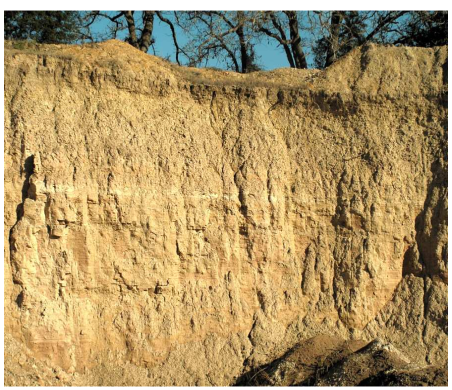
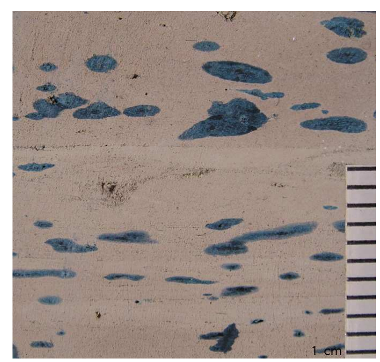
LATE EOCENE DIATOMITES REVEAL GULF OF MEXICO BIOSILICEOUS SEDIMENTATION

Thomas E. YANCEY, Dept. Geology & Geophysics, Texas A&M University
Diane M. WINTER, Academy of Natural Sciences, Philadelphia, Pennsylvania

