Site Selection and Geology of Key Chemo III Sample Sites

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Objective

Identify sites of fluid-gas expulsion (WD > 1000 m) that have geologic characteristics consistent with the known occurrence of chemosynthetic communities of the upper slope.

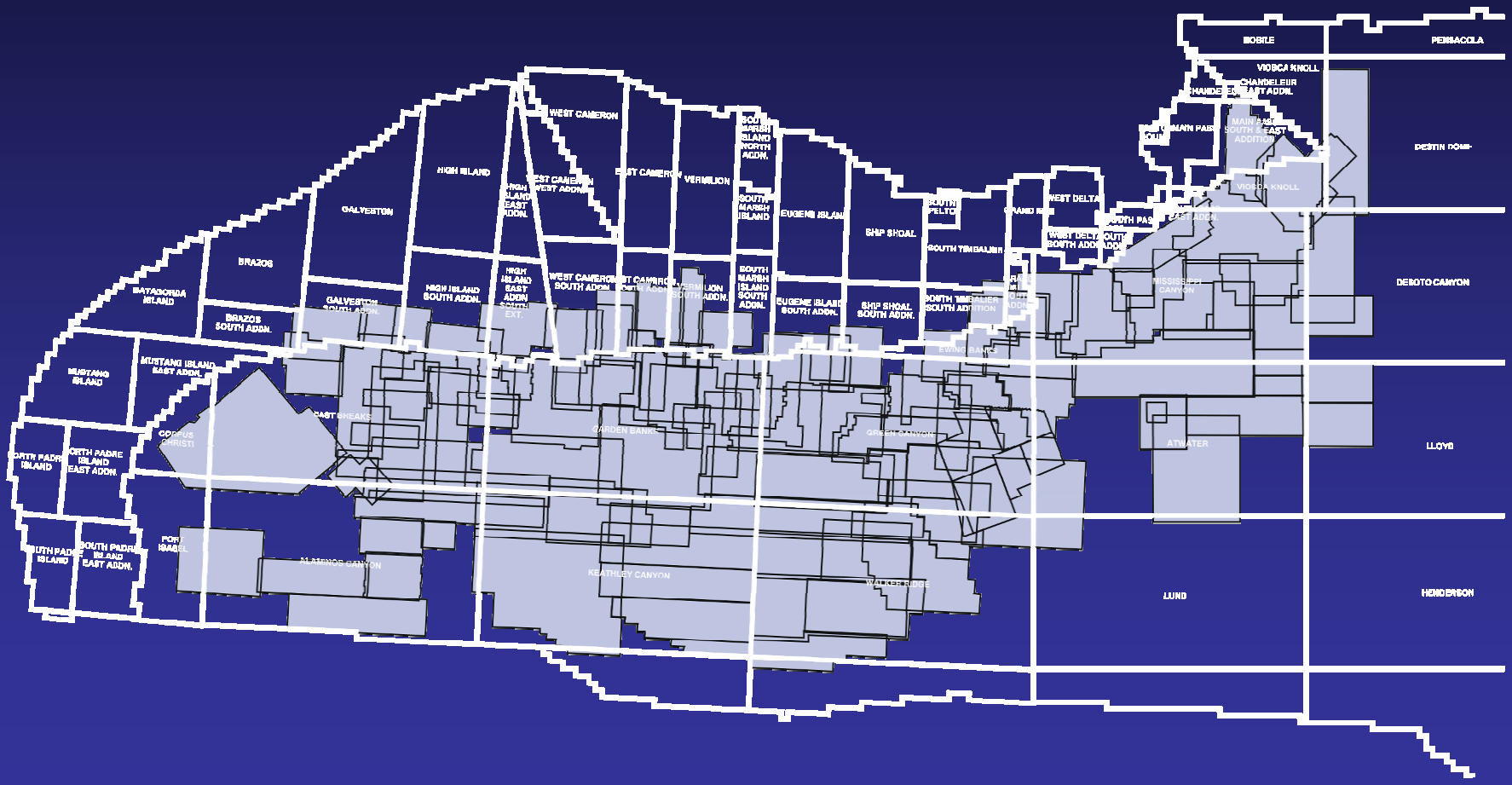
Presentation Points

- Seismic Database
- Analysis and Site Selection Procedures
- Seafloor Verification Data
- Key Sample Site Characteristics

Seismic Database

Interpreted Seafloor Maps

186 3-D Seismic Surveys Completed



Analysis and Site Selection Procedures

Data Characteristics and Procedures

1. Used GeoQuest's IESX Interpretation Software
2. Seafloor Identified (Auto- and Hand-Picked) – Generally a Strong Reflector
3. Posted Seafloor Amplitude Extraction for Survey and Selected Sites of Interest
4. High Positives – Hard-Bottom Areas
5. Low Positives or Negatives – Gas-Rich Sediments
6. Plan-View Amplitude Patterns – Flows, Cones, etc.
7. Seismic Profiles – Identify Migration Pathways
8. Care Taken to Identify Non-Expulsion Anomalies

Time-Table for Major Project Objectives

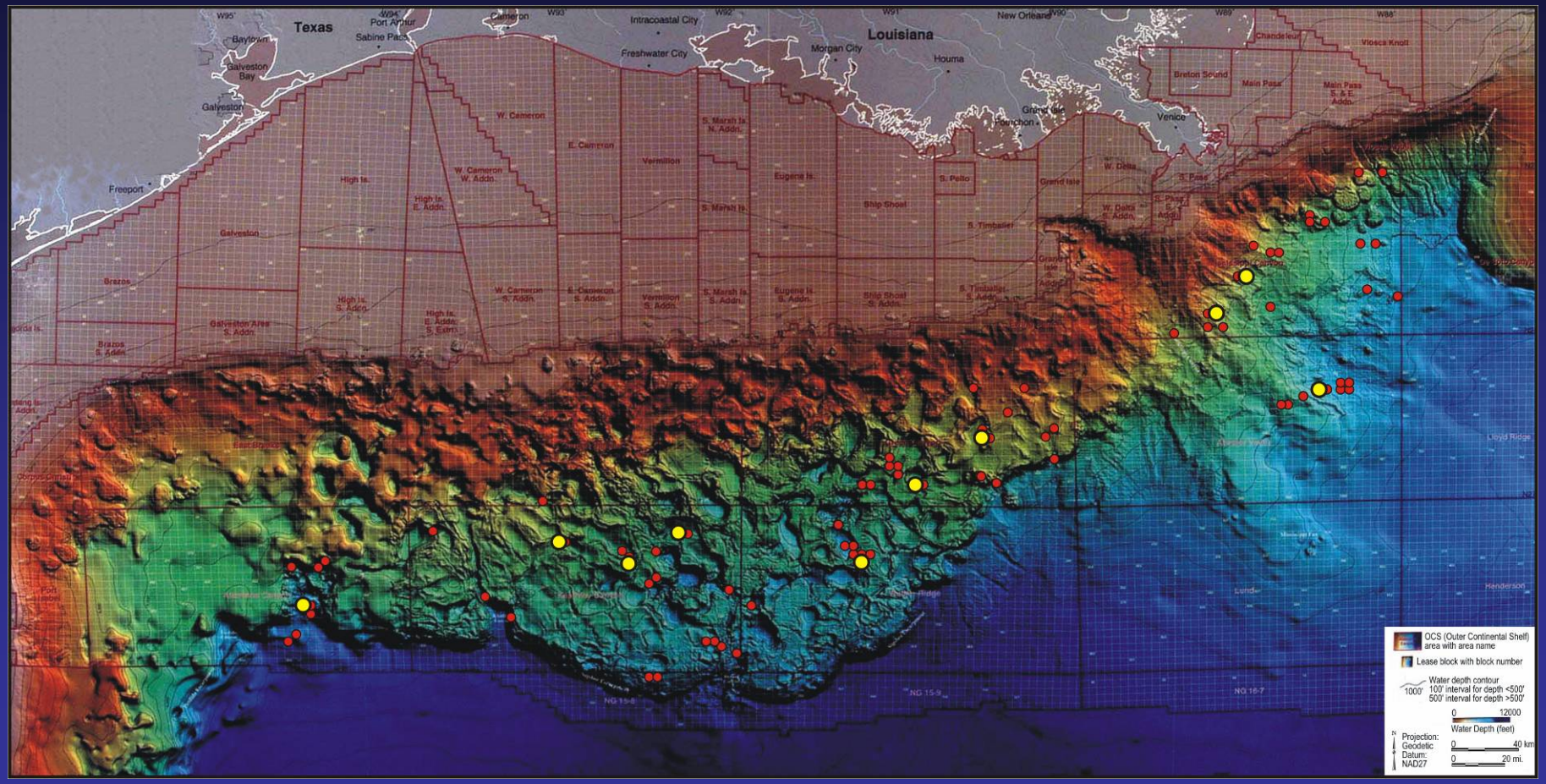
October 2005 – Contract put in place

October 2005 to March 2006 – Sites chosen

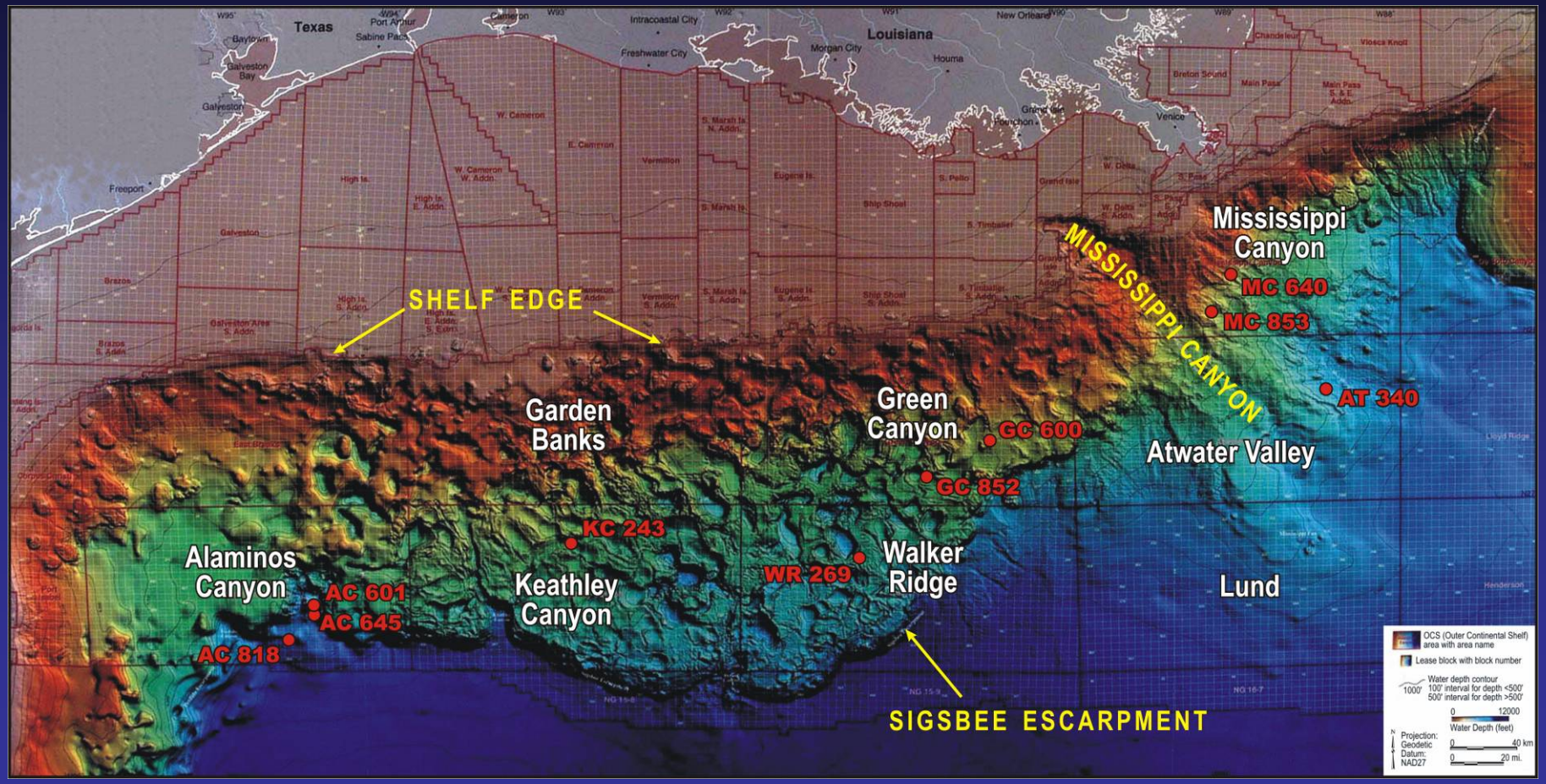
March 2006 – Photo reconnaissance cruise

