The bizarre lives of bone-eating worms

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The females of the recently discovered Osedax marine worms feast on submerged bones via a complex relationship with symbiotic bacteria, and they are turning out to be far more diverse and widespread than scientists expected. Californian researchers investigating the genetic history of Osedax worms have found that up to twelve further distinct evolutionary lineages exist beyond the five species already described. The new findings about these beautiful sea creatures with unusual sexual and digestive habits are published today in the online open access journal *BMC Biology*.

Geneticists placed the new Osedax genus in the polychaete annelid family Siboglinidae when it was first discovered on whalebones in Monterey Bay, California in 2004. Siboglinidae or 'beard worms' are among the few known animals that, as adults, completely lack a mouth, gut and anus, and rely entirely on endosymbiotic bacteria for their nutrition. Found to date in the eastern and western Pacific and the north Atlantic, Osedax are unique because they penetrate and digest bones using bacteria housed in a complex branching "root" system. Sexual inequality is also part of daily life for Osedax: harems of dwarf males live inside the tubes of the much larger female.

Robert Vrijenhoek and Shannon Johnson from Monterey Bay Aquarium Research Institute, together with Greg Rouse from Scripps Institution of Oceanography, both in California, US looked at two mitochondrial genes and three nuclear genes from Monterey Bay Osedax worms. Their study revealed 17 distinct evolutionary lineages, clustered into five clades (groups including a single common ancestor and all its descendants). The

researchers could tell these clades apart based on the anatomy of the worms as well as their genetics.

Precisely when these Osedax boneworms split from their other beard worm relatives depends whether researchers pick a 'molecular clock' calibrated for shallow or deep-sea invertebrates (Osedax have been found at depths ranging from 30 to 3000 metres). Based on the shallow invertebrate scenario Osedax probably branched off about 45 million years ago when archeocete cetaceans first appeared and then diversified during the late Oligocene and early Miocene when toothed and baleen whales arrived. Using the slower, deep-sea invertebrate clock model Osedax evolved during the Cretaceous and began to diversify during the Early Paleocene, at least 20 million years before the origin of large marine mammals.

Research to settle the evolutionary age of Osedax might examine fossil bones from Cretaceous marine reptiles and late Oligocene cetaceans to find possible trace fossils left by Osedax roots, suggest the authors. "Regardless, the present molecular evidence suggests that the undescribed Osedax lineages comprise evolutionarily significant units that have been separate from one another for many millions of years, and provide a solid foundation for their future descriptions as new species," concludes Vrijenhoek.

More information: A remarkable diversity of bone-eating worms (Osedax; Siboglinidae; Annelida), Robert C Vrijenhoek, Shannon B Johnson and Greg W Rouse, *BMC Biology* (in press), www.biomedcentral.com/bmcbiol/

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