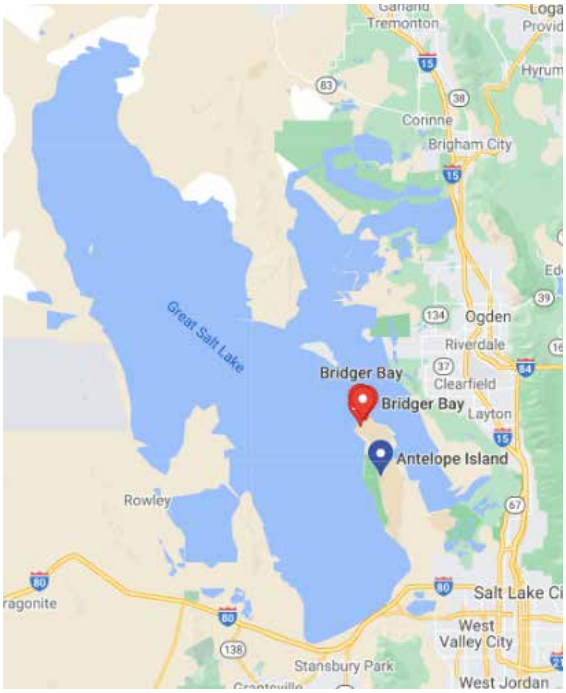
MIDAS _____ - Tectonics Outside at Antelope Island

Saturday, March 12, 2022 Noon - 3 PM

Experience Tectonics!!

with Genevieve Atwood, former Utah State Geologist

BRING your family! Lunch for all... PD for teachers... noon to 3 PM



Where: ANTELOPE ISLAND
Bridger Bay Campground sites 7, and 8.

Why: It will amaze!!.
You will learn how to bring *TECTONICS* and *Earth Processes* into you classroom.

Earn MIDAS credit (3 relicensure hours + optional zoom follow up for 1 additional relicensure hour).

Your school district may offer additional support.

PD meets SEEd standards for 2nd Grade, 5th Grade, 7th Grade, and Earth and Space Science teachers.

LUNCH for all, includes families. Teachers must attend lunch at noon (build a sandwich that models Utah's Basin and Range). After lunch, children under 15 must be supervised by an adult other than the teacher. There are trails and attractions.

Teachers who attend the workshop and take the (easy) quiz at Buffalo Point overlook will receive a set of "tectonic blocks" for teaching tectonics of the Wasatch fault zone and Utah's Basin and Range region.

Teachers will receive $40 for travel and park expenses.

SEEd Standards Covered Earth

- ESS.2.4 Construct explanation for how plate tectonics results in patterns on Earth's surface.
- ESS.2.4 Develop and use models to illustrate Earth's processes through time and space (constructive and destructive forces- weathering)

EXPERIENCE TECTONICS

MIDAS _____
Earth Science Outside -- ANTELOPE ISLAND -- March 12, 2022
Led by Earth Science Eduation. http://www.earthscienceeeducation.org
DRAFT - January 20-2022. To Candace Penrod re MIDAS

Bridger Bay Campground - Sites 7 and 8

SCHEDULE:

Noon - 12:45 PM	Welcome and LUNCH - Exercise 1: Construct a "Basin and Range sandwich"
12:45	Earth's two great processes: tectonics and erosion.
1:00	Look around. Recognize basins and ranges... Discuss erosion ("from" and "to").
1:30 - 2:15	Evidence of tectonics: world-scale -Exercise #3- USGS Dynamic Earth Evidence for Western North America. - Exercise #4- UNAVCO- GPS data
2:45 -	Antelope Island: model Great Salt Lake / Antelope Island with wooden blocks. Connections to SEEd standards by grade.
2:50	Drive to Buffalo Point (5 minutes away)
2:45 - 3:15 PM	Buffalo Point overlook.. Quiz (easy). Receive credit. Receive compensation.
Follow up Zoon	About 10 days later: teachers will suggest how they can tie Tectonics Outside to SEEd.

