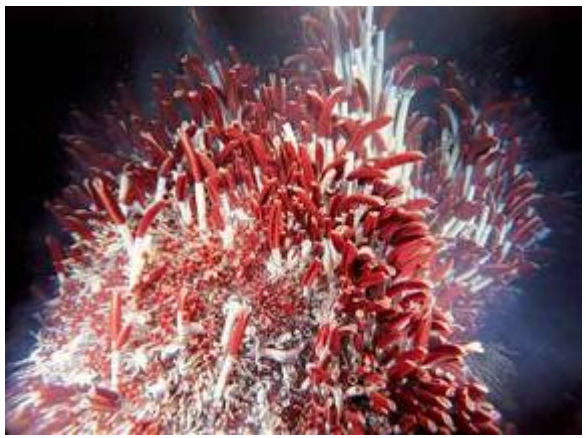
INVESTIGATIONS OF CHEMOSYNTHETIC COMMUNITIES ON THE LOWER CONTINENTAL SLOPE OF THE GULF OF MEXICO

Overview



James M. Brooks
TDI-Brooks International, Inc.
College Station, Texas

2009 ITM Presentation Outline: MMS Chemo III

- Site selection criteria and procedures: Chemo III
  Harry H. Roberts
- Changes in cold seep and hard ground community structure along a depth gradient on the Louisiana Slope
  C. Fisher
- Quantitative image analyses of cold seep and hard ground communities on the lower Louisiana Slope
  Ian Macdonald
- Microbial biogeochemistry along the deep slope
  Mandy Joye
- Trophic landscape of cold seeps and their environs
  R.S. Carney

MMS/NOAA Chemo III: Objectives

- Characterize known or newly discovered chemosynthetic communities below 1,000-meters
- Characterize other hard bottom biological communities encountered regardless of association with active seepage and living chemosynthetic communities
- Determine the comparative degree of sensitivity of anthropogenic impacts as well as similarity/differences with their shallower water counterparts
- Develop successful assessment methodologies to develop predictive capability that can be used by MMS to avoid impacts to lower slope sensitive biological communities
- Contribute to assessing and explaining diversity distribution and abundance at depths below 1,000-meters and understanding functional role of marine species in areas of active seepage

Principal Investigators

Dr. James Brooks, TDI-Brooks, Program Manager

Dr. Charles Fisher, Penn State, Biology Group Leader

Dr. Harry Roberts, LSU, Geology/Geophysics Group Leader

Dr. Robert Carney, LSU, Deep-Sea Ecology

Dr. Ian MacDonald, TAMU-CC, Imaging & Remote Sensing

Dr. Samantha Joye, Univ. of GA, Microbiology & Geochem

Dr. Erik Cordes, Harvard, Hard-bottom & Ecology

Ms. Liz Goehring, Penn State, Education Outreach

Dr. Gary Wolff, TDI-Brooks, Data Management

Dr. Bernie Bernard, TDI-Brooks, Bus. Mgt & HC Geochem.

