GOVERNING BOARD MEETING
OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

March 18, 2019
8:30 a.m.

Portland, OR

Public Meeting Agenda

The Board makes every attempt to hold strictly to the sequence of the distributed agenda. Times and topics may change up to the last minute, but the times for public comment will be available as indicated below. This agenda is available on the DOGAMI website: www.oregongeology.org.

8:30 a.m.	**Item 1**:	**Call to Order** – Chair Laura Maffei
8:35 a.m.	**Item 2**:	**Introductions** – Chair Laura Maffei and staff
8:40 a.m.	**Item 3**:	**Review Minutes of December 10, 2018** Board Action: The Board will be asked to take an action on this item
8:45 a.m.	**Item 4**:	**Financial Report** – Kim Riddell, Chief Financial Officer Board Action: The Board will be asked to take an action on this item
9:15 a.m.	**Item 5**:	**Grassy Mountain Update** – Randy Jones, Chemical Process Mining Coordinator Briefing: The board will not be asked to take an action on this item
9:25 a.m.	**Item 6:**	**MLRR Update** – Sarah Lewis, MLRR Program Manager Briefing: The board will not be asked to take an action on this item
9:45 a.m.	**Item 7:**	**Public Comment** Three minutes limit per person unless otherwise specified at the meeting by the Chair
9:55 a.m.	**Break**	
10:05 a.m.	**Item 8:**	**Mt. Hood Fault Presentation** – Ian Madin, Senior Scientist and Earthquake Hazard Geologist Briefing: The board will not be asked to take an action on this item
10:35 a.m.	**Item 9**:	**Legislative Update** – Bob Houston, Interim Legislative Coordinator Briefing: The board will not be asked to take an action on this item
10:50 a.m.	**Item 10**:	**GS&S Update** – Alyssa Pratt, GS&S Manager Briefing: The board will not be asked to take an action on this item

11:00 a.m. **Item 11**: **Director's Report** – Brad Avy, Director

Briefing: The board will not be asked to take an action on this item

11:20 a.m. **Item 12**: **Public Comment**

Three minutes limit per person unless otherwise specified at the meeting by the Chair

11:30 a.m. **Item 13**: **Board Adjourn**

PLEASE NOTE

AGENDA
The Board meeting will begin at 8:30 am, and proceed chronologically through the agenda.

PUBLIC TESTIMONY
If you wish to give testimony on any item scheduled on this agenda, please sign up on the sheets provided on the day of the meeting and you will be called to testify by the Board Chair. The Board places great value on information received from the public. Persons desiring to testify or otherwise present information to the Board are encouraged to:

1. Provide written summaries of information to the Board (7 sets);
2. Limit testimony to 3 minutes, recognizing that substance, not length, determines the value of testimony or written information;
3. Endorse rather than repeat testimony of other witnesses; and
4. Designate one spokesperson whenever possible when groups or organizations wish to testify.

THANK YOU FOR TAKING TIME TO PRESENT YOUR VIEWS
If you bring written materials to the meeting, please provide seven (7) copies. If you have questions regarding this agenda, please contact Lori Calarruda at (971) 673-1537 or you may email her at **lori.calarruda@oregon.gov**

REASONABLE ACCOMMODATION OF DISABILITIES
Reasonable accommodation, such as assisted hearing devices, sign language interpreters, and materials in large print or audiotape, will be provided as requested. In order to ensure availability, please contact the Director's Office at (971) 673-1555 at least 72 hours prior to the meeting to make your request.

Staff Report and Memorandum

To: Chair, Vice-Chair, and members of the DOGAMI Governing Board

From: Lori Calarruda, Executive Assistant

Date: March 8, 2019

Regarding: Agenda Item 3 – Review Minutes of December 10, 2018

Attached are draft Board Minutes from December 10, 2018.

Proposed Board Action: The Board Minutes of December 10, 2018 be Approved/Approved as amended/Not Approved.

GOVERNING BOARD MEETING MINUTES
OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

Monday, December 10, 2018
8:30 a.m.
Portland, Oregon

1) **Call to Order:** (Laura Maffei, Board Chair)

Chair Laura Maffei called the meeting to order at 8:40 a.m.

2) Introductions: (Laura Maffei, Board Chair and staff)

Chair Laura Maffei, Vice-Chair Katie Jeremiah, and Board Members Scott Ashford, Diane Teeman, and Linda Kozlowski were in attendance.

Department of Geology and Mineral Industries (DOGAMI) Staff in attendance:
Brad Avy, Director/State Geologist
Lori Calarruda, Recording Secretary/Executive Assistant
Kim Riddell, Chief Financial Officer (CFO)
Bob Houston, Interim Legislative Coordinator
Sarah Lewis, MLRR Program Manager
Alyssa Pratt, Acting GS&S Program Manager
Christina Appleby, Acting GIS & Remote Sensing Supervisor
Bill Burns, Acting Earth Science Supervisor
Laura Gabel, Acting Natural Hazards Supervisor
Connor Anderson, Chief Information Officer
Becky Johnson, Office Operations Assistant
Randy Jones, Chemical Process Mining Coordinator
Yumei Wang, Resilience Engineer

Others in attendance:
Sherry Carter, DAS Human Resources (HR)
Diane Lloyd, Department of Justice (DOJ)
Haylee Morse-Miller, DAS Office of the Chief Financial Officer (CFO)
Doug Toomey, Professor University of Oregon
Mike Harryman, State Resilience Officer
Emilie Hooft, University of Oregon
Amira Streeter, Natural Resources Policy Advisor

3) **Review Minutes of October 1, 2018:**

Chair Maffei asked if there were any changes to the minutes as presented. No changes.

Board Action: **Ashford moved to approve the minutes of October 1, 2018 as submitted. Kozlowski seconded. Motion carried.**

4) **<u>Proposed 2019 DOGAMI Board Meeting and Retreat Location(s):</u>**

Lori Calarruda, Executive Assistant and Bob Houston, Interim Legislative Coordinator presented the proposed location(s) for the 2019 Board Meeting and Retreat location(s), which are currently scheduled for July.

Houston provided details for each proposed location and answered Board member questions.

<u>Proposed 2019 Board Meeting and Retreat location(s)</u>

Option A: Ontario, OR - Neal Hot Springs Geothermal Area
One (1) stop to visit the Neal Hot Springs Geothermal area, tour a working geothermal power plant, and discuss regional geologic controls, future development, and regulatory oversight.

Option B: Ontario, OR – Proposed Grassy Mountain Gold Mine
One (1) stop to visit the proposed Grassy Mountain gold mine. Learn about the geologic history of the deposit, the initial discovery and exploration, mining methods, permitting, and reclamation requirements.

Option C: Burns, OR – Geology and Aggregate/Hydrocarbon Resources of the Burns Basin
Three (3) stops to visit key rock outcrops and learn how recent geology mapping is helping answer local groundwater resource needs. Visit an upland quarry and observe mining and reclamation techniques.

Option D: Bend, OR – Geology, Volcanic Hazards and Geothermal Potential of the Lower Crooked River Basin
Three (3) stops to visit key locations and learn about the geology, volcanic hazards, geothermal exploration at Newberry Volcano, and regional geologic controls on groundwater and surface water.

Option E: The Dalles, OR – Geology and Natural Hazards of the mid-Columbia Basin
Three (3) stops to visit key locations and learn about the regional geologic history, volcanic hazards, landslide hazards, Missoula floods, and geologic controls on groundwater and surface water.

Chair Maffei thanked Houston for the detailed chart. Ashford asked what would be seen at the Grassy Mountain site and if it would be possible to see actual drilling. Houston explained it would most likely be historical work done in the past with a slight possibility to see actual work being done, but mainly just rock and sagebrush. Ashford asked about the Neal Hot Springs Geothermal Area. Houston explained they would see a working geothermal plant and cooling facility, with above ground pipes that connect the geothermal plant to various drilled geothermal wells. It is the only one in the State.

Jeremiah asked if it was possible to have board meetings at other locations throughout the year other than Portland and not just for the one in July. Chair Maffei explained the normal meetings are held in Portland, but the two-day meeting/retreat format meeting as a group facilitates the ability to setup a tour(s). There would be a lot of expense and drive time for both staff and Board members to have multiple meetings throughout the state.

Ashford asked if the geology at the hot springs and Grassy Mountain is similar. Houston replied yes, there are similar mineral deposits as well, but not accessible during the trip to see the geothermal field. Jeremiah asked what the forced ranking would be based on what activities the Board might be considered to take action on in those areas. Houston answered it would be where staff is currently working. He explained the Agency is wrapping up a five-year project on geologic mapping identifying hazards and ground water issues in The Dalles and Bill Burns' team has been working on hazards related to the recent fire. Houston also mentioned mapping in the Burns area. Avy added the most immediate action item is at the Coast which is where the Board held their July meeting.

The Board chose Option A, Neal Hot Springs Geothermal Area, which requires a third day. The Board Retreat, field trip and Board meeting dates are now July 8, 9 and 10, 2019.

Board Action: **Ashford moved to accept Ontario, OR as the proposed 2019 Board meeting and retreat location with July 10, 2019 being added to the meeting dates as presented/discussed. Kozlowski seconded. Motion carried.**

5) Financial Report:

Kim Riddell, Chief Financial Officer, presented the budget status report as of October 31, 2018.

Riddell discussed an email that went out to staff regarding the amount of General Fund being spent on overbudget grants and their time. She wanted the Board to be aware that it may sound like the Agency is in trouble financially but that is not the case. It is meant to make the staff aware that they need to pay closer attention to their budget, not overspend, and is a stricter message to all staff not just the Principal Investigators (PIs) in charge of the projects. Riddell stated she has asked staff to keep their time being charged to General Fund to under 15%, except for staff who do grant writing, she will allow more for those staff members because it is not covered on a project but falls under General Fund.

Chair Maffei asked if this is only related to grant funded projects. Riddell explained that some of it is but also regarding training and presentations being held around the State. Riddell discussed a specific funder that is over budget in total of $100,000 and covers five grants, which is about 10% of the total funds. The funder had made some additional requests on the projects and may be providing more money to cover those requests. Riddell said that all PIs will be receiving training on how to track budgets and properly determine the actual budget. Riddell said she wanted to keep these issues open and transparent.

Ashford asked how many projects are over budget. Riddell replied there are 55 active grants with about 20 overbudget. Some are just slightly over but some are extremely over budget. Riddell explained her plan on upcoming projects, how she will be tracking them closer, and stated there will be actual consequences. Maffei asked if it has to do with staff not saying no to additional requests being done. Riddell said that was part of it. Ashford discussed his concern, stating other entities must be on budget and time, that DOGAMI staff need to be held accountable and have reviews done based on their work. Maffei asked if PIs are removed, does the Agency have staff capable to take their place. Riddell said she felt there are staff who could do the job. Kozlowski provided her point of view as a new Board member, stating she thinks it is great Riddell is being proactive and that holding staff accountable is a good step. She said you cannot have progress if you do not teach and develop your staff.

Avy said Riddell has worked hard to get the systems and policies in place but the previous culture at DOGAMI has been that project costs overbudget will be covered. He believes the Agency will be able to change that going forward. Avy wants DOGAMI to be considered not only a well-respected science Agency but a well-managed one as well.

Ashford asked about the outreach portion mentioned. Riddell explained the training, public outreach, and presentations being done around the State but stated a budget was not established for it. Chair Maffei asked if Riddell makes the decision regarding no more training/presentations or if it is in consultation with management. Riddell replied it is through consultation. Ashford asked if anyone is vetting the requests to determine which ones should be done. Riddell said no, unfortunately that is where the Agency is at this time. Kozlowski believes an overarching strategy for the Agency is necessary and asked if it has determined what strategy it wants to take related to outreach and training. Avy said the new Communication Director will be tasked to do this when they start. Ashford suggested there should be key elements put in every presentation.

