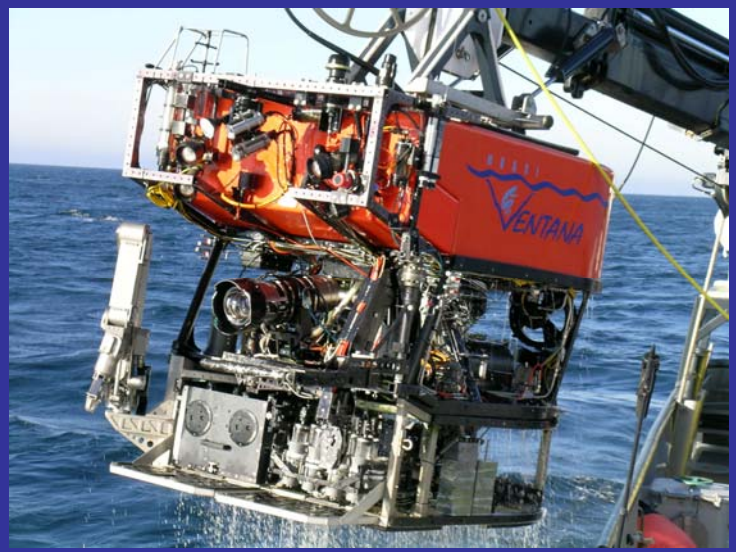
MBARI Video Data
Video Annotation Reference System (VARS)
Seep Search – example



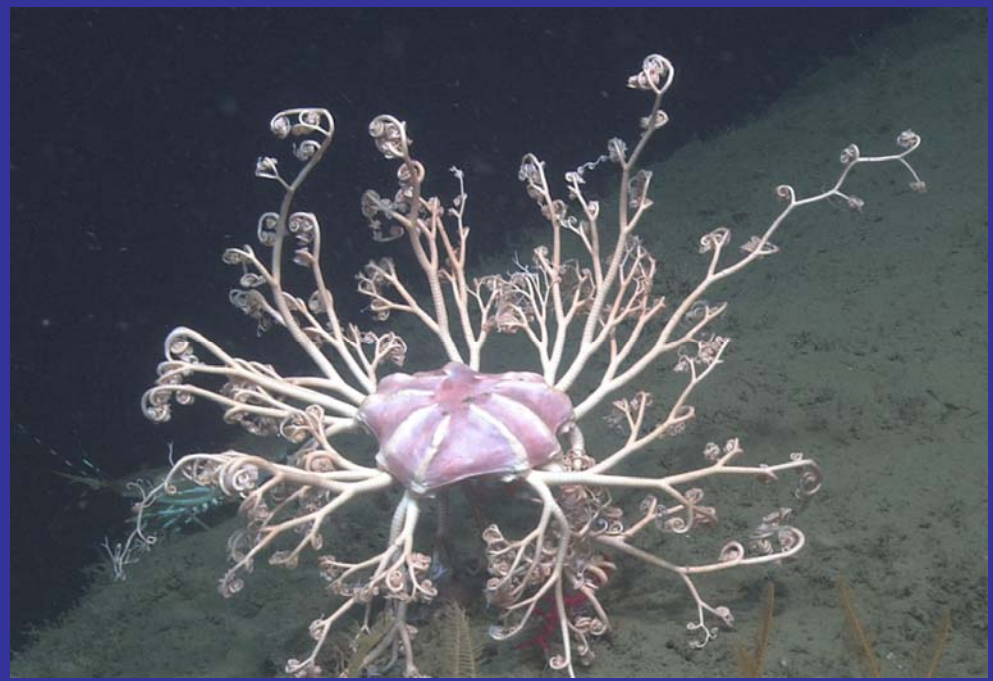
- More than 300 ROV dives per year
- More than 11,000 hours of video observations generated in 16 years
- More than 1.2 million individual observations

Scientific Applications

Video observations and related data

- Used by MBARI researchers in well over 200 professional publications and presentations, in addition to countless education and outreach projects
- Span multiple sub-disciplines within biology, geology, chemistry

Benthic Diversity



Bizarre Taxa (gorgonocephalus)

"A picture can be worth a thousand words"

(if you can find it!)

Annotation

- Trained science staff identify animal taxonomy, animal behavior, geological features, evidence of human impact, and other objects recorded in the ROV video stream
- Database continues to evolve as our researchers learn more
- Work closely with and rely on scientists to keep updated on new discoveries and publications in a timely fashion

VARS
System Components

Knowledge Base = *hierarchical constraint lexicon & reference*

More than 3500 taxonomic, geologic, technical concepts.
Reference media and descriptions.

Annotation = *catalog video observations, inc. visual media*

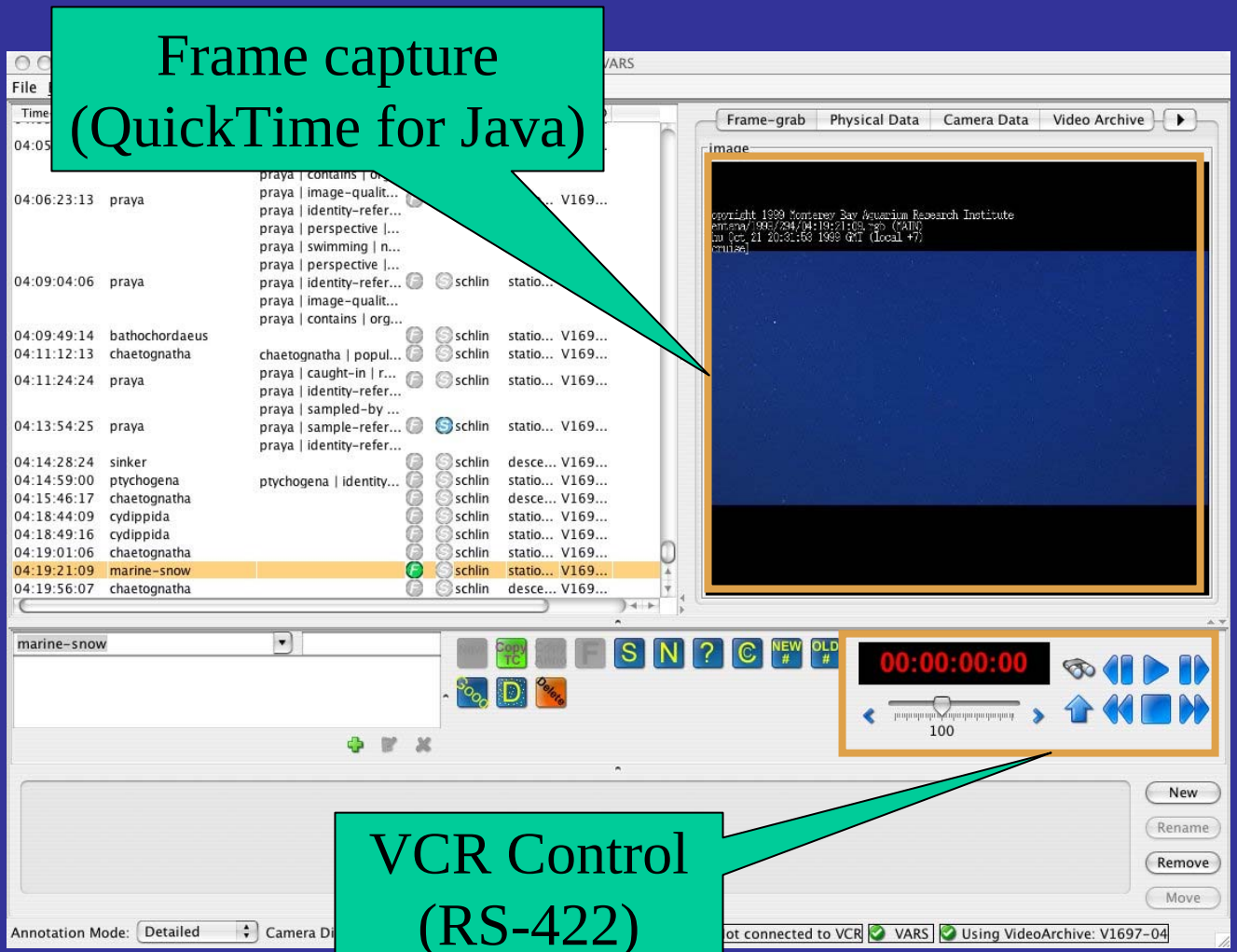
Uses the KB data to create and edit structured annotations for objects in the video stream.

