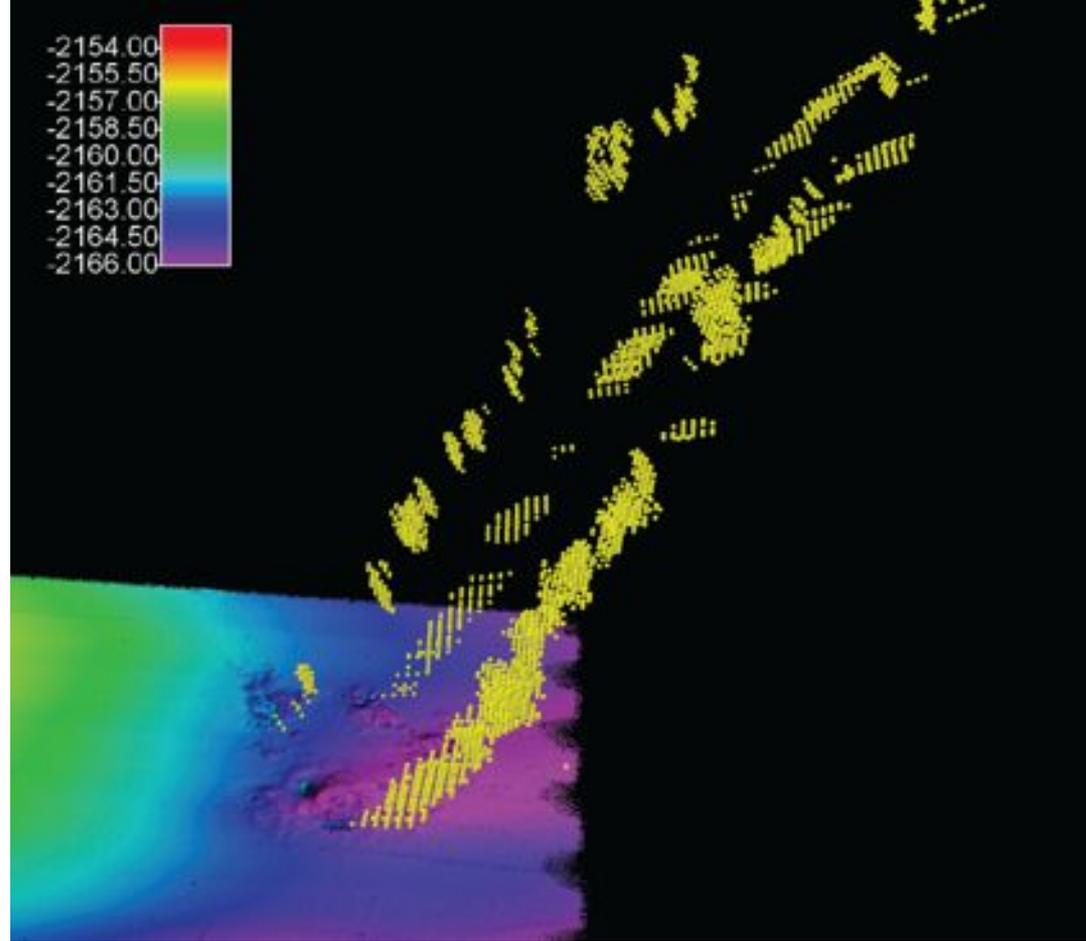


Evidence of Extensive Gas Venting at the Blake Ridge and Cape Fear Diapirs



L.L. Brothers, C.L. Van Dover, C.R. German, D.R. Yoerger, C.L. Kaiser, C.D. Ruppel, E. Lobecker, A.D. Skarke