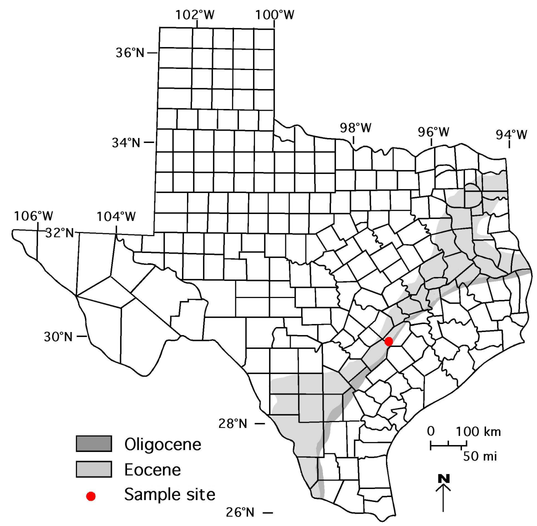


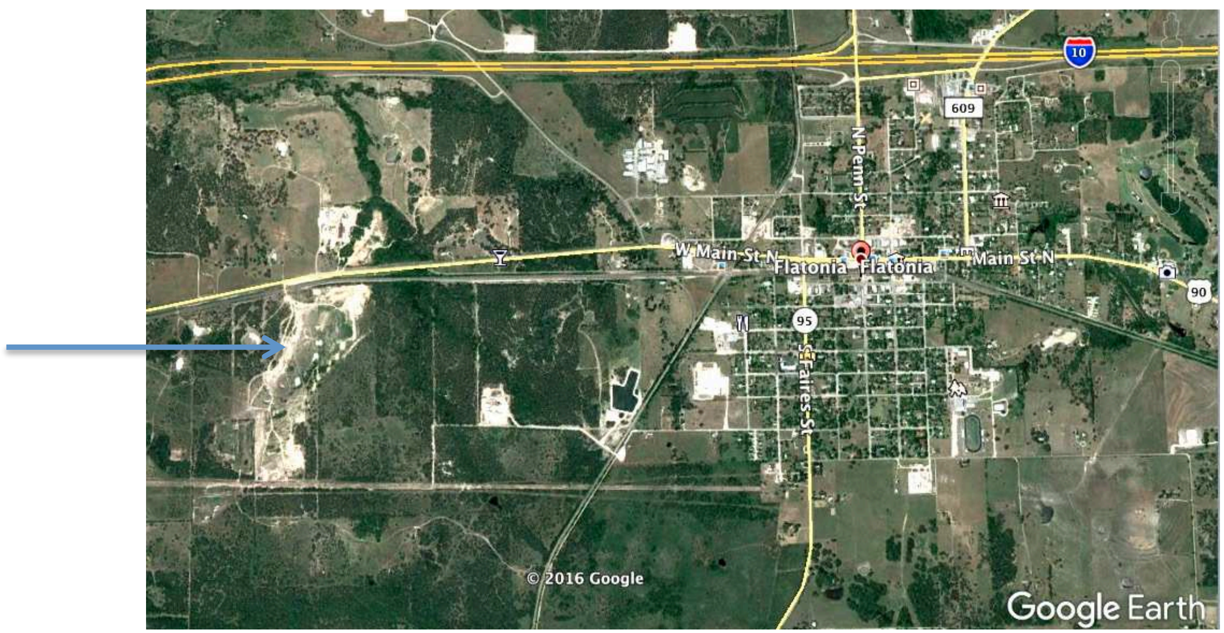


DIATOMITE DEPOSIT

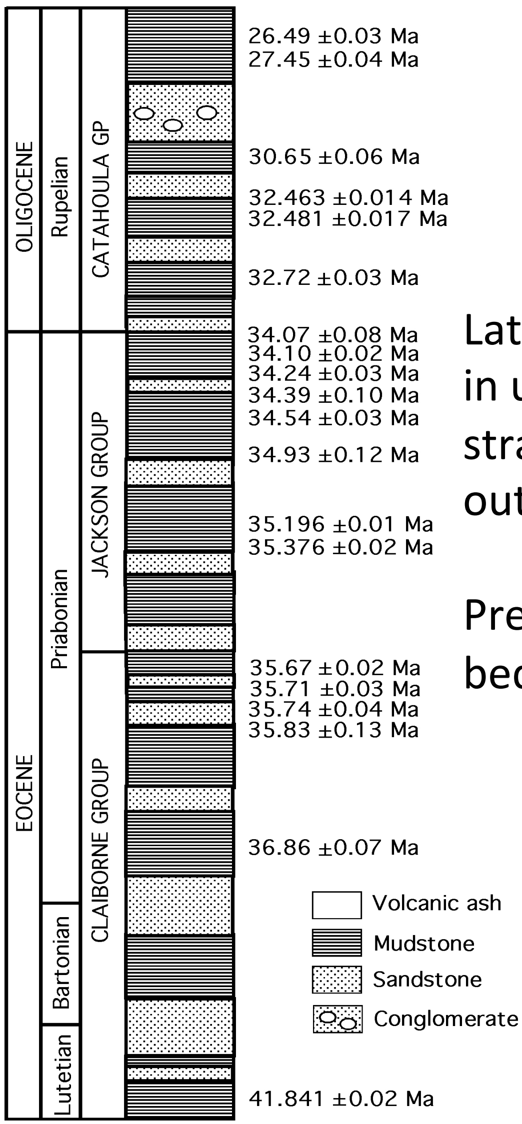
BALCONES MINERAL CORPORATION, FLATONIA, FAYETTE COUNTY, TEXAS

A unique deposit that has been quarried as an absorbant for many years; yet there is no record of diatomite being present in Texas until last year's report (at GCAGS)





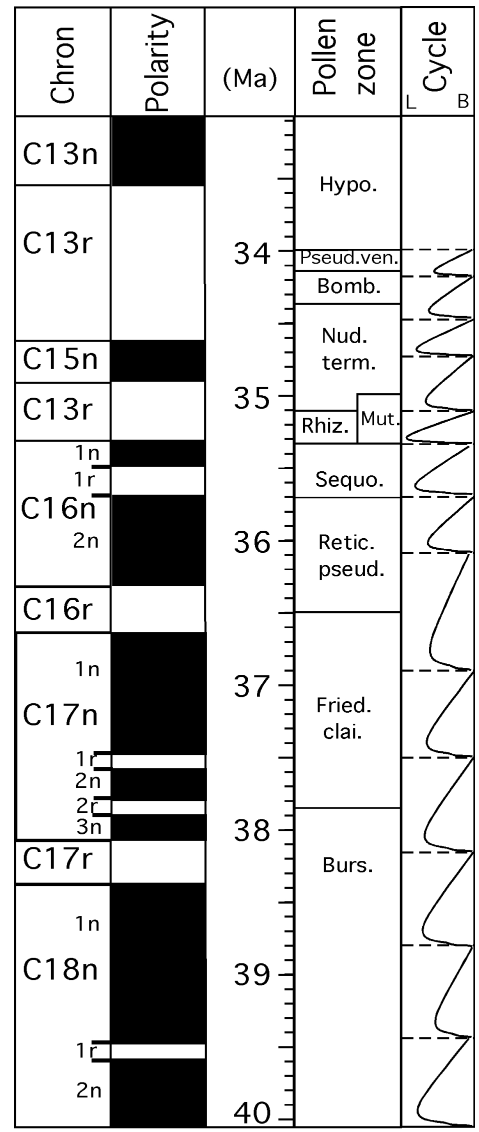
AGE OF DIATOMITE



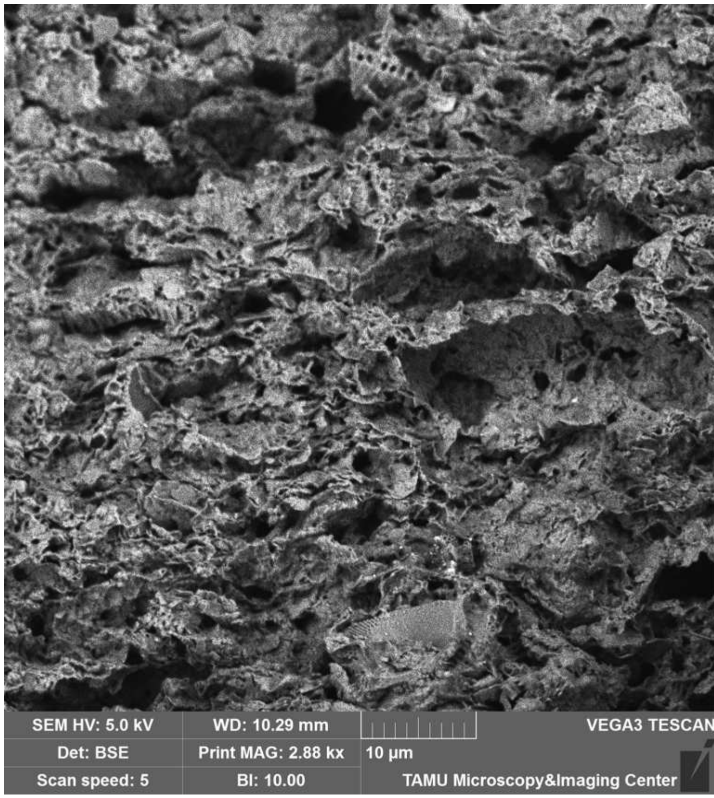
Ar/Ar dates of volcanic ash beds (Heintz et al. in part)

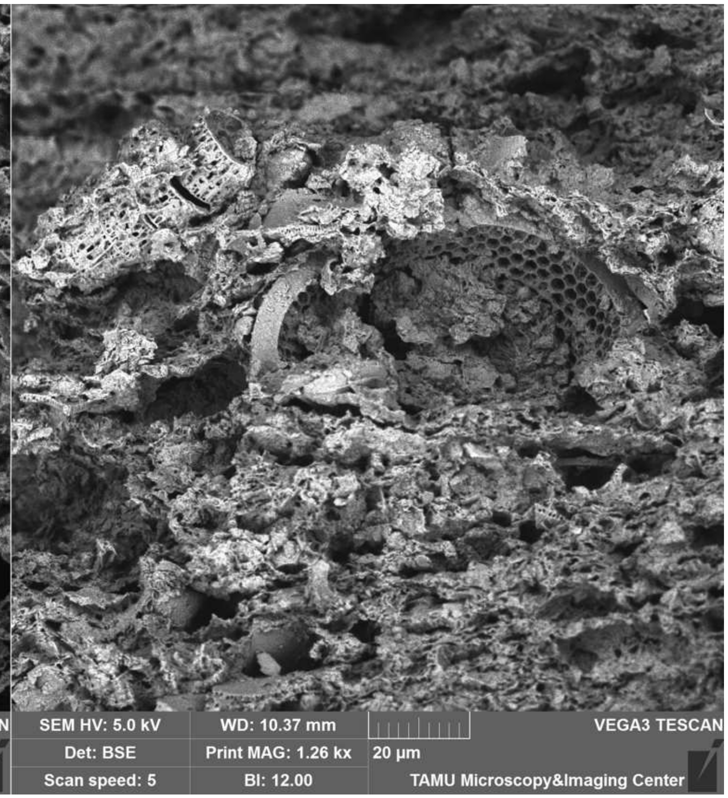
Latest Eocene (late Priabonian) in upper part of Jackson Group strata of the Texas coastal plains outcrop belt.

