TecRocks

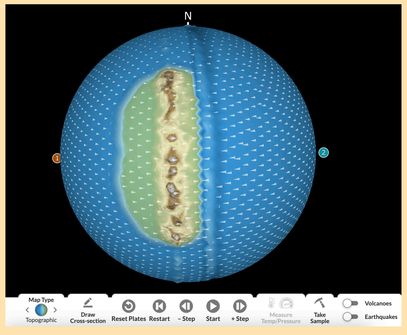
Connecting Plate Tectonics with Rock Genesis & Formation

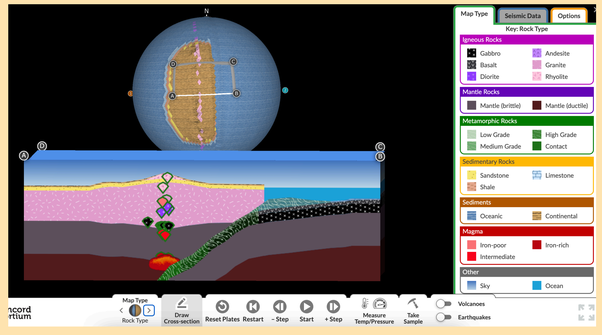
Overview

The primary goal of the Geological Construction of Rock Arrangements from Tectonics project (called TecRocks for short) is to leverage current technology's capacity to develop an Earth system simulation and curriculum modules to transform how land formation, rock genesis, and the rock cycle are traditionally taught. This project has focused on what teaching and learning might look like if Earth science education around plate tectonics and rock formation—which are typically taught independently—are instead integrated and part of one system.

OBJECTIVES

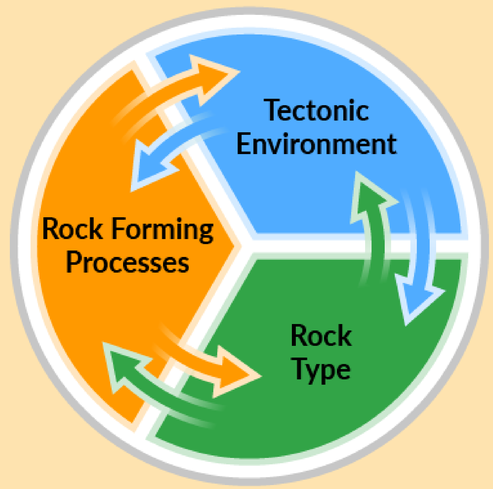
- Create a dynamic simulation embedding rock genesis within the plate tectonics system (see figures of TecRocks Explorer below).
- Develop a simulation-based curriculum module.
- Conduct research on the design, development, and enactment of the curriculum and the simulation.





DEVELOPING TECROCKS REASONING

The TecRocks Reasoning Framework (below) captures the complex reasoning that integrates tectonic processes and rock-forming processes. Through our model and scaffolded curriculum module, **we use this framing to facilitate students' ability to reason about the interconnected processes related to tectonic environment, rock-forming processes, and rock type.**



Tectonic Environment: Tectonic environments include locations where plates move away from each other, move towards each other, or slide past each other.

Rock-forming Processes: Rock-forming processes describe the conditions and processes through which Earth's materials form and transform rocks.

Rock Type: The rock types include igneous, metamorphic, and sedimentary rocks and a limited suite of rocks within each rock type category, describing a story that offers evidence about the dynamic and changing environments in which they formed.

CLASSROOM TRIALS

The TecRocks project developed pre- and post-assessments and a five-activity curriculum. With these materials, the project conducted two field tests in the past year, one in fall 2022 and the other in spring 2023. Feedback from the first field test, with 8 teachers in 3 states and 635 students, informed the revisions to the module. The spring 2023 field test included 14 teachers in 12 states and 779 students.

"I usually don't teach about the locations of the different rock types, and now I think this is very important to connect the genesis of rock types with plate movement. I will most definitely teach plate tectonics and the rock cycle in a connected fashion as this module does."

— Field test teacher

CURIOSITY SURVEY

We developed an instrument to explore students' epistemic curiosity relating to both the general world around them and rock formation in particular. The survey was divided into four parts: 1) General curiosity in objects and events near students (GN); 2) General curiosity in objects and events far away from students (GF); 3) Specific curiosity in rocks, rock formation, land formation, and Earth processes near students (RN); 4) Specific curiosity in rocks, rock formation, land formation, and Earth processes far away from students (RF). We scored students' responses from 1 (strongly disagree) to 5 (strongly agree).

CURIOSITY RESULTS TABLE

Category	Pre-test Mean	Post-test Mean
General Near (GN)	3.71	Not asked
General Far (GF)	3.86	Not asked
Rocks Near (RN)	3.15	3.40
Rocks Far (RF)	3.27	3.42

Mean scores for each of the four types of epistemic curiosity questions. For the pre-test, n=673, for the post-test, n=562. There was significant increase in students' epistemic curiosity on the RN and RF scales after using the module ($p<.001$).

FUTURE WORK

The project will analyze student work from the spring 2023 field test. We will explore 1) how well the TecRocks Reasoning Framework captures student reasoning, 2) how students' epistemic curiosity influences or is influenced by their learning, and 3) how students interact with TecRocks Explorer in explaining rock formation fueled by tectonic movements.

The Concord Consortium

PennState

This material is based upon work supported by the National Science Foundation under Grant No. DRL-2006144. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

concord.org/tecrocks

Amy Pallant (Principal Investigator)
apallant@concord.org

Christopher Lore (Research Assistant)
clore@concord.org