Query = *retrieve video-related data*

Uses the KB to structure simple to complex queries against annotations database

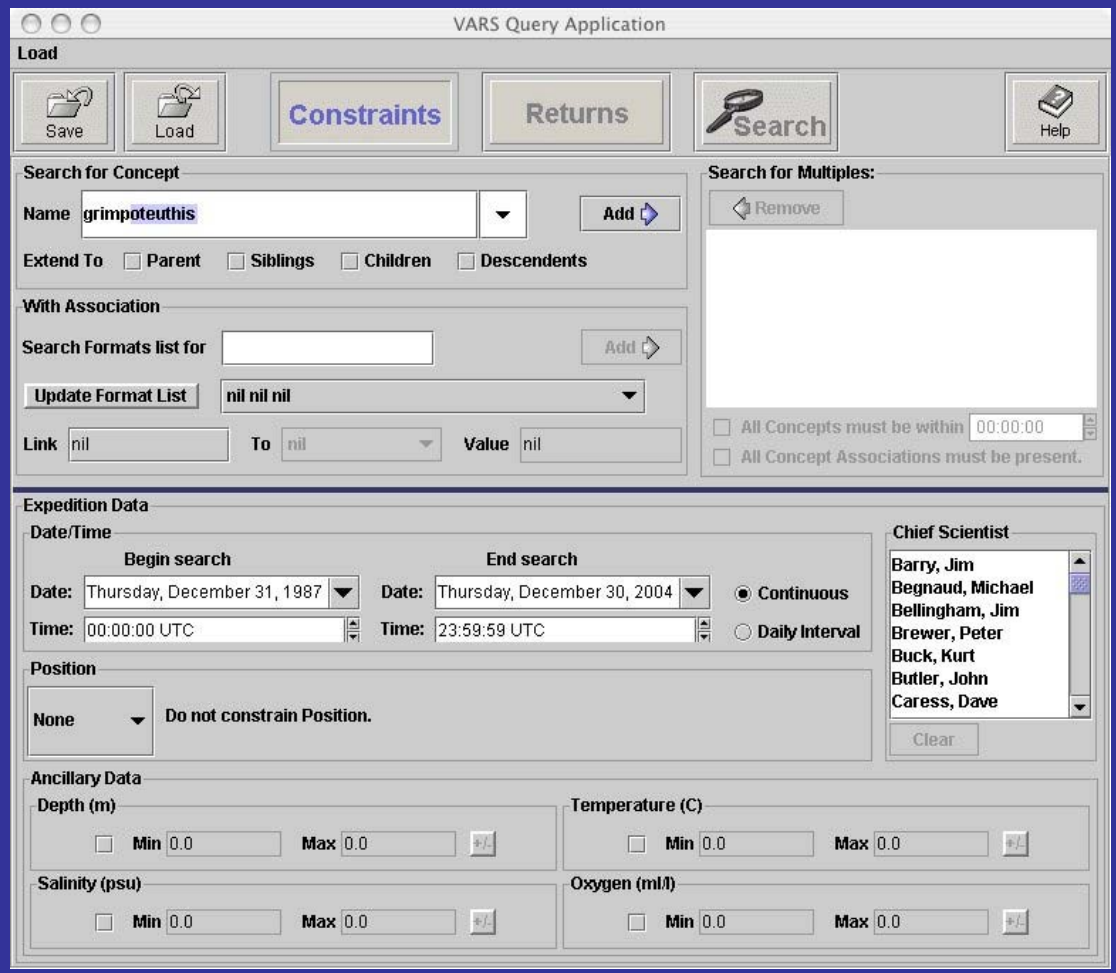
VARS - Annotation

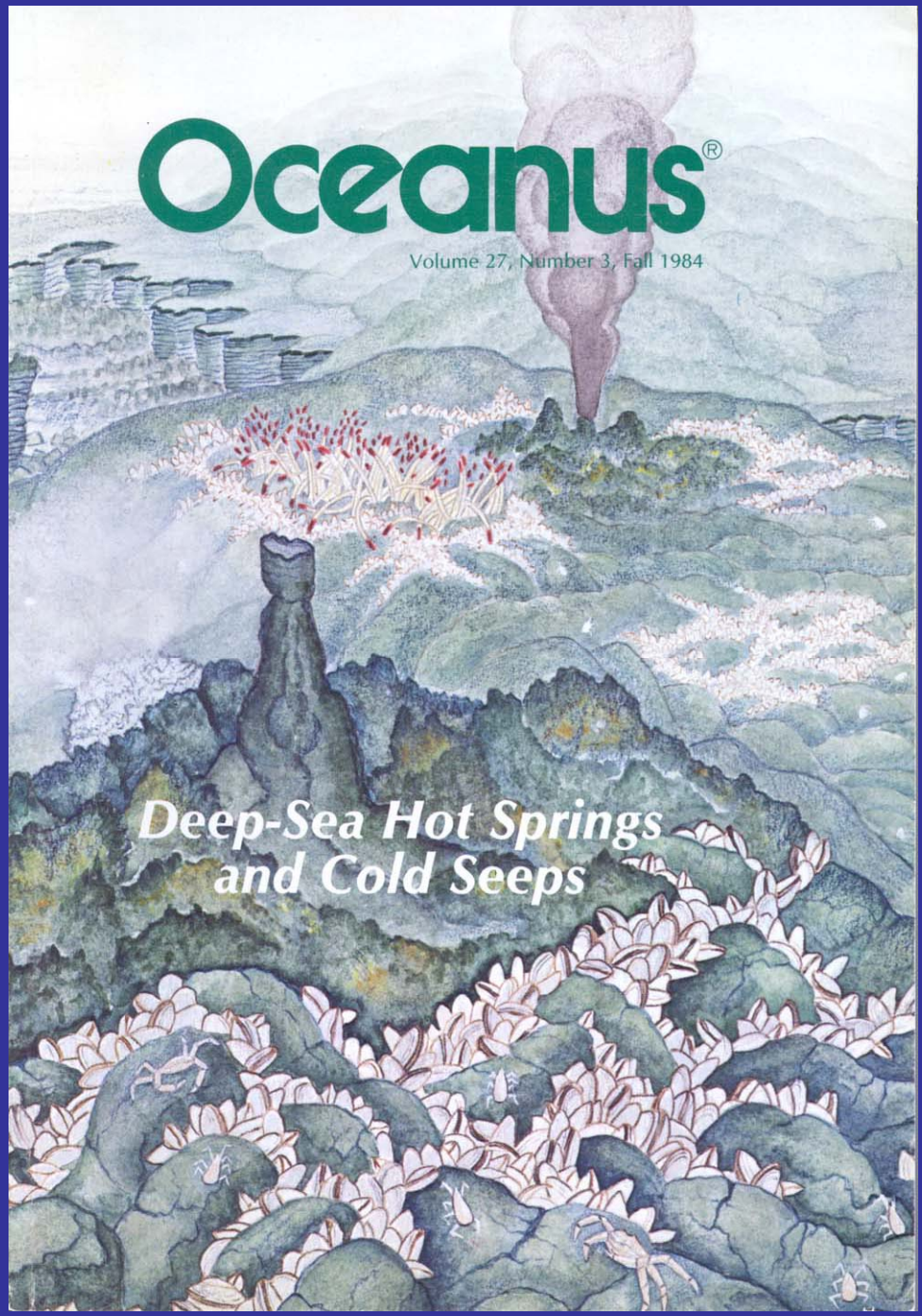
Generates video-annotations and frame-grabs



VARS - Query

Searches for and retrieves information and frame-grabs.