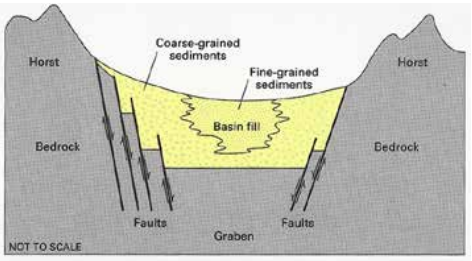


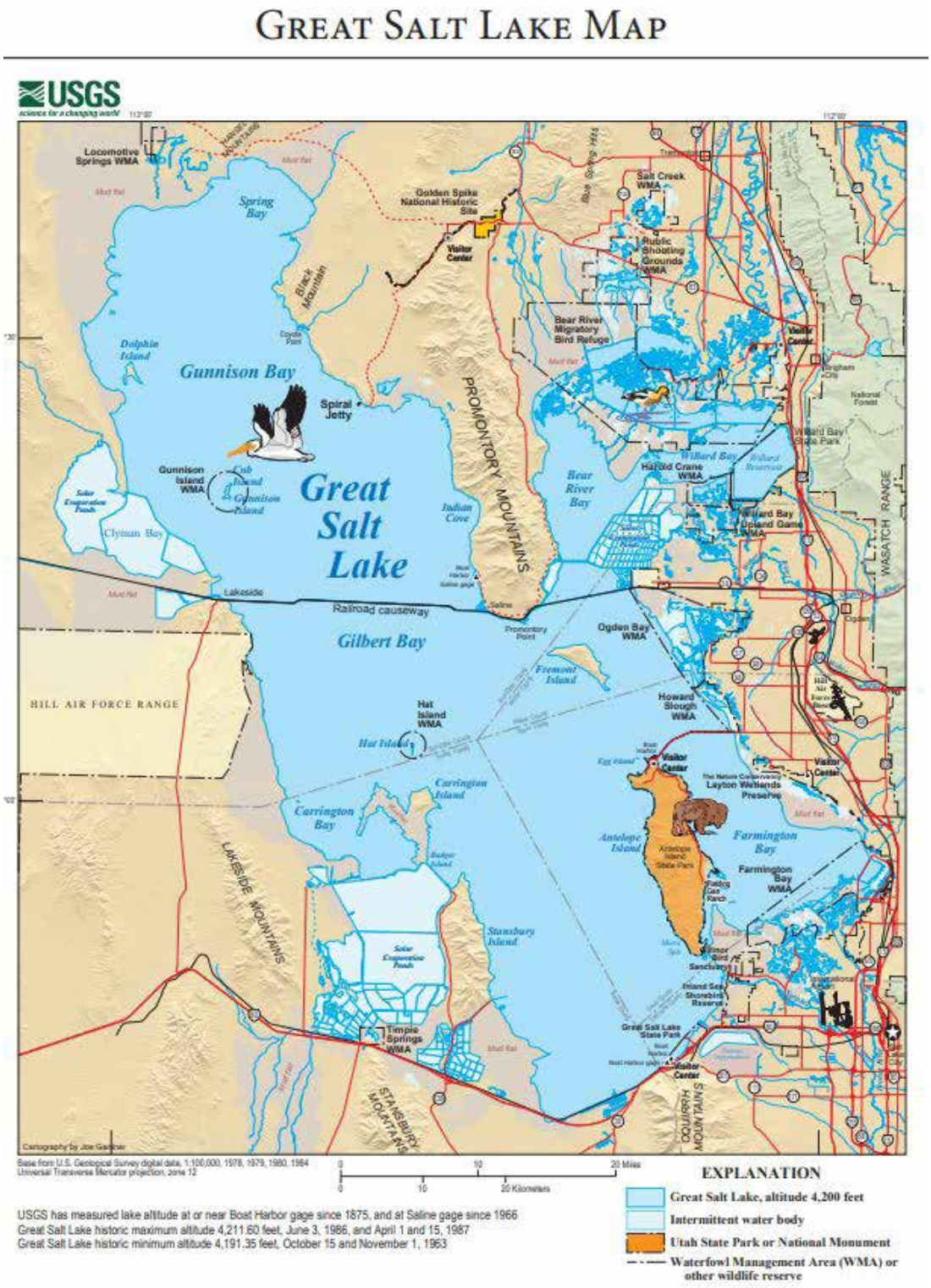
Figure 34. *Basin fill is located between bedrock mountain blocks and contains fine-grained sediments near the center of the basin. Coarse-grained sediments were deposited near the basin margins, primarily as alluvial fans.*

Exercise #1-Tectonics (extensional tectonics along faults) creates the ranges and basins of the Basin and Range. Structural basins (gray) have "basin fill." Erosion/deposition from the ranges and from rivers carrying sediments into the lake lays down thousands of feet of layers of sand, mud, and organic matter.

