

## GEOL 1102 GEOLOGIC HAZARDS PART 2

### Volcanic hazards

In the continental U.S., the most active volcanoes occur in the Cascades. These volcanoes are caused by subduction of the Juan de Fuca plate underneath the North American plate and can erupt both quiet lava flows and pyroclastic ash falls and ash flows (nuee ardentes).

Mt. Rainier is especially susceptible to lahars (volcanic debris flows and mudflows) from the unstable volcanic rock that has been altered in many places to a slippery clay. Geologists have studied the history of Mt. Rainier lahars in order to educate the tens of thousands of people that are at risk. Past lahars have been estimated to have traveled down the slopes of Mt. Rainier at speeds of 70 - 80 km per hour (up to 50 mph). Material carried by these lahars travels down the pre-existing drainages forming deposits up to 150 meters (almost 500 feet!) of volcanic sediment, burying valleys in debris. Some have reached Puget Sound over 100 km away, forming broad thinner deposits of volcanic debris in the lower, flatter elevations.

You will use the Mt. Rainier topographic map provided by your instructor and the small maps of lahar deposits to answer the following questions:

5600 years ago, the large **Osceola Lahar**, formed during a series of several eruptions. The lahar flowed down the northeastern part of Mt. Rainier along the White River all the way to Puget Sound.

1. Using the small map that shows the Osceola Lahar, determine the distance the lahar flowed (in kilometers) from the summit of Mt. Rainier to the town of Kent.
2. The area covered by this mudflow is almost 550 km<sup>2</sup>, and the debris from this lahar is 8 meters (25 feet!) deep. There was so much material incorporated into the lahar, a collapse crater was left along the eastern side of the summit of Mt. Rainier. This crater was originally about the size of the caldera formed by the 1980 eruption of Mt. St. Helens, but was later partially filled in with younger lavas. From the topographic map, find the central part of the crater near the summit of Mt. Rainier (you really have to look closely!). How are depressions indicated on topo maps?
3. Go back to the smaller map showing the extent of the Osceola Lahar. Why do you think the lahar becomes so much wider near Enumclaw and Buckley?
4. Estimate the extent in km at the widest part of the Osceola Lahar.

About 2500 years ago, another lahar, called the **Round Pass Lahar**, formed during another series of eruptions. The Round Pass lahar began when volcanic material near the Sunset Amphitheater and headwall of Tahoma Glacier collapsed. The Round Pass Lahar flowed about 30 km down the volcano, and deposited as much as 30 meters (98 feet) of material along the creeks of the North Puyallup River.

5. Look at the topography of the head of Tahoma Glacier and Sunset Amphitheater. Why do lahars commonly begin near the heads of glaciers?

6. The slope of a hill is called the **gradient**, where:

**Gradient = difference in elevation ÷ distance.**

Determine the gradient in feet per mile of the glacier headwall (the headwall of the cirque) at the Sunset Amphitheater from the high point at Liberty Cap to the 10200 contour of the Tahoma Glacier.

About 2200 years ago, an explosive (pyroclastic) eruption triggered several lahars, which flowed down at least 3 major drainages: the White River, the Cowlitz River, and the Nisqually River and minor drainages like Kautz Creek and Tahoma Creek. The **National Lahar**, which flowed for at least 100 km down the Nisqually River, is almost as large as the Osceola Lahar.

7. Find Nisqually River and Kautz Creek on the large topo map, and then locate the National Lahar on the smaller maps. Notice how three smaller lahars from the smaller creeks merge into a larger lahar flowing down the Nisqually River. Which 2 towns are along the National Lahar flow path?

8. Why do you think the National Lahar stops at Elbe?

Do you think 2200 years ago the lahar really stopped at Elbe?

The most recent lahar is the Electron Lahar. This lahar is very interesting because it occurred only 500 years ago and it is **NOT** associated with an eruption of lava. The triggering mechanism for this lahar is possibly a **steam eruption (phreatic eruption) or earthquake**. Phreatic eruptions are much more difficult to predict - it was this type of eruption that killed the 36 hikers in Japan on September 27, 2014.