U.S. Department of the Interior
U.S. Geological Survey

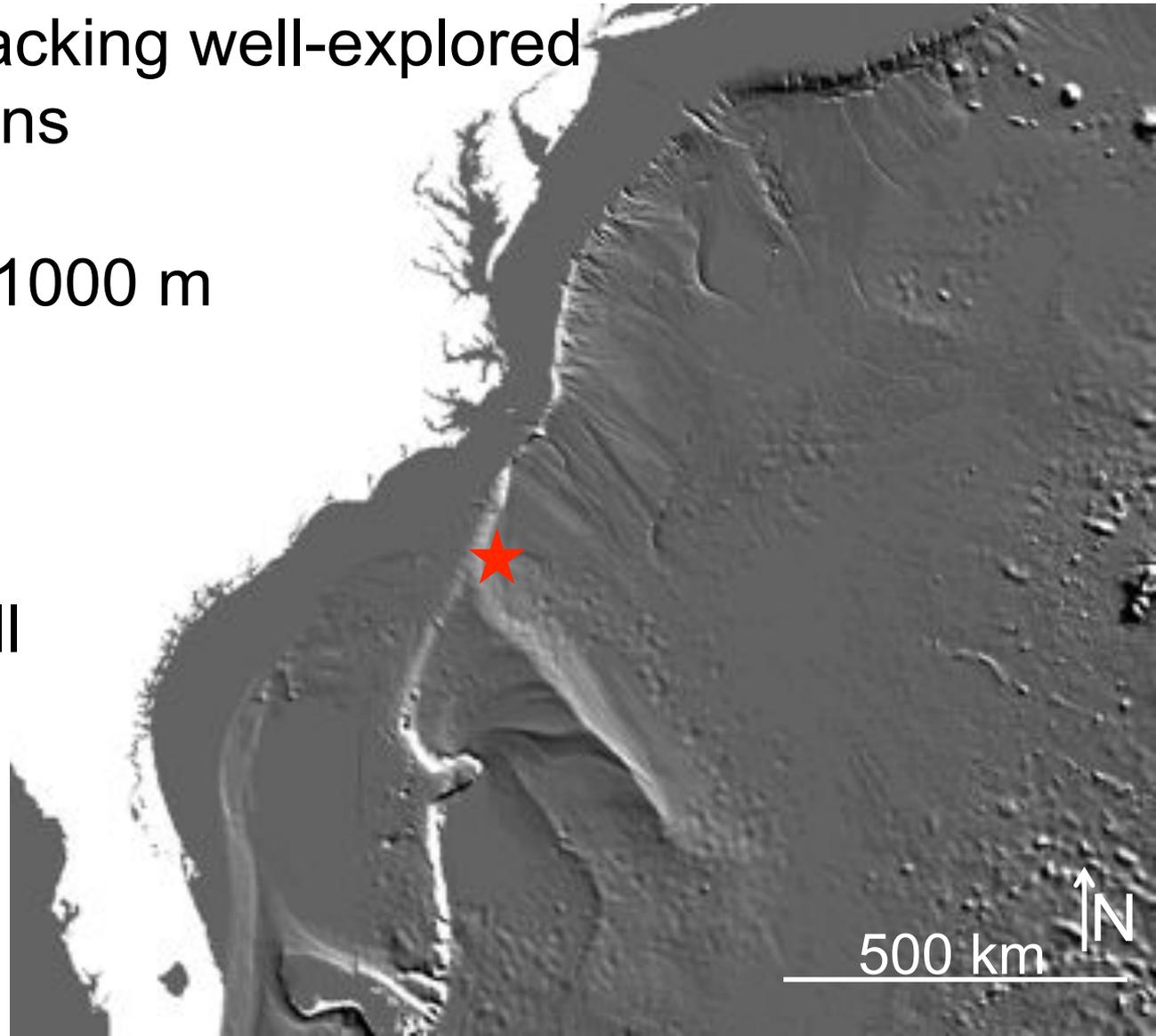


I. Background: Deep seafloor venting on the U.S. Atlantic Margin

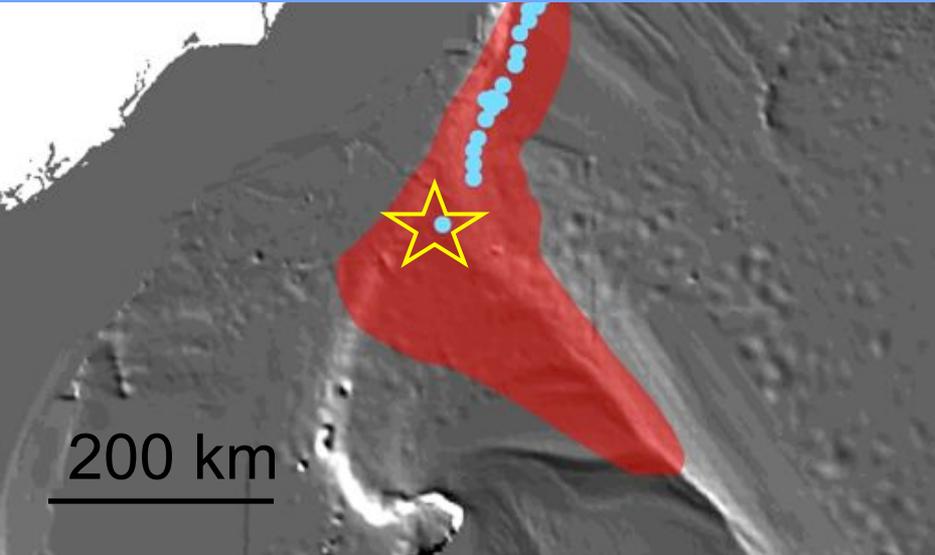
Passive Margin, lacking well-explored
Thermogenic basins

Only one seep > 1000 m
water depth

The Blake Ridge
Diapir Seep (Paull
et al., 1995)

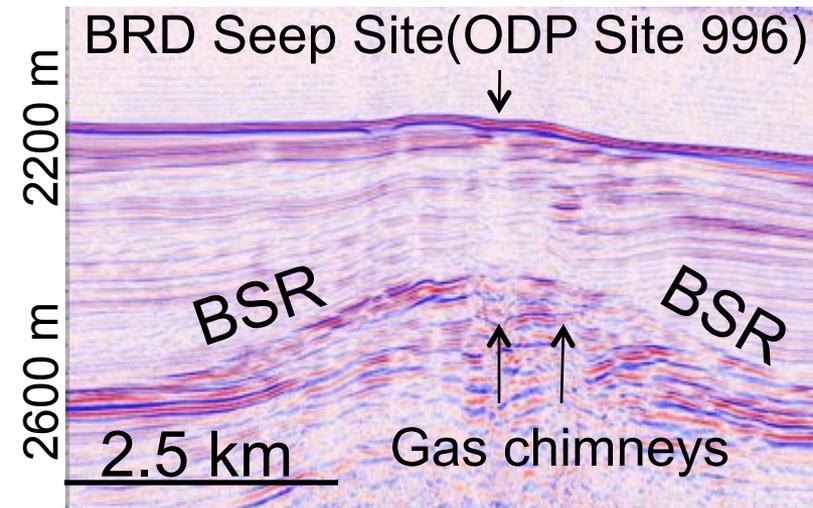


II. Background: The Blake Ridge Diapir Seep site



* Located in the Blake Ridge gas hydrate province (Dillion and Paull, 1983).

* Large, dilute low-saturation (2-11 % bulk volume) reservoir (Paull et al., 1996).



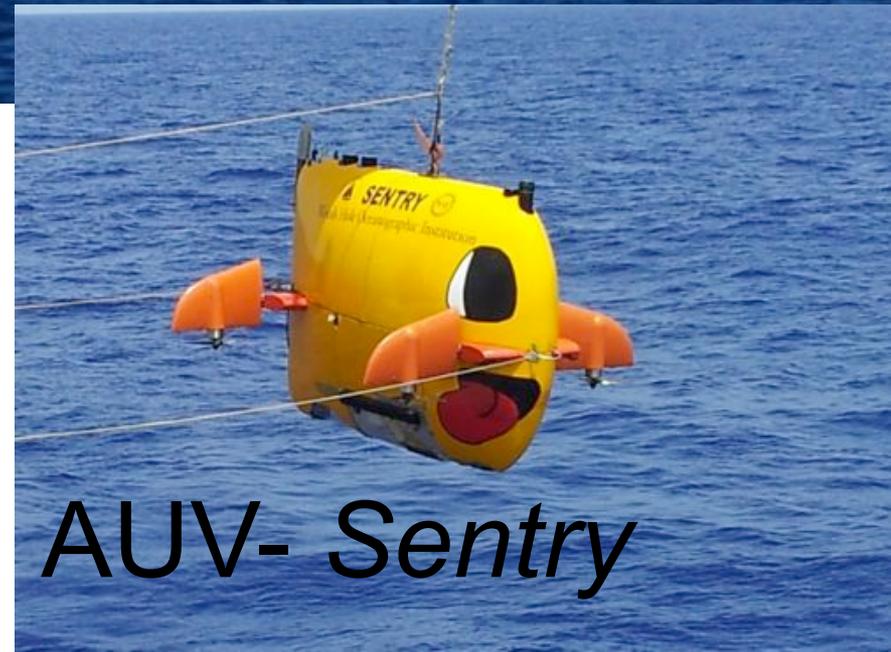
From Hornbach et al.,
2005

* Such a low-saturation accumulation is generally thought to typify the volumetric bulk of gas hydrate accumulations in marine sediments (Boswell and Collett, 2010).

II. The Problem: Is the Blake Ridge Diapir seep site anomalous?

July 2012 EX1205L1
Searching for evidence of
seafloor methane escape
at the Blake Ridge Gas
Hydrate province

NOAA Ship
Okeanos Explorer



AUV- Sentry

II. Seep detection July 2012

NOAA Ship *Okeanos Explorer*

Water Column

EK 60 (18 kHz) EM302 (30kHz)

Bathymetry

EM302 (30kHz)

Subbottom Data

3.5 kHz Knudsen

AUV *Sentry*

Bathymetry

Reson 7125 (400kHz)

