PRPA Repercussions & Implications for Real World Study by Citizen Scientist Avocational Paleontologists

Linda McCall

President: North Carolina Fossil Club

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NE/NC GSA 2017

PRPA 2009
Paleontological Resource Protection Act

- First LAW to regulate fossil collecting on public lands
- Designed to protect scientifically important fossils
  - Damaged, destroyed or removed from public land
  - Goal of preserving them for study, curation and preservation
  - Purpose, educational benefit of all mankind
  - Adding information to the collective body of knowledge we have about our planet/past
- Restricts vertebrate fossil collecting to: "by permit only"
- Allows "casual collecting" of a "reasonable amount" of "common" non-vertebrate fossils without a permit
- Penalties for breaking the law
- Worthy cause and should be universally supported

PRPA Repercussions

- Proposed Rules have serious repercussions for Citizen Scientist Avocational Paleontologists – Problematic wording includes:
  - Prohibit research on casually collected specimens
  - Limit casual collecting to only "common" specimens
  - Limit casual collecting to 25 lbs. a day, not to exceed 250 lbs. annually
  - Defines "negligible disturbance" as little to no change to the surface of the land; limits disturbance to 1 square yard; separates multiple collectors by at least 10 feet
  - All other collecting requires a permit
  - Criteria for applying for permit includes:
    - a graduate degree in paleontology or related field of study…
    - experience in collecting, analyzing, summarizing, reporting , preparing collections
    - Experience in planning, equipping, staffing, organizing, etc., etc. field crews
    - Other expertise
    - Past performance history
  - All specimens collected under permit must be housed in an approved repository

Spectacularly Preserved, Mollusc-Dominated Fauna from a Cavity Layer in the Lower Cretaceous Edwards Formation, Central Texas

Linda McCall, James Sprinkle, Ann Molineux

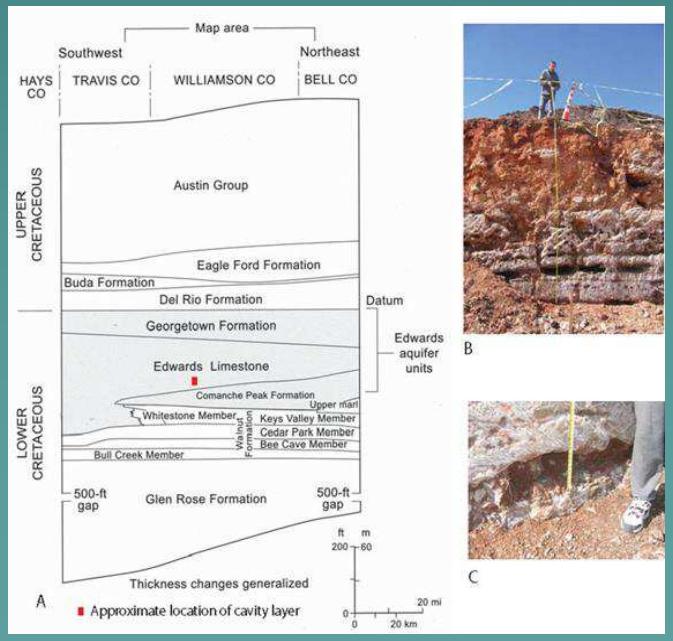
The University of Texas at Austin

GCAGS 2008

Paper Background

- Road construction – 2006
- Uncovered Cretaceous fossils from the Edwards Formation
- Unusually good preservation
- Time sensitive accessibility (4 mo.)
- UT notified – unable to participate
- Obtained permission and spent parts of 22 days between August and December 2006

Documentation of Site



- Location: Georgetown, TX
  - Specimens embedded in red clay
  - Layer exposed only at road base
  - Exposure intermittent
- Total Road cut
  - .2 miles long
- Total collecting area:
  - 135 ft. long by 52 ft. wide, 8 inches high & intermittent
  - 13 feet below ground

Processing Cavity Material

Processing Cavity Material

Processing Cavity Material

Relevant Numbers

- 22 days field collecting
- 500 hours curating
- 900 kg (1 ton) of material
- 90 kg (200 lbs) ~ 152,000 individual loose specimens
- 90% of material has already been donated to UT

How did the Paper Happen?

- Showed material to UT in 2006
- 2008, Jim Sprinkle contacted me – want to write a paper?
  - Abstract done in 2 weeks, submitted it to GCAGS
- They suggested I be lead author
  - I had done all the work
  - Asked for an outline (never having done this before)
  - I wrote the paper in layman's terms
  - Ann and Jim helped upscale it into scientific terms
- I presented at the October 2008 GCAGS Convention
  - Awarded 2nd place for best paper at the conference
- Reprinted in the South Texas Geological Society bulletin in March 2010

Paper Highlights

- Note: Most Texas Cretaceous fossils are moldic, or internal casts
- Specimens at this site showed beautiful external ornamentation and details, down to growth lines, and was more diverse than any Edwards Formation fauna found anywhere else
- Over 100 taxa present
- 60 unidentified at the species level
- 26 unidentified at the genus level or higher

Comparison of Two Mollusc-Dominated Faunas from Cavity Layers in the Lower Cretaceous Edwards Formation of Central Texas

Linda McCall, James Sprinkle, Ann Molineux

Paleontological Society of Austin

GCAGS 2010

University of Texas - Austin

Background Basics

- Site 1, 2006
- Site 2, 2008
- Beautiful, atypically preserved specimens
- Freshly exposed section
- Bulk collected – single collector
- Both paved after construction

Location, Similarities and Differences

- 230 meters difference laterally
- 5 meter difference in elevation
- Moderately karstified zone - unable to determine if coeval
- Few fossils in remainder exposure

Collection Statistics

- Site 1: 4 months, 1 ton of material
- ~152,000 specimens
- Site 2: 1.5 days, 280 lbs of material
- ~7,400 specimens
- Block material – specimen tansport?

Processing Cavity Material

How did the Paper Happen?

- Showed material to UT while collecting 2008
- 2009 – Jim again – want to write another paper?
- Second abstract was submitted to GCAGS
- They asked me to be lead author again,
  - I made up the outline this time,
  - wrote the paper in layman's terms, and
  - Ann and Jim helped me upscale it into scientific terms
- I presented at the October 2010 GCAGS Convention
- Reprinted in the South Texas Geological Society Bulletin in December of 2011

