NCSO Institute
Coaches Clinic 2019

FOSSILS

Information for Coaches and Contestants

NORTH CAROLINA
SCIENCE OLYMPIAD

Overview: Main ideas

- Fossil identification and classification
  - group morphology, adaptations
- Prehistoric life
  - ecologic relationships, behaviors → trace fossils
  - habitat, environmental adaptations
- Geologic processes
  - fossil formation (conditions, processes), lagerstätten
  - sedimentary rocks, mineral/organic tissue composition
- Dating and the Geologic Time Scale
  - index fossils and correlation vs. radiometric dating
- Important discoveries and evolutionary events/transitions
  - e.g. discovery of transitional species such as *Tiktaalik, Archaeopteryx*
  - major events such as Cambrian explosion, evolution of tetrapods, Permian extinction

Overview: Format

- Emphasis on task-oriented activities
- Rotating through stations (e.g. 20 stations, 2 minutes each)
- Binder (≤ 2 inches this year) and Official Fossil List
  - Can’t usually remove materials from binder during competition
- Magnifying glass
- No guidebook

The Fossil List

- List with ~100 groups (will only need to identify groups on the list, but other groups may be used to illustrate key concepts)
- Team members can divide up the fossil groups for depth
- Changes this year
  - a few new genera (mostly dinosaurs, hominids)
  - some groups marked for states/nationals only
  - emphasis on intermediate levels of classification
    - e.g. corals and dinosaurs
    - form taxa for plants

Order Tabulata (tabulate corals)
Genus *Favosites*
Genus *Halysites**
Order Rugosa (rugose corals)
Genus *Heliophyllum* (horn coral)
Genus *Hexagonaria*
Order Scleratinia (stony corals)
Genus *Septastrea*

The Binder: For learning

- Converting research into a useful binder is about selectively rather than comprehensiveness
- Get to know a lot of the background, and as you keep learning more, think about what is more significant to time periods as a whole, comparisons between groups, geological and evolutionary processes, etc
- Overall understanding typically helps more than specific details
- For identification, students should try to become familiar with several images or specimens of each group in advance

The Binder: For reference

- Fossil List (can be separate from binder)
- ID images (multiple forms)
- Geologic Time Scale
- Concise taxa information (environment, time range, significance, etc.)
  - organized by classification (in order of list)
  - trace fossils, stromatolites, petrified wood, etc.
- Graphics and info about environments, modes of life
- Lists of fossilization modes, Lagerstätten, etc.
- Glossary of important terms

Sample Questions/Tasks

- Identify each fossil, record its mode of preservation, the type of rock the sample is embedded in, and the geologic period it represents.
- List samples in order from oldest to most recent.
- Based on the fossil and rock associations, determine the environment in which the organism lived.
- The fossils illustrated were discovered in the Solnhofen Limestone, a unique Lagerstätten in Germany. What geological period is indicated based on the specimens in this limestone?
- How can the occurrence of both marine and terrestrial animals in the Solnhofen Limestone be explained?
- Describe the evolutionary relationships between the organisms illustrated on the family tree (cladogram/phylogenetic tree).
- Construct a range chart and determine the age of the fossil assemblage.

Example 1

Identify the corals:

_____ *Favosites*

_____ *Halysites*

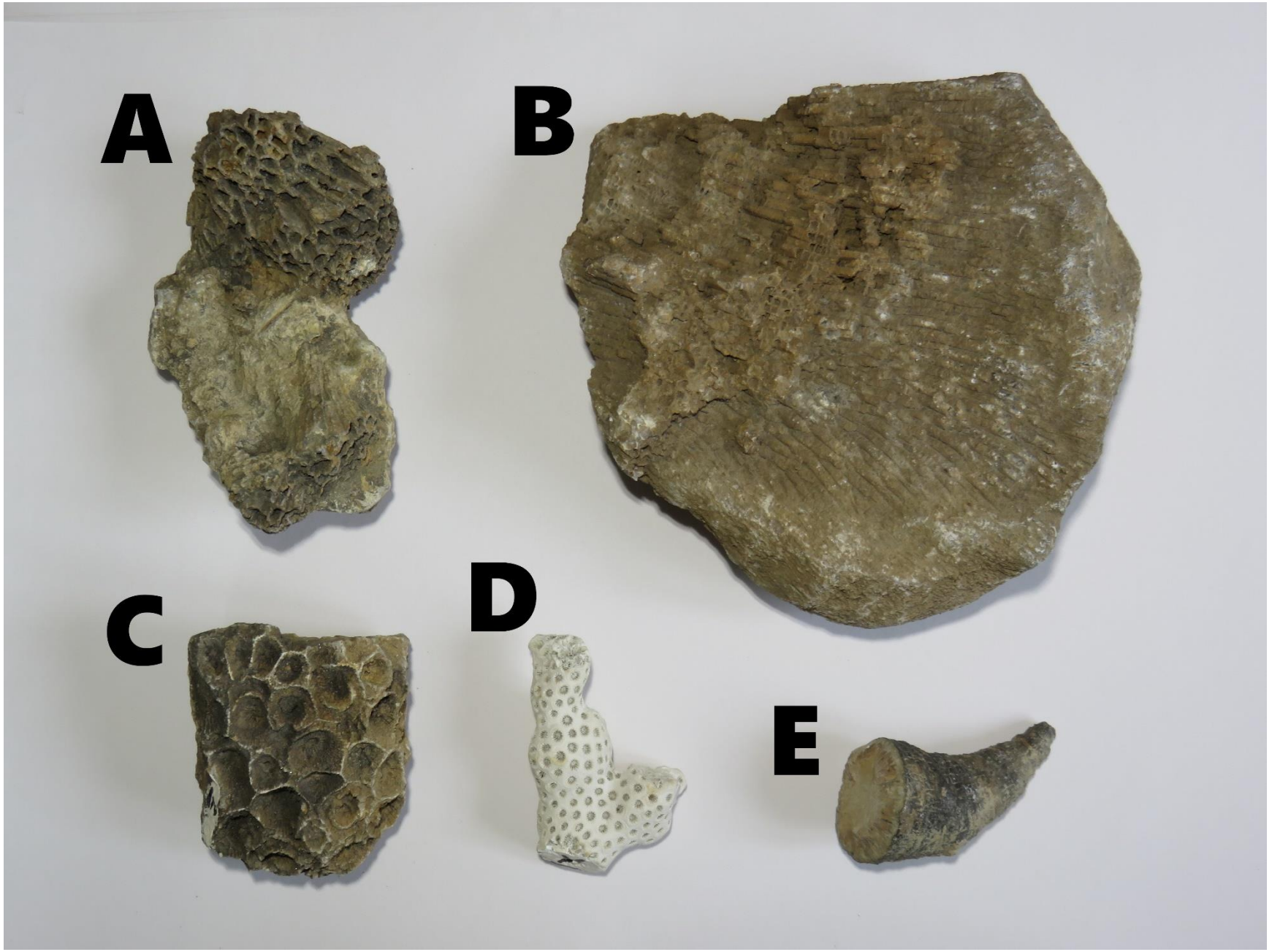
_____ *Heliophyllum*

_____ *Hexagonaria*

_____ *Septastrea*

Which of these existed in the Paleozoic?

Which of these were colonial?



Example 2

Many fossil remains are fragmentary. Match each fragment with its identity:

_____ Cetacean rib

_____ Cetacean limb element

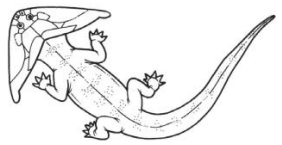
_____ Dinosaur rib

_____ Turtle shell

_____ Crocodilian skull

Example 3

Match each of the animals pictured here with its most likely trace fossil:



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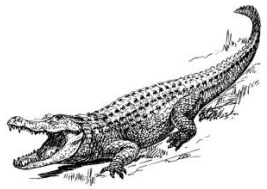

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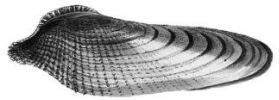

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Example 4

Use the NC Geological Survey map found at this Station to decide if each of the following is true or false.