Etymology of:

“Cold Seep”

First used on the cover of Oceanus (April 1984) to describe chemosynthetic biologic communities in none ridge crest environments.

Rare find!

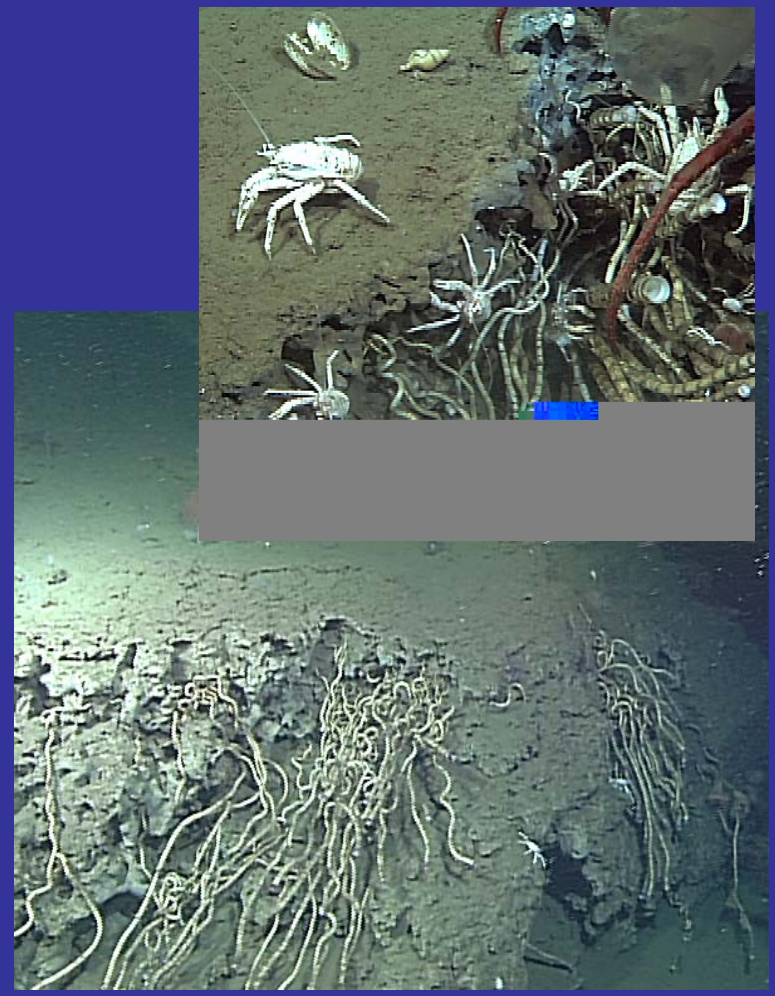
“Seep” implies fluid flow.

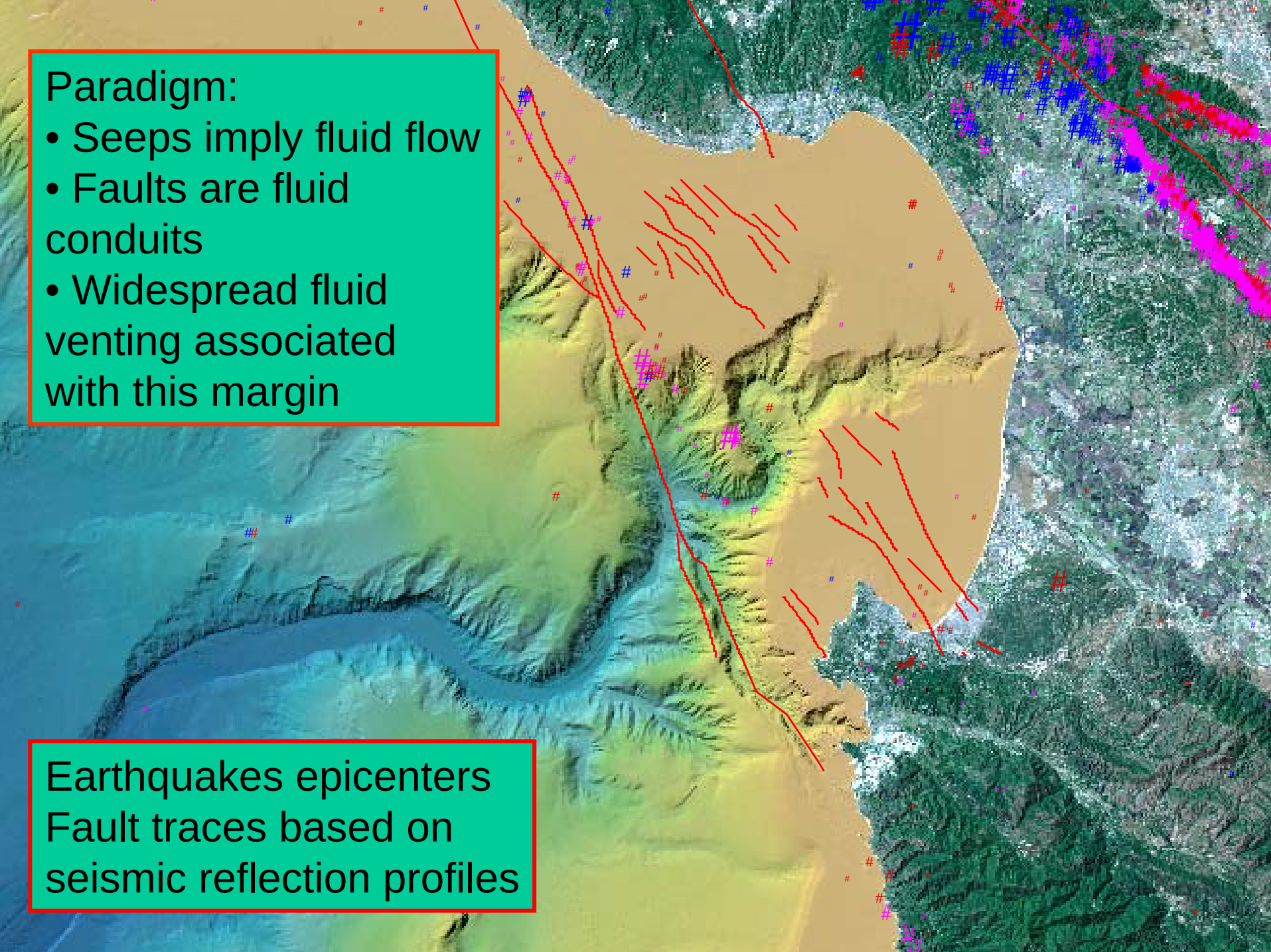
What you really know is that reduced inorganic compounds are available to the organisms.

