INTRODUCTION

As you travel along this portion of Interstate 84, you also travel through historic and geologic time. Join other travelers—early-day explorers, missionaries, emigrants on the Oregon Trail, and geologists—and read their descriptions of the area. Compare your observations with theirs. Experience the continuing saga of the Oregon Trail, its geology, and its marvelous scenery.

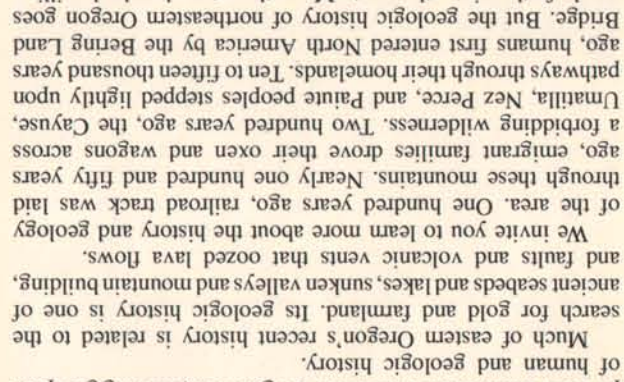
From 1841 through the 1860s, emigrants crossed river valleys and mountains in northeastern Oregon on a wagon road that became famous as the Oregon Trail. Following pathways that had been used by Native Americans for hundreds of years, the early explorers and fur traders became familiar with the landscape and abundant resources of the region. The form and shape of the land presented obstacles for those traveling by horseback—and even more so for the first pioneer wagons to cross from the Snake River Plain in Idaho to the Columbia River, and thence west.

Through time, native inhabitants and pioneers discovered natural passes imprinted upon the geologic fabric of the land, and those passes helped determine the location of the Oregon Trail. The geologic forces that shaped the landscape thus influenced the route of the emigrants' road and the history of settlement and transportation in Oregon. Today, Interstate 84 parallels much of the route of the Oregon Trail, offering glimpses of human and geologic history.

Much of eastern Oregon's recent history is related to the search for gold and farmland. Its geologic history is one of ancient seabeds and lakes, sunken valleys and mountain building, and faults and volcanic vents that oozed lava flows.

We invite you to learn more about the history and geology of the area. One hundred years ago, railroad track was laid through these mountains. Nearly one hundred and fifty years ago, emigrant families drove their oxen and wagons across a forbidding wilderness. Two hundred years ago, the Cayuse, Umatilla, Nez Perce, and Paiute peoples stepped lightly upon pathways through their homelands. Ten to fifteen thousand years ago, humans first entered North America by the Bering Land Bridge. But the geologic history of northeastern Oregon goes much farther into the past. More than two hundred million years ago, some of these lands were an island chain off the western coast of North America.

Mount Emily near La Grande



Ellen Morris Bishop

SIDE TRIPS

To explore the sightseeing treasures along the Oregon Trail, take the side trips marked on the map inside and described briefly below. Reserve a full day for each of the trips. Before you start, always check on road conditions and note special warnings below. More detailed maps of each area are available from sources listed under "Important Map Information" on the inside.

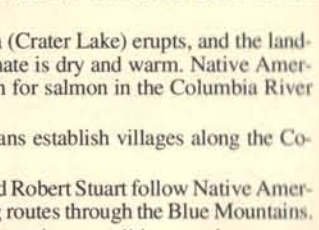
SIDE TRIP A: Leads from La Grande north and east to Joseph and Wallowa Lake on Oregon Highway 82, with a ite (National Forest road 39) to Side Trip C. — **See:** Glacial moraines and Wallowa Lake, rocks of the Columbia River Basalt Group, Wallowa Lake.

