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**Systematics of the bubblegum corals  
(Cnidaria: Octocorallia: Paragorgiidae)  
with description of new species from New Zealand and the Eastern Pacific**

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## Systematics of the bubblegum corals (Cnidaria: Octocorallia: Paragorgiidae) with description of new species from New Zealand and the Eastern Pacific

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## Abstract

Bubblegum corals, Paragorgiidae, are among the largest and most ecologically important benthic sessile deep-water organisms harboring hundreds of associated. However, no recent reviews of their diversity and systematics are yet available, despite the recent increase in the sampling and fishing of deep-water habitats. This study covers 17 Paragorgiidae species. There were only five previously known species for *Paragorgia* (*P. arborea* [Linnaeus], *P. johnsoni* Gray, *P. splendens* Thomson & Henderson, *P. regalis* Nutting [= *dendroides* Bayer], and *P. coralloides* Bayer) and just one of *Sibogorgia* (*S. weberi* Stiasny). Eleven new species are described here comprising 9 *Paragorgia* spp. (*P. alisonae*, *P. kaupeka*, *P. maunga*, *P. aotearoa*, *P. wahine*, *P. whero*, *P. yutlinux*, *P. stephencairnsi*, and *P. tapachtli*) and 2 *Sibogorgia* spp. (*S. tautahi* and *S. dennisgordoni*). This study also uncovered two areas of endemism for bubblegum corals corresponding to New Zealand and the Eastern Pacific (Mexico to Canada). New Zealand has 6 likely endemic species of *Paragorgia* (*P. alisonae*, *P. kaupeka*, *P. maunga*, *P. aotearoa*, *P. whero*, and *P. wahine*) and the two new species of *Sibogorgia*, whereas *P. yutlinux*, *P. stephencairnsi*, and *P. tapachtli* were collected in the Eastern Pacific. There seem to be a few trans-Pacific species such as *P. regalis*, and likewise in the Atlantic with *P. johnsoni*, but it is clear that no other species is as cosmopolitan as *P. arborea* with discontinuous but bi-polar distribution. There are cases of morphological sister species such as *P. johnsoni* and *P. aotearoa* that correspond to the Atlantic and Pacific respectively, but the phylogenetic relationships of the remaining species indicate that most paragorgiid diversity and speciation took place in the Indo-Pacific region, as suggested by a number of sympatric species. Surface sclerites, radiates, exhibit a great deal of variation under the Scanning Electron Microscope (SEM), providing a number of characters for phylogenetic reconstruction, including three kinds of radial ornamentation and several types of surfaces and sub-ornamentation at the ultrastructure level. The three most parsimonious trees of equal length, using morphological characters, showed *P. arborea* as basal to the rest of the *Paragorgia* species (using *Sibogorgia* as the outgroup), which were divided in two clades. One clade includes the species with asymmetrical surface sclerites with some radial ornaments larger or different than others have (*P. maunga* - [*P. coralloides*-*P. tapachtli*-*P. regalis*-*P. kaupeka*]). In this clade, *P. maunga* conserved the basal position in the most parsimonious trees whereas relationships among the other species were not consensual. The other clade comprised species with symmetrical surface sclerites ([*P. splendens*-*P. wahine*] *P. alisonae*- [*P. yutlinux*-*P. stephencairnsi*]-*P. johnsoni*-*P. aotearoa*). *P. splendens*-*P. wahine*-*P. whero* and *P. yutlinux*-*P. stephencairnsi* maintained their sister relationships respectively in all most-parsimonious trees but no consensual relationships with respect to and among the other species of the clade. Complete descriptions of described and new species using SEM, species comparisons, character states, and a species key are also provided in this paper.

**Key words:** Paragorgiidae; *Paragorgia*; *Sibogorgia*; New Zealand; seamounts; Eastern Pacific; octocoral; phylogeny; Octocorallia; deep-water coral; bubblegum corals; Coelenterata; Cnidaria