Jeremiah had a question about the grant writing and if it can be recovered in the grant. Riddell explained it is specifically stated it cannot be included. Jeremiah asked questions about the specifics of grant projects regarding the frequency of reporting on status of their progress versus the budget. Riddell said she will be asking more questions going forward.

Riddell said the Governor's Budget came out last week and DOGAMI did well with the Agency getting additional $600,000; $300,000 is for lidar and, thanks to the Resilience Officer, $300,000 is to do a vertical evacuation study at the Coast. The fee increases for MLRR were approved to go through the legislative process.

Riddell stated the budget looks good, she does not have concerns at this time and does not feel the Agency will be going over. As a follow up, at the last Board meeting there were two budget line items named "Data Processing Hardware", she determined one is supposed to be software. Chair Maffei wanted to verify the negative numbers for GS&S and MLRR. Maffei believed GS&S is due to the federal funding. Riddell confirmed it and said MLRR's is due to Grassy Mountain.

Board Action: **Kozlowski moved to accept the Budget Status Report as presented with the corrected pages. Jeremiah seconded. Motion carried.**

6) Grassy Mountain Update:

Randy Jones, Chemical Process Mining Coordinator, provided the Grassy Mountain Update.

Jones discussed the Engagement Snapshot, which is a list of entities involved in this project. Jones said for the Process Snapshot, eighteen Baseline Data Reports have been reviewed/pending and two have yet to be submitted/finalized. Calico may submit a Land Use application to Malheur County in Q1 of 2019, which will be the company's first official permitting in Oregon.

Jones said they are continuing to develop products for periodic briefings, including a joint product with BLM and alignment between the State's required Environmental Evaluation and the federally required Environmental Impact Statement. He is expecting intense interagency conversations related to the tailing's storage facility (TSF). The Communications Strategy is unfolding with

stakeholder interviews completed and GNRO briefing papers provided quarterly. The company acquired 100% interest/control of claims in its overall 9,300 acre claims area and secured additional interest in Frost, a 900-acre claim located 12 miles west of Grassy Mountain. Calico is requesting 1:1 agency meetings with DEQ, DOGAMI, ODFW and Water Resources to refine its application materials. MLRR is expecting a second quarter Consolidated Permit Application submission.

Jones presented a snapshot of the underlying geology at the TSF largely composed of massive clay and how this may relate to the requirement of an adequately lined TSF for groundwater resource protection. He briefly discussed the next steps and also highlighted the Land Use process. This will likely result in the first sage grouse mitigation plan in the State. Ashford asked about the liner and asked if it will require more land disturbance. Jones said it will not demand any significant earth work other than the impounding embankments.

Teeman said she is the contact for the Burns Paiute Tribe and will be recusing herself from any discussion or action related to the Grassy Mountain project.

Briefing: **No Board Action Required.**

7) **MLRR Update:**

Sarah Lewis, MLRR Program Manager, provided an MLRR update:

Lewis said the staff has been continuing to work on internal procedures. They are working on roles and responsibilities, including a new phone tree to get callers to the correct person. There is now a Field Inspection Calendar for MLRR staff to coordinate site visits.

ENGAGe Newsletter

Lewis stated the last newsletter was done in the early 2000s. They are looking to do it more as a flyer to answer questions coming into the office and announce changes related to staff and/or legislation.

Becky Johnson, Office Operations Assistant for MLRR, introduced herself and stated the newsletter will be going out with all new renewals through a listserv and posted on the website. Kozlowski asked how often the newsletter will go out. Johnson replied quarterly or seasonally unless there is some need to get information out before then. The team is expecting the next one to go out in mid-January and are trying to keep it to one page but still interesting. The Board really likes the idea.

Permit Status Summary

Lewis reviewed the detailed list of permits. She changed Tables 1 and 2 slightly to accommodate information going forward. The handout is an “at the moment” snapshot as of the end of November and will be updated each meeting. Lewis discussed the numbers in detail, stating four long-term applications had been crossed off and completed. They are looking at closing out some of the sites that are unable to move forward. The Board is happy with the information and status.

Use of Civil Penalties

Lewis discussed Civil Penalties as a possible tool to bring mining sites into compliance. She explained the previous discussion on the topic and that moving forward with Civil Penalties requires a Board action and wanted to bring it back to the Board’s attention. For unpermitted sites, MLRR can send a

notice of violation but there is no way of enforcing the order, as an unpermitted site does not have a bond or security deposit. For permitted sites, a renewal notice is sent out 30 days before it is due, a second notice is sent 45 days after that, but it is about six months late before the department can threaten to pull the bond. While this usually results in payment of the renewal fee, by then there is only six months left on the permit.

Lewis explained to Board members that she was giving them a heads up, not asking for action. For the notices of violations, a notice of a civil penalty package would need to be prepared, which might require a special session between Board meetings to get them completed due to timeline requirements. It would be case by case. Lloyd said there is a template and approval process, but each one would require an approval from the Board. There is currently a case that may be processed. She stated these could be done via a special meeting phone call or as part of the Board meetings.

Ashford asked how much discretion the Agency has on doing these. Lloyd replied the Agency has total discretion, but in the past nothing has been done. Lewis said there are 15 permittees responsible for 57 of the 182 late payments. Lloyd said that specific criteria could be determined going forward. Chair Maffei asked if DOJ would be involved in the process. Lloyd said yes. It might justify the costs to get these started but could cause contested cases to go higher. The Board asked about tracking the cost of staff's time spent on preparing these. Lewis said it could be done. She said Civil Penalties come back to the department to cover the costs incurred for the case and any remaining money goes into the voluntary reclamation program.

Briefing: **No Board Action Required.**

8) **<u>Public Comment:</u>**

Chair Maffei asked for public comment. No public comments.

Break

9) **<u>Legislative Update:</u>**

Bob Houston, Interim Legislative Coordinator, provided a Legislative update for DOGAMI.

The Agency has two Legislative Concepts (LCs). The first LC is for MLRR program fee adjustments for mineral exploration, mining operation, exclusion certificates, oil and gas development and exploration, and permit issuance related to geothermal well drilling operations. Some permits have not had fees raised in decades. The concept also limits the distribution and numbers of onshore exploration sites, oil and gas, geothermal and exploration drilling sites to accommodate more effective permitting and consistency amongst the rules.

The current revenue projections indicate that in 21-23 current fees do not support basic program functions and will require staff reductions. Service levels will be affected and recent improvements to the overall service deliverables will not be sustainable.

The goals of the LC are to sustain the existing program beyond 2023, implement/develop and provide parity and fairness across the permit fees for the same permit action and their associated permit fee

amounts. The overall idea is the same fee for the same level of effort should be paid. The revenue generated would provide one (1) FTE for field inspector and one (1) FTE ISS system specialist for IT and ePermitting online programming.

The second LC corrects unintended capture of hobby mining by establishing a minimum yardage threshold for when an Exclusion Certificate is required. It also corrects the unintended capture of construction sites in the mining law unless those operations are competing in the commercial market. Houston said 17 stakeholder groups have been identified, representing industry and environmental. Most of them understand the need for the increase. In the next several weeks the LCs will be given bill numbers.

Houston briefly discussed the Policy Option Packages (POPs). He said POP 103, which is the mineral resource information study—digitizing historical data online, is not going forward. Avy said this was the third effort for this POP and the Agency does not plan to try again. POP 101 is for additional MLRR staff and POP 102 is for Lidar.

Session starts January 22, 2019.

Briefing: **No Board Action Required.**

10) **<u>ShakeAlert/Seismic Presentation:</u>**

Professor Douglas Toomey, University of Oregon, gave a ShakeAlert/Seismic presentation.

Professor Toomey presented "Oregon Hazards Lab: Science for Public Safety". The Oregon Hazards Lab (O-HAZ) uses science, technology, and education to understand, monitor and mitigate multi-hazards within the Pacific Northwest. Projects they are involved with include Pacific Northwest Seismic Network (PNSN), ShakeAlert, AlertWildfire, and Oregon Research Platform.

<u>Pacific Northwest Seismic Network (PNSN)</u>

PNSN monitors earthquake and volcanic activity across the Pacific Northwest, cooperatively operated by the University of Washington (UW) and the University of Oregon (UO). PNSN is sponsored by the US Geological Survey (USGS), US Department of Energy, State of Washington, and State of Oregon. There are more than 300 seismograph stations distributed across the region.

UO has been participating for nearly 30 years. Since 2014, it has expanded due to ShakeAlert. UO Earth Science department is largest seismology group on the West Coast, with eight faculty who claim expertise in seismology earthquake mechanics, or earthquake related processes. It is also one of the largest volcanology centers in the country. They were gifted $10 million from Chuck Lillis, which established the Oregon Volcanology Center, with currently fourteen faculty members working in the center.

UO purchased, from the State of Oregon, 30 high-quality sensors located at 15 sites. They need to add more in SW Oregon on the Coast. There are 1,600 stations planned for buildout in CA/OR/WA, with 650 currently contributing for ShakeAlert. There are 110 seismic stations currently in Oregon and there needs to be an additional 125 to be 100% operational for earthquake early warning. Oregon is currently at 50% buildout but needs a minimum of 75% to be a public alert state.

Since 2014 DOGAMI has contributed $297,000 to capital investments from the Strong Motion program, which resulted in 17 sites currently contributing to PNSN and ShakeAlert, with 16 more to be installed. After they are installed, USGS assumes ongoing operations and maintenance. Toomey discussed what it takes to get a site operational. It requires 1-3 days to install a site. Multi-hazard monitoring installations take 2-3 days for install of solar powered sites and 1 day for urban site installs. In building a robust telemetry model, the breakout is approximately 10% satellite, 30% cellular, 30% internet of opportunity (schools, fire stations, etc.), and 30% microwave, which is their preferred method. Multi-hazard monitoring sites require yearly maintenance visits because they are exposed to various environmental conditions, including bear attacks.

ShakeAlert – What is it?

ShakeAlert is the name of the West Coast Earthquake Early Warning System (EEW), developed by the USGS, Caltech, UC Berkeley, University of Washington, and University of Oregon. It can provide warning times from seconds to minutes. There are early warning systems in Mexico and Japan. There need be discussions to decide how to educate for ShakeAlert warnings. Toomey discussed the applications for ShakeAlert regarding people, things and situational awareness.

Toomey talked about when it will be available for public alerts and discussed where California is in their setup of the program. He stated Oregon is currently last. Toomey discussed the contributions other states are making to rollout the program and provided examples of state-wide coordination efforts. There are 30 stakeholders from across all sectors for the Oregon Committee on Communication, Education and Outreach (CEO). Toomey briefly discussed the six key strategies of Governor Brown's Resiliency 2025 report, the ShakeAlert Committee, ShakeAlert project partners, and partnerships and impacts.

AlertWildfire and ShakeAlert

AlertWildfire and ShakeAlert is a multi-hazards platform that increases state resilience by linking the two programs and using microwave for the telemetry system. It leverages funding sources that can save state tax dollars and will help with other hazards by pulling together technical and human resources to improve coordination and response within the state. Toomey briefly discussed the "State of Colorado 5 Lessons Learned from the 2018 Spring Fire", which mentioned microwave proved to be the most reliable technology.

Toomey reviewed AlertWildfire (www.alertwildfire.org/oregon/), which can discover/locate/confirm fire ignition, quickly scale fire resources, monitor fire behavior through containment, help evacuations during firestorms, and ensure contained fires are monitored. A demonstration of the camera system was included in the presentation. These cameras can be viewed by the public. The sponsors and partners include federal agencies, utilities, counties, private stakeholders, and communities, which provides an opportunity for statewide cooperation.

In summary, there has been significant progress since 2014 for PNSN and ShakeAlert, with expected public alerts becoming available when the network is at least 75% complete. AlertWildfire hardens the telemetry of ShakeAlert, diversifies funding sources for hazards detection and monitoring, and is a benefit to other stakeholders.

