

Révision de la collection de référence des bivalves d'eau douce déposée à l'Institut Scientifique de Rabat

Review of the reference collection of freshwater bivalves deposited in the Scientific Institute of Rabat

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Abstract. Freshwater bivalves are among the most threatened groups in the world and receive less attention despite their important role in freshwater aquatic ecosystems. The collection of the National Museum of Natural History of the Scientific Institute of Rabat constitutes a reference collection for all studies on freshwater bivalves, hence the importance of revising this collection. The study of the collection of freshwater bivalves deposited in the museum of the Scientific Institute of Rabat has shown a diversity in terms of species comprising 858 valves and 64 whole shell, the revision also resulted in the modification of 14 species names considered as synonymies, while 7 species kept their valid names. We examined samples from the type localities that will have to be kept in the types collection, with a specific label clearly identified. More extensive studies are necessary to contribute to the knowledge and subsequent conservation of the malacofauna diversity of freshwaters in Morocco.

Keywords: Freshwater bivalves, Scientific Institute of Rabat, Molluscs, Morocco.

Résumé. Les bivalves d'eau douce sont parmi les groupes les plus menacés au monde et reçoivent moins d'attention malgré leur rôle important dans les écosystèmes aquatiques d'eau douce. La collection du Muséum National d'Histoire Naturelle de l'Institut Scientifique de Rabat constitue une collection de référence pour toutes les études sur les bivalves d'eau douce, d'où l'importance de la révision de cette collection. L'étude de la collection des bivalves d'eau douce déposée au muséum de l'Institut Scientifique de Rabat a montré une diversité en termes d'espèces comprenant 858 valves et 64 coquilles entières, la révision a également entraîné la modification de 14 noms d'espèces considérés comme des synonymes, tandis que 7 espèces ont conservé leurs noms valides. Nous avons examiné des échantillons provenant des localités types qui devront être conservés au sein de la typonthèque avec une étiquette spécifique bien identifiée. Des études plus approfondies sont nécessaires pour contribuer à la connaissance et à la conservation de la diversité de la malacofaune des eaux douces au Maroc.

Mots-clés : Bivalves des eaux douces, Institut Scientifique de Rabat, Mollusques, Maroc.

INTRODUCTION

The roles of natural history museums are the conservation and management of collections, pedagogy and teaching and the development of scientific knowledge. Within this framework, the National Museum of Natural History in Rabat (NMNH), under the responsibility of the Scientific Institute (formerly known as Institut Scientifique Chérifien), was created in 1920. The study of the collections deposited there is therefore an essential step, as it provides a reference of the biodiversity that Morocco's ecosystems contain. Freshwater bivalves are an important component of this biodiversity because of the major role they play in freshwater ecosystems (Howard & Cuffey 2006; Vaughn & Hakenkamp 2001; Vaughn & Hoellein 2018). This group has been highly threatened globally due to human activities, which has attracted the attention of conservationists worldwide for the safeguarding of these molluscs (Lopes-Lima *et al.* 2014; Lopes-Lima *et al.* 2018; Ferreira-Rodriguez *et al.* 2019).

In Morocco, the first investigations on freshwater bivalves began with Pallary (1918, 1920, 1923), from then on and since their first description, no interest has been paid to species of this freshwater group, until the end of the first decade of the 2000s when research on the systematics of the species began (e.g. Araujo *et al.* 2009; Van Damme *et al.* 2010; Araujo 2011). Other aspects such as the phylogeny, ecology and conservation of Moroccan freshwater bivalve species have been the subject of several recent studies, notably for endemic species listed as Critically Endangered by the IUCN (Froufe *et al.* 2016a; Froufe *et al.* 2016b; Lopes-Lima *et al.* 2017a;

Lopes-Lima *et al.* 2017b; Sousa *et al.* 2018; Sousa *et al.* 2019; Gomes dos Santos *et al.* 2019; Benaïssa *et al.* 2019).

The present work is the first published data about the freshwater bivalves' collection of the National Museum of Natural History. It aims mainly to give a revised list of the reference collection of the Moroccan freshwater bivalves deposited in the National Museum of Natural History of Rabat based on the information given in the labels (Fig. 1).