The "faulted" bread of your sandwich represents the "bedrock" of the diagram, the gray.
The lunch fixings represent layers of loose sediments deposited on the bedrock of in the basin.

Imagine the sandwich.. the first model of the PD. Image to be added TBD.

Basins and Ranges: The Basin and Range region extends into eight states including western Utah. It was labeled "the Basin and Range" based on patterns of landforms. Earth has two great, really great, processes: tectonics and erosion. Tectonics sets the scene making regsons and areas of regions high or low. Erosion sculpts the scene. Together they make landforms: naturally occruring physical features on Earth's surface.



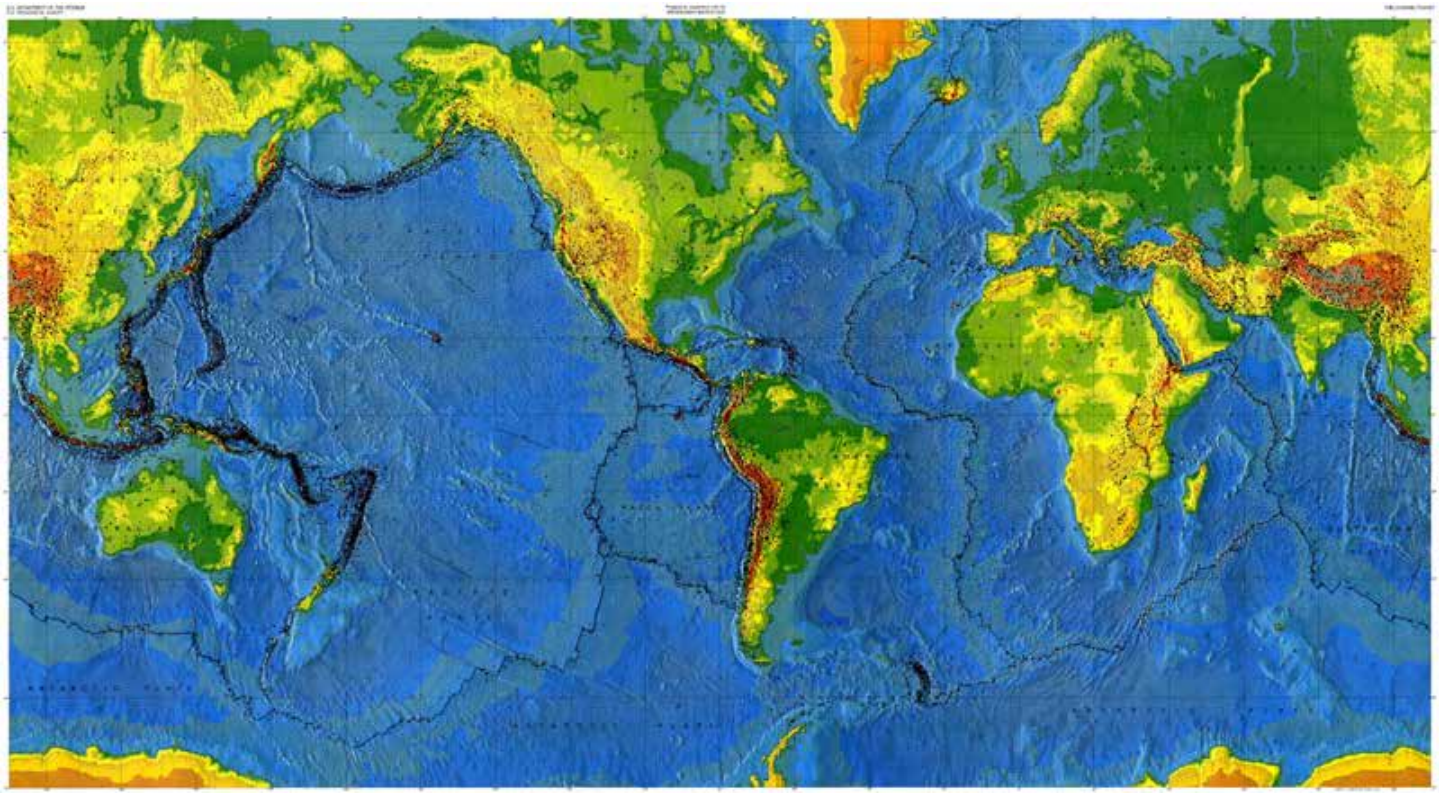
Exercise #2. Where are we?