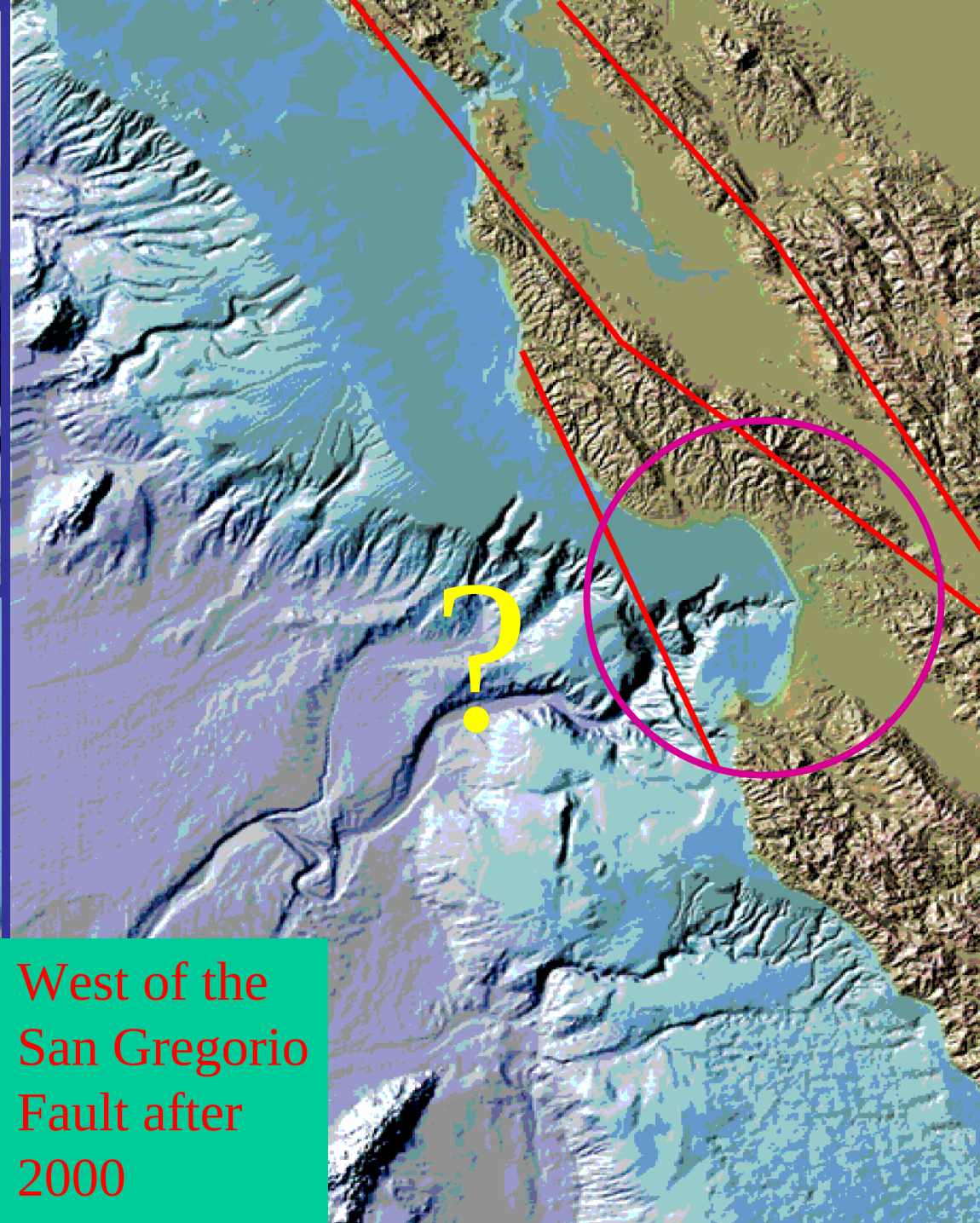
Monterey Bay Chemosynthetic Biological Communities (Called Cold Seeps)

Vesicomyid Clams

Vestimentiferan Tubeworms




Paradigm:
• Seeps imply fluid flow
• Faults are fluid conduits
• Widespread fluid venting associated with this margin
Earthquakes epicenters
Fault traces based on seismic reflection profiles



West of the San Gregorio Fault after 2000

Monterey Bay – Best observed seafloor in the world?

What has been learned about the distribution of "cold seeps'?

Where do they occur and where don't they occur?

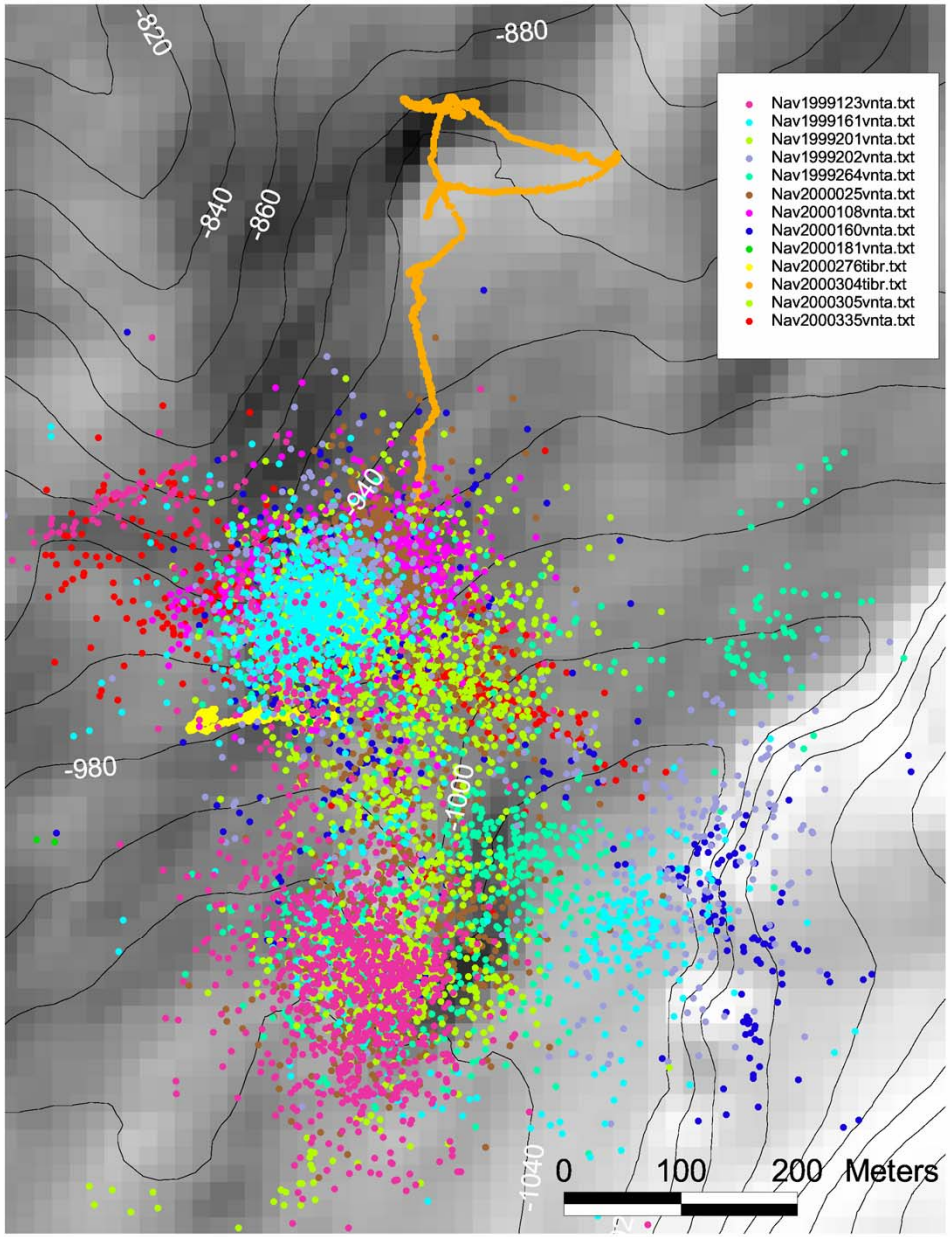
Data:

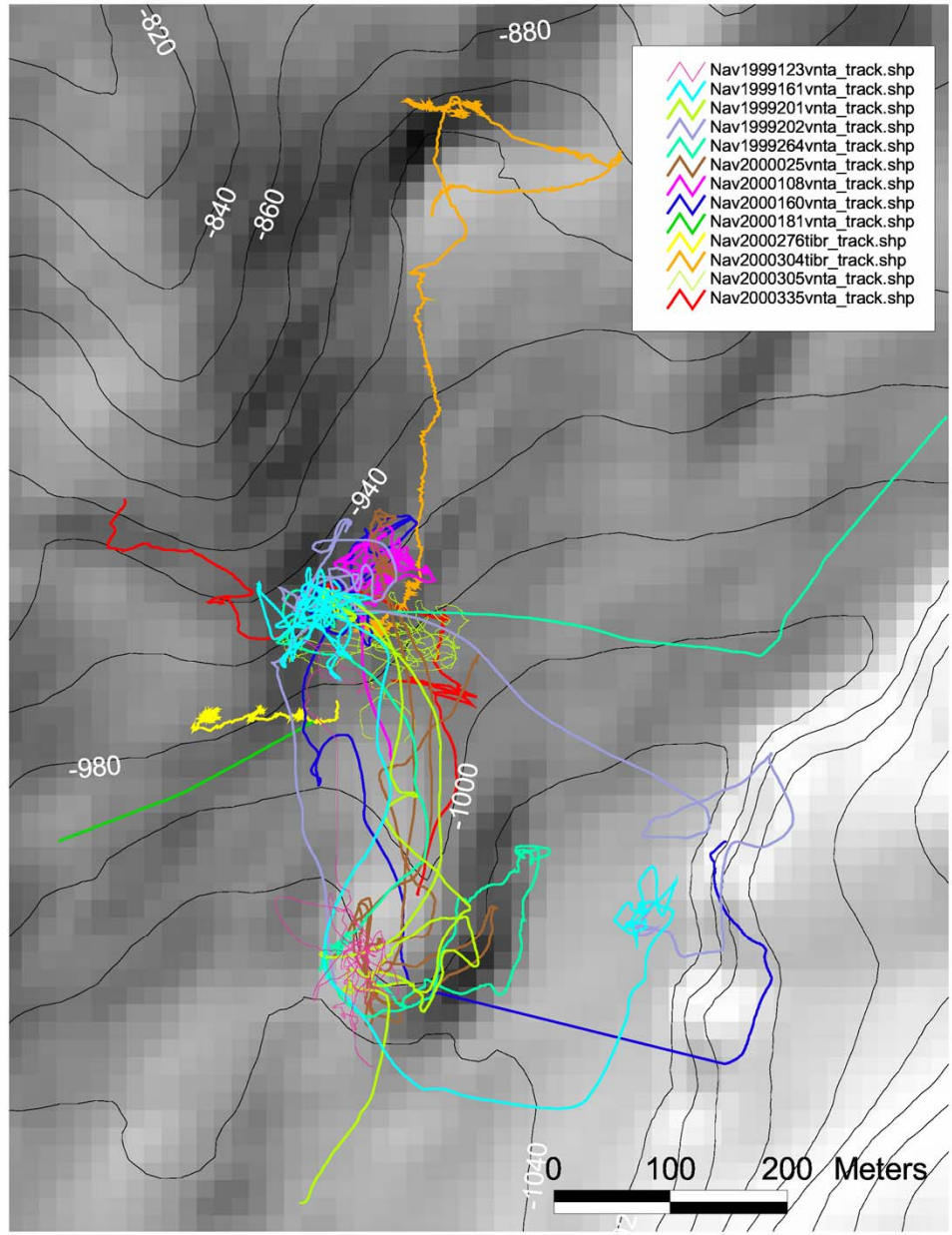
- >2,400 ROV dives
- VARS –annotations
- EM-300 bathymetry

Issues:

- Poor navigation
- When on bottom?
- Overlapping tracks
- Biases

Extravert Cliff

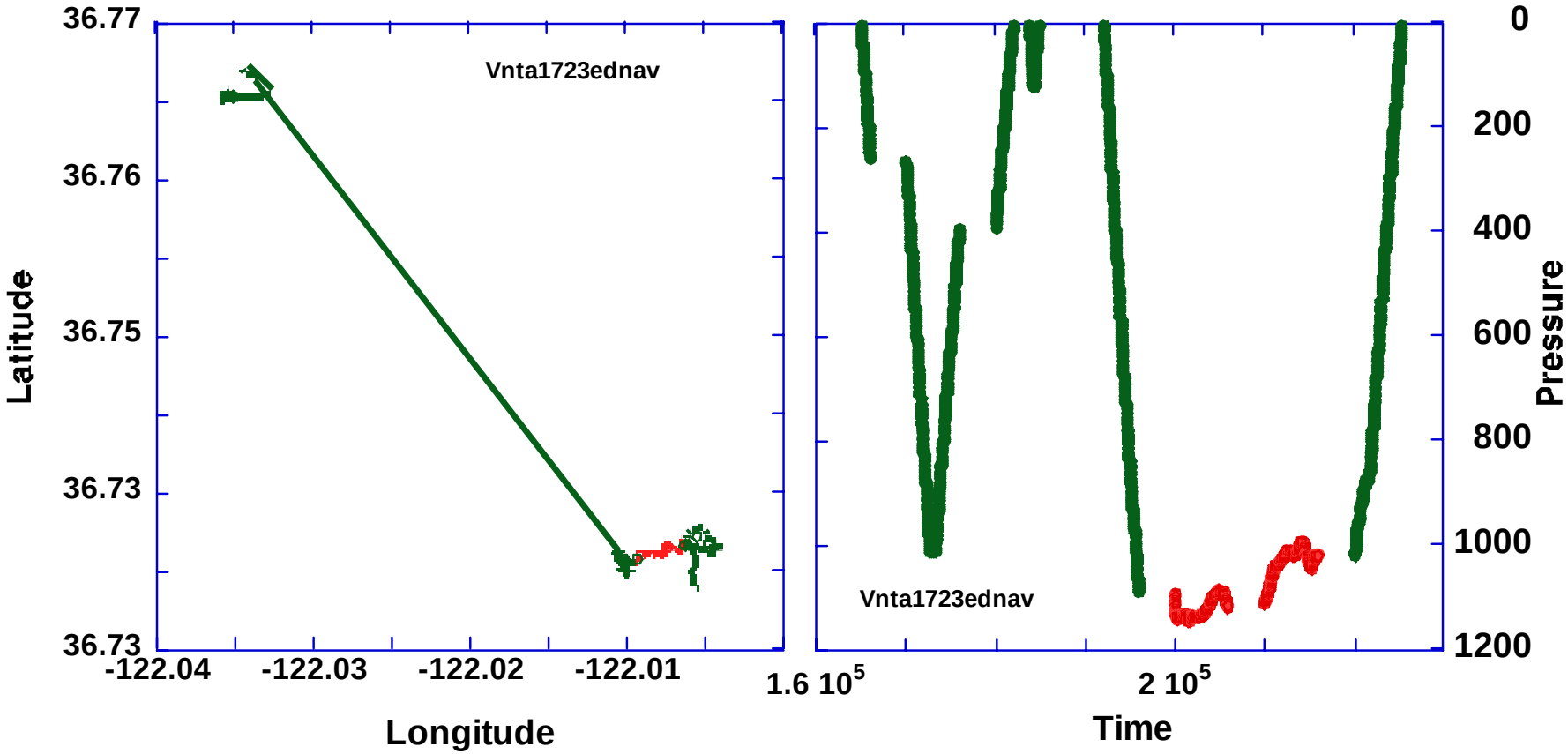




"raw" ROV navigation

"cleaned" ROV navigation

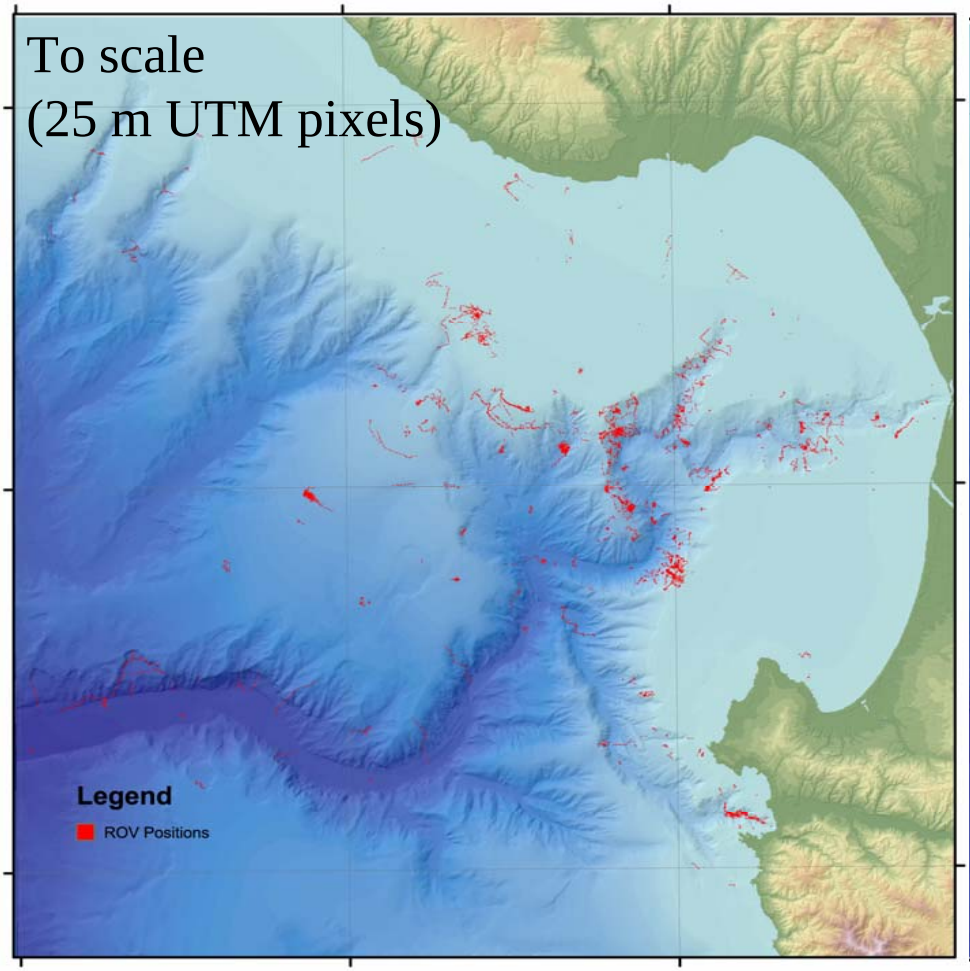
Problem: Need to edit navigation to remove mid-water fixes to determine where ROV has encountered the bottom?

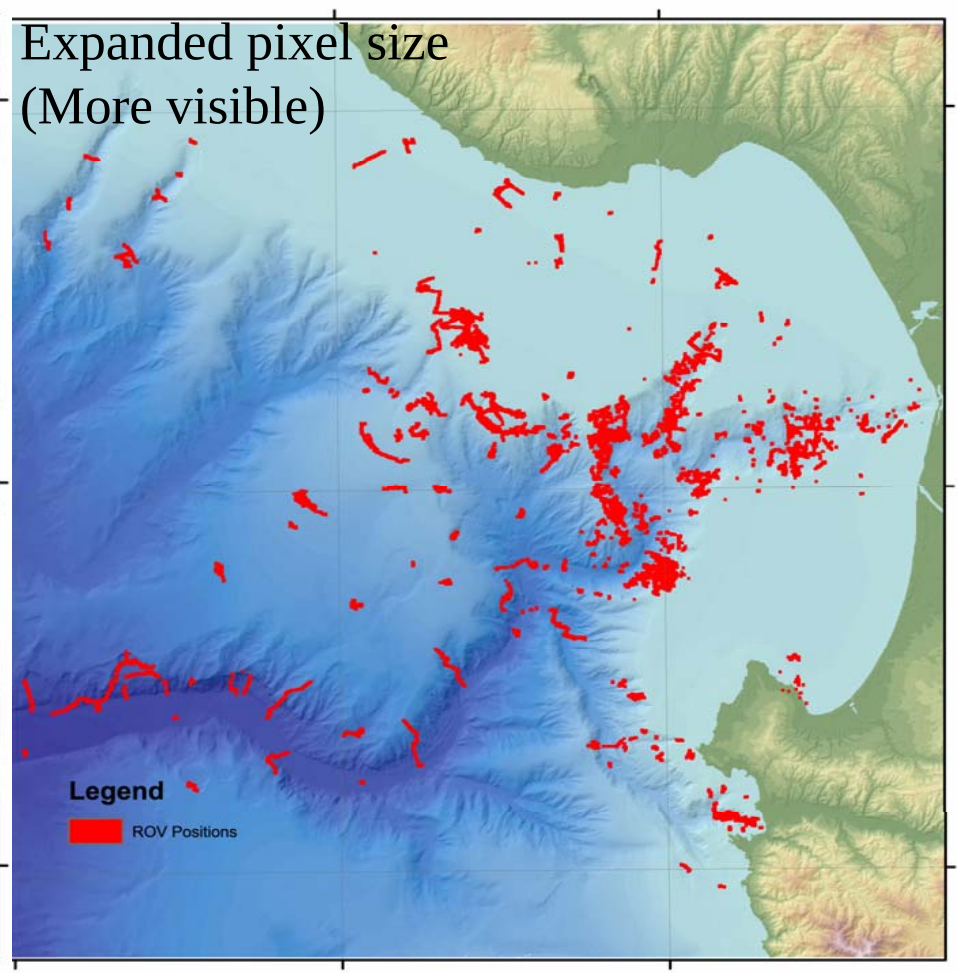


Solution: Compare EM-300 bathymetry with ROV navigation. Eliminate all ROV navigation fixes that do not match within 20 m. Eliminate multiple “hits” to same pixel.

Locations of MBARI's benthic dives:

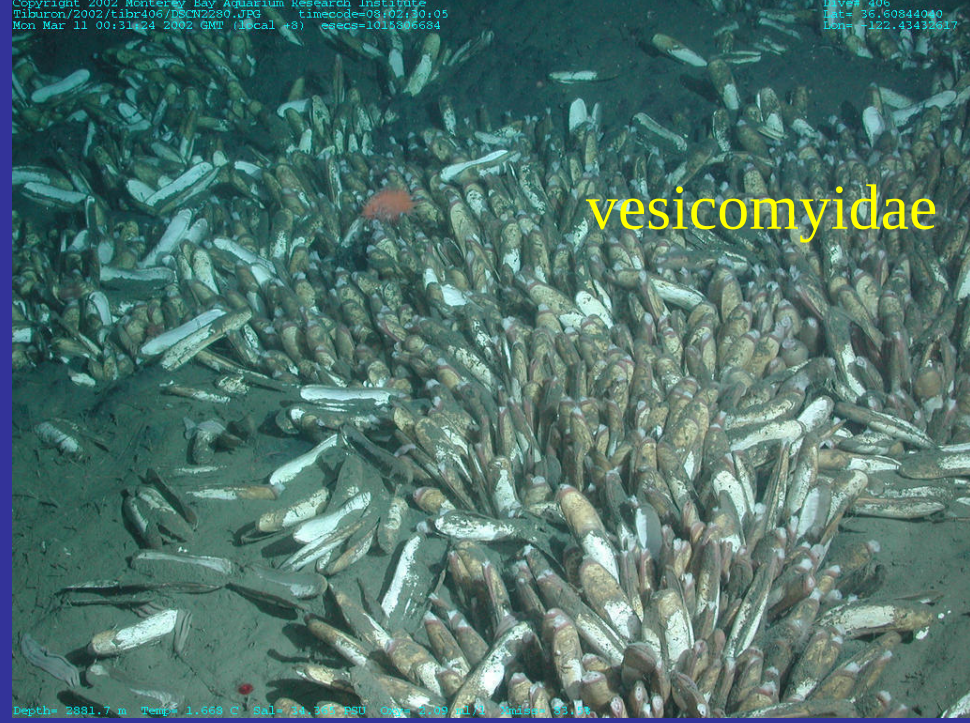
(Calculated as pixels with ROV navigation fixes that match EM-300 depth within 20 m.)

