



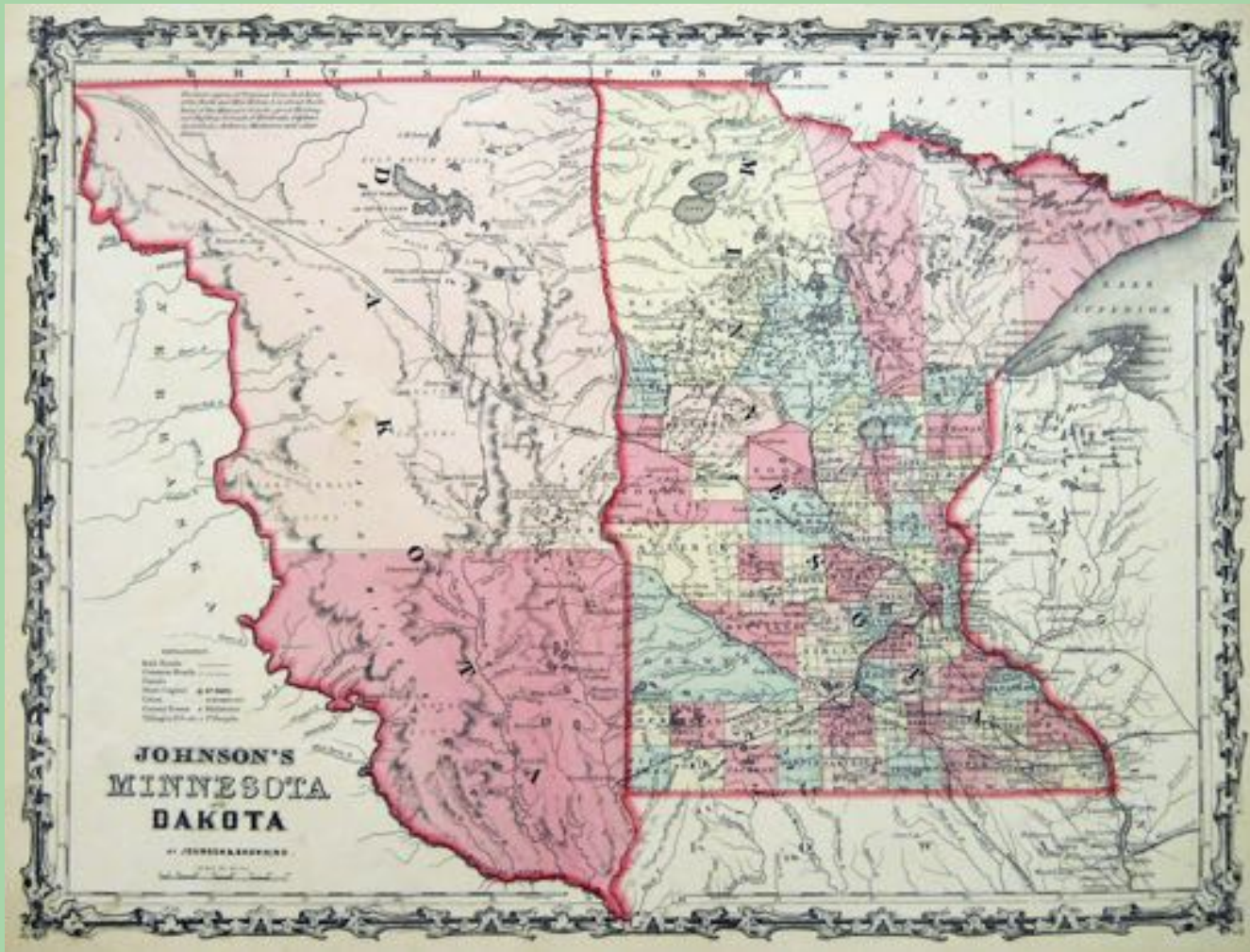
Place-Based Earth Science Teaching



When we envision, name, explore, inhabit, or in any other way experience a locality, we make it a **place.**

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What begins as undifferentiated space becomes *place* as we get to know it better and endow it with value. **Yi-Fu Tuan, *Space and Place* (1977)**



Johnson & Ward (1862)

Places populate the **cultural landscape** just as landforms, water, and biota comprise the physical landscape.

