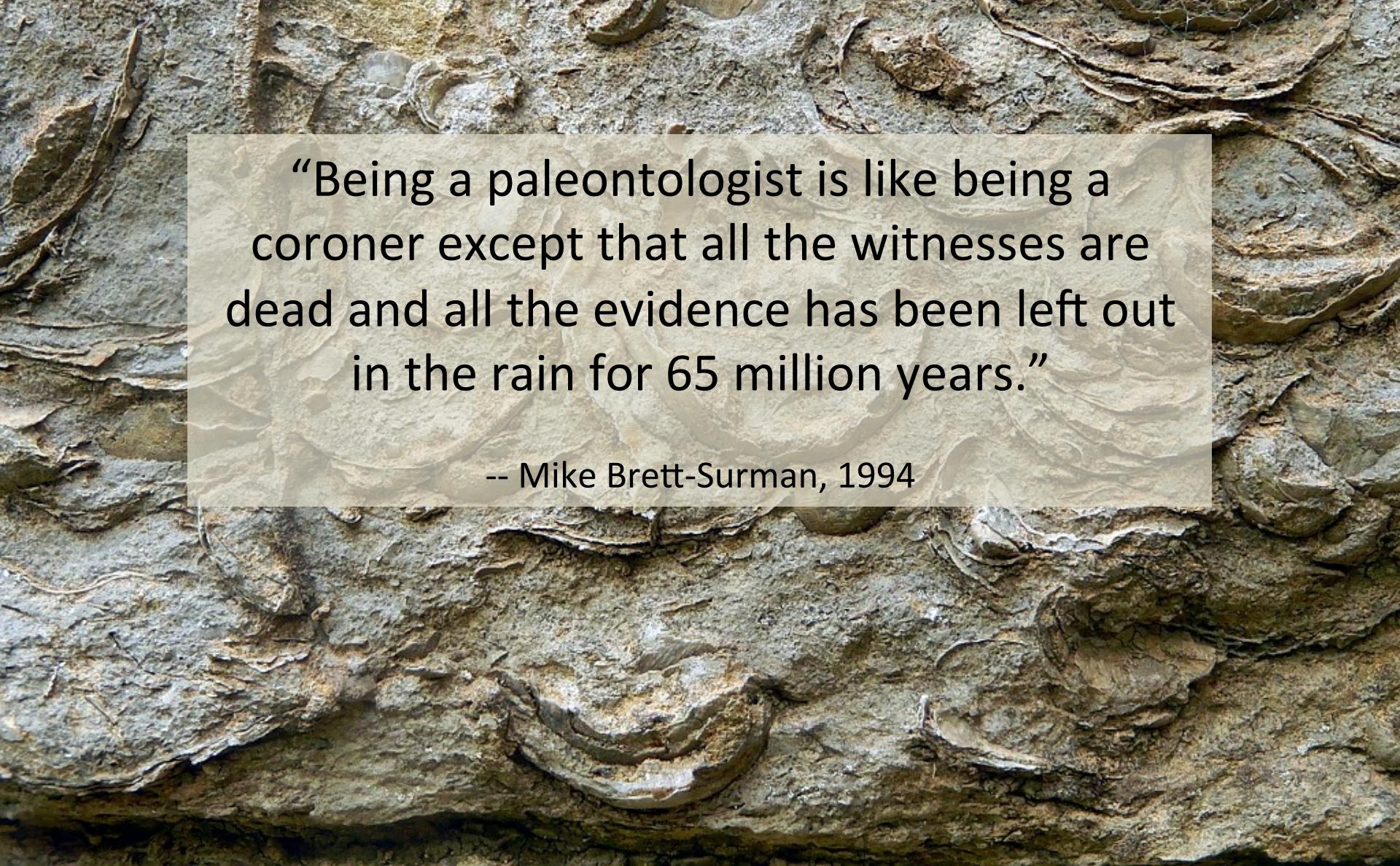


From Information Loss to Information Gain:

How taphonomy informs ancient and
modern ecological processes

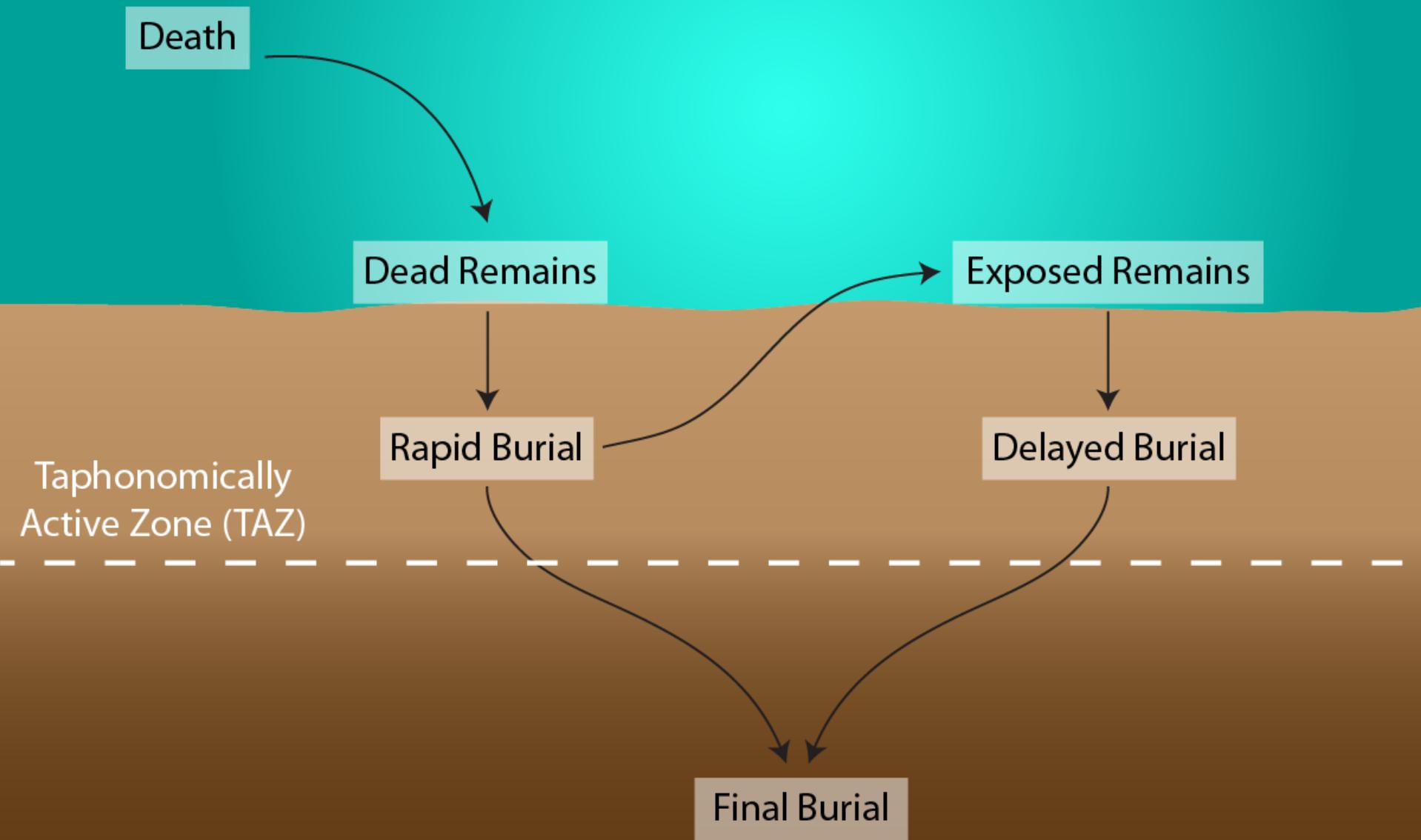
Taphonomy



“Being a paleontologist is like being a coroner except that all the witnesses are dead and all the evidence has been left out in the rain for 65 million years.”

-- Mike Brett-Surman, 1994

Taphonomy

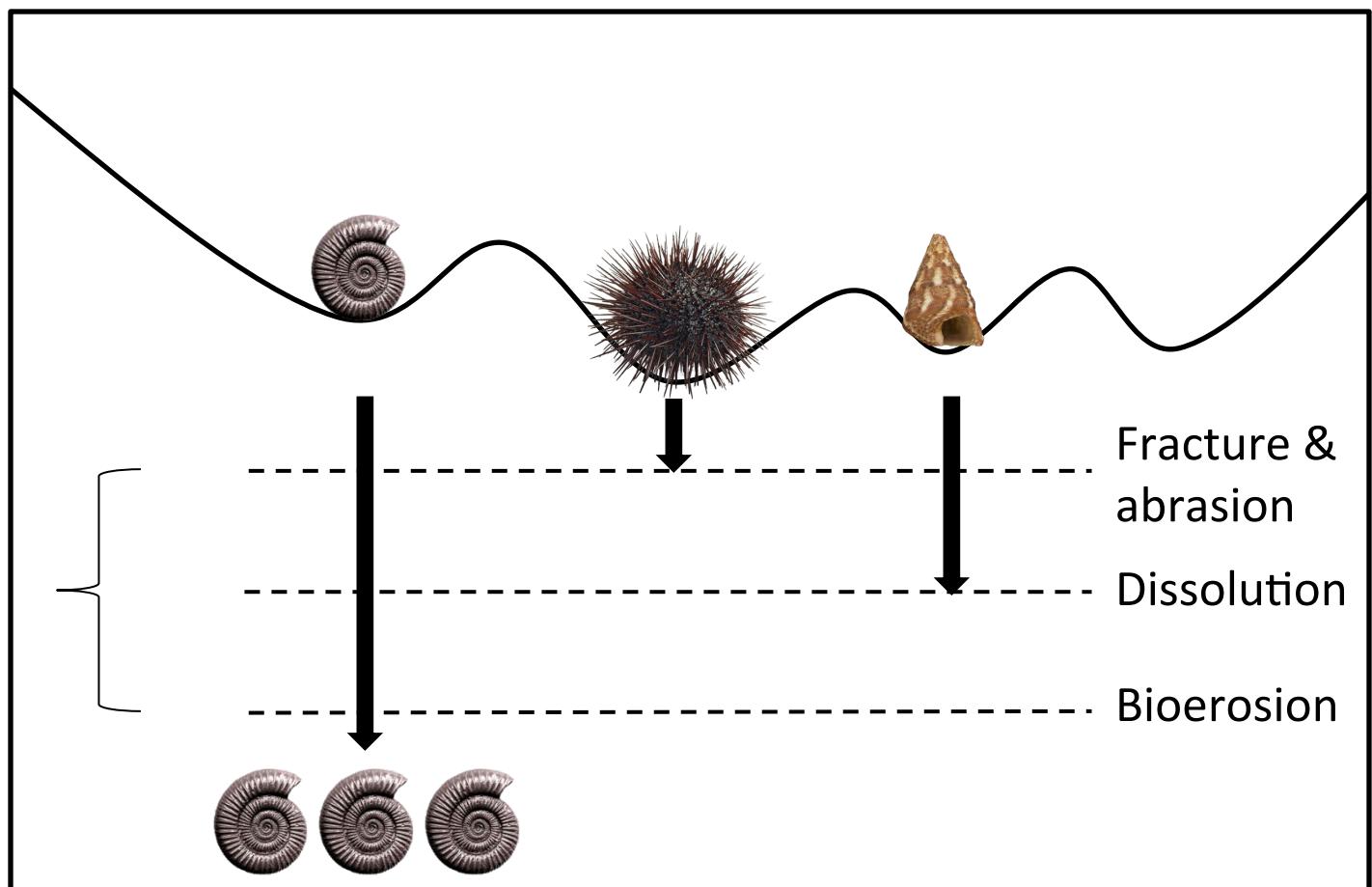


What information is lost through taphonomic processes?