MATERIAL AND METHODS

The taxonomic classification including nomenclature has been based on recent publications for each taxon listed below (e.g. Lopes-Lima *et al.* (2017) for Unionidae and Cooley & Ó. Foighil (2000) for Sphaeriidae). The material of the collection was carefully studied in order to observe the characteristic features of each species, an examination under a laboratory binocular microscope was performed for small specimens. After examination and identification, the specimens were returned to their original lots.

The following list faithfully synthesizes the bivalves collection of the Natural History Museum with the information removed from the corresponding labels. All the species names, authors and dates were double-checked on the international database Mollusca Base.

Abbreviations: Coll.: collector, C.y.: collection year, Det.: determination, Nbr.s.: number of specimens, Pr.: preservation, ND: No data.

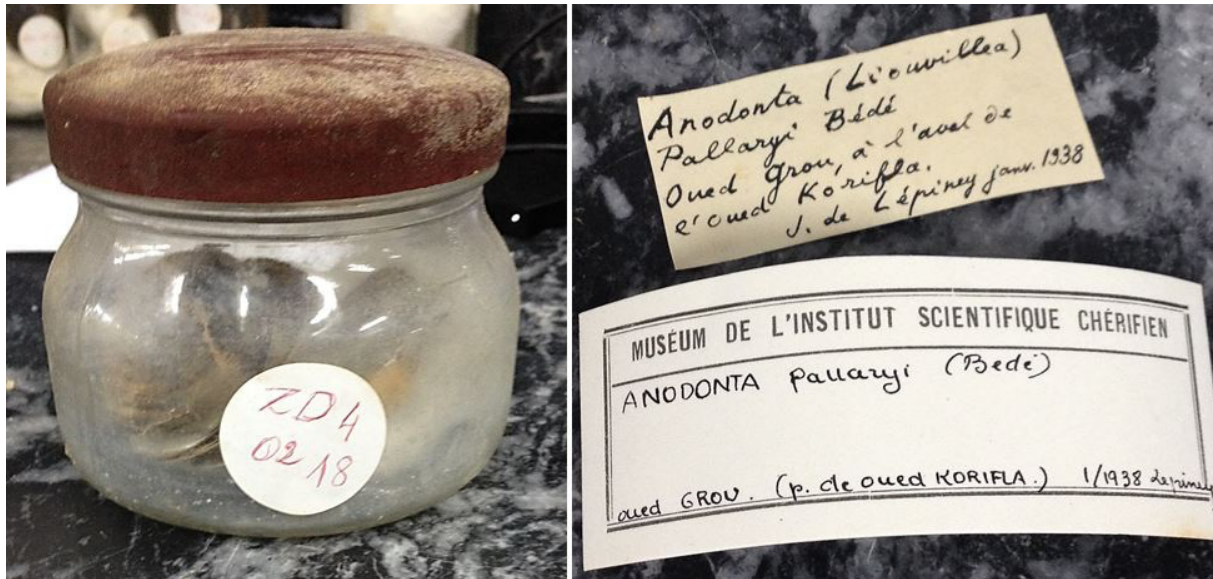


Figure 1. Left- Bottle containing the specimens with the code, Right- Labels with the collection information.

LIST OF SPECIES

SFamily Margaritiferidae Haas, 1940

Genus *Pseudunio* F. Haas, 1910

Pseudunio marocanus (Pallary, 1918)

Original description: *Margaritana marocana* Pallary (1918). Bull. Soc. Hist. Nat. Afr. Nord., Alger 9: 117.

Label in the bottle: *Margaritana redomica* Pallary, 1923

Bottle n°13; ZD4-02-2; Locality: Oued (River) Redom; Coll.: Pallary, C.y.: ND ; Nbr. s: 2 valves ; Pr. : dry-preserved; Det.: ND

Bottle n°39 ; ZD4-02-17; Locality : Oued Redom (Meknes); Coll. : ND, C.y. : ND ; Nbr.s : 6 valves ; Pr. : dry-preserved ; Det.: Pallary.

Label in the bottle: *Margaritana marocana* Pallary, 1918

Bottle n°15 ; ZD4-02-11 (Fig. 2-f); Locality : Fes; Coll. : Martel, C.y. : ND ; Nbr.s : 4 valves ; Pr. : dry-preserved; Det.: ND

Bottle n°35; ZD4-02-10; Locality : Fes; Coll. : Martel, C.y. : ND ; Nbr.s : 4 valves ; Pr. : dry-preserved; Det. : ND

N.B.: These samples come from the type locality and must be preserved in a types collection.

