The Trace Fossil *Zoophycos* from the Shallow Water Facies of the Middle Pennsylvanian Sandia Formation, Jemez Mountains, New Mexico

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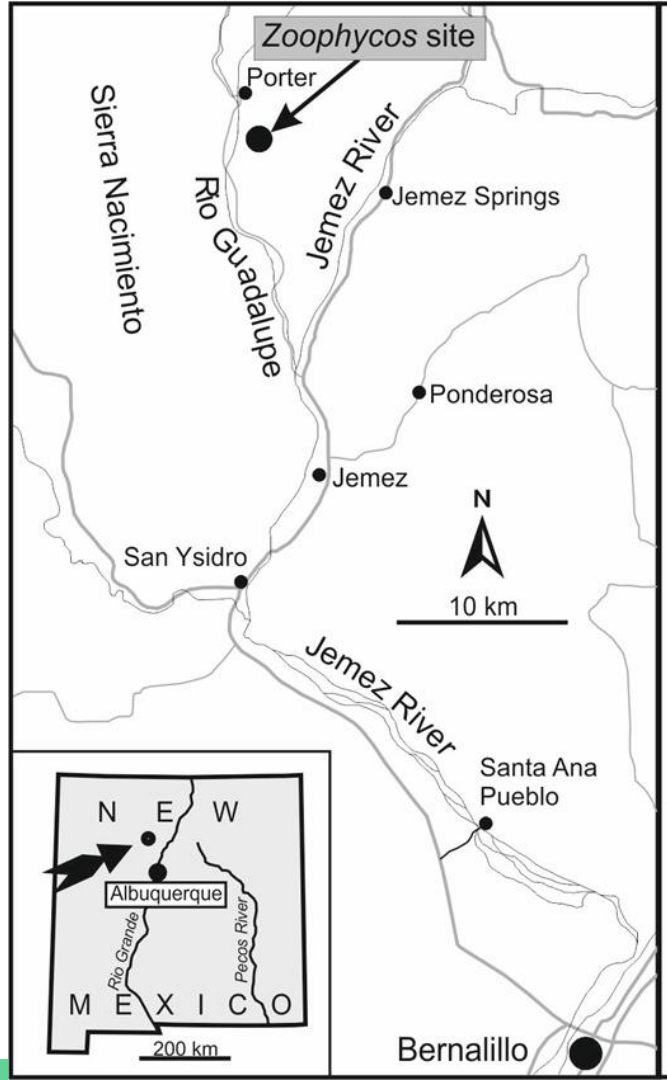
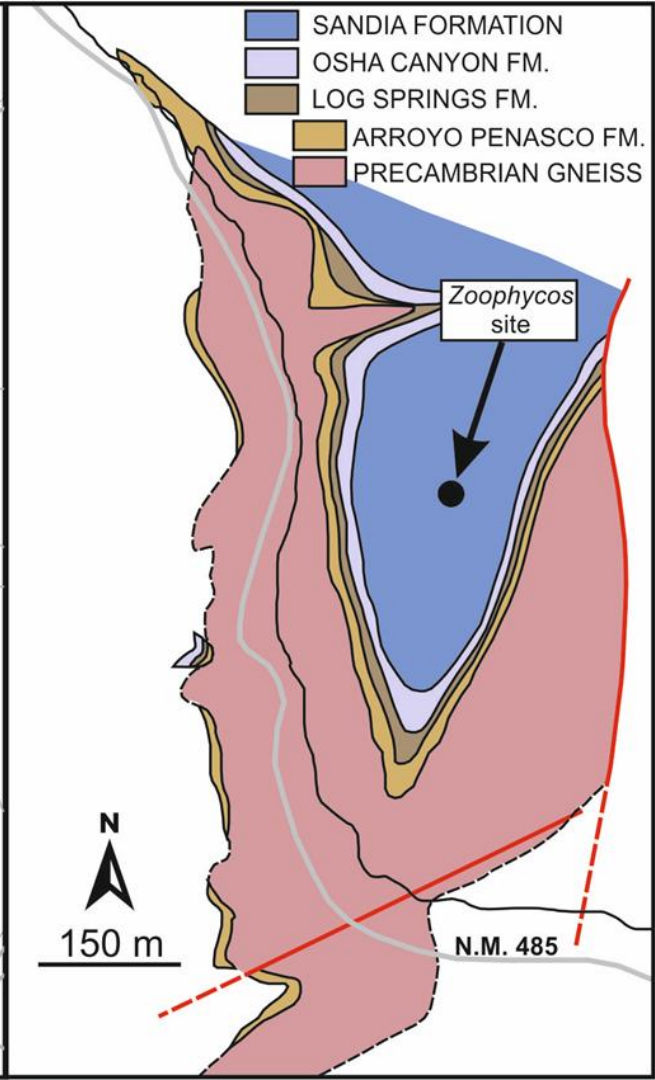
Location

