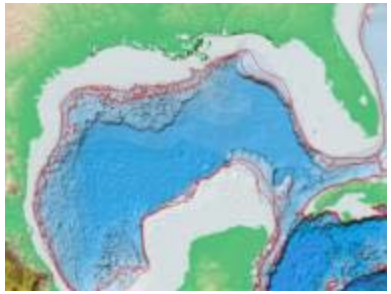
Biomass and Mass Balance Isotope Content of Mussel Seep Populations



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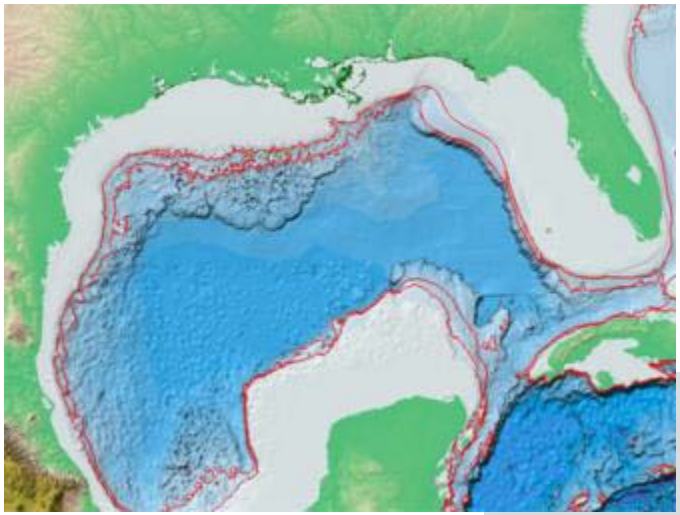


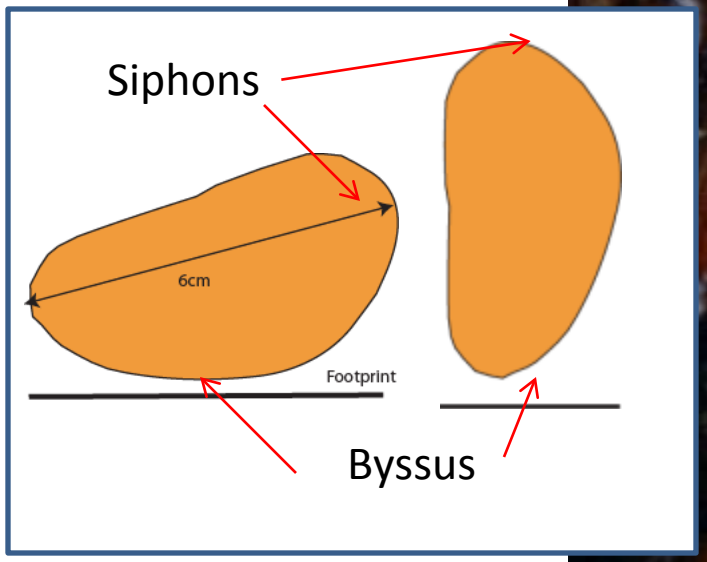
Chemo I Upper-Slope Sampling Sites Green Canyon 184/5, 234, 233, 272

Upper Limit Seep Communities ~ 400m

Lower Limit JSL Sampling ~ 1,000m

Bathymodiolus childressi

- Methanotroph
- Functional suspension-feedin g anatomy



Methane is important for this mussel!

There are two methane sources identified in these systems with very different $\delta^{13}C$ values.