Kozlowski asked about the Governor's Budget and ShakeAlert. Toomey replied the request is for $12 million and would bring the State to 100% buildout, improve the telemetry system and move more of

the sites onto microwave, and add AlertWildfire and cameras. Kozlowski asked about the sensor population for the Coastal region. Toomey showed the contribution map and discussed it. Toomey mentioned the area west of Portland throws a lot of false alerts because it does not have enough station coverage yet. Kozlowski asked more questions regarding the locations. Ashford asked if the budget was base budget or tax increase. Toomey said base budget. Ashford asked about the microwave stability. Toomey replied the technology has advanced and become more reliable.

Briefing: **No Board Action Required.**

11) **GS&S Update:**

Alyssa Pratt, acting GS&S Program Manager, provided an update on GS&S.

Pratt introduced herself, stating she started the rotational manager position November 1, 2018. She joined DOGAMI 5 years ago and is grateful for the opportunity for developmental roles during her tenure and expressed the benefits of her experience. Pratt discussed the rotational program and introduced Laura Gabel, Christina Appleby and Bill Burns as the new section supervisors.

Jeremiah asked Pratt if there is anything the Board can do to support her, and the new supervisors related to grant budgets, she replied not at this time since they are still trying to figure things out but will be working closely with the Business Office.

Maffei expressed the Board's gratitude to Jed Roberts for the work that he did during his rotation.

Briefing: **No Board Action Required.**

12) **Director's Report:**

Director Avy presented his Director's Report on the following:

November All Staff Meeting

The meeting was held on November 1, 2018 in Salem. Avy mentioned Chair Maffei and Board member Kozlowski attended part of the day. Avy listed the agenda items covered during the meeting and said there was a wall of informative posters related to different content areas within the Agency. Collectively staff felt it was time well spent and feedback reinforced objectives were met. Eight items from the Employee Engagement Survey were voted on by staff for prioritization. A survey will go out to rank the top three results for management to focus on. Avy acknowledged the great job done by the planning team, which included Rachel Hiller (Hatfield Fellow), Sarah Lewis, Alyssa Pratt, Kim Riddell, Lisa Reinhart, and Jason McClaughry. The Passport Program idea has been created for a more collaborative effort between staff and programs. In-the-moment recognitions took place throughout the day.

Kozlowski said she was really impressed. It was energetic and she thought the diversity at each table was great.

Director's Board of Pharmacy Interim Role

Avy discussed his interim director role at Board of Pharmacy (BOP) and thanked the Board for allowing him the opportunity to help them get through their recruitment. The final round of

interviews happen this week and his interim role may end in January. Through this process, it has opened the opportunity to have someone from BOP help our Business Office one day a week.

Communications Director Position

This position has been open since the previous Communications Director moved on. Avy said Pratt has put together a team to provide input into what the position description should be. The team consists of Alyssa Pratt, Jon Allan, Sarah Lewis, Connor Anderson, Bob Houston and Deb Schueller. This effort is to determine what to recruit for and what the Agency really needs. Ashford asked if this position will coordinate the outreach efforts from the staff for projects. Avy replied yes.

Tsunami Line Letter to the Governor's Office

Chair Maffei will provide a draft to Director Avy for review. Kozlowski mentioned she was at a tsunami conference recently and the SB 379 tsunami line came up a lot. It was very emotional for architects and designers regarding how it would relate to building codes. The good news is the interest is spreading and they are interested in getting a solution. Avy mentioned the Tsunami letter during a conversation with Senator Johnson. She encouraged having a public member or two on the task force.

Leadership Team Changes (Rotational)

Avy discussed the rotational interviews, stating there was a strong field of candidates for both the manager and supervisor positions. There were seven candidates for the rotational manager position and eight for the rotational supervisor positions. Avy acknowledged Sherry Carter who served on the manager interviews and Jason Clary, Oregon Commission for the Blind, who served on both the manager and supervisor interviews.

Ashford asked to have updates at upcoming Board meetings on Riddell's budget report regarding projects overbudget, progress of the steps being taken, and if they are effective.

Briefing: **No Board Action Required.**

13) **Public Comment:**

Chair Maffei asked for public comment. No public comments.

14) **Board Adjourn:**

Chair Maffei adjourned the meeting at 11:45 a.m.

APPROVED

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Laura Maffei, Chair

Staff Report and Memorandum

To: Chair, Vice-Chair, and members of the DOGAMI Governing Board

From: Kim Riddell, Chief Financial Officer

Date: March 8, 2019

Regarding: Agenda Item 4 – Financial Report

Attached is the DOGAMI Budget Status Report, as of January 31, 2019 for the Geological Survey and Services (GS&S) Program and the Mineral Land Regulation & Reclamation (MLRR) Program.

Proposed Board Action: The Budget Status Report be Approved/Not Approved as presented.

Department of Geology & Mineral Industries
Budget Status Report: As of January 31, 2019

% of Time Spent
79%

Geological Survey & Services (GS&S) Program

Budget Category / Line Item	2017-19 Budget by Funding Source: General Funds	Other Funds	Federal Funds	All Funds	2017-19 Actual Revenue & Expenditures: General Funds	Other Funds	Federal Funds	All Funds	Actual Budget Spent: GF	OF	FF	All Funds	2017-19 Projected Revenue & Expenditures: General Funds	Other Funds	Federal Funds	All Funds	2017-19 Actual + Projected Revenue & Expenditures: General Funds	Other Funds	Federal Funds	All Funds	Actual + Projected Budget Total: GF	OF	FF	All Funds
Revenue																								
Beginning Balance	-	1,288,080	-	1,288,080	-	-	-	-					-	546,069	-	546,069	-	546,069	-	546,069				
2017-19 Revenue	4,709,949	3,732,066	5,937,915	14,379,930	4,421,091	926,406	2,487,534	7,835,031					288,858	369,402	1,533,000	2,191,260	4,709,949	880,796	4,020,534	10,026,290				
Total Available Revenue	**4,709,949**	**5,020,146**	**5,937,915**	**15,668,010**	**4,421,091**	**926,406**	**2,487,534**	**7,835,031**	94%	18%	42%	50%	**288,858**	**915,471**	**1,533,000**	**2,737,329**	**4,709,949**	**1,426,865**	**4,020,534**	**10,157,348**	100%	37%	68%	67%
Expenditures:																								
Personnel Services	3,080,942	1,171,742	2,678,734	6,931,418	3,412,077	607,204	1,002,674	5,021,955	111%	52%	37%	72%	733,638	301,317	282,228	1,317,182	4,145,715	907,573	1,284,901	6,339,137	135%	78%	48%	91%
Services & Supplies																								
Instate Travel	2,191	77,224	150,519	229,934	71,540	9,139	13,143	93,821					8,460	10,861	11,857	31,179	80,000	20,000	25,000	125,000				
Out of State Travel	7,177	22,405	6,294	35,876	14,691	3,768	9,087	27,546					5,309	3,732	913	9,954	20,000	7,500	10,000	37,500				
Employee Training	2,569	10,556	7,956	21,081	49,521	2,118	2,322	53,961					15,479	557	611	16,647	65,000	2,675	2,932	70,608				
Office Expenses	10,575	32,886	1,419	44,880	89,827	339	6,433	96,599					23,639	89	1,693	25,421	113,466	428	8,126	122,020				
Telecomm	88,461	227	9,395	98,083	71,889	-	-	71,889					18,111	-	-	18,111	90,000	-	-	90,000				
State Gov't Svc Chg	65,001	104,843	92,650	262,494	251,010	-	-	251,010					28,990	-	-	28,990	280,000	-	-	280,000				
Data Processing	893,490	-	6,499	899,989	259,134	-	-	259,134					207,866	-	-	207,866	467,000	-	-	467,000				
Publicity & Publications	-	4,805	57,231	62,036	2,035	438	109	2,581					966	115	29	1,109	3,000	553	137	3,691				
Professional Services	6,537	1,573,602	2,757,369	4,337,508	56,585	226,120	1,393,027	1,675,732					25,000	(89,817)	623,973	559,156	81,585	(237,394)	2,017,000	2,234,888				
IT Professional Services	-	80,000	-	80,000	12,507	-	-	12,507					3,291	-	-	3,291	15,798	-	-	15,798				
Attorney General	4,826	-	-	4,826	25,594	7,589	-	33,183					9,406	1,997	-	11,403	35,000	9,586	-	44,586				
Employee Recruitment	268	1,350	-	1,618	40	-	-	40					-	-	-	-	40	-	-	40				
Dues & Subscriptions	1,430	922	2,109	4,461	4,723	-	-	4,723					2,277	-	-	2,277	7,000	-	-	7,000				
Facilities Rent	203,312	178,665	55,339	437,316	263,370	-	-	263,370					79,829	-	-	79,829	343,199	-	-	343,199				
Fuels & Utilities	-	-	-	-	1,903	-	-	1,903					2,097	-	-	2,097	4,000	-	-	4,000				
Facilities Maintenance	-	-	-	-	1,418	-	-	1,418					373	-	-	373	1,792	-	-	1,792				
Agency Related S & S	-	-	-	-	2,367	-	-	2,367					623	-	-	623	2,989	-	-	2,989				
Intra agency Charges	-	-	-	-	-	-	-	-					(50,362)	-	-	(50,362)	(50,362)	-	-	(50,362)				
Other Services & Supplies	239,807	667,215	56,438	963,460	389,785	244	464	390,493					40,215	64	4,536	44,815	430,000	308	5,000	435,308				
Undistributed (S&S)	-	-	-	-	-	-	-	-					(251,000)	251,000	-	-	(251,000)	251,000	-	-				
Expendable Prop ($250-$500	7,141	18,489	27,341	52,971	2,591	-	-	2,591					682	-	-	682	3,272	-	-	3,272				
IT Expendable Property	5,982	-	28,622	34,604	184,854	-	23	184,877					5,146	-	6	5,153	190,000	-	29	190,029				
Technical Equipment	-	-	-	-	670	-	-	670					176	-	-	176	846	-	-	846				
Data Processing Software	90,240	-	-	90,240	-	-	-	-					-	-	-	-	-	-	-	-				
Data Processing Hardware	-	-	-	-	27,938	-	-	27,938					-	-	-	-	27,938	-	-	27,938				
Other Capital Outlay	-	-	-	-	-	-	-	-					-	-	-	-	-	-	-	-				
Indirect	-	-	-	-	(774,976)	175,710	385,003	(214,264)					(620,474)	113,505	265,533	(241,436)	(1,395,450)	289,215	650,535	(455,700)				
Total Services & Supplies	1,629,007	2,773,189	3,259,181	7,661,377	1,009,014	425,464	1,809,609	3,244,087	62%	15%	56%	42%	(443,901)	292,105	909,151	757,355	565,113	343,872	2,718,760	3,627,745	35%	26%	83%	52%
Total Expenditures	**4,709,949**	**3,944,931**	**5,937,915**	**14,592,795**	**4,421,091**	**1,032,668**	**2,812,283**	**8,266,042**	94%	26%	47%	57%	**289,737**	**593,422**	**1,191,378**	**2,074,537**	**4,710,828**	**1,251,445**	**4,003,661**	**9,965,935**	100%	41%	67%	71%
GS&S Ending Balance	**$ -**	**$ 1,075,215**	**$ -**	**$ 1,075,215**	**$ -**	**$ (106,262)**	**$ (324,749)**	**$ (431,011)**					**$ (879)**	**$ 322,049**	**$ 341,622**	**$ 662,791**	**$ (879)**	**$ 175,420**	**$ 16,873**	**$ 191,413**				

Strong Motion Instrument Fund

Revenue:	2017-19 Actual Revenue & Other Funds	2017-19 Projected Other Funds	2017-19 Actual + Projected Other Funds
Beginning Balance	342,130		342,130
2017-19 Revenue	242,090	172,921	415,011
Total Available Revenue	**584,220**	**172,921**	**757,141**
Expenditures:			
Personnel Services	237	711	947
Services & Supplies			
Professional Services: U of O	207,559	166,138	373,697
Total Expenditures	**207,796**	**166,848**	**374,644**
SMIF Ending Balance	**$ 376,424**	**$ 6,073**	**$ 382,497**

