

Digitizing Fossils to Enable New Syntheses in Biogeography – The PALEONICHES - TCN



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TCN Overview

• “Digitization TCN: Collaborative Research: Digitizing Fossils to Enable New Syntheses in Biogeography – Creating a PALEONICHES-TCN”

- **Principal Investigators:**
- Bruce Lieberman (Univ. Kansas)
- Alycia Stigall (Ohio Univ.)
- Jonathan Hendricks (San Jose State Univ.)



TCN: Goals

- Database several major invertebrate fossil collections.
- Georeference fossil collections to enable study of biogeographic patterns over time.
- Generate digital atlases of fossil life for the general public and scientific community:
 - Digital images of ancient biodiversity.
 - Paleogeographic maps for individual species over multiple time intervals.

Project Coverage in Time and Space

Younger
↓
Older

Eon	Era	Period	Epoch
Phanerozoic	Cenozoic	Quaternary	Holocene
			Pleistocene
		Neogene	Pliocene
			Miocene
			Oligocene
		Paleogene	Eocene
			Paleocene
	Mesozoic	Cretaceous	-
		Jurassic	-
		Triassic	-
	Paleozoic	Permian	-
		Pennsylvanian	-
		Mississippian	-
		Devonian	-
		Silurian	-
		Ordovician	-
		Cambrian	-
Proterozoic	-	Ediacaran (630-542 Ma)-	-
Archean	-	-	-
Hadean	-	-	-



Ordovician (488-444 Ma) Collections

- Region: Cincinnati area.
- **Collections:**
 - Ohio University Zoological Collections (Alycia Stigall)
 - Department of Invertebrate Paleontology, Cincinnati Museum Center (Brenda Hunda)
 - Karl E. Limper Geology Museum, Miami University (Kendall Hauer)
- **Material to be digitized:**
 - 100,000 specimens
 - 115 species



Pennsylvanian (318-299 Ma) Collections

- Region: Mid-Continent.
- **Collection:**
 - University of Kansas Biodiversity Institute, Division of Invertebrate Paleontology (Bruce Lieberman and Una Farrell along with Jim Beach)
- **Material to be digitized:**
 - 170,000 specimens
 - 240 species



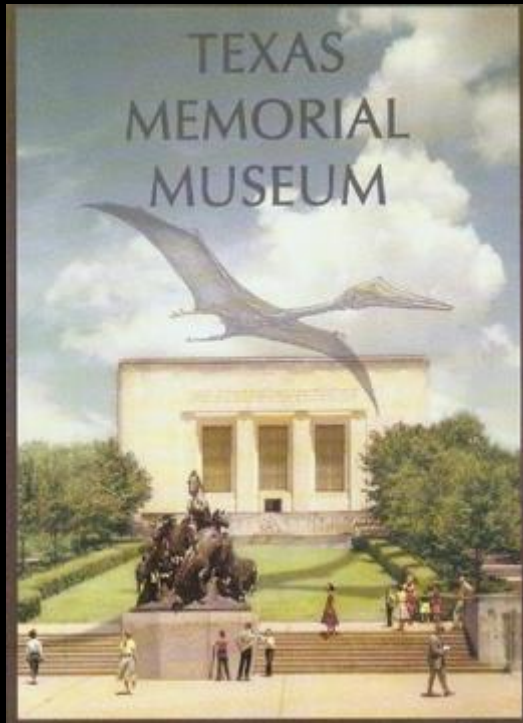
Neogene (23-2.6 Ma) Collections

- Region: Southeastern USA.
- **Collection:**
 - Division of Invertebrate Paleontology, Florida Museum of Natural History (Roger Portell)
- **Material digitized (focus will be on digital atlases):**
 - 176,615 specimens
 - 500 species

