



# DYNAMIC PLANET

See General Rules, Eye Protection & other Policies on [www.soinc.org](http://www.soinc.org) as they apply to every event.

1. **DESCRIPTION:** Students will demonstrate an understanding of the large-scale processes affecting the structure of Earth's crust.

**A TEAM OF UP TO:** 2

**APPROXIMATE TIME:** 50 minute

2. **EVENT PARAMETERS:** Each team may bring four 8.5" x 11" sheets of paper that may contain information on both sides in any form from any source. Each **participant** may also bring a "non-graphing" calculator.

3. **THE COMPETITION:** Participants will be presented with one or more tasks presented as an exam and/or timed stations. An emphasis will be placed on the NGSS Science and Engineering Practices shown on [soinc.org](http://soinc.org). Topics will include the following:
  - a. History of the theory of plate tectonics, including key scientists.
  - b. Identification of Earth's layers - crust, lithosphere, mantle, asthenosphere.
  - c. Types of plates, boundaries and margins - with specific examples. Identification of tectonic boundaries from paleogeographic reconstructions.
  - d. Types of tectonic basins, processes that form them, and the nature of the sedimentary record for each (rift basin, back arc basin, foreland basin, intermontane basin).
  - e. Driving forces of plate tectonics - mantle convection, mantle plumes, subduction.
  - f. Plate movement and impacts of plate movement - Wilson Cycle, terranes, orogenic belts, past supercontinents, convergence, divergence, transform motion, associated faults, opening and closing of ocean gateways and landbridges (with impacts on biota).
  - g. Aulacogens and hot spots.
  - h. Isostatic adjustments - plate thickness, and the impact of mass wasting and glaciation. Hypsometry and the elevation/depth of continental and oceanic crust.
  - i. Natural hazards due to plate tectonics - earthquakes, volcanoes, tsunamis and landslides.
  - j. Magma formation - geological settings, chemistry, and properties.
  - k. Geologic history of North America: Evolution of the North American craton, Rocky Mountains, Appalachian Mountains and Yellowstone Hot Spot.
  - l. Interpretation of geophysical data to understand plate tectonics including brittle and ductile deformation in rocks, magnetic anomalies, gravity anomalies, stress, and seismicity.
  - m. Engineering and societal practices to mitigate hazards and protect human life in tectonically active areas.

4. **REPRESENTATIVE TASKS:**

- a. Given a map of selected islands and seamounts of the Hawaiian chain accompanied by the approximate age and distance from the Island of Hawaii for each, participants may be asked to plot the movement of the Pacific Plate on a graph and respond to interpretative questions, including calculations, related to that graph.
- b. Using a paleogeographic reconstruction of the late Cretaceous identify the location of major plate boundaries represented (<http://cpgeosystems.com/paleomaps.html>).
- c. Given a rate of erosion of rock, estimate the actual movement of the mountaintops over time due to isostatic rebound.
- d. Deconstruct geological event histories from block diagrams.

5. **SCORING:** Points will be awarded for the quality and accuracy of responses. Ties will be broken by the accuracy and/or quality of answers to pre-selected questions.

**Recommended Resources:** All reference and training resources including the **Dynamic Planet CD (DPCD)** and the **Bio/Earth CD (BECD)** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>.