



Craig Cary
30 November – December 20, 2004

Extreme 2004 - Nov. 30 - Dec. 20th, 2004

(Manzanillo - San Diego)

Primary funded project: A metagenomic analysis of an extreme symbiosis - NSF Biocomplexity (S.C. Cary, A. Murray, G. Luther, G. Gao)

Science themes: Microbial ecology, genomics, invert. Physiology and population genetics, geochemistry

Vehicles used: Atlantis/Alvin

Dives scheduled: 12

Areas: 9° N and 13° N EPR



Goals and accomplishments

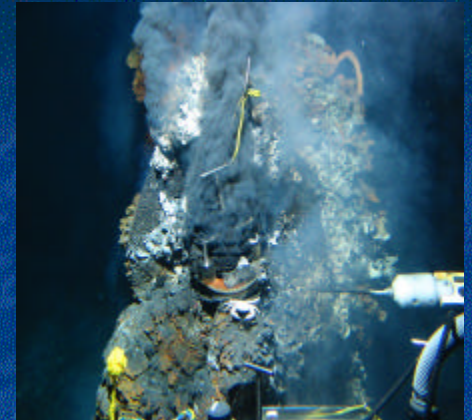
- Discretely sampled *Alvinella* with associated geochemistry
- Collected 24 and 48 hr protochimneys
- Collected large vol. of vent water (>200 L) for viral studies
- Collected large vol. of vent water for protozoan studies
- Collected Riftia for genomic and proteomic studies
- Collected for population genetics research

PI's involved: Cary (U. Delaware), Murray (DRI), Wommack (U. Delaware), Caron (USC), Felbeck (SIO), Cavanaugh (Harvard).

Accomplishments:

- 13 dives completed out of 12 scheduled
- 11 at 9°N and 2 at 13°N
- Successful discrete collection of *Alvinella* with geochemistry
- 5 successful deployments of proto-chimney collection devise
- 5 ancillary programs all successful

Assessment: An amazing leg - great cooperative spirit between Science, Alvin Group and Crew - all equipment essential to the leg, operated flawlessly
-We thank the crew of the Atlantis and the Alvin Group for all their efforts -



Cover : McCliment and Cary, Environmental Microbiology, Jan. 2006

Education and Outreach

The EXTREME 2004 - a major educational and outreach effort

The “Virtual Fieldtrip” concept:

Allows students to experience the discovery of science

Targeting ages 8-18 yrs - cultural and socioeconomic diversity

Direct communication with shipboard scientists

Developed resource materials, interactive website
and curricula



Extreme results to date for 5 years of the program:

- Over 2000 schools (> 190,000 students enrolled) - 50 states, 9 countries
- Web site internationally acclaimed for education and outreach
- Curriculum adapted by science programs around the world
- Recently fully translated into German - Austrian distribution



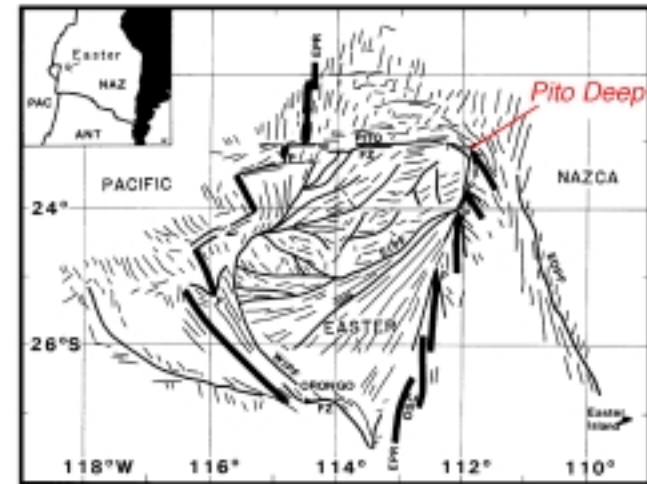
www.ocean.udel.edu/extreme2004

Jeff Karson
30 January - March 8

Structure & Composition of Super-Fast Spread Crust at Pito Deep: AT11-23 Alvin, Jason II, DSL-120

Easter Island, Jan. 30, 2005-Tahiti, March 8, 2005

3 Ma EPR Crust (149 mm/yr)



PARTICIPANTS

Duke University: Jeff Karson (chief scientist), Emily Klein, Nick Hayman, Lindsay Morgan, Meagen Pollock, Marshall Bowles

University of Hawaii: Richard Hey

University of South Florida: David Naar, Brian Donahue, Kate Ciembronowicz, Dana Gaydos

Scripps Institute of Oceanography: Jeff Gee

College of Wooster: Bob Varga

University of Victoria: Kathy Gillis, Laurence Coogan*, Kerri Heft

University of Illinois: Steve Hurst

University of Rhode Island: Chris Popham

FRANCE: Jean Francheteau*, Roger Hekinian*

PROGRAM SUMMARY

2 Study Areas: 6x3 km, 4500-3000 m;
full side-scan & transects at 300-500 m

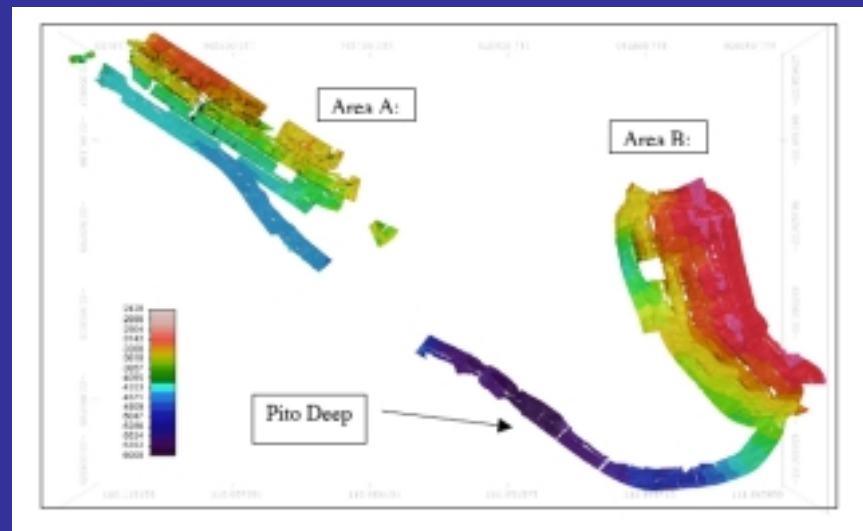
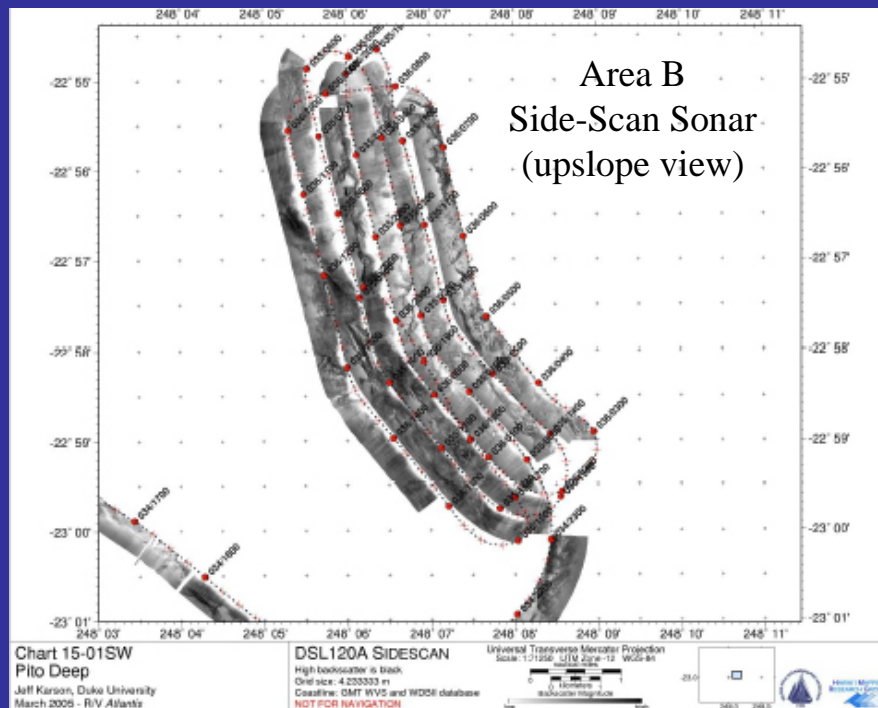
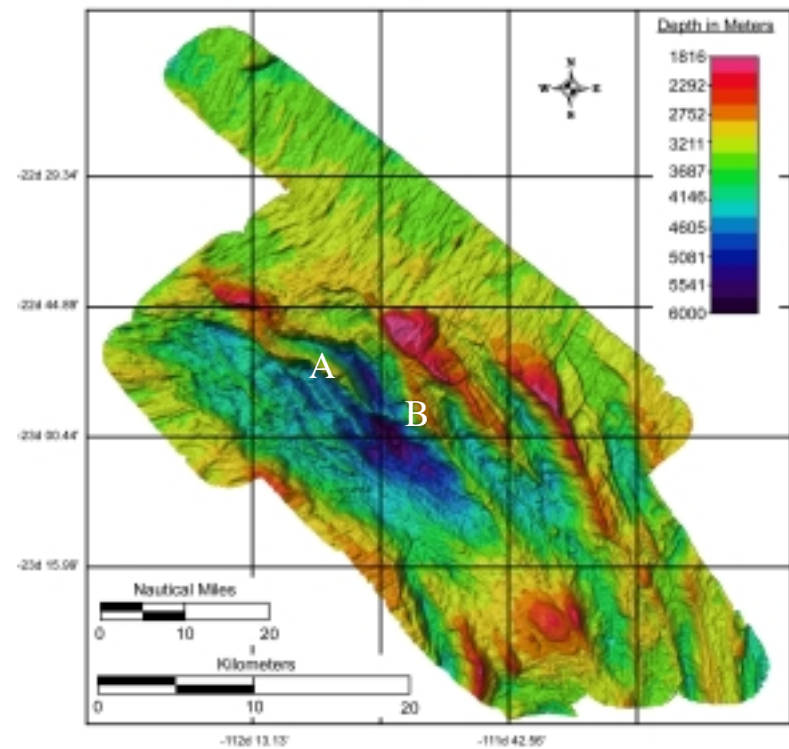
DSL-120 Side-Scan Sonar: 5 days, 4.5 hrs.; up/down data;
towed magnetometer

