Geophysical Research Abstracts, Vol. 8, 10774, 2006
SRef-ID: 1607-7962/gra/EGU06-A-10774

How do physico-chemical parameters influence reproductive and developmental patterns of deep-sea hydrothermal vent organisms?

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Environmental physico-chemical parameters such as temperature can impair biological functions. Consequences of these perturbations are significant if they occur during embryonic development. The polychaete annelid *Alvinella pompejana*, here chosen as our model, naturally experiences high temperature at deep-sea hydrothermal vents. Embryos and larvae are involved in dispersal processes and colonization of distant sites, which is crucial to maintain the species. How these early-life-stages can tolerate physico-chemical challenges encountered in the vent habitat and during dispersal is essential in understanding mechanisms of adaptation to extreme conditions.

In previous studies, we showed that the structure of the genital apparatus and gametogenesis mode in females of *A. pompejana* might allow a control of the spawning timing depending on environmental conditions. In addition, using experimental colonization devices deployed at vent sites, we showed that reproductively mature females seem to avoid areas that are most exposed to abrupt temperature variations. This suggests various controlling mechanisms that protect freshly spawned embryos from extreme conditions.

Combining data from incubations under controlled conditions in pressure vessels, and those from incubations conducted at vent sites, we determined the pressure and temperature parameters compatible with embryonic survival and development. The low thermal tolerance of *A. pompejana* embryos, their barophily, and their sensitivity to chemical conditions suggest that embryonic life can not sustain harsh hydrothermal vent conditions with environmental extremes. Embryos might develop at the site of

release in areas with moderate hydrothermal influence or disperse in an arrested state through abyssal sea water. We recently developed molecular methods to identify larval stages directly collected *in situ*, which now allow us to track embryos and larvae in the environment, enabling us to test the hypotheses on dispersal capabilities of vent species.