Quaternary molluskan assemblages of cold-water coral mounds:

a new perspective on deep-sea ecosystem dynamics in the western Mediterranean

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SENCKENBERG world of biodiversity

How do CWC mollusk communities vary over space & time?

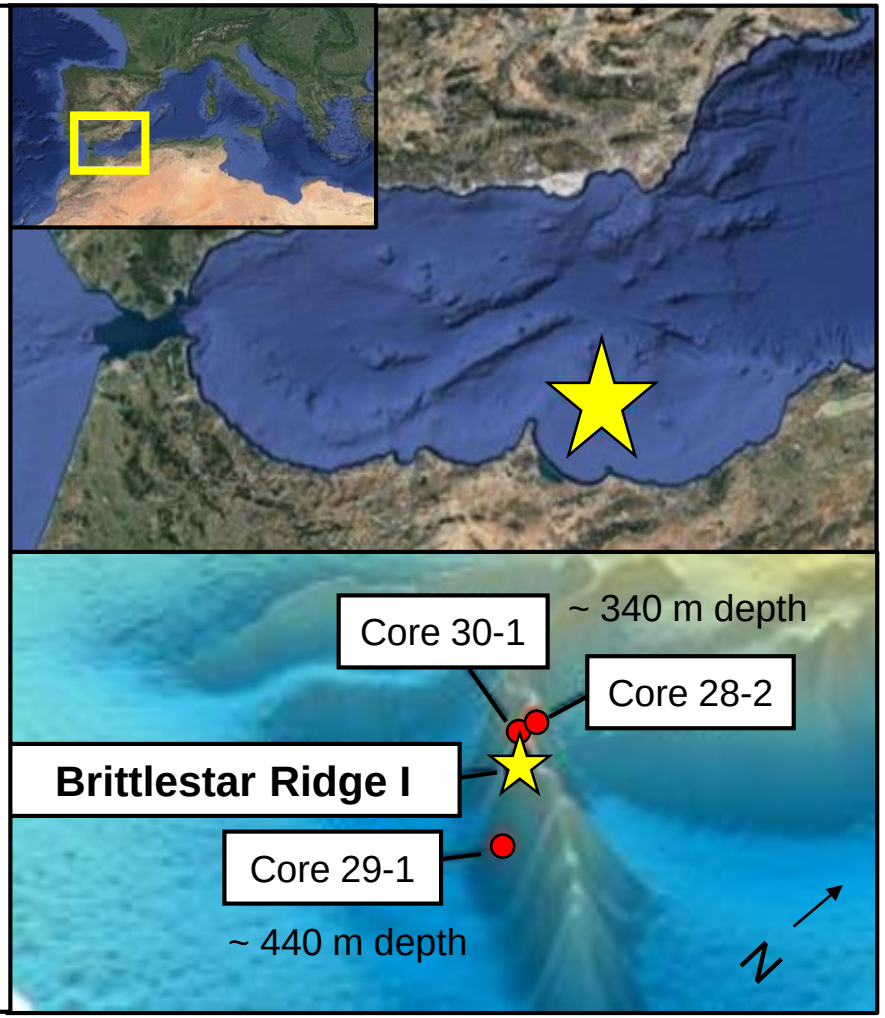
What are the potential environmental drivers?

