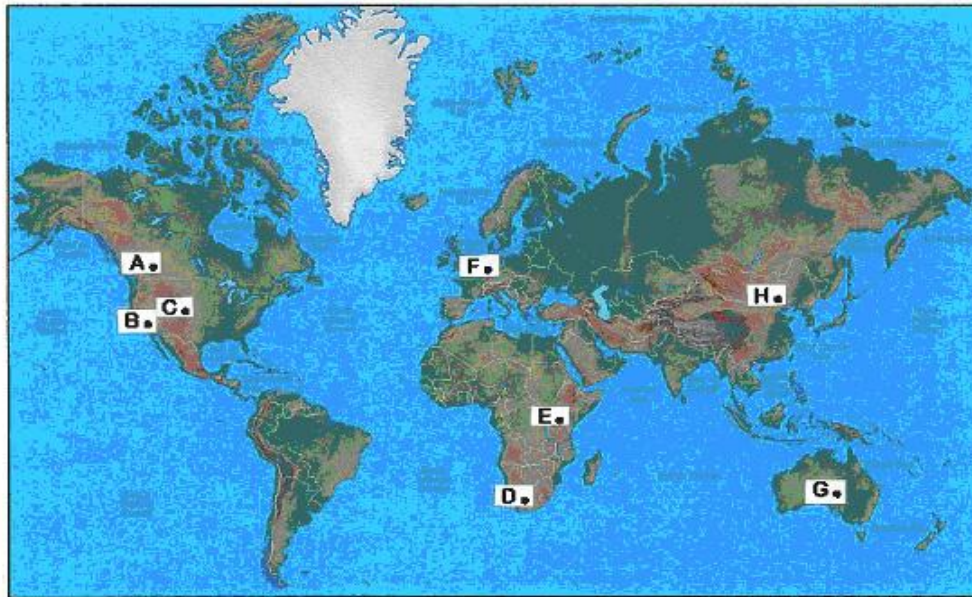


STATION 1



<http://geology.com/world/world-map.shtml>

**Match the description of each of these famous fossil sites with its location. Write the location label (A, B, C, etc) from the map in the corresponding blanks on your answer sheet for each description.

1. ____ **Yixian Formation:** Remains of many different animals from Early Cretaceous time, including feathered dinosaurs, are found in this Formation in Liaoning Province.
2. ____ **Burgess Shale:** This Cambrian-age deposit preserved delicate, soft-bodied shallow marine invertebrates that were swept off the edge of the continental shelf and rapidly buried. The site was discovered in 1909 by Charles Walcott.
3. ____ **Morrison Formation:** Late Jurassic-age rocks preserve terrestrial floodplain fossils, including bones and tracks of giant sauropods like *Diplodocus* and *Apatosaurus*, as well as vegetation from that time.
4. ____ **Olduvai Gorge:** This Early Pleistocene site contains remains of human ancestors, together with stone tools and campsites, that were buried and preserved in volcanic ash. Louis and Mary Leakey discovered this site in the 1930s.
5. ____ **Rancho LaBrea Tar Pits:** Sticky tar pools trapped predators and prey, insects and pollen during the Pleistocene, providing thousands of fossils and preserved skeletons of a wide variety of animals, including dire wolves, mammoths and saber tooth cats.
6. ____ **Ediacara Hills:** Proterozoic (570-543 million years ago) deposits preserve abundant soft-bodied inter-tidal invertebrate marine life known as Ediacaran Fauna. Fossils include jellyfish, segmented worms, feather-like soft corals and early arthropod-like forms.
7. ____ **Karoo Beds:** These Late Carboniferous to Early Permian deposits provide evidence of early complex terrestrial ecosystems and evolution of synapsid ancestors of today's mammals.
8. ____ **Solnhofen Limestone:** Jurassic-age lithographic limestone deposits famous for beautifully preserved fossils of Archaeopteryx and pterosaurs. The fossils are preserved in fine-grained limestone that formed from the calcareous mud deposited in quiet lagoons.

STATION 2



9. Identify specimens labeled A-D by Genus name.

10. Place the specimens in order from oldest to youngest (use the letter labels from the specimens).

****11.** The colonial organism represented by specimen B is made up of connected individuals called:

- A) corallites
- B) spicules
- C) zooids
- D) frustules
- E) none of these; it is a solitary organism

12. The skeletons of the individual animals making up the colonial organism represented by specimen D are called:

- A) corallites
- B) spicules
- C) zooids
- D) frustules
- E) none of these; it is a solitary organism

STATION 3

13. The Law of Superposition indicates that:

- A) the oldest rocks in an undisturbed sedimentary sequence will be on the top.
- B) the oldest rocks in an undisturbed sedimentary sequence will always be PreCambrian in age.
- C) the oldest rocks in an undisturbed sedimentary sequence will be on the bottom.
- D) horizontal layers of sedimentary rocks are always older than tilted rock layers.

14. The rock record:

- A) provides a continuous record of life on earth.
- B) is affected by non-deposition and erosion.
- C) is not affected by tectonic forces.
- D) demonstrates that igneous rock is older than sedimentary rocks.