Side scan sonar

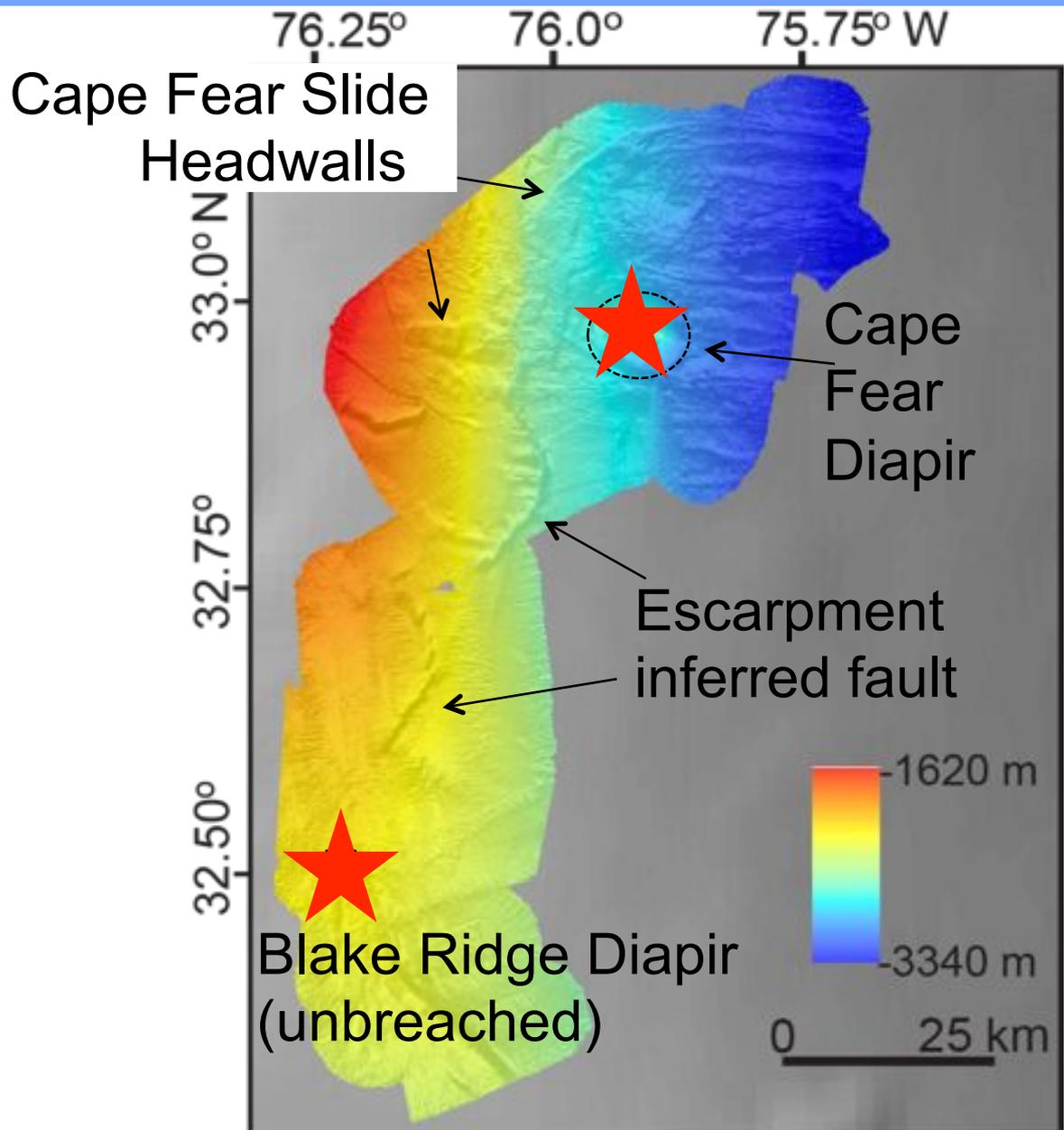
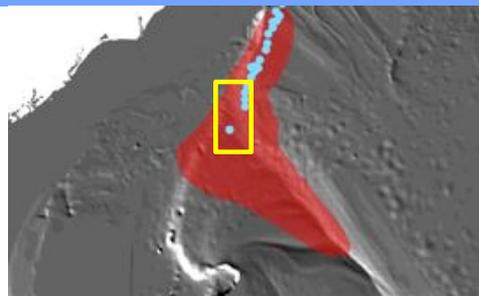
Edgetech 2200M (120/410kHz)

Photo Survey

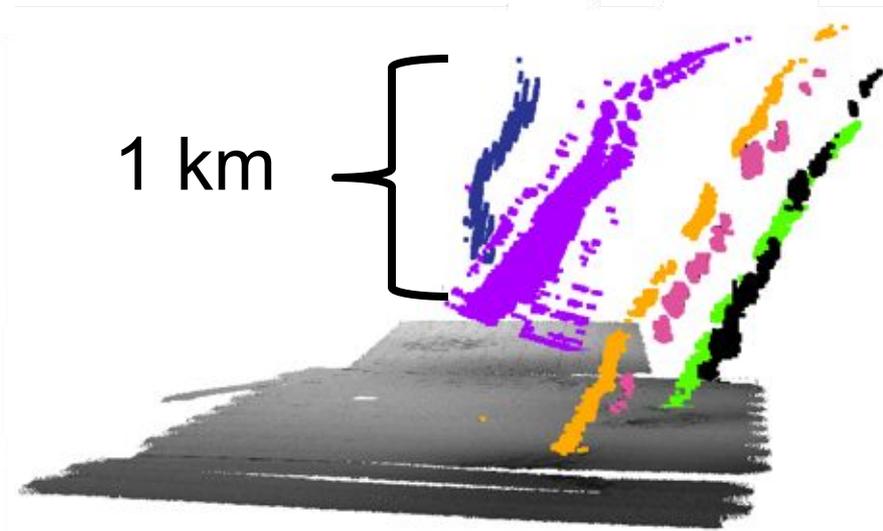
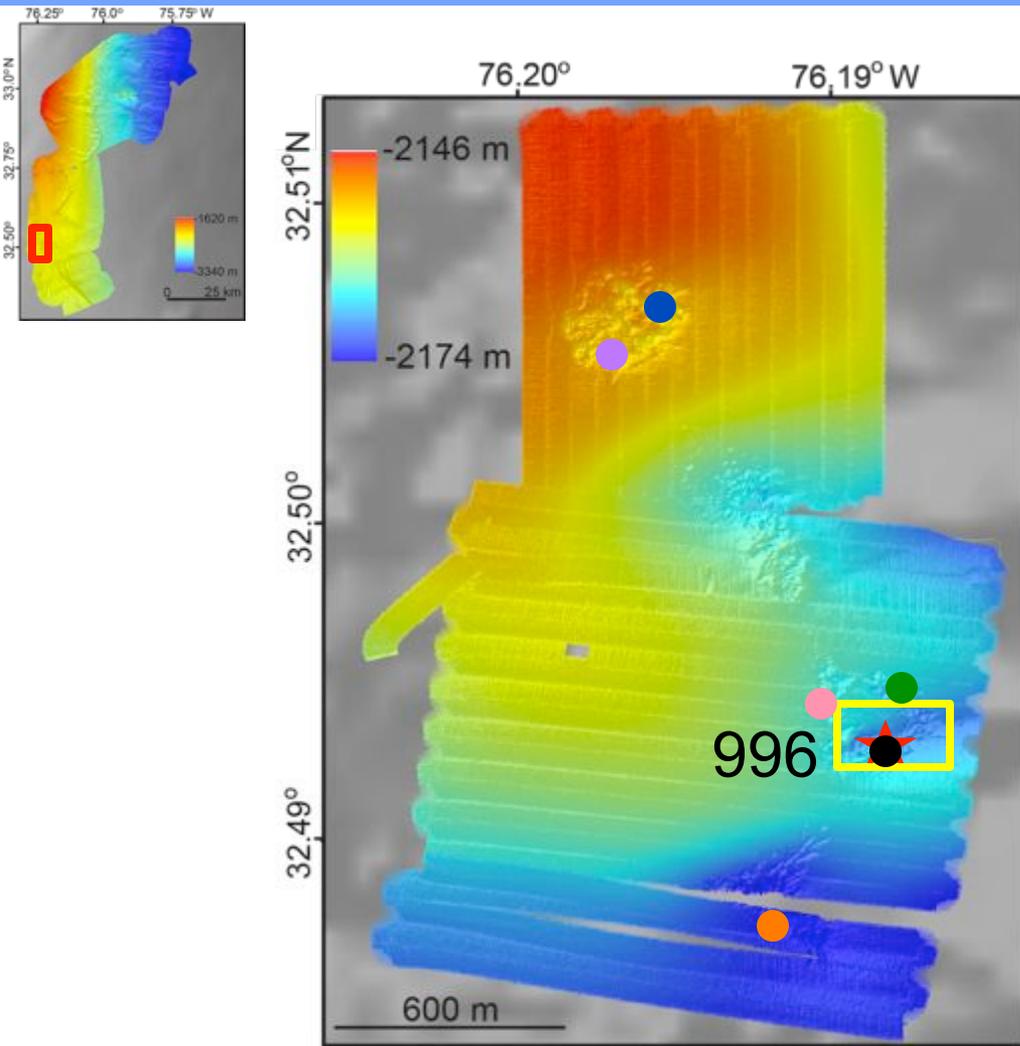
~3.5-7 s sampling interval