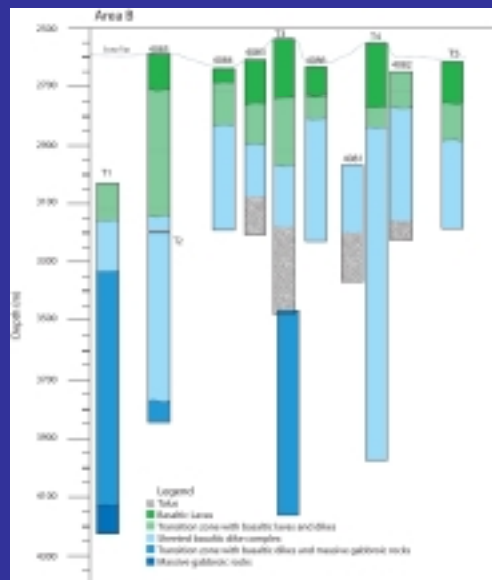
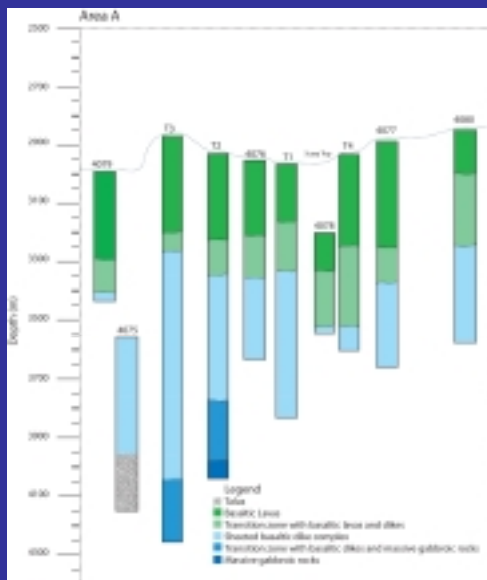
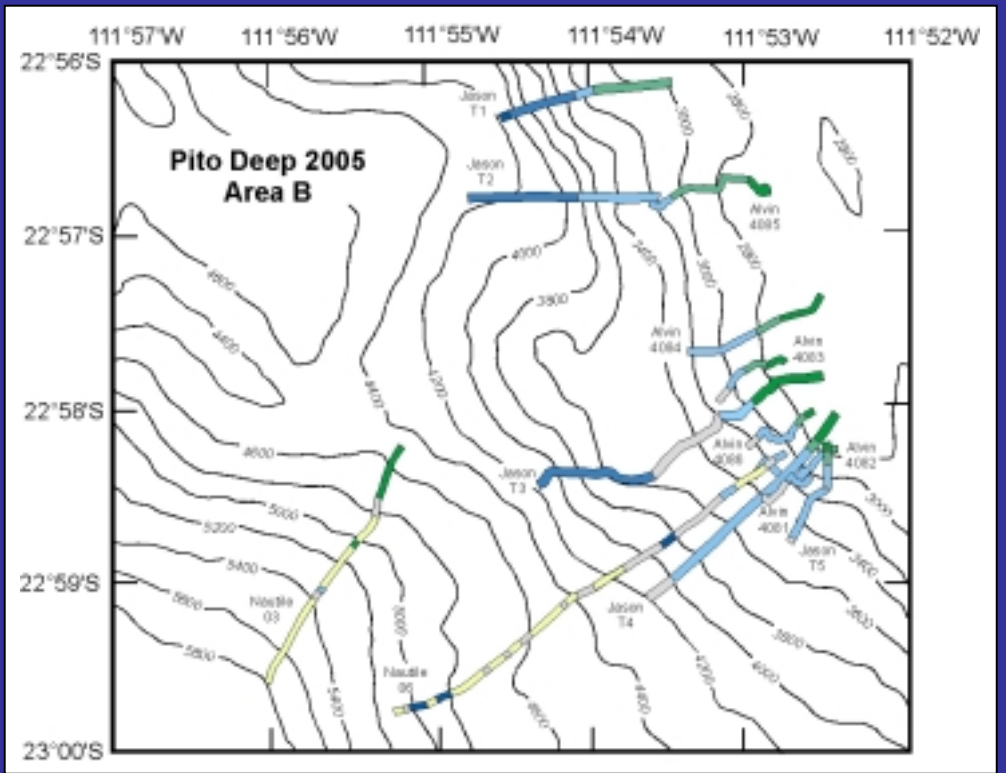
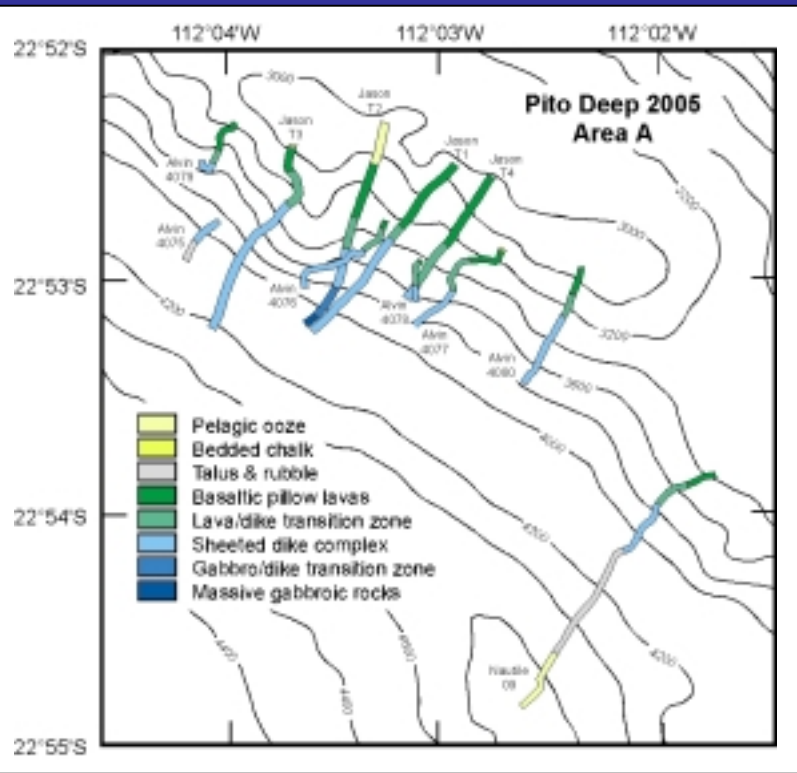
Jason II ROV 9 Transects (11 days): 200 hrs on bottom;
254 samples (\pm oriented); magnetics; mosaics

