Cascadia EarthScope Earthquake and Tsunami Education Program (CEETEP)

Bob Butler
University of Portland
Nancee Hunter & Bob Lillie
Oregon State University
Beth Pratt-Sitaula
Central Washington University

Workshop for K-12 Teachers, Park/Museum Interpreters, and Emergency Management Educators

OSU Hatfield Marine Science Center
August 12-15, 2013

Robert J. Lillie

Cascadia EarthScope Earthquake and Tsunami Education Program (CEETEP)

Introductions:

CEETEP, EarthScope, Participants, Instructors

Robert J. Lillie

Goal and Objectives
CEETEP Training Workshop

<u>Goal</u>: To provide coastal educators with background knowledge, strategies, and materials to engage students and visitors on the science of, and preparedness for, earthquakes and tsunamis.

<u>Objectives. Participants will be able to</u>:

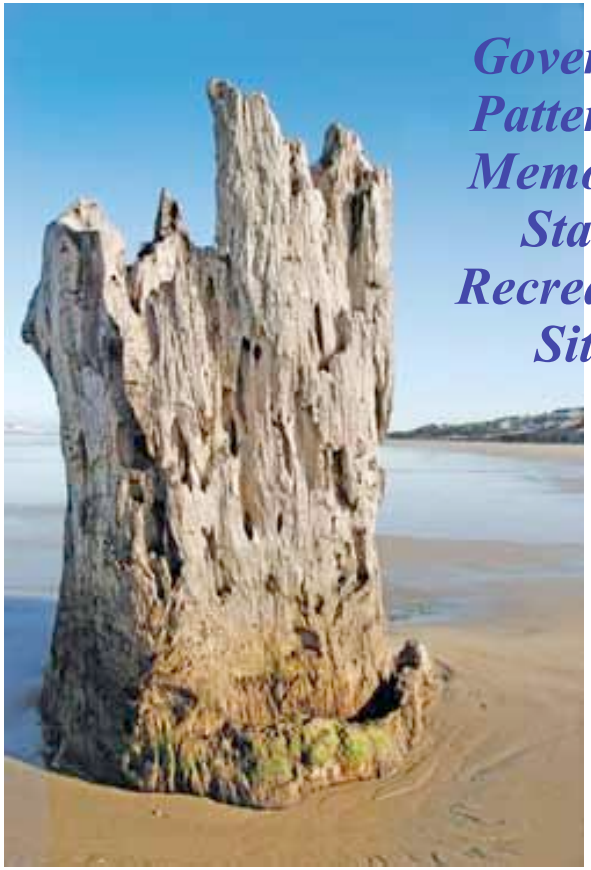
1. **Explain how the landscape of western Oregon formed.**
2. **Discuss geological hazards of the Oregon Coast.**
3. **Incorporate the region's geological landscape and geophysical monitoring into lesson plans and interpretive programs that tell the story of the Coast's formation and potential for earthquakes and tsunamis.**

CEETEP Training Workshop

Beauty and the Beast

"The same geological processes that threaten our lives with earthquakes and tsunamis also nourish our spirits by creating the spectacular headlands and beaches of the Pacific Northwest."

Otter Crest State Scenic Viewpoint



Governor Patterson Memorial State Recreation Site

http://www.oregoncoasttoday.com/bigstumpbeach.html

Cascadia Earthquake and Tsunami EarthScope Education Program (CETEEP)

Teachers on the Leading Edge (TOTLE)

Workshops for Earth Science Teachers in Oregon and Washington

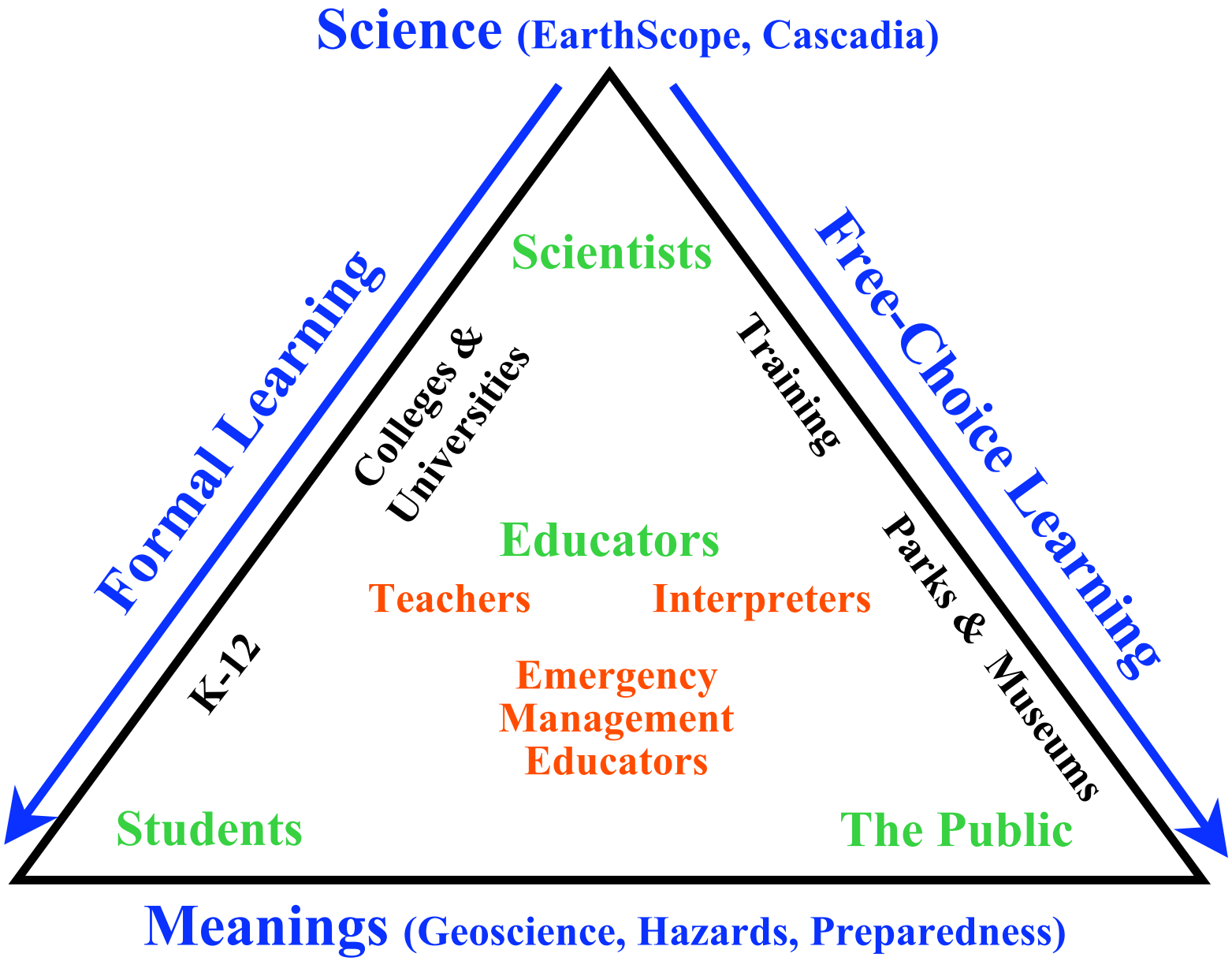
(2005 - 2011)

EarthScope Education and Outreach

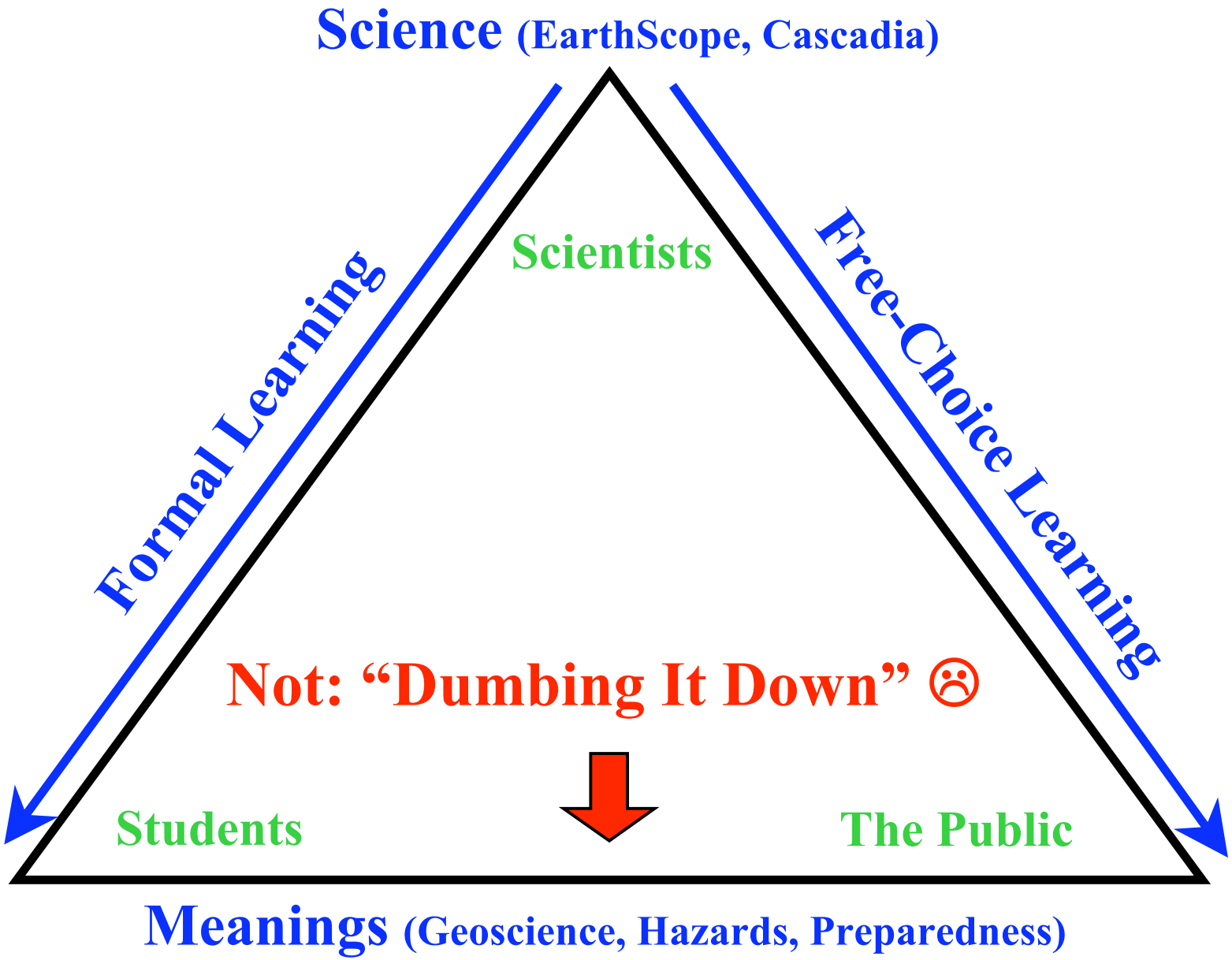
Workshops for Interpretive Professionals in Parks and Museums

(2008 - Present)

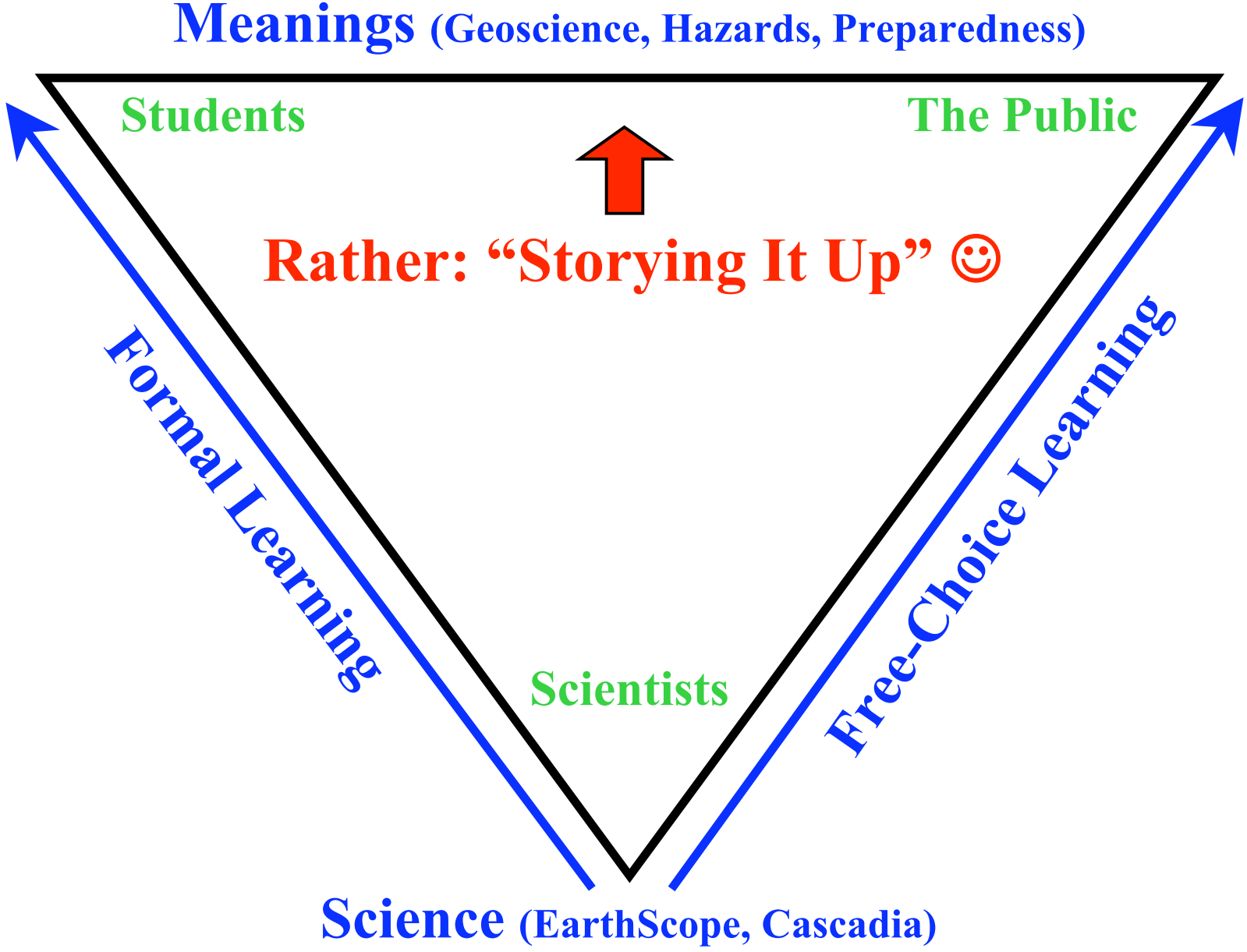
CEETEP
Cascadia EarthScope Earthquake and Tsunami Education Program