Margaritana redomica and *Margaritana marocana* were synonyms of the species *Margaritifera marocana*, it is only recently that Lopes-Lima *et al.* (2019) changed the name to *Pseudunio marocanus* based on molecular analysis.

Family Unionidae Rafinesque, 1820

Genus *Anodonta* Lamarck, 1799

Anodonta anatina (Linnaeus, 1758)

Original description : *Mytilus anatinus* Linnaeus (1758). Syst. Nat. 1(2) : 1158, sp. 258

Label in the bottle: *Anodonta pallaryi* Bédé, 1932

Bottle n°36 ; ZD4-02-18; Locality : ND; Coll. : ND ; C.y. : ND ; Nbr.s : 3 valves and 1 shell ; Pr. : dry-preserved; Det.: ND

Bottle n°12 ; ZD4-02-15; Locality: Oued Bouregreg; Coll. : Pallary; C.y. : ND ; Nbr.s : 2 valves; Pr. : dry-preserved ; Det. : Bédé

Bottle n°26 ; ZD4-02-3(Fig. 2-c) ; Locality: Oued Grou, downstream Oued Korifla; Coll. : Lepiney; C.y. : 1938 ; Nbr.s : 8 valves; Pr. : dry-preserved ; Det. : Bédé

Bottle n°34 ; ZD4-02-19; Locality : Oued Grou; Coll. : Lepiney; C.y. : 1938 ; Nbr.s : 1 valve with animal and 1 whole shell; Pr. : Ethanol ; Det. : Bédé

Bottle n°38 ; ZD4-02-6; Locality : Oued Grou near the confluence with Oued Korifla; Coll. : Lepiney and Pérés; C.y. : 1937 ; Nbr.s : 4 valves and 1 shell; Pr. : dry-preserved ; Det. : Bédé

Bottle n°46 ; ZD4-02-4; Locality : Oued Grou in the Schoul forest; Coll. : ND ; C.y. : 1932 ; Nbr.s : 2 valves ; Pr. : dry-preserved; Det.: ND

Bottle n°49 ; ZD4-02-13; Locality : Oued Grou near the confluence with Oued Korifla; Coll. : ND ; C.y. : 1938 ; Nbr.s : 26shells; Pr. : dry-preserved; Det.: ND

Bottle n°51 ; ZD4-02-1; Locality : Oued Grou near the confluence with Oued Korifla; Coll. : ND ; C.y. : 1938 ; Nbr.s : 24shells; Pr. : dry-preserved; Det. : ND

Bottle n°47 ; ZD4-02-14 ; Locality : ND ; Coll. : ND ; C.y. : ND ; Nbr. s : 15 shells ; Pr. : dry-preserved; Det. : ND

Bottle n°50 ; ZD4-02-14 ; Locality : ND ; Coll. : ND ; C.y. : ND ; Nbr. s : 13 shells ; Pr. : dry-preserved; Det. : ND

Label in the bottle: *Anodonta theryi* Bédé, 1932

Bottle n°28 ; ZD4-02-5; Locality : Oued M'da; Coll. : Monziès; C.y. : ND ; Nbr.s : 2 valves; Pr. : dry-preserved ; Det. : Bédé

Bottle n°12 ; ZD4-02-15; Locality : Oued Bouregreg; Coll. : Pallary; C.y. : ND ; Nbr. s : 2 valves; Pr. : dry-preserved ; Det. : Bédé

Label in the bottle: *Anodonta gruveli* Perès, 1938

Bottle n°22 ; ZD4-02-7; Locality : Oued Grou, downstream Oued Korifla; Coll. : Lepiney; C.y. : 1938 ; Nbr.s : 2 valves; Pr. : dry-preserved; Det. : ND

Bottle n°32 ; ZD4-02-8 ; Locality : ND ; Coll. : Pérès & Lepiney; C.y. : 1938 ; Nbr.s : 1 valve; Pr. : dry-preserved; Det. : ND

Bottle n°40 ; ZD4-02-9 (Fig. 2-d showing morphological differences of *A. anatina*); Locality: Oued Grou, downstream Oued Korifla; Coll.: Lepiney; C.y.: 1938; Nbr.s: 2 valves; Pr.: dry-preserved; Det.: Pérès.

Although the literature considers *A. pallaryi* and *A. theryi* to be synonymous with *A. cygnea* (Daget, 1998), no studies have confirmed this assumption. Gomes dos Santos et al (2019) state that only the species *A. anatina* is present in Morocco and therefore all synonymies refer to the latter.

