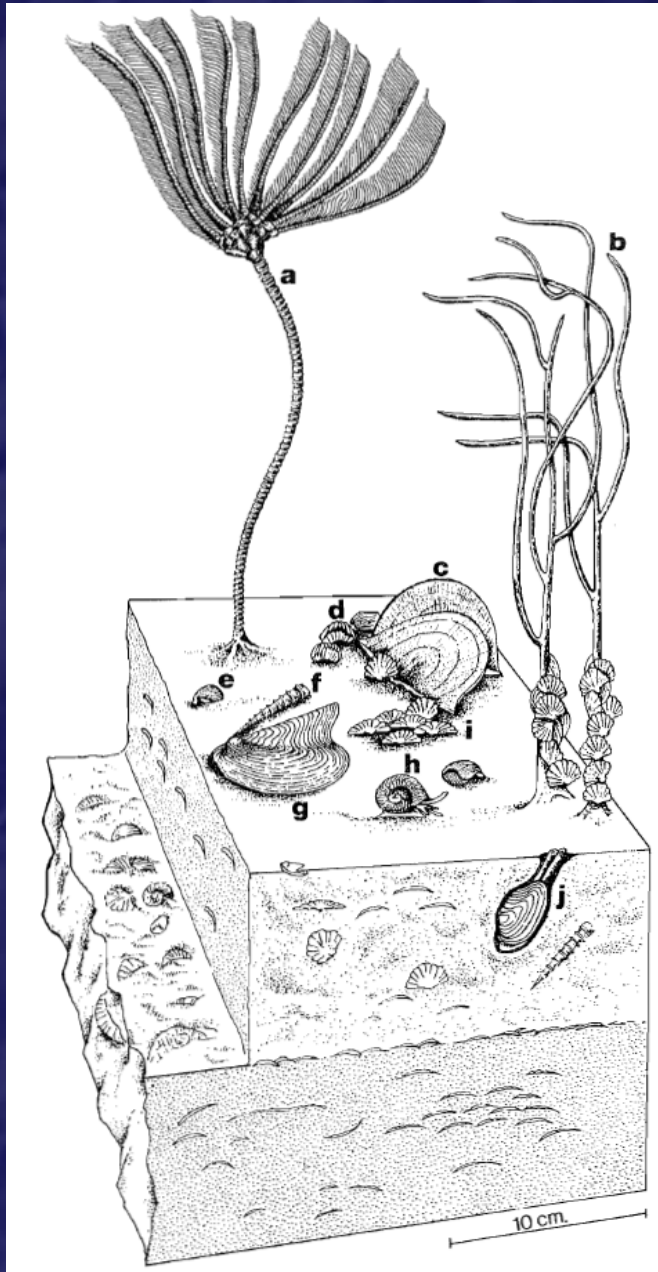


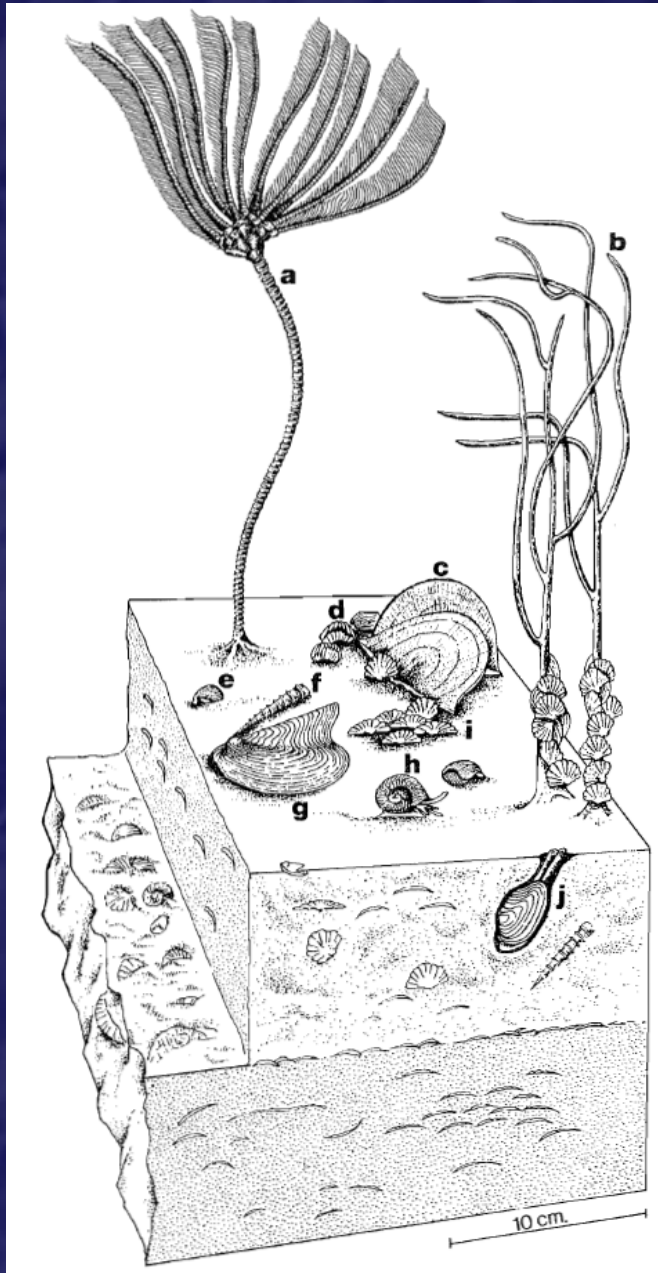
Comparative Paleoecology of Fossils and Fossil Assemblages

Andrew M. Bush
University of Connecticut

Gwen M. Daley
Winthrop University

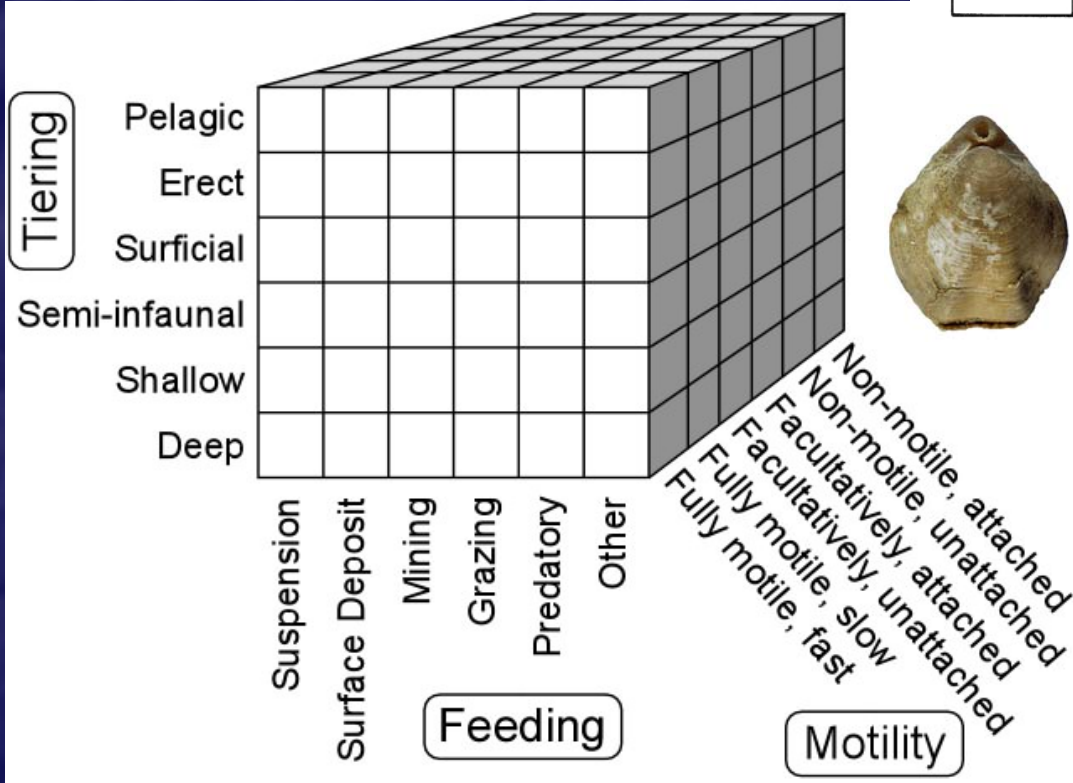
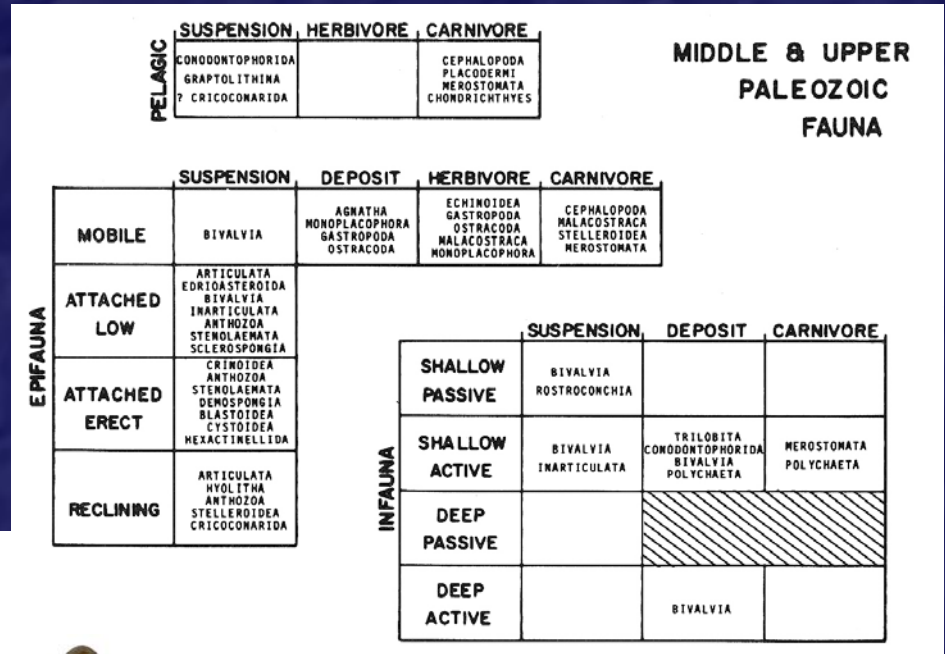


Comparative Analysis of Individual Ecology



McKerrow (1978)

