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, 1890–2004"

Website: http://www.dnr.wa.gov/geology/ Vol. 1, No. 1, Spring 2004

MANY GEOLOGY PUBLICATIONS NOW SOLD THROUGH THE DEPARTMENT OF PRINTING

To better serve our customers, we are now selling many of our publications through the Washington State Department of Printing (DOP) and plan to transfer all publications sales to them in the near future. While this will result in an increase in some publication prices, it will also provide major benefits, such as online ordering, credit-card payment, fast shipping, the ability to view publication covers online, and walk-in service.

Our publications list describes all of our publications currently in print. It is on our website at http://www.dnr.wa.gov/geology/pubs/. Some publications are available for free download (as indicated by an internet address accompanying the publication description). We encourage all of our customers to check our website frequently.

Publications Available at the DOP

All of our in-print bulletins, geologic maps, information circulars, reports of investigations, and topographic maps, as well as our page-size and postcard-size geologic maps, are now sold through DOP.

To order these publications, note the publication series, number, and title of the desired publication(s) from our publications list before using DOP's online General Store (http://www.prt.wa.gov/) or visiting their offices in person (7580 New Market Street SW, Tumwater; see http://www.prt.wa.gov/ for directions). To use the General Store, select "Shop by Agency", then "Department of Natural Resources (Geology Division)". Publications are organized by series, and listed prices include shipping and handling.

Publications Still Available from Our Olympia Office

Open file reports, digital reports, and miscellaneous publications must still be ordered by mail from our Olympia office. An order form is on our website at http://www.dnr.wa.gov/geology/pubs/. All orders must be prepaid and will be filled by mail; over-the-counter sales are no longer available at our office. Listed prices for publications sold through our office do not include postage and handling, which must be included in your prepayment (postage and handling charges are listed on the order form). ■

This is the first issue of *DGER News*. It is being mailed to everyone on our *Washington Geology* subscribers list to give them an opportunity to sign up for e-mail notification. If you wish to be notified when we release new publications, send a request with your name and e-mail address to:

geology@wadnr.gov

MESSAGE FROM THE STATE GEOLOGIST

Ron Teissere
State Geologist

The Division of Geology and Earth Resources (DGER) had one of its most productive years in 2003. We released 28 publications (18 of which were geologic maps). We eliminated our backlog of unpublished maps and completed all new mapping projects within the contract period.

The bad news is that we no longer have the budget to actually print most of our publications, and our technical journal *Washington Geology* is still on hiatus in favor of contract projects that have money attached. Our new publication, *DGER News,* is not designed to replace *Washington Geology*, but to keep you posted on what the Division is doing. It will be electronic-only after this initial printing. If you wish to be notified when we release new publications, send a request with your name and e-mail address to: geology@wadnr.gov.

The 2003 legislature, following the recommendations in the Governor's budget, eliminated about 40 percent of our General Fund support. The result has been a reduction in office and cartographic support, the elimination of one library position, a reduction in library hours, and the shifting of five geologists to project funding.

This reduction in funding has hampered our ability to respond to Washington's need for geological information to support its continued population growth. Under the Growth Management Act, local governments need geological information for critical area and mineral resource overlay designations. Water-right decision-makers require subsurface geology data to make accurate models of aquifers. The landslide potential of many waterfront and coastal areas of the state is inadequately documented, and implementation of the new state building code is not yet supported with adequate, easily used, soil condition information.

We plan to ask the 2005 legislature to address these shortcomings in the 05-07 Biennium budget. Without this help, more positions in the Division will be at risk when current project funds run out in June of 2005. As part of the budget process, the Division has been working on a strategic plan for the next five years. The draft plan is posted at http://www.dnr.wa.gov/geology/pdf/05_09plan.pdf. The plan will be finalized in June as part of our budget process. Your comments and support will be appreciated. ■

DENDROCHRONOLOGY RESEARCH SUPPORTED BY MURDOCK GRANT

by Patrick T. Pringle

A Partners in Science Grant from the M. J. Murdock Charitable Trust was awarded to DGER Geologist Pat Pringle and Russ Weaver, a science teacher at Heritage High School in Vancouver, Wash., to use dendrochronology to date and better understand the Bonneville landslide in the Columbia River Gorge, Washington. The grant was successfully completed on May 1, 2004. Russ has been awarded a supplemental grant to continue his research.

The Partners in Science Program provides high school science teachers with opportunities in cutting-edge science to revitalize their teaching skills and encourage the use of inquiry-based methods in teaching science. Grants are based on the qualifications of the teacher's scientist mentor, the quality of the scientific research proposed, and the potential school benefits.

