Fossils and Geology of Litzsinger Road Ecology Center

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Key Terms 1

- **Sediment**: is a naturally occurring material that is broken down by processes of weathering and erosion, and is subsequently transported by the action of wind, water, or ice, and/or by the force of gravity acting on the particles.
- **Alluvium**: a deposit of clay, silt, sand, and gravel left by flowing streams in a river valley or delta, typically producing fertile soil.
- **Loess**: a loosely compacted yellowish-gray deposit of windblown sediment.
- **Carbonate**: a class of sedimentary rocks composed primarily of carbonate minerals.
- **Karst**: a landscape formed from the dissolution of soluble rocks such as limestone, dolomite, and gypsum. It is characterized by underground drainage systems with sinkholes, dolines, and caves.

https://en.wikipedia.org/wiki

Key Terms 2

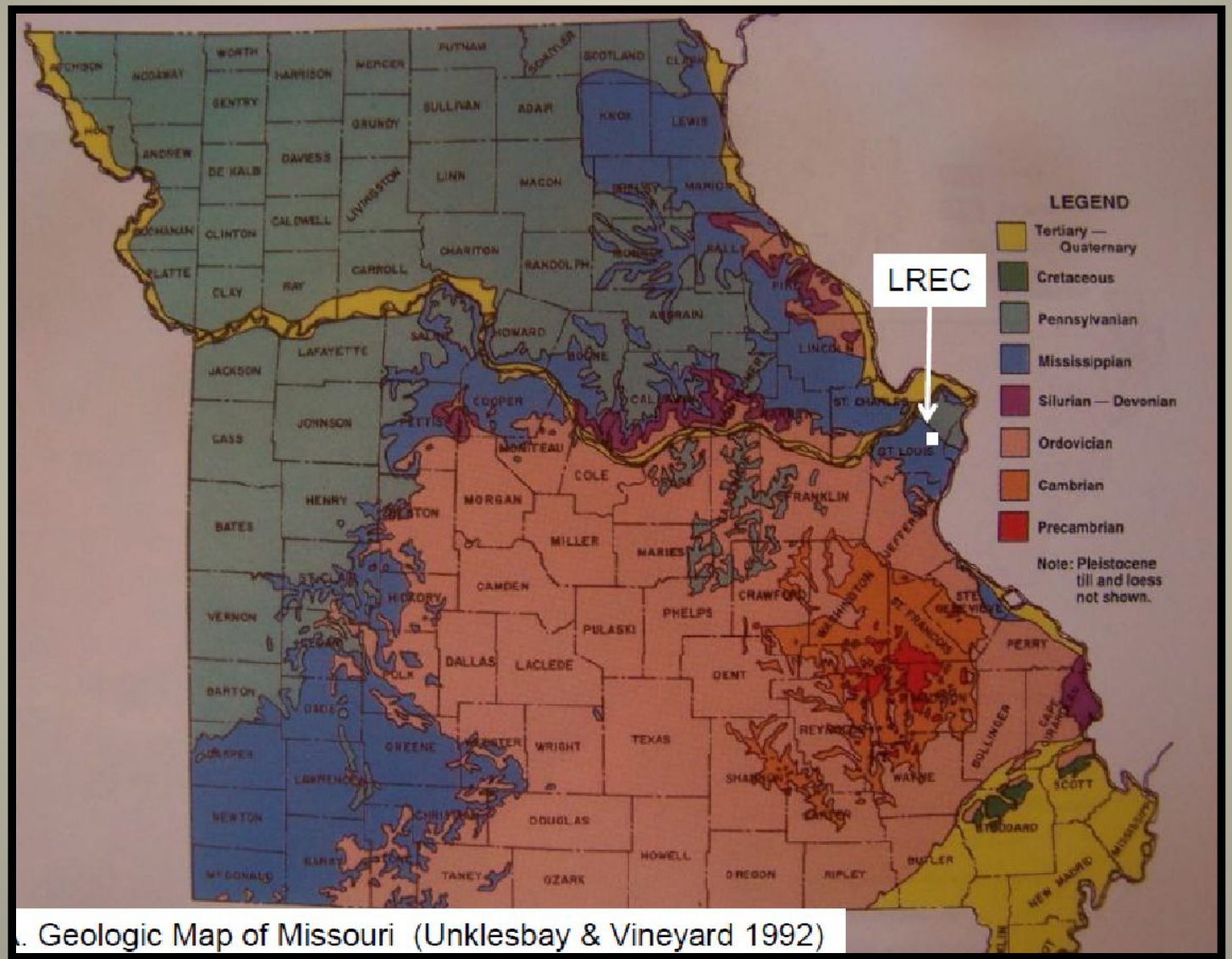
- **Limestone**: is a sedimentary rock composed largely of the minerals. Most limestone is composed of skeletal fragments of marine organisms such as coral, forams and molluscs.
- **Lithographic**: when referring to texture, is a grain size under 1/250 mm.
- **Crystalline**: being, relating to, or composed of crystal or crystals.
- **Dolomitization**: is a process by which dolomite is formed when magnesium ions replace calcium ions.
- **Dolostone**: rock consisting of dolomite.
- **Dolomite**: a mineral composed of calcium magnesium carbonate.

https://en.wikipedia.org/wiki

What you need to know

- There are eight different types of geologic rock formations that make up Missouri, each dating back to different periods in time.
- The type of bedrock formation on site at Litzsinger dates back to the Mississippian period which occurred during the Paleozoic era, estimated to be around 300-340 million years ago.
- Along the bedrock of Deer Creek, that runs next to Litzsinger, four types of sediment have been found.
- One comes from the very bottom of the creek itself and is referred to as Alluvium.
- Two of the most commonly found types of sediment can be found alongside the creek and they are referred to as Loess over Carbonate and Karst in Carbonate.
- The last and least commonly found type of sediment is referred to as Loess over Pennsylvanian. The Pennsylvanian sediment is typically only found in the creek bed as the result of flooding from upstream.