Genus *Unio* Philipsson, 1788

Unio foucauldianus Pallary, 1936

Original description: *Unio foucauldiana* Pallary (1936). J. de Conch.: 63, pl. 4, fig. 2.

Label in the bottle: *Unio foucauldiana* Pallary, 1936

Bottle n°6; ZD4-02-26; Locality: Oued Sous; Coll.:Pallary; C.y.: ND; Nbr. s : 8 valves; Pr. : dry-preserved; Det.: ND

N.B.: These samples come from the type locality and must be preserved in atypes collection.

Unio rhomboideus Bourguignat, 1864

Bottle n°3 ; ZD4-02-35; Locality : Oued Tensift, Marrakech; Coll. : Pallary; C.y. : 1921 ; Nbr.s : 10 valves; Pr. : dry-preserved ; Det. : Alluaud

Label in the bottle: *Unio durieui* Deshayes, 1847

Bottle n°16 ; ZD4-02-23; Locality : Oued Bouregreg; Coll. : Lepiney; C.y. : 1937 ; Nbr.s : 17 valves and 3 shells; Pr. : dry-preserved; Det. : ND

Bottle n°41 ; ZD4-02-25; Locality : Oued Bouregreg; Coll. : ND ; C.y. : ND ; Nbr.s : 4 valves ; Pr. : dry-preserved ; Det. : Pallary

Bottle n°24 ; ZD4-02-32; Locality : Oued Grou; Coll. : ND ; C.y. : ND ; Nbr.s : 2 valves and 1 shell; Pr. : dry-preserved ; Det. : Bédé

Bottle n°20 ; ZD4-02-42(Fig. 2-a) ; Locality : Oued Bouregreg; Coll. : ND ; C.y. : ND ; Nbr.s : 10 valves ; Pr. : dry-preserved ; Det. : Pallary

Unio gibbus Spengler, 1793

Original description: *Unio gibbus* Spengler (1793). Skr. Naturhist. Selsk. 3(1): 16-69p.

Label in the bottle: *Unio rhomboideus* Bourguignat, 1864

Bottle n°7 ; ZD4-02-40 (Fig. 2-b) ; Locality : Oued Bouregreg; Coll. : Lepiney; C.y. : 1937 ; Nbr.s : 2 valves ; Pr. : dry-preserved; Det. : ND

Label in the bottle: *Margaritana* sp.

Bottle n°44 ; ZD4-02-12; Locality : Oued Ghériss, near Erfoud; Coll. : ND, C.y. : 1938 ; Nbr.s : 29 valves ; Pr. : dry-preserved; Det.: ND

Label in the bottle: *Unio durieui* Deshayes, 1847

Bottle n°23 ; ZD4-02-39; Locality : Oued Grou near the confluence with Oued Korifla; Coll. : Pérès&Lepiney; C.y. : 1937 ; Nbr.s : 6 valves and 3 shells; Pr. : dry-preserved; Det.: ND

Label in the bottle: *Unio tiftetica* Pallary, 1923

Bottle n°4 ; ZD4-02-33; Locality : Oued Tilfet; Coll. : Pallary; C.y. : ND ; Nbr.s : 2 valves; Pr. : dry-preserved ; Det. : Pallary
Label in the bottle: *Unio* sp.

Bottle n°9 ; ZD4-02-37; Locality : Oued Grou; Coll. : ND ; C.y. : 1938 ; Nbr.s : 4 valves ; Pr. : dry-preserved

Bottle n°45 ; ZD4-02-28; Locality : Lake of Oued Mellah; Coll. : ND ; C.y. : 1938 ; Nbr.s :5 valves and 3 shells ; Pr. : dry-preserved; Det.: ND

Bottle n°30 ; ZD4-02-44; Locality : ND; Coll. : Gubler ; C.y. : 1939 ; Nbr.s :2 valves and 2 shells ; Pr. : dry-preserved ; Det. : Berguent

Genus *Potomida* Swainson, 1840

Potomida littoralis (Cuvier, 1798)

Original description: *Unio littoralis* Cuvier (1798).Tab. Elem. Hist. Nat. Anim. 710 pp.