Selective Preservation

1. Life assemblage
2. Death and supply of skeletons
3. Taphonomic filters
4. Death assemblage



Modified from Kidwell and Bosence, 1991

Postmortem Transportation

GEOGRAPHICAL DISTRIBUTION OF NAUTILUS



Living distribution



Drifted shells outside living distribution



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Marshall
Islands



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Horizontal shell



Encrusted shell

modified from Maeda and Seilacher 1996

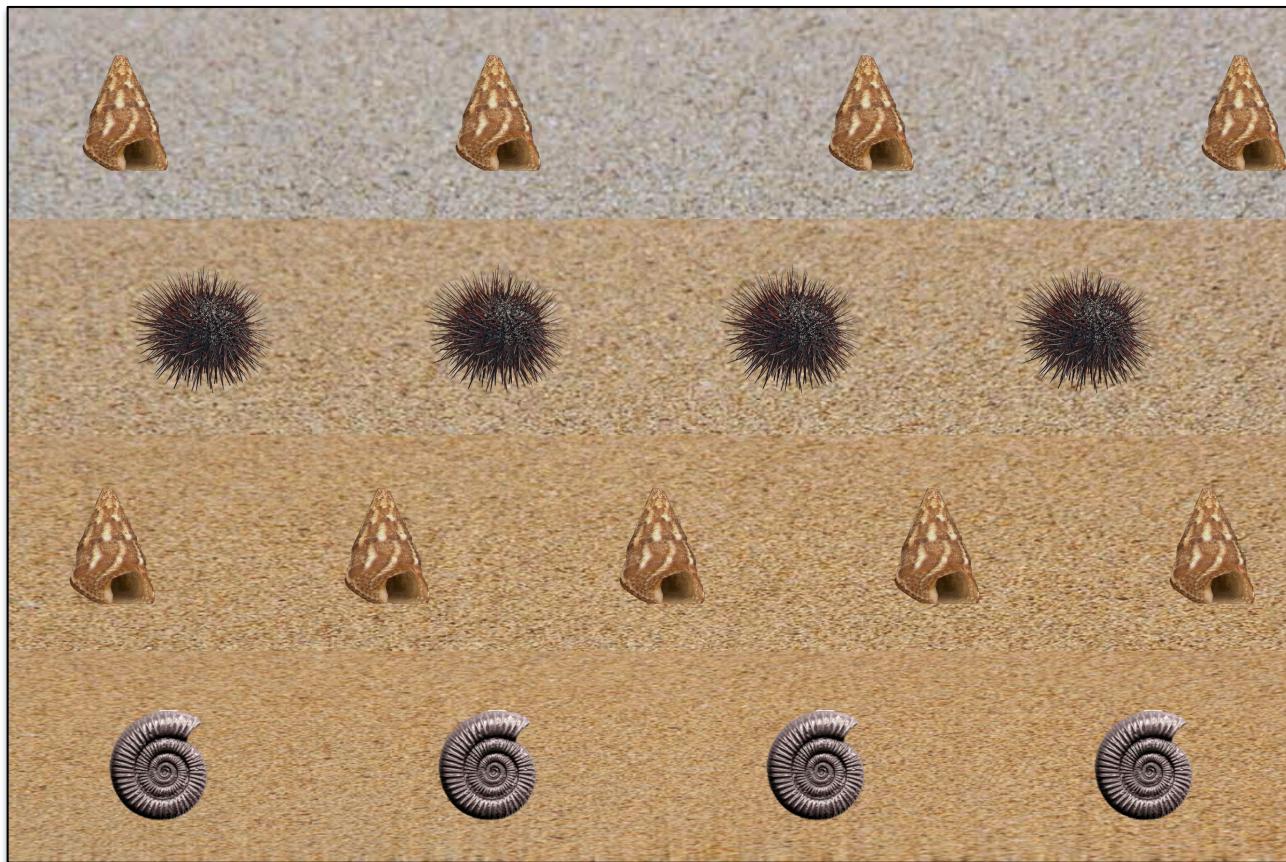
Postmortem Transportation



Three identical sets of 40 marked bones were placed in different positions on and around Graveyard Bar in April, 1975 , before the spring floods. This view shows sets "B" and "C." Larger bones were laid out upstream of the smaller ones to avoid Interference during initial transport.