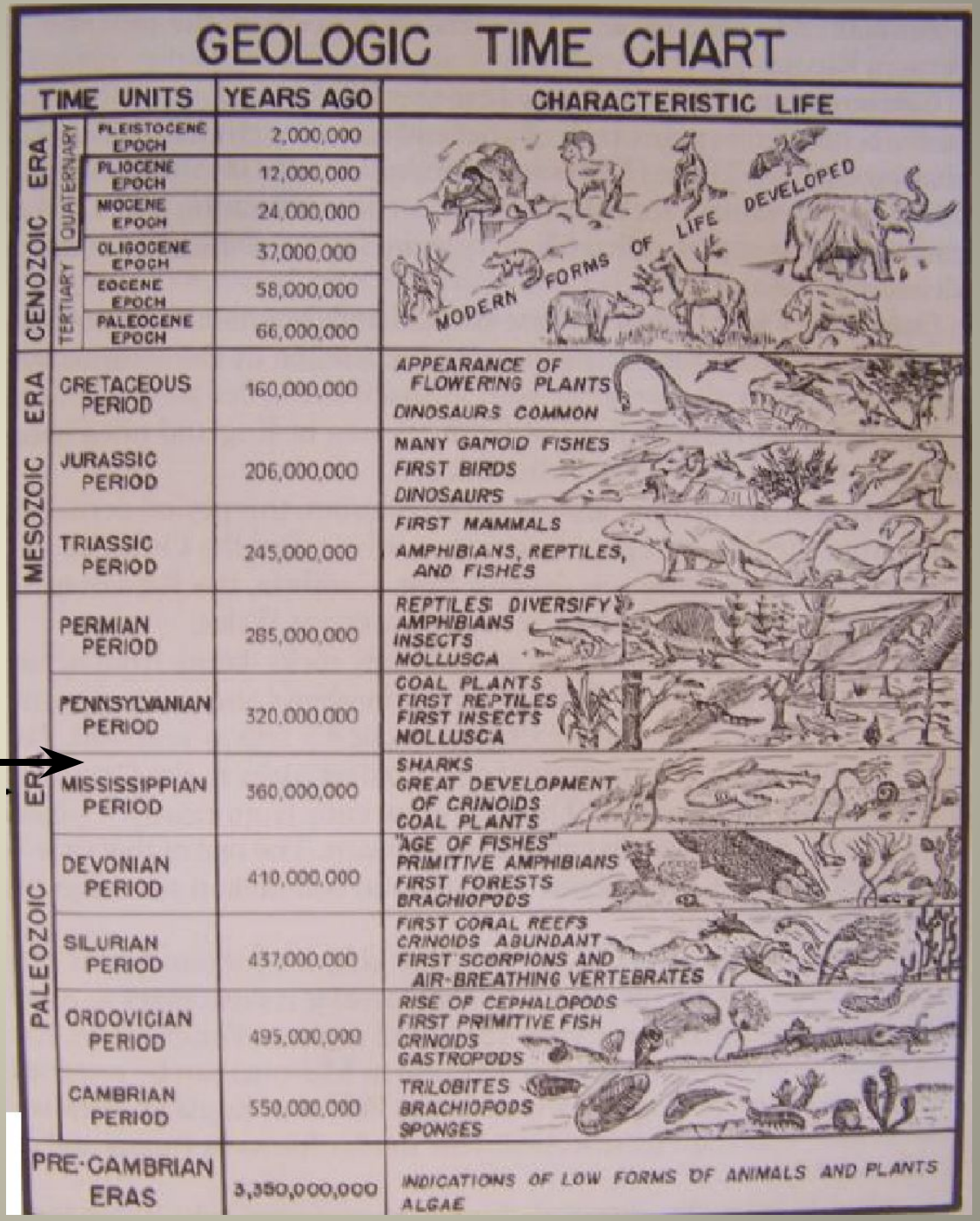
Geologic Map of Missouri



. Geologic Map of Missouri (Unklesbay & Vineyard 1992)

Geologic Time Chart

Litzsinger Road Ecology Center geologic origins



GEOLOGIC TIME CHART

TIME UNITS			YEARS AGO	CHARACTERISTIC LIFE
CENOZOIC ERA	QUATERNARY	PLEISTOCENE EPOCH	2,000,000	MODERN FORMS OF LIFE DEVELOPED
		PLIOCENE EPOCH	12,000,000	
		MIOCENE EPOCH	24,000,000	
	TERTIARY	OLIGOCENE EPOCH	37,000,000	
		EOCENE EPOCH	58,000,000	
		PALEOCENE EPOCH	66,000,000	
MESOZOIC ERA	CRETACEOUS PERIOD		160,000,000	APPEARANCE OF FLOWERING PLANTS DINOSAURS COMMON
	JURASSIC PERIOD		206,000,000	MANY GANOID FISHES FIRST BIRDS DINOSAURS
	TRIASSIC PERIOD		245,000,000	FIRST MAMMALS AMPHIBIANS, REPTILES, AND FISHES
PALEOZOIC ERA	PERMIAN PERIOD		285,000,000	REPTILES DIVERSIFY AMPHIBIANS INSECTS MOLLUSCA
	PENNSYLVANIAN PERIOD		320,000,000	COAL PLANTS FIRST REPTILES FIRST INSECTS MOLLUSCA
	MISSISSIPPIAN PERIOD		360,000,000	SHARKS GREAT DEVELOPMENT OF CRINOIDS COAL PLANTS
	DEVONIAN PERIOD		410,000,000	"AGE OF FISHES" PRIMITIVE AMPHIBIANS FIRST FORESTS BRACHIOPODS
	SILURIAN PERIOD		437,000,000	FIRST CORAL REEFS CRINOIDS ABUNDANT FIRST SCORPIONS AND AIR-BREATHING VERTEBRATES
	ORDOVICIAN PERIOD		495,000,000	RISE OF CEPHALOPODS FIRST PRIMITIVE FISH CRINOIDS GASTROPODS
	CAMBRIAN PERIOD		550,000,000	TRILOBITES BRACHIOPODS SPONGES
PRE-CAMBRIAN ERAS			3,350,000,000	INDICATIONS OF LOW FORMS OF ANIMALS AND PLANTS ALGAE

Geologic Time Compressed into One Year:

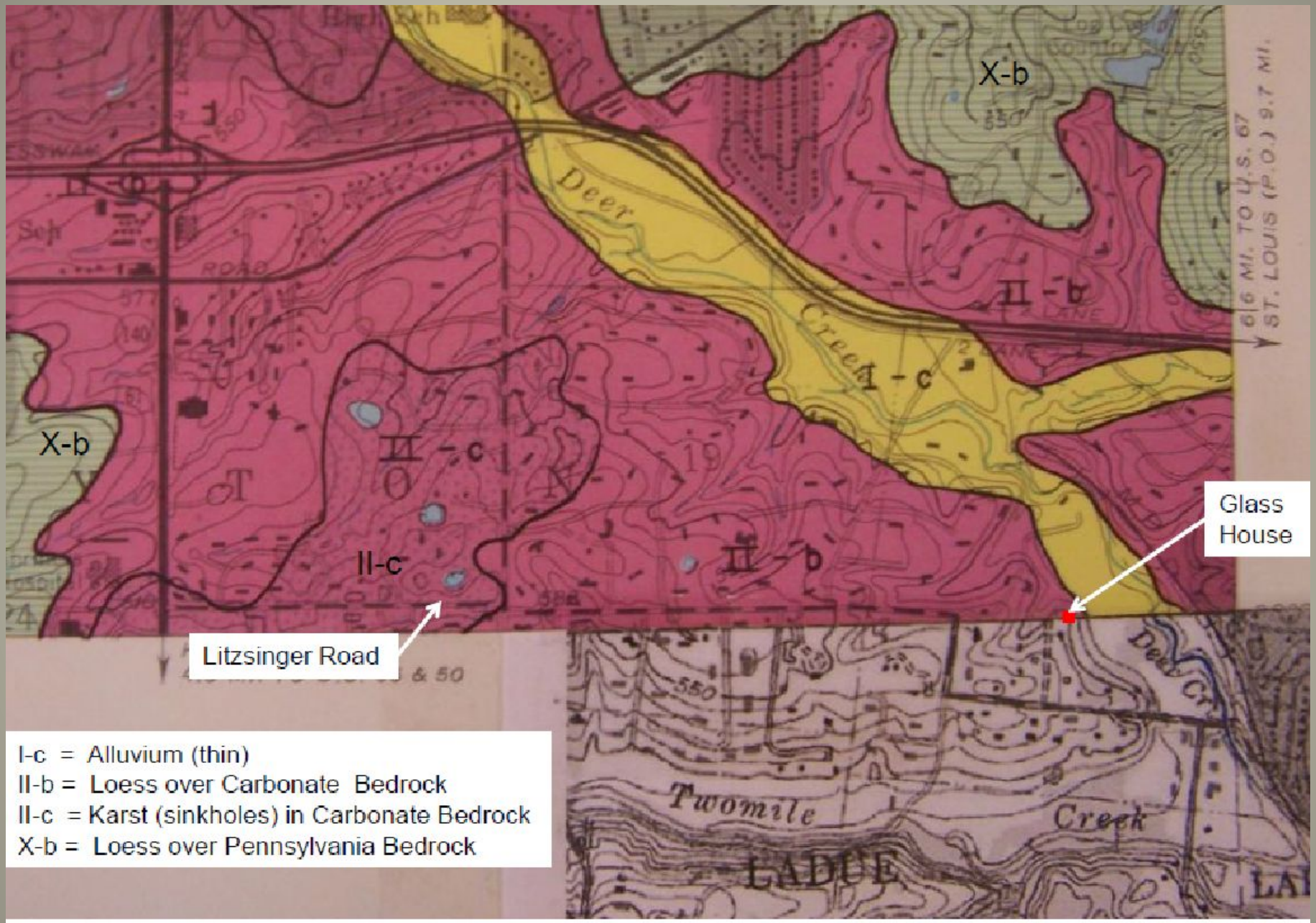
- The earth is 4.6 BY old, therefore:
- 1 day = 12,300,000 years
- 1 hour = 513,000 years
- 1 minute = 8,550 years
- 1 second = 142 years

Geologic Time Compressed into One Year

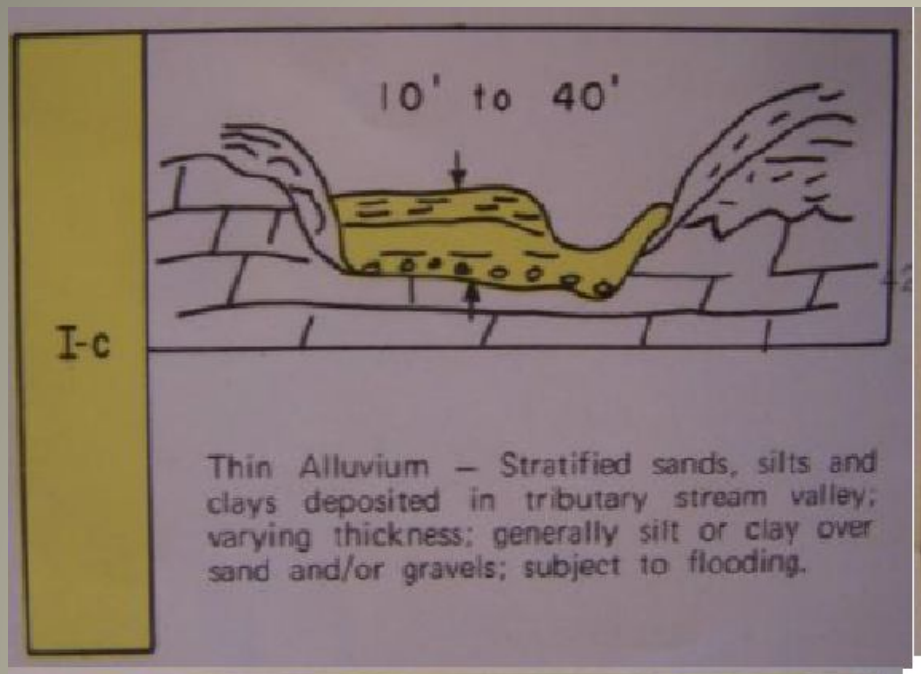
- 3.5 BY, first fossils, 81 days, March 22
- 2.5 BY, large continents, 162 days, June 11
- 600 MY, first animals, 316 days, Nov. 12
- 540 MY, first trilobites, 321 days, Nov. 17
- 480 MY, primitive fish, 326 days, Nov. 28
- 344 MY, Appalachians forming, 337 days, Dec. 3 **LREC Bedrock**
- 270 MY, Appalachians finished, 343 days, Dec. 9
- 221 MY, start of dinosaurs, 347 days, Dec. 13
- 65 MY, extinction of dinosaurs, 360 days, Dec. 26
- 4.5 MY, earliest hominids, 365 days, Dec. 31, 4 p.m.
- *Homo habilis* (1.8 M.Y): about 8 p.m. on Dec. 31, the last 0.05% of earth history
- *Homo sapiens* (0.1 M.Y.): just before the 10 minute warning on Times Square

