

**ON WENTLETRAPS (GASTROPODA: EPITONIIDAE)
FROM THE UPPER GLOBIGERINA LIMESTONE FORMATION
(MIOCENE: LANGHIAN) OF MALTA**

David P. CILIA¹

ABSTRACT

In this study, a collection of fossil wentletraps (Gastropoda: Epitoniidae) representing five nominal taxa, all from the Upper Globigerina Limestone Formation of the Maltese Miocene (Langhian) and deposited in the National Museum of Natural History, Mdina (Malta), is reviewed. The replacement name *Sthenorytis garigor* **nom. nov.** is proposed for *Scalaria melitensis* Cowper Reed in Baldacchino, 1939, primary homonym of *Scalaria melitensis* Fuchs, 1876. Lectotypes for *S. garigor* **nom. nov.**, *Scalaria crassicostata* var. *inequalis* Cowper Reed in Baldacchino, 1939 and *Scalaria crassicostata* var. *obliquata* Cowper Reed in Baldacchino, 1939 are selected from the type series for nomenclatural stability. The varieties *S. crassicostata* var. *inequalis*, *S. crassicostata* var. *obliquata*, and *S. crassicostata* var. *taurina* Sacco, 1891 fall within the spectrum of intraspecific diversity expressed by *Cirsotrema crassicostatum* (Deshayes, 1850) and are synonymized with this species. Updated chresonymies and synonymies are given for *C. crassicostatum*, *Cirsotrema duciei* (Wright, 1855), and *S. garigor* **nom. nov.**

Keywords: Mollusca, *Scalaria*, *Cirsotrema*, *Sthenorytis*, fossil species, Maltese archipelago

SINTEZI

[Dwar garigori (Gastropoda: Epitoniidae) mill-Formazzjoni tal-Franka ta' Fuq (Mioċenu: Langjan) ta' Malta.] F'dan l-istudju qiegħda tiġi pprezentata revizzjoni ta' kollezzjoni ta' garigori fossili (Gastropoda: Epitoniidae) minn ħames tassoni nominali, kollha mill-Franka ta' Fuq mill-Mioċenu Malti (Langjan), u miżmumin fil-Mużew Nazzjonali tal-Istorja Naturali, Mdina (Malta). L-isem ta' sostituzzjoni *Sthenorytis garigor* **nom. nov.** huwa propost għal *Scalaria melitensis* Cowper Reed in Baldacchino, 1939, omonimu primarju ta' *Scalaria melitensis* Fuchs, 1876. Lektotipi għal *S. garigor* **nom. nov.**, *Scalaria crassicostata* var. *inequalis* Cowper Reed in Baldacchino, 1939 u *Scalaria crassicostata* var. *obliquata* Cowper Reed in Baldacchino, 1939 qegħdin jiġu magħżulin mis-serje tat-tip għall-istabilità tan-nomenklatura. Il-varjetajiet *S. crassicostata* var. *inequalis*, *S. crassicostata* var. *obliquata* u *S. crassicostata* var. *taurina* Sacco, 1891 jaqgħu fl-ispektrum tad-diversità intraspeċifika espressa minn *Cirsotrema crassicostata* (Deshayes, 1850) u qegħdin jiġu sinonimizzati ma' din l-ispeċi. Il-kresonimiji u s-sinonimiji ta' *C. crassicostatum*, *Cirsotrema duciei* (Wright, 1855), u *S. garigor* **nom. nov.** qegħdin jiġu aġġornati.

Kliem muftieħ: Mollusca, *Scalaria*, *Cirsotrema*, *Sthenorytis*, speċi fossili, l-arċipelagu Malti

INTRODUCTION

Not later than 1939, the curator of the Maltese natural history collections presented an assortment of fossil wentletraps (Gastropoda: Epitoniidae) from the Upper Globigerina Limestone Member (*Franka ta' Fuq*) of the Maltese Miocene to English geologist Frederick Richard COWPER REED.

¹ Mużew Nazzjonali tal-Istorja Naturali / National Museum of Natural History, Vilhena Palace, St. Publius Square, Mdina, MDN 1011, Malta; dpcilia@gmail.com; ORCID: 0000-0001-8437-8913.

Submitted **24 Nov. 2023**; accepted **02 Apr. 2024**.

urn:lsid:zoobank.org:pub:D8A5EC4B-90AC-4CA7-9772-9FF256DE8BBD

This curator, Joseph George BALDACCHINO (1894–1973), probably asked COWPER REED to provide a species determination of these fossils. (For biographical data on COWPER REED (1869–1946), reference is made to WOODS (1946) and CLEEVELY et al. (1989); see **Pl. 1 Fig. A**).

Specific documents attesting to correspondence between BALDACCHINO and COWPER REED could not be located within the NMNH, NMA or NHMUK archives, however, BALDACCHINO's (politically motivated) willingness to supply material and collaborate with British academics, especially archaeologists and natural historians, is well-documented (e.g. in BATE, 1935; TRECHMANN, 1938, and the description of *Helix baldacchini* within; BALDACCHINO & DUNBABIN, 1953; BALDACCHINO & EVANS, 1954; BUGEJA, 2006; ROSSI, 2017; etc.; see **Pl. 1 Fig. E**). COWPER REED's analysis of the fossils was reproduced *verbatim* in an article by BALDACCHINO, himself a medical doctor by profession and an amateur archaeologist, in the Maltese Government's *Museum Annual Report* (MAR) of that year (BALDACCHINO, 1939).

The report commissioned by BALDACCHINO resulted in the treatment of five nominal taxa of epitoniids of specific or infraspecific rank, three of which were newly described as species or as new varieties of known species (one and two taxa, respectively), namely (as written in the original document): *Scalaria (Stenorhytis) melitensis* (a new species), *Scalaria (Cirsotrema) Duciei* Wright, *Scalaria (Cirsotrema) crassicostata* Brocchi var. *taurina* Sacco, *Scalaria (Cirsotrema) crassicostata* Brocchi var. *obliquata* (a new variety), and *Scalaria (Cirsotrema) crassicostata* Brocchi var. *inequalis* (a new variety). *Scalaria* Lamarck, 1801 is a junior subjective synonym of *Epitonium* Röding, 1798, but the discussed entities are nowadays placed in the genera *Cirsotrema* Mörch, 1852 and *Sthenorytis* Conrad, 1863. Some of them were represented in the palaeontological display of the NMNH, inaugurated in 1973 (**Pl. 1 Fig. I**) (see ZAMMIT-MAEMPEL, 1977).

The new names published in BALDACCHINO (1939) satisfy the criteria established in ICZN Art. 10 and are therefore deemed available. The detailed descriptions, however, are not accompanied by the illustrations of any of the specimens. Neither did COWPER REED explicitly designate types for any of the new taxa, although specific quantities of specimens are always cited in his treatments.

The collection, subsequently deposited at the NMNH by BALDACCHINO, could be re-examined by the present author. The objectives of this study are to (1) evaluate the current status of the nominal taxa treated by COWPER REED, (2) provide an updated chresonymy and synonymy for the resultant (valid and available) entities, and (3) for the first time illustrate all the specimens he examined, as two-thirds of them qualify as syntypes according to ICZN Art. 72.1.1. Furthermore, (4) onomatophores (lectotypes) are selected from among the syntypes in accordance with ICZN Art. 72.2, for the stability of their nomenclature.