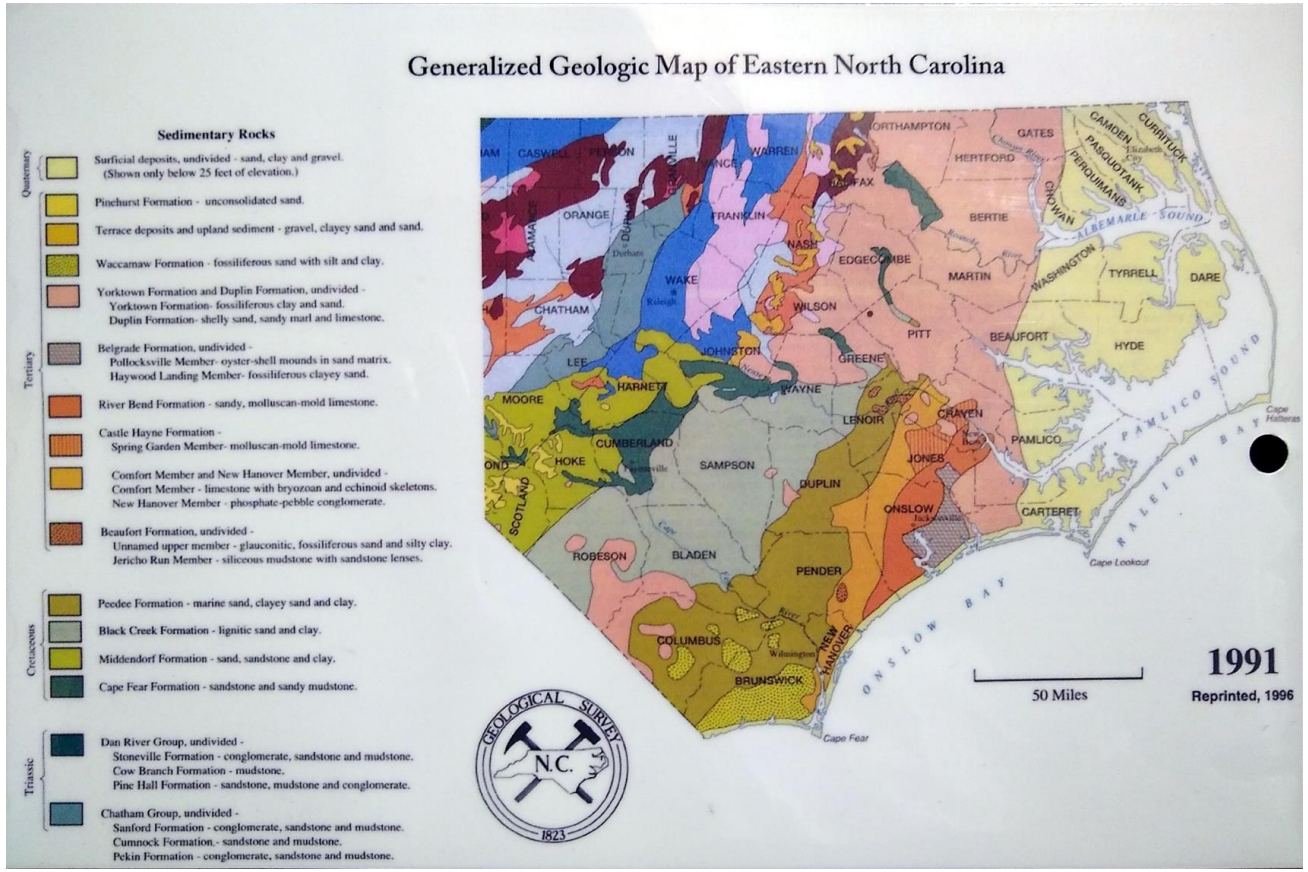
_____ If you travel east from Fayetteville to Beaufort, the rock strata dip toward the east

_____ There are no fossil deposits in Chatham and Lee Counties

_____ The rocks exposed in Bladen County are the right age to contain dinosaur remains

_____ Trilobites have been found in Edgecombe County fossil deposits

_____ *Plesiosaurus* teeth are occasionally found in eastern North Carolina fossil deposits



Example 5

Many famous fossils are identified with a particular location. Associate each location listed here with the most appropriate specimen in the photograph.

