1-Cascadia DEM. Megathrust is at base of continental slope from Vancouver Island south to Mendocino fracture zone (MFZ) at south end. Triple junction at E. end of MFZ; Pacific Plate to south, Gorda Plate to north. Gorda Ridge and Blanco fracture zone are prominent, Juan de Fuca Ridge less so; note seamounts. Queen Charlotte transform at upper left at base of slope. To E, onshore, Coast Range and Olympic Mts. are outer-arc ridge; farther E are Willamette Valley, Puget Lowland, and Georgia Strait. Farther E are Cascades with active volcanoes.

2-Jdf\_alleq\_lowerr.jpg. Detail DEM of offshore. Earthquakes (blue) are concentrated in Gorda and Explorer plates, not Juan de Fuca Plate. Mendocino Fracture Zone (MFZ) extends along southern margin, separating older, hence deeper, oceanic crust of Pacific Plate from younger Gorda Plate, except for eastern end, where Pacific Plate on the south is higher than Gorda Plate even though the crust is older. This is due to tectonics related to San Andreas system, including strike-slip offset of continental slope across MFZ.

3-20430078.jpg. DEM of Gorda Plate and Mendocino Fracture Zone (MFZ). Faults in Gorda Plate turn from N-S to NE-SW, probably due to being caught in right slip between the larger Pacific and North America plates. The high-standing Vizcaino block south of the MFZ is underlain by older crust and should be deeper but is not, because of deformation along San Andreas fault off to SE and to right-lateral offset along MFZ. NE-trending faults in the Gorda Plate are seismically active, largely on strike-slip faults.

4-Willapa Bay general. At very low tide, roots of a forest ~1700 yrs old are exposed. Another set of roots at belt level of observer, Jim McCalpin, is of a forest drowned in the AD 1700 earthquake. At top is the modern marsh, which subsided during the 1700 earthquake and could not support a forest such as the one in the background. Photo by Robert Yeats, based on work by Brian Atwater, USGS. Reference: Atwater, B.F. and Hemphill-Haley, E., 1997, *USGS Prof. Paper 1576*,108 p.

5-Willapa closeup. At observer’s belt level, note dark soil zone, similar to the modern soil. This soil existed before the 1700 earthquake and was drowned by subsidence accompanying that earthquake. Photo by Robert Yeats, based on work by Brian Atwater. *op. cit*.

6-Copalis R. ghost forest. Dead trees killed by subsidence accompanying A.D. 1700 earthquake. Only marsh grass grows there now; forest in background subsided in 1700, but not enough to kill the trees. Radiocarbon dates from trees are late 1600s to early 1700s, consistent with their being killed by an earthquake ib 26 January 1700 generating a tsunami recorded in Japan. Photo by Brian Atwater, USGS. Reference: Atwater, *op. cit.*, and Satake et al., 2003, *Jour. Geophys. Research 108*,B11.

7-Offshore flt. from Delta. Active fault offshore Oregon observed from submersible DELTA at a depth of 249.5 m. The two light spots are 20 cm apart. Photo by Gary Huftile, Queensland University of Technology.

8-Elvis. Sidescan sonar image of Wecoma fault at base of continental slope off Newport, Oregon. Fault displaces left margin of deep-sea landslide left laterally. Now famous as the Elvis image.

9-20430079.jpg. Sidescan sonar image of North Nitinat fault off the coast of central Washington. The upper linear feature is the nadir of the image, not a geological feature. The fault itself is in the lower part of the image. It is accompanied by a mud volcano. Reference: Goldfinger, C., et al., 1997, *Jour. Geophys. Research 102*:8217-8243.

10-20430080.jpg. Block diagram of faulting at the base of the continental slope off central Oregon. The vertical boundaries are based on multichannel seismic profiles and the surface is based on sidescan sonar. Fault A in this image is the Wecoma fault, which also is in the Elvis image. The well-bedded strata are part of the Astoria fan, overlying oceanic crust (OC). T, toward; A, away. Reference: Goldfinger, C., et al., 1997, *Jour. Geophys. Research 102*:8217-8243.

11-Heceta\_EM300.png. Oblique view of Heceta Bank showing beach cliffs eroded by low-stand sea level during a glacial maximum. Surface features were formed subaerially; grooves are strike ridges and fault features modified by surface drainage. Features in deeper water include submarine landslides. Detailed EM-300 side-scan sonar survey by Bob Embley, NOAA Newport. Survey tracks are N-S.

12-20430083.jpg. Another view of Heceta Bank showing the low-stand shoreline and beach cliffs based on EM-300 side-scan survey by Bob Embley, NOAA Newport. North is to top of image.