Biogenic Methane

$\delta^{13}C$ = -50 to -100‰

Whiticar and Faber 1986

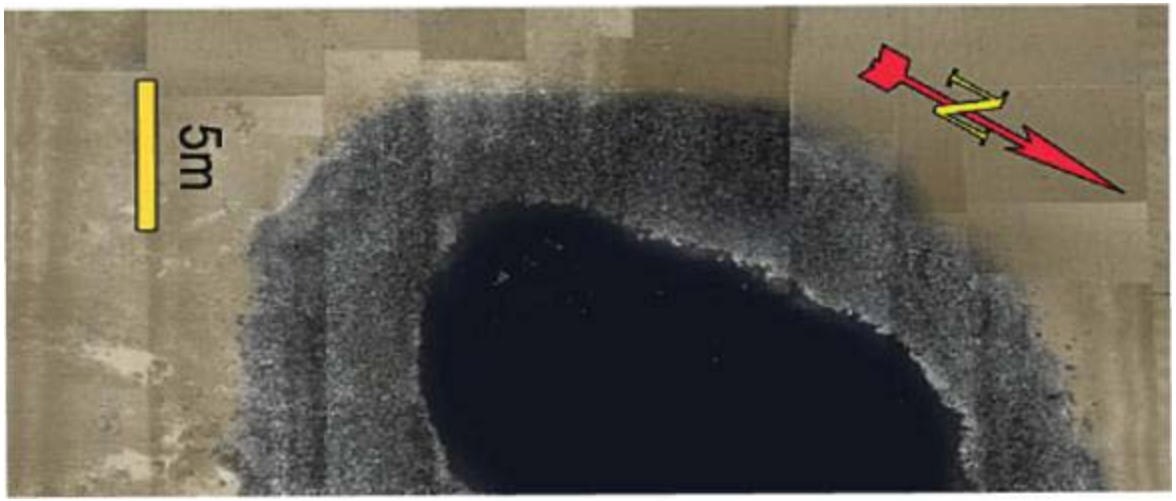
Microbially derived

Thermogenic Methane

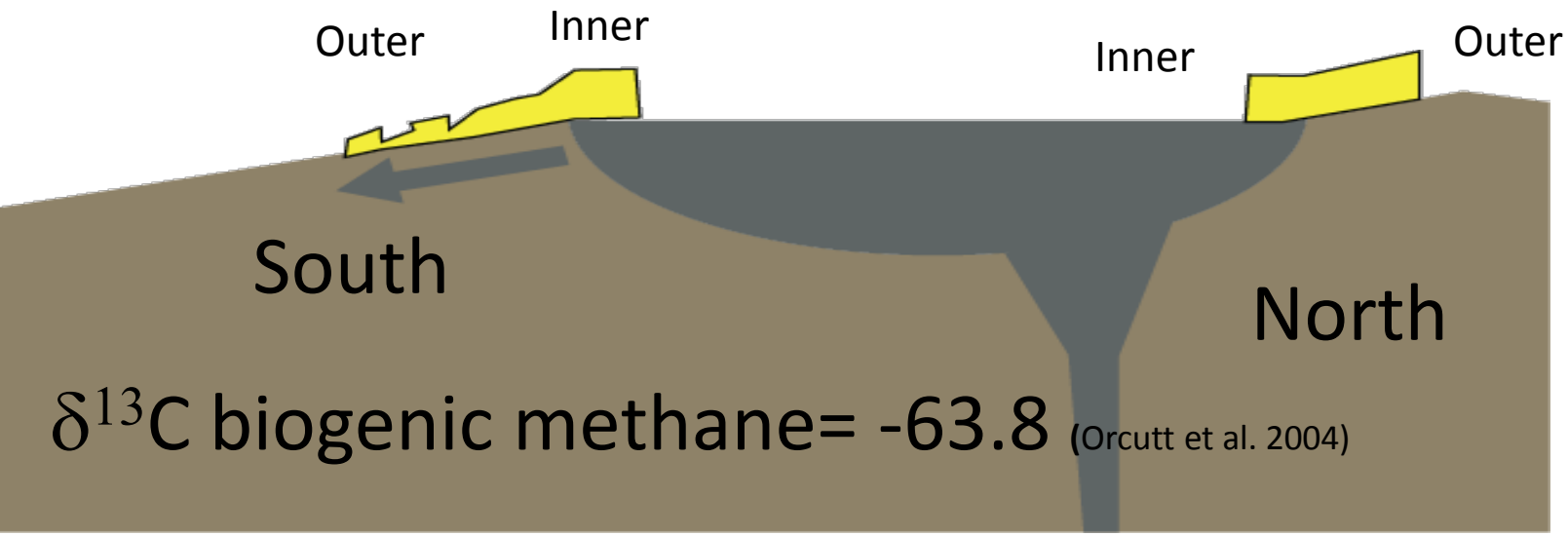
$\delta^{13}C$ = -30 to -50 ‰

Hydrocarbon chains heated to the point of breakdown into methane

Brine Pool Mussel Bed & Pool Surface

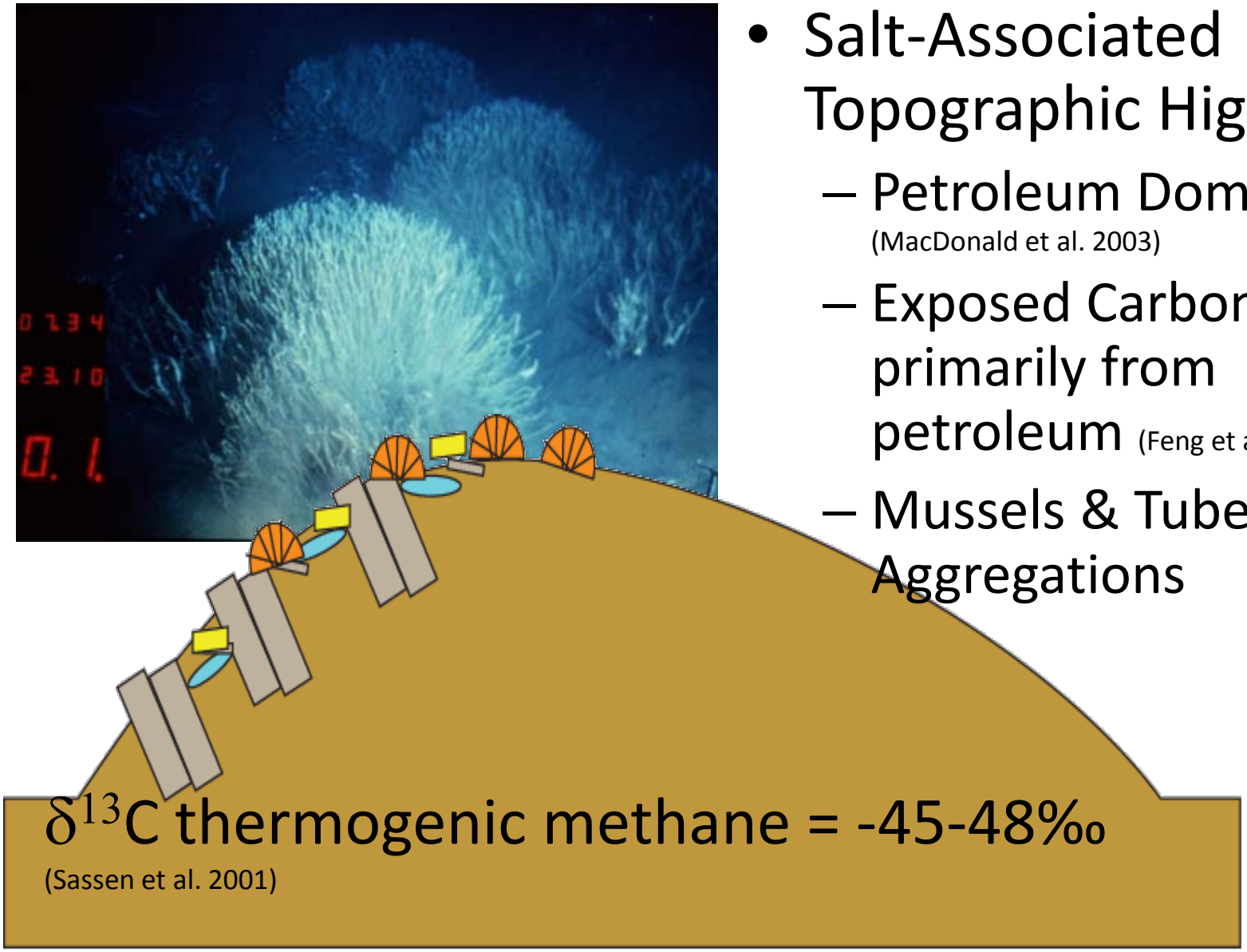


- Brine dominated (locally)