Alvin HOV 12 Dives: 181 samples (\pm oriented); magnetics

Sea Beam Mapping, Dredging (5)

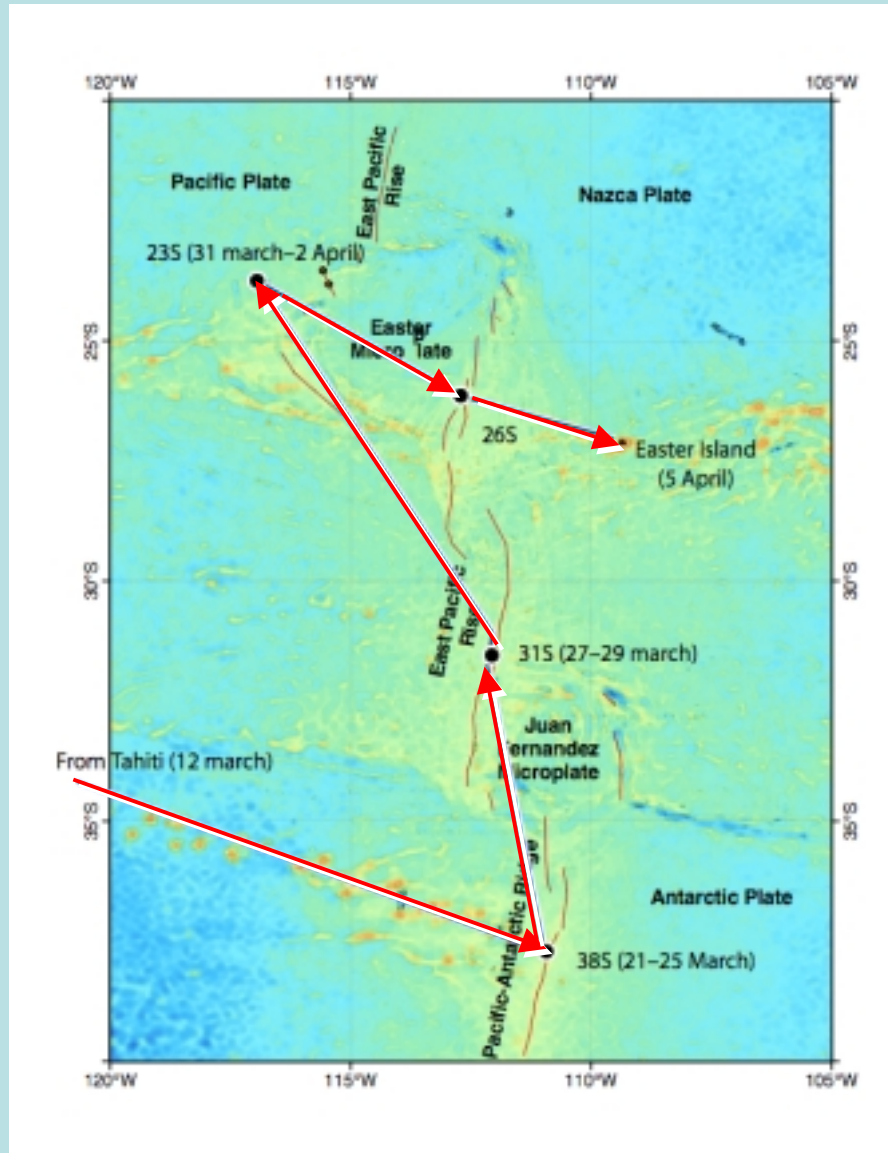
Seabeam Survey of Pito Deep, February 2005
(gridded at 150 m)





Robert Vrijenhoek
Cindy Van Dover
March 12 - April 6

PAR-5 *Alvin* expedition: 12 March–3 April 2005



Investigators:

- R Vrijenhoek: 12 NSF-funded dives
- CL Van Dover: 2 NSF-funded dives

Goals:

- Sample biology at 38°S vents on Pacific Antarctic Ridge
- Revisit vents in 31–32S region of EPR
- Sample biology at vents on eastern and western flanks of Easter Microplate



