



WASHINGTON STATE DEPARTMENT OF  
**Natural Resources**  
Doug Sutherland - Commissioner of Public Lands

# DGER NEWS

**DIVISION OF GEOLOGY AND EARTH RESOURCES**  
"Washington State's Geological Survey since 1890"

Website: <http://www.dnr.wa.gov/geology/>

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## DECISION-MAKERS FIELD CONFERENCE

On August 10, DGER held the second annual Decision-Makers Field Conference. The theme of the one-day conference was "Geological Hazards and the Economy of Washington: A Fragile Truce". The conference is an opportunity for legislators and other local decision-makers to learn first-hand about natural hazards and their impacts on people, transportation, and the economy.

In an informal, primarily outdoor setting, speakers presented the latest information on understanding and mitigating geologic hazards. Participants visited sites that are the current focus of concern. The field-trip format stimulated on-site debates about public policy, strategies for growth, funding for geologic hazard work, and methods for solving problems.

The first stop was Safeco Field, a state-of-the-art earthquake-resistant structure that lies within the Seattle fault zone, which runs from east of Issaquah to west of Bremerton (Fig. 1). On the roof of the Safeco Field parking garage (Fig. 2), Tim Walsh of DGER gave an introduction to Puget Sound geology and the Seattle fault. Steve Kramer of the University of Washington discussed the threat to the Alaskan Way Viaduct from a major local earthquake due to its age and the liquefiable soil (hydraulic fill) it rests on. The 53-year-old viaduct was damaged in the 2001 Nisqually earthquake and continues to deteriorate. Its design and situation are similar to that of the Cypress Freeway that collapsed near Oakland, California, during the 1989 Loma Prieta quake. Also in jeopardy is the Seattle waterfront seawall, which helps stabilize the soil that supports the viaduct (Fig. 3).

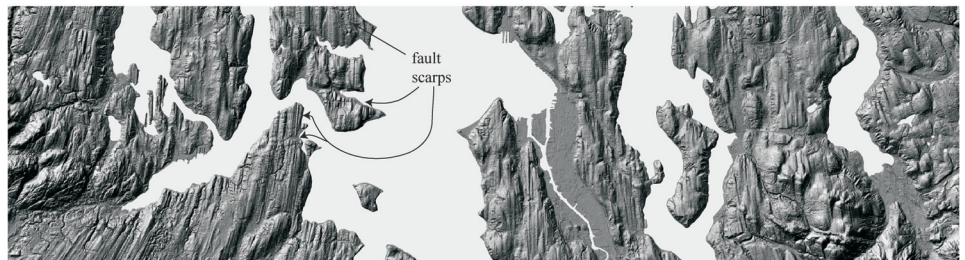
Ron Paananen of the Washington State Department of Transportation (WSDOT) outlined the challenges faced in replacing the



Geologic Map



Landsat Image



Lidar Image

**Figure 1.** Three views of the Seattle fault zone. **Top panel:** Geologic map showing geology along the Seattle fault (dotted lines). Note that bedrock is concentrated around the fault zone but adjacent areas are underlain by unconsolidated sediments (shades of yellow and gray; labels begin with "Q"). **Middle panel:** Photographic infrared false color composite of a Landsat 7 image of the same area. Because water absorbs infrared radiation, it appears black; urban areas are pink. Dense forest cover (green) obscures the underlying geology and topography. **Bottom panel:** Shaded relief map of a lidar digital elevation model with forest cover mathematically removed. Note high definition of topography, showing fluting characteristic of glaciated terrain and fault scarps (several noted) of the Seattle fault interrupting the glacial topography. Shaded relief generated from a lidar bare-earth digital elevation model (available from Puget Sound Lidar Consortium, <http://pugetsoundlidar.ess.washington.edu/>).

viaduct and the seawall. Two alternatives currently being considered are an elevated structure similar to the current viaduct with a separate seawall, and a tunnel that combines both the roadway and the seawall (<http://www.wsdot.wa.gov/projects/viaduct>).



**Figure 2.** (right) Conference session on the roof of the Safeco Field parking garage, with the retractable stadium roof in the background. Three independent roof panels, covering 8.8 acres, are supported by eight 655-foot-long trichord trusses. The trusses sit on eight steel lattice legs, which in turn bear on 800-foot-long trestle-like runway structures. Weighing in at 10,800 tons with over 12,800 individual pieces, the entire roof structure rolls along the runways atop direct-drive travel trucks at a rate of 1 ft/sec. When fully retracted (as shown), the roof stacks over adjacent Burlington Northern Railroad tracks, completely off the field.