[Landscape] may be defined as an area made up of a distinct association of forms, both physical and cultural. **Carl Sauer, *The Morphology of Landscape* (1925)**



Map of *Diné bikéyah*—homeland of the Navajo people—and adjoining lands
Rock Point Community School (1982)

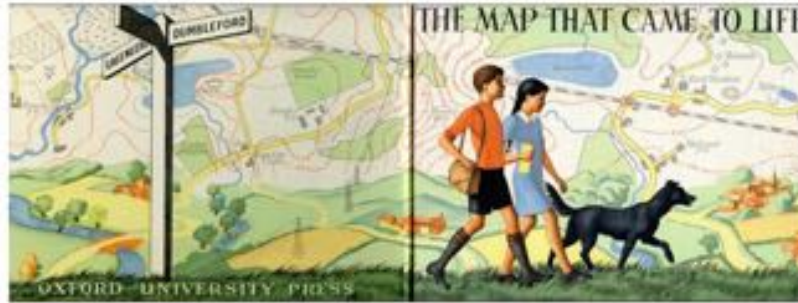
We teach and learn about the Earth
by means of places, whether in situ or by proxy.

Our access to space and time is how they happen in a given place.
Edward Casey, philosopher



EarthScope Interpretive Workshop at Acadia National Park, Maine

People are naturally connected to places.
Sense of place allows us to leverage this connection
in our teaching.



People imbue places
with diverse
meanings

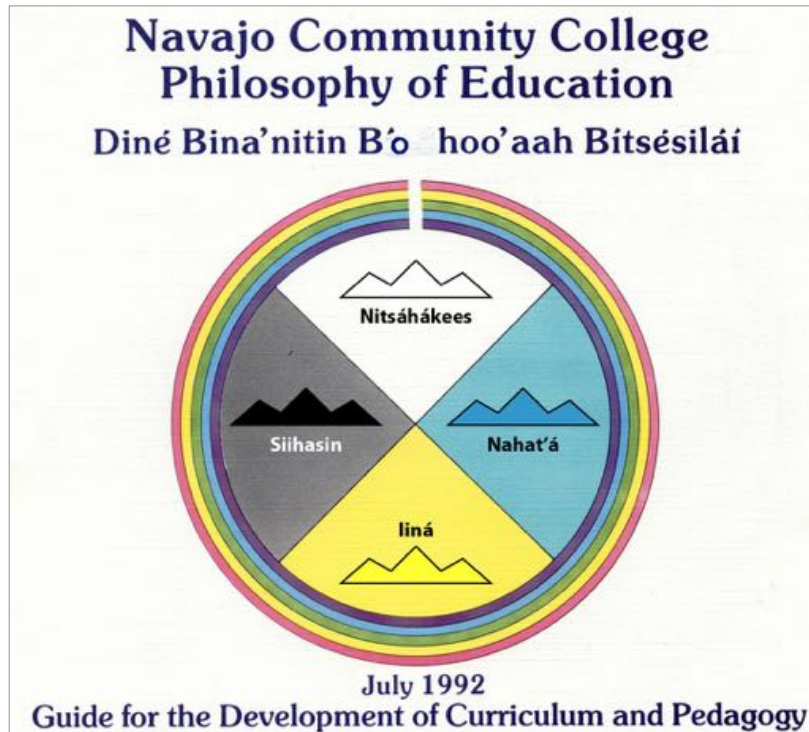
People form
attachments
to meaningful places

Both can be measured, whether *quantitatively* (surveys)
or *qualitatively* (interviews, observations, analyses of artifacts)
e.g., Williams & Vaske, 2003; Williams & Semken, 2011

Sense of place is the set of all meanings and attachments
held by an individual or a group for any given place.

e.g., Brandenburg & Carroll, 1995

The power of place as an **organizing theme** for contextualized teaching has long been understood and utilized.



Indigenous (e.g., Native American) philosophies of education are **place-based**: prioritizing and transmitting **locally situated knowledge** for long-term sustainability (e.g., Cajete, 1994).

John Dewey (1916): Learning should be **experiential and active**, and situated in the learner's **immediate physical and cultural surroundings**.



Río Tanama, Puerto Rico

Place-based teaching is fully situated in place. Typical characteristics of the approach include:

Experiential learning in the field, environment, neighborhood (or online??).

Use of ***local examples and cases***: focus on Earth-system features and processes that occur or occurred locally or regionally.

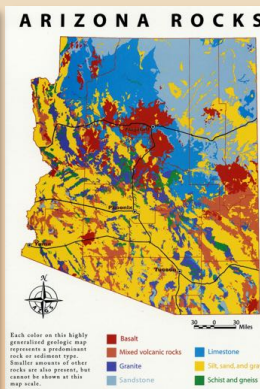
Integration of ***artistic, humanistic, cross-cultural, and cross-lingual place knowledge*** as relevant context for scientific inquiry and interpretation

Engagement with ***relevant environmental and cultural issues and case studies*** of local or regional significance.