III. Results: Bathymetry & Water Column Anomalies

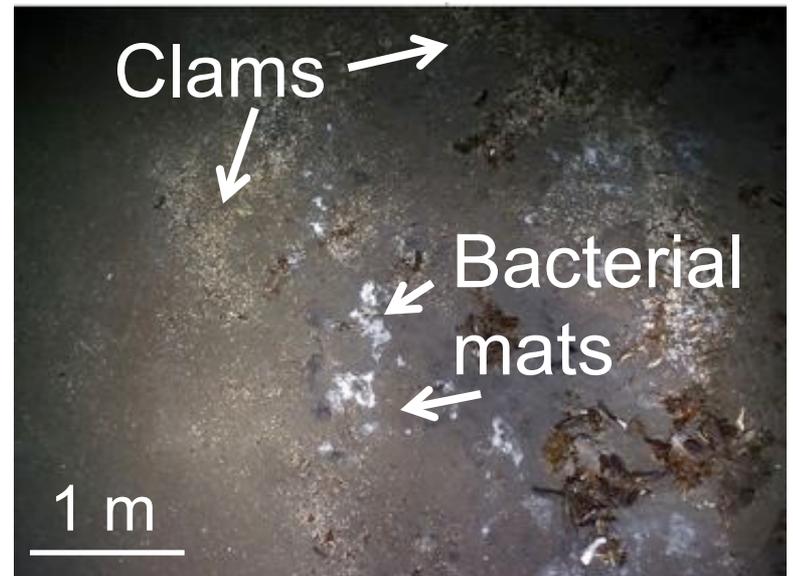
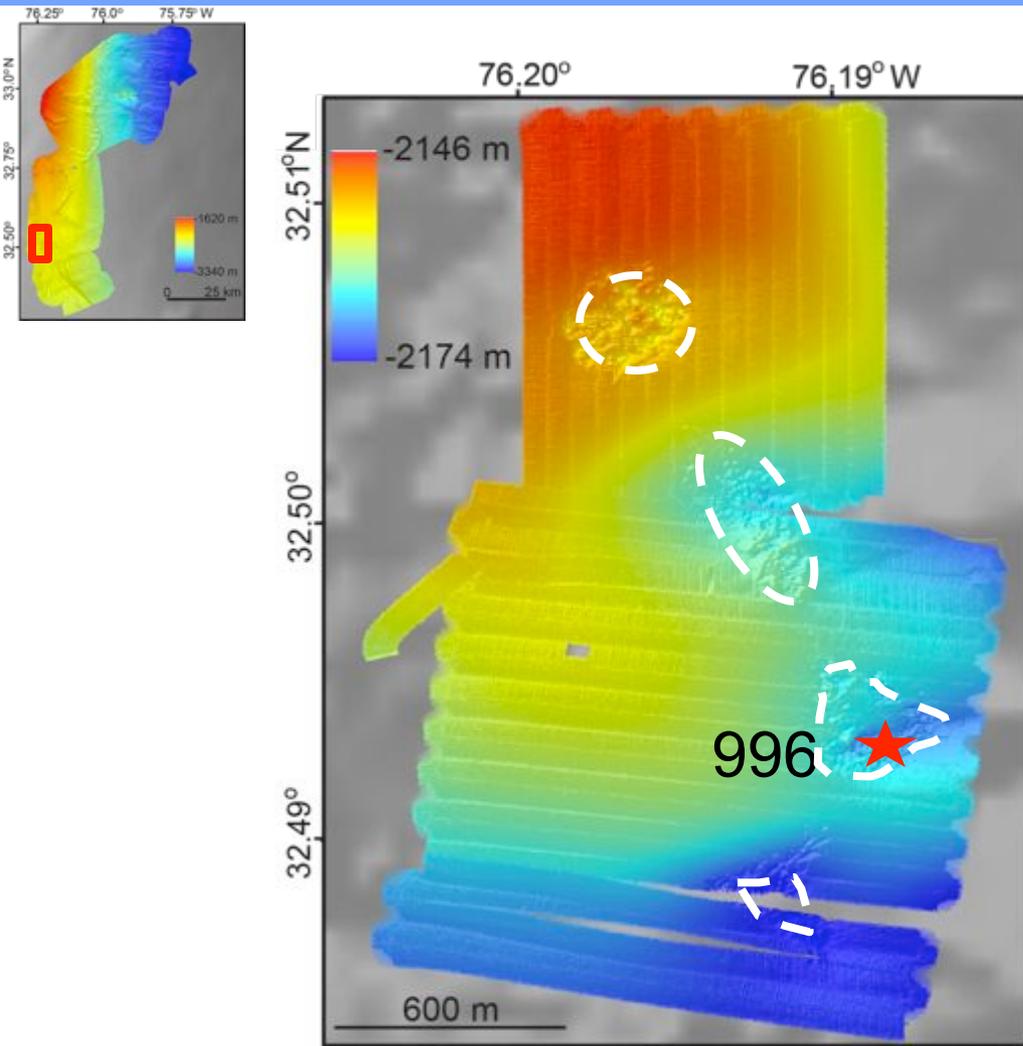