Dr. Stephane Hourdez, France, Polychaete Group Leader

Scientific Review Group

Dr. James P. Barry
Monterey Bay Aquarium Research Institute

Dr. William R. Schroeder
University of Alabama

Dr. Daniel L. Orange
AOA Geophysics & University of California - Santa Cruz

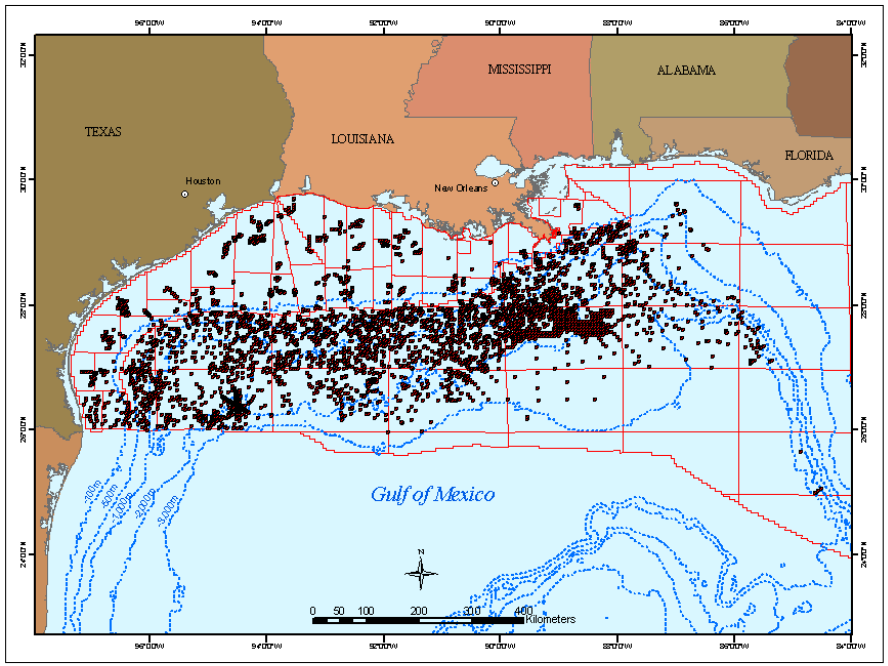
MMS Chemo I & II Programs

"Bush Hill" seeps, hydrates, tube worms and bivalves

Chemo I and II MMS projects were directed toward earlier reconnaissance and process studies using the *Johnson Sea-Link* and *NR-1* submersibles and were thus restricted to studies of communities in water depths < 1,000-meters.

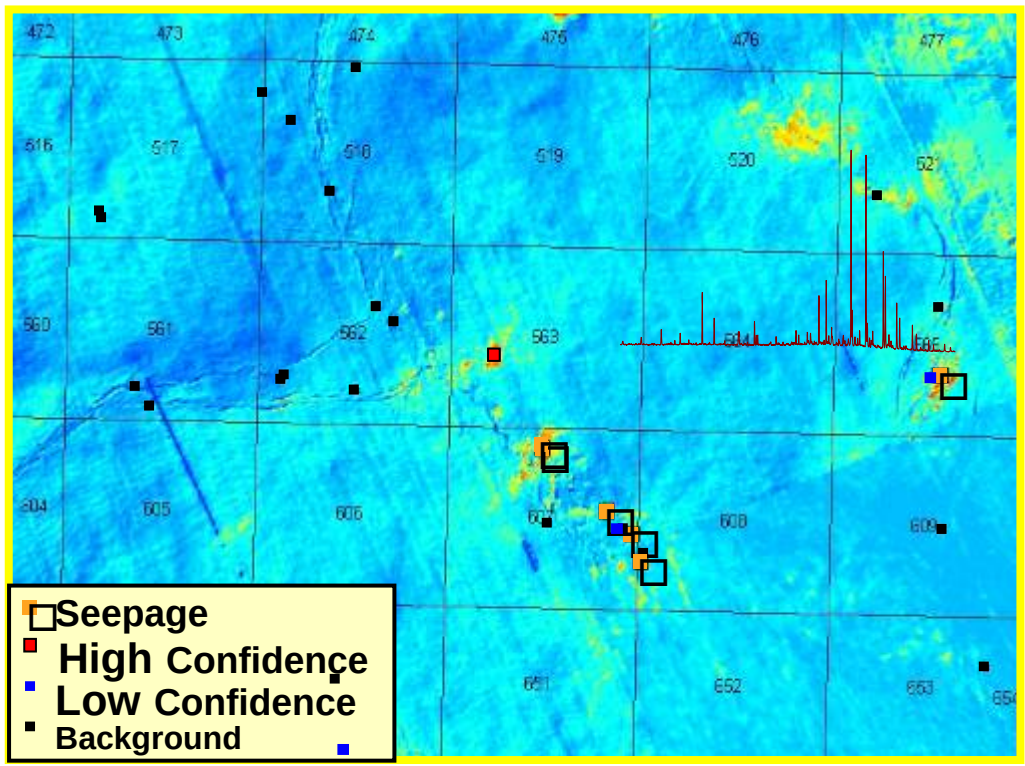
Chemo III – Historical Review – Cores

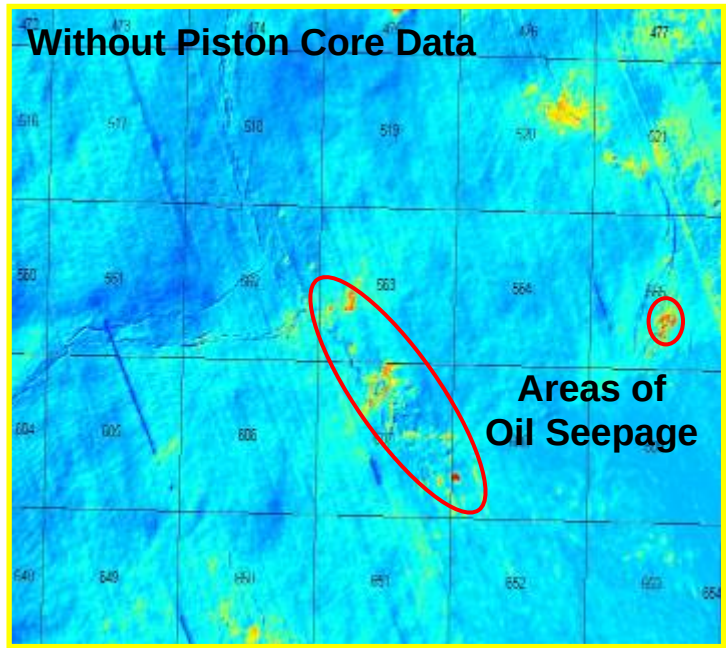
- Review historical cores, SAR, AUV and 3-D seismic and industrial data to select 20–40 sites – Roberts et al.