15. Which principle explains why *Mucrospirifer* cannot be found in Carboniferous-age rocks?

- A) Principle of Inclusions
- B) Principle of Unconformities
- C) Principle of Original Lateral Continuity
- D) Principle of Faunal Succession

16. The correlation of sedimentary rock units on separate continents can best be done by using:

- A) sedimentary rock unit types
- B) fossils
- C) principle of Original Lateral Continuity
- D) radiometric dating of igneous rocks

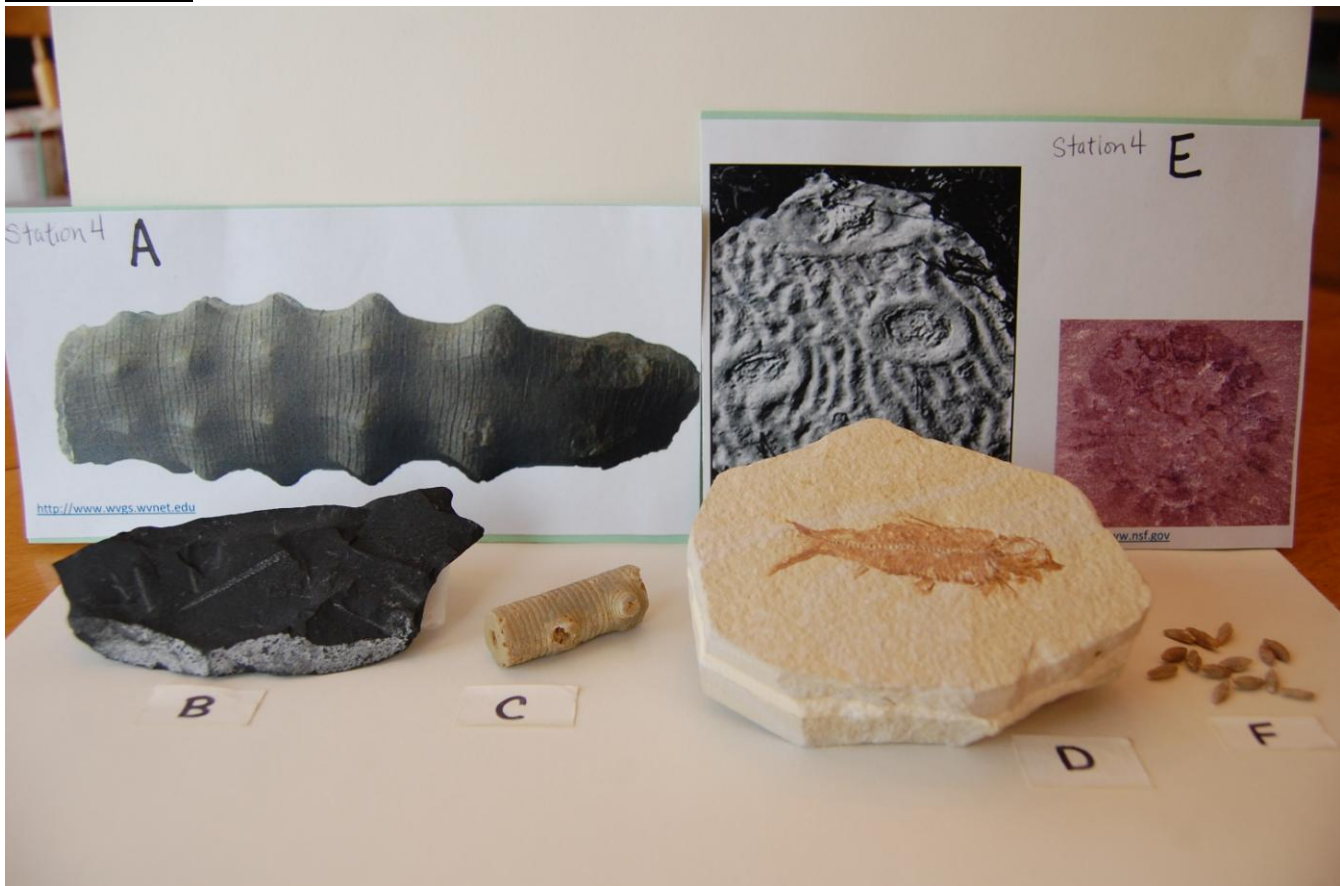
17. Unconformities represent gaps in geologic time when layers were not deposited or when erosion removed layers. Fill in the blanks with the name of the correct type of unconformity-

- A) An unconformity between parallel layers is called a _____.
- B) A _____ is produced when sedimentary layers overlie igneous or metamorphic rocks.
- C) A sequence showing tilted rock strata overlain by younger horizontal rock layers is called a _____.

****18.** A geologist is studying sedimentary strata in Utah. At one rock outcrop he finds fossils of *Elrathia* in a horizontal layer of shale. At another rock outcrop 2 miles away he again finds horizontal sedimentary rocks, including another layer of the shale with *Elrathia* fossils. At this second outcrop, one of the rock layers below the shale contains fossils of a Silurian-age horn coral.

