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FIELD GUIDE TO THE GEOLOGY OF CORVALLIS AND VICINITY, OREGON

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Introduction and Geologic Background

This field guide had its origin in a class in environmental geology taught in the spring of 1971. The original road log has been modified so that those with an introduction to elementary geology will find it self-guiding. It emphasizes the practical aspects of local geology. It is divided into two parts, each of which provides a pleasant bicycle trip for an afternoon. The first half of the trip discusses the area west and north from Corvallis and deals largely with the bedrock geology of the area and the structure responsible for major landforms. The second half covers the area east and south of town and deals largely with surface sediments and the behavior of the Willamette River.

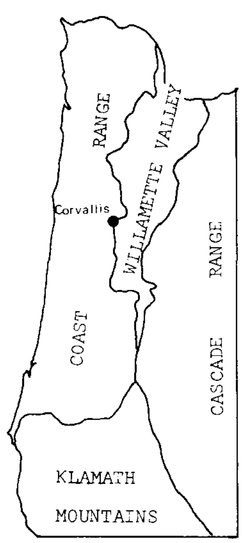


Figure 1. Geomorphic provinces of western Oregon.

Western Oregon is divided into four geomorphic provinces: the Cascade Range, the Willamette Valley, the Coast Range, and the Klamath Mountains. Corvallis, located at the western edge of the Willamette Valley adjacent to the Coast Range (Figure 1), lies on the west bank of the Willamette River, mostly north of the mouth of Marys River. The Coast Range reaches its maximum elevation about 15 miles west of town at Marys Peak. From Marys Peak, a long ridge called Vineyard Mountain (MacDonald State Forest) trends northeast past town. The Corvallis fault, located along the southeastern edge of this ridge, separates erosion-resistant volcanic rocks on the northwest from soft sedimentary rocks which are mostly covered by valley alluvium on the southeast (Figure 2). The Corvallis fault forms the eastern boundary of the Coast Range near Corvallis.

The four bedrock units under the Corvallis area are, from oldest to youngest: the Siletz River Volcanics, the Tyee Formation*, the Spencer Formation, and diabase dikes and sills (Vokes and others, 1954). The first three units were

* Mapped as Flournoy Formation by Baldwin (1974).

deposited during Eocene time (40-60 million years ago), and the dikes and sills were intruded into them during the mid-Oligocene (25-30 million years ago). No younger materials were preserved until the accumulation of unconsolidated terrace, flood, and floodplain deposits of Pleistocene to Recent age (less than 100,000 years old). The bedrock units are more widely exposed in the Coast Range, whereas the unconsolidated materials are typical of the Willamette Valley.

The Siletz River Volcanics are basaltic rocks many thousands of feet thick that erupted onto the early to early-middle Eocene sea floor from submarine vents (MacLeod and Snavely, 1973). They are the oldest rocks in the area and include basaltic pillow lavas, breccias, tuffs, and associated basaltic sedimentary rocks. The lower part of the unit is similar to oceanic crustal basalts and is thought to be oceanic crust which accreted onto the continental margin. In the upper part of the unit, rocks of more varied composition accumulated locally in sufficient thickness to form island similar to modern seamounts (Snavely and others, 1968). The Siletz River Volcanics crop out only northwest of the Corvallis fault in the vicinity of Corvallis. The unit is widely exposed in the Coast Range.

The Tyee Formation, which overlies the Siletz River Volcanics with little or no unconformity, is a thick sequence of rhythmically bedded sandstones and siltstones of middle Eocene age (Snavely and others, 1964). Many of the individual beds (6 inches to 3 feet thick) are composed of sediments which are graded in size from coarse at the bottom to fine at the top and are interpreted as marine turbidite deposits derived from the Klamath Mountains, to the south. The sediments, which become finer to the north, were deposited in a relatively deep trough which they gradually filled. The Tyee Formation is widespread in the Coast Range and is over 6,000 feet thick in places, such as west of Marys Peak (Baldwin, 1955). The few deep exploratory wells near Corvallis (Newton, 1969) suggest that it thins rapidly to the east. The Tyee Formation is exposed in several hills along the southeast side of the Corvallis fault.