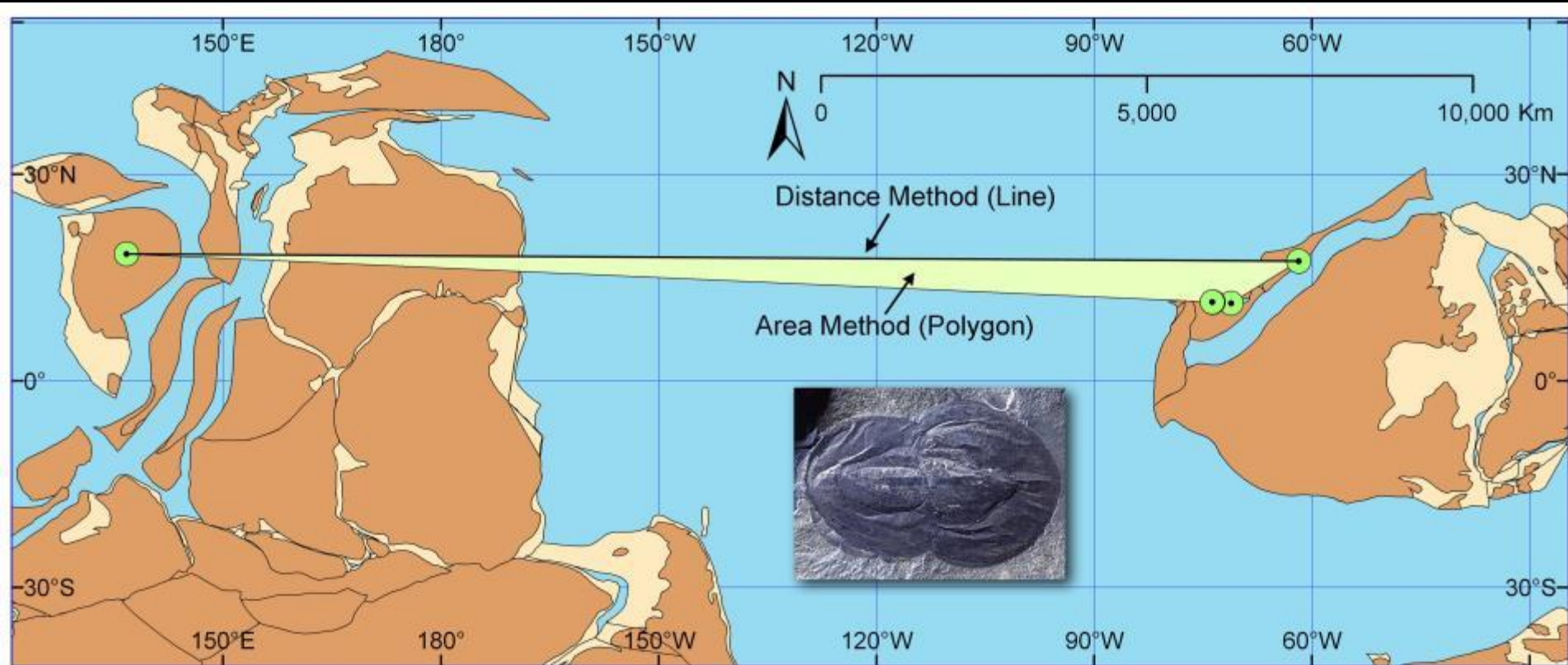


Since Our TCN Was Funded Two New Partners (PENs) Added

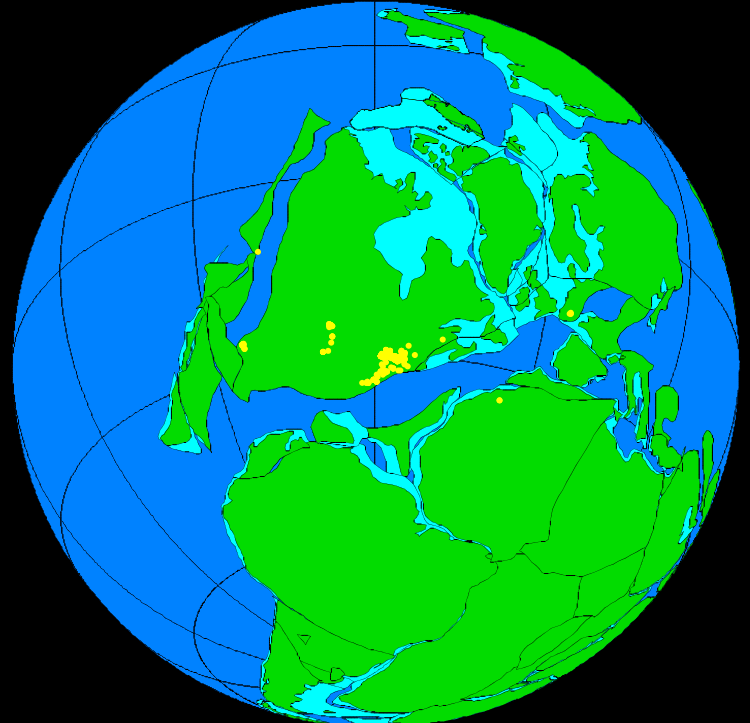
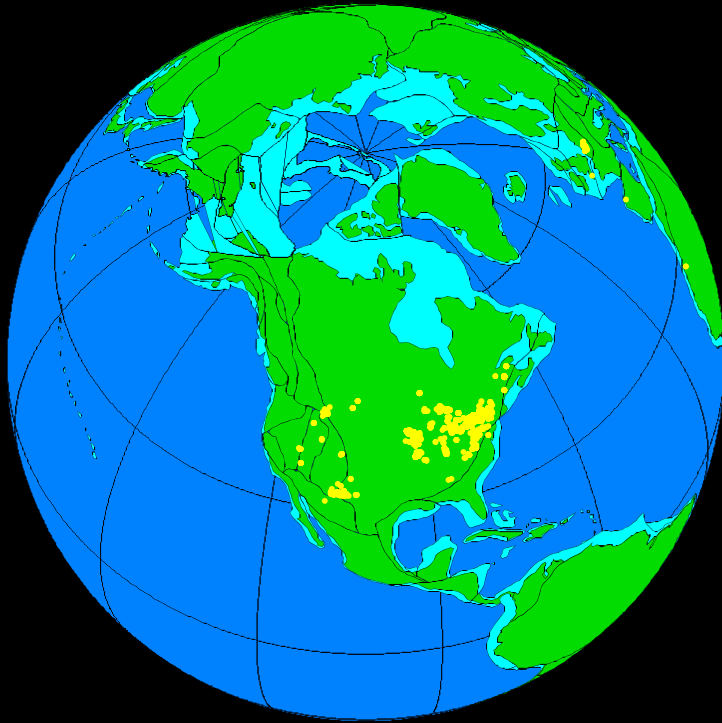
- University of Texas
 - Ann Molineux
- Yale University
 - Susan Butts & Derek Briggs