Chemo III – Historical Review – Seismic

- Review historical cores, SAR, AUV and 3-D seismic and industrial data to select 20–40 sites – Roberts et al.





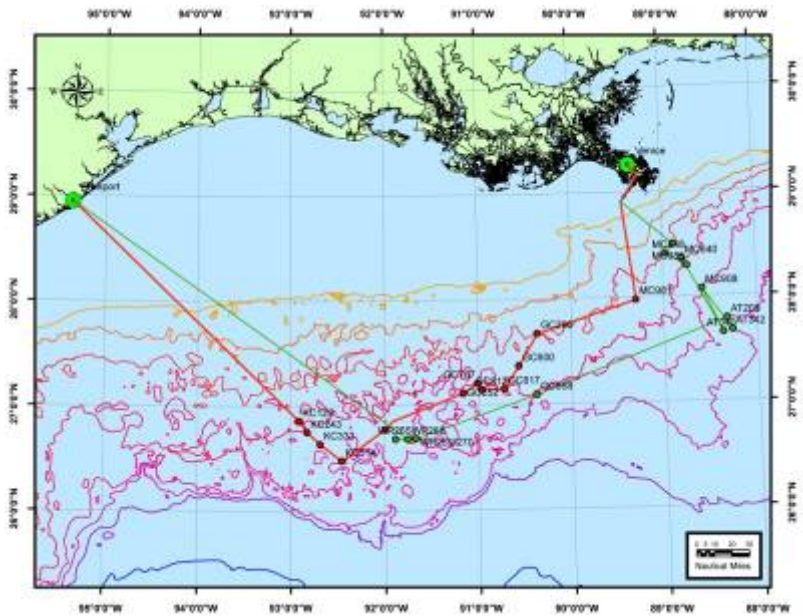
Green Canyon (Marco Polo and K2/Timon) – Fluorescence

Reconnaissance Cruise (Site Confirmation)

Goals

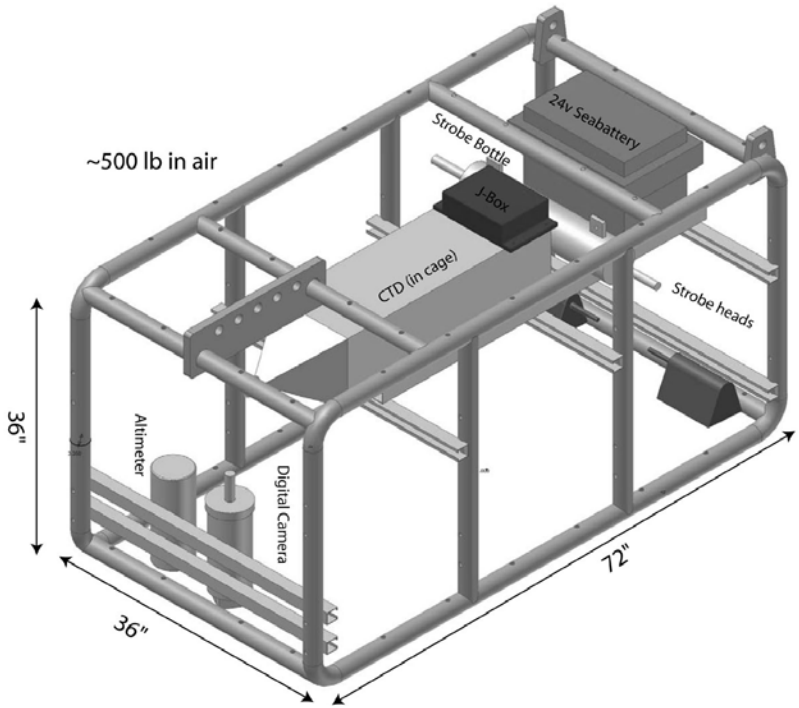
- Determine new sites for *ALVIN*
- Characterize a larger number of sites for predicative capability
- Collect box cores and trawls for seep-background studies