Inside Safeco Field, John Hooper of Magnusson Klemencic Associates pointed out the building's structural features designed to withstand a magnitude 7+ earthquake, such as eight 22-foot-long shock absorbing dampers, cross bracing with steel girders, and dividing the stadium into sections with expansion joints that widen as they go up. Susan Ranf of the Seattle Mariners described her experiences at Safeco Field during the Nisqually earthquake, and Bob Freitag of the Cascadia Region Earthquake Workgroup (CREW) showed how earthquake hazard information is used in community planning (<http://www.crew.org/>).

At Mee-Kwa-Mooks Park in West Seattle, Kathy Troost of the University of Washington explained why the folded peat beds visible at low tide (Fig. 4) are interpreted by many geologists as evidence for movement on the Seattle fault.

The group then traveled on the Bainbridge Island ferry while Tim Walsh

pointed out various landslides around Puget Sound (Fig. 5) and Don West of Golder Associates discussed how planning for and monitoring geologic hazards can prevent costly pipeline breaks. Ned Kiley of WSDOT talked about the Washington State Ferries contingency plans for earthquakes and tsunamis and how a ferry can serve as a floating command center, since ferries are equipped to go as long as two weeks before having to refuel and reprovision.

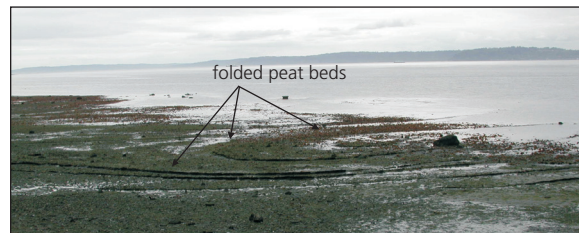
Brian Sherrod of the U.S. Geological Survey (USGS) described his research on the Seattle fault and pointed out the 20+ feet of fault uplift on the wavecut platform at Restoration Point as the ferry went past (Fig. 6).

Craig Weaver of the USGS discussed the use of lidar (Fig. 1) (<http://pugetsoundlidar.ess.washington.edu/>) in geologic mapping and specifically how it is used to locate hidden faults.

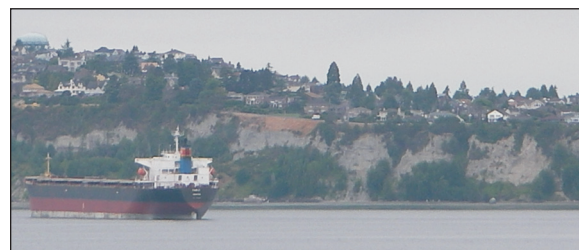
Tim Walsh closed the ferry trip by describing the computer-modeled tsunami in Elliott Bay expected from a magnitude 7+ earthquake on the Seattle fault. Because Harbor Island is uplifted by the quake, the Duwamish Waterway initially drains rapidly before the wave reflects off the north side of the bay and then returns to inundate the Harbor Island area (Fig. 7). DGER Open File Report 2003-14 ([http://](http://www.dnr.wa.gov/geology/pdf/ofr03-14.pdf)



**Figure 3.** Seattle waterfront showing the seawall and the Alaskan Way Viaduct (two-deck elevated roadway) just above it, which are at risk from any major earthquake. View to the east.



**Figure 4.** Folded peat beds at Mee-Kwa-Mooks Park, visible at low tide, have been interpreted as evidence for movement on the Seattle fault. View to the west across Puget Sound to Restoration Point on the south end of Bainbridge Island, following the approximate trace of the Seattle fault.



**Figure 5.** This bluff is an area of continuing instability. The site of one of the larger Seattle landslides along Perkins Lane on the southwest side of the Magnolia neighborhood following the 1996/97 storms, it was a reactivation of a pre-existing deep-seated landslide. View to the northeast.