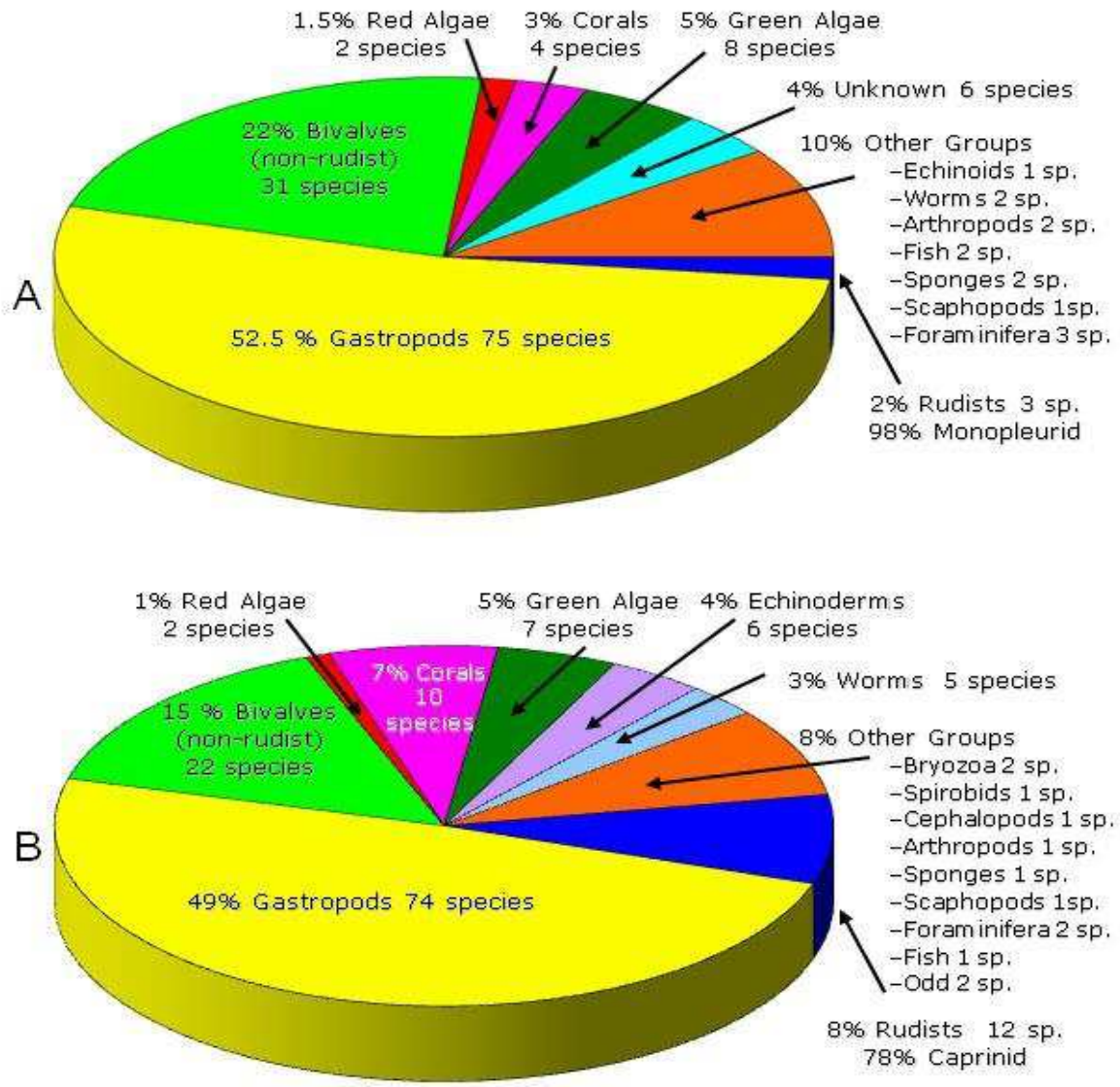
Paper Findings

- Single crystal calcite casts
- Beautifully preserved external ornamentation
- Re-crystallized matrix
- Red clay pockets / 20 cm
- Random orientation
- Mollusc dominated faunas – differ size, comp, diversity

Paper Highlights

- 200+ species level taxa
  - Largest and most diverse fauna from a single locality
- 134 Taxa new to the Edwards
  - extending ranges forward
  - extending ranges back
  - 96 new taxa to be described
- Wealth of material allowed for multiple biodiversity comparisons
  - Species comparisons
  - Weight – rough proxy for biomass