Label in the bottle: *Unio foucauldiana* Pallary, 1936

Bottle n°6; ZD4-02-26; Locality : Oued Sous; Coll. : Pallary; C.y. : ND ; Nbr.s : 2 valves; Pr. : dry-preserved; Det. : ND

Label in the bottle:*Unio rhomboideus* Bourguignat, 1864

Bottle n°3 ; ZD4-02-35; Locality : Oued Tensift, Marrakech; Coll. : Pallary; C.y. : 1921 ; Nbr.s : 2 valves; Pr. : dry-preserved ; Det. : Alluaud

Bottle n°14 ; ZD4-02-30; Locality : Oued Tensift; Coll. : ND ; C.y. : nd ; Nbr.s : 14 valves ; Pr. : dry-preserved ; Det. : Pallary

Bottle n°7 ; ZD4-02-40; Locality : Oued Bouregreg; Coll. : Lepiney; C.y. : 1937 ; Nbr.s : 12 valves ; Pr. : dry-preserved

Bottle n°8 ; ZD4-02-27; Locality : Oued Bouregreg; Coll. : ND ; C.y. : ND; Nbr.s : 2 valves ; Pr. : dry-preserved ; Det. : Pallary

Bottle n°11 ; ZD4-02-22; Locality : ND; Coll. : Lamarck ; C.y. : ND ; Nbr.s :6 valves ; Pr. : dry-preserve; Det.: ND

Bottle n°17 ; ZD4-02-24; Locality : Oued Kseb, Mogador; Coll. : Pallary ; C.y. : ND; Nbr.s : 2 valves and 2 shells ; Pr. : dry-preserved; Det.: ND

Bottle n°18 ; ZD4-02-31; Locality : Oued Oum Er Rbia in Mechrâa Ben Abbou; Coll. : Alluaud ; C.y. : ND; Nbr.s : 4 valves ; Pr. : dry-preserved ; Det. : Pallary

Bottle n°19 ; ZD4-02-41; Locality : Oued Yquem; Coll. : ND ; C.y. : ND; Nbr.s : 10 valves and 3 shells; Pr. : dry-preserved ; Det. : Pallary

Bottle n°55 ; ZD4-02-48 ; Locality : Rabat ; Coll. : ND ; C.y. : ND; Nbr.s : 3 shells; Pr. : dry-preserved; Det.: ND

Bottle n°27 ; ZD4-02-21; Locality : Oued Bouregreg; Coll. : ND ; C.y. : ND; Nbr.s : 6 valves; Pr. : dry-preserved ; Det. : Pallary

Bottle n°25 ; ZD4-02-29; Locality : Oued Grou; Coll. : ND; C.y. : ND; Nbr.s : 4 valves and 1 shell; Pr. : dry-preserved ; Det. : Bédé

Bottle n°1 ; ZD4-02-38; Locality : Oued Grou near the confluence with Oued Korifla; Coll. : Lepiney&Pérès ; C.y. : 1937 ; Nbr.s : 12 valves and 2 shells; Pr. : dry-preserved ; Det. : Bédé

Unio marteli Pallary, 1918

Bottle n°5 ; ZD4-02-36 (Fig. 2-e) ; Locality : Fes; Coll. : Martel; C.y. : ND ; Nbr.s : 12 valves and 1 shell; Pr. : dry-preserved ; Det. : Pallary

Label in the bottle: *Unio lebossariasius* ND

Bottle n°10 ; ZD4-02-34; Locality : Oued Grou; Coll. : Pechaud ; C.y. : ND ; Nbr.s : 3 valves; Pr. : dry-preserved ; Det. : Bédé

Unio sp.

Bottle n°2 ; ZD4-02-43; Locality : Oued Drâa, Tamegrout; Coll. : ND; C.y. : 1934 ; Nbr.s : 1 valve ; Pr. : dry-preserved; Det. : ND

Bottle n°29 ; ZD4-02-45; Locality : Oued Grou; Coll. : ND, C.y. : 1938 ; Nbr.s : 4 valves and 1 shell ; Pr. : dry-preserved; Det.: ND

Label in the bottle: *Margaritana sp.*

Bottle n°33 ; ZD4-02-20; Locality : Oued Grou; Coll. : ND, C.y. : 1938 ; Nbr.s : 9 valves ; Pr. : dry-preserved; Det.: ND

Bottle n°21 ; ZD4-02-16; Locality : ND; Coll. : Gubler, C.y. : 1939 ; Nbr.s : 12 valves ; Pr. : dry-preserved ; Det. : Berguent

Bottle n°44 ; ZD4-02-12; Locality : Oued Ghériss, near Erfoud; Coll. : ND, C.y. : 1938 ; Nbr.s : 6 valves ; Pr. : dry-preserved; Det. : ND

Family **Cyrenidae Gray, 1840**

Genus-***Corbicula* Megerle von Mühlfeld, 1811**

***Corbicula fluminea*(O. F. Müller, 1774)(Fig. 3-a)**

Original description: *Tellina fluminea* O. F. Müller (1774). Verm. Terr. et Fluv. 2: 1-214.