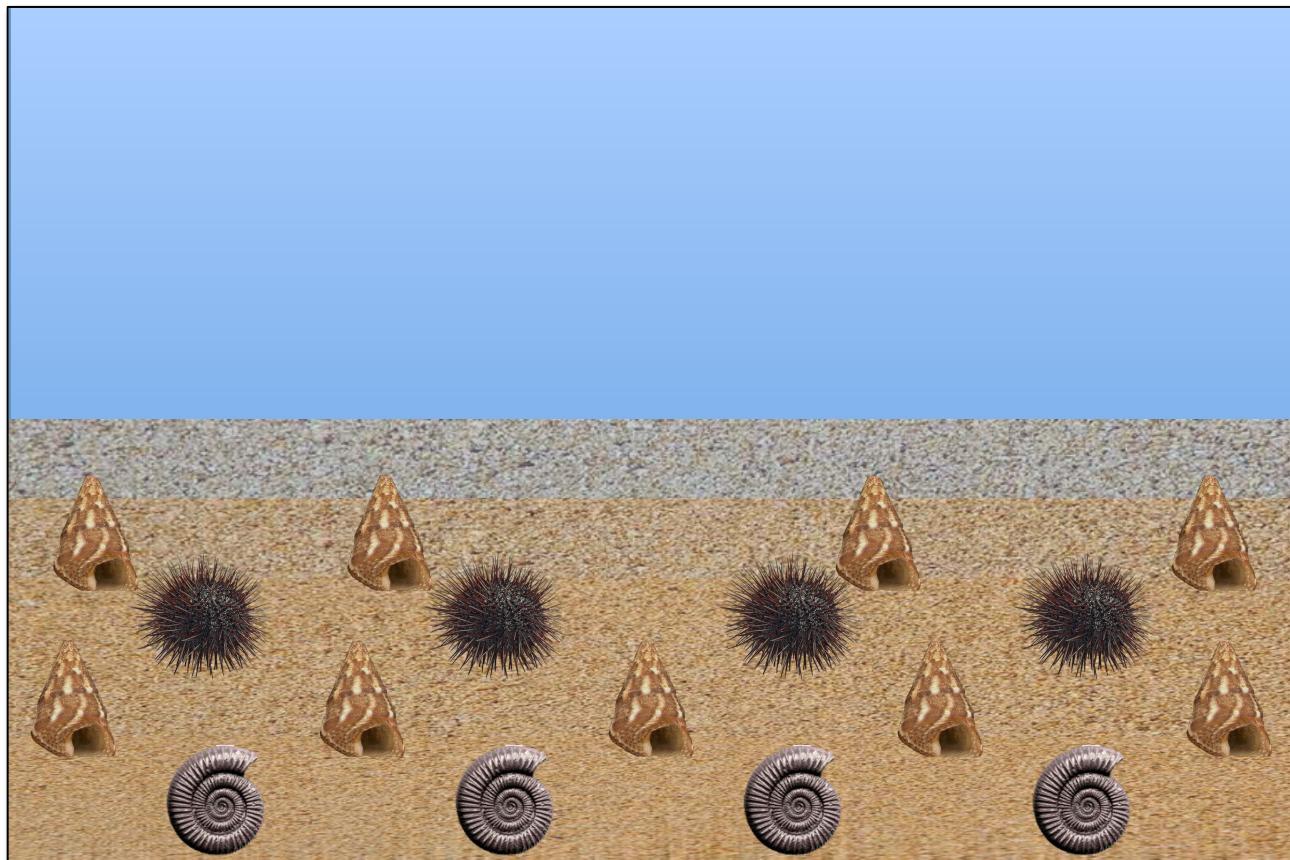
Time-Averaging

Shell Production = Sedimentation Rate



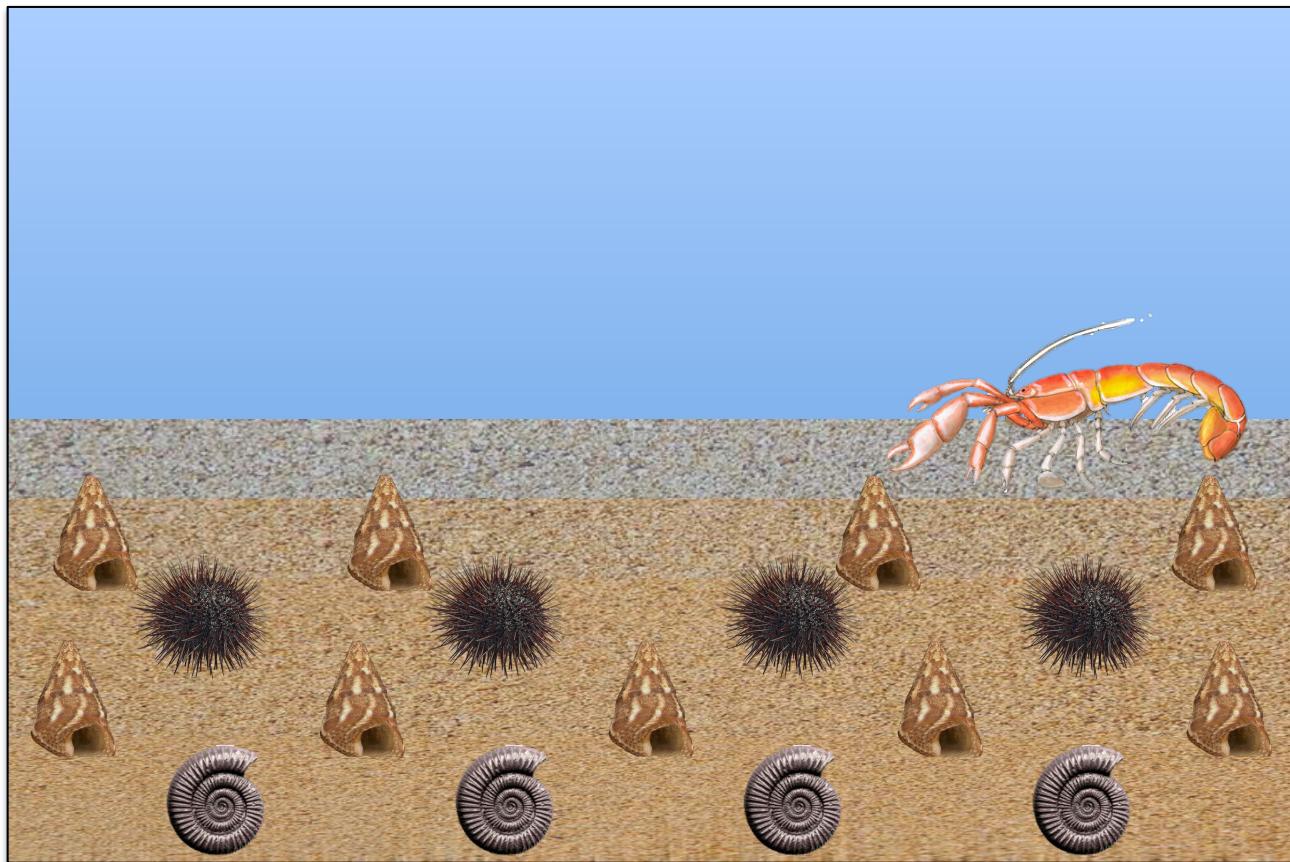
Time-Averaging

Shell Production > Sedimentation Rate



Time-Averaging

Bioturbation



Duration of Time-Averaging

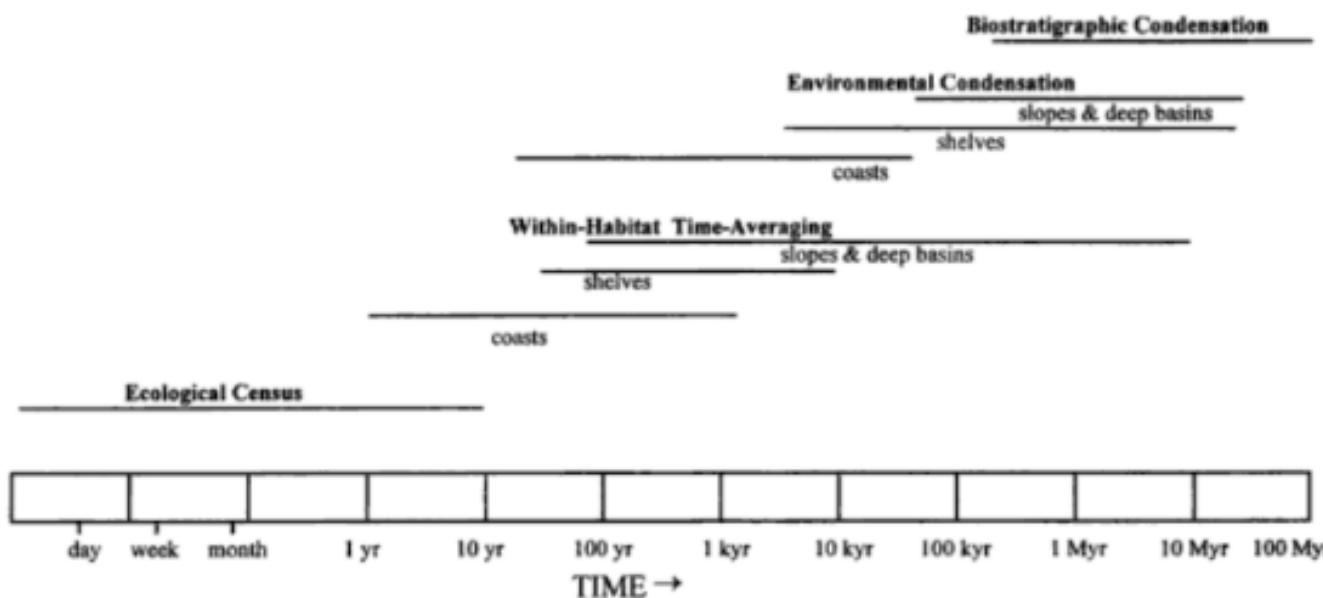
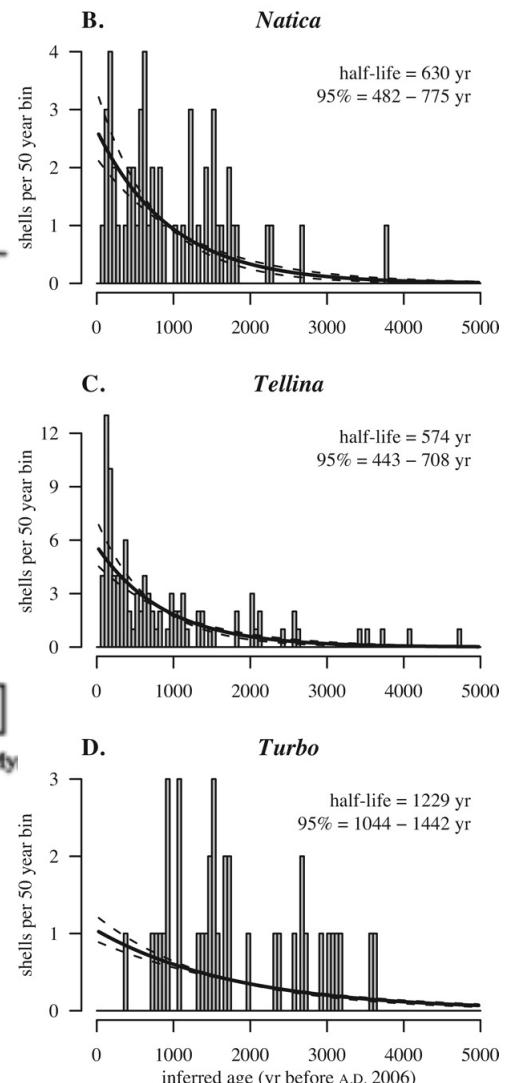


Figure 5.4. Estimates of time-averaging for various types of fossil assemblages.
(Redrawn from Kidwell and Bosence, 1991.)

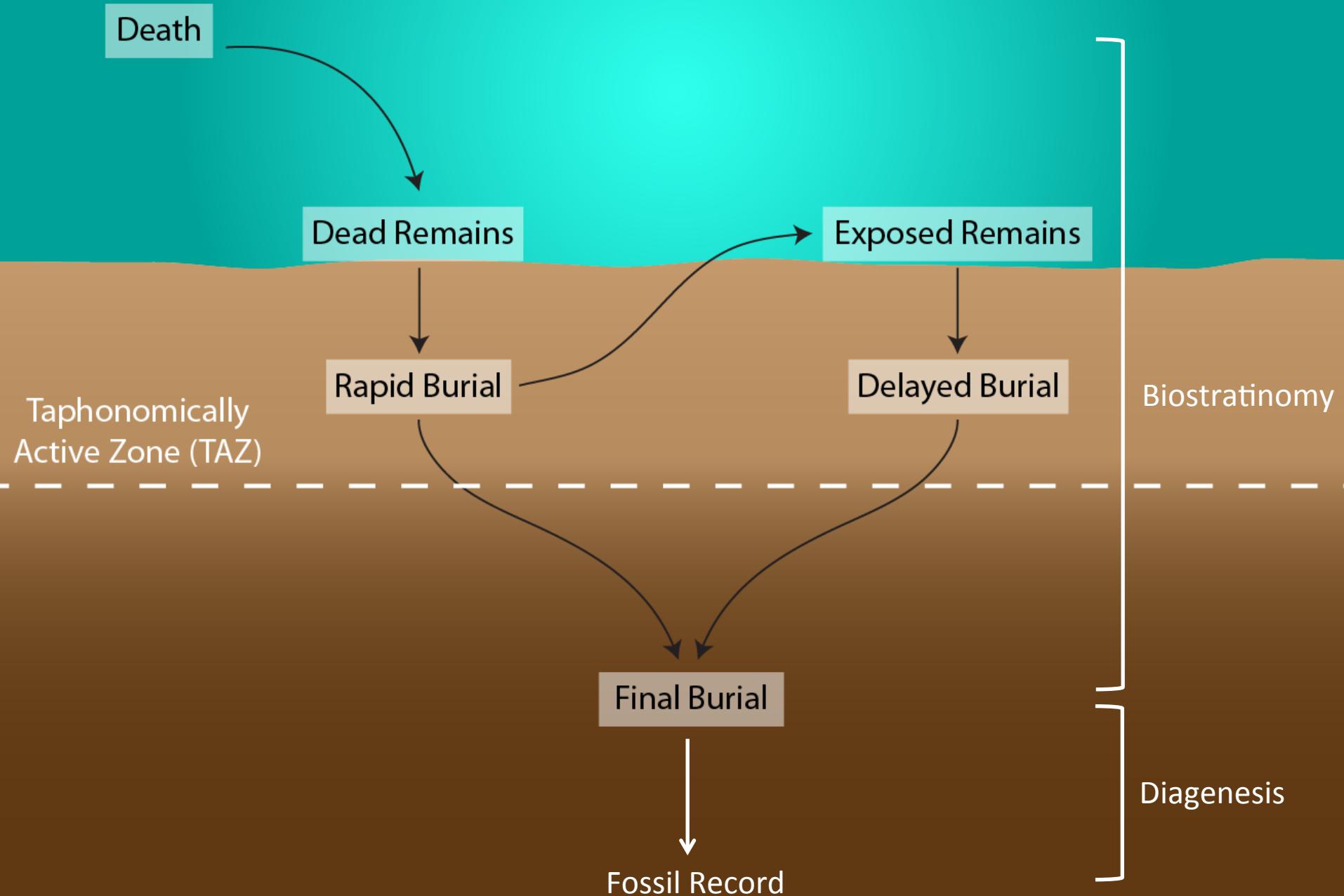


What information is gained through taphonomic processes?

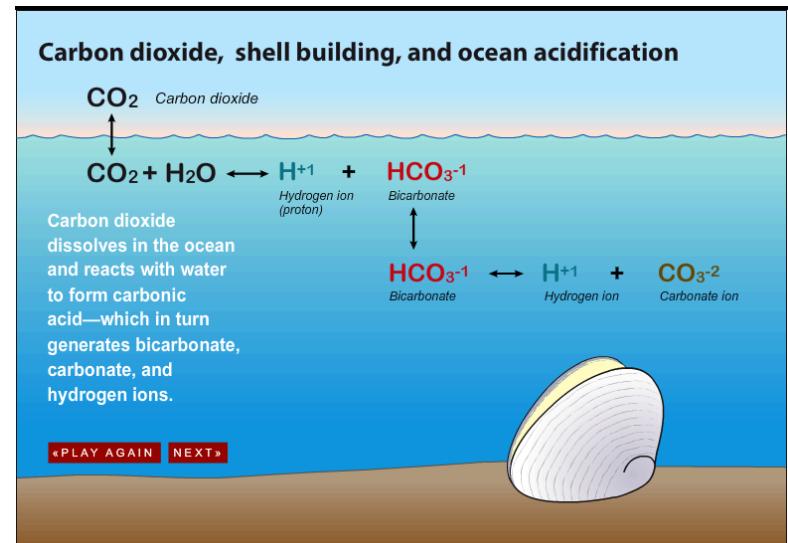


What information is gained through taphonomic processes?