<http://www.mbari.org/expeditions/eastermicroplate/>

Motivation: vent habitats are discontinuous

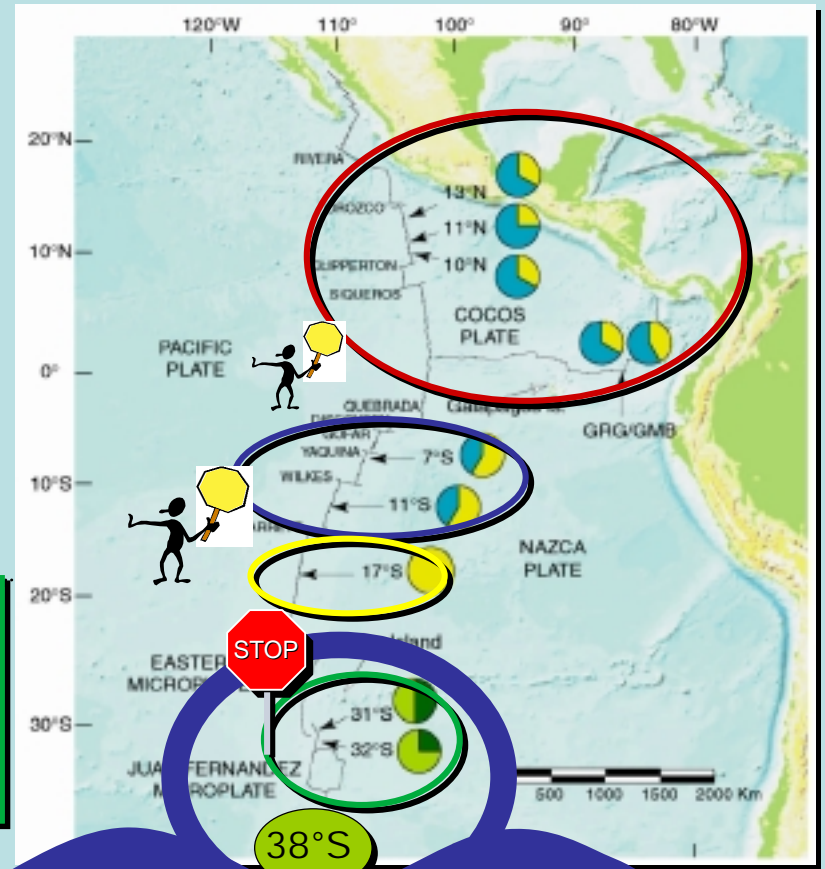
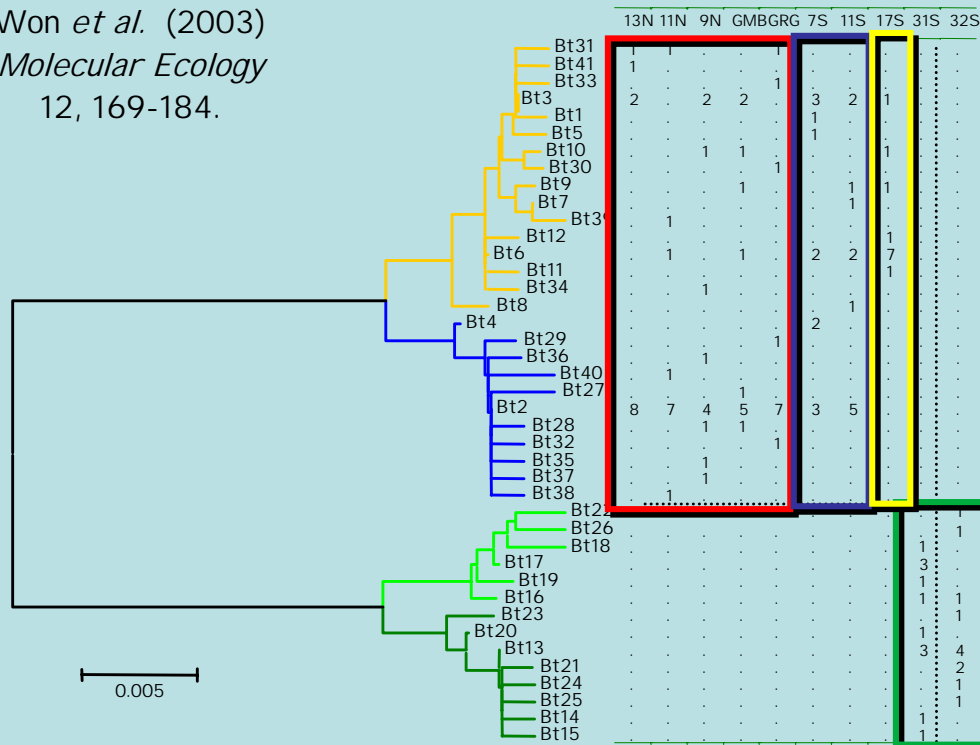


How do chemosynthetic taxa disperse between discrete habitat islands?
Do discontinuities in ridge system create dispersal barriers?

Bathymodiolus mussels from eastern Pacific vents

Mitochondrial cytochrome oxidase-I
(COI) haplotypes

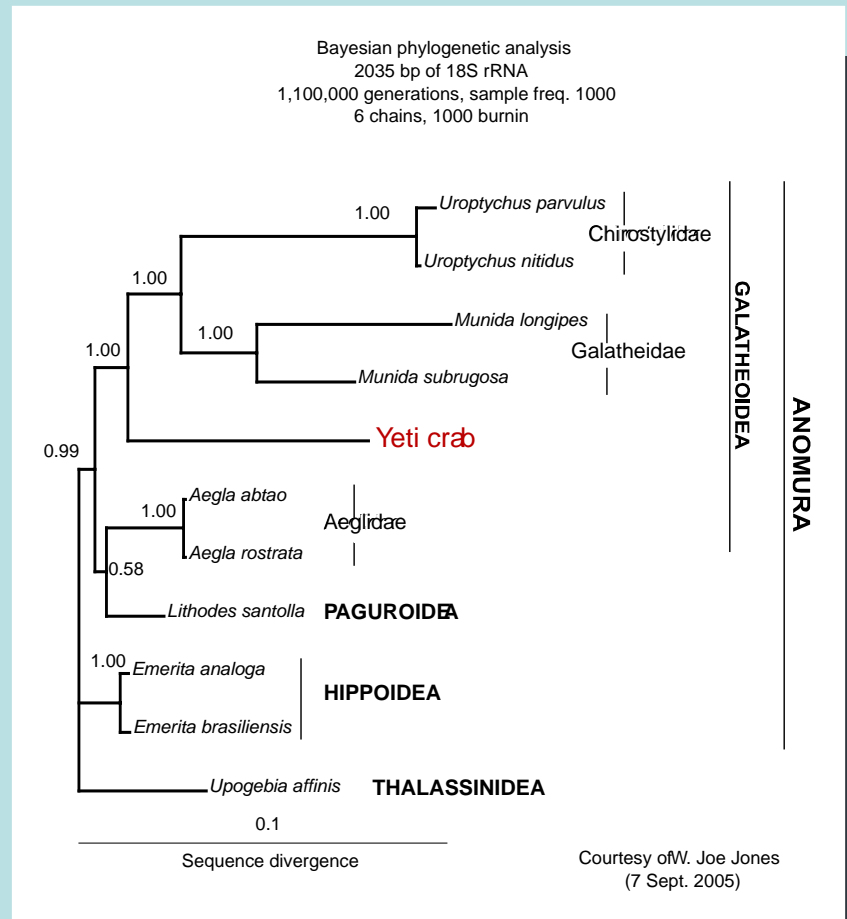
Won *et al.* (2003)
Molecular Ecology
12, 169-184.



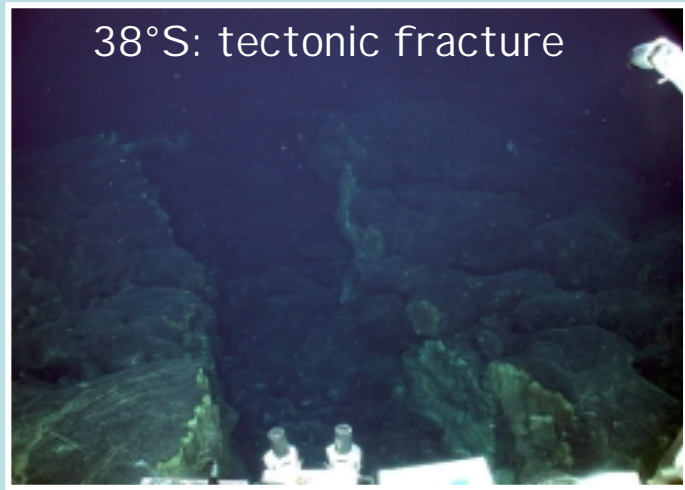
Antarctic Circumpolar Current

New Discoveries: 38° S PAR

Segonzac, McPherson & Jones 2005 in press



PAR-5 expedition: SUMMARY



Accomplishments:

- 12 successful *Alvin* dives
- 2 dives lost to weather
- *Alvin* digital video: very good
- DVD copies very useful
- *Alvin* payload: improved
- *Alvin* pilots: excellent

What went wrong:

- No weather days scheduled
- Transit time underestimated
- Vacuum sampling needs improvement
- Recommend rotary suction sampler like Harbor Branch design
- Digital overhead cameras: not very useful