Biogeography of Soft-Bodied Faunas During the Cambrian Radiation

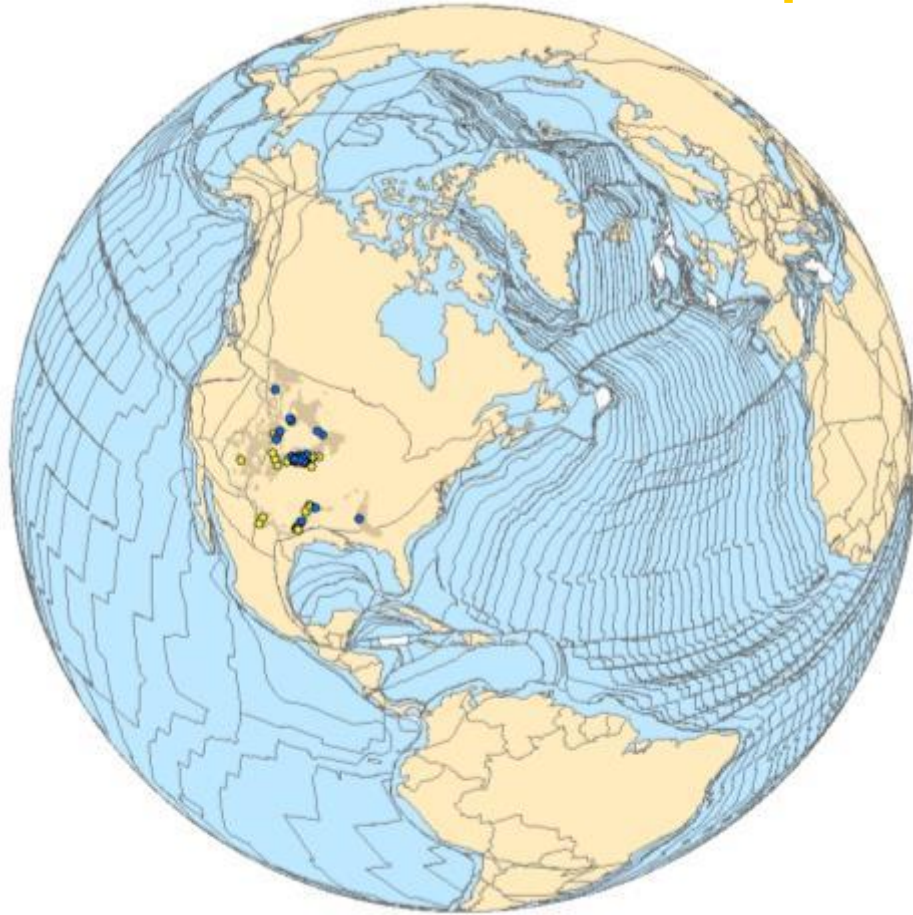


Late Devonian Biodiversity Crisis



Rode and Lieberman. 2004. *Palaeo* 3
Stigall and Lieberman. 2006. *Journal of Biogeography*