- Brine filled crater overflows to south
- Mussels only
  - Tubeworms peripherally



$\delta^{13}C$ biogenic methane= -63.8 (Orcutt et al. 2004)

Bush Hill: Mussels on Hard Substrate

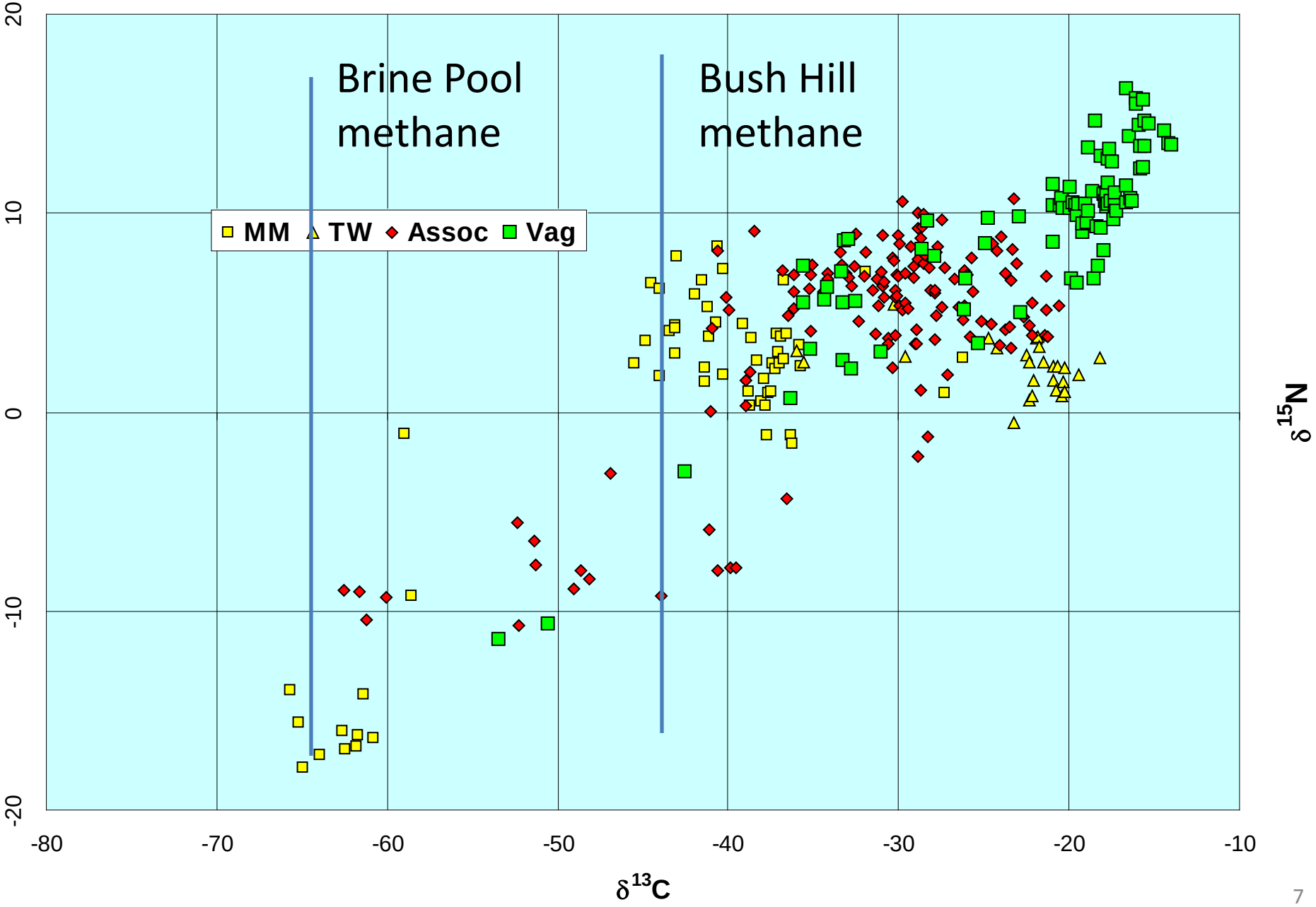


- Salt-Associated Topographic High
  - Petroleum Dominated (MacDonald et al. 2003)
  - Exposed Carbonates primarily from petroleum (Feng et al. 2009)
  - Mussels & Tubeworm Aggregations