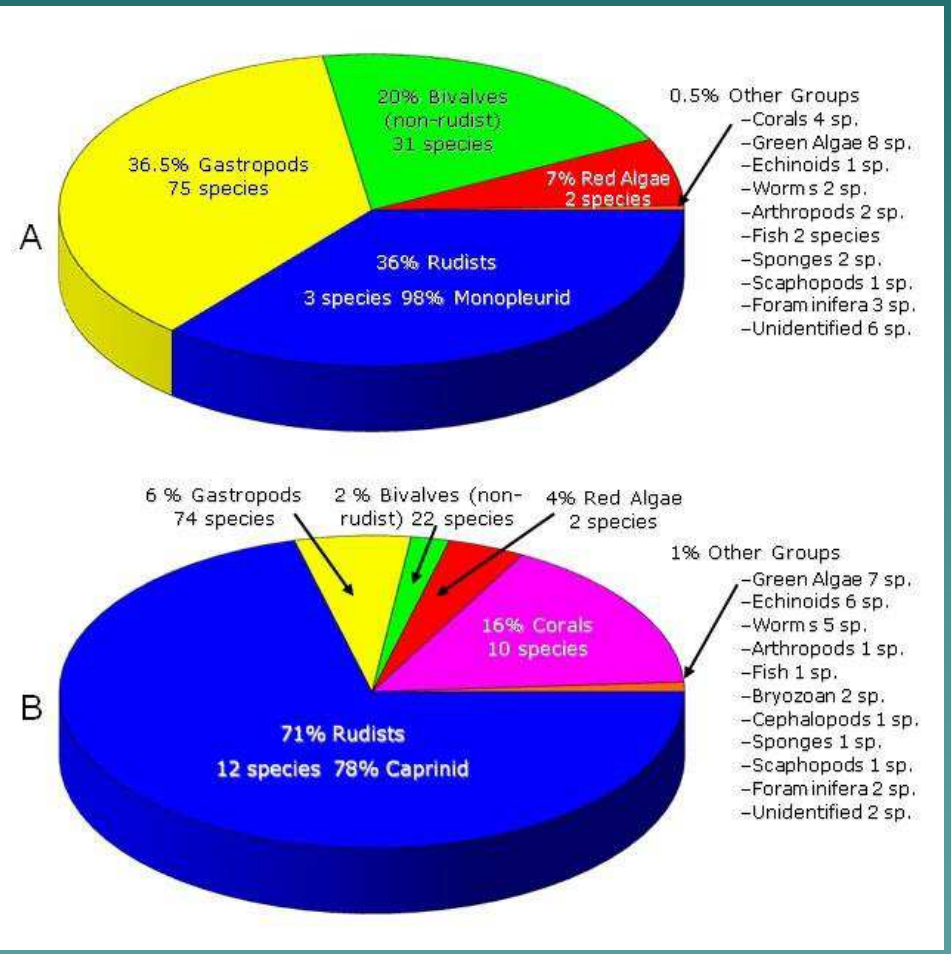
Species Diversity - Cavity



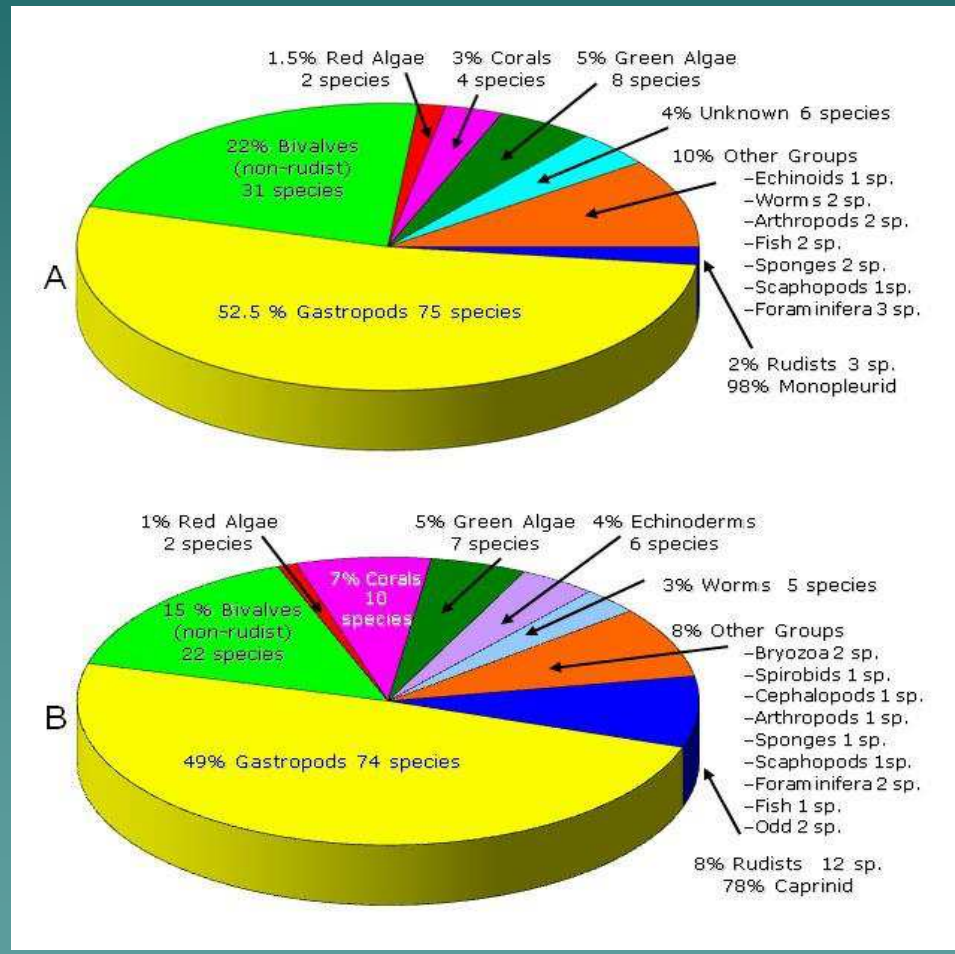
- 70 sp. unique to Site 1
- 77 sp. unique to Site 2
- 73 sp. present at both
- Site 1
  - rudists (Monopleurid)
  - less corals (4 sp.)
  - gastropods – diff.
  - bivalves - large
- Site 2
  - rudists (Caprinid)
  - more corals (10 sp.)
  - gastropods – diff.
  - bivalves – small
  - more echinoderms
  - more worms
  - taxa smaller

Comparison of Weight vs. Species

Weight (Biomass)

