

# Integrating Web GIS in Earth Science Curriculum to Investigate Tectonics

Alec Bodzin, Lori Cirucci, David Anastasio, Dork Sahagian, Denise Bressler, Jill Burrows, and Scott Rutzmoser

*Environmental Literacy and Inquiry*  
<http://www.ei.lehigh.edu/eli>



DR K-12 Award 1118677



## Project Features

- Tectonics investigations for curriculum enhancement
- Javascript Web GIS to be platform independent (i.e. tablets, laptops, cellphones)
- Interface design and customized data display
- Visualizations and tool features designed to enable spatial thinking
- Content and pedagogical supports for teachers to implement geospatial learning investigations

NGSS Disciplinary Core Ideas (Achieve, Inc., 2013) MS-ESS2 Earth's Systems; MS-ESS3 Earth and Human Activity	K-12 Framework Core Ideas (NRC, 2011)
<ul style="list-style-type: none"> <li>• Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.</li> <li>• Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.</li> <li>• Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.</li> <li>• Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.</li> </ul> <p>Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.</p> <ul style="list-style-type: none"> <li>• Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.</li> </ul>	<p><b>ESS1.C: The History of Planet Earth</b>  <b>ESS2.A: Earth's Materials and Systems</b>  <b>ESS2.B: Plate Tectonics and Large-Scale System Interactions</b>  <b>ESS3.A: Natural Resources</b>  <b>ESS3.B: Natural Hazards</b>  <b>ESS3.C: Human Impacts on Earth Systems</b>  <b>ESS3.D: Global Climate Change</b></p>

## Research-based Curriculum

- Pilot testing and field testing in an urban school district (2 schools, 4 teachers, 12 classrooms)
- Tectonics content knowledge measures
- Spatial thinking and reasoning measures
- Teacher implementation practice to assess fidelity of implementation and curriculum enactment—adherence to geospatial learning design model
- Classroom observations
- Post-implementation survey to assess pedagogical effectiveness of the educative curriculum materials

---

---

---

---

---


---

---

---

**eli** Environmental Literacy & Inquiry

Tectonics Home  
Overview  
Instructional Framework  
Instructional Sequence  
Student Resources  
Assessments  
Instructional Resources  
Support Materials

**Tectonics Home**


**Tectonics** is a series of geospatial investigations designed to augment existing middle school Earth science curriculum. Students use Web GIS to investigate important tectonics concepts. The investigations include scientific practices, crosscutting concepts, and core ideas from the National Research Council (2012) *Framework for K-12 Science Education*.

The materials are best used with the Firefox or Google Chrome Web browser. This material is based upon work supported by the National Science Foundation (DRL-1118677).

Copyright © 2012 Environmental Literacy and Inquiry Working Group at Lehigh University • Credits and Copyright Information • Recognitions • Contact Us

<http://www.ei.lehigh.edu/eli/tectonics>

---

---

---

---

---

---

---

---

**Tectonics - Student Resources**

**Investigations**

Investigation 1: Geohazards and Me: What geologic hazards exist near me? Which plate boundary is closest to me?

Investigation 2: How do we recognize plate boundaries?

Investigation 3: How does thermal energy move around in the Earth?

Investigation 4: What happens when plates diverge?

Investigation 5: What happens when plates move sideways past each other?

Investigation 6: What happens when plates collide?

Open-ended Investigations

**Learn More**

Reference Frames

Heat Flow

Geologic Faults

Gravity Anomaly

GPS Geodesy

---

---

---

---

---

---

---

---

## Menus

**Environmental Literacy & Inquiry**

**Overview**

Environmental Literacy & Inquiry is a comprehensive, multi-disciplinary program that integrates environmental science, social science, and communication. The program is designed to provide students with the knowledge, skills, and attitudes necessary to understand and address environmental issues.

**Assessments**

The program includes a variety of assessments to evaluate student learning, including quizzes, exams, and projects. These assessments are designed to measure student understanding of environmental concepts and their ability to apply this knowledge to real-world situations.

**Environmental Literacy & Inquiry**

**Instructional Framework**

The instructional framework for the program is based on a set of core competencies that all students should achieve. These competencies include understanding environmental systems, evaluating environmental information, and taking action to address environmental issues.

**Support Materials**

The program includes a variety of support materials to help students learn, including textbooks, lecture notes, and online resources. These materials are designed to provide students with a comprehensive understanding of environmental concepts and their applications.