The Tyee Formation is overlain unconformably by the Spencer Formation, a 4,500-feet thick series of basaltic, arkosic, and micaceous marine sandstones. Most outcrops of the Spencer Formation are thick bedded without the grading typical of the Tyee Formation. The unconformity, which is generally slight, is quite pronounced near the Corvallis fault northeast of Lewisburg, where a 50° discordance is reported (Vokes and others, 1954). The Corvallis fault apparently developed, at least in part, during the time between the deposition of the Tyee and Spencer Formations. Because the latter was deposited during late Eocene times, the fault must have been active during late-middle to early-late Eocene and probably continued to be active through late Eocene, as locally it cuts beds of the Spencer Formation. Indeed, the upper Spencer Formation was probably derived in large part from erosion of the Tyee Formation, which formed the block rising northwest of the Corvallis fault.

Figure 2. Aerial oblique view of Corvallis showing trace of Corvallis fault along the base of Vineyard Mountain. Note old millrace south of Marys River. (Photo courtesy of Western Ways, Inc.

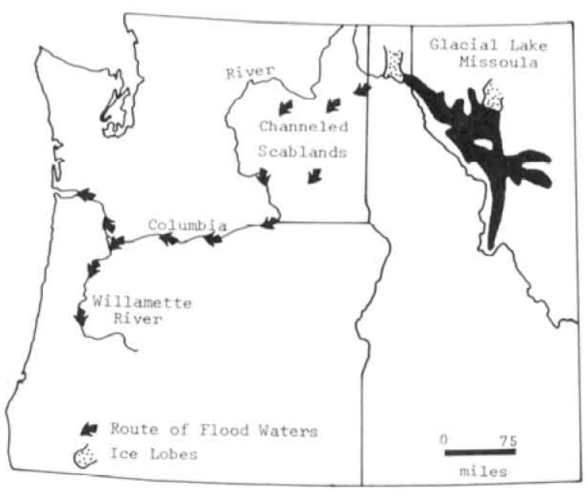


Figure 3. Origin and route of the Spokane Flood waters that deposited the Willamette Silt.

Marine Oligocene rocks, present to the south near Eugene (Baldwin, 1964) and to the east under the alluvium of the Willamette Valley (Newton, 1969), are not present near Corvallis. If they ever were present, they have been removed by erosion. During the middle Oligocene, dikes and sills of diabase (shallow intrusive rocks of basaltic composition) were injected into the Eocene deposits. Near Corvallis, sills seem to be common along the Tyee/Spencer contact. These dikes and sills are relatively erosion resistent and so support many of the ridges and hills, such as Marys Peak (4,097 feet), in the area. Neither Miocene nor Pliocene materials are present, and it is unlikely that they ever were. Thus the geologic record has a gap of about 25 million years, during which erosion probably occurred, before the most recent materials were deposited.

The most recent episode of uplift of the Coast Range occurred near the end of this period of erosion and may be continuing at the present. The Willamette Valley, a structural depression between the Coast Range and the Cascades, collects water draining from both the east and west to form a major north-flowing river, the Willamette. Thus, this is one case where a river did not carve its own valley. The bottom of the structural depression is interrupted by several sets of hills, and as it has only a gentle slope to the north, the river has often been unable to carry away all of its sediment load. Most of this sediment comes from the Cascades, as the largest part of the Coast Range drainage goes directly into the sea. During the Pleistocene, great fans of sediments from the Cascades repeatedly accumulated in the valley and forced the Willamette River over to the western edge of the valley (Beaulieu, Hughes, and Mathiot, 1974). Remnants of these sediments, sometimes deeply weathered, are preserved as terraces in the valley. In general, the higher the terrace is above the valley floor, the older it is (Balster and Parson, 1968).

Toward the end of the most recent of these periods of accumulation, the Willamette Valley was a minor participant in one of the most dramatic events in the geologic history of the Pacific Northwest - the Spokane Flood (McKee, 1972). In northern Idaho a lobe of the great continental ice sheet dammed the Clark Fork River, creating Lake Missoula, an enormous lake which extended into Montana. The ice dam failed abruptly, and the lake emptied in a period of a few days. Grand Coulee and the channeled scablands of southeastern Washington are a result of this great (estimated at 50 cubic miles), but brief, flood of water. All of this water reached the ocean via the Columbia River; and at the sharp bend in the river at Portland, a vast pileup of water occurred. An ephemeral iceberg dam may have been present at the bend. Backwash from this water filled the Willamette Valley to a maximum water level of 400 feet (Figure 3). Glenn (1965), working to the north near Portland, reports that as many as 40 floods of this origin, reflecting repeated advances and retreats of the continental ice lobes, may have washed up the Willamette Valley.

