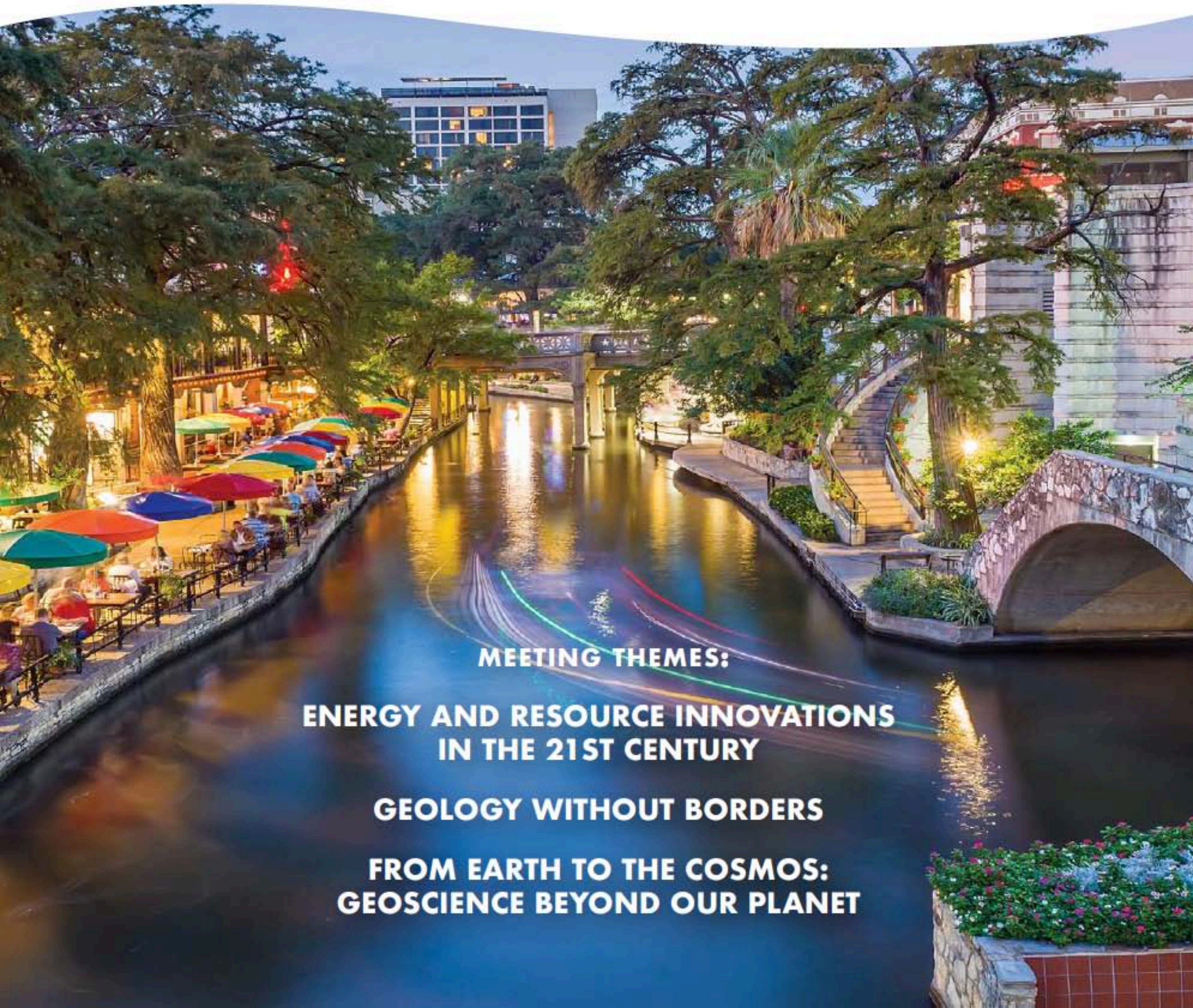




# CONNECTS

SAN ANTONIO, TEXAS, USA **2025** 19-22 OCTOBER

## PROGRAM BOOK



**MEETING THEMES:**

**ENERGY AND RESOURCE INNOVATIONS  
IN THE 21ST CENTURY**

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[Home](#) / [GSA Connects 2025: Abstract Collection Session Schedule](#) / [Paleontology, Paleoecology/Taphonomy \(Posters\)](#) / [Environmental Controls on Niche Space Occupation and Feeding Ecology of Late Ordovician \(Katian\) Crinoid Communities](#)