Identify 5 ranges of the Basin and Range.

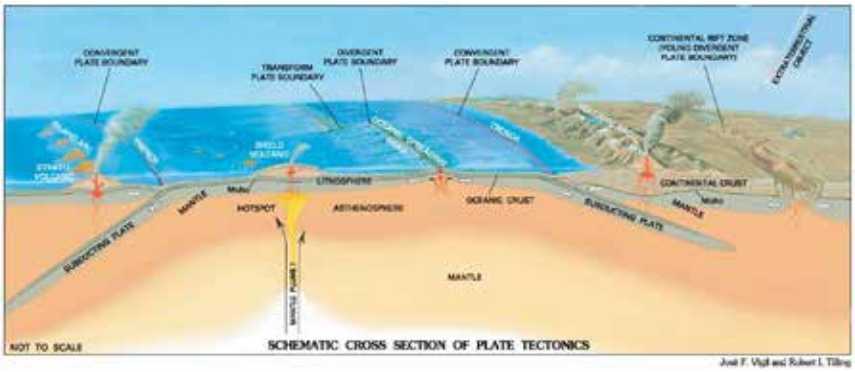
Identify 5 basins of the Basin and Range.

How do we "know." Let's discuss PATTERNS and CAUSE and EFFECT.

Exercise #3. Dance of the Plates.

