EARTHQUAKES AND PLATE BOUNDARIES: A MODEL EARTHINQUIRY ACTIVITY (46-54)

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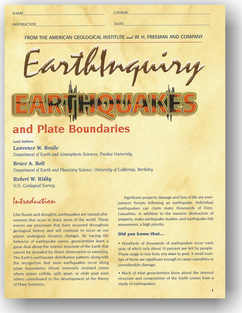
Abstract

EarthInquiry activities are being developed by the American Geological Institute, along with geoscience instructors. They are designed to help introductory college students interact with the abundant real-time and archived geoscience data available on-line. Each activity has its own workbook, printed by W.H. Freeman and Company Publishers, that contains a Web access code, allowing students entry into the EarthInquiry web site. The EarthInquiry web site, maintained by AGI, provides students with detailed instructions on how to access and interpret the data collected in each activity. The web site also supplies supplementary information, glossary terms, and, in some cases, web-based tools to assist with numerical manipulation.

In the Earthquakes and Plate Boundaries activity, students first learn about earthquakes as natural hazards, in terms of their cost, magnitude and global distribution. This understanding is established using short media excerpts and historical statistics. Students are then introduced to the USGS National Earthquake Information Center database. An "Earthquake Orientation" encourages students to look at recent worldwide earthquake activity. To become more comfortable with how earthquake data is recorded and displayed, students look at the extremes in earthquake depth and magnitude over the past week. They also consider how earthquake distribution largely coincides with plate boundaries. Following a brief summary of the different types of plate boundaries, the students once again access the NEIC data to examine a seismic cross-section in western South America. Using trends in hypocenter depth, an on-line plotting utility, and an "angle calculator," students quantify the angular relationship that exists along the cross-section and develop an understanding of how earthquake distribution can be used to express the geometric relationship between Earth's plates.

The focus of the activity then shifts north to the San Andreas Fault in California. Students compare and contrast the earthquake distribution observed in California to the distribution observed in South America. Finally, students investigate predicting earthquake hazards using spatial and temporal patterns in earthquake distribution. The Loma Prieta event (1989) is used to help demonstrate this concept.



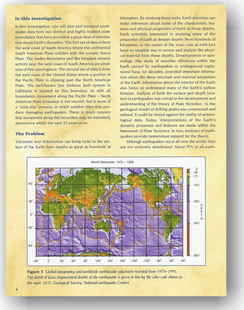
EarthInquiry is...

A series of web-based investigations in the Geosciences that:

- Utilize the abundant geological data available on-line, and
- Target the introductory college student

How does it work?

- Each activity consists of a workbook and an accompanying web site.
- The workbook poses questions and anchors the activity with background material.
- The web site, maintained by the American Geological Institute, gives detailed directions for accessing and interpreting the data.



First things first...

Students are introduced to the topics presented in the activity using media excerpts, historical records, and statistical data.

When it's time to go on-line...

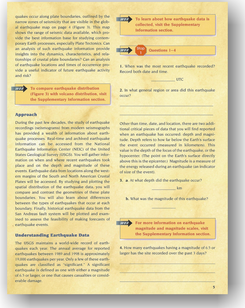
Students are instructed to go to http://www.earthinquiry.com by a blue *Web* icon. When they first enter the EarthInquiry web site, they type in a unique Web access code, found on the inside back cover of each EarthInquiry booklet.

The web site serves two purposes. It leads students through the investigations, while also offering access to additional resources like: Supplementary Information, a Glossary, and a list of References.

Students are directed on-line whenever they need to access data, or if there is helpful information available to them. Otherwise, students focus their attention on the workbook and let that anchor and guide their investigation.

Why does this matter anyway?

In an effort to answer the "ever present question," the Quest defines the objectives of the activity and launches the investigation. The Problem grounds the investigation in a specific real-world application, outlining what students will learn by analyzing the available data.