**Environmental Literacy & Inquiry**

**Technical - Student Resources**

This section provides students with technical resources and information about the program. It includes links to program materials, contact information for program staff, and information about program fees and scholarships.

**Environmental Literacy & Inquiry**

**Instructional Resources**

This section provides instructors with instructional resources and information about the program. It includes links to program materials, contact information for program staff, and information about program fees and scholarships.

**To access assessments:**  
**Login: eliteacher**  
**Password: 87dja92**

---

---

---

---

---

---

---

---

## Where's the nearest hazard to my location?

*from Investigation 1*

---

---

---

---

---

---

---

---

## Where's the nearest hazard to my location?

---

---

---

---

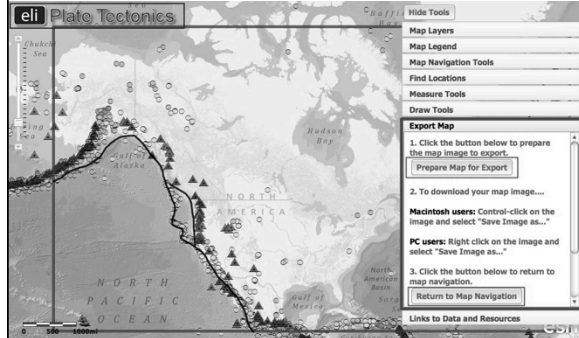
---

---

---

---

## How do we recognize plate boundaries?




---

---

---

---

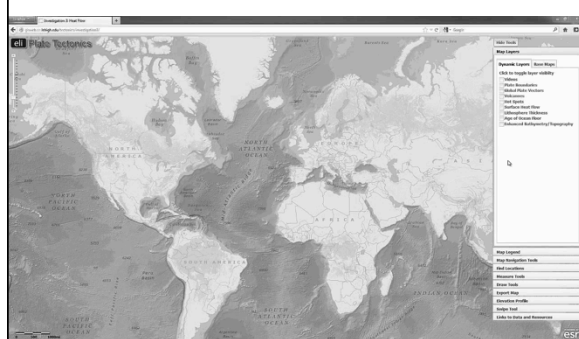
---

---

---

---

## How does thermal energy move around in the Earth?




---

---

---

---

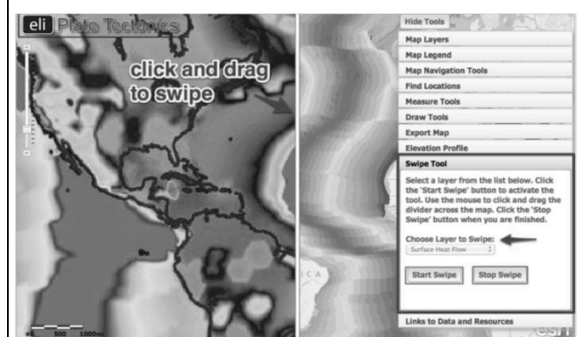
---

---

---

---

## How does thermal energy move around in the Earth?




---

---

---

---

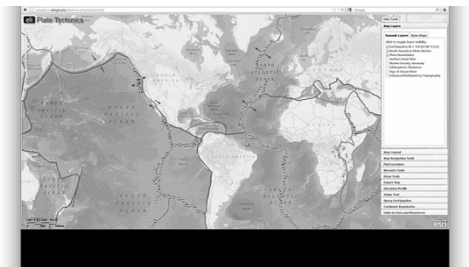
---

---

---

---

## What happens when plates diverge?




---

---