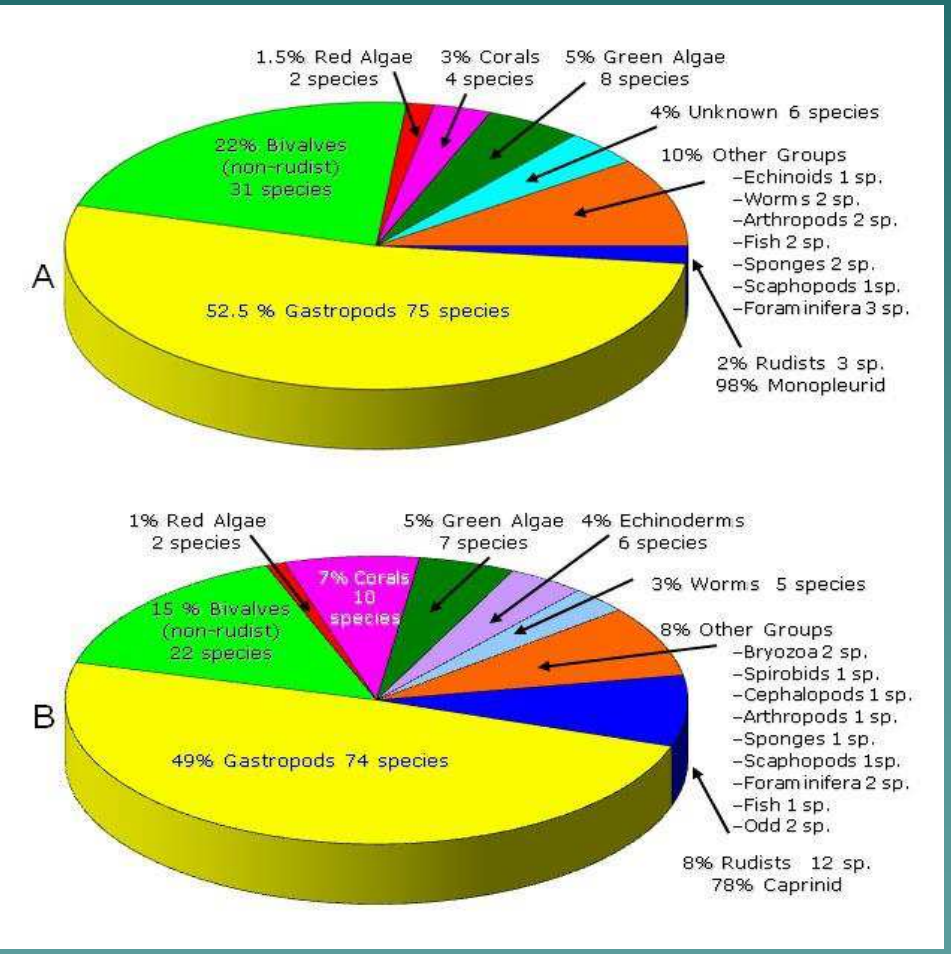


Species

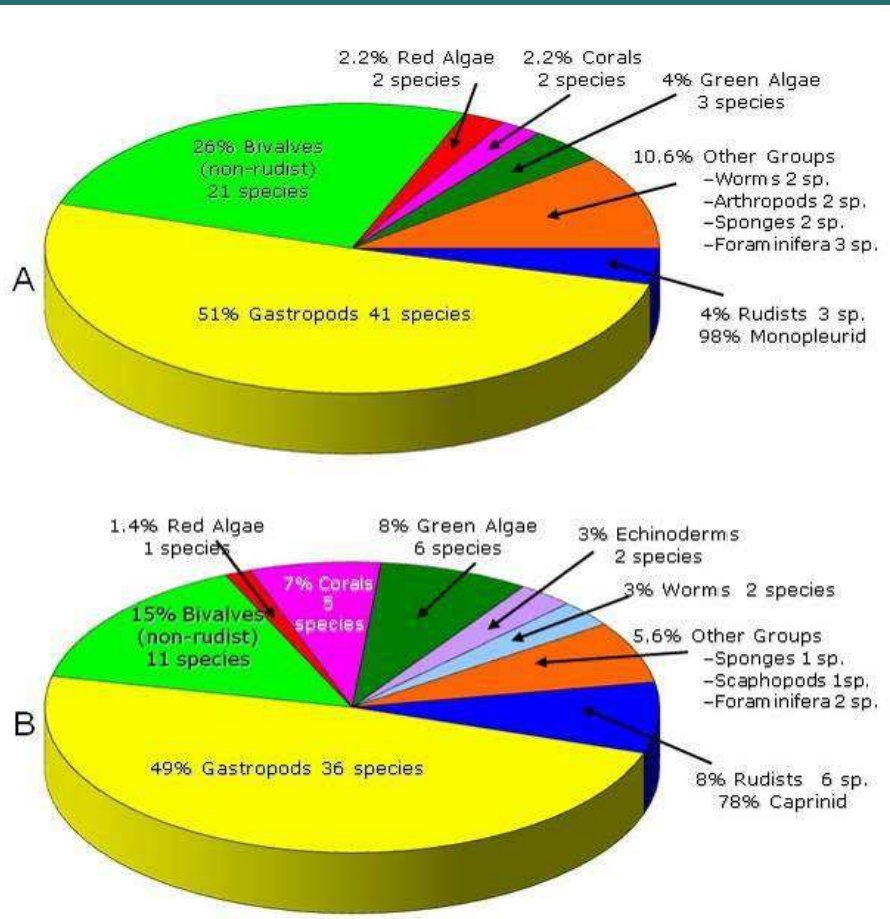


Comparison of Cavity vs. Wall Rock

Cavity



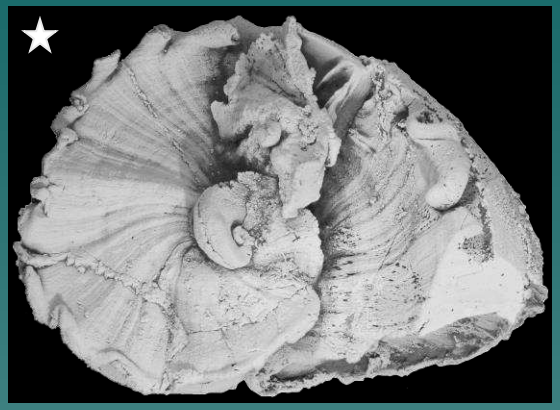
Wall Rock



Conclusions

- Two distinct faunal assemblages located close together
- Range extensions
- Many "new" species added to Edwards faunal record
- Cavity faunas worthwhile candidates for study when taken with wall rock
- Valuable resource for further study/future research

Bivalves
Site 2



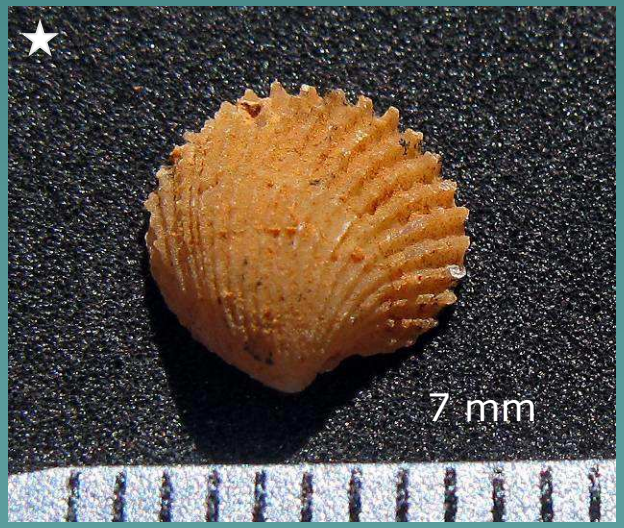
20 mm

Toucasia hancockensis

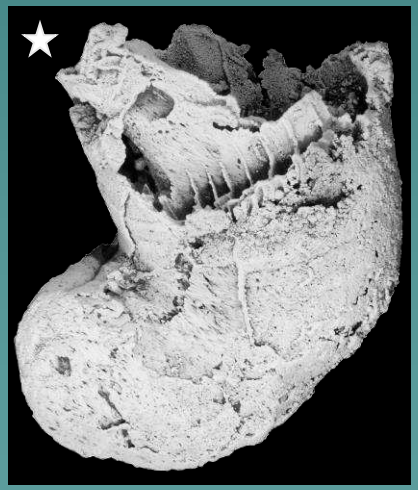
10 cm

Caprinid rudist

Cosmetodon sp.



aff. Carditae



10 mm

Caprinuloidea perfecta

Gastropods - Site 1

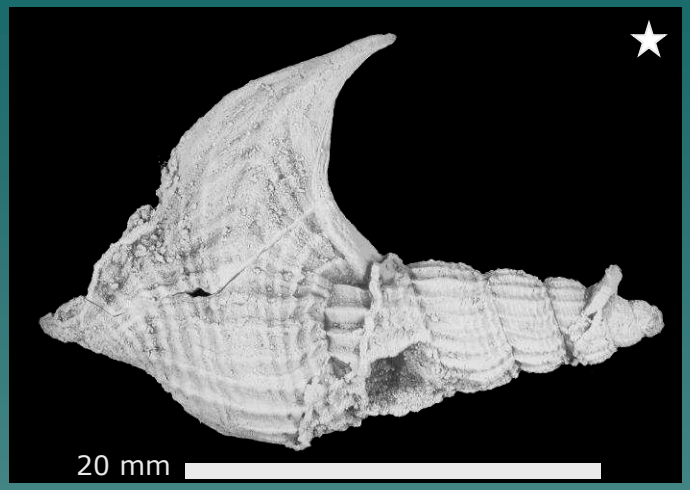
Monocyphus singleyi (1 prong)

Monocyphus singleyi (4 prong)

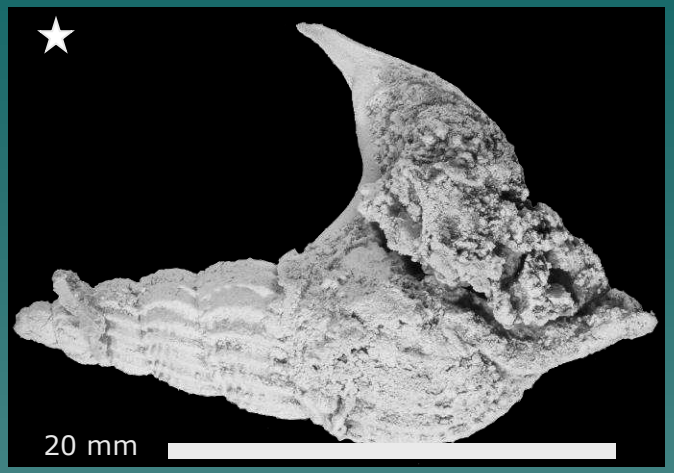
Monocyphus brittsi

Arrhoges sp.

Gastropods - Site 2



Arrhoges sp.



Arrhoges sp.

Aporrhais sp.

Monocyphus singleyi (4 prong)

Gastropods - Site 2

Cerithium austinense

Nerinea cultrispira

aff. *Paziella*

Cerithium sp.