Luther, Tolstoy, Shank

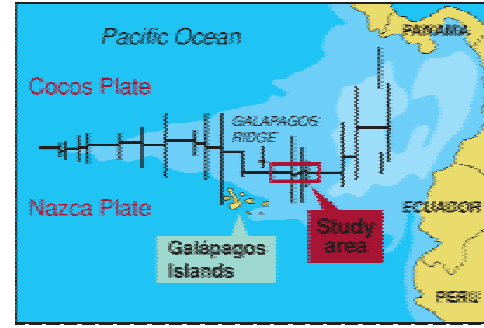
23 April - 15 May

Tim Shank
19 May - June 3

Exploring New Patterns of Biological Succession at the Rosebud Hydrothermal Vents - Galápagos Rift



www.divediscover.who.edu
www.oceanexplorer.noaa.gov



R/V Atlantis 11-27 Operations Summary

Date	Area	Alvin Dive	TowCam	Other Operations
19 May	Depart Puntarenas 0600			
20 May	Transit			
21 May	RoseBud	4114	1 - MusselBed	Deploy Xponders (2) Deploy larval traps (2)
22 May	RoseBud	4115	2 Š MusselBed	Deploy TimeLapse Camera
23 May	RoseBud	4116	3 Š MusselBed	
24 May	RoseBud	4117	4 Š Garden of Eden	
25 May	MusselBed	4118	5 Š East of Eden	
26 May	Rosebud	4119	6 Š East of East of Eden	
27 May	Garden of Eden	4120	7 Š West of Rosebud	
28 May	Garden of Eden	4121		Multibeam GSC
29 May	Rosebud	4122	8 Š North of RoseBud	
30 May	Rosebud	4123	9 Š Across axis	Recover TimeLapse camera
31 May	Rosebud RoseBowl	4124		Recover xponders Transit to Pt Caldera 1800
1 June	Transit			
2 June	Transit			
3 June	Arrive Pt Caldera 0800			



Shipboard Pls

Shank, Fornari
 Seyfried, Ding, Ward
 Rzhanov, Beaulieu
 Soule, Humphris

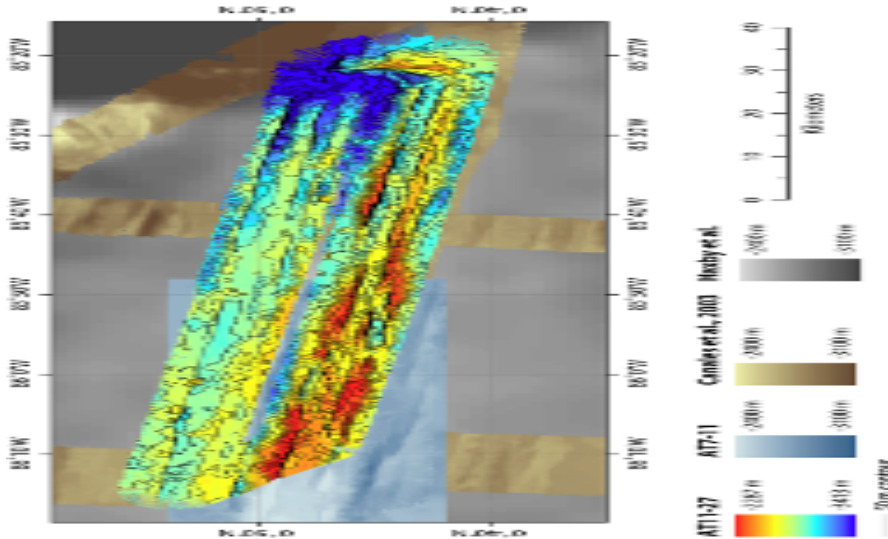
Alvin, TowCam, Ghostbuster Chem Sensor, In-situ Chemical Analyzers, Larval/Sediment Traps, Time-lapse camera, In-situ Fixation Chambers, Major Samplers, Basalt Colonization Panels and Vemco T°C loggers, Dive and Discover Exp9

Science Program Objectives

- 1. Biologically characterize and chemically "map" Rosebud and its microhabitats using in-situ characterization of temperature, pH, and other physiochemical parameters to link the formation of microbial biofilms, fluid chemistry and the colonization of different invertebrate species;**
- 2. Conduct comparative quantitative digital image surveys of Rosebud to assess the changes in community structure that have occurred since May 2002;**
- 3. Assess correlations in the structure of the various vent communities with the presence of specific larval species (through time-series larval collectors), larval settlement (via basalt panel, time-lapse camera and temperature probe array deployments), and vent fluid temperature and chemistry (through autonomous in-situ measurements);**
- 4. Obtain adults and juveniles (from larvae in traps) of vent species (e.g., tube worms and mussels) to examine their genetic composition. By temporally sampling discrete populations, inferences of how related each individual is to its community on the Galápagos Rift as well as to other communities inhabiting vent sites in the Eastern Pacific are possible;**
- 5. Conduct a night exploration program employing TowCam digital camera system to explore for additional hydrothermal vents and conduct reconnaissance at the previously studied vents sites (e.g., Garden of Eden, Clambake II, Musselbed) to determine if and how these sites might have been affected by the volcanic activity that covered the Rose Garden site by 2002;**
- 6. Develop an easy-to-use software package for PC-based computers tailored to convert video imagery acquired from Alvin, operated within both absolute (e.g. LBL) and relative (DVL) and quickly produce a set of geo-referenced photomosaics, directly layered within a GIS.**

R/V Atlantis 11-27 Highlights

1. Multibeam survey - 2 lines to 85°24W
2. TowCam - 9 surveys (E & W Garden of Eden)
3. Mosaicked Rosebud field (60x50m area) from Alvin downlooking camera
4. Alvin - 11 dives
Imagenex Sonar (mapped Rosebud field)
near bottom magnetometer data
5. Surveyed and sampled vents:
Rosebud (active; comm. structure changing)
Garden of Eden (1977; thriving with *Riftia*)
Clambake II (1977; 100x130m now dead field)
Musselbed (1979; 50x70m, dead, exp. found)
6. Discovered new venting area - "Rosebowl"
7. Deployed 2 integrated colonization expts
 - 12 basalt panel/T-probe arrays w/in 2 comm.
 - 4 in-situ chemical sensors
 - 1 time-lapse camera
 - 2 larval/sediment traps
 - recovered all after 9 days
 - biofilms formed and colonization by inverts high; composition dependent on type of dominant proximal population (*Riftia* or mussels)



TowCam

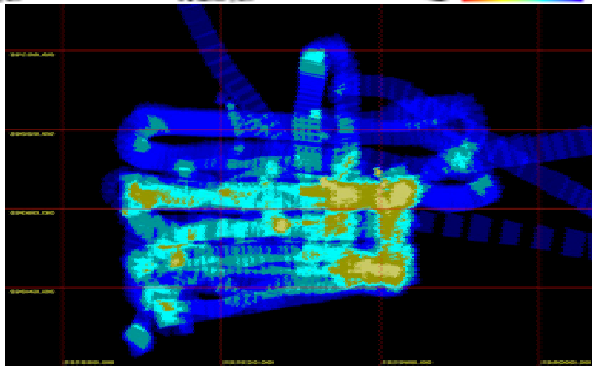
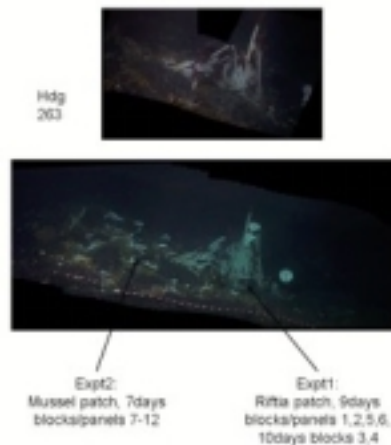
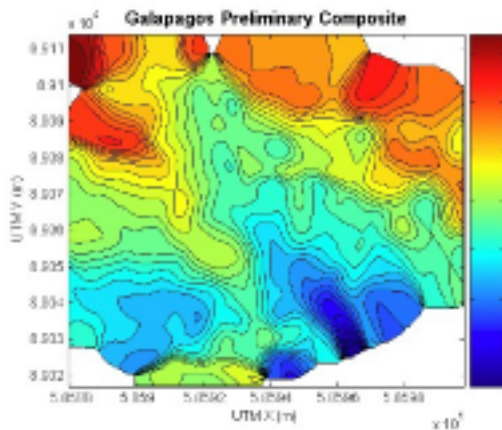


Fig. 11. Coverage of downlooking digital images over the Rosebud vent field. Dark black is light black 5%, brown is 5% and tan is 5% overlap.



