John Muir Study Guide
Science Lesson Plan
Grade Seven
Glaciers

Throughout much of Earth's history, glaciers have played an important role in shaping the landscape. Even today, glaciers are carrying out these same processes in various places on Earth, including the high Sierra Nevada Range of California.

At a time when it was popularly believed that a sudden cataclysmic event had created Yosemite Valley, it was John Muir who rightly conjectured that it was the slow movement of glaciers over time that actually carved the Valley. His observations and measurements helped to prove that living glaciers still existed in the Sierra. This research was instrumental in making significant advances in the new science of his day--glaciology.

Objective:

Students will be able to summarize how Earth processes today are similar to those that occurred in the past, and explain how slow geologic processes have large cumulative effects over long periods of time.

California Science Standard Grade Seven, Earth and Life History:

4a. Students know Earth processes today are similar to those that occurred in the past, and slow geologic processes have large cumulative effects over long periods of time.

Materials:

John Muir on Glaciers Reading Handout (also provided below)
Library and/or Internet access

Preparation:

Read the following excerpts from John Muir's "Yosemite Glaciers," *New York*

Tribune, December 5, 1871; and *Studies in the Sierra* , 1950 reprint of 1874 serial.

"...The great valley [Yosemite] itself, together with all its domes and walls, was brought forth and fashioned by a grand combination of glaciers, acting in certain directions against granite of peculiar physical structure. All of the rocks and mountains and lakes and meadows of the whole upper Merced basin received their specific forms and carvings almost entirely from this same agency of ice."

"Five immense glaciers from five to fifteen hundred feet in depth poured their icy floods into Yosemite, uniting to form one huge trunk, moved down through the valley with irresistible and never-ceasing energy, crushing and breaking up its strongest rocks, and scattering them in moraines far and near. Many, while admitting the possibility of ice having been the great agent in the production of Yosemite valleys, conjecture that earthquake fissures, or cracks from cooling or upheaval of the earth's crust, were required to enable the glaciers to make a beginning and to guide them in the work....During five years' observation in the Sierra, I have failed to discover a single fissure of any kind, although extensive areas of clean-swept glacial pavements afford ample opportunity for their detection, did they exist. "

Activity:

Students will divide into four groups, and using the Internet and library resources, each group will research one of the following aspects of glacial activity and find answers to the questions listed:

1. Glacial Formation
   What is a glacier?
   What is it made of and what causes it to form?
   How and why do glaciers move?
   What is some of the terminology associated with glaciers?
2. Glacial Landscapes and Hazards
   What are the names of some of the various kinds of landscapes and features created by the movement of glaciers?
   What effects do glaciers have on climates and geography?
   What are some of the dangers associated with glaciers (flooding,

avalanches, icebergs)?

3. Glacial history

   What was the most recent glacial period in North America?

   Where in North America has recent glacial activity has occurred?

   What evidence do glacial features tell us about past climates?

4. Glaciation in the Sierra Nevada

   What role have glaciers played in the shaping of the the Sierra Nevada Range?

   What is the geologic history of glaciation in Yosemite National Park?

   What are the names of some of the features of Yosemite National Park that have been shaped by glaciers, and how where they formed?

Conclusion:

Have the students present their findings in an oral report to the class. Follow the presentations with a discussion of how Muir's understanding of glaciers developed and evolved over time.

References:

Websites:

John Muir's Studies in the Sierra- studying glaciers
http://www.sierraclub.org/john_muir_exhibit/writings/studies_in_the_sierra/

Where does a glacier come from
http://tvl1.geo.uc.edu/ice/Image/parts/parts.html

How a glacier changes
http://tvl1.geo.uc.edu/ice/Image/topic/portage.html

The Crevasse Zone
http://crevassezone.org/Other_Research/other_research_frameset.htm

---

John Muir Study Guide
http://www.sierraclub.org/john_muir_exhibit/lessons/science/