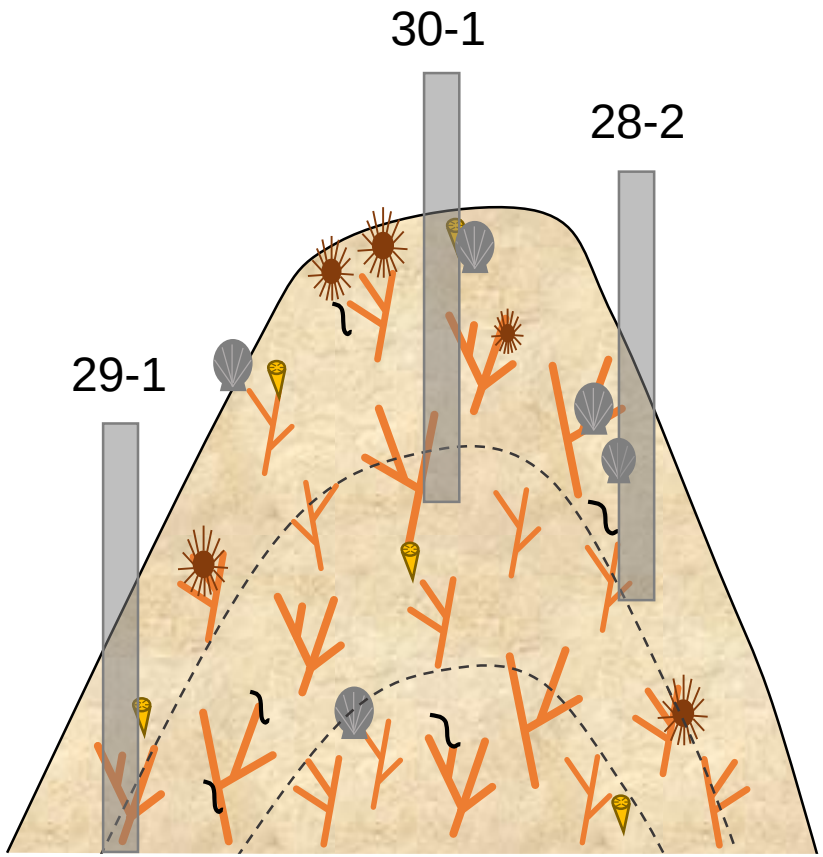
East Melila Coral Province

Alboran Sea

western Mediterranean

3 gravity cores

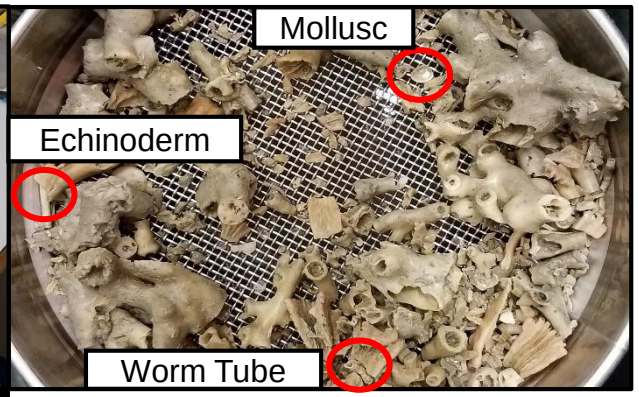


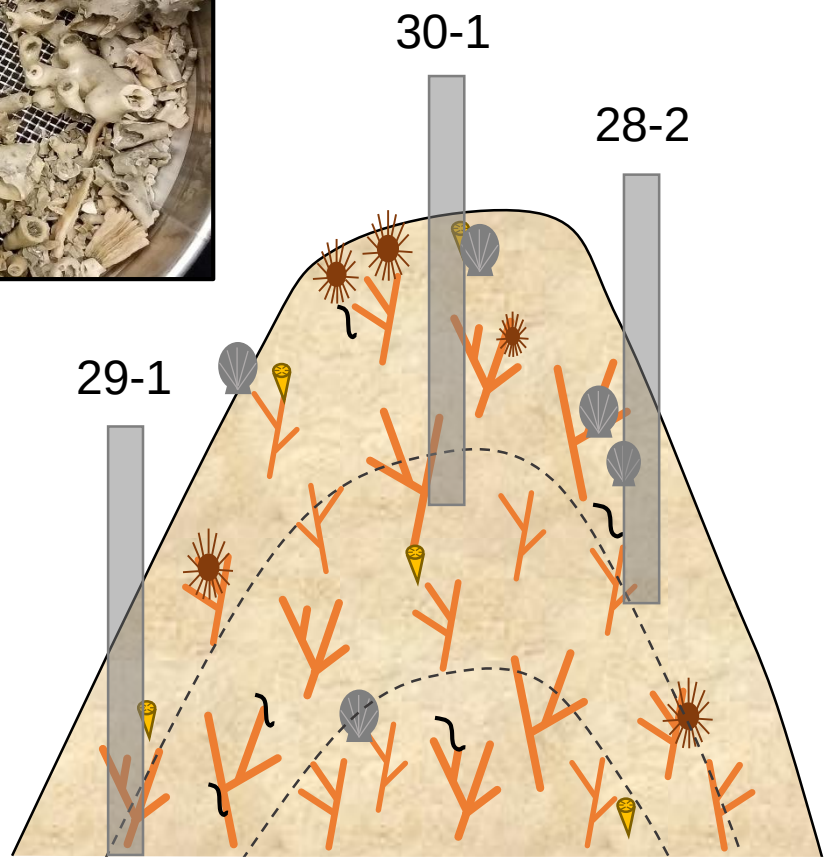


How do CWC mollusk communities vary over space & time?