Service-learning or creative projects that offer return to the community.

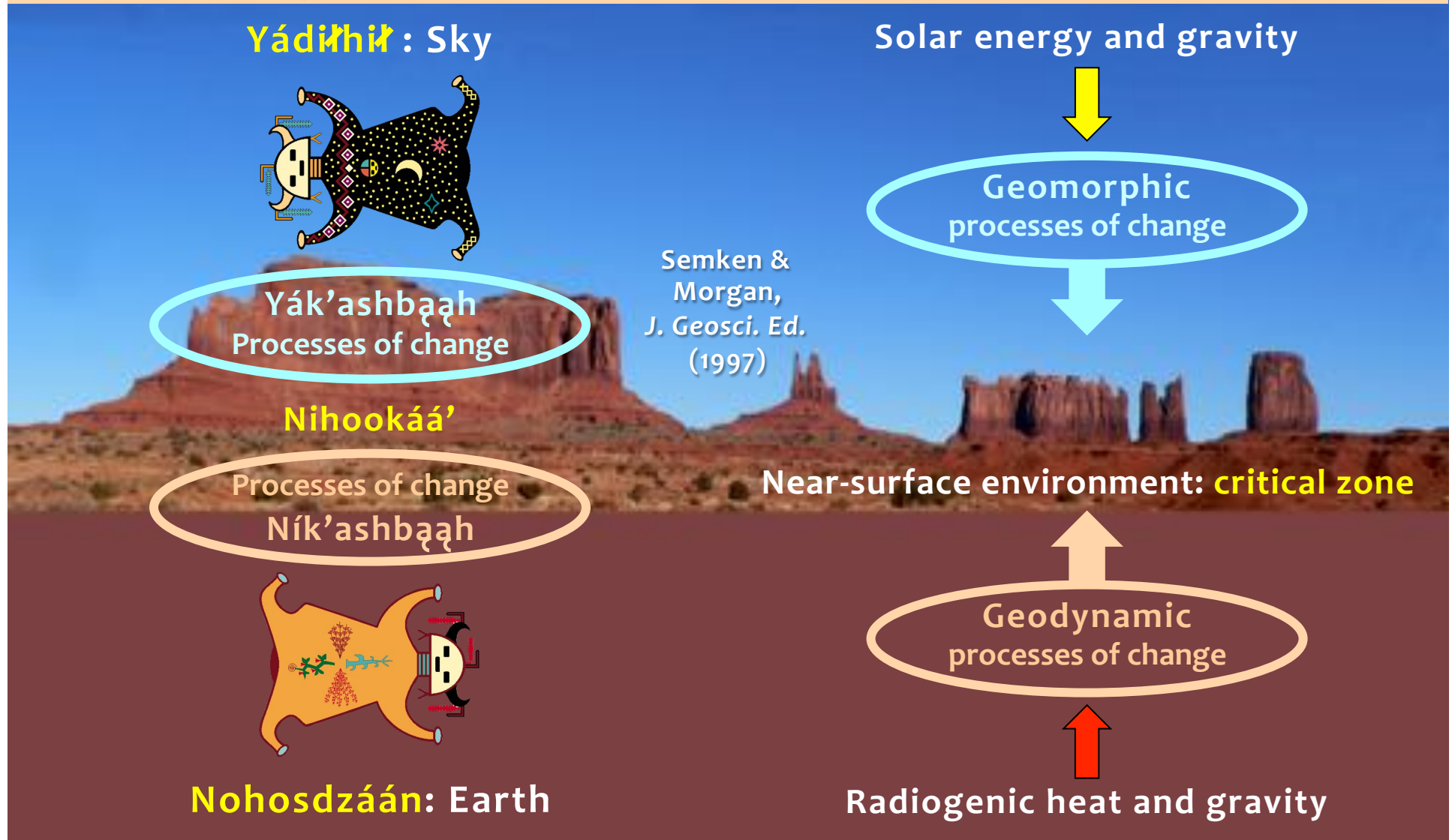
Teaching to promote ***environmental*** and ***cultural sustainability*** of places studied.