IV. Results: AUV Bathymetry & Water Column Anomalies



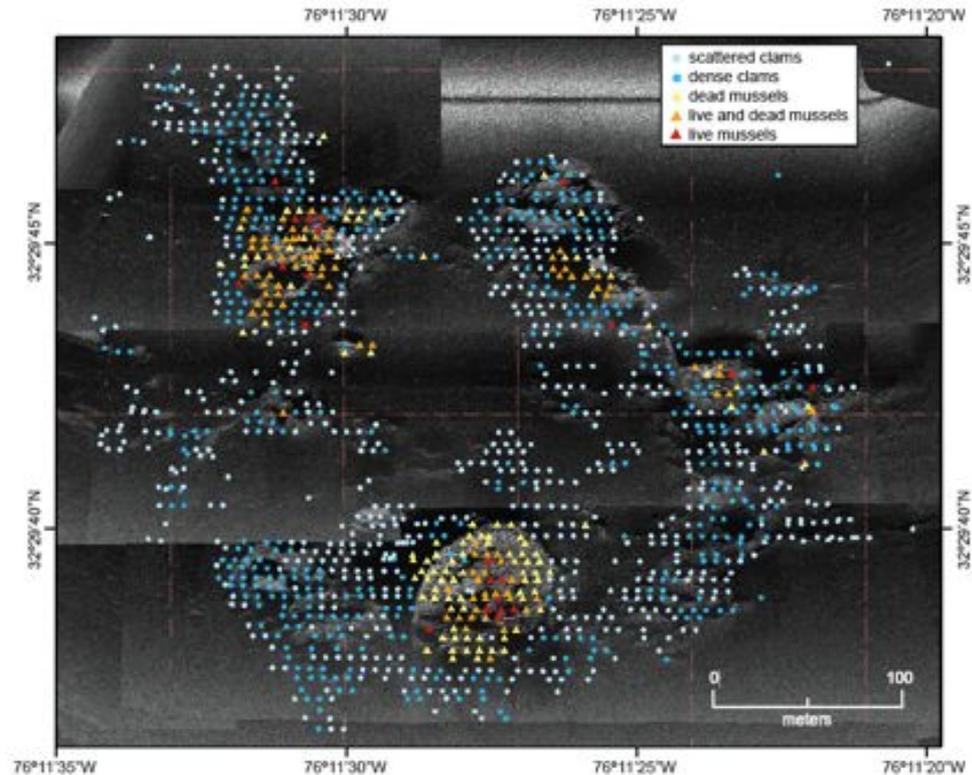
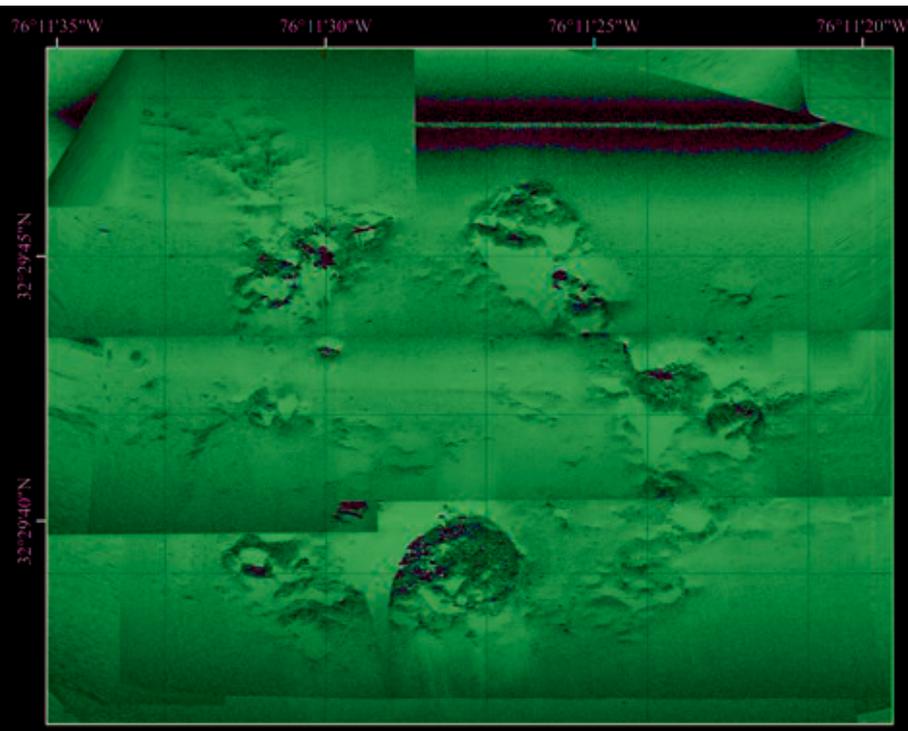
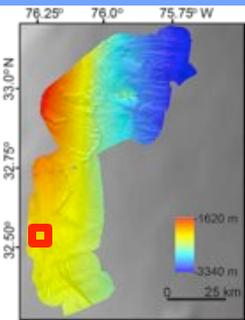
Plumes present outside the known Blake Ridge Diapir seep (mapped Van Dover et al., 2003)

IV. Results: AUV Bathymetry & Photos



IV. Results: AUV SSS & Photos

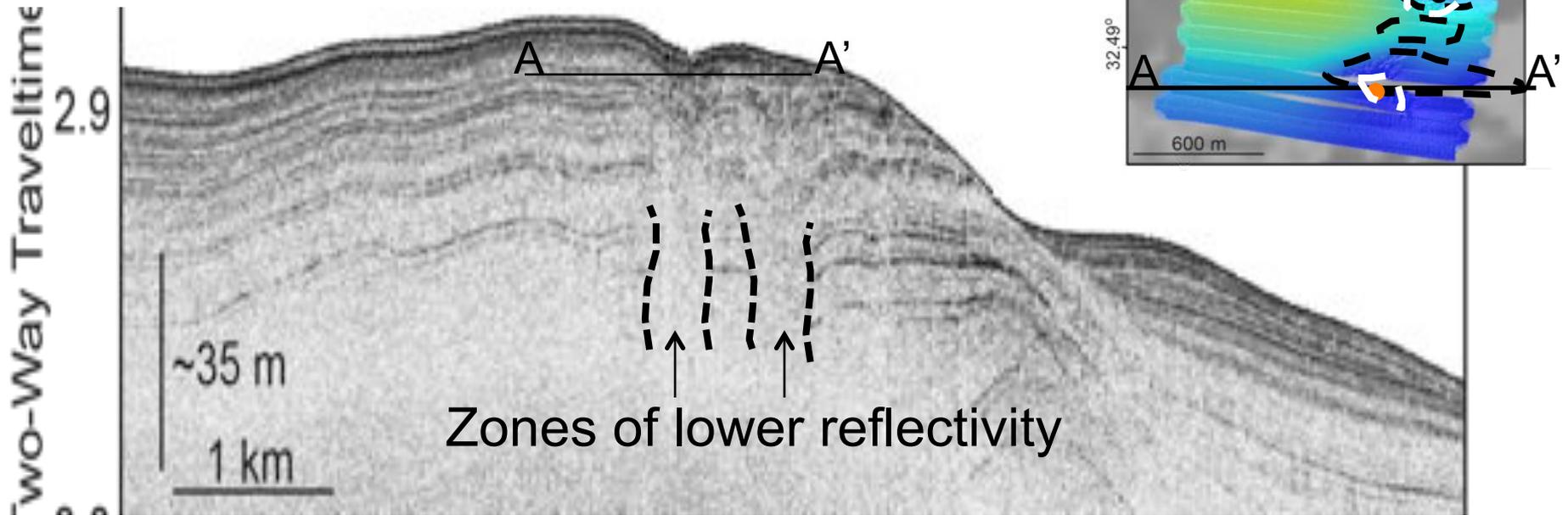
Chemosynthetic communities: A potential proxy for geochemical gradients in the shallow sediments