Cerithium kikapooense

Gastropods - Site 1

Solarium(?) *planorbis*

Margarites brownii

Unidentified

Solariella serrata

Pileolius septangularis

Gastropods - Site 2

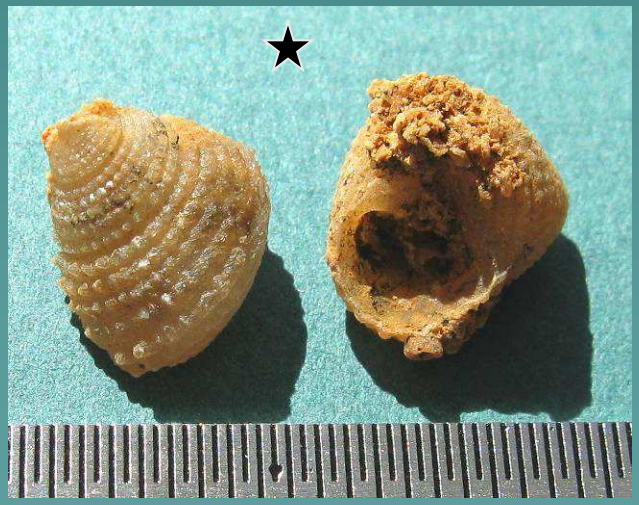
Solarium(?) *planorbis*

Semineritina apparata

Unidentified

Emarginula(?) sp.

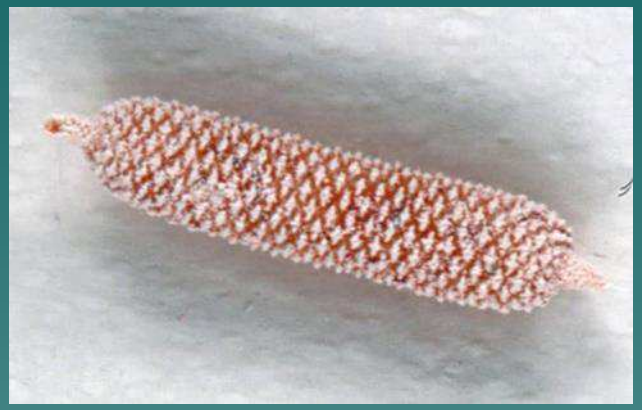
Amaurellina sp.



Monodonta bartonensis

Algae
Site 2

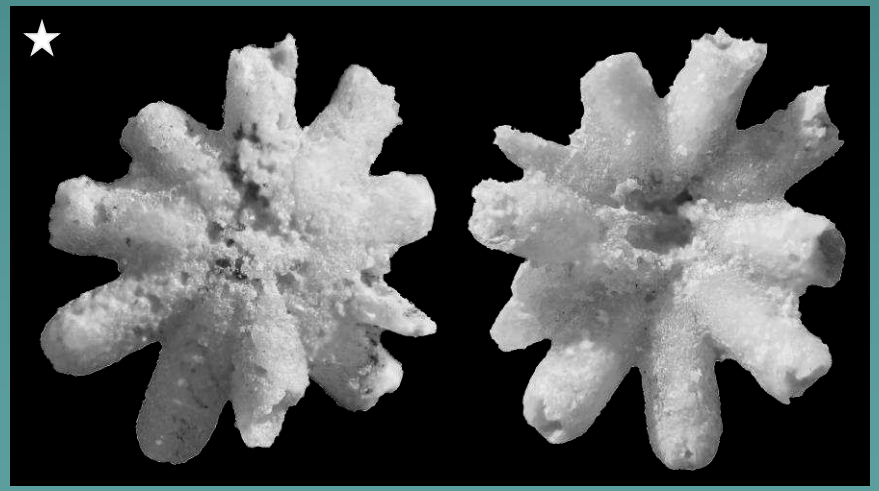
Calcareous dasyclad green alga



Calcareous dasyclad green alga – *Cylindroporella barnesii*

Calcareous dasyclad green alga

Calcareous dasyclad green alga



Calcareous dasyclad green alga

Rare Fossil Groups - Site 1

Crustacean claw

Rogerella cragini
barnacle borings on bivalve

Scaphopod – *Dentalium* sp.

Predatory gastropod drilled bivalve

Pycnodont teeth

Rare Fossil Groups - Site 2

Crustacean claw

Unidentified bryozoan

Scaphopod – *Dentalium* sp.

unidentified cephalopod jaws

Pycnodont teeth

PRPA Compliant?

- Prohibit research on casually collected specimens
- Limit casual collecting to only "common" specimens
- No vertebrate collecting without a permit (5 Pycnodont teeth)
- Limit casual collecting to 25 lbs. a day, not to exceed 250 lbs. annually
- Defines "negligible disturbance" as little to no change to the surface of the land; limits disturbance to 1 square yard; separates multiple collectors by at least 10 feet
- All other collecting requires a permit
- Criteria for applying for permit includes:
  - a graduate degree in paleontology or related field of study…
  - experience in collecting, analyzing, summarizing, reporting , preparing collections
  - Experience in planning, equipping, staffing, organizing, etc., etc. field crews
  - Other expertise
  - Past performance
- All specimens collected under permit must be housed in an approved repository

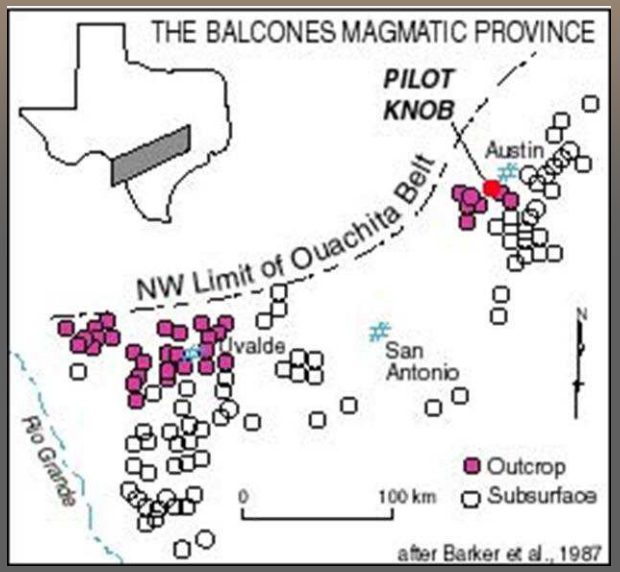
An undescribed fauna from the Upper Cretaceous "Pyroclastic Zone" of the Austin Group at Pilot Knob, central Texas

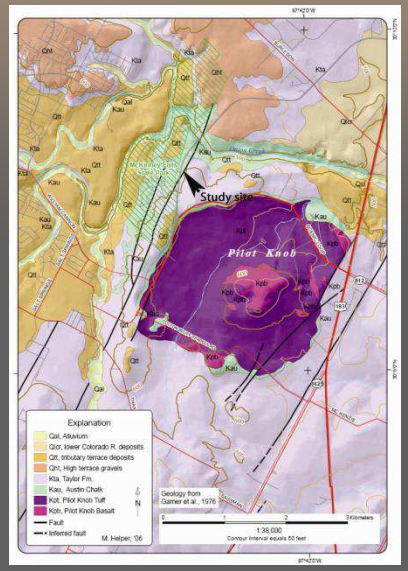
Linda McCall, James Sprinkle, Ann Molineux, Christopher Garvie
University of Texas – Austin