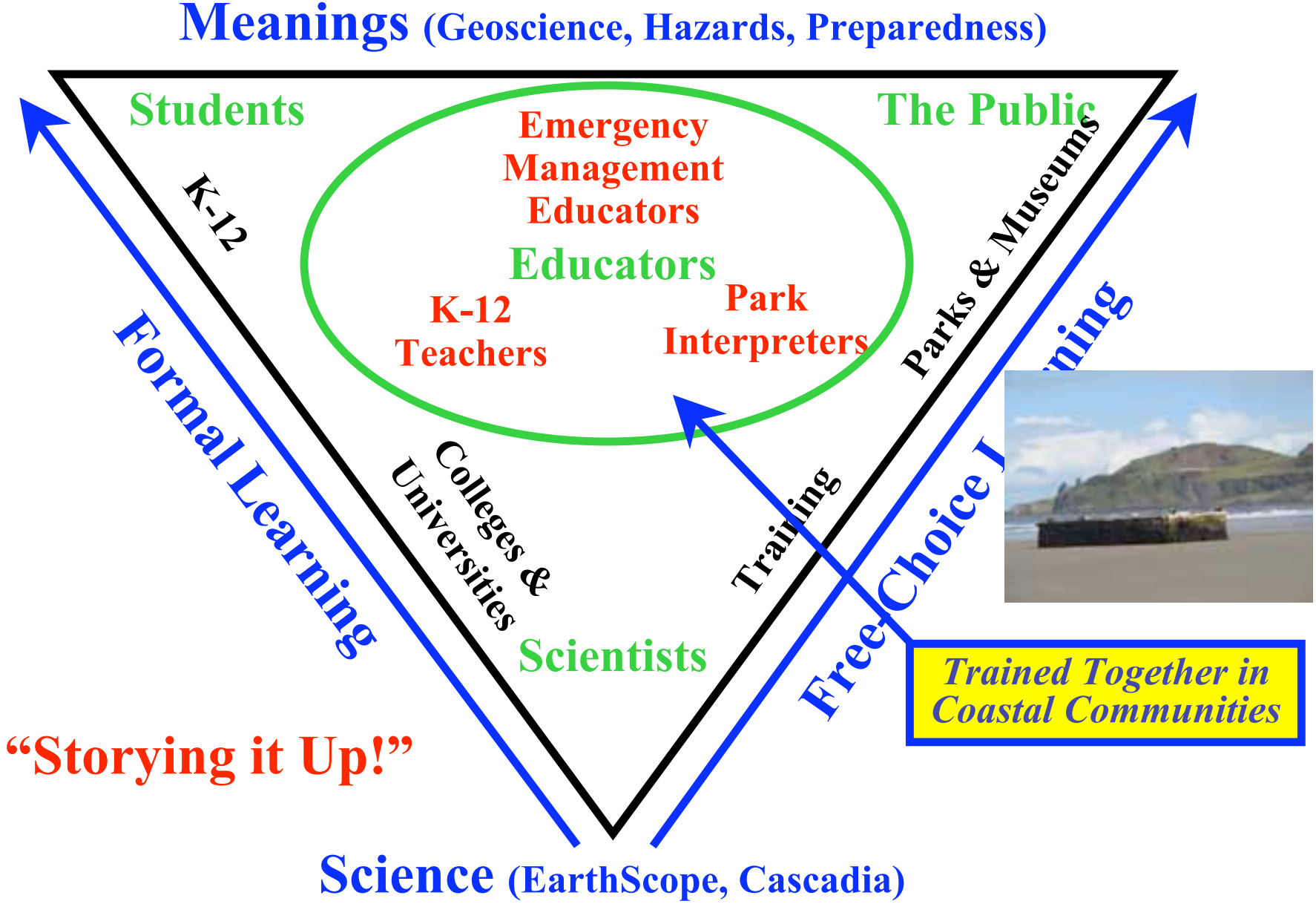
CEETEP
Cascadia EarthScope Earthquake and Tsunami Education Program



CEETEP
Cascadia EarthScope Earthquake and Tsunami Education Program



Cascadia Earthquake and Tsunami EarthScope Education Program (CETEEP)



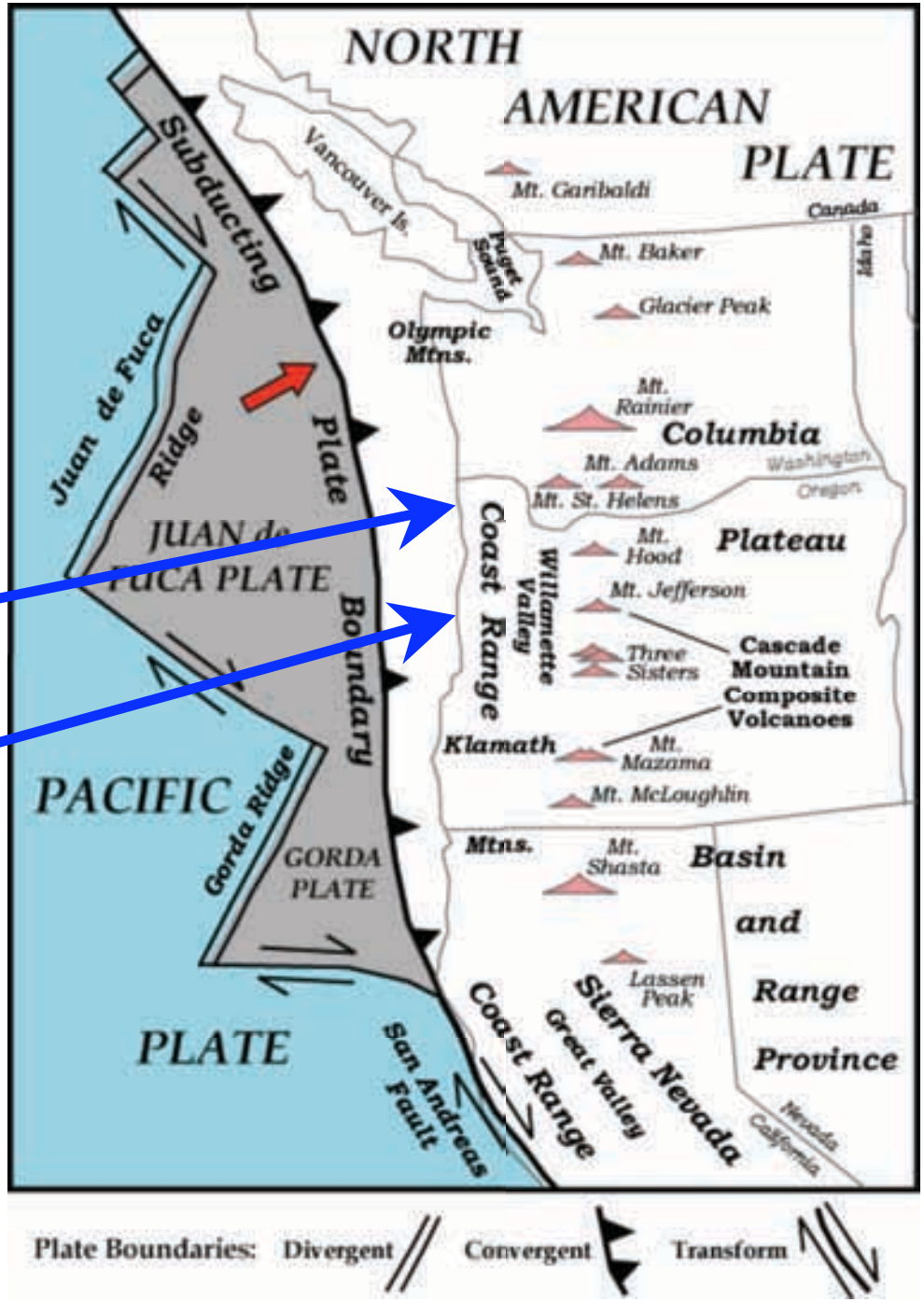
Cascadia EarthScope Earthquake and Tsunami Education Program (CEETEP)

Workshops on Cascadia Science and Preparedness:

Astoria, Oregon
October 11-14, 2013

Newport, Oregon
August 12-15, 2013

Other parts of Cascadia Coast in 2014 and 2015



Parks and Plates ©2005 Robert J. Lillie

CEETEP Workshop

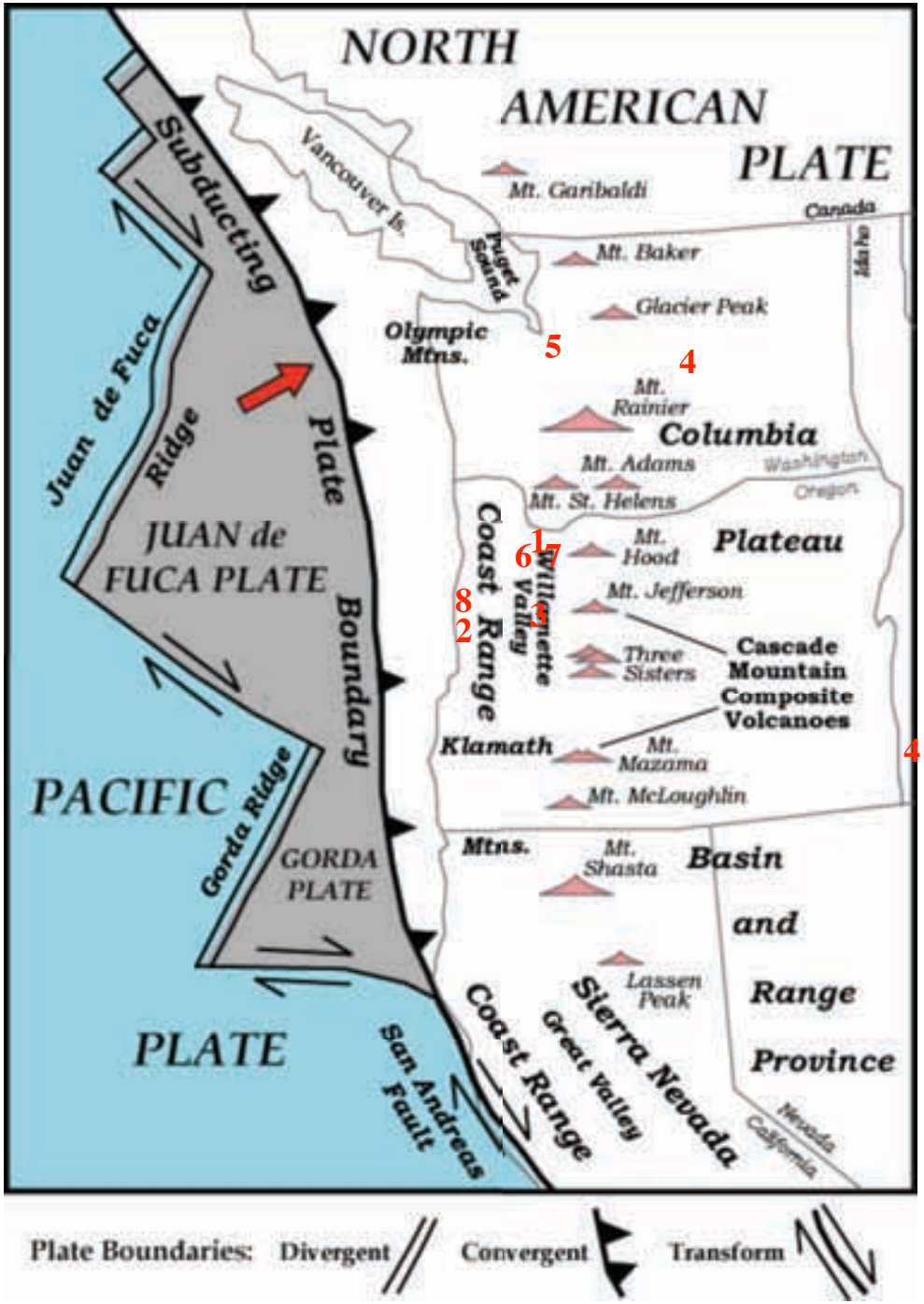
OSU Hatfield Marine Science Center
Newport, Oregon
August 12-15, 2013

CEETEP Principle Investigators and Instructors

1. Bob Butler, University of Portland, Portland
2. Nancee Hunter, OSU Hatfield Marine Science Center, Newport
3. Bob Lillie, Oregon State University, Corvallis
4. Beth Pratt-Sitaula, Central Washington University, Ellensburg, and UNAVCO, Boulder, CO

Master Teachers and Co-Instructors

5. Brian Atwater, U. S. Geological Survey, Seattle, WA
6. Bonnie Magura, Portland Public Schools (retired), Portland
7. Roger Groom, Mt. Tabor Middle School, Portland
8. Sue Graves, Lincoln County Schools, Newport



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CEETEP Workshop

OSU Hatfield Marine Science Center
Newport, Oregon
August 12-15, 2013

CEETEP Partner Organizations

9. Shelley Olds, UNAVCO, Boulder, CO
10. Bob de Groot, Southern California Earthquake Center, Los Angeles, CA
11. Sarah Robinson, EarthScope National Office, Arizona State University, Tempe, AZ