Wagner et al., *In Revision*

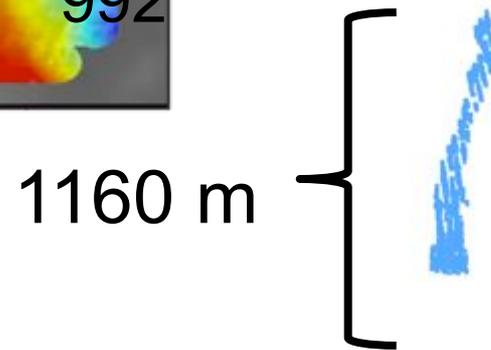
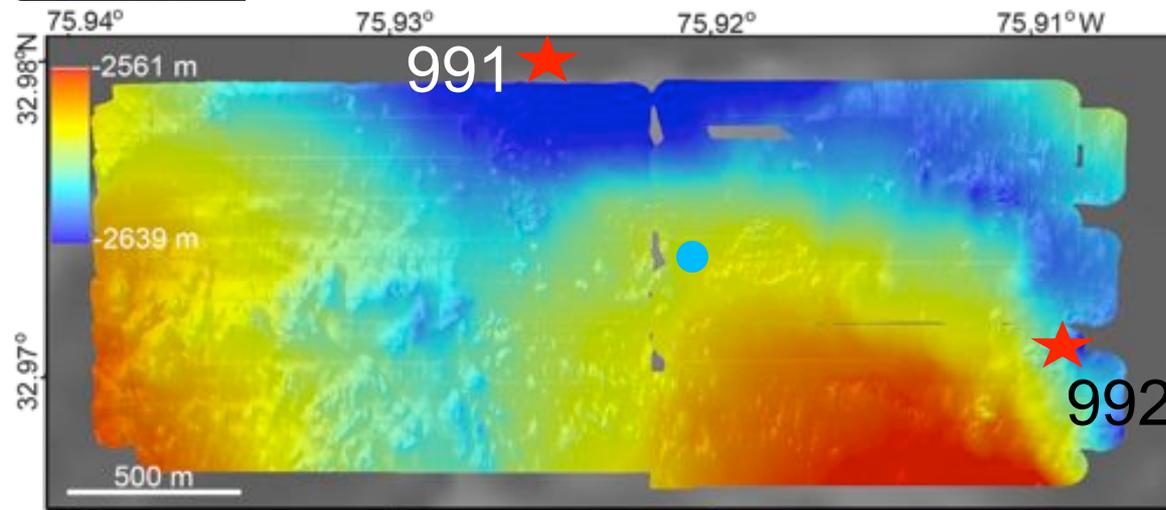
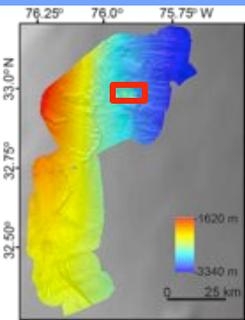
IV. Results: Subsurface Pathways

Fluid Migration pathways resolved from -40 mbsf to ~1000 m in the water column

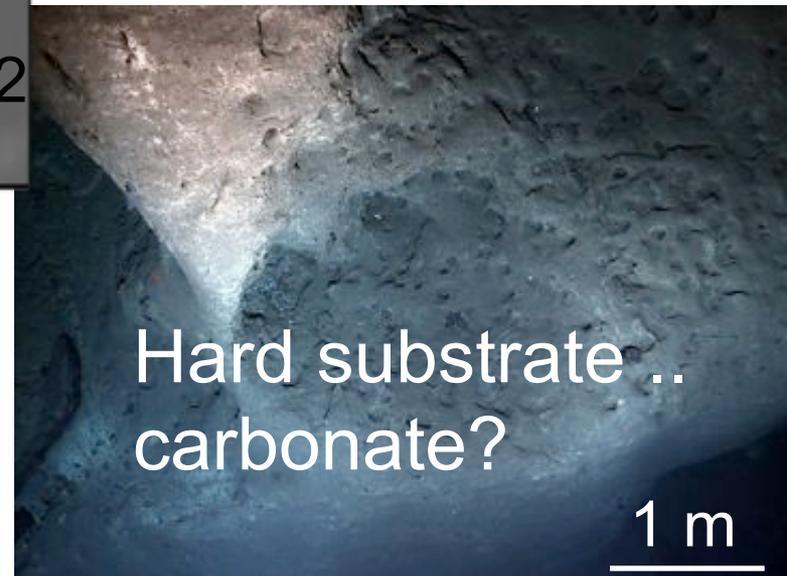
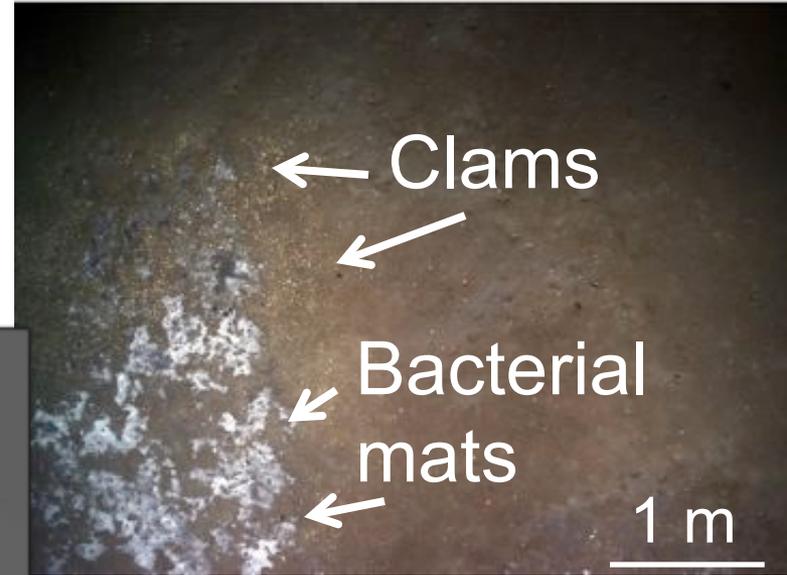
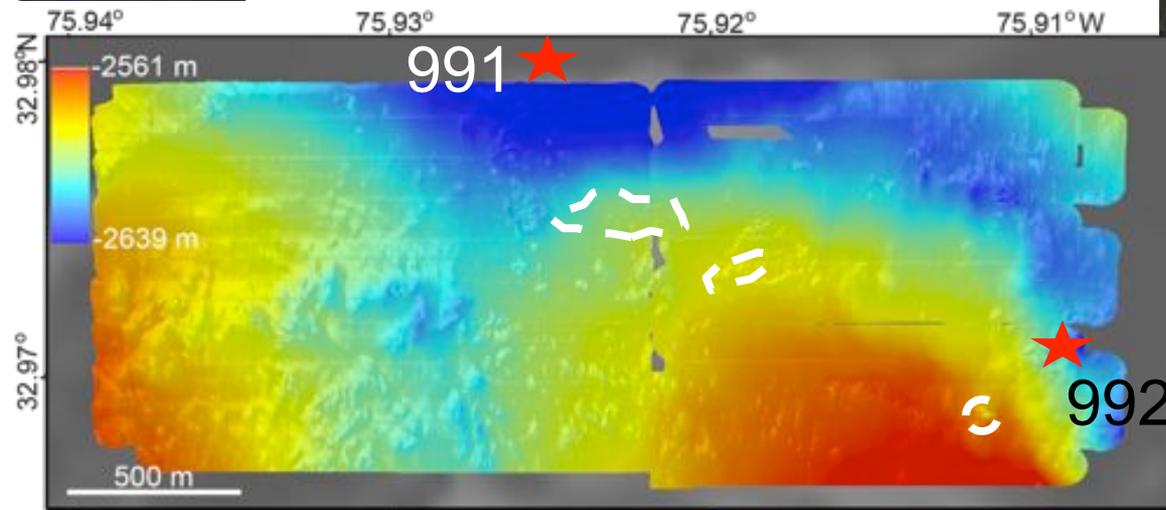
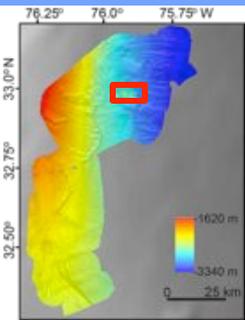


