

## MESONERILLA PROSPERA, A NEW ARCHIANNELID FROM MARINE CAVES IN BERMUDA

Wolfgang Sterrer and Thomas M. Iliffe

*Abstract.*—A new species of Archiannelida, *Mesonerilla prospera*, is described from inland marine caves of Bermuda. This new species is particularly interesting in that it was collected from thin layers of mud on and under stones in totally dark areas of the caves, whereas all other marine Archiannelida (except one deep-water species) are members of the interstitial sand fauna.

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Recent studies of island marine caves in the Western Atlantic have revealed the presence of rich marine faunas. Comprehensive cave faunal surveys are now underway in Bermuda (Sket and Iliffe 1980) and on San Salvador Island, Bahamas (Carpenter 1981). Additionally, spot collections have been made from a number of sites (Peck 1973). Significant marine troglobites discovered include Remipedia, a new class of Crustacea from Grand Bahama Island (Yager 1981), a variety of caridean shrimps from diverse localities (Hobbs *et al.* 1977), and a mysid from Jamaica (Bowman 1976). Further collections from anchialine pools, as yet unclassified ecologically, have produced representatives of the amphipod suborder Ingolfiellidea (Stock 1977a), hadziid amphipods (Stock 1977b), an amphipod of the genus *Psammogammarus* (Stock 1980), the isopod family Microparasellidae (Stock 1977c), and the order Thermosbaenacea (Stock 1976).

The Bermuda Islands, site of the current survey, consist of Pleistocene and Recent eolian and marine limestones completely capping a mid-ocean volcanic seamount. The islands' limestone caves were primarily formed during low stands of sea level corresponding to periods of Pleistocene glaciation (Bretz 1960, Palmer *et al.* 1977, Iliffe 1981). As postglacial sea levels rose, much of the former extent of the caves was flooded by sea water. Approximately 200 inland caves are known from Bermuda, over half of which contain tidal, sea level pools. Bermuda's longest cave is the 1.8 km, totally underwater Green Bay Cave system (Iliffe 1980). A biological survey of the terrestrial and marine caves of Bermuda was begun in 1978 (Sket and Iliffe 1980). Although most of the animals collected from marine caves were more or less regular immigrants from open littoral habitats, a number of new species including blind and probably subterranean ones were found. Two new species of caridean shrimp, *Somersiella sterreri* and *Typhlatya iliffei* (Hart and Manning, 1981); an isopod, *Atlantasellus cavernicolus*, representing a new family (Sket, 1979); and a new calanoid copepod, *Miostephos leamingtonensis* (Yeatman, 1980) have so far been described from Bermuda's caves. We here describe a new species of Archiannelida collected from the Walsingham Caves, Bermuda.

*Mesonerilla prospera*, new species

Fig. 1

*Material.*—Walsingham Caves, Hamilton Parish, Bermuda: 8 December 1978, Walsingham Sink Cave, 1 specimen from 1 m water depth collected with long-

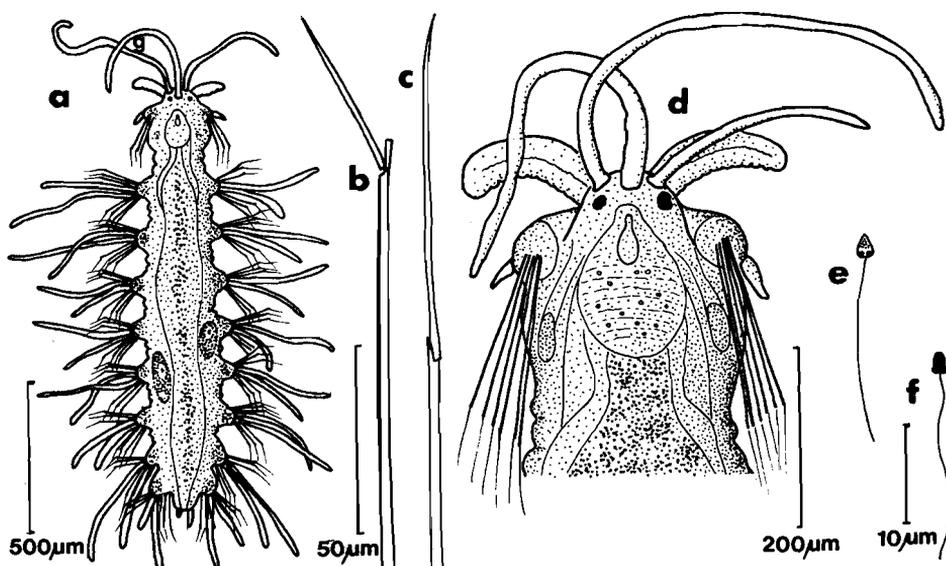


Fig. 1. *Mesonerilla prospera*: a, Young female specimen, dorsal view; b, Detail of setae from segments 2-9; c, Detail of setae from segment 1; d, Anterior end, dorsal view; e, Spermatid; f, Sperm.