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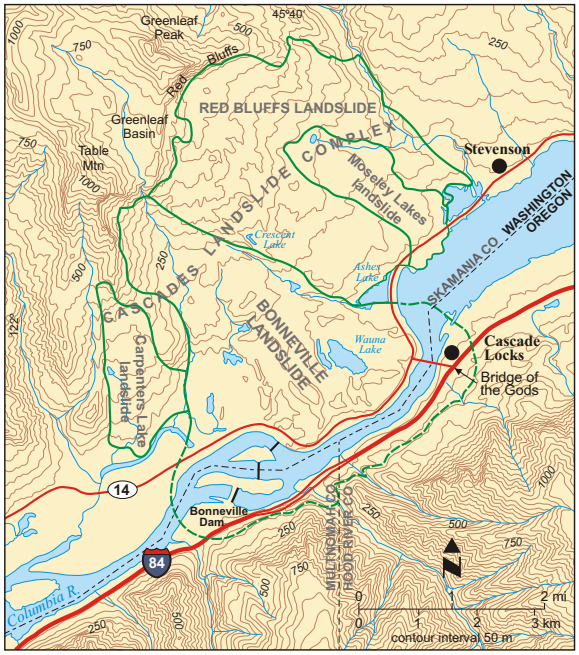

Figure 1. Approximate boundary of the Bonneville landslide within the Cascades landslide complex, dashed where approximate maximum extent inferred.

The Bonneville landslide (Fig. 1), part of the Cascades landslide complex in the Columbia River Gorge, is significant to the geologic, environmental, and cultural history of the Pacific Northwest. Just a few centuries ago, it dammed the entire Columbia River. Native peoples memorialized this event in allegories about "the Bridge of the Gods". Lewis and Clark noted the landslide and described the "submerged forest" drowned by the lake that formed behind the landslide.

An old-growth refugium of Douglas fir is living on the landslide. (A refugium is a biological community that has survived a climatic change or disaster, in this case, fire.) Many of the oldest trees are situated on 'balds' of rubbly Columbia River Basalt that have little or no soil, and hence sparse vegetation. Because of the scarcity of vegetation (i.e., fuel) on the balds, the trees have survived the catastrophic fires that have swept through the area. And because these trees are not growing on intact blocks of landslide debris, we infer that they were not transported to their present location while in growth position. Thus, the oldest of these trees should provide a viable minimum age for the landslide deposit.

To this end, we used dendrochronology (tree-ring dating) to help us further constrain the age of the landslide, as well as the fire history of the site. We cored more than 40 old-growth trees living on the landslide deposit (Fig. 2). We also located these trees geographically using GPS (global positioning system) to within several meters and noted the characteristics of each tree, such as breast-height diameter, fire or other damage (curvature, lean, or missing top), and geologic/ecologic environment (rock and soil type, sparsely vegetated area versus thicker forest canopy, etc.)

Russ prepared the samples for analysis and used the image analysis program *Scion Image* for ring-width measurements of scanned images of many of the oldest samples. The sample measurements and GPS data are being tabulated in spreadsheet format, and ring-width measurements are being processed and analyzed using the dendrochronology software *Cofecha* and other analysis programs. Russ is also making visual observations of the rings and using historical photographs to assist in assessing the fire history and other aspects of the study area.

Figure 2. Russ Weaver extracts a tree core from one of the trees in the refugium growing on the Bonneville landslide deposit. Photo by Pat Pringle.

Principal Findings

Previous estimates for the year of the Bonneville landslide ranged from about A.D. 1100 to 1750. The oldest tree sampled thus far on the landslide deposit began growing before A.D. 1595. Adding in the amount of time it likely took for trees to become established on the fresh rubble, we estimate that the Bonneville landslide probably dates to before A.D. 1550. Thus, our data show that the landslide was not triggered by the great (~Magnitude 9) Cascadia earthquake of January 26, 1700, as was allowed by previous age estimates.

We have identified a possible younger and much smaller landslide near the headscarp. We have also discovered a drowned forest in Crescent Lake, a small lake situated on the southwest margin of the Red Bluffs landslide, which is adjacent to the Bonneville landslide. Using wet suits, and assisted by collaborator Nathan Reynolds of Wash. State Univ. and Eric Plunkett, a volunteer, we sampled seven subfossil trees from this lake. We will measure the tree rings and have submitted a sample of one of the trees for radiocarbon dating. These trees are uniformly tilted to the northwest at about 10 degrees from vertical, probably in response to slight movement of the Red Bluffs landslide mass (which was in the opposite direction). That movement likely carried the trees into the topographic depression that drowned them. We want to date the trees to see if there is some connection to the generation of the Bonneville landslide, or perhaps to the destruction of the Bonneville landslide dam.