Times are displayed in (UTC-05:00) Central Time (US & Canada) [Change](#)

## 189-3 Environmental Controls on Niche Space Occupation and Feeding Ecology of Late Ordovician (Katian) Crinoid Communities

**Session:** Paleontology, Paleoecology/Taphonomy (Posters)

**Poster Booth No.:** 88

**Presenting Author:**

Nicolas Bell

**Authors:**

Bell, Nicolas<sup>1</sup>, Cole, Selina<sup>2</sup>, Wright, David<sup>3</sup>, Ausich, William<sup>4</sup>, Cournoyer, Mario<sup>5</sup>

**Abstract:**

Understanding the role of environmental variables in ecological strategies and niche space occupation is critical for disentangling drivers of community assembly and evolution over time. Communities of species all showing similar traits can indicate a dominant process of habitat filtering where specific traits are required for survival. In contrast, high levels of trait variation within a community indicate competition plays a stronger role. Crinoids are incredible paleoecological model specimens: their skeletons preserve ecomorphological traits reflective of their filter-feeding life mode, and rapid post-mortem disarticulation of crinoid skeletons means death assemblages containing well-preserved specimens represent ecological snapshots of their paleocommunities. Crinoids are also well-represented through time, allowing for the potential to track their shifting ecologies during radiations, extinctions, and in between. The Katian Stage of the Late Ordovician (453.0-445.2 Ma) was a time of high taxonomic, ecological, and morphological diversity for crinoids resulting in elevated community complexity. Crinoid generic diversity reached its Ordovician peak during the Katian, making it an ideal time interval to investigate the ecological strategies of crinoids in different sedimentary environments.

To determine how crinoid feeding strategies co-vary with environmental variables, we compared the feeding ecology and niche space occupation of multiple Katian crinoid communities from different environments. Here, we present results from an analysis of the feeding ecology of crinoids from an exceptionally well-preserved Katian fauna from the Neuville Formation (Upper Trenton Group, Quebec, Canada). A principal coordinates analysis (PCO) was conducted to model the ecomorphospace occupation of the Neuville crinoid fauna based on ecomorphological traits collected from fossil specimens. Traits associated with the primary axes of differentiation within ecomorphospace included calyx size and filtration fan density. To investigate how environmental differences may affect crinoid feeding ecology, we compared the Neuville and Brechin (Ontario, Canada) crinoid faunas. The Neuville fauna represents a low-energy, deep-water marine environment, whereas the Brechin represents a shallow marine shelf setting near in age and location to the Neuville. Additional comparisons with crinoids sampled across environmental gradients from the Cincinnati Series provide further data for investigating relationships between feeding ecology and environmental variables. Understanding how crinoid niche space occupation and ecological strategies vary environmentally will allow for more effective comparison between temporally distant crinoid communities and establish the drivers of community assembly and evolution over time.