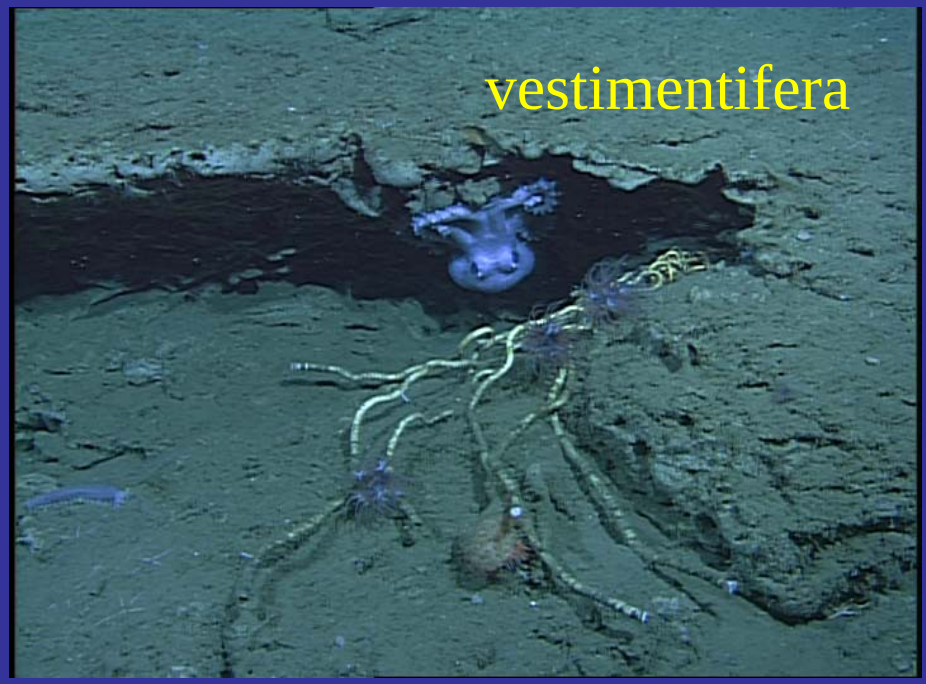




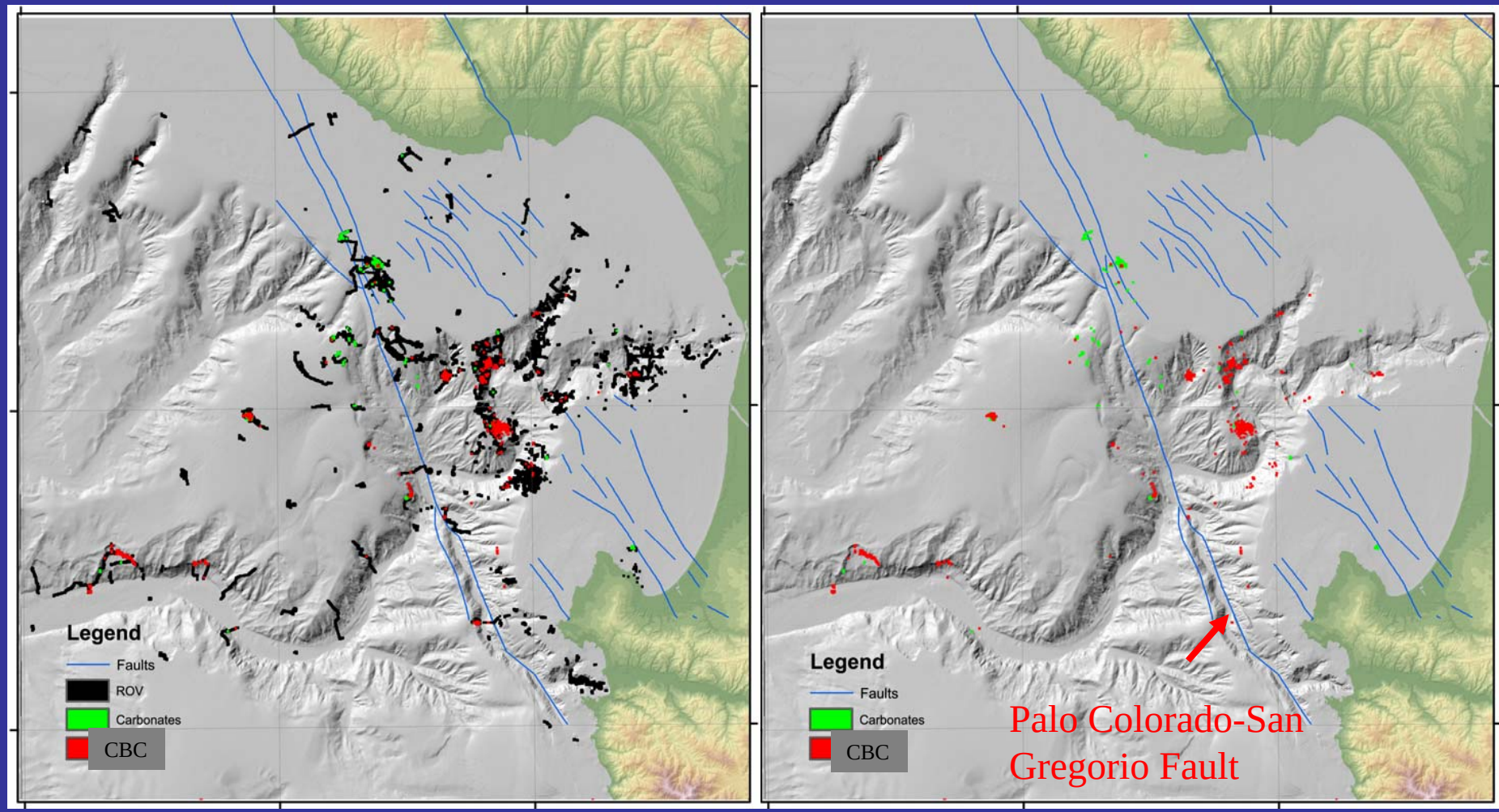
Seafloor was visited in 0.9% of the 25 x 25 m pixels within 45 km of Moss Landing.