May to June 2006 – ALVIN cruise

Potential ALVIN Dive Sites

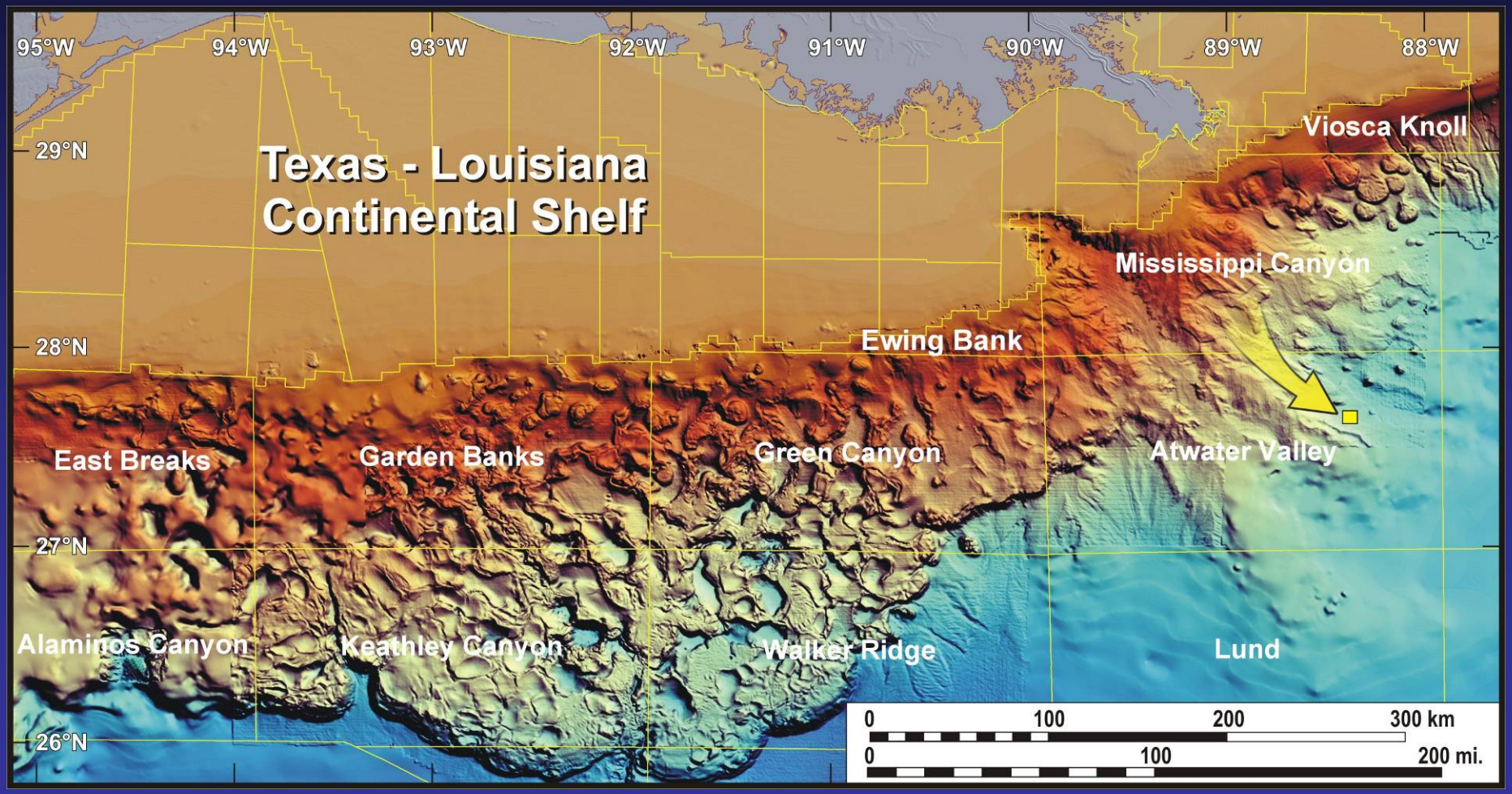


Final ALVIN Dive Sites

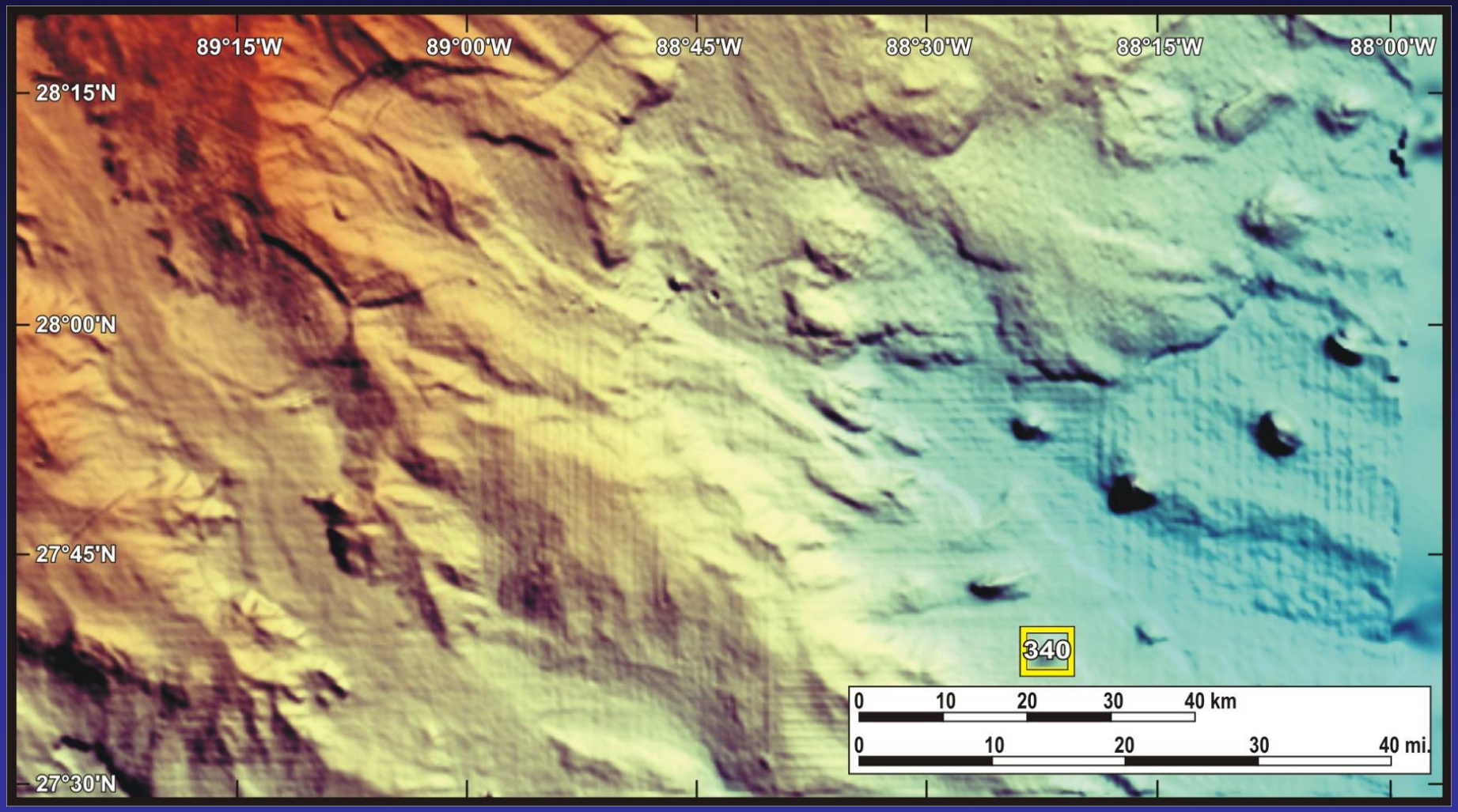


Seafloor Verification and Site Characteristics

AT 340
Location Map



AT 340
Site Map

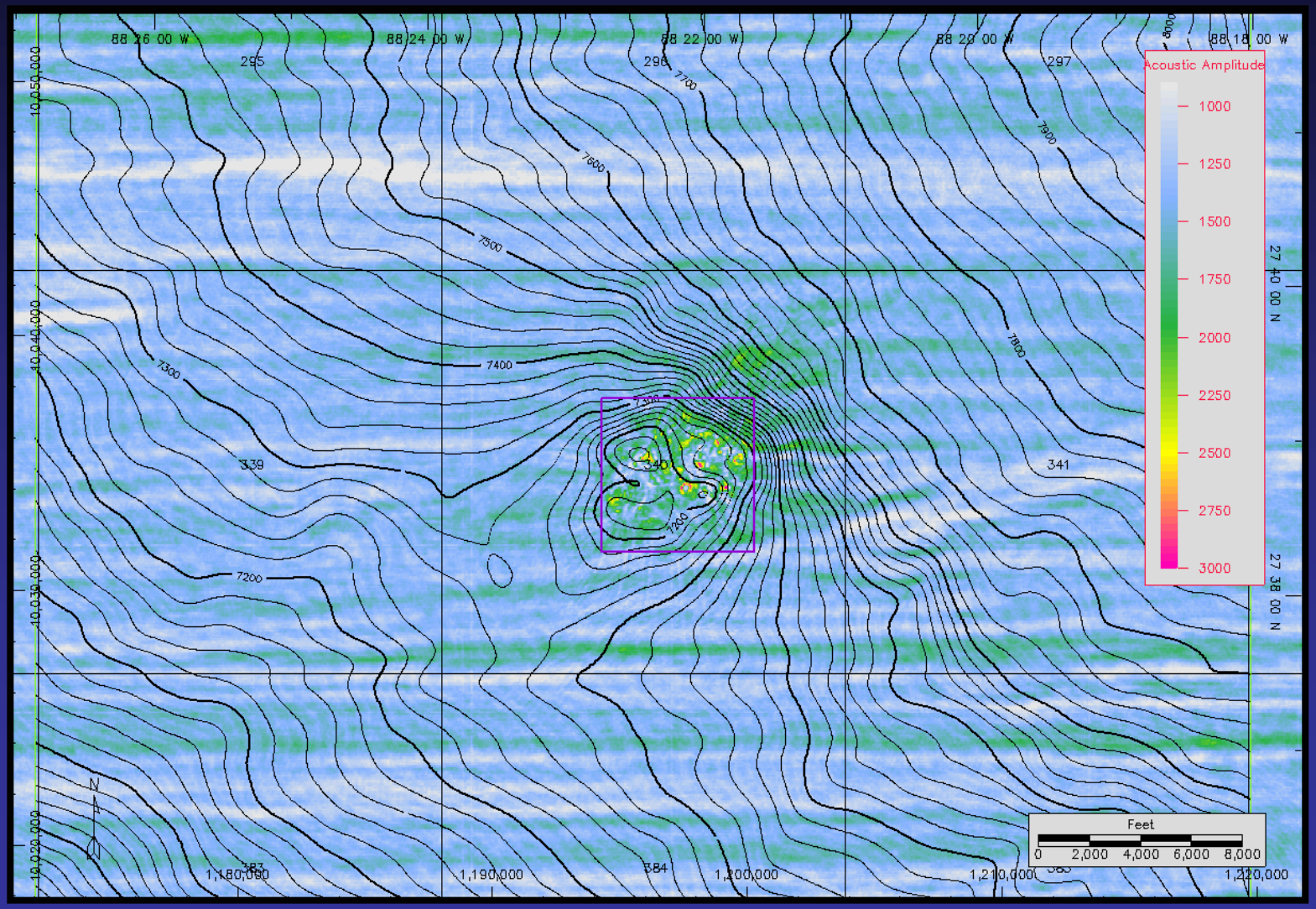


AT 340
Geologic Framework

- Site: Salt-Supported Bathymetric High
- Fluid-Gas Expulsion: Fault-Controlled Migration Pathways
- Bathymetry: Complex Mound
- High Seafloor Amplitudes: Scattered at Mound Crests
- Moderate Seafloor Amplitudes: Off-Mound Flows

