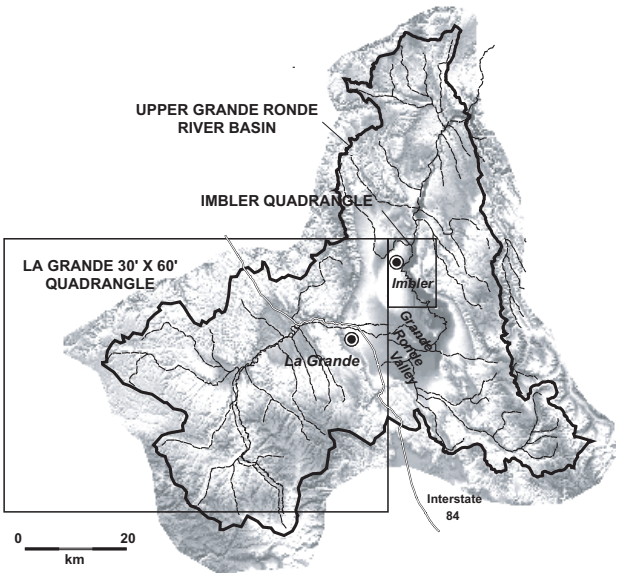
SUMMARY OF THE GEOLOGY OF THE IMBLER QUADRANGLE, UNION COUNTY, OREGON

For more detailed information, please see the accompanying text and references.



INTRODUCTION

The Imbler quadrangle covers the northern end of the Grande Ronde Valley. The eastern escarpment of the Grande Ronde Valley rises nearly 800 m (meters, about 2,600 ft) above the valley floor; elevations in the quadrangle range from 1,636 m (5,368 ft) at the top of the Mount Harris volcano to 786 m (2,579 ft) where the Grande Ronde River exits the valley in the northeast corner of the quadrangle. The City of Imbler is located on the east flank of Sand Ridge, a broad, central highland made up of low-relief rolling hills. Sand Ridge stands 10–30 m (about 30-100 ft) above the adjoining channel and flood plains of the Grande Ronde River on the east and Willow Creek on the west.

Mint, grass seed, and alfalfa are the major crops raised on the intensely cultivated valley floor. Uplands are used for grazing and timber harvest.

HISTORY

The Imbler quadrangle geology provides a record of 17 million years of volcanic and associated tectonic activity.

Evolution of the Grande Ronde Valley at Imbler passed through three developmental stages: first the eruption of the Columbia River Basalt Group flood basalts; then volcanic eruptions forming small volcanoes in the Powder River Volcanic Field; and finally the large-scale faulting that created the modern valley.

Columbia River Basalt Group volcanism began at about 17 million years ago with eruption of Imnaha Basalt lavas, which are exposed in the Minam River Canyon 15 km (kilometers, about 9 miles) to the east. Flows of Imnaha Basalt eventually covered more than 50,000 square kilometers (19,305 square miles) of Oregon, Idaho, and Washington. About 16.5 million years ago, vents in eastern Oregon, Washington, and western Idaho began erupting even more massive amounts of flood basalts, producing as much as 150,000 cubic kilometers (about 36,000 cubic miles) of Grande Ronde Basalt over the next million years. These massive eruptions resulted in a blanket of stacked lava flows 700–800 m (about 2,300–2,600 ft) thick that would serve as the platform upon which younger Powder River Volcanic Field volcanoes would be built.

Eruptions began in the Powder River Volcanic Field at about 14.5 million years ago. Although extensive, the amount of lava erupted was much smaller than earlier Columbia River Basalt Group eruptions.

Eruption of dacite and high-silica andesite flows began at about the same time, forming a volcano 600 m (about 1,970 ft) high at Mount Harris. The last eruptions at Mount Harris occurred about 11.9 million years ago. The style of volcanism changed about 10 million years ago, when small eruptions along the northern margin of the Imbler quadrangle formed a number of small shield volcanoes between Imbler and Elgin. An unusually iron-rich lava was erupted at about this same time from a vent southeast of Mount Harris. It flowed down channels that guided it around the foot of the Mount Harris volcano and toward the northeast corner of the quadrangle.

The Grande Ronde Valley began developing as a basin bounded by faults about 10 million years ago, in response to regional uplift and deformation of the Blue Mountains. By 8 million years ago, the Grande Ronde Valley was actively subsiding, forming a catch basin for airfall tuffs and finegrained silts. Similarities between the approximately 8-million-year-old fish fossils in the Grande Ronde Valley and Ringold Formation fish fossils in the Pasco Basin to the northwest suggest a northwest outlet to the Grande Ronde Valley at that time.

From that time to the present, the floor of the valley at Imbler has been settling unevenly; it has been tilting progressively to the south, as the basin floor has been fragmented along faults. In response to climate and topographic changes, the valley at Imbler has been at different times a marshland with shallow, warm-water ponds; a shallow to moderately deep lake system; and a windswept dune field.

HAZARDS

Landslides

Debris flows, possibly triggered by earthquakes, make up the most visible geologic hazard in the Imbler quadrangle. These occur when rock cliffs collapse and send debris cascading down the mountainside. The greatest potential for catastrophic debris flows exists downslope from places where high cliffs crop out along the southwest flank of Mount Harris. Large landslide deposits on that flank are evidence of old collapses upslope from Grays Corner. The chance that future debris flows might reach the valley floor has been somewhat lessened, because a catchment basin has formed above the Mount Harris Loop Road. Movement along the East Grande Ronde Valley fault zone might trigger future debris flows, although steep cliff faces can fail at any time without an apparent cause. In general, the large landslides in the southwestern part of the Imbler quadrangle do not appear to be of recent origin.

Earthquakes

The seismic threat presented to the Imbler area by the East Grande Ronde Valley fault zone cannot be determined at the present time. Most recent work has indicated that the West Grande Ronde Valley fault zone has been more active in the recent past than the East Grande Ronde Valley fault zone. Reasonable earthquake risk assessments for the Imbler quadrangle should be based on the premise that the West Grande Ronde Valley fault zone is more likely to generate a sizeable earthquake in the future. Currently, the West Grande Ronde Valley fault zone is viewed as being capable of generating a maximum credible earthquake of magnitude 7.

GEOLOGIC RESOURCES

Aggregate in the form of crushed rock is the only mineral resource found in the quadrangle. Platy Powder River Volcanic Field flows such as dacite and andesite are locally crushed and used as aggregate. Blocky varieties of dacite may be suitable for use as coarse for riprap.

Nearly all deep (more than 500 m/1,640 ft) flowing wells in the Grande Ronde Valley yield water warm enough to be considered as low-temperature (20°–30°C/68°–86°F) geothermal aquifers. Records from irrigation and municipal wells drilled to date indicate that significant flows of water (>1,000 gallons per minute) are nearly always encountered only after the water enters the Grande Ronde Basalt. To date, the overlying Powder River Volcanic Field has not yielded appreciable amounts of water. Warmest waters are encountered where irrigation wells penetrate the Grande Ronde Basalt at depths greater than 800 m (2,600 ft).