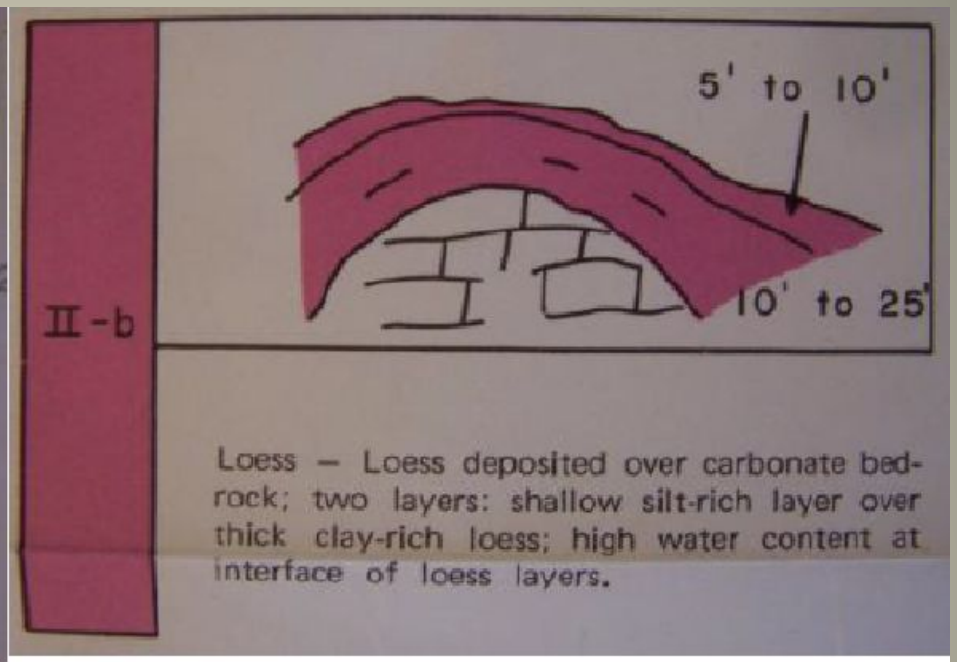
More of what you need to know

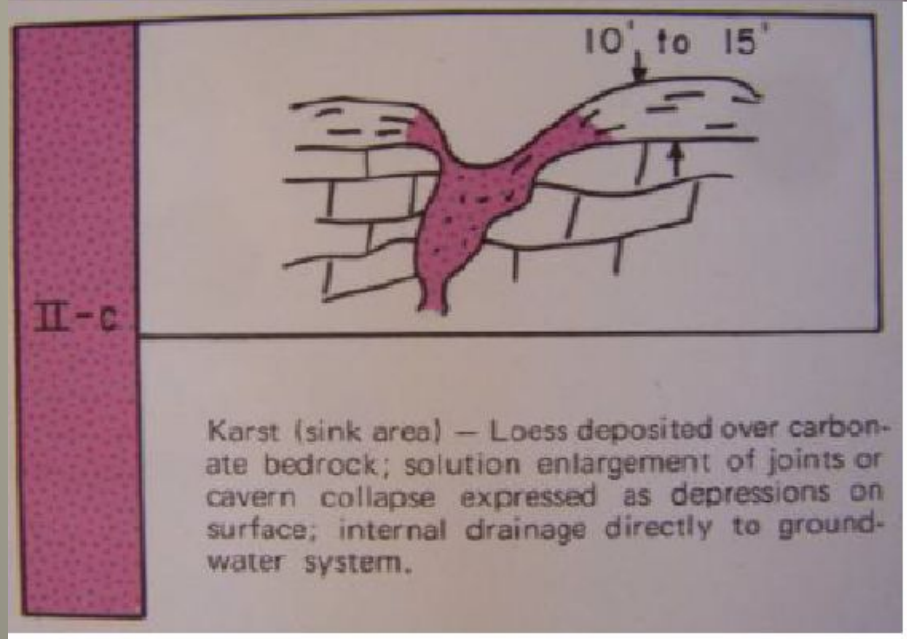
- The majority of rock composition at Litzsinger is limestone and dolomite.
- The limestone in St. Louis county is mostly lithographic to fine crystalline. This means that the size of the sedimentary particles that make up the rock are very, very small granules.
- The sediment at Litzsinger was deposited roughly 300-340 million years ago when North America was located under the equator and tropical to sub-tropical seas covered much of Missouri.
- Most of the rocks found at Litzsinger show signs of Dolomitization.
- Since dolomitization is speculated to have occurred in shallow reef areas and the geological evidence in St. Louis is suggesting that it was all at one point under a shallow sea, then it would explain why dolomitization has been found on site.
- It is because of the geologic evidence that has been identified that explains why there are so many fossils in Deer creek.

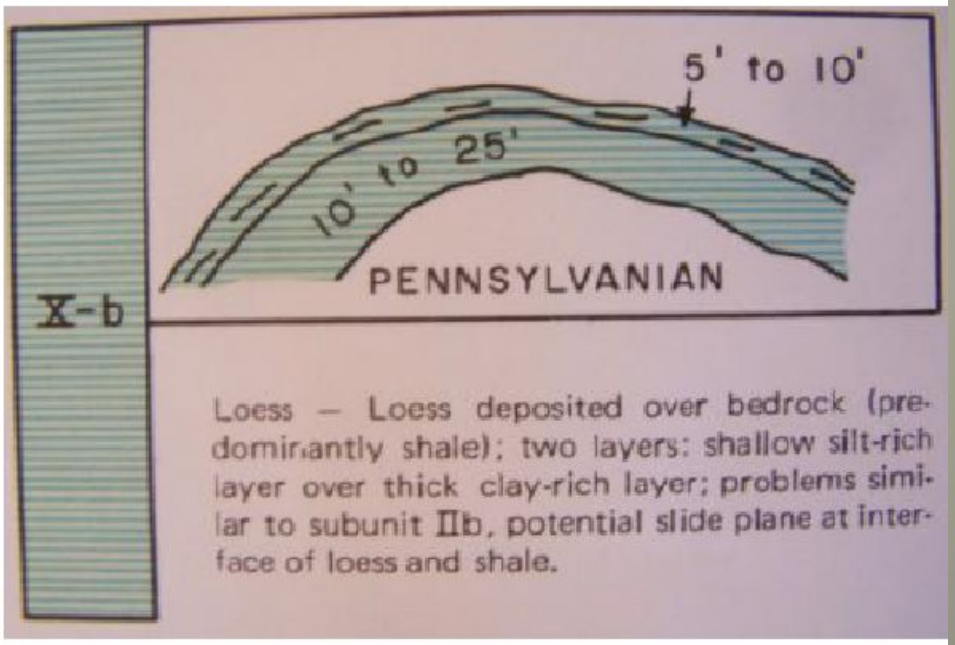


#3 Engineering Geologic Map of the Creve Coeur Quad. (Lutzen & Rockaway 1970)



