



Three new species of the deep-water genus *Bathycadulus* (Mollusca, Scaphopoda, Gadilidae)

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The genus *Bathycadulus* Scarabino, 1995 was described on the basis of a bathyal species (*Bathycadulus fabrizioi* Scarabino, 1995) collected from the southern Indian and western Pacific waters. Here we describe three new species, and conduct a morphometric analysis of shells of the four species. Those findings confirming the rather large bathyal and abyssal geographic distribution of the genus.

Shell measurements were taken according to Shimek (1989), Steiner (1999) and Steiner and Linse (2000), including length (L); maximum curvature (Arc); anterior aperture height (Ha); anterior aperture width (Wa); apical aperture height (Hp); apical aperture width (Wp). *Bathycadulus* has unique characters that provide additional meristic information, those are: (Wol) maximum diameter at anterior swelling, lateral view; (Wal) maximum diameter at posterior swelling, lateral view; (Wtom) distance between anterior swelling and aperture; (Wtoa) distance between posterior swelling and apex; (Wl) maximum diameter at equator (Fig. 13-A). New species descriptions are based on the holotypes.

We performed a Discriminant Function Analysis to integrate all morphometric data in a single analysis by standardizing the morphometric data following Romesburg (1984). We also employed a Multivariate Analysis of Covariance (MANCOVA) to detect differences in mean values of morphometric measures between species, with shell length as a covariate (Adams and Funk 1997). We adjusted the p-value for rejection of MANCOVA null hypothesis to 0.0001 in order to compensate for variance homogeneity. All statistical procedures were performed using STATISTICA for Windows (Statistica 7.0) by StatSoft, Inc, Tulsa, Oklahoma.

SEM pictures were taken at the Service Commun de Microscopie Electronique du Laboratoire des Sciences de la Vie (MNHN).

Abbreviations. IFREMER: Institut Français de Recherche pour l'Exploitation de la Mer, Brest, France; MCZ: Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA; MNHN: Muséum national d'Histoire naturelle, Paris, France; MNHNM: Museo Nacional de Historia Natural, Montevideo, Uruguay; MOM: Musée Océanographique de Monaco, Monaco; NMP: Natal Museum, Pietermaritzburg, South Africa; SAM: South African Museum/Natural History, Capetown, South Africa; USNM: National Museum of Natural History, Washington, D.C., USA; WHOI: Woods Hole Oceanographic Institution, Massachusetts, USA; dd: empty shells; lv: live specimens (shell with soft parts).

Taxonomy

Scaphopoda Bronn, 1862

Gadilida Starobogatov, 1974

Gadilidae Stoliczka, 1868

Genus: *Bathycadulus* Scarabino, 1995

Type species by original designation *Bathycadulus fabrizioi* Scarabino, 1995