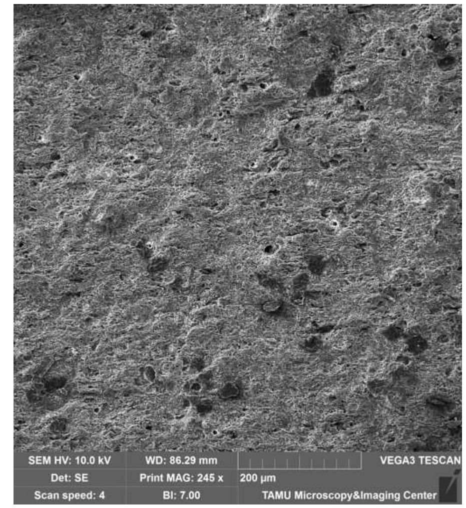
Present in an interval with many beds of volcanic ash.



DIATOMITE SEDIMENT





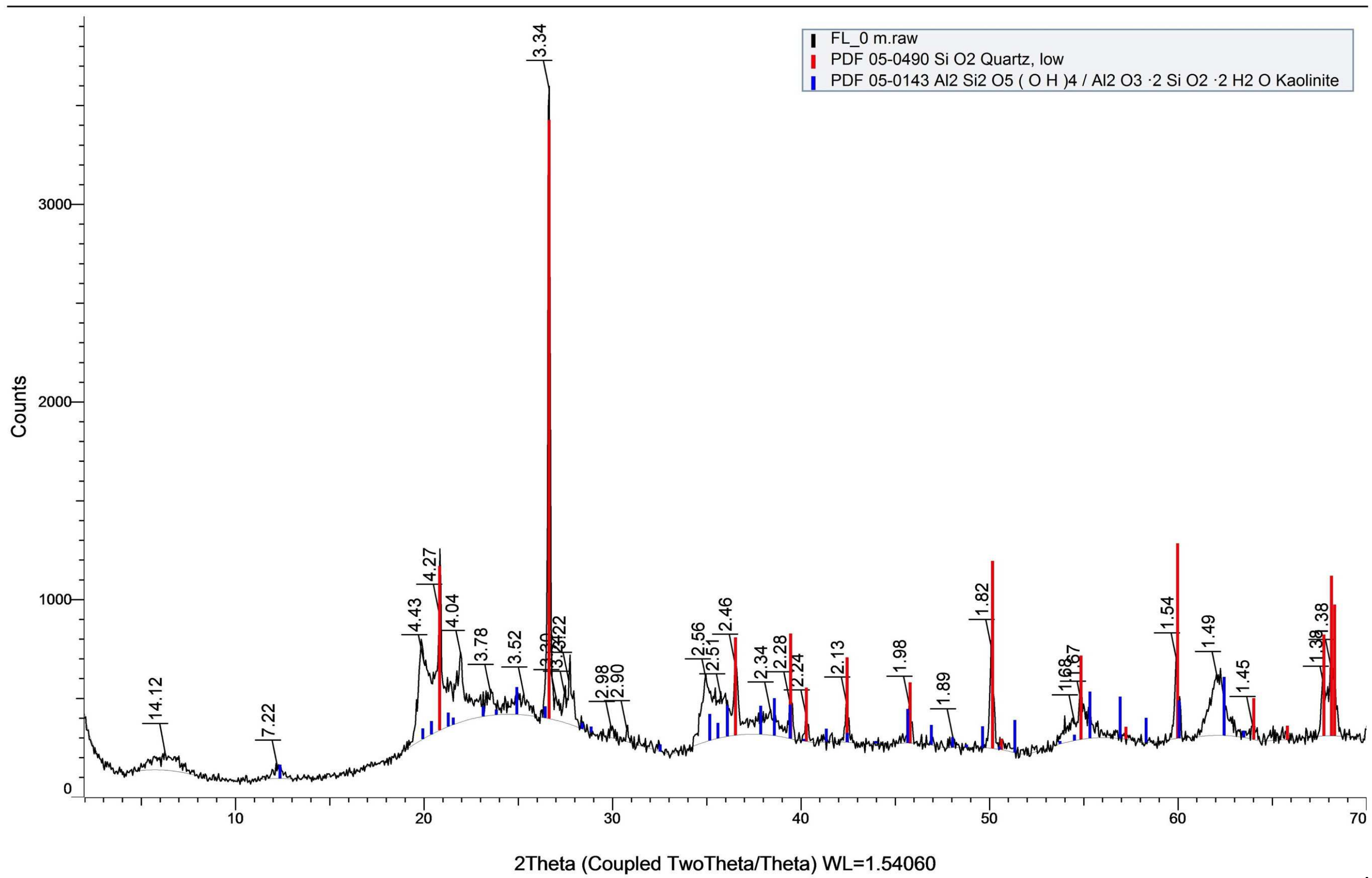


Product granule, showing high porosity after milling and furnace treatment

Diatoms get crushed as mud matrix compacts, but many are sturdy enough to retain form and the sediment retains a porosity of 63-65%

(Data from Doug McCarty, Chevron)