External Evaluators

12. Kip Ault, Lewis and Clark College, Portland
13. Michael Coe, Cedar Lake Research, Portland

Animator/Videographer

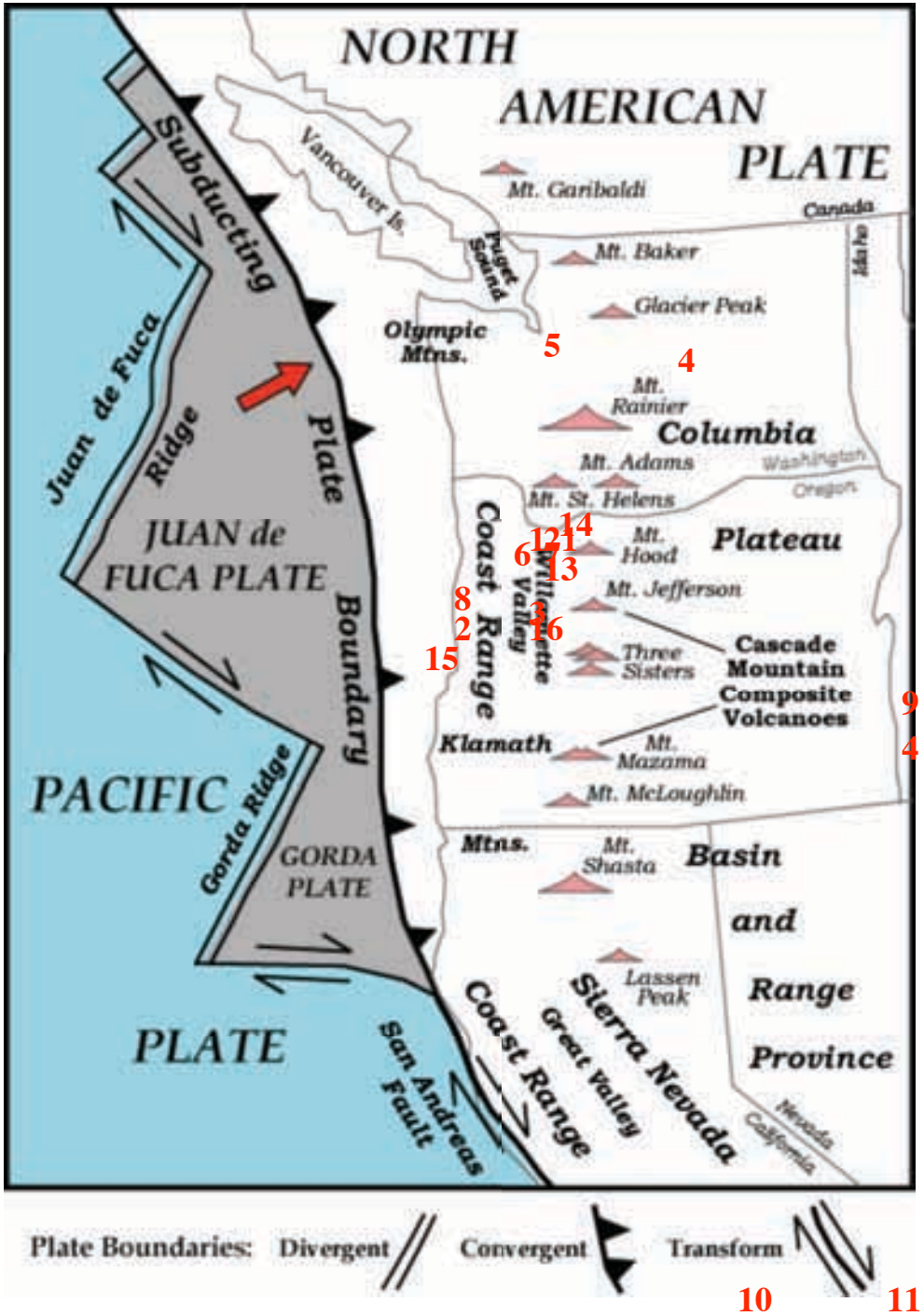
14. Jenda Johnson, Portland

CEETEP Office Administrator

15. Kathryn Hawes, OSU Hatfield Marine Science Center, Newport

Student Assistant

16. Rachel Hausmann, Oregon State University, Corvallis



6

CEETEP Earthquake and Tsunami Education Workshop

Hatfield Marine Science Center

August 12-15, 2013

8
11
7 5
9 2 10 4 3
1

K-12 Teachers:

1. Kama Almasi	Waldport	Waldport High School
2. Josh Beaudry	Newport	Lincoln County School District
3. Sean Bedell	Eddyville	Eddyville Charter School
4. Judith Clark Upton	Toledo	Toledo Jr/Sr High School
5. Annette Delehanty	Depoe Bay	Lincoln County School District
6. Charlotte Kelly	Long Beach, WA	Ilwaco Middle/High School
7. Avery Marvin	Depoe Bay	Taft High School
8. Kate Parker	Neskowin	Neskowin Valley School
9. Rachel Sievers	Newport	Taft Elementary School
10. Dana Spink	Toledo	Toledo Elementary School
11. Kelly Stroh	Lincoln City	Oceanlake Elementary School

20-Second Introductions:

1. Who are you?

2. Your school?

If you wish:

3. One aspect of earthquake and tsunami education you would like to incorporate into your work as a teacher?

CEETEP Earthquake and Tsunami Education Workshop

Hatfield Marine Science Center

August 12-15, 2013

Park/Museum Interpreters:

1. Christian Burns	Newport	Yaquina Head Outstanding Natural Area (BLM)
2. Dawn Grafe	Newport	U. S. Fish and Wildlife Service (USFWS)
3. Rebecca Harver	Newport	Hatfield Marine Science Center (OSU)
4. Brian Hoeh	Yachats	Cape Perpetua Scenic Area (USFS)
5. Carl Krigbaum	Bandon	Bullards Beach State Park (OPRD)
6. Robert Ivey	Eugene	Museum of Natural and Cultural History (UO)
7. Sarah Lobner	Florence	Jessie M. Honeyman Memorial State Park (OPRD)
8. Stephanie Miller	Coos Bay	Sunset Bay State Park (OPRD)
9. Megan Miller-Morgan	Newport	Hatfield Marine Science Center (OSU)
10. Doug Purcell	Newport	Yaquina Head Outstanding Natural Area (BLM)

20-Second Introductions:

1. **Who are you?**
2. **Your park/museum?**

If you wish:

3. **One aspect of earthquake and tsunami education you would like to incorporate into your work as an interpreter?**

CEETEP Earthquake and Tsunami Education Workshop

Hatfield Marine Science Center

August 12-15, 2013

Emergency Management Educators:

3
4 5
1 6

1. Beth Bunce Frame	Yachats	It's A New Day Preschool and Kindergarten
2. Nathan Keffer	Lane/Douglas County	Red Cross
3. Jim Kusz	Lincoln City	North Lincoln Fire and Rescue District #1
4. Anne Schatz	Gleneden Beach	DBFD CERT Leadership
5. Karen Shafer	Gleneden Beach	CERT and other Community Outreach
6. Jim Upton	Newport	Toledo Jr/Sr High School

2

20-Second Introductions:

1. **Who are you?**
2. **Your organization?**

If you wish:

3. **One aspect of earthquake and tsunami education you would like to incorporate into your work as an emergency management educator?**

CEETEP Earthquake and Tsunami Education Workshop

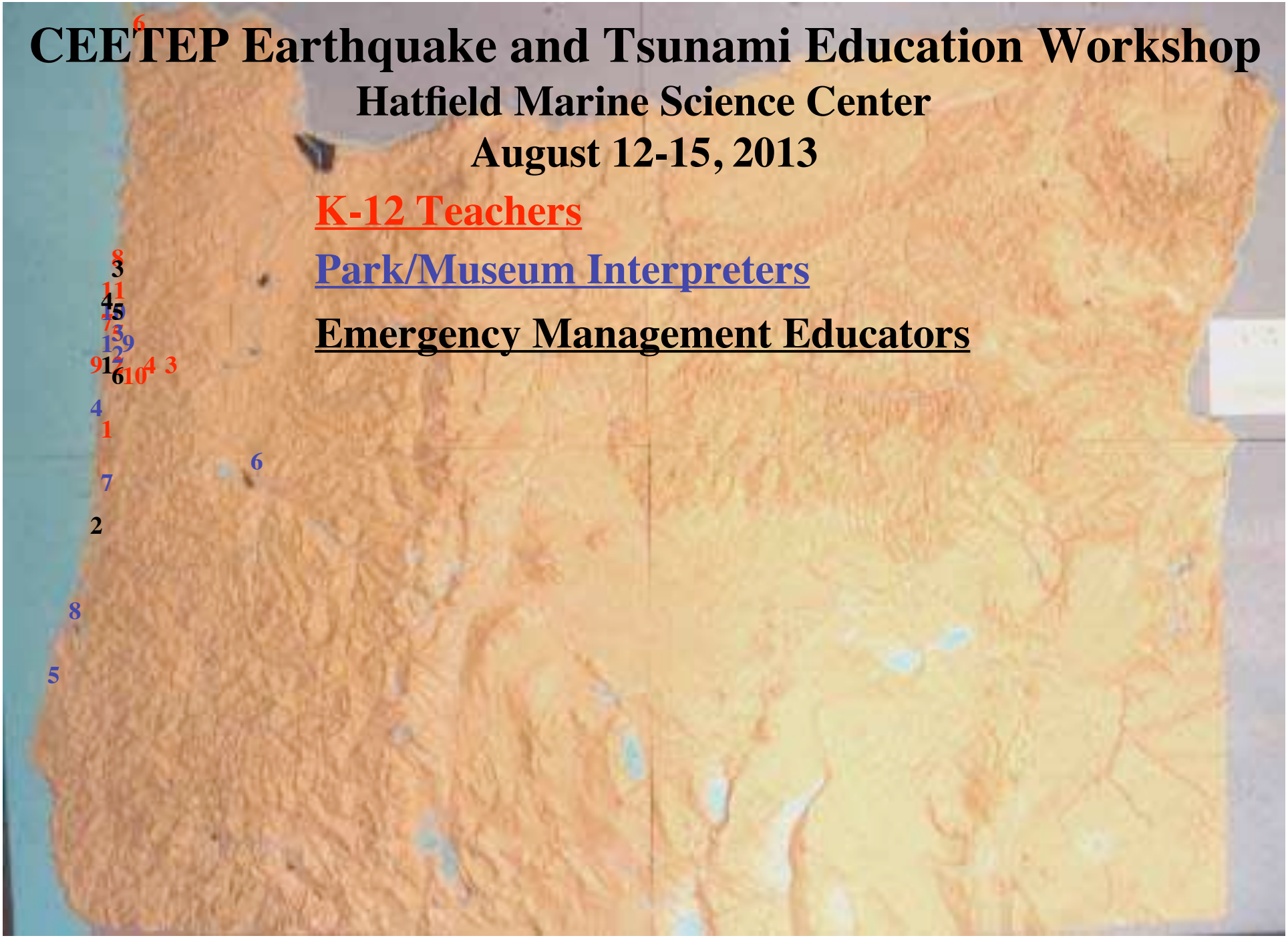
Hatfield Marine Science Center

August 12-15, 2013

K-12 Teachers

Park/Museum Interpreters

Emergency Management Educators

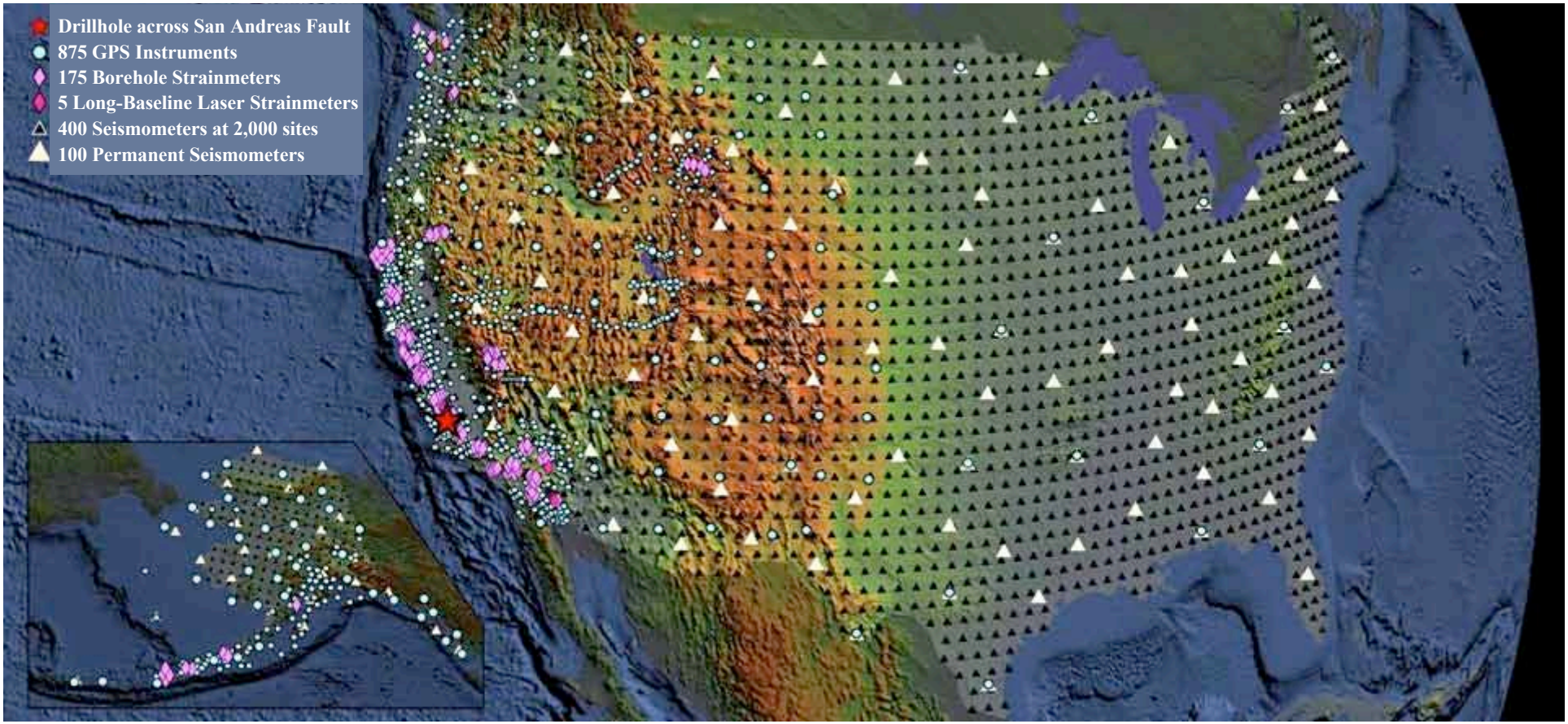


EarthScope

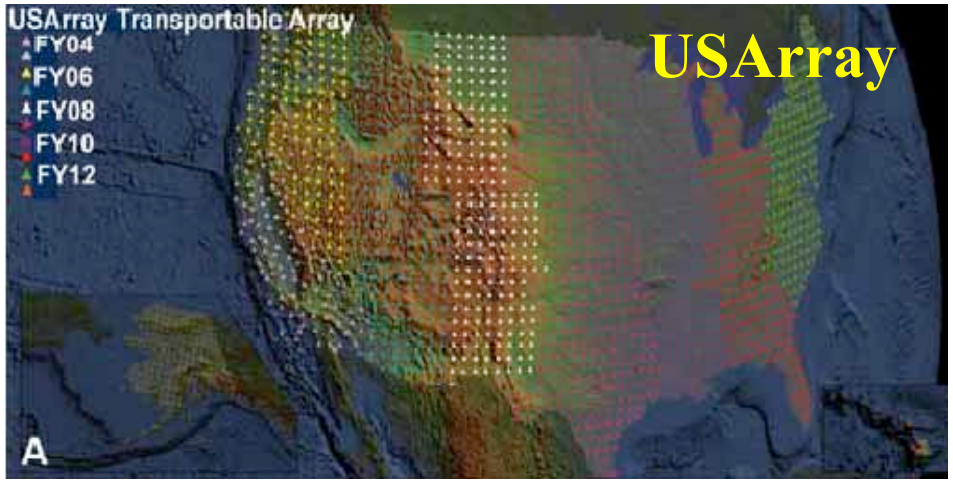
A National Science Foundation (NSF) effort to …..