Video Annotation Referecne System (VARS)



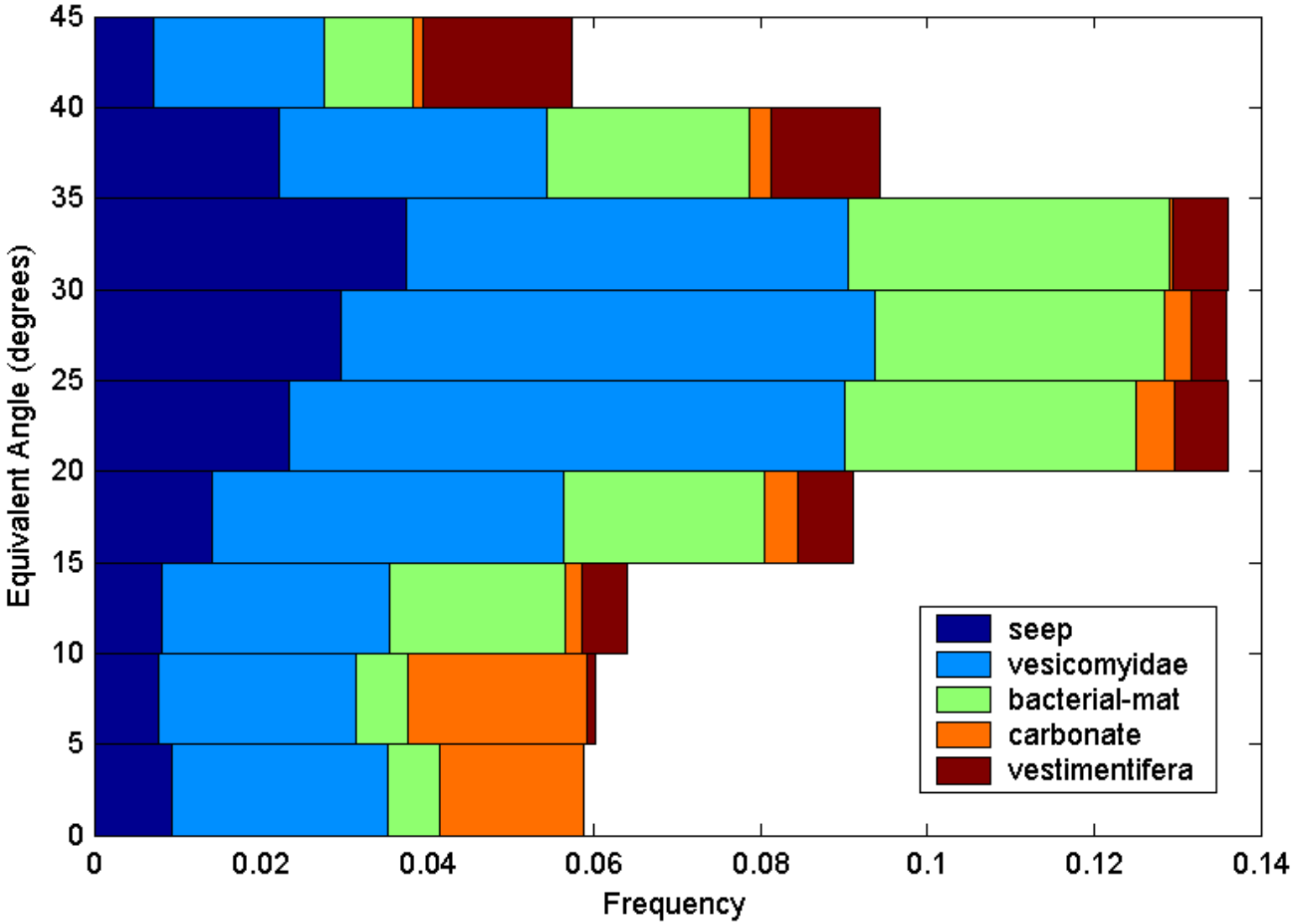


Locations of MBARI's benthic dives with 'Seep' observations:



2% of 25 by 25 m pixels within 45 km of Moss Landing contain VARS entries for CBC indicators (vestimentifera, vesycomide, bacterial mats, and 'seep').

Chemosynthetic Biological Communities occur preferentially on steep slopes?



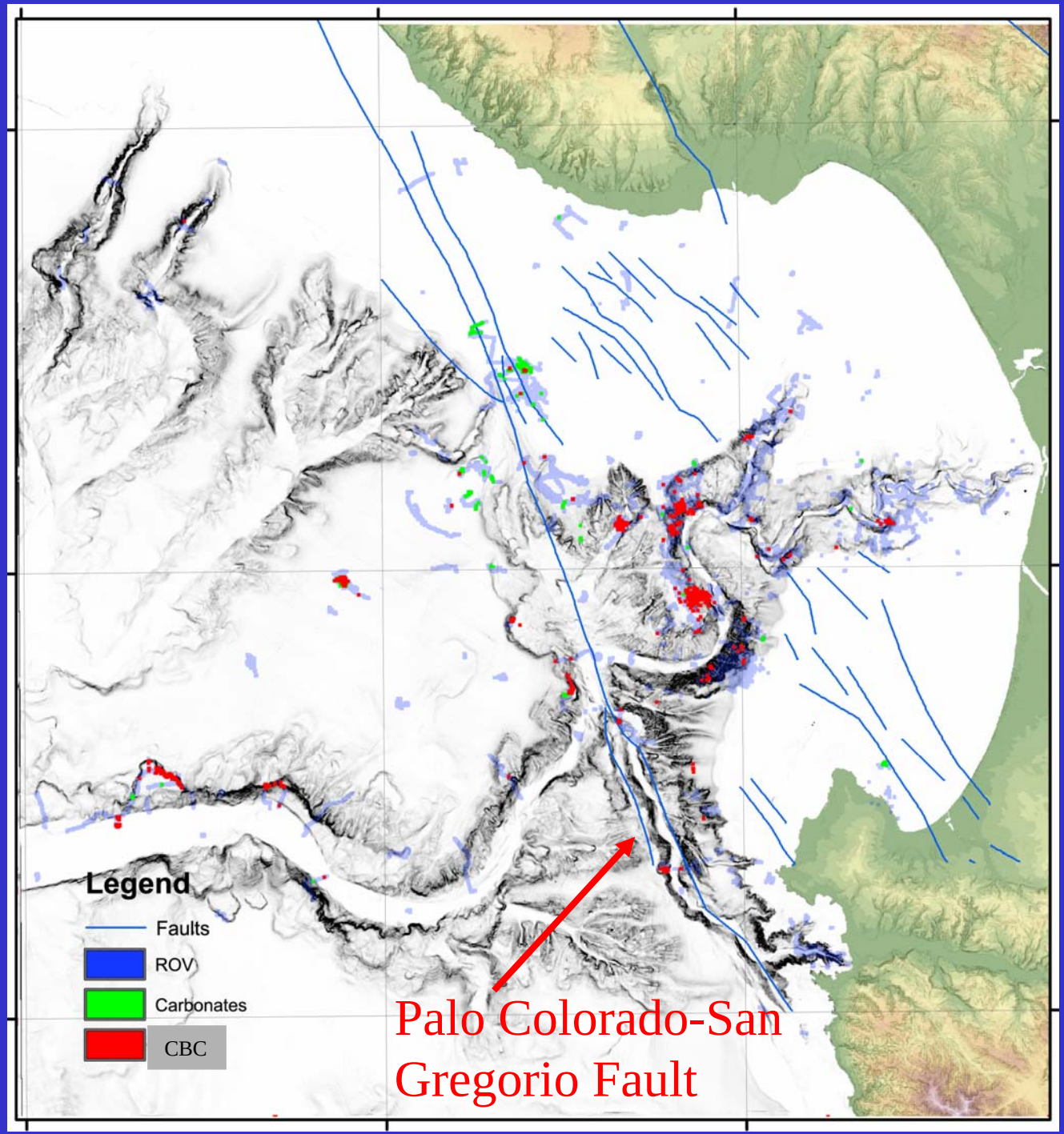
Steep slopes imply areas of recent erosion.

CBC's are common!

Occur in 9% of the pixels more than 5 km west of the Palo Colorado-San Gregorio Fault.

Occur preferentially on steep slope or recently eroded sites.

Relationship between seepage indicators and regional faults?



Monterey Bay –
Best observed seafloor in the world?

What has been learned about the distribution of "cold seep' communities?

- They are common, not rare.
- They do not occur where the fluid flow paradiem predicted.
- This would be nearly impossible to have learned without the sustained effort.