---

---

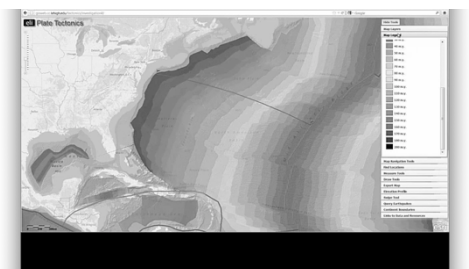
---

---

---

---

## Half Spreading Rate




---

---

---

---

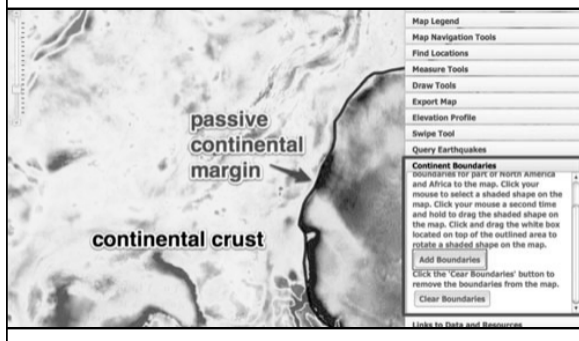
---

---

---

---

## Continental Boundaries




---

---

---

---

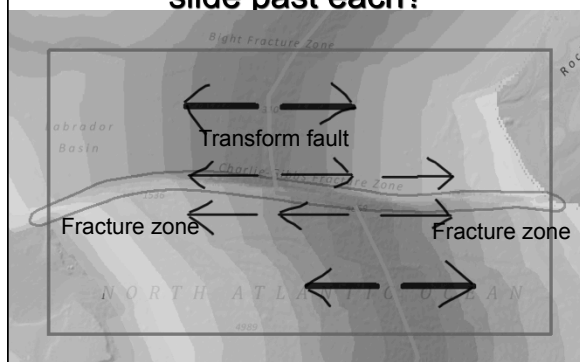
---

---

---

---

## What happens when plates slide past each?




---

---

---

---

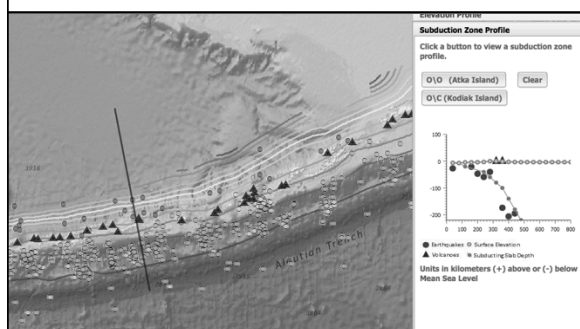
---

---

---

---

## What happened when plates converge?




---

---

---

---

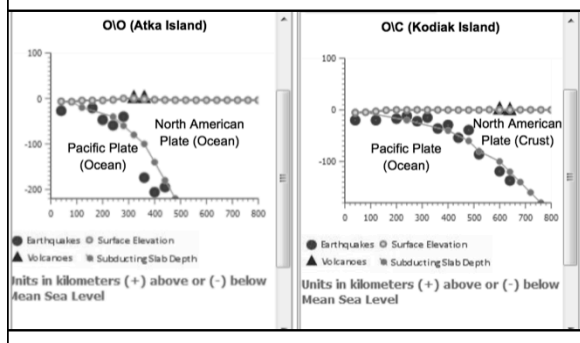
---

---

---

---

## Subduction zone profiles




---

---

---

---

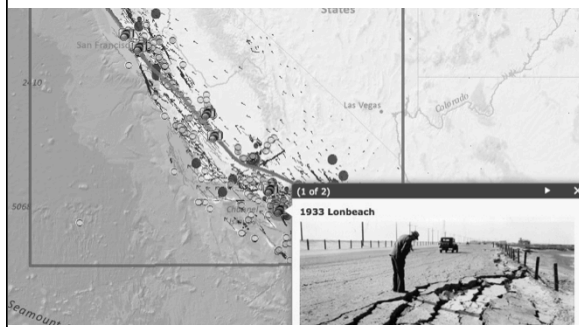
---

---

---

---

### Investigating the San Andreas Fault Zone




---

---

---

---

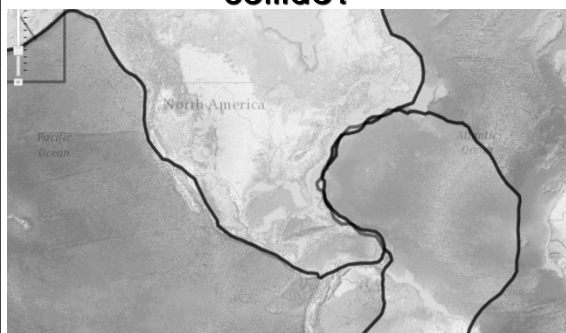
---

---

---

---

### What happens when plates collide?




---

---

---

---

---

---

---

---

### Results

- **Significant student learning gains**  
Tectonics content and geospatial thinking and reasoning skills
- **High student engagement**
- **Ease of use for urban middle school teachers and students**
- **Well developed teacher support materials**
- **High fidelity of implementation in classrooms**

---

---

---

---

---

---

---

---

**Questions or Comments?**

**<http://www.ei.lehigh.edu/eli/tectonics>**

**To access assessments:**

**Login: eliteacher**

**Password: 87dja92**

---

---

---

---

---

---

---