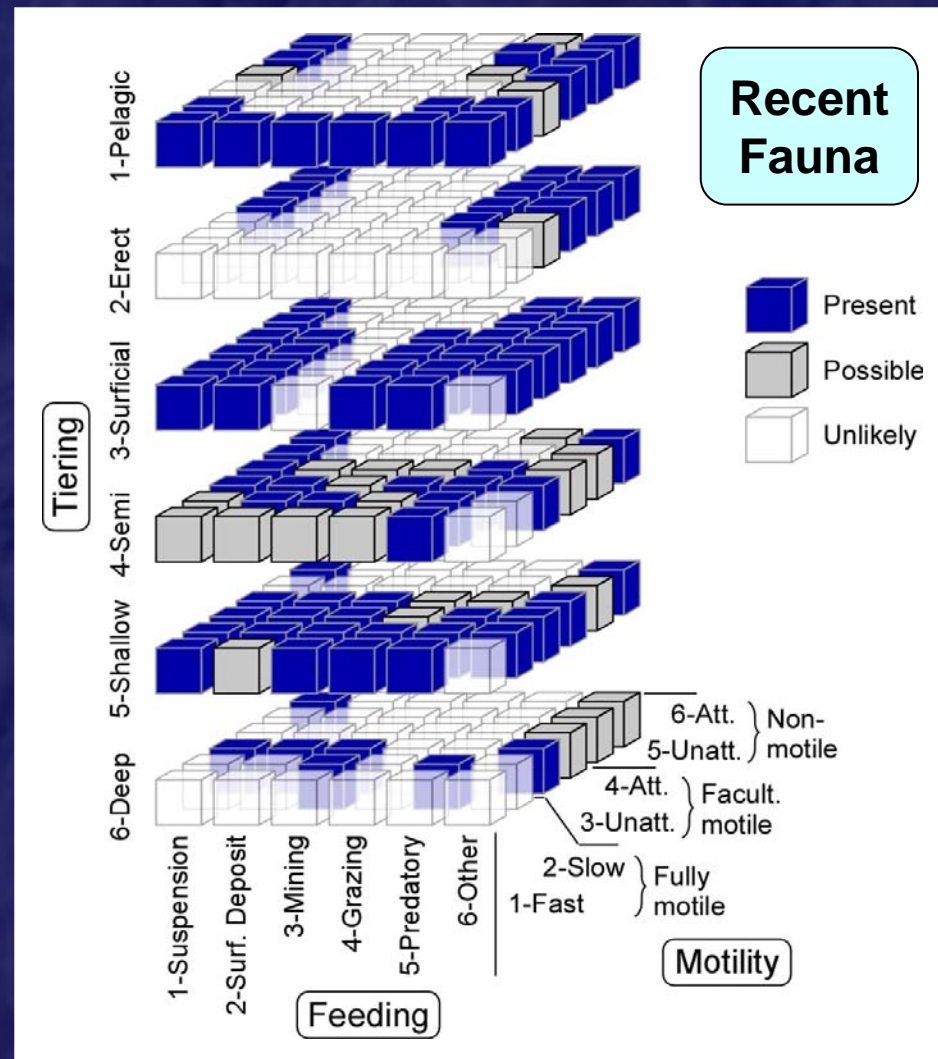
Theoretical Ecospace



Bambach (1983)

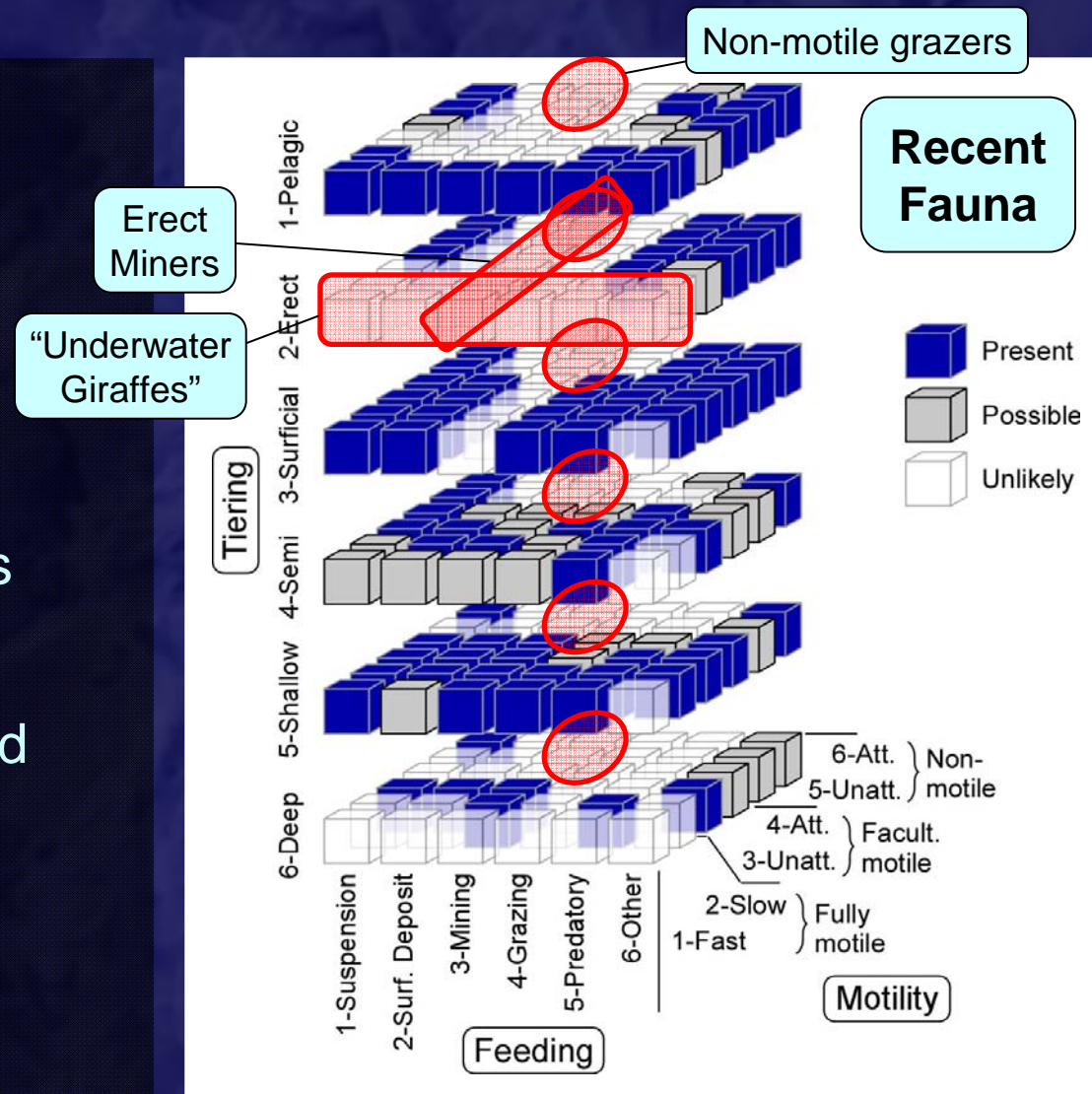
Constraints on Ecospace Use

- Total Modes of Life: 216
- Observed: 92 (43%)
- Why aren't 100% of possible modes found?
 - Evolution hasn't had time to find them?
 - Some modes unlikely due to evolutionary constraints (e.g., impossible? inefficient?)
- 98 modes are unlikely (45%)

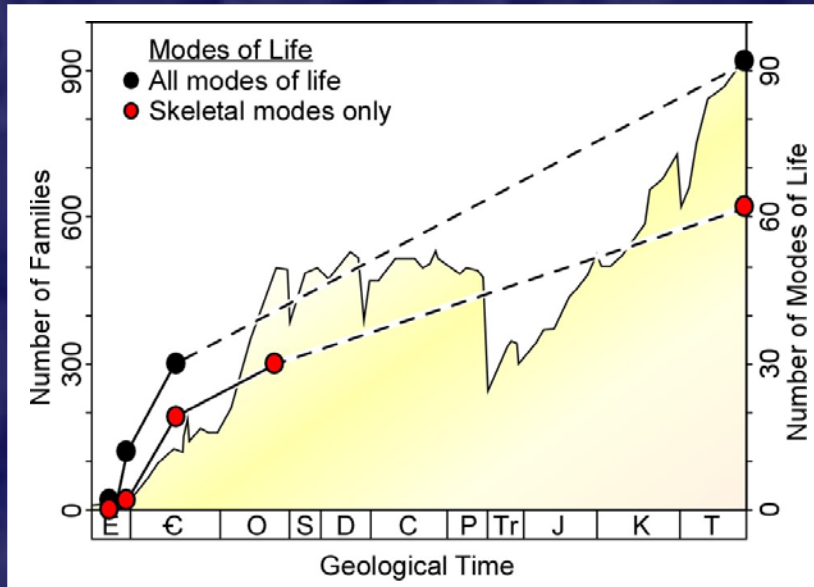


Constraints on Ecospace Use

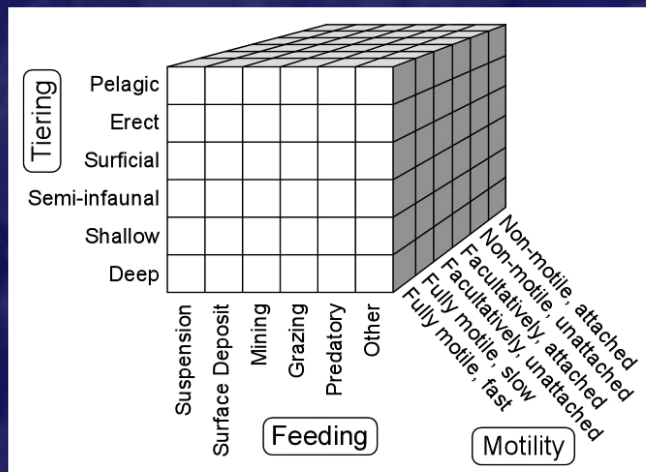
1. Either the animal or the food should be mobile so that they meet
2. The animal and the food should occur in the same tier (unless one of them travels)
3. Motility can be limited by the physical properties of the surrounding medium

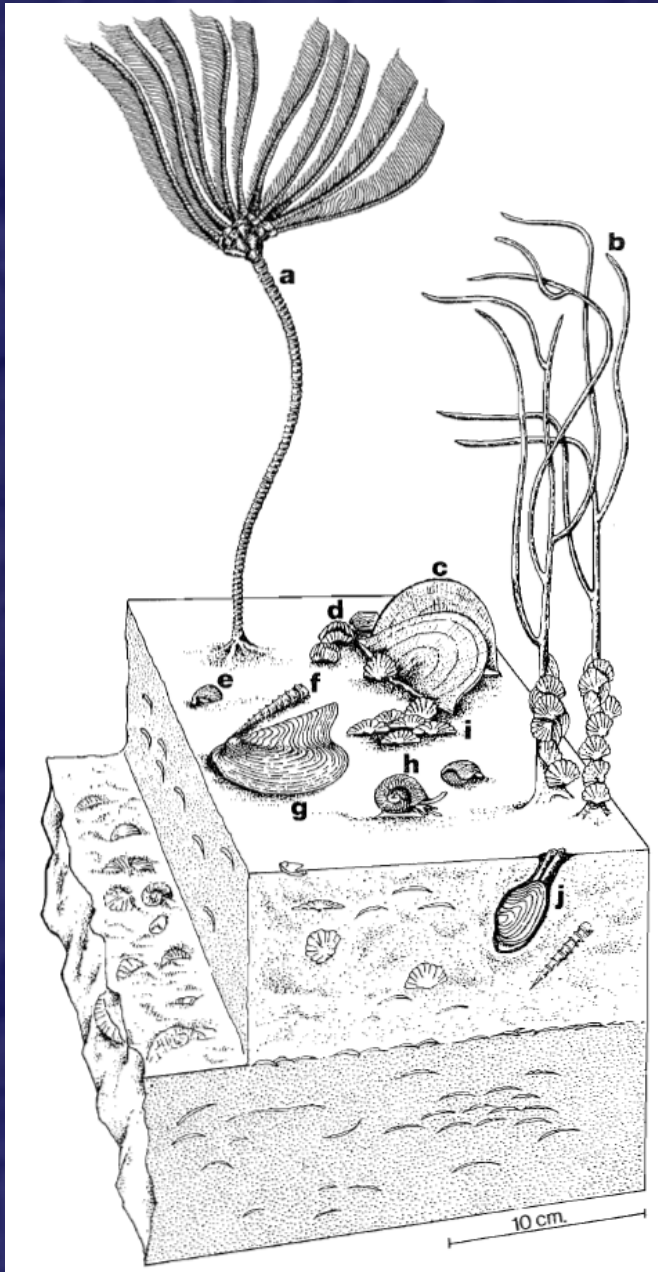


Taxonomic vs. Ecologic Diversification



- Globally & locally, taxa & ecologic lifestyles seem to have radiated together
- Which one was the causative agent?
- Analysis of local scale:
Tuesday, 9:15—Were Local Ecological Interactions Linked to Secular Trends In Alpha Diversity In Level-Bottom Marine Communities?