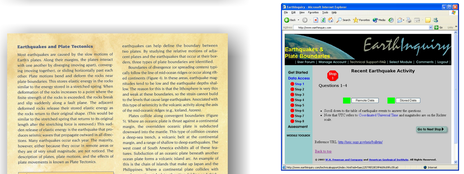


The Approach

This section of the activity walks students through the heart of the investigation, asking relevant questions and directing students to the Web to access on-line data when necessary. When students see a [red dot] In their booklet, they will go to the corresponding Stop on the web site to access and interpret data.

Stop 1: An Earthquake Orientation

At Stop 1, students take an "Earthquake Orientation" and learn how to read an interpret USGS earthquake data using the most recent information available online. AGI stores local copies of all data necessary to complete the exercise, just in case the USGS web site is unavailable.

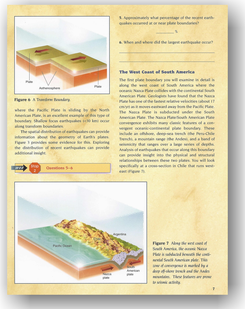


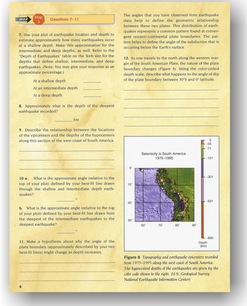
"Just-in-time" learning!

As students continue through the activity, they learn why earthquakes commonly occur along Earth's plate boundaries. EarthInquiry is not intended to replace textbooks or classroom lecture. It does, however, provide students with the information and resources necessary to make educated analyses and hypotheses about the data.

Stop 2: Connecting Earthquakes with Plate Boundaries

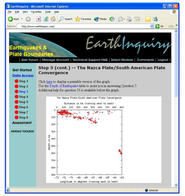
After learning about, or reviewing, the different types of plate boundaries, students look at the most recent earthquake data spatially, and start to develop a better understanding of the link connecting earthquakes and plate boundaries.





Stop 3: Collecting, Processing and Analyzing Data from the Peru-Chile Trench

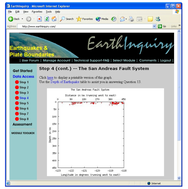
Students again access the USGS earthquake data to learn more about a seismic cross-section in western South America. Students plot hypocentral depth against distance using an on-line plotting utility.



An "angle calculator" helps students to quantify the angular relationship that exists along the cross-section. They develop an understanding of how earthquake distribution can be used to express the geometric relationship between Earth's plates.

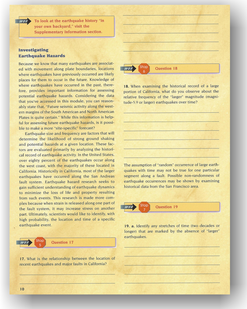
Stop 4: Collecting, Processing and Analyzing Data from the San Andreas Fault

At Stop 4, students refocus their attention on the San Andreas Fault in California. Students compare and contrast the earthquakes along this transform boundary with those from the convergent boundary they studied in South America.



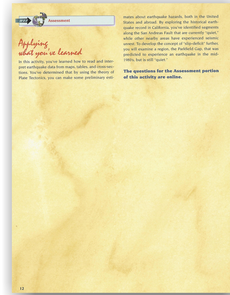
Stops 5-7: Looking at the Distribution Pattern of Earthquakes

Students start to identify patterns in the spatial and temporal distribution of Californian earthquakes. This procedure helps them to understand how an earthquake might be predicted.



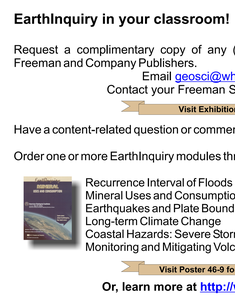
Stop 8: Seismic Gaps and the Loma Prieta Earthquake

The October 1989 Loma Prieta Earthquake is used to teach students the concept of "seismic gaps" and how they are used to help predict when and where the next "big" earthquake might be.



The Assessment: Applying what you've learned

Now that students have learned about the concept of "seismic gaps," they take this knowledge and apply it to the Parkfield Gap. This entirely on-line investigation is graded automatically, with student responses stored in a database for Instructor viewing at a later time.



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