Analyses of planktonic chronostratigraphic markers by GIANNELLI & SALVATORINI (1972), JACOBS et al. (1996), and JANSSEN (2012a) situate the entirety of the Globigerina Limestone Formation within a late Oligocene (mid-Chattian) to a mid-Miocene (Langhian) timeframe. Deposition of its Upper Member occurred throughout the Langhian, likely up until the threshold with the Serravallian (ROSE et al., 1992; JANSSEN, 2012a). Translation of the lithostratigraphic data presented in PEDLEY (1976) and GATT (2006) to chronostratigraphy (see 'Materials and Methods') reveals that the taxa discussed in this paper are restricted to mid- to late Miocene deposits (Langhian to Tortonian), although the specimens studied by COWPER REED are from the Upper Globigerina, therefore, of an exclusively Langhian age.

Other wentletraps confirmed as occurring in the Maltese Miocene include, among others, *Cirsotrema melitensis* (Fuchs, 1876 in *Scalaria*) and *Cirsotrema taurovaricosum* Sacco, 1891 (Gatt, 2006), but these taxa are not systematically treated in this work, with the exception of the former's status as senior homonym of one of the taxa described by COWPER REED in BALDACCHINO (1939).



Pl. 1 Figs. A–I: Museum and archival material related to the authors mentioned in this paper. **A:** Portrait of Frederick Richard COWPER REED from the Library and Archives of the NHMUK. **B:** COWPER REED's handwritten label reading '*t. Scalaria crassicostata* var. nov. *inequalis*' for the specimen selected as lectotype in this paper (NMNH/M211). **C:**

COWPER REED's handwritten label reading '*l. Scalaria crassicostata var. obliquata*' for the specimen selected as lectotype in this paper (NMNH/M211). **D**: COWPER REED's handwritten label reading '*b. Scalaria melitensis*' for the specimen selected as lectotype in this paper (NMNH/M200). **E**: A photograph taken on the 5th of April of 1934 at the National Museum (Valletta, Malta) showing Maltese archaeologist Themistocles ZAMMIT (1864–1935) on the left, British palaeontologist Dorothea BATE (1878–1951) at the centre, and Curator of Natural History with the Museums Department, Joseph G. BALDACCHINO, on the right (from the archives of Heritage Malta, reproduced with permission). **F, G**: BALDACCHINO's typewritten labels for specimens in the geological collection of the NMNH, dating from between 1933 and 1947. **H**: BALDACCHINO's typewritten label for a specimen selected as lectotype in this paper (NMNH/M200). **I**: Specimens of the three varieties of *Cirsotrema crassicostatum* (Deshayes, 1850) discussed in this paper are exhibited in the George Zammit-Maempel Halls of Geology and Palaeontology at the National Museum of Natural History, Mdina, Malta. These specimens do not form part of the material studied for this paper. The museum display was planned and organized by Assistant Curator of Geology and Palaeontology, George ZAMMIT-MAEMPEL (1925–) and inaugurated by the Minister of Education, Culture, and Tourism, Agatha BARBARA (1923–2002), in 1973.

MATERIALS AND METHODS

Chresonyms and synonyms for the present taxa taken from other works were verified and integrated into an updated listing for each species. For *C. crassicostatum*, only the bibliographic references that describe Maltese occurrences, or that delimit the international stratigraphic range, are listed; the otherwise extensive corpus of literature referring to this species may be consulted in the exhaustive chresonymy by VAN DER VOORT (in press). The lists for the other species (hitherto only known from Maltese strata) are more complete. Notes in square brackets are additions of the present author.

Labels and correspondence were scanned and cropped with their borders retained within the image, then saved in *.jpeg* format. Measurements of specimens do not include the fossiliferous matrix. They were obtained using digital callipers and are reported in millimetres (mm). Photography of specimens was executed by means of Nikon D90 and Sony Alpha 7 II cameras. The resulting images were processed and collated into plates using Adobe Photoshop 2024®.

The translation from lithostratigraphy to chronostratigraphy follows the interpretations of LIRER & IACCARINO (2011) and JANSSEN (2012a: 208 fig. 3).

Symbols and abbreviations:

?: uncertain taxonomic allocation

ICZN: International Commission for Zoological Nomenclature

NHMUK: Natural History Museum, London, England

NMA: National Museum of Archaeology, Valletta, Malta

NMNH: National Museum of Natural History, Mdina, Malta

sh.: fossil shell

[**sic**]: intentionally so written

unn.: unnumbered

RESULTS

With each of the specimens he studied, COWPER REED included a handwritten note including the species (or varietal) name and a unique alphabetical identifier (**Pl. 1 Figs. B–D**). Additional samples of COWPER REED's calligraphy were not present within the NMNH collection, but confirmation that his hand was involved was achieved by comparison with correspondence traced within the Library and Archives of the NHMUK (letters addressed to British palaeontologist Francis Arthur BATHER (1863–1934), file DF PAL/100/182/12; unfortunately, none of the seen correspondence was addressed to BALDACCHINO).

The only specimens without COWPER REED's label consist of one *C. duciei* (of which he mentions three specimens, although four are actually present – the fourth (NMNH/M220, **Pl. 3 Fig. M**) may have been added by BALDACCHINO later) and two *C. crassicostata var. inequalis* (NMNH/M214–15, **Pl. 2 Figs. L, I**). The label for the single specimen of *C. crassicostata var. taurina* (NMNH/M216, **Pl. 2 Fig. N**) is the only to omit the varietal name, as well as the unique

alphabetical identifier. COWPER REED's label information is synthesized with the data generated at present in **Table 1**.

Also associated with each specimen is a second label attached to the glass lids of the containment boxes. Although there are no personal names on these labels, one can safely assume that they are BALDACCHINO's additions, as several other labels elsewhere in the geological collection that do bear his name are set in the same style and format, are dated from the period of his tenure (1933–1947) and were typewritten using the same machine (**Pl. 1 Figs. F–H**). These second labels include the species name, authority, variety (where applicable), and the provenance of the specimens: 'Globigerina Limestone, Malta', a phrase often abbreviated simply as 'Glob.L.'. The only specimens lacking BALDACCHINO's labels are the two *C. crassicosata* var. *inequalis* mentioned in the previous paragraph, and the singular *C. crassicosata* var. *taurina* specimen.

Table 1: Original label and updated data for each specimen in the COWPER REED & BALDACCHINO collection of Maltese fossil wentletraps. **L:** lectotype; **P:** paralectotype; **Reg.:** registration number; **NA:** not applicable; **St.:** status.

