

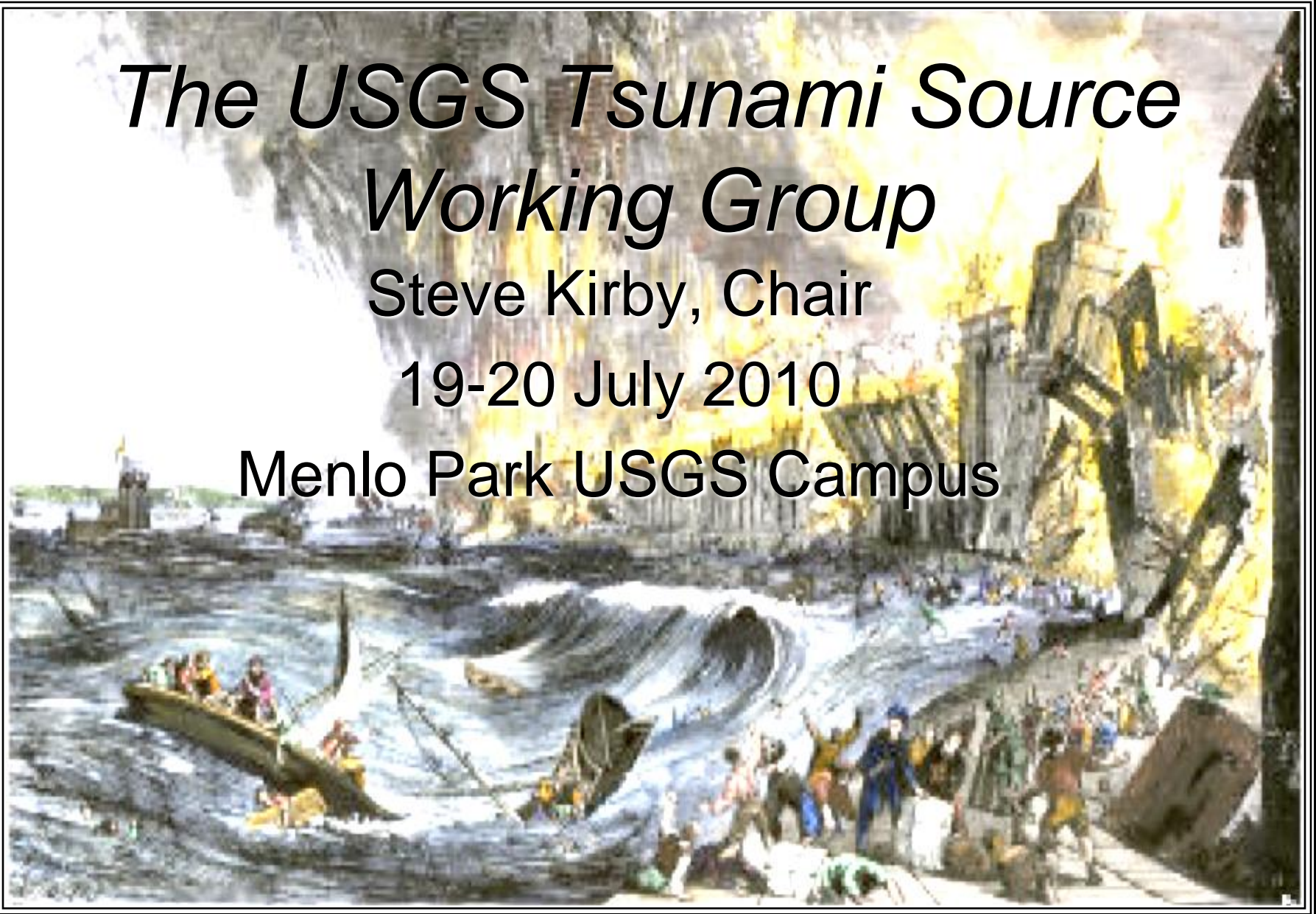
# *The USGS Tsunami Source*

## *Working Group*

Steve Kirby, Chair

19-20 July 2010

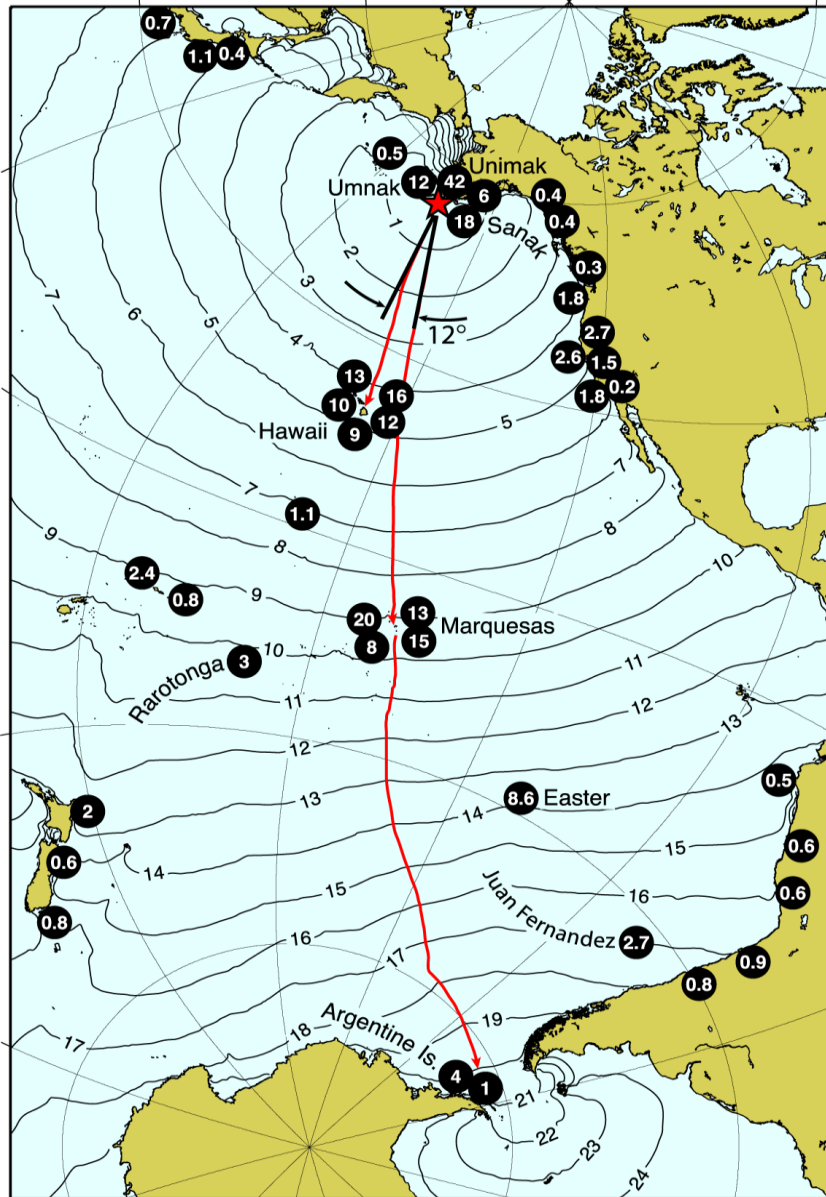
Menlo Park USGS Campus



# Who are we?

- An ad-hoc (self assigned) USGS group focused on the hazards connected with tsunamigenic earthquakes.
- Multi-program, multi-team, multi-region (**Coastal and Marine Geology**, **Earthquake Hazards**, **Geology and Geophysics**, and **NEIC**). Some are Scientist Emeritus.
- Members are all part time.
- Members: Willie Lee, Steve Kirby, Walter Mooney, George Plafker, Rolie von Huene, Jakob Wartman, Steve Walter, Dave Scholl, Holly Ryan, Eric Geist, Stephanie Ross, Amy Draut, **Rick Blakely**, **Ray Wells**, **George Choy**, & Tracy Vallier (USGS, Ret.).
- External research associates [Hiroo Kanamori (CIT), Emile Okal (Northwestern), Katie Keranen (U. OK) Gerard Fryer (PTWC), *Rick Wilson (CA State Conservation Div.)*, Katie Farnsworth (Indiana U.), Akira Hasegawa, Ryota Hino, Naoki Uchida, Norihito Umino (All RCEVEP, Tohoku U.) and Azusa Nishizawa (JHD)]

# Earthquake-induced tsunamis can have a long reach, sometimes crossing whole oceans



M8.5 Unimak  
earthquake of 1 April  
1946: maximum  
tsunami runups  
in meters

*Modified from map by Gerard Fryer  
based largely on data collected by  
Plafker, Okal, Synolakis, and Fryer)*

# *What We Do: Tsunamigenic Earthquakes*

- **All subduction zones are not equal in tsunami production. Why?** What variables control earthquake rupture length and width? Seafloor geometrical barriers? Sediment flux? Seafloor age and plate thickness? Other? (All)
- **Subduction zone kinematics.** Distributed deformation: IPT, SFT, SS, and other forearc faulting. What processes control slip rate partitioning and how does this partitioning affect the tsunami wave field? Seismic/aseismic slip. Forearc basin subsidence and slip distribution of great interplate thrust earthquakes. (Plafker, Scholl, von Huene, Blakely, and Wells)