What are the potential environmental drivers?

3 Gravity Cores
- 3.6 – 4.4 m, long
- Bulk sampled
- Fauna sorted
- Mollusks counted
  - → bivalves
  - → gastropods
- Life-strategy traits

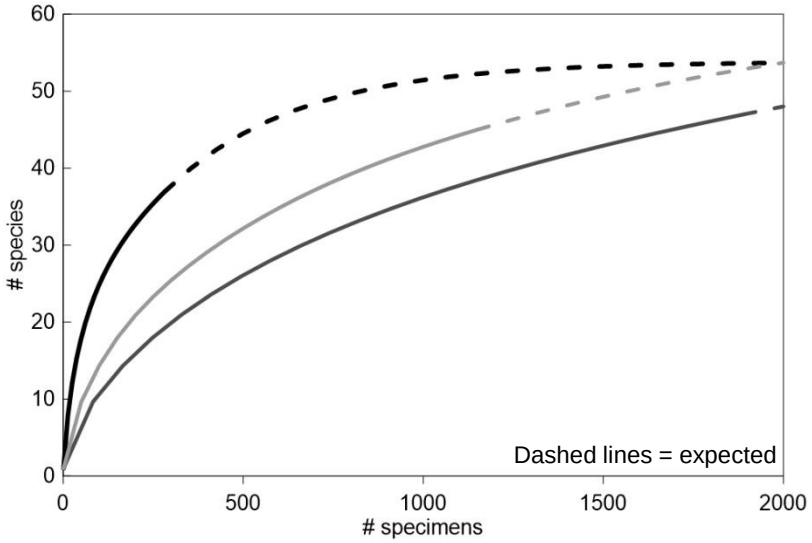


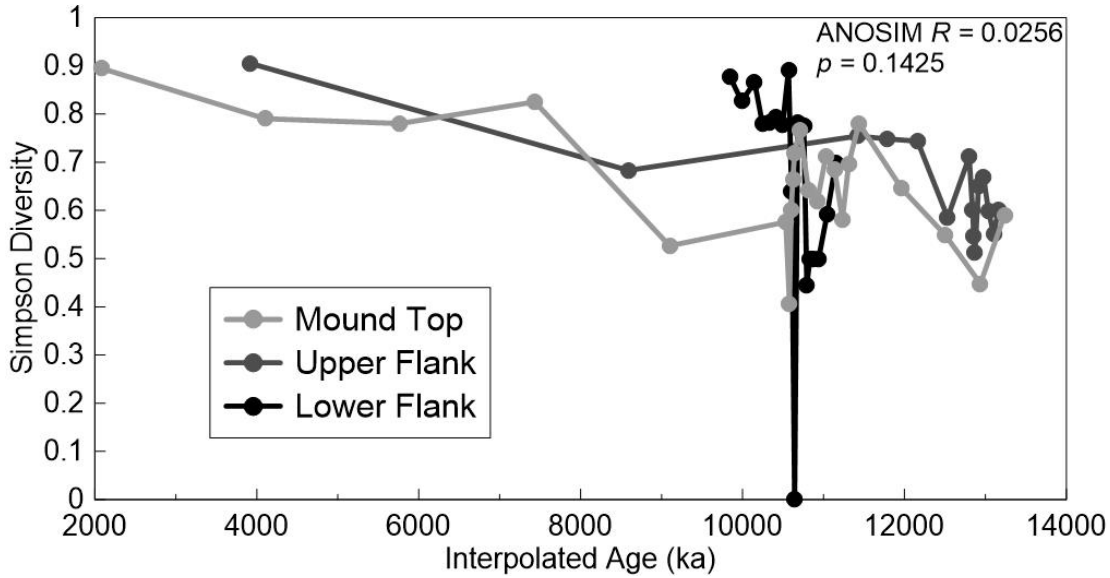


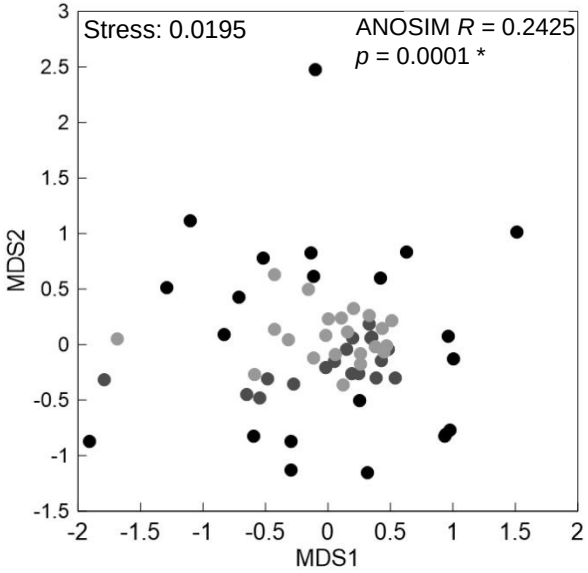
Environmental Proxy Records
- Off-mound sediment cores
  - → Food, oxygen, grain size, temperature, salinity
- On-mound cores ^{14}C coral ages & CT scans
  - → Mound aggradation rate, coral volume & orientation

Ecological Analyses → R software

Spatial Variation: Taxonomic Diversity & Composition







Rarefaction

- Greatest diversity (at 100 specimens)