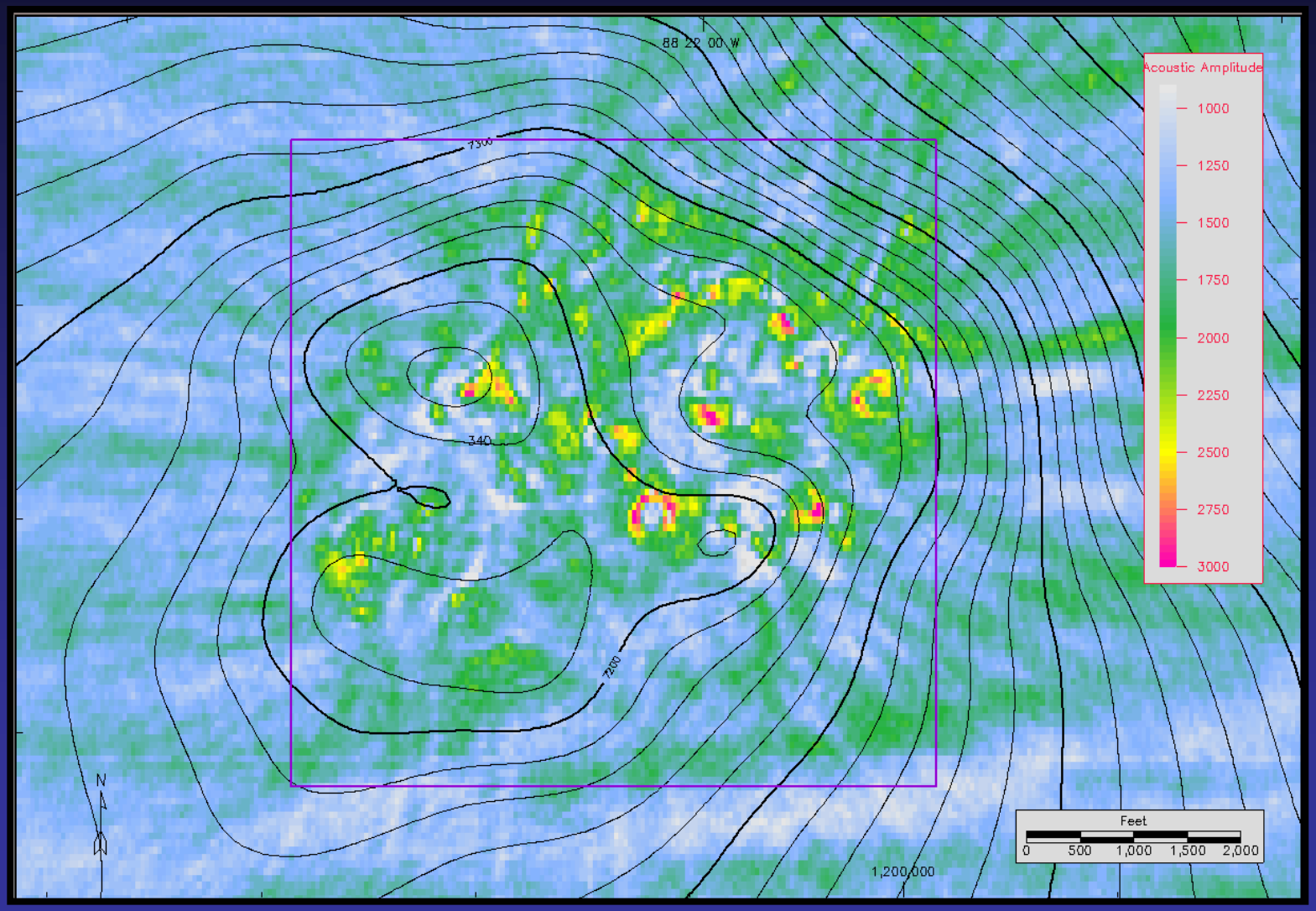
AT 340

Bathymetry

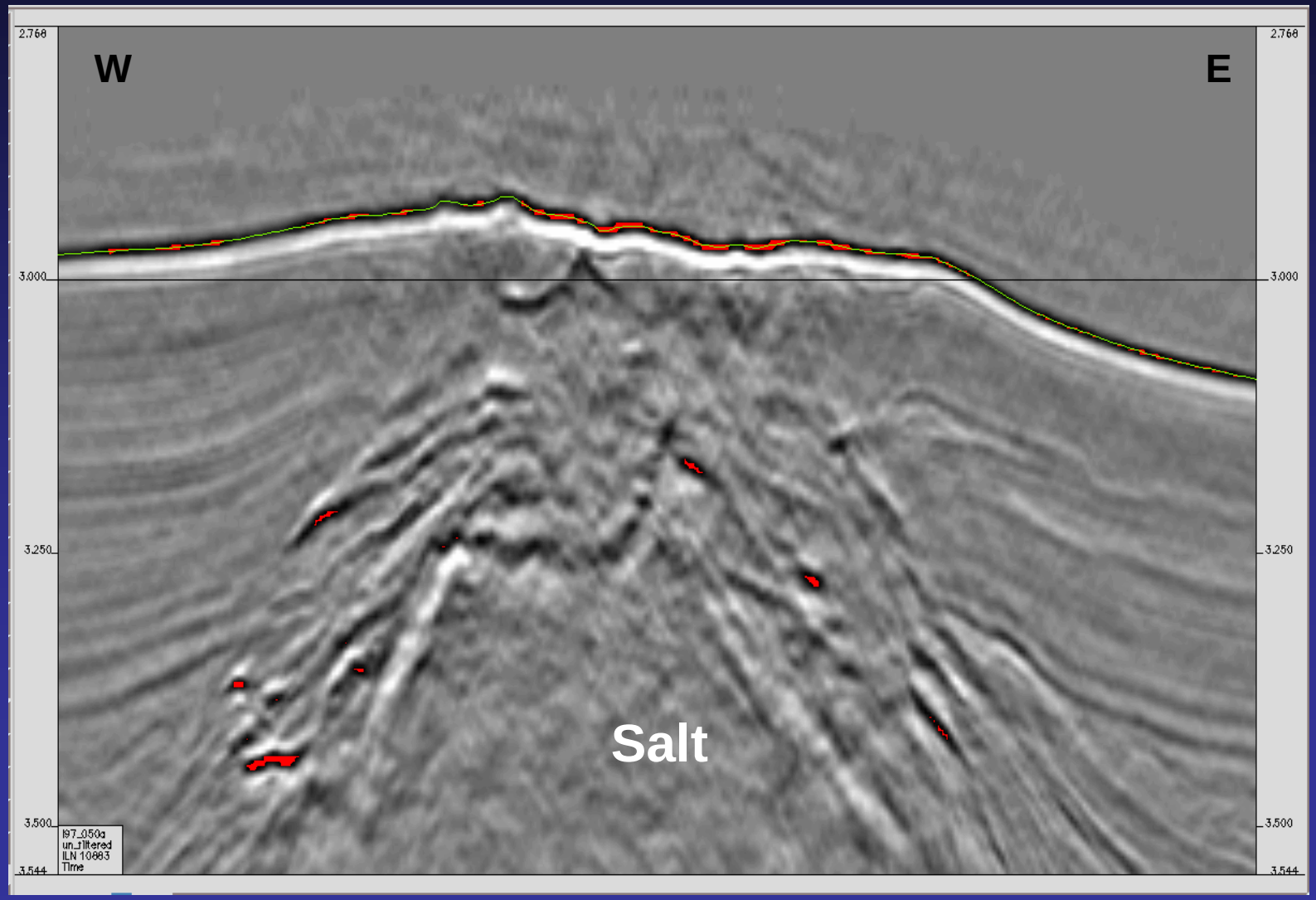


AT 340

3-D Seismic Surface Amplitude Map



AT 340
3-D Seismic Profile

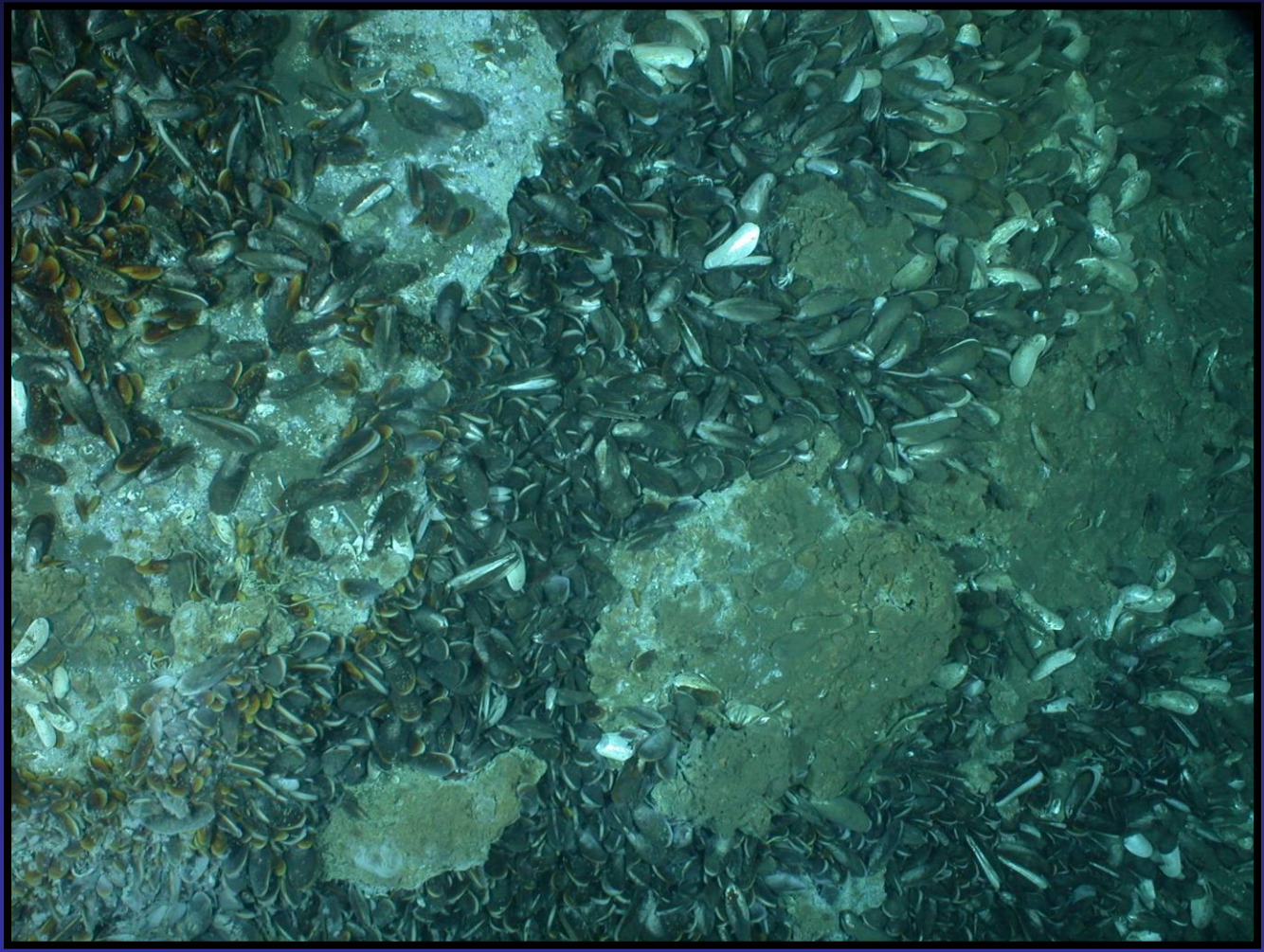


AT 340
Seafloor Characteristics

- ALVIN Dives: 5
- High Amplitudes: Extensive Lithifiction (Blocks and Pavement)
- Low Amplitudes: Expulsion Centers
- Abundant Mussel Beds, Tube Worms, Urchins (Some Soft Corals)
- NW Mound: Brine, Hydrocarbons, Fluidized Sediment (Mussel Shell Pavements-Blocks)

AT 340

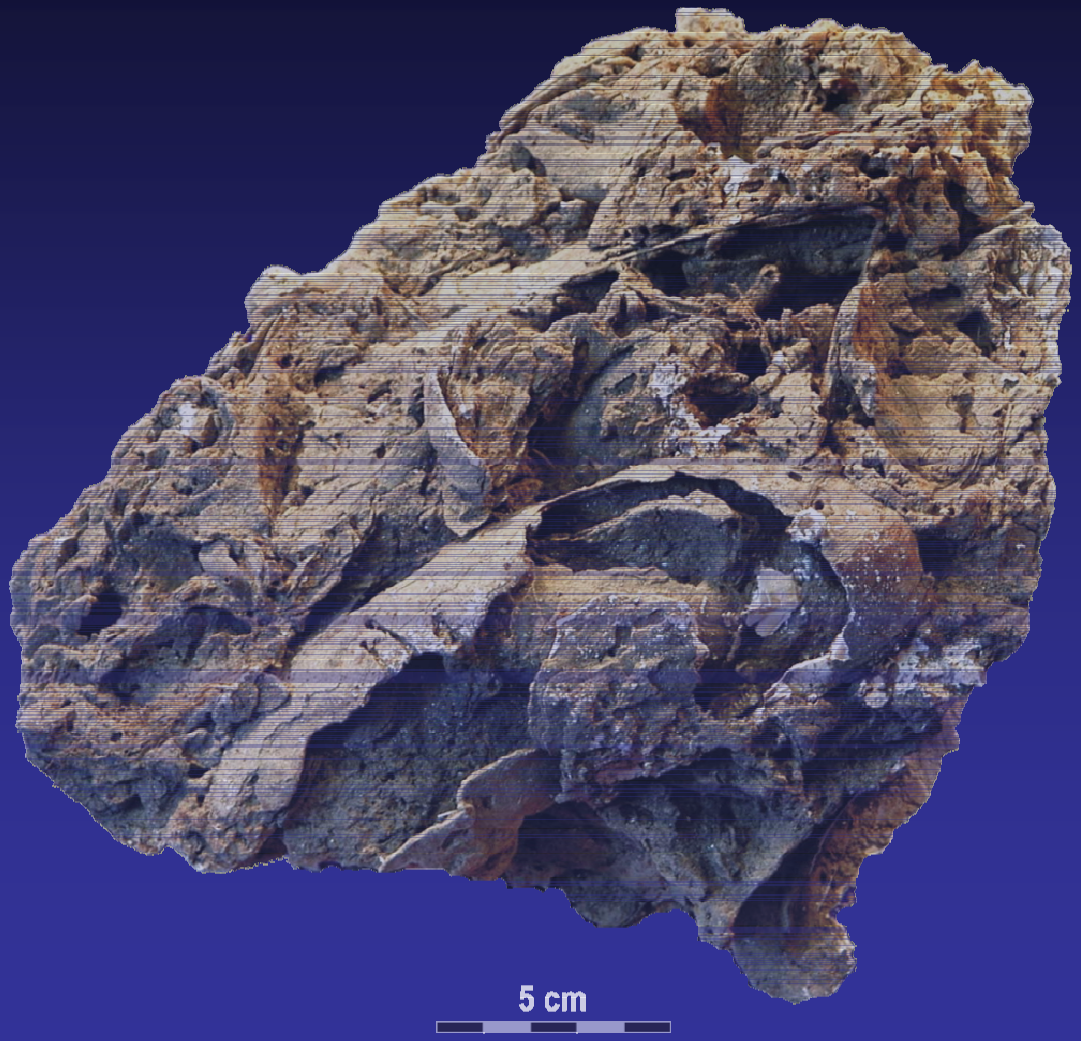
Extensive Mussel Communities and Associated Carbonates



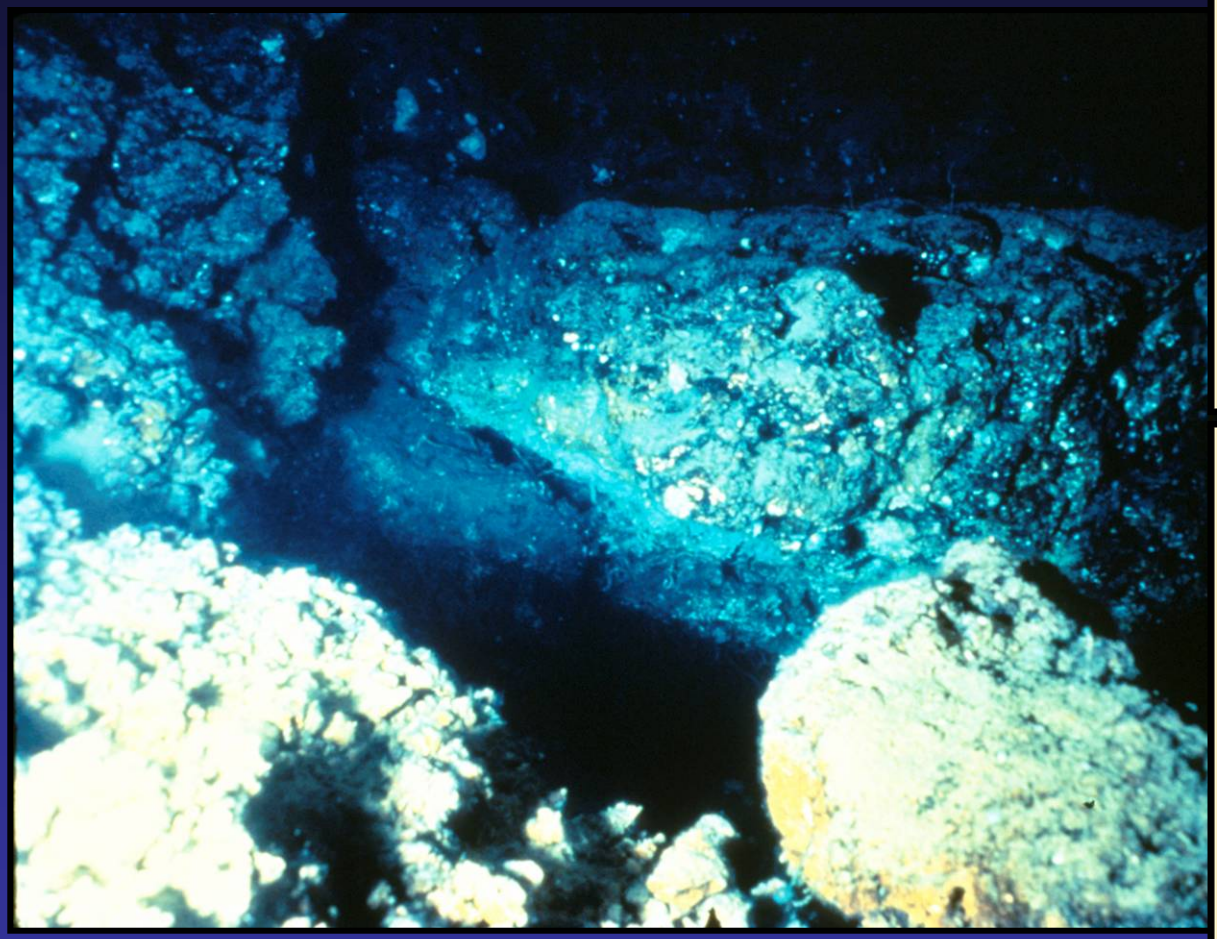
AT 340

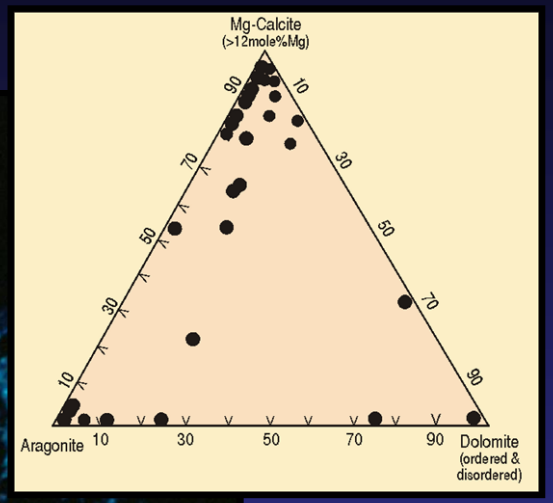
Tube Worm “Bushes” at Edges of Carbonate Slabs