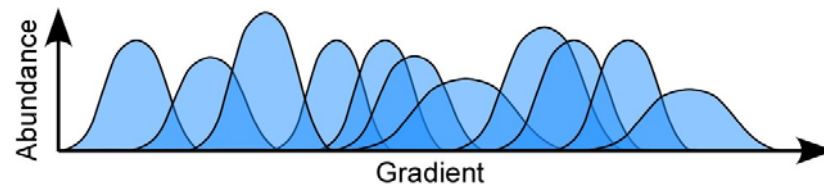


Comparative Analysis of Assemblages: Ecological Ordination

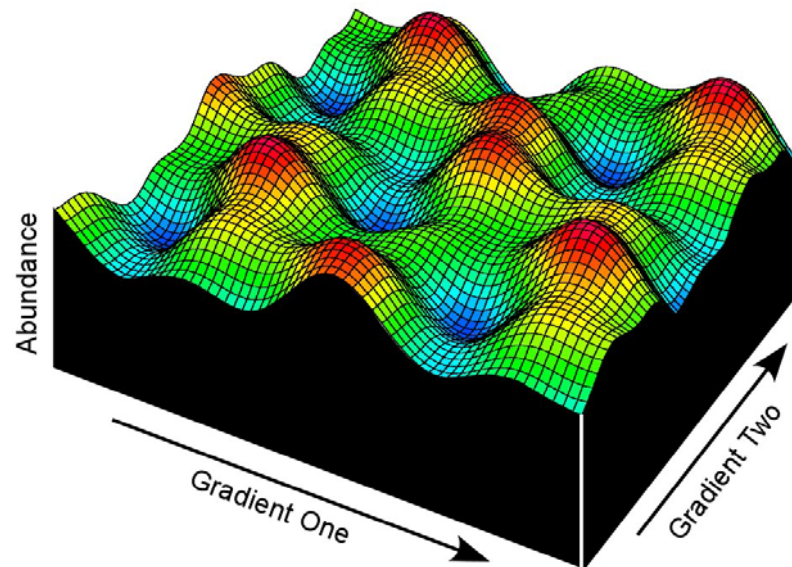
McKerrow (1978)