DIATOMITE MINERALOGY



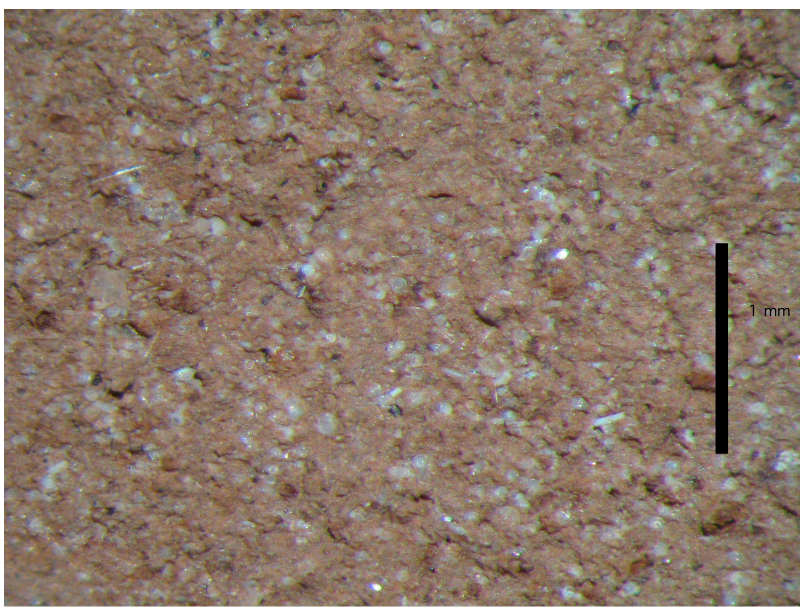
Xray pattern by Y. Deng, TAMU

Raised base of pattern reveals high content of opal. Minor smectite clay present, minimal kaolinite. No opal CT present, showing opal not recrystallized.
Sharp quartz peak results from admixture of minor quartz sand grain component.

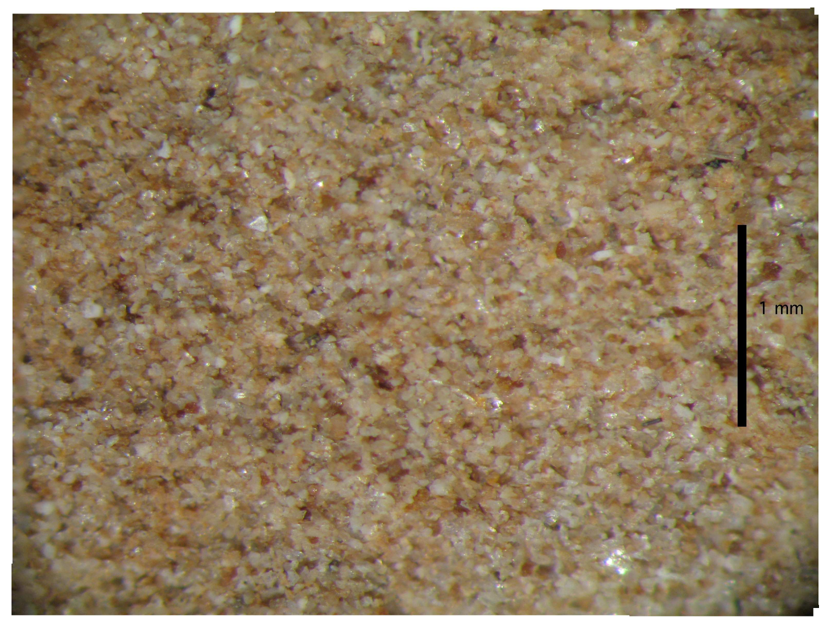
DIATOMITE SEDIMENT

Lamination in diatomite

Porosity in diatomite (micro, macro)



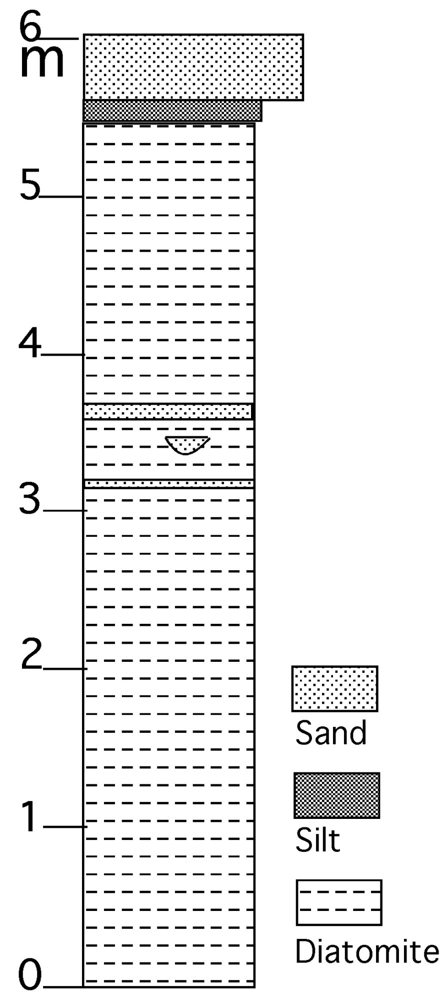
Bedding plane of diatoms & sponge



Bedding plane view of sand lamination

DEPOSITIONAL ENVIRONMENT

Shoaling (regressive) marine environment, within storm wave base on an open marine shelf; a "coastal" setting



SEDIMENT INDICATORS OF ENVIRONMENT

Storm sand bed (extends across entire quarry)

Bidirectional cross bedding (lower shoreface)

Exposure surface (truncates burrowed sands)

Laminated diatomite

Upward changes in sediment and sedimentary structures correspond to shoaling water conditions from below storm wave base to wave-washed shore