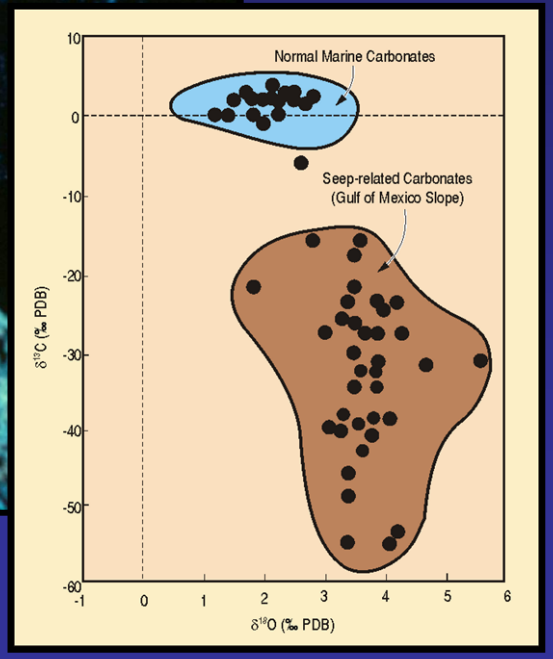
AT 340



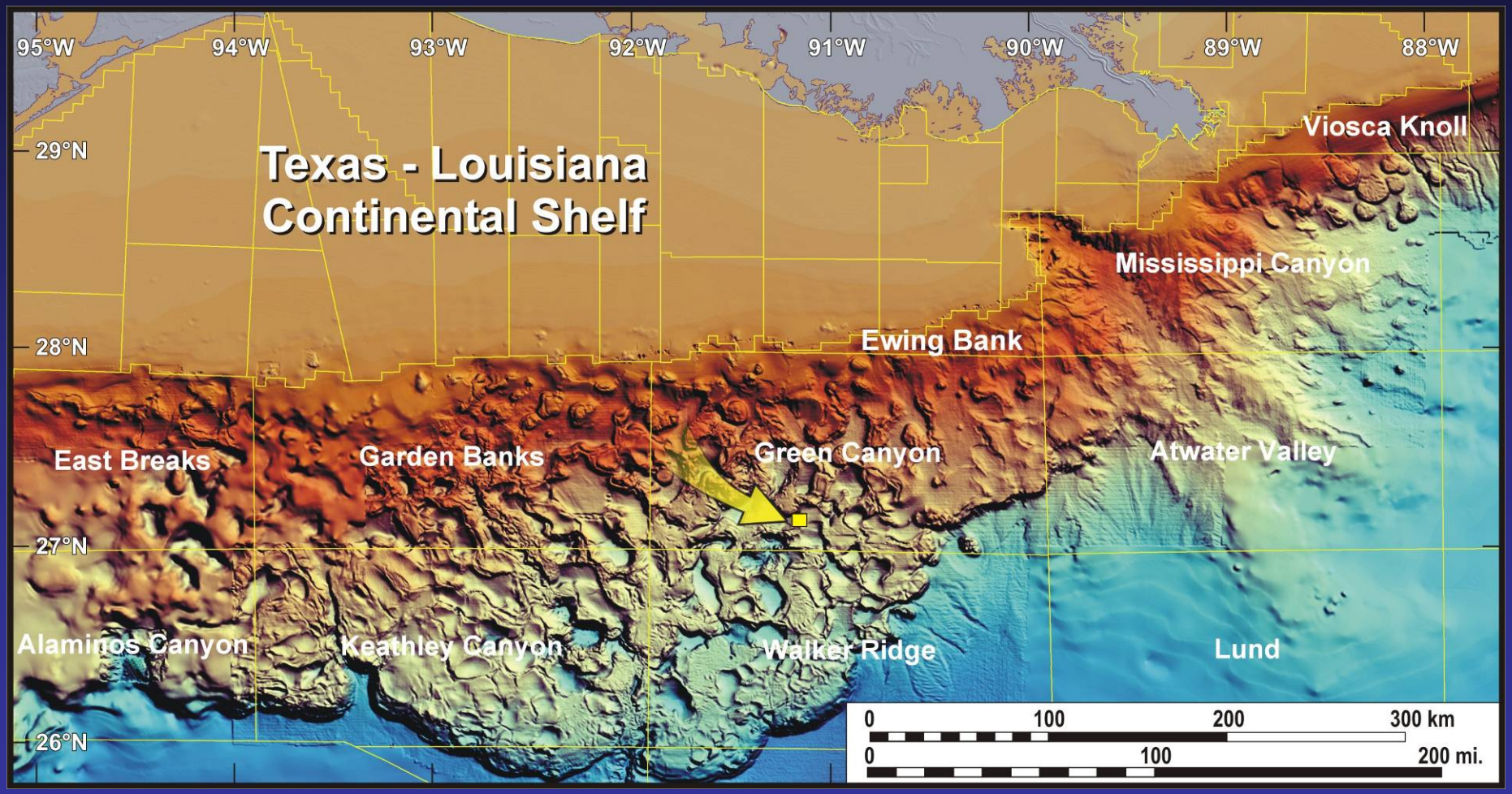
Authigenic Carbonates



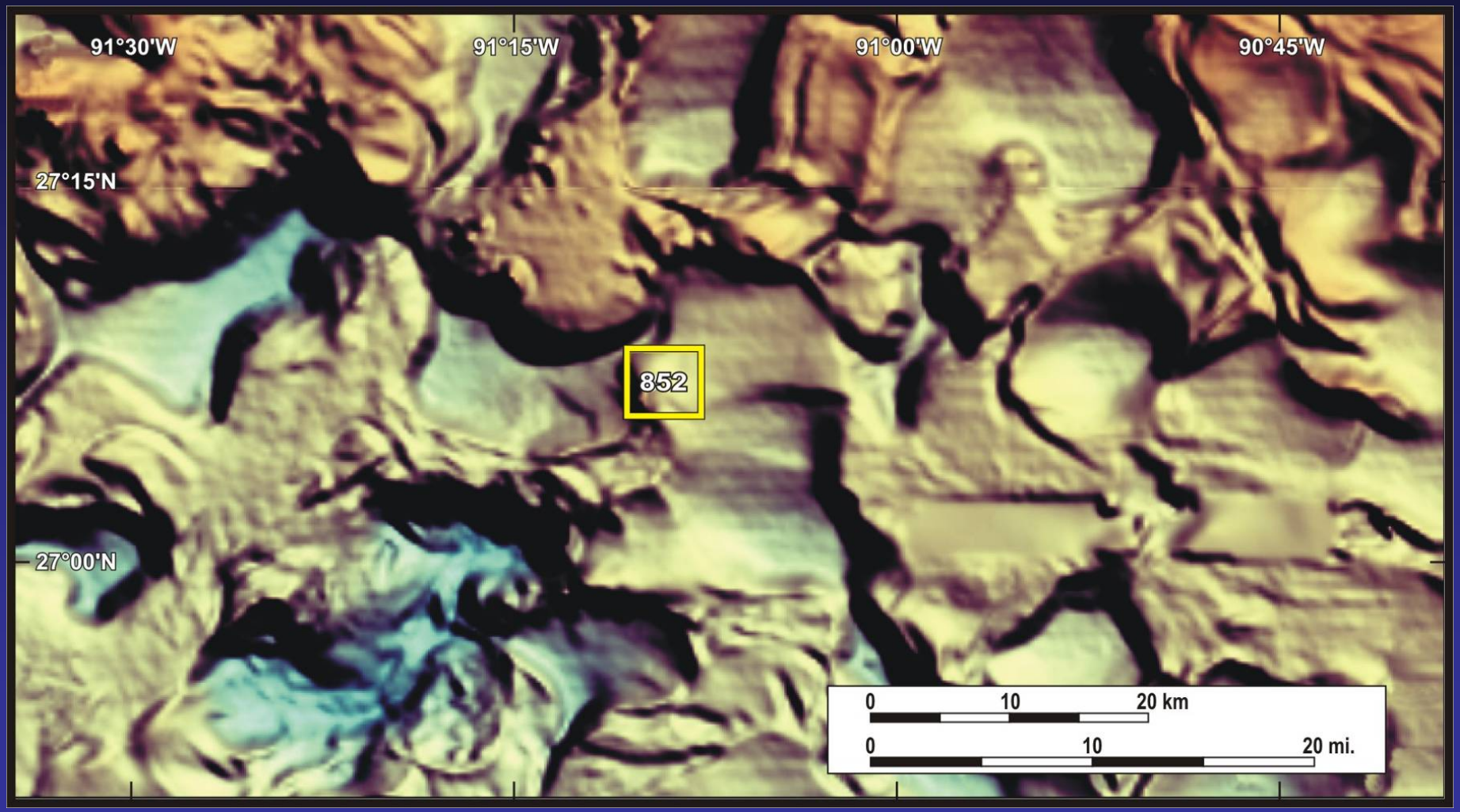




GC 852
Location Map



GC 852
Site Map

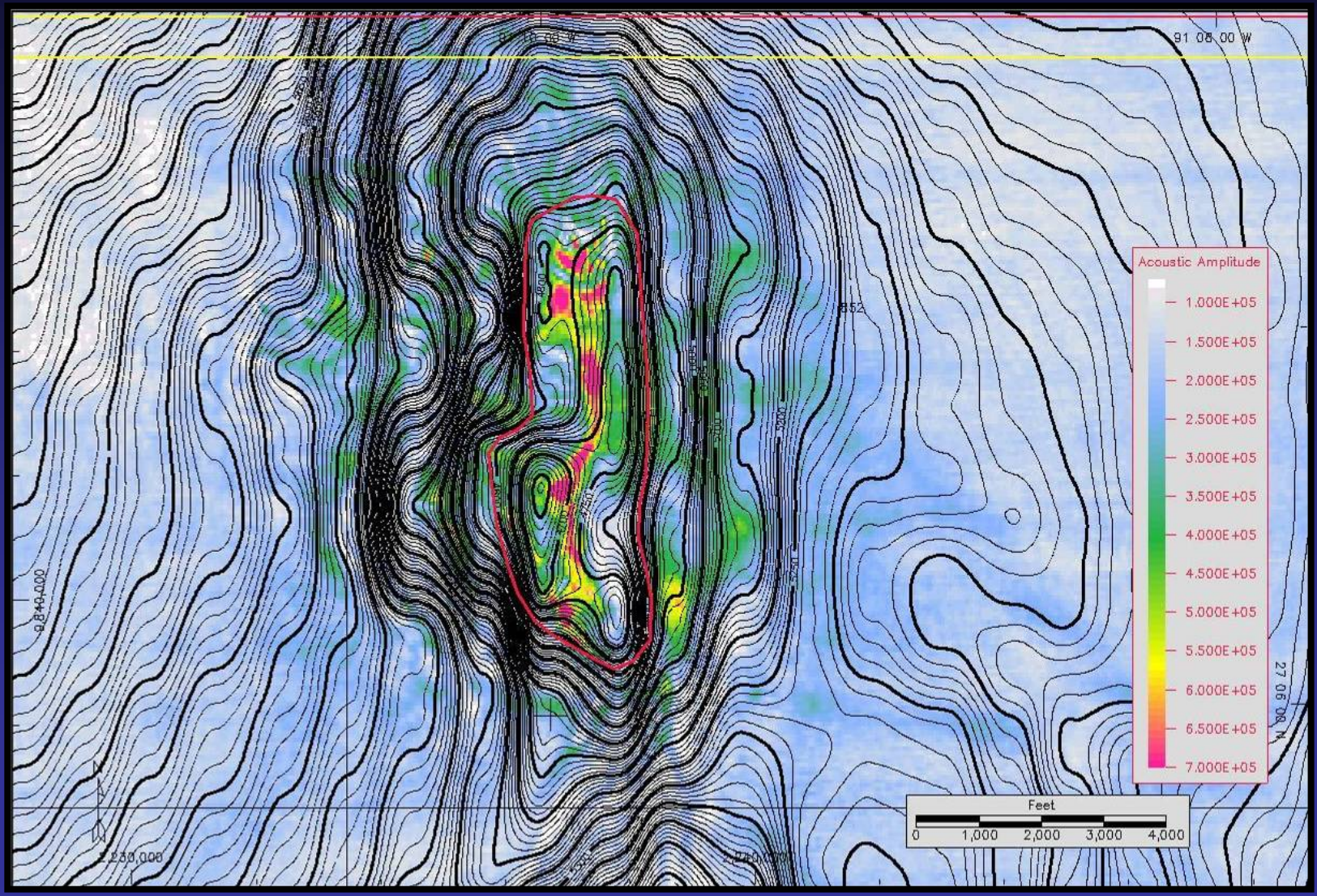


GC 852
Geologic Framework

- Site: Salt-Supported Ridge (WD ~1450 m)
- Bathymetry: N-S Ridge > 200 m Relief
- High Seafloor Amplitudes: Along Ridge Crest and West Flank
- Oil Slicks Over Site

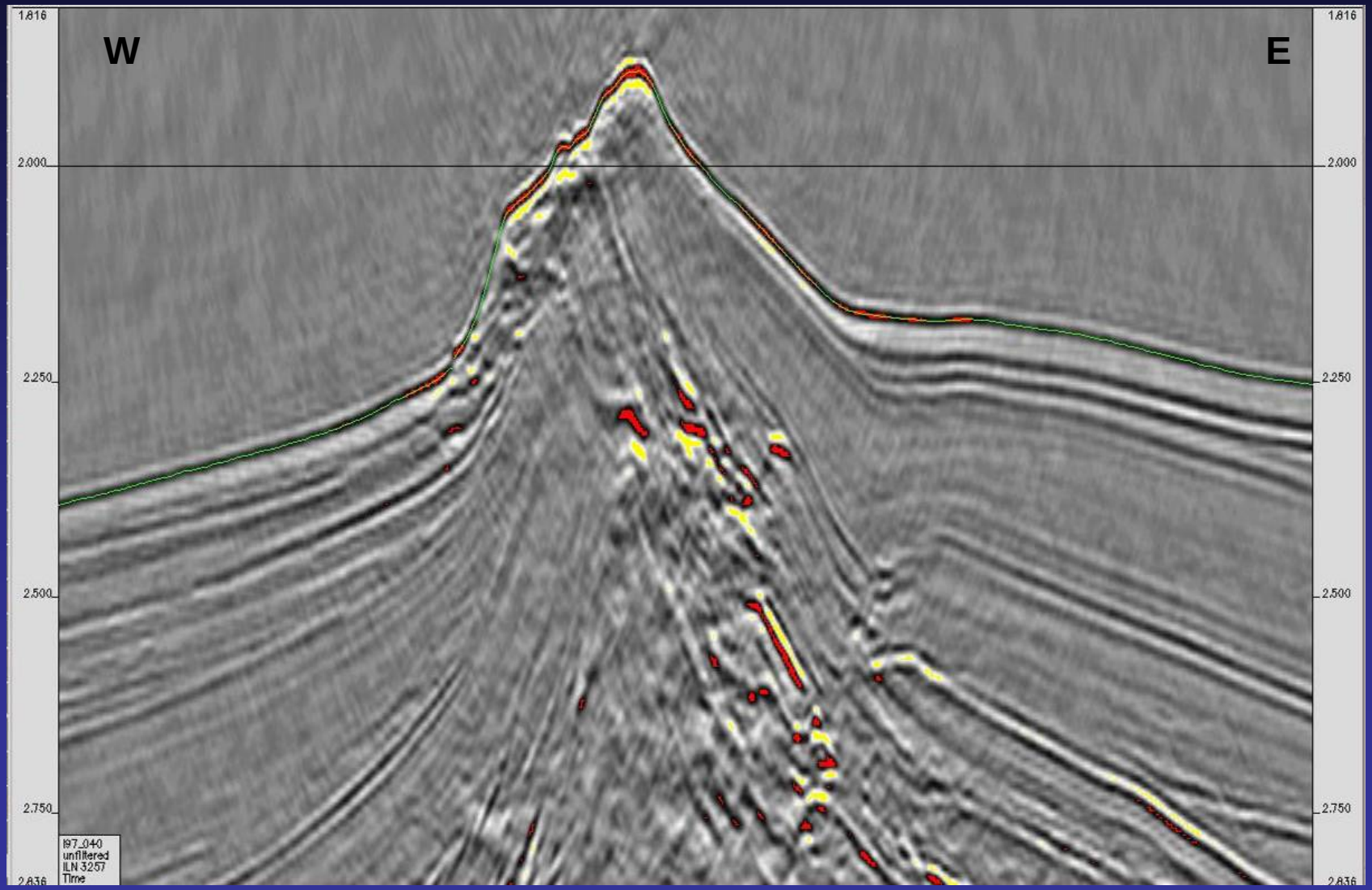
GC 852

3-D Seismic Surface Amplitude Map



GC 852

E-W Oriented Profile



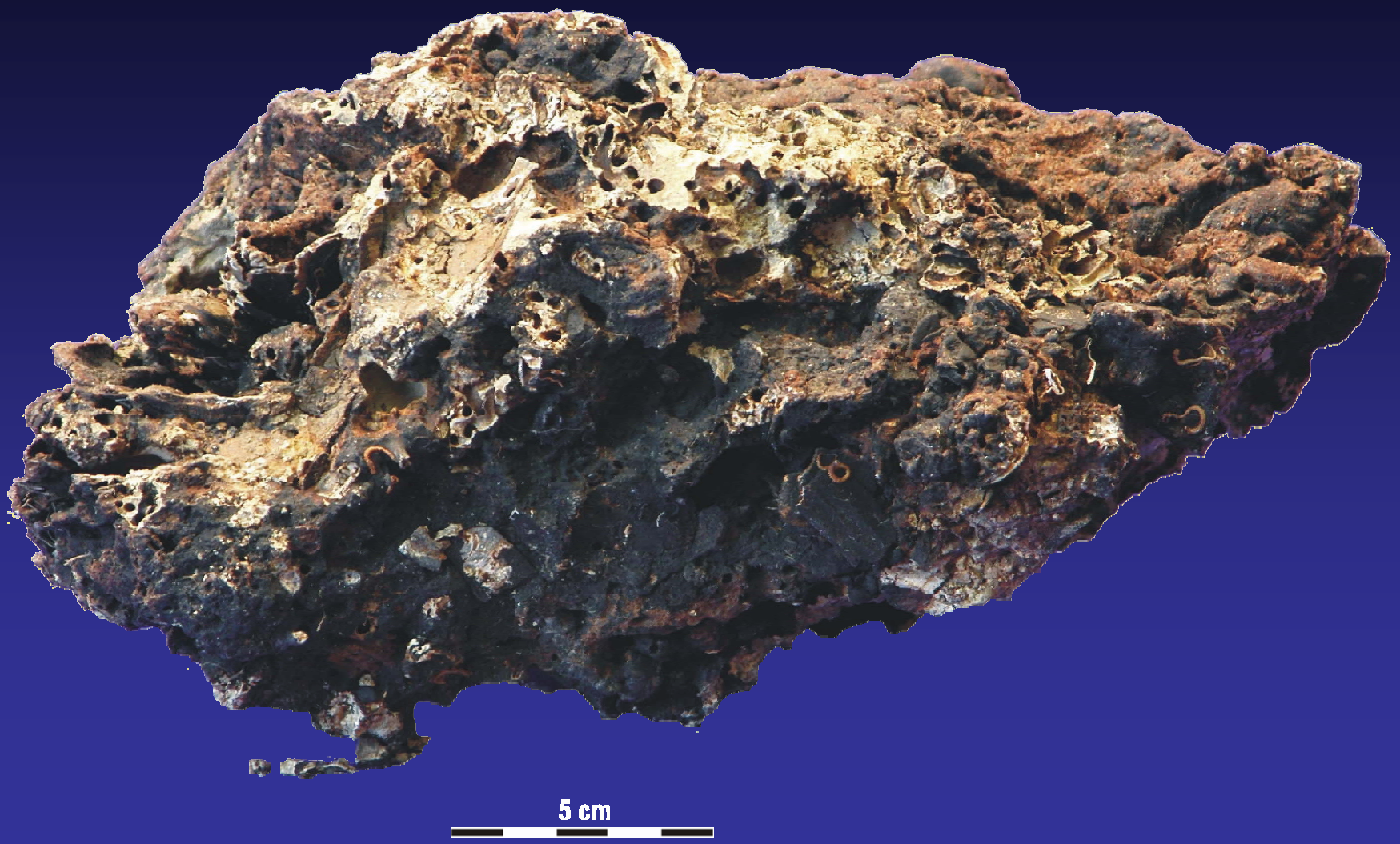
GC 852
Seafloor Characteristics

- ALVIN Dives: 5
- High Amplitudes: Extensive Lithification (Blocks and Pavement)
- Mussel Beds, Tube Worms, Clams along Crest
- Hard and Soft Corals on Authigenic Carbonates (Strong Current)