  → Lower Flank
- Greatest expected diversity
  → Mound Top, Lower Flank
- Most specimens → Upper Flank

Simpson Diversity Index

- Simpson Index: accounts for number of species & abundances
- Diversity variable among cores, time
- Diversity generally increases over time

- **Diversity among cores = not significantly different (ANOSIM)**

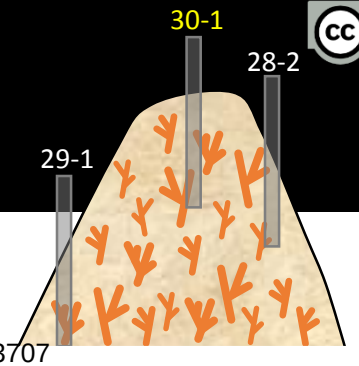
Bray-Curtis Dissimilarity MDS

- Proportional abundances of species, per sample, per core
- Greatest variability → Lower Flank
- Upper Flank, Mound Top more similar

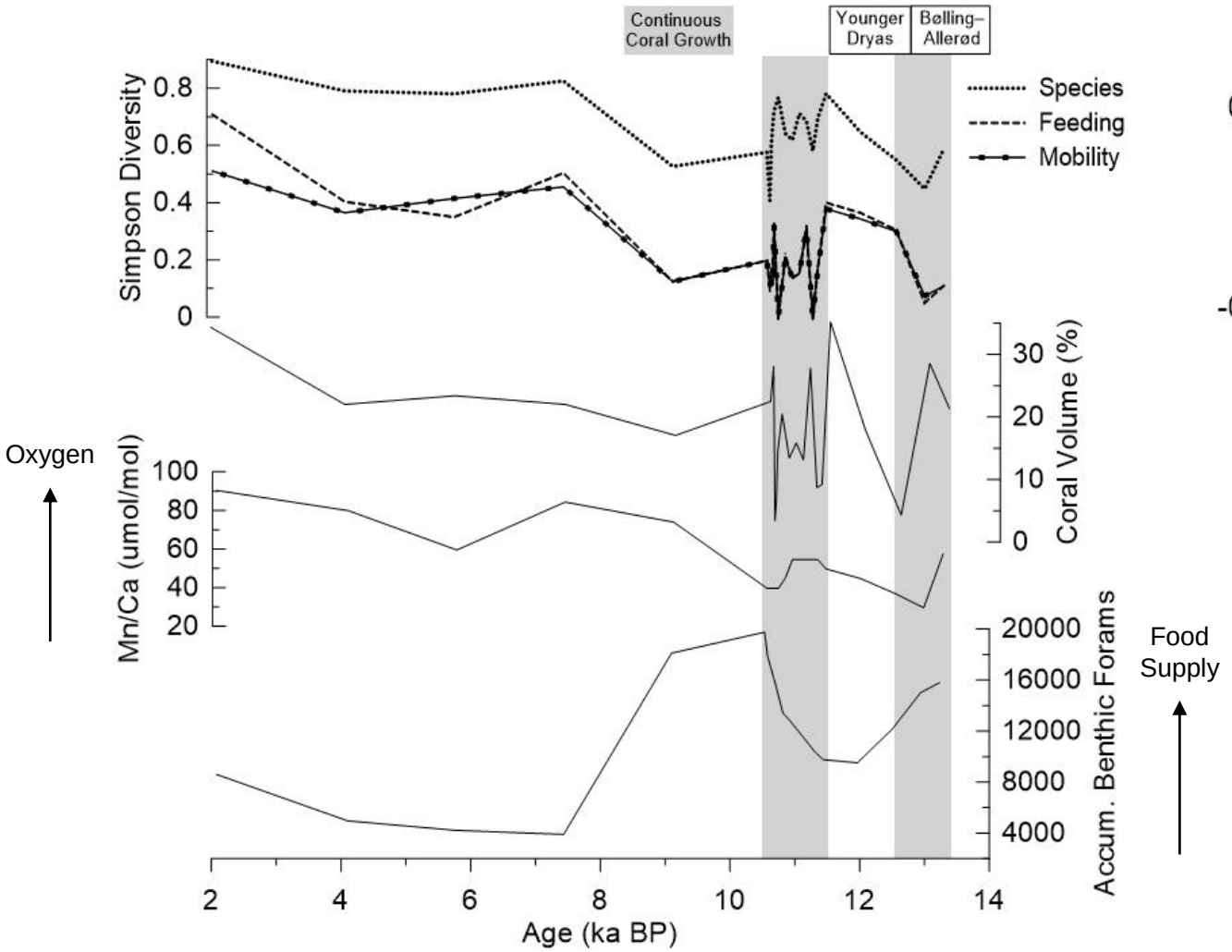
- **Species composition among cores = significantly different (ANOSIM)**