$\delta^{13}C$ thermogenic methane = -45-48‰

(Sassen et al. 2001)

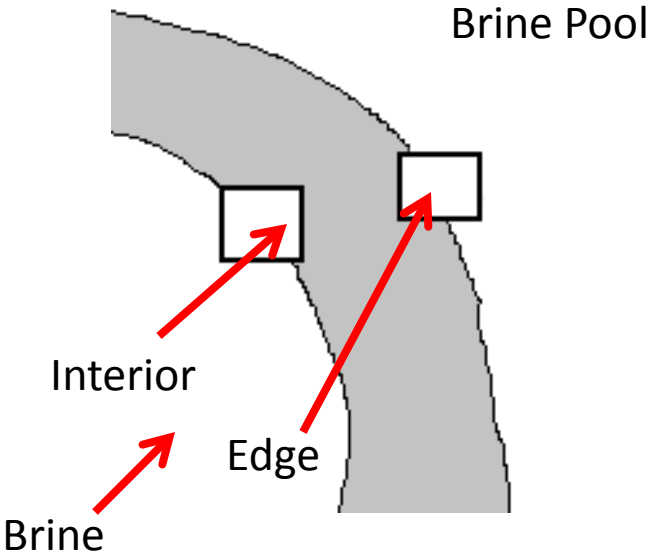
Established Upper-Slope Relationships

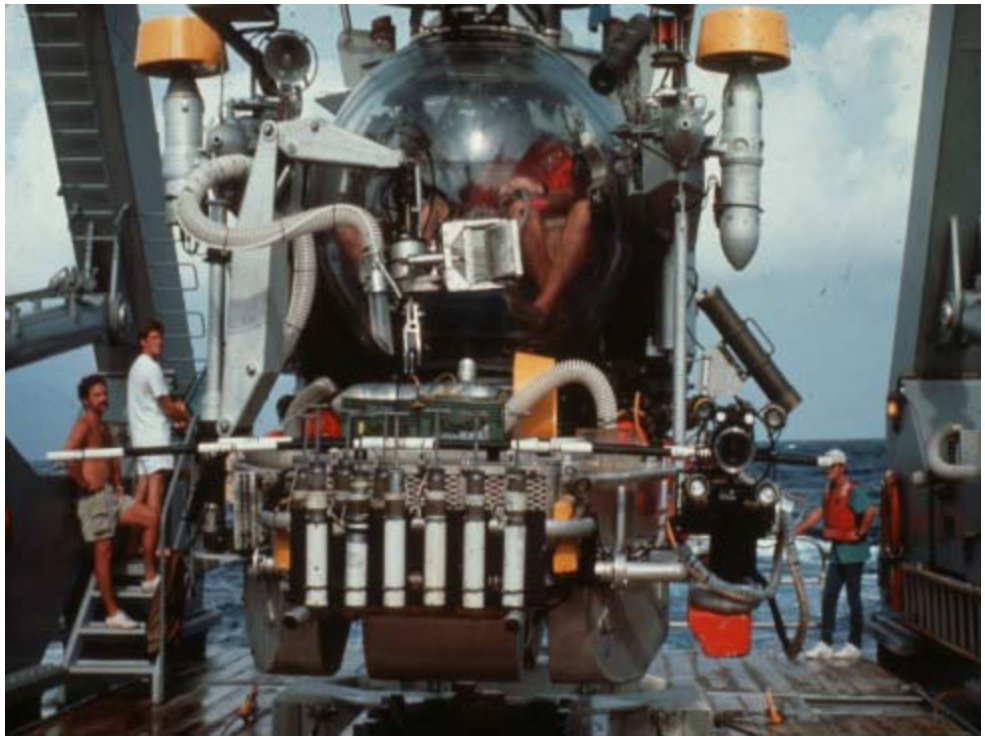


Questions to Be Addressed

- What are the patterns and variance in stable isotope values of *Bathymodiolus childressi* within different seep sites?
- What information about ecology/biology does this variance tell us?
- How would you identify an ecosystem change or impact for mussels?