Evidence for Competitive Replacement



Cretoxyrhina mantelli



Tylosaurus sp



Dinocardium robustum



Maxent

GARP

Present

2021-2040

2041-2060

2081-2100



Terebra dislocata

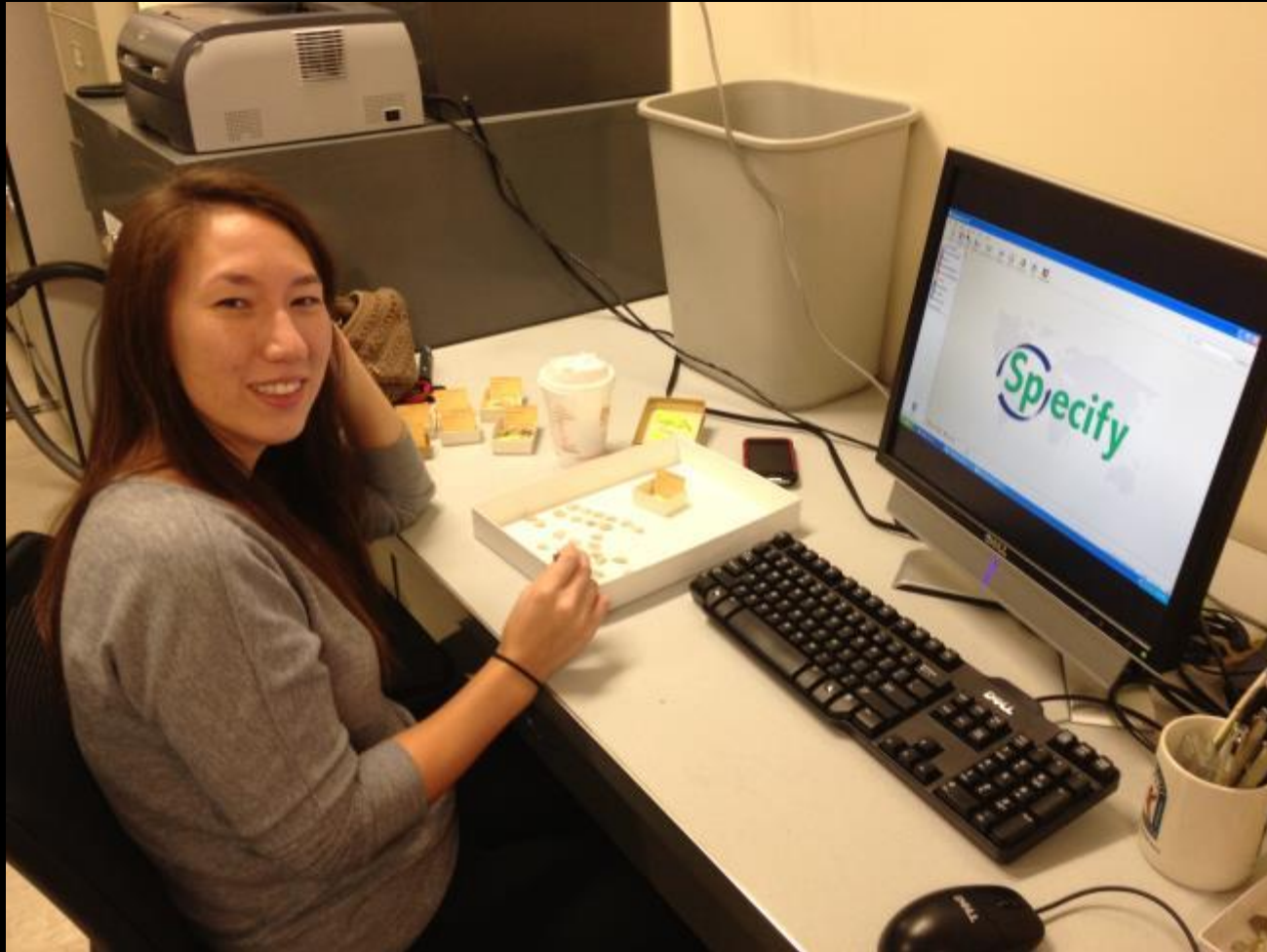


Maxent

GARP



Databasing Activities



Specimen number(s)

Taxon

Lithostratigraphy

Geologic Age

Locality

Collector

Locality number



▼ **Collection Object**

CatNo:

OriginalCatNo:

AccessionID:

Cataloger:

Cataloged Date:

▼ **Determinations**

Taxon	Type Status	Determination Citations	Pagination	Qualifier	Questionable	Current	Remarks

Form ▼

Collecting Events:

▼ **Preparations**

Prep Type	Count	Is On Loan		Preparation Attachments	Description	Storage

- ☒ This Collection Object belongs to Container:
- ☐ This Collection Object is the Container:

