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Deep-sea hydrothermal vent parasites: where do we stand?

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Introduction

Parasites are organisms that develop durable and intimate interactions with their hosts and adversely affect their hosts' fitness (Combes, 2001). Numerous recent reports have clearly indicated that these organisms are major driving forces in the evolution of their hosts as well as in the evolution of host community structure (Brooks & McLennan, 1993; Poulin et al., 2000; Combes, 2001). Since no living species is free of parasites, knowledge about those present at deep-sea vents and their distribution patterns within and between hosts in these ecosystems would allow a better understanding of vent community structure and dynamics. However, a cursory review of the literature indicates that there is a paucity of data relative to parasites reported from deep-sea hydrothermal vents. Therefore, our aim in this work was to review the present state of knowledge of the parasite fauna from deep-sea hydrothermal vents in order to ascertain how well studied vent parasites are and to determine if the deep-sea environment is itself a factor affecting the apparent lack of reports of parasites from these vents. It is expected that the knowledge gained through this work will provide a baseline for targeting future studies of these important organisms and their effects in vent communities in general.

Methods

A literature search focusing on both the deep-sea vent and non-vent parasites was carried out using the Zoological Record database. Additionally, an exhaustive back-tracking of the literature from primary sources was also performed. In order to determine if the deep-sea environment was a factor affecting the number of parasites reported from vents, a comparison of parasites reported from deep-sea vents with parasites from non-vent areas below 1000 m was performed. Although numerous papers on parasites from "deep-sea" environments were found, only those specifying precise depths were utilized in the analysis.

Results and Discussion

Reports of parasites from deep-sea hydrothermal vents are extremely scarce. To our knowledge, only six parasite species have thus far been described from these vents: four copepods (two from the Galapagos Rift vents, one at 13°N EPR, and one at Juan de Fuca Ridge: Humes & Dojiri, 1980; Huys & Conroy-Dalton, 1997; Lopez-Gonzales et al., 2000; and Humes & Voight, 1997, respectively), one nematode from Logatchev and Snake Pit/Moose of the MAR (Justine et al., in press), and one acanthocephalan at 13°N EPR (Buron, 1988), also present at 9°N EPR (samples provided by R.A. Lutz). The hosts of deep-sea hydrothermal vent parasites include fish, copepods, annelids, and mollusks. Further, although not officially reported in the literature, digeneans and another acanthocephalan were recently recovered at various vents along the Mid Atlantic Ridge and East Pacific Rise (M. Segonzac, pers. com.; A. Marques, pers. com.). Further, one fungus has been reported from the Galapagos Rift and 21°N EPR (Van Dover & Lichtwardt, 1986), as have several polychaetes (from the Galapagos Rift, the Okinawa Trough, and more recently from Hakuno

Knoll: Pettibone, 1984; Miura & Hashimoto, 1991; and Hashimoto et al., 2001, respectively). However, further work needs to be done before these latter organisms, currently categorized as commensals, may be considered parasitic. This data contrasts sharply with the number of parasites reported from non-vent deep-sea areas, wherein more than one hundred species have been reported over 200 times from various hosts (mostly teleosts, but also skates, mollusks, and crustaceans). Among the 105 species of non-vent deep-sea metazoan parasites thus far identified from below 1000 m deep, 57% are digeneans (trematodes), 25 % are crustaceans (of which 80% are copepods); 10% are cestodes, 4% are acanthocephalans, 2% are nematodes, and 2% are monogeneans. Protistans (including myxozoans) make up less than 17% of all parasites found in this environment, although many of these require more accurate identification before they are useful in further analysis. These results show that the deep-sea environment is not a limiting factor in-and-of itself in determining the presence of parasites at vents because a relatively large number of parasites have successfully conquered the non-vent deep-sea environment. As more data comes on line, these results may change although they are considered at this time to be accurate given the completeness of the literature search performed. Based upon this data it is highly likely that a number of deep-sea hydrothermal vent parasites are yet to be discovered and that, as Dollfus noted in 1931 regarding deep-sea parasites in general, deep-sea hydrothermal vent parasites are regrettably *terra incognita*. Since vent hosts are often found at high concentration (Van Dover, 2000), a condition highly conducive to parasitization, it is likely, given the ever growing number of potential hosts being identified from vents, that the lack of parasites reported from these areas is most likely due to the fact that they are not searched for rather than that they are scarce or absent. Because parasites have such a strong influence on their hosts, including important roles in determining host population size and host community structure in other ecological contexts (Combes, 2001), it is important to acknowledge their existence and to study them at all levels of their biology in the vents. Any knowledge acquired about host-parasite systems from such an extreme environment would take us a step further in understanding the biological dynamics both of the vents and the parasites while allowing the elucidation of coevolutionary relationships affecting the more general community in this unique environment.

