Cruise Prospectus
Flow Mow:
Precise Measurement of the Heat Flux from a Hydrothermal Vent System

***R/V Thomas G. Thompson*, 3 August-21 August, 2000**
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Research Program

The goal of the Flow Mow program is to measure the flux of heat from the Main Endeavour Field (MEF), Endeavour Segment, Juan de Fuca Ridge with unprecedented accuracy and precision. The measurement approach taps the technological capabilities of the autonomous vehicle ABE to survey a tightly-spaced grid on a horizontal plane above the vent field. This grid will be placed ~50-100 meters off the seafloor to intersect buoyant hydrothermal plumes while they rise, in a regime where the time scale since discharge from the seafloor is tens of minutes. Synthetic computer-based surveys suggest that a survey at this level provides a statistically meaningful sampling density while optimizing signal-to-noise levels in the measured parameters (the velocity, temperature, salinity and hydrothermal tracer fields). We have three principal program elements:

ABE Surveys. The MEF has been visited by deep submergence vehicles in 1984, 1987, 1988, 1991, 1995, 1996, 1997 and 1999; these place the extent of field at ~200 x 400 meters (Figure 2). With new battery technology we anticipate 18 hours dives separated by 12 hour servicing periods. During the cruise approximately 12 dives of this duration would be completed. In an 18 hour dive travelling at 0.6 knots, a track of ~20 km can be covered allowing ~10 m track spacing in a two-directional grid survey of the field. The measurements in this grid will allow calculation of the upward flux of heat and the ability to relate specific heat-salt-tracer signatures to the spatial variability of composition of fluids exiting from the vents. If all work at MEF proceeds satisfactorily, we would devote the last four of these to single measurements of the Mothra, High Rise and Salty Dawg fields and to evaluating one of the CTD targets (see below).

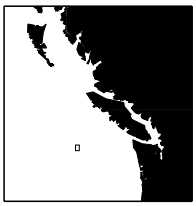
CTD Operations. The servicing periods for ABE would be used for CTD operations to achieve three goals: 1) determine the stability of the water column in the axial valley between known vent fields, 2) determine the hydrographic character of the vertical walls of the box defined by the survey area, and 3) probe possible sources of venting identified by Veirs et al. (*J. Geophys. Res.*, **104**, 29239-29247, 1999) (Figure 3). One of these targets would be surveyed by ABE if all MEF objectives are achieved (see above).

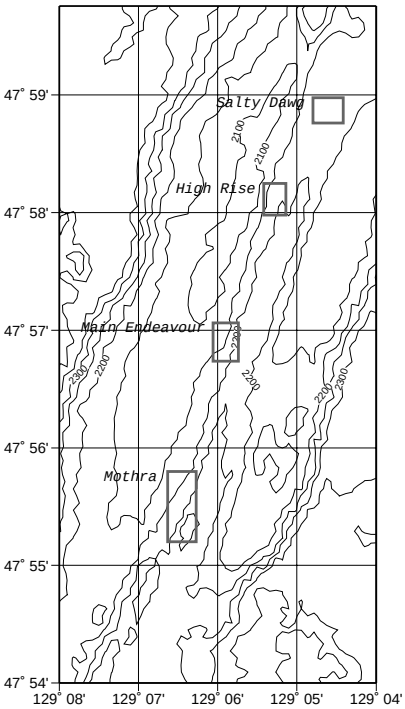
Bathymetry. ABE carries a scanning high frequency sounder of ~10 cm vertical resolution. This instrument would be the focus of a cautious initial dive (so that we could then use this high quality bathymetric map to program ABE so as to avoid unnecessary expenditures of energy for obstacle avoidance). Additional data from the dive series will provide a detailed view of the topography of the MEF.

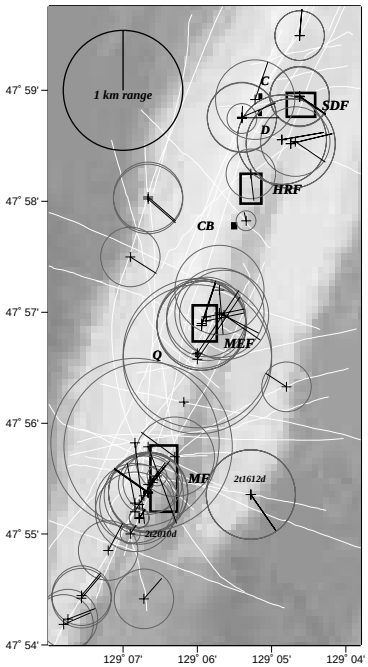
Operations Area

The work would be conducted on Endeavour Segment, Juan de Fuca Ridge (Figure 1). The principal focus for ABE surveys is the Main Endeavour Field (MEF) (Figure 2). If all our scientific objectives are met at MEF, then ABE surveys would be conducted the other three fields. Between ABE dives, we would be conducting CTD work at MEF, at other targets in the general vicinity (Figure 3) and on initial approach at a site ~10 km east of the axial valley.

Figures 1, 2 and 3







Schedule

Start	End	
0900, 3 Aug	1200, 4 Aug	transit to work area
1200, 3 Aug	1400, 4 Aug	CTD background station
1600, 4 Aug		arrive work area
1600, 4 Aug	1600, 5 Aug	test dive
1600, 5 Aug	0900, 20 Aug	alternate CTD and dive operations
0900, 20 Aug	0900, 21 Aug	transit to port

Clearance

The area of operations requires clearance from Canada.

We are aware that the Canadian government is in the process of establishing a Marine Protected Area in this work area. While formal rules have not yet been established, we emphasize that all of our activities will be conducted in the water column above the vent fields and, because of the very nature of our work vehicle, samples of vent materials (biota, rocks, fluids) will not be taken nor instruments placed.

We have a long-standing collaboration with Dr. Richard E. Thomson of the Institute of Ocean Sciences/Fisheries and Oceans Canada focused on measurement of the heat flux from vent systems (e.g., Thomson et al., *Earth Planet. Sci. Letters*, **111**, 141, 1992). We are in the process of establishing a formal cooperative agreeement between this study and his on-going work on physical oceanographic processes within the MPA. His work in the area from the *CCGS John P. Tully* just before our cruise is the central element of this collaboration.

For More Information

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Participants *(current as of 07Jun2000)*

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5	Al Duester	Engineer, Woods Hole Oceanographic Institution	ABE Operations
6	Curtis Martin	Eagle Pitcher	ABE Operations
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10	Shusaku Goto	Tokai University, Japan	Vehicle Sensors
11	Scott Veirs	Graduate Student, University of Washington	Lead, CTD Operations
12	Christian Sarason	Instructor, Seattle Central Community College	Lead, Topography
13	Ryan Delaney	University of Washington	CTD Operations
14	Diane Nielson	Teacher, Mercer Island High School	REVEL, Lead Teacher
15	TBN		REVEL
16	TBN		REVEL
17	TBN		REVEL
18	TBN		REVEL
19	Hold		REVEL
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