Original label (pre-1940)		NMNH Collection (2024)			Fig. (in this paper)
Determination	Letter	Accepted name	Reg.	St.	
<i>Scalaria melitensis</i>	b	<i>S. garigor</i> nom. nov.	M200	L	Pl. 3 Figs. A–C
<i>Scalaria melitensis</i>	c	<i>S. garigor</i> nom. nov.	M201	P.I	Pl. 3 Figs. D–F
<i>Scalaria melitensis</i>	a	<i>S. garigor</i> nom. nov.	M202	P.II	Pl. 3 Figs. G–I
<i>Scalaria crassicosata</i> var. <i>obliquata</i>	l	<i>C. crassicosatum</i>	M203	L	Pl. 2 Fig. D
<i>Scalaria crassicosata</i> var. <i>obliquata</i>	m	<i>C. crassicosatum</i>	M204	P.II	Pl. 2 Fig. B
<i>Scalaria crassicosata</i> var. <i>obliquata</i>	o	<i>C. crassicosatum</i>	M205	P.I	Pl. 2 Fig. A
<i>Scalaria crassicosata</i> var. <i>obliquata</i>	i	<i>C. crassicosatum</i>	M206	P.III	Pl. 2 Fig. C
<i>Scalaria crassicosata</i> var. <i>obliquata</i>	d	<i>C. crassicosatum</i>	M207	P.IV	Pl. 2 Fig. E
<i>Scalaria crassicosata</i> var. <i>obliquata</i>	q	<i>C. crassicosatum</i>	M208	P.V	Pl. 2 Fig. G
<i>Scalaria crassicosata</i> var. <i>obliquata</i>	p	<i>C. crassicosatum</i>	M209	P.VI	Pl. 2 Fig. J
<i>Scalaria crassicosata</i> var. <i>obliquata</i>	v	<i>C. crassicosatum</i>	M210	P.VII	Pl. 2 Fig. M
<i>Scalaria crassicosata</i> var. <i>inequalis</i>	t	<i>C. crassicosatum</i>	M211	L	Pl. 2 Fig. F
<i>Scalaria crassicosata</i> var. <i>inequalis</i>	r	<i>C. crassicosatum</i>	M212	P.I	Pl. 2 Fig. H
<i>Scalaria crassicosata</i> var. <i>inequalis</i>	j	<i>C. crassicosatum</i>	M213	P.II	Pl. 2 Fig. K
NA	NA	<i>C. crassicosatum</i>	M214	NA	Pl. 2 Fig. L
NA	NA	<i>C. crassicosatum</i>	M215	NA	Pl. 2 Fig. I
<i>Scalaria crassicosata</i> [var. <i>taurina</i>]	NA	<i>C. crassicosatum</i>	M216	NA	Pl. 2 Fig. N
<i>Scalaria Duciei</i>	g	<i>C. duciei</i>	M217	NA	Pl. 3 Fig. J
<i>Scalaria Duciei</i>	k	<i>C. duciei</i>	M218	NA	Pl. 3 Fig. K
<i>Scalaria Duciei</i>	f	<i>C. duciei</i>	M219	NA	Pl. 3 Fig. L
NA	NA	<i>C. duciei</i>	M220	NA	Pl. 3 Fig. M

SYSTEMATICS

Gastropoda Cuvier, 1795

Caenogastropoda Cox, 1960

incerti ordinis

Epitonioidea Berry, 1910 (1812)

Epitoniidae Berry, 1910 (1812)

Cirsotrema Mörch, 1852

(type species by monotypy: *Scalaria varicosa* Lamarck, 1822)

Cirsotrema crassicosatum (Deshayes, 1850) (**Pl. 2 Figs. A–N**)

Scalaria crassicosata DESHAYES, 1850: 42, pl. 70 figs 1–3.

Cirsotrema crassicosatum (Desh.) – SACCO, 1891: 45.

Cirsotrema crassicosatum var. *taurina* SACCO, 1891: 45, pl. 2 fig. 12.

Cirsotrema crassicosatum Deshayes – COOKE, 1896: 510.

Cirsotrema crassicosatum Deshayes var. – COOKE, 1896: 510.

Scalaria (*Cirsotrema*) *crassicosata* [sic] Brocchi var. *taurina* Sacco – COWPER REED in BALDACCHINO, 1939: 171.

Scalaria (*Cirsotrema*) *crassicosata* [sic] Brocchi var. *obliquata* COWPER REED in BALDACCHINO, 1939: 171.

- Scalaria (Cirsotrema) crassicosata* [sic] Brocchi var. *inequalis* COWPER REED in BALDACCHINO, 1939: 171.
Scala (Cirsotrema) crassicosata [sic] Deshayes, 1839 – GLIBERT, 1952: 40–42, pl. 3 fig. 8a–d.
Cirsotrema (Cirsotrema) crassicosatum (Deshayes, 1839) – ANDERSON, 1964: 217, pl. 16 fig. 137.
Cirsotrema (Cirsotrema) crassicosatum (Deshayes, 1839) – JANSSEN, 1967: 141.
Cirsotrema (Cirsotrema) crassicosatum (Deshayes, 1839) – JANSSEN, 1972: 9.
Scalaria [sp.] – ZAMMIT-MAEMPEL, 1977: 25.
Cirsotrema (Cirsotrema) crassicosatum (Deshayes, 1839) – JANSSEN, 1984: 166, pl. 50 fig. 15.
Cirsotrema crassicosatum (Deshayes, 1853) – LOZOUET et al., 2001: 51, pl. 19 fig. 6.
Cirsotrema (Cirsotrema) crassicosatum (Deshayes, 1839) – WIENRICH, 2001: 450, pl. 73 figs. 1–3, pl. 91 fig. 7.
Cirsotrema crassicosata [sic] Deshayes var. *taurina* Sacco, 1891 – GATT, 2006: 177–178, 177 fig. [unn.].
Cirsotrema crassicosata [sic] Deshayes var. *obliquata* Reed, 1939 – GATT, 2006: 178, 178 fig. [unn.].
Cirsotrema crassicosata [sic] Deshayes var. *inequalis* Reed, 1939 – GATT, 2006: 178, 178 fig. [unn.].
Cirsotrema crassicosata [sic] (Deshayes, 1839) – CARONE & ARDOVINI, 2008: 609–620, 611 fig. 1 [map], 612 fig. 2 [diagram], 613 fig. 3, 616 fig. 4, 616 tab. 1, 614 pl. 1, 615 pl. 2.
Cirsotrema crassicosatum (Deshayes, 1839) – JANSSEN, 2012a: 218, 224, 226, 234.
Cirsotrema crassicosata [sic] (Deshayes, 1839) – JANSSEN, 2012a: 514.
Cirsotrema crassicosatum (Deshayes, 1850) – VAN DER VOORT, in press.

Type material studied:

MALTA • **lectotype** of '*Scalaria (Cirsotrema) crassicosata* Brocchi var. *obliquata* Cowper Reed in Baldacchino, 1939' (**established herein**); '*Globigerina Limestone*' [Upper Globigerina Limestone Formation]; 1939 or before; Miocene (Langhian); ex coll. J.G. BALDACCHINO; NMNH/M203; NMNH • **7 paralectotypes** of '*S. (C.) crassicosata* var. *obliquata*'; data as previous; NMNH/M204–210; NMNH • **lectotype** of '*Scalaria (Cirsotrema) crassicosata* Brocchi var. *inequalis* Cowper Reed in Baldacchino, 1939' (**established herein**); '*Globigerina Limestone*' [Upper Globigerina Limestone Formation]; 1939 or before; Miocene (Langhian); ex coll. J.G. BALDACCHINO; NMNH/M211; NMNH • **2 paralectotypes** of '*S. (C.) crassicosata* var. *inequalis*'; data as previous; NMNH212–13; NMNH.

Other material studied:

GERMANY • 1 sh.; Twistringen, Niedersachsen; Twistringer Schichten (Upper Mica Clay); Miocene (Langhian to Early Serravallian) (Reinbekian); J. VAN DER VOORT leg.; coll. J. VAN DER VOORT.
MALTA • 2 sh. of '*S. (C.) crassicosata* var. *inequalis*'; '*Globigerina Limestone*' [Upper Globigerina Limestone Formation]; 1939 or before; Miocene (Langhian); ex coll. J.G. BALDACCHINO; NMNH/214–15; NMNH • 1 sh. of '*Cirsotrema crassicosata* Deshayes var. *taurina* Sacco, 1891'; '*Globigerina Limestone*' [Upper Globigerina Limestone Formation]; 1939 or before; Miocene (Langhian); ex coll. J.G. BALDACCHINO; NMNH/M216; NMNH • 1 sh.; Gozo, San Lawrenz outcrop 1 km south of San Dimitri Point; Upper Globigerina Limestone Formation; Miocene (Langhian); 25 May 1993; A.W. JANSSEN leg.; 5–8m above main phosphorite level C2; NMNH • 2 sh.; Xwejni Bay, Marsalforn, Ghawdex; Upper Globigerina Limestone Formation; Miocene (Langhian); S. ATTARD leg.; coll. S. CARDONA • 1 sh.; Fomm ir-Riħ, Mgarr; Upper Globigerina Limestone Formation; Miocene (Langhian); 15 Apr. 2015; S. CARDONA leg.; coll. S. CARDONA • 1 sh.; Blata Step, Bahrija, Rabat; Upper Globigerina Limestone Formation; Miocene (Langhian); 20 Jan. 2016; S. CARDONA leg.; coll. S. CARDONA • 1 sh.; Rdum il-Hmar, Mellieħa; Blue Clay Formation; Miocene (Serravallian to Tortonian); 1995; S. CARDONA leg.; uppermost densely glauconitic sediments; coll. S. CARDONA • 3 sh.; Qammieħ, Mellieħa; Upper Globigerina Limestone Formation; Miocene (Langhian); 08 Mar. 2011; S. CARDONA leg.; coll. S. CARDONA • 2 sh.; Selmun, San Pawl il-Baħar; Upper Globigerina Limestone Formation; Miocene (Langhian); 19 Oct. 2014; S. CARDONA leg.; coll. S. CARDONA • 1 sh.; Xatt l-Aħmar towards Mgarr ix-Xini, Ghawdex; Upper Globigerina Limestone Formation; Miocene (Langhian); 08 Apr. 2015; S. CARDONA leg.; coll. S. CARDONA • 1 sh.; Qammieħ, Mellieħa; Upper

Globigerina Limestone Formation; Miocene (Langhian); 13 Feb. 2011; S. CARDONA leg.; coll. S. CARDONA.

THE NETHERLANDS • 1 sh.; Winterswijk-Miste bed, Gelderland; Breda Formation; Miocene (Late Burdigalian to Early Langhian) (Hemmoorian); J. VAN DER VOORT leg.; coll. J. VAN DER VOORT.

Stratigraphic range: Miocene: Langhian (from data collected by GATT (2006: 177–178) and from material deposited by Arie W. JANSSEN (1937–2021) in the NMNH) to the upper Serravallian (unpublished, ex coll. S. CARDONA). Non-locally, the chronologically and geographically wide-ranging species has been reported from all other chronostratigraphic units within the Miocene, namely: the Aquitanian of France; the late Burdigalian to the late Langhian of Belgium, the Netherlands, and Germany; and the Tortonian of southern Italy (GLIBERT, 1952; ANDERSON, 1964; JANSSEN, 1967, 1972, 1984; LOZOUET et al., 2001; WIENRICH, 2001; CARONE & ARDOVINI, 2008).

Remarks: The grammatical gender of *Cirsotrema* is neuter; consequently, the species name must be cited as *Cirsotrema crassicostatum*, and not *Cirsotrema crassicostata*. Citations as the latter in this paper are due to the author/s cited being quoted *verbatim*. The year of description for the species is often cited as 1939, although this is incorrect, for reasons elaborated upon by VAN DER VOORT (in press).

COWPER REED mentions one specimen of *C. crassicostata* var. *taurina* (NMNH/M216) and eight specimens of *C. crassicostata* var. *obliquata* (NMNH/M203–10); the specimens of both varieties are found in the collection in those exact numbers. The handwritten label of the specimen of *C. c.* var. *taurina* just reads '*Scalaria crassicostata* Desh.', without the varietal name (although interestingly, COWPER REED in BALDACCHINO (1939) erroneously attributes the species to BROCCHI, and not to DESHAYES). As for *C. crassicostata* var. *inequalis*, COWPER REED states that he examined '*four examples and a doubtful fifth*', agreeing with the number of specimens currently in the collection (NMNH/M211–15), although only three of these specimens bear his label (NMNH/M211–13). For this reason, and also due to the perceived doubtful nature of the fifth fossil, only the labelled three specimens are being regarded as syntypes, and the lectotype (NMNH/M211) has been selected from among them.

All three varieties fit within the intraspecific diversity expressed by the highly polymorphic *C. crassicostatum*, and therefore they may all be relegated to the voluminous synonymy of DESHAYES' species.

***Cirsotrema duciei* (Wright, 1855) (Pl. 3 Figs. J–M)**

Scalaria Duciei WRIGHT, 1855: 274–275, pl. 7 figs. 3a, 3b.

Scalaria duciei – CARUANA ex MAMO, 1867: 41.

Scalaria ducei [sic] – ADAMS, 1870: 266.

Scalaria swanni ADAMS, 1870: 266, 271, pl. 10 fig. 9.

Scalaria Duciei Wright – FUCHS, 1876: 69.

Scalaria Duciei Wright – DE BOURY, 1891: 188.

Scalaria Duciei Wrigt. – DE GREGORIO, 1895: 8 [figs. incorrect].

Scalaria Ducei [sic] Wright – COOKE, 1896: 505, 510.

Cirsotrema Ducei [sic] – COOKE, 1896: 506.

Cirsotrema Swanni Adams – COOKE, 1896: 510.

Scalaria (Cirsotrema) Duciei Wright – COWPER REED in BALDACCHINO, 1939: 170.

Epitonium duciei – PEDLEY, 1976: 231 fig. 9.

Scalaria duciei – ZAMMIT-MAEMPEL, 1989: 195.

Scalaria swanni Adams – ZAMMIT-MAEMPEL, 1989: 195.

Cirsotrema ducei [sic] (Wright, 1855) – GATT, 2006: 176–177, 177 fig. [unn.].



Pl. 2 Figs. A–N: *Cirsotrema crassicostatum* (Deshayes, 1850) from the Langhian Upper Globigerina Limestone Formation of Malta. The measurements indicate the height. **A:** Paralectotype I of *Scalaria crassicostata* var. *obliquata* Cowper Reed in Baldacchino, 1939, NMNH/M205, 24.1 mm. **B:** Paralectotype II of *S. c.* var. *obliquata*,

NMNH/M204, 27.6 mm. **C:** Paralectotype III of *S. c. var. obliquata*, NMNH/M206, 26.1 mm. **D:** Presently designated lectotype of *S. c. var. obliquata*, NMNH/M203, 27.8 mm. **E:** Paralectotype IV of *S. c. var. obliquata*, NMNH/M207, 33.8 mm. **F:** Presently designated lectotype of *Scalaria crassicostata* var. *inequalis* Cowper Reed in Baldacchino, 1939, NMNH/M211, 27.5 mm. **G:** Paralectotype V of *S. c. var. obliquata*, NMNH/M208, 31.8 mm. **H:** Paralectotype I of *S. c. var. inequalis*, NMNH/M212, 25.8 mm. **I:** NMNH/M215, 33.5 mm. **J:** Paralectotype VI of *S. c. var. obliquata*, NMNH/M209, 23 mm. **K:** Paralectotype II of *S. c. var. inequalis*, NMNH/M213, 25.2 mm. **L:** NMNH/M214, 20.6 mm. **M:** Paralectotype VII of *S. c. var. obliquata*, NMNH/M210, 46 mm. **N:** NMNH/M216, 39.7 mm.

Material studied:

MALTA • 4 sh.; ‘Globigerina Limestone’ [Upper Globigerina Limestone Formation]; 1939 or before; Miocene (Langhian); ex coll. J.G. BALDACCHINO; NMNH/217–20; NMNH • 1 sh.; Kalanka, Delimara; Upper Globigerina Limestone Formation; Miocene (Langhian); 26 Feb. 2014; S. CARDONA leg.; coll. S. CARDONA • 1 sh.; Qala, Għawdex; 36°01'37"N 14°18'19"E; Upper Globigerina Limestone Formation; c. 1 m above phosphorite hardground; Miocene (Langhian); 22 Feb. 2024; A. BOCHA leg.; NMNH.