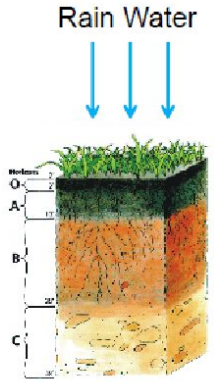






#4 LREC Geologic Map Legend (Lutzen & Rockaway 1970)

Karst

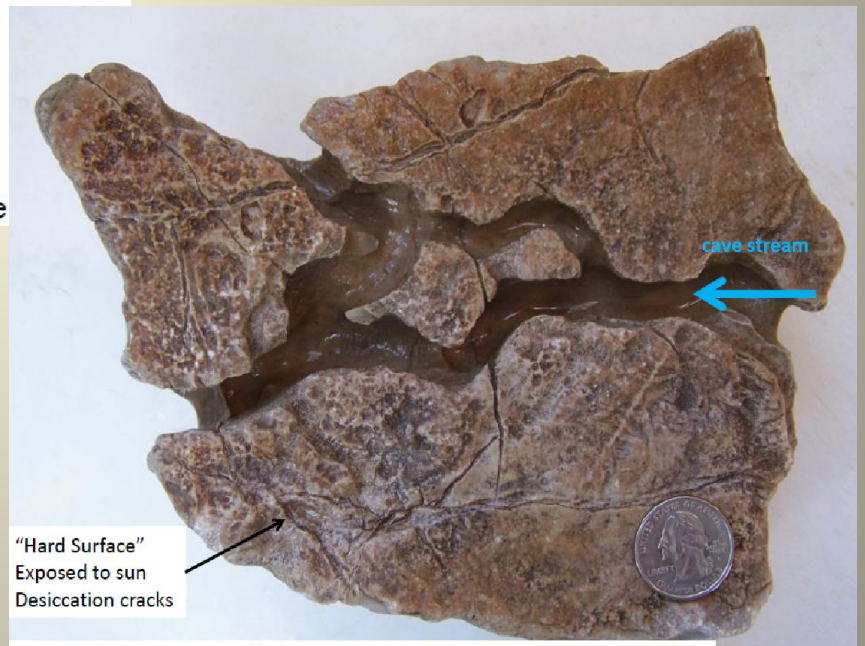


Carbon Dioxide (CO_2) from decay & bugs combines with water (H_2O), to form carbonic acid (H_2CO_3)

Carbonic acid dissolves limestone ($CaCO_3$) to form calcium bicarbonate water (Ca^{2+} and $2HCO_3^{1-}$)

Calcium carbonate is later deposited as cave formations

#5 The formation of karst features (solution conduits) in limestone and dolomite



#7 Cave Stream Rock showing "karst" conduit St. Louis Limestone. LREC 2013

Limestone

#8 Limestone is created by sea life; corals, clams, algae, etc. Mississippian Salem Formation

#9 Fresh surface of "clean" Mississippian St. Louis Limestone. Mudstone or micrite. LREC 2013

Chert: a hard, dark, opaque rock composed of silica (chalcedony) with an amorphous or microscopically fine-grained texture. It occurs as nodules (flint) or, less often, in massive beds.

#10 Fresh chert [silicon dioxide – SiO_2] Mississippian St. Louis Limestone. LREC 2013

Calcite Crystal
($CaCO_3$) = Limestone

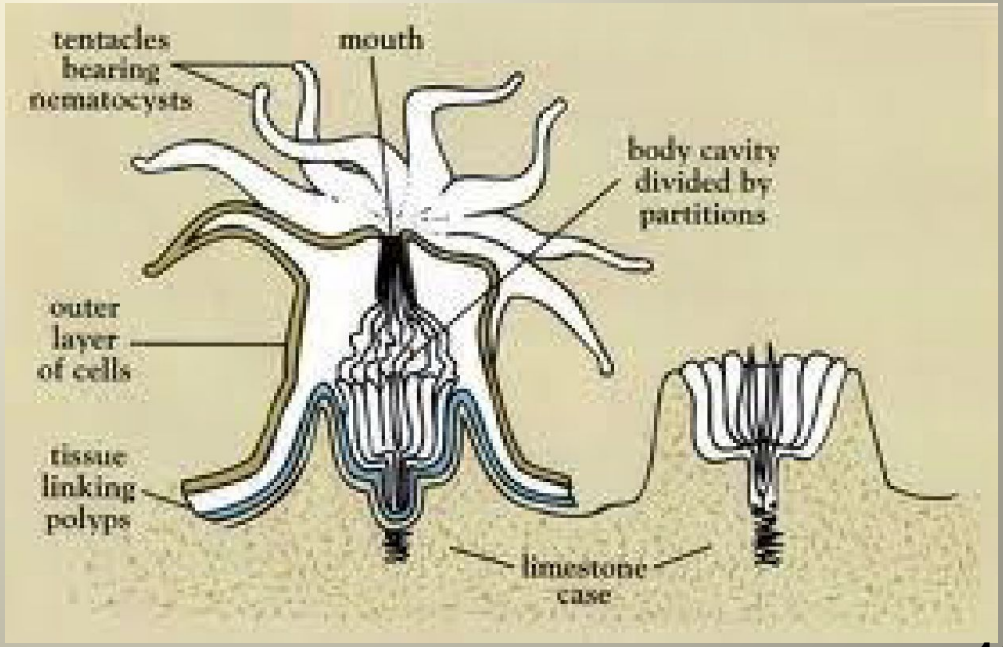
Quartz Crystal
silicon dioxide ($SiO_{2)}$ = chert

#11 Calcite and Quartz Crystals

Table of LREC Fossils

Common Name:	Scientific Name:
Tabulate Coral	Lithostronella
Pipe Organ Coral	Syringopora
Lamp Shell (Brachiopods)	Spirifer & Lindoductus
Moss Animal (Bryozoans)	Fenestrellate
Sea Pen & Sea Lilly (Pelecypod)	Aviculopinna & Crinoids