Wallowa Lake

Ellen Morris Bishop

SIDE TRIP B: Elkhorn Scenic Byway (on Oregon Highway 7 south and west from Baker City; National Forest roads to Sumpter, Granite, North Fork John Day River, and Anthony Lakes; and east to North Powder). — **See:** Baker Terrane (Elkhorn Ridge Argillite), Bald Mountain Batholith. Abandoned gold dredge and dredge tailings in Sumpter Valley, Sumpter Valley Railroad, and old mining towns of Sumpter and Granite. Partially on National Forest land.

Sumpter Dredge



Paul F. Lawson

SIDE TRIP C: Baker City east to Oregon Trail Interpretive Center at Flagstaff Hill and Snake River in Hells Canyon (Oregon Highway 86 to Richland, Halfway, and Hells Canyon Dam). — **See:** Wallowa Terrane (Sparta Complex, basement to an island arc along Powder River; greenstones and sedimentary rocks along the Snake River), Columbia River Basalt Group, old mine complex at Cornucopia, and active gold placer mines along Pine Creek. Access to Side Trip A on National Forest road 39 via Pine Creek and Wallowa Lake. Partially on BLM and National Forest land. Contact the Baker County Visitor and Convention Bureau, 490 Campbell St., Baker City, OR 97814, phone (503) 523-5855 or 1-800-523-1235, for more information.

Historic Baker City

U.S. Bureau of Land Management

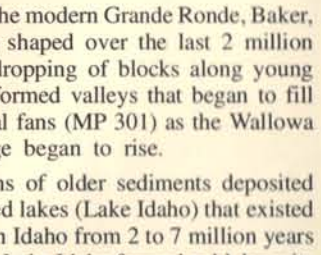
SIDE TRIP D: Mormon Basin and Dooley Mountain (from Rye Valley, exit 340, west up Dixie Creek to old mining camp at Mormon Basin, down Clarks Creek road to Burnt River, west to Oregon Highway 245, north on Oregon Highway 245 over Dooley Mountain to Oregon Highway 7, and north on Oregon Highway 7 to Baker City). — **See:** Baker Terrane (Burnt River Schist), ancient Lake Idaho sediments, Dooley Mountain rhyolite, historic placer workings, dredge tailings on Burnt River, El Dorado Ditch, and access to historic mining camps of Malheur City and Rye Valley. Part of the trip is on an unimproved, narrow dirt road that requires four-wheel drive in wet weather. Partially on BLM and National Forest land.

Burnt River Schist

Ellen Morris Bishop

SIDE TRIP E: Snake River Road, east and north from Huntington to Richland (narrow gravel road along the Snake River not recommended for motor homes). — **See:** Old placer mines, views of the scenic Snake River and the Brownlee Reservoir, Olds Ferry Terrane (Huntington and Weatherby Formations), and Baker Terrane (Burnt River Schist and Elkhorn Ridge Argillite). Ties with Side Trip C at Richland. Partially on BLM land.

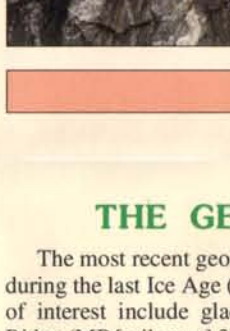
Snake River



Ellen Morris Bishop

SIDE TRIP F: Oregon Trail, Succor Creek, Lake Owyhee dam. From exit 376 west through Ontario follow signs to Vale, turn south on Lyle Blvd. (BLM Interpretive Site at Keeney Pass) to Sunset Corner, then right (west) to lower part of Lake Owyhee and dam, or left (east) to Owyhee Corner and on Highway 201 south to Adrian and, via "improved" gravel road (National Back Country Byway), to Succor Creek State Recreation Area and access to upper Lake Owyhee at Leslie Gulch (off map, follow signs). — **See:** Oregon Trail (and wagon ruts) along Lyle Blvd. and at Oregon Trail Grange (Oregon Highway 201), spectacular scenery (especially Leslie Gulch), ancient Lake Idaho sediments, basalt and caldera rhyolites, thunderegg, hot springs and mushroom farm at Vale, and hot spring ("no-see-um") gold prospects. Slow roads can make this a long day. Check locally for road conditions. Contact Vale BLM, 100 Oregon Street, Vale, OR 97918, phone (503) 473-3144; Vale Chamber of Commerce, 275 N. Main Street, Box 660, Vale, OR 97918, phone (503) 473-3800; and Nyssa Chamber of Commerce, 212 Main Street, PO Box 2515, Nyssa, OR 97913, phone (503) 372-3091, for detailed maps and more information.