Department of Geology & Mineral Industries
Budget Status Report: As of January 31, 2019

% of Time Spent
79%

Mineral Land Regulation & Reclamation (MLRR) Program

Budget Category / Line Item	2017-19 Budget by Funding Source				2017-19 Actual Revenue & Expenditures				Actual Budget Spent				2017-19 Projected Revenue & Expenditures				2017-19 Actual + Projected Revenue & Expenditures				Actual + Projected Budget Total Spent			
	General Funds	Other Funds	Federal Funds	All Funds	General Funds	Other Funds	Federal Funds	All Funds	GF	OF	FF	All Funds	General Funds	Other Funds	Federal Funds	All Funds	General Funds	Other Funds	Federal Funds	All Funds	GF	OF	FF	All Funds
Revenue																								
Beginning Balance	-	370,374	-	370,374	-	-	-	-					-	462,218	-	462,218	-	462,218	-	462,218				
2017-19 Revenue	-	2,933,296	-	2,933,296	-	2,454,245	-	2,454,245					-	1,204,806	-	1,204,806	-	3,659,051	-	3,659,051				
Total Available Revenue	**-**	**3,303,670**	**-**	**3,303,670**	**-**	**2,454,245**	**-**	**2,454,245**	**0%**	**74%**	**0%**	**74%**	**-**	**1,667,024**	**-**	**1,667,024**	**-**	**4,121,269**	**-**	**4,121,269**	**0%**	**125%**	**0%**	**125%**
Expenditures:																								
Personnel Services	-	2,335,732	-	2,335,732	-	1,805,977	-	1,805,977	0%	77%	0%	77%	-	525,000	-	525,000	-	2,330,977	-	2,330,977	0%	100%	0%	100%
Services & Supplies																								
Instate Travel	-	66,724	-	66,724	-	42,616	-	42,616					-	2,384	-	2,384	-	45,000	-	45,000				
Out of State Travel	-	-	-	-	-	4,413	-	4,413					-	1,161	-	1,161	-	5,574	-	5,574				
Employee Training	-	69	-	69	-	11,884	-	11,884					-	4,000	-	4,000	-	15,884	-	15,884				
Office Expenses	-	29,287	-	29,287	-	20,469	-	20,469					-	5,387	-	5,387	-	25,856	-	25,856				
Telecomm	-	79,456	-	79,456	-	16,980	-	16,980					-	11,020	-	11,020	-	28,000	-	28,000				
State Gov't Svc Chg	-	-	-	-	-	-	-	-					-	-	-	-	-	-	-	-				
Data Processing	-	76,055	-	76,055	-	25,008	-	25,008					-	16,750	-	16,750	-	41,758	-	41,758				
Publicity & Publications	-	3,464	-	3,464	-	1,143	-	1,143					-	857	-	857	-	2,000	-	2,000				
Professional Services	-	91,305	-	91,305	-	285,013	-	285,013					-	114,987	-	114,987	-	400,000	-	400,000				
IT Professional Services	-	-	-	-	-	-	-	-					-	-	-	-	-	-	-	-				
Attorney General	-	52,746	-	52,746	-	137,122	-	137,122					-	36,085	-	36,085	-	173,207	-	173,207				
Employee Recruitment	-	5	-	5	-	8,248	-	8,248					-	1,000	-	1,000	-	9,248	-	9,248				
Dues & Subscriptions	-	575	-	575	-	640	-	640					-	168	-	168	-	808	-	808				
Facilities Rent		76,801				56,767		56,767						29,633		29,633	-	86,400	-	86,400				
Fuels & Utilities		10,629				9,825		9,825						5,175		5,175	-	15,000	-	15,000				
Facilities Maintenance		10,595				6,609		6,609						3,000		3,000	-	9,609	-	9,609				
Agency Related S & S		-				29,455		29,455						7,751		7,751	-	37,207	-	37,207				
Intra agency Charges	-	-	-	-	-	-	-	-					-	-	-	-	-	-	-	-				
Other Services & Supplies	-	32,839	-	32,839	-	1,692	-	1,692					-	1,308	-	1,308	-	3,000	-	3,000				
Undistributed (S&S)	-	-	-	-	-	-	-	-					-	-	-	-	-	-	-	-				
Expendable Prop ($250-$500	-	4,486	-	4,486	-	9,055	-	9,055					-	2,383	-	2,383	-	11,438	-	11,438				
IT Expendable Property	-	5,580	-	5,580	-	16,457	-	16,457					-	9,905	-	9,905	-	26,361	-	26,361				
Technical Equipment	-	-	-	-	-	-	-	-					-	-	-	-	-	-	-	-				
Data Processing Hardware	-	18,282	-	18,282	-	-	-	-					-	5,000	-	5,000	-	5,000	-	5,000				
Data Processing Hardware	-	-	-	-	-	-	-	-					-	-	-	-	-	-	-	-				
Other Capital Outlay	-	-	-	-	-	-	-	-					-	-	-	-	-	-	-	-				
Indirect	-	-	-	-	-	212,064	-	212,064					-	241,436	-	241,436	-	453,501	-	453,501				
Total Services & Supplies	-	558,898	-	558,898	-	895,459	-	895,459	0%	160%	0%	160%	-	499,391	-	499,391	-	1,394,850	-	1,394,850	0%	250%	0%	250%
Total Expenditures	**-**	**2,894,630**	**-**	**2,894,630**	**-**	**2,701,436**	**-**	**2,701,436**	**0%**	**93%**	**0%**	**93%**	**-**	**1,024,391**	**-**	**1,024,391**	**-**	**3,725,827**	**-**	**3,725,827**	**0%**	**129%**	**0%**	**129%**
MLRR Ending Balance	**$ -**	**$ 409,040**	**$ -**	**$ 409,040**	**$ -**	**$ (247,191)**	**$ -**	**$ (247,191)**					**$ -**	**$ 642,633**	**$ -**	**$ 642,633**	**$ -**	**$ 395,442**	**$ -**	**$ 395,442**				

Reclamation Guarantee Fund	
Beginning 2017-19:	
47 Cash Security's	**448,123**
2 Security release	(28,860)
6 new Security	109,969
Biennium to date:	
51 Cash Security's	**$ 529,232**

Staff Report and Memorandum

To: Chair, Vice-Chair, and members of the DOGAMI Governing Board

From: Randy Jones, Chemical Process Mining Coordinator

Date: March 8, 2019

Regarding: Agenda Item 5 – Grassy Mountain Update

Chemical Process Mining Coordinator Randy Jones will provide an update on Grassy Mountain.

Proposed Board Action: The Board will not be asked to take an action on this item.

Staff Report and Memorandum

To: Chair, Vice-Chair, and members of the DOGAMI Governing Board

From: Sarah Lewis, MLRR Program Manager

Date: March 8, 2019

Regarding: Agenda Item 6 – MLRR Update

Sarah Lewis, MLRR Program Manager, will provide an update on MLRR and report on the following topics:

1) Permit Status Summary
2) Use of Civil Penalties

Proposed Board Action: The Board will not be asked to take an action on this item.

Staff Report and Memorandum

To: Chair, Vice-Chair, and members of the DOGAMI Governing Board

From: Ian Madin, Senior Scientist and Earthquake Hazard Geologist

Date: March 8, 2019

Regarding: Agenda Item 8 – Mt. Hood Fault Presentation

Ian Madin, Senior Scientist and Earthquake Hazard Geologist, will give a presentation based on the attached publication "The Mount Hood Fault Zone – Late Quaternary and Holocene Fault Features Newly Mapped with High-resolution Lidar Imagery".

Proposed Board Action: The Board will not be asked to take an action on this item.

The Mount Hood Fault Zone—Late Quaternary and Holocene Fault Features Newly Mapped with High-resolution Lidar Imagery

By Ian P. Madin, Ashley R. Streig, William J. Burns, and Lina Ma

The Mount Hood Fault Zone—Late Quaternary and Holocene Fault Features Newly Mapped with High-resolution Lidar Imagery

By Ian P. Madin[1], Ashley R. Streig[2], William J. Burns[1], and Lina Ma[1]

Introduction

Although most of the focus of earthquake resilience efforts in Oregon is on the Cascadia Subduction Zone and its potential for M9 earthquakes, local earthquakes on crustal faults remain a potential, but poorly understood, threat to the region. Few active crustal faults have been identified in western Oregon, in part because of the thick forest that covers most of the state west of the crest of the Cascade Range. In recent years, the Oregon Department of Geology and Mineral Industries (DOGAMI) has collected high-resolution (8 points per square meter [m^2]) light detection and ranging (lidar) data over much of western Oregon. The very closely spaced sampling of the data allows enough laser pulses to penetrate the vegetation and reach the ground that nominal 1-m (3 feet) resolution bare-earth digital elevation models (DEMs) can be produced. By analyzing this data with 2D and 3D visualizations, we have identified a series of late Quaternary-Holocene fault scarps and related features that define a large, previously unknown active fault zone at Mount Hood, a stratovolcano in the Oregon High Cascades last active in the Holocene (fig. 1). The fault features are located in an environment of steep terrain, which is actively being shaped by volcanic eruptions, glaciation, landslides, and debris flows. Below the timberline on Mount Hood the area is covered with dense conifer forest in which wind throw commonly perturbs the ground surface to a depth of 1–2 m. The preservation of so many surface rupture features suggests that the features are either very young and have not yet been obscured by the geomorphic activity, or the faults have high slip rates so that features are frequently refreshed.

We have completed limited reconnaissance of the fault features identified in the lidar imagery and excavated two reconnaissance trenches across the one of the scarps. This paper describes the limited data available for two of these faults, and suggests options for further research. These faults are still poorly mapped and we know little about their slip rates, earthquake history, and recurrence intervals. Because the system is so extensive, it could conceivably generate large earthquakes, and may pose a significant threat to the surrounding communities and critical infrastructure. It is therefore important to investigate these faults in detail in future studies.