## DIGITAL MAPPING TECHNIQUES WEBSITE

Proceedings papers from the Digital Mapping Techniques 2006 (DMT'06) workshop are now being assembled online (<http://ngmdb.usgs.gov/Info/dmt/>). As papers are completed, they will be posted on the website prior to formal publication. DMT'06 is the latest in a series of workshops designed to share information and develop more efficient methods for digital mapping and GIS analysis. The workshops are sponsored by the Association of American State Geologists and the U.S. Geological Survey. Oral and poster presentations are also available for most of the nine previous workshops. ■

## OREGON GEOLOGIC DATA

The Oregon Department of Geology and Mineral Industries (DOGAMI) has launched a website to explore Oregon geology online at <http://www.oregongeology.com/sub/ogdc/>. The website is the culmination of the first two years of a planned six-year project, detailed at <http://pubs.usgs.gov/of/2004/1451/ferns/index.html>, to digitally compile geologic data for the entire state. It brings together the best available geologic mapping from state and federal agencies, student theses, and consultants, although viewers are cautioned that it is a work in progress. You can view Oregon stratigraphy, rock type, and rock property theme maps on topographic and shaded relief backdrops. ■

[www.dnr.wa.gov/geology/pdf/ofr03-14.pdf](http://www.dnr.wa.gov/geology/pdf/ofr03-14.pdf) shows the computer-modeled tsunami inundation areas for Seattle.

At the last stop outside the Colman Dock ferry terminal, George Crawford of the

## MESSAGE FROM THE STATE GEOLOGIST

The Geology and Earth Resources Division received funding in two areas for fiscal year 2007. The Division's geological hazards program has restarted as a result of a \$654,000 appropriation to the Department. We have assigned one geologist full-time to shoreline slope stability work, contracted with the GeoMapNW group at the University of Washington for additional shoreline slope stability work in central Puget Sound, and are in the process of hiring two new geologists for seismic risk assessments and general hazard assessment support. The other funding source is a significant increase in fees for surface mine reclamation permits. This will allow the Division to add five people to the surface mine reclamation program.



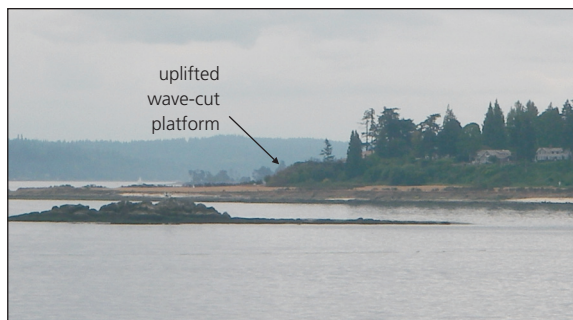
**Ron Teissere**  
State Geologist

The Division has proposed budget initiatives for the 07–09 biennium for additional geologic hazards work, initial work on a statewide subsurface database, a three-dimensional surface and subsurface geologic map of Lincoln County, and additional aggregate resource mapping on a county by county basis. The dollar requests are: geologic hazards fieldwork (\$620,000), statewide subsurface database (\$500,000), Lincoln County 3-D map (\$600,000), and aggregate mapping (\$627,000), for a total of \$2,347,000.

Bringing these requests to fulfillment will require broad support from all of our stakeholders. Your continuing support of the Division is deeply appreciated. ■

Washington State Emergency Management Division (EMD) explained the All Hazard Alert Broadcasting (AHAB) radio warning system (Fig. 8) and emergency preparedness (<http://www.emd.wa.gov/>). AHAB is a self-sufficient outdoor warning system tied into the NOAA (National Oceanic and Atmospheric Administration) Weather Radio All Hazards system. Alerts activate a brilliant blue U.S. Coast Guard light and a siren that can be heard for at least a mile, followed by an equally loud spoken message that advises the public how to respond to the hazard.

Specifics of next year's Decision-Makers Field Conference, tentatively on the topic of energy and alternative energy sources, will be announced next spring. If you would like to be considered as a guest or speaker, e-mail your request along with your title, business address, and phone to [geology@wadnr.gov](mailto:geology@wadnr.gov). ■



**Figure 6.** Restoration Point on the southeast end of Bainbridge Island where a bedrock wave-cut platform has been raised 20+ feet by uplift along the Seattle fault. View to the south.



**Figure 7.** Harbor Island and the SoDo District are at risk from a tsunami generated by an earthquake on the Seattle fault. View to the south.



**Figure 8.** The AHAB radio warning system tower (red trim) at Colman Dock ferry terminal on the Seattle waterfront. Seattle AHAB stations use seismic instruments, cameras, a weather station, and chemical sensors to detect natural and man-made hazards. They can also be activated by NOAA Weather Radio. A siren and a loud voice message tell the public how to seek safety. View to the north.

## CELEBRATE EARTH SCIENCE WEEK, OCTOBER 8–14

Earth Science Week is coming up fast! You can organize your own local activity or try one of the many activities already being planned for the week of October 8–14. How will you celebrate Earth Science Week 2006?