- A. What is the age of the fossil *Elrathia*?
- B. What can the geologist deduce about the age of the two shale layers?
- C. What did the geologist determine had happened to the rock layers at the second outcrop?

STATION 4



19. Identify the PHYLUM for each specimen/photo (labeled A-F):

20. Specimen B is an index fossil. These organisms are good index fossils in part because:

- A) They were benthic.
- B) They were widespread in lacustrine environments.
- C) Individual species lasted only a short time before becoming extinct.
- D) They commonly appear on black shale which is found worldwide.

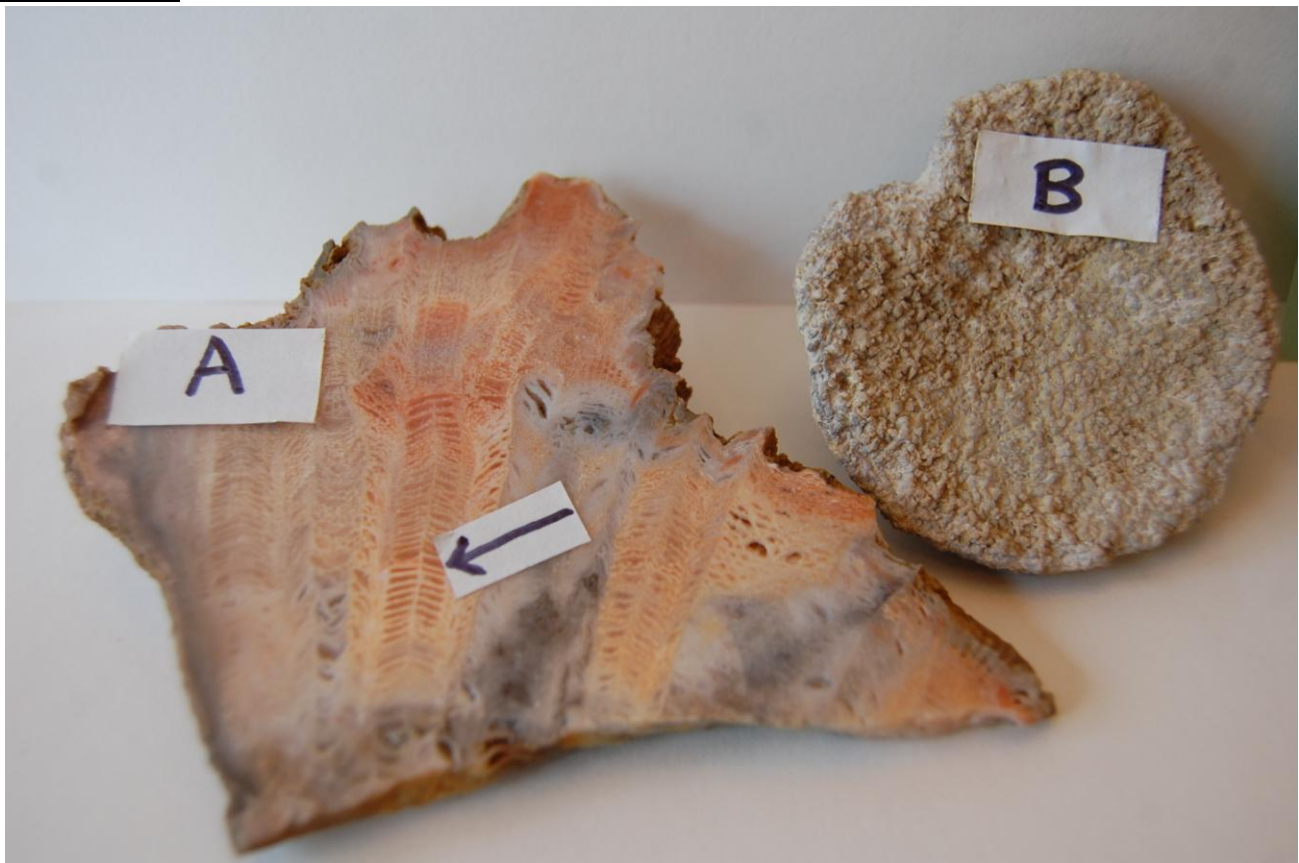
****21.** Specimen F is an important fossil for:

- A) Bio-stratigraphy/relative dating of rocks
- B) Studying past ocean conditions
- C) Studying past climate conditions
- D) Exploration for oil deposits
- E) All of the above
- F) A, B, and C only

22. Answer the following questions using the letter labels from the specimens:

- A) Which Specimen spent most of its life in the medusa stage?
- B) Which Specimen's informal name is "glass sponge"?
- C) Which Specimen is a single-celled organism?
- D) Which Specimen's phylum is named for its stinging cells?

STATION 5 Identify the specimens as indicated and answer the related questions-



Specimen A

23. Identify the Phylum and Subclass of Specimen A.
24. What is the name of the horizontal feature on this specimen that is marked with an arrow?
25. What ancient environment is represented by the presence of this fossil?
26. Is this organism colonial or solitary?