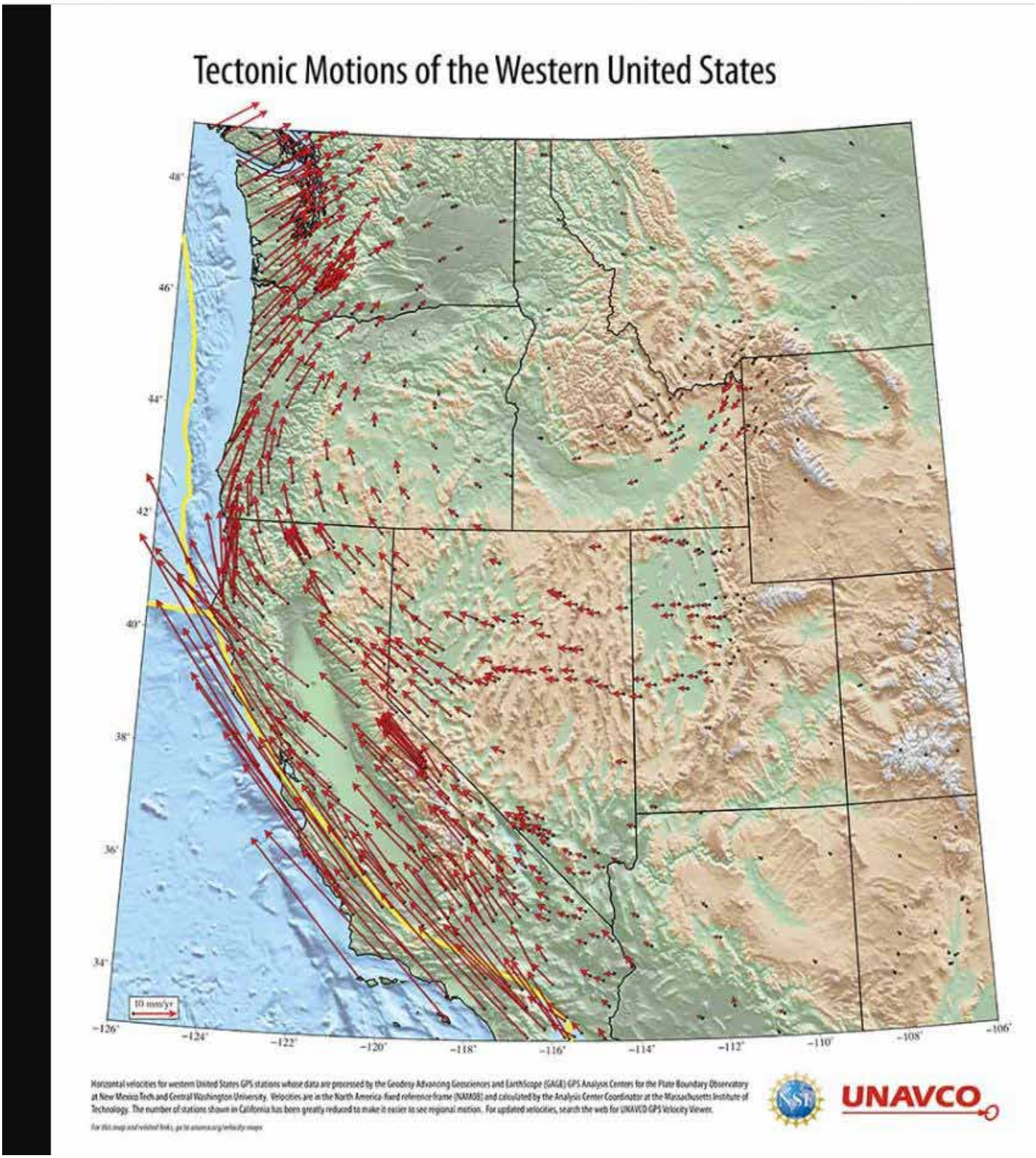


Step 1. Look at the map.
Are the black dots random? They represent earthquakes. That's how Earth's tectonic plates are defined. Utah is on the North American plate. Where is its eastern margin?
Now find the white and the black arrows. They indicate the direction and speed that place travels with respect to Hawaii.
Take a "Dance Card." It says... your "place," its plate, its direction, and its speed in mm per year.
North America and Europe "dance" meaning: the dancers face the direction that their plate is heading, know the mm/year, and they move accordingly.
South America and Nazca plates dance. They face their "direction" and move accordingly... what fun!!
When teaching, this can take a period of exploration and explanation: USGS https://pubs.usgs.gov/imap/2800/



Find Hawaii, Oregon, Nevada, and Utah.

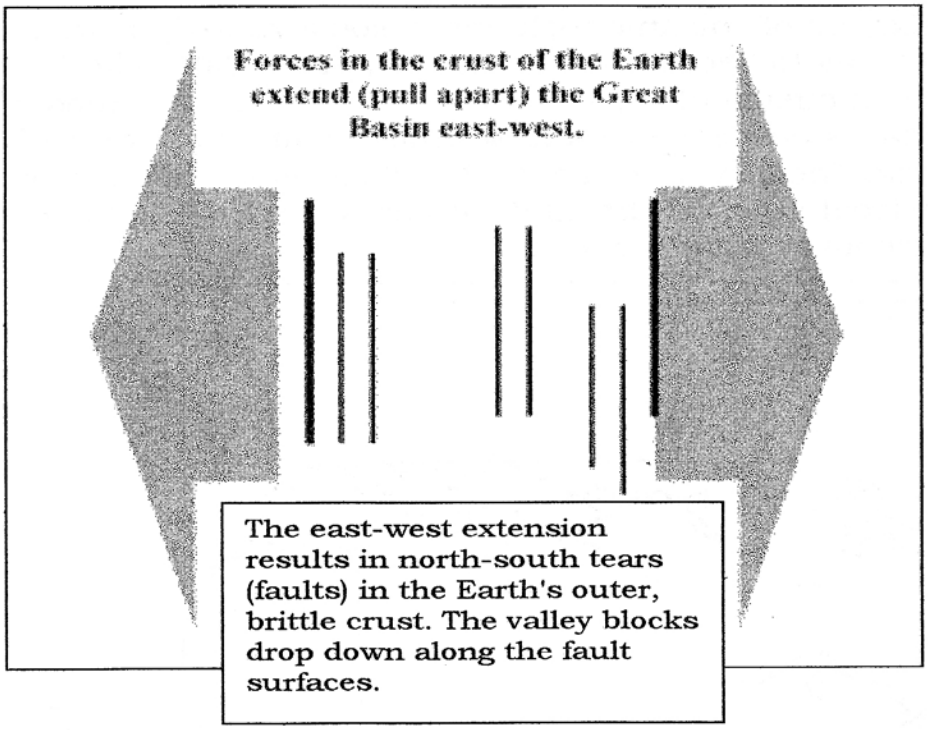
unavco.org/education/resources/modules-and-activities/exploring-tectonic-motions/exploring-tectonic-motions-1-large.jpg