Stratigraphic range: Miocene: Langhian to lower Tortonian (from data collected by PEDLEY (1976: 231 fig. 9) and GATT (2006: 176)). Finds of this species seem to be restricted to the Maltese archipelago. The material studied at present is exclusively Langhian.

Remarks: COWPER REED states that he examined three specimens, although four are present in the collection. As stated in the introduction, it is safe to assume that the single specimen out of these without COWPER REED’s handwritten label (**Pl. 3 Fig. M**) is the one excluded from the series he examined. Furthermore, this fourth specimen was set into a customized cottonwool support, an artifact not met with anywhere else within the collection.

WRIGHT named this species after Henry John REYNOLDS-MORETON, third EARL OF DUCIE (1827–1921) and cartographer of Malta (DUCIE, 1854); therefore, the spelling ‘ducei’ is incorrect.

ADAMS’ illustration of *Scalaria swanni* (1870) seems to be the same as fig. 3b in WRIGHT’s description of *Scalaria Duciei*, except for the superfluous addition of a protoconch, likely for aesthetic reasons (FUCHS, 1876). There is no description of *S. swanni*, nor any designation of types associated with it. In any case, this taxon must be regarded as a junior subjective synonym of *C. duciei*. The taxon *Cirsotrema duciei* var. *crassicostanomala* Sacco, 1891, described from the Italian mid-Miocene, is a separate and unrelated species (HARZHAUSER et al., 2014). In DOLLFUS et al. (1904), *C. duciei* is listed as a synonym of *C. crassicostatum* (p. 11 sub *Scalaria crassicostata* Deshayes), although the present author disagrees with that assessment on the basis of adequately divergent morphologies (compare **Pl. 2 Figs. A–N** to **Pl. 3 Figs. J–M**).

Sthenorytis Conrad, 1863

(type species by subsequent designation: *Scalaria expansa* Conrad, 1862)

Sthenorytis garigor nom. nov. pro ***Scalaria melitensis*** Cowper Reed in Baldacchino, 1939 non Fuchs, 1876 (**Pl. 3 Figs. A–I**)

urn:lsid:zoobank.org:act:61A49F42-3F93-4275-A701-08E3A644FCD3

? *Scalaria retusa* Brocchi – FORBES in SPRATT, 1843: 230, 231.

? *Scalaria retusa* Brocchi – CARUANA ex MAMO, 1867: 41.

? *Scalaria retusa* – ADAMS, 1870: 266.

Scalaria retusa Brocc. – DE GREGORIO, 1895: 8, pl. 2 figs. 9a–c. [non *retusus* Brocchi, 1814]

? *Scalaria retusa* – COOKE, 1896: 505.

? *Cirsotrema retusa* – COOKE, 1896: 506, 510.

Scalaria (Stenorhytis) [sic] melitensis COWPER REED in BALDACCHINO, 1939: 169–170. [non *melitensis* Fuchs, 1876]

Sthenorytis melitensis Reed, 1939 – GATT, 2006: 180–181, 180 fig. [unn.].

Type material studied:

MALTA • **lectotype** of ‘*Scalaria (Stenorhytis) melitensis* Cowper Reed in BALDACCHINO, 1939’ (**established herein**); ‘Globigerina Limestone’ [Upper Globigerina Limestone Formation]; 1939

or before; Miocene (Langhian); ex coll. J.G. BALDACCHINO; NMNH/M200; NMNH • **2 paralectotypes** of '*S. (S.) melitensis*'; data as previous; NMNH/M201–02; NMNH.

Stratigraphic range: Miocene: Langhian to Tortonian (from data collected by GATT (2006: 180); FORBES in SPRATT (1843: 230), who mentions specimens (as *Scalaria retusa*) from 'Bed B', corresponding to the Greensands Formation [*Rina*], a deposit of lower Tortonian age; and DE GREGORIO (1895: 8), who mentions specimens (as *Scalaria retusa*) from a '*calcaire jaunâtre friable et léger*', corresponding to the Globigerina Limestone Formation, and from '*une espèce de grès rougeâtre*', corresponding to the Greensands Formation). Finds of this species seem to be restricted to the Maltese archipelago. The material studied at present is exclusively Langhian.

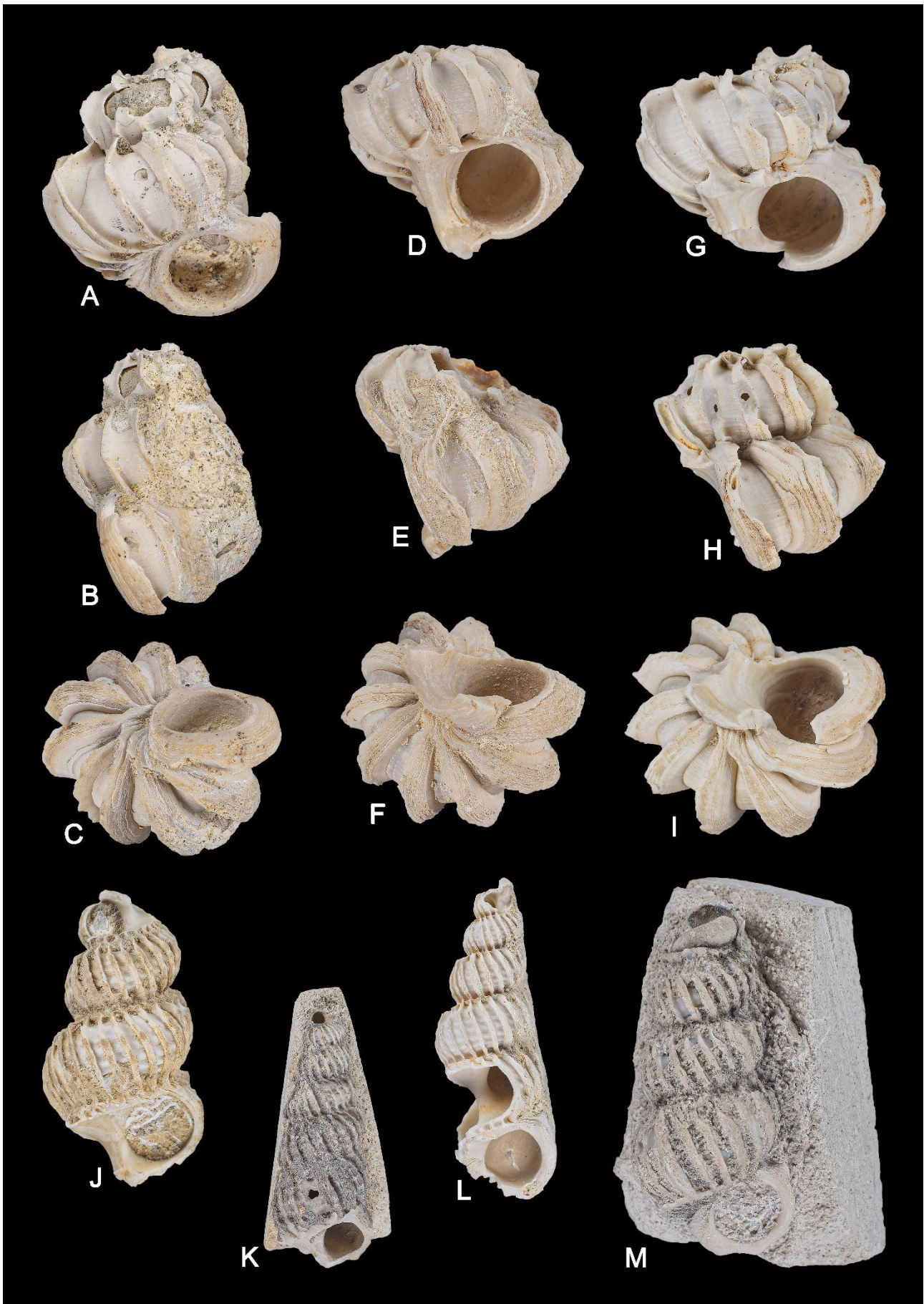
Original description: 'Shell trochiform, of few whorls, apical angle about 60°. Whorls tubular, rather loosely coiled, increasing slowly in size, cylindrical in cross section, bearing equidistant transverse lamellae corresponding but not in direct line on successive whorls; sutures rather deeply sunken; sutural angle about 75°. Lamellar costae crossing whorls at regularly decreasing intervals from mouth to apex, strong, prominent, sharp, plate-like, concavo-convex with the convexity on oral side, composed of several thin shelly layers; free edge of lamellae irregularly and weakly crenulated, with one deeper broader marginal crenulation near the upper (sutural) end forming a blunt spine; particularly developed on that lamella which forms the outer lip of the mouth; upper ends of successive lamellae bent back along the suture and fused with base of corresponding lamellae on next upper whorl; interspaces between lamellae flattened or slightly concave, curving up into aboral face of the lamellae and crossed by transverse equidistant lines, usually alternately strong and weak passing up with diminished strength on to the concave face of the lamellae. Mouth projecting laterally, circular, with broad thickened inner lip reflexed on basal whorl and thick outer lip formed chiefly by first transverse lamella; 8-10 lamellae present on basal whorl, 10-12 on next whorl, successively more closely placed, and corresponding with those on basal whorl but curved forward at base and overlapping them.' (BALDACCHINO, 1939: 169).