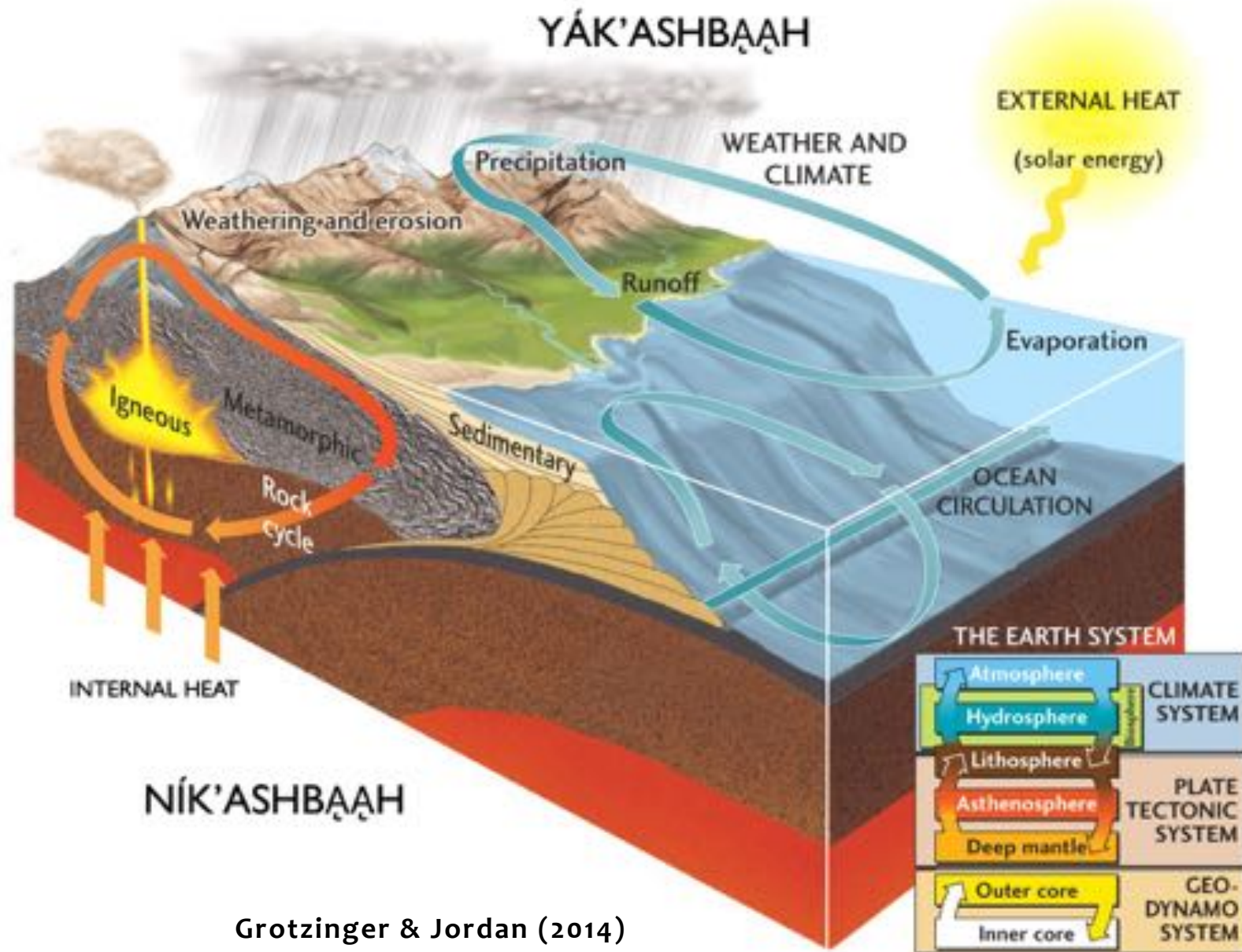
Leveraging and enhancing ***sense of place*** to motivate learners and instructor alike.



Native American geological knowledge informs place-based teaching in Native American schools and communities.

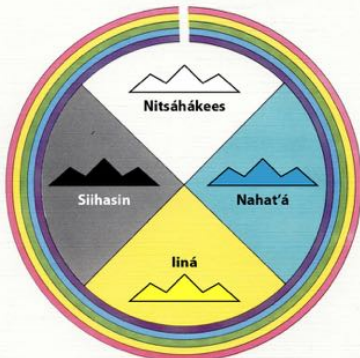
For example: a comparison of traditional **Diné (Navajo)** ideas of **Earth as a system** with the **global Earth system science model** reveals many similarities.