- Explore the structure and evolution of North American continent
- Study processes that cause earthquakes and volcanic eruptions

EarthScope has three main "observatories" …..



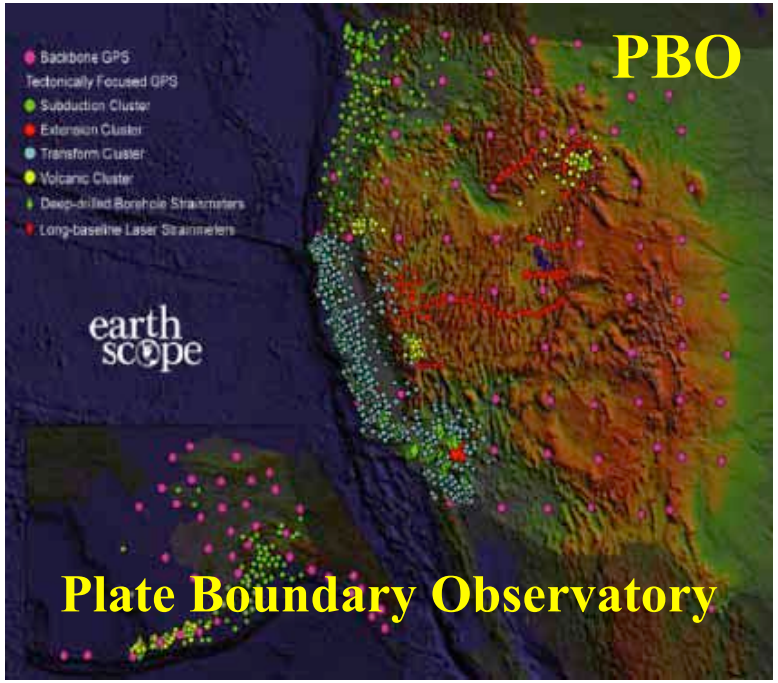
EarthScope Observatories

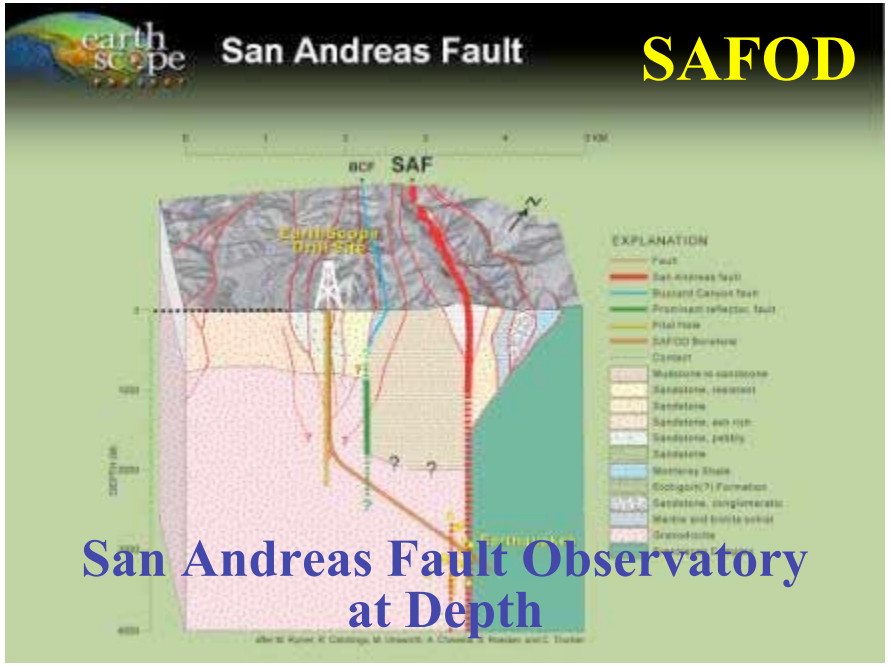


Seismometers

Geodetic Instruments

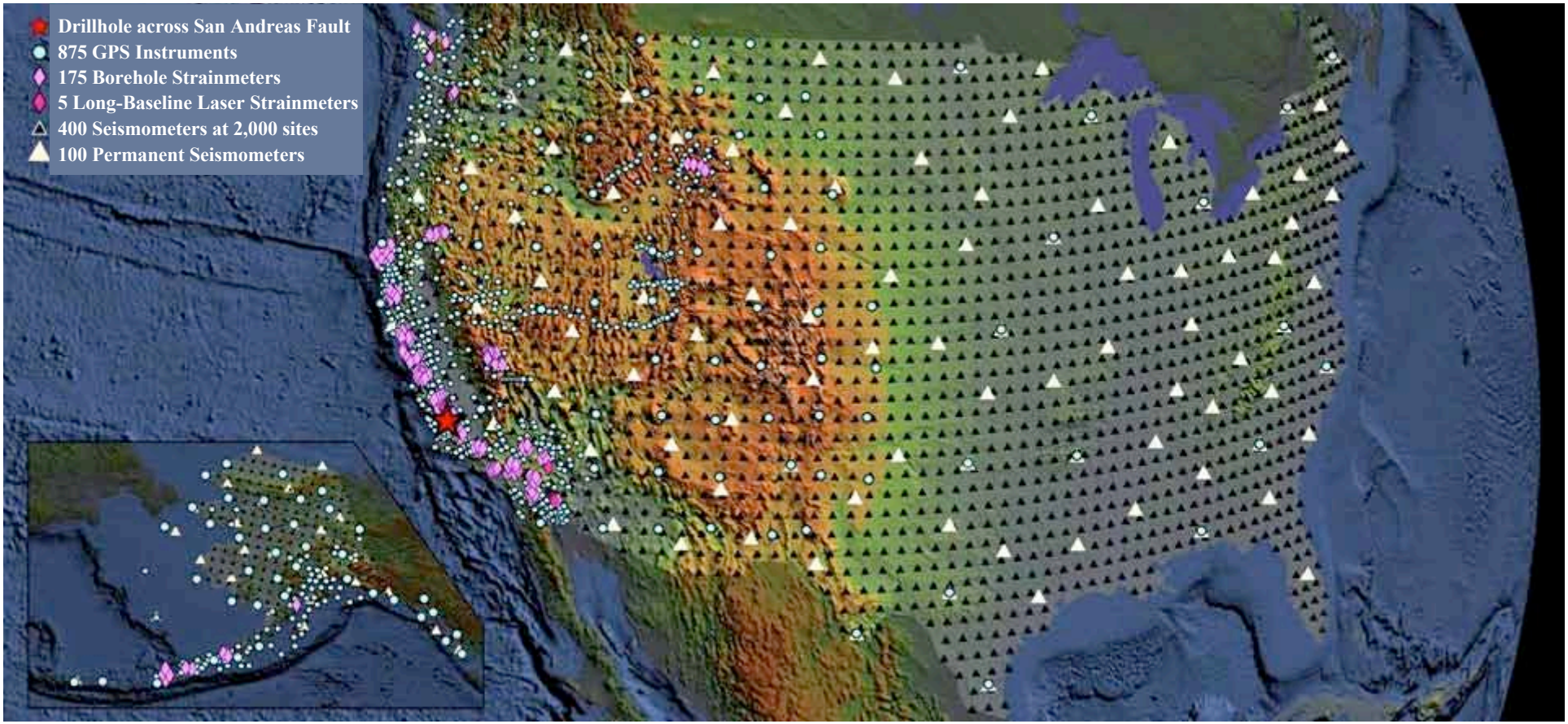
Deep Drillhole





EarthScope

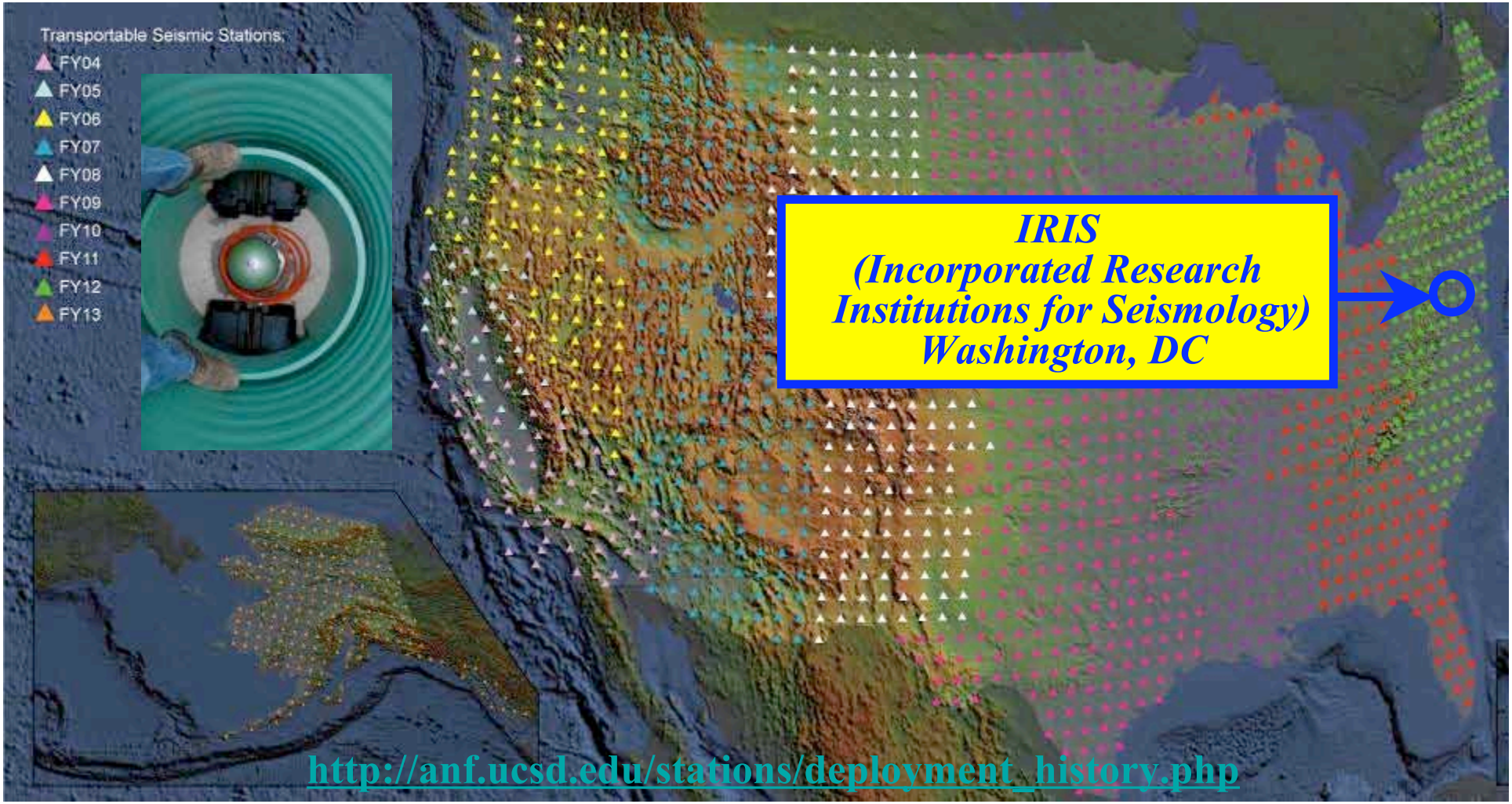
Like a "Hubble Telescope" aimed into the Earth



earth scope Observatories

1. USArray

- Includes 400 Transportable Seismometers
- Each station occupies a site for 1½ to 2 years
- 10 years to leap-frog across the country