### Be a Citizen Scientist

You can promote this year's theme—Be a Citizen Scientist—by conducting real citizen-science research. Record observations of cloud patterns. Dig up fossil evidence of past life. Gather rocks in your neighborhood, crack them open with a rock hammer, and examine their insides with a magnifying glass. Take field trips to museums, science centers, parks, university geoscience departments, and weather stations. Volunteer to collect data on water and air quality, biodiversity, climate change, and other phenomena for environmental monitoring efforts. Do activities featured in the Earth Science Week Toolkit and website (see below).

### Try Geocaching

Looking for adventure? Be one of the thousands of people nationwide who will go online the first day of Earth Science Week to look up predetermined latitude and longitude coordinates and use a Global Positioning System (GPS) to hunt down a nearby geocache (<http://www.earthcache.org>). This event is being organized by the Geological Society of America (GSA). On Oct. 8, geocachers can visit geological outcrops, fossil and mineral collecting sites, college

geoscience departments, and state geological surveys and find earth scientists and other experts who will give educational talks about their site.

For more ideas, read about successful past events at <http://www.earthsciweek.org/highlights/index>, or see recommendations for planning, fundraising, and advertising your event at <http://www.earthsciweek.org/forplanners/index>.

### Get a Toolkit

The new Earth Science Week Toolkit is packed with everything you need to join the celebration, lead earth science educational activities, and promote science literacy. The 2006 toolkit includes a school-year calendar running from August 2006 through July 2007 that features classroom activities, important geoscience information, and dates of relevant current events and earth science milestones for each month. The toolkit also features an overview of resources available from the USGS, a NASA brochure on geoscience education programs and products, a National Parks DVD, a NOAA booklet on climate, a CD about Geographic Information Systems (GIS) from ESRI, a Scholastic/AGI poster for elementary-level earth science teachers, and more.

In addition, the careers-oriented 2005 Toolkit ("Geoscientists Explore the Earth") and the natural hazards-focused 2004 Toolkit ("Living on a Restless Earth") are still available for order.

### Enter a Contest

This year, the photography contest, open to all ages, focuses on "Using and Studying Earth's Resources." Participants are encouraged to think creatively and submit pictures of geoscientists studying or working with the Earth's natural resources or people using these resources.

The 2006 visual arts contest is titled "Earth Science in Your Home Town." Students in grades K–5 are encouraged to draw, paint, or create a poster on any aspect of earth science that affects their community.

Students in grades 5–9 are eligible to enter the essay contest: "Be a Citizen Scientist!" Essays must be no longer than 500 words and should highlight the ways every person can contribute to a better understanding of our planet.

These contests offer opportunities for both students and the general public to participate in the celebration. The first-place prize for each contest is \$300. To learn more, visit <http://www.earthsciweek.org/contests>.

### Visit Websites

The American Geological Institute (AGI) (<http://www.agiweb.org/> and <http://www.earthscienceworld.org/>) organizes this event to educate the public about the earth sciences. The USGS also supports Earth Science Week ([www.earthsciweek.org](http://www.earthsciweek.org)). DGER Earth Science Week activities will be posted at <http://www.dnr.wa.gov/geology/esweek/2006/>. ■



## NORTHWEST UNDERGROUND EXPLORATIONS MEMBERS FIND MISSING HIKER

by Chris Bell

On Tuesday, June 20, 2006, Ronald Calder was last seen napping on the couch. When his wife arrived home that evening, he was nowhere to be found. On Thursday, June 22, a group of Northwest Underground Explorations (NWUE) members noticed a car parked off US 97 near Blewett Pass. On Friday, June 23, the car was still there, and when we returned on Monday, June 26, and the car was still there, we made an effort to contact the authorities. Starting at the Kittitas County Sheriff's Office in Cle Elum, we were redirected to several other law enforcement agencies. Eventually, we gave up. Feeling discouraged, and as it was late, we headed home.

On Friday, June 30, a member returned to the site to find the car was still there. He then called the Chelan County Sheriff's Office. The operator told him that the sheriff would like to be shown the location of the car. The sheriff confirmed that the car belonged to a missing hiker. Within several hours, the sheriff's office responded with searchers, tracking dogs, and an ORV officer, and the vicinity was searched. Our group provided maps of the area showing dangerous mine workings and pinpointing locations to check first. The search ended quickly due to time of day and a lack of manpower. It was to resume in the morning.