Grotzinger & Jordan (2014)

Navajo Community College
Philosophy of Education
Diné Bina'nitin B'ó hoo'aah Bitsésilái



July 1992
Guide for the Development of Curriculum and

Yádiłhił: Sky



Yák'ashbąąh
Processes of change

Nihookáá'

Processes of change
Ník'ashbąąh



Nohosdzáán: Earth

Tsé na'alkaah 101: Indigenous Geology at Diné College



Yádiłhił: Sky

Tsé na'alkaah:
Geological inquiry

Nohosdzáán dóó
Yádiłhił: Interactions
of the Earth and Sky

So' naalts'id:
Impact cratering

Diné bikéyah:
A geological
sense of place

Náháltsááh:
Dryland climates
and climate change
in the Southwest

Nik'ashbaah:
Processes of
plate tectonics

Tó be'iina:
Ground and
surface water
resources

Tsé:
Interpreting
local rocks

Yizhosh:
Surface processes and
hazards on the Plateau

'Alnáozt' i':
Sedimentary rocks
and ancient environments
of the Plateau

Dzil:
Building the
sacred mountains

Tsézhin:
Volcanoes
and igneous
rocks of the
Plateau

Nohosdzáán: Earth

Semken, Journal of Geosci. Ed (2005)

Earth Science in Arizona and the Southwest at ASU



A SENSE OF THE AMERICAN SOUTHWEST



ESAS students walk through Southwest geologic history on the Trail of Time at Grand Canyon. (Photo by Steven Semken)

Place-Based Earth System Science for Diverse Students

People connect to their surroundings by means of **places**, the myriad physical localities that we endow with diverse meanings by experiencing them, learning about them, caring for them, living in them, defending them and in other ways. Scientific study and interpretation are part of the human process of meaning-making that names and forms places in natural landscapes. But most places also hold cultural and other humanistic meanings and can inspire strong emotional responses and personal or communal feelings of attachment and stewardship. The meanings people find and make in a place and their affective relationships to that place (whether attachment, indifference or aversion) together constitute the *sense of place*.

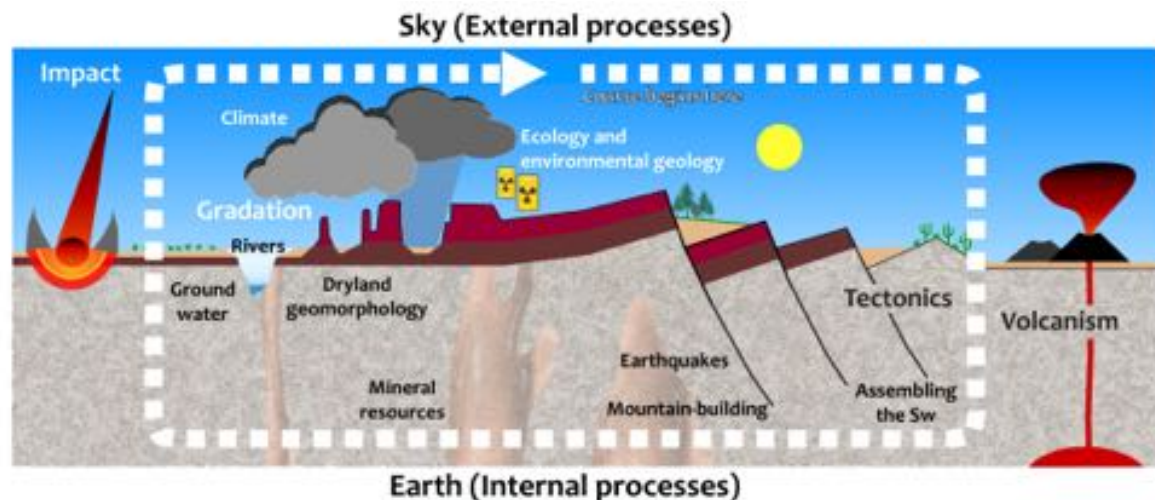
We teach and learn Earth science in and through places, whether directly through learning experiences in the field or the community or by making use of examples, materials or data collected from one place or another. Place also shapes Earth

science education because Earth processes are locally as well as temporally contingent. What happens in one place differs from what happens in another. (Consider the global distribution of volcanism or a regional seismic "shakemap.") And events in a particular place can influence or indicate what happens later in the same place. (Envision a poorly placed roadcut prone to repeated mass movements.)

Authentically **place-based** science teaching and learning is distinguished from other situated approaches to science education such as field-based or problem-based teaching because it constructively leverages humanistic place meanings (Eldred, 1998) and affective place attachments, i.e., sense of place (Semken and Butler Freeman, 2000), as engaging and relevant contexts for scientific inquiry and interpretation. Place-based teaching typically encompasses experiential learning in the field or neighborhood, a focus on Earth system processes and features that can be observed locally; integration of artistic, humanistic and multicultural ways of knowing place, e.g., sketching, journaling, photography, studies of literary and visual arts, interviews; engagement with environmental issues and cases of local importance; and service-learning projects. Studies of Earth system components and processes at increasingly fine scales,

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IN THE TRENCHES — 1



Semken, *In the Trenches* (2011)

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Whatever and wherever you teach,
situate it in your place... and leverage your sense of place!

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