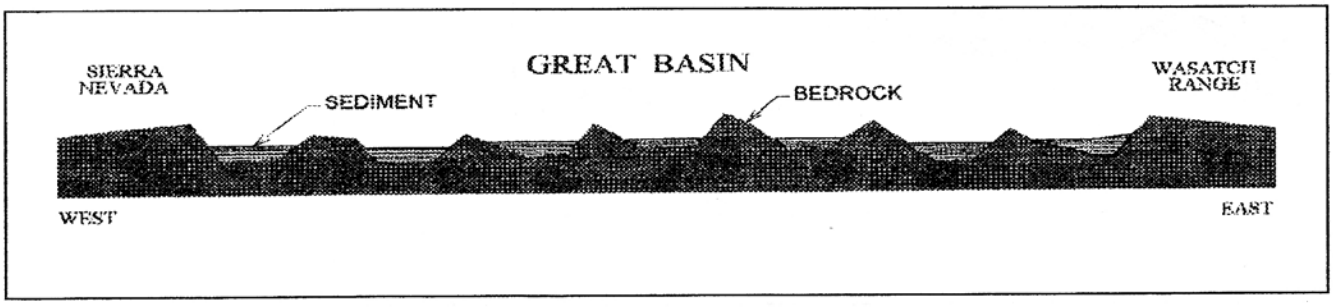


Exercise #4 - Another dance... a bit more chaotic!!
Note the little arrows of the Basin and Range. They "end" at the Wasatch Fault zone. They get progressively faster across the Basin and Range. According to GPS stations, Antelope Island moves faster westward than Denver, Chicago and Florida. How can that happen? Tectonics rules!! Earth is not getting bigger or smaller. If one region gains another loses.
Extensional tectonics makes regions wider. Compressional tectonic shortens them.

Tectonic extension... down-dropping results in Salt Lake Valley

Sometime after 20 million years ago, probably about 17 million years ago, the western part of the North American continent begin to change. Tectonic forces began to stretch the Earth's crust in the area that is now the northern Basin and Range province in a generally east-west direction. The upper brittle layer of the Earth's crust broke into north-south blocks along faults (fractures). Alternating blocks dropped down or rotated one side up and one side down. In these ways the land surface accommodated the extension. Salt Lake Valley became one of the down-dropped areas and the Oquirrh Mountains remained high. As tectonic forces pulled the region apart, the Earth's crust also thinned. The general level of surface of the northeast part of the Basin and Range Province subsided.