Early Pennsylvania Sandia Formation at **Guadalupe Box**

- Originally mentioned by DeChene, 1974
- Initially described by Kues, 2005

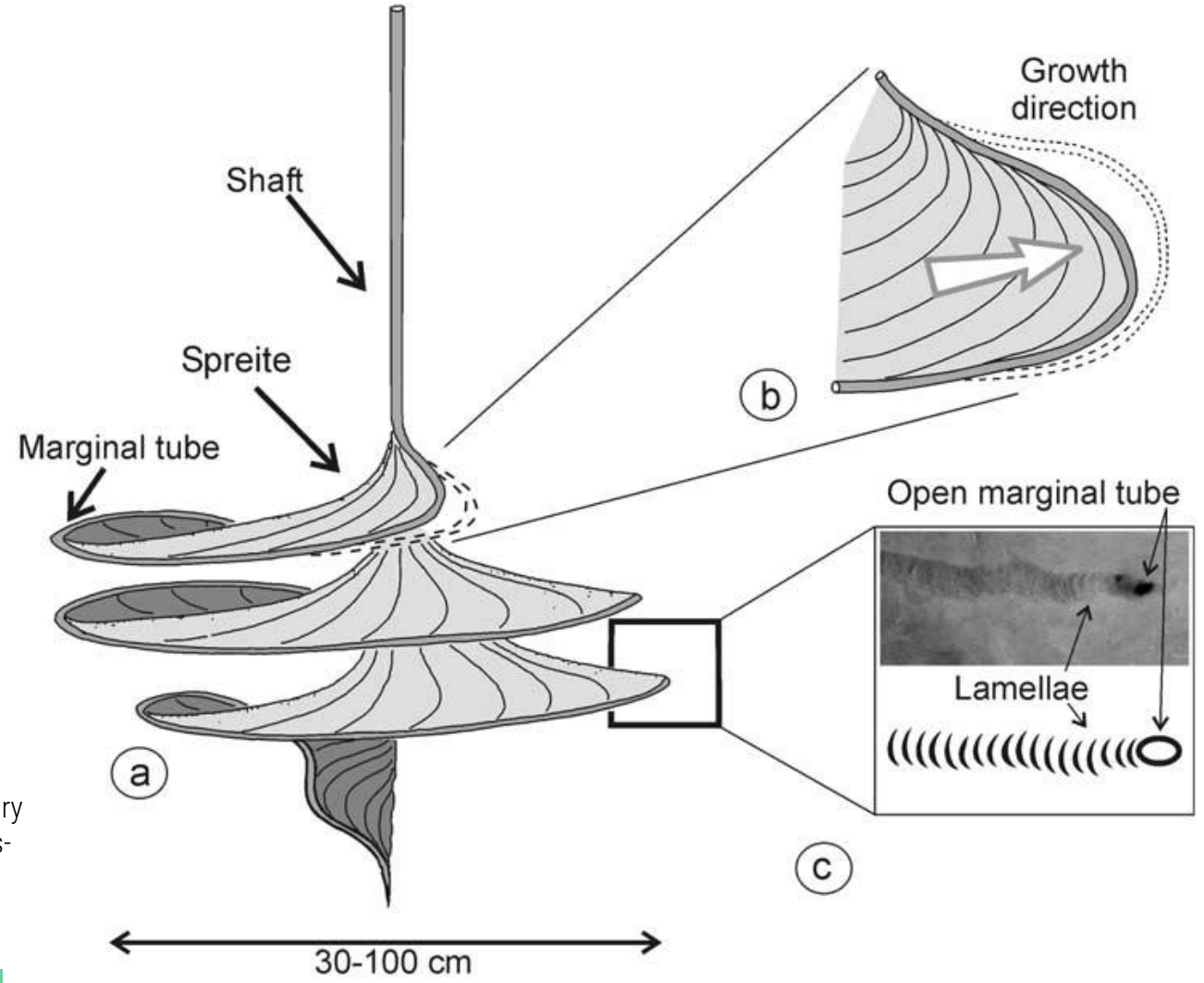




Zoophycos Characterization

- Large, distinctive trace fossil of deposit-feeding marine worm
- Found in marine deposits throughout the Phanerozoic
- Rarely reported from New Mexico
- Archetypal ichnofacies characterized by Seilacher, 1967 as being deposited in deep or dysaerobic bottom water.
- Subsequently it was found that Mesozoic and Cenozoic examples are usually from deep water, while Paleozoic traces are common from shallow water.

Formation of the *Zoophycos* trace fossil



Löwemark, Ludvig & Grootes, P. (2001). Severe AMS 14 C Dating Errors in Quaternary Deep-sea Sediments Caused by Zoophycos-Bioturbation and Foraminifer Abundance Variations. AGU Fall Meeting Abstracts.