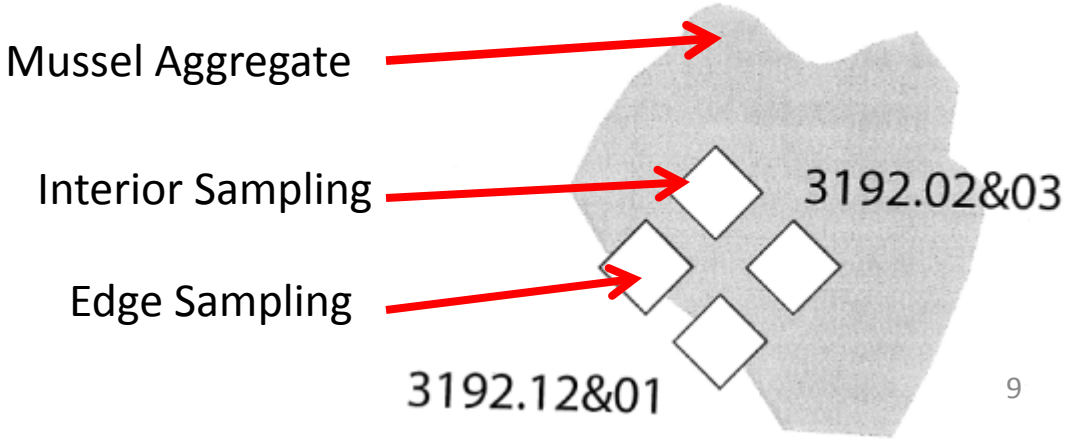
Sampling Design and Methods



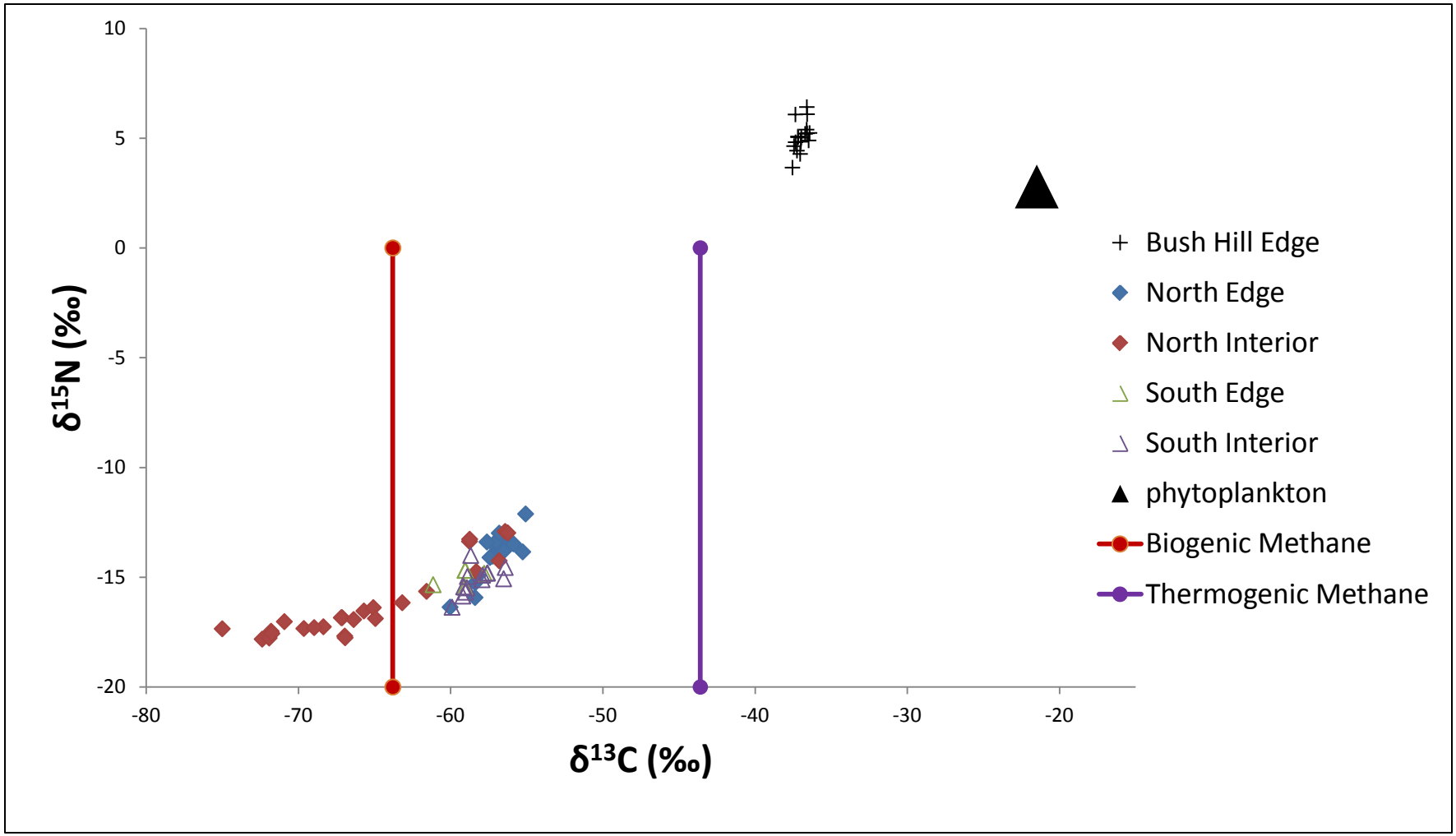


This allowed for paired samplings of aggregates that can now be compared to each other in order to investigate patch specific differences in biogeochemical processes along with trophic level differences amongst these communities at each site.