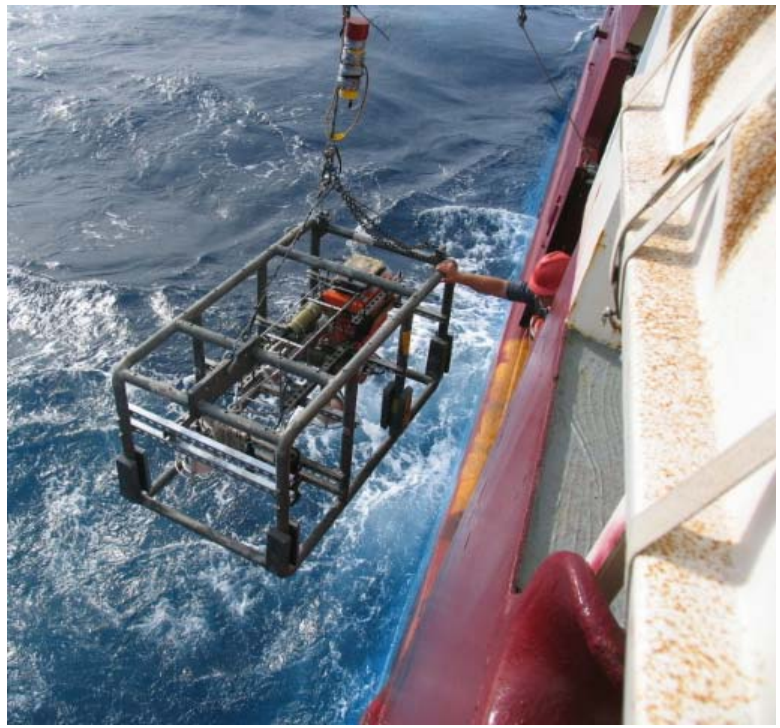
Conducted 11–25 May 2006
on TDI-Brooks' *R/V GYRE*



Reconnaissance Cruise

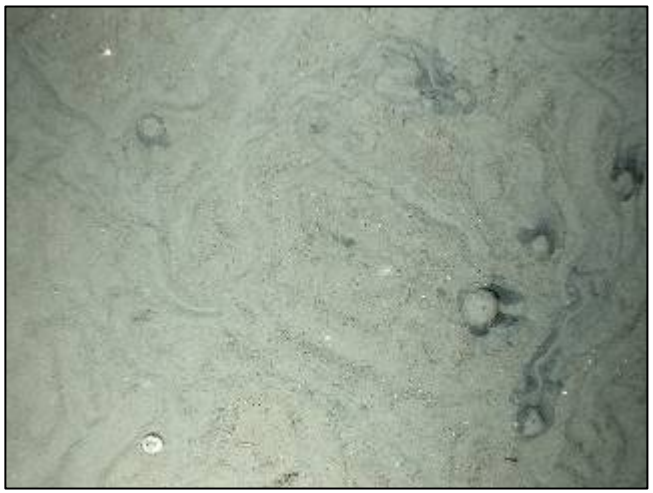
Survey 20+ sites from review of historical data





Dr. MacDonalds' Drift Camera System. The drift camera is lowered with a 3-pt bridle and communicates to the surface through a conducting cable. The right panel shows the DCS being deployed from GYRE.

Reconnaissance Cruise



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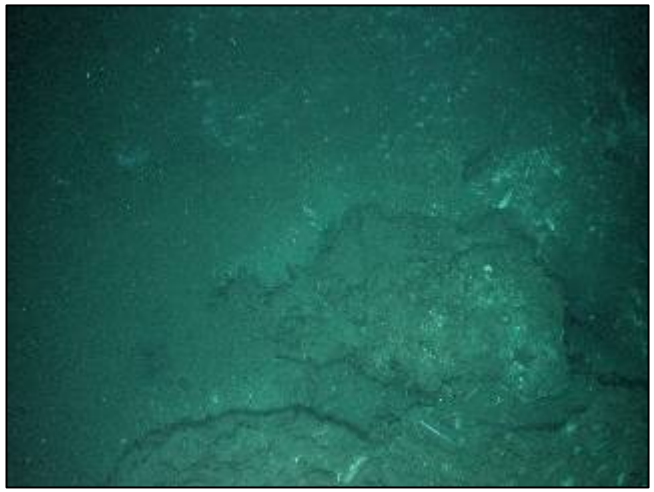

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Photographs from TAMU-CC Photo Sled – AT-340