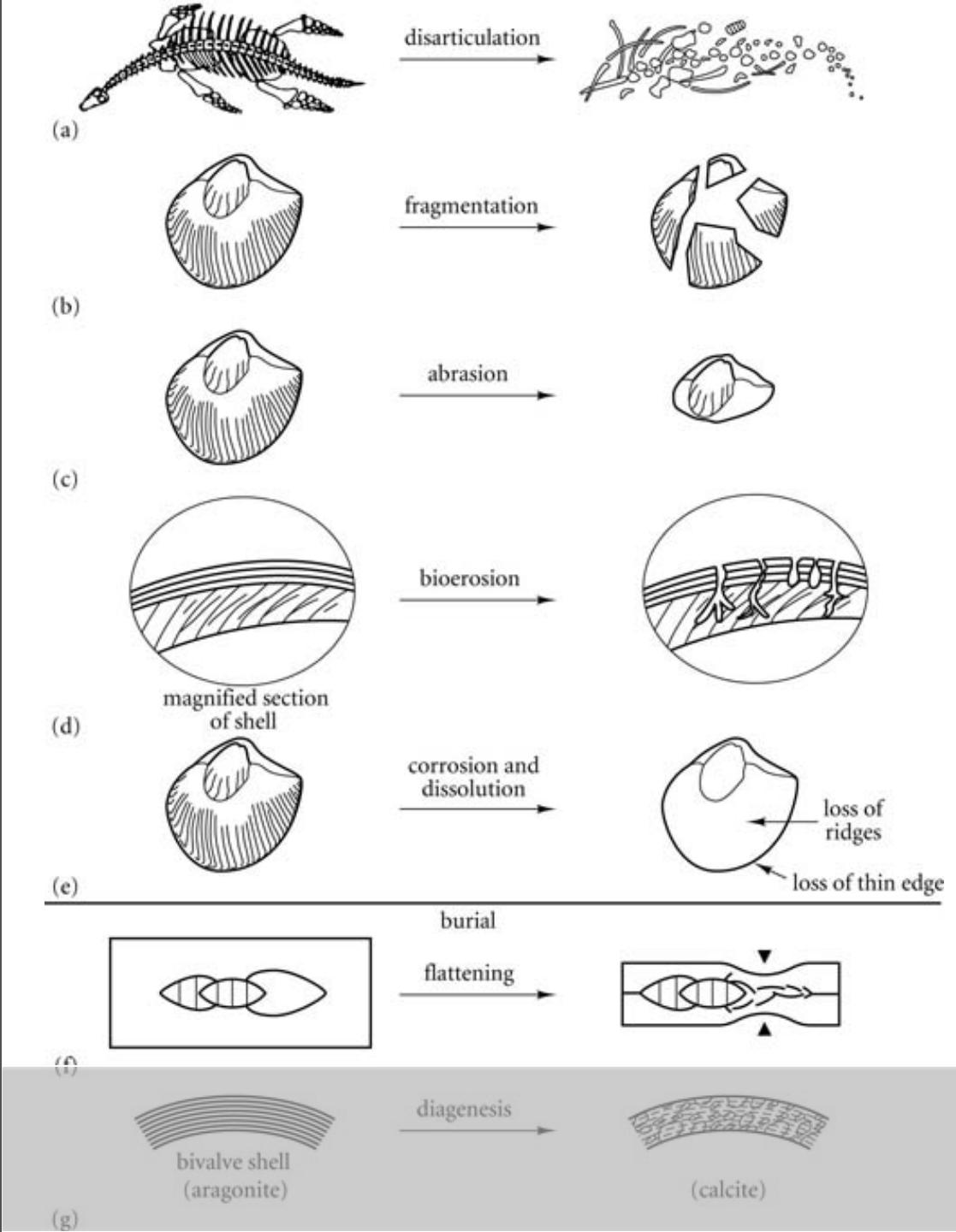




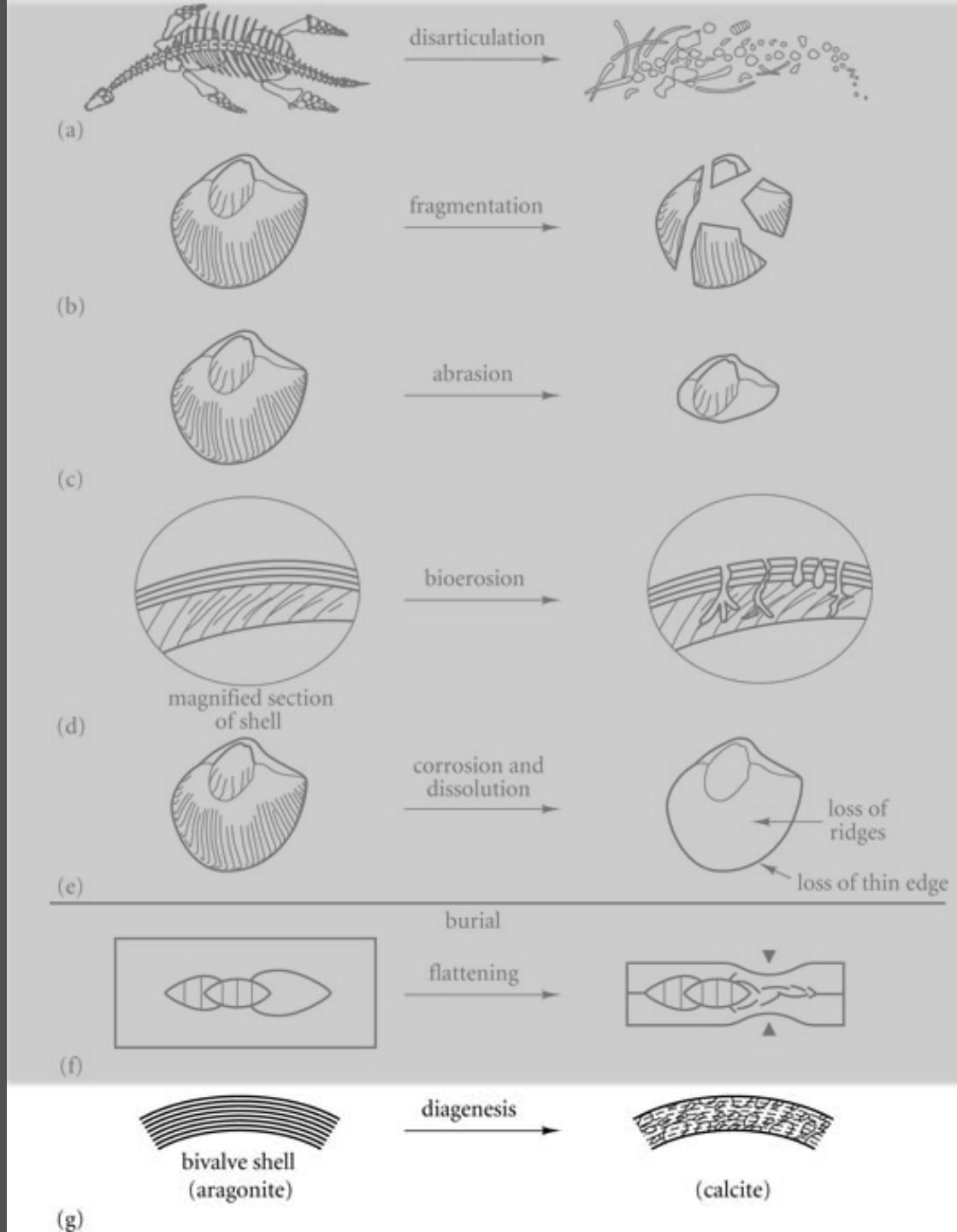
Biostratinomic Agents



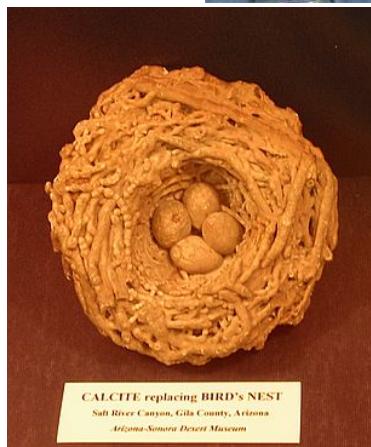
Biostratinomy: Death to Final Burial



Diagenesis: Final Burial to Fossilization



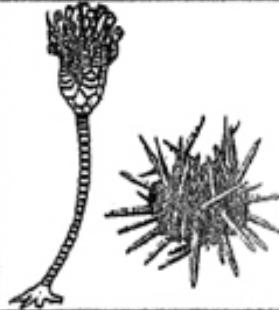
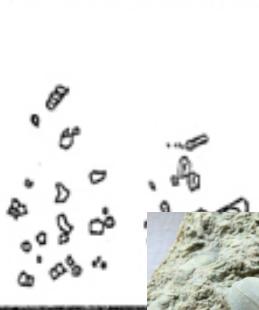
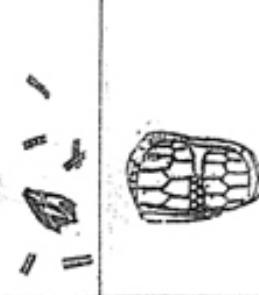
Diagenetic Processes



Taphonomic Indicators and their Paleoenvironmental Implications

Taphonomic Feature	Implications
Abrasion	Indicates transport and erosion.
Disarticulation	SugGESTS biological or physical separation.
Bioerosion	Indicates biological dissolution or weathering.
Dissolution	Indicates chemical dissolution in water-rich environments.
Rounding	Indicates reduced particle size due to abrasion.
Encrustation	Indicates colonization by organisms like algae or bacteria.
Fragmentation	Indicates mechanical breakdown of larger structures.
Orientation	Indicates original position relative to gravity.
Size	Indicates range of particle sizes resulting from abrasion.

Reconstructing Past Conditions

Category examples	Conditions with Varying Burial Rate			
	Hours to 1 Day	1 Day to 2 Weeks	2 Weeks to 1 Year	More Than 1 Year
TYPE 1: ophiuroids, asteroids, "carpoids," paleoechinoids, echinoids, edrioasteroids				
TYPE 2: most crinoids, "cystoids," regular echinoids				
TYPE 3: robust camerate, microcrinoids, blastoids, irregular echinoids				



Obrution Deposits



Karim & Westrop, 2002

Taphofacies Analysis

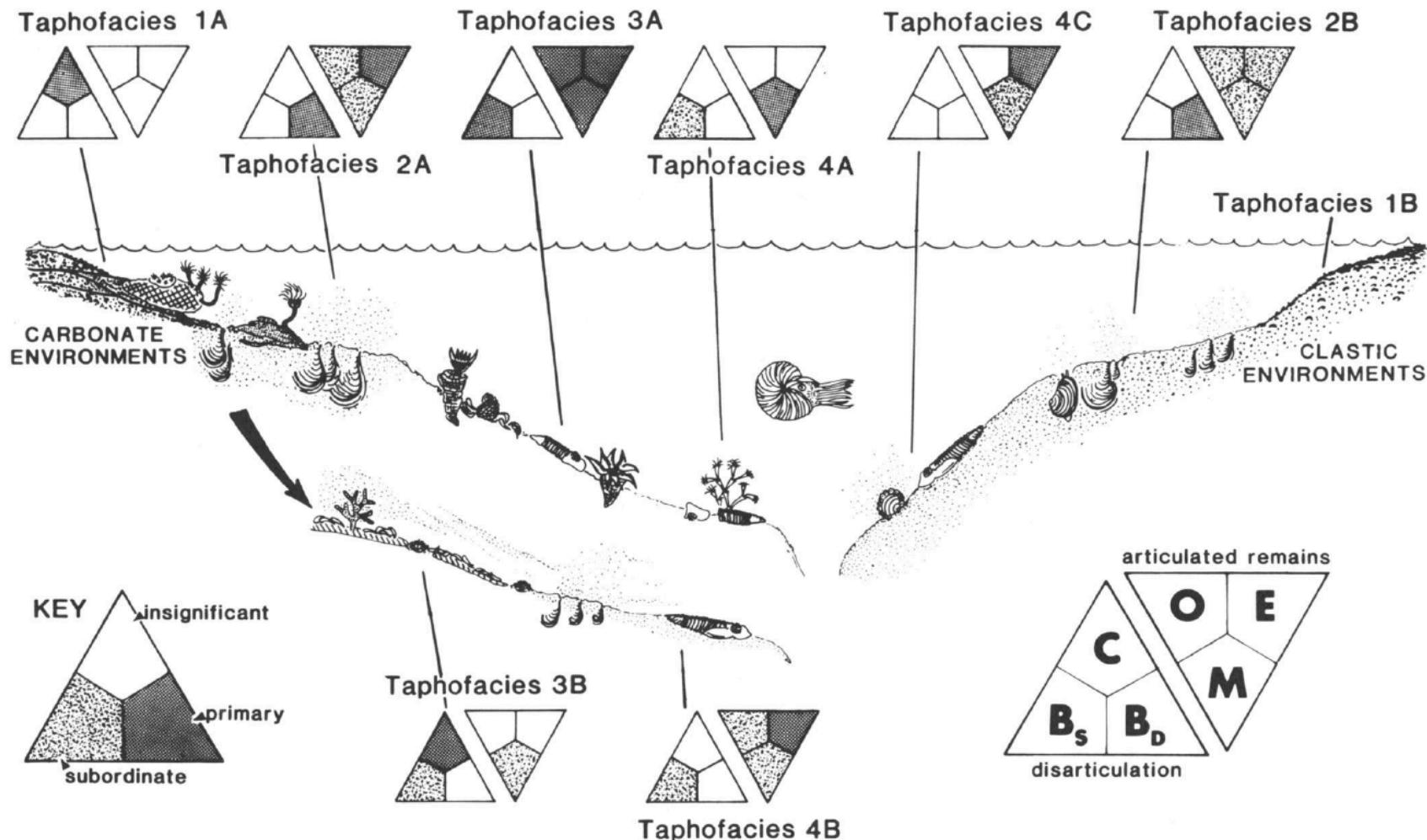
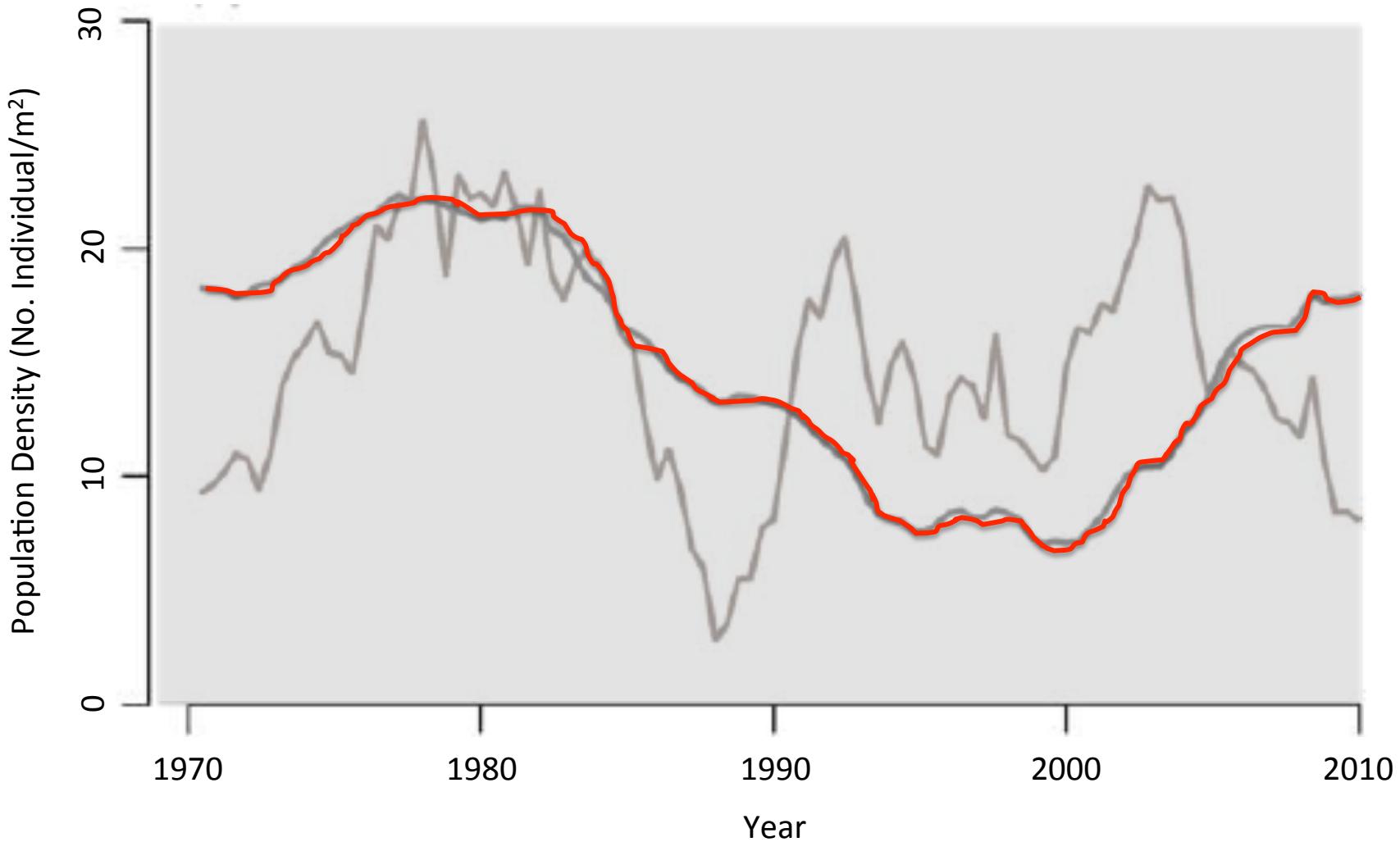