GCAGS 2012

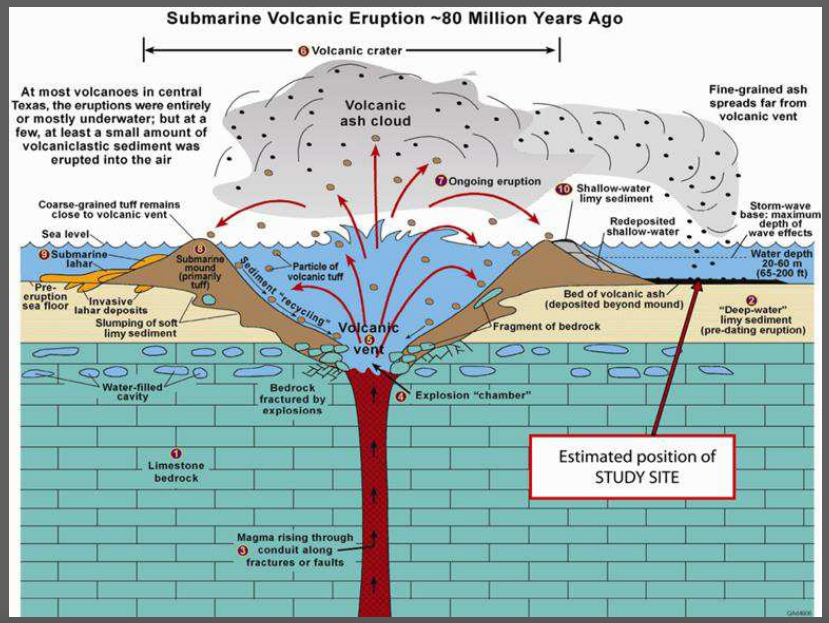
How did the Paper Happen?

- Collected the material back in 1996 and 1997 and sat on it for 16 years.
- 2012, Jim Sprinkle contacted me – want to write another paper?
- I had always wanted to do something with the Pilot Knob material
- I wrote the abstract, they proofed it and it was submitted to GCAGS
  - I did the outline and most of the paper
  - Ann and Jim helped me when I would get stuck
- I presented the paper at the October 2012 GCAGS Convention,
  - It was awarded 3nd place for best presentation at the conference.



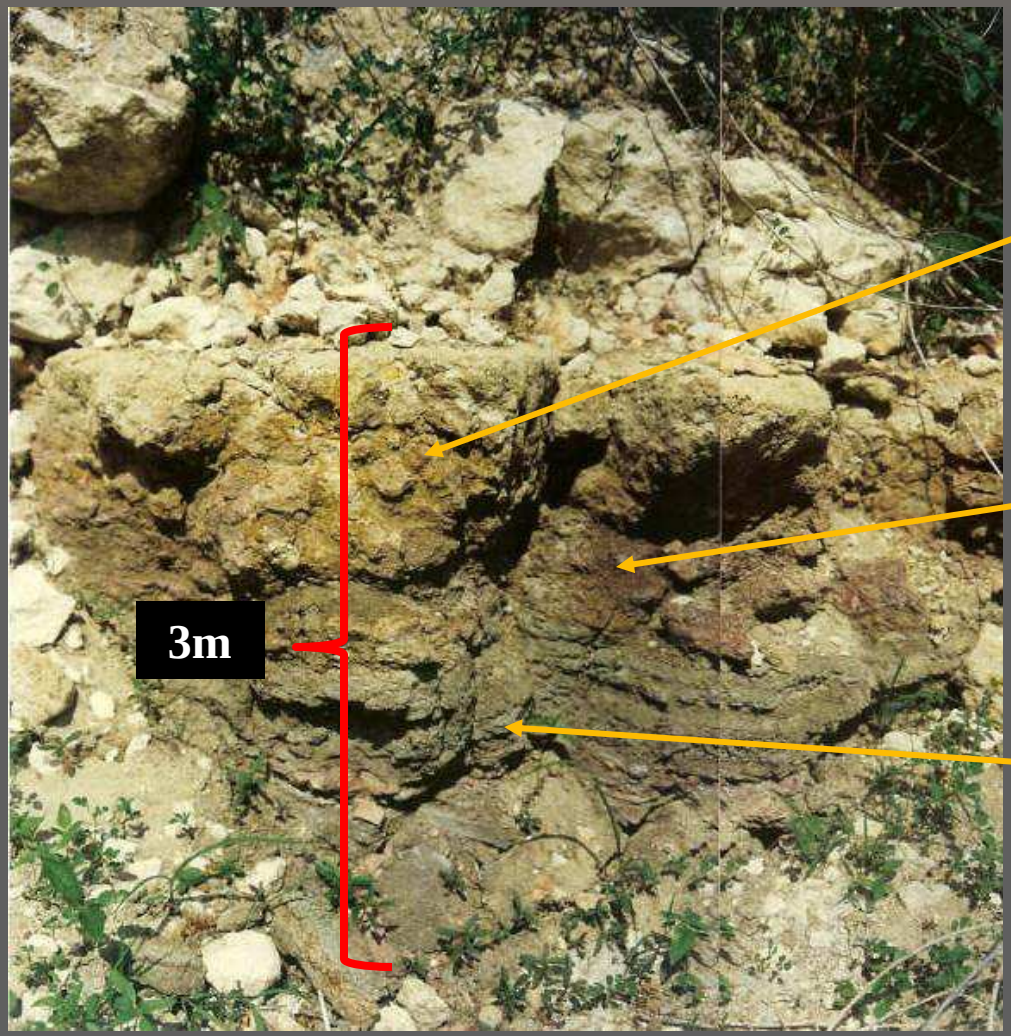


- Pilot Knob – Little volcano south of Austin, TX near the airport
- Area quarried for McKown Limestone deposited after the eruptions ended
- Fossil clubs hunted the area frequently – Austin Chalk fossils
- Quarries routinely left a foot or so of limestone on quarry floor



1996 Drainage Ditch

Stratigraphic Sequence



Yellow Layer

(base of McKown Formation)

Red Layer

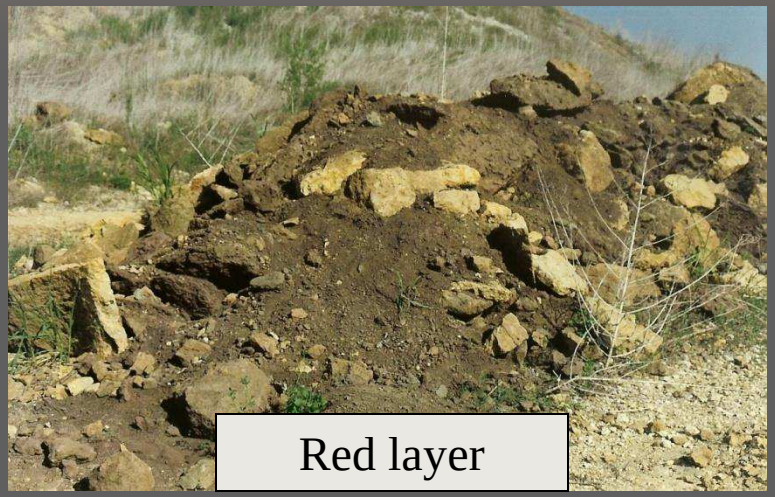
(clay – altered ash deposit)