Bush Hill



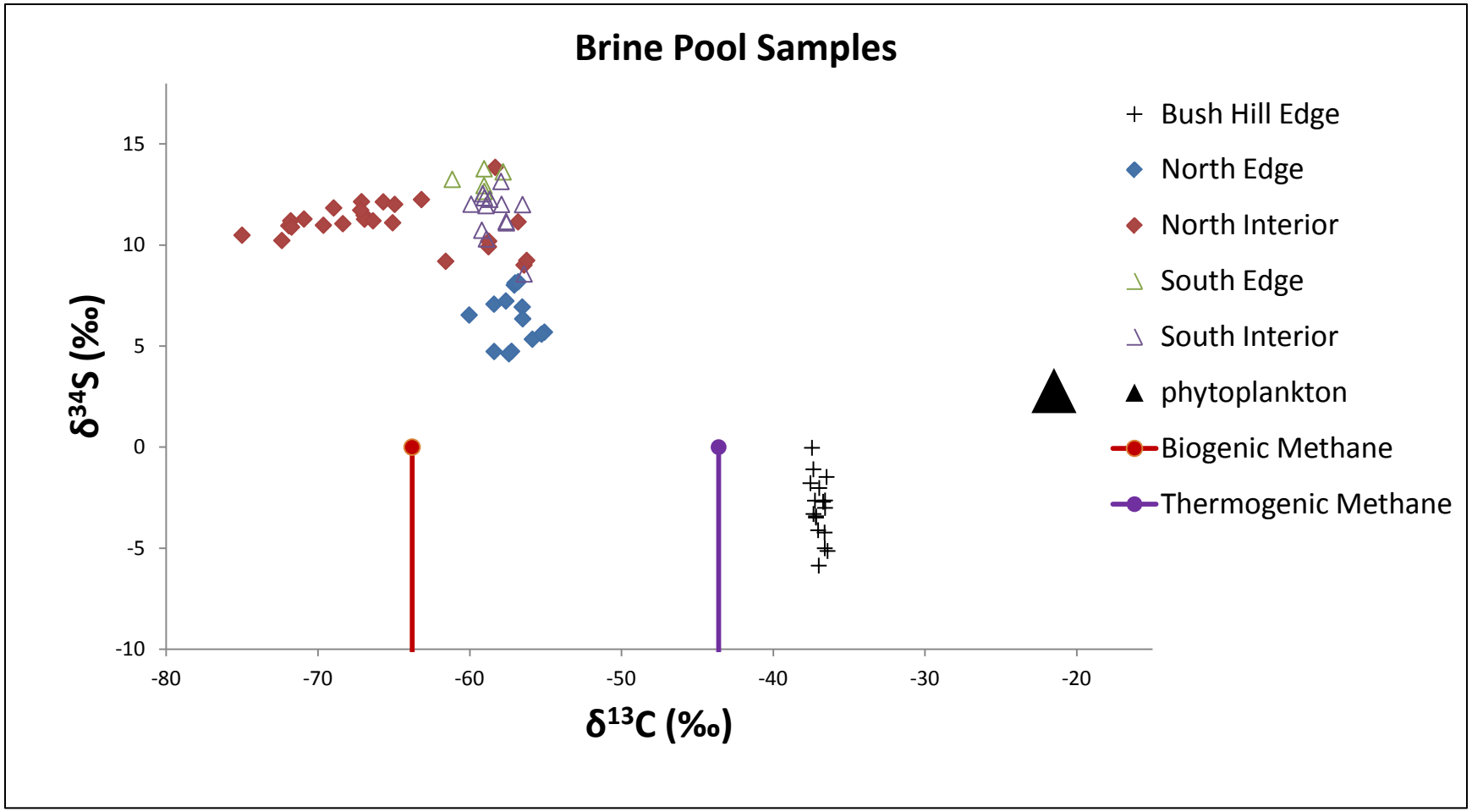
Summary of All Samples $\delta^{15}N$ vs $\delta^{13}C$

