R2K Letter of Intent for 15 Aug 2006 NSF proposal deadline

Collaborative Research: Effects of seismic disturbance on the breeding and recruitment of vent animals in the Lau back-arc basin

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Fires and storms play major roles as disturbance factors that initiate reproductive responses while signaling the availability of newly available habitat in terrestrial plants and intertidal animals, respectively. At deep-sea hydrothermal vents, earthquakes may play a similar role. The proposed research is for a synoptic program of geophysical measurements and biological collections and observations to test the hypothesis that seismic activity cues reproductive responses and influences subsequent recruitment dynamics of invertebrates at and near hydrothermal vents in the Lau Basin. The seismic data will be generated by another funded NSF project (Wiens et al., P.I.'s) that will run concurrently.

Hydrothermal vents on fast-spreading ocean ridges are dynamic and frequently disturbed, with new vents opening and closing on decadal timescales, and flow pathways reorganizing more frequently. Vent animals are restricted in their distributions, squeezed between their dependence on chemosynthetic microbes and the opposing physiological limitations of their multicellular bodies. This tenuous existence is further complicated by a general lack of those cyclic cues that are used for entrainment of life-cycle rhythms (e.g., initiation of gametogenesis, spawning) by shallow-water and terrestrial organisms. In the "normal" deep sea, seasonal food falls from the lighted surface waters provide a seasonal cue that may entrain reproductive cycles. At vents, however, the food supply is from hydrothermal fluid, which depends on maintenance of existing flow pathways. As the communities are so closely tied to vent fluids, we hypothesize that life cycles might be organized by the geophysical factors, including earthquakes, that control the rates and locations of fluid delivery.

As we learn more about how our planet works, it is increasingly recognized that biological, physical and chemical processes are inextricably linked. It is this recognition that forms the basis for the Ridge 2000 program. Projects with integrative multidisciplinary approaches are vital for understanding these linkages. The connections between earthquakes and life have far-reaching implications, even for where life might be found on other planets. On earth, earthquakes are best known for taking life, but they may also be vital for sustaining life. Should this prove to be true, our results will help balance the views of a populace that view earthquakes only in terms of their tragic human toll. The P.I.'s on this grant have strong records of outreach and education at both the college and k-12 levels. Deep-sea and oceanographic research done in their labs often is

included in textbooks, in television documentaries, in magazine and newspaper articles, on educational websites, in museum exhibits and on radio programs. The project provides extensive and intensive learning opportunities for students in hands-on multidisciplinary research through various REU and internship programs. Cruises with internet outreach components will be available to k-12 and college students throughout the world, including the GK-12 program at the University of Oregon that uses graduate marine biology students to teach more than 3000 elementary school children weekly.