handled dip net; 5 January 1979, Walsingham Cave, 3 specimens from 1 m water depth collected with long-handled dip net; 22 May 1979, Walsingham Cave, 3 specimens collected from 1 m depth with long-handled dip net; 24 July 1979, Walsingham Cave, 3 specimens collected from 1 m depth with slurp gun, 3 specimens collected from 1 m depth with small dip net; 9 October 1981, Cripplegate Cave, 1 specimen collected from surface waters of outflowing tidal spring with plankton net; 28 November 1981, Deep Blue Cave, 1 specimen collected from 12-15 m depth by hand net with scuba; 17 January 1982, Emerald Sink Cave, 1 specimen collected from 11 m depth by hand net with scuba; 26 January 1982, Cherry Pit Cave, 4 juvenile specimens collected by pumping water from 2.5 m depth through a plankton net; 31 January 1982, Myrtle Bank Cave, 1 specimen collected from rock walls and ledges at 5 m depth by hand net with scuba; 23 June 1982, Cherry Pit Cave, 6 specimens collected from 1-5 m depths by hand net. Observations and measurements from 9 specimens were used for the species description. A whole mount of a female specimen collected on 23 June 1982 at Cherry Pit Cave has been deposited as holotype (USNM 73764).

*Distribution.*—Known only from the anchialine habitats of the Walsingham Caves, Bermuda.

*Habitat.*—The Walsingham Caves are located in a 450 m wide strip of land separating the nearly enclosed Harrington Sound from the more open Castle Harbour. At least 40 cave entrances are known from the Walsingham tract, a low, hilly, heavily overgrown area of 0.15 km<sup>2</sup>. Caves of this area are characterized by fissure entrances and large collapse chambers. Two large underwater caves with a total of 1 km explored length, 20 m depths and 7 known entrances probably represent only segments of a much larger and more complex cave system. Walsingham and Deep Blue Caves have already been connected by cave

divers, as have Cripplegate and Myrtle Bank Caves. Both of these groups of caves as well as Cherry Pit and Walsingham Sink Caves are believed to be hydrologically connected as part of the same system. Emerald Sink Cave, located only 300 m away from Cherry Pit Cave, may also be connected.

Amplitude and phase of the tides have been measured in Harrington Sound, Castle Harbour and pools of the Walsingham Caves. While there is no significant difference between tides in Castle Harbour and those of the open sea, Harrington Sound tides have an average lag time of 2 hours and 45 minutes and a range of only 30% of the open sea tides. Tides for the Walsingham Caves are intermediate, having an average 1 hour lag and 60% range. This difference in phase between Harrington Sound and Castle Harbour tides produces alternating tidal currents flowing through the caves such that an estimated 50% of the tidal volume of Harrington Sound (half a million m<sup>3</sup>) passes through caves (Morris *et al.* 1977). Plankton and organic detritus carried by tidal currents probably provide the primary source of food for the cave animals. Surface salinities in pools of the Walsingham Caves average 27‰, while at 1 m salinities already reach 34‰.

In order to determine where exactly within the cave pools *Mesonerilla prospera* is living, selective collecting was carried out. Using a slurp gun, material was collected from the steep rock walls of the cave. A small dip net was used to obtain animals from the upper few centimeters of the thick silt on the cave floor. Material from piles of 30–60 cm diameter rocks with only thin layers of silt was collected both with the slurp gun and by moving rocks quickly up and down to generate a flushing action and then sweeping a small net through the disturbed water. Six specimens of *Mesonerilla prospera* were collected from the piles of rock, three each with the slurp gun and net, while none were obtained from either the cave walls or floor. The discovery of an archiannelid living in inland caves, on and under stones, is exceptional since all other marine members of this group, except one deep-water species (Sterrer 1968), are members of interstitial sand fauna. The collection of four juveniles from open water in Cherry Pit Cave and one adult from the Cripplegate tidal spring indicates that subterranean water currents may be significant in determining the distribution of *Mesonerilla prospera*.

*Description.*—The length of adults (excluding appendages) ranges from 1500 to 2050  $\mu\text{m}$ , with the maximum width of 250–420  $\mu\text{m}$  (to 520  $\mu\text{m}$  including parapodia) somewhat behind midbody (Fig. 1a). The largest juvenile (i.e., without visible gonads) was 1300  $\mu\text{m}$ ; smaller juveniles collected in water pumped from above the bottom measured 300  $\mu\text{m}$  (with 5 segments), 400  $\mu\text{m}$  (7 segments) and 450  $\mu\text{m}$  (8 segments).