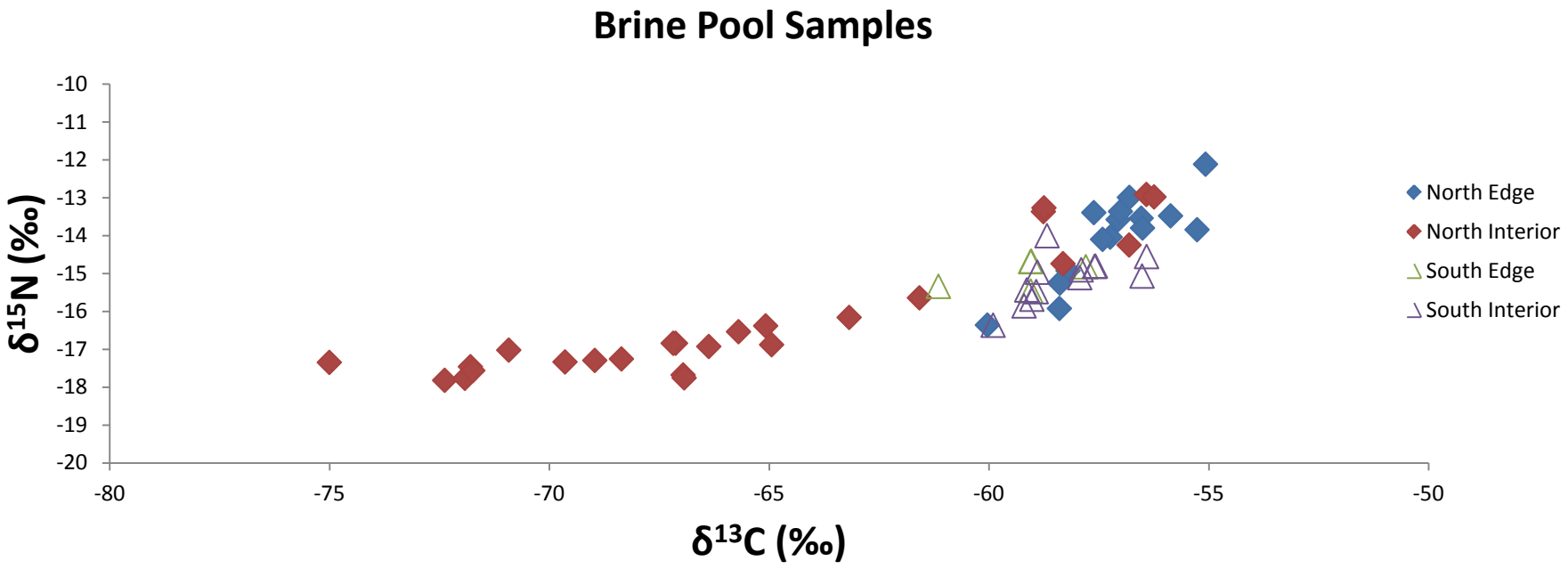


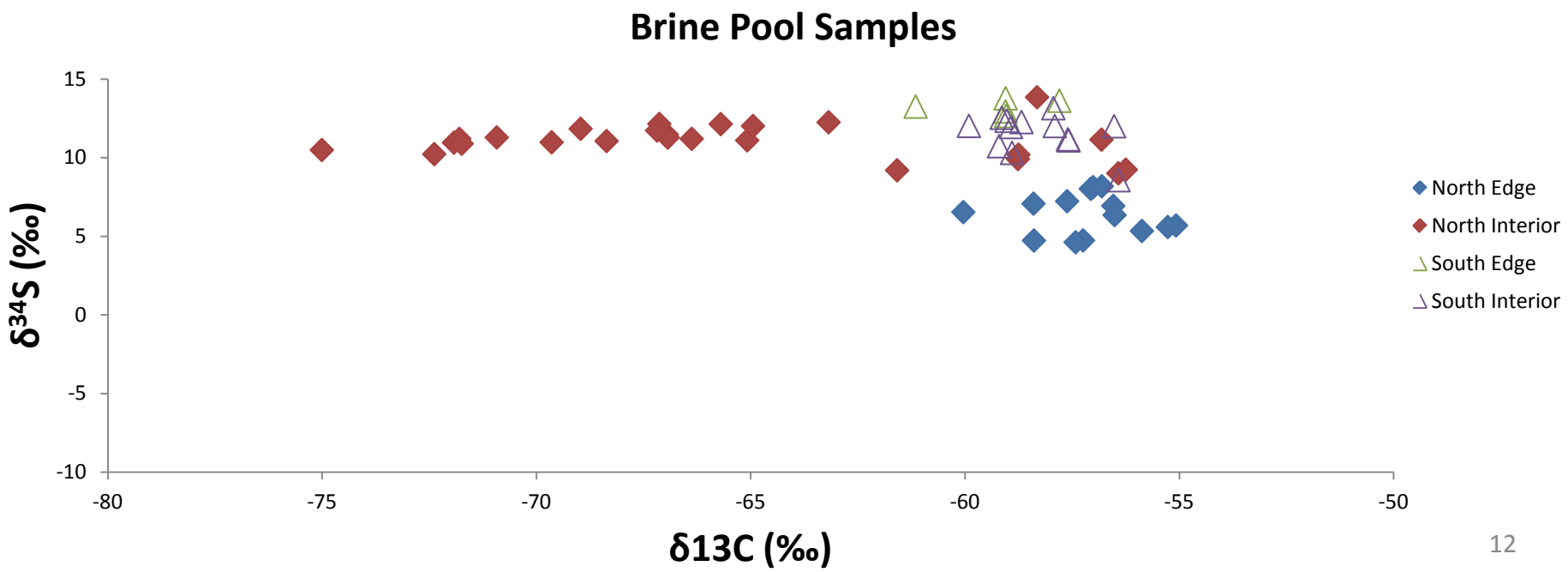
At Brine Pool, n=58

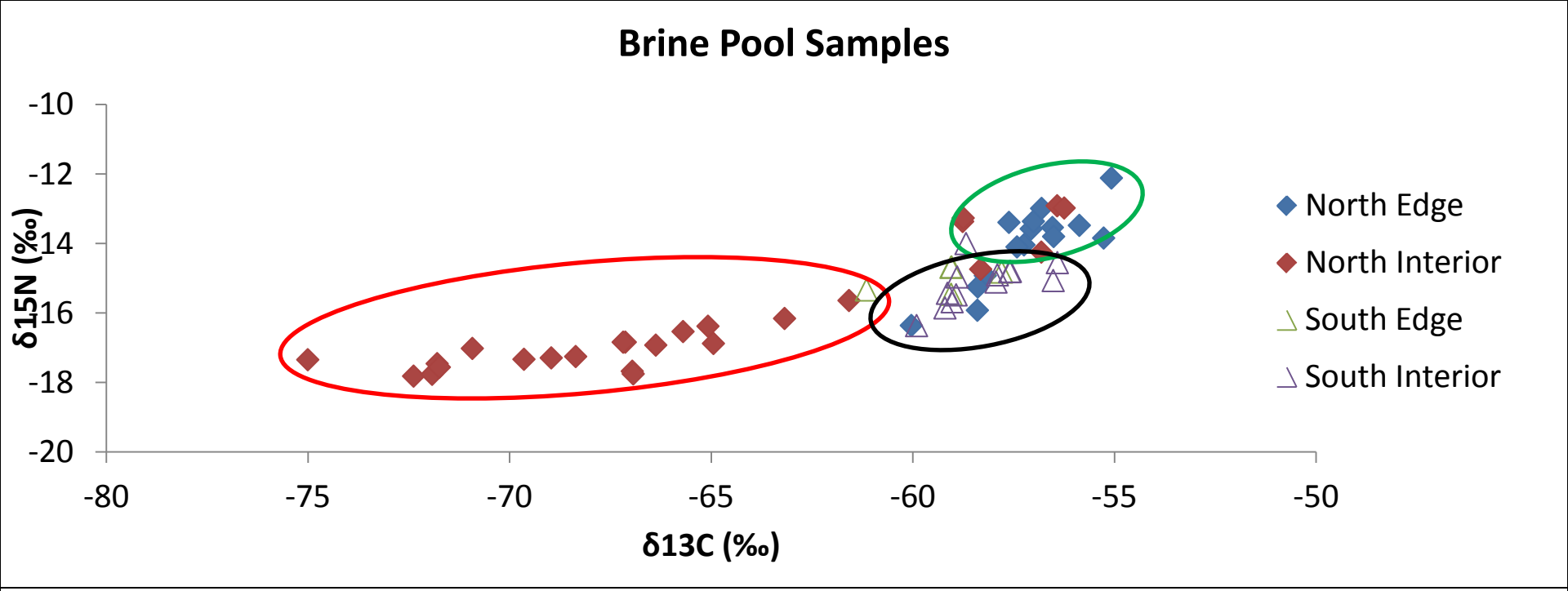
At Bush Hill, n=17, more samples are prepped, but have yet to be run.