Succor Creek Area



Malheur County Economic Development Dept.

THE GEOLOGIC STORY

The most recent geologic changes were caused by glaciation during the last Ice Age (10,000 to 2 million years ago). Features of interest include glacial valleys and moraines on Elkhorn Ridge (MP [milepost] 301), alluvial fans and valley-fill deposits in Baker and Grande Ronde valleys (MP 261-268 and MP 277-305), windblown silt (loess) (MP 368), and glacial flood deposits (MP 353).

The present topography of the modern Grande Ronde, Baker, and Durkee valleys was also shaped over the last 2 million years by uplifting and downdropping of blocks along young faults. Downdropped blocks formed valleys that began to fill with shallow lakes and alluvial fans (MP 301) as the Wallowa Mountains and Elkhorn Ridge began to rise.

Faulting also tilted sections of older sediments deposited in a large lake or interconnected lakes (Lake Idaho) that existed in eastern Oregon and southern Idaho from 2 to 7 million years ago. Hot springs emptying into Lake Idaho formed gold deposits responsible for the present-day gold rush (Kirby deposit at MP 358). Lake Idaho (MP 359-371) drained away at Farewell Bend (MP 353) when the Snake River began to cut Hells Canyon (Side Trips C and E) about 2 million years ago, leaving terrace gravels north of Ontario (MP 373) and at Durkee (MP 329).

Voluminous volcanic eruptions predate Lake Idaho. Huge amounts of rhyolitic and basaltic magmas (molten rocks) came to the surface in eastern Oregon from about 14 to 17 million years ago, resulting in the formation of the great rhyolite caldera complexes of the Owyhee region (Side Trip F) and the spectacular Columbia River Basalt Group (MP 267-282 and Side Trip A), whose lava flows were erupted from dike swarms (example at MP 337) near the Idaho-Oregon border and flowed westerly sometimes as far as the Pacific Ocean.

From 17 to about 85 million years ago, the Pacific coastline was gradually shifted from the Idaho border westward to the Willamette Valley, and rocks along Burnt River Canyon (MP 330-347) were deeply buried.

About 150 million years ago, granitic rocks that now form the cores of Elkhorn Ridge and the Wallowa Mountains rose as magma from deep in the earth and solidified along great faults, such as the Connor Creek Fault (MP 334-335). The Cornucopia (Side Trip C) and Cracker Creek gold veins also were formed at this time.

The Connor Creek Fault and other faults bound fragments of islands and ocean basins that were formed far from the North American coastline many million years ago and were dismembered, welded together by plate tectonic processes, and rafted into their present locations. Called "exotic terranes," these island and ocean-basin fragments, which contain the oldest rocks in northeastern Oregon, include pieces of the 170- to 240-million-year-old ocean island chains making up the Olds Ferry Terrane (Burnt River Canyon at MP 335-352), the 220- to 300-million-year-old bits of ocean floor making up the Baker Terrane (MP 317-324 and MP 331-334), and the 220- to 280-million-year-old islands of the Wallowa Terrane (Wallowa Mountains).

THE HUMAN STORY

15,000-10,000 years ago. Ice Age is ending. Humans arrive in North America via Bering Land Bridge. Climate is cold and wet as hunters stalk giant bison and mastodon. Glaciers retreat from terminal moraines on flanks of Blue Mountains. Wind-driven glacial dust blankets the landscape as great floods roll from broken ice dams on the Snake and Columbia Rivers.

