CEETEP

Cascadia EarthScope Earthquake and Tsunami Education Program

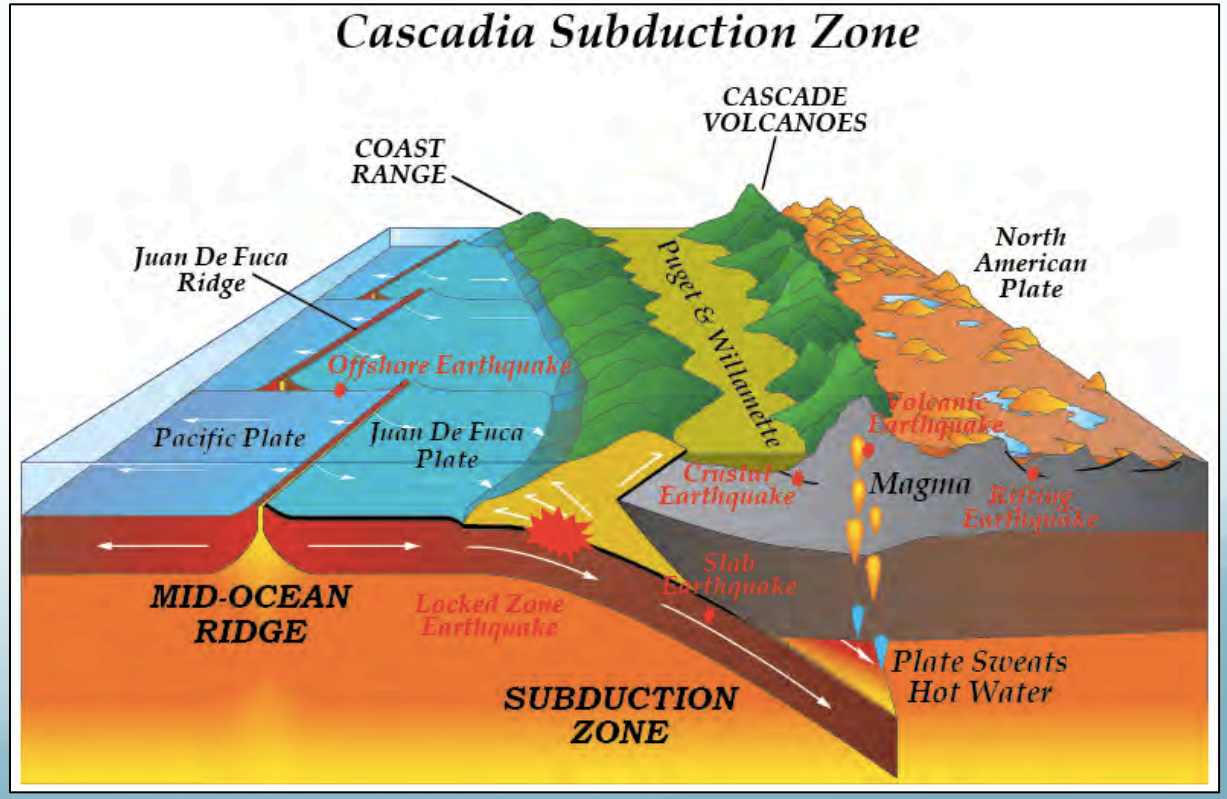
Professional development workshops for coastal teachers, interpreters, and emergency management educators.

Bob Butler
University of Portland

Nancy Hunter

Bob Lillie
Oregon State University

Beth Pratt-Sitaula
Central Washington University

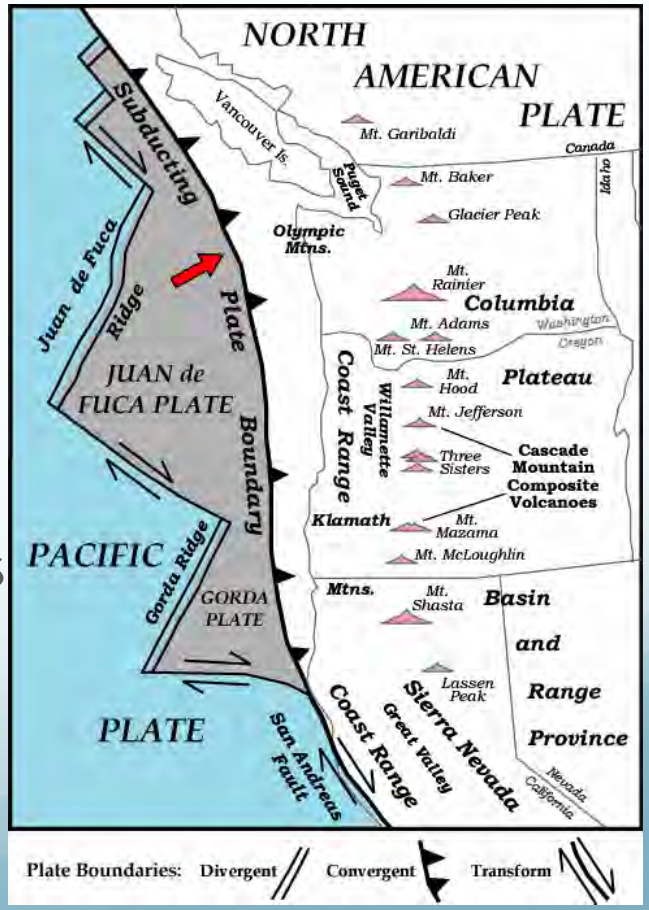


Introductions

- CEETEP
- Instructors
- Participants
- EarthScope

CEETEP

- Primary Aim: Improve disaster resilience through educator professional development
- Goals – Participants will:
  - **Learn Geoscience** and be able to communicate about earthquake and tsunami science and research
  - **Understand Risk** and be able to communicate about Cascadia geohazards
  - **Take Action** and be able to work with learners to improve preparedness
  - **Exchange Pedagogy** on how to teach about EarthScope, hazards/risk, and preparedness



Beauty and the Beast

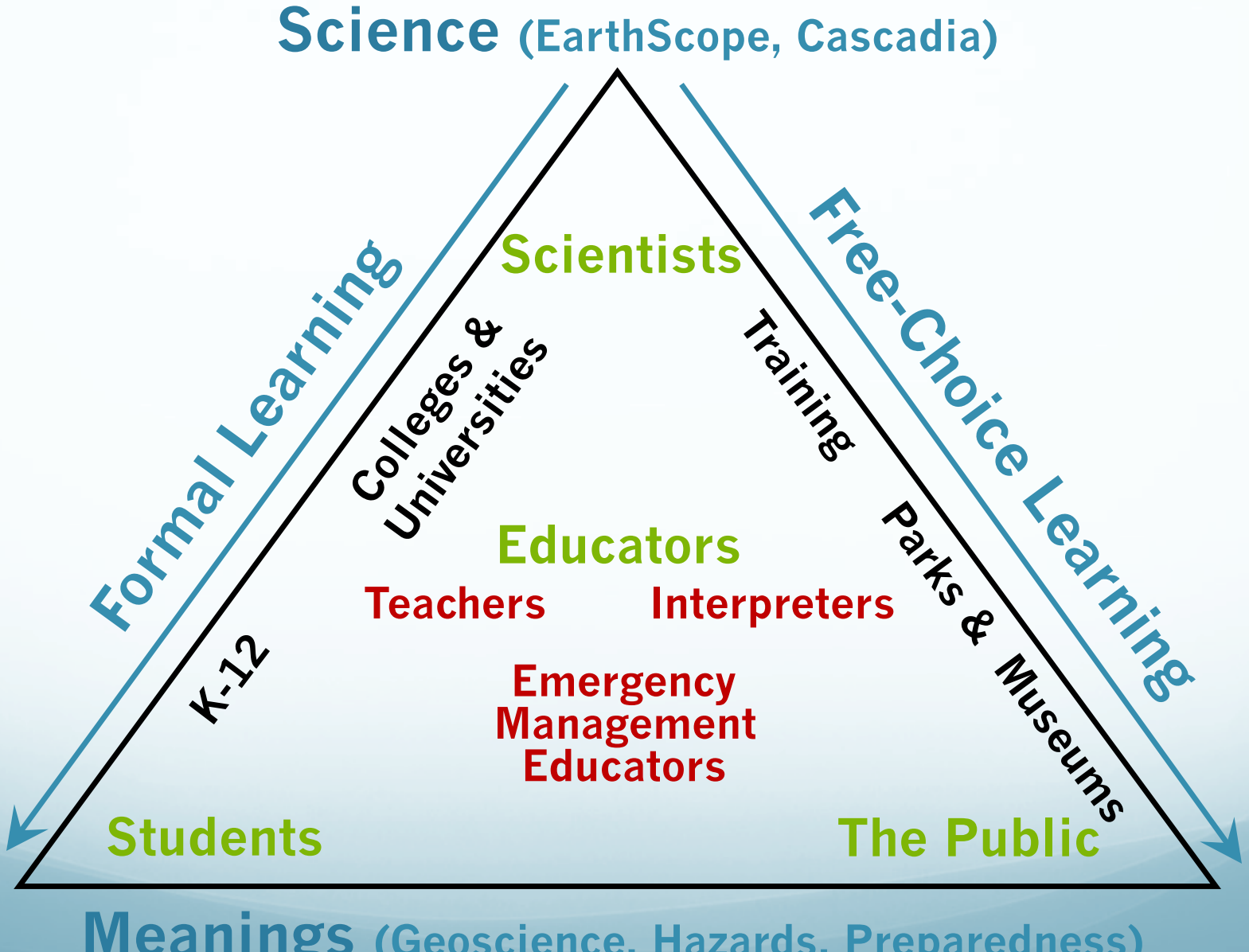
"The same geological processes that threaten our lives with earthquakes and tsunamis also nourish our spirits by creating the spectacular headlands and beaches of the Pacific Northwest." – Bob Lillie

CEETEP Precursors

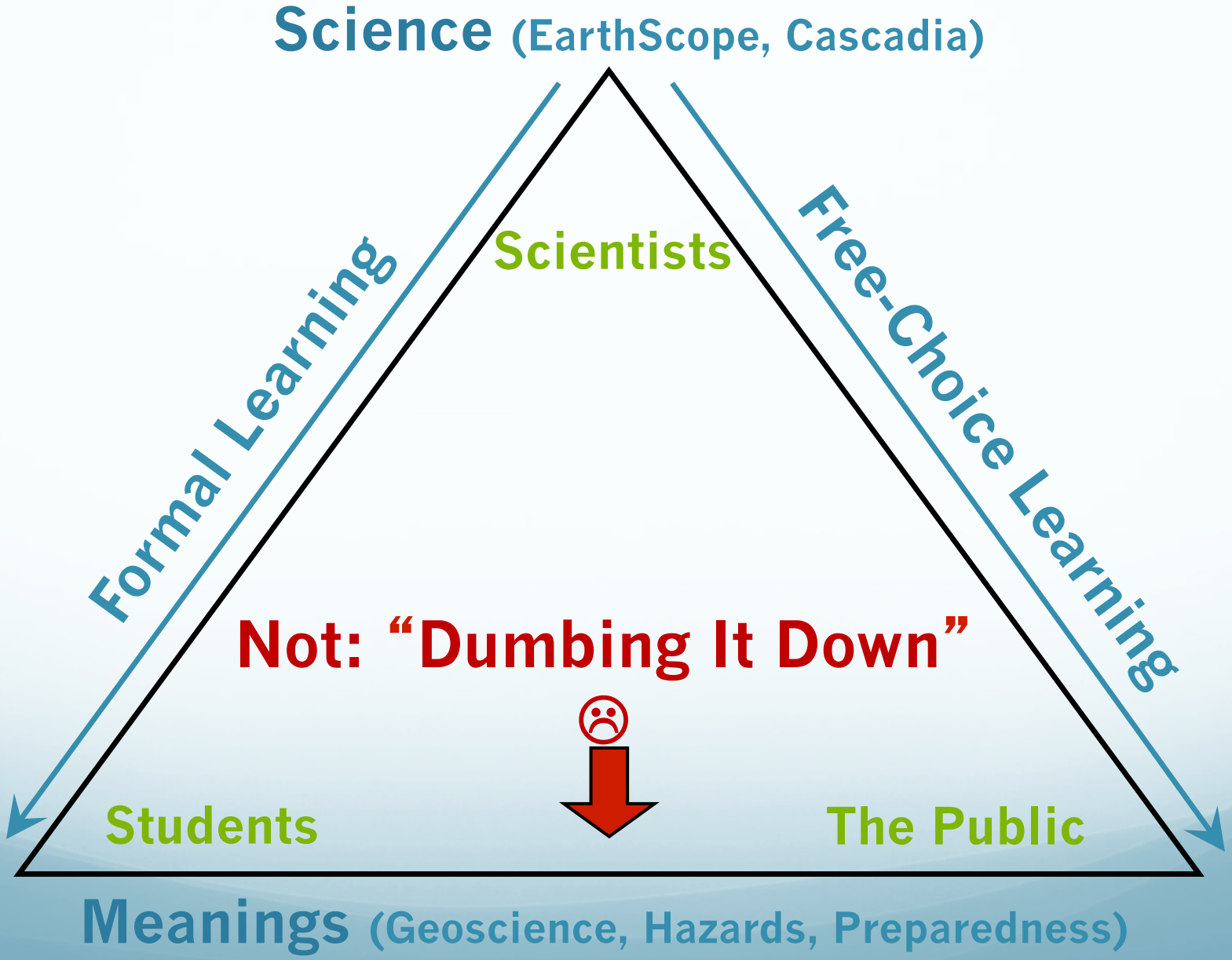
Teachers on the Leading Edge (TOTLE)
Workshops for Earth Science Teachers in Oregon and Washington (2005 - 2011)