13-Turbidite.map. Cores (red circles) of offshore turbidites generated by Cascadia subduction-zone earthquakes. Turbidites preserved in deep-sea channels;. Reference: Goldfinger, C., et al., 2003, *Ann. Rev. Earth and Planet. Sci. 31*:555-577.

14-Cascadia\_channel\_turb\_001.jpg. Core 24 includes entire Holocene turbidite record. Turbidites in blue; hemipelagic sediment in yellow, providing age control; Mazama Ash in red. AMS radiocarbon ages for several layers are in cal. yrs. Turbidites are dated by ages of fine-grained hemipelagic sediment immediately overlying and underlyin turbidite sand. Reference: Goldfinger, C., et al., 2003, *Ann. Reviews Earth and Planet. Sci. 31*:555-577; Goldfinger, C., 2011, *Ann. Rev. Marine Sci. 3*:35-66.

15-Slide11.jpg. Normal sedimentation on the Juan de Fuca Plate comprises fine-grained hemipelagic sediments dated by Foraminifera. These are interrupted by turbidite sands dislodged by plate-boundary earthquakes from shelf and redeposited in and around submarine channels, identified here by electric-log signature and by graded-bedding lithology. Electric logs allow an estimate of mass of sand dislodged in each earthquake, showing that the 1700 AD turbidite was not the largest in the Holocene. Two others, T11 and T16, were at least twice as large. Inset map shows where most of turbidite cores were collected. After Goldfinger, C., et al., 2012, *U.S. Geol. Survey Prof. Paper 1661F*.

16-Cascadia.superquakes.pdf. Size of Cascadia subduction zone earthquakes based on energy state: size of turbidite deposit and evidence for subsidence or uplift. Vertical line is proportional to size of earthquake; sloping line shows buildup of interplate strain toward the next earthquake. The largest earthquakes struck at 5900 and 8800 yrBP; the 8800 event was more than twice the size of the 1700 AD earthquake. From Goldfinger, C., work in progress.

17-Toe Jam Hill jpg. Flexural-slip fault on Bainbridge Island W of Seattle, deformed by folding related to Seattle fault. Inset shows trench logs demonstrating Holocene offsets. Contour map of fault based on LiDAR. Reference Nelson, A.R., et al., 2003, *Geol. Soc. America Bull. 115*:1388-1403.

18-Restoration Pt. Uplifted terrace on E end of Bainbridge Island, uplifted during most recent earthquake on Seattle fault about 1000 yrs ago. Photo by Brian Sherrod, USGS. Reference, Bucknam, R.C., et al., 1992, *Science 258*:1611-1614.

19-20430084.jpg. Cross section through the Seattle fault, which was the source of a large earthquake about 1000 yrs ago. Much of work is based on seismic surveys by Tom Brocher and his colleagues at USGS. Reference, Brocher, T., et al., *Seismol. Soc. America Bull.96*:1379-1401

20-Columbia3\_c.jpg. Oblique DEM looking west from above Pasco Basin showing Yakima folds. Large river is the Columbia River, flowing SE to Wallula Gap, where it turns W and becomes the Oregon-Washington border. Yakima folds in Miocene Columbia River basalt are largely north-vergent except along the west-trending Columbia. Diagonal lineament extending NW from Wallula Gap is part of the Olympia-Wallowa lineament extending from Puget Sound to the Wallowa Mountains of eastern Oregon. The Cascade Mountains west of the Yakima folds contain active volcanoes, marked here by snow. Image by Dr. William A. Bowen, California Geographical Survey (http://geogdata.csun.edu), California State University Northridge.

21-20430072.jpg. View N from Patrick Point in Humboldt County, California showing two marine terraces. The older terrace, 83 ka, is more strongly tilted than the younger terrace, 64 ka. Photo by Robert Yeats.

22-00190011.jpg. Clam Beach, Humboldt County, CA. McKinleyville fault; conjugate shear fractures show1 horizontal. N. to left. Photo by Robert Yeats.

23-20430081.jpg. Marine bench uplifted in the April 1992 Cape Mendocino earthquake on the southern end of the Cascadia subduction zone. Uplift is expected here because the plate boundary is closer to shore than it is in Oregon and Washington. Barnacles living on this bench were killed by uplift. Scale is provided by Gary Carver of Humboldt State University. Reference Oppenheimer et al., 1993, *Science 261*:433-438.

24-20430082.jpg. These faults formed at a high rate on the floor of the blown-out crater of Mt. St. Helens at the same time a new dome was forming and expanding outward in the center of the amphitheater (top of photo). Although these faults are related to volcanism and not tectonics, their expression is very similar to reverse faults accompanying earthquakes with shallow hypocenters. Photo by Don Swanson, USGS, based on work by him and Bill Chadwick, also of USGS.