Reconnaissance Cruise – Summary

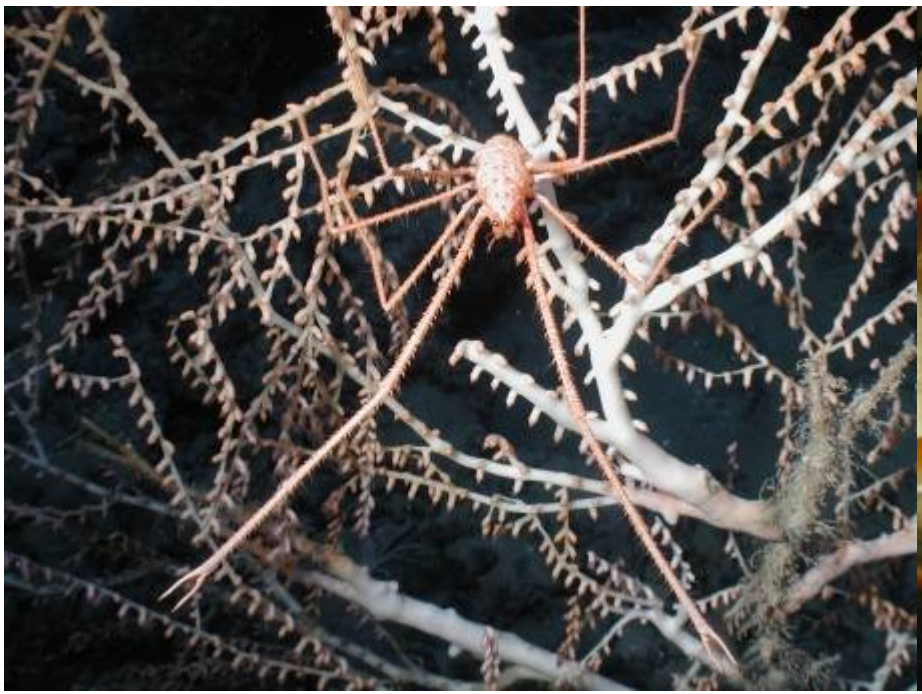
- Photo-reconnaissance of 24 sites
- USBL tracking and positioning of photo sled over target sites
- Collection of 10,922 photos
- Significant observations in the photographs of brine, bacteria, mussels (131), tube worms (135), and coral
- Cruise was successful in high grading sites for future *ALVIN* dives
- Trawls collected at three sites and box cores obtained for isotopic analysis of faunal contents

Deep Chemosynthetic Community Characterization Cruise

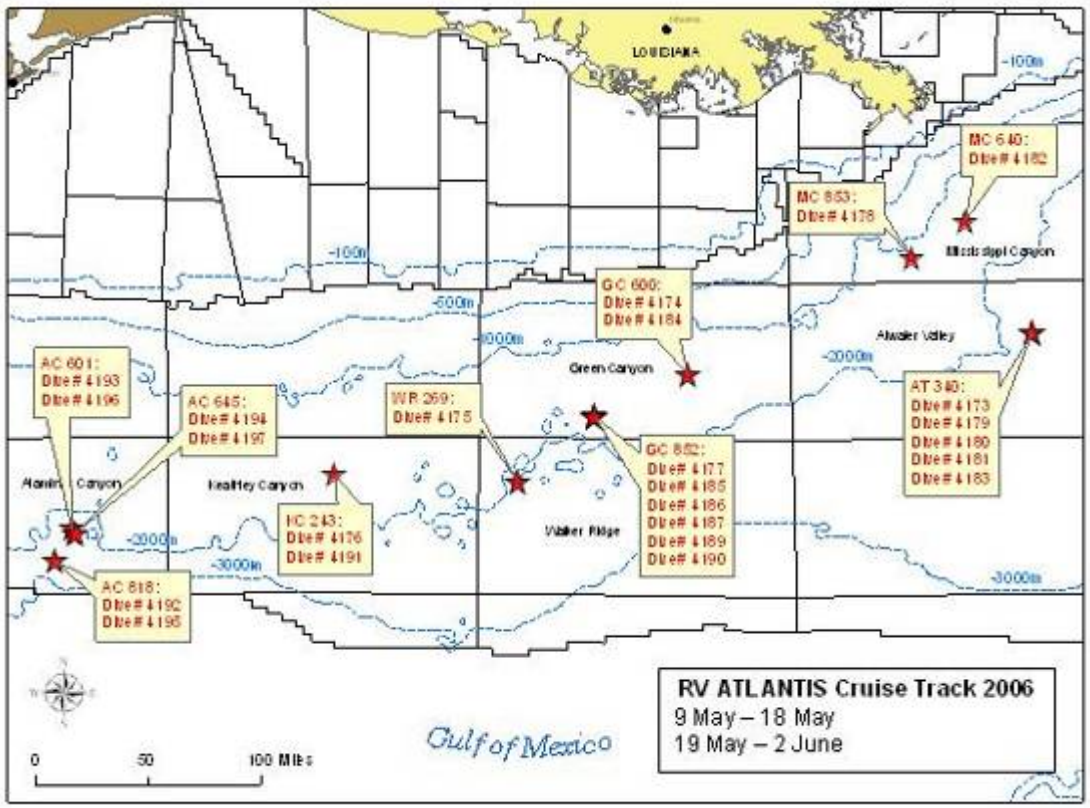
DSRV ALVIN / RV ATLANTIS

Deep Chemosynthetic Community Characterization Cruise

Goal: Discover and characterize the seafloor communities that live in areas associated with HC seepage and on hard ground in the deep GOM