Form ▼

▼ **Paleo Context**

Chrono Strat:

Bio Strat:

Litho Strat:

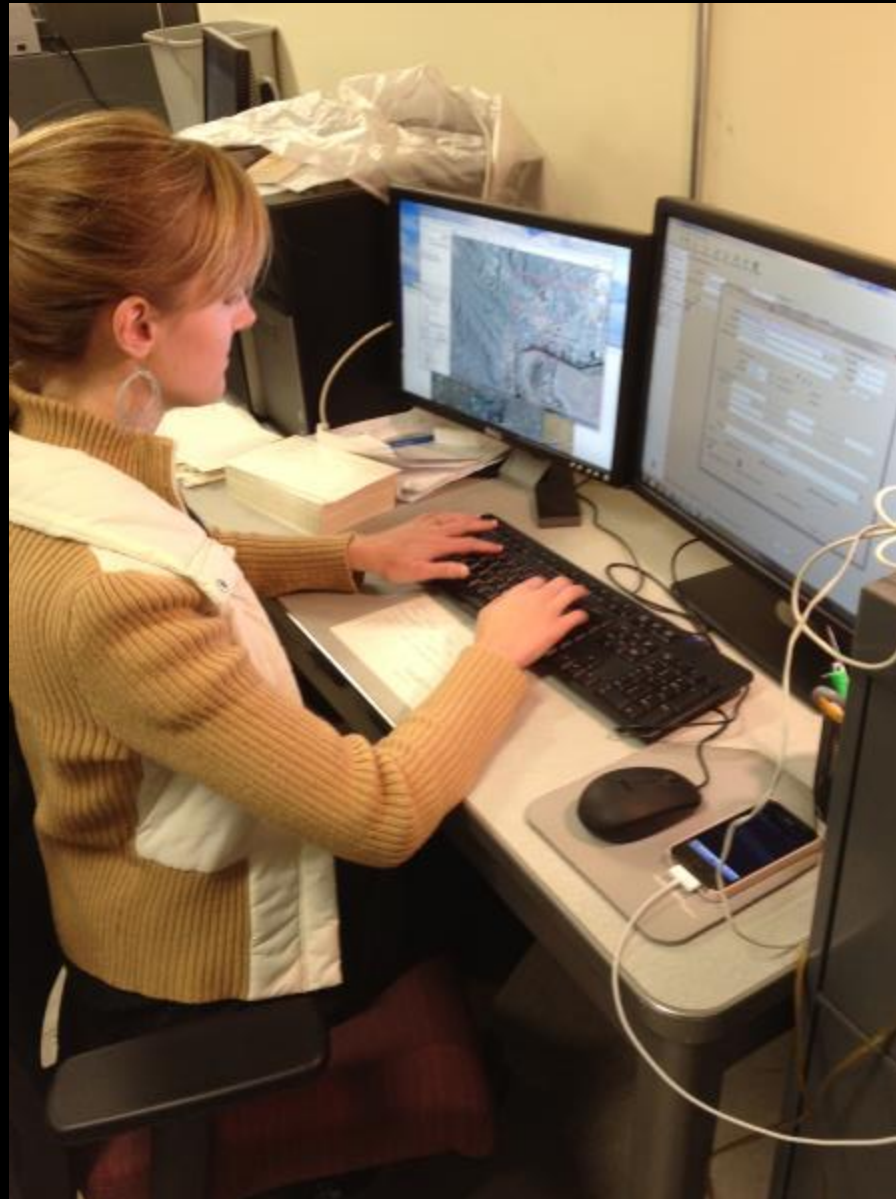
Remarks:

Remarks:

Labels (GML):

Material:

Georeferencing Activities



Geologic Age

Locality Number

Higher
Geography

TRS

Collector(s)

Locality

Lithostratigraphy

Collection
Date

Geologic Age: Upper Pennsylvanian (Virgilian)

Field Loc. No. DLB1-16

U.S.A. Kansas Lyon
Country State County

Map Edition & Scale

SW $\frac{1}{4}$, SE $\frac{1}{4}$, Sec. 5, T18S, R13E
Survey Coord. or Grid

Lat. Long.