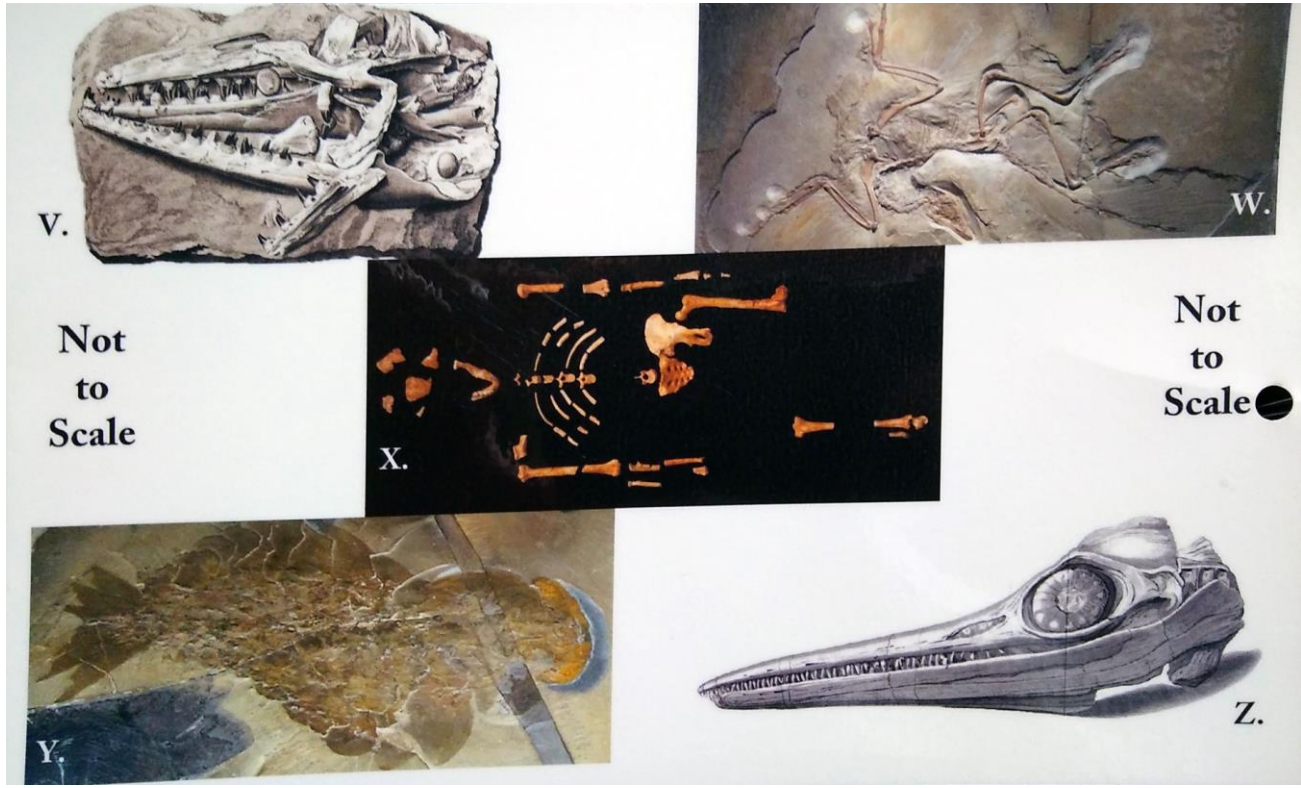
_____ Burgess Shale, Canada

_____ Hadar, Ethiopia

_____ Lyme Regis, England

_____ Maastricht, Netherlands

_____ Solnhofen, Germany



Example 6

Identify the various trilobite parts:

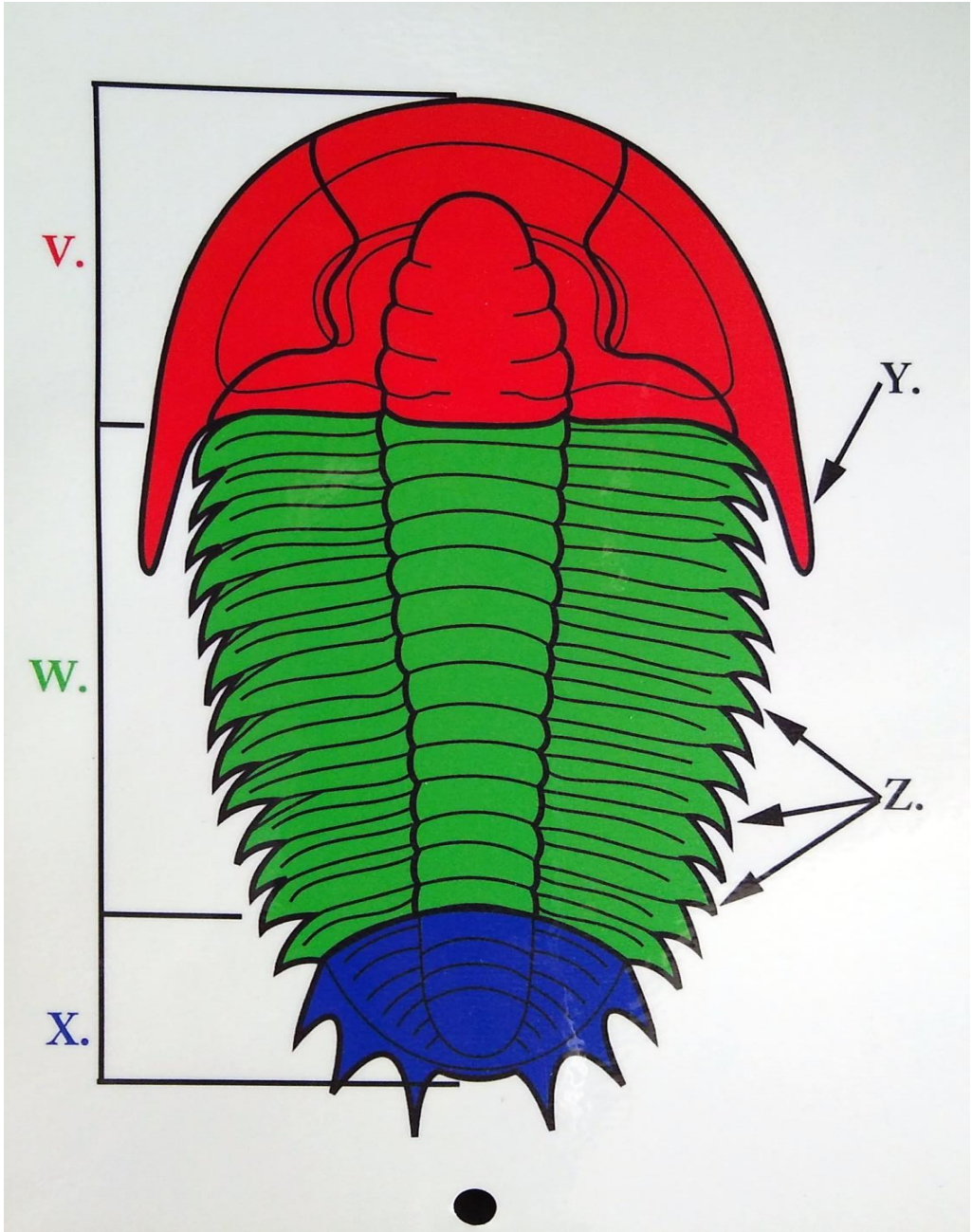
_____ Thorax

_____ Pleural spine

_____ Pygidium

_____ Cephalon

_____ Genal spine



Resources

- Wikipedia/Google
- Fossil Guides
  - DK Smithsonian Handbook
  - Simon and Schuster
  - Audubon, Golden Guide
- scioly.org Student Center
  - wiki, forum, test exchange
- Local Resources (can be great for seeing specimens in-person)
  - Local colleges and universities
  - NC Museum of Natural Sciences
  - Local Geology/Fossil clubs
- Geologic History Lab Manuals
  - Pamela Gore, Historical Geology Lab Manual
  - Levin & Smith, Laboratory Studies in Earth History

Resources: Recommended websites

- UC-Berkeley Museum of Paleontology
  - ucmp.berkeley.edu/education-outreach/k-12-resources/
  - paleoportal.org
  - ucmp.berkeley.edu/exhibits/historyoflife.php
  - ucmp.berkeley.edu/help/timeform.php
- Smithsonian
  - naturalhistory.si.edu
- Historical geology textbook
  - higheredbcs.wiley.com/legacy/college/levin/0471697435/chap_tut/chaps/index.html
- Virtual Petrified Wood Museum
  - petrifiedwoodmuseum.org/SciOly.htm
- Fossils of Kentucky
  - www.uky.edu/KGS/fossils/
- Paleobiology Database
  - PalebioDB.org