GC 852

Tube Worms, Mussels, Shells, and Carbonates

GC 852

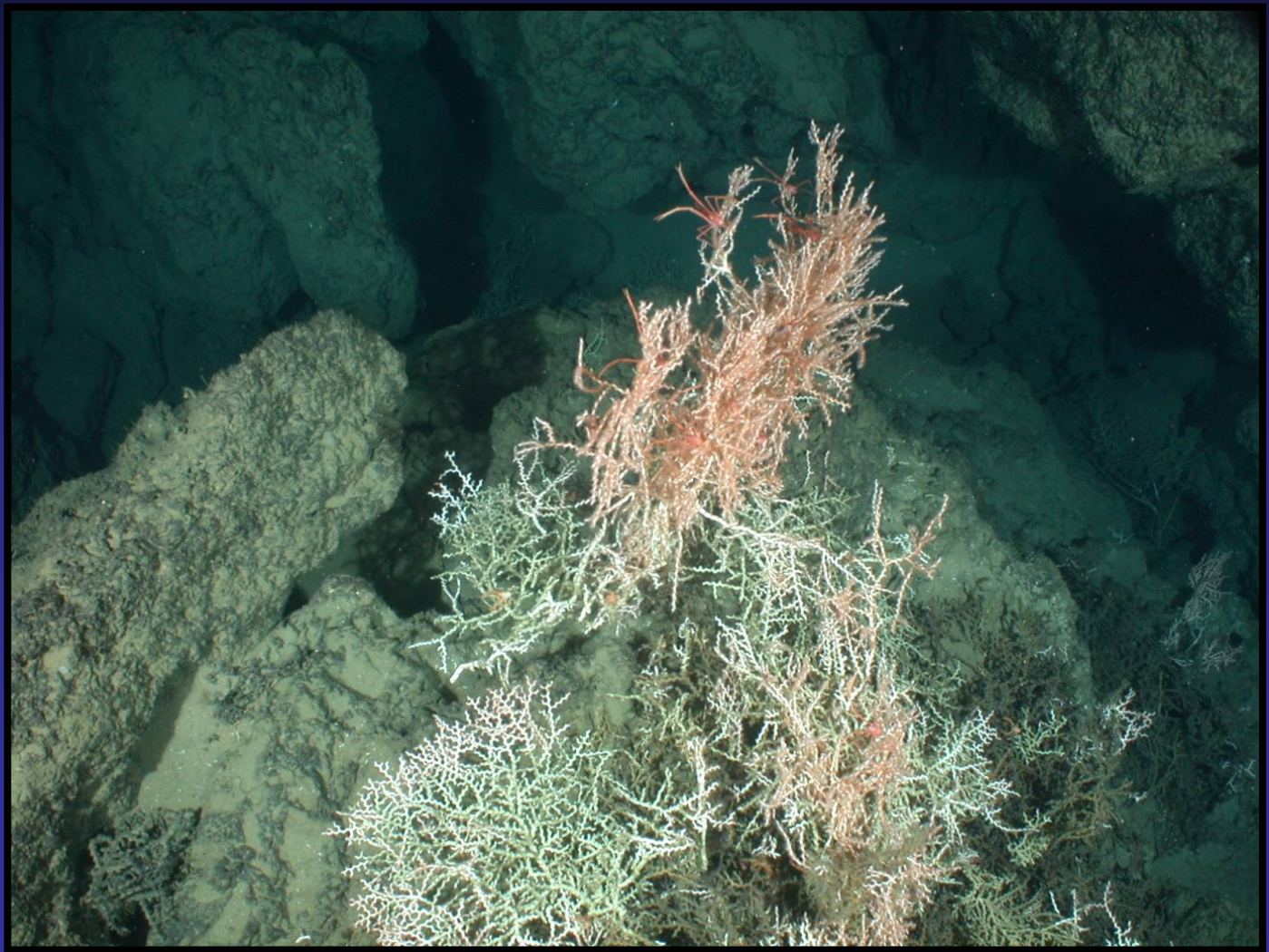


GC 852

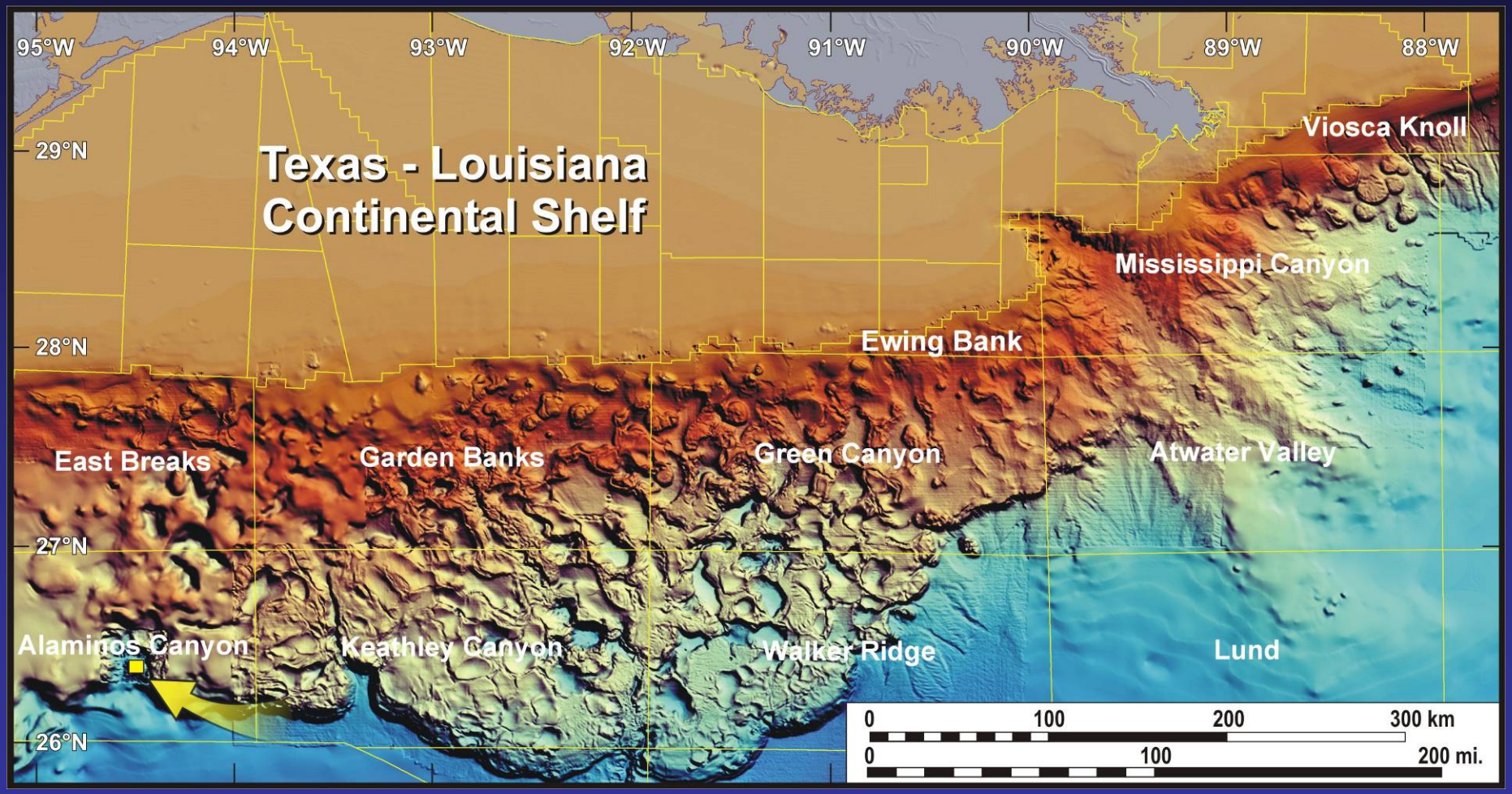
Gorgonians (Soft Corals) in a Strong Current

GC 852

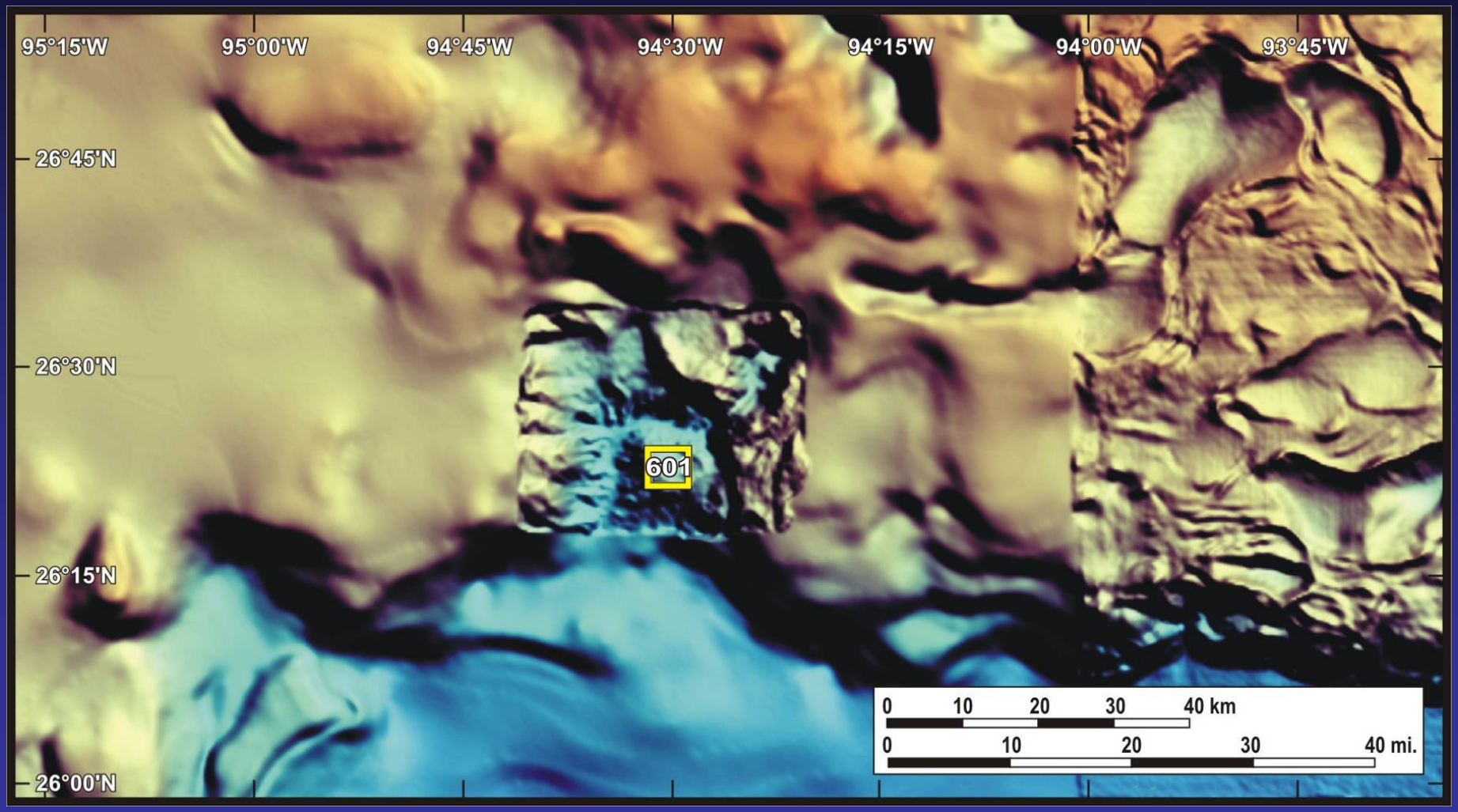
Hard Corals on Authigenic Carbonate Substrates



AC 601
Location Map



AC 601
Site Map

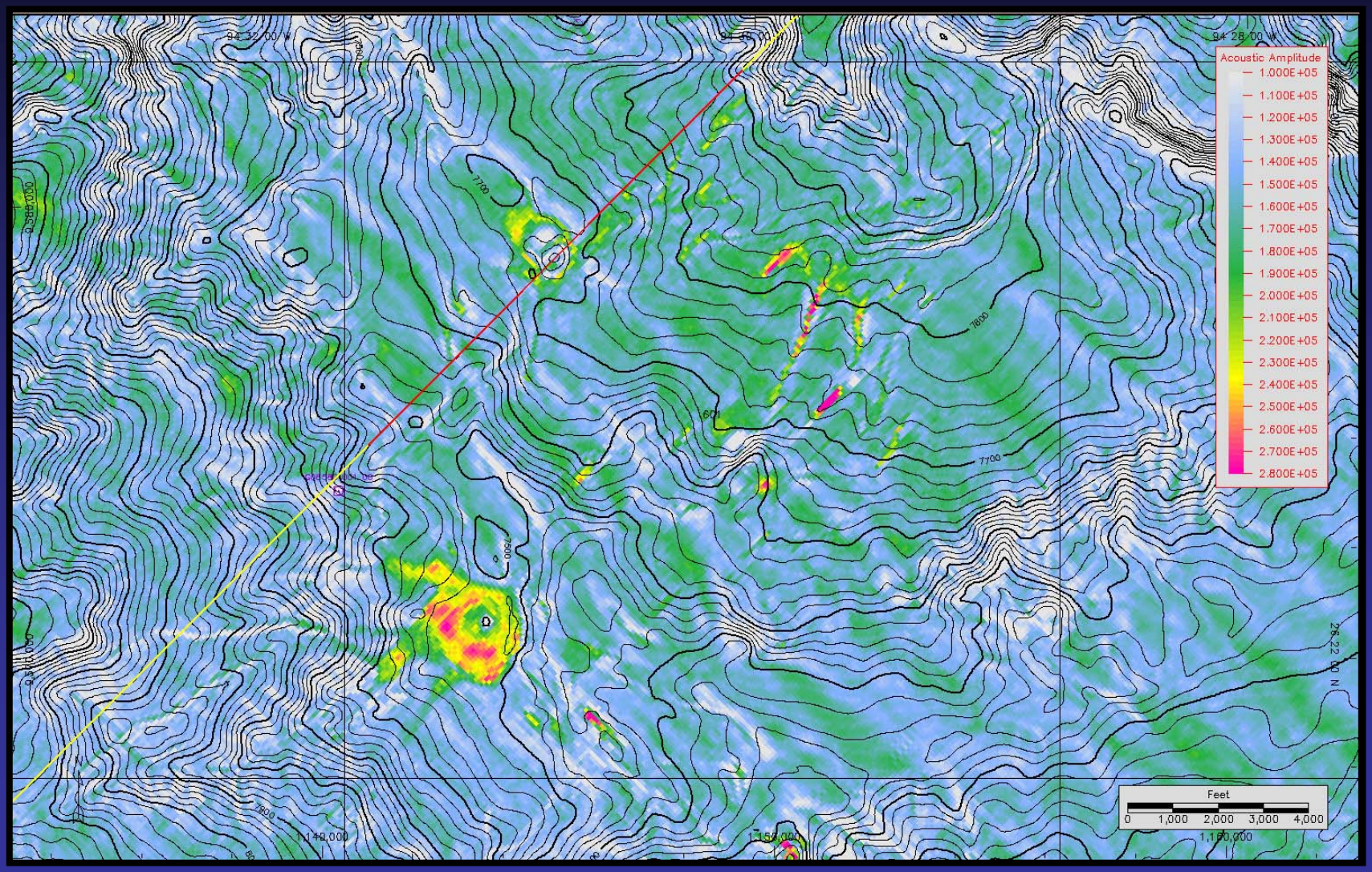


AC 601
Geologic Framework

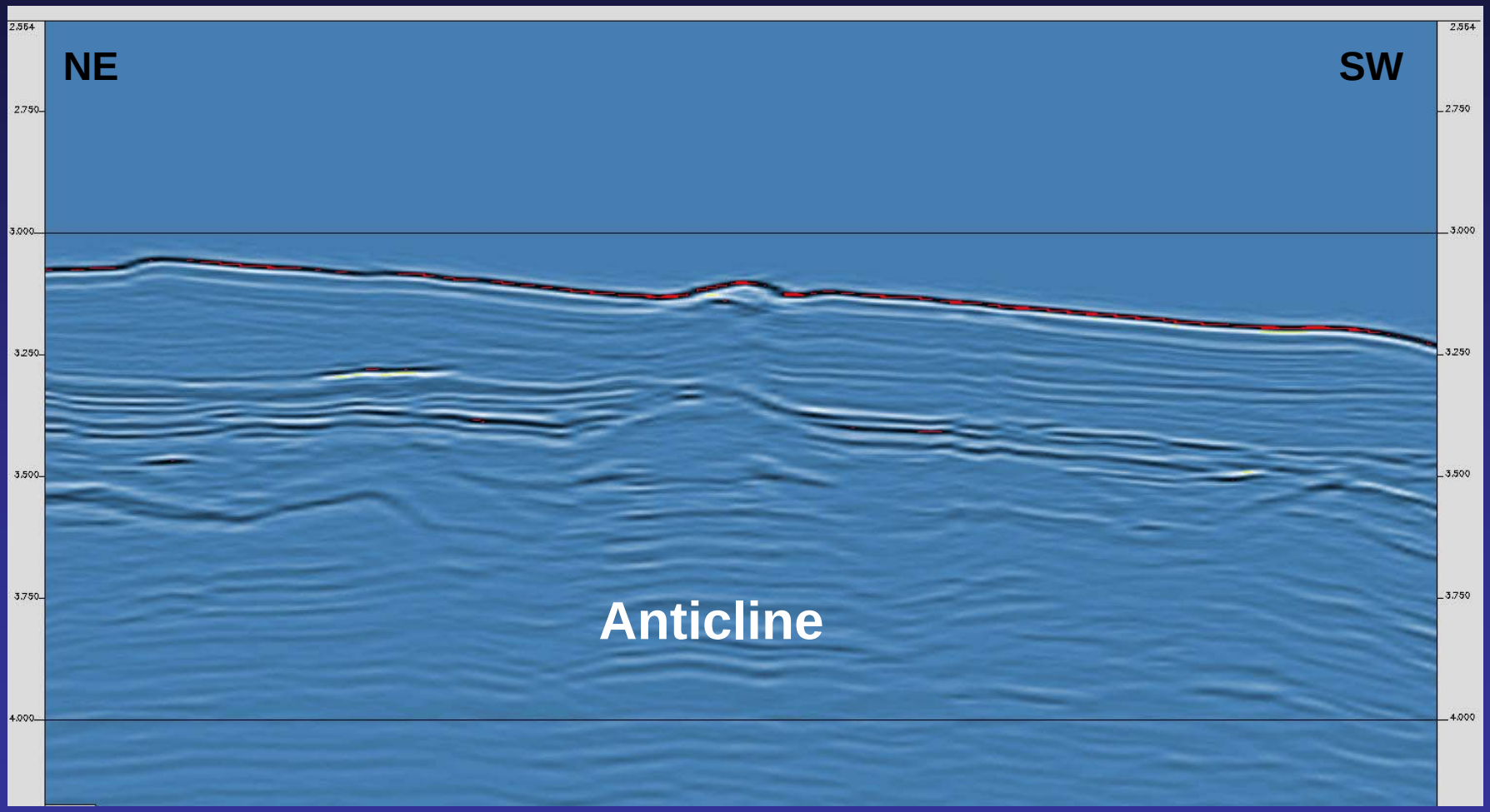
- Site: Sigsbee Escarpment Reentrant (WD ~2340 m)
- Fluid-Gas Expulsion: Breached Anticline
- Bathymetry: Complex
- High Seafloor Amplitudes: Around Localized Expulsion Sites (4 in AC 601)
- Brine Seepage