Remarks: *Stenorhytis* Cossmann, 1912 is an unjustified emendation of *Sthenorytis* Conrad, 1863. The large number of nominal taxa assigned to genus *Sthenorytis* may be a consequence of high intraspecific variability misinterpreted as speciation (SACCO, 1891: 34), although rapid speciation accelerated by the animals' strict niche requirements and host-specific interactions is also plausible (LANDAU et al., 2006; SCHNEIDER et al., 2009). The latter view is adopted in the present research, thoroughly supported by the ample morphological and stratigraphic data discussed further below. The validity of this taxon is thus confirmed.

Unfortunately, however, *Scalaria melitensis* Cowper Reed in Baldacchino, 1939 is primarily homonymous with *Scalaria melitensis* Fuchs, 1876 (68, pl. 1 fig. 4), a Serravallian '*minute form*' (COOKE, 1896: 503) found in the Blue Clay Formation [*Tafal*] and at present assigned to *Cirsotrema* Mörch, 1852 (see GATT, 2006). COWPER REED assigned his species to the subgenus *Scalaria (Stenorhytis)* [sic], but original subgeneric placement is irrelevant according to ICZN Art. 57.4. Together with the absence of junior synonyms for the 1939 taxon, this necessitates the proposal of a replacement name: *Sthenorytis garigor* nom. nov. Requirements for reversal of precedence according to ICZN Art. 23.9 are not met.

As noted in the original description, all three specimens of *S. garigor* are imperfect, lacking the upper whorls to varying degrees. The specimen selected as lectotype of *S. garigor* (NMNH/M200) is the most complete. This integrity of this specimen is also noted in the paper by BALDACCHINO (1939).

DE GREGORIO (1895) seems to have been the first to illustrate *S. garigor* (1895: 8, pl. 2 figs. 9a–c), although it is therein classified as *Scalaria retusa* Brocchi (currently *Sthenorytis retusus* Brocchi, 1814). His illustration of a Maltese specimen is not of optimal quality, although it does show the more numerous costae (and therefore the shorter intercostal spaces) that differentiate *S. garigor* from *S. retusus*, on which the costae are situated further apart. Any type specimens corresponding to BROCCHI'S (1814) original description of *S. retusus* are lost (MANGANELLI et al., 2011), but a



Pl. 3 Figs. A–M: Epitoniidae from the Langhian Upper Globigerina Limestone Formation of Malta: *Stenorythis garigor* nom. nov. and *Cirsotrema duciei* (Wright, 1855). A–C: Presently designated lectotype of *Scalaria* (*Stenorythis*) *melitensis* Cowper Reed in Baldacchino, 1939 (NMNH/M200); apertural, lateral, and ventral views;

diameter 24 mm. **D–F**: Paralectotype I of *Scalaria (Stenorhytis) melitensis* Cowper Reed in Baldacchino, 1939, NMNH/M201; apertural, lateral, and ventral views; diameter 25.9 mm. **G–I**: Paralectotype II of *Scalaria (Stenorhytis) melitensis* Cowper Reed in Baldacchino, 1939, NMNH/M202; apertural, lateral, and ventral views; diameter 27.5 mm. **J–M**: *Cirsotrema duciei* (Wright, 1855). The measurements indicate the height. **J**: NMNH/M217, 30.3 mm. **K**: NMNH/M218, 26.1 mm. **L**: NMNH/M219, 32.6 mm. **M**: NMNH/M220, 36 mm.

topotype is illustrated by DE BOURY (1890: pl. 4, fig. 15), while photographs of a typical specimen may be found in STRAUZ (1966: pl. 13, fig. 16). DE BOURY (1891) remarked that *S. retusus* is reminiscent of an octahedron, on account of the eight regular costae on the body whorl; whereas all type specimens of *S. garigor* possess nine ('eight to ten' according to the original description). In addition, DE BOURY (1891) noticed a maximum basal diameter of 20 mm for *S. retusus*, and an unusual absence of transverse striae on the interspaces between its costae, although this is contradicted by STRAUZ (1966), who also sets a diameter of between 22 to 26 mm. The type specimens of *S. garigor* measure between ~24 to ~28 mm in diameter, and consistently feature numerous, fine, but clearly defined transverse striae on each intercostal surface, many of which extend onto the concave side of the corresponding costa. Costae in *S. retusus* are flatter and less elevated. Whorls of *S. garigor* are rounder in cross section, spiral less tightly, and widen more slowly, also resulting in deeper sutures. The aperture is oriented more obliquely in *S. garigor*.

Morphological characteristics aside, DE BOURY (1912) attributes an Aquitanian age to *S. retusus*, while SACCO (1890) a 'Helvetian' one. The latter is an obsolete term usually indicating a period roughly contemporary to the Serravallian (see LIRER & IACCARINO, 2011), although HARZHAUSER et al. (2003) demonstrate that SACCO (1890) was actually misinterpreting a stratum of late Burdigalian deposition. This indicates that *S. retusus* is of slightly older age than, and conceivably ancestral to, *S. garigor*. No verified specimens from Malta of *S. retusus* could be traced during the studies leading to the present paper. It is highly likely that all bibliographic citations of *S. retusus* from Malta are actually referable to *S. garigor*, as in the case of DE GREGORIO (1895).

By far, the species of *Sthenorytis* morphologically closest to *S. garigor* is a Pliocene entity: *Sthenorytis trochiformis* (Brocchi, 1814), the neotype of which is similar to *S. garigor* by way of size, profile, number of costae, and distinct transversal sculpture (see CHIRLI, 2009; MANGANELLI et al., 2011). It differs by way of its thicker, more elevated, and more concavo-convex costae, which together attain a higher degree of fusion as they approach the umbilical region, almost fully concealing the intercostal spaces, whereas clear grooves between the costae are discernible in *S. garigor*. Another Pliocene species, *Sthenorytis globosa* De Boury, 1891, is smaller, with lower, thinner and more numerous costae. In any case, no post-Messinian marine deposits are to be found in Malta, with the exception of a small outlier from the mid-Pleistocene (PEDLEY, 2011).