Life-strategy traits (feeding, mobility) → generally similar trends, variability among cores

Temporal Variation & Drivers: Mound Top

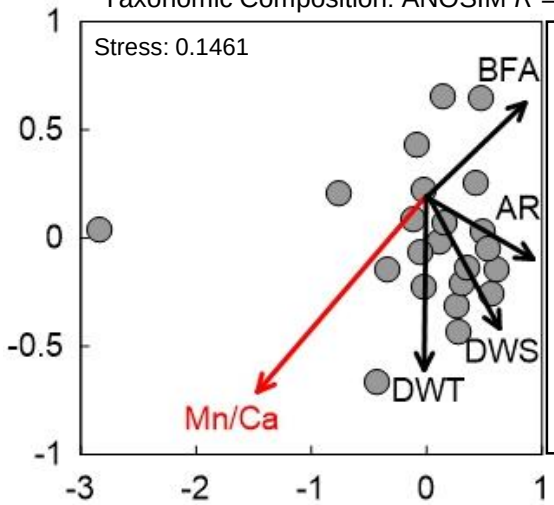


Ecological & Environmental Trends



MDS + EnvFit

Taxonomic Composition: ANOSIM R = 0.0484, p = 0.3707



Environmental Proxies

AR: Mound Aggradation Rate
BFA: Benthic Foram Accumulation = FOOD
DWS: Deep-water salinity (correlated with DWT)
DWT: Deep-water temperature
GS: Mean Grain Size = FLOW / FOOD
Mn/Ca: Oxygen *

Tested separately:
Coral Volume (%) *
Coral Orientation (0-30º, 30-60 º, 60-90 º)

Key Results

Significant correlations MDS + EnvFit analysis:

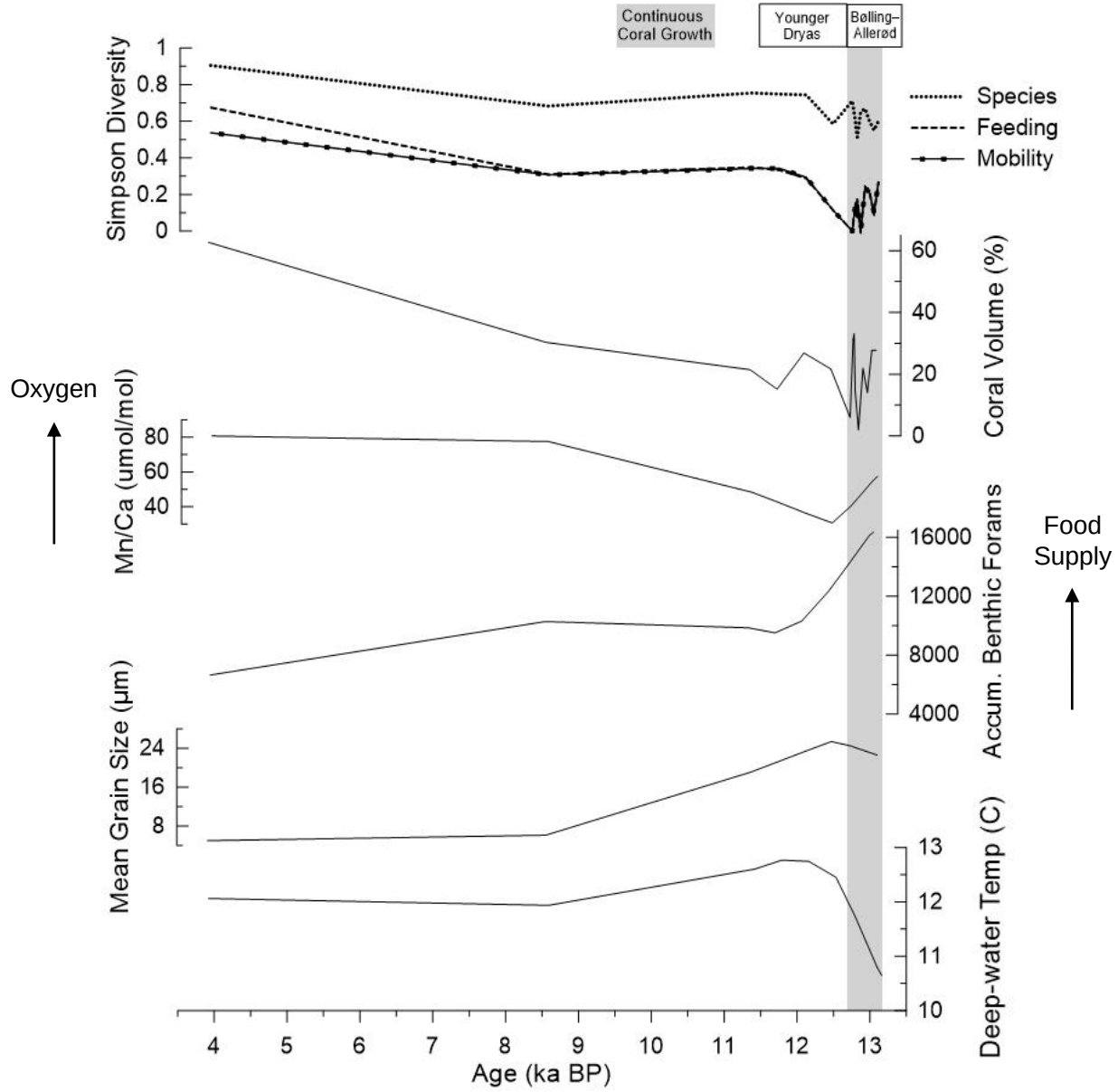
Taxonomic compositions → Coral Volume, Mn/Ca
Feeding trait compositions → Coral Volume, BFA, Mn/Ca ^
Mobility trait compositions → Mn/Ca ^

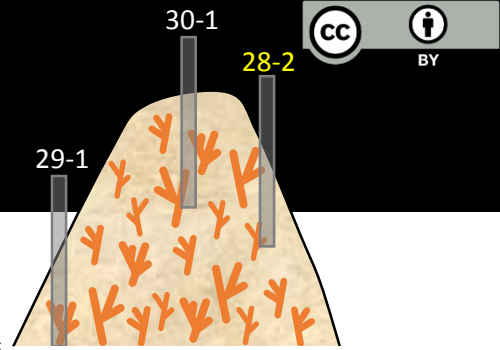
Greater diversity values generally associated with

→ greater coral volume & oxygen
→ decreased food supply
→ decreased abundance of filter feeders & sessile taxa ^
→ increased abundance of mobile epifaunal taxa ^

^not shown

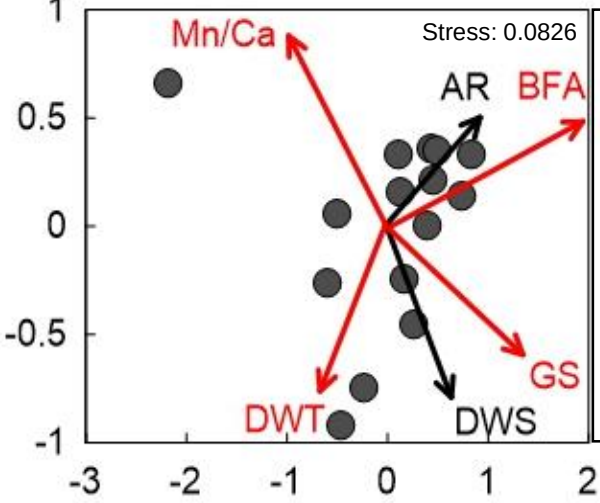
Temporal Variation & Drivers: Upper Flank