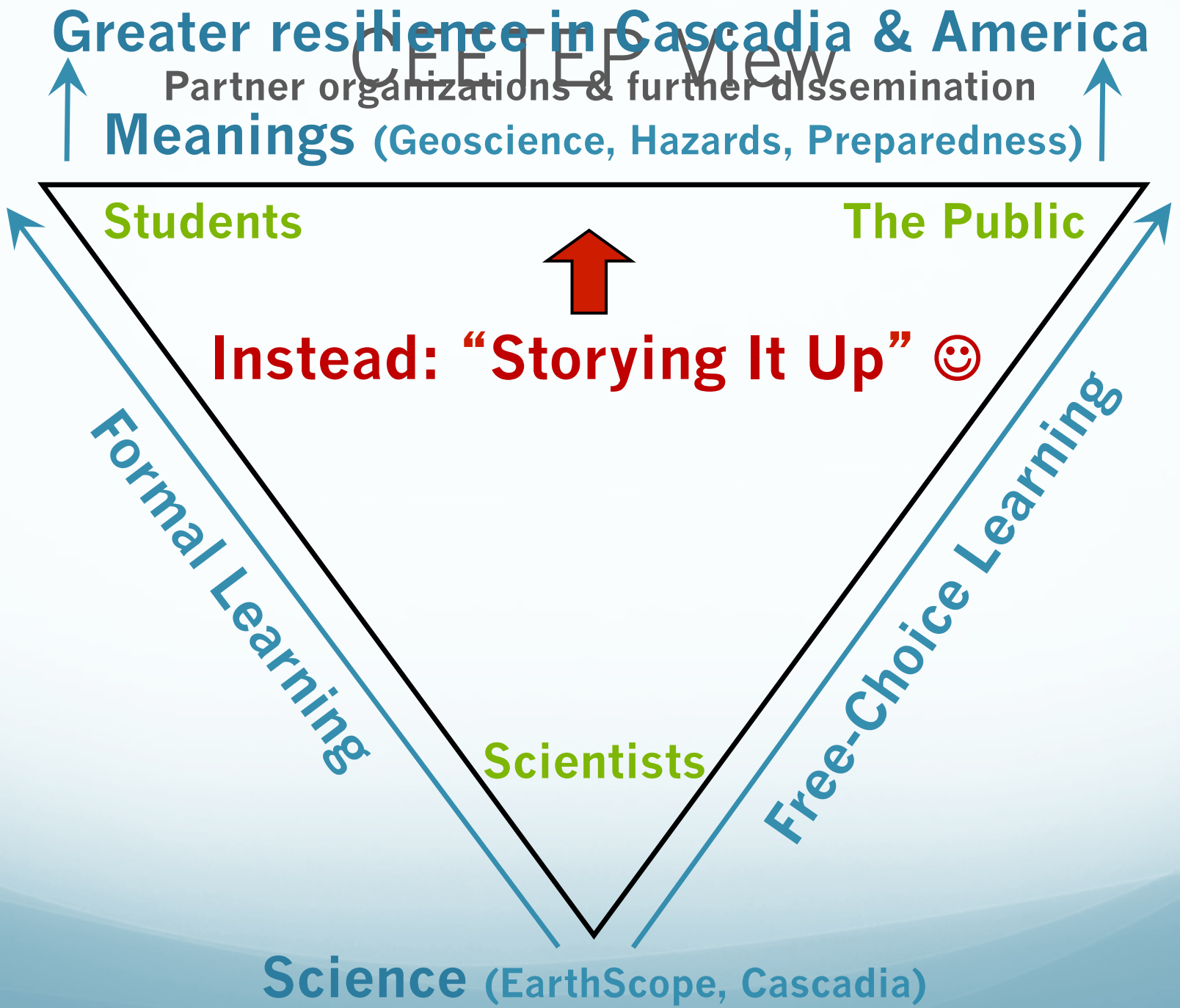
EarthScope Education and Outreach
Workshops for Interpretive Professionals in Parks and Museums (2008 - Present)

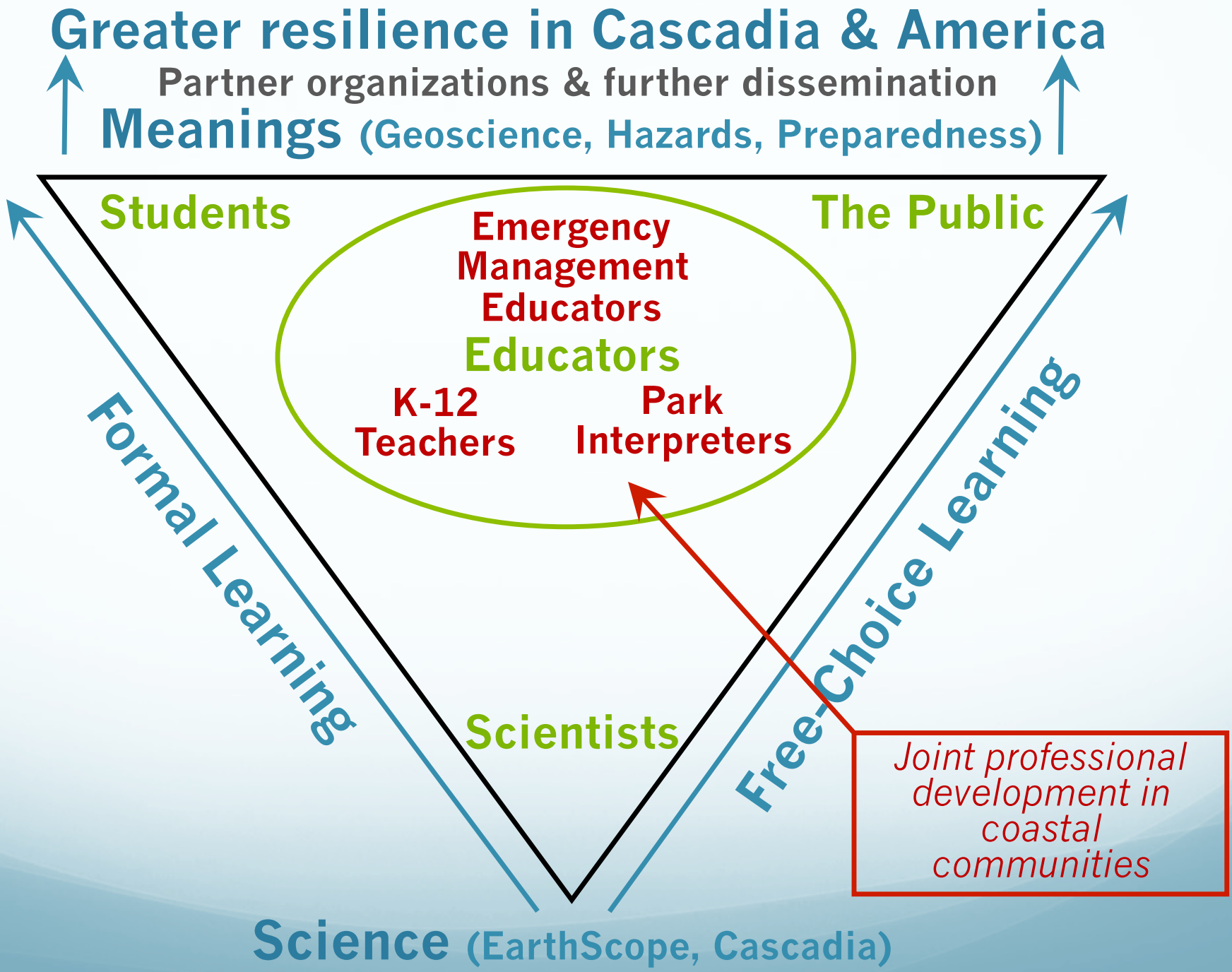
Traditional View



Rethinking the View




Greater resilience in Cascadia & America
CEETEP View
Partner organizations & further dissemination
Meanings (Geoscience, Hazards, Preparedness)
Students
The Public
Instead: "Storying It Up" ☺
Formal Learning
Free-Choice Learning
Scientists
Science (EarthScope, Cascadia)


Greater resilience in Cascadia & America
Partner organizations & further dissemination
Meanings (Geoscience, Hazards, Preparedness)
Students
The Public
Emergency Management Educators
Educators
K-12 Teachers
Park Interpreters
Formal Learning
Free-Choice Learning
Scientists
Joint professional development in coastal communities
Science (EarthScope, Cascadia)

Galvanizing change in preparedness

- Research on behavioral change (Wood 2012; Mileti 2011)
  - Simple consistent messaging on what TO DO
  - From many trusted sources
  - For a long long time
  - Seeing others take preparedness steps
- FEMA (2010) suggests that science classrooms are under-utilized for hazard and preparedness connections

FEMA, Bringing Youth Preparedness Education to the Forefront: A Literature Review and Recommendations, Federal Emergency Management Administration. 21 pp., 2010. Available from: http://www.citizencorps.gov/resources/research/prepresearch.shtm

Mileti and colleagues (National Hazards Center, University of Colorado) http://www.colorado.edu/hazards/

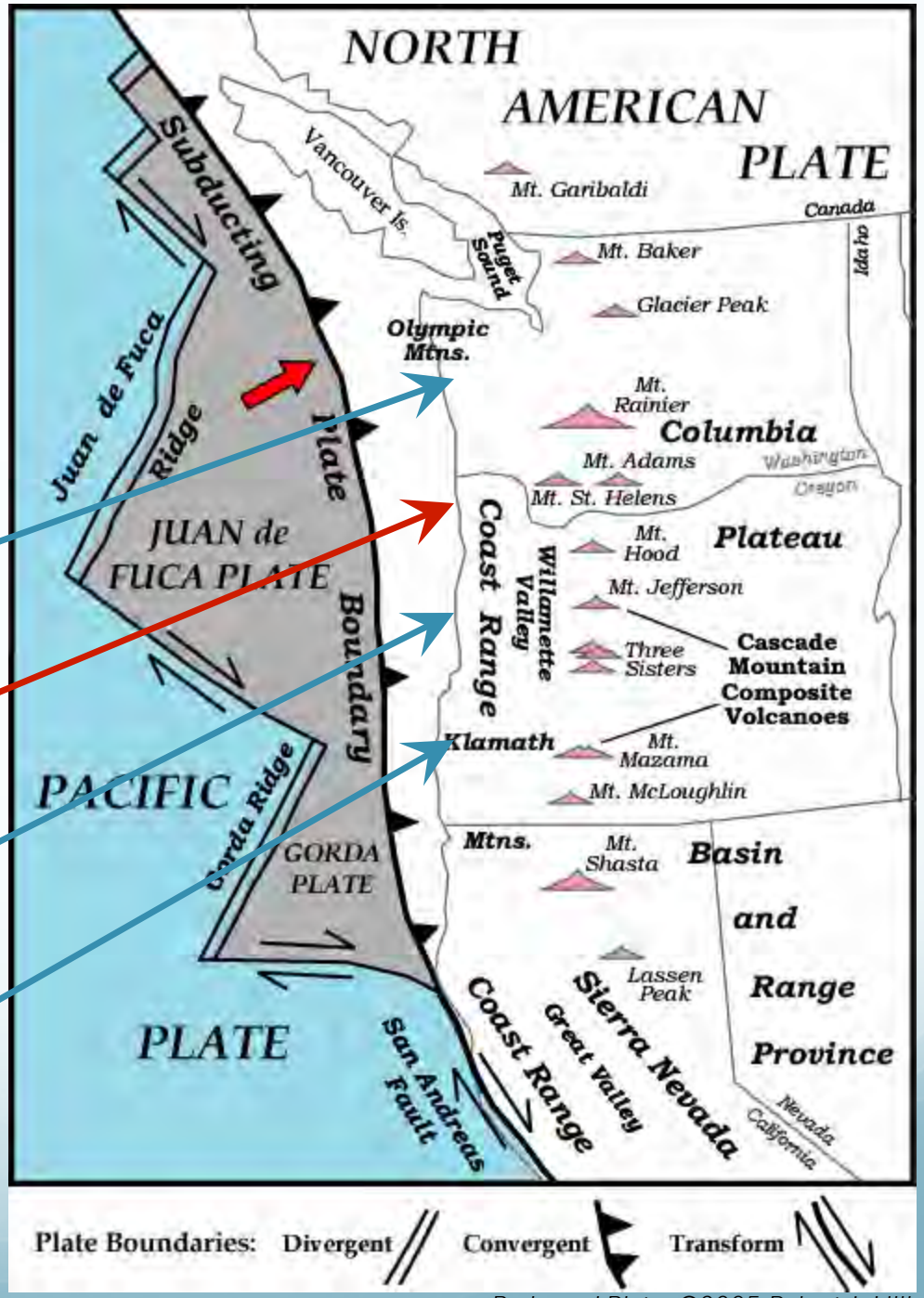
Wood, M. M., D. S. Mileti, M. Kano, M. M. Kelley, R. Regan, & L. B. Bourque, Communicating Actionable Risk for Terrorism and Other Hazards, Risk Analysis, v. 32, 601–615, 2012.