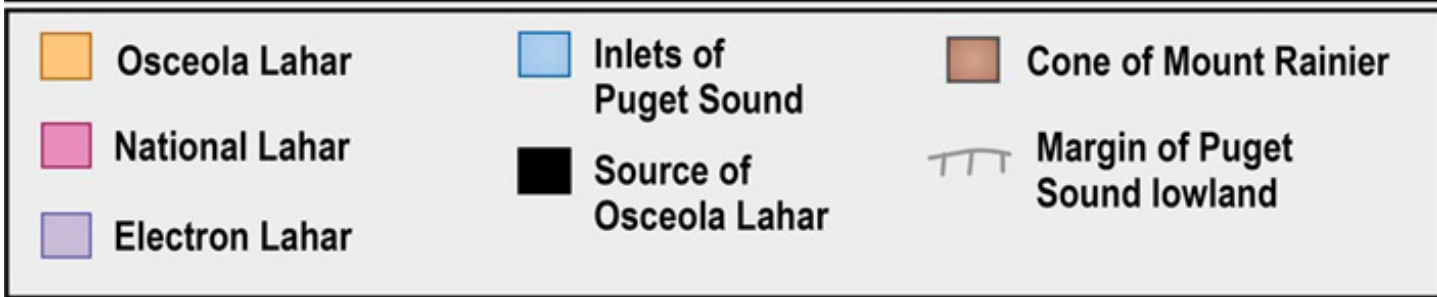
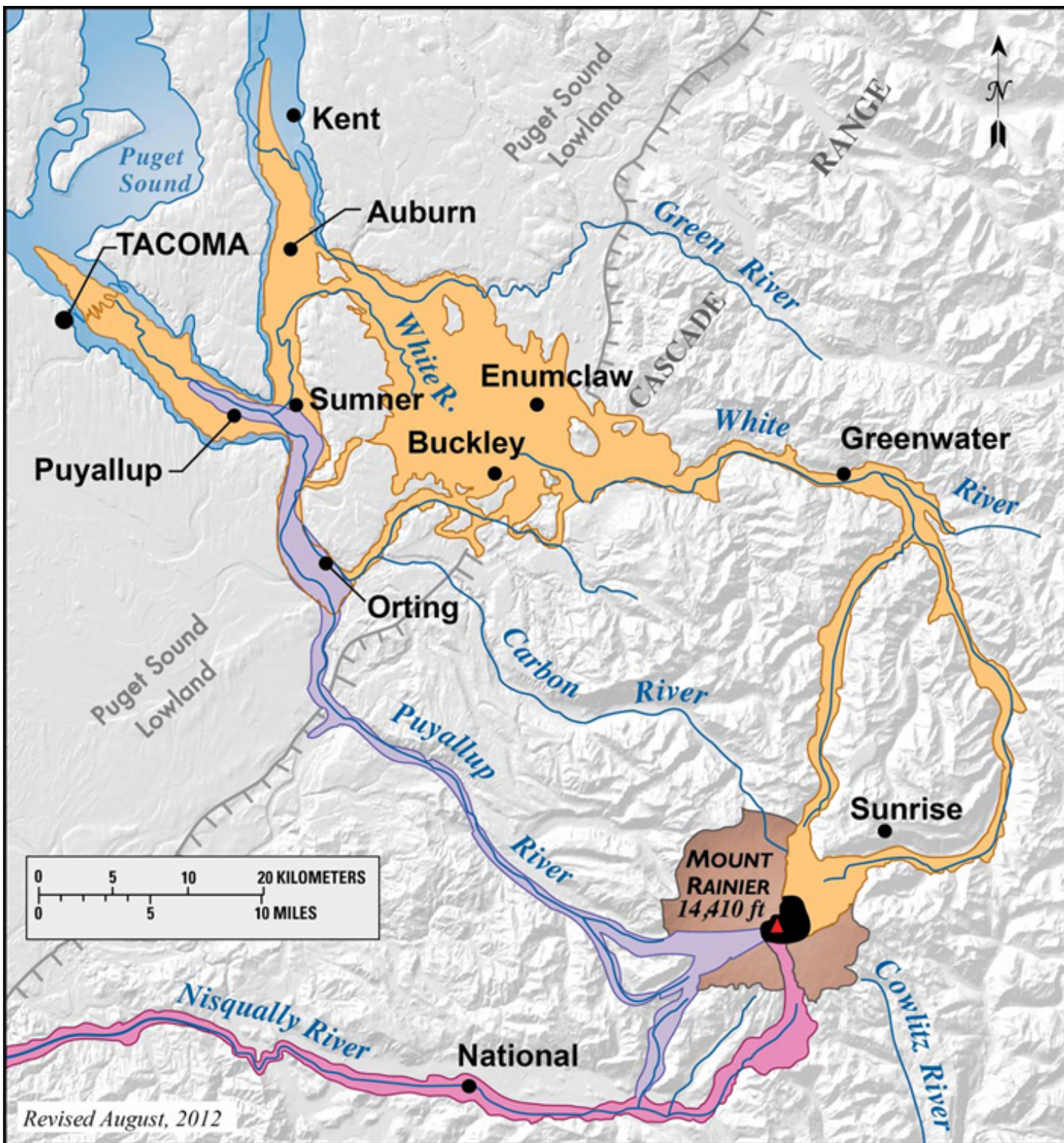
The Electron Lahar was extremely water rich and flowed almost 100 km into the Puget Sound lowlands. Even at the end of the lahar in the lowlands, the lahar deposits are still 30 m (98 feet) deep!

9. The town of Orting is built on top of Electron Lahar sediments. Look at the Mt. Rainier Risk map and determine the recurrence interval of this type of lahar.