[1]Oregon Department of Geology & Mineral Industries

[2]Portland State University

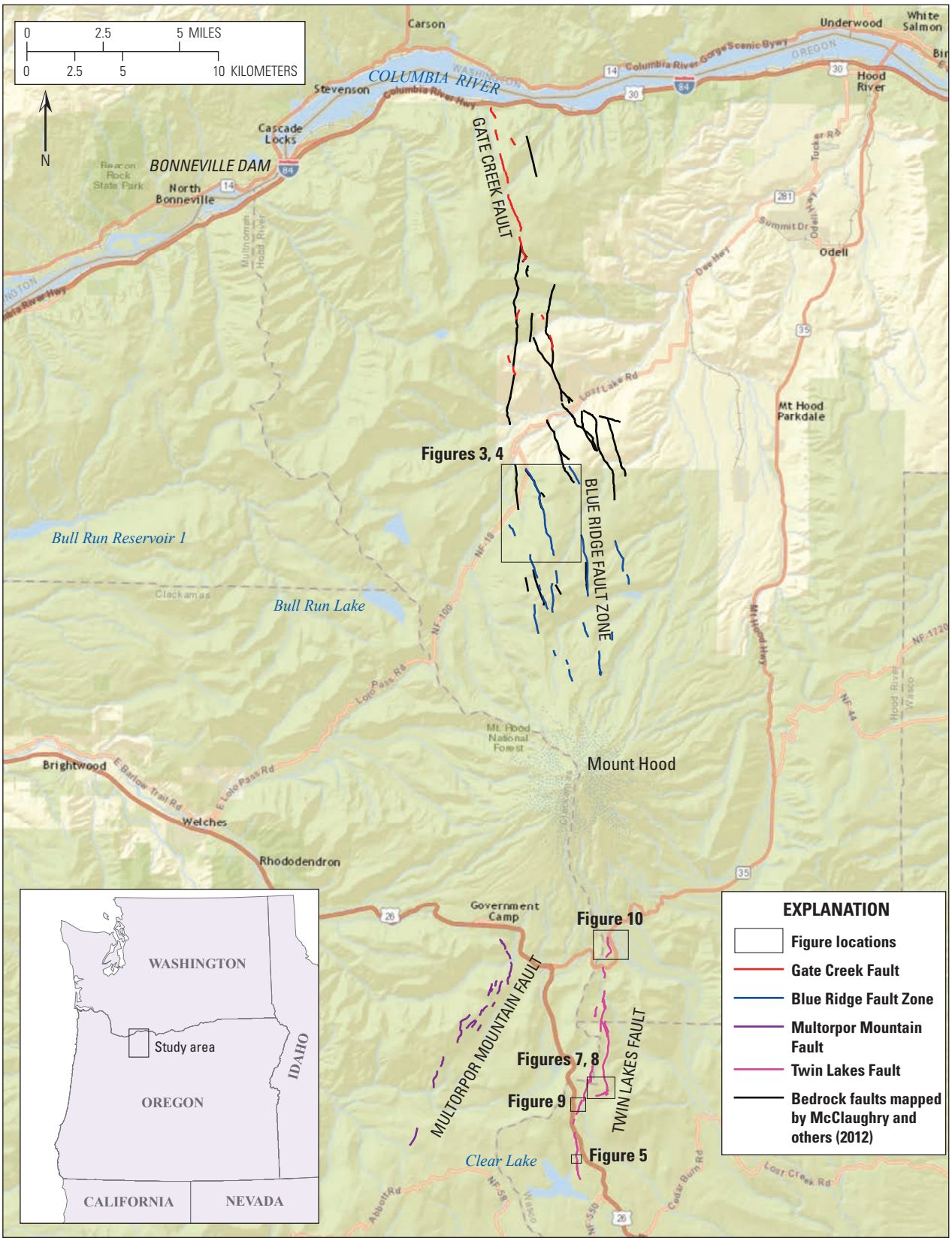
Mount Hood Fault Zone

The Mount Hood Fault Zone consists of four north-trending normal fault segments and extends ~55 kilometers (km) north from Clear Lake to the Columbia River (figs. 1, 2). South of Mount Hood, the zone roughly defines a 6-km-wide graben bounded on the west by the east-dipping Multorpor Mountain Fault, and on the east by the west-dipping Twin Lakes Fault. North of Mount Hood, the west-dipping Blue Ridge Fault and east-dipping Gate Creek Fault form a north-northwest trending en-echelon zone. None of these faults can be mapped across the volcanic edifice of Mount Hood, which is not surprising given its recent history of eruptions, glaciation, erosion, and debris flows. This paper will describe our current understanding of the Blue Ridge and Twin Lakes Faults.

Blue Ridge Fault Zone

The Blue Ridge Fault Zone is a 12-km-long, 4.5-km-wide area defined by about a dozen scarp segments ranging in length from a few hundred meters to nearly 5 km (figs. 1, 2). All but one segment have west-side-down displacement, and based on their topographic expression are probably west-dipping normal faults. A few short segments were previously mapped, but not recognized as active (Sherrod and Scott, 1995). Several faults in this zone extend up the steep north flank of Mount Hood, reaching elevations of 1,600 m and coming within 5 km of the summit.

The longest segment in the zone is the Blue Ridge Fault, which is defined by a continuous scarp that can be traced approximately 5 km across the top of Blue Ridge, becoming indistinct at either end where it descends into glaciated valleys (figs. 1–3). The scarp cuts and offsets a well-defined lateral moraine (fig. 3) which we correlate with the latest Pleistocene (~20 ka) Evans Creek unit of Sherrod and Scott (1995), indicating relatively recent movement. Numerous scarp profiles extracted from the lidar data show single-event scarps, ranging



Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Figure 1. Location map of the Mount Hood Fault Zone. Lidar-mapped fault features shown in color, black rectangles show locations of other figures in this paper, and heavy black lines are bedrock faults from recent geologic mapping by McClaughry and others (2012).

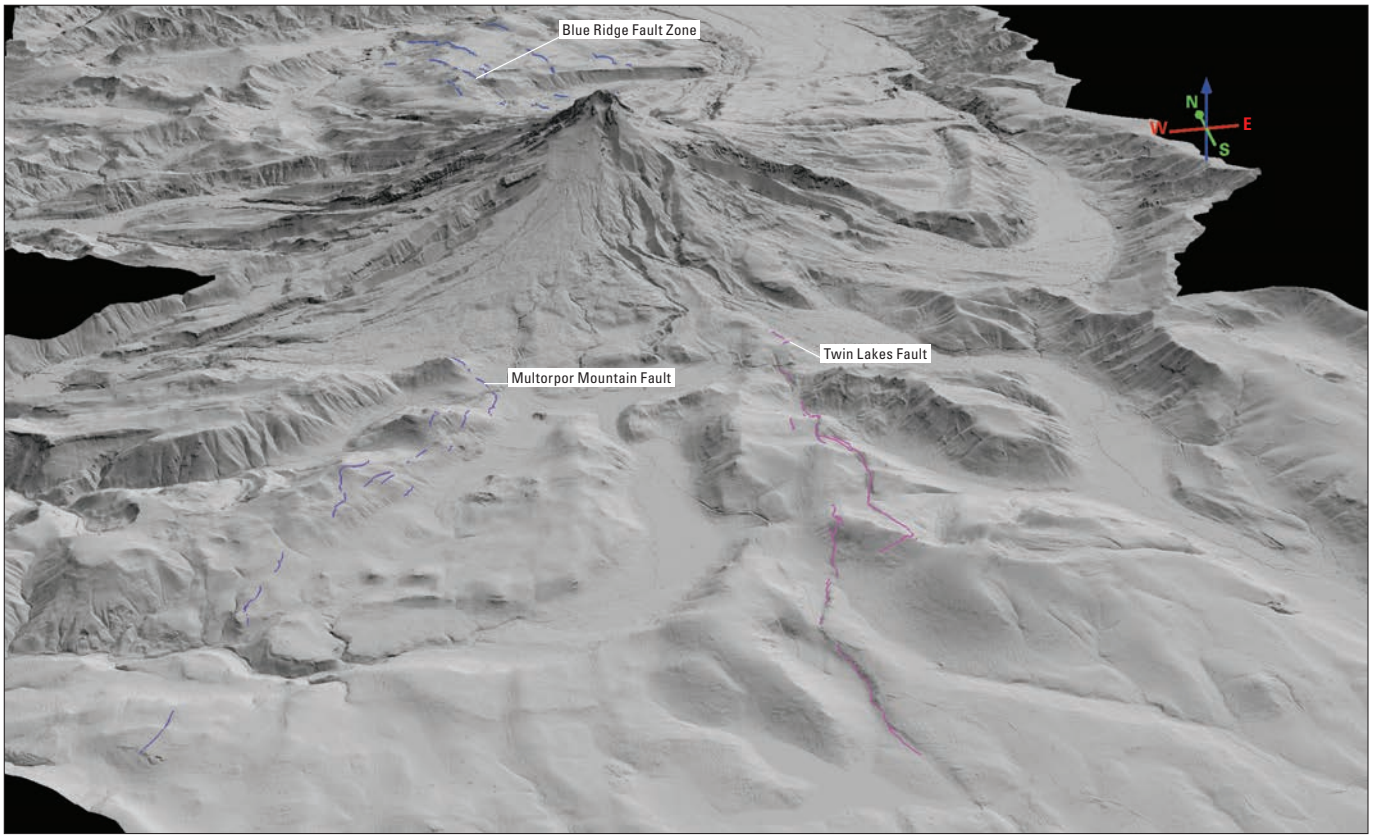


Figure 2. Perspective view of Mount Hood from the south-southwest,, based on nominal 1 meter lidar data. Magenta, Twin Lakes Fault; purple, Multorpor Mountain Fault; blue, Blue Ridge Fault. Scale varies in this perspective view, the Twin Lakes Fault is 12.75 km long.

in height from 1.2 to 2.1 m with surface offset ranging from 1.2 to 1.8 m (fig. 3). In 2011, DOGAMI partnered with the Portland Water Bureau (excavation equipment and staff) and U.S. Geological Survey (USGS, trench logging staff and ^{14}C dates) to excavate two exploratory trenches across the Blue Ridge scarp (Madin and Ma, 2012). Both trenches exposed well consolidated till, which was offset by a west-dipping normal fault. A simplified log of trench BR-1 is shown in figure 4; the till (unit A) is offset vertically by 1.8 m and has a fissure 6-m wide at the foot of the scarp. The bottom of the fissure is filled with scarp collapse rubble (unit B) consisting of blocks of till (unit AB) and loose cobbles and boulders of platy lava (fig. 4). A depression in the top surface of the collapse rubble unit is filled with muddy pebble colluvium (unit C). These units, and the till on either side of the fissure are overlain by three additional colluvium layers (units D–F) and the entire sequence is overlain by an organic-rich A horizon (unit G). Detrital charcoal was recovered from all four of the colluvial units, and accelerator mass spectroscopy (AMS) ^{14}C ages were determined for six samples (table 1). The preliminary investigation of trench BR-1 shows evidence for a single earthquake event, which occurred between ~13,540 and 9,835 years before present (B.P.). We interpret the scarp collapse unit (unit B, fig. 4) to be material that slid into the fissure during and for some time immediately after the earthquake, and the muddy pebble colluvium to be material that washed into the fissure during the first significant rainy period after the earthquake (unit C, fig. 4). In this interpretation, the muddy colluvium was deposited within years of the earthquake, and its age approximates the age of the event. The three AMS ^{14}C samples (table 1) from this unit have 2σ calibrated ages of 13,600–13,380 years B.P., 13,640–13,400 years B.P., and 13,710–13,430 years B.P., providing a lower bound age for the event of ~13,540 years B.P. Units D–G are successively younger, unfaulted colluvial units that drape both the faulted till and the fissure-filling units. The oldest of these (unit D) yielded a single detrital charcoal AMS ^{14}C sample (table 1), which has a 2σ calibrated age range of 10,160 to 9,980 years B.P. and 9,970 to 9,700 years B.P., which provides an upper bounding age for the earthquake of ~9,835 years B.P.

Trench BR-2 exposed similar till, vertically offset by 1.5–2 m, but without the fissure. No dateable material was recovered from the colluvium layers that postdated the event. However, together these results suggest that the Blue Ridge Fault is nominally Holocene in age.