Types of gradients

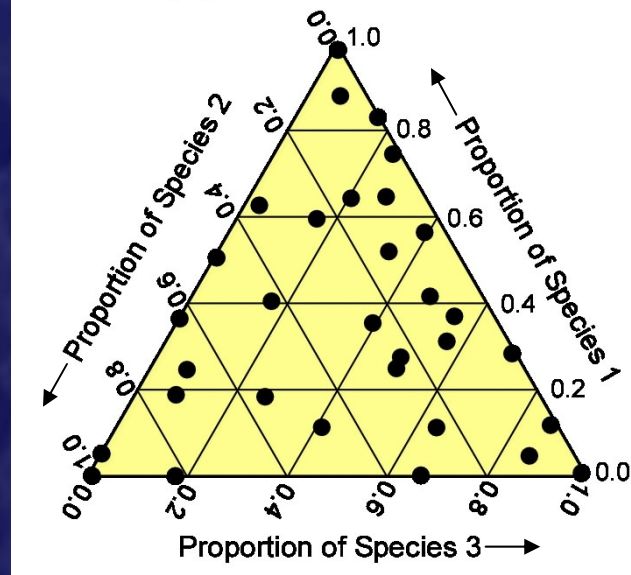
1. Species distributions—one gradient



2. Species distributions—two gradients

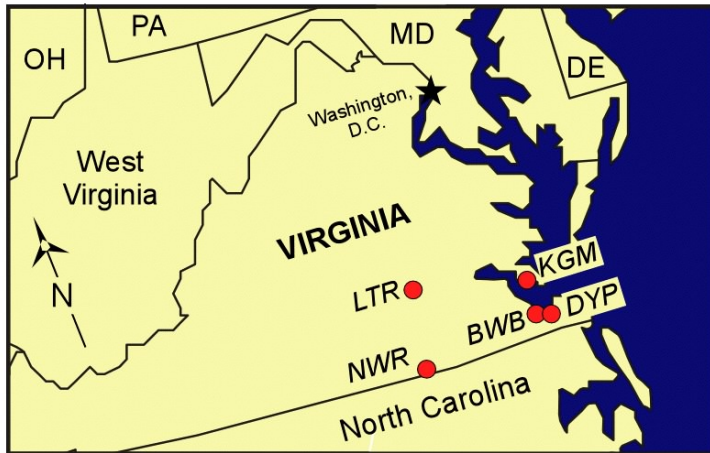


3. Ternary gradient

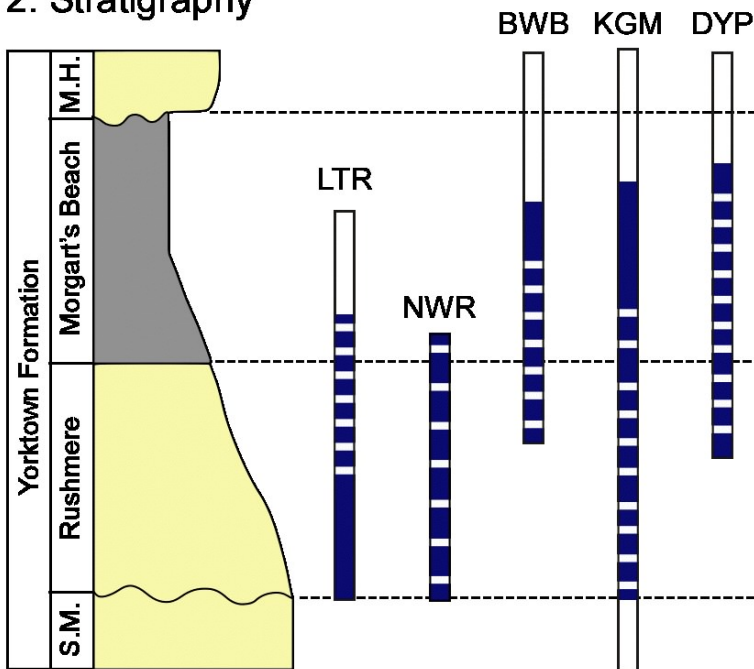


Species are not aligned
along a gradient

1. Localities



2. Stratigraphy

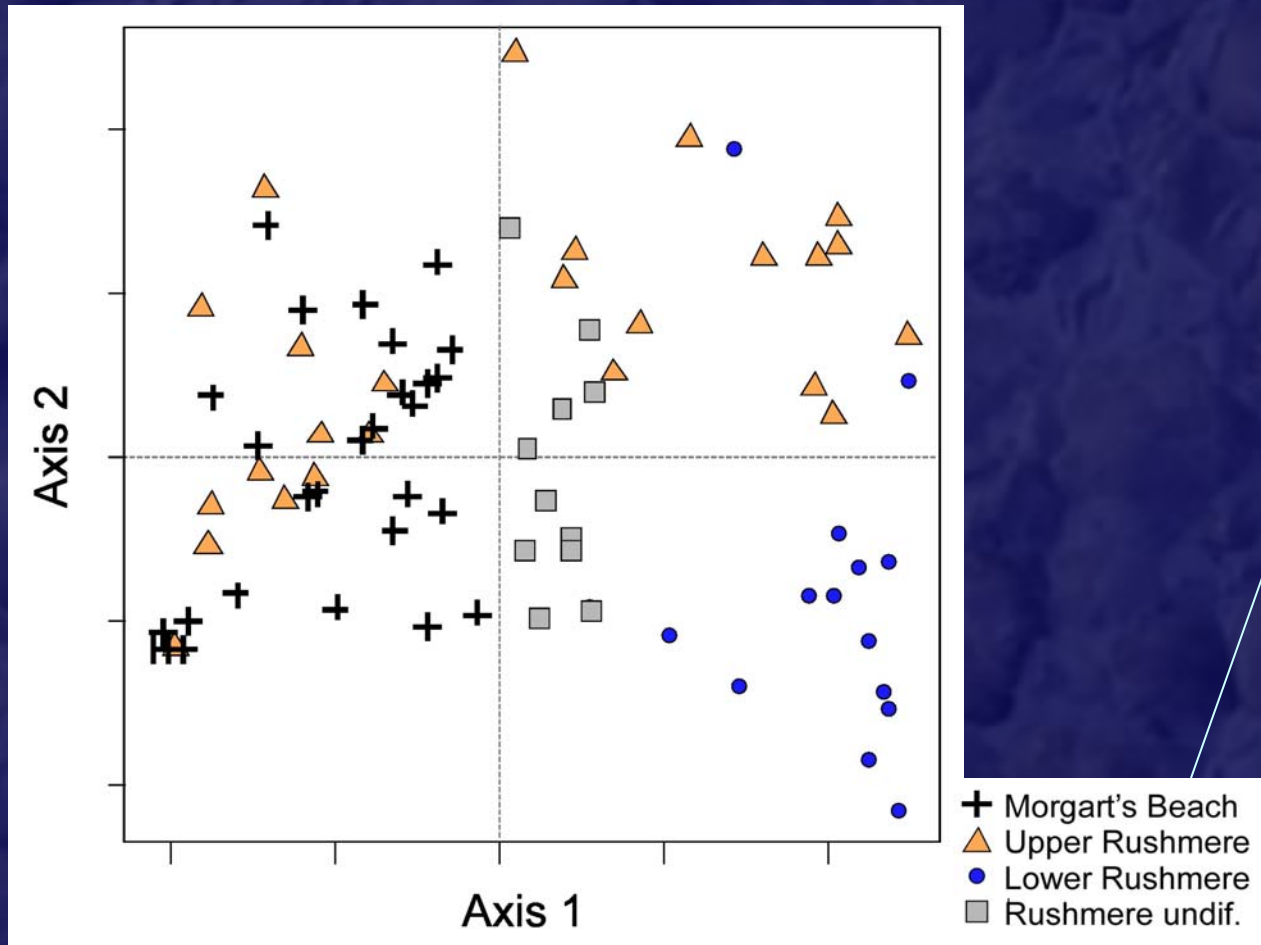


Example: Yorktown Formation

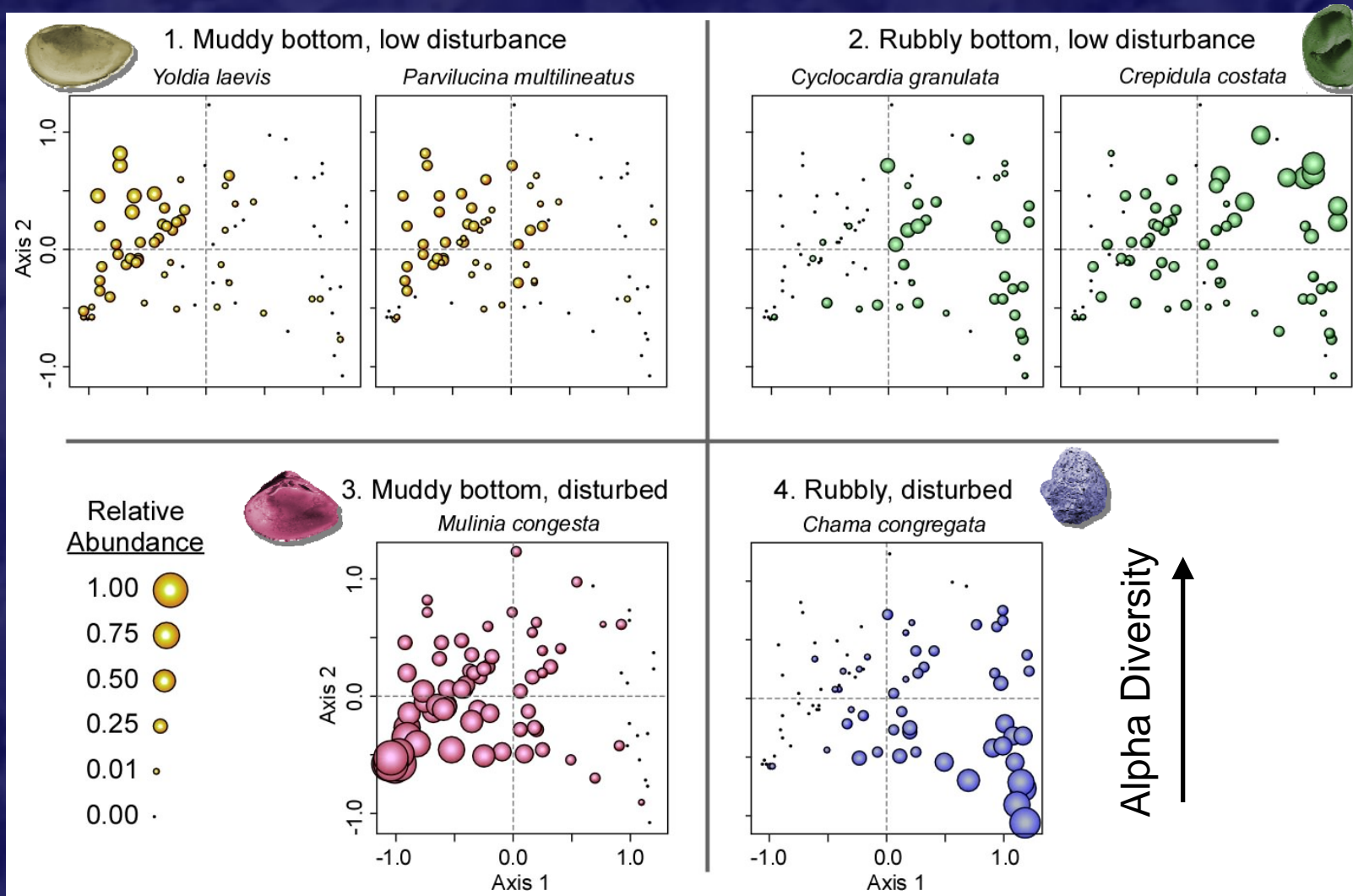
- Pliocene, shallow water
- Preserves a transition from a rubbly/sandy substrate to a muddy one



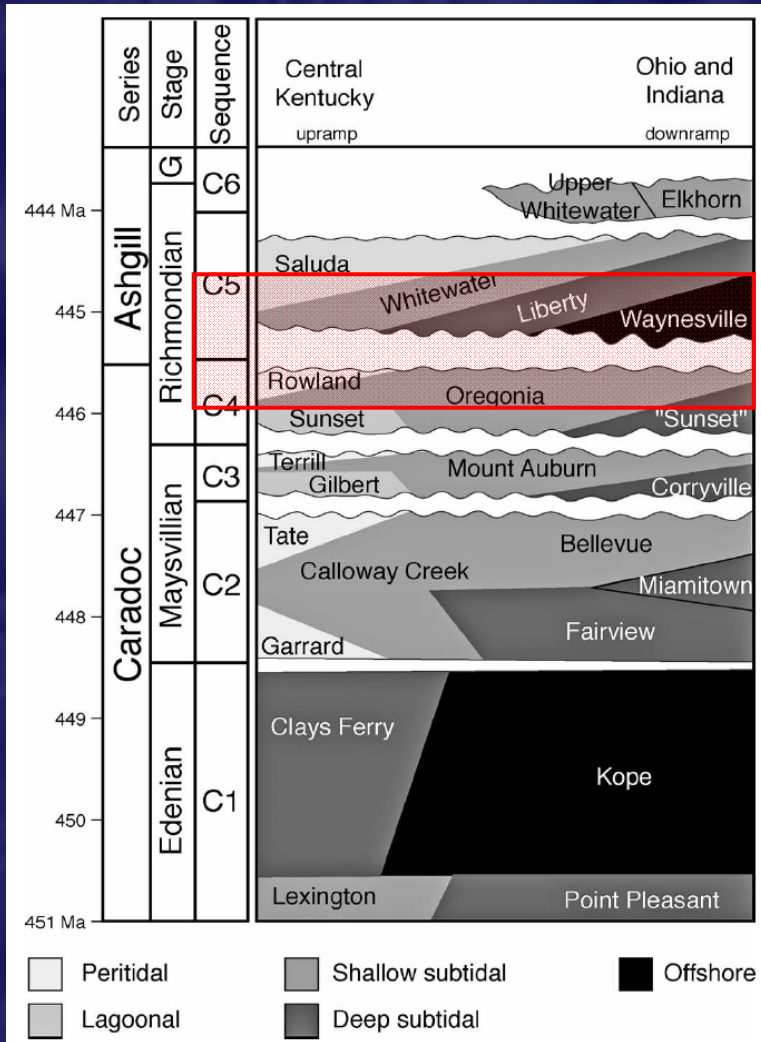
NMDS of Yorktown Fm.



NMDS of Yorktown Fm.



Gradients through Time (Millions of years)

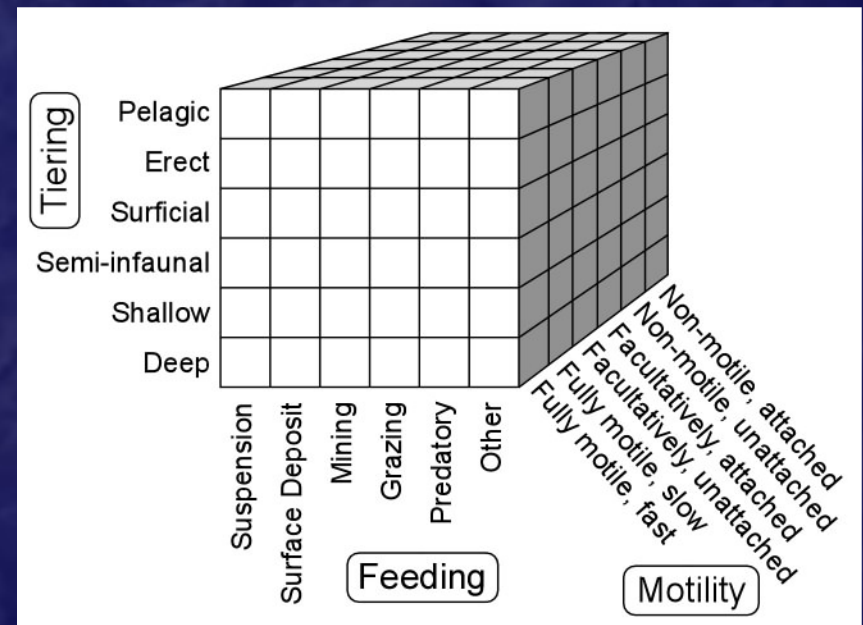


- How did extinctions, originations, migrations, and environmental changes affect gradient structure (i.e., the ways in which species assembled)?

Gradients through Time

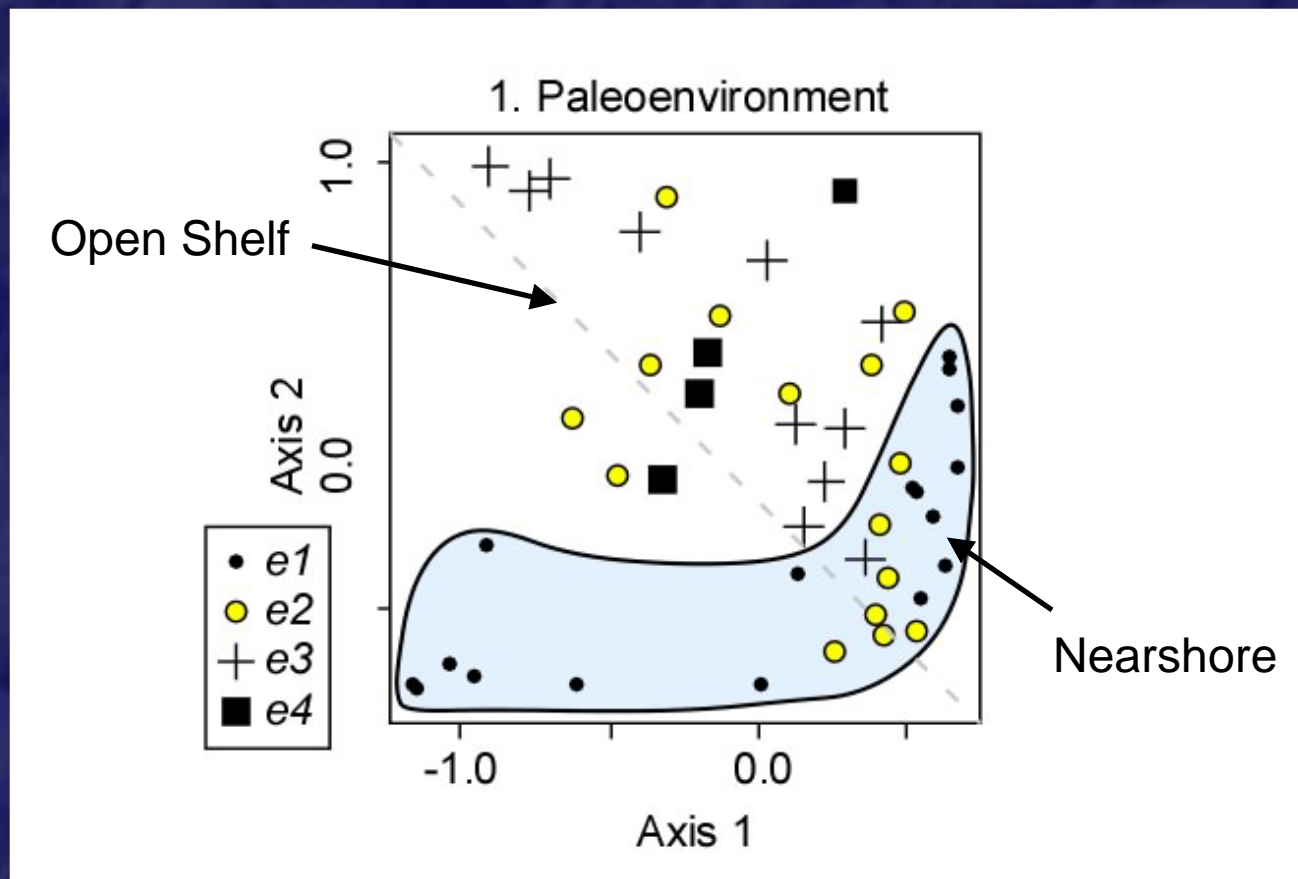
(Hundreds of millions of years)

- Many changes through time in how organisms related to the environment (tiering, motility, etc.)
- Were there changes in how environmental parameters controlled species distributions?
- i.e, Did organisms form similar taxonomic/ecologic gradients in response to similar environmental gradients?