A lobe of *Zoophycos* spreiten, showing a marginal tube, 1 cm-wide.

Many ***Zoophycos*** show multiple lobes.

NMMNH P-84542

The axial tunnel is always collapsed, but the spreiten are usually filled with sediment.

NMMNH P-84537

Zoophycos bed at Guadalupe Box

- Dozens of traces are exposed in a distinct bed 28 meters above the base of the Sandia Formation.
- Total thickness of the Sandia Formation is 60 meters in this area.
  (Woodward et al., 1977)

Main *Zoophycos* bed

- The primary ***Zoophycos*** bed is ~20cm thick, in multiple layers.
- It is also sporadically exposed for ~300m to the north.

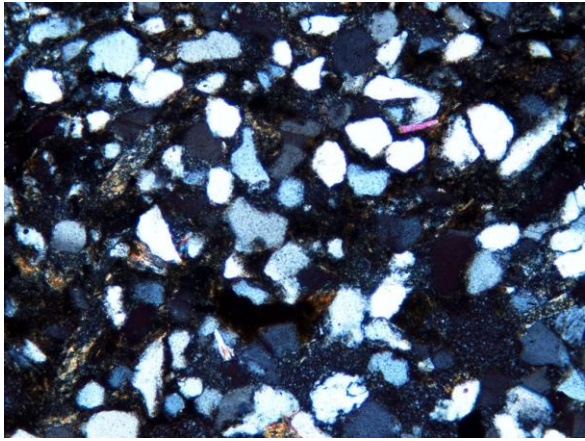
Lithology of the *Zoophycos* bed

Fine grained sandstone, containing:

- high amount of matrix (32-52%)
- monocrystalline quartz grains
- minor polycrystalline quartz grains
- rare detrital feldspar grains