Twin Lakes Fault

The Twin Lakes Fault extends north for more than 12 km from Clear Lake to Oregon Route 35, and forms the southeast margin of the Mount Hood Fault Zone. The Twin Lakes Fault consists of two en-echelon west-dipping normal fault

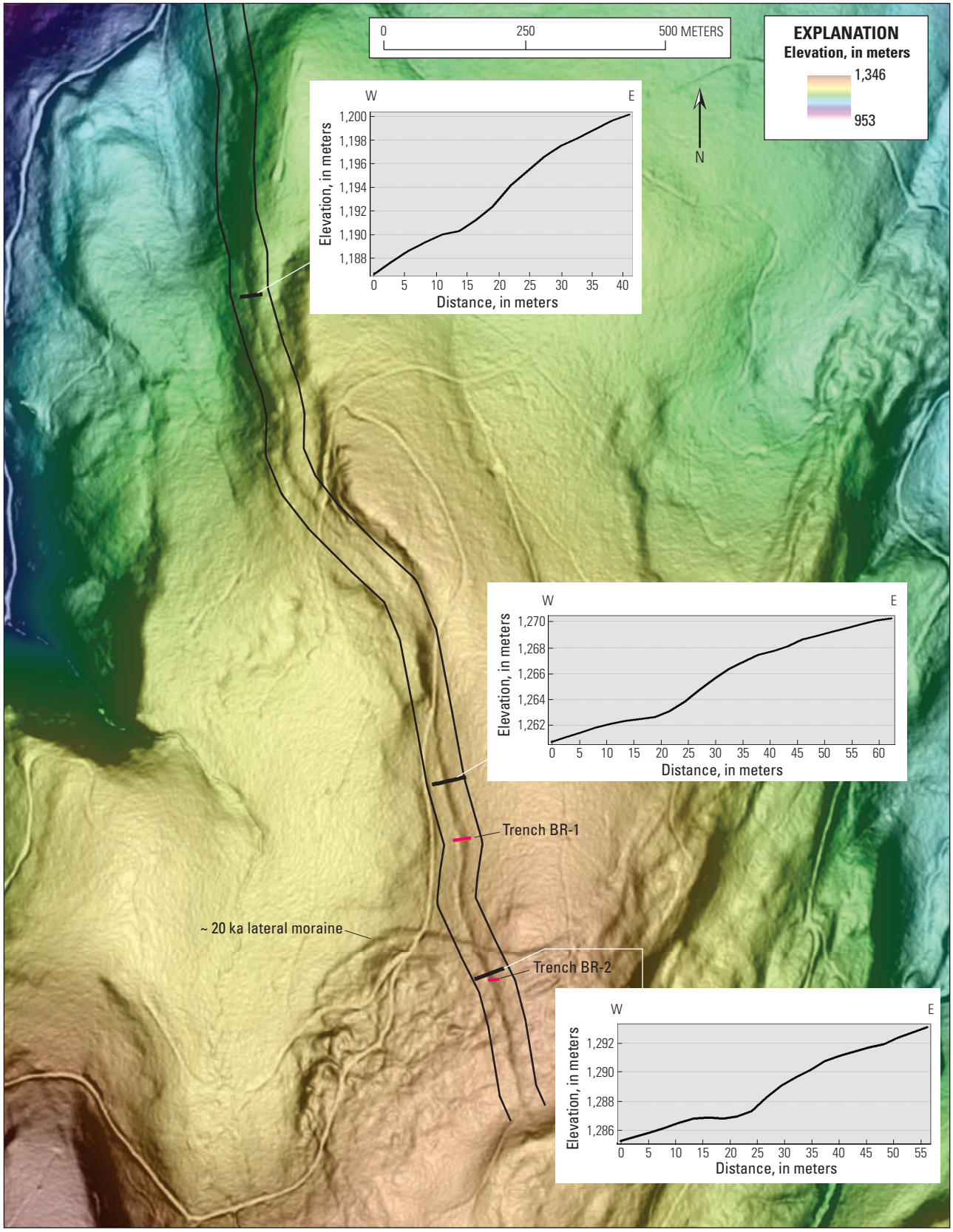


Figure 3. Map of the Blue Ridge Fault. Base map is 1-meter resolution lidar imagery combined with elevation color gradient over slopeshade. Double lines bracket the fault trace, which is expressed as a north-northwest trending, west-facing scarp. The fault offsets an ~20 ka glacial moraine that appears as a sinuous north-facing break in slope. Inset profiles are fault-normal, profile locations are shown by black lines. Red lines, location of 2011 trenches.

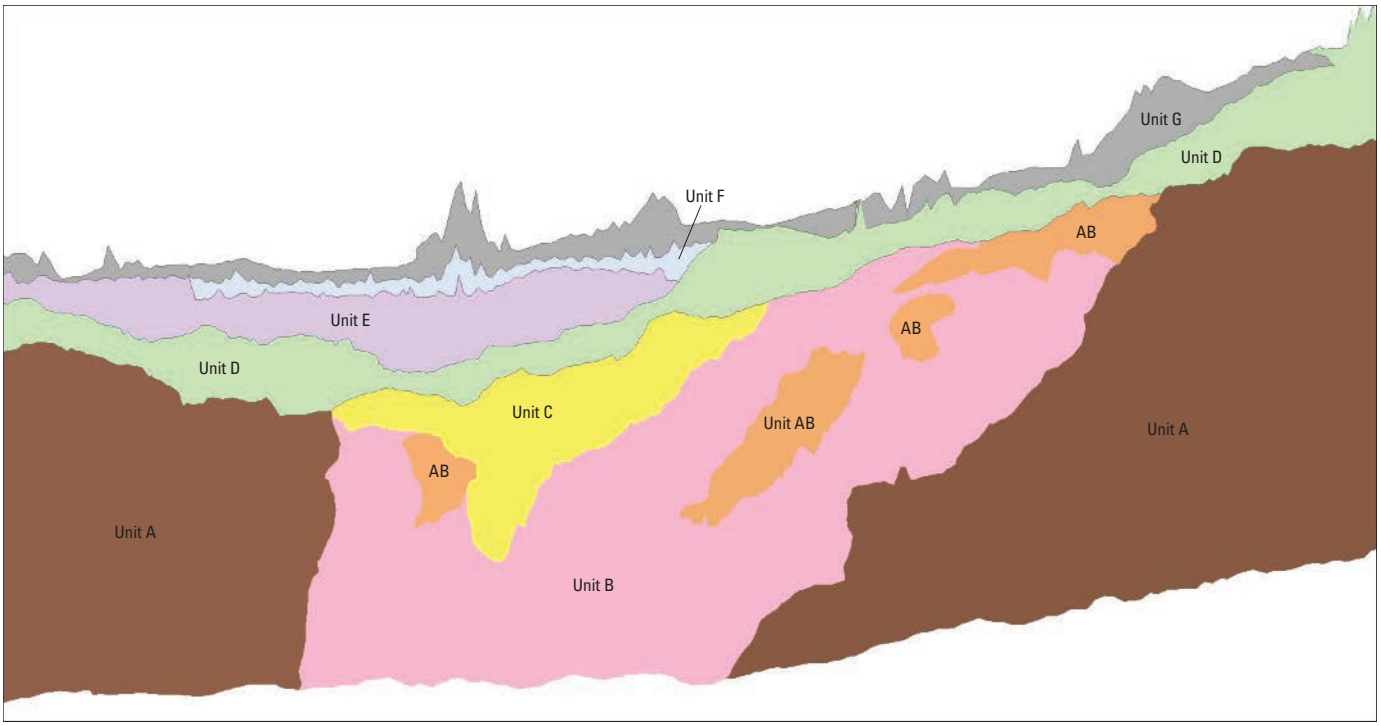


Figure 4. Simplified diagram of the log. Trench walls were sloped at approximately 1:1, and features were mapped in 3D on a 2-centimeter resolution digital elevation model (DEM) developed from a terrestrial lidar scan. This figure is a projection of the trench wall onto a vertical plane oriented east-west. The spiky appearance of units at top is due to inclusion of roots in the DEM. Scale varies due to the projection of a sloping surface, overall the area shown is ~10 meters wide and 2.5 meters high. Unit A is till older than 20 ka, and unit B is scarp-collapse rubble that fills a fissure formed along the fault. Unit AB is composed of blocks of till within the collapse rubble. Unit C is a muddy pebble colluvium that fills a depression in the middle of the fissure. Units D-F are colluvial layers that drape the entire scarp face, and unit G is the modern forest soil A horizon.

Table 1. Accelerator mass spectroscopy radiocarbon age data for samples from trench BR-1 (figs. 3, 4).

[All ages in years before present. Analyses by Beta Analytic]

Sample	Unit	Conventional radiocarbon age	2σ calibrated age
BR1_10/3-8	F	1,330 ± 30	1,300–1,240
			1,200–1,180
BR1_10/3-9	E	2,050 ± 30	2,040–2,020
			2,010–1,920
			1,920–1,900
BR1_10/3-2	D	8,830 ± 40	10,160–9,980
			9,970–9,700
BR1_MC-4	C	11,640 ± 50	13,600–13,380
BR1_MC-8	C	11,670 ± 50	13,640–13,400
BR1_MC-9	C	11,720 ± 50	13,710–13,430

segments, connected by a nearly continuous stepover. The fault impounds Frog Lake and the Twin Lakes along their eastern margins, and extends nearly to the dam at the east end of Clear Lake. The Twin Lakes appear to occupy a 50-m-deep half-graben formed by long-term movement on the fault and perhaps enhanced by glaciation. The fault parallels Oregon Route 35, and many features are easily accessible from the highway.

The southern segment of the fault is a single, fairly continuous scarp, which is well preserved near Clear Lake where the scarp cuts a debris fan originating from a small drainage (fig. 5). Little new fan material has been deposited across the scarp, suggesting that it formed in a fairly recent earthquake. Figure 6 shows the stepover area between the northern and southern segments of the fault where the northern segment forms a bench on an east-facing slope, the western segment forms scarps on west-facing slopes, and the stepover forms a north-facing scarp crossing the ridge east of Frog Lake. A detailed view of the stepover fault crossing the ridge, where it forms a sharp 1.5-m-high scarp in bedrock is shown in figure 7. Exposed bedrock on the scarp at this location is a good candidate for ^{3}He cosmogenic dating.

The northern segment of the Twin Lakes Fault impounds Frog Lake, and the basin around the lake is surrounded by a large fringing meadow that grades into forest (fig. 8). Exploratory hand-auger holes showed that there are at least 2 m of basin-filling sand and pebble gravel under the meadow and the edge of the forest. This is a good target for additional trenches or cores to look for dateable material and stratigraphic and sedimentological evidence of abrupt lake-level changes associated with fault movement raising the outlet level. Currently, the lake has no outlet, but there is a well-developed abandoned channel on the upthrown side of the fault (fig. 8). The abandoned channel floor is approximately 1 m above the current lake level.

At the northern end of the Twin Lakes Fault (figs. 1, 2) lidar data show a clear scarp extending west-northwest for 500 m along the southwest edge of the glaciated canyon of the White River (figs. 1–2, 9). Field observations confirm the presence of a sharp, well-preserved feature about 2-m high that extends along the break in slope at the top of the canyon wall. The scarp is formed in boulder colluvium or till, and forested with mature trees, which suggest that it has been several hundred years since the most recent movement. A small stream on