Continuation of Research

We are sampling trees along the margins of the landslide to look for movement of the landslide recorded in annual growth rings. We will also look more closely at the geology and trees above the slide's headscarp in Greenleaf Basin.

Our main focus now, however, is analysis of the data. We have coauthored four recent abstracts based on or using our research and are collaborating with researchers from other institutions on a paper to be submitted to the Geological Society of America Bulletin. ■

CURRENT DGER PROJECTS

GEOLOGIC HAZARDS PROGRAM

Hazard Mitigation Grant Program

In response to the Nisqually earthquake of 2001, DGER was awarded a grant by the Federal Emergency Management Agency and Washington Emergency Management Division to develop two types of earthquake hazard maps for every county in the state—

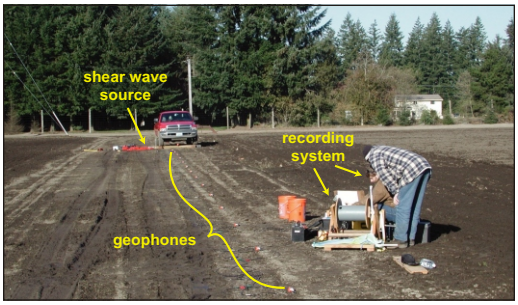

Figure 1. The survey method used to collect shear wave velocities of geologic units measures the time of travel from the shear wave source to each of the geophones. The recording system stores these times so that the shear-wave velocities can be calculated.

liquefaction susceptibility maps, which outline areas where water-saturated sandy soil loses strength during earthquake shaking, and NEHRP (National Earthquake Hazards Reduction Program) site class maps, which outline areas where soils amplify ground shaking. The maps will be used by State and local governments to update existing hazard mitigation plans and to delineate geologically hazardous areas under the Growth Management Act.

The project team of Eric Bilderback, Derek Folger, Sammantha Magsino, Rebecca Niggemann, and James Poelstra is led by Steve Palmer. The team's first task was the completion of preliminary statewide hazard maps based on existing 1:100,000-scale geologic mapping. These preliminary maps were distributed through an FTP site created by project staff, and user response has been overwhelming. (E-mail rebecca.niggemann@wadnr.gov to request access to the FTP site.)

The project team is working on developing detailed liquefaction susceptibility and NEHRP site class maps for a number of areas throughout the state. They have conducted more than 70 shear-wave velocity surveys (Fig. 1) to provide data used in developing the site class maps. Geotechnical data has been collected and analyzed to delineate areas susceptible to liquefaction. The final earthquake hazard maps will be released in September of 2004.

Looking for Active Faults

DGER investigates possible active faults to improve our understanding of Washington's earthquake risk. Tim Walsh and Josh Logan recently trenched the Canyon River fault (Fig. 2) in the southeast Olympic Mountains, showing that a Holocene quake on the fault produced at least 20 feet of slip.

They have also been interested in landslide-dammed lakes, which often form as the result of strong shaking from an earthquake. Clusters of these lakes near the Canyon River fault may prove to be the same age—more evidence for recent movement on the Canyon River or other fault in the area.

Figure 2. Geologist Tim Walsh logs a trench across the Canyon River fault. Note the use of flags and nails as position markers.

SURFACE MINE RECLAMATION

Assuring reclamation of Washington's 1200 permitted surface mines is a key responsibility of the Surface Mine Reclamation Program. The basic objective of reclamation is to re-establish stable slopes, topsoil, and self-sustaining vegetative cover and to implement long-term erosion control measures. An example of high-quality reclamation is the Northwest Alloy's mine site, which is currently undergoing closure (Fig. 3).

To increase the effectiveness and efficiency of the reclamation program's regulatory function, DGER is developing a remote-sensing system based on aerial photography to assess the reclamation status of surface mines throughout the state. Using updated, accurate, high-resolution aerial photographs, inspectors will soon be able to document ground conditions remotely.

