



Acteonidae, Bullinidae and Ringiculidae (Gastropoda: Heterobranchia) from the Plio-Pleistocene of the Philippines

RENATE A. HELWERDA^{1,2}

¹Naturalis Biodiversity Center, P.O. Box 9517, 2300 RA Leiden, The Netherlands

²Corresponding author. E-mail: Renate.Helwerda@naturalis.nl

Abstract

Twenty-three species of Acteonidae, Bullinidae and Ringiculidae are documented from the so-called “Cabarruyan” fauna from the Plio-Pleistocene of Pangasinan, the Philippines. There are eleven species of Acteonidae, one species of Bullinidae and eleven species of Ringiculidae. Seven species are described here as new, these are: *Bathyacteon valdesi* nov. spec., *Bullina virgoidea* nov. spec., *Ringicula bella* nov. spec., *R. circumscripta* nov. spec., *R. caelestis* nov. spec., *R. opima* nov. spec. and *Microglyphis angulata* nov. spec.. The presence of Acteonidae and Bullinidae indicates that polychaete worms were also present.

Key words: fossil, molluscs, new species, marine, Indo-West Pacific, Cabarruyan

Introduction

The investigation of the highly diverse “Cabarruyan” fossil fauna is continued in this paper. The holoplanktonic gastropods and the vetigastropods were previously investigated (Janssen 2007; Helwerda *et al.* 2014; Helwerda & Wesselingsh 2014). This paper focuses on the gastropod families Acteonidae, Bullinidae and Ringiculidae.

The higher classification of Acteonidae, Bullinidae and Ringiculidae is not yet fully resolved. They belong within subclass Heterobranchia; representatives of Acteonoidea are either placed in the informal clade “Lower Heterobranchia” (Bouchet & Rocroi 2005; Dinapoli & Klussmann-Kolb 2010; Göbbeler & Klussmann-Kolb 2010; Jörger *et al.* 2010), in the order Architectibranchia (Malaquias *et al.* 2009; Gründel & Nützel 2012) or in an unnamed clade with Rissoelloidea, which is a sister clade to either Nudipleura or Tectipleura (Zapata *et al.* 2014). Acteonidae and Bullinidae are usually placed together in superfamily Acteonoidea, along with the Aplustridae, whereas Ringiculidae is placed in its own superfamily Ringiculoidea (Bouchet & Rocroi 2005). These superfamilies are probably related; Gründel & Nützel (2012) go as far as to include Ringiculidae within the Acteonoidea, but unfortunately there is no molecular evidence to support this, because members of Ringiculidae have not been included into molecular studies yet.

The Acteonidae, Bullinidae and Ringiculidae have a long geological record, with the earliest known representatives of each of the three families occurring in the Jurassic (Gründel & Nützel 2012). This is congruent with the divergence times estimated in molecular phylogenies (Dinapoli & Klussmann-Kolb 2010; Jörger *et al.* 2010; Zapata *et al.* 2014), which place the split between representatives of Acteonoidea and sister clade *Rissoella* in the Triassic or the Jurassic. Family Acteonidae probably has the largest number of extant species, with about 110 described to date (Göbbeler & Klussmann-Kolb 2010). Ringiculidae has about half that number and Bullinidae fewer still. However, some species are poorly described and illustrated. Species delimitation can also be problematic. For example, the delimitation of the Mediterranean *Ringicula* species has been the subject of much debate (e.g. Mariottini *et al.* 2000). Many more species are probably awaiting discovery, especially in deeper waters of the Indo-Pacific. Valdés (2008), for instance, added 17 new species from Indo-Pacific waters deeper than 100 m to the Acteonidae and one to the Bullinidae. Indo-Pacific Ringiculidae are not well studied, with the exception of those from Japanese waters (e.g. Hori 2000). Our knowledge on the ecology of these groups is also far