Specimen B

27. Identify the Phylum and Genus of Specimen B:
28. Is this organism colonial or solitary?
29. What part of this organism makes up the star-shaped features on its surface?
30. In this specimen, the composition of these star-shaped features is:
A) siliceous B) calcareous C) spongin

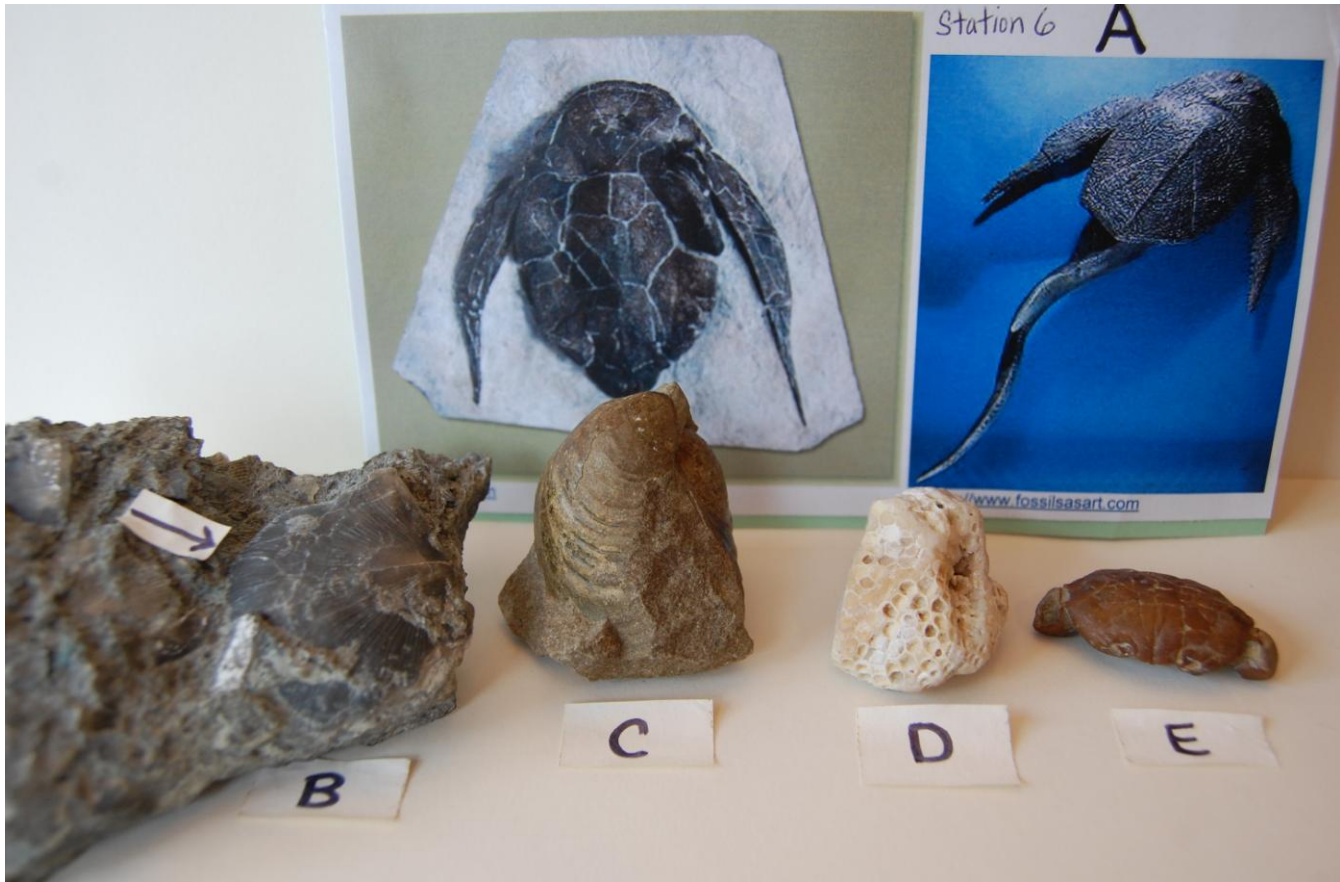
Specimen C

31. What is the Order of Specimen C?
32. During what geologic time period did this Order first appear?
33. What Genus represents this Order on the official Science Olympiad 2011 Fossil List?

Specimens D and E

34. Identify the Class for Specimen D:
35. Identify the Class for Specimen E:
36. What held the valves of Specimen D together?
37. The valves of Specimen E articulate with teeth and sockets at the _____.
- **38. What feeding structure did these organisms share with Bryozoans?