We decided to keep searching, as the hiker had now been missing for 11 days. We headed up the hill, checking all known open tunnels and looking for any sign of a hiker.

Darkness was closing in. At 9:45 pm, we arrived at the 300-foot vertical shaft—the location that had worried us the most. We spotted a rope dropping into the darkness. Another rope held two burned out chem lights. We then found a backpack. Inside were a digital camera, binoculars, candles, GPS, ID, cell phone (still charged and with service)—all the right things needed to survive in an emergency.

We called the sheriff's office immediately, but were told rescue would have to wait until morning. We yelled down the shaft for a while, getting no response, and then headed back to camp, hoping for the best, but expecting the worst.

At 5:30 am, we met the rescue team and took them to the mine shaft. We explained the 100-year-old mine workings and what dangers they could expect to encounter. After about 1½ hours of prep work, the rescue team descended into the shaft. At the 100-foot level, they spotted the hiker down one of the tunnels. They knew immediately that he was dead and informed us above. We watched as they lowered the recovery gear, and when it was time to bring the hiker up, we helped pull him out. They said it looked like the hiker had unhooked himself from his rope to explore the tunnel and then found it had swung out of reach when he was ready to climb back up. After the rescue team secured the site and did a debriefing, we all headed back to the command center where they thanked us for our help.

We now know that Calder died from hypothermia and that our first attempt to

contact authorities at the six-day mark would not have saved him. Still, we know if he had just told someone where he was going, most likely he would have been rescued. We were told he was inexperienced, but he carried IDs saying he was certified in CPR and that he was a volunteer for the King County Sheriff's search and rescue team.

This accident should remind us that all abandoned mine workings are dangerous. The best advice is to "Stay Out and Stay Alive"—the motto adopted by the Nevada State Division of Minerals. Their 11-minute video on the subject is available for use at public meetings from Fritz Wolff of DGER's Abandoned Mine Lands Program (360-902-1468). Most fatal accidents in abandoned mines occur before the victim even realizes there is a problem. Stay out of mines unless you have legitimate business there and have been trained and equipped to deal with the hazards. It is important to exercise care even while searching for mineral specimens on the surface dumps. Find out if the land is open to the public before entering. Many mines are on active private mining claims and you need the owner's permission to explore.

Always take a partner when hiking, or at the very least, let people know where you are going. Leave an envelope in your car marked I.C.E. (In Case of Emergency) and fill it with your emergency and destination information. Be safe and explore smart!!!! ■

Visit Northwest Underground Explorations websites at <http://www.geocities.com/nwue/site/index.html> and <http://finance.groups.yahoo.com/group/NWUNDERGROUND/>.

To see the Wednesday, July 5, Seattle Times article on this incident, "Sammamish Climber, 46, Found Dead in Mine Shaft", go to <http://archives.seattletimes.nwsource.com/cgi-bin/texis.cgi/web/vortex/display?slug=rock05m&date=20060705&query=sammamish+climber+dead+mine>.

## EARTH SCIENCE WEEK AT DGER

To publicize Earth Science Week, DGER will be donating copies of the book "Bedrock—Writers on the Wonders of Geology" (edited by Lauret E. Savoy, Eldridge M. Moores, and Judith E. Moores; Trinity University Press, San Antonio, Texas; 339 p.) to the Washington State Library, the Timberland Regional Library, and the Office of the Superintendent of Public Instruction. From the back cover: "Novelists, poets, artists, anthropologists, traditional elders, philosophers, and naturalists come together to create a geological portrait of the Earth—from the violence of earthquakes and erupting volcanoes to epochal patterns in stone and the sinuous flow of rivers. With insights from many cultures and across time, 'Bedrock' wonderfully illuminates the geology of our home planet."

During Earth Science Week, DGER will hold a silent auction to benefit a geoscience organization that provides public education and outreach. Items to be auctioned include a gem and mineral collection, copies of Em Hansen (geologist) mysteries by Sarah Andrews, and a "Tapestry of Time and Terrain" jigsaw puzzle (GSA product).

DGER will also be collecting used geoscience books, textbooks, and journals to donate to the American Association of Petroleum Geologists' Publication Pipeline Committee to send to foreign universities. If you have books you would like to donate, drop them off at the Geology Library.

Information on DGER Earth Science Week activities will be posted at <http://www.dnr.wa.gov/geology/esweek/2006/>. ■



### DGER NEWS

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