Label in the bottle: *Corbicula consobrina* (Cailliaud, 1827)

Bottle n°37 ; ZD4-02-46; Locality : ND; Coll. : ND, C.y. : ND ; Nbr.s : 2 valves and 2 shells; Pr. : dry-preserved; Det.: ND

Family **Sphaeriidae Deshayes, 1855**

Genus ***Pisidium* C.Pfeiffer, 1821**

***Pisidium casertanum* (Poli, 1791)**

Original description : *Euglesa casertana* Poli (1791). Testacea Utriusque Siciliae1:1-6.

Bottle n°ND ; ZD4-02-47 (Fig. 3-b) ; Locality : Vierges waterfall, Middle Atlas near Ifrane; Coll. : Kuiper, C.y. : ND ; Nbr.s : 191 valves ; Pr. : dry-preserved; Det. : ND

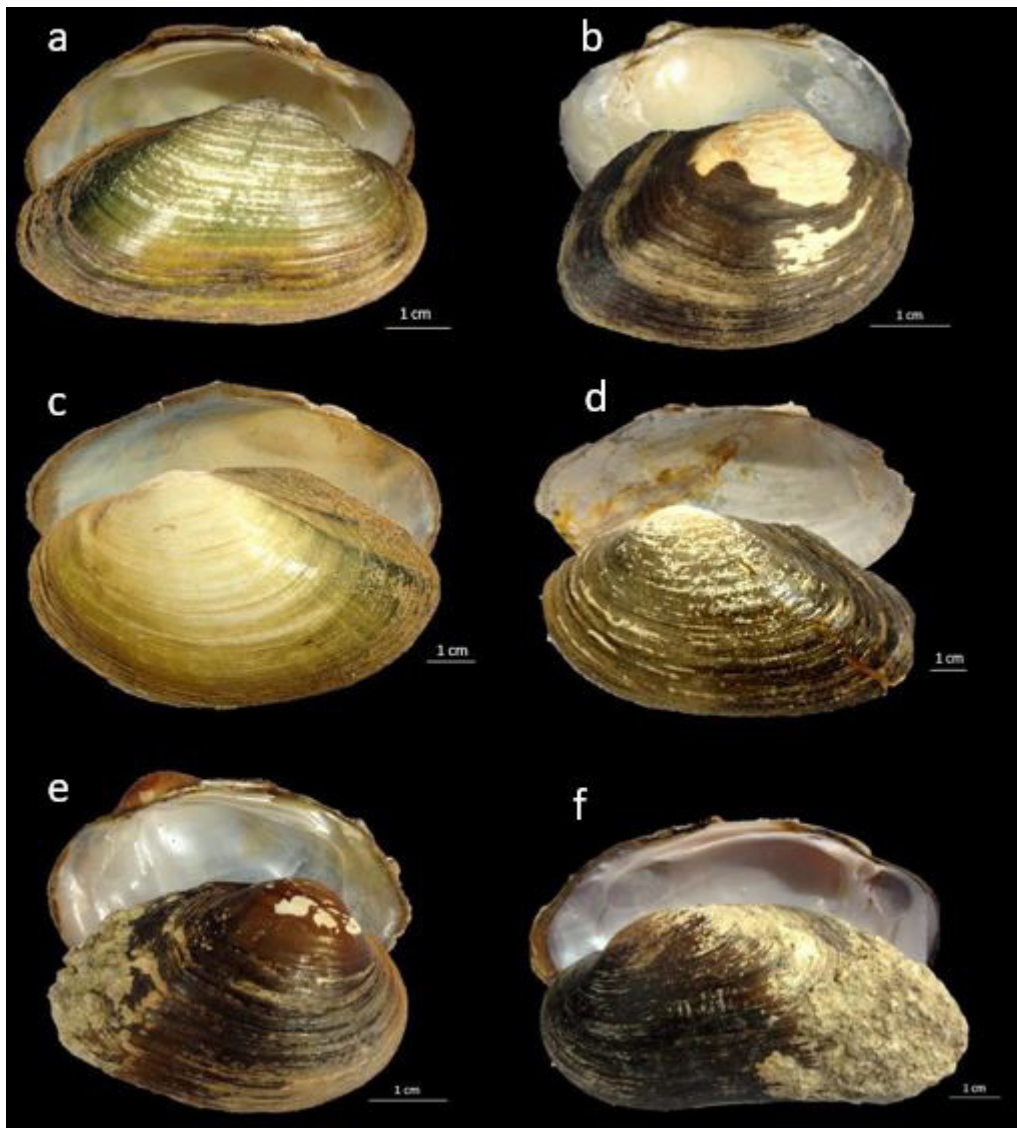


Figure 2. a- *Unio foucauldianus*, b- *Unio gibbus*, c- *Anodonta anatina*, d- *Anodonta gruveli*, e- *Potomida littoralis*, f- *Pseudunio maroccanus*.

Bottle n°ND ; ZD4-02-47; Locality : Aremd; Coll. : Lepiney, C.y. : 1937 ; Nbr.s : 5 valves ; Pr. : dry-preserved ; Det.: ND

