Quaternary molluskan assemblages of cold-water coral mounds:

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

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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

Brittlestar Ridge I
Core 30-1 ~ 340 m depth
Core 28-2
Core 29-1 ~ 440 m depth

30-1
28-2
29-1
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**

- **Simpson Diversity**
- **Feeding**
- **Mobility**

- **Oxygen (umol/mol)**
- **Mn/Ca**
- **Coral Volume (%)**
- **Accum. Benthic Forams**

**MDS + EnvFit**

- **Taxonomic Composition**: ANOSIM $R = 0.0484$, $p = 0.3707$
- **Stress**: 0.1461

**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 (0-30°, 30-60°, 60-90°)

**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

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

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 (0-30°, 30-60°, 60-90°)

MDS + EnvFit
Taxonomic Composition: ANOSIM $R = 0.1287$, $p = 0.1176$
Temporal Variation & Drivers: Lower Flank

**Environmental Proxies**
- **AR**: Mound Aggradation Rate
- **BFA**: Benthic Foram Accumulation = FOOD * (corrl. DWT, GS)
- **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 (0-30°, 30-60°, 60-90°)

**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
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