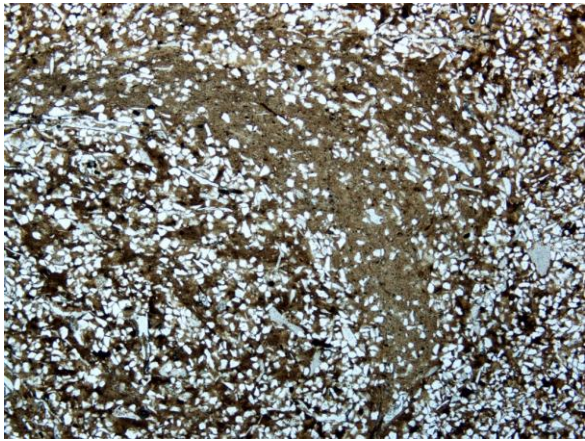
Immature sandstone

Length of image: 1.2mm



Zoophycos in thin section

Length of image: 6.3mm

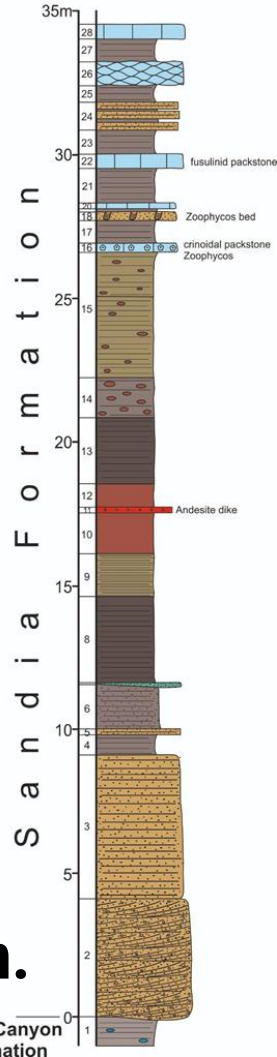


Zoophycos, part of a newly measured section

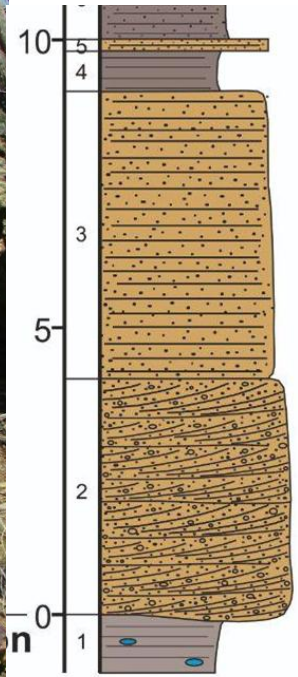
The *Zoophycos* bed is near the top of a newly measured exposure of the lower Sandia Formation. This exposure, totalling 34.5 meters, can be divided into three units based on lithology.

- Upper unit: 8 meters
- Middle unit: 18 meters
- Lower unit: 9 meters thick

This represents a well-developed fining-upward succession.

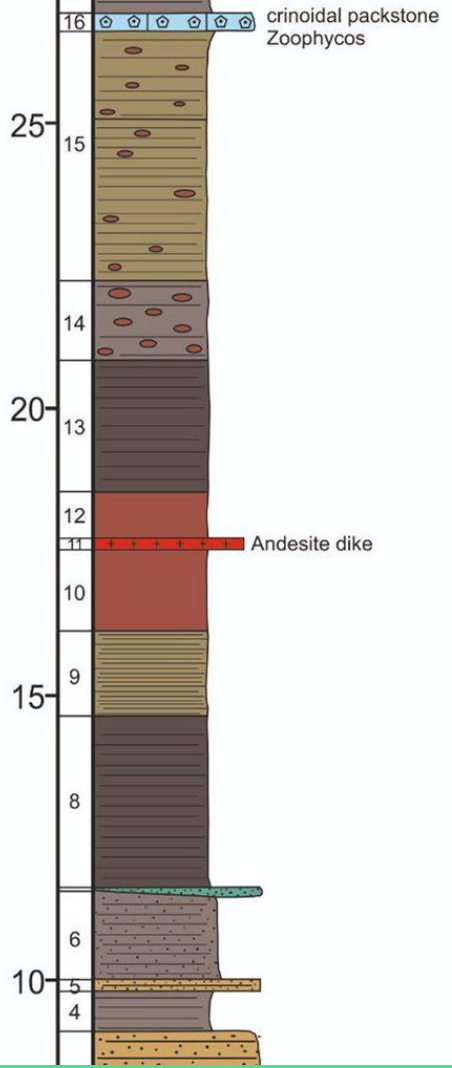


Lower unit:
9 meters thick, coarse, crossbedded sandstone at its base,
fluvial in origin



Middle unit: 18 meters of interlayered shale and siltstone, initially deposited on a coastal plain that became inundated as sea level rose.