Bottle n°ND ; ZD4-02-47; Locality : Imlil at 1750 m; Coll. : Lepiney, C.y. : 1939 ; Nbr.s : 15 shells ; Pr. : dry-preserved; Det.: ND

***Pisidium amnicum* (O. F. Müller, 1774) (Fig. 3-c)**

Original description: *Pisidium amnicum* O. F. Müller (1774). Verm. Terr. et Fluv. 2: 205.

Bottle n°ND ; ZD4-02-47; Locality : Vierges waterfall, Middle Atlas near Ifrane; Coll. : Kuiper, C.y. : ND ; Nbr.s : 66 valves ; Pr. : dry-preserved; Det. : ND

***Pisidium milium* Held, 1836 (Fig. 3-d)**

Original description: *Pisidium milium* Held (1836). Aufzählung der in Bayern lebenden Mollusken. Isis (Oken). (4): 271-281.

Bottle n°ND ; ZD4-02-47; Locality : Vierges waterfall, Middle Atlas near Ifrane; Coll. : Kuiper, C.y. : ND ; Nbr.s : 5 valves ; Pr. : dry-preserved; Det.: ND

***Pisidium nitidum* Jenyns, 1832 (Fig. 3-e)**

Original description: *Pisidium nitidum* Jenyns (1832). Trans. Cambridge Phil. Soc. 4: 304, pl. 20, figs. 7-8.