MDS + EnvFit

Taxonomic Composition: ANOSIM R = 0.1287, p = 0.1176



Environmental Proxies

AR: Mound Aggradation Rate
BFA: Benthic Foram Accumulation = FOOD *
DWS: Deep-water salinity
DWT: Deep-water temperature *
GS: Mean Grain Size = FLOW / FOOD *
Mn/Ca: Oxygen *

Tested separately:
Coral Volume (%) *
Coral Orientation (0-30º, 30-60 º, 60-90 º)

Key Results

Significant correlations MDS + EnvFit analysis:

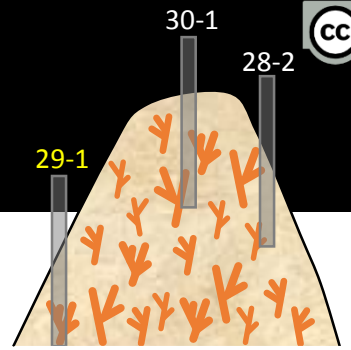
Taxonomic compositions → Coral Vol, BFA, DWT, GS, Mn/Ca
Feeding trait compositions → Coral Vol, BFA, GS ^
Mobility trait compositions → Coral Vol, BFA ^

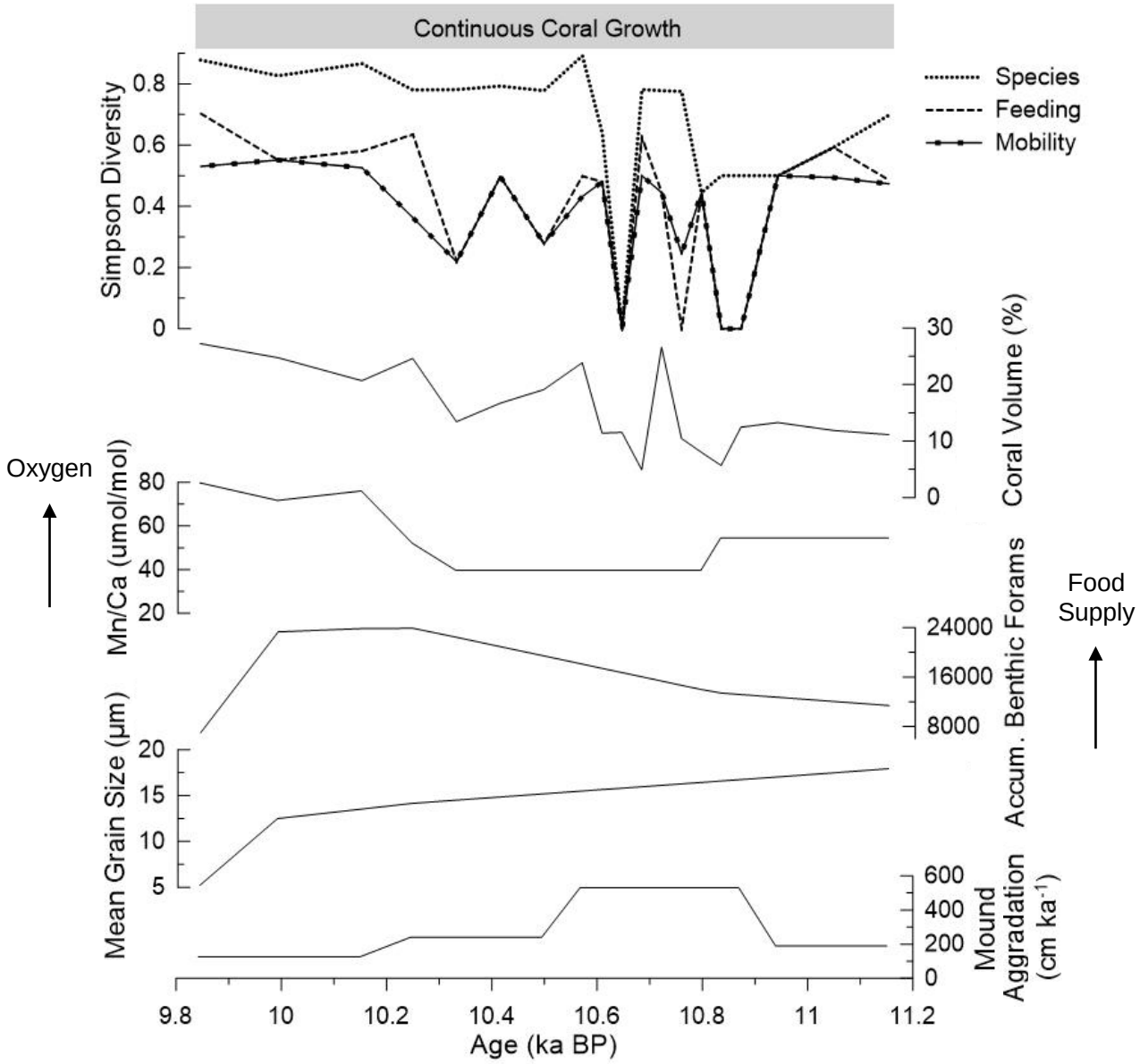
Greater diversity values generally associated with