RatCam

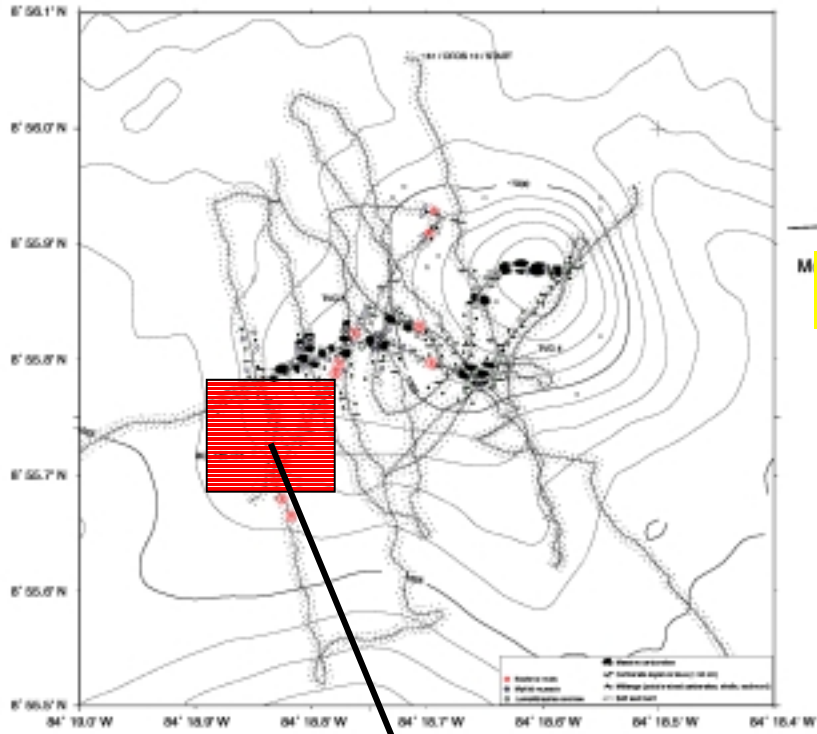


Time-series sediment traps to identify local larval availability and genetic studies

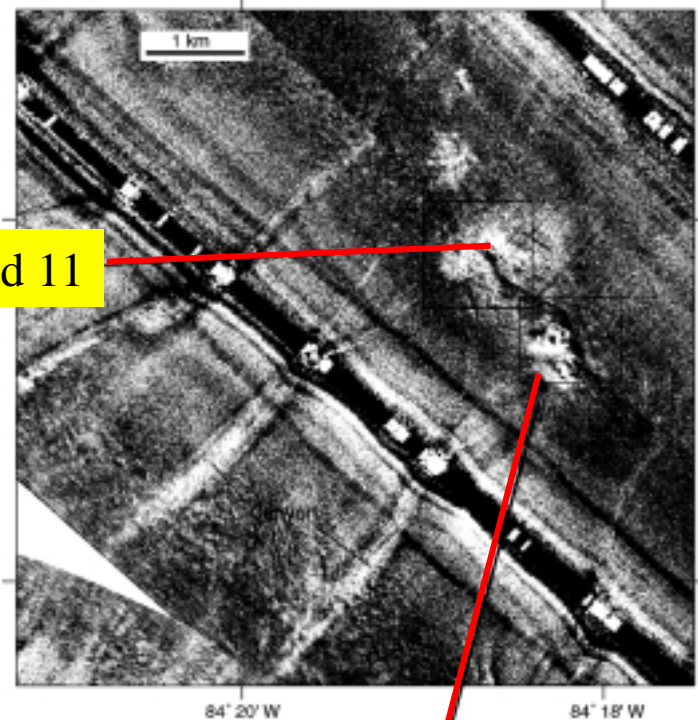
Kevin Brown

Dave Hilton

June 7 - June 16

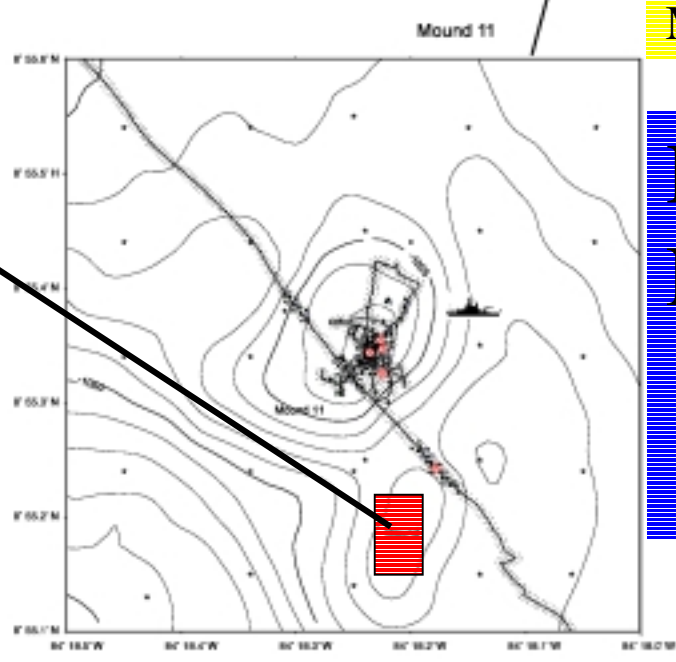


Mound 11



Mound 11

Main instrumented seepage sites



Deployment site
NW Osa
Costa Rica

Deploy instrumentation packages on Mounds 11 and 12

- I. 1 OTIS meter- Electronic flow measurement (5 cm/y to 1000+ m/y) plus Osmotic sampler
- II. 6 CAT meter- Osmotic sampler and flow measurement (0.1mm/y to ~30m/y)
- III. Deep sea (**Mass Surfer**) mass spectrometer system.
- IV. A precision pressure gauge and temperature sensors were also deployed.
- V. Deployed 5 peepers for pore water analysis.
- VI. Made ~15 low temperature probe measurements.
- VII. Collected various biological samples of: Cold seep crabs, tubeworms, clams, scrimps for microbiological studies.
- VIII. Collected ~60-68 cores for microbiological and pore water analysis.

Night program

Water column sampling above seeps He and methane, organics, microbiological studies:

- 1) CTD/METS sensor
- 2) Water samples (10,000 gals)

June 2006 pickup- Instruments to be left out for a period of one year excepting the MassSurfer (which was recovered after 6 months).

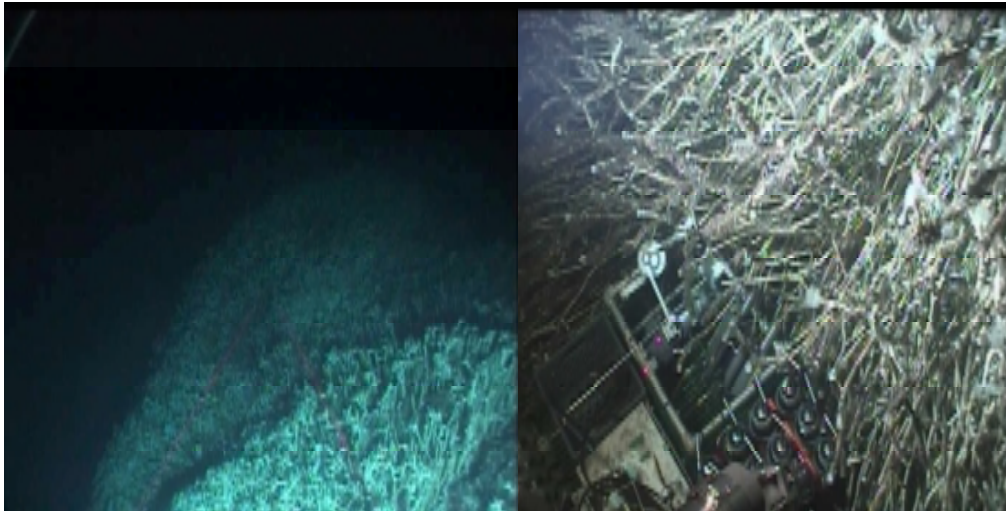
QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