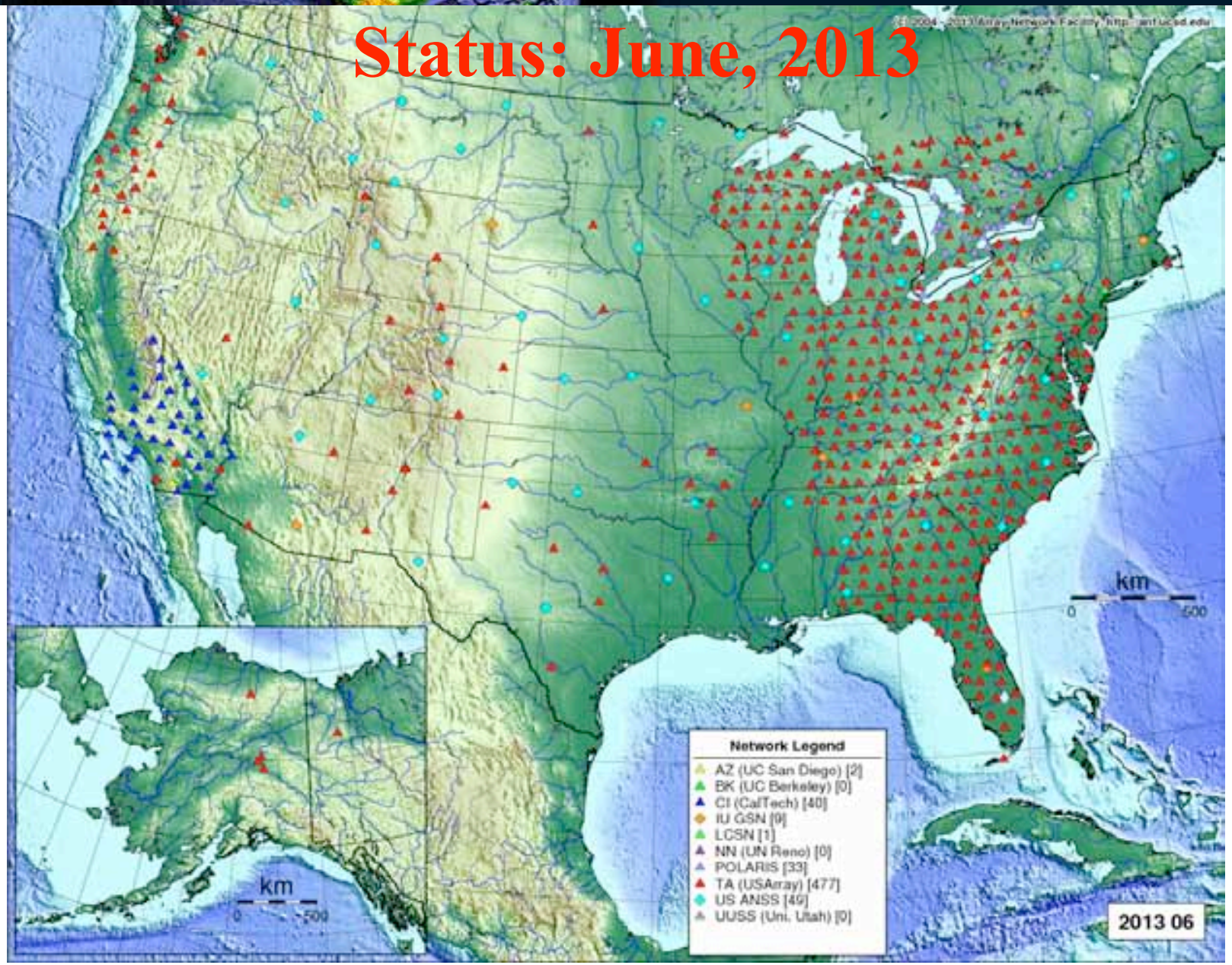
http://anf.ucsd.edu/stations/deployment_history.php

earth scope

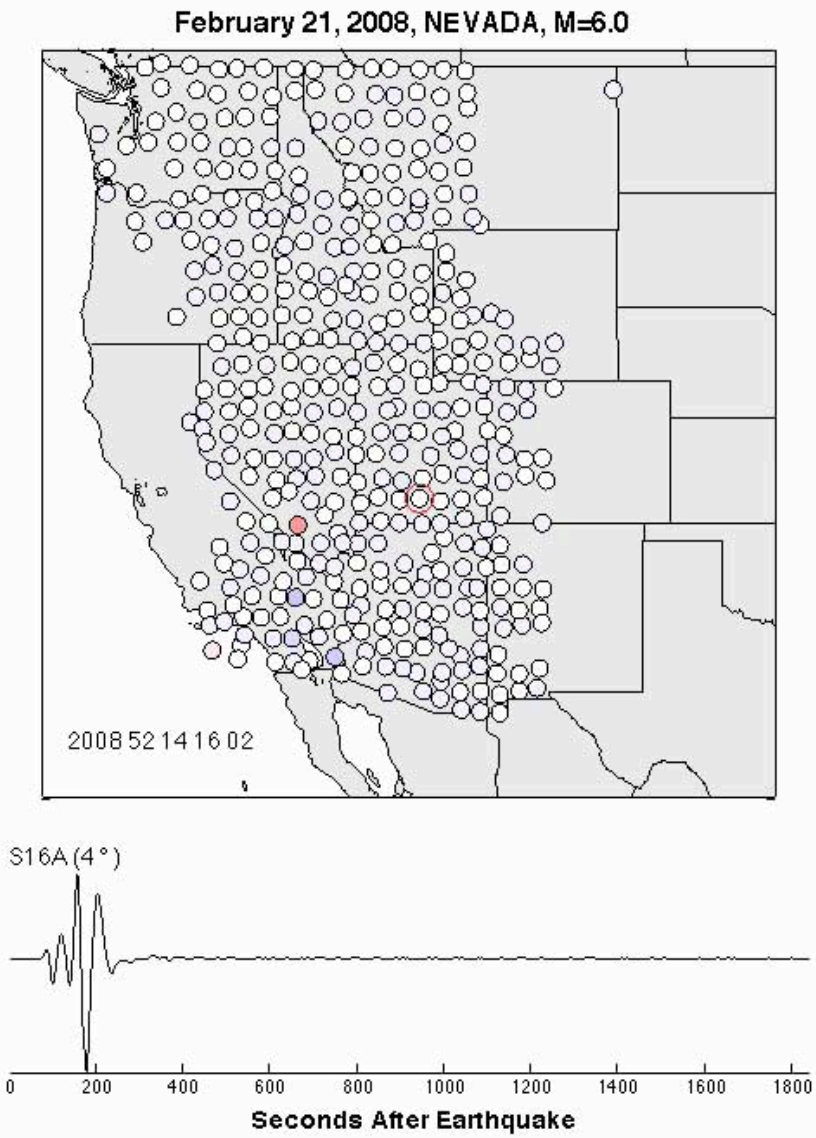
Observatories

1. USArray

Status: June, 2013



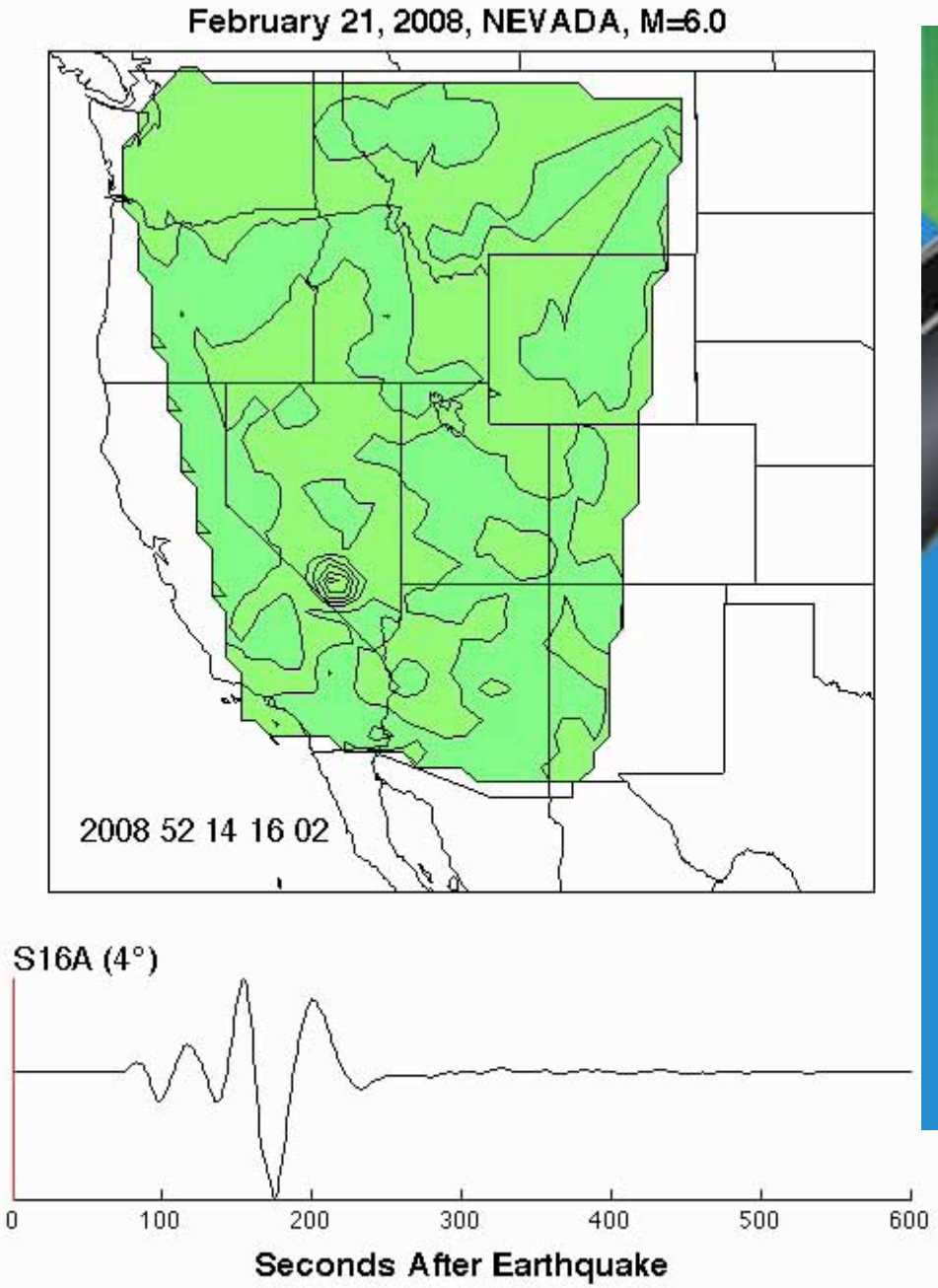
Visualizations



Visualization of Seismic Waves Moving Across USArray

Wells, Nevada, 2008

Bob Woodward - IRIS
Chuck Ammon - Penn State

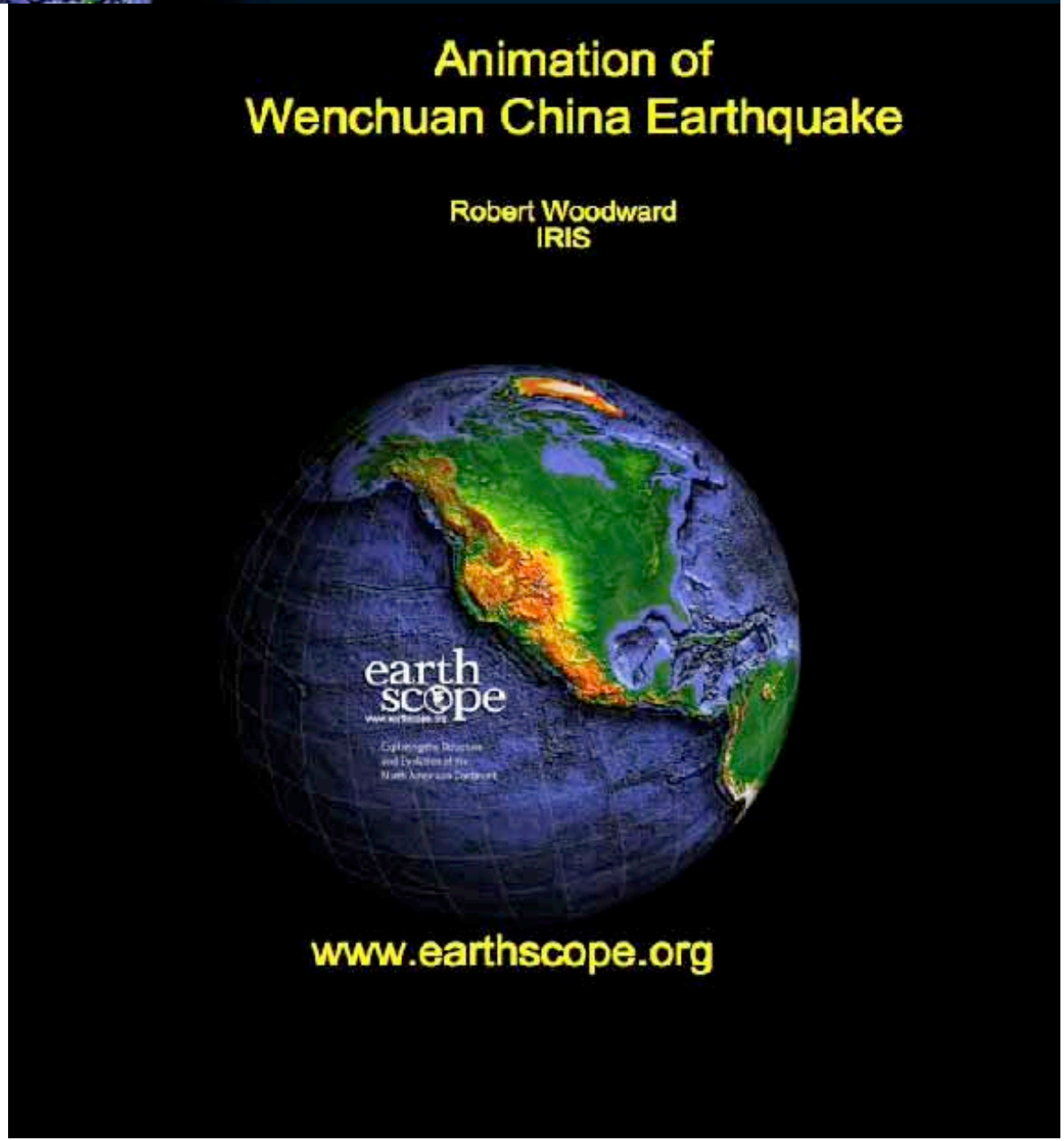

February 21, 2008, NEVADA, M=6.0
2008 52 14 16 02
S16A (4°)
0
100
200
300
400
500
600
Seconds After Earthquake