10. From looking at all these lahar deposits, where is the **most dangerous place** to be if there is an eruption and/or lahar ?

11. In 2004, it was decided that the town and especially the schools in Orting needed some type of early warning system in case of a lahar. Schools now have lahar drills twice a year. Where do you think the students will go in case of a lahar, so that they would be safe?

Estimates of the time between the warning and the arrival of the lahar in Orting are between 30 - 45 minutes. In 2004, it was determined that the students in a new elementary school would not be able to get to a safe place fast enough due to the school's location. It was decided that there needed to be a bridge built that would allow students to get to higher ground quickly. As of 2015, the bridge had not yet been built.



# Mt. Rainier risk map

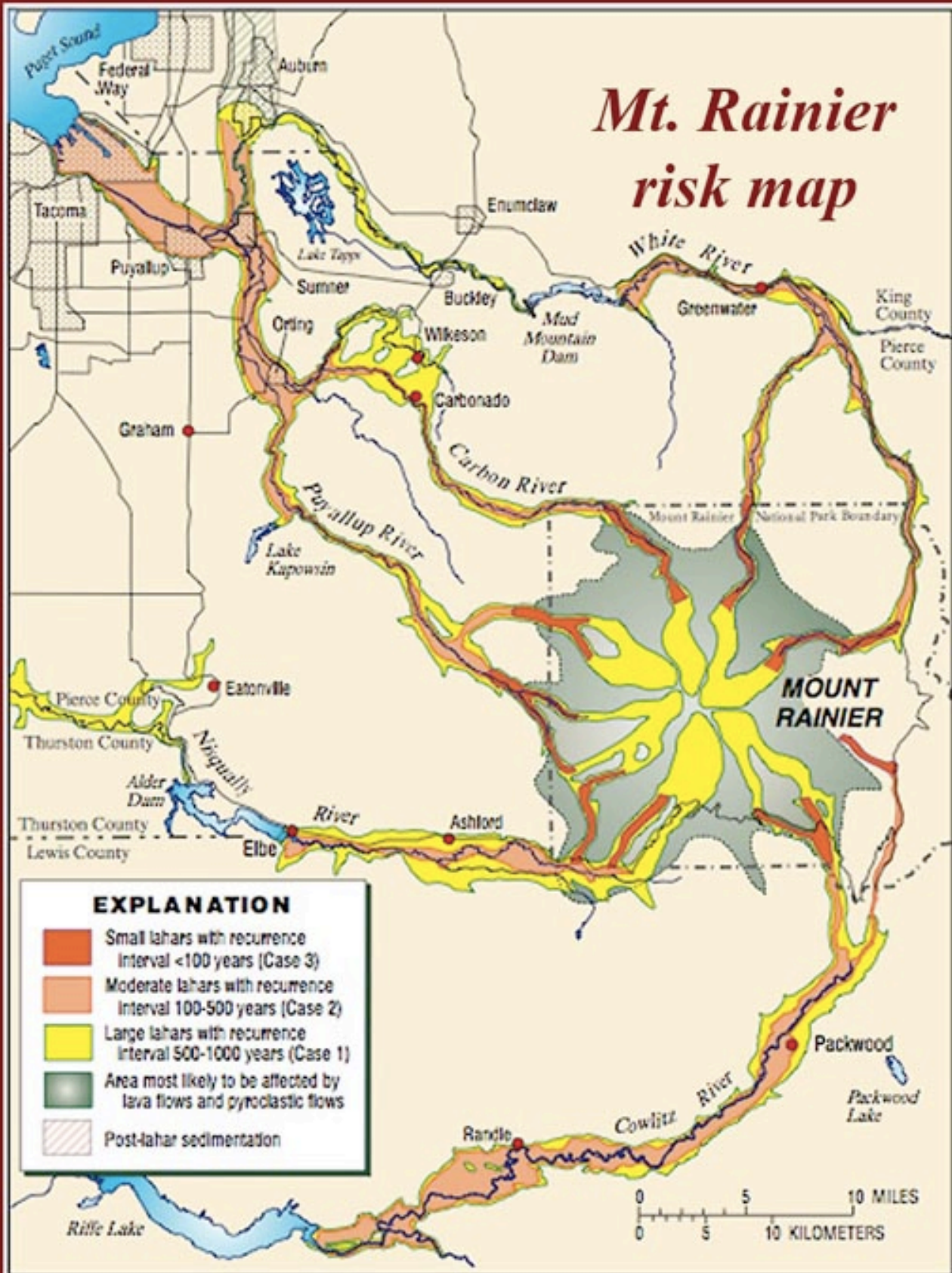


FIGURE 3.—Hazard zones for lahars, lava flows, and pyroclastic flows from Mount Rainier (Hobitt and others, 1998; US Geological Survey Open-File Report 98-428).