CEETEP

Cascadia EarthScope Earthquake and Tsunami Education Program

Workshops on Cascadia Science and Preparedness:

- *Gray's Harbor & Olympic Peninsula 2014*
- *Astoria, Oregon October 11-14, 2013*
- *Newport, Oregon August 12-15, 2013*
- *Coos Bay & South Oregon 2015*



Parks and Plates ©2005 Robert J. Lillie

Astoria workshop space

- Columbia Hall 219 – Main room
- Columbia Hall 221 – Drinks, snacks, lunch and some breakout activities or team planning
- Water fountains & Restrooms – Far other end of hallway

CEETEP Binder

- Agenda
- Contact lists
- Resources
- Feedback

Agenda Day 1- Getting started

Friday, October 11	
8:30	**Coffee, tea, juice, snacks for those who arrive early**
9:00	Introductions: CEETEP, EarthScope, Participants, Instructors Please sit with your Action Team.
10:15	**Break (Coffee, tea, juice, snacks)**
10:30	Beauty and the Beast: Plate Tectonics and Geological Hazards of the Pacific Northwest
12:00	Thoughts/questions/reflection
12:15	**Lunch**
1:00	Basics of Earthquake and Tsunami Science and Hazards and Related Teaching Activities
3:15	**Break (Coffee, tea, juice, snacks)**
3:30	Preparedness for Distant Tsunami and Surviving an Earthquake
4:30	Forms: Reimbursements; Stipends; Photo Permissions; Logistics for Day 2 Field Trip
4:45	Reflection, Questions, Implications
5:30	**Adjourn**

Agenda Day 2- Field Trip

Saturday, October 12	
8:30	**Coffee, tea, juice, snacks for those who arrive early**
9:00	Depart
9:15	**Stop 1:** Tongue Point GPS station
10:45	**Stop 2:** Long Beach interpretive site and evacuation challenges
12:00	**Lunch** in Ilwaco (packed lunches)
12:45	**Stop 3:** Ilwaco Evacuation Walk
2:30	**Stop 4:** Niawiakum River Tsunami Geology
5:30	**Adjourn**

Agenda Day 3 – Cascadia

Sunday, October 13 (Day 3)	
8:30	**Coffee, tea, juice, snacks for those who arrive early**
9:00	Cascadia Earthquakes and Tsunami and Related Teaching Activities
10:30	**Break (Coffee, tea, juice, snacks)**
10:45	Cascadia Earthquakes and Tsunami and Related Teaching Activities
12:00	Thoughts/questions/reflection
12:15	**Lunch**
1:00	Preparedness and Surviving Local Tsunami Events
1:45	Native American Oral Histories
2:30	Exchange of Pedagogies: Interpreting the "Beauty and the Beast" Story along the Cascadia Coast
3:00	**Break (Coffee, tea, juice, snacks)**
3:15	Reflection, Questions, Implications
4:00	Action Teams: Interpretive Program Development. Teams work on 10-minute interpretive program that they will present on Day 4.
5:30	**Adjourn**

Agenda Day 4 – Bringing it together

Monday, October 14 (Day 4)			
8:30	**Coffee, tea, juice, snacks for those who arrive early**		
9:00	Digital Resources		
9:45	Preparedness for Post-event Personal and Community Survival		
10:30	**Break (Coffee, tea, juice, snacks)**		
10:45	Break Out Sessions	Tsunami Vertical Evacuation Structures **Teachers**	Hazard Inventory **Interpreters & EM Educators**
11:25	Break Out Sessions	Tsunami Vertical Evacuation Structures **Interpreters & EM Educators**	Hazard Inventory **Teachers**
12:00	**Lunch**		
12:45	Action Teams: Interpretive Program Presentation. Each group presents their 10-minute Interpretive Programs. Discussion after each about content and efficacy.		
2:15	**Break (Coffee, tea, juice, snacks)**		
2:30	Action Teams: Collaboration and Share-a-Thon Plans. Collective discussion about the task, schedule, and logistics for each Action Team to develop their March 8, 2014 Share-a-Thon products		
4:15	Post-Workshop Assessment. Survey and focus groups.		
5:30	**Adjourn**		

CEETEP

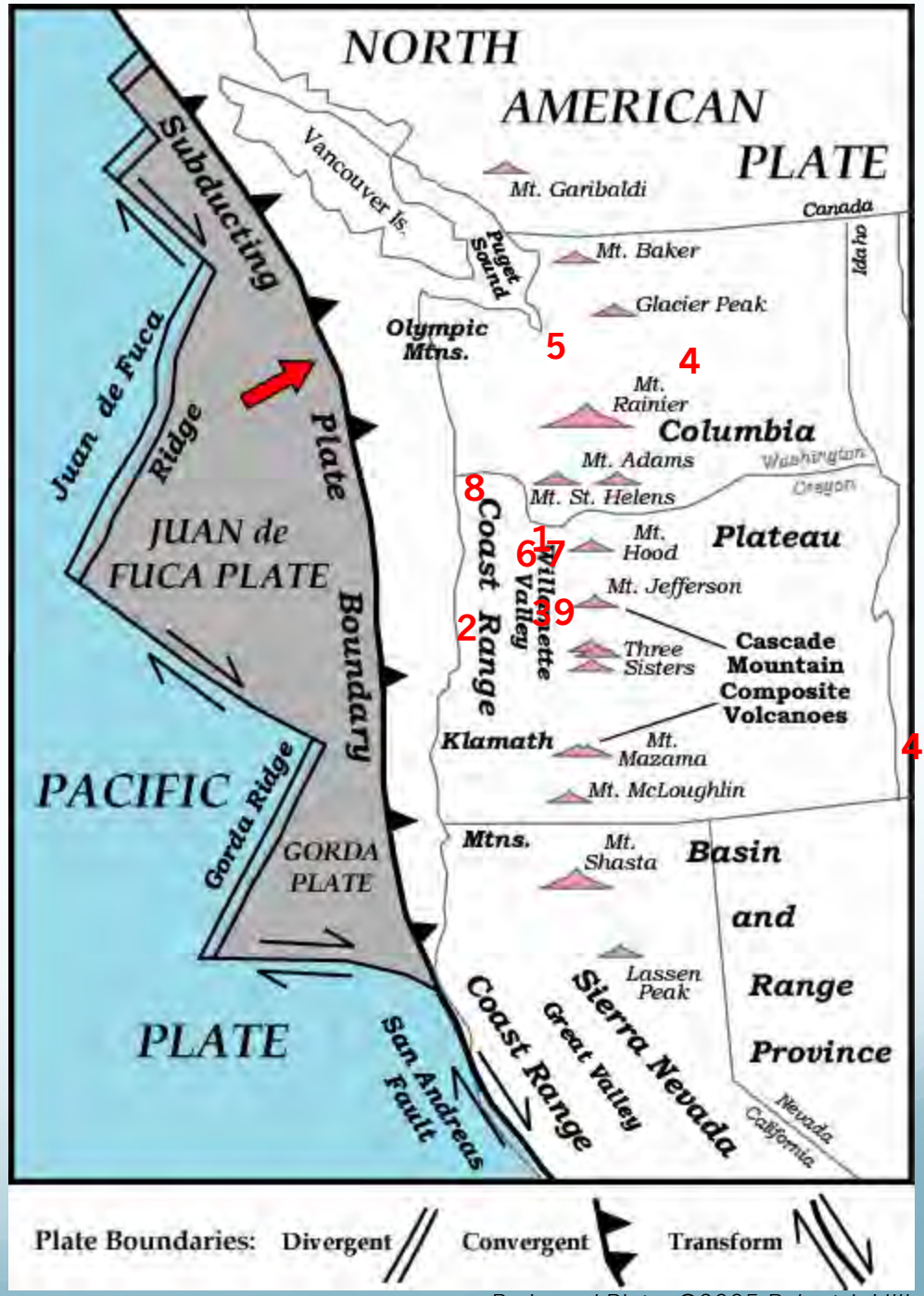
Astoria, Oregon
October 11-14, 2013

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
6. Bonnie Magura, Portland Public Schools (retired), Portland
7. Roger Groom, Mt. Tabor Middle School, Portland
8. Pat Corcoran, OSU Extension, Astoria
9. Althea Rizzo, Oregon Emergency Management, Corvallis



Parks and Plates ©2005 Robert J. Lillie

CEETEP

Astoria, Oregon
October 11-14, 2013

CEETEP Partner Organizations

10. Bob de Groot, Southern California Earthquake Center, Los Angeles, CA

External Evaluators

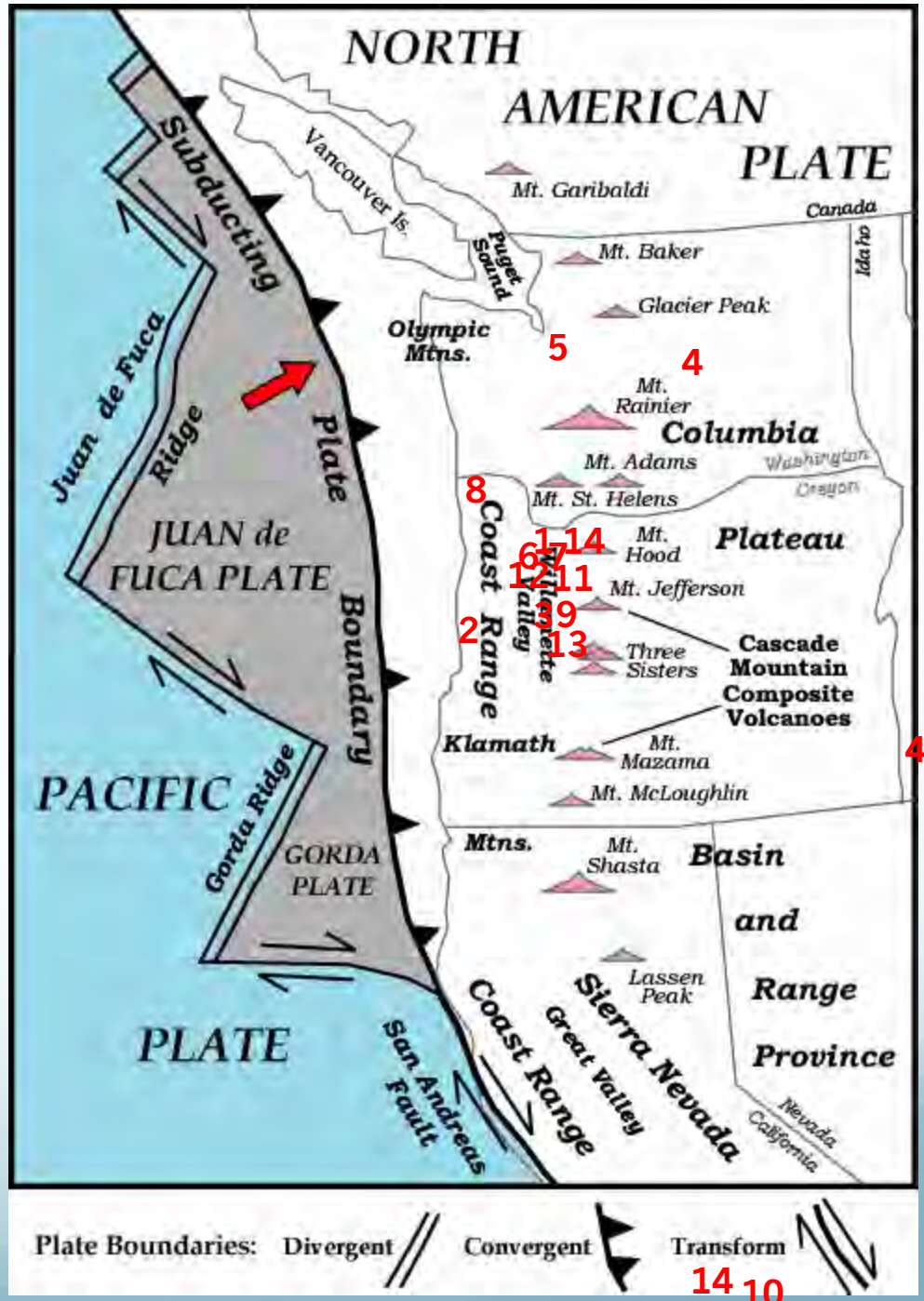
11. Michael Coe, Cedar Lake Research, Portland

Animator/Videographer

12. Jenda Johnson, Portland

Student Assistants

13. Rachel Hausmann, Oregon State University, Corvallis
14. Leslie Moclock, University of California Davis & Portland, OR



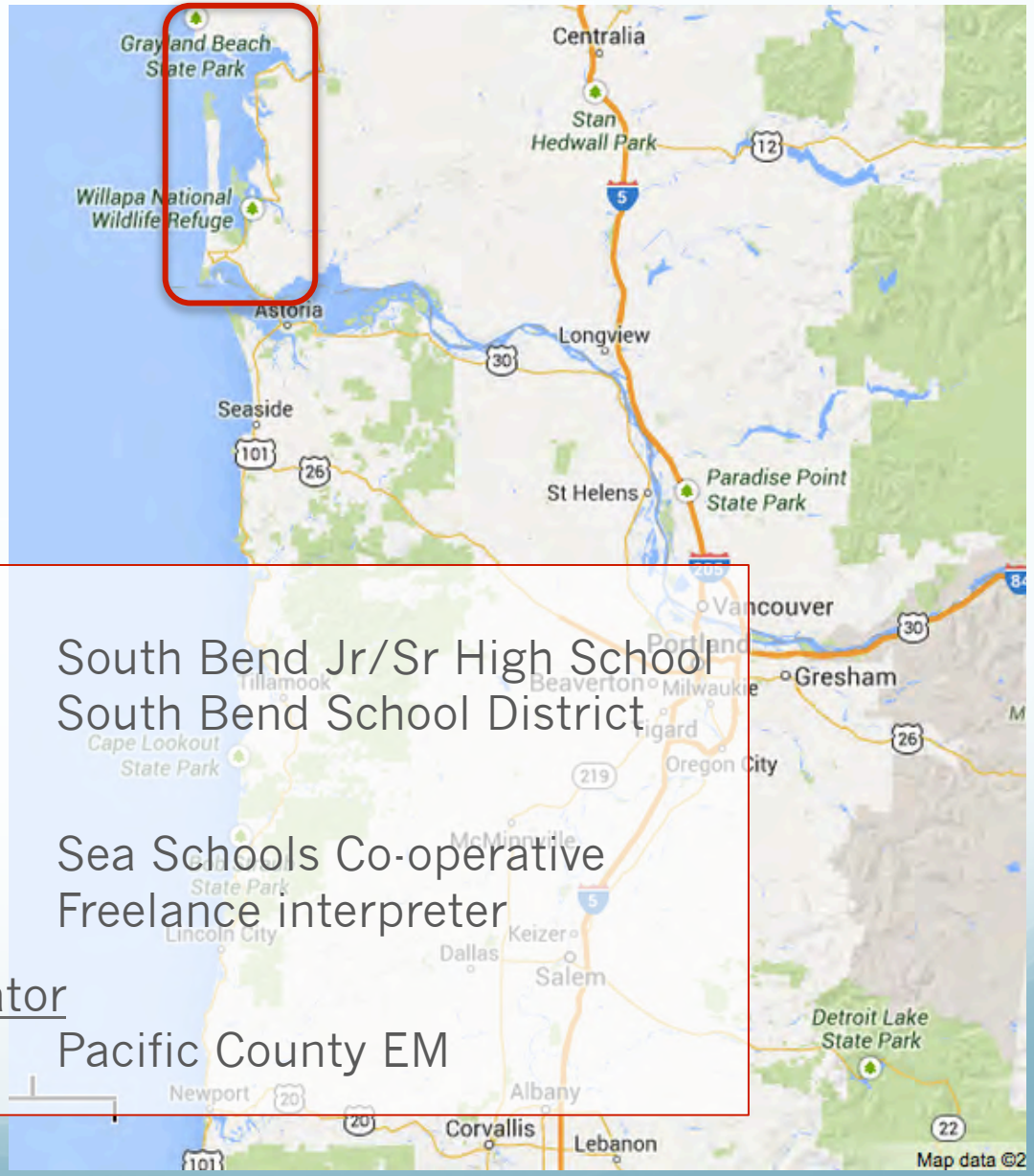
Action Team 1 – SW Washington

20-second Intro

1. Who are you?
2. Your organization and/or educational setting?

Optional:

3. What you particularly hope to get from CEETEP?



K-12 Teacher		
Alyssa Caudill	South Bend	South Bend Jr/Sr High School
Key McMurry	Raymond	South Bend School District
Park/Museum Interpreter		
Lee Knott	Long Beach	Sea Schools Co-operative
Julie Tennis	Naselle	Freelance interpreter
Emergency Management Educator		
Ed Archer	Ocean Park	Pacific County EM

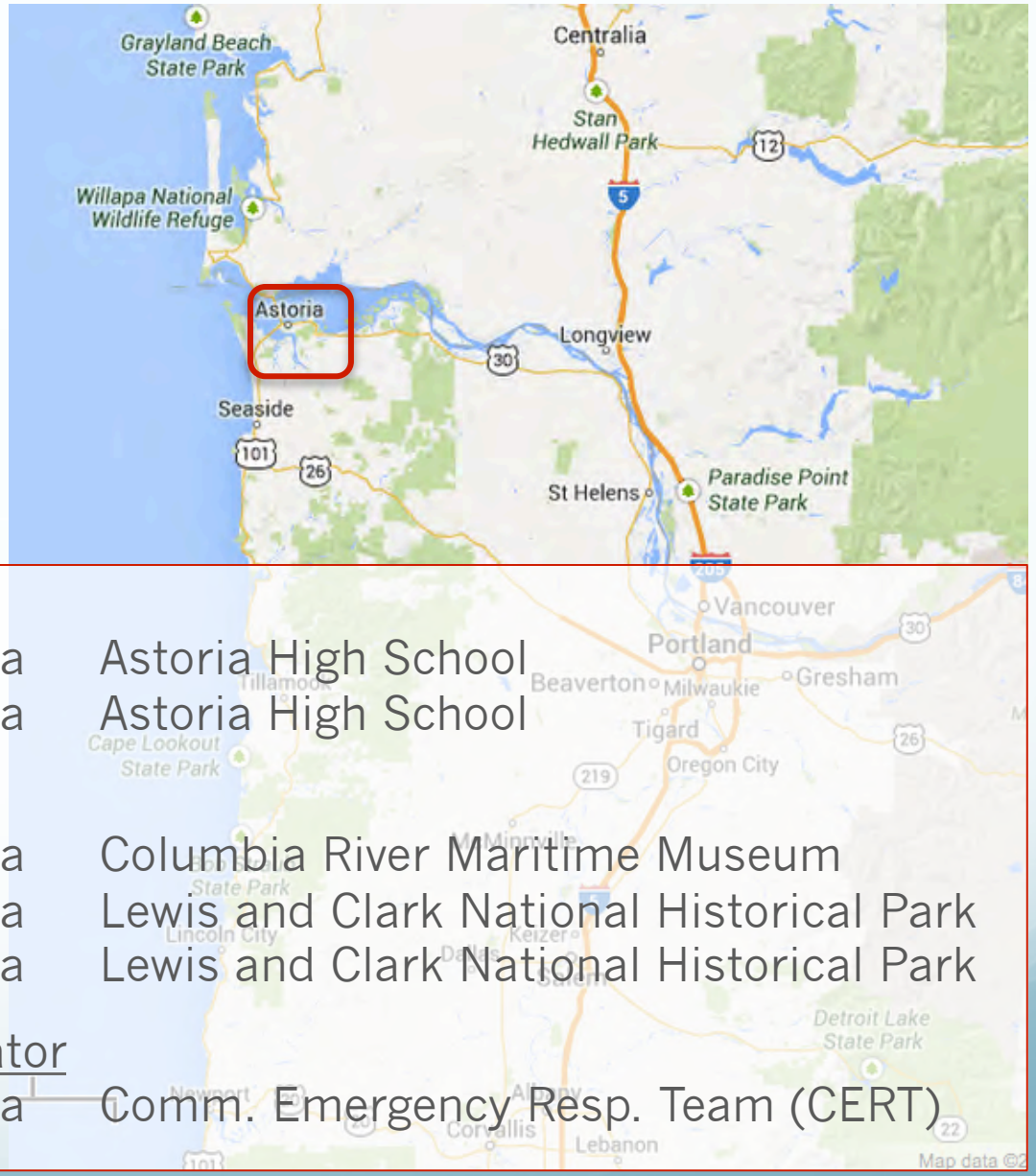
Action Team 2 – Astoria

<u>20-second Intro</u>

1. Who are you?
2. Your organization and/or educational setting?

Optional:

3. What you particularly hope to get from CEETEP?



<u>K-12 Teacher</u>

Nick Baisley	Astoria	Astoria High School
Michael Baker	Astoria	Astoria High School

<u>Park/Museum Interpreter</u>

Betsey Ellerbroek	Astoria	Columbia River Maritime Museum
Cathy Peterson	Astoria	Lewis and Clark National Historical Park
Susan Rhoads	Astoria	Lewis and Clark National Historical Park

<u>Emergency Management Educator</u>

Lianne Thompson	Astoria	Comm. Emergency Resp. Team (CERT)

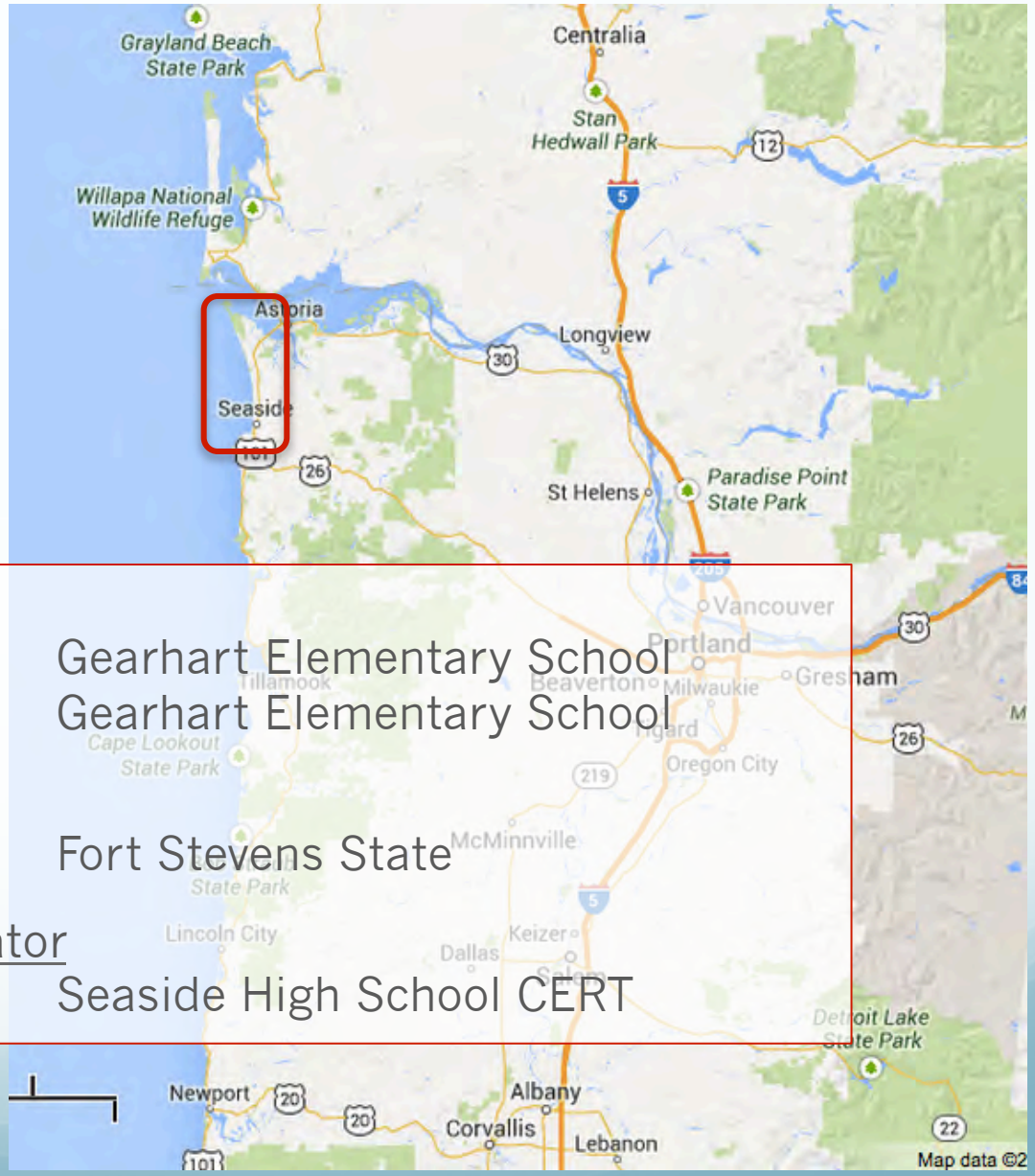
Action Team 3 – Seaside-Warrenton

<u>20-second Intro</u>

1. Who are you?
2. Your organization and/or educational setting?

Optional:

3. What you particularly hope to get from CEETEP?



<u>K-12 Teacher</u>

Sena Berquist	Gearhart	Gearhart Elementary School
Becky Seybold	Gearhart	Gearhart Elementary School

<u>Park/Museum Interpreter</u>

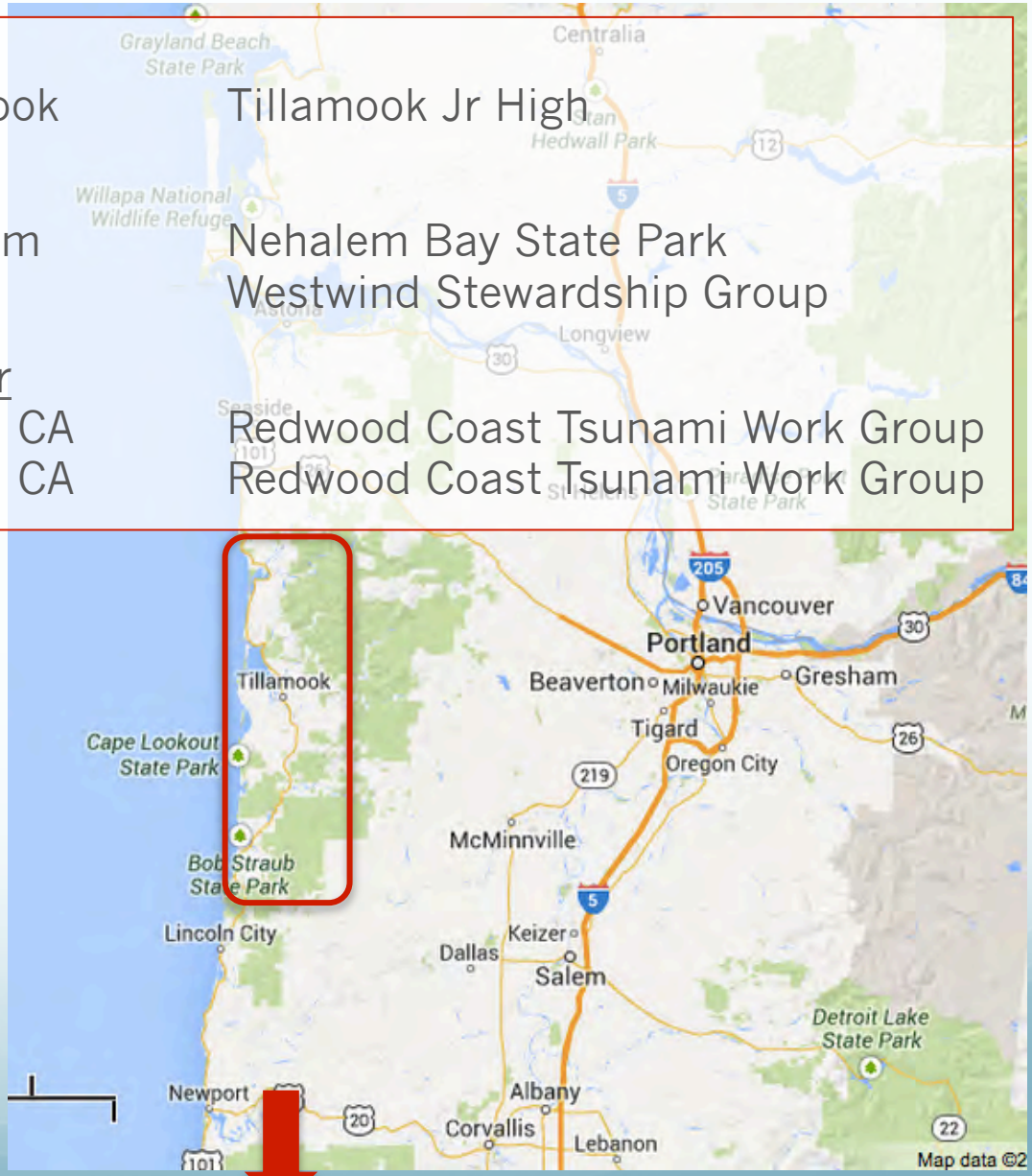
John Koch	Hammond	Fort Stevens State

<u>Emergency Management Educator</u>

Adam Morse	Seaside	Seaside High School CERT

Action Team 4 – Tillamook & south

K-12 Teacher		
Beth Kroiz	Tillamook	Tillamook Jr High
Park/Museum Interpreter		
Shelley Parker	Nehalem	Nehalem Bay State Park
Dave Pete	Otis	Westwind Stewardship Group
Emergency Management Educator		
Amanda Admire	Arcata, CA	Redwood Coast Tsunami Work Group
Kerry Varkevisser	Arcata, CA	Redwood Coast Tsunami Work Group



20-second Intro

1. Who are you?
2. Your organization and/or educational setting?

Optional:

3. What you particularly hope to get from CEETEP?

Action Team 5 – Wider Oregon

K-12 Teacher

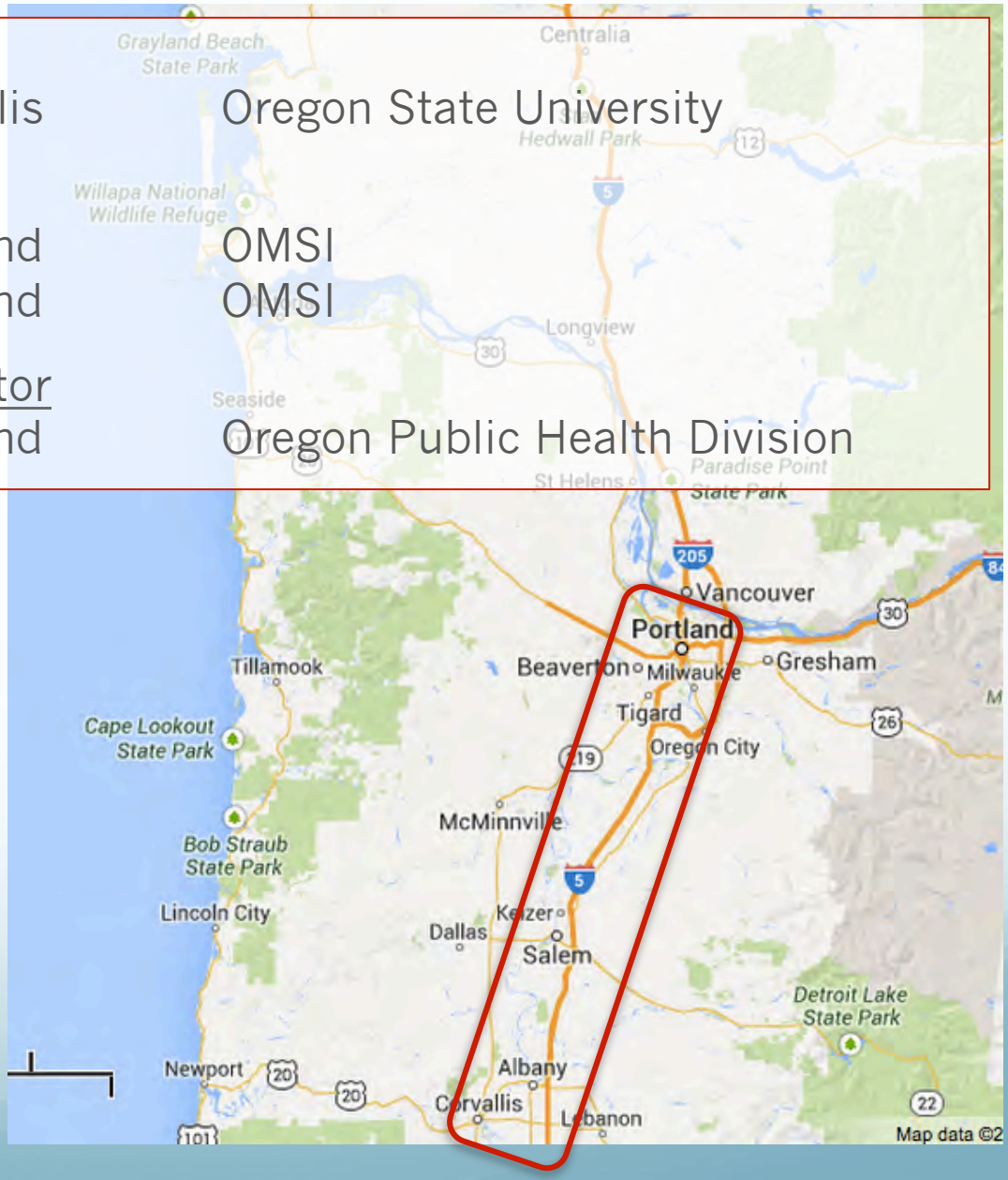
Douglas Lownsbery	Corvallis	Oregon State University

Park/Museum Interpreter

Anne Armstrong	Portland	OMSI
Sue Wu	Portland	OMSI

Emergency Management Educator

Nick May	Portland	Oregon Public Health Division



20-second Intro

1. Who are you?
2. Your organization and/or educational setting?

Optional:

3. What you particularly hope to get from CEETEP?

Get to know your team

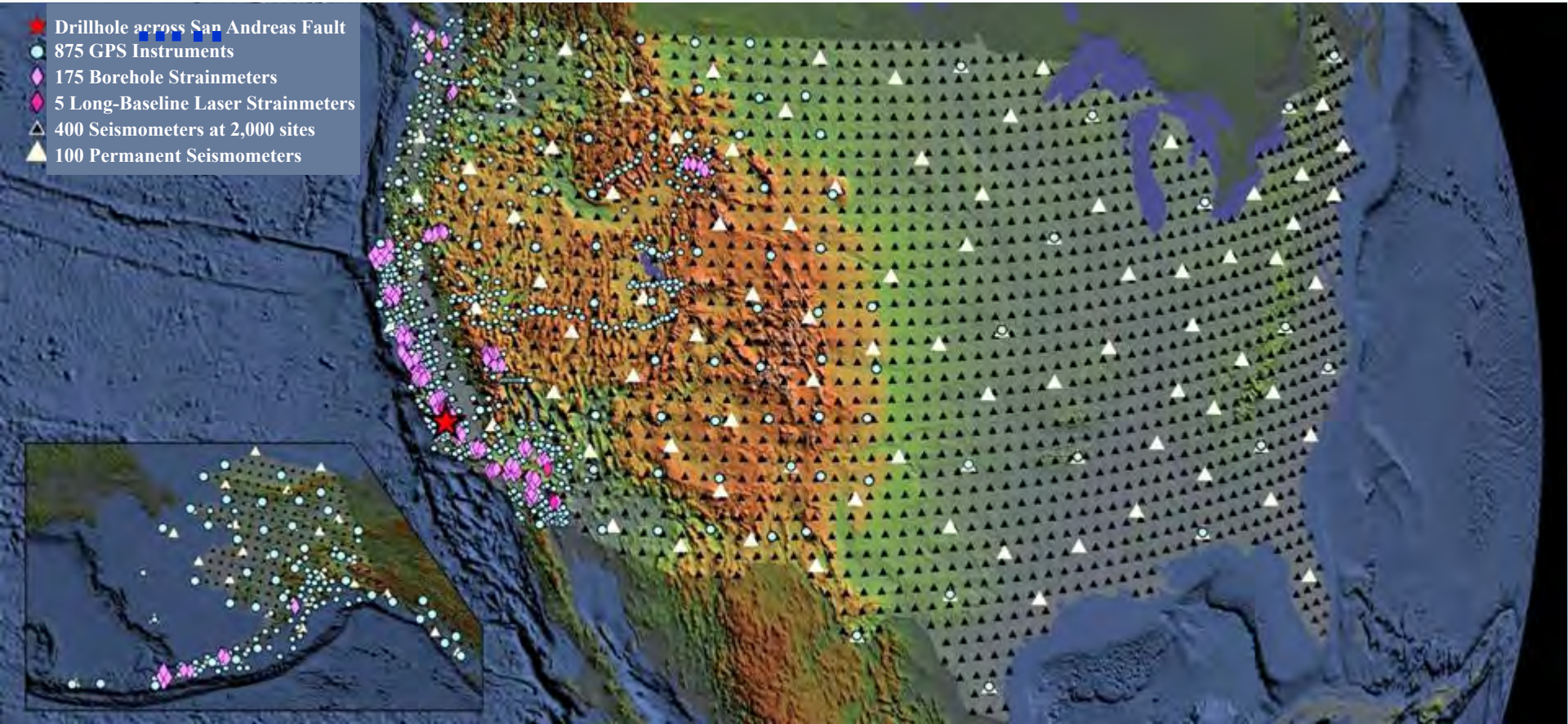
- Several minute intro – Each member of the team should share a little more details about their:
  - Teaching setting and audience
  - Existing strengths or experience with geoscience and preparedness
  - Goals for gaining knowledge and abilities in teaching tsunami and earthquake education

EarthScope

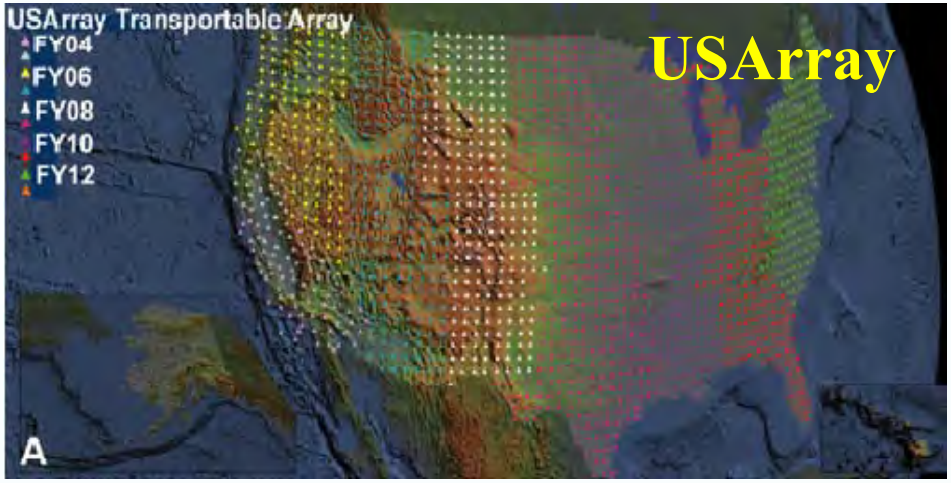
A National Science Foundation (NSF) effort to .....

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

EarthScope has three main "observatories"



