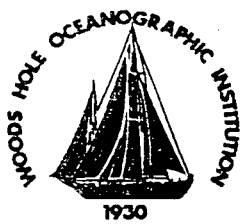
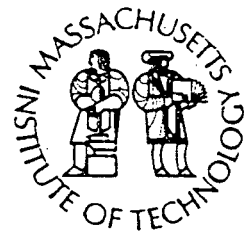


WHOI-91-23

**Woods Hole Oceanographic Institution
Massachusetts Institute of Technology**



**Joint Program
in Oceanography
and
Oceanographic
Engineering**



DOCTORAL DISSERTATION

Diffuse Flow from Hydrothermal Vents

by

D. Andrew Trivett

August 1991

WHOI-91-23

Diffuse Flow from Hydrothermal Vents

by

D. Andrew Trivett

Woods Hole Oceanographic Institution
Woods Hole, Massachusetts 02543

and

The Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

August 1991

DOCTORAL DISSERTATION

Funding was provided by the National Science Foundation through Grant OCE-8917448, NOAA National Sea Grant College Program Office, Department of Commerce, under Grant No. NA86-AA-D-SG090, Ocean Ventures Fund, and WHOI Friends of Vents through a Grant from the Mellon Foundation.

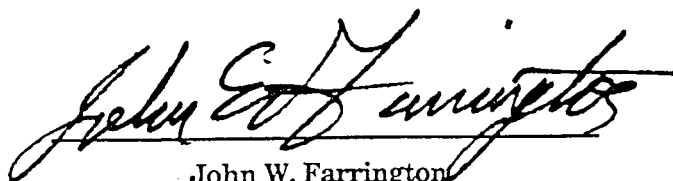
Reproduction in whole or in part is permitted for any purpose of the United States Government. This thesis should be cited as: D. Andrew Trivett, 1991. Diffuse Flow From Hydrothermal Vents. Sc.D. Thesis, MIT/WHOI, WHOI-91-23.

Approved for publication; distribution unlimited.

Approved for Distribution:



Albert J. Williams 3rd, Chairman
Department of Applied Ocean Physics and Engineering



John W. Farrington
Dean of Graduate Studies

DIFFUSE FLOW FROM HYDROTHERMAL VENTS

by

D. ANDREW TRIVETT

Submitted to the Woods Hole Oceanographic Institution / Massachusetts Institute of Technology Joint Program in Oceanographic Engineering in June, 1991 in partial fulfillment of the requirements for the degree of Doctor of Science.

Abstract

The effluent from a collection of diffuse hydrothermal vents was modelled to determine the fate of this source of flow under typical environmental conditions at seafloor spreading centers. A laboratory simulation was conducted to test an analytic model of diffuse plume rise. The results showed that diffuse plumes are likely to remain near the seafloor, with their maximum rise height scaled with the diameter of the source of diffuse flow. The entrainment of ambient seawater into these plumes is limited by the proximity to the seafloor, thus slowing the rate of dilution.

The model of diffuse plume behaviour was used to guide the design and implementation of a scheme for monitoring the flow from diffuse hydrothermal vents in the ocean. A deployment of an array at the Southern Juan de Fuca Ridge yielded measurements of a variety of diffuse plume properties, including total heat output.

Two distinct sources of hydrothermal flow were detected during the field deployment. The larger source was 1-1.5km north of the instrument array, and its energy output was 450 ± 270 MW. A smaller source was located 100m east of one instrument in the array. The energy output of this source was 12 ± 8 MW. The rise heights of the centerlines of these plumes were 45m and 10m, respectively.