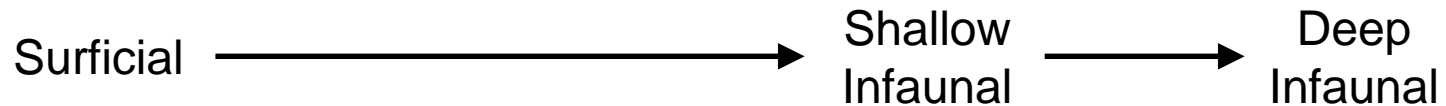
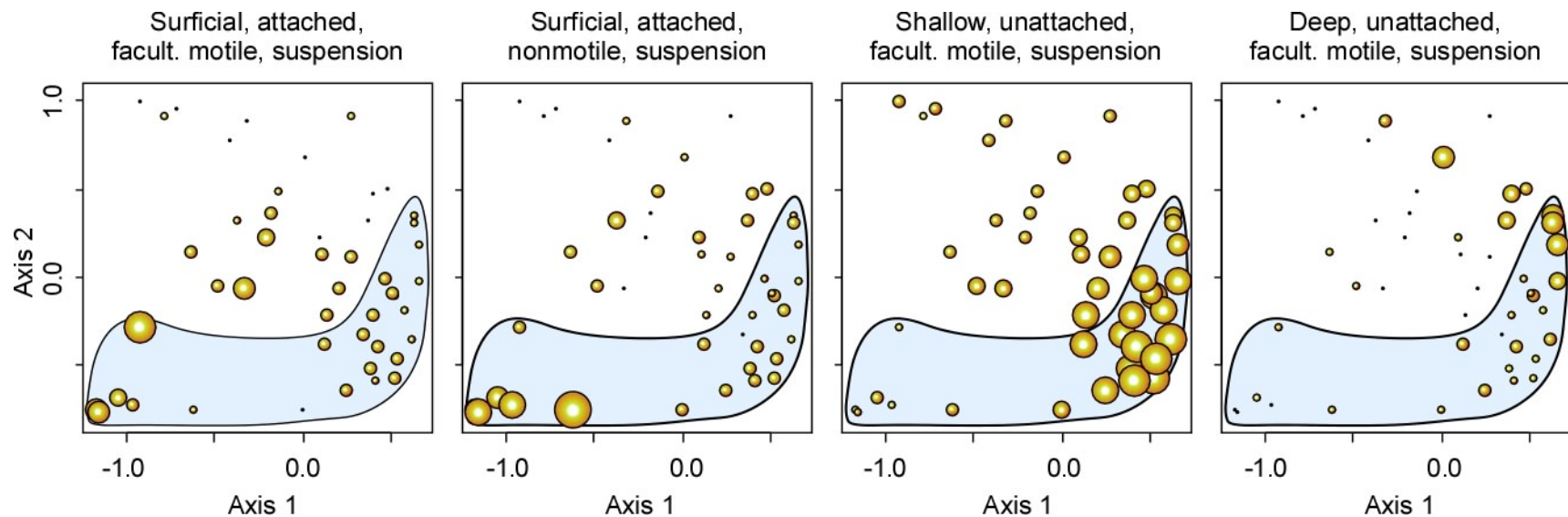
Gradient Analysis: CZ modes of life

Onshore-Offshore Gradient

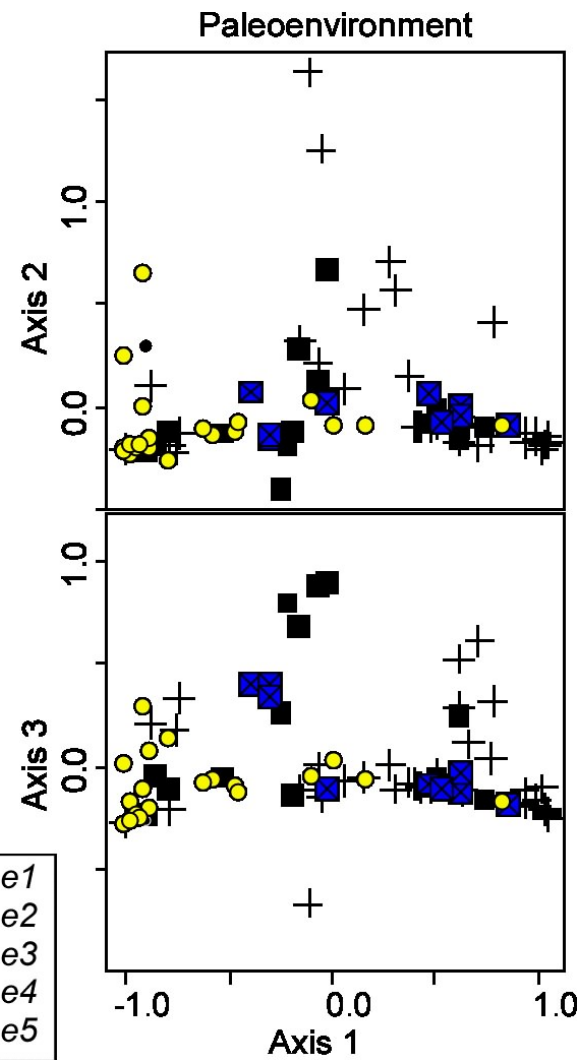
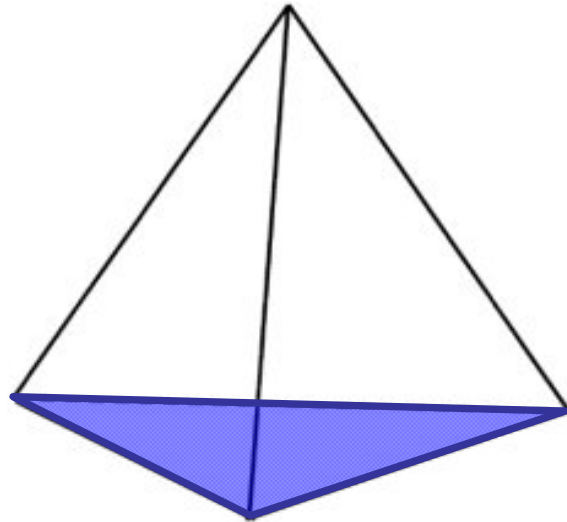


Gradient Analysis: CZ modes of life

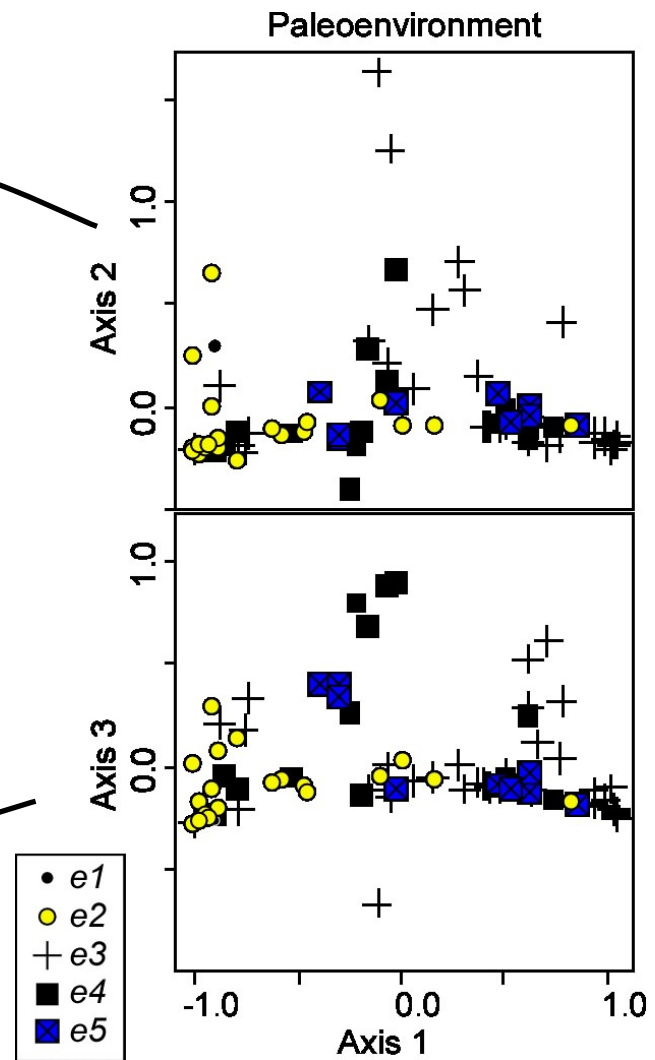
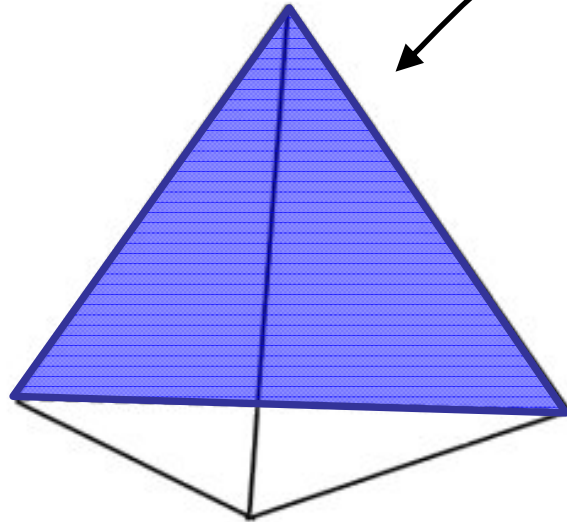
Tiering Gradient



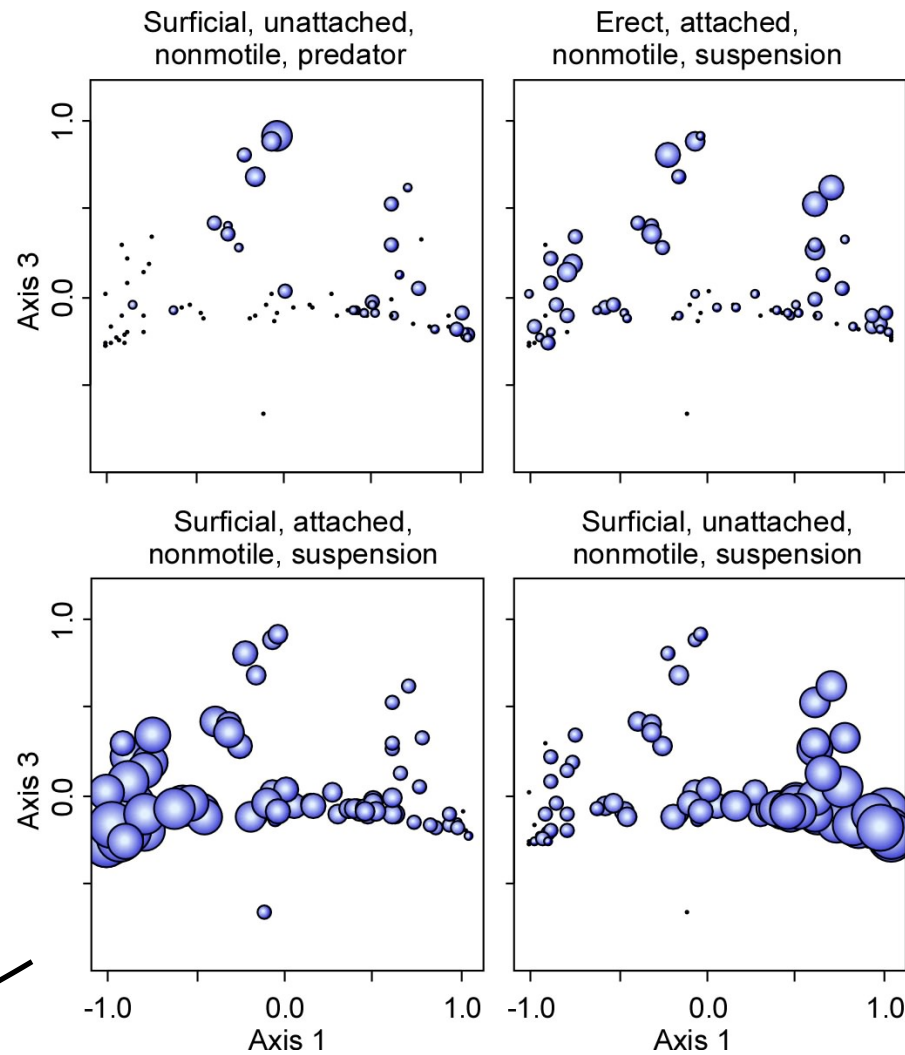
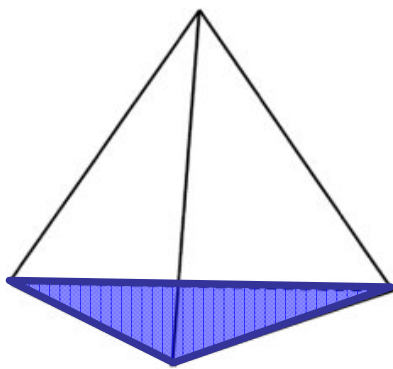
Gradient Analysis: PZ modes of life