The original description of *S. garigor* also includes comparisons with *Sthenorytis retuspina* De Gregorio, 1889. This is a Tortonian species with a body whorl that is broader than that of *S. garigor*. Its whorls increase rapidly towards the peristome, which is less rounded, with a columellar edge that rests on a basal callus separating it from the external surface of the body whorl (SACCO, 1891). Finally, the upper Burdigalian *Sthenorytis proglobosa* Sacco, 1890 is more elongated, and also has finer costae in a greater quantity (up to 15) on the body whorl (SCHNEIDER et al., 2009).

So far, it seems that *S. garigor* is endemic to the Maltese Langhian, a distinction shared with other deep-sea taxa, such as the gastropods *Carinaria maempeli* Janssen, 2012 and *Clio tripartita* Janssen, 2012 (JANSSEN, 2012a; 2012b) and the cirripedes *Trilasmis melitense* Withers, 1953 and *Scalpellum lovisatoi* de Alessandri, 1895 (GATT, 2006).

Etymology: The Maltese word *garigor* indicates a spiral stone staircase, essentially a transliteration of the German *Wendeltreppe* or the Greek derivation *Gyroscala* de Boury, 1887. It was applied by MIFSUD (in SULTANA & FALZON [eds.], 1995: 174) as the vernacular Maltese name of *Gyroscala lamellosa* (Lamarck, 1822).

ACKNOWLEDGEMENTS

The author is greatly indebted to Andrea NAPPO (Hamrun, Malta), who kindly photographed the specimens, prepared plates 2 and 3, and critically read an earlier version of the manuscript. John J. BORG (NMNH) and Sharon SULTANA (NMA) facilitated access to Heritage Malta archival material for bibliographic research, and Charlotte BIRKETT and Kathryn ROOKE (Library and Archives of the Natural History Museum, London, England) made available biographical data on F.R. COWPER REED, together with samples of his handwriting. Luigi ROMANI (Muséum national d'Histoire naturelle, Paris, France) and Jaap VAN DER VOORT (Ostercappeln, Germany) critically read an earlier version of the manuscript and suggested improvements, and the latter permitted comparison with specimens from his collection. Stephen CARDONA (Mqabba, Malta) loaned material for examination and comparison. Antoni BOCHA (Pietà, Malta) donated a specimen of *C. duciei* to the NMNH. Philippe BOUCHET (Muséum national d'Histoire naturelle, Paris, France) advised on nomenclature, and James LICARI (Heritage Malta) advised on calligraphy.

REFERENCES

- ADAMS A.L., 1870. *Notes of a naturalist in the Nile valley and Malta, a narrative of exploration and research in connection with the natural history, geology, and archæology of the lower Nile and Maltese Islands*. xvi + 295 pp.; Edinburgh, UK: Edmonston and Douglas.
- ANDERSON H.-J., 1964. Die miocäne Reinberk-Stufe in Nord- und Westdeutschland und ihre Mollusken-Fauna. *Fortschritte in der Geologie von Rheinland und Westfalen*, **14**: 31–368 + pls. 1–52 + figs. 1–18 + tabs. 1–3.
- BALDACCHINO J.G. & DUNBABIN T.J., 1953. Rock Tomb at Ghajn Qajjet, near Rabat, Malta. *Papers of the British School at Rome*, **21**: 32–41 + pls. 12–14.
- BALDACCHINO J.G. & EVANS J.D., 1954. Prehistoric Tombs near Zebbug, Malta. *Papers of the British School at Rome*, **22**: 1–21.
- BALDACCHINO J.G., 1939. Specimens of *Scalaria* from the Globigerina Limestone of Malta. *Reports on the working of Government Departments during the financial year, 1938-1939*: 169–171.
- BATE D.M.A., 1935. Two new mammals from the Pleistocene of Malta, with notes on the associated fauna. *Proceedings of the Zoological Society of London*, **112**: 247–264.
- BOURY E. DE, 1890. Révision des Scalidae miocènes et pliocènes de l'Italie. *Bullettino della Società Malacologica Italiana*, **14** (9^{1/2}–20): 161–326 + pl. 4.
- BOURY E. DE, 1891. Étude critique des Scalidae Miocènes et Pliocènes de l'Italie décrits ou cités par les auteurs et description d'espèces nouvelles. *Bullettino della Società Italiana di Malacologia*, **15**: 81–213 + pl. 4.
- BUGEJA A., 2006. Dr J. G. Baldacchino and his archaeological bequest to St. George's parish church, Qormi (Malta). In: C. SAGONA, VELLA GREGORY I. & BUGEJA A. (eds). *Punic antiquities of Malta and other ancient artefacts held in ecclesiastical and private collections, 2 (Ancient Near Eastern Studies Supplement 18)*; pp. 23–45; Leuven, Belgium: Peeters.
- CARONE G. & ARDOVINI R., 2008. Sul rinvenimento di *Cirsotrema crassicosata* (Gastropoda, Epitoniidae) nel Miocene superiore del Monte Poro (Calabria, Italia). *Bollettino del Museo Regionale di Scienze Naturali, Torino*, **25**: 609–620.
- CARUANA A.A., 1867. *Enumeratio ordinata molluscorum Gaulo-Melitensium of the late Mr. Giuseppe Mamo*. 78 pp.; Malta: British Press.
- CHIRLI C., 2009. *Malacofauna pliocenica toscana. Vol.7. Ptenoglossa Gray J.E., 1847*. 98 pp. + 31 pls.; Tavernelle, Italy: self-published.