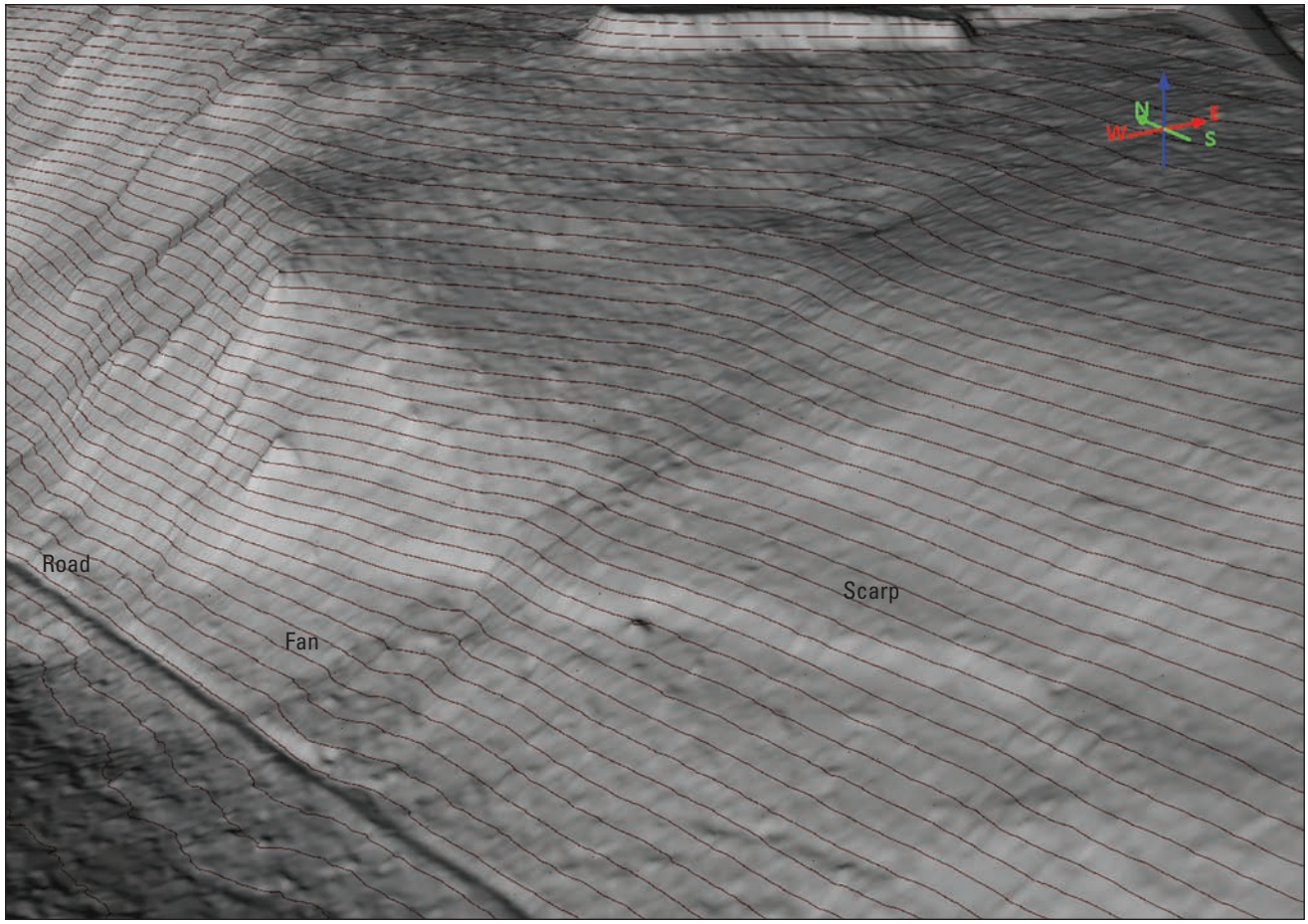


Figure 5. A 3D perspective view of a small, offset fan along the Twin Lakes Fault near Clear Lake. The fan has been beheaded by the scarp and no fan material appears to have been deposited across the scarp since it formed. Contours are at 2 meter intervals, roadway is ~4 meters wide.

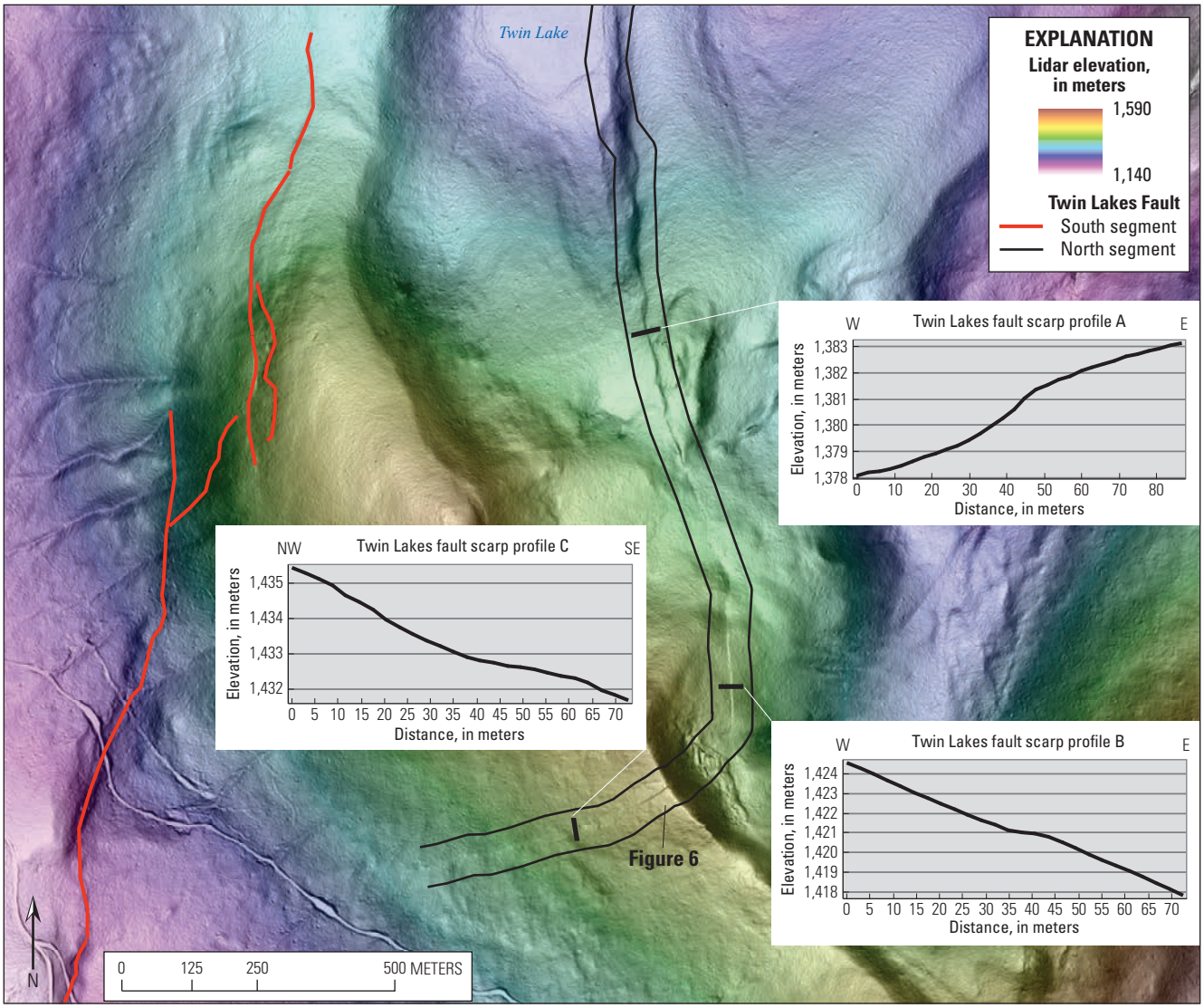


Figure 6. Map of fault features along the stepover zone on the Twin Lakes Fault. The base map is 1-meter lidar slopeshade with an elevation color gradient. Scarp profile locations on are shown by black bars. Profile A shows a west-facing scarp on a west-facing slope. Profile B shows a bench formed by west-side-down motion on an east-facing slope. Profile C shows an uphill-facing scarp where the fault bends to the west at the southern end of the north segment of the fault.

the downthrown side is partly blocked by the scarp, forming a wetland covering a few hundred square meters. Exploratory gouge cores recovered bedded sandy gravel with peat layers, and further coring may provide dateable stratigraphic evidence of fault movement. To the north, the fault descends into the White River canyon where it is buried by the highly active outwash plain of the White River Glacier.

Conclusions

Based on the examination of high-resolution lidar imagery and limited field reconnaissance and trenching, we have defined a major late Quaternary-Holocene age fault zone centered on Mount Hood. The discovery of this active fault system is important for understanding the potential seismic threat for nearby communities. Reconnaissance trenching across the Blue Ridge Fault (figs. 3, 4) identified a single earthquake with approximately 1.8 m of normal slip that occurred between ~13,540 and 9,835 years B.P. (fig. 4, table 1). Holocene-age displacement of 1.8 m suggests that the Mount Hood Fault Zone could produce relatively large crustal earthquakes frequently enough to pose a significant hazard. Although the mode of fault rupture is unknown due to the lack of paleoseismic constraints on past surface-rupturing earthquakes, we can estimate potential earthquake magnitude using empirical scaling laws derived from regressions of observed displacement, rupture length, and moment magnitude for normal fault ruptures from Wells and Coppersmith (1994). Using the measured normal displacement of 1.8 m as both the

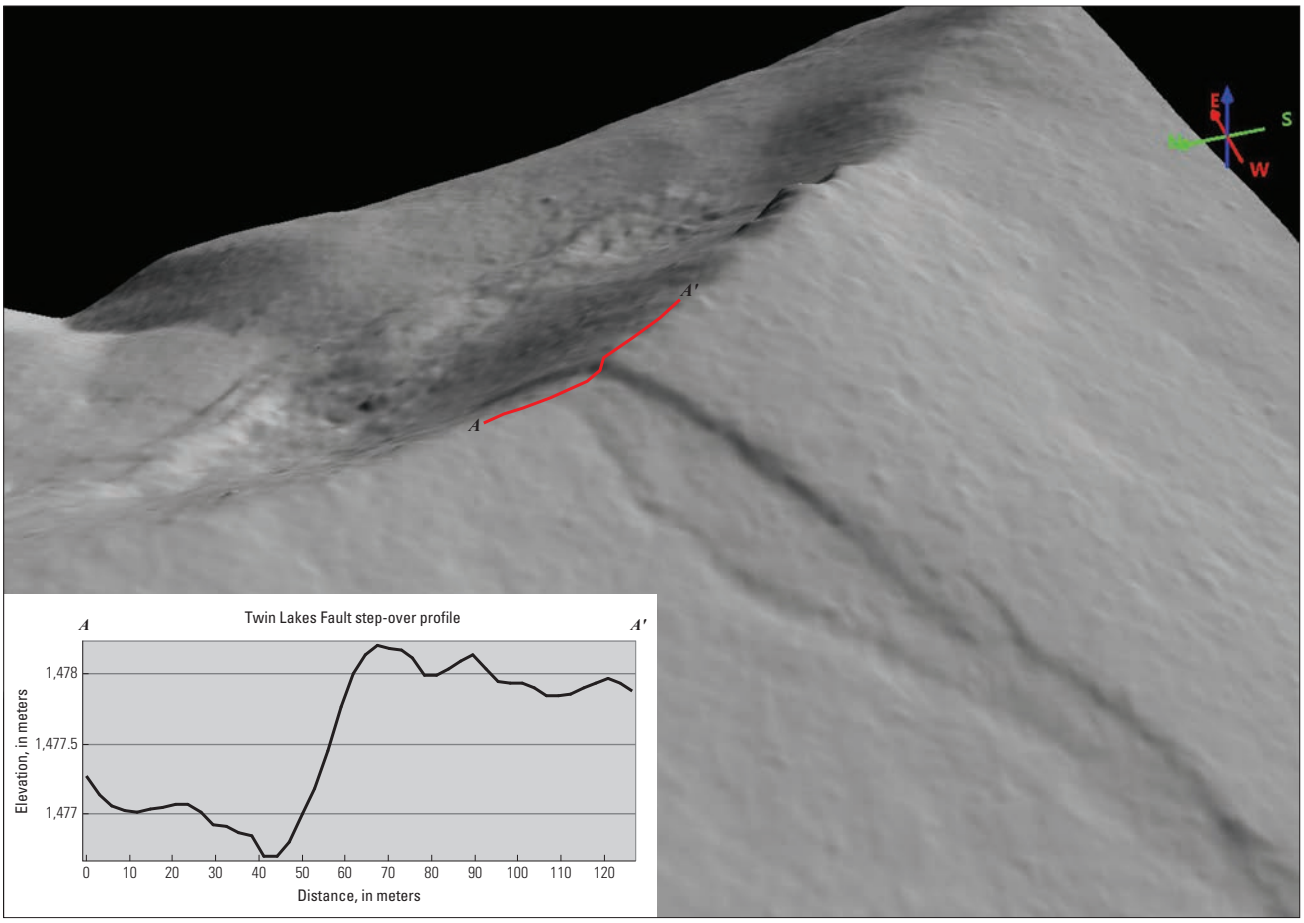


Figure 7. Perspective view of the Twin Lakes Fault stepover on the ridge east of Frog Lake, based on 1-meter lidar topography. Red line corresponds to the inset topographic profile. Scale varies in perspective view.