These short-lived lakes deposited a layer up to 30 feet thick, called the Willamette Silt, on the older terrace gravels. Included in these silts are boulders similar to rocks exposed in northern Idaho that were frozen in icebergs that washed up the valley (Allison, 1935). These exotic boulders are the principal confirmation of the Spokane Flood in the Willamette Valley.

Since the close of the Pleistocene, the Willamette River has been cutting into the older terraces and Willamette Silts. A new flood plain that has been established, as well as several low terraces not far above the flood plain, show many features related to river erosion processes. Parts of the flood plain are inundated annually during the winter rainy season. Other slightly higher parts are affected only during more infrequent major floods. Such a flood occurred in 1964 and will be discussed in the road log.

Road Log

(Refer to map, p. 62-63.)

Mileage*

Interval	Cumulative	
	0.0	Leave the Earth Science Building (Wilkinson Hall), Oregon State University, and proceed northwest on Arnold Way to N.W. Harrison. Turn left on Harrison and go to 36th Street.
0.7	0.7	Turn right on 36th Street. The flat area you cross here to get to Witham Hill is an old terrace mantled with river deposits. At the base of Witham Hill, swing left onto Witham Hill Drive and look for the outcrop of rock beside St. Mary's Cemetery.
0.5	1.2	St. Mary's Cemetery outcrop, an outcrop of Spencer Formation sandstones intruded by diabase. The sandstone can be seen near the cemetery entrance; in places bedding is visible. The intrusive contact is under the spruce trees up the road; good exposures of the diabase follow. Near the uphill intrusive con-contact, small concretions can be seen in rocks of the Spencer Formation. These concretions are cemented by zeolite minerals (Enlows and Oles, 1966). Bedding occurs again, and careful observation suggests that the intrusive body crosscuts bedding at a low angle. Continue over the top of the hill past the University Park Apartments. From the crest of the hill to the sharp bend, the roadcuts expose deeply weathered Tyee sandstones and siltstone.
1.0	2.2	At the sharp right-hand bend in the road, you cross the Corvallis fault for the first time. Weathered Siletz River Volcanics are in the first outcrops on the left. The low notch through which the small

* Left column, intervals; right column, cumulative mileage.

stream flows is carved out of the weaker rocks that were broken and ground up by the fault motion. The Siletz River Volcanics have moved up along the fault, and the sandstones have dropped down. The older volcanics are more resistant to erosion and support the hills northwest of Corvallis. Note the small white mineral blebs in the volcanic rocks. These blebs are zeolite vesicle fillings, and they help distinguish
0.3 these rocks where they occur elsewhere on the trip.

2.5 Turn right onto Walnut Boulevard. More Siletz River Volcanics are visible on the hillside above
0.4 the turn.

2.9 Hoover School. As the homes in this area were being constructed, the broken and sheared rock of the Corvallis fault zone could be seen in many of the basement and foundation openings. The fault comes down the small valley you just left, crosses the road just west of the school, and goes through the notch in the hills to the northeast. You will
0.9 see it again near Crescent Valley High School.

Continue along Walnut Boulevard. In several places weathered sandstones appear again in road cuts.

3.8 Intersection of Walnut Boulevard and Kings Road. In the small quarry just up the hill, another diabase intrusive body occurs. The rock has coarse crystals that show an interlocked texture characteristic of rock that crystallized from a melt. The presence of these intrusives in the hills around Corvallis is not coincidental. The more erosion-resistant rock of the intrusives supports the hills, preventing them from being carved away as rapidly as the rest of the Tyee and Spencer Formations. During the winter and spring, this locality will also have a spring which marks the place where the ground surface intersects the water table, proving that much
1.5 of the ground is saturated during the wet months.

Proceed down Kings Boulevard to Circle Drive and turn left. At Highland Drive, turn left again.

5.3 Stop sign at Highland Drive and Walnut Boulevard. Looking to the left at the profile shape of the hillside, you see the steep upper hillside that is underlain by bedrock; a lower, gentler slope across which debris from the higher slopes is transported; and the flat terrace upon which Corvallis is built. This slope pattern, typical of much of the area through which you are riding, created a slight problem during heavy winter rains; water that ran down the gentle "transportation slope" accumulated at the base in an almost imperceptible depression at the back of the terrace, drained toward the Willamette River until it

intersected Highland Boulevard, and then flowed along the roadway out onto the terrace. The sewer here is
0.6 needed to carry off future large amounts of water.

5.9 Proceed up the hill past outcrops of weathered Spencer sandstone exposed in the roadcuts. The beds dip about 25° to 30° to the east in the large cut on
0.2 the right just north of crossroads.

6.1 Here you cross the contact into the Tyee Formation. The Tyee dips about 40° to the north. The difference in degree of dip between the Tyee and the Spen-
0.7 cer Formations shows an unconformity between the units.

6.8 Crescent Valley School. At the entrance to the school, a spring in the pasture near the base of the hill keeps the ground moist and the vegetation green during all but the driest parts of the year. The Corvallis fault crosses just south of the school and then continues northeast through the notch followed by Highway 99W and the railroad. The basalt you see in the ditch of the road south of the school shows that you have crossed the fault. The spring in this location may be related to the proximity of the fault and the more permeable rock produced by the ground breakage.

The age of the fault is indicated partially from this area. You can see that since the fault crosses the middle of the broad eroded valley, and since the rocks on the northwest side are eroded back from the fault line for a long distance, it has been a relatively long period since the fault was last active. Other lines of evidence support this interpretation and suggest that the fault has not moved for several tens of millions of years. Thus this is not a feature that would be likely to offer an earthquake hazard to structures constructed across it.

1.0 The high school here is constructed on a low terrace that rises above the valley floor far enough to protect it from flooding. The terrace, however, is underlain by material containing abundant expansive clay minerals which swell up greatly when wet and contract when dry. They can be a very serious hazard to building foundations. The stream flowing through the middle of the school is beautiful and is also useful in that it is the visible portion of a drainage network that greatly reduces the expansion of the clays by maintaining a fairly constant moisture content in the ground.

Continue on Highland Drive. Note the terraces with elevation differences of only a few feet as you cross the valley. The lowest level is the modern flood plain of the small creeks.

7.8 Lewisburg Road. Turn right. Siletz River Volcanics are exposed in the roadcut at the turn, con-

firming that you are still northwest of the Corvallis
fault. Note the zeolite minerals again. Continue
0.3 east on Lewisburg Road.
8.1 Mountain View Drive. An optional loop on the
trip goes 0.6 miles up this drive to the Lewisburg
quarry, where good exposures of Siletz River Volcanics
0.1 can be seen. From the quarry return to Lewisburg Road.
8.2 The Corvallis fault, which you cross again here,
0.3 continues through the notch to the northeast.
8.5 This low hill is formed of Tyee Formation with
a cap of Spencer Formation. Sandstone occurs in the
0.3 ditch (as does poison oak).
8.8 Lewisburg. Turn right on Highway 99W. Climb
over a low sandstone hill and descend onto the ter-
1.0 race system.
9.8 At the bridge, note the extensive swampy ground.
This area, which is part of the flood plain of the
small streams draining Crescent Valley, has a high
0.7 water table and is often flooded during the winter.
10.5 This low hill is made up of Spencer Formation,
0.3 which can be seen poorly exposed in the roadcuts.
10.8 Swing sharply right onto Elks Drive. Climb to
the Elks Club parking lot for an overview of the valley. On a clear day the volcanic peaks of the Cascades are clearly visible from here.

From this vantage point you can see the pattern of the Willamette River terraces and flood plain. The channel of the river is to the east and can be located by the dense growth of conifer trees lining its bank. The foreground is occupied by a terrace, well above the river, which developed during the Pleistocene when the Willamette River partially filled the valley with debris. Willamette Silts from the Spokane Flood are found on top of these terraces in some places.

Where the Willamette Silts are present, the topography tends to be flat, with minor variations produced by old meander scrolls that have been partially filled with alluvium. Meander scrolls are arcuate landforms which are actually abandoned river channels left by the river as it has meandered back and forth in the valley. The river has since cut into the fill, leaving the terraces above its present level. During winter rains and spring snow melt, the Willamette will commonly rise out of its channel and cover part or all of the flood plain. The terraces, high enough to not be affected by this kind of flooding, have other high-water problems at these seasons. The sediments forming the terraces were also originally deposited during floods and are therefore old flood plains. The sediments are coarser in size close to the river and finer in size farther from the river. This sorting of sedi-

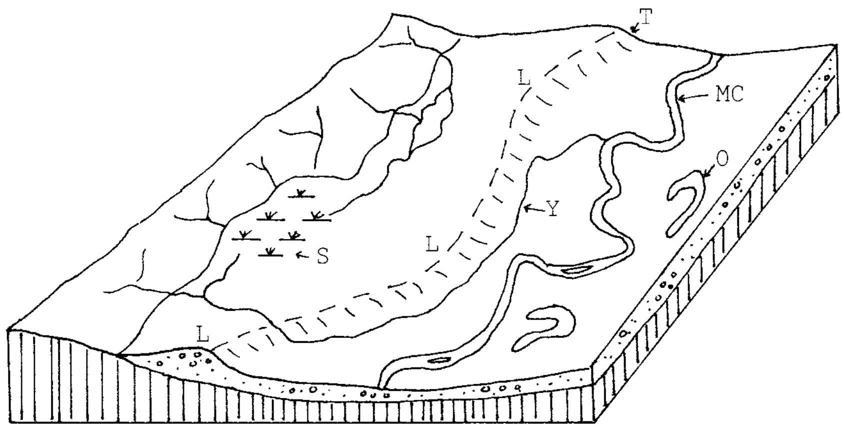
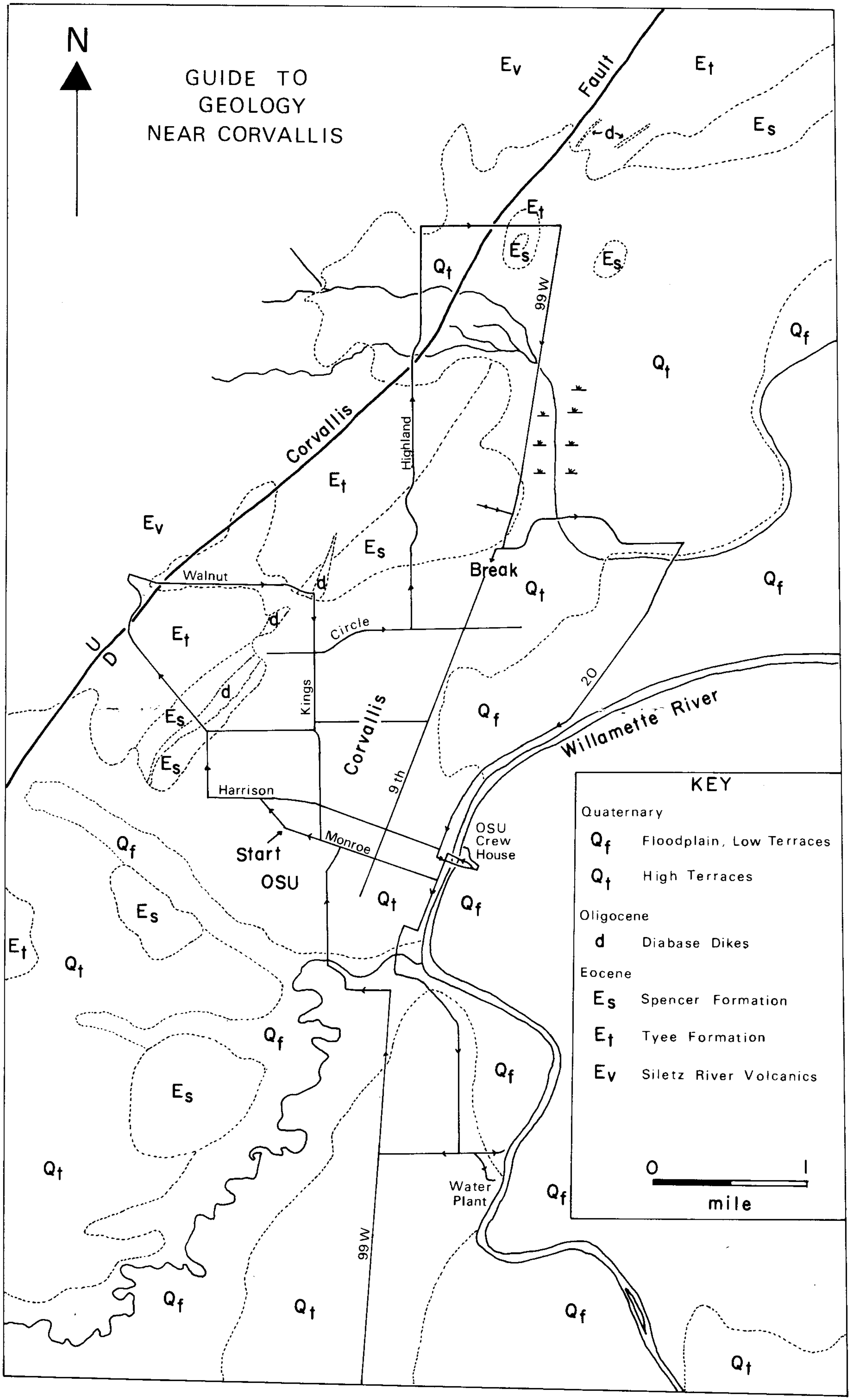


Figure 4. Block diagram of yazoo stream: MC = main channel of river; Y = yazoo stream; S = swamps; O = oxbow lake; T = terrace scarp; and L = levee.

ments by size occurs because fast-moving water carries coarser material than slow-moving water does. Once the fast-moving flood waters overflowed the riverbanks and spread out over the flood plain, their velocity dropped, the coarser material was deposited closest to the riverbanks, and the finer material was deposited
0.7 farther away.

This sorting of sediment produced a levee and backswamp effect, as shown in Figure 4. This effect can be seen in the area below you. The trailer court to the northeast is built on a site that is lower than the rest of the ancient flood plain to the east. The soil is fine-grained clay, in part from the backswamp; and during the rainy season standing water that cannot escape over the rising terrace is a serious problem. Even when water is not present above the surface, the ground-water table may be only inches below the surface, making it impossible to build and use basements. Consultation with an engineering geologist before development is very important in such an area.

For a wider perspective, look out toward the Cascade Range of volcanic mountains to the east. Behind you is the Coast Range. Cascade Range rocks are generally younger than those of the Coast Range, but both areas have undergone uplift in the recent past. The Willamette Valley has been left behind as a structural depression down which the Willamette River flows. Some of the volcanoes of the High Cascades have been active in the recent past, and it is possible that they could



MAP SHOWING FIELD TRIP ROUTE AND GEOLOGY NEAR CORVALLIS

erupt again.
Ride back down the hill to Ninth Street. Turn right on Ninth and proceed.

11.5 THIS IS THE BEST SPOT TO SPLIT THE TRIP INTO TWO PARTS.
To return to Oregon State University from this point, continue along Ninth Street and then follow the bike route signs to the center of town and, eventually, the campus. If you plan to complete the trip at this time, turn left on Conifer Avenue, cross Highway 99W, and ride into Kings Village Housing Develop-
0.4 ment.

11.9 On the left is the area just viewed from the Elks
0.2 Club.

12.1 A small creek crosses the road here. The banks expose the Willamette Silt. Note the high clay content of the unit, how sticky and easy to mold it is when it is wet. This high clay content makes it difficult for water to sink into the ground and contributes significantly to the problem of standing water
1.0 when the creek floods.

13.1 Turn right onto Highway 20. Just after the turn, you drop over the terrace edge and go down onto the
0.1 present-day flood plain of the Willamette River.

13.2 Bridge across small stream. This swampy creek is the same one you crossed at mile 12.1, where you looked at the clay. There, at higher elevation, the creek flows south, parallel to the Willamette River but in the opposite direction. After crossing the terrace, the creek descends to the flood plain, where it is still trapped behind the levee of the river. It then flows north, parallel to and in the same direction as the Willamette, until the flood plain disappears on this side of the river and the river cuts into the high terrace (see Figure 4). A stream that becomes entrapped in this manner is called a "yazoo stream," named after a Mississippi tributary that shows this behavior.
0.2 Yazoo streams are common in the Willamette Valley.

13.4 From the intersection of Garden Drive and Highway 20, you can look back for a good view of the terrace scarp that you just rode down. For the next mile or so, watch the minor relief features of the fields, which are developed on more old Willamette River mean-
1.1 der scrolls.

14.5 At this curve in the road you are climbing up onto the higher terrace again. The city of Corvallis is built on this terrace level and thus is normally im-
0.8 mune from flooding.

15.3 The creek flowing under the road at this point permits the entry of flood water during high-water stages of the Willamette