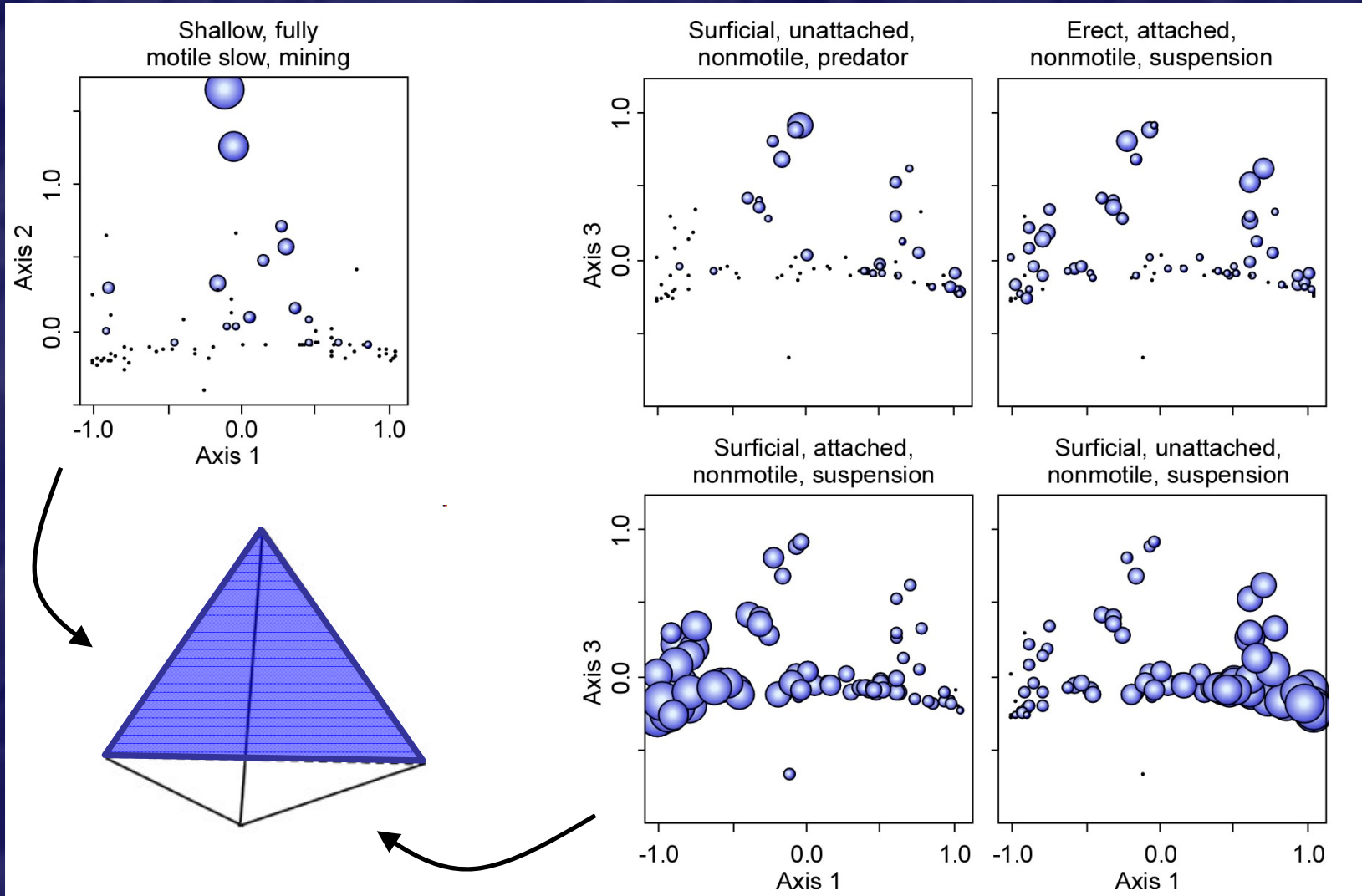
Gradient Analysis: PZ modes of life



Gradient Analysis: PZ modes of life



Gradient Analysis: PZ modes of life

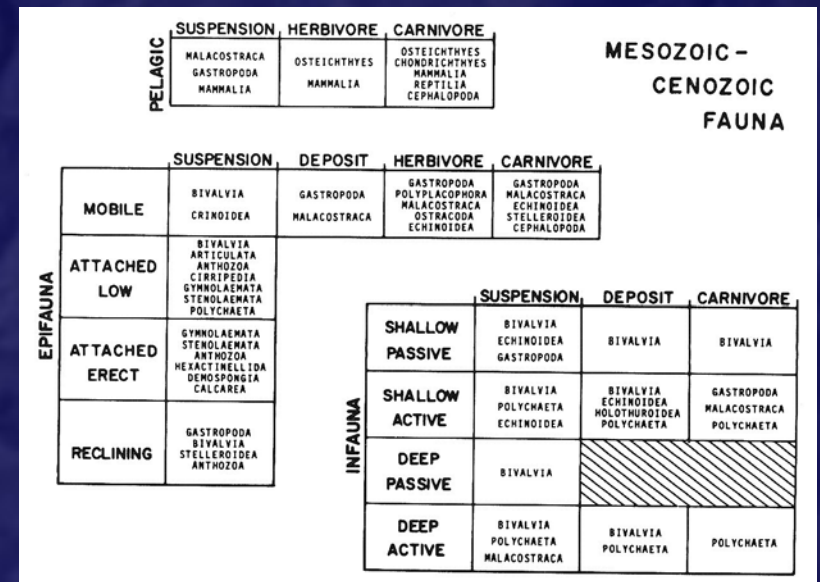
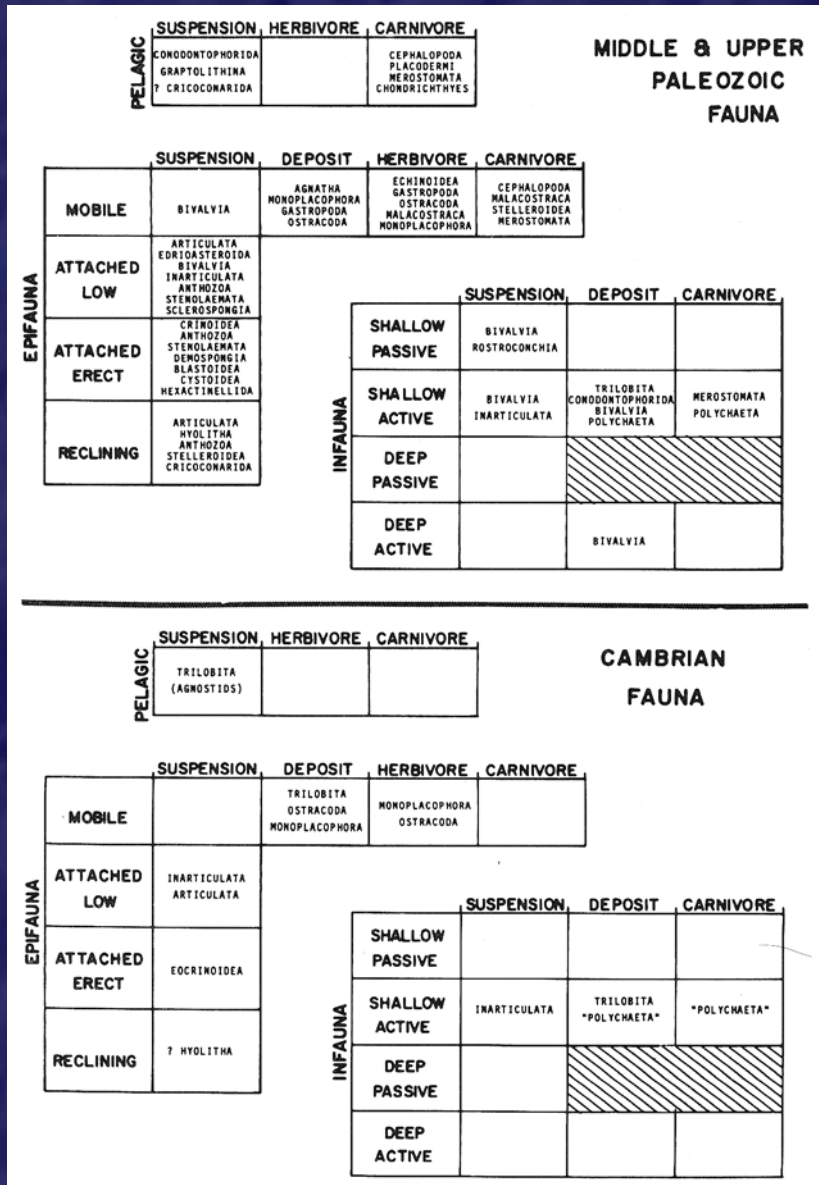


Why does the PZ appear more random than the CZ? Three possibilities:

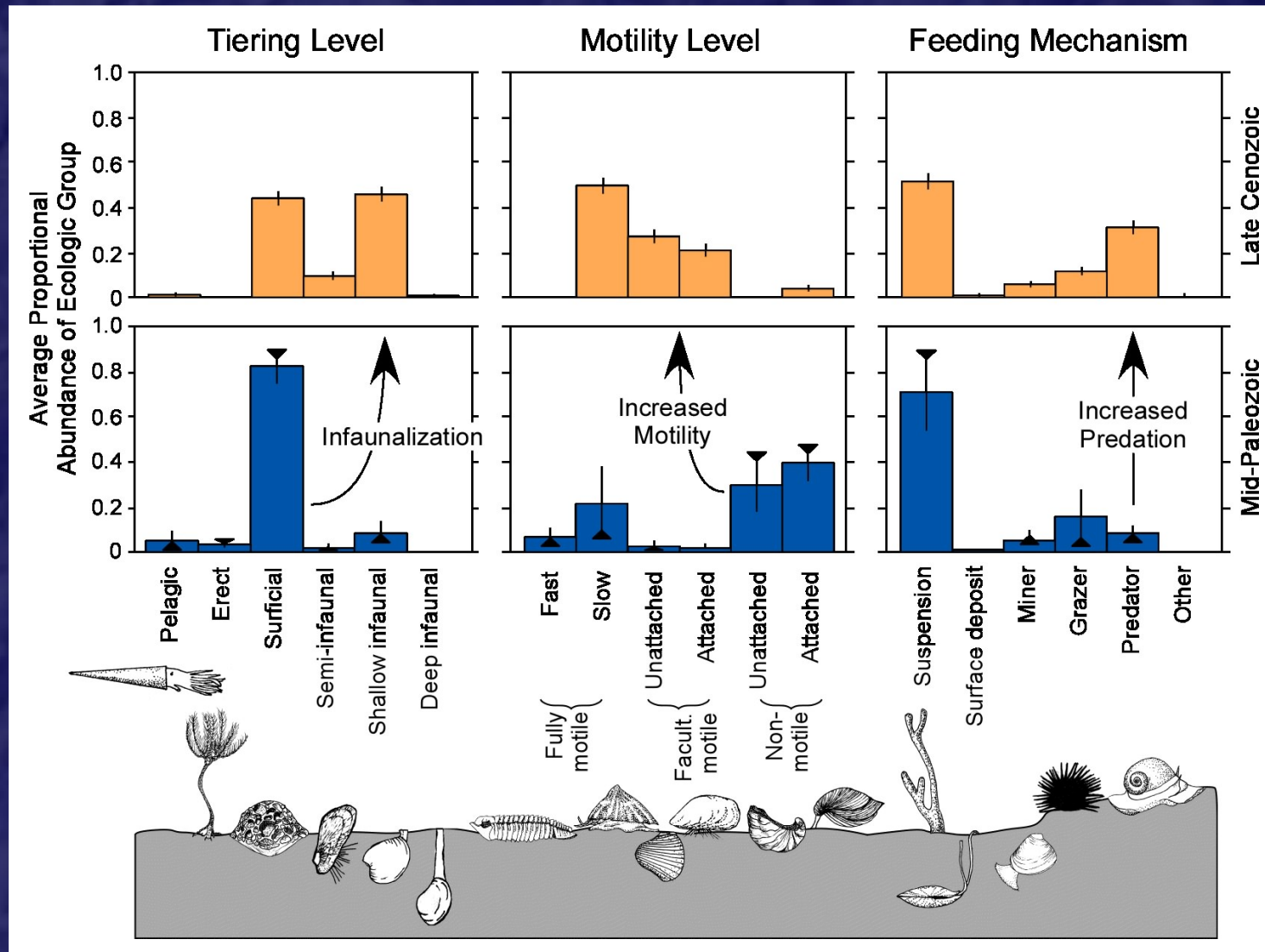
1. Fossil assemblages were more randomly structured with respect to ecology in the Paleozoic
2. The environmental parameters that structured Paleozoic fossil assemblages were more randomly distributed in space
 - Habitats dominated by different modes of life were themselves not organized along regular gradients
3. Linear gradients are more prevalent onshore, and these habitats were more intensively sampled in the Cenozoic data set