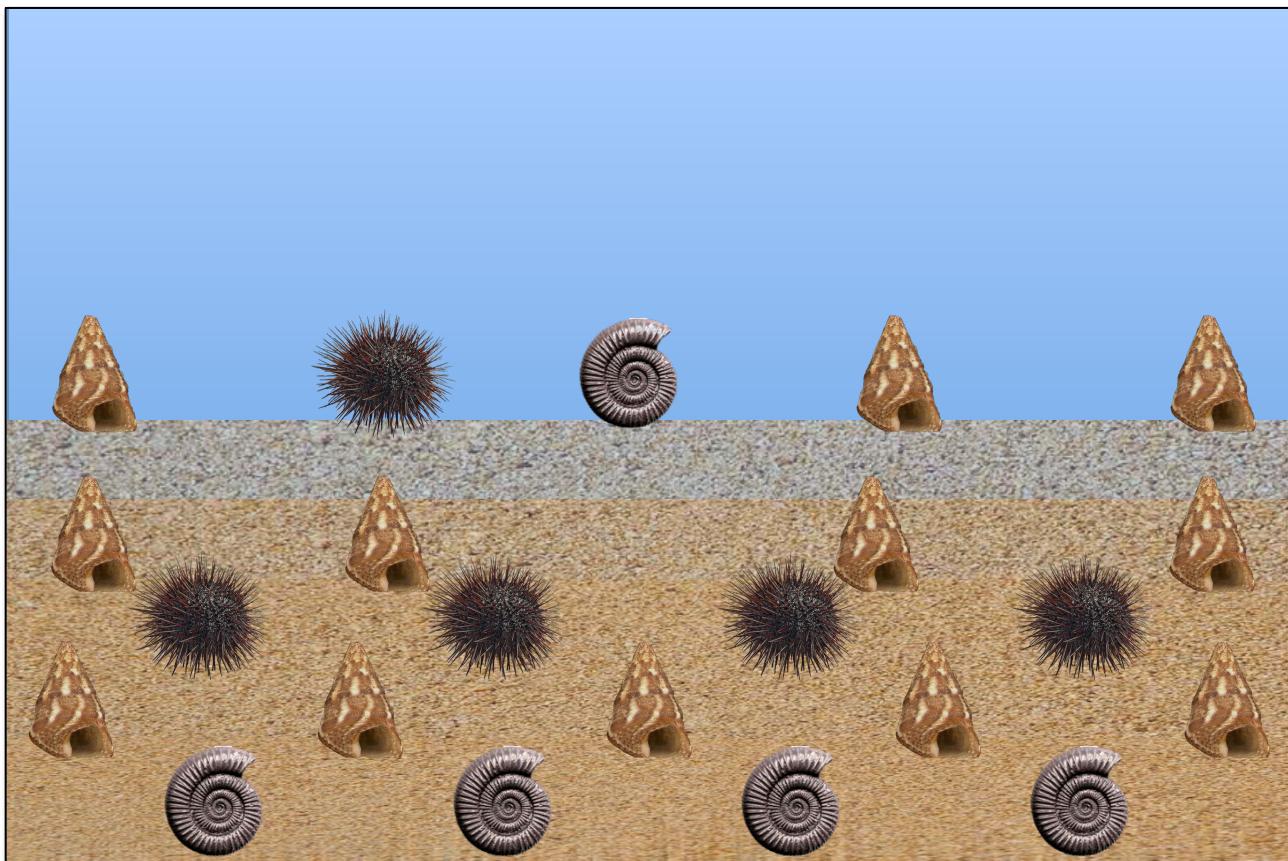
FIGURE 5—Reconstructed panorama of Hamilton Group trilobite taphofacies and summary of distinguishing taphonomic attributes. Disarticulation was mediated by current-related processes (C), surficial bioturbation (B_s), and/or deep, intrastratal bioturbation (B_d); these agents are differentiated on the basis of sclerite orientation (see Table 2 and Fig. 3). Articulated remains are categorized according to body posture (O = outstretched, E = enrolled) and mode of generation (M = moult).

Time-Averaging Dampens “Noise”



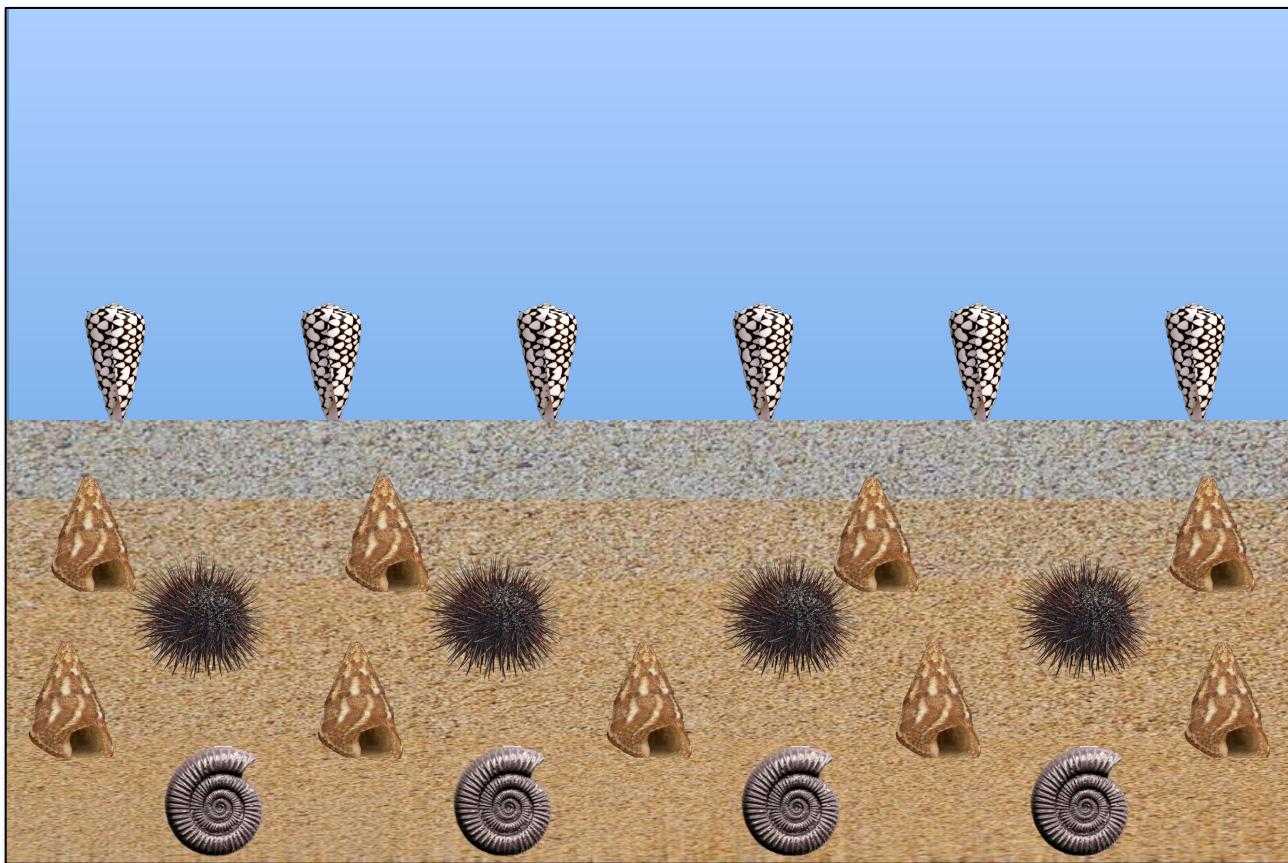
Informing the Present Using Live/Dead Analysis