AC 601

3-D Seismic Surface Amplitude Map



AC 601
NE-SW Oriented Profile

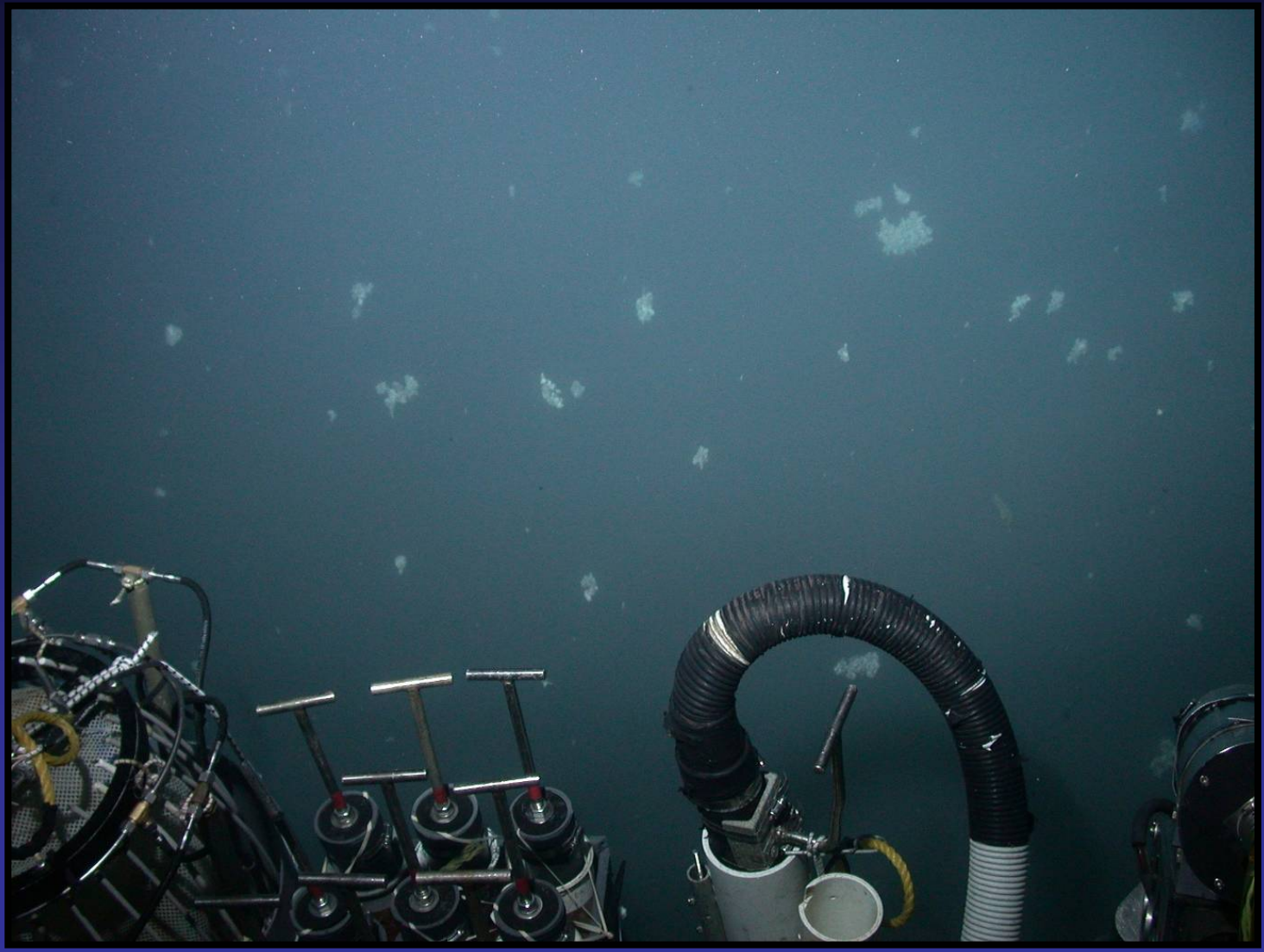


AC 601
Seafloor Characteristics

- ALVIN Dives: 2
- Low Amplitude: Depression with Brine
- Brine Lake: ~4 m Deep, ~180 m Diameter
- White Crystalline “Flocs” in Brine, Lake Bottom
- Scattered Mussels, Clams, Tube Worms, Urchins Around Lake
- High Amplitudes: Local Lithification Around Lake

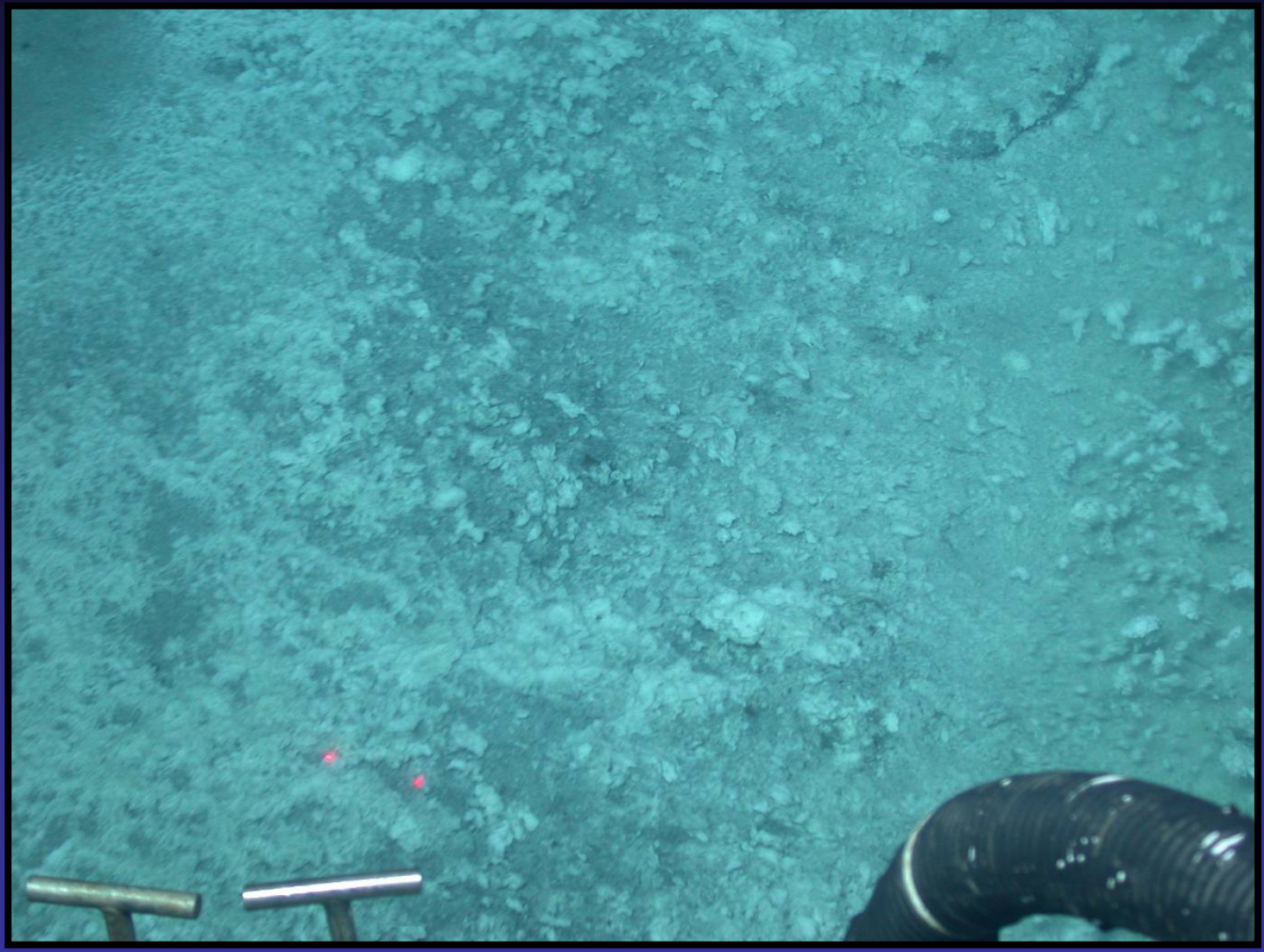
AC 601

Barite Crystal “Rafts” in Brine Lake



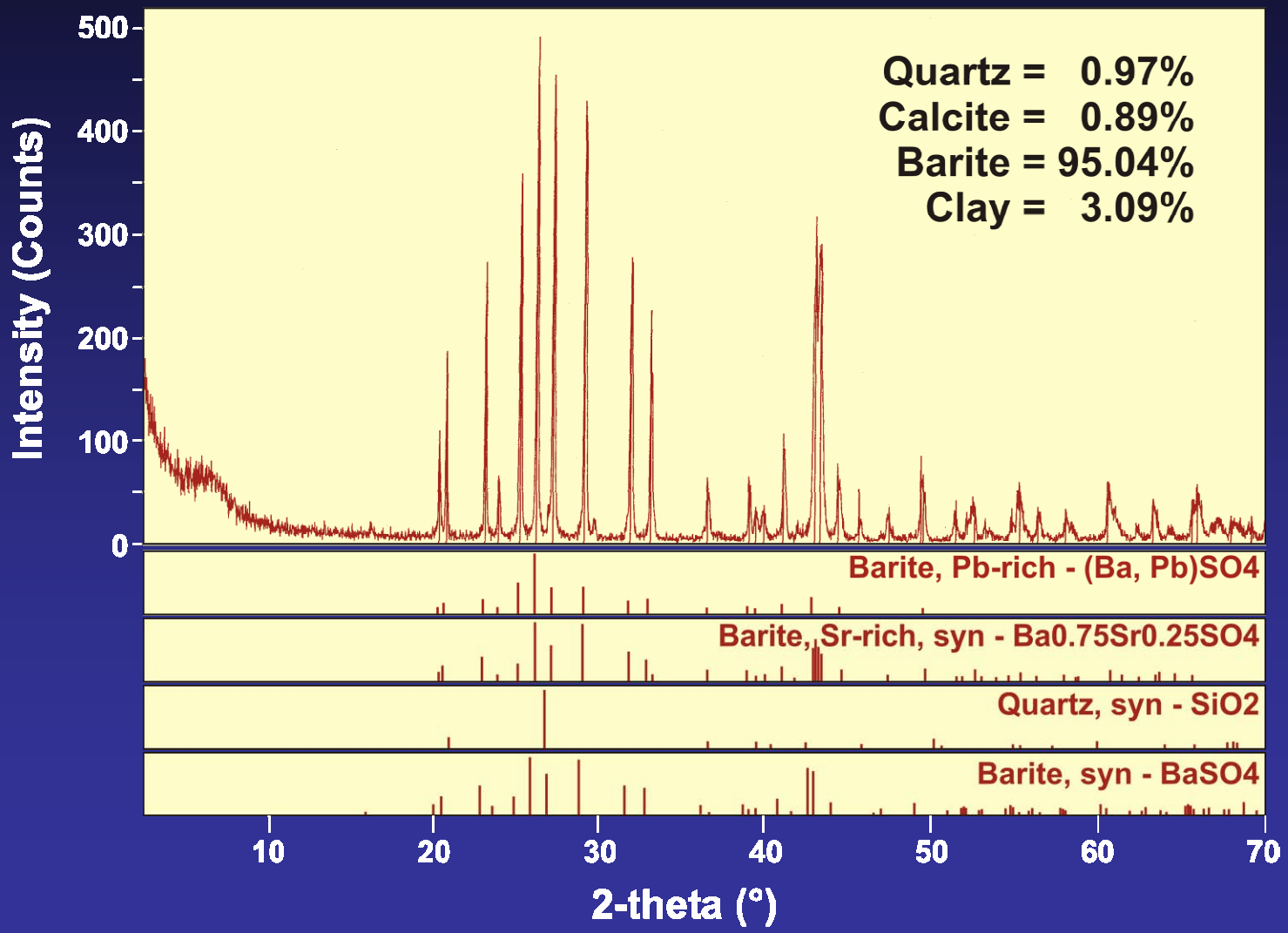
AC 601

Barite “Clots” Along Brine Lake Shoreline

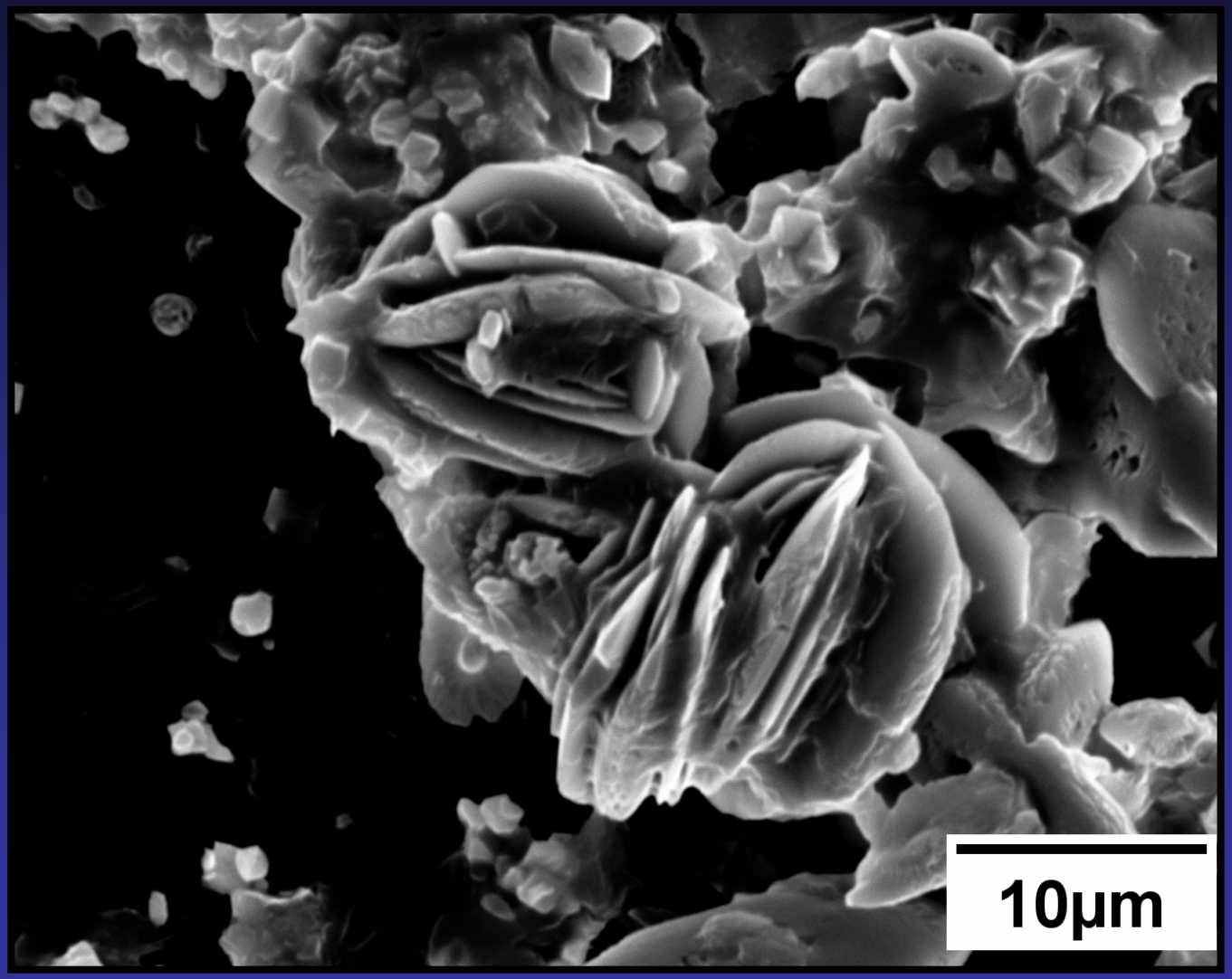


X-Ray Diffraction (Long Scan)