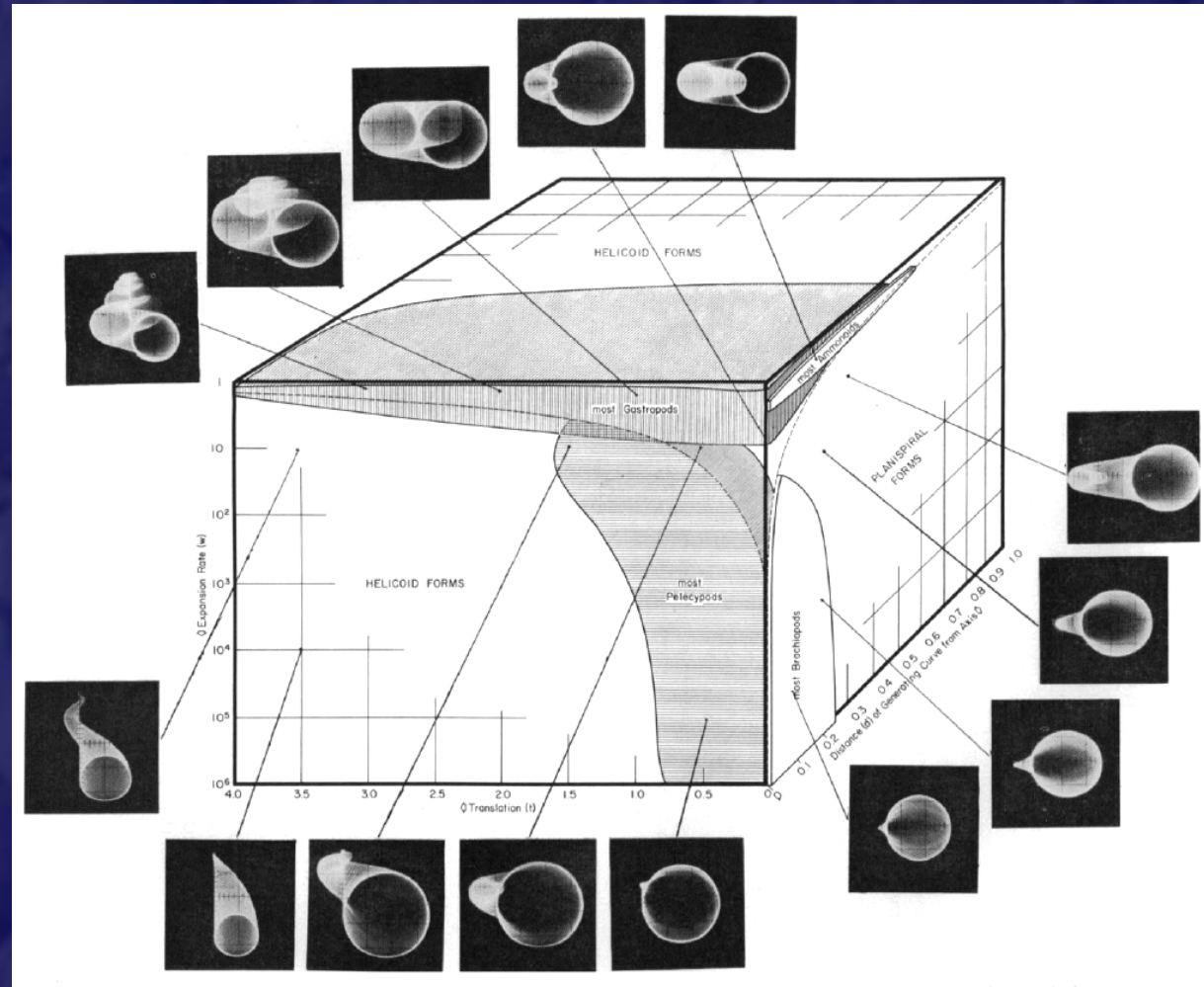
Deleted Slides



Quantitative Changes in Ecospace Use



Raup's Theoretical Morphospace for Spiral Growth



Yorktown Formation



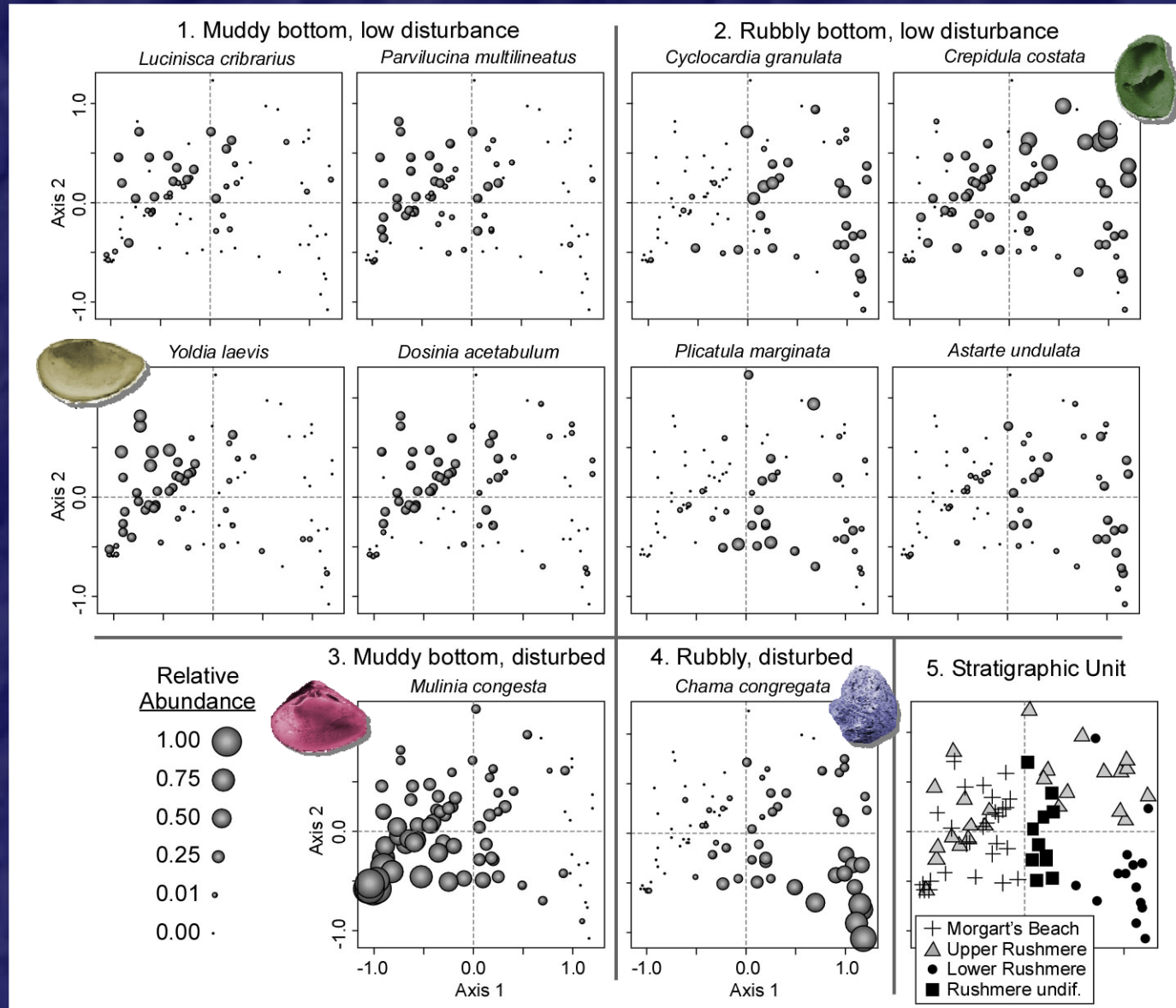
Burwell's Bay

Transition from the Rushmere Member (sandy-shelly) to the Morgart's Beach Member (muddy)



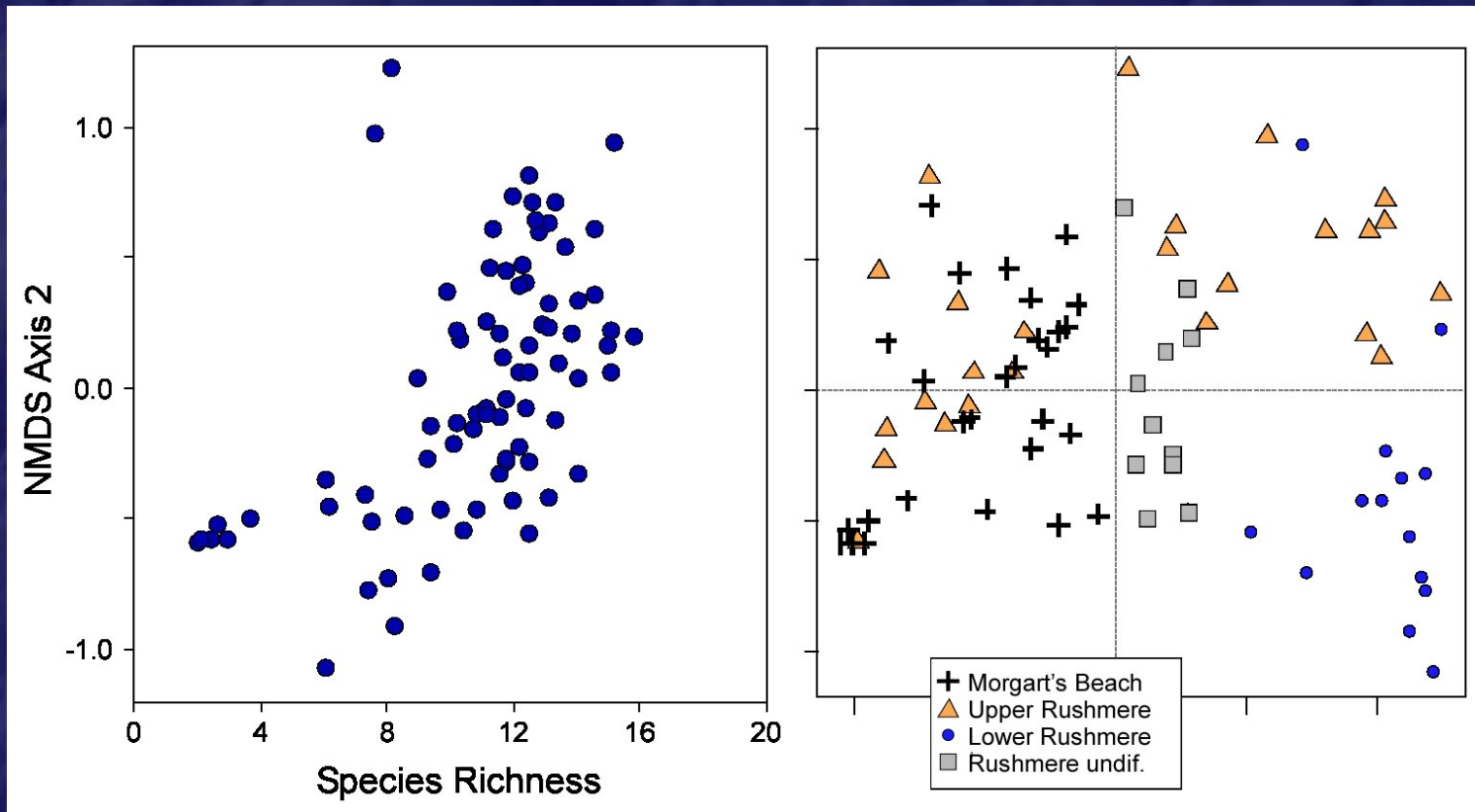
Day's Point

NMDS of Yorktown Fm.