? Live/Dead Fidelity

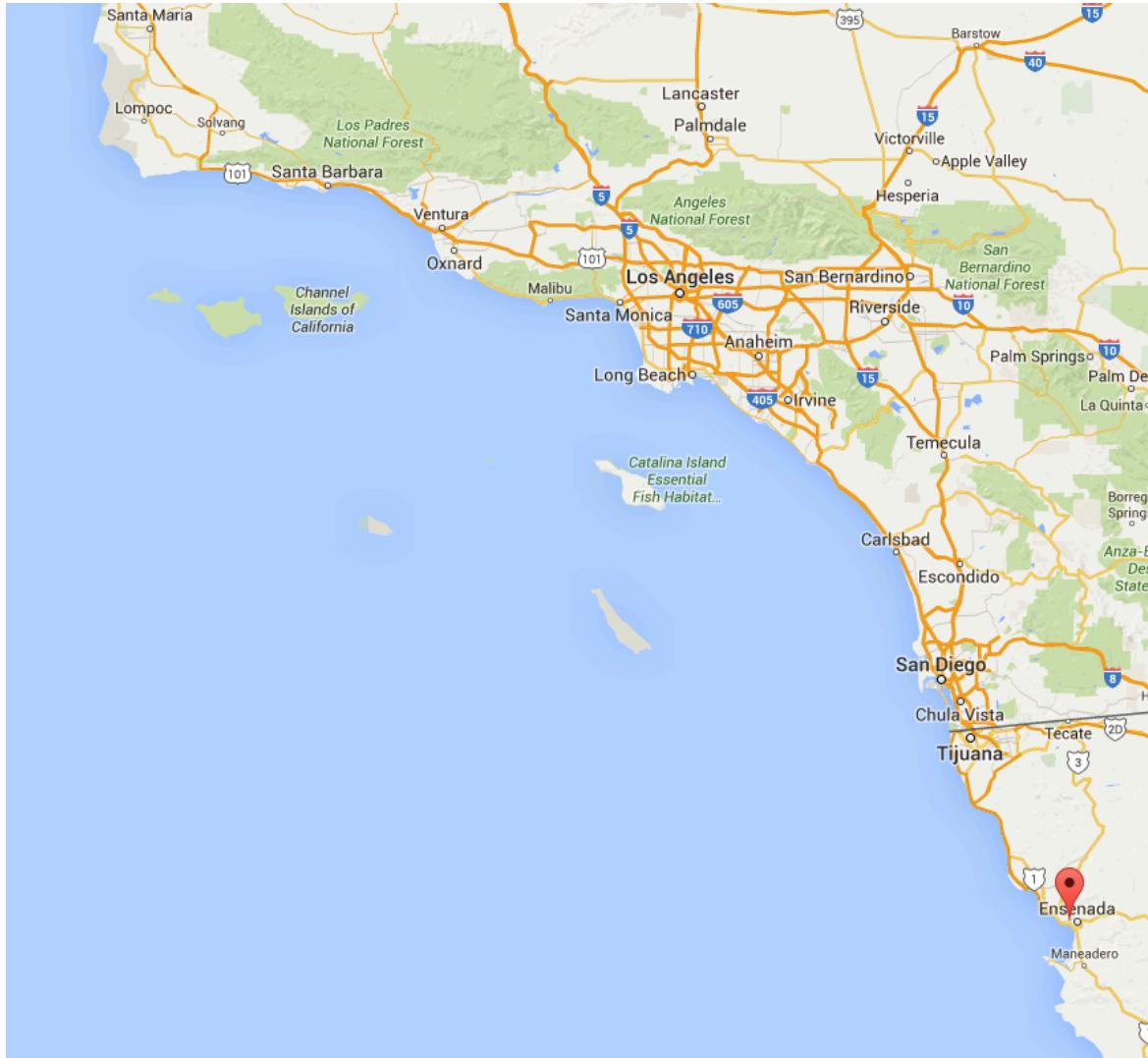


Informing the Present Using Live/Dead Analysis

? Live/Dead Fidelity

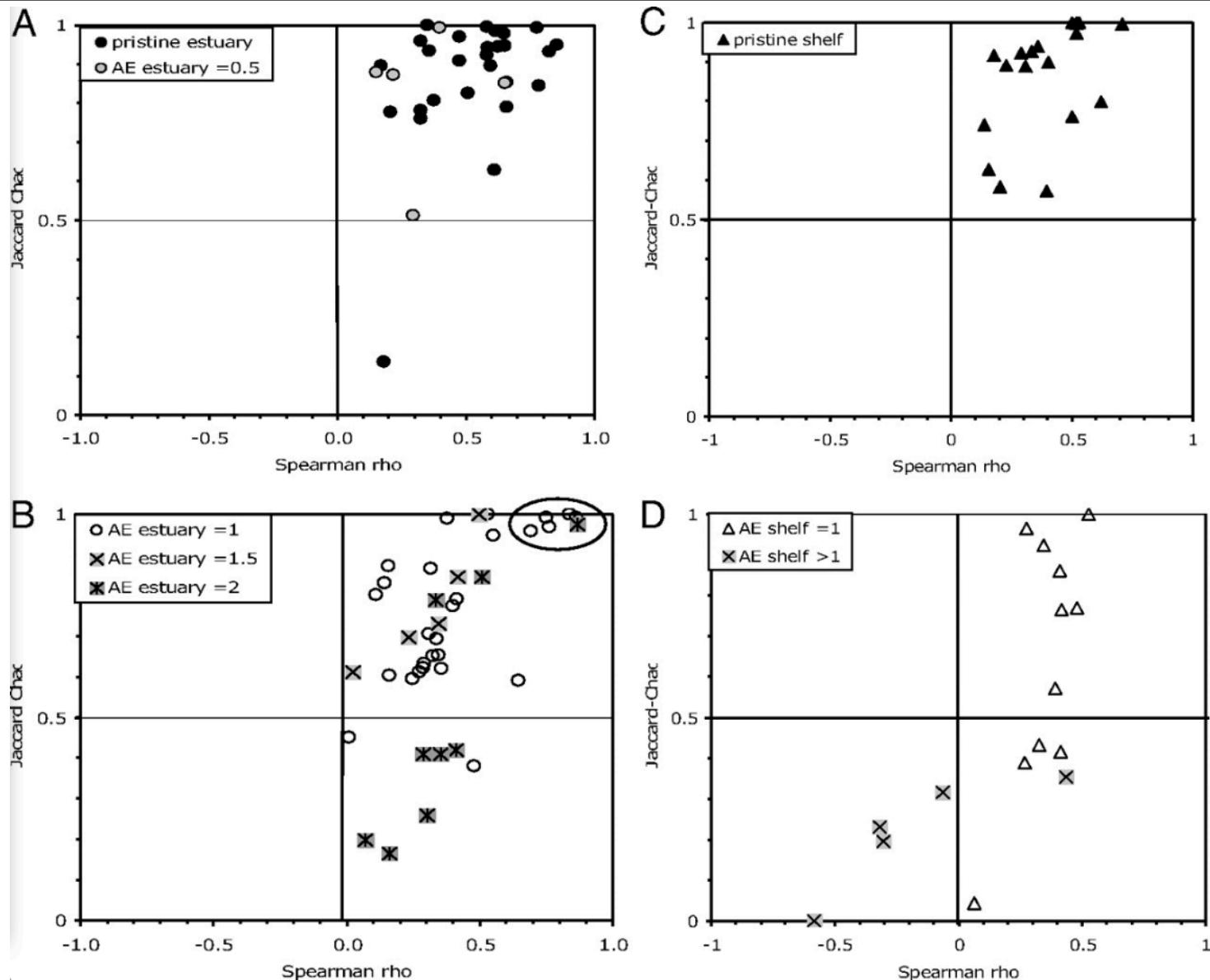


Case Study 1: Valentine 1989

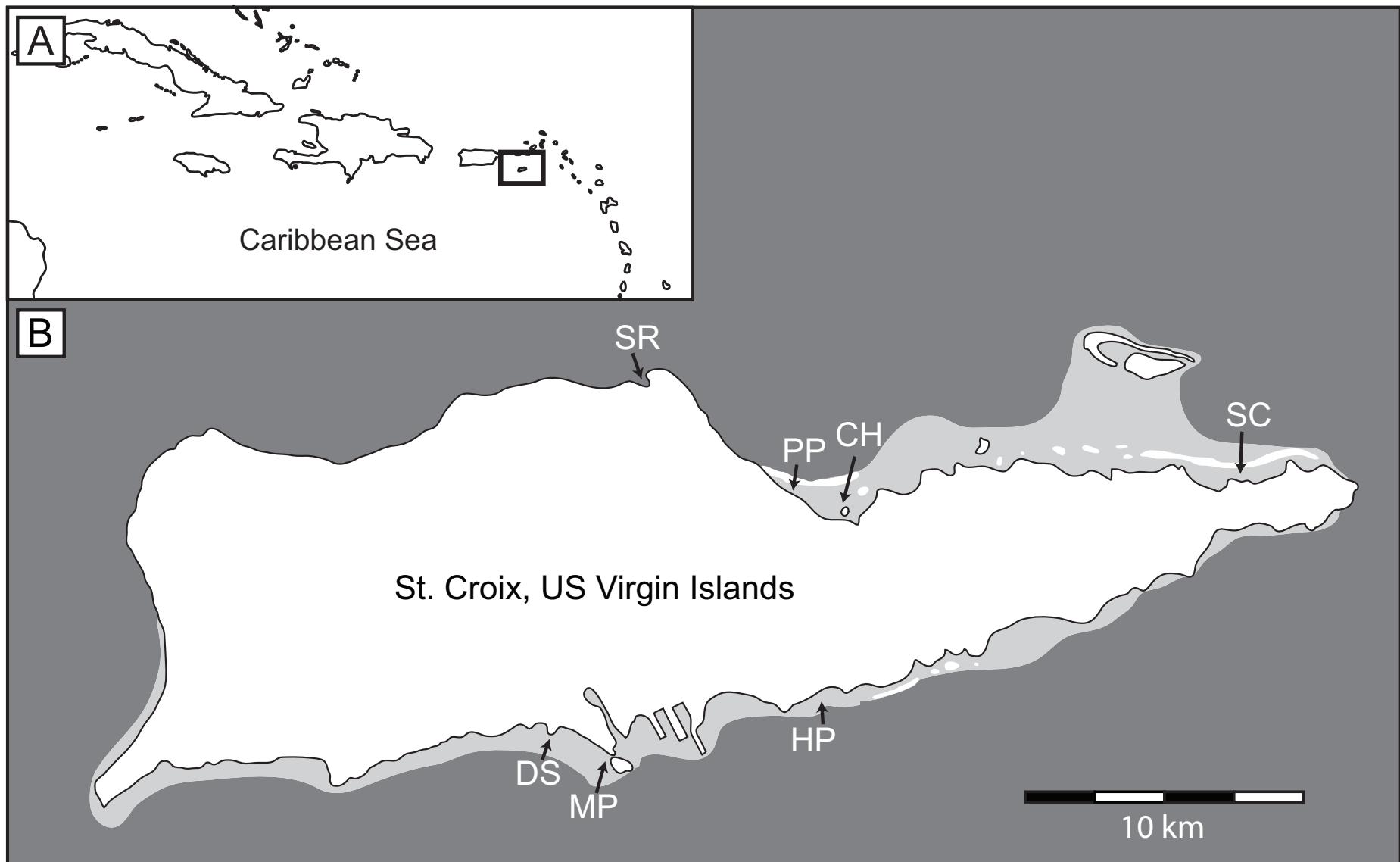


Live
↓
Dead
↓
Fossil

Case Study 2: Kidwell 2007



Case Study 3: My Research



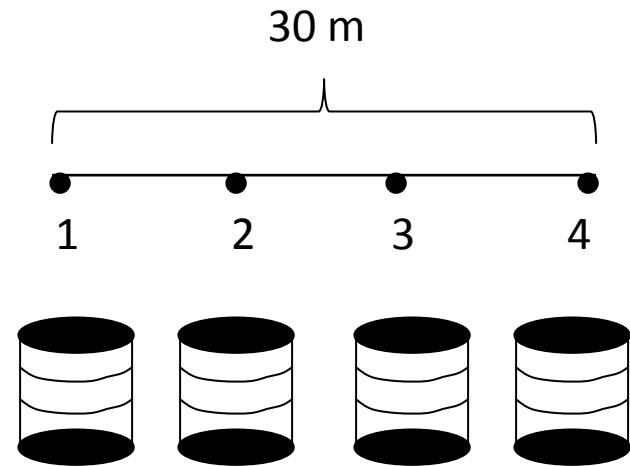
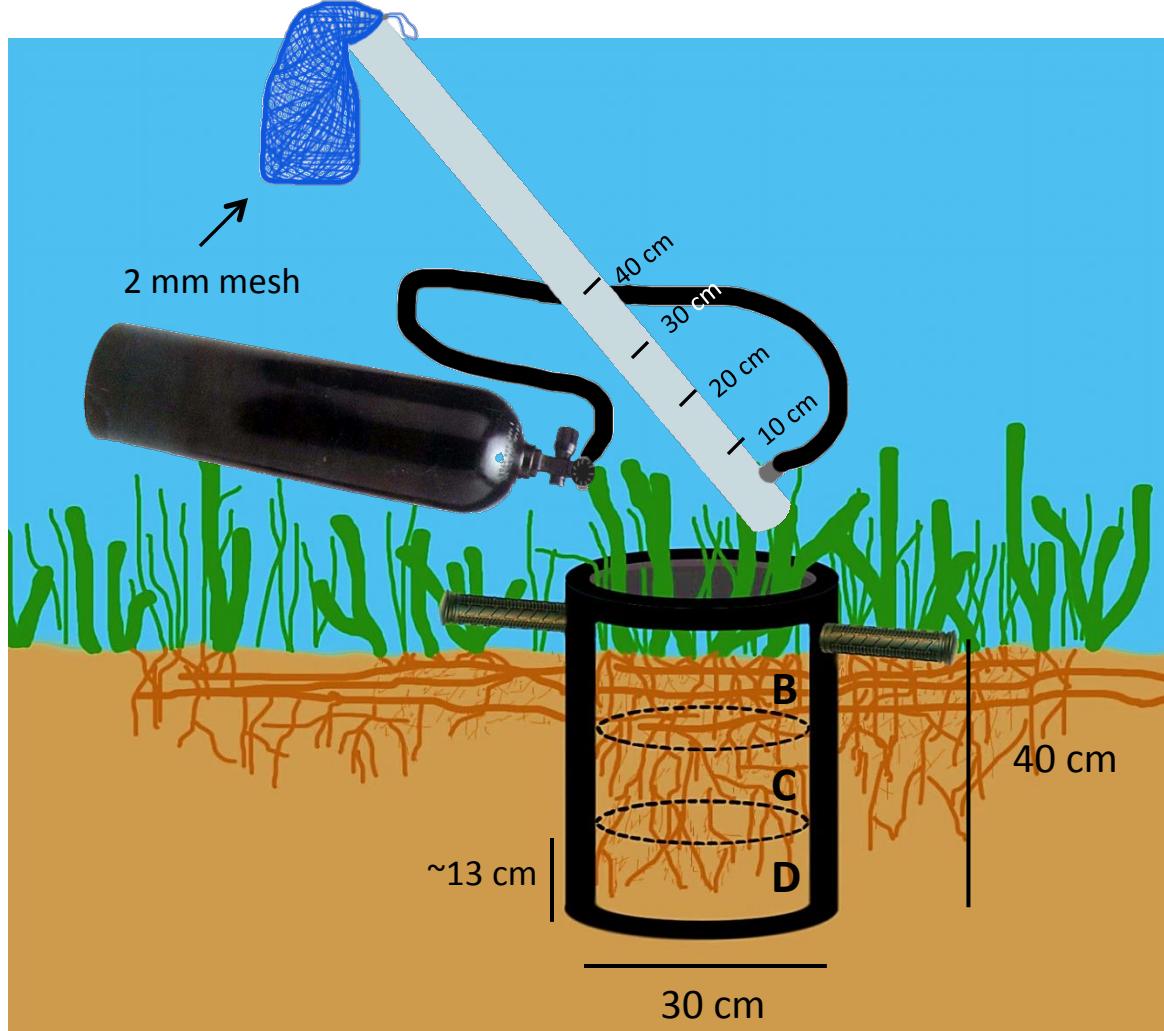
Case Study 3: St. Croix, USVI