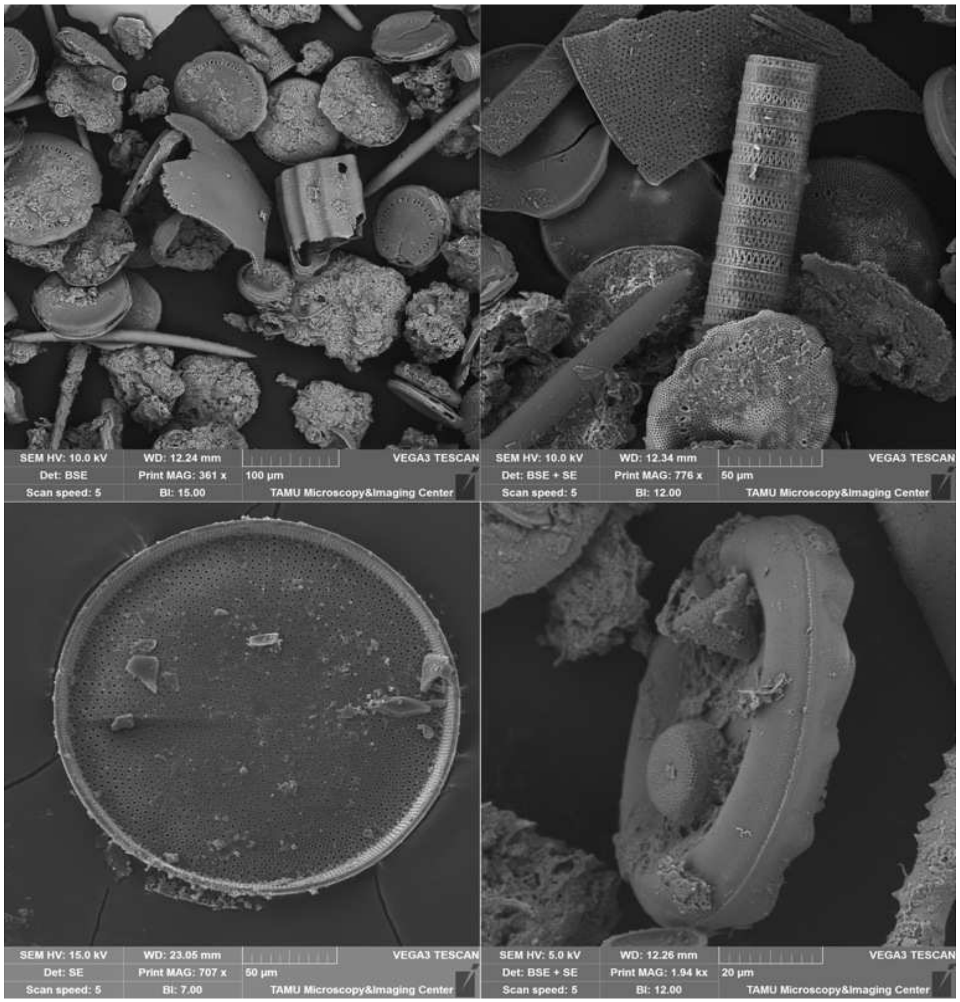
Bioturbated sands (upper shoreface)

Base of diatomite on clay

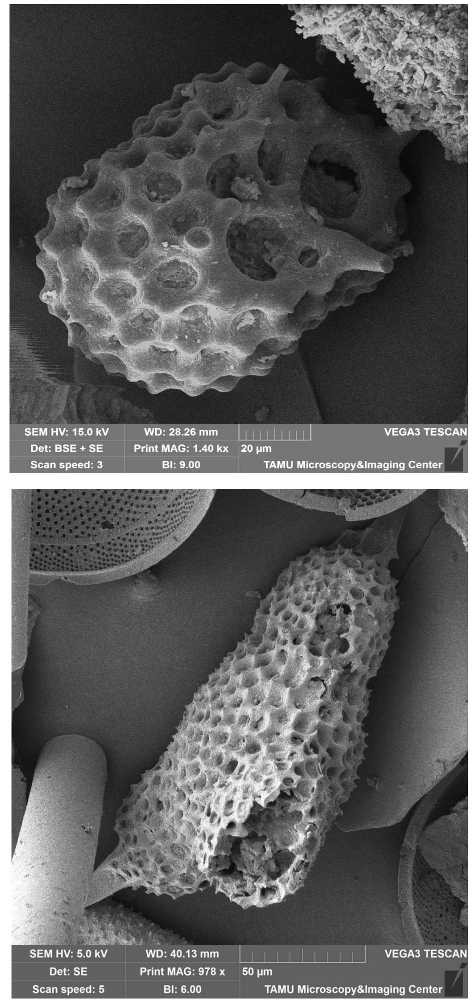
Storm gutter cast

Laminated coarse sand (lower shoreface)