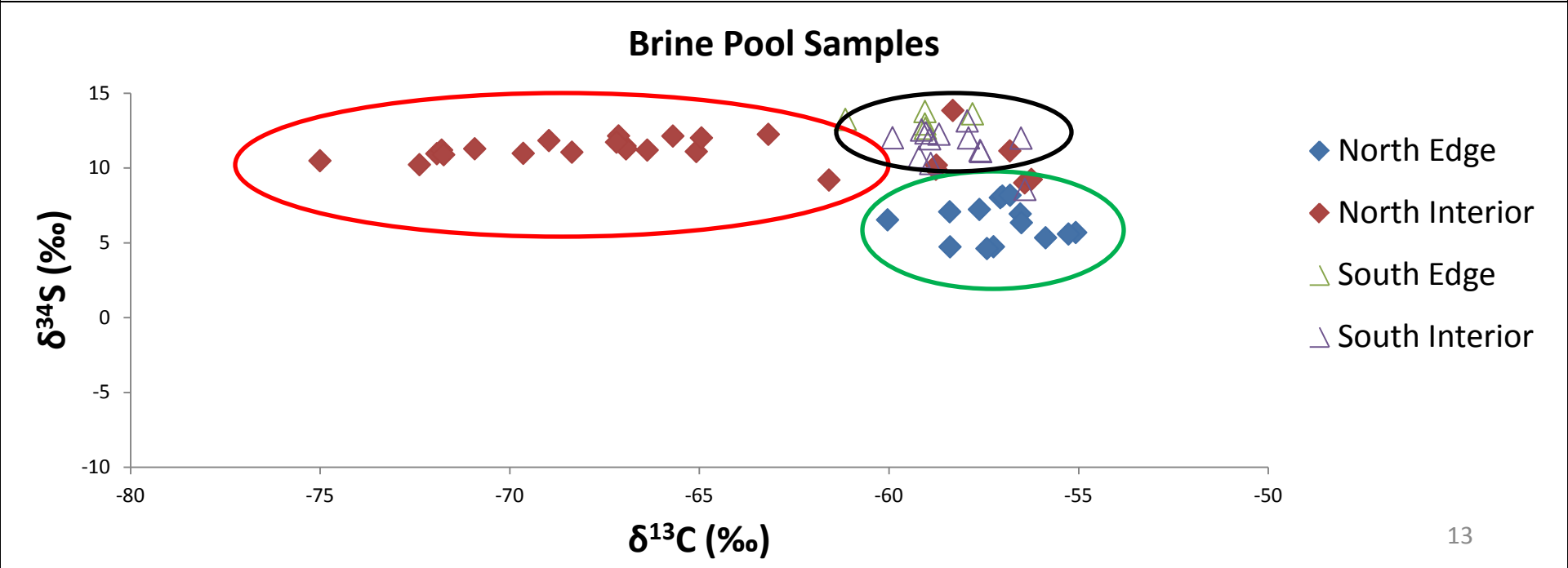
Summary of All Samples $\delta^{34}S$ vs $\delta^{13}C$




Brine Pool Samples
δ15N (‰)
δ13C (‰)
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-80
-75
-70
-65
-60
-55
-50
North Edge
North Interior
South Edge
South Interior


Brine Pool Samples
δ34S (‰)
δ13C (‰)
15
10
5
0
-5
-10
-80
-75
-70
-65
-60
-55
-50
North Edge
North Interior
South Edge
South Interior


Brine Pool Samples
-10
-12
-14
-16
-18
-20
δ15N (‰)
-80
-75
-70
-65
-60
-55
-50
δ13C (‰)
North Edge
North Interior
South Edge
South Interior


Brine Pool Samples
15
10
5
0
-5
-10
δ34S (‰)
-80
-75
-70
-65
-60
-55
-50
δ13C (‰)
North Edge
North Interior
South Edge
South Interior

Questions We Have Addressed

1. What are the patterns and variance in stable isotope values of *Bathymodiolus childressi* within different seep sites?

   Location.

2. What information about ecology/ biology does variance tell us?

Organisms exist in several types of (isotopically) distinct ecosystems.

3. How would you identify an ecosystem change or impact for mussels?

Location is important for isotope variance, so e.g. for BACI before/after makes more sense than control/impact.

References

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