Visualizations

Visualization of Seismic Waves Moving Across USArray

China, 2008

Bob Woodward - IRIS

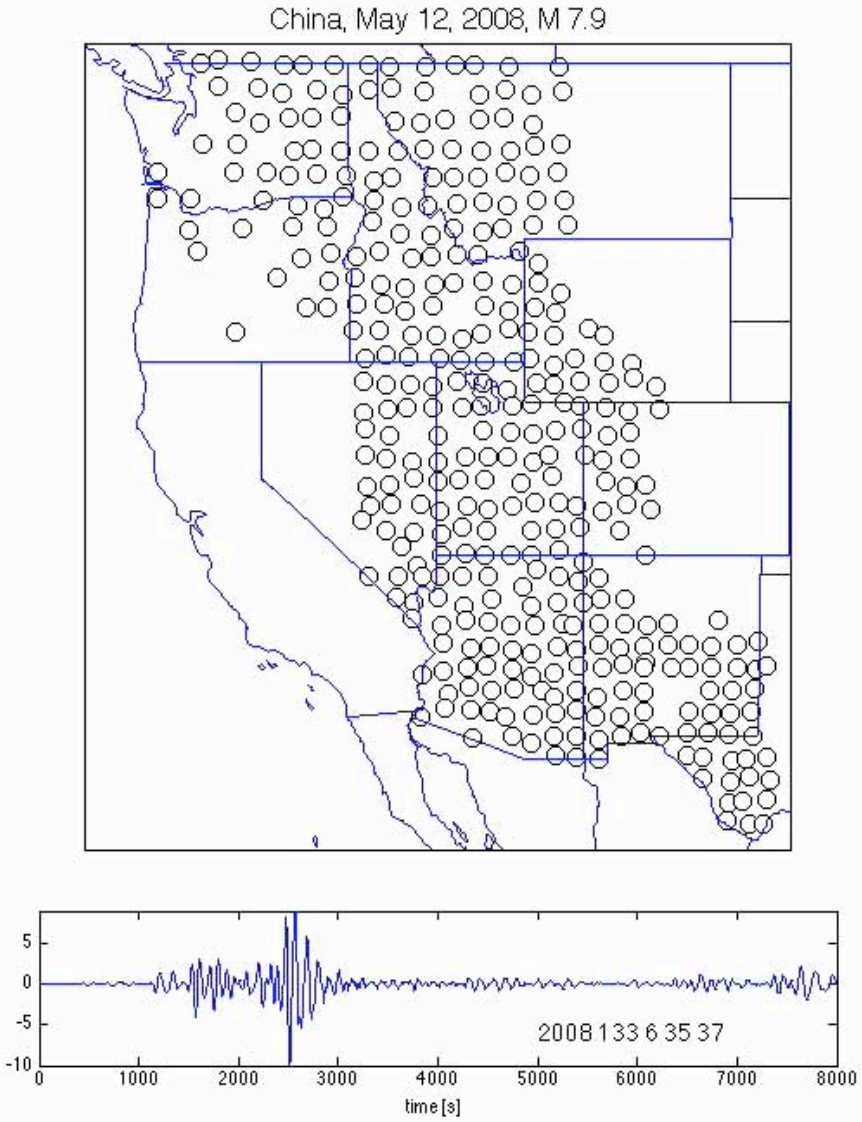


Visualizations

Visualization of Seismic Waves Moving Across USArray - 3D

China, 2008

Bob Woodward - IRIS
Chuck Ammon - Penn State

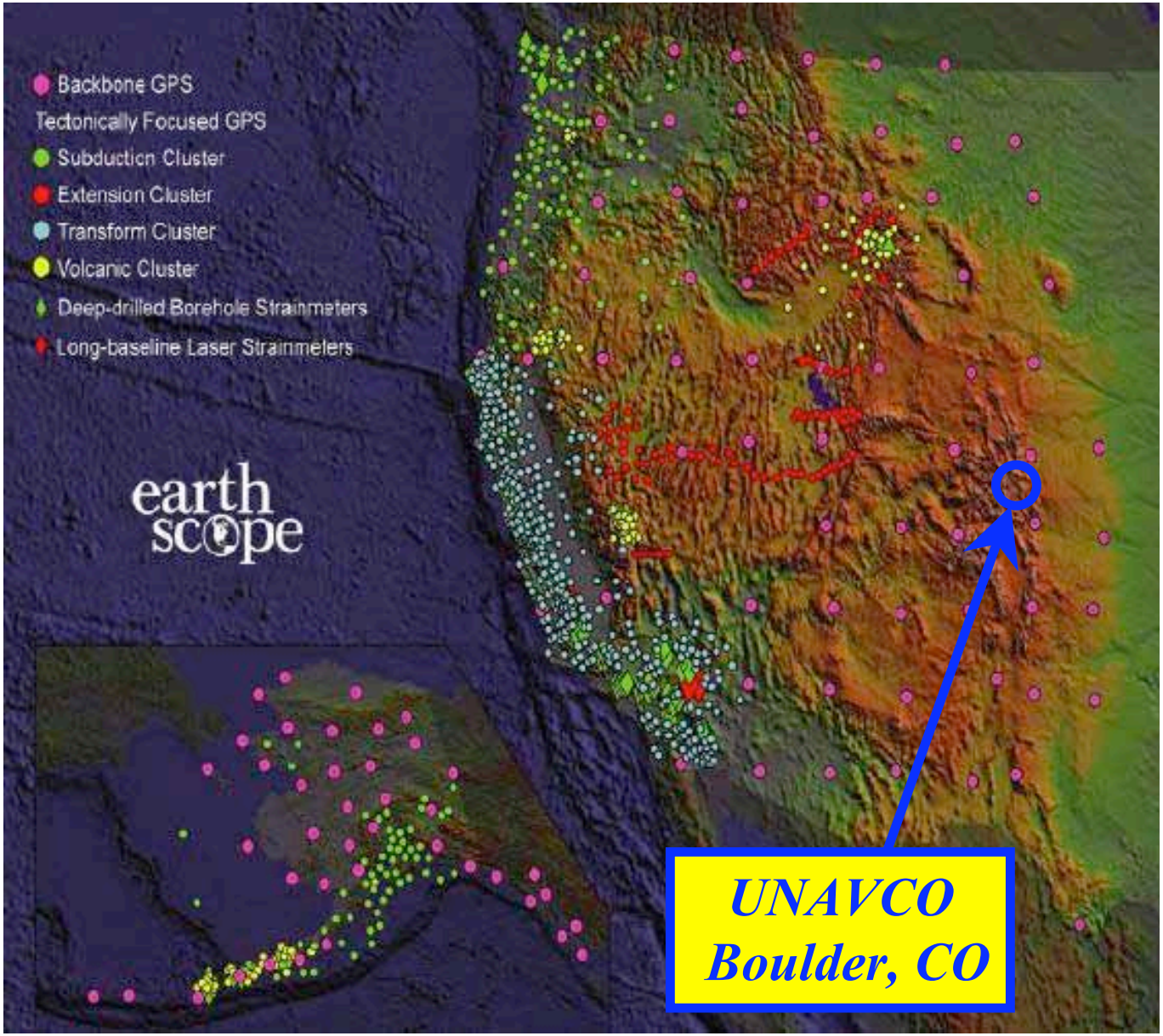


earthscope Observatories

2. PBO
Plate Boundary Observatory

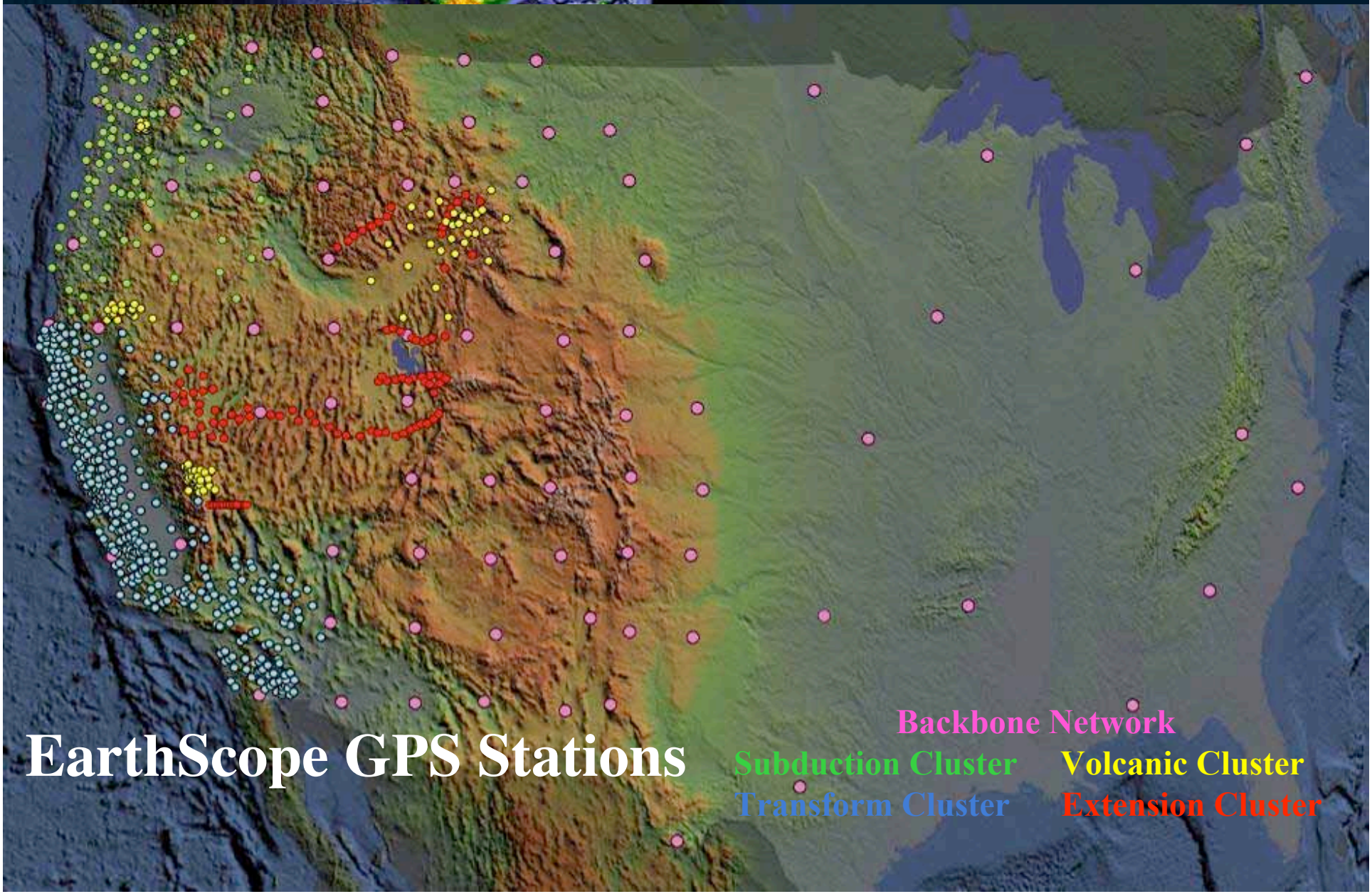
- **GPS Instruments**
- **Strainmeters**

GSP Station
California State University
at San Bernardino



Observatories

2. PBO
Plate Boundary Observatory



Wegener's Dream

"This [direct measurement of continental drift] must be left to the geodesists. I have no doubt that in the not too distant future we will be successful in making a precise measurement of the drift of North America relative to Europe."-- **Alfred Wegener, 1929**

200 million years ago all of the present-day continents combined to form a single supercontinent called Pangaea.

300 Million Years Ago

Supercontinent of Pangea

<u>Geologic Observations</u>
give rates averaged over
<u>Millions of Years</u>

Parks and Plates
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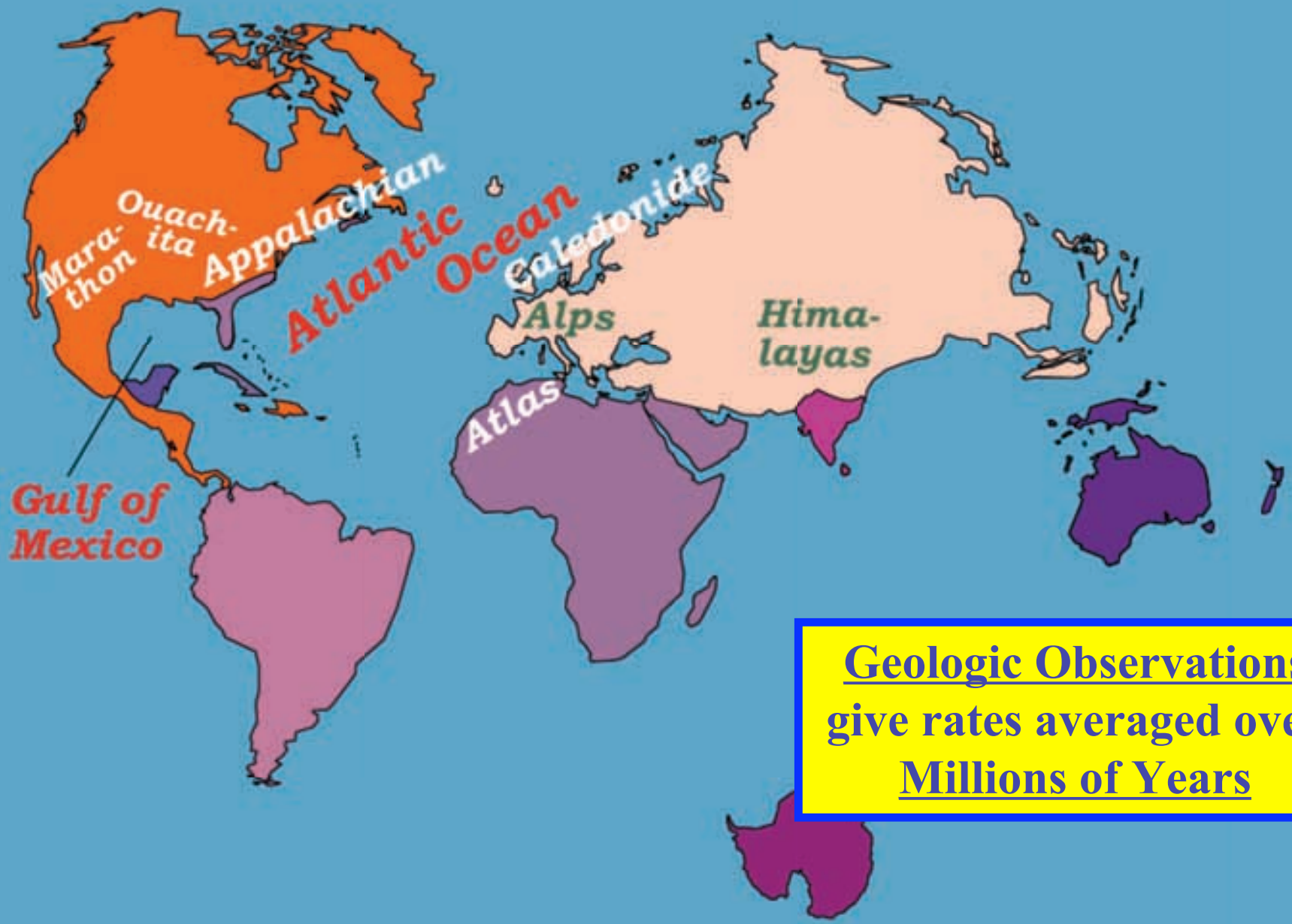
Today *Atlantic Ocean Ocean Continues to Open*