A Geographic Information System (GIS) database is being generated to compare reclamation plan maps, aerial photographs, and Global Positioning System (GPS) ground control points. This will reduce the number of field-based inspections needed each year. The most important benefit, however, will be the increased clarification and feedback resulting from a reliable and timely snapshot of a surface mine's reclamation status. ■

Figure 3. *(top)* East-looking view of Northwest Alloy's "East Pit" near Addy in Stevens County, circa March 2002. For more than two decades, dolomite extracted from this quarry provided the primary raw material for the production of magnesium metal. *(bottom)* Similar view taken in October 2003 demonstrating a large array of high-quality reclamation features: backfilling of quarry highwalls with waste rock, replacement of growth media, placement of large woody debris, revegetation with multiple species, establishment and armoring of drainage channels, and creation of a lake and island. Vegetation has been placed to create travel corridors, food, and shelter for migratory wildlife.

IN MEMORIAM: PARKE D. SNAVELY, JR.

by Weldon W. Rau

Parke D. Snavely, Jr.
Depoe Bay, Oregon, 1999

On November 24, 2003, the geologic community of the Pacific Northwest lost one of its most innovative and productive field and research geologists. Parke D. Snavely, Jr., age 84, had a long and distinguishing career with the U.S. Geological Survey, spanning nearly 60 years. His geologic mapping of Cenozoic rocks in western Washington and Oregon has provided us with a modern geologic and tectonic framework for both the onshore and offshore areas of the Pacific Northwest.

Early on he led efforts to map and record coal reserves in the Centralia–Chehalis Coal District. Over the years Parke instigated and led efforts to map the geology of much of the north flank of the Olympic Peninsula, extending from Cape Flattery southward to La Push. In Oregon, he mapped much of the coast from Waldport northward to Tillamook and extending inland to and including much of the Coast Range. Parke was responsible for describing and naming many rock formations, including the Skookumchuck, McIntosh, Northcraft, Aldwell, and Makah Formations in Washington and the Nestucca and Alsea Formations in Oregon.

Because of Parke's diverse interest in geologic research and his ability to organize and lead, he served as Chief of the Pacific Coast Branch of Regional Geology for the USGS and was instrumental in organizing their Office of Marine Geology and Hydrology, which he served as its first chief. While there he initiated international cooperative research programs with the governments of Canada, Spain, Liberia, Japan, and Taiwan.

Parke was proud to receive the Dibblee Foundation's Dibblee Medal for his significant contribution to geologic mapping and the U.S. Department of Interior's Distinguished Service Award, its highest award to employees.

Personally, it has been my good fortune and pleasure to have known and worked with Parke for most of our careers, beginning in 1950 when I joined his crew on the Centralia–Chehalis Coal Project. Together with his pleasant demeanor, Parke displayed an outstanding ability to instill interest and enthusiasm in his colleagues. His mind was actively engaged in unraveling the problems of geologic processes, which in turn led to his ability to present sound concepts when explaining geologic phenomena. I will miss Parke, a true friend and an outstanding professional among fellow geologists.

In his honor, the Geological Society of America has established the Parke D. Snavely, Jr., Cascadia Research Award, an endowment fund for student research. Contributions can be made to the GSA Foundation, PO Box 9140, Boulder, CO 80301-9140. ■

MEETING CHALLENGES WITH GEOLOGIC MAPS

Geologic maps are our most important and complete compilation of information about the planet on which we live, and we cannot understand Earth without them. We use geologic maps and the fundamental information they provide in many ways.

DGER was asked to submit an article for the book "Meeting Challenges with Geologic Maps", which presents examples of how geologic maps help delineate fragile habitat and ecosystems, outline natural hazard areas, and locate needed resources. Joe Dragovich and Dave Norman wrote an article showing how geologic mapping was used to determine areas at risk from lahars from Glacier Peak volcano.

Intended for educators, policy-makers, and the general public, the book is written clearly and concisely and contains many photographs and graphics of natural phenomena and their corresponding representation on a geologic map.

"Meeting Challenges with Geologic Maps" may be ordered from the American Geological Institute for $15.95 at http://www.agiweb.org/pubs. ■

RAU'S FORAMINIFERA DATABASE RELEASED

More than 6000 slides of fossil foraminifera were collected by Weldon Rau for biostratigraphic studies in support of about 80 geologic mapping projects in Washington, Oregon, California, and Alaska over the course of his career. Most of the slides are from the U.S. Geological Survey and DGER collections. The slide collections, associated reports, and foraminiferal reference library have been archived at the Burke Museum at the University of Washington.

Digital Report 4, Pacific Northwest Tertiary Foraminiferal Collections of the U.S. Geological Survey and the State of Washington, by Weldon W. Rau, consists of a database in Microsoft Excel that lists the salient features of each slide from the USGS collection and a text that describes the database and the archive. ■

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