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References

Brooks D.R & McLennan D.A. 1993. *Parascript: parasites and the language of evolution*. Smithsonian Series in Comparative Evolutionary Biology (Edt V.A. Funk and P.F. Cannell). Smithsonian University Press. 429 pp.

Buron I. de 1988. *Hypoechinorhynchus thermaceri* n.sp. (Acanthocephala: Hypoechinorhynchidae) from the deep-sea zoarcid fish *Thermarces andersoni* Rosenblatt and Cohen, 1986. *Journal of Parasitology*, **74**: 339-342.

Combes C. 2001. *Parasitism: the ecology and evolution of intimate interactions*. The University of Chicago Press. 728 pp.

Dollfus R-Ph. 1931. Acanthocephalidé d'un poisson capturé par 4785 m de profondeur. *Annales de Parasitologie*, **2**: 185-187.

Hashimoto J., Ohta S., Chiba H., Yamaguchi H., Tscuchida S., Okudaira T., Watabe H., Yamanaka T. & Kitazawa M. 2001. Hydrothermal vents and associated biological communities in the Indian Ocean. *InterRidge News*, **10**: 21-22.

Humes A.G. & Dojiri M. 1980. A siphonostome copepod associated with a vestimentiferan from the Galapagos Rift and the East Pacific Rise. *Proceedings of the Biological Society of Washington*, **93**: 697-707.

Humes A.G. & Voight J.R. 1997. *Cholidya polypi* (Copepoda: Harpacticoida: Tisbidae), a parasite of deep-sea octopuses in the Norther Altantic and Northeastern Pacific. *Ophelia*, **46**: 65-81.

Huys R. & Conroy-Dalton S. 1997. Discovery of hydrothermal vent Tantulocarida on a new genus of Argestidae (Copepoda: Harpacticoida). *Cahiers de Biologie Marine*, **38**: 235-249.

Justine J.L, Cassone J & Petter A. (In press). *Moravecnema segonzaci* n.sp., n. gen. (Nematoda: Cystidicolidae) from *Pachycara thermophilum* (Zoarcidae), a deep-sea hydrothermal vent fish from the Mid-Atlantic Ridge. *Folia Parasitologica*.

Lopez-Gonzalez P.J., Bresciani J., Huys R., Gonzales A.F., Guerra A., & Pascual S. 2000. Description of *Genesis vulcanoctopusi* gen. et sp. nov. (Copepoda: Tisbidae) parasitic on a hydrothermal vent octopod and a reinterpretation of the life cycle of cholidyinid harpacticoids. *Cahiers de Biologie Marine*, **41**: 241-253.

Miura T., & Hashimoto J. 1991. Two new branchiate scale-worms (Polynoidae: Polychaeta) from the hydrothermal vent of the Okinawa Trough and the volcanic seamount off Chichijima Island. *Proceedings of the Biological Society of Washington*, **104**: 166-174.

Pettibone M.H. 1984. A new scale-worm commensal with deep-sea mussels on the Galapagos hydrothermal vent (Polychaeta: Polynoidae). *Proceedings of the Biological Society of Washington*, **97**: 226-239.

Poulin R., Morand S. & Skorping A. 2000. *Evolutionary biology of host-parasite relationships: theory meets reality.* Elsevier, Amsterdam. 250 pp.

Van Dover C.L. 2000. *The ecology of deep-sea hydrothermal vents*. Princeton University Press. 424 pp.

Van Dover C.L. & Lichtwardt R.W. 1986. A new trichomycete commensal with a galatheid squat lobster from deep-sea hydrothermal vents. *Biological Bulletin*, **171**: 461-468.