→ greater coral volume, oxygen, & temperature
→ decreased food supply & grain size
→ decreased abundance of filter feeders & sessile taxa ^
→ increased abundance of mobile epifaunal taxa ^

^not shown

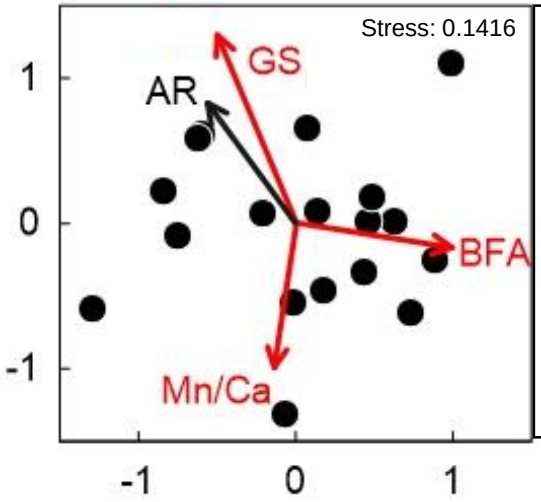
Temporal Variation & Drivers: Lower Flank





MDS + EnvFit

Taxonomic Composition: ANOSIM = n/a



Environmental Proxies

AR: Mound Aggradation Rate
BFA: Benthic Foram Accumulation = FOOD *
DWS: Deep-water salinity * (corrl. DWT, GS)
DWT: Deep-water temperature *
GS: Mean Grain Size = FLOW / FOOD *
Mn/Ca: Oxygen *

Tested separately:
Coral Volume (%) *
Coral Orientation (0-30º, 30-60 º, 60-90 º)

Key Results

Significant correlations MDS + EnvFit analysis:

Taxonomic compositions → Coral Vol, BFA, GS (DWS, DWT), Mn/Ca
Feeding trait compositions → AR, DWT, Mn/Ca ^
Mobility trait compositions → AR ^

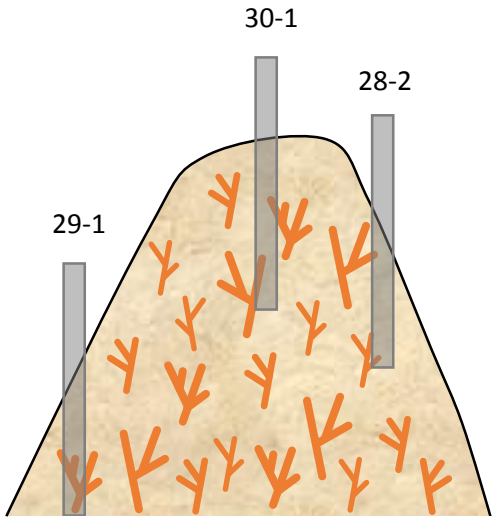
Greater diversity values generally associated with

→ greater coral volume (& oxygen)
→ decreased grain size
→ decreased abundance of filter feeders & sessile taxa ^
→ increased abundance of mobile epifaunal taxa ^

^not shown

Conclusions

- Spatially, CWC mounds support significantly different molluscan assemblages, from mound top – lower flank
- Temporally, assemblages are variable but not sig. different
- Lower food (BFA) and food transport (GS) drive increases in taxonomic, feeding, and mobility diversities over time
  - → Ecosystem less dominated by sessile, filter feeders
  - → Increase in mobile species to seek reduced food supply



- Higher oxygen (Mn/Ca) promotes more mobile/energetic life strategies
- Higher coral volume likely artifact of reduced sediment input over time
  - → may contribute to diversity changes by altering habitat complexity

Thanks

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