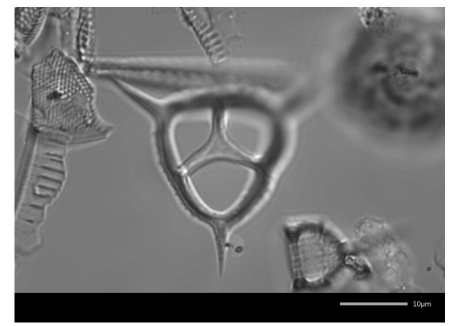
FOSSIL INDICATORS OF ENVIRONMENT



Centric diatoms, marine indicators



Radiolaria, marine taxa

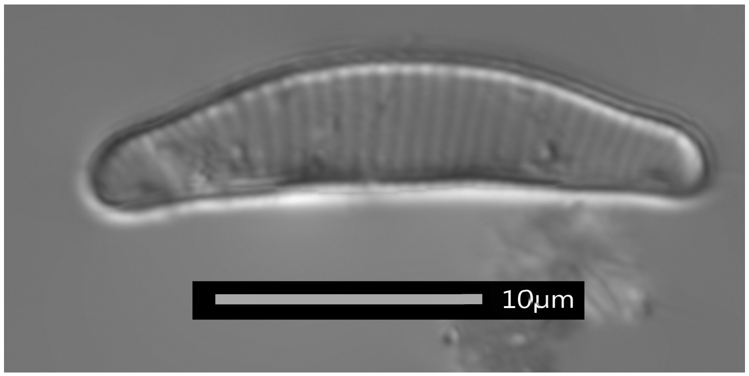


Corbisema, marine silicoflagellate

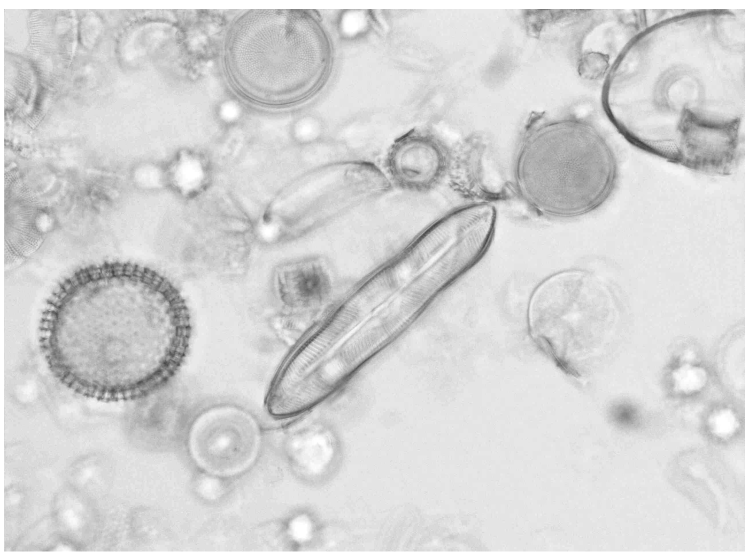
(Diane Winter photo)

NONMARINE FOSSIL COMPONENT

Pennales: freshwater diatoms are a minor component of flora

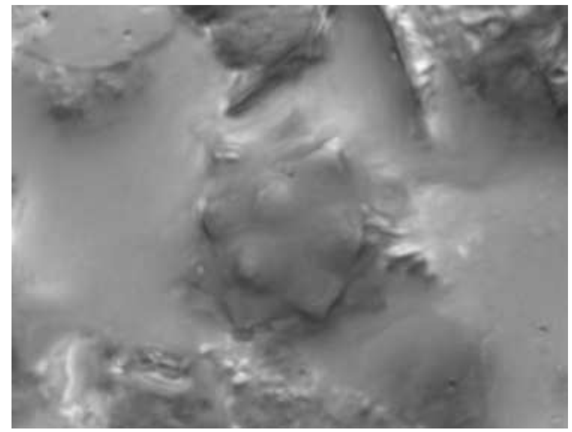


Eunotia sp. (Diane Winter photo)



Pinnularia sp. (Ghervy Nzoumba photo)

Phytolith: palm tree origin



Freshwater diatoms and phytoliths occur in most samples as a secondary component. They show the presence of fresh water input, that is probably the major source of dissolved silica to ocean waters.

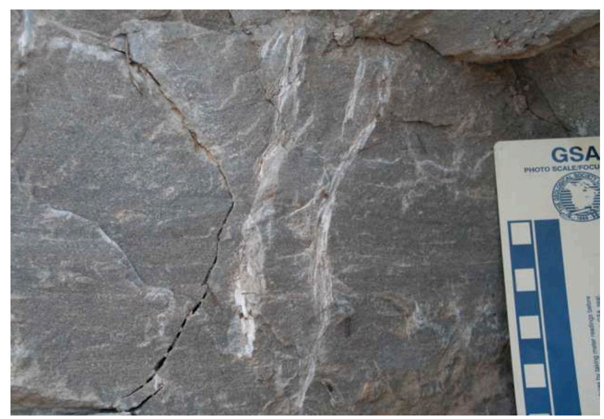
COASTAL MARINE ENVIRONMENT

Deposited in an inner shelf, coastal marine environment as part of the offshore between fair-weather wave base and storm wave base along a strand-plain, sand-shoreline type of coastal regime.

Inner shelf marine deposits are the most common type of latest Eocene sediment in the outcrop belt of coastal plains Texas.

Periodic Eocene exposure generated diagenetic modification of marine sediments.

