1. **DESCRIPTION:** Teams use fossils to date and correlate rock units as well as demonstrate their knowledge of ancient life by completing tasks related to fossil identification and classification.

   **A TEAM OF UP TO:** 2  
   **APPROXIMATE TIME:** 50 minutes

2. **EVENT PARAMETERS:**
   a. Each team may bring one magnifying glass, the Science Olympiad Official Fossil List and one standard 3-inch or smaller, 3-ring binder containing information in any form and from any source attached using the available rings.
   b. If the event features a rotation through a series of laboratory stations where the participants interact with samples, specimens, or displays; no material may be removed from the binder.

3. **THE COMPETITION:**
   a. Participants will move from station to station, with the length of time at each station predetermined and announced by the event supervisor.
   b. Participants may not return to stations but may continue to work on their responses throughout.
   c. Emphasis will be placed upon task-oriented activities at each station.
   d. Identification will be limited to specimens on the Science Olympiad Official Fossil List, but other samples may be used to illustrate key concepts. Questions will be chosen from the following topics:
      i. Identification of all fossil specimens on the Science Olympiad Official Fossil List
      ii. Taxonomic classification restricted to the hierarchy on the Science Olympiad Official Fossil List
      iii. Conditions required for a plant or an animal to become fossilized
      iv. Common modes of preservation: petrification/petrifaction (e.g., permineralization & mineral replacement including silicification and pyritization), cast/mold, imprints, carbonization, unaltered remains
      v. Uncommon modes of preservation: encasement in amber, mummification, freezing
      vi. Relative dating: law of superposition, original horizontality, cross cutting relationships, unconformities
      vii. Absolute dating: radiometric dating, half-life, carbon dating, volcanic ash layers
      viii. The Geologic Time Scale, its organization, major events, the 5 major mass extinctions, and the Pleistocene-Holocene extinction of megafauna. An official Science Olympiad Geologic Time Scale is posted at soinc.org & should be used for all competitions.
      ix. Index Fossils: characteristics and use in determining the age of rocks & geologic formations
      x. Fossil bearing sedimentary rocks: limestone, shale, sandstone, mudstone, coquina
      xi. Modes of life: filter feeder, predator, scavenger, deposit feeder, benthic, pelagic
      xii. Environments: shallow marine, deep marine, terrestrial, fresh water
      xiii. Mineral and organic components of exoskeletons, shells, and bones/teeth (e.g., calcite, aragonite, silica, chitin, biological apatite)
      xiv. Adaptations and morphologic features of major fossil groups
      xv. Important paleontological discoveries (i.e., non-avian dinosaurs with feathers; transitional species such as Tiktaalik and Archaeopteryx)
      xvi. Lagerstätten (conservation and concentration) and their significance, limited to: Burgess Shale, Beecher’s Trilobite Bed, Mazon Creek, Ghost Ranch, Solnhofen Limestone, Yixian Formation (Liaoqing), Green River Formation, and LaBrea Tar Pits
      xvii. Fossils as evidence for evolutionary trends and patterns such as morphologic adaptations within groups and major evolutionary events (i.e., Cambrian explosion, fish to tetrapods, dinosaurs to birds, whales, horses)

4. **SAMPLE QUESTIONS/TASKS:**
   a. Identify each fossil, record its mode of preservation, the type of rock the sample is embedded in, and the geologic period it represents.
   b. List samples in order from oldest to most recent.
   c. Based on the fossil and rock associations, determine the environment in which the organism lived.
   d. Construct a range chart and determine the age of the fossil assemblage.

5. **SCORING:**
   a. High score wins. Points will be awarded for the quality and accuracy of responses.
   b. Ties will be broken by the accuracy and/or quality of responses to several pre-identified questions.

**Recommended Resources:** The Science Olympiad Store (store.soinc.org) carries the Fossil and the Bio/Earth Science CDs; other resources are on the event page at soinc.org.

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KINGDOM PROTOZOA
Phylum Foraminifera (Forams)
1) Order Fusulinida (Fusulinids)
2) Genus Nummulites

KINGDOM ANIMALIA
INVERTEBRATES:
Phylum Porifera (Sponges)
3) Genus Astraeospongia (calcareous sponge)
4) Genus Hydnoceras (glass sponge)
Phylum Bryozoa
5) Genus Archimedes
6) Genus Rhombopora
Phylum Hemichordata
7) Class Graptolithina (Graptolites)
Phylum Cnidaria
Class Anthozoa (Horn & Colonial Corals)
8) Genus Favosites
9) Genus Halysites
10) Genus Heliohyphum
11) Genus Hexagonaria
12) Genus Septastraea
Phylum Arthropoda
13) Subphylum Crustacea (shrimp, lobster, crabs, barnacles, ostracods)
14) Order Eurypterida (Eurypterids)
15) Class Insecta (Insects)
Class Trilobita (Trilobites)
16) Genus Cryptolithus
17) Genus Calymene
18) Genus Elrathia
19) Genus Isotelus
20) Genus Eldredgeops (formerly Phacops)
Phylum Brachiopoda
Class Inarticulata:
21) Genus Lingula
Class Articulata:
22) Genus Atrypa
23) Genus Composita
24) Genus Juresania
25) Genus Leptaena
26) Genus Mucrospirifer
27) Genus Platystrophia
28) Genus Rafinesquina
29) Order Rhychnonellida
30) Genus Exogyra
31) Genus Gryphaea
32) Genus Pecten
33) Genus Glycymeris
34) Subclass Ammonoidea (Ammonoids)