Objectives:

1. Does the **death assemblage** of mollusks reveal compositional change through time?
2. Are shallower samples more compositionally similar to the **life assemblage**?

Sampling Methods

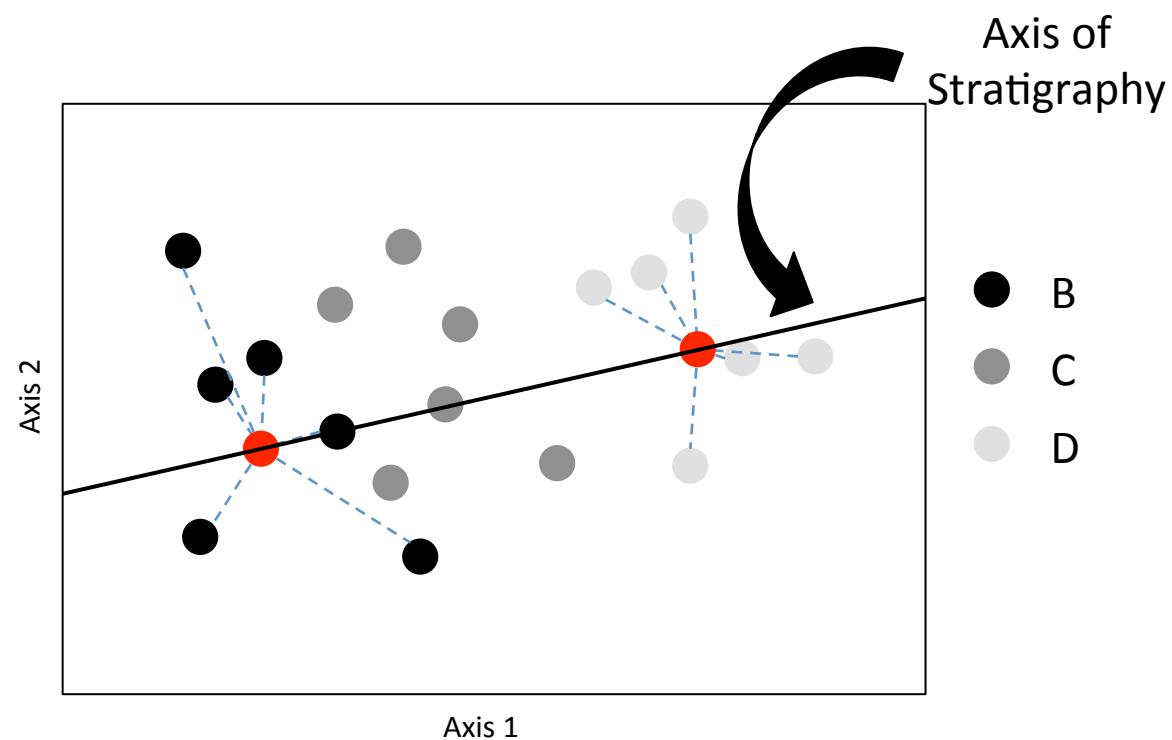
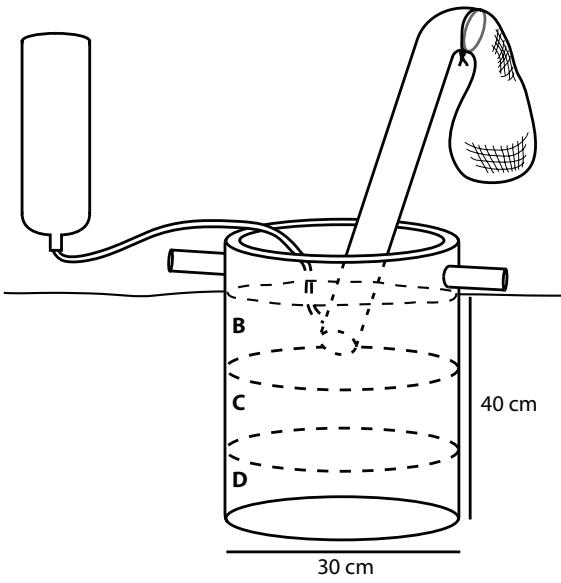