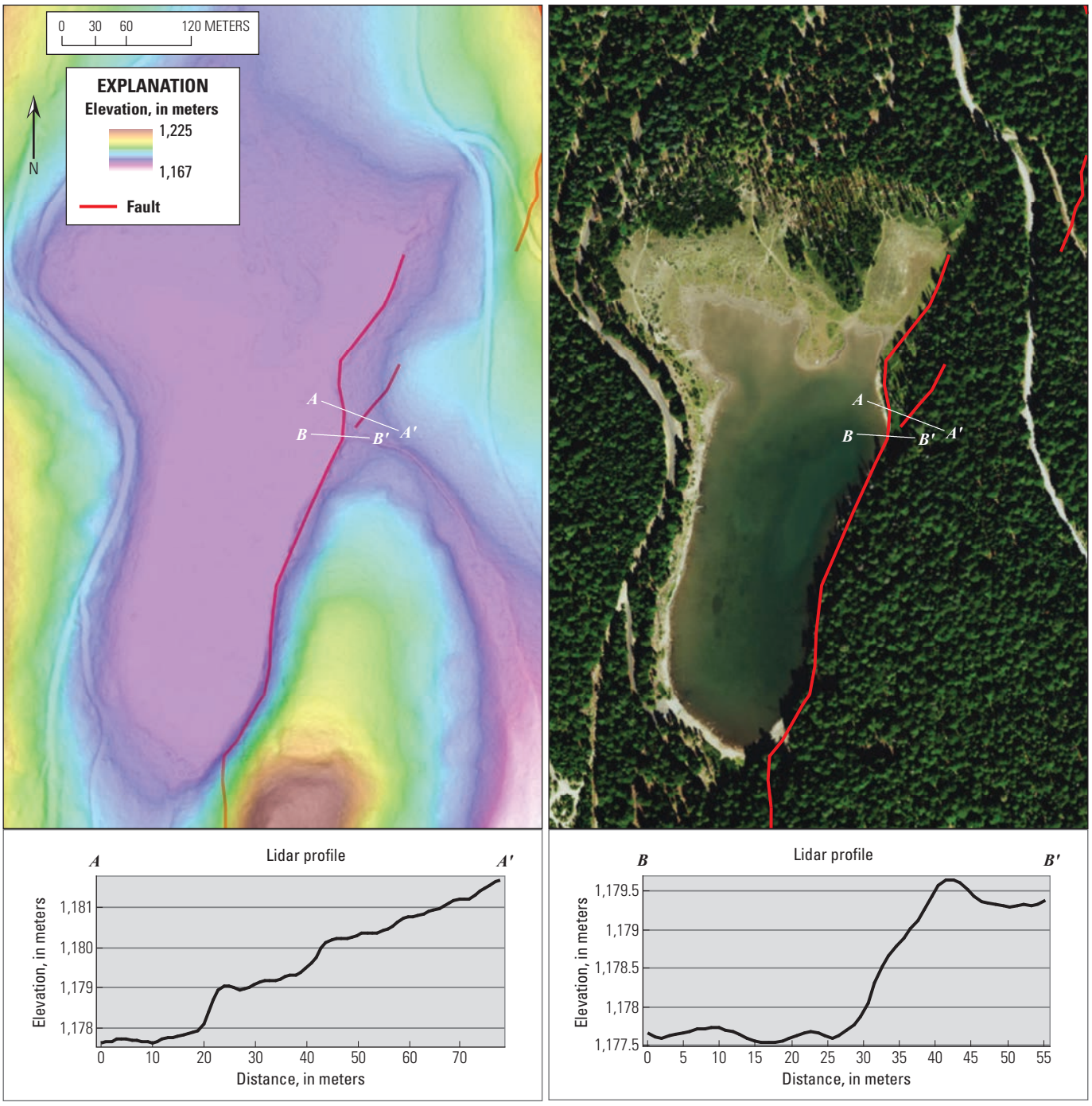
maximum and average displacement values, we estimate an approximately M6.8 to 6.9 earthquake caused the displacement/created the fault scarp. To evaluate the seismic hazard based on rupture length alone, we consider two end member rupture lengths; a full rupture of the 55-km length fault zone in a single earthquake, and a smaller rupture of 25-km length—just a part of the fault zone. Rupture of the full ~55-km-length of fault traces would result in an earthquake of approximately M7.9 earthquake, and rupture of a 25-km-long segment of the fault zone would result in an earthquake of approximately M7.7 (Wells and Coppersmith, 1994).

Earthquake magnitude estimates for this fault zone are, not surprisingly, poorly constrained, but estimates of earthquake capability, based on observations of average displacement and surface rupture, suggest that this fault zone could produce an earthquake greater than M6.5.

Although distant from major population centers, the fault zone poses a serious seismic threat to the cities of Hood River, Odell, Parkfield, White Salmon, Stevenson, Cascade Locks, Government Camp, and the Villages at Mount Hood. In addition it may pose a threat to critical regional infrastructure including the City of Portland's Bull Run drinking water system, storage reservoirs operated by Portland General Electric, the highway and rail transportation corridors in the Columbia Gorge, and the U.S. Army Corps of Engineers power generation facilities at Bonneville Dam. It is important to understand the spatial and temporal distribution of slip along this fault zone so its impact on regional seismic hazard can be assessed and accommodated in seismic design.

Acknowledgments

We would like to recognize the contributions to this work by Dr. Ray Wells and Elizabeth Barnett of the U.S. Geological Survey (USGS) who helped log and interpret the Blue Ridge Fault trenches. We would also like to thank Dr. Brian Sherrod of the USGS who paid for the accelerator mass spectroscopy ^{14}C dating for the trenches. Mike Marshall helped with the trenching project, and Kaleena Hughes, Dr. Vicki McConnell, Christina Appleby, and Kris Hornsby helped with field reconnaissance visits. This paper benefitted by thorough and thoughtful reviews by Jack Albright and Haley Cabaniss.



Base from Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 8. Map of the Twin Lakes Fault at Frog Lake using (*A*) 1-meter lidar imagery combined with an elevation color gradient and slopeshade, and (*B*) digital orthophotography. The fringing marsh around the lake may have a record of lake level changes associated with past earthquakes. Profile A-A′ shows an offset bench that may be uplifted lake bottom. Profile B-B′ shows the barrier the fault creates at the outlet to the lake.

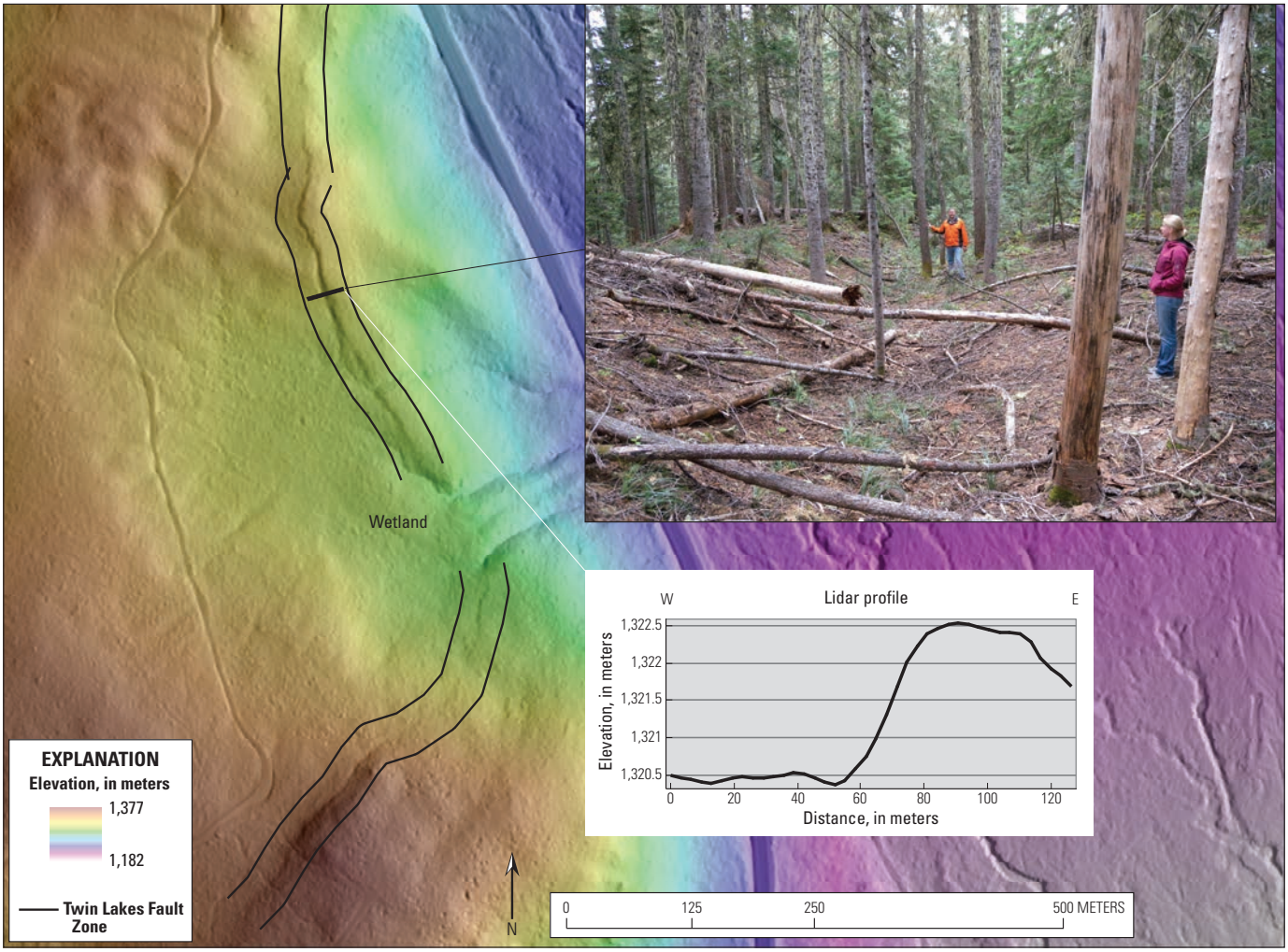


Figure 9. Map of the Twin Lakes Fault near White River. Base map is 1-meter lidar imagery combined with an elevation color gradient and hillshade. Photo at top of figure shows field reconnaissance of scarp relief along the mapped trace. Person on left is in the fault scarp-generated swale, person on right is standing on the west side of the fault.

References

Madin, I.P., and Ma, L., 2012, The Blue Ridge Fault, a newly discovered Holocene fault near Mt. Hood, Oregon: Seismological Research Letters, v. 83, no. 2, p. 374.

McClaughry, J.D., Wiley, T.J., Jones, C.B., and Lite, K.E., 2012, Digital geologic map of the Hood River Valley, Hood River and Wasco Counties, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-12-13, 142 p.

Sherrod, D.R., and Scott, W.E., 1995, Preliminary geologic map of the Mount Hood 30- by 60- minute quadrangle, Northern Cascade range, Oregon: U.S. Geological Survey Open-File Report 95-219, 1 plate, 35 p.

Wells, D.L., and Coppersmith, K.J., 1994, New empirical relationships among magnitude, rupture length, rupture width, rupture area and surface displacement: Bulletin of the Seismological Society of America, v. 84, no. 4, p. 974–1002.

Staff Report and Memorandum

To: Chair, Vice-Chair, and members of the DOGAMI Governing Board

From: Bob Houston, Interim Legislative Coordinator

Date: March 8, 2019

Regarding: Agenda Item 9 – Legislative Update

Bob Houston, Interim Legislative Coordinator, will provide a Legislative Update for DOGAMI.

Proposed Board Action: The Board will not be asked to take an action on this item.

Staff Report and Memorandum

To: Chair, Vice-Chair, and members of the DOGAMI Governing Board

From: Alyssa Pratt, Acting GS&S Program Manager

Date: March 8, 2019

Regarding: Agenda Item 10 – GS&S Update

Acting GS&S Program Manager Alyssa Pratt will provide an update on GS&S.

Proposed Board Action: The Board will not be asked to take an action on this item.

Staff Report and Memorandum

To: Chair, Vice-Chair, and members of the DOGAMI Governing Board

From: Brad Avy, Director & State Geologist

Date: March 12, 2019

Regarding: Agenda Item 11 – Director's Report

Director Avy will deliver his report on the following topics:

1) Business Office Staffing
2) Tsunami Line Letter
3) SEIU Representation
4) Leadership Rotations Update
5) DOGAMI Budget Hearing

Proposed Board Action: The Board will not be asked to take an action on this item.