Partly silicified sandstone with Ophiomorpha, Brazos Co., Texas

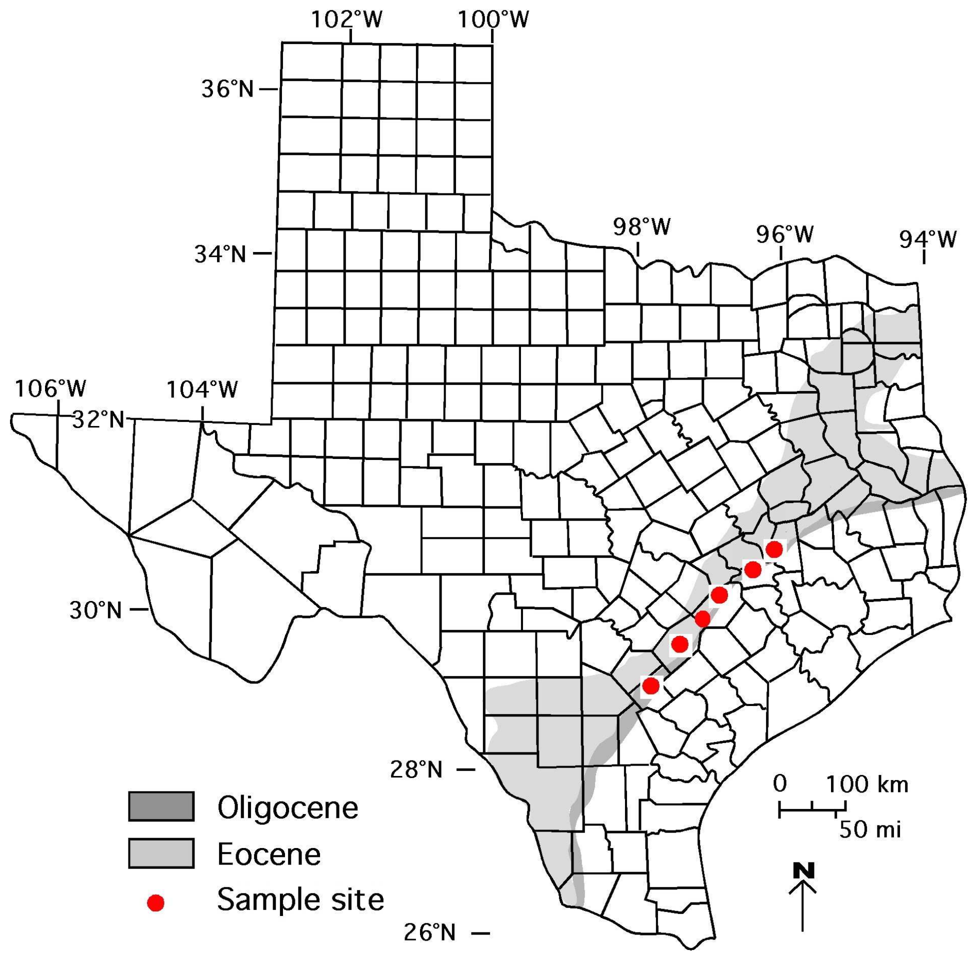


Silcrete rock with opalized roots, Brazos Co., Texas

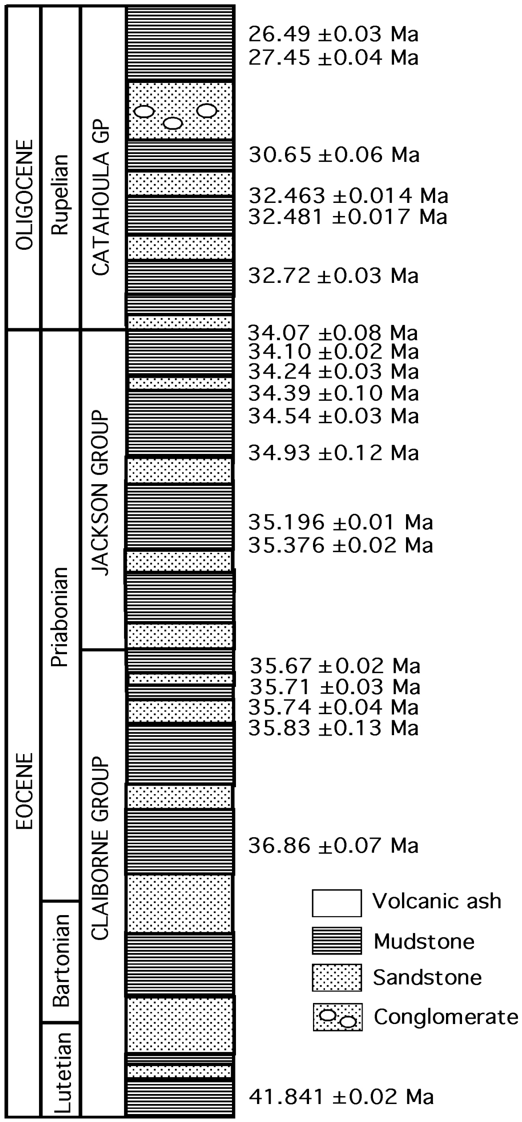
DISTRIBUTION OF BIOGENIC SILICA IN LATE EOCENE COASTAL PLAIN

Although diatomite has been identified only in the Flatonia quarry, biogenic silica is present in age-equivalent strata across all of central Texas.

The map show sites where *casual* examination of *sand-size* sediment has revealed biogenic silica. The presence of sponge spicules (large) is an indicator of biogenic silica content.



VOLCANIC ASH DEPOSITS



Data partly from
Heintz et al.,

Occurrence is related to the deposition of volcanic ash, derived from silicic volcanism along the western margin of North America.

The greatest concentration of ash is present in latest Eocene strata.

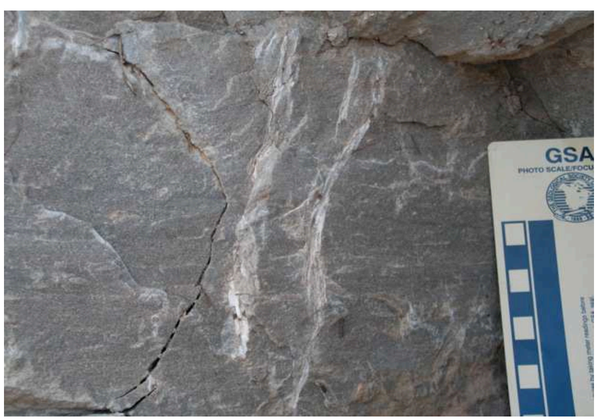
Is the source material of commercial bentonites in Gonzales bentonite district.