- **Slow (“tsunami”) earthquakes:** Where and why? (Choy and Kirby)
- **Off-trench bending earthquakes.** What processes control maximum rupture lengths? Spreading fabric vs. trench azimuth? Seamounts? (Kirby, Geist, Hino, Uchida, Hasegawa, and Umino).
- **Development and Use of Geophysical Tools:** Global seismology (digital and predigital), bathymetry, Advanced MC seismics, gravity, and magnetics (All)
- **The USGS Seismic Archive:** A pre-digital legacy collection of seismograms and station bulletins in Menlo Park, Golden, and Albuquerque. Goal: Digital access to all to facilitate better characterization of pre-digital earthquakes. (Lee and Walter and others)
- **Development of a national USGS marine geohazards research program** (Scholl, Ryan, Kirby, and others).

# Principal Research Products (1)

- Subduction earthquake hazard zonation for the western Pacific (NOAA, 2005)
- “Slab 1.0”: Global subduction boundary characterization using broadband hypocenters and focal mechanisms of subduction earthquakes and multi-channel seismic reflection profiles (Hayes, Wald, Keranen, GJI, 2009, 2010)
- Seismological evidence for seamount detachment in NE Japan (Uchida, Kirby, Okada, and Hasegawa, JGR, 2010)
- Earthquake source characterization for Japan Trench outer-rise/outer-trench-slope earthquakes (Gamage, Umino, Hasegawa, and Kirby, 2009).
- Reappraisal of the Sumatran earthquake of 1907 (Kanamori and Lee, 2010)

# Principal Research Products (2)

- Sediment fill from comparisons between trench gravity and bathymetry profiles (Keranen, Blakely, et al., in preparation).
- Role of trench sediment fill in the rupture lengths of subduction earthquakes (Scholl, Keranen, Kirby, Wells, and Blakely, in preparation).
- Forearc gravity anomalies and slip distributions for earthquakes from 2003 to 2010 (Wells, Blakely, and Scholl, in preparation)
- Source characterization and effects of the M8.6 tsunamigenic off-trench earthquake of 1933, Sanriku, Japan (Kirby, Hino, Kanamori, Uchida, Geist, and Okal, ongoing research.)

*Thank You*