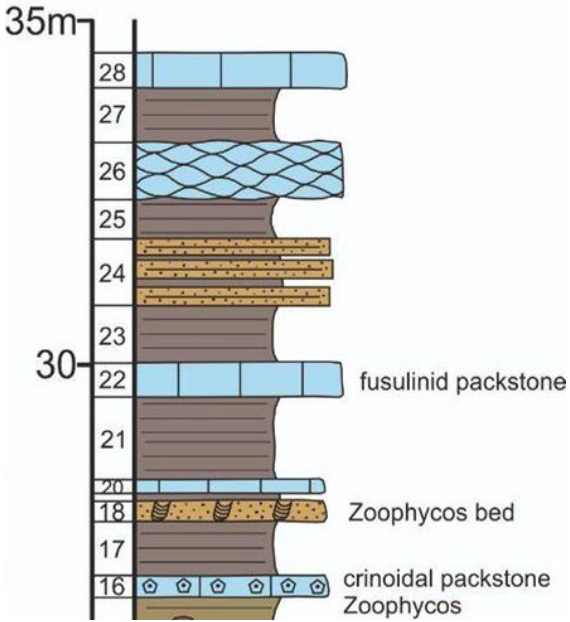
This represents a transition between terrestrial and marine environments.



Upper unit:

Early in transgression

- Grain-supported crinoidal limestone
- Deposited in shallow, open marine water
- Moderate to high turbulence

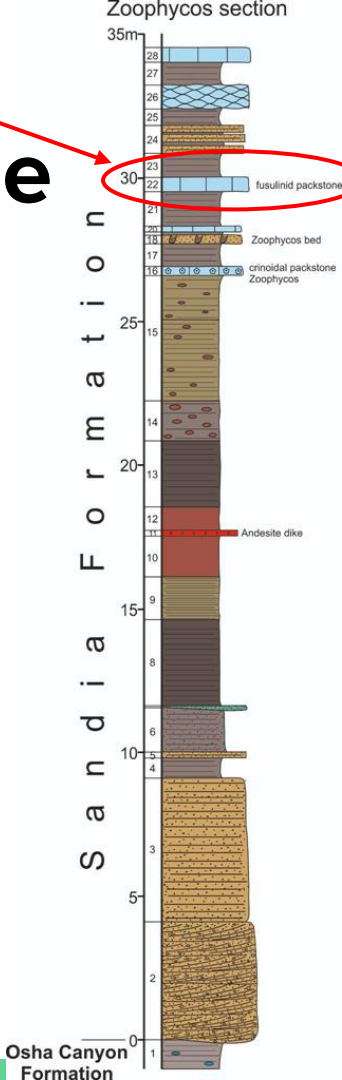


As deepening continued

- Deposition dropped below wave base
- Limestones with muddy texture and diverse fossil assemblage deposited when siliciclastic input is absent
- Calcareous shale deposited when terrigenous sediments are abundant
- Low energy, yet shallow marine environment

Atokan Age from Fusulinid Limestone

- Two meters above the Zoophycos bed is a thin bed of fusulinid packstone limestone containing ***Fusulinella***, indicative of Atokan Age.
- This bed also contains a diverse fossil assemblage.



Depositional Environment of *Zoophycos* at Guadalupe Box

- Deposited in shallow water below wave base
  - Based on lithology and associated fossils
  - Same environment reported for *Zoophycos* from the Middle Pennsylvanian of Sierra County (Lerner et al., 2011)
- *Zoophycos* bed (and the other thin, fine-grained sandstone strata in the upper unit) may represent distal storm layers.
- Further study is needed to estimate the degree of oxygenation in these unusual *Zoophycos*-bearing beds.


Thank you!
Questions?