7,000 years ago. Mount Mazama (Crater Lake) erupts, and the landscape is blanketed with ash. Climate is dry and warm. Native Americans hunt, gather plants, and fish for salmon in the Columbia River and its tributaries.

3,000 years ago. Native Americans establish villages along the Columbia and Snake Rivers.

1811-1812. Wilson Price Hunt and Robert Stuart follow Native American trails to establish fur trapping routes through the Blue Mountains.

1820s. Peter Skene Ogden's fur trapping expeditions explore mountainous interior along the Snake River.

1834-1836. Missionaries, among them Marcus and Narcissa Whitman, accompany fur traders into the Pacific Northwest. Captain Bonneville crosses the Wallowa Mountains seeking new routes.

1840. Mountain men bring wagon carts from Fort Hall over the Blue Mountains to Whitman Mission.

1843. Captain John C. Fremont describes and maps the route of the Oregon Trail. A great overland emigration lasting for two decades begins when the first large wagon trains cross from the Midwest to the Snake River Plain and thence over the Blue Mountains.

1847. Cayuse War follows attack on Whitman Mission.

1855. Treaties describing reservation boundaries are signed with the Cayuse, Umatilla, Walla Walla, and Nez Perce tribes.

1859. State of Oregon is admitted to the Union.

1861. Gold is found at Griffin Gulch. Mining camps are established throughout the region. Settlement of eastern Oregon begins.

1877. Nez Perce War begins when homesteaders' and miners' claims force the tribe from its ancestral homelands in Wallowa Valley.

1886. Railroad is completed through the Blue Mountains.

1898-1907. Discovery of gold in the Alaskan Klondike rekindles interest in the Blue Mountain Gold Belt, resulting in mining boom. Waldemar Lindgren investigates geology of local mining districts.

1914. Mining town of Sumpter burns to the ground as gold boom subsides. Logging and stock raising become major local industries.

1930s. Construction of dam on Owyhee River brings water to the fertile plains at Vale and Ontario.

1935. Price of gold increases to $35/ounce. Large-scale floating dredge mining occurs at Sumpter, Granite, and John Day. Cornucopia Gold Mine is in full swing.

1950-1960s. Last floating dredge shuts down in Sumpter Valley.