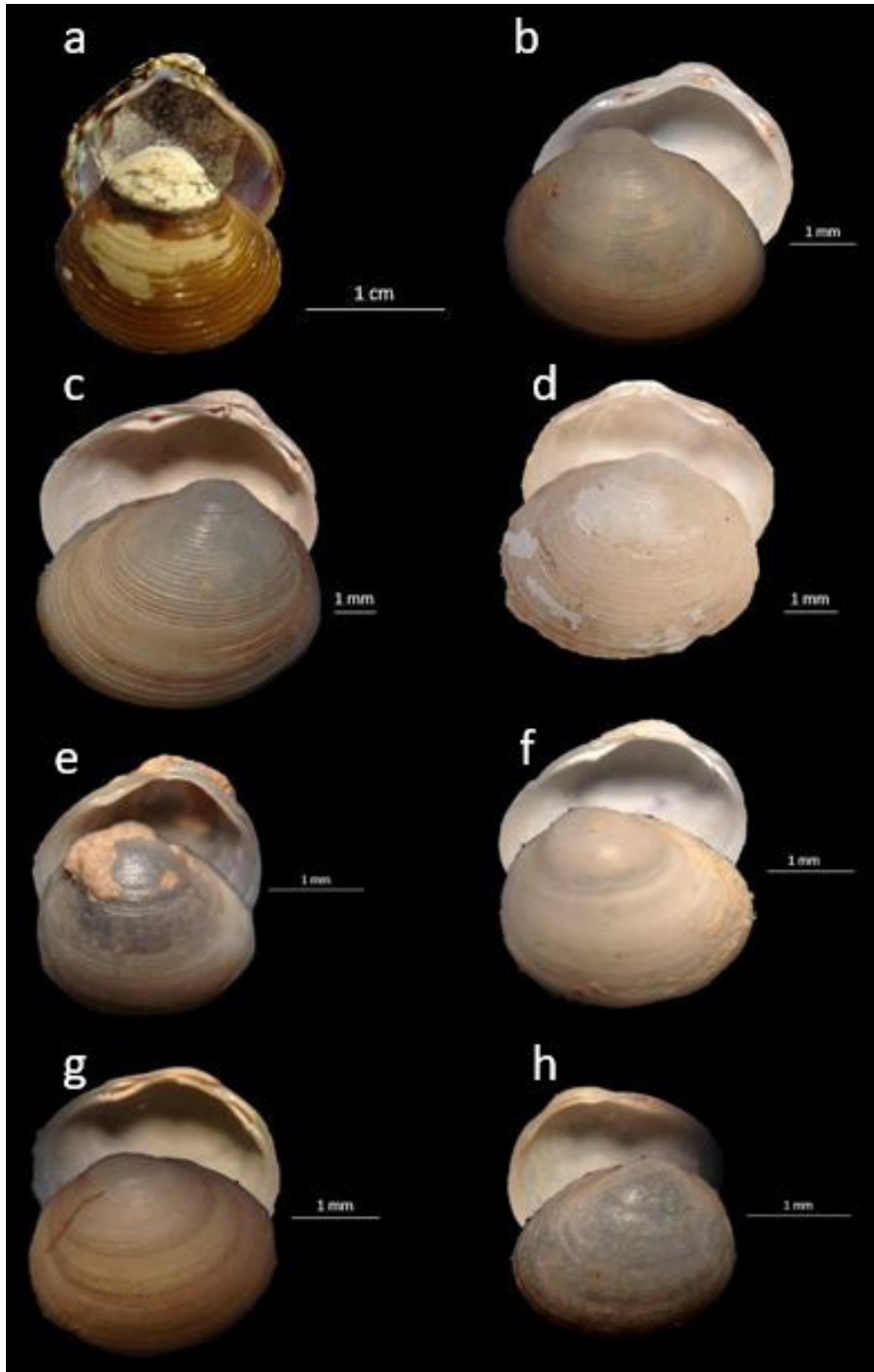


Figure 3. a- *Corbicula fluminea*, b- *Pisidium casertanum*, c- *Pisidium amnicum*, d- *Pisidium milium*, e- *Pisidium nitidum*, f- *Pisidium personatum*, g- *Pisidium subtruncatum*, h- *Pisidium tenuilineatum*.

Bottle n°ND ; ZD4-02-47; Locality : Vierges waterfall, Middle Atlas near Ifrane; Coll. : Kuiper, C.y. : ND ; Nbr.s : 12 valves ; Pr. : dry-preserved; Det.: ND

***Pisidium personatum* Malm, 1855** (Fig. 3-f)

Original description: *Pisidium personatum* Malm (1855). Götheborgs K. Ver. Vitt. Samh. Handl. 3: 107, fig.

Bottle n°ND ; ZD4-02-47; Locality : Vierges waterfall, Middle Atlas near Ifrane; Coll. : Kuiper, C.y. : ND ; Nbr.s : 237 valves and 39 shells ; Pr. : dry-preserved; Det.: ND

***Pisidium subtruncatum* Malm, 1855** (Fig. 3-g)

Original description: *Pisidium subtruncatum* Malm (1855). Götheborgs K. Ver. Vitt. Samh. Handl. 3: 73-152, 92, text figs.

Bottle n°ND ; ZD4-02-47; Locality : Vierges waterfall, Middle Atlas near Ifrane; Coll. : Kuiper, C.y. : ND ; Nbr.s : 57 valves and 8 shells ; Pr. : dry-preserved; Det.: ND

***Pisidium tenuilineatum* Stelfox, 1918** (Fig. 3-h)

Original description: *Pisidium tenuilineatum* Stelfox (1918). J. of Conch. 15: 296, pl. 8, fig. 1, 4-13.

Bottle n°ND ; ZD4-02-47; Locality : Vierges waterfall, Middle Atlas near Ifrane; Coll. : Kuiper, C.y. : ND ; Nbr.s : 14 valves and 1 shell; Pr. : dry-preserved; Det. : ND

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