Geological Society of America Abstracts with Program. Vol. 57, No. 6, 2025

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**Environmental Controls on Niche  
Space Occupation and Feeding  
Ecology of Late Ordovician (Katian)  
Crinoid Communities**

Category

Topical Sessions

Description

**Session Format:** Poster

**Presentation Date:** 10/21/2025

**Presentation Room:** HGCC, Hall 1

**Poster Booth No.:** 88

**Author Availability:** 9:00–11:00 a.m.

[Back to Session](#)

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# Environmental Controls on Niche Space Occupation and Feeding Ecology of Late Ordovician (Katian) Crinoid Communities

Nicolas J.M. Bell<sup>1,2</sup>, Selina R. Cole<sup>1,2</sup>, David F. Wright<sup>1,2</sup>, William I. Ausich<sup>3</sup>, Mario Cournoyer<sup>4</sup>

<sup>1</sup>School of Geosciences, University of Oklahoma, Oklahoma, US; <sup>2</sup>Sam Noble Oklahoma Museum of Natural History, Oklahoma, US; <sup>3</sup>School of Earth Sciences, Ohio State University, Ohio, US; <sup>4</sup>Musée de Paléontologie et de l'Évolution, Quebec, CA

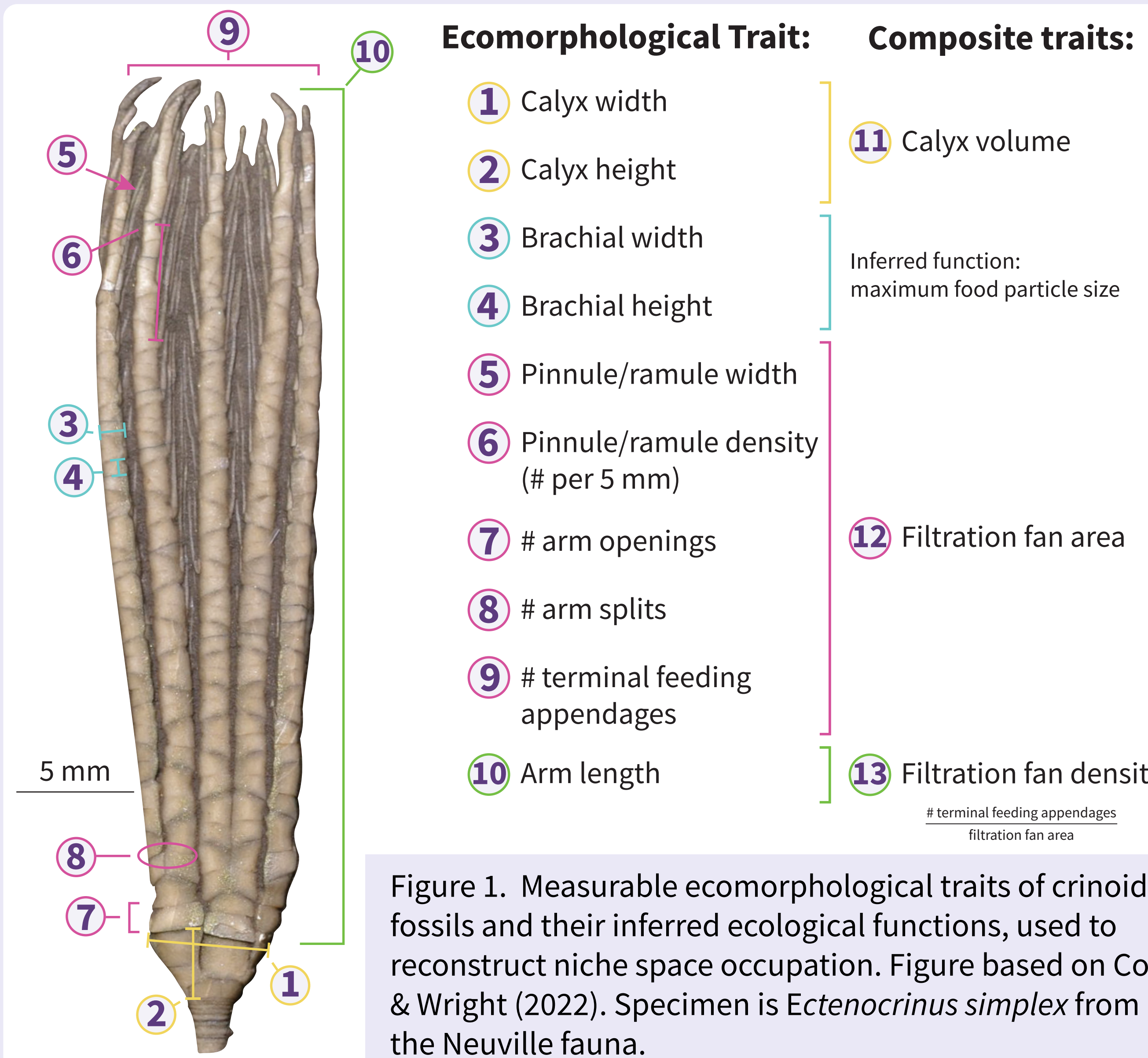
## Introduction: Crinoid Paleocology

Crinoids represent a strong model group to study deep-time paleoecology:

1. They rapidly disarticulate upon death, meaning well-preserved specimens and communities reflect ecological snapshots (Ausich, 2021)
2. Crinoid body plans have ecomorphological traits, physical traits that reflect their suspension-feeding, sessile life habits (Holterhoff, 1997)

Here, we test the question: **How is crinoid feeding ecology controlled by, and how does it differ between, the sedimentary environment in which crinoids live?**

We present a comparison of the niche space occupation from two Katian-age Canadian crinoid faunas (~450 Ma): the deep-water, relatively lower energy, primarily siliciclastic Neuville Fauna from Quebec and the shallow, relatively higher energy, primarily carbonate Brechin Fauna from Ontario.



## Methods

Our study uses the methods of Cole et al. (2019) and Cole & Wright (2022). **Data Collection**

We measured ecomorphological traits of the Neuville fauna crinoids from specimens housed at the Musée de Paléontologie et de l'Évolution. The ecomorphological trait data for the Brechin crinoids comes from Cole et al. (2019). The measured traits for each crinoid were combined into species averages within faunas for all specimens with full measurements per trait.

### Data Analysis

We conducted a principal coordinate analysis (PCO) from a dissimilarity matrix constructed between each non-composite ecomorphological trait measured (fig. 1). Traits connected to each PCO axis were identified via Spearman's rank correlation tests with significance assigned at  $p < 0.01$  (see Table 1).