<u>Geologic Observations</u>
give rates averaged over
<u>Millions of Years</u>

Parks and Plates
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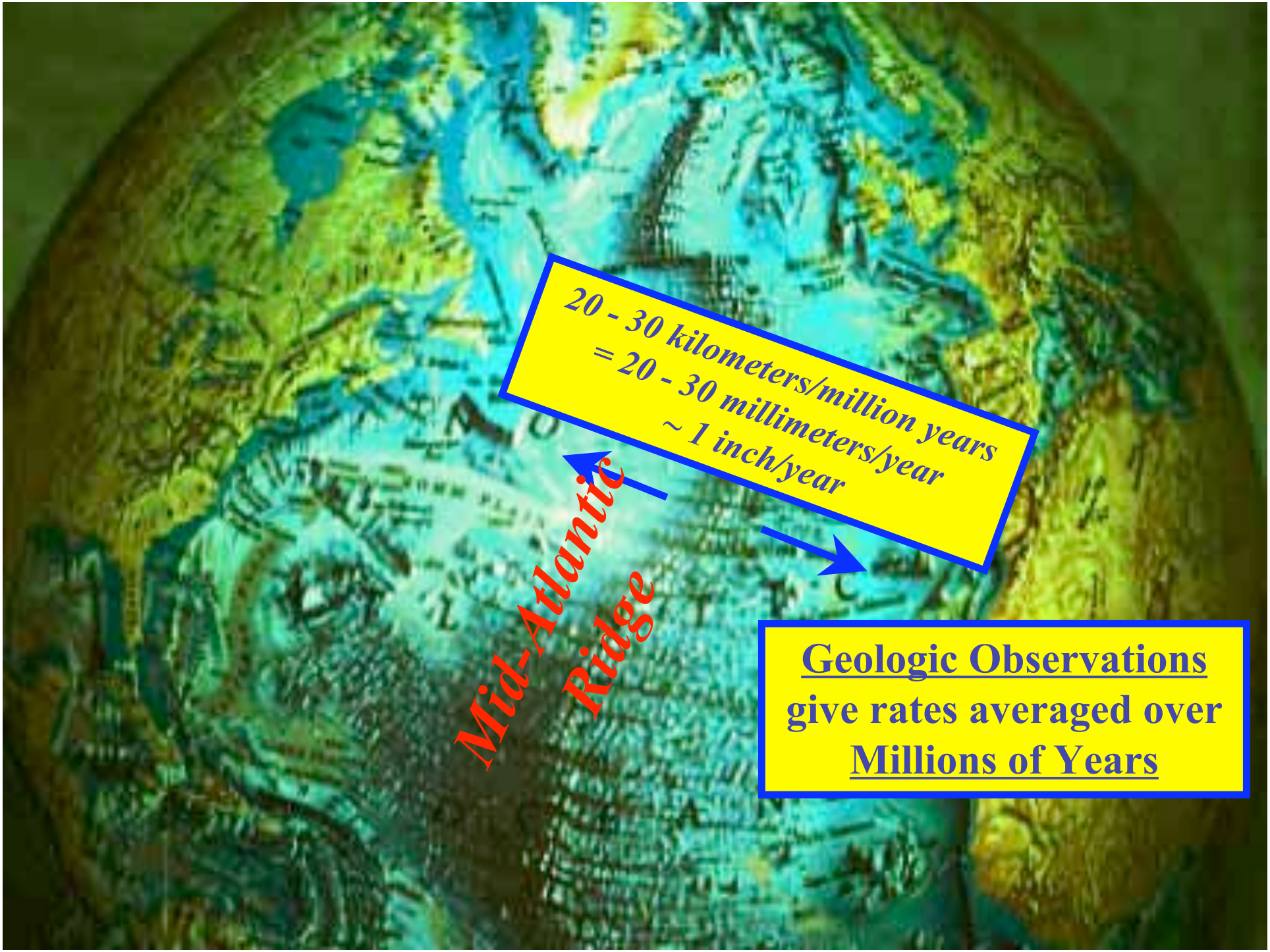
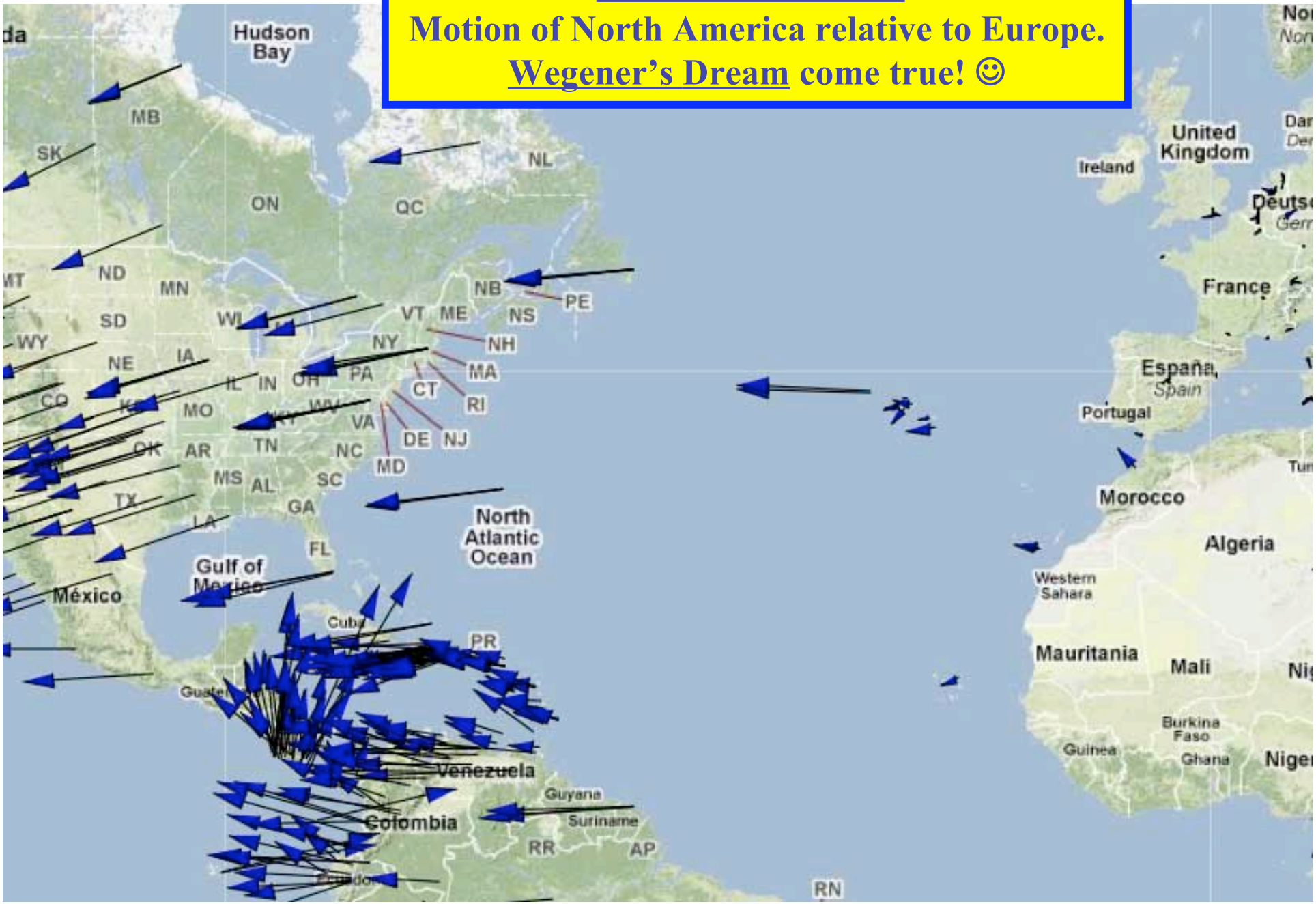
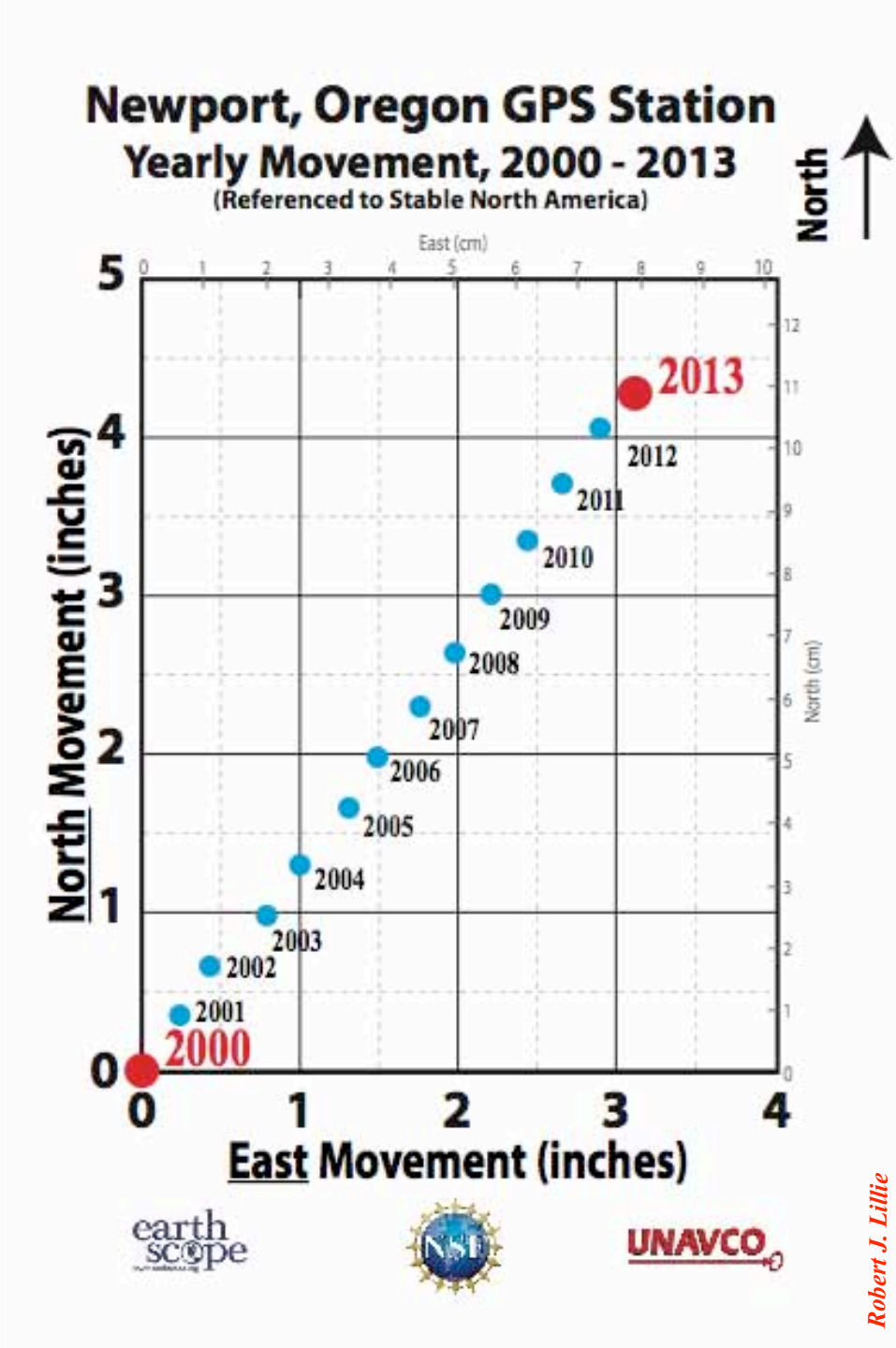
Mid-Atlantic
Ridge


20 - 30 kilometers/million years
= 20 - 30 millimeters/year
~ 1 inch/year
Mid-Atlantic Ridge
Geologic Observations
give rates averaged over
Millions of Years

GPS Measurements:
Motion of North America relative to Europe.
Wegener's Dream come true! ☺