Deep Chemosynthetic Community Characterization Cruise



- 23 Dives
- Chemos at all sites
- No unproductive dives

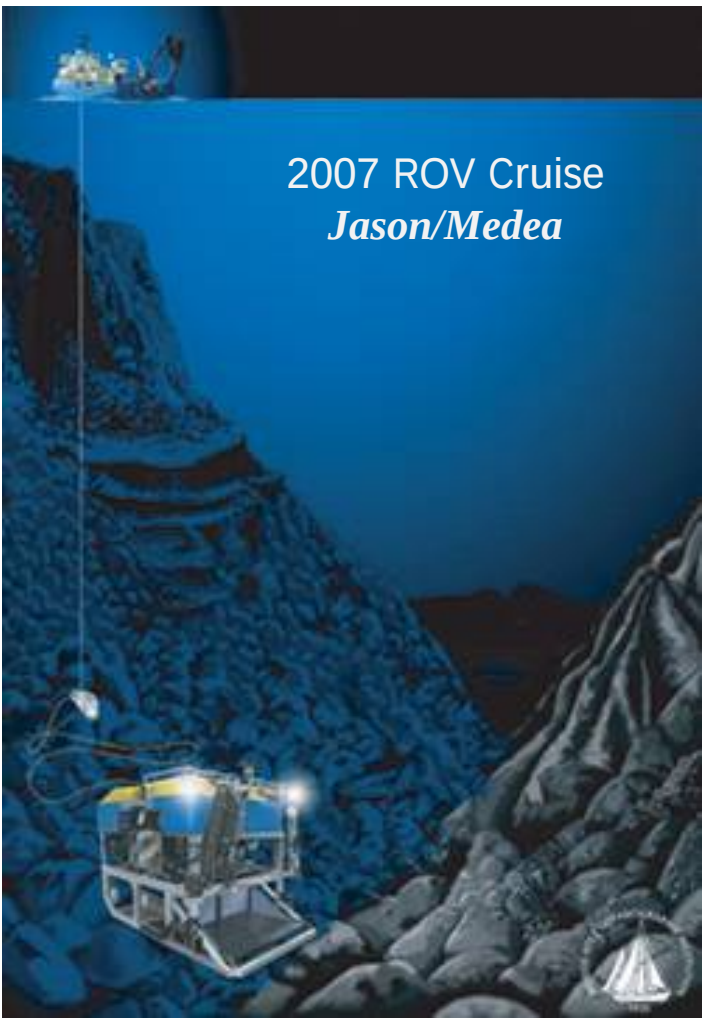
Deep Chemosynthetic Community Characterization Cruise

Activities:

- Photography – videos and stills
- Push cores
- Animal collections using various tools
- Growth studies