EarthScope Observatories

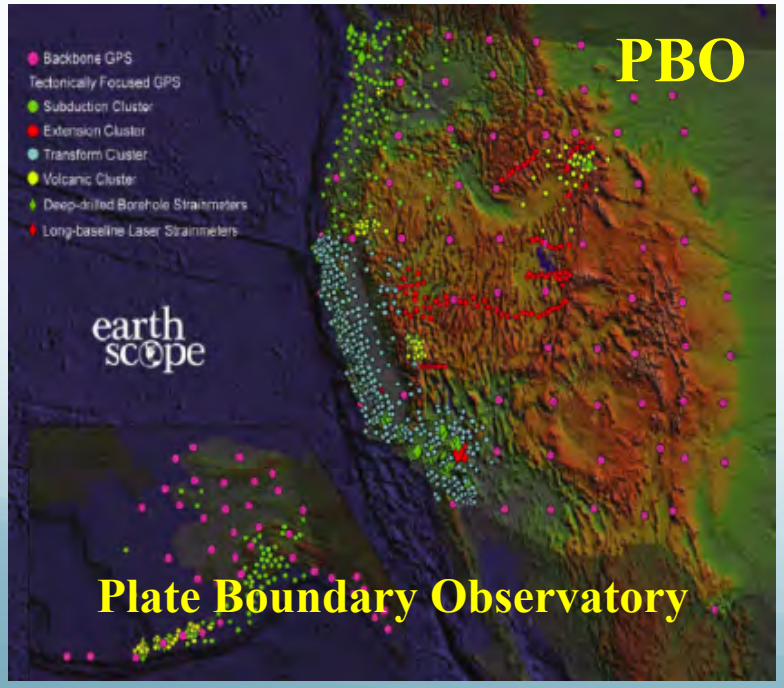


USArray

Seismometers

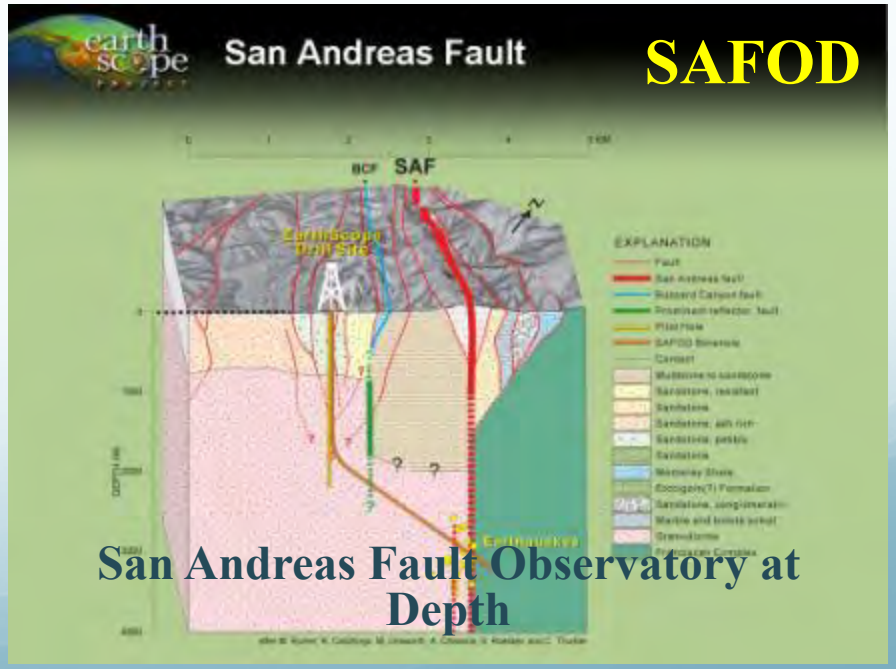
Geodetic Instruments

Deep Drillhole



PBO

Plate Boundary Observatory

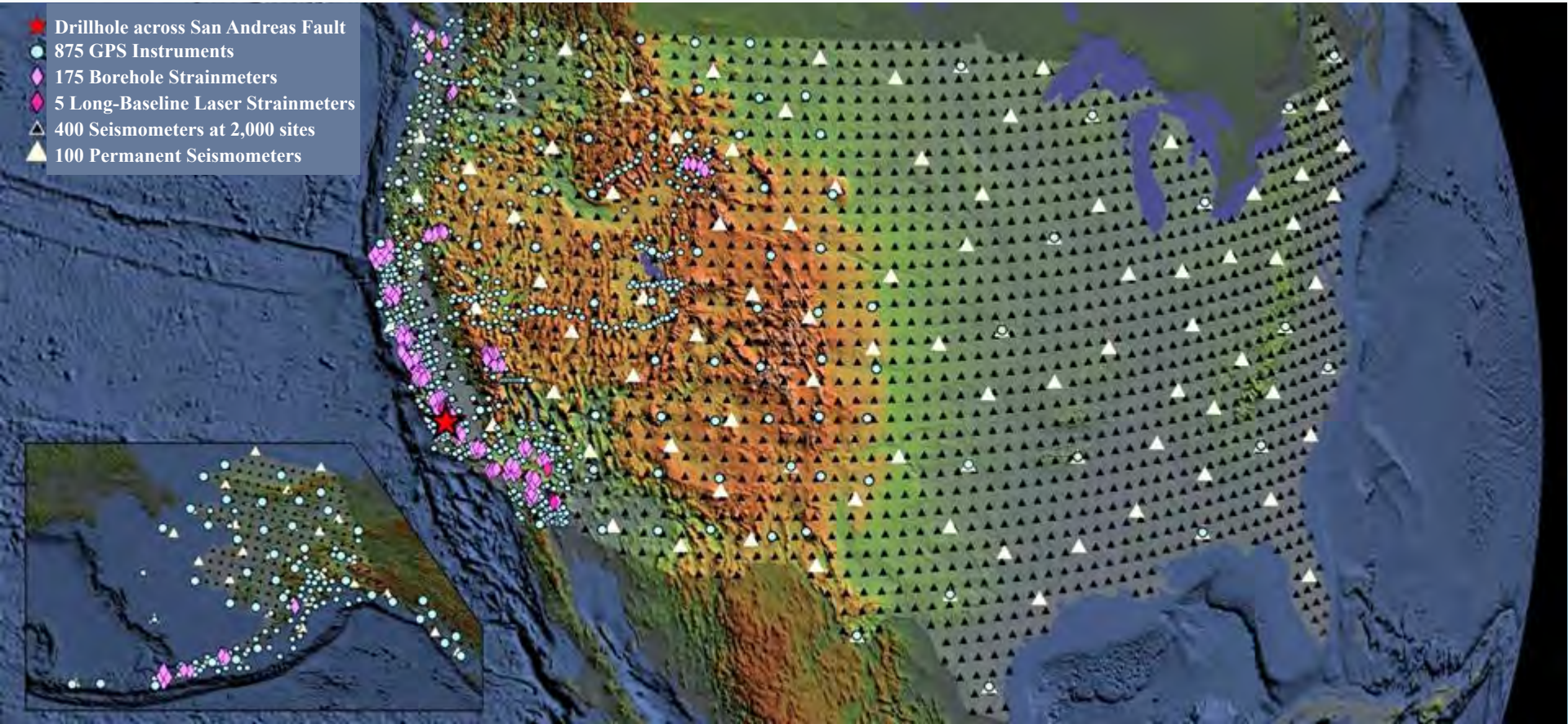


SAFOD

San Andreas Fault Observatory at Depth

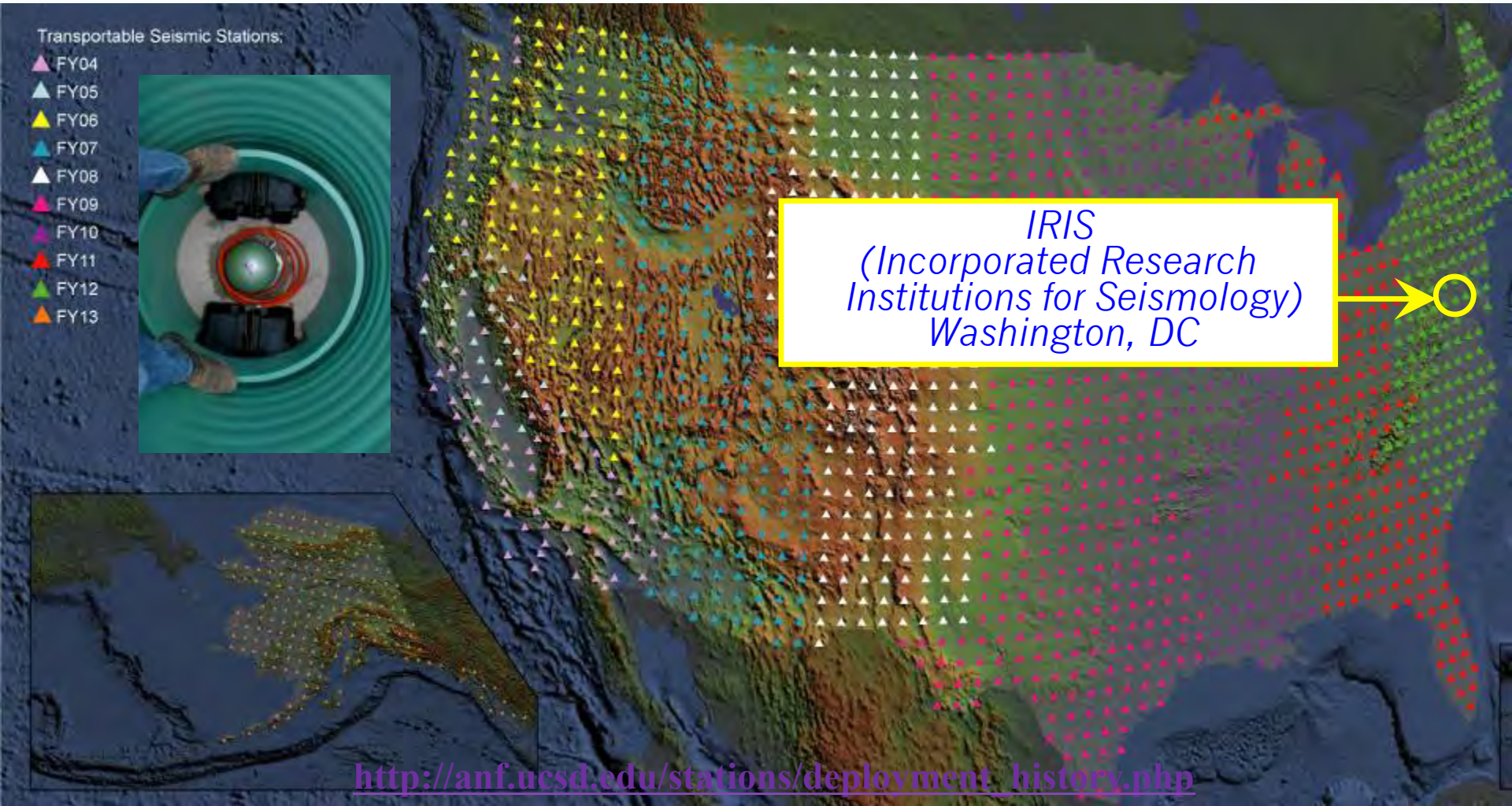
EarthScope

Like a "Hubble Telescope" aimed into the Earth



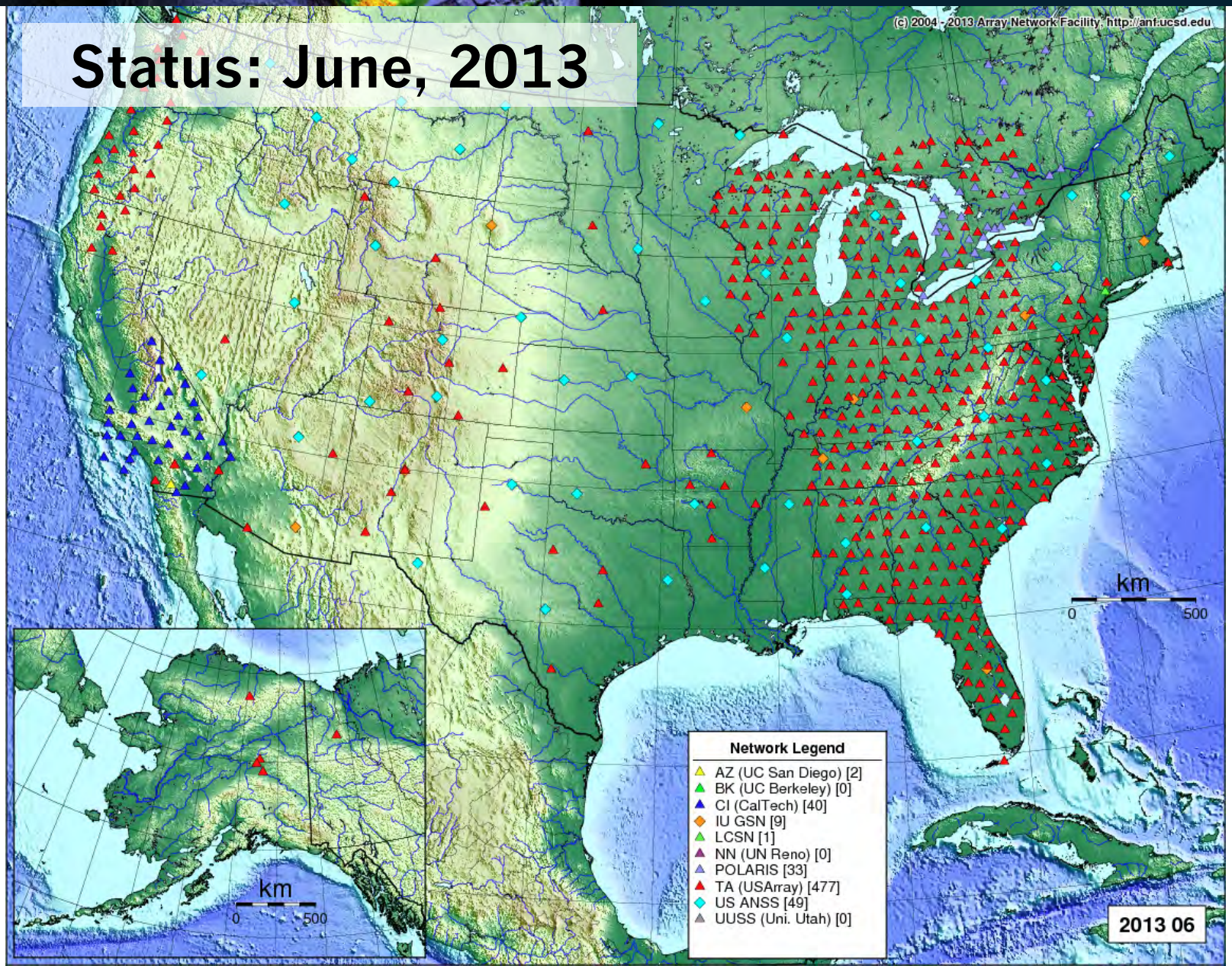
1. USArray

- 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

1. USArray


Status: June, 2013
(c) 2004 - 2013 Array Network Facility, http://anf.ucsd.edu
km
0
500
Network Legend
AZ (UC San Diego) [2]
BK (UC Berkeley) [0]
CI (CalTech) [40]
IU GSN [9]
LCSN [1]
NN (UN Reno) [0]
POLARIS [33]
TA (USArray) [477]
US ANSS [49]
UUSS (Uni. Utah) [0]
2013 06
km
0
500

Visualizations

Seismic waves moving across USArray

Wells, Nevada, 2008

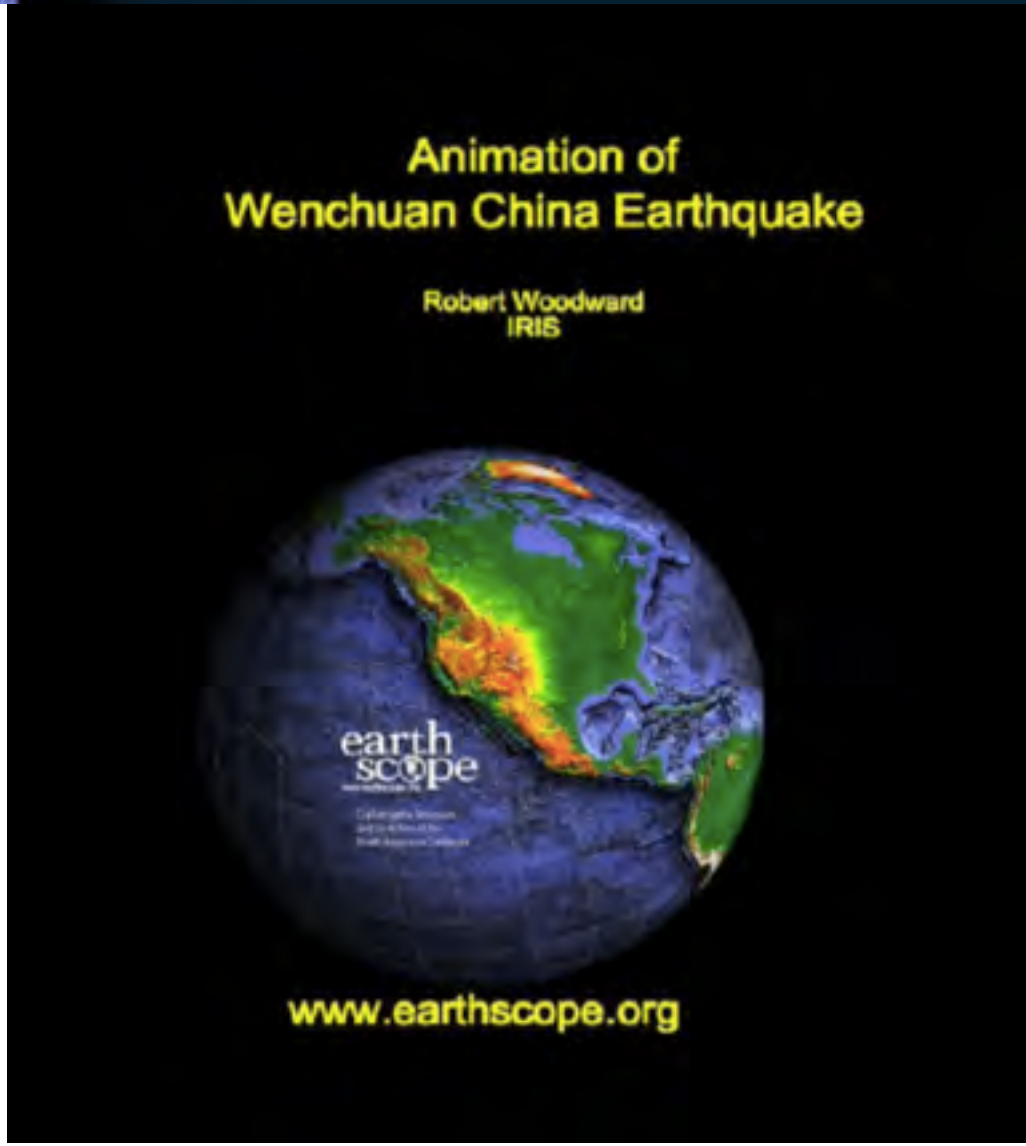
Bob Woodward - IRIS
Chuck Ammon - Penn State