CAT meter

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

OTIS meter

Jaco Scar



QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Mass Surfer

Karl Booksh

Marv Lilley

Bill Seyfried

Maurice Tivey

13 August - September 3

AT11-31 13 Aug – 3 Sept, 2005

Alvin Cruise to
Endeavour Comprised of Three
Groups

ASU/UW

U Minn

COMRA

ASU/UW – Instrument Testing/Sampling

Karl Booksh, Marvin Lilley

Brian Marquardt

RAMAN Spectrometer

Surface Plasmon Resonance Spectrometer

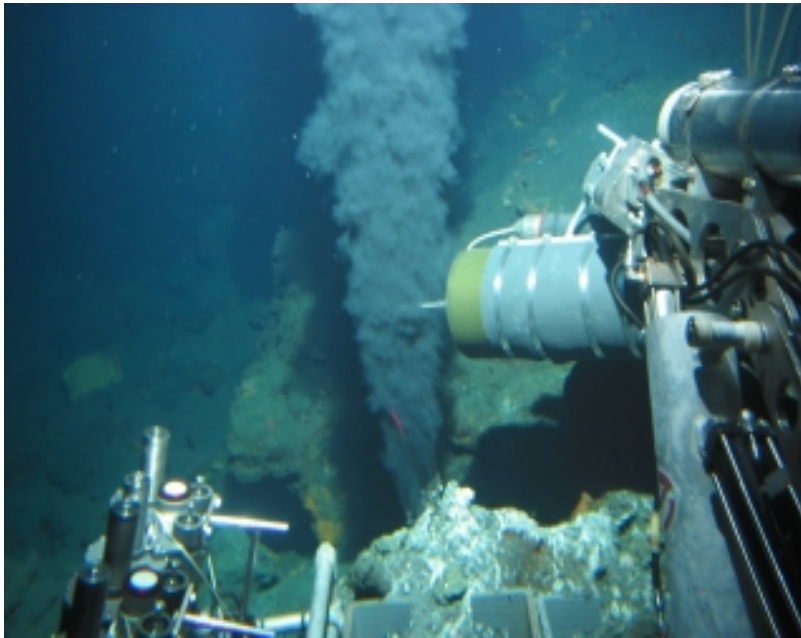
Excitation Emission Matrix Fluorescence

Resistivity

Collected Water Samples

Raman Analysis at 2200m

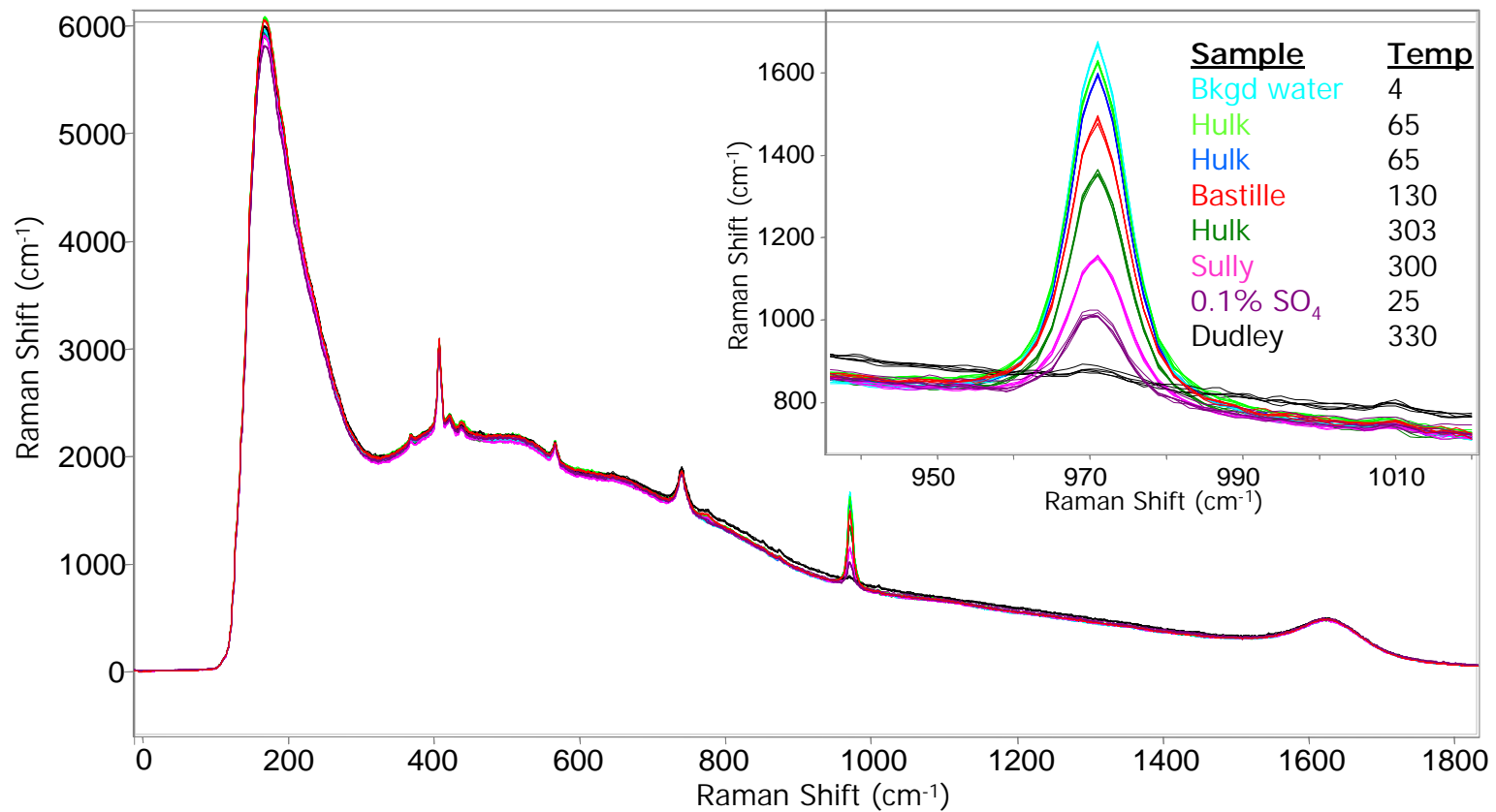
Analysis of Puffer Plume



Analysis of Diffuse Flow at Sully



Sulfate in Hydrothermal Fluids

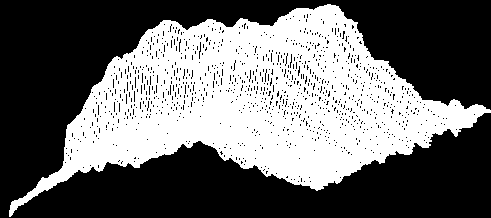


Alvin Data at Dante Run 1

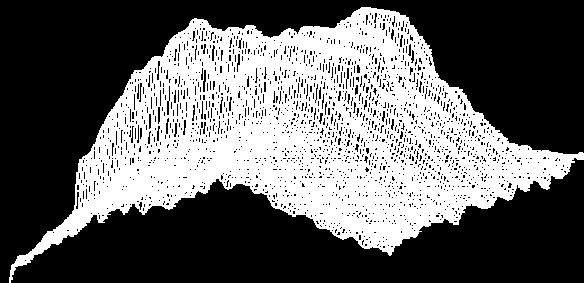
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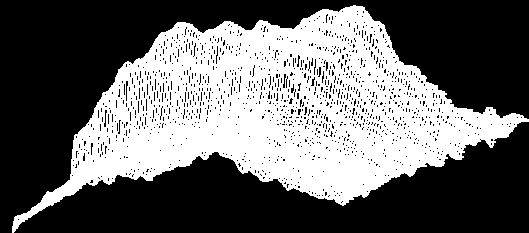
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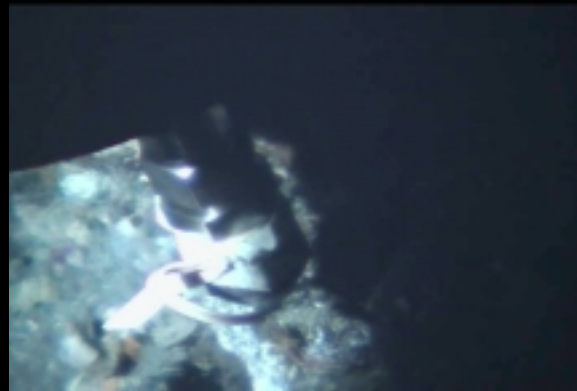
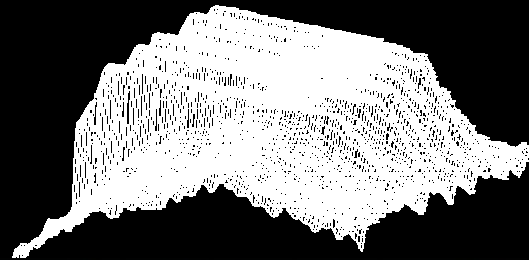
3.



4.



5.



Bill Seyfried
Kang Ding

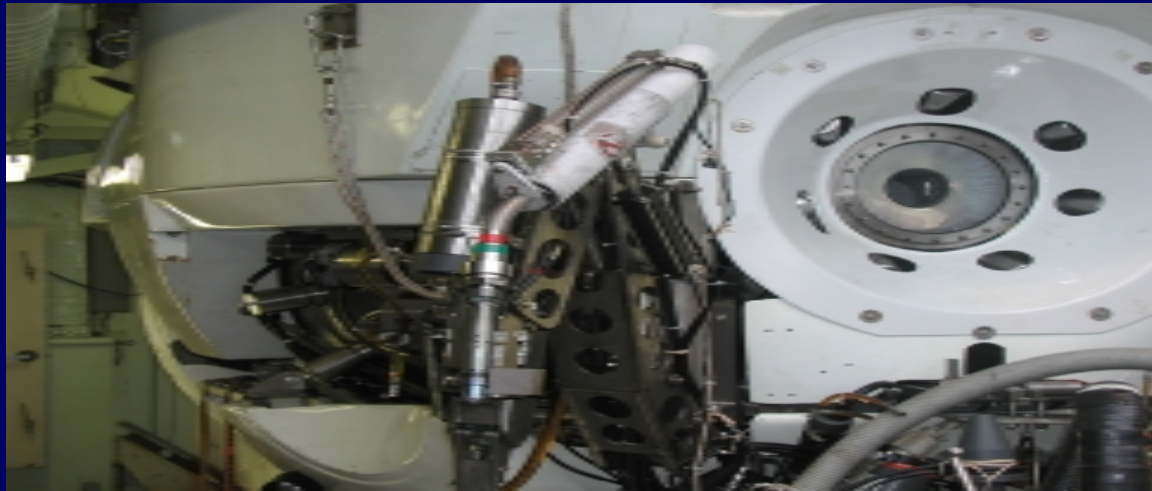
Cruise AT-11

August 13- September 03, 2005

MEF, JDF