Tabulate Coral
(*Lithostronella)*



Pipe Organ Coral
(Syringopora)

Living Pipe Organ coral similar to the fossils found at LREC

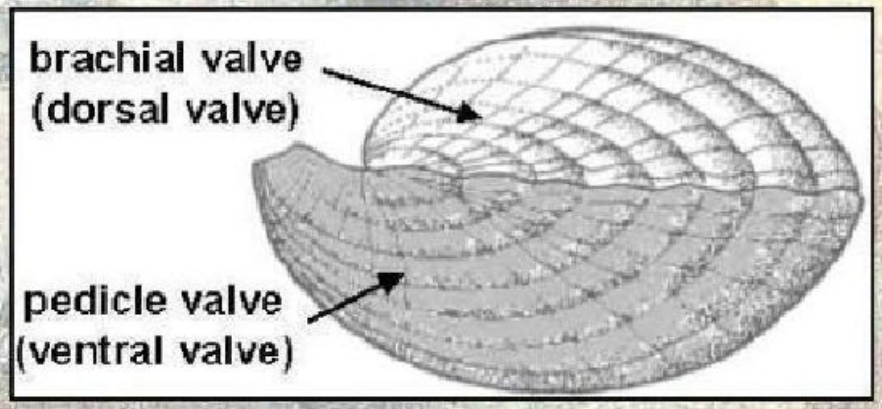
Lamp Shells

Brachiopods

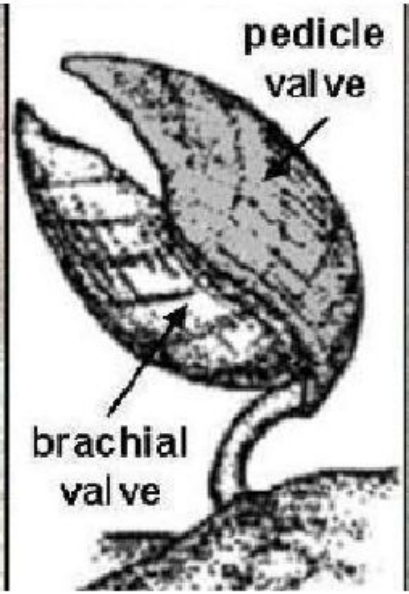
- Long fossil record - Cambrian (534 mya) to Recent 0 (mya)

- Brachiopods have one of, if not the best, fossil record of any group

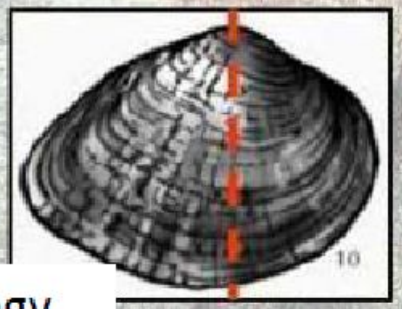
- ~ 4,500 fossil genera compared to ~ 250 living genera

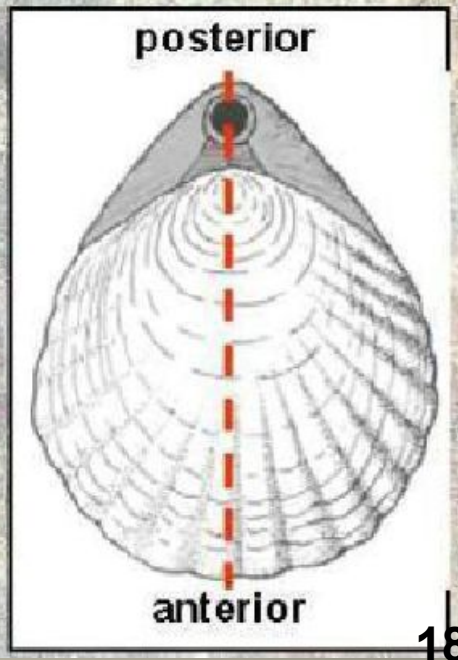


- In life, the pedicle valve goes on the top and the brachial valve goes on the bottom



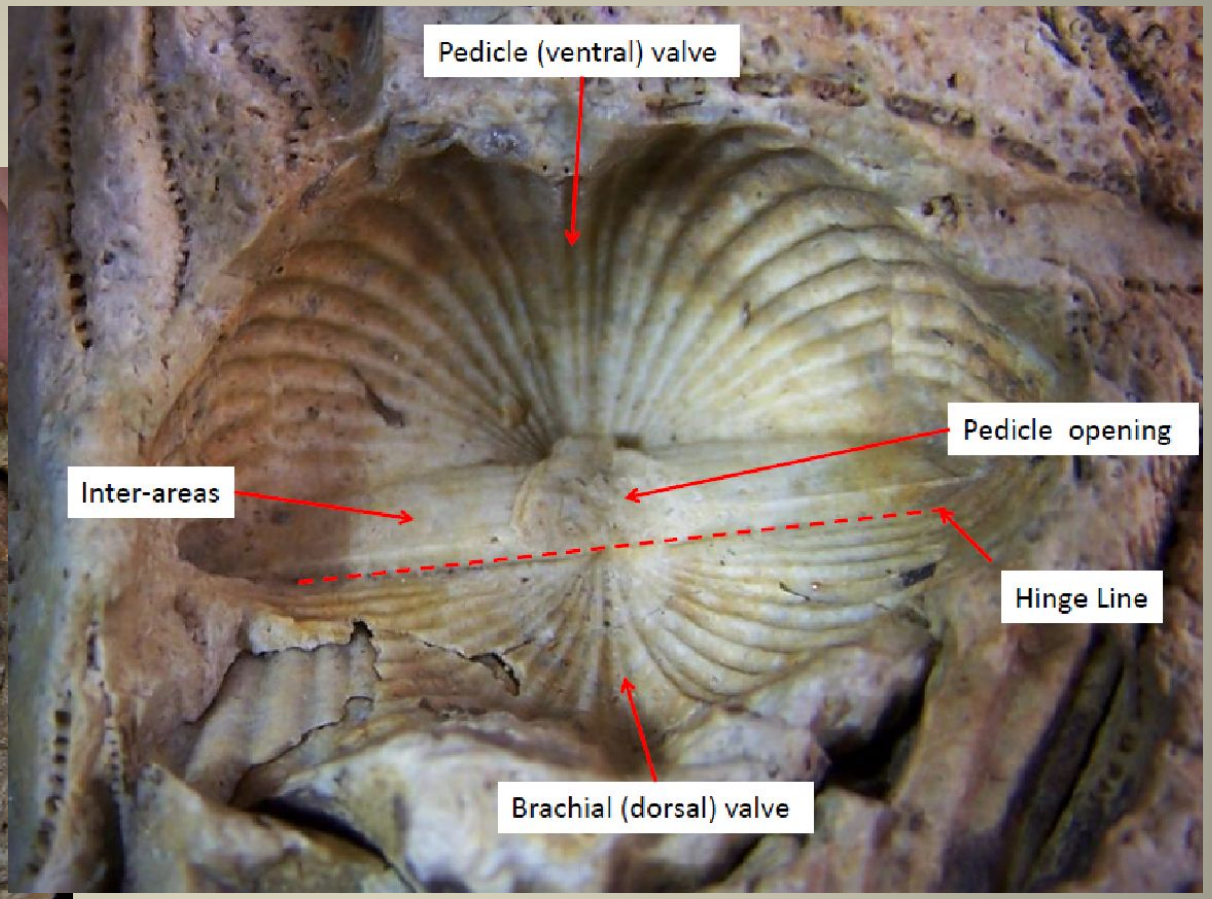
- Bilaterally symmetrical in plan (dorsal) view