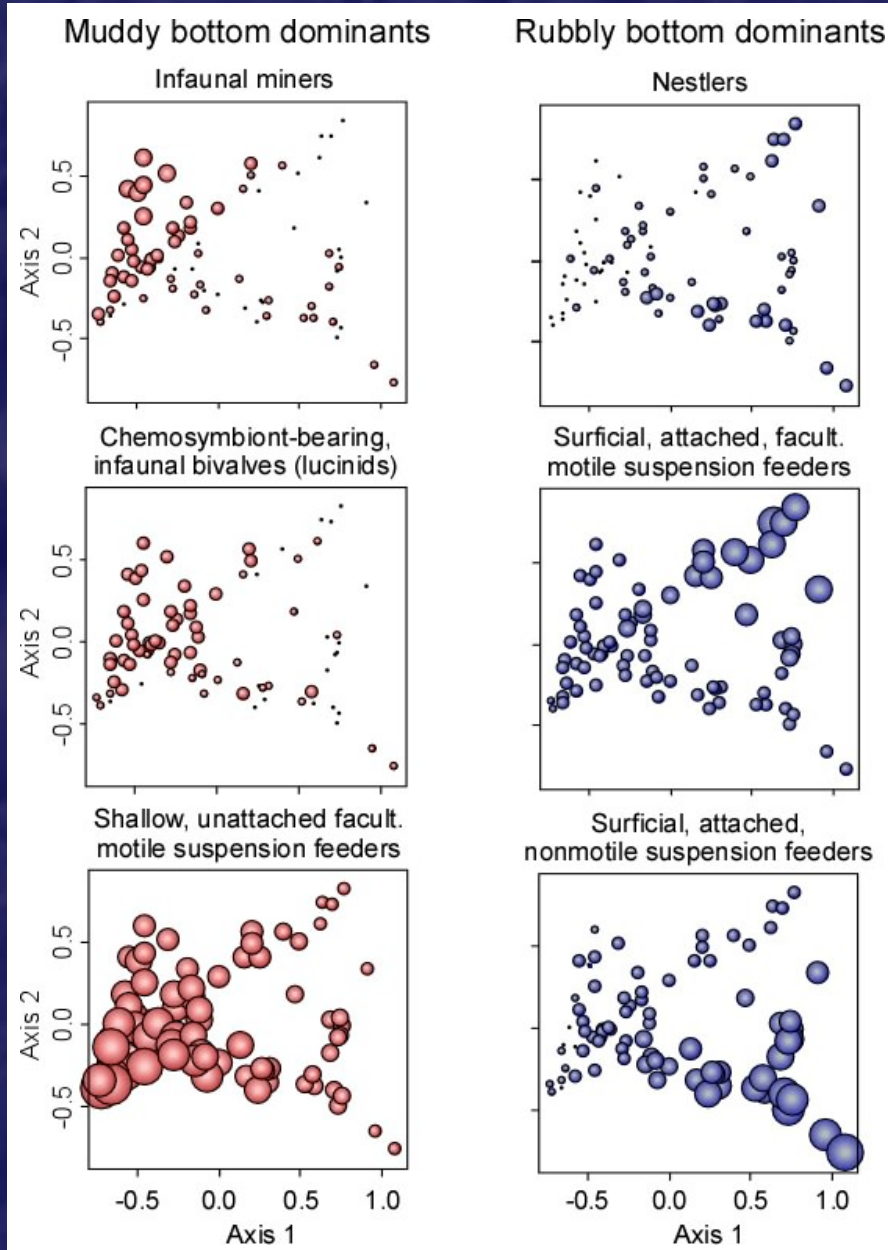


NMDS of Yorktown Fm.

Sample Richness (30 specimens)



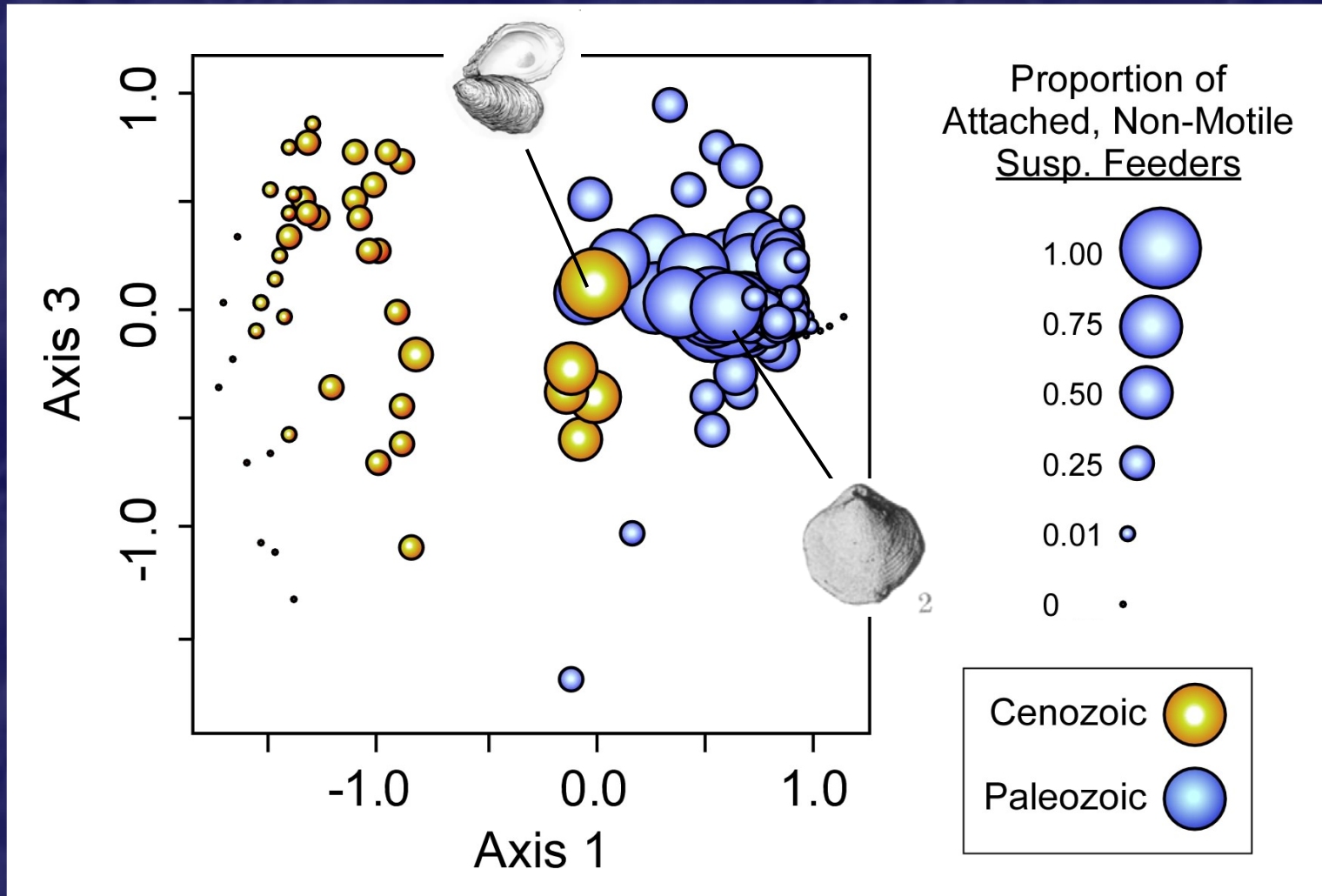
Ordination based on ecologic guilds



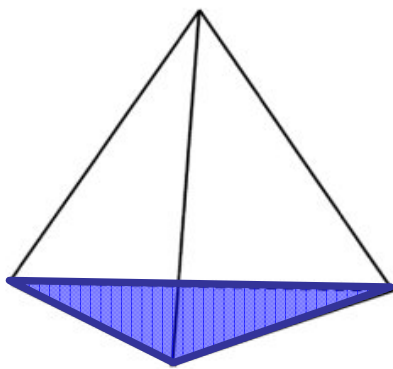
- Similar to ordination based on species abundances
- Main gradient: infauna-dominated to epifauna-dominated assemblages

Gradient Analysis: CZ vs. PZ

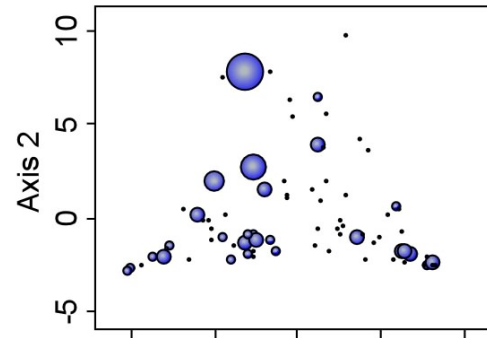
based on relative abundances of modes of life



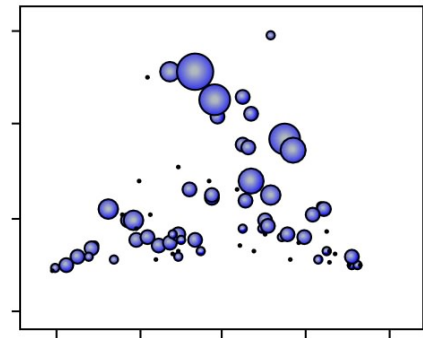
PZ modes of life randomized



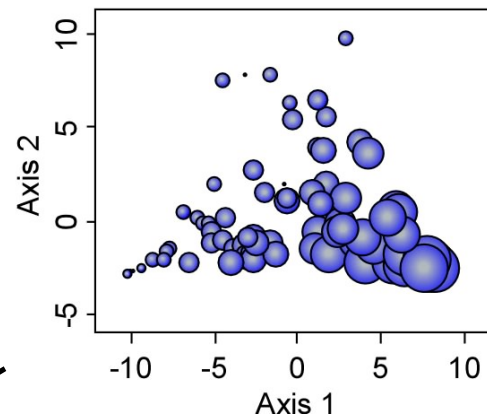
Surficial, unattached,
nonmotile, predator



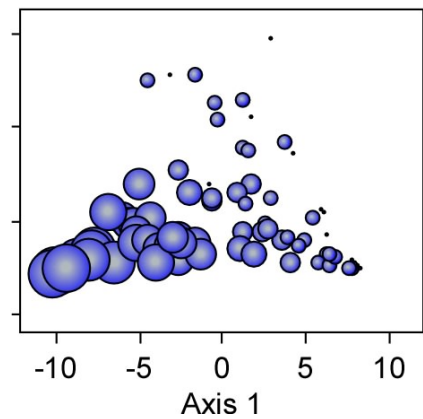
Erect, attached,
nonmotile, suspension



Surficial, attached,
nonmotile, suspension



Surficial, unattached,
nonmotile, suspension



PZ modes of life randomized