Bentonite quarry, Gonzales, Texas

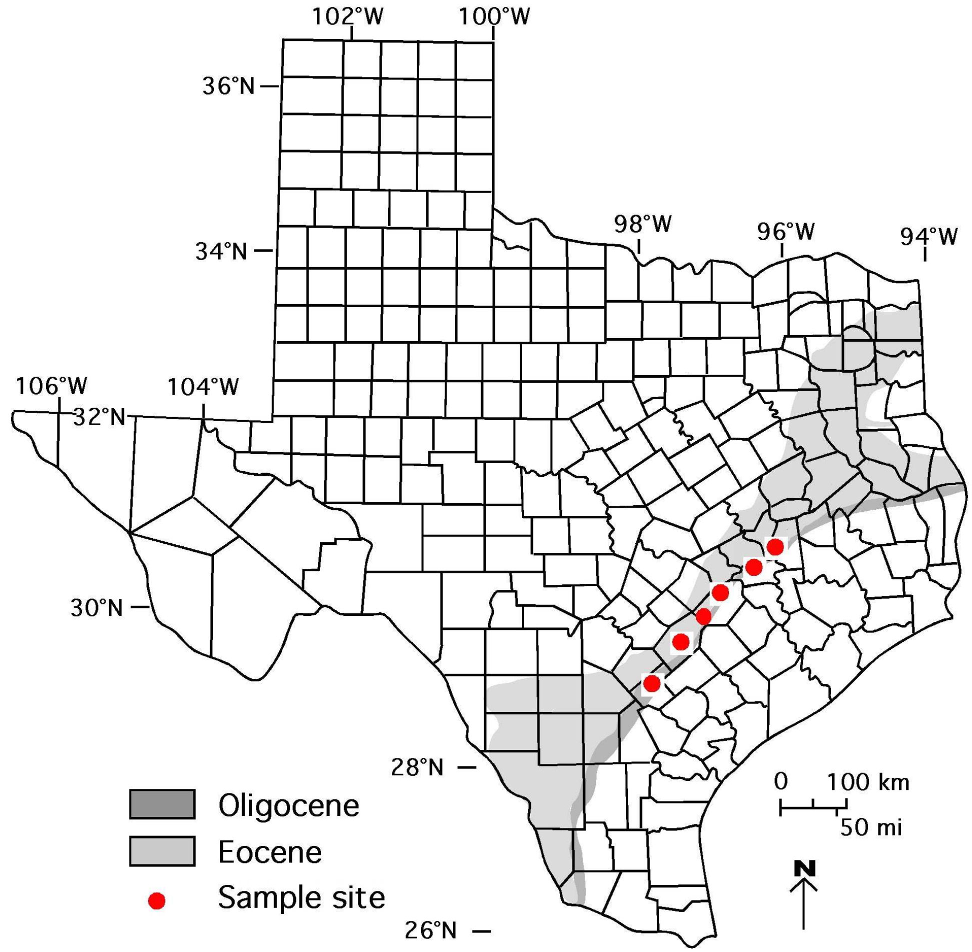
SOURCE OF DISSOLVED SILICA

Weathering of ash glass and mobilizing of silica in ground waters is shown by occurrence of silica-cemented sandstones in sections with volcanic ash.

Presence of fresh-water diatoms and phytoliths is evidence of dissolved silica input from rivers and groundwater.

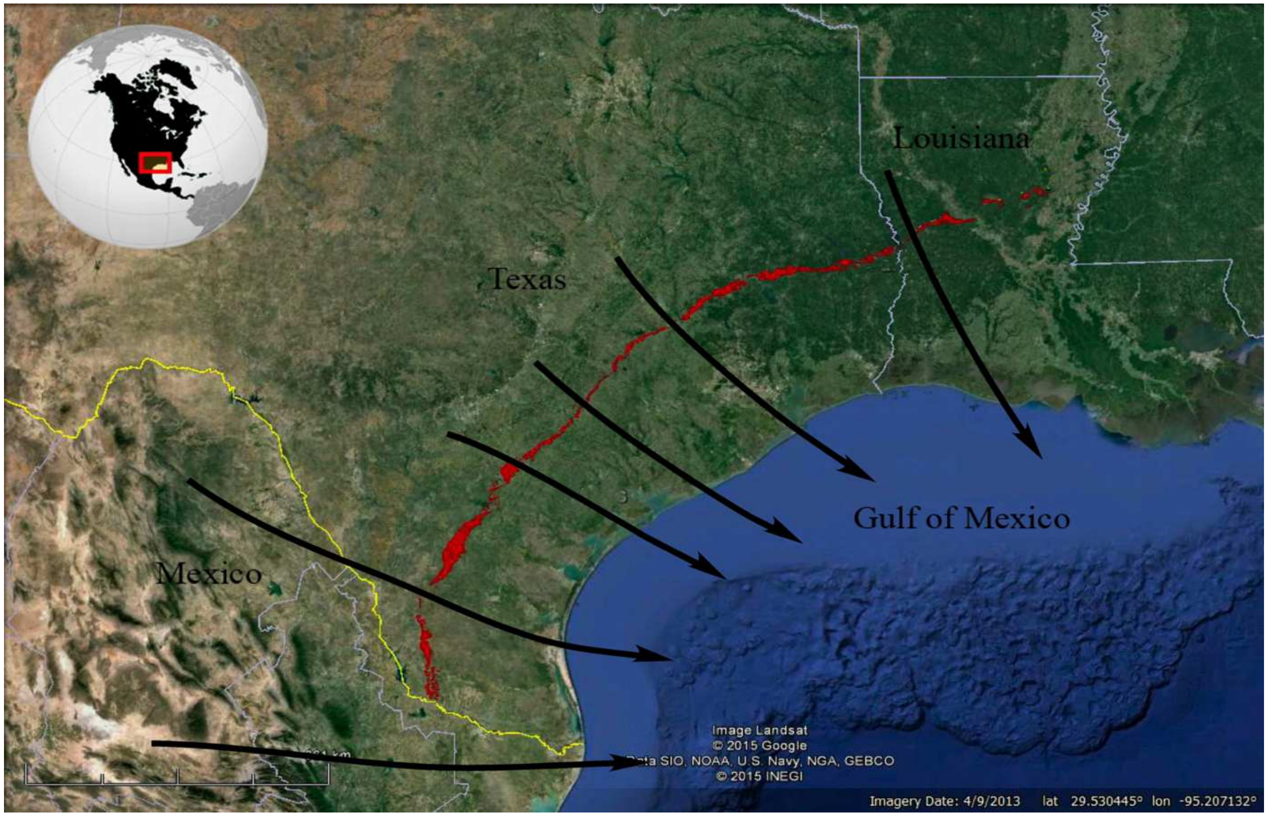


Silcrete rock with opalized roots



Areas with biosiliceous fossils co-occur with silica-cemented sandstones formed during times of subaerial exposure.
(McBride et al., 2012)

LATE EOCENE BIOSILICEOUS EVENT



Conclusion: Dissolution of volcanic ash glass shards produced large volumes of dissolved silica that moved into Gulf waters, creating blooms of siliceous benthos and plankton in ocean waters.

These biosiliceous fossils produced a marker that can be expected to show up throughout Late Eocene sediments of the western Gulf.