1979. Modern-day gold rush begins in eastern Oregon.

Acknowledgments

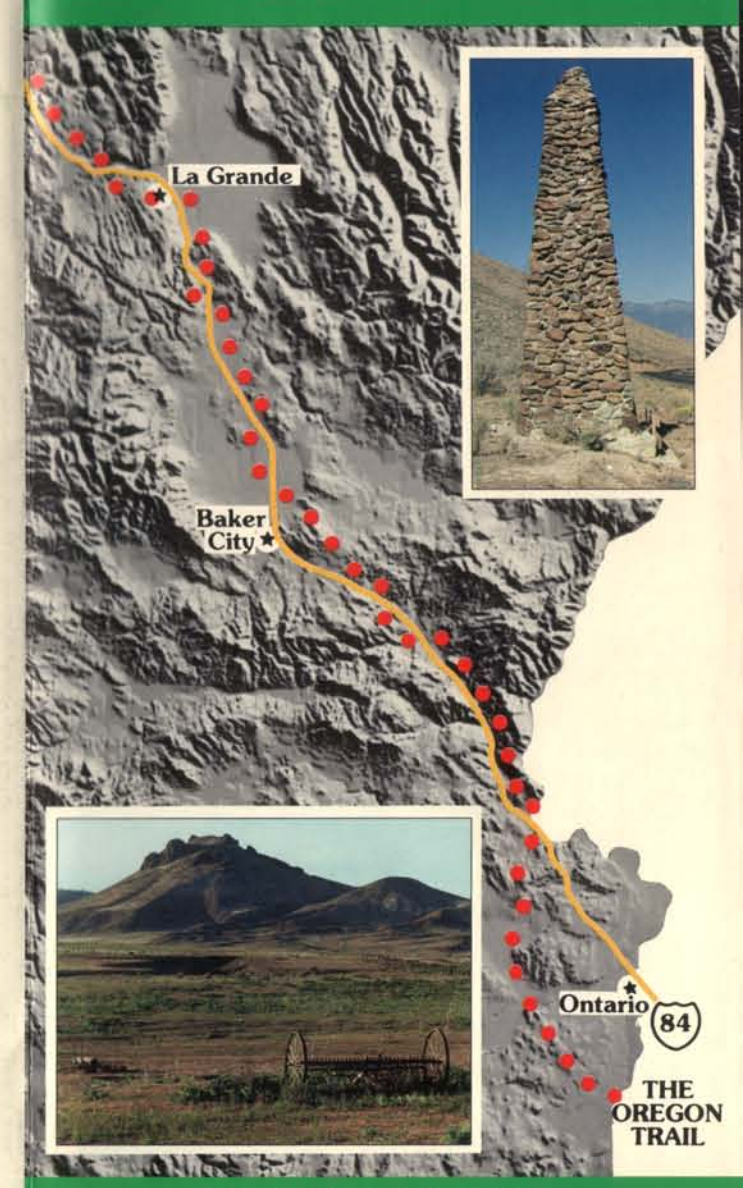
Partial funding for the printing of this brochure was provided by the Baker City Transient Room Tax funds, the Oregon Trail Preservation Trust, and the Ontario Visitors and Convention Bureau. Text by Mark L. Ferns, Oregon Department of Geology and Mineral Industries (DOGAMI); with assistance from Joyce Badgley Smith, Oregon Trail Preservation Trust; Ellen Morris Bishop, Eastern Oregon State College; Mary I. Oman and Ralph R. Kuhns, Jr., U.S. Bureau of Land Management; and Beverly F. Vogt, DOGAMI. Cover photo of Oregon Trail marker near Flagstaff Hill from Oregon Department of Transportation. Cover photo of Iron Mountain by Ellen Morris Bishop. Lake Idaho boundaries on Oregon Trail tour map from Margaret D. Jenks, Idaho Geological Survey.

Highways to History

THE OREGON TRAIL

I-84: Eastern Oregon

Ontario — Baker City — La Grande



Oregon's Heritage Brochure 3

Ontario Visitors & Convention Bureau

OREGON TRAIL TOUR ON INTERSTATE 84

If starting from La Grande, start at the top of the page; if from Ontario, start at lower right of page. MP= green milepost.

EXIT 261 **La Grande.** Home of Eastern Oregon State College and gateway to Wallowa Lake and the northern flank of the Wallowa Mountains. Terminus for Side Trip A. The round shape of the valley is due to intersecting fault systems that became active about one million years ago. To the north, Mount Emily rises from the plain along a fault; to the south, other faults have lifted Craig Mountain above the town of Union. To the east, Mount Harris and Mount Fanny are uplifted on faults. The Grande Ronde, or Great Round, valley was, from all pioneer accounts, a welcome sight.

"A beautiful level basin, or mountain valley, covered with good grass, on a rich soil, abundantly watered, where a farmer would delight to establish." *(Captain John C. Fremont, 1843)*

"It is, for a settlement, the prettiest place I have passed on the route." *(Major Osborne Cross, 1849)*

MP 267 **Grande Ronde Valley.** Ladd Marsh and old shallow lakes lie along an old river meander channel. Hot Lake, discovered in 1812, was a favorite resting place for early-day travelers.