Green Layer

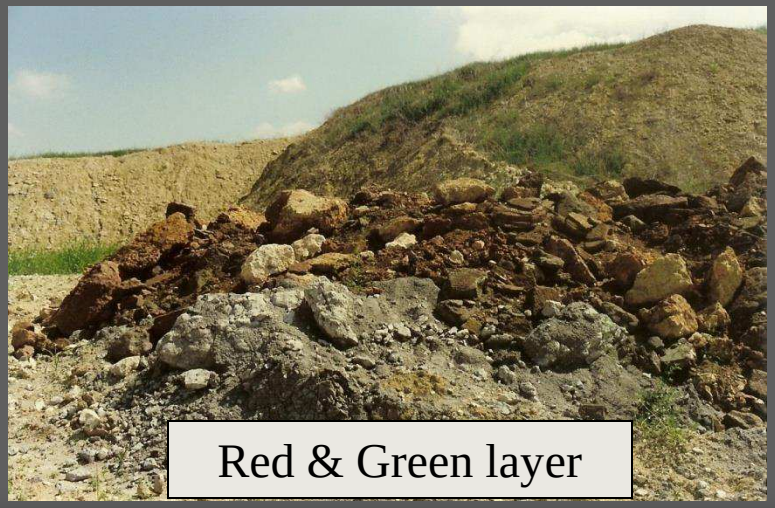
(clay – altered ash deposit)

Color/Strata Zones


Yellow layer


Red layer


Green layer


Red & Green layer

Paper Highlights

Collecting site 1996-1997

- Unique fauna eroded out – very different from contemporary Austin Group deposits
- Most specimens were quite small, though not technically "dwarf"
- Outstanding preservation – external ornamentation, possible color pattern retention, rare 3D sponges

Ecosystem Fauna

Unique Crustacean – dominated ecosystem

~168 Different Taxa/Traces

New & Rare Species and Range Extensions

- 63 GASTROPODS
- 51 BIVALVES
- 5 AMMONITES
- 10 WORM TUBES
- 8 ECHINOIDS
- 7 CRUSTACEANS
- 4 BURROWS
- 4 SHARK
- 3 SPONGES
- 2 CORAL
- 2 BRYOZOAN
- 2 FISH
- 1 VERTEBRATE
- Numerous FORAMS

Vertebrate Fossils

Cretalamna appendiculata

Squalicorax falcatus

Hybodont fin spine

Fish tooth

Vertebrate bone

New Gastropods

Gegania sp.

Gyrodes sp.

Cerithiella sp.

Oligopytcha sp.

Paraturbo sp.

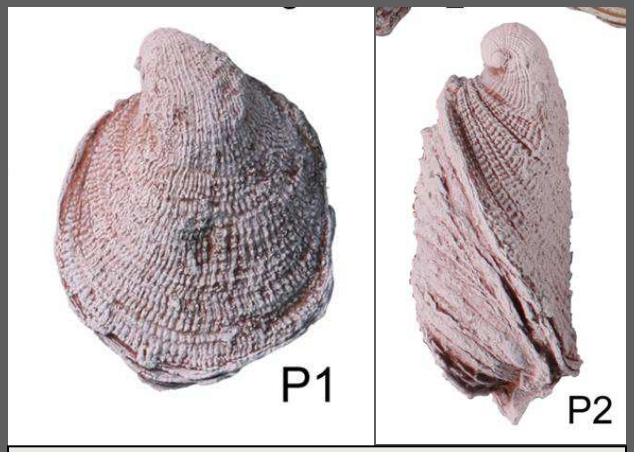
Volutomorpha sp.

New Bivalves

Crassatella sp.

Astarte? sp.

Barbatia sp.



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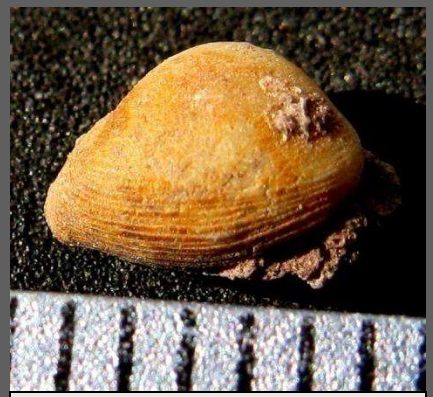
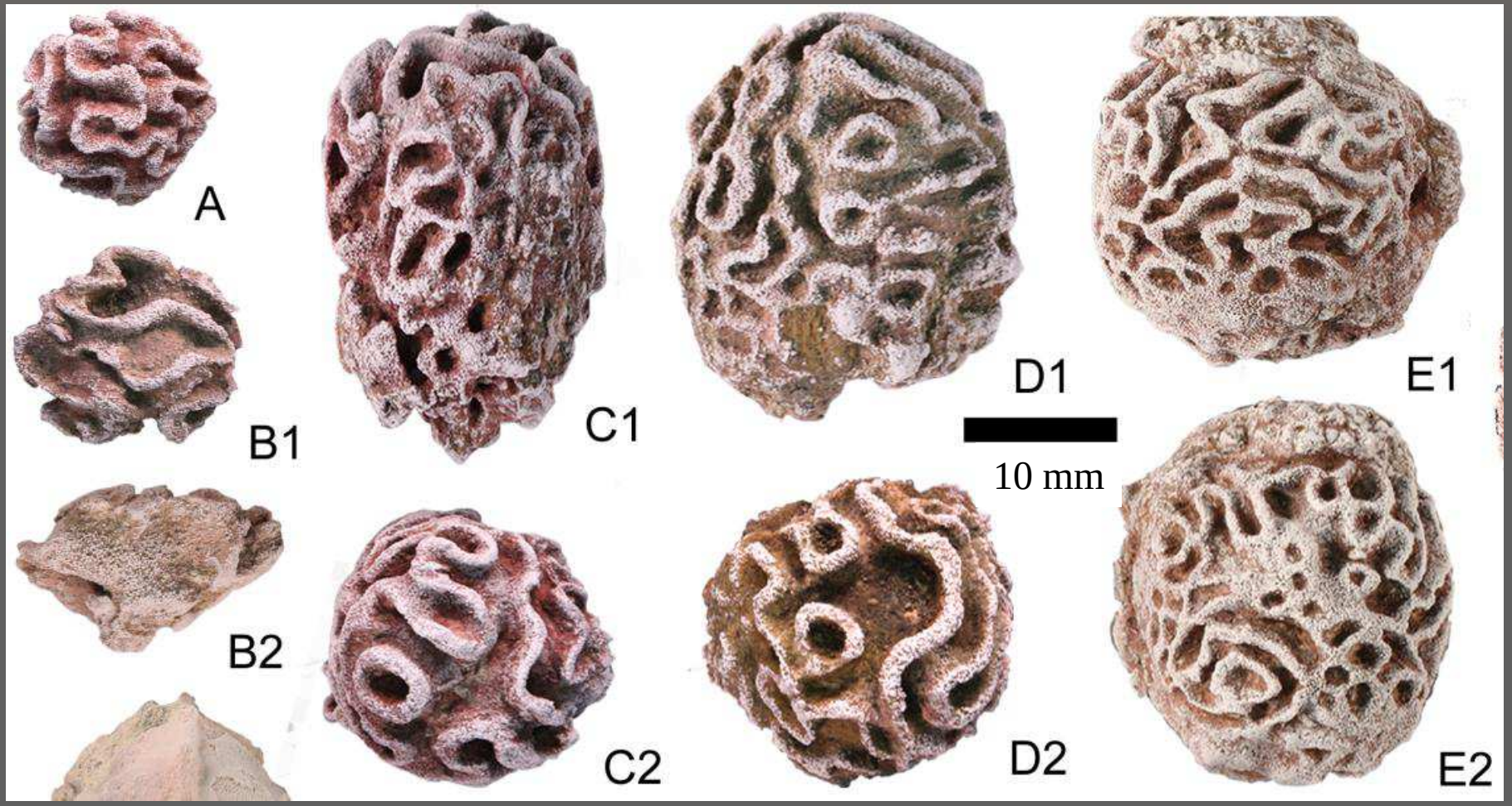
Barbatia sp.