## Crinoid Faunas Studied

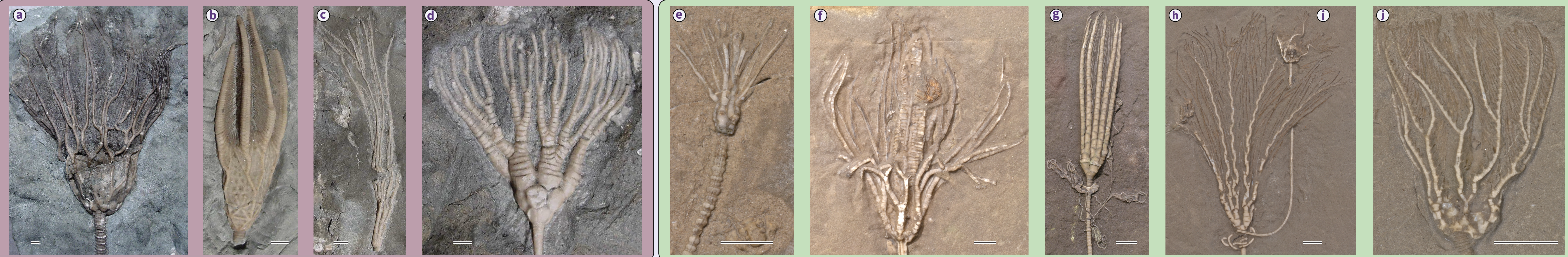


Figure 2. Representative crinoid specimens from the Brechin (a-d) and Neuville (e-j) faunas. Pentacrinoids (c-h) are apinnulate but may have ramules, and camerates (a-b, i-j) have pinnules, save for the stem eucamerates from the Brechin fauna. Brechin crinoid specimen photos courtesy of J. Konecki and Neuville crinoid images taken from specimens at Musée de Paléontologie et de l'Évolution in Québec, CA. (a) *Glyptocrinus ramulosus*; (b) *Periglyptocrinus strictus*. (c) *Eustenocrinus springeri*; (d) *Cupulocrinus jewetti*; (e) *Cincinnatiocrinus sevastopuloi*; (f) *Iocrinus trentonensis*; (g) *Ectenocrinus simplex* with attached rhombiferans; (h) *Ectenocrinus geniculatus*; (i) Camerate sp. A; (j) *Rhaphanocrinus* sp. A. All scale bars are 5 mm.