STATION 6 Speed ID-



****39.** Identify specimens A - K as indicated.

A) Genus- _____

B) Genus- _____

C) Class- _____

D) Informal name- _____

E) Phylum- _____

F) Genus- _____

G) Genus- _____

H) Phylum- _____

I) Order- _____

J) Genus- _____

K) Genus- _____

40. Give the age of the specimens as indicated.

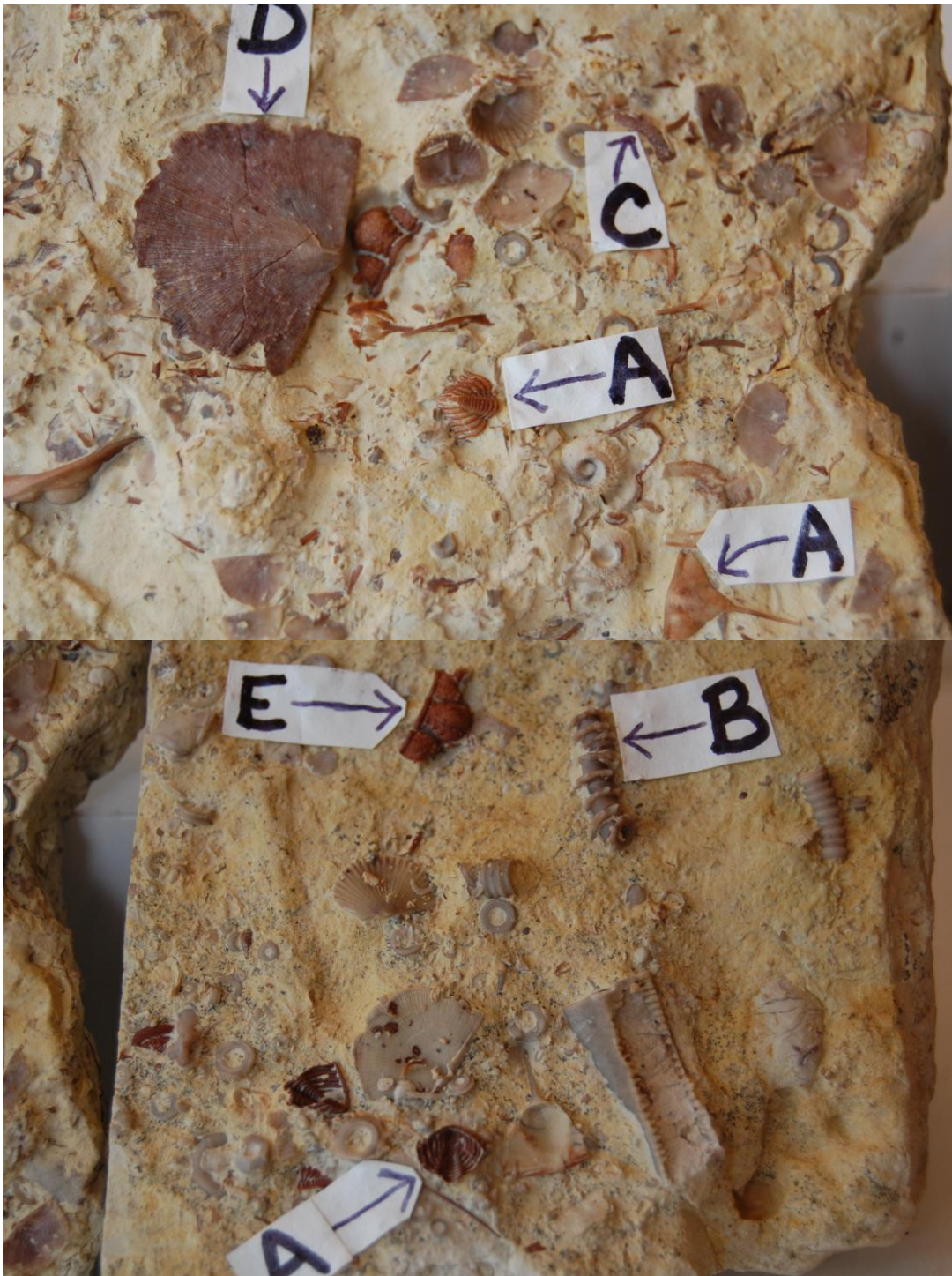
Specimen A) Era- _____

Specimen B) Period- _____

Specimen H) Era- _____

Specimen K) Period- _____

STATION 7 Look at the rock slabs at this station and answer the questions below:



41. What is the scientific term for the fossil body parts labeled A?
42. What is the Phylum for the fossils labeled A?
43. What is the fossil labeled B?
44. What is the Phylum for the fossil labeled C?
45. Which describes the symmetry of the fossil labeled D?
A) Between the valves B) Through the valves
46. What is the scientific term for the fossil body part labeled E?
47. What is the scientific term for the rounded, bulb-shaped feature in the center of Fossil E?
48. What geologic Era are these fossils from?
49. What type of environment do these fossil slabs represent?

STATION 8



50. What type of rock is Specimen A?
51. What does the color of the rock imply about the environment that Specimen A formed in?
A) Oxygen-rich conditions prevented formation of iron-oxides in the sediment.
B) The environment was anaerobic.
C) Flooding had occurred, leaving black sand deposits where these plants grew.
52. What mode of fossilization is shown by the fossils in Specimen A?
53. What type of rock is Specimen B?
54. What mode of fossilization is present in Specimen C?
55. The specimen in the bag labeled D-1 is an example of the extant plant *Equisetum*, also known as the "scouring rush". What is the Genus name of the fossil pith cast of the extinct, tree-like version of this plant?