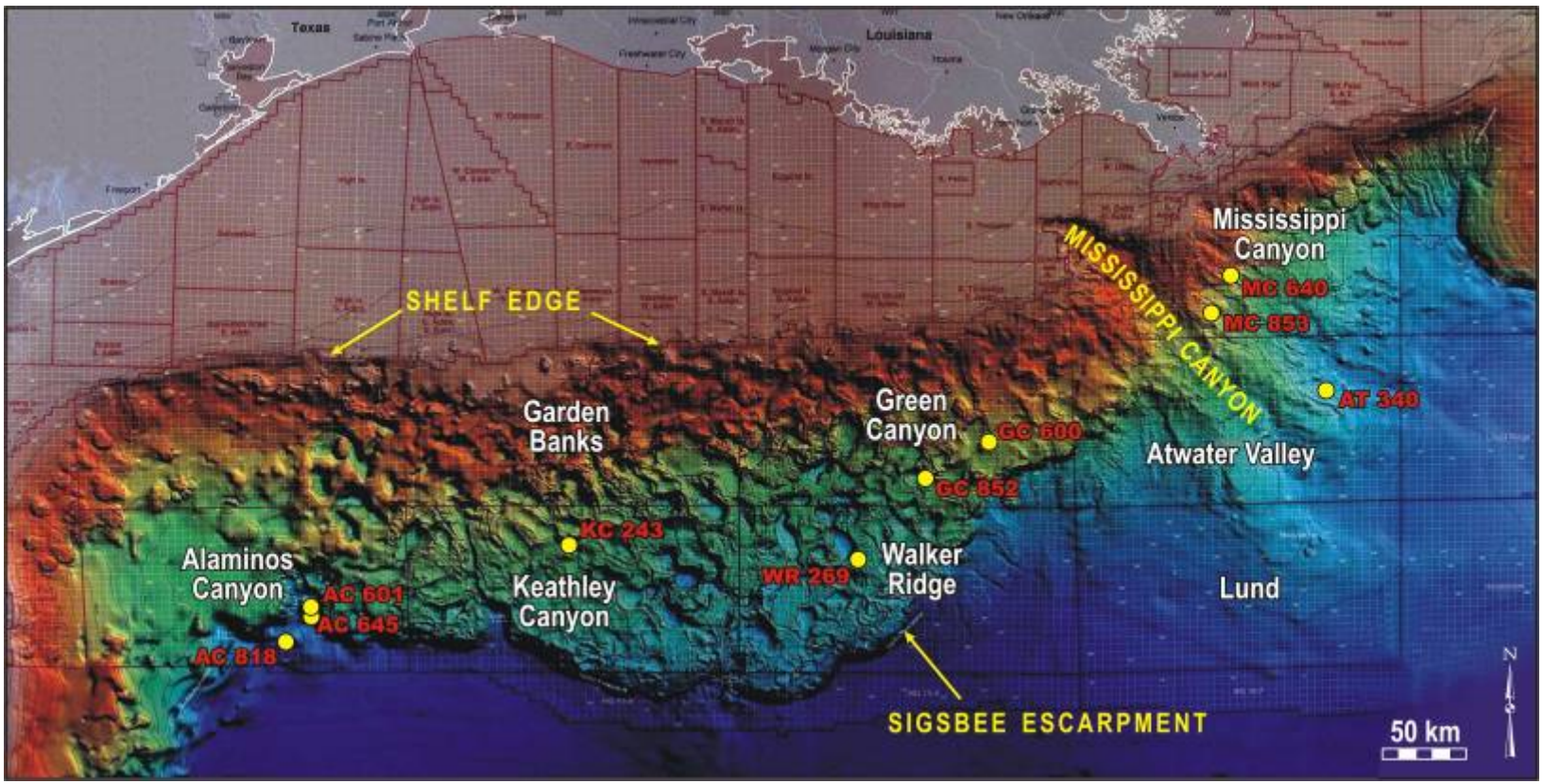
Deep Chemosynthetic Reconnaissance II CRUISE

- Mobilization – 6 May 2007, Ft. Lauderdale, FL
- Demobilization – 9 July 2007, St. Petersburg, FL
- Four Additional AUV quarter block surveys



Deep Chemosynthetic Reconnaissance II CRUISE

- Use ROV JASON to conduct near-bottom multibeam (SM 2000) and photographic surveys of the prime sampling sites identified during 2006 R/V Atlantis & DSV ALVIN
- Detailed sampling and mapping of benthic communities, sediments, lithified substrates, and brines
- Tubeworms stained in 2006 were collected for growth studies.
- Remote camera systems were deployed and recovered.
- New sites were explored based on analyses of 3-D seismic data



Data Interpretation, Synthesis & Reporting

- Two Narrative Interim (Draft, Final & Proof) Reports
  - Purpose – dissemination of results of field and initial findings
- Final Report (Draft, Final & Proof) – 45 months into Project
  - Assessment of data collection
  - Description of methods and analysis
  - Interpretation, results and discussion
  - Synthesis of findings
- Technical Summary
  - Concurrent with submission of the Final Report
- Publications (MMS review and approval)

Cordes E.E., S.L. Carney, S. Hourdez, R.S.. Carney, J.M. Brooks, and C.R. Fisher. 2007. Cold seeps of the deep Gulf of Mexico: Community structure and biogeographic comparisons to Atlantic equatorial belt seep communities. Deep-Sea Research I 54: 637–653.