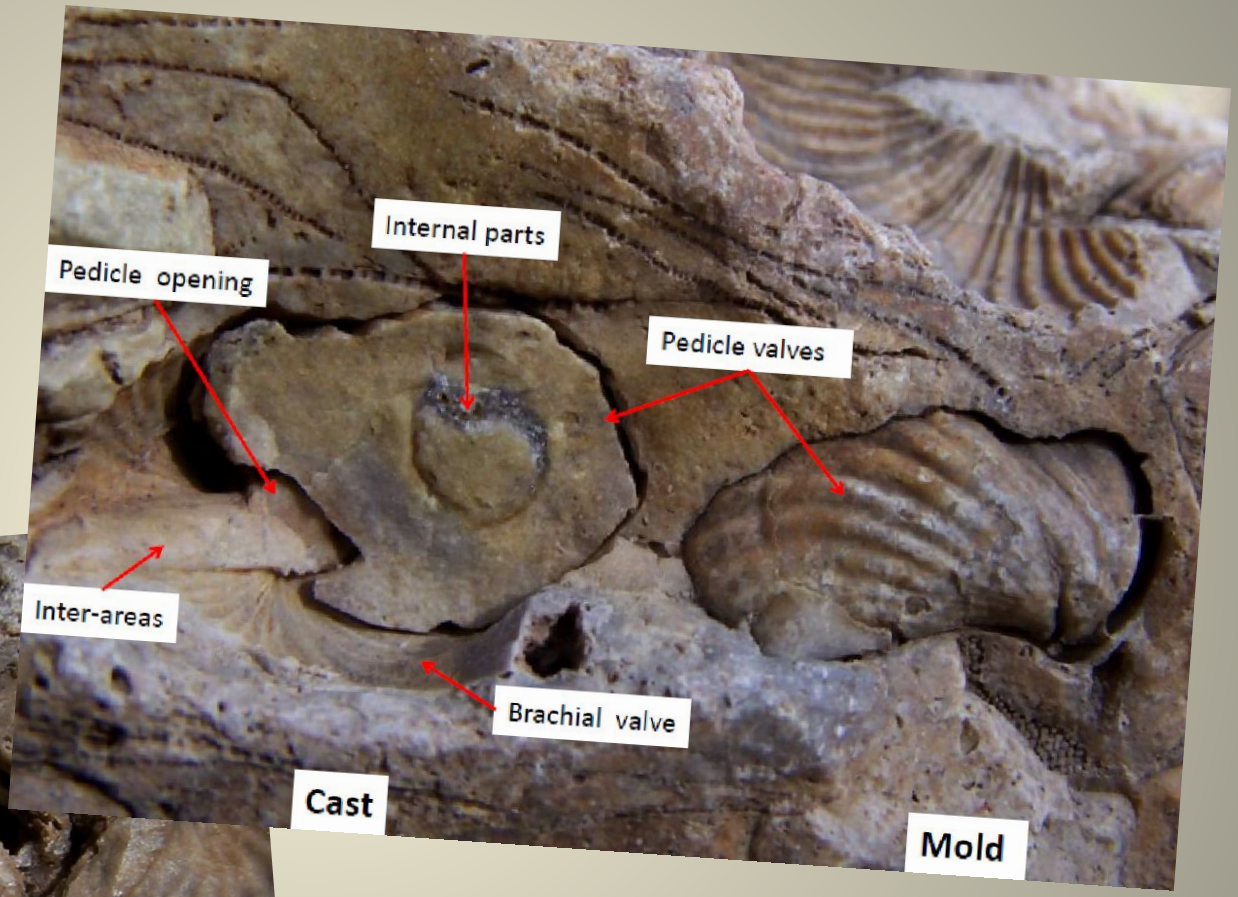


#17 Web: GEOS312: Brachiopod Morphology

Lamp Shell Casts

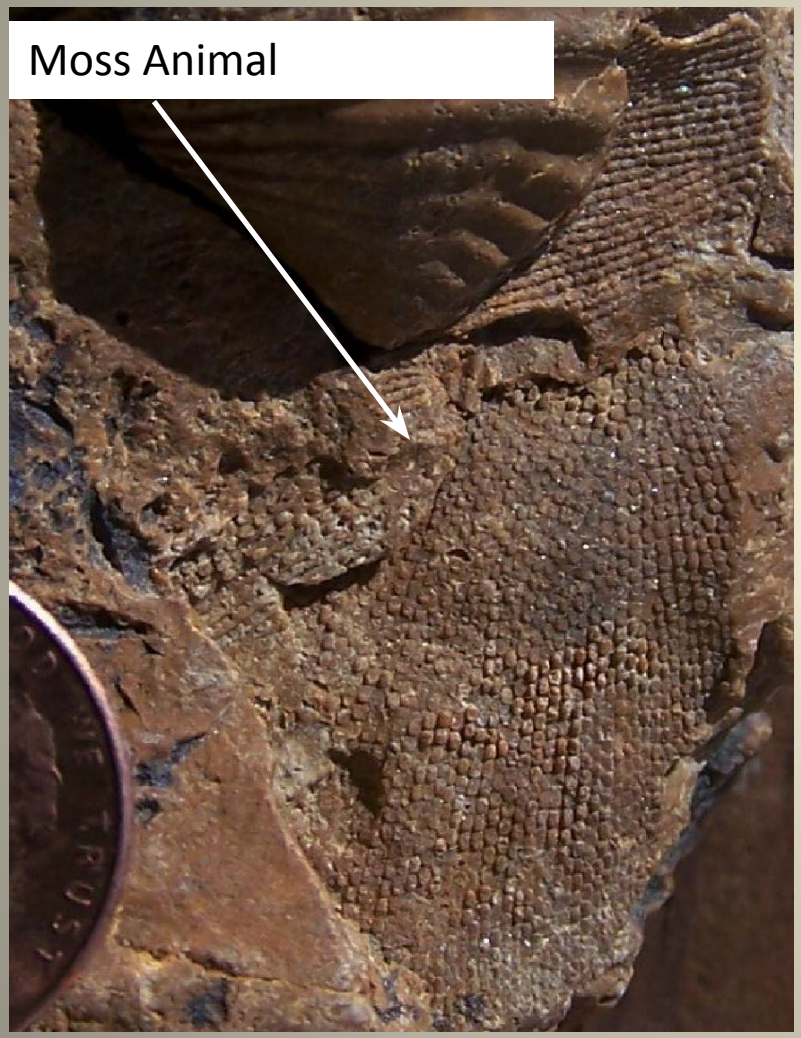


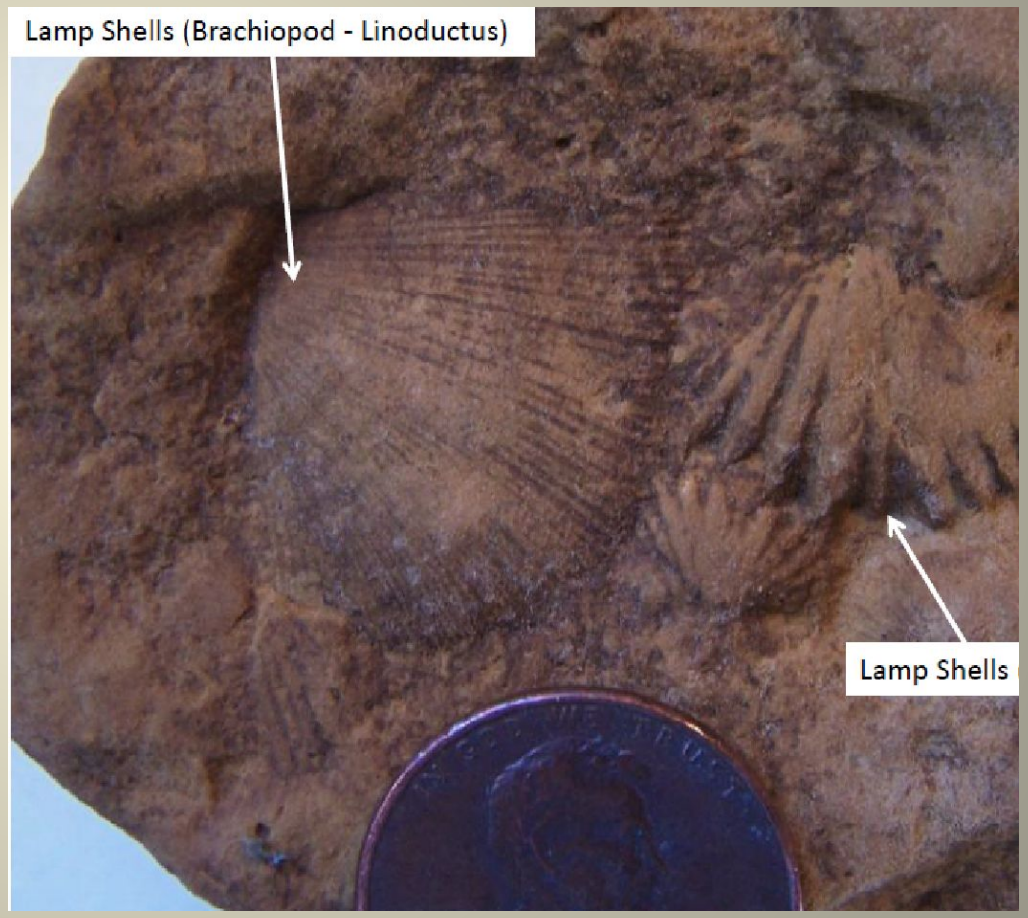
Lamps shell fossils with crystallization of soft body



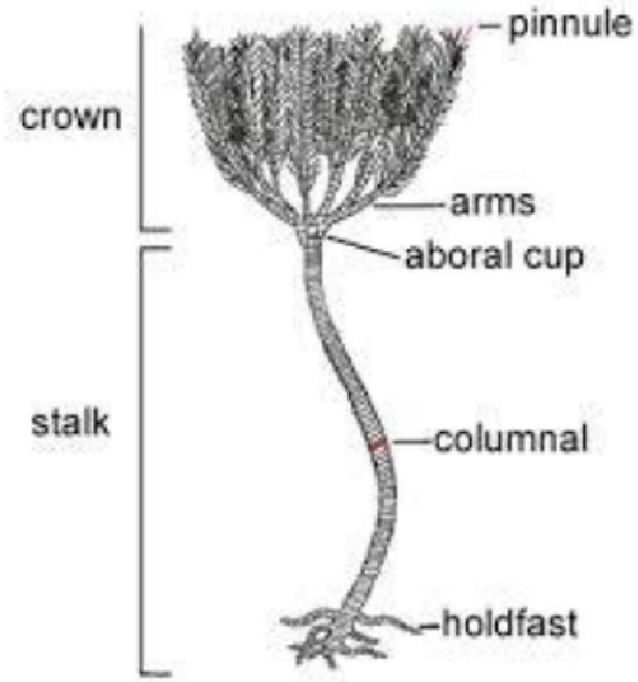
#21 Quartz crystallization of Brachiopod (Spirifer sp.) soft body parts; lophophore (gills)

Moss Animal and Linoductus Brachiopods





Sea Pen and Sea Lilly



#26 Crinoids (Sea Lily). St. Louis Limestone. LREC 2013

Mississippian Period Sea Life

Pennsylvanian Period Sea Life