56. Identify specimen D-2 (Genus).

Tell what part of the plant it was:

- A) Flower
B) Cone
C) Leaves
D) Root
57. What Division (Phylum) is represented by Specimen E?
A) Pteridophyta
B) Coniferae
C) Lycopodiophyta
58. Identify Specimen F, explain what it is, and give the mode of fossilization it represents.
59. Which of these statements is true about copal?
A) Volatile terpenes in the resin have not yet been fully driven off by heat/pressure.
B) The process to change freshly hardened resin into fossil resin is a continuum with no specific length of time at which copal becomes amber.
C) Copal is used for incense.
D) All of the above.
E) B and C

- **60.** Which two fossil specimens at this station are examples of major components of Carboniferous-age deposits represented by specimen G?

STATION 9



- 61.** What was the function of the fossil body part labeled A?
- 62.** What was the mode of life for fossil A?
- 63.** Identify the Class and the Genus of the fossil labeled B.
- 64.** What was the mode of life for fossil B?
- 65.** The bag labeled C has several column-shaped specimens that have a central opening. When the organism was alive, this opening contained a fluid-filled sac and nerve. This opening is called the:
- A) axial canal
 - B) genal spine
 - C) aperture
 - D) calyx tube
- 66.** Give the Class name for each of Specimens D, E, and F.
- 67.** The bodies of organisms D, E and F are arranged in a certain pattern. What is this type of symmetry called?
- A) Phragmoconical symmetry
 - B) Ambulacral symmetry
 - C) Pentameral symmetry
 - D) Asymmetrical symmetry

STATION 10



68. Which specimen has living relatives of the same Genus?
69. In which specimen(s) would the siphuncle be located along the ventral side of the chambers?
70. Which specimen(s) is/are most closely related to Specimen A?
71. Which specimen(s) is/are most closely related to Specimen B?
72. Which specimen(s) is/are most closely related to Specimen E?
73. List the letters for the specimens that are not class Cephalopoda.
- **74.** Identify the Genus of Specimen F.
75. Which Specimen is an internal support structure?
76. What is the Genus of the answer to question 75?
77. Which answer correctly describes the evolution of ammonite suture patterns?
- A) Sutures became simpler as they evolved through time.
 - B) Sutures became more complex as they evolved through time.
 - C) Sutures became random in pattern as they evolved through time.

STATION 11



78. Specimen A contains part of a dinosaur tooth in matrix. Is this tooth from a saurapod or a theropod? Explain your answer.

79. Specimen B is a model of the Pterosaur that had the longest known wingspan. What is the Genus name of this Pterosaur and during which geologic time period did it live?

- A) *Quetzalcoatlus*; Late Cretaceous
- B) *Rhamphorynchus*; Jurassic
- C) *Pterodactylus*; Late Jurassic
- D) *Dimorphodon*; Early Jurassic

80. Dinosaur trackways provide a means of estimating the relative velocity at which the animals were moving. Footprint length is used to estimate the hip height of the animal. Stride length is the distance between consecutive steps made by the same foot. The stride length and hip height are used to calculate the relative stride length ratio which is used to estimate relative speed. Paleontologists took measurements of an ornithopod trackway found at Dinosaur Ridge and determined that the footprint length was 30 cm and the relative stride length ratio for that animal was 1.85. Measurements were also taken of the tracks of a carnivorous dinosaur that were intermingled with those of the ornithopod. The footprint length of the carnivorous dinosaur was 15 cm and the calculated relative stride length ratio was 2.99. Based on the information above and your knowledge of dinosaurs and trackways, answer the following questions:

- A) What is the approximate hip-height of the ornithopod dinosaur (in cm)?
- B) Was the ornithopod dinosaur walking, trotting or running?
- C) What is the approximate hip-height of the carnivorous dinosaur (in cm)?

- D) Was the carnivorous dinosaur walking, trotting or running?
- E) What type of fossil is a dinosaur track or trackway?

81. Dinosaur tracks are the state fossil for which of the states listed below?

- A) Kentucky
- B) North Dakota
- C) Connecticut
- D) Colorado

82. Specimen C is from a Mosasaur, a very large marine reptile that had a stream-lined body, enormous skull, long tail and four small paddle-like limbs. What part of the skeleton is Specimen C?