Filtered Sample, Crystal Rafts—Brine Lake (AC601)

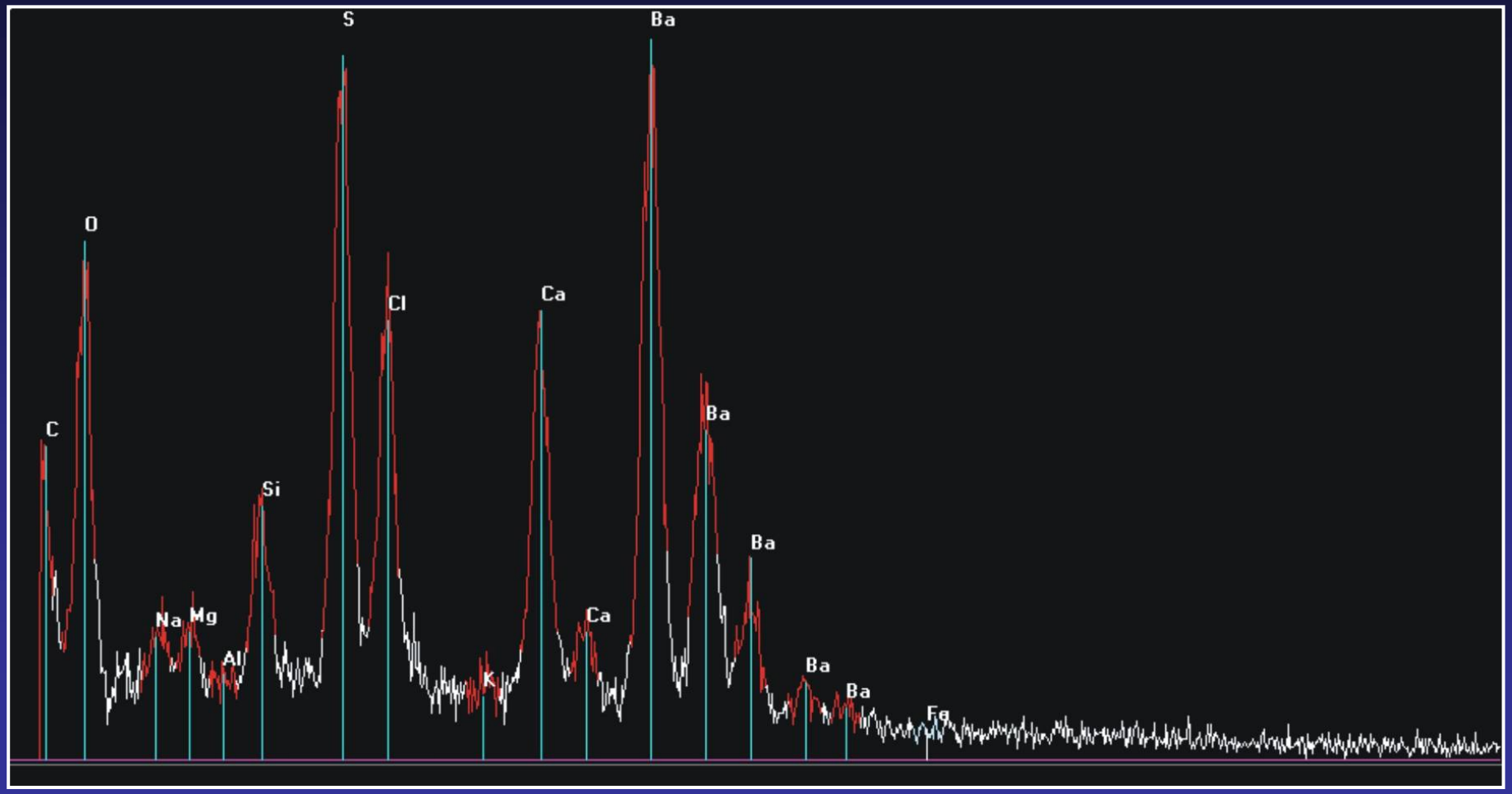


AC 601
Brine Lake Sample

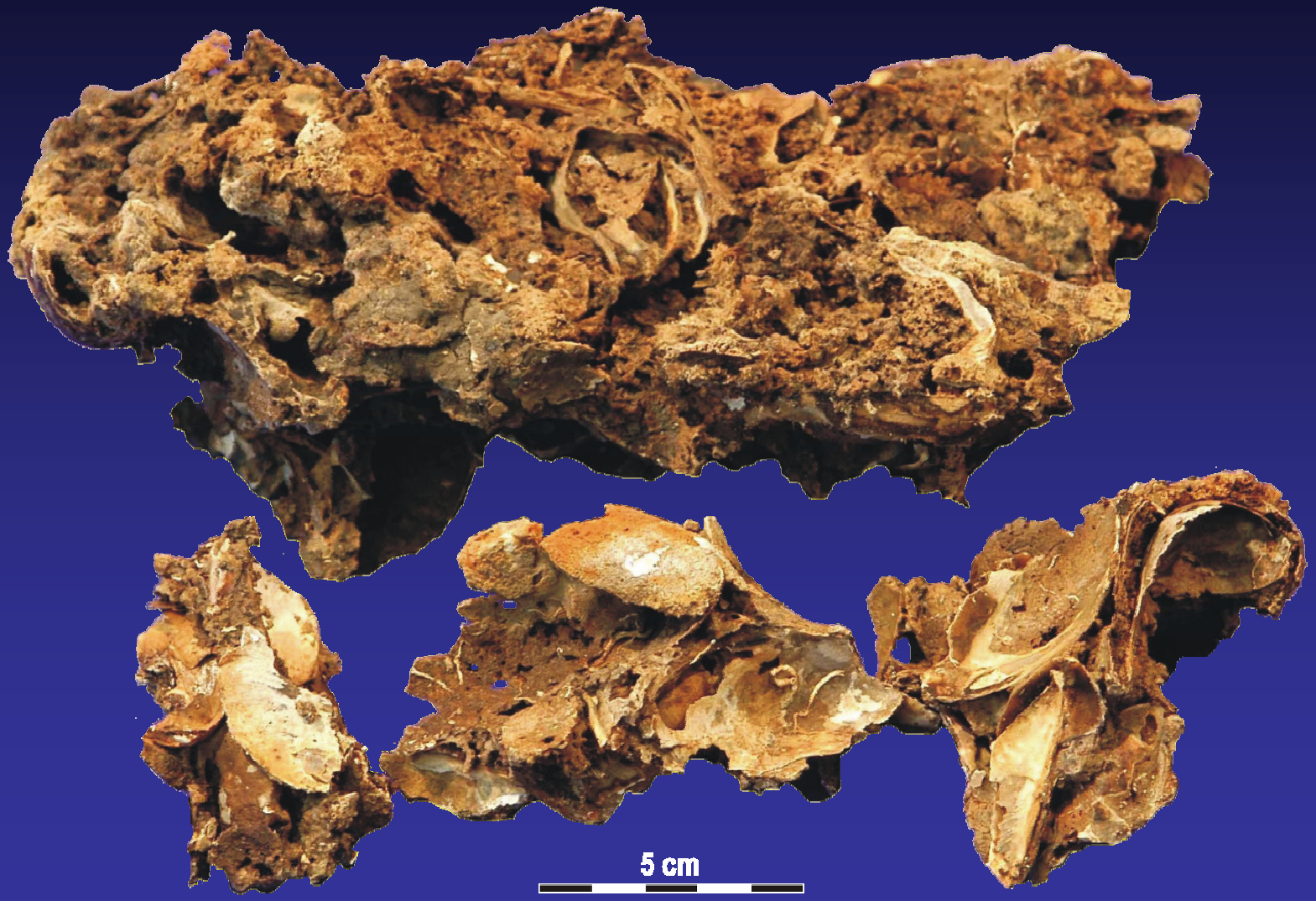


AC601—Brine Lake

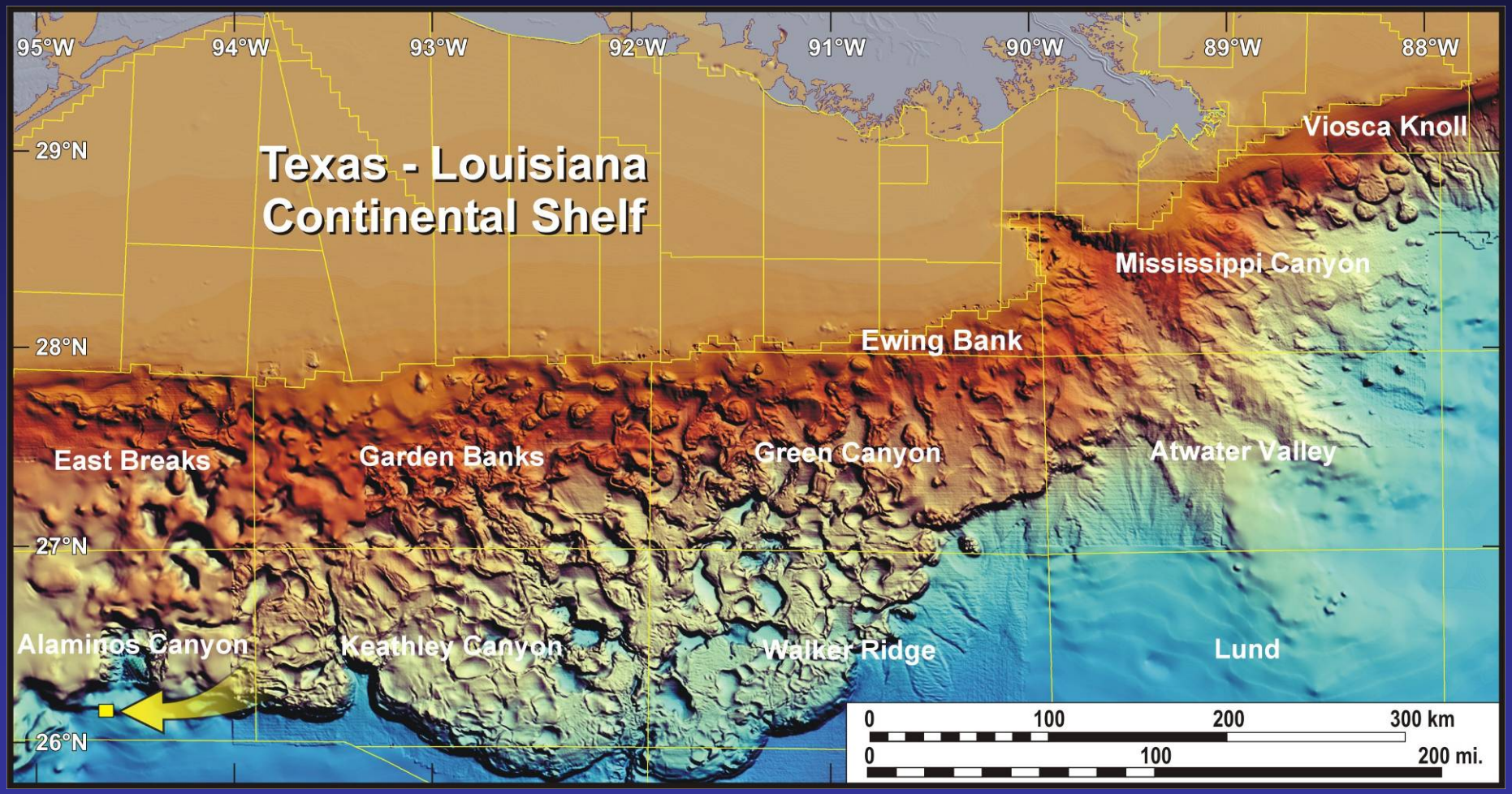
Large Barite Crystal



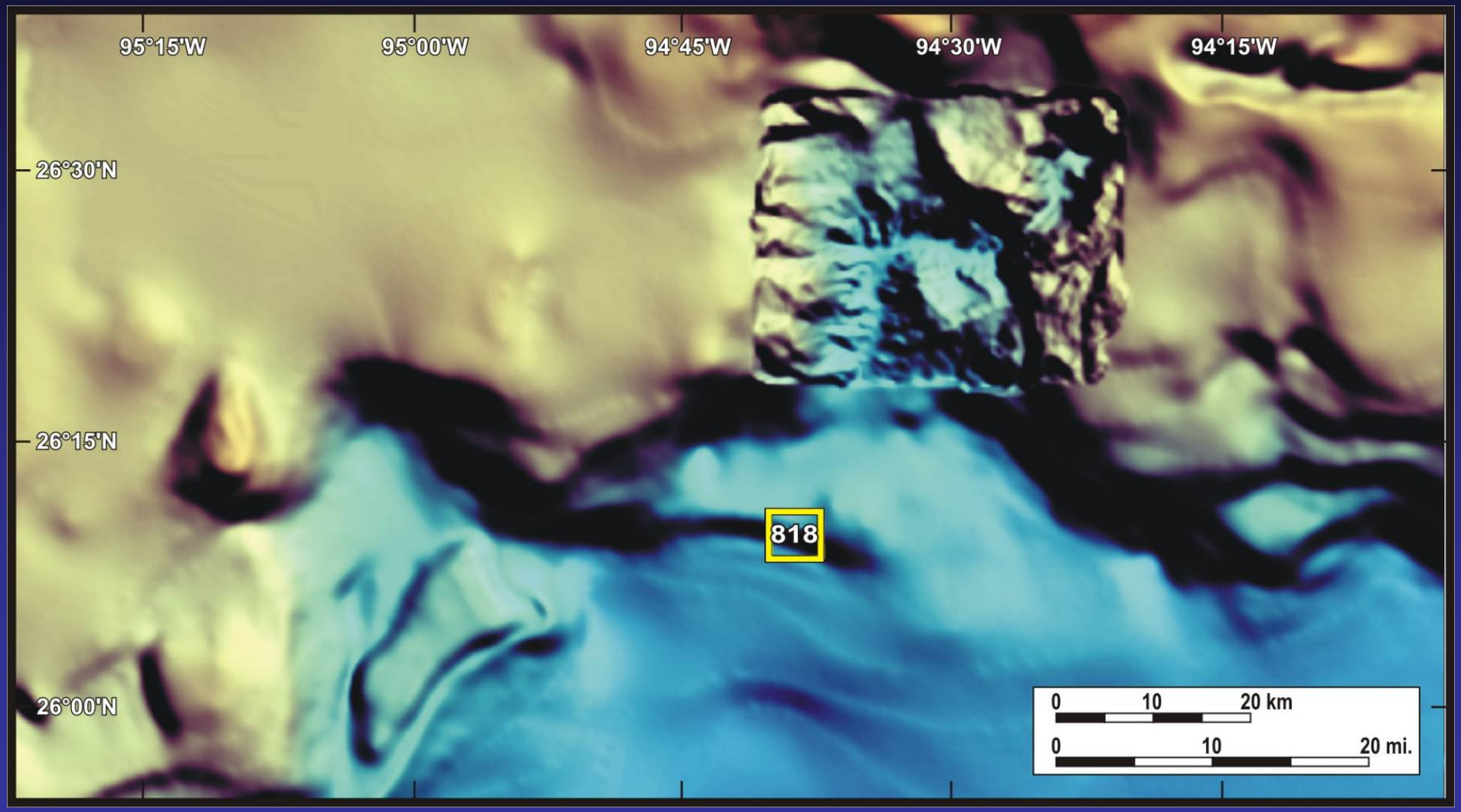
AC 601



AC 818
Location Map



AC 818
Site Map

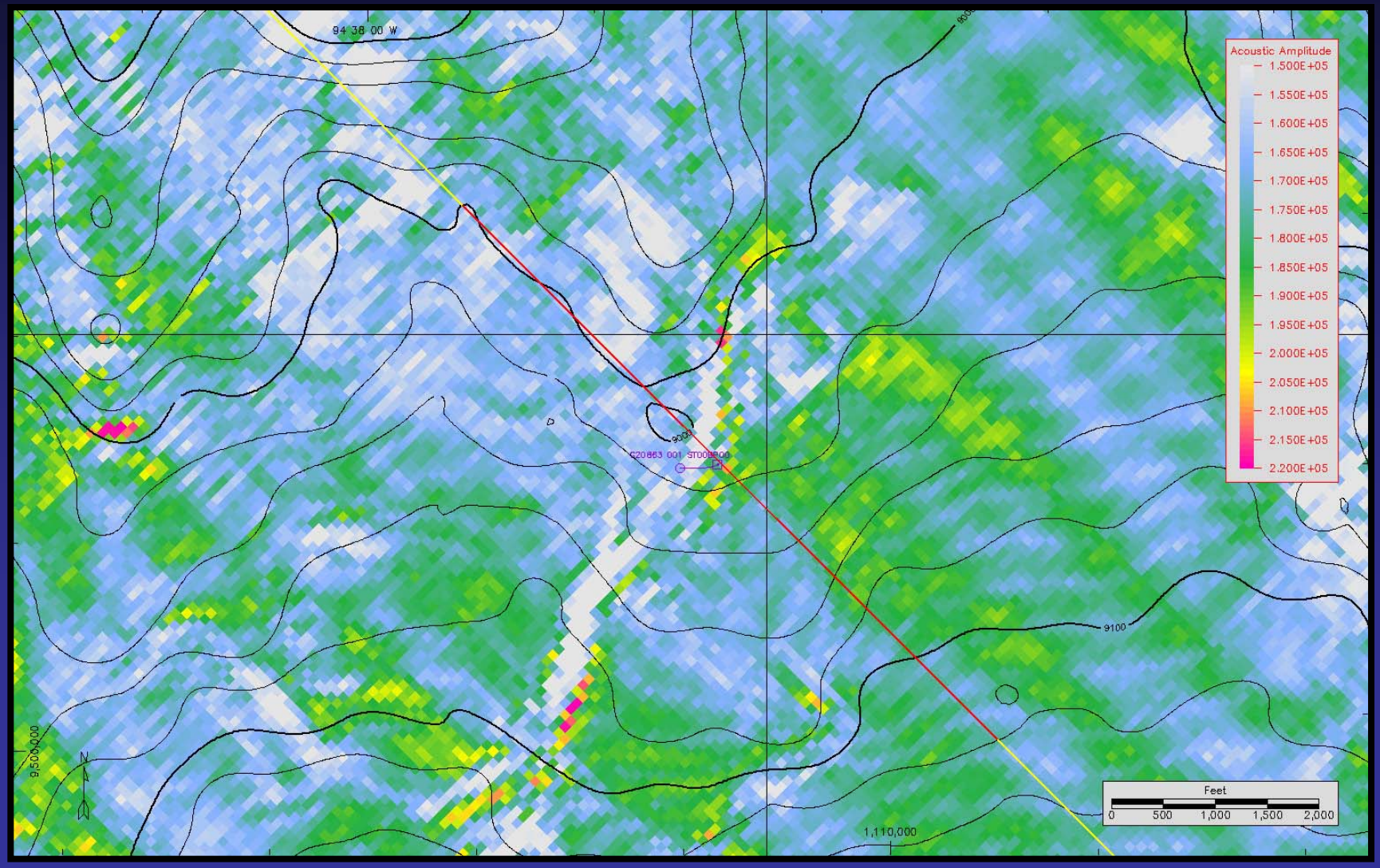


AC 818
Geologic Framework

- Site: Seaward of Sigsbee Escarpment (WD ~2775 m)
- Seepage: Along N-NE to S-SW Trending Fault
- Bathymetry: Simple
- High Seafloor Amplitude: Localized Along Fault

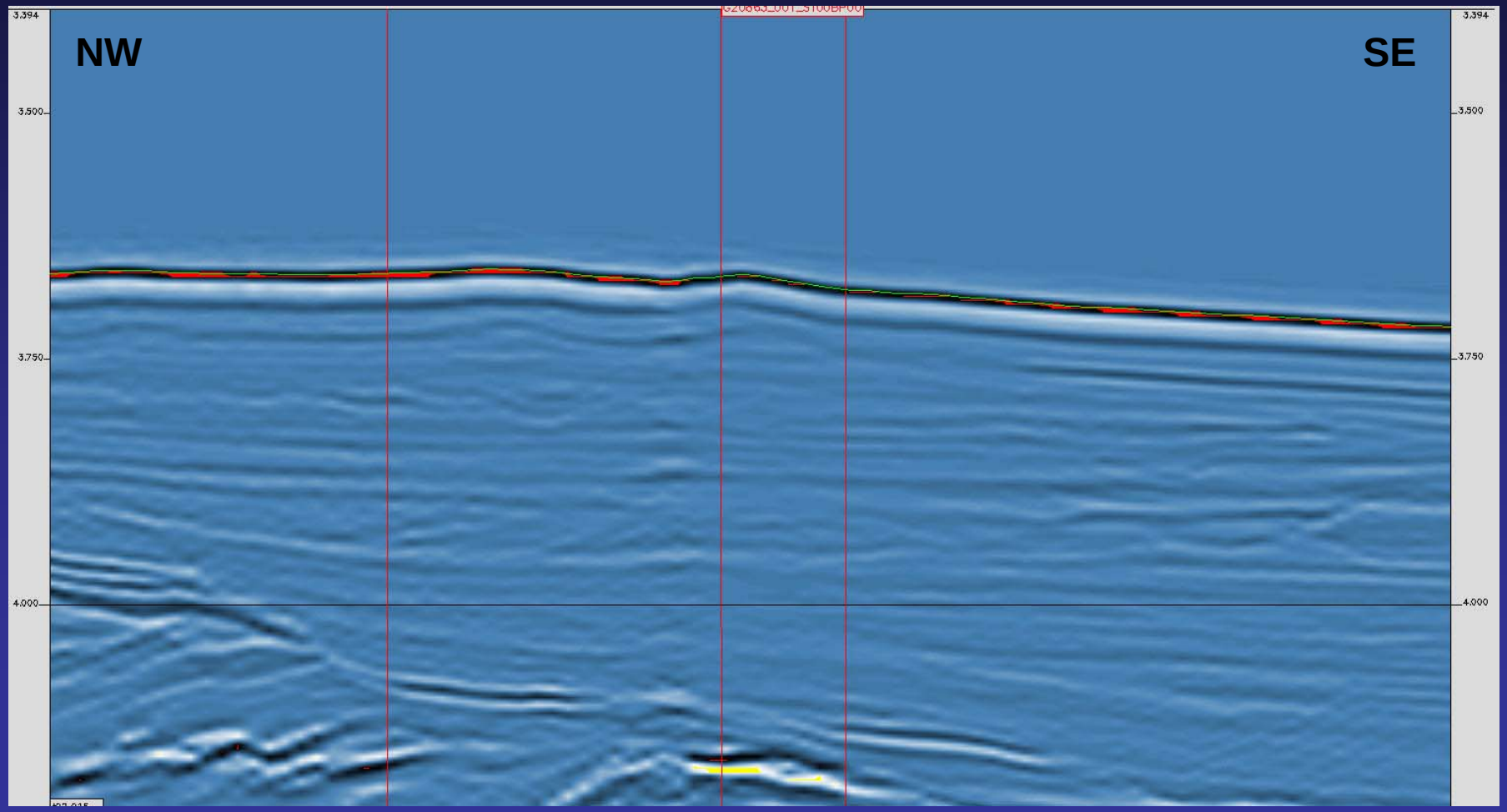
AC 818

3-D Seismic Surface Amplitude Map



AC 818

NW-SE Oriented Profile

