which inhabits marshland, alluvial river flats, small ponds or temporary waters, the new species lives in open water of a large lake.

Beside the new species mentioned above two more freshwater gastropods have been recorded for the first time on the island. During our field work we found *Ancylus fluviatilis* (O.F. Müller, 1774) in Meso Potami (Fig. 30) and *Radix labiata* (Rossmässler, 1835) at Lake Kournas. They are not mentioned for Crete by Bank & Neubert (2017). Thus 19 species of freshwater gastropods are currently known from Crete (Tab. 1).
Table 1. The freshwater gastropods from Crete.

| Species (Genus) | Species (Genus) |
|-----------------|-----------------|
| *Theodoxus* (*Theodoxus*) *saulcyi* (Bourguignat, 1852) | *Bythinella sitiensis* n. sp. |
| *Theodoxus* (*Neritaea*) *anatolicus* (Récluz, 1844) | *Valvata kournasi* n. sp. |
| *Melanopsis buccinoidea* (Olivier, 1801) | *Bulinus (Isidora) truncatus rivularis* (Philippi, 1836) |
| *Bithynia candiota* Westerlund, 1886 | *Planorbus (Planorbus) atticus* Bourguignat, 1852 |
| *Bithynia cretensis* Glöer & Maassen, 2009 | *Planorbus (Planorbus) cretensis* Glöer & Hirschfelder, 2015 |
| *Heleobia (Eupaludestrina) maltzani* (Westerlund, 1886) | *Anisus (Anisus) leucostoma* (Millet, 1813) |
| *Pseudamnicola brachia* (Westerlund, 1886) | *Segmentina nitida* (O.F. Müller, 1774) |
| *Pseudamnicola occulta* n. sp. | *Ancylus fluviatilis* (O.F. Müller, 1774) |
| *Bythinella cretensis* Schütt, 1980 | *Radix labiata* (Rossmässler, 1835) |
| *Bythinella magdalena* n. sp. | |

Springs are very sensitive ecosystems. All habitats where we collected *Pseudamnicola* and *Bythinella* are captured or partly captured and have been changed and modified for water supply. In several springs the snail populations were very small and therefore potentially endangered. This is especially true for the type locality in Topólia because it is a captured source in the center of the village. Many leaves of the surrounding trees where the molluscs feed on are deposited in the gutter. Someone might try to “clean” the water basins and the snails can be eradicated easily. This problem is evident in most of the springs. It is very important to inform the local people about their endemic snails and the need of protection.

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