Wakarusa ls. Mbr. (top 25 cm)
Bern ls.
Formation or depth

1990

D.L. Baars & W.L. Watney
Coll. by

Loc. Descr.: SW $\frac{1}{4}$, SE $\frac{1}{4}$, Sec. 5, T18S, R13E, approx. 1 $\frac{1}{2}$ mi. SW of Reading,
Lyon County, Kansas

Organisms

Alice Hart 15
Entered into Museum Date

Museum Coll. Nos. _____

▼ Locality

Location:

Geography:

SurveyCoords:

MapEditionScale:

▼ Locality Details + -

Township:

Range:

Section:

Decimal Degrees

Latitude:

N

Longitude:

W

(Source)

(Source)

▼ Geo Coord Details + -

Named Place

Extent:

Max Uncert Est (m):

Source:

Error Polygon:

Orig Coord System:

Error Method:

No Geo Ref

Because:

Geo Ref Det By:

Geo Ref Det Date:

Remarks:

Plugins



GEOLocate



Display in WorldWind



Display in GoogleEarth

Attachments



0

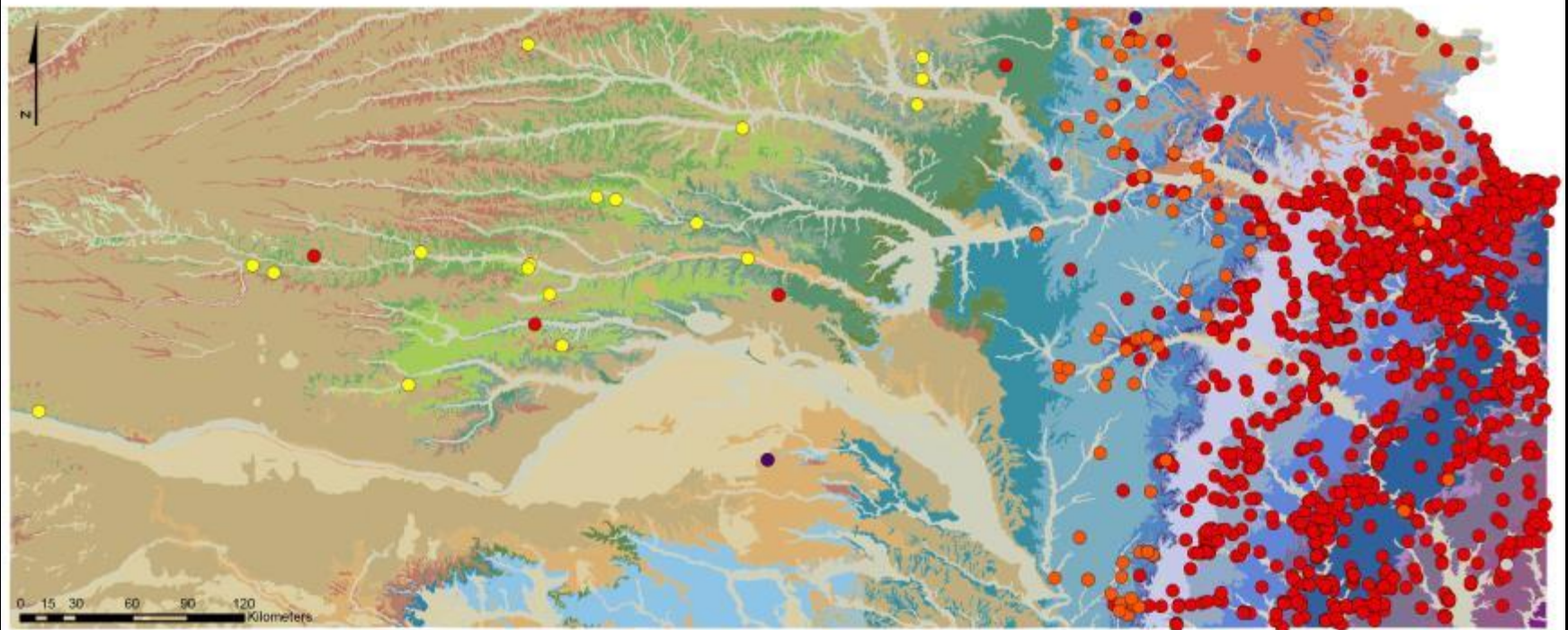


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KUMIP Results/Stats

- Specimens databased – 127,303
- Specimens georeferenced – 102,485
- Localities georeferenced – 6,720

KUMIP Results/Stats Cont.



Legend

Quaternary Tertiary Cretaceous Jurassic Permian Pennsylvanian Mississippian



Locality Age

- Yellow dot: Cretaceous
- Orange dot: Permian
- Red dot: Pennsylvanian
- Purple dot: Mississippian
- Grey dot: Unknown

KUMIP Results/Stats Cont.