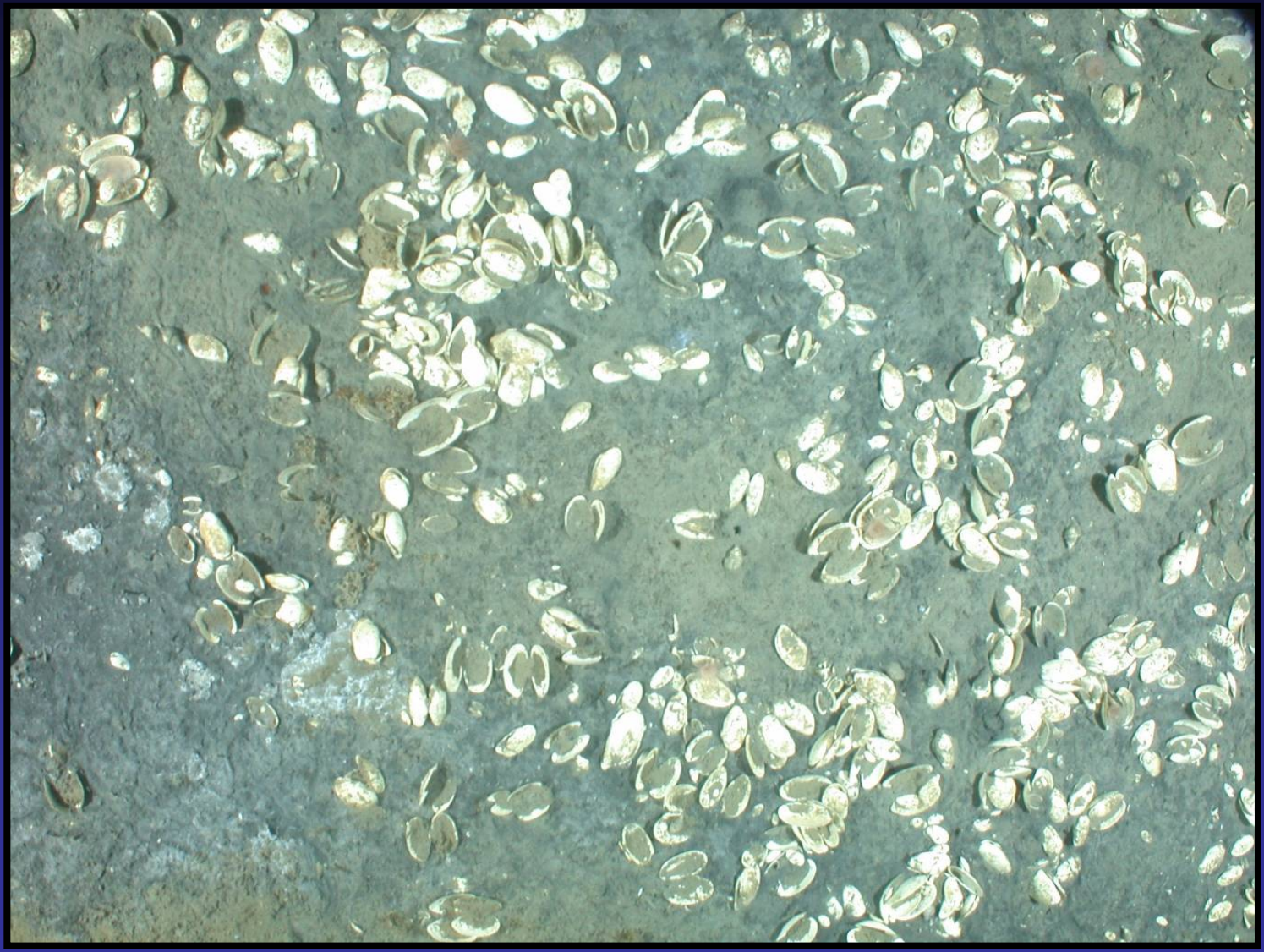


AC 818
Seafloor Characteristics

- ALVIN Dives: 2
- Narrow Belt of Chemosynthetic Communities
- Lucinid-Vesycomyid Clam Beds Common
- Localized Mussels, Tube Worms, Urchins, Carbonates
- Community Scale: Generally Below Seismic Resolution

AC 818

Clam Beds Distributed Along Fault

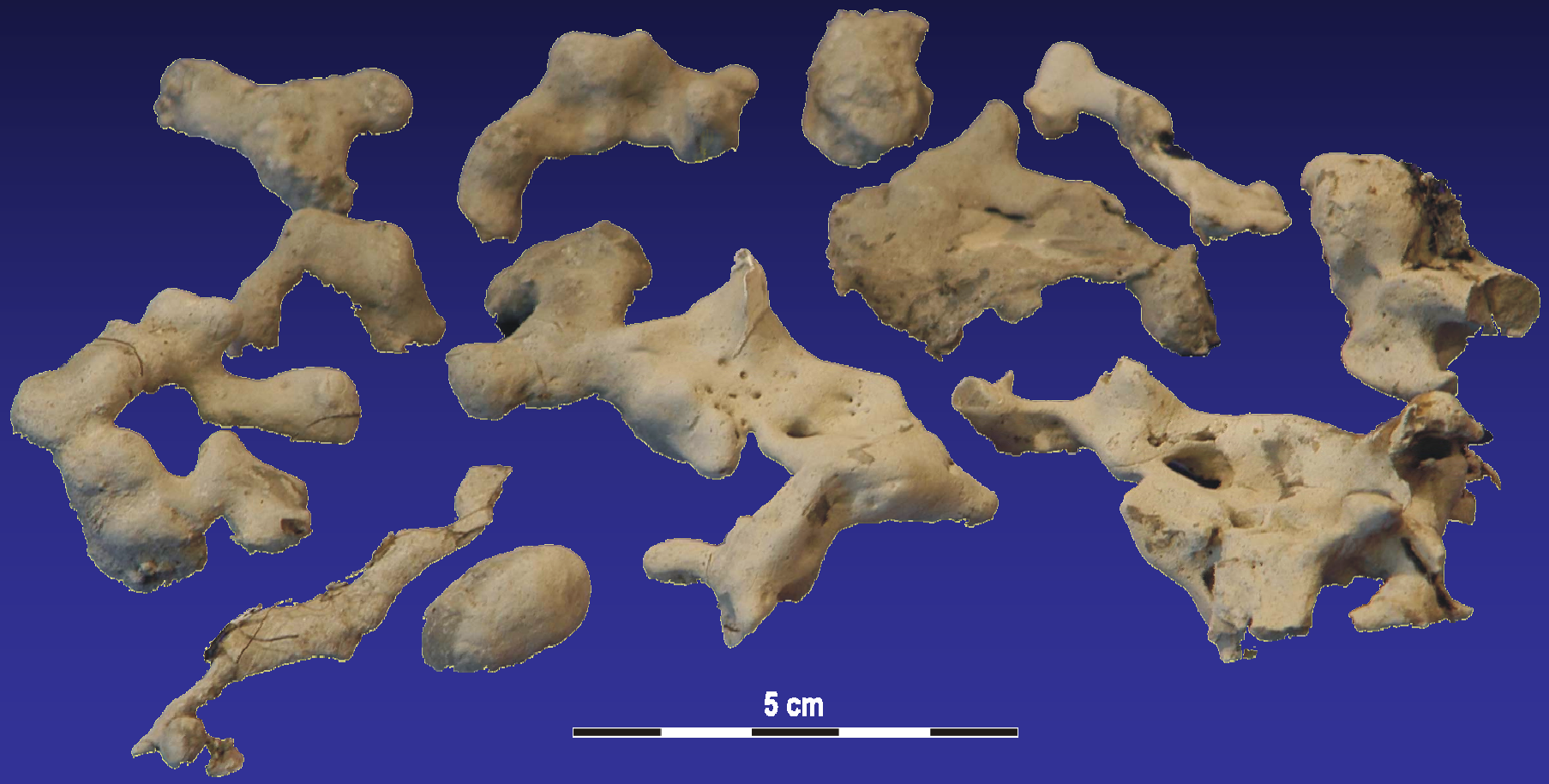


AC 818
Urchins Exploiting Reducing Sediment

AC 818

Tube Worm “Bush” and Mussels Along Fault

AC 818



Summary

- Chemosynthetic Communities: All Ten Dive Sites
- Dive Sites: Covered Cross-Slope and Along-Slope Variability
- Key Dive Sites: Valuable Biologic and Geologic Sampling Opportunities
- ’06 Cruise Results: Good Foundation for ’07 Cruise