- CLEEVELY R.J., TRIPP R.P. & HOWELLS Y., 1989. Mrs Elizabeth Gray (1831-1924): a passion for fossils. *Bulletin of the British Museum of Natural History (Historical Series)*, **17** (2): 167–258.
- COOKE J.H., 1896. Notes on the Globigerina Limestones of the Maltese Islands. *Geological Magazine*, **3** (33): 502–511.
- DESHAYES G.P., 1839–1858. *Traité élémentaire de conchyliologie avec les applications de cette science à la Géologie*. Vol. 1(1): xii + 1–368 pp., 9 fold-out tables; vol. 1 (2): 1–824 pp.; vol. 2: 1–384 pp.; Atlas: 80 + [iii]–xi pp., pls. 1–79, 81–85, 88–93, 100–128, 131–132, 8bis, 12bis, 14bis, 32bis, 41bis, 44bis, 59bis, 59ter, 60bis, 73bis, 73ter. Paris, France: Victor Masson.
- DOLLFUS G.F., BERKELEY COTTER J.C. & GOMES J.P., 1904. *Mollusques Tertiaires du Portugal. Planches de Céphalopodes, Gastéropodes et Pélécy-podes laissées par F.A. Pereira da Costa, accompagnées d'une explication sommaire et d'une esquisse géologique*. 5 [v–ix] + 46 pp. + 1 tab. + pls. 28–36, 37, 1–22; Lisbon, Portugal: Commission du Service Géologique du Portugal / Imprimerie de l'Académie Royale des Sciences, Lisbonne.
- DUCIE [H.J.R.-M.] EARL OF, 1854. *Geological chart of the island of Malta*. 1 sheet; Valletta, Malta: Edmund Goodenough.
- FUCHS TH., 1876. Über den sogenannten "Badener Tegel" auf Malta. *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften - Mathematisch-Naturwissenschaftliche Classe*, **73**: 67–74 + pl. 1.
- GATT M., 2006. Il-Ġeologija u l-Paleontologija tal-Gżejjer Maltin – I. *Kullana Kulturali*, **68**: 1–264.
- GIANNELLI I. & SALVATORINI I., 1972. Foraminiferi planctonici dei sedimenti Terziari dell'arcipelago Maltese, 1. Biostratigrafia del 'Globigerina Limestone'. *Atti della Società Toscana di Scienze Naturali, Memorie*, **A79**: 49–74.
- GLIBERT M., 1952. Faune malacologique du Miocène de la Belgique, II Gastropodes. *Mémoire Institut Royal des Sciences Naturelles de Belgique*, **121**: 1–197 + pl. 1–10.
- GREGORIO A. DE, 1895. Description de quelques fossiles tertiaires (surtout miocènes) de Malte. *Annales de Géologie et de Paléontologie*, **19**: 1–22.
- HARZHAUSER M., LANDAU B.M., MANDIC O., KROH A., KUTTELWASCHER K., GRUNERT P., SCHNEIDER S. & DANNINGER W., 2014. Gastropods of an Oligocene (Early Miocene) rocky shore in the North Alpine Foreland Basin (Allerding, Austria). *Jahrbuch Der Geologischen Bundesanstalt*, **154**: 83–113.
- HARZHAUSER M., MANDIC O. & ZUSCHIN M., 2003. Changes in Paratethyan marine molluscs at the Early/ Middle Miocene transition: diversity, palaeogeography and palaeoclimate. *Acta Geologica Polonica*, **53** (4): 323–339.
- JACOBS E., WEISSERT H. & SHIELDS G., 1996. The Monterey event in the Mediterranean: a record from shelf sediments of Malta. *Paleoceanography*, **11**: 717–728.
- JANSSEN A.W., 1967. Beiträge zur Kenntnis des Miocäns von Dingden und seiner Molluskenfauna 1. *Geologica et Paläontologica*, **1**: 115–173.
- JANSSEN A.W., 1972. Die Mollusken-Fauna der Twistringer Schichten (Miocän) von Norddeutschland. *Scripta Geologica*, **10**: 1–95 + pls. 1–11.
- JANSSEN A.W., 1984. *Mollusken uit het Mioceen van Winterswijk-Miste. Een inventarisatie, met beschrijvingen en afbeeldingen van alle aangetroffen soorten*. 451 pp. + 82 pl.; Amsterdam, The Netherlands: Koninklijke Natuurhistorische Vereniging & Rijksmuseum van Geologie en Mineralogie.

- JANSSEN A.W., 2012a. Systematics and biostratigraphy of holoplanktonic Mollusca from the Oligo-Miocene of the Maltese Archipelago. *Bollettino del Museo Regionale di Scienze Naturali, Torino*, **28**: 197–601.
- JANSSEN A.W., 2012b. Validation of holoplanktonic molluscan taxa from the Oligo-Miocene of the Maltese Archipelago, introduced in violation with ICZN regulations. *Cainozoic Research*, **9** (2): 189–191.
- LANDAU B., LA PERNA R. & MARQUET R., 2006. The Early Pliocene Gastropoda (Mollusca) of Estepona, Southern Spain. Part 6: Triphoroidea, Epitonioidae, Eulimoidea. *Palaeontos*, **10**: 1–96.
- LIRER F. & IACCARINO S., 2011. Mediterranean Neogene historical stratotype sections and Global Stratotype Section and Point (GSSP): state of the art. *Annalen des Naturhistorischen Museums in Wien, Serie A*, **113**: 67–144.
- LOZOUET P., LESPORT J.-F. & RENARD R., 2001. Révision des Gastropoda (Mollusca) du stratotype de L'Aquitainien (Miocène inf.) site de Saucats "Larley", Gironde, France. *Cossmanniana*, **8**: 1–189.
- MANGANELLI G., SPADINI V. & BENOCCI A., 2011. Mediterranean neogene *Sthenorytis*: taxonomic and nomenclatural status of Brocchi's (1814) *Turbo retusus* and *Turbo trochiformis* (Gastropoda Epitoniidae). *Journal of Conchology*, **40**: 605–610.
- PEDLEY H.M., 1976. A palaeoecological study of the Upper Coralline Limestone, *Terebratula-Aphelesia* Bed (Miocene, Malta) based on bryozoan growth-form studies and brachiopod distributions. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **20** (3): 209–234.
- PEDLEY H.M., 2011. The Calabrian Stage, Pleistocene highstand in Malta: a new marker for unravelling the Late Neogene and Quaternary history of the islands. *Journal of the Geological Society*, **168**: 913–926.
- ROSE E.P.F., PRATT S.K. & BENNETT S.M., 1992. Evidence for sea-level changes in the Globigerina Limestone Formation (Miocene) of the Maltese islands. *Paleontologia y Evolución*, **1** (24–25): 265–276.
- ROSSI A.M., 2017. Archaeology and archaeological discourse in pre-Independence Malta. *Malta Archaeological Review*, **11**: 51–59.
- SACCO F., 1890. Catalogo paleontologico del bacino terziario del Piemonte. Continuazione e fine. *Bollettino della Società Geologica Italiana*, **9**: 185–340.
- SACCO F., 1891. I molluschi dei terreni terziarii del Piemonte e della Liguria, 9. Naticidae (fine), Scaliidae ed Aclidae. *Bollettino dei Musei di Zoologia ed Anatomia comparata della Reale Università di Torino*, **6**: 1–103 + 2 pl.
- SCHNEIDER S., BERNING B., BITNER M., CARRIOL R.-P., JÄGER M., KRIWET J., KROH A. & WERNER W., 2009. A parautochthonous shallow marine fauna from the Late Burdigalian (early Ottnangian) of Gurlarn (Lower Bavaria, SE Germany): Macrofaunal inventory and paleoecology. *Neues Jahrbuch für Geologie und Paläontologie – Abhandlungen*, **254**: 63–103.
- SPRATT T.A.B., 1843. On the geology of the Maltese Islands. *Proceedings of the Geological Society of London*, **97**: 225–232.
- STRAUSZ L., 1966. *Die Miozän-Mediterranen Gastropoden Ungarns*. 693 pp.; Budapest, Hungary: Akadémiai Kiadó.
- SULTANA J. & FALZON V. [eds.], 1995. *Flora u Fawna ta' Malta*. 434 pp.; Floriana, Malta: Dipartiment għall-Farsien tal-Ambjent.
- TRECHMANN C.T., 1938. Quaternary conditions in Malta. *Geological Magazine*, **75** (1): 1–26.

VAN DER VOORT J., in press. Note on the correct year of publication of Deshayes' *Scalaria crassicostata* (*Cirsotrema crassicostatum*) (Gastropoda: Epitoniidae), and its precise bibliographic reference. *Bulletin of the National Museum of Natural History, Malta*, **1** (1).

WIENRICH G., 2001. Gastropoda bis Cancellariidae. *Die Fauna des marinen Miozäns von Kevelaer (Niederrhein)*, **3**: 388–639.

WOODS H., 1946. Dr. F. R. Cowper Reed. *Nature*, **157**: 400.

WRIGHT T., 1855. On fossil echinoderms from the island of Malta: with notes on the stratigraphical distribution of the fossil organisms in the Maltese beds. *Annals and Magazine of Natural History*, **15**: 101–127, 175–196, 262–277, pls. 4–7.

ZAMMIT-MAEMPEL G., 1977. *An outline of Maltese geology and guide to the Geology Hall of the National Museum of Natural History, Mdina, Malta*. 44 pp.; Malta: Progress Press Ltd.

ZAMMIT-MAEMPEL G., 1989. *Pioneers of Maltese geology*. 302 pp.; Malta: P.E.G. Ltd.