- Taxa Completed –
 - C. Trilobita, P. Brachiopoda, P. Bivalvia



- Currently working on –
 - C. Cephalopoda



Digital Atlas of Ancient Life

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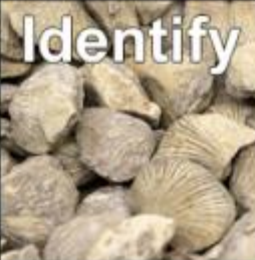
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Explore



Identify



Ordoevian



Pennsylvanian



Neogene



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www.digitalatlasofancientlife.org

Digital Atlases: Goals

- Digital atlases:
 - “Field guides to the past” for three of the United States’ most fossil-rich regions
 - Online webpages
 - “App” for mobile devices
 - Intended audiences: scientists and avocational fossil collectors
- Atlases will be generated for the following numbers of species for each time period:
 - Ordovician: 115 species
 - Pennsylvanian: 240 species
 - Neogene: 500 species

Species Page

- Classification (hyperlinks)
- Geological range
- Stratigraphic occurrences (hyperlinks to taxon lists)
- Paleogeographic distributions with “time-slice maps”
- Remarks:
 - Features useful for identification
 - Important references
- Photographs illustrating key features for identification

Atlas of Neogene Paleontology

[Home](#) [Atlas](#) [Geology](#) [Other Information](#)

Conus adversarius

Classification
Phylum: Mollusca
Class: Gastropoda
Family: Conidae
Genus: *Conus*
Species: *Conus adversarius* Conrad, 1840



Geological Range
Early Pliocene to Early Pleistocene

Stratigraphic Occurrences
Early Pleistocene: Caloosahatchee Fm. (S. FL); Nashua Fm. (N. FL); Waccamaw Fm. (NC)
Late Pliocene: Duplin Fm. (NC); Intracoastal Fm. (FL); Jackson Bluff Fm. (N. FL); Raysor Fm. (SC); Tamiami Fm. (S. FL); Yorktown Fm. (VA)
Early Pliocene: Goose Creek Limestone (SC)

Paleogeographic Distribution
South Florida to Virginia.



Pliocene

Early Pleistocene

Remarks
Conus adversarius can be differentiated from all other cone shells (living or extinct) by its sinistral, or left handed, shell coiling: when held with the apex pointing upwards and the aperture opening facing the viewer, the opening is on the left. All other cone shells have dextral, or right-handed shell coiling. See Hendricks (2009) for recent review.

Photographs



Conus adversarius from the Caloosahatchee Fm. of southern Florida. Scale bars equal 1 cm.

The Digital Atlas of Pennsylvanian Life: American Midcontinent



[Home](#) [Atlas](#) [Geology](#) [Other Information](#)

Welcome

Welcome to the Digital Atlas of Pennsylvanian Life for the American Midcontinent!

=====

To enter the atlas pages for each of these groups, click on an image below.

Brachiopods



To find out more about the geology of the American Midcontinent, click on "Geology" above.

Funding for development and construction of this webpage was provided by the [National Science Foundation](#) (EF-1206757, EF-1206769, and EF-1206750).