Visualizations

Seismic Waves Moving Across USArray

China, 2008

Bob Woodward - IRIS

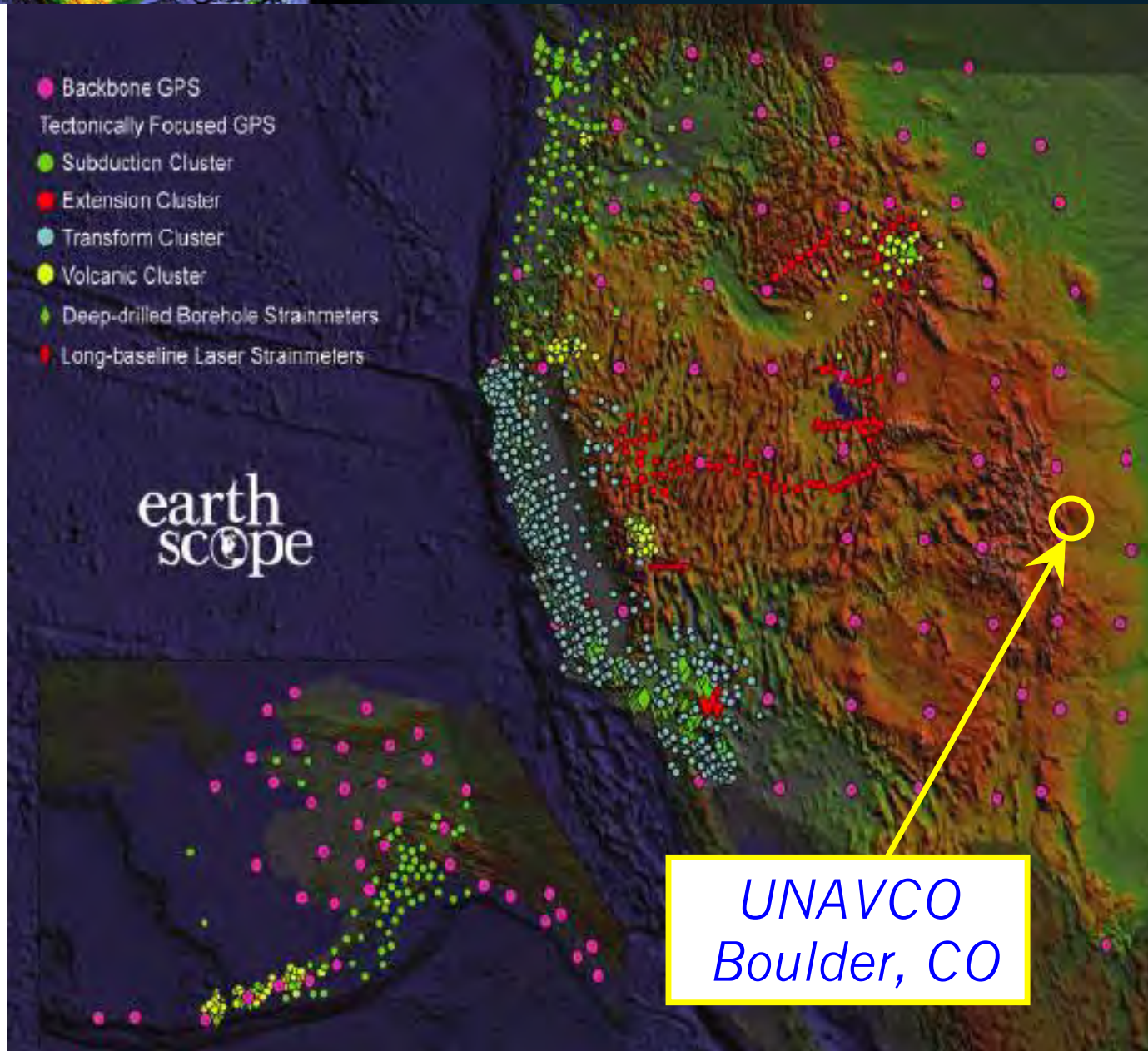


Insert animation

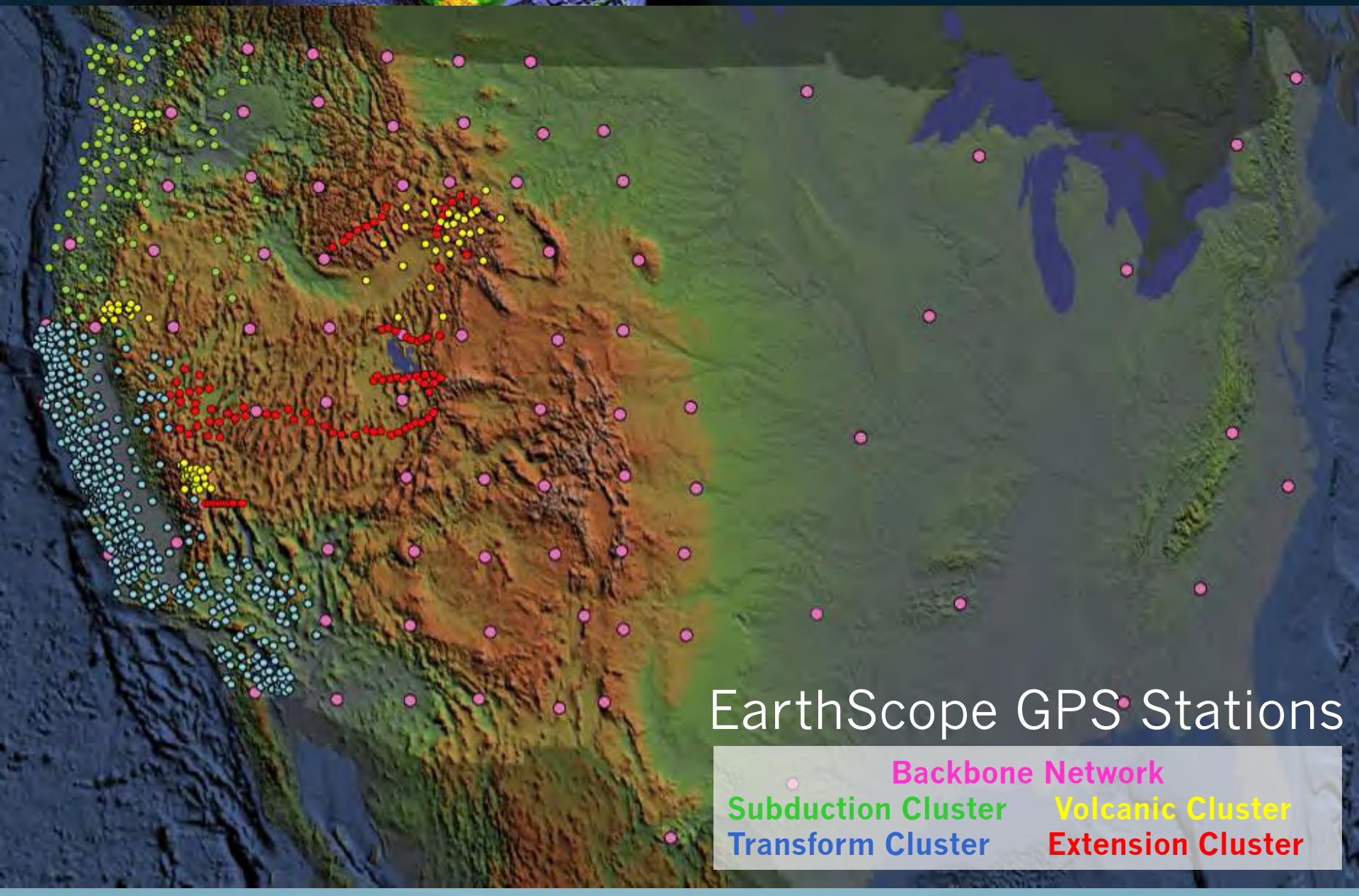
2. PBO
Plate Boundary Observatory

- GPS Instruments
- Strainmeters

GSP Station California State University at San Bernardino

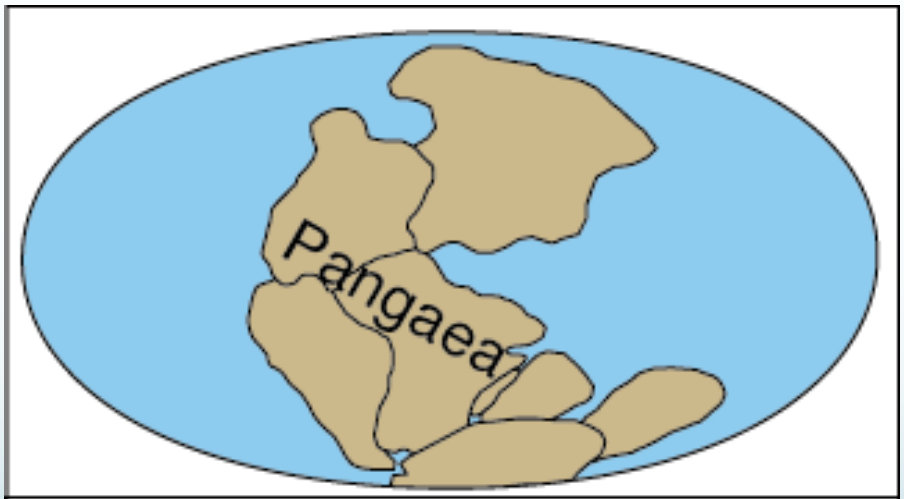


2. PBO
Plate Boundary Observatory



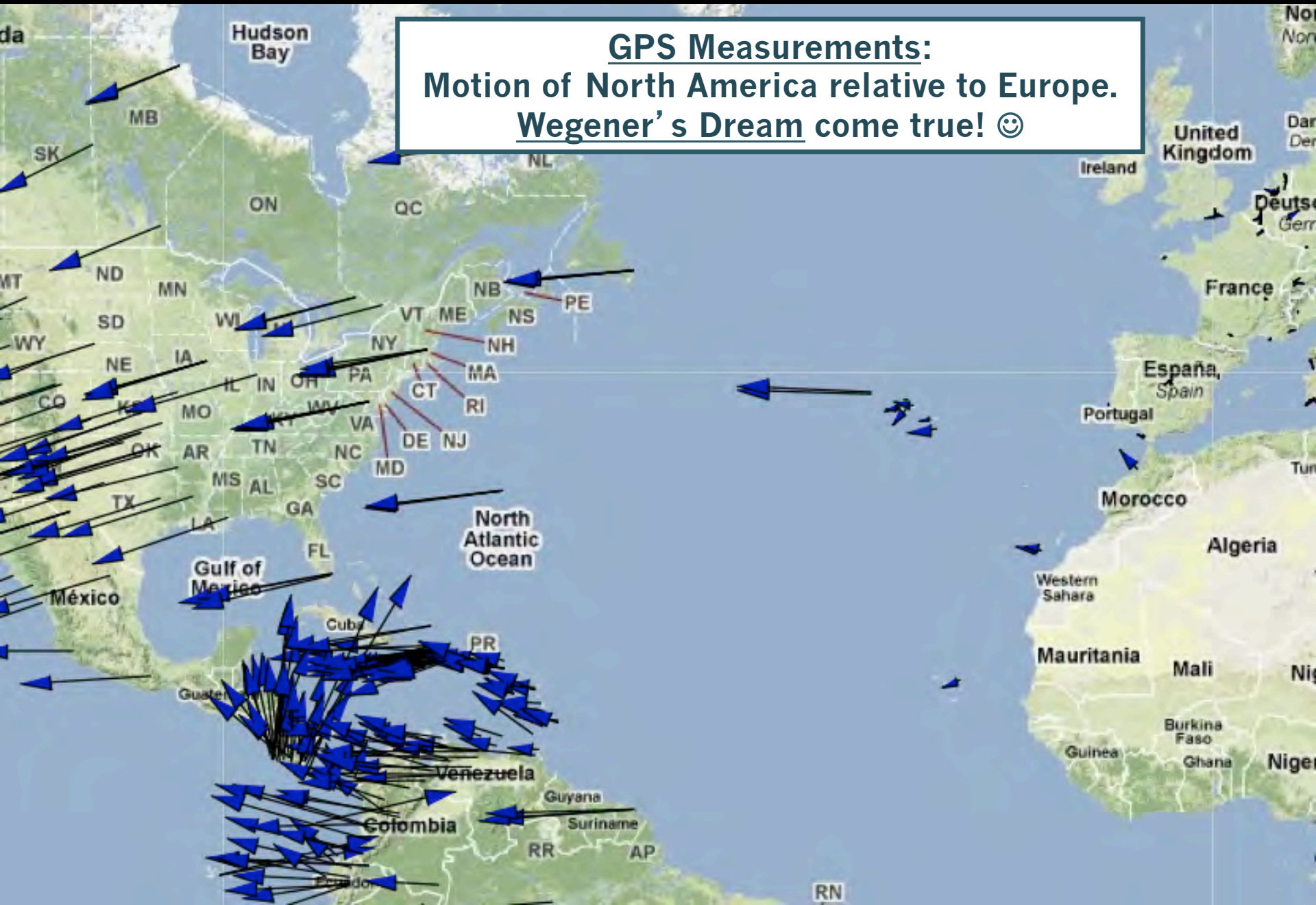
Wegener's Dream

"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**

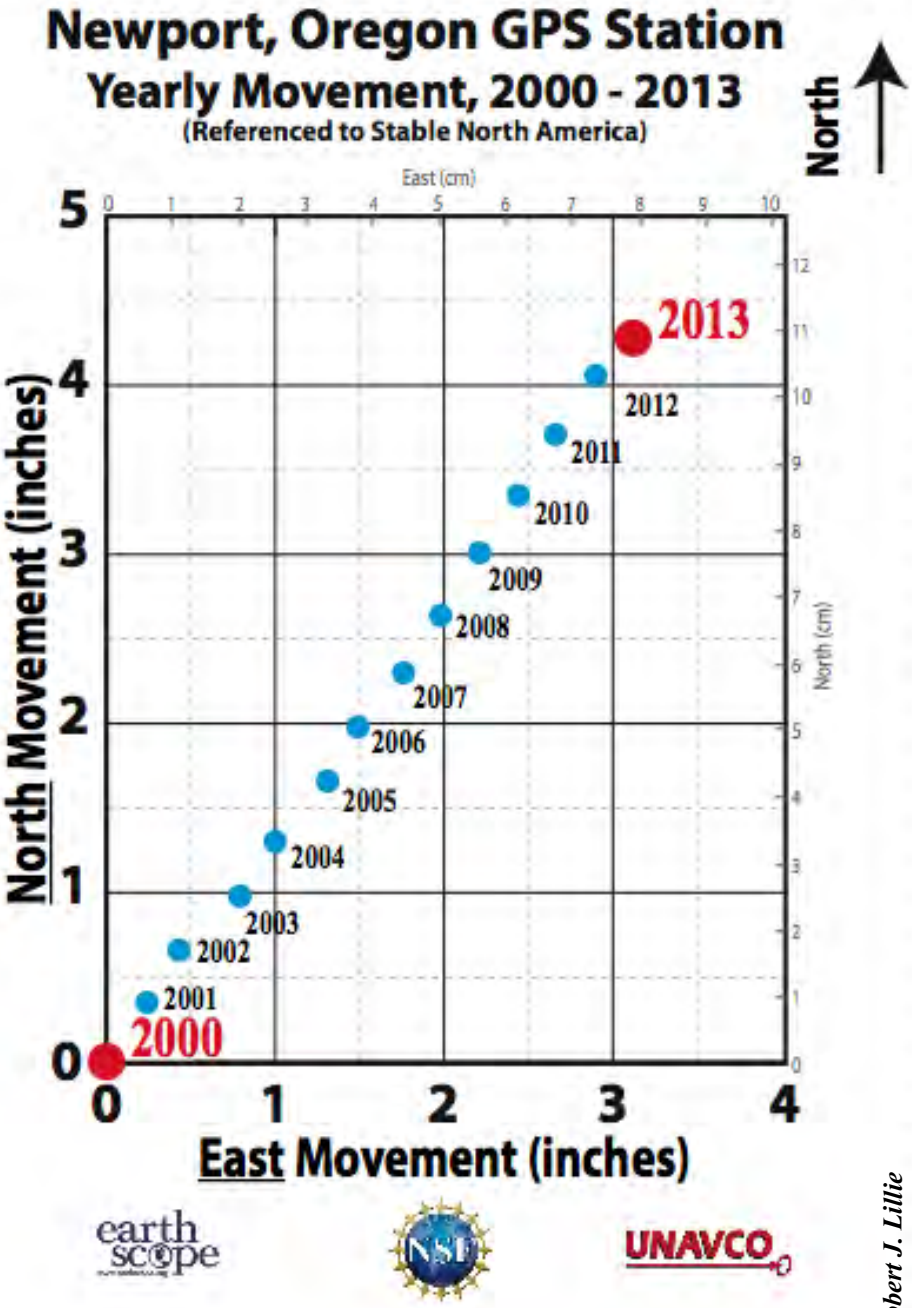


200 million years ago all of the present-day continents combined to form a single supercontinent called Pangaea.


20-30 kilometers/million years
20-30 millimeters/year
~1 inch/year


GPS Measurements:
Motion of North America relative to Europe.
Wegener's Dream come true! ☺
Hudson Bay
MB
SK
ON
QC
NL
ND
MN
SD
WI
MT
WY
NE
IA
IL
IN
OH