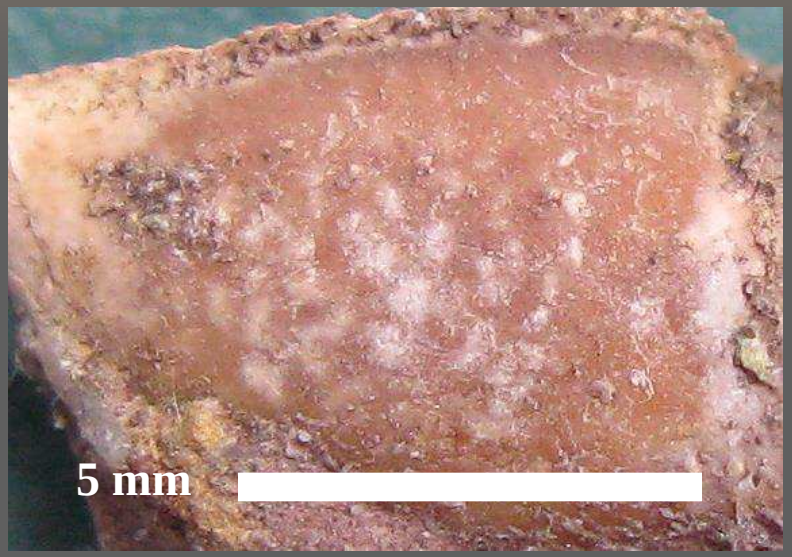
Corbula sp.

Rare Sponges

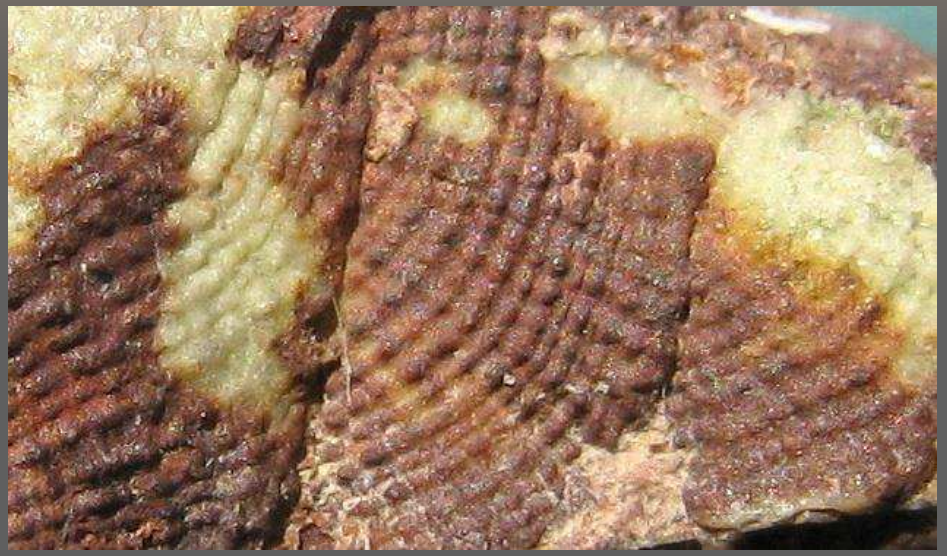


Plocoscyphia? sp.

Crustaceans (color pattern retention)



Preservation



Preservation

Plocoscyphia? sp.

Parasmilia sp.

Conclusion

- Little published / ecosystems / late Cretaceous submarine volcanoes / rare / overlooked?
- Important for understand shallow-water inhabitants / helping locate future hydrocarbon traps
- Pilot Knob / exceptional preservation / rare fauna / unprecedented look at Santonian volcanic habitat
- Further research needed

PRPA Compliant?

- Prohibit research on casually collected specimens
- Limit casual collecting to only “common” specimens
- No vertebrate collecting without a permit (teeth and bone fragment)
- Limit casual collecting to 25 lbs. a day, not to exceed 250 lbs. annually
- Defines “negligible disturbance” as little to no change to the surface of the land; limits disturbance to 1 square yard; separates multiple collectors by at least 10 feet
- All other collecting requires a permit
- Criteria for applying for permit includes:
  - a graduate degree in paleontology or related field of study…
  - experience in collecting, analyzing, summarizing, reporting , preparing collections
  - Experience in planning, equipping, staffing, organizing, etc., etc. field crews
  - Other expertise
  - Past performance
- All specimens collected under permit must be housed in an approved repository

Beach Sand Restoration Project on Topsail Island, North Carolina, Yields Oligocene Fauna with Unusual Preservation, Including Color Retention

Linda McCall, NCFC; University of Texas – Austin
Ann Molineux, James Sprinkle, University of Texas – Austin

Topsail Island

Erosional Beach

Phase 5
December 18, 2014
to June 30, 2015

Primitive Whale Brain Casts/Teeth








Relevant Numbers so far

- 50+ days field collecting
- 300+ hours sorting/curating
- 1 ton of material collected
- 1,000 lbs. already processed 8714 specimens already donated to UT
- 1,000 lbs. left to sort

PRPA Compatible?

- Prohibit research on casually collected specimens
- Limit casual collecting to only "common" specimens
- No vertebrate collecting without a permit (whale endocasts, fish, shark…)
- Limit casual collecting to 25 lbs. a day, not to exceed 250 lbs. annually
- Defines "negligible disturbance" as little to no change to the surface of the land; limits disturbance to 1 square yard; separates multiple collectors by at least 10 feet
- All other collecting requires a permit
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Conclusion

- Not unique or alone
  - 15 fossil clubs studied in 2015
  - 51 non-professional members peer-review published. Often multiple times.
  - Jack Horner
- Hundreds of non-professionals authoring and co-authoring scientifically valuable paleontological papers
- Current proposed PRPA rules effectively disenfranchises an entire subset of non-professional paleontologists
  - Negative impact on the number of scientific papers being published
  - Negative impact on the depth of scientific knowledge being gained about the history of life on earth.
- We have a lot to contribute. I hope the authors of the proposed rules realize this and work to alter the current wording to be more inclusive of the non-professional sector.

Acknowledgements/References

- FOSSIL Project
- Ann Molineux for her time and effort mentoring and guiding me
- Jim Sprinkle for his mentoring and guidance
- Louis Zachos, and Katharine Criswell, University of Texas, Austin, for help with digital photography and specimen figure design
- Joan Crane, Kevin Durney, Rodney Feldmann, Alex Osso-Morales, Hannes Loeser, Frank Wittler, and Keith Minor for their help in identification and prep work
- Angie Thompson took the photographs and helped assemble the figures
- NSF Grant DBI-0646468 provided funds to purchase the digital camera and photographic supplies
- Non-vertebrate Paleontology Laboratory, Texas Natural Science Center, Austin, supplied research facilities, references and supplies