1 cm 

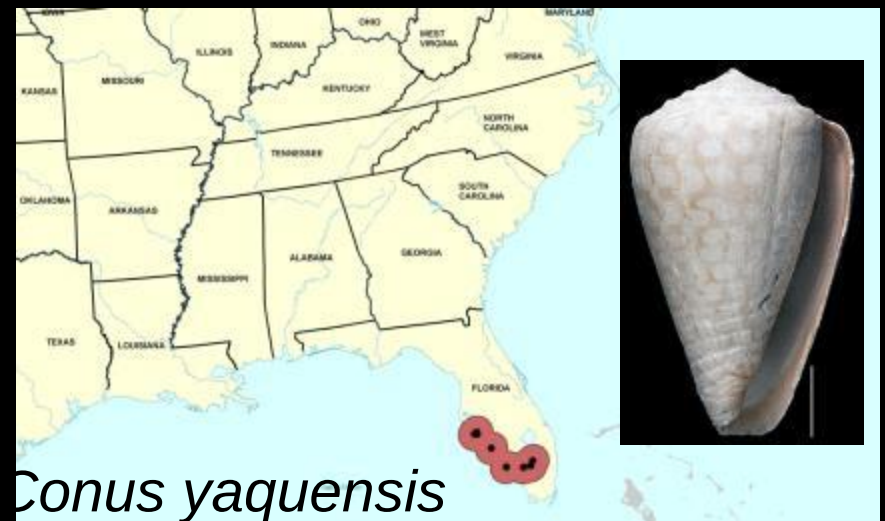
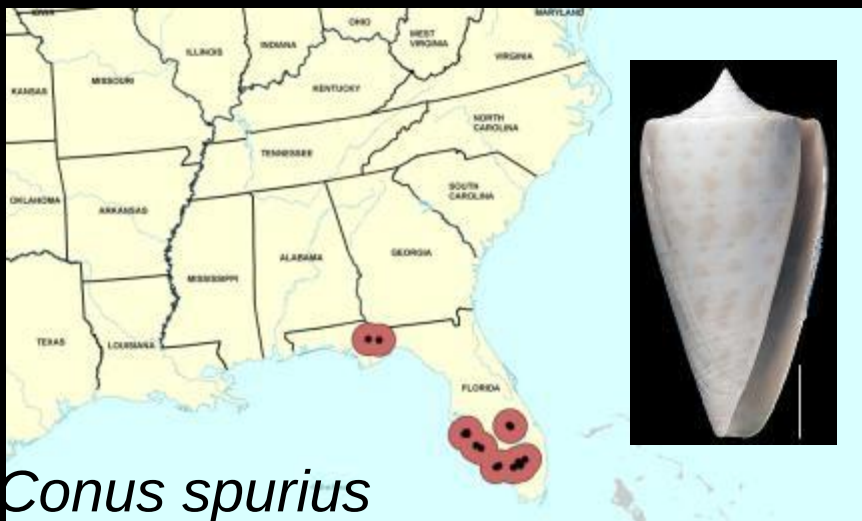
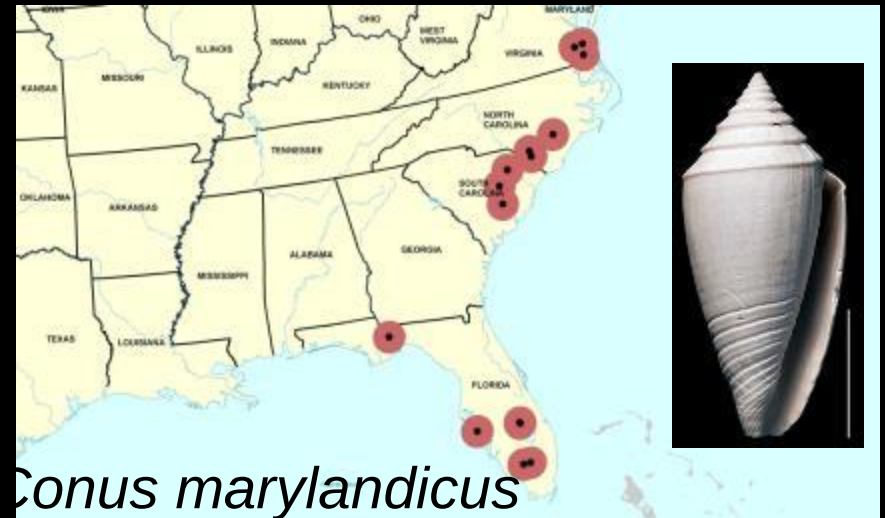
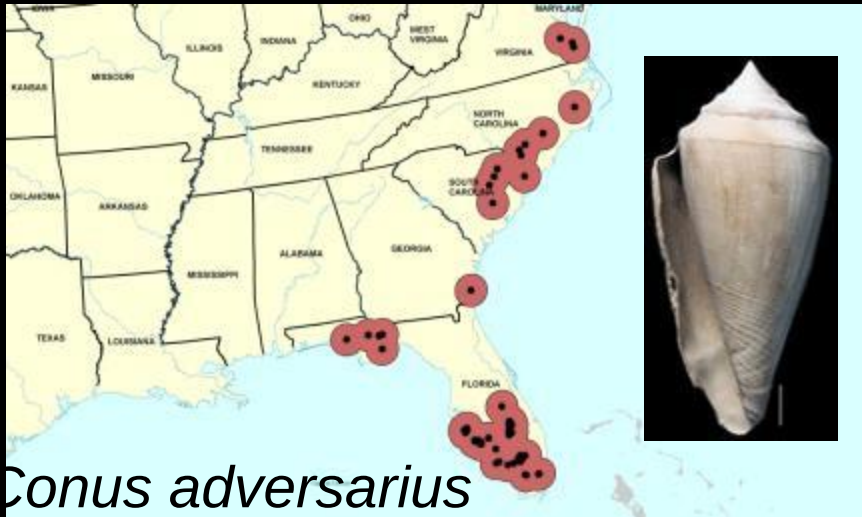


2 CM





Different Ranges of Four *Conus* Species During the Pliocene



Conclusions

- Specify an excellent databasing platform
- Work on project continuing apace
 - Databasing and georeferencing fossils opens up new research and outreach opportunities

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Specify (KU)

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NSF Systematic Biology