83. Identify the Order and Genus of Specimen D.

84. Which of these statements is true of the Order represented by Specimen E:

- A) They were air breathers.
- B) They swam in marine waters worldwide.
- C) They lived in large inland lakes.
- D) They were herbivores.
- E) They were carnivores.
- F) They were related to snakes.
- G) all of the above
- H) A, B, and E
- I) A, C, E, and F

STATION 12

85. Linnaean taxonomy is used to classify organisms in a ranked hierarchy, from general to more specific. Place these taxonomic divisions in the correct order from general to more specific:

Class Species Phylum Family Order Genus Kingdom

For Questions 86-100: Using the word list provided, write the word that best matches the definition/description in the corresponding blank on your answer sheet

WORD LIST*****

**benthic fossil pelagic ichnology lacustrine strata Conservation Lagerstatte matrix
Concentration Lagerstatte deltaic aragonite chelicerae theca angiosperm sessile calcite
septa gymnosperm chitin thorax steinkern pedicle paleontology half-life nacreous**

- 86. period of time it takes for half of a radioactive substance to decay, regardless of sample size
- 87. unusually well-preserved fossils
- 88. rooted to the floor or bottom; staying in one place
- 89. fleshy stalk that passes through the ventral valve, attaching animal to substrate
- 90. plants that produce seeds that are not enclosed within plant tissue; "naked seed"
- 91. living at the bottom of the ocean or on the ocean floor
- 92. layers of sedimentary rock or soil with characteristics that distinguish them from other layers
- 93. form of calcium carbonate with orthorhombic crystals, common in invertebrate shells
- 94. remains or traces of past life
- 95. living above the sea floor, in the water column; free swimming
- 96. pair of appendages used for grasping food that are located in front of the mouth in some arthropods
- 97. the segments between the head and the tail of a trilobite
- 98. the study of ancient life
- 99. lakes and ponds
- 100. rock or sediment in which a fossil is embedded

STATION 13



101. Which taxonomic classification do all of the specimens at this station have in common?

102. How did Specimen A live and how did it feed?

- A) lived in muddy areas subject to inundation; bored through shells of mollusks
- B) lived in marine environment with pedicle anchoring to sea floor; filter feeder
- C) lived in lacustrine environment, cemented to firm objects; scavenger
- D) lived in marine environment, cemented to firm objects; filter feeder

103. What is the subphylum of Specimen A?

104. Specimen B is just a portion of a skeleton; it is missing part of its head shield. Why are many fossils of this Class of animal disjointed?

- A) the skeletons were broken apart by predators feeding on the animals
- B) the animals molted or shed their exoskeletons to allow for growth
- C) portions of the skeleton were made of aragonite which dissolved over time
- D) the underside of these animals was almost never preserved

105. What is the genus of Specimen B?

106. Specimen C is the state fossil of which state?

107. What was the purpose of the posture displayed by Specimen C?

108. What is the scientific term for the portion of the body represented by Specimen D?

109. What was the mineral composition of the eye lenses of Specimen D?

110. When did Specimen C live?

111. Answer T (true) or F (false) for the following statements about Specimen E.

Lived in both fresh water and saltwater.

Lived in saltwater only.

Body consists of cephalothorax and antennae.

Chelicerae were used in feeding.

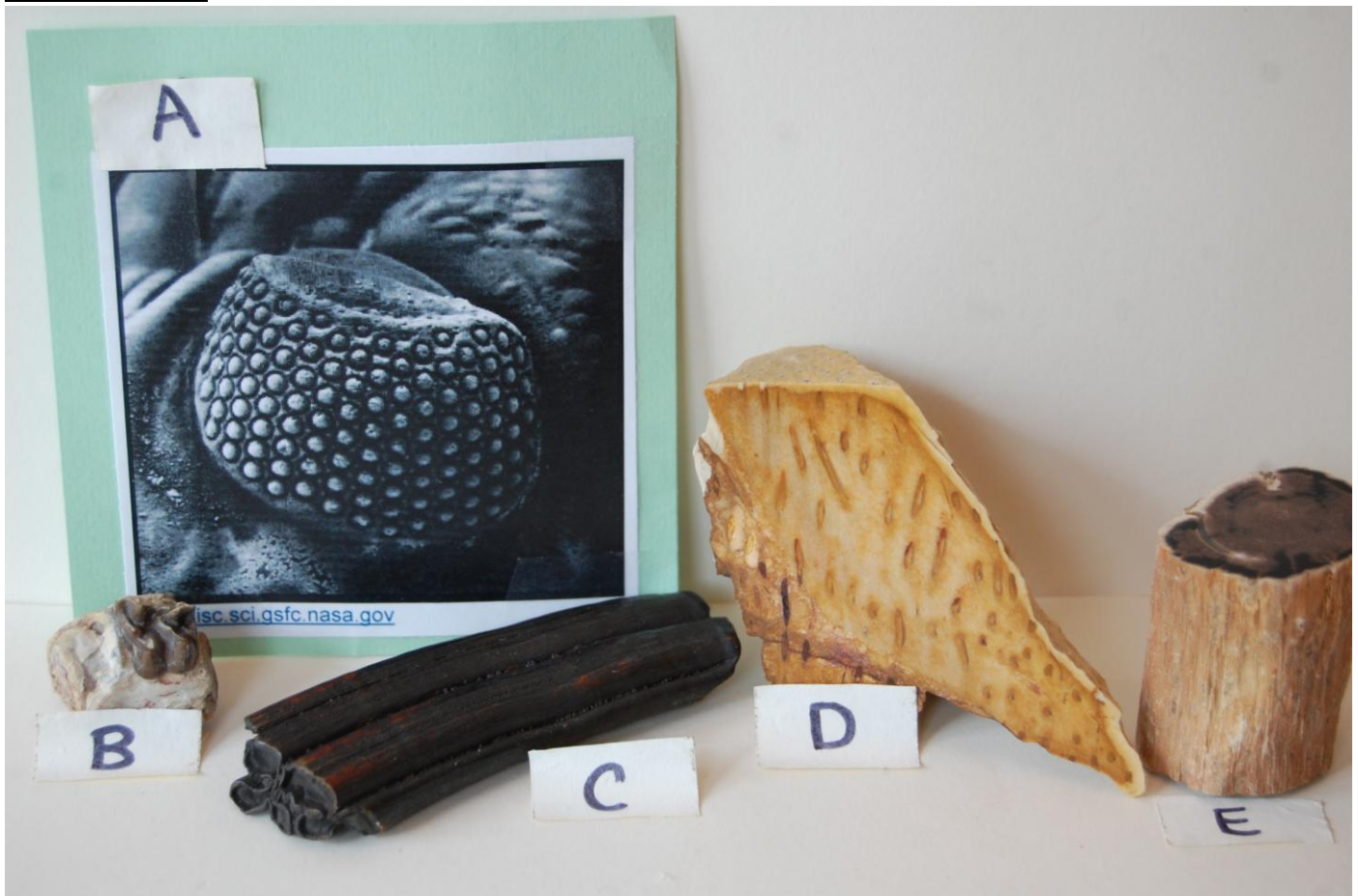
Most living members of this Specimen's superclass are spiders.