## Results

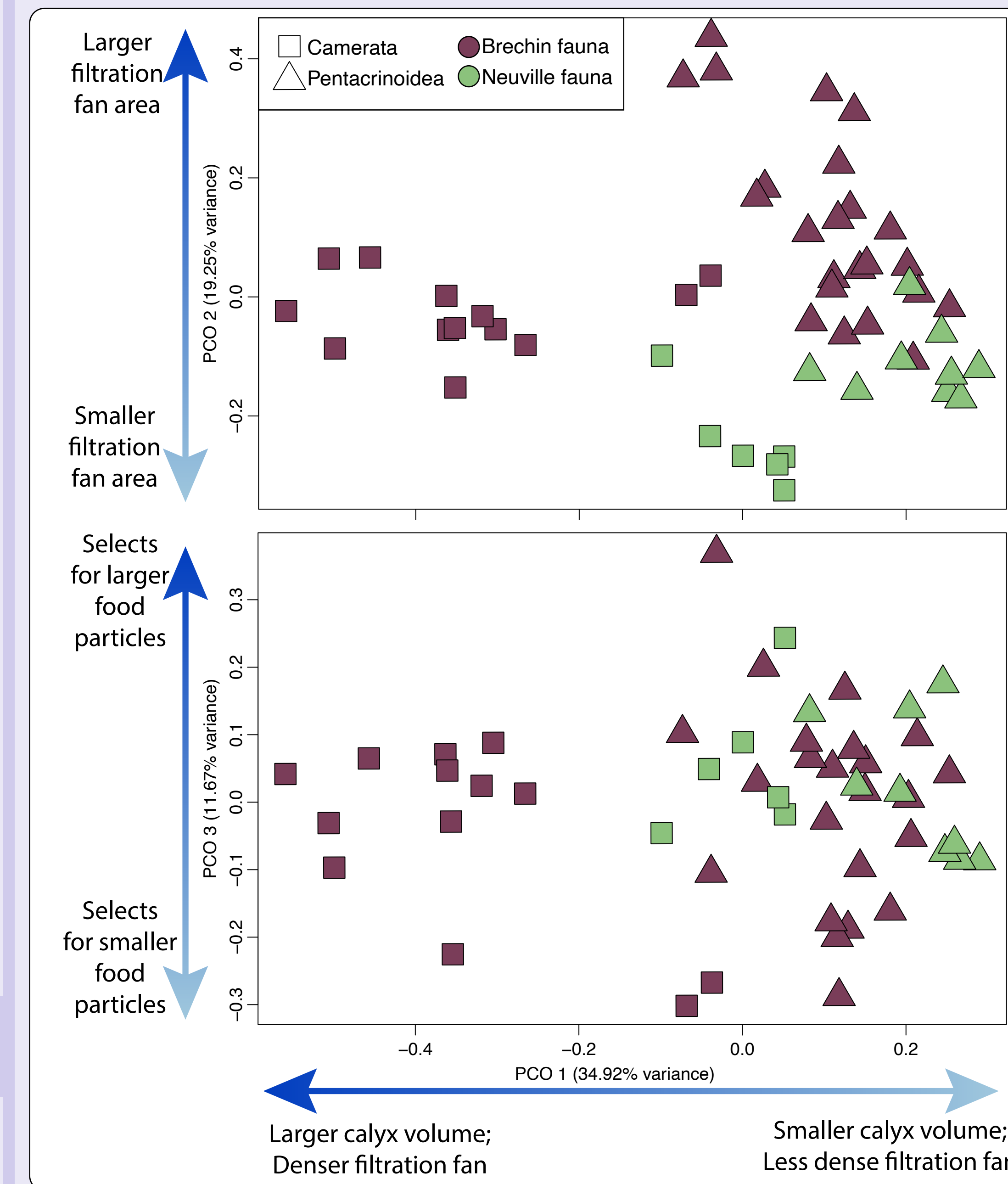


Figure 3. PCO graphs showing (a) PCO axes 1 and 2, and (b) axes 1 and 3.

Table 1. Spearman's rank correlation test p-values for composite and measured variables.

\*\*\*  $p < 0.001$   
 \*  $p < 0.01$

Variable	PCO 1 p-value	PCO 2 p-value	PCO 3 p-value
Calyx volume	*** $<2.2 \cdot 10^{-16}$	*** $8.2 \cdot 10^{-6}$	0.128
Filtration fan density	*** $8.6 \cdot 10^{-6}$	0.049	0.312
Filtration fan area	*0.002	*** $8.37 \cdot 10^{-4}$	*** $3.53 \cdot 10^{-6}$
Brachial width	0.021	*** $<2.2 \cdot 10^{-16}$	0.277
Brachial height	0.157	*** $9.173 \cdot 10^{-11}$	0.466
Pinnule width	*** $2.73 \cdot 10^{-8}$	0.802	*0.007
Pinnule density	*** $5.47 \cdot 10^{-16}$	0.134	0.084
Arm openings	0.114	0.114	0.480
Arm splits	*** $5.93 \cdot 10^{-5}$	0.156	0.096
Arm length	0.036	*0.002	*** $1.47 \cdot 10^{-8}$
Terminal feeding appendages	*** $1.03 \cdot 10^{-8}$	0.877	*** $4.30 \cdot 10^{-4}$