IV. Results: AUV Bathymetry & Water Column Anomalies

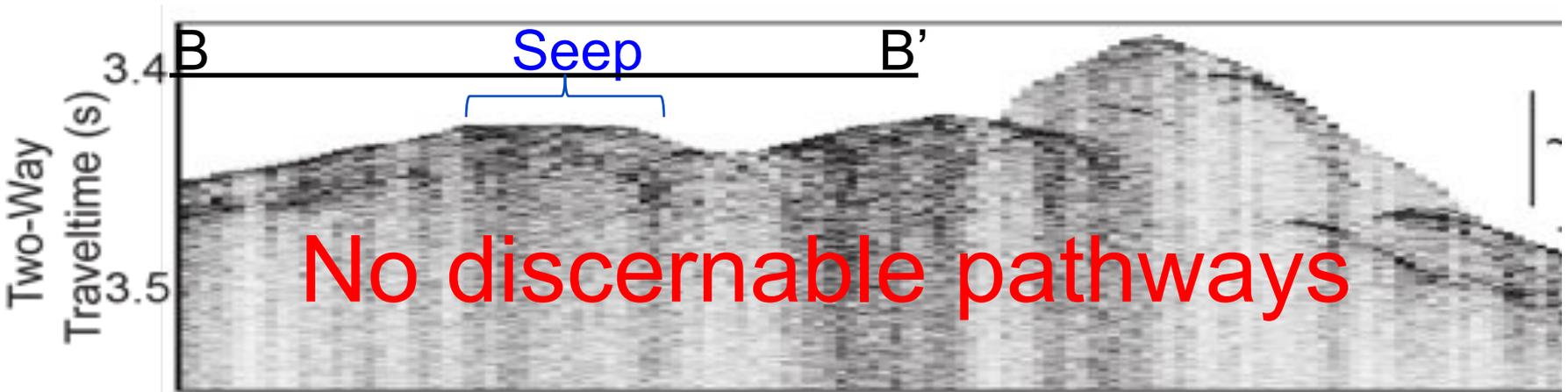
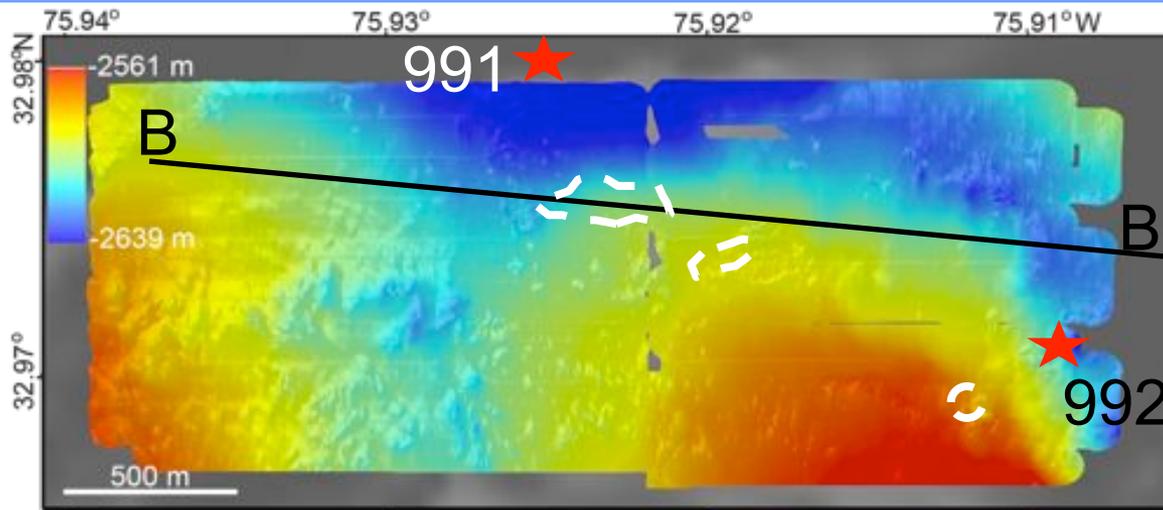
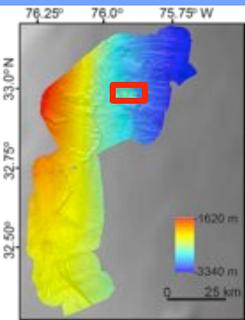
Plume within 1 km of drill sites that found no active venting and minimal evidence for past venting