Was a major marine predator during the Cambrian period.

Is the state fossil of New Jersey.

Largest of the known members of its Phylum.

STATION 14



112. Which geologic period ended with the largest mass extinction?
113. What is believed to have caused the great extinction at the end of the Ordovician Period?
- A) global warming; rise of sea levels
 - B) glaciation; lowering of sea levels due to glaciation
 - C) volcanic activity, resulting in global warming
 - D) solar flares and meteoroid showers
114. Which extinction led to the "Age of Mammals"?
115. What two things are believed to have been the most likely possible causes of the answer to question 114?
116. The photo labeled Specimen A is a close-up image of the eye of a *Phacops* trilobite. How did the eyes of *Phacops* differ from those of most trilobites?
- A) The eyes had triple lenses, similar to trifocal lenses used in eyeglasses today, and the eyes were located at the forward edge of the head shield.
 - B) The lenses of the eyes were composed of aragonite which allowed greater depth perception.
 - C) The lenses of the eyes were rounded, doublet lenses composed of calcite crystals, with separate cornea for each lens.
 - D) The lenses were hexagonal in shape, composed of clear silica (quartz), and the eyes themselves were located above the glabella.

117. Specimens B and C are from which Class of animals?

118. What is the reason for the adaptations in the teeth that occurred between the time of the "Dawn Horse" and the time of Specimen C?

- A) The teeth adaptations were caused by changes in feeding patterns due to early humans' efforts to domesticate the animals through supplemental feeding.
- B) A shifting of tectonic plates during the previous mass extinction event led to major habitat changes for the animals, resulting in a new diet of soft, forest vegetation.
- C) The animals' diet changed because of competition from Pleistocene mega-fauna encroaching into the open meadows where they lived, resulting in evolution of the tooth form.
- D) Teeth evolved as the animals' food source changed from soft vegetation/fruits to drier plant material due to changes in habitat from tropical forests to semi-arid grasslands.

**119. Between the Eocene and the Pleistocene Periods, how did the feet and legs of the animals represented by Specimens B and C change?

- A) the number of toes increased and the length of legs decreased
- B) the number of toes did not change, but leg length increased
- C) the number of toes decreased and the leg length increased
- D) the number of toes increased and the leg length increased

120. Why did these changes in the feet and legs occur?

- A) Greater speed was needed for the animals to survive in new habitat of wide open grasslands.
- B) The domestication efforts of early humans to use the animals for riding led to the changes.
- C) Changes occurred because the animals' habitat changed from open meadows to forested hills.
- D) Competition for food decreased as Ice Age glaciers retreated, reducing need for fast motion.

121. Specimens D and E are examples of:

- A) permineralized pieces of unidentified mammal bones
- B) two types of petrified wood
- C) a portion of a brain cast and a tusk section from *Lystrosaurus*
- D) insect gallery and portion of fossilized bee hive

122. Which Specimen, D or E, is an example of a dicot?

123. Which Specimen, D or E, is an example of a monocot?

124. Which Specimen, D or E, had parallel leaf venation?

125. To which Kingdom do specimens D and E belong?

What was one of the adaptations needed by members of this Kingdom to move from aquatic to terrestrial environments?

- A) photosynthesis
- B) vascular system to transport water, minerals and sugars (food)
- C) reproductive spores for transport by insects
- D) diversification of multi-cellular rhizomes