- In-situ sensors for monitoring the chemistry of hydrothermal vent fluids:
Experimental calibration and seafloor applications
 - NSF OCE-0117117
- Atlantis/Alvin
 - 4 Dives
- Chemical sensors successfully deployed at both high-temperature and diffuse flow sites at MEF
- Ship and submersible performed extremely well
 - 19 Dives total- none lost for weather or for mechanical difficulties with Atlantis or Alvin

Temperature and In-Situ Chemical (pH, H₂ and H₂S) Data of High Temperature Vent Fluids: MEF, JDF August 2005

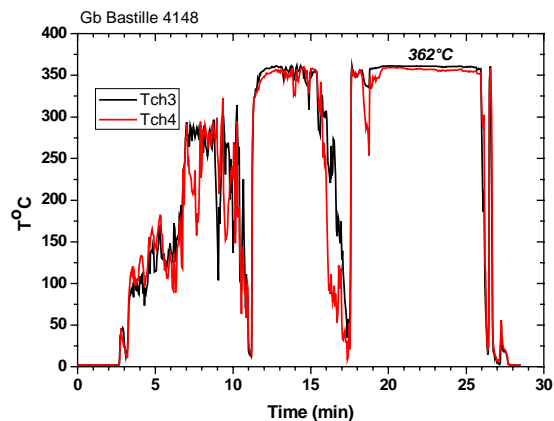


Time Series

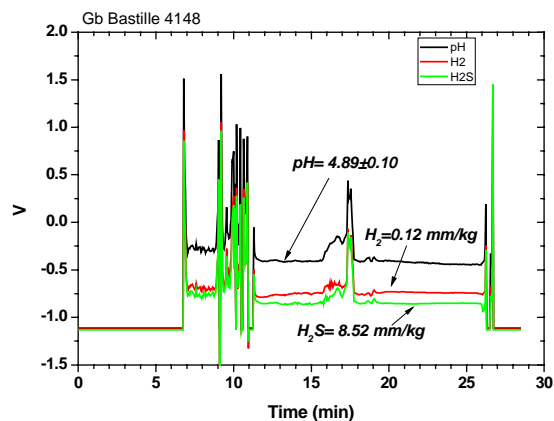
Real Time Deployment

Deployment

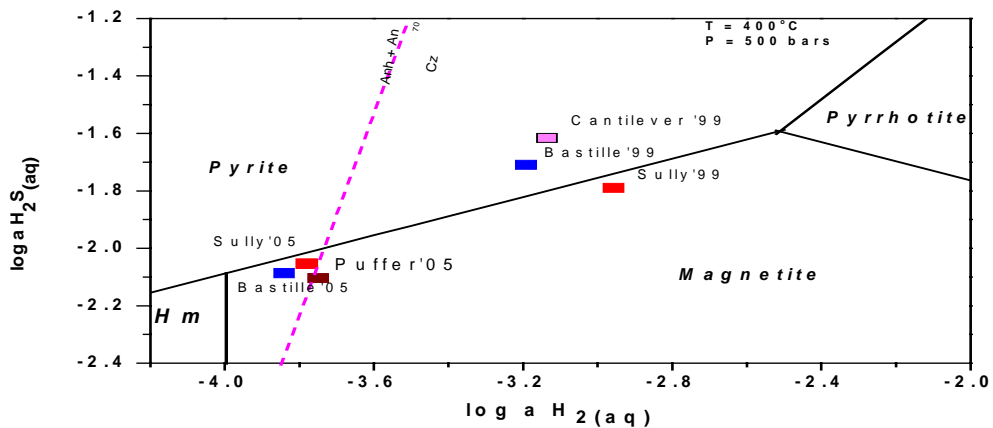
Temperature



pH Redox



Phase Relations



Maurice Tivey
COMRA



COMRA / ALVIN Dive Program



4 Alvin dives
Purchased by COMRA

*China Ocean Mineral Resources
R & D Association (COMRA)*



COMRA

Participants:
4 Engineers
1 Scientist

Cruise AT11-32
Chf. Sci: Marv Lilley/
Bill Seyfried

Main Endeavour Field
Clam Bed Field
Juan de Fuca Ridge



COMRA / ALVIN N Dive Program



3 Vent caps deployed and retrieved

18 Mineral baskets deployed and recovered

Gas tight water bottles tested and used successfully

375 kg sulfide samples and biological material

15 sediment cores (172 kg)



COMRA