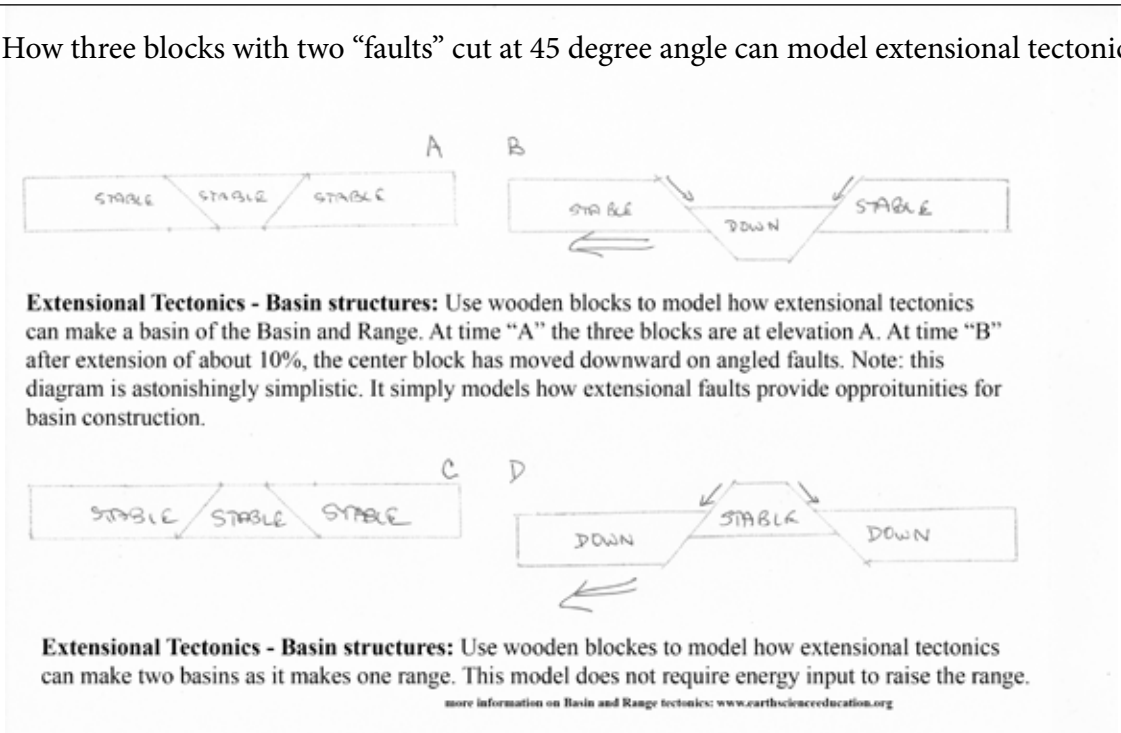


Tectonics is an exciting field. It's young. We embrace uncertainty. One approach is to create models how the Basin and Range could extend along faults. The following very simple model of extensional tectonics spreading the Basin and Range can be drawn (above) and/or enacted kinesthetically with blocks (next page).

Exercise #5 is fun... although a bit chaotic. We will show how extensional tectonics of the Basin and Range may be modeled using sets of wooden blocks.
First: Use the blocks to create a simple basin. (Remember: Erosion/deposition "fills" basins with sediment Tectonics makes the structural basin, the accommodation space. Erosion/deposition adds materials into it.
Second: Create a simple range of the Basin and Range. One person holds the central block steady. Another person extends the outer blocks by letting them slide down the "faults." The result is one range and two basins. The range is made by creating two basins NOT by raising the range.
Third: We will ask 5 - 15 of us to model the spreading of the basin and range region. They will stand shoulder to shoulder, blocks relatively horizontal, and gradually extend by allowing blocks to spread.

It's a model, an explanation... and not the only one. Tectonics is an exciting field of science that requires participants to embrace uncertainty.

Figure: How three blocks with two "faults" cut at 45 degree angle can model extensional tectonics.



DISCUSS connections to SEEd:

Standard ESS.2.3 Construct an explanation for how plate tectonics results in patterns on Earth's surface. Emphasize past and current plate motions. Examples could include continental and ocean floor features such as mountain ranges and mid-ocean ridges, magnetic polarity preserved in seafloor rocks, or regional hot spots. (ESS2.B)

Standard ESS.2.4 Develop and use a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales. Emphasize how the appearance of land and seafloor features are a result of both constructive forces and destructive mechanisms. Examples of constructive forces could include tectonic uplift or mountain building. Examples of destructive mechanisms could include weathering or mass wasting. (ESS2.B)

NEXT --- DRIVE to BUFFALO BAY OVERLOOK. How? Leave the campground and turn right (south). At the next intersection, turn right (west) to BUFFALO POINT. Go there. Park. Admire the view. Find Genevieve. Take a brief oral quiz. You've earned your PD credit, and your wooden blocks, and will receive $40 toward the Antelope Island State Park pass and your transportation.

Take an image of Utah's Basin and Range country. Subtle beauty.
Consider taking the follow-up zoom session. Enroll at MIDAS, section 2 of this PD.
Please complete the PD evaluation (envelope attached).

Tectonics Rules! Thank you for taking the PD. genevieveatwood@comcast.net

BIG concepts: PATTERNS of landforms are EVIDENCE of processes.
CAUSE and EFFECT: Extensional tectonics and erosion / deposition are the processes have made and continue to make the basins and ranges of the Basin and Range Province.