"Some very white spots glistening on the plain . . . found them to be the bed of a dry salt lake, or marsh, very firm and bare, which is covered thickly with a fine powder, containing a large quantity of carbonate of soda." *(Captain John C. Fremont, 1843)*

MP 271 **Columbia River basalt in road cuts.** A great outpouring of lava between 17 and 6 million years ago covered approximately 425,000 square miles in Oregon, Washington, and Idaho and is up to two miles thick. These flood basalts issued mostly from large cracks in the ground in the Wallowa Mountains and the Snake River Canyon. Reddish and yellowish-brown zones mark the weathered tops of individual lava flows.

EXIT 285 **North Powder.** Terminus for Side Trip B, the Elkhorn Scenic Byway. Mica in the North Powder River was often mistaken for gold—"fool's gold".

"The sand and mud were full of shining particles which some took to be gold. There were some so eager to wash gold that they could not eat." *(Lucia Williams, 1851)*

Art Seamans, USDA Forest Service

MP 289 **Columbia River basalt on flanks of Wallowa Mountains to the east.**

"The sharp slopes became sloping plateaus, and finally the Blue Mountains stood like islands in a basaltic sea." *(Waldemar Lindgren, U.S. Geological Survey, 1901)*

MP 297 **Oregon Trail crossing Baldock Slough near historic Lone Tree.**

"The place called Lone Tree is a beautiful valley in the region of Powder River, in the center of which is a solitary tree, by the side of which travelers usually stop to refresh themselves." *(Narcissa Whitman, missionary wife, 1836)*

"From the heights we had looked in vain for a well-known landmark on Powder River, which had been described to me by Mr. Payette as l'arbre seul (the lone tree). We found a fine tall pine stretched on the ground, which had been felled by some inconsiderate emigrant axe." (Captain John C. Fremont, 1843)

MP 301 **White-steepled, 150-million-year-old granite core of the Wallowa Mountains to the northeast.**

"Some of these are very lofty; their peaks present a very lustrous appearance, resembling the snow mountains. This shining, dazzling appearance they possess is derived I think from the material of which they are composed, being a kind of white clay." *(Joel Palmer, 1845)*

EXIT 302 **Flagstaff Hill to the east.** Future site of the Oregon Trail Interpretive Center. Location of Virtue Flat and the Virtue Mining District, where the Oregon Trail crossed close to the rich Virtue Mine discovered in 1862. Access to Side Trips C and E.