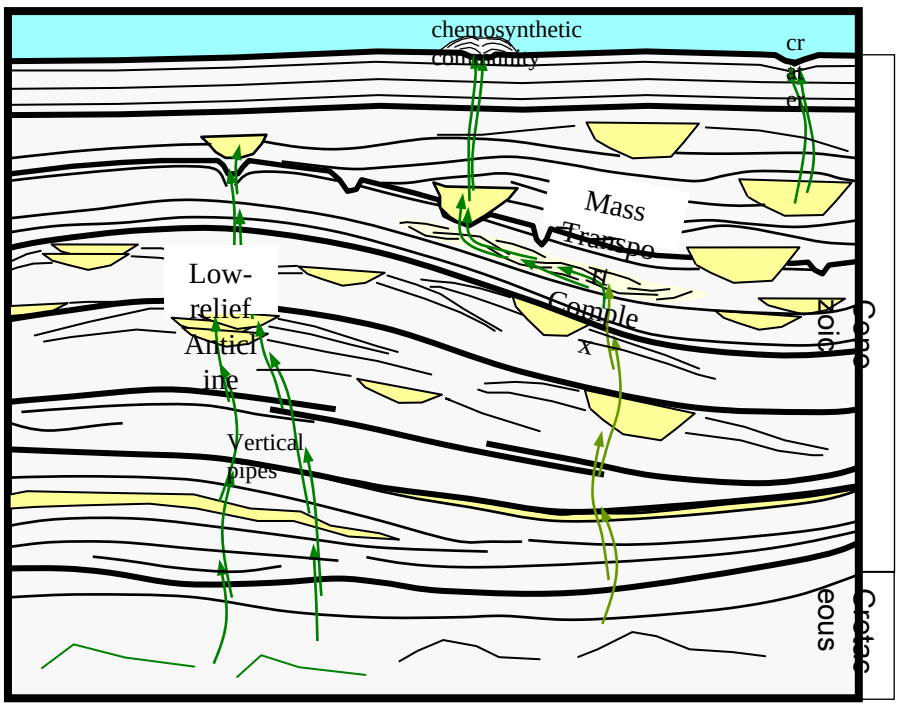
Fisher, C., H. Roberts, E. Cordes, and B. Bernard. 2007. Cold seeps and associated communities of the Gulf of Mexico. Oceanography 20(4):68–79.

Roberts, H., R. Carney, M. Kupchik, C. Fisher, K. Nelson, E. Becker, L. Goehring, S. Lessard-Pilon, G. Telesnicki, B. Bernard, J. Brooks, M. Bright, E. Cordes, S. Hourdez, J. Hunt, W. Shedd, G. Boland, S. Joye, V. Samarkin, M. Bernier, M. Bowles, Ian MacDonald, H. Niemann, C. Petersen, and J. Potter. 2007. Alvin explores the deep northern Gulf of Mexico Slope. EOS 88(35): 341–348.

Nigerian Chemo Discoveries

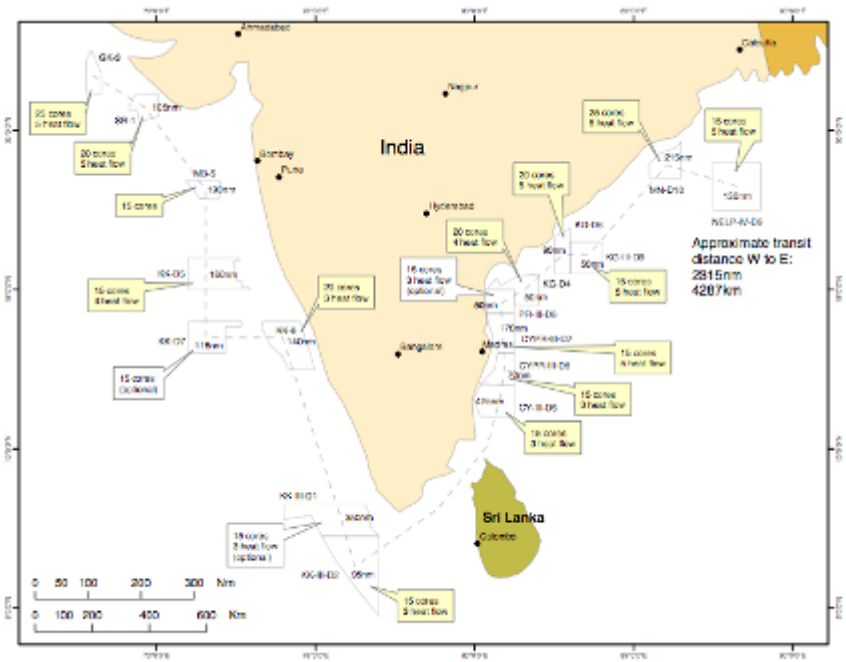
Two Sites – 1,600 and 2,200 m water depths; 200 miles apart; box core sampling only

OPL-248 Nigeria – 1,600 m



OPL-256 Nigeria – 2,200 m

Indian Chemo Discoveries – Bay of Bengal



Indian Geochemical Coring – 480 cores

Bay of Bengal Chemos – 1,100 m

<u>Dr. Charles Fisher & Colleagues Observations</u>

Tube worms – new species related to species off Papau, New Guinea

Mussels – new species related to *B. childressi*; may be two species in collection

Clams – two species of vesicomyid clams

References

Cordes E.E., S.L. Carney, S. Hourdez, R.S. Carney, J.M. Brooks, and C.R. Fisher. 2007. Cold seeps of the deep Gulf of Mexico: Community structure and biogeographic comparisons to Atlantic equatorial belt seep communities. Deep-Sea Research I 54: 637–653.

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