*Also collected sediments for metal analysis

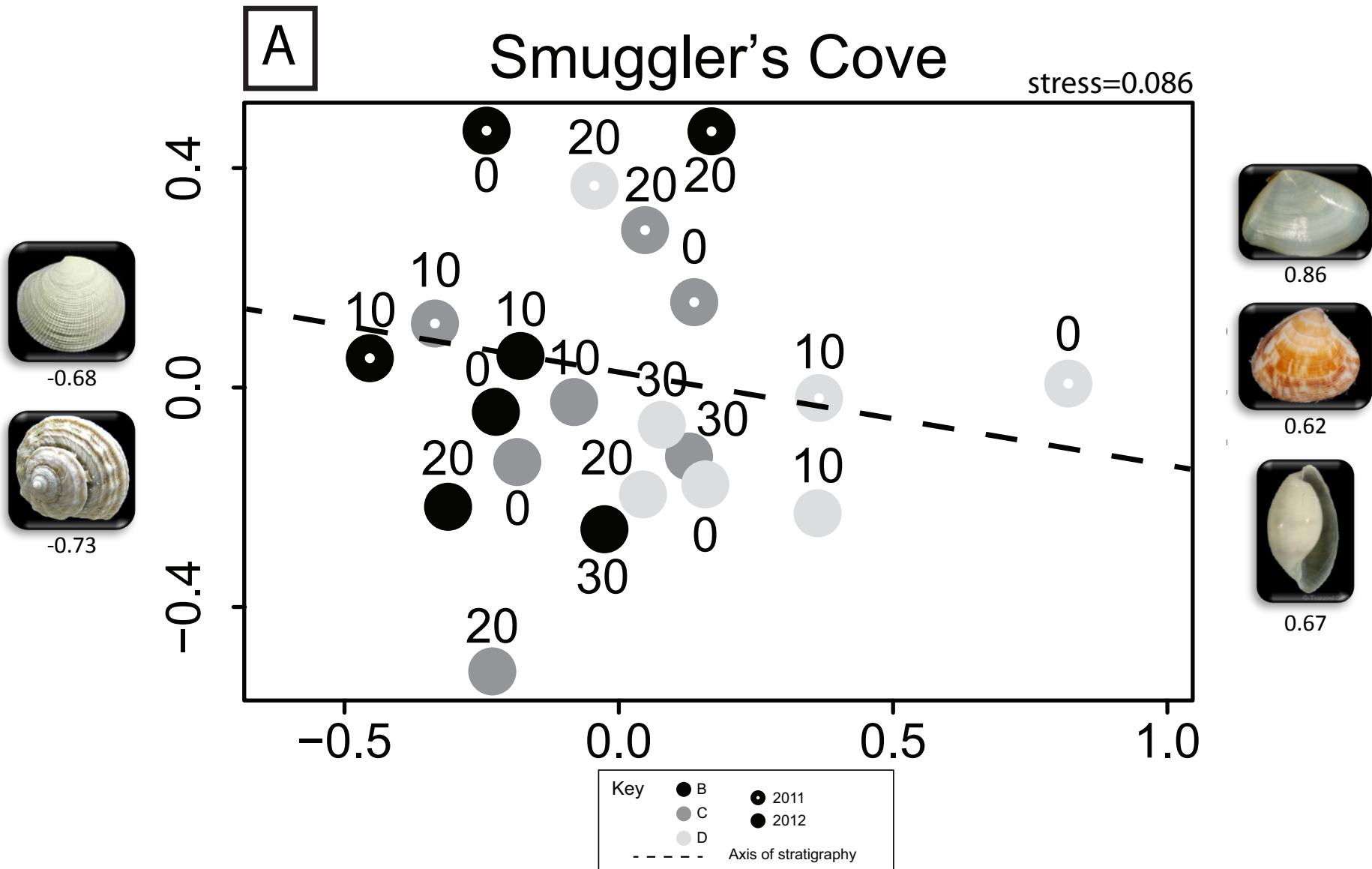
Sampling Methods



Changes with depth using NMDS ordination

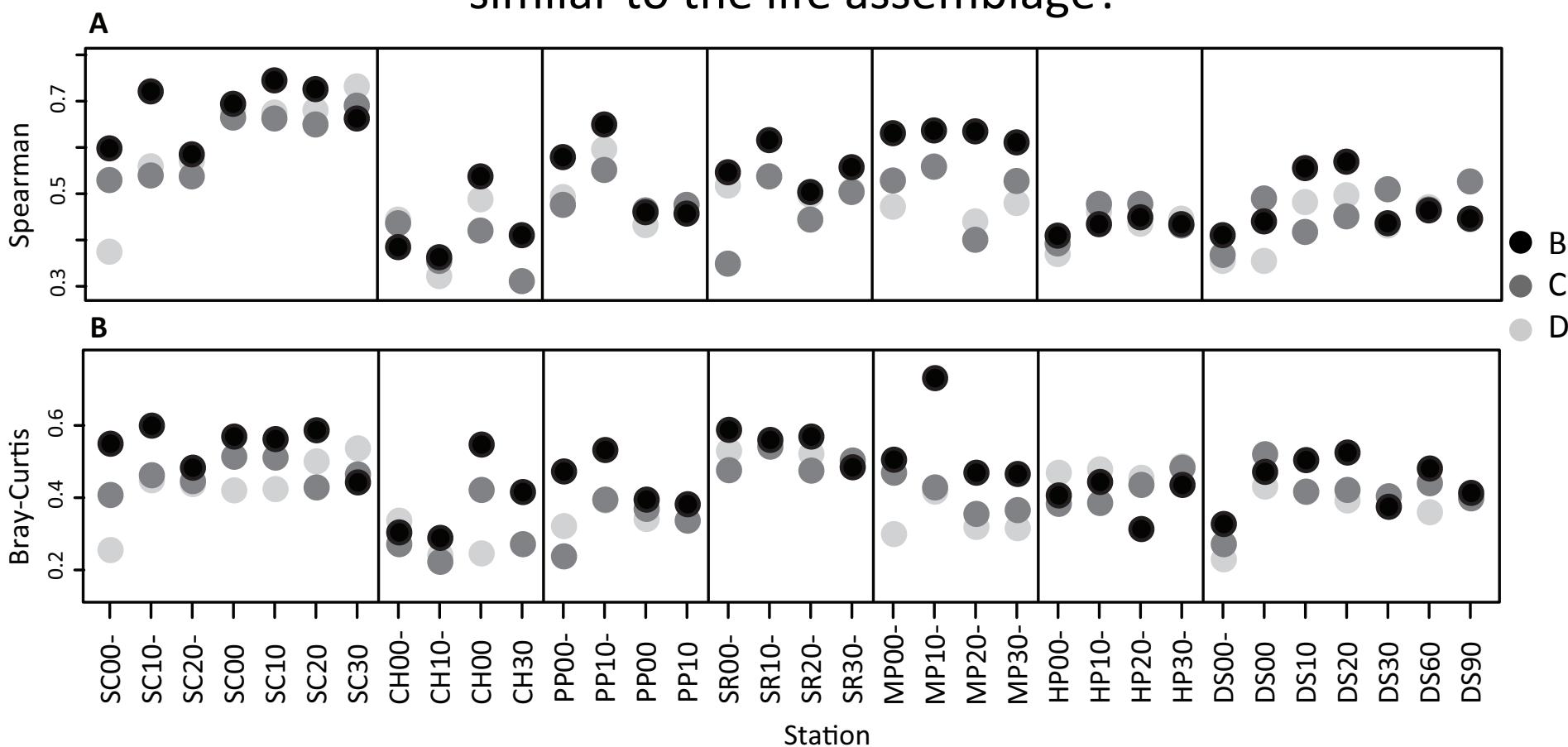


Changes with depth using NMDS ordination

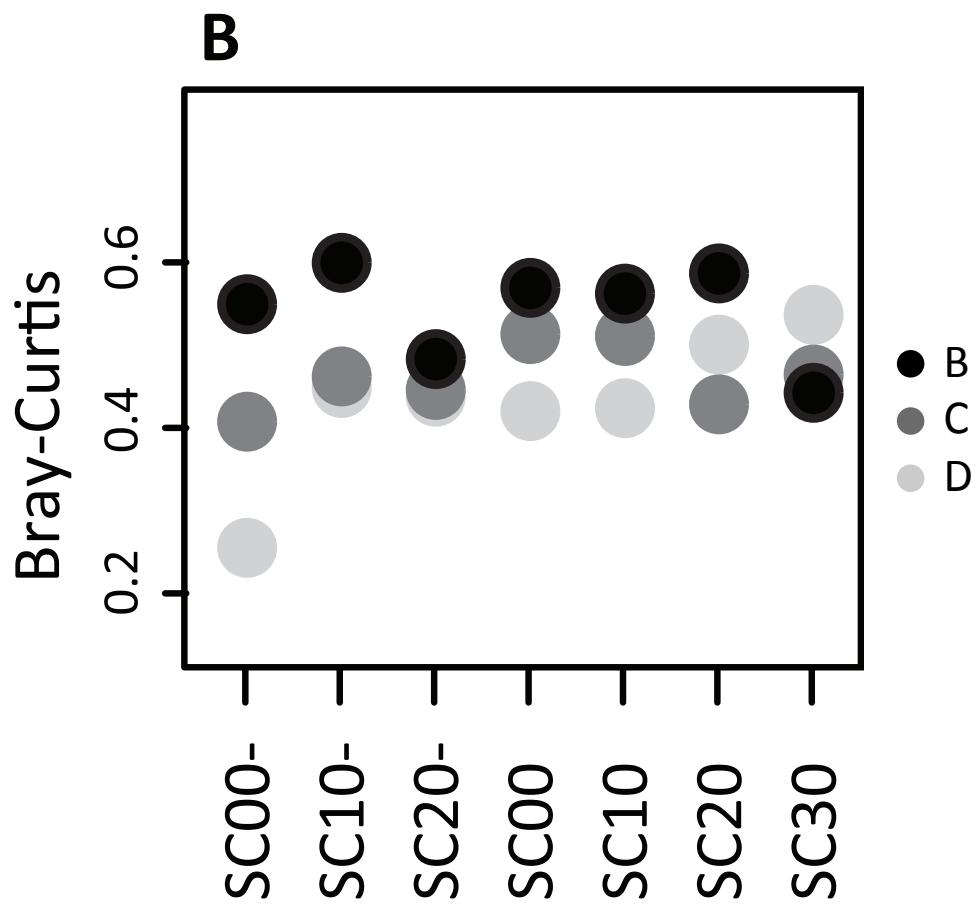
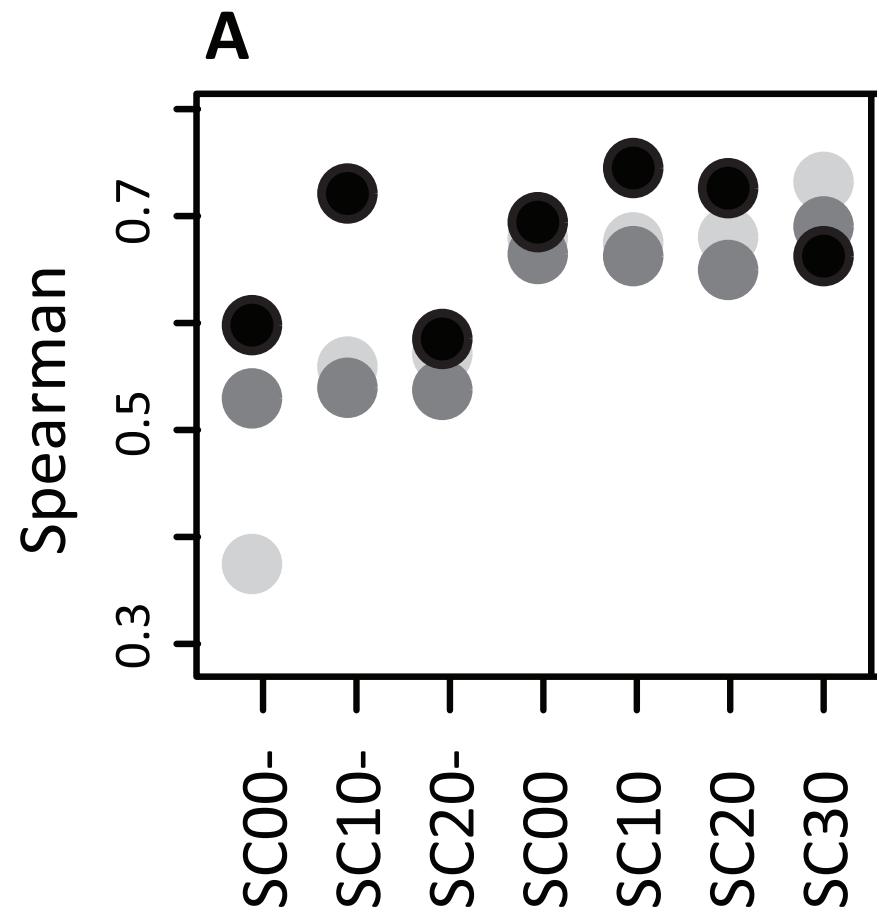


Fidelity with depth

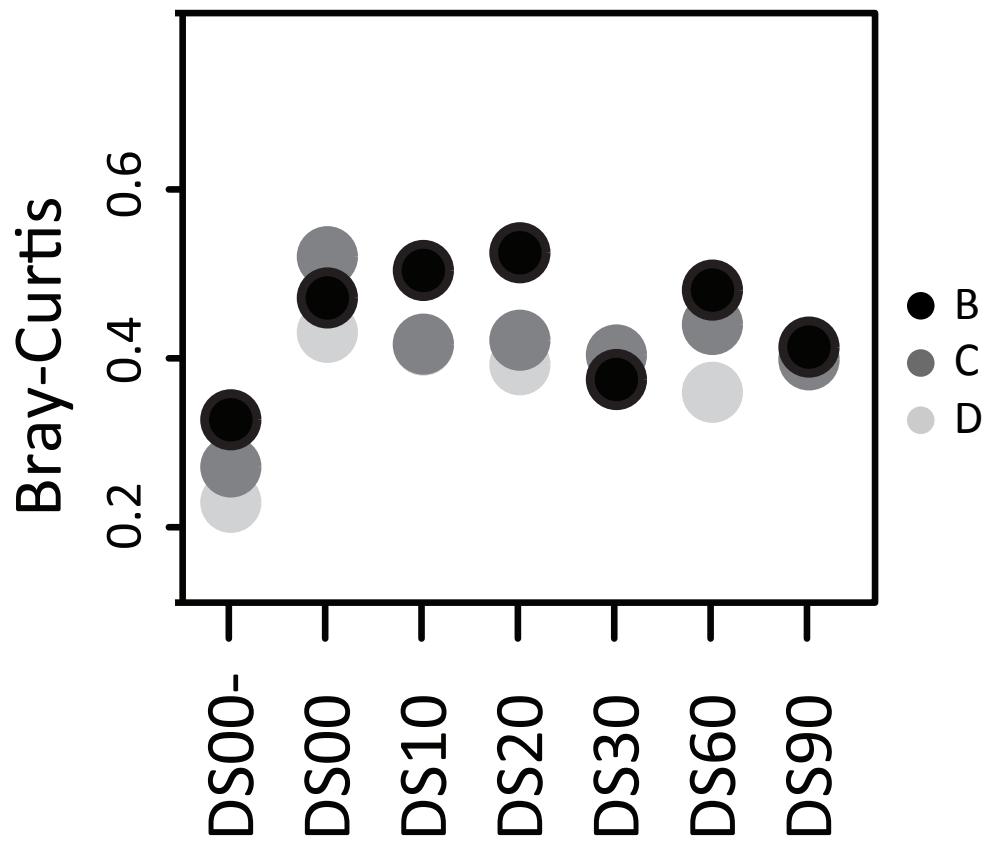
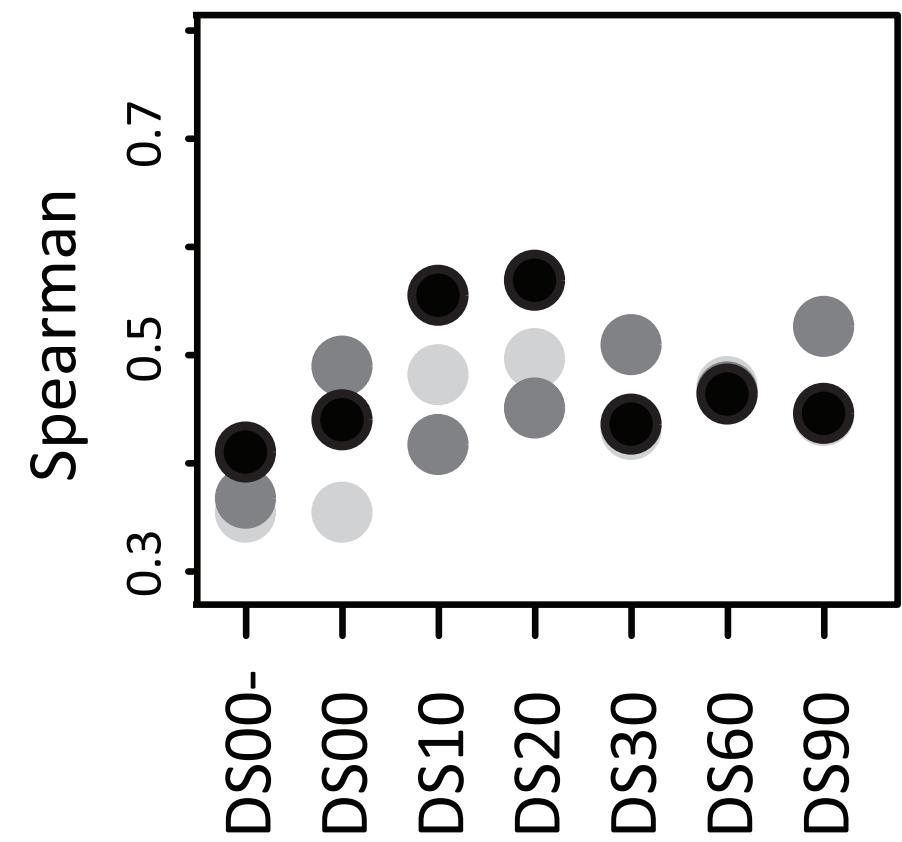
Are shallower samples more compositionally similar to the life assemblage?



Fidelity with depth: Smuggler's Cove



Fidelity with depth: Dump Site



Implications: Shifting Baselines



Life
Assemblage

Deeper intervals may reflect more accurate historical baselines.