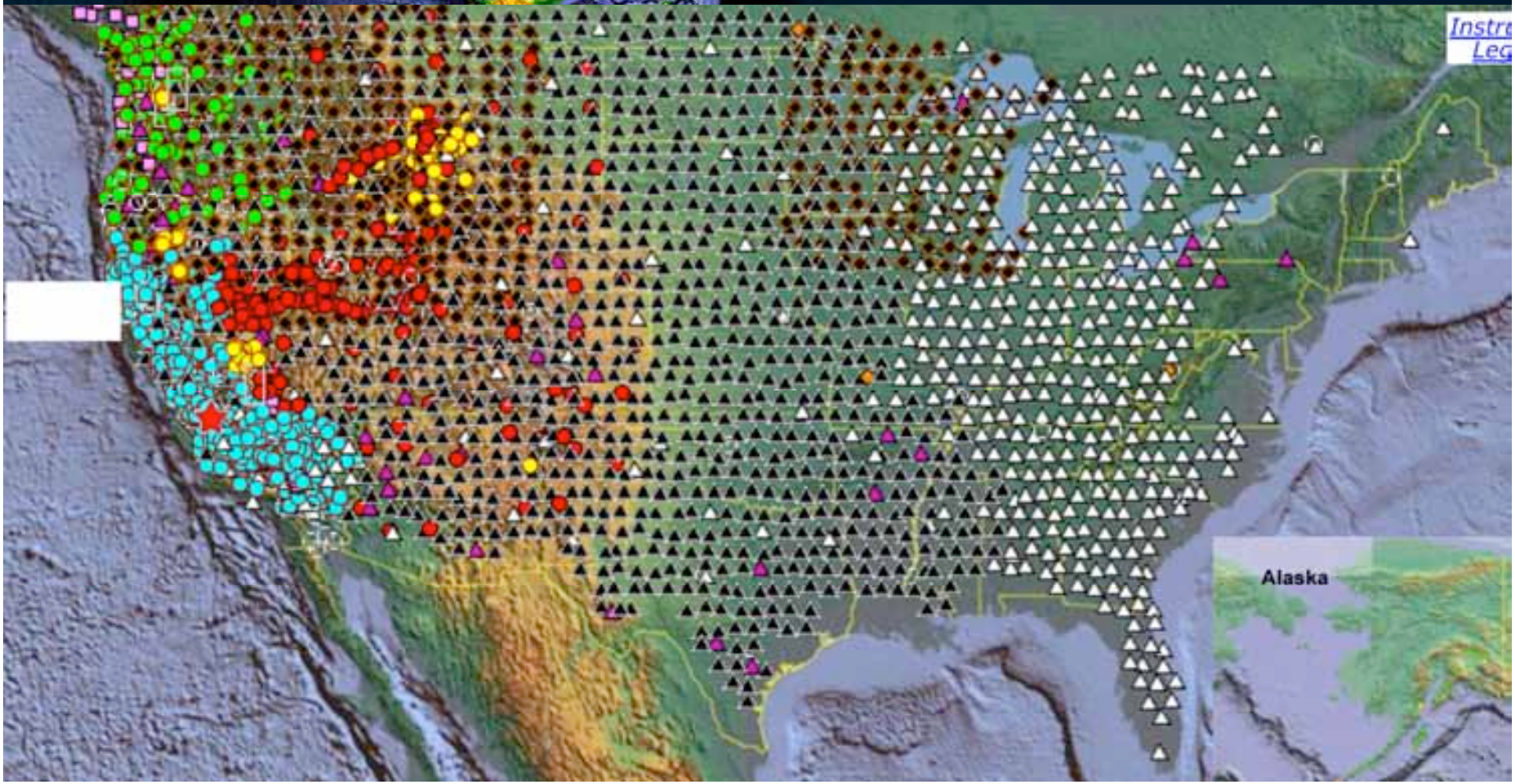


Illinois EarthScope 2010



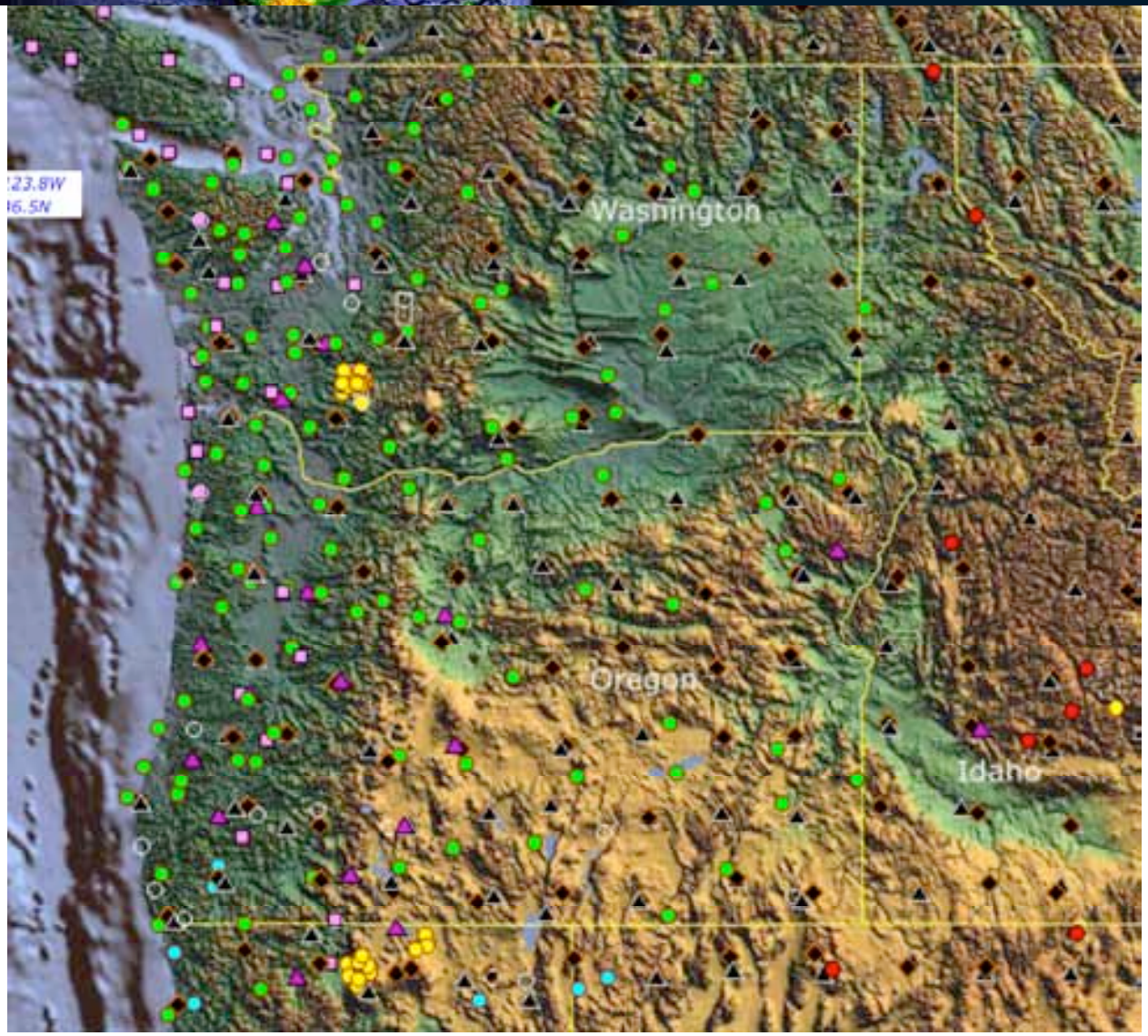
Robert J. Lillie

EarthScope Station Status
July 1, 2013



http://www.earthscope.org/current_status

Pacific Northwest Status
July 1, 2013



http://www.earthscope.org/current_status/showstatus.php?map=NW&Facility=All&Instrument=All&StartDate=2000-01-01&Display=Instruments

Cascadia Initiative

New seismometers being deployed offshore and onshore to complement existing onshore seismometers and GPS instruments

Four year project:

2011 - 2014

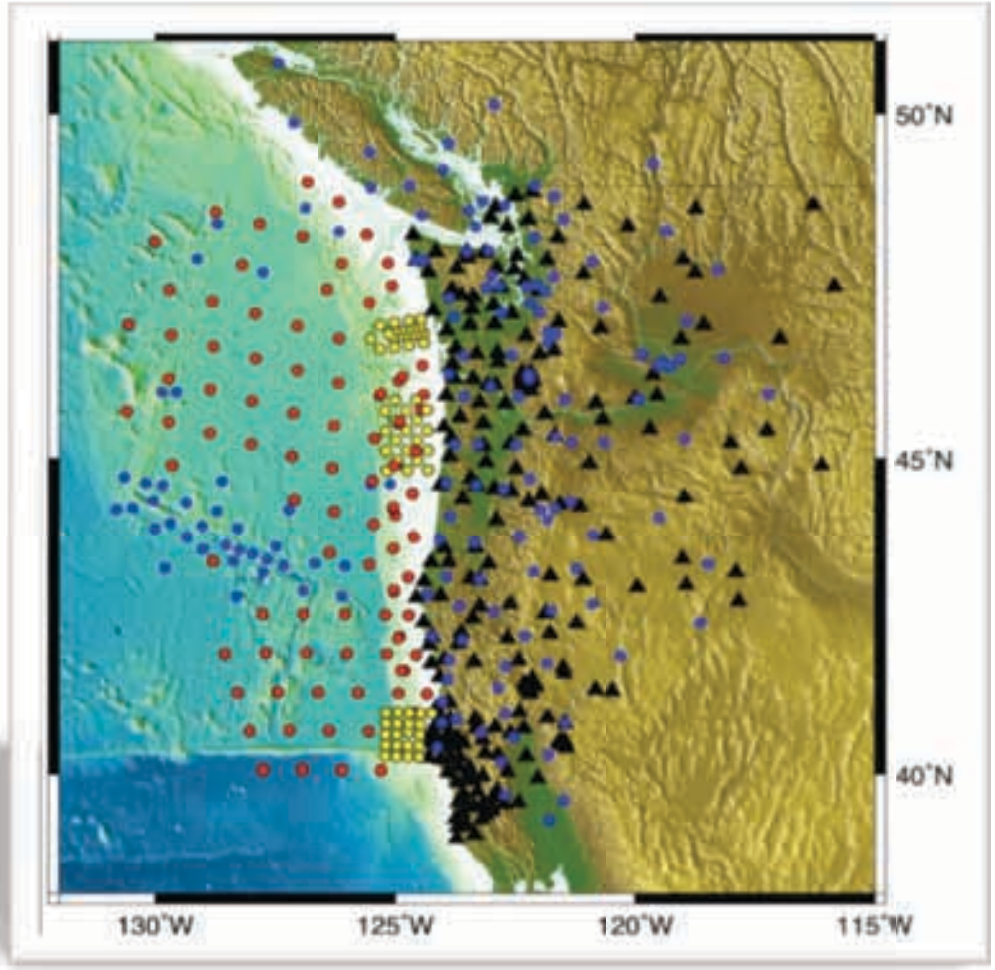
Onshore:

232 GPS stations

27 seismometers

Offshore:

60 ocean-bottom seismometers



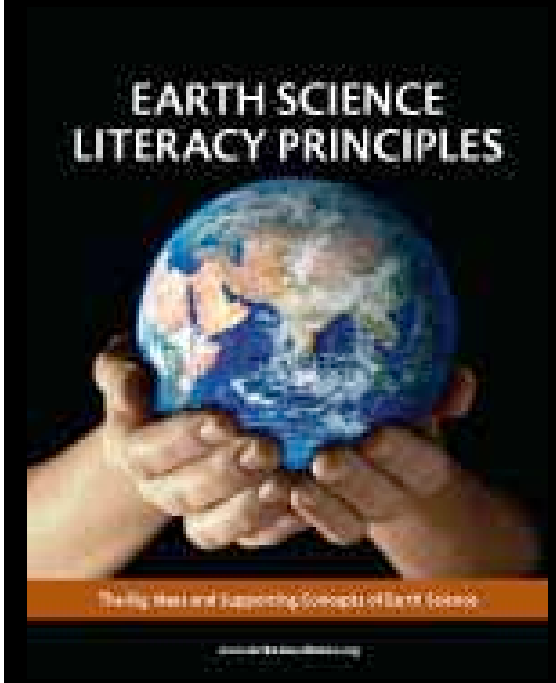
Education and Outreach Goals

1. Create high profile **EarthScope identity**
2. Promote science literacy through **informal education**
3. Advance **formal education** in the classroom
4. Foster use of **data, discoveries, technology**
5. Establish sense of **community ownership**

Earth Science Literacy Principles

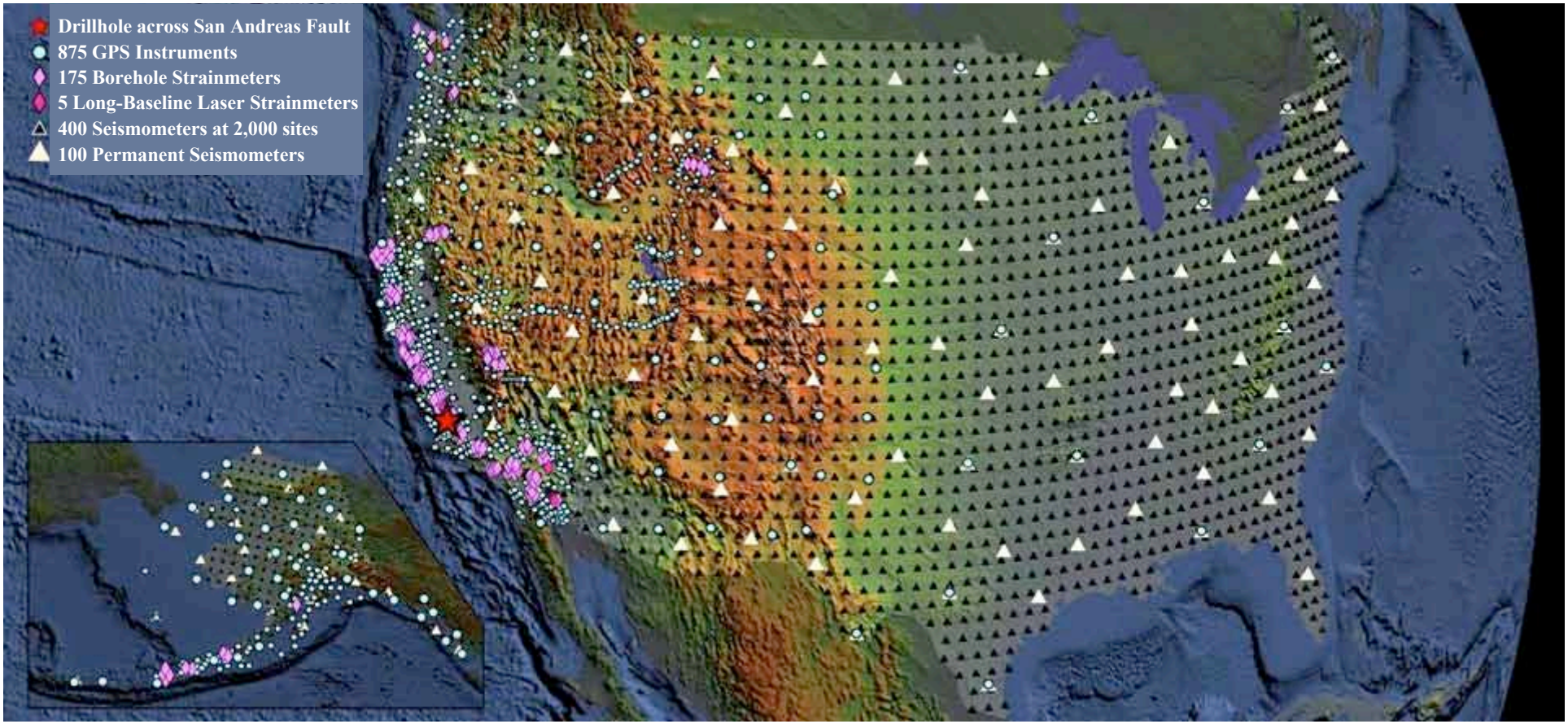
http://www.earthscienceliteracy.org

Big Ideas:



1. Earth scientists use repeatable observations and testable ideas to understand and explain our planet.
2. Earth is 4.6 billion years old.
3. Earth is a complex system of interacting rock, water, air, and life.
4. Earth is continuously changing.
5. Earth is the water planet.
6. Life evolves on a dynamic Earth and continuously modifies Earth.
7. Humans depend on Earth for resources.
8. Natural hazards pose risks to humans.
9. Humans significantly alter the Earth.

EarthScope

Sense of Place …..

- Our hometowns and other special places are part of exciting new exploration and discovery.
- Our communities are not standing still--they are moving!