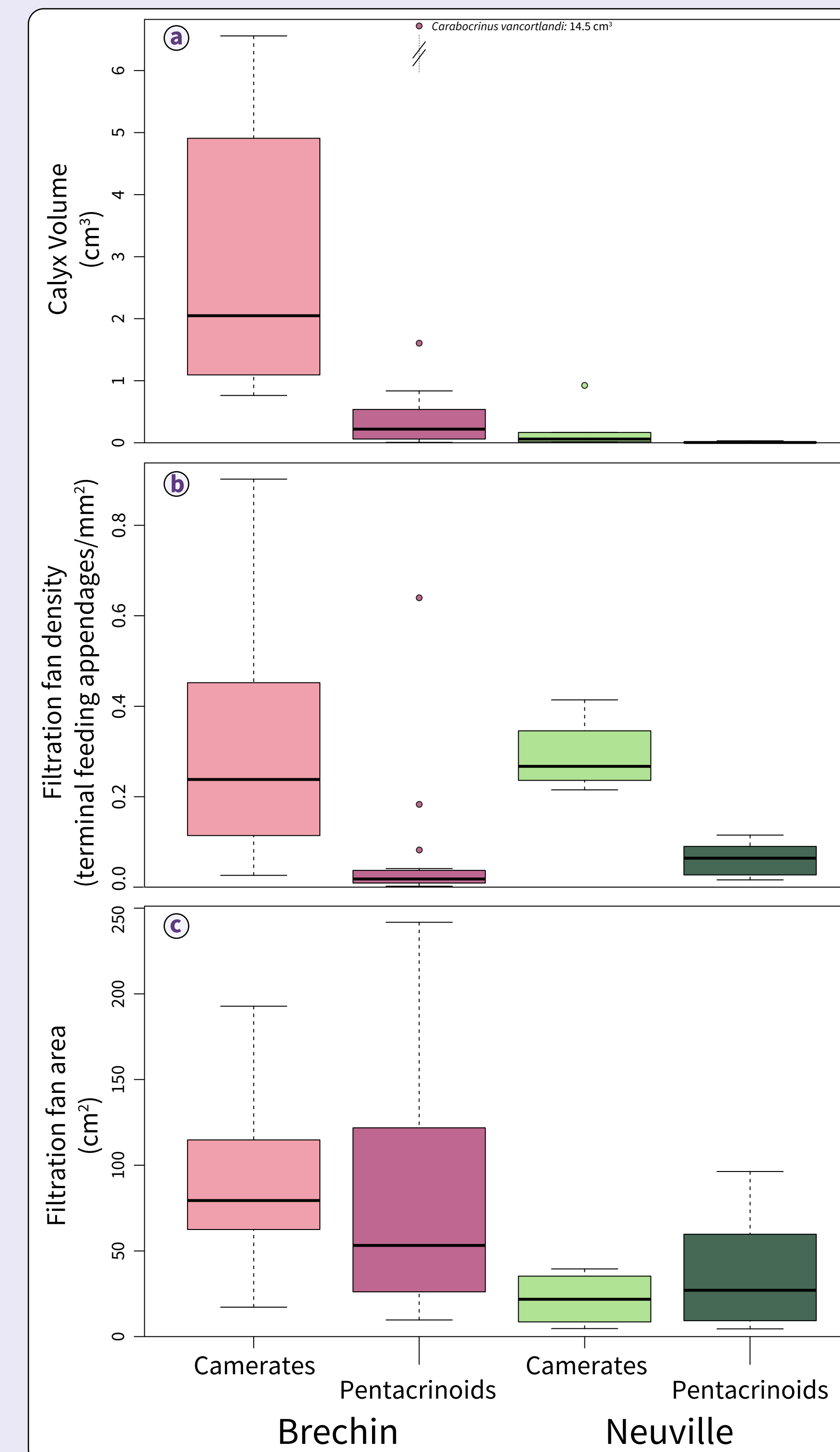


Figure 4. Boxplots of the (a) calyx volume (body size), (b) filtration fan density, and (c) filtration fan area of camerates and pentacrinoids from the Brechin (left two bars) and Neuville (right two bars) Faunas.

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## Conclusions and Future Directions

### Major observations

- Crinoids from the Brechin fauna show a greater variety of feeding strategies than those from the Neuville Fauna
- All Neuville crinoids plot more similarly to the niche space occupation of Brechin pentacrinoids

### Potential Drivers

- Ecomorphological trait differences among Neuville crinoids are minimized, possibly due to habitat filtering selecting for similar traits,
  - e.g., dense filtration fans may be selected against due to the high silt content, smaller body sizes may be due to lower overall nutrient availability
- Potential microhabitats in the Brechin fauna may allow for wider trait differentiation, or competition may drive greater trait variability and niche partitioning

### Future Work

- Identify if differences in feeding ecology between the Brechin and Neuville faunas is primarily environmentally controlled or driven by other factors (e.g., variations in other organisms present, broader ecological communities, latitude)
- Integrate additional Katian crinoid faunas from a spectrum of intermediate environments between the shallower, higher energy Brechin fauna and the deeper, lower energy Neuville fauna

### Acknowledgements

I would like to thank the Dry Dredgers Paleontological Research Award, the University of Oklahoma Robberson Research Grant, and the Oklahoma Geological Foundation Research Grant for providing summer funding for research and travel. I would also like to thank the Cincinnati Museum Center and the Musée de Paléontologie et de l'Évolution for providing support and access to their paleontology collections. Thank you as well to the OU Paleobiology research group for their support. This work is funded in part by NSF grant #2346400.