The prostomium (Fig. 1d) is rounded and carries a pair of reddish eyes and 3 tentacles dorsally, and a pair of palps ventrally. The median tentacle can be up to 650  $\mu\text{m}$  long, the lateral ones to 600  $\mu\text{m}$ ; in most specimens however, they are much shorter. Palps are up to 230  $\mu\text{m}$  long and 50–60  $\mu\text{m}$  wide. They are gently curved, and are broadest near the base, tapering gradually towards the tip.

There are 9 setigerous segments. Whereas each parapodium carries 2 thin and sometimes rather long (to 550  $\mu\text{m}$ ) cirri in segments 2–9, the buccal parapodia carry only 1 usually very short cirrus (30  $\mu\text{m}$ ). A pair of anal cirri (urites) were seen in only one of the specimens; they were short (120  $\mu\text{m}$ , and 30  $\mu\text{m}$ ), and are probably easily lost. Each parapodium carries about 20 setae arranged in 2 bundles. Setae are compound on all segments; they are of fairly equal length

(shaft 170  $\mu\text{m}$ , end piece 45  $\mu\text{m}$ ) throughout segments 2–9, but longer (shaft 220  $\mu\text{m}$ , end piece 90  $\mu\text{m}$ ) on the first segment. The setae of segment 1 also differ in having a pointed shaft spur whereas it is blunt in the setae of all other segments (Fig. 1b, c).

The mouth opening is longitudinally slit-shaped and sometimes appears triangular. The internal epithelia of pharynx, esophagus and rectum are ciliated. None of the food particles present in the gut could be identified.

Sexes are separate. A female may have up to 8 mature eggs (to 200  $\mu\text{m}$  diameter) arranged on both sides of the gut posterior to segment 4. None of the females observed carried eggs or embryos externally. Of the two males, one had segments 4–9 full of sperm (Fig. 1f) and spermatids (Fig. 1e). Sperm is about 22  $\mu\text{m}$  long, with a bullet-shaped head of 2  $\mu\text{m}$ , and a tail of about 20  $\mu\text{m}$ .

The unrestrained animal glides slowly over the substratum by means of its ciliation. Like many other Nerillidae, this species shows a rapid escape reaction when disturbed.

*Etymology.*—The name of the species refers to its well-fed appearance, but is also an allusion to Prospero's Cave in Shakespeare's "The Tempest," a play allegedly inspired by the shipwreck of Bermuda's first settlers.

*Discussion.*—The number of segments (9) and the compound setae clearly place the new species in the genus *Mesonerilla* Remane, 1949. Of 7 species presently ascribed to this genus [*M. minuta* Swedmark, 1959 has been assigned to another genus (Jouin 1971)], 3 are distinct from *M. prospera* in being hermaphroditic; a fourth, *M. luederitzi* Remane, 1949, is known only as juveniles. One of the remaining 3 species, *M. biantennata* Jouin, 1963, differs from *M. prospera* in lacking a median tentacle. Another, *M. intermedia* Wilke, 1953, is characterized by brood protection devices ("elytres") in the female (Jouin 1968) which *M. prospera* does not have. The most recently described species, *M. ecuadoriensis* Schmidt and Westheide, 1977, from shallow sandy bottoms in the Galapagos Islands, is also the one that most closely resembles *M. prospera*; there are differences, however, in the shape of the palps, the number of parapodial cirri, the presence of eyes, and the body size. At 2000  $\mu\text{m}$ , *M. prospera* is by far the largest of all *Mesonerilla* species; of the described species *M. intermedia* reaches 1200  $\mu\text{m}$ , most of the others only measure 1000  $\mu\text{m}$  or less.

Finally, the habitat in which *M. prospera* occurs, sets it apart from all other marine Nerillidae, which live interstitially in sand, with the exception of *Paranerilla limicola* Jouin and Swedmark, 1965, which lives on deep mud bottoms (Sterrer 1968). The only freshwater nerillid, *Troglochaetus beranecki* Delachaux, 1921, although not closely related morphologically, shares with *M. prospera* the troglobitic way of existence (Pennak 1971). A biogeographic observation of interest is that *M. prospera* has its closest relative on another oceanic island, Galapagos, just as Bermuda's cave decapod shrimps are most closely related to species from Caribbean islands (Antigua, Cuba, Caymans, Bahamas), Ascension Island and, again, Galapagos (Hart and Manning 1981). Whether this indicates that oceanic islands, and island cave habitats in particular, are refuges for the descendants of formerly widely distributed but now extinct marine faunas must await further evidence.

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Bermuda Biological Station, Ferry Reach 1-15, Bermuda.