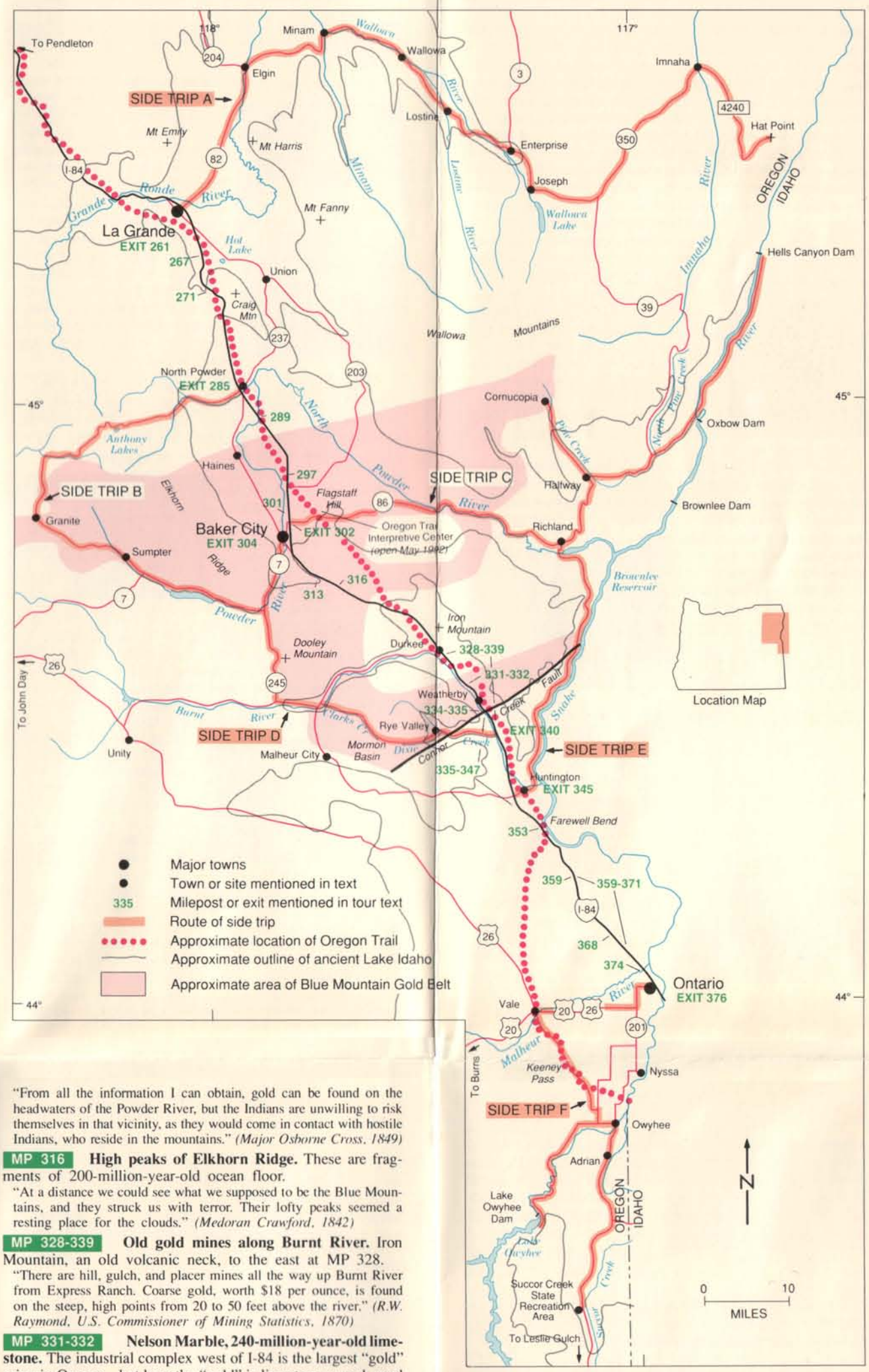
"The somewhat celebrated mine of Colonel Ruckel is situated eight miles east of Baker City, on the eastern slope of a range of hills, overlooking a large interior basin, across which for many miles may be seen the gleaming, white, dusty line of the old emigrant road (Oregon Trail)." *(R.W. Raymond, U.S. Commissioner of Mining Statistics, 1870)*

EXIT 304 **Baker City.** Queen City of the eastern Oregon gold fields. That glorious past is preserved through the National Register Historic District, the Oregon Trail Regional Museum, and the modern Miners Jubilee (held each July). Access to Side Trips B and D.

MP 313 **Griffin Gulch on the flank of Elkhorn Ridge to the west.** Here was the center of the old northeastern Oregon gold mining districts, where gold had been produced since 1861.

Oregon Historical Society, Negative Number ORHi 39601

"Stuck Fast"—Hutchings' Illustrated California Magazine, 1853.



"From all the information I can obtain, gold can be found on the headwaters of the Powder River, but the Indians are unwilling to risk themselves in that vicinity, as they would come in contact with hostile Indians, who reside in the mountains." *(Major Osborne Cross, 1849)*

MP 316 **High peaks of Elkhorn Ridge.** These are fragments of 200-million-year-old ocean floor.

"At a distance we could see what we supposed to be the Blue Mountains, and they struck us with terror. Their lofty peaks seemed a resting place for the clouds." *(Medoran Crawford, 1842)*

MP 328-339 **Old gold mines along Burnt River.** Iron Mountain, an old volcanic neck, to the east at MP 328.

"There are hill, gulch, and placer mines all the way up Burnt River from Express Ranch. Coarse gold, worth $18 per ounce, is found on the steep, high points from 20 to 50 feet above the river." *(R.W. Raymond, U.S. Commissioner of Mining Statistics, 1870)*

MP 331-332 **Nelson Marble, 240-million-year-old limestone.** The industrial complex west of I-84 is the largest "gold" mine in Oregon—but here the "gold" is limestone, a rock used in making cement and in refining sugar beets.

MP 334-335 **Crossing Connor Creek Fault and 170- to 280-million-year-old ocean-island and ocean-floor rocks.** This fault is the southern boundary of the "Gold Belt of the Blue Mountains." The oceanic-crust terrane probably represents a collage of pieces of several different generations of crust, broken and deformed both before and while they were being assembled by plate tectonic forces.

MP 335-347 **Lower Burnt River Canyon.** The river cuts into a 150- to 200-million-year-old sedimentary rock formation named after nearby site of Weatherby.

"We are now travelling through a very mountainous country; the stream running rather in a ravine than a valley, and the road is decidedly bad and dangerous . . . The mountains . . . were composed, near the river, of a slaty calcareous rock in a metamorphic condition." *(Captain John C. Fremont, 1843)*

EXIT 340 **Rye Valley.** Access to Side Trip D.

EXIT 345 **Huntington.** Gateway to water recreation on 40-mile-long Brownlee Reservoir; starting point for Side Trip E.

MP 353 **Farewell Bend.** Active sand dunes are being formed from flood deposits of the Ice Age (14,000 years ago).

"Hence we descended to the Snake River . . . It forms here a deep bay, with a low sand island in the midst." *(Captain John C. Fremont, 1843)*

MP 359 **Tilted and faulted blocks of volcanic rock 15 million years old.**

"The mind can hardly appreciate the amounts of dynamics adequate to displace and disrupt the surface of the earth so immensely. It appears like a great harrow, fit only for Hercules to use in leveling off the surface of some planet. Oh, when shall I view, once more, a verdant landscape! One thousand miles of naked rocks!" *(Riley Root, 1848)*

MP 359-371 **Lake sediments (2-7 million years old) of ancient Lake Idaho.**

"The entire basin, from the Rocky Mountains to the Blue Mountains of Oregon, was once a fresh-water lake, on whose bottom was deposited a curious succession of sand and clay beds . . . the scene has entirely changed, and monotonous, blank desert now spreads itself as far as the eye can reach." *(Clarence King, first U.S. Geological Survey director, 1903)*

MP 368 **Ice Age loess (fine dust) deposits.**

"Proceeded about five miles over a very dusty road till it became so bad that we could not see our teams or hardly breathe and were obliged to heave to for a season." *(Cecelia Adams and Parthenia Blank, 1852)*

MP 374 **Crossing Malheur River.** Oregon Trail crossing is 12 miles west at hot springs at Vale Butte—a place for the early-day travelers to rest and bathe.

"Temperature of the water was 193°. The ground, which was too hot for the naked foot, was covered and below the springs with an incrustation of common salt, very white and good." *(Captain John C. Fremont, 1843)*

EXIT 376 **Ontario.** Gateway city into Oregon, on the fertile plain at juncture of Malheur and Snake Rivers. Vegetables, grains, and sugar beets are grown here under irrigation. Oregon Trail enters state farther south and is farther west at this point. Starting point for Side Trip F.

Ellen Morris Bishop

Farewell Bend, Snake River

IMPORTANT MAP INFORMATION

Topographic maps of these areas and a geologic field trip guide are available from the Oregon Department of Geology and Mineral Industries, 1831 First Street, Baker City, OR 97814, phone (503) 523-3133. For traveling on BLM or National Forest lands obtain special maps from: U.S. Bureau of Land Management, Room 215; or USDA Forest Service, Wallowa-Whitman National Forest Office, 3rd Floor, both at Post Office, 1550 Dewey Avenue, Baker City, OR 97814, phone (503) 523-6391.