

Paper Task: Fossil Record

Background

In this task, students examine evidence from rock layers and radiometric data to determine the relative age and complexity of fossils. Next, they consider disturbances of rock layers and make a claim about the evidence provided by rock strata. Paper tasks allow more flexibility for teachers to assess in other ways, while still minimizing the language load for students.

In preparation for this task, students should have an understanding of the *Next Generation Science Standards* (disciplinary core ideas, science and engineering practices, and crosscutting concepts) as outlined in the tables below.

Disciplinary Core Ideas (DCI)
ESS1.C: The History of Planet Earth Analyses of rock strata and the fossil record provide relative dates for the sequence of geological events. In an undisturbed rock column, the youngest rocks are at the top and the oldest are at the bottom.
Science and Engineering Practices (SEP)
Modeling - Develop a model to describe phenomena. Engaging in Argument - Construct a written argument based on empirical evidence.
Crosscutting Concepts (CCC)
Patterns Graphs, charts, and images can be used to identify patterns in data.

Learning Progressions

The tasks were designed based on current understanding of learning progression research in science education (National Research Council, 2012). Learning progressions describe how students develop successively more sophisticated ways of reasoning about science content as they obtain more experience with phenomena/representations, and improve their cognitive abilities (Smith, Wiser, Anderson, & Krajcik, 2006).

The Framework for K-12 Science Education (National Research Council, 2012) addresses the progression of Disciplinary Core Ideas (DCIs) throughout the sciences. The focus for Fossil Record is growth and reproduction in organisms, heredity, natural selection and adaptation. This task incorporates concepts from molecular biology, evolution and reproduction. The following are the "Grade Level End Points" identified within the *Framework* (2012). These endpoints are included here because they summarize the learning progressions intended by the standards prior to middle school and by the end of middle school.

ESS1.C: The History of Planet Earth

By the end of grade 5. Earth has changed over time. Understanding how landforms develop, are weathered (broken down into smaller pieces), and erode (get transported elsewhere) can help infer the history of the current landscape. Local, regional, and global patterns of rock formations reveal changes over time due to Earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. Patterns of tree rings and ice cores from glaciers can help reconstruct Earth's recent climate history.

By the end of grade 8. The geological time scale interpreted from rock strata provides a way to organize Earth's history. Major historical events include the formation of mountain chains and ocean basins, the evolution and extinction of particular living organisms, volcanic eruptions, periods of massive glaciation, and development of watersheds and rivers through glaciation and water erosion. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale.

(National Research Council, 2012, page 178)