Phylum Mollusca
Class Bivalvia (clams, oysters, mussels)
30) Genus Exogyra
31) Genus Gryphaea
32) Genus Pecten
33) Genus Glycymeris
34) Genus Baculites
35) Genus Dactylioceras
36) Genus Nautiloceras
37) Genus Belemnitella
38) Genus Nautilus
39) Genus Orthoceras
Class Gastropoda (Snails)
40) Genus Conus
41) Genus Cypraecassis
42) Genus Platyserus
43) Genus Trituritella
44) Genus Wortheni
Class Cephalopoda
45) Class Asteroidea (Starfish)
46) Genus Pentremites
47) Class Crinoidea (stems, columns, calyxes)
48) Class Echinoidea (regular or irregular echinoids including sea urchins, sand dollars and heart urchins)
49) Class Ophiuroidea (brittle stars)

VERTEBRATES:
Phylum Chordata
Subphylum Vertebrata
Class Placodermi (Armored Jawed Fish)
50) Genus Bothriolepis
51) Genus Dunkleosteus
Class Chondrichthyes (Cartilaginous Fish)
52) Superorder Selachimorpha (Sharks)
53) Genus Carcharodon
54) Genus Carcharodes
55) Species C. megalodon
56) Superorder Batoidea (Rays)

Note: Numbers indicate that members of that taxon rank should be identifiable to that level. For ranks not underlined, indented ranks are in the rank above it.
Superclass Osteichthyes (Bony Fish)
57) Class Actinopterygii (ray-finned)
   Class Sarcopterygii (lobe-finned)
58) Order Coelacanthiformes (Coelacanth)
59) Genus Tiktaalik

Class Amphibia (Amphibians)
60) Genus Acanthostega
61) Genus Eryops
62) Genus Diplocaulus

Class Reptilia (Reptiles)
63) Order Ichthyosauria (Ichthyosaurs)
64) Family Mosasauridae (Mosasaurs)
65) Order Plesiosauria (Plesiosaurs & Pliosaurs)
66) Order Pterosauria (Pterosaurs)

Clade Dinosauria (Dinosaurs)
Order Saurischia (lizard-hipped)
67) Genus Allosaurus
68) Genus Diplodocus
69) Genus Coelophysis
70) Genus Dilophosaurus
71) Genus Plateosaurus
72) Genus Velociraptor
73) Genus Tyrannosaurus

Order Ornithischia (bird-hipped)
74) Genus Iguanodon
75) Genus Parasaurolophus
76) Genus Stegosaurus
77) Genus Triceratops
78) Genus Ankylosaurus
79) Genus Dracorex

Class Aves (Birds)
80) Genus Archaeopteryx
81) Genus Titanis (Terror Bird)

Clade Synapsida

Mammal-like reptiles
82) Genus Dimetrodon (polyosaurs)
83) Genus Lystrosaurus (therapsids)

Class Mammalia (Mammals)
84) Genus Basilosaurus (prehistoric whale)
85) Genus Equus (modern horse)
   Genus Homo (human)
86) Species H. neanderthalensis

87) Genus Mammut (Mastodon)
88) Genus Mammutus (Mammoth)
89) Genus Megacerops (Brontotheres)
90) Genus Mesohippus (three-toed horse)
91) Genus Smilodon (saber-toothed cat)

KINGDOM PLANTAE
Phylum Anthophyta (Flowering plants)
92) Genus Acer
93) Genus Populus
94) Genus Platanus

Phylum Ginkgophyta (Ginkgos)
95) Genus Ginkgo

Phylum Lycopodiophyta (Club Mosses)
96) Genus Lepidodendron (scale tree)

Phylum Pinophyta (Conifers)
97) Genus Metasequoia

Phylum Pteridospermatophyta (Seed Ferns)
98) Phylum Pterodendron (Horsetails)
99) Genus Calamites
100) Genus Annularia

Phylum Pteridophyta (True Ferns)
101) Genus Pecopteris

OTHER
Trace Fossils:
   Trails, Tracks, Trackways,
   Boring, Burrows, Tubes
   Predation marks, Repair scars
   Coprolites

Stromatolites
Amber/copal
Petrified wood

Sedimentary Rocks
   Coquina
   Limestone (Chalk/Fossil limestone)
   Sandstone
   Shale
   Mudstone/Siltstone

Note: Numbers indicate that members of that taxon rank should be identifiable to that level. For ranks not underlined, indented ranks are in the rank above it.