IV. Results: AUV Bathymetry & Photos

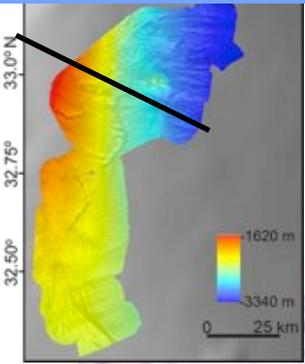


IV. Results: Subsurface Pathways

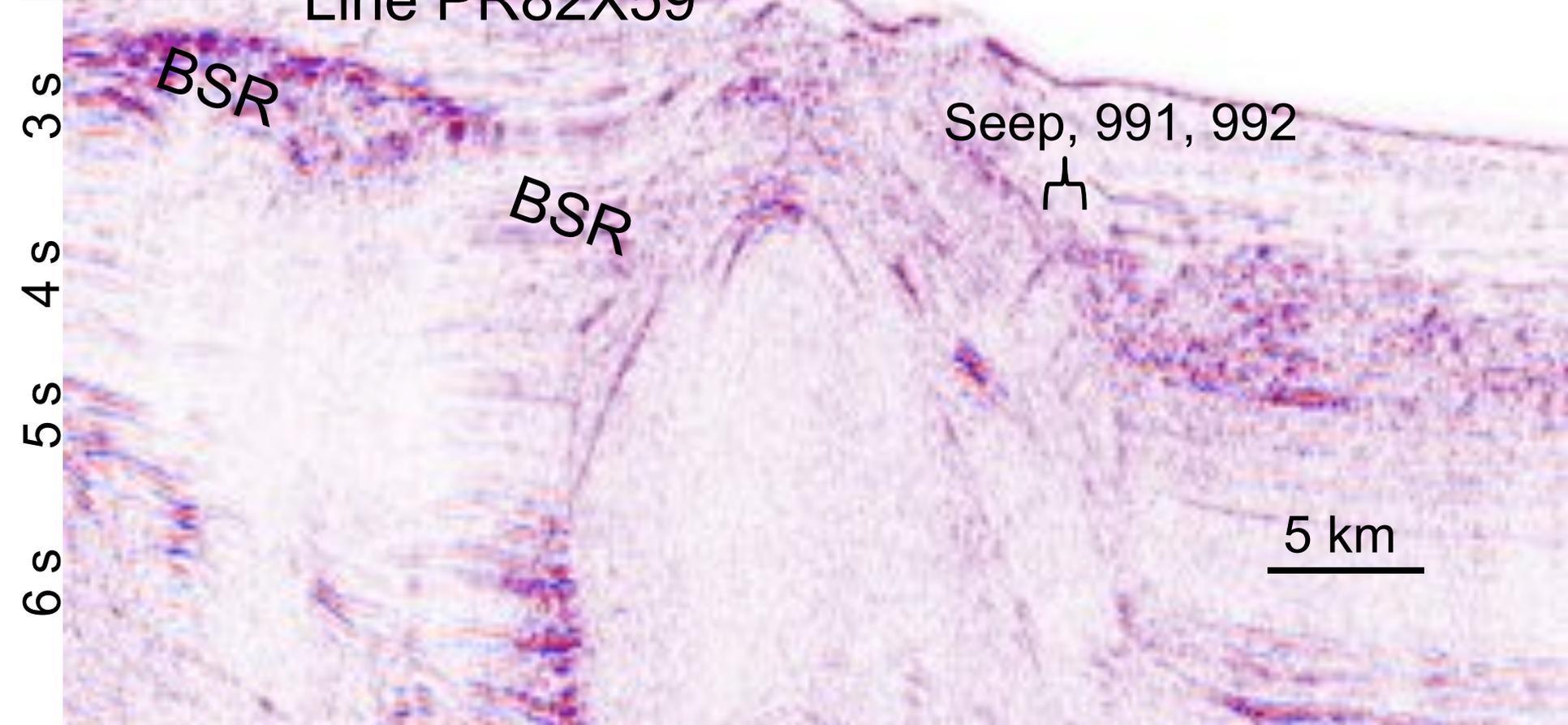


IV. Results: Subsurface Pathways

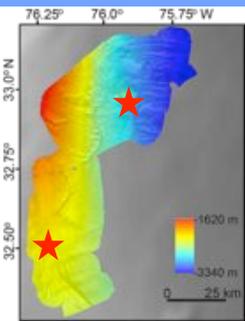
Very localized shallow pathways



Line PR82X59

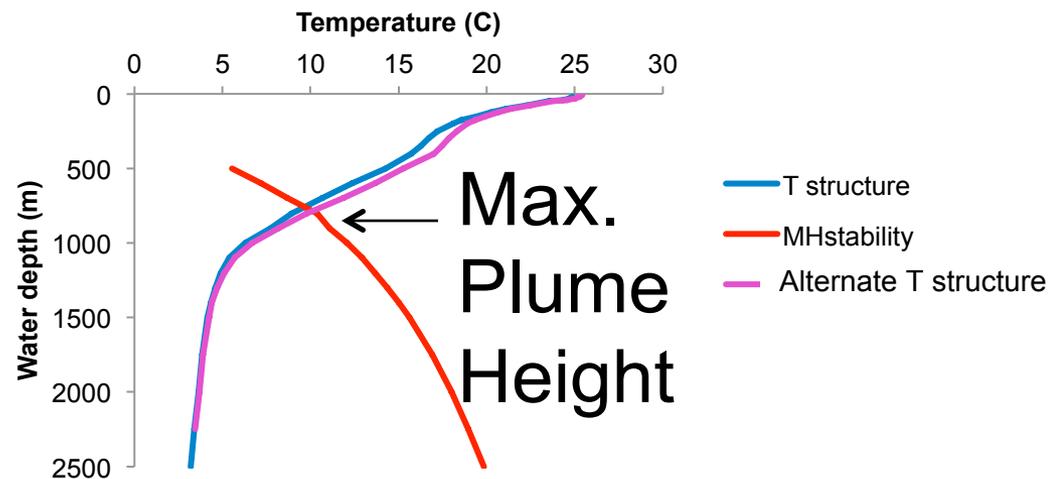


V. Discussion: Plumes

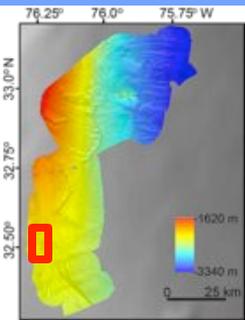


- * Imaged in multiple passes in variable weather conditions
- * All within 20 meters of benthic chemosynthetic communities
- * Plumes do not rise above the water column hydrate stability zone

* Gas Hydrate likely plays a role in bubble ascension



V. Discussion: 996 Still Venting...



(Paull et al., 1995)

1995 Geophysical/
Deep tow survey (Paull
et al., 1995)

1996 ODP Leg 164
(Paull et al., 1996)

2001, 2003 Alvin
Dives (Van Dover et
al., 2003; Heyl et
al., 2007)

2012

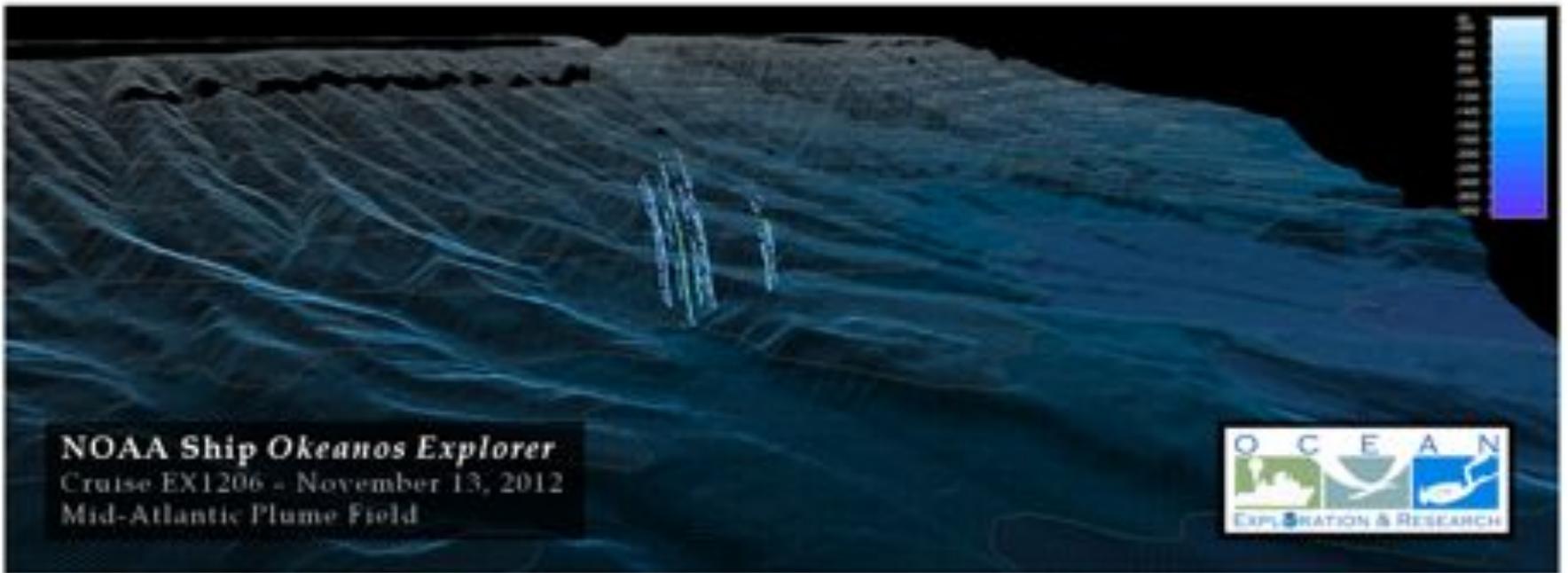


Released an estimated 1.541×10^{-1}
tons of Carbon

VI. Conclusions

- *Even at the known Blake Ridge Diapir, seabed fluid flux more spatially extensive than previously known
- *Active Fluid venting at Cape Fear Diapir
- *Reevaluate what we expect from 'low-flux' settings, especially those punctuated with diapirs

VI. Conclusions



Acknowledgements/Questions

Related Friday Poster Sessions

OS51D. Ocean Exploration Posters

OS51E. Science at Sea: Results from the oceanographic research fleet Posters