PA
NY
VT
ME
NB
PE
NS
NH
MA
CT
RI
DE
NJ
MD
VA
WV
KY
CO
KS
MO
TN
NC
SC
GA
FL
AL
MS
AR
OK
TX
LA
North Atlantic Ocean
Gulf of Mexico
México
Cuba
PR
Venezuela
Colombia
Guyana
Suriname
RR
AP
RN
Ecuador
United Kingdom
Ireland
France
España
Spain
Portugal
Morocco
Western Sahara
Algeria
Mauritania
Mali
Burkina Faso
Guinea
Ghana

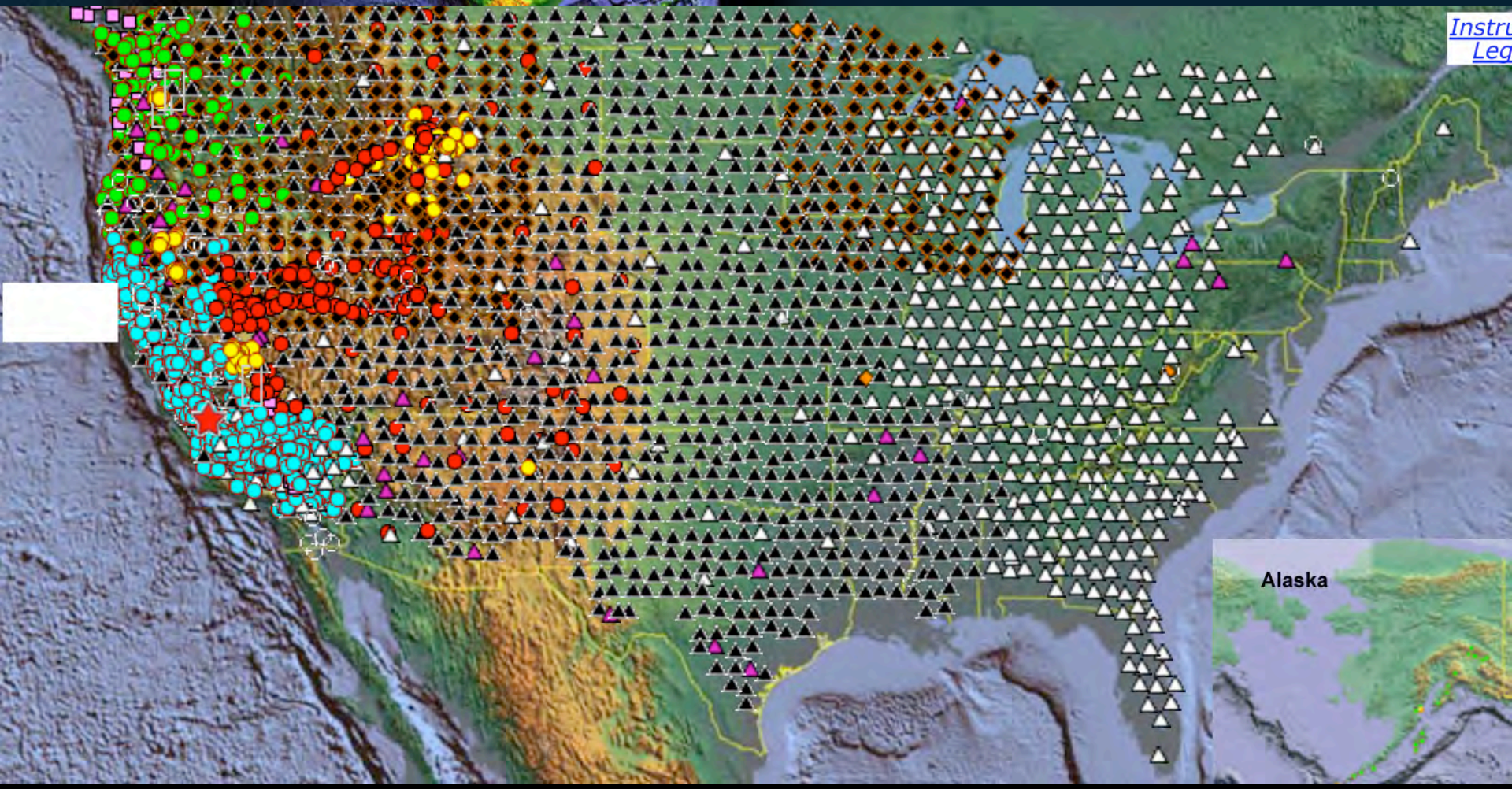
Illinois EarthScope 2010



Newport, Oregon GPS Station

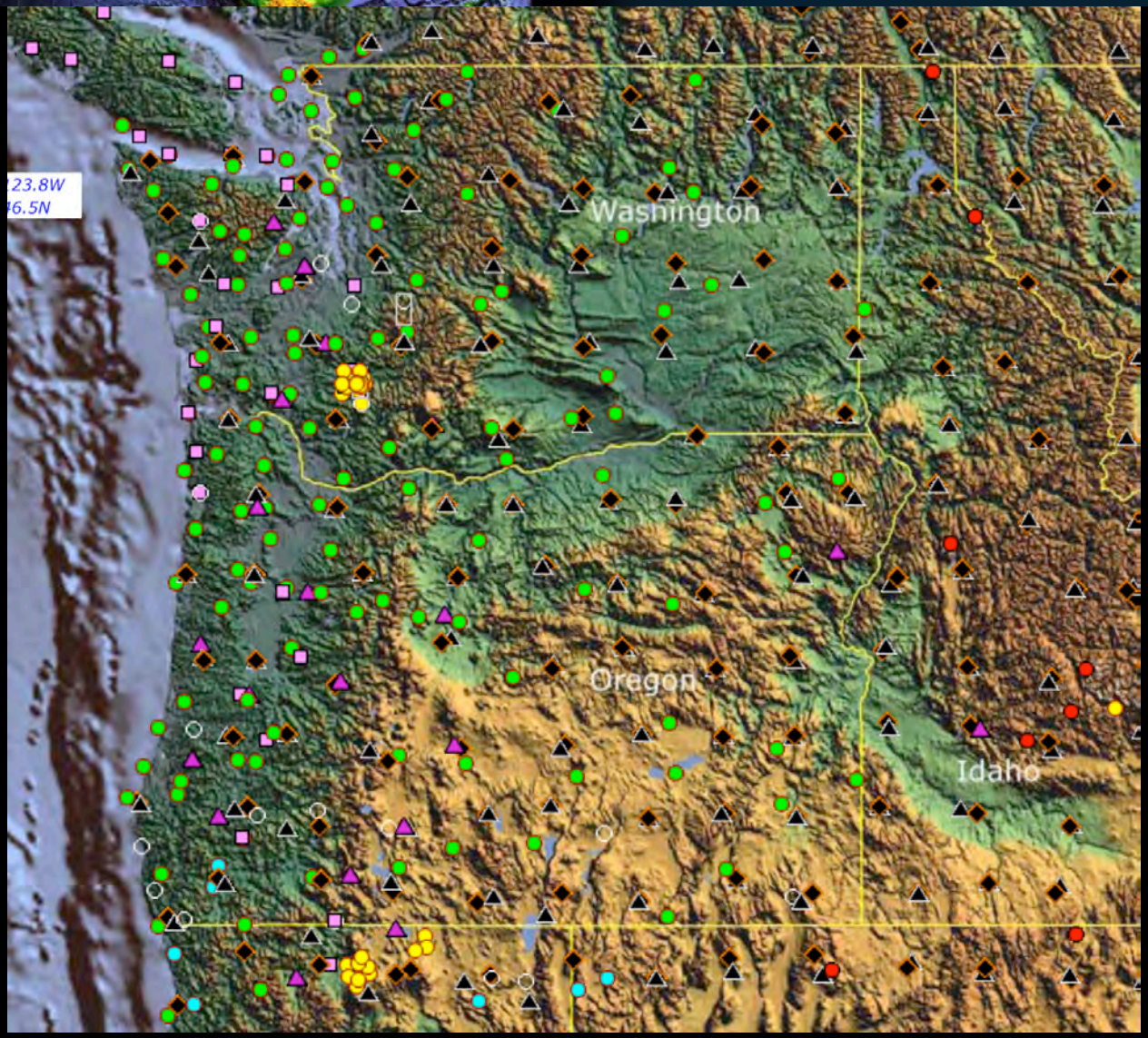
Robert J. Lillie

EarthScope Station Status
July 1, 2013



http://www.earthscope.org/current_status

Pacific Northwest Status
July 1, 2013

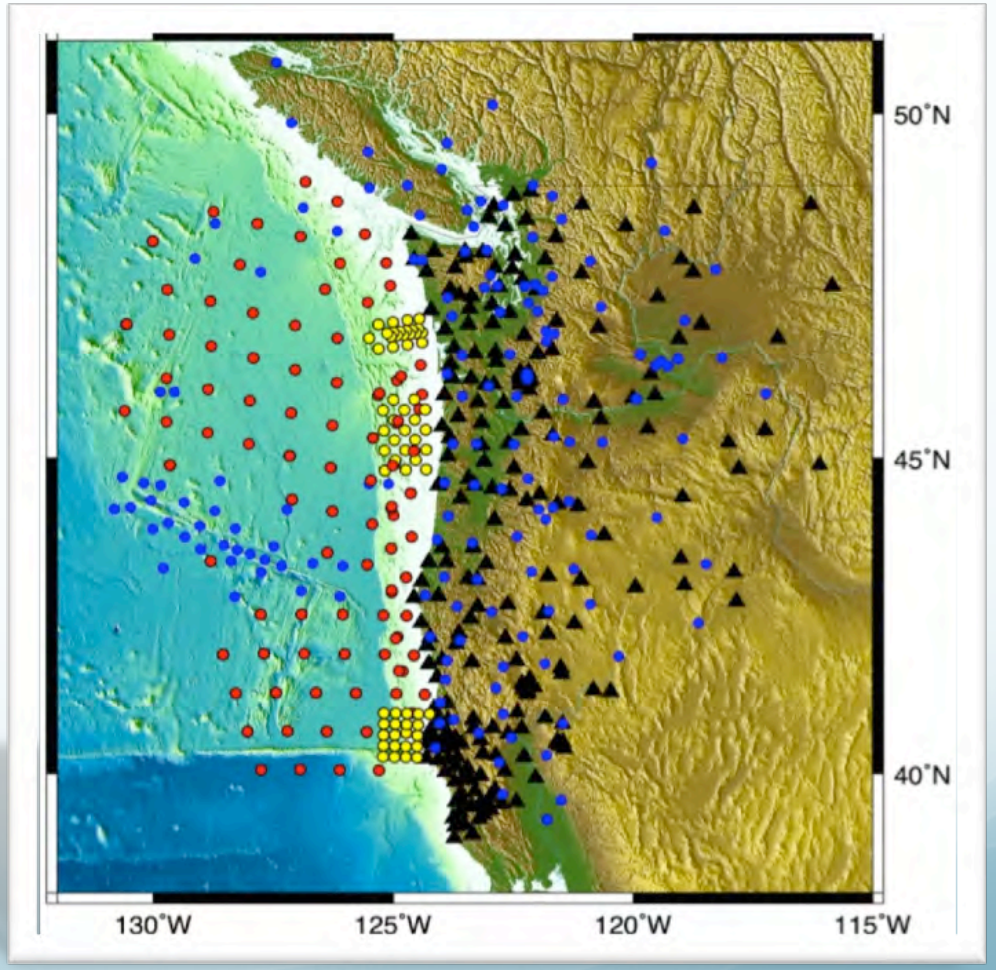


http://www.earthscope.org/current_status/showstatus.php?map=NW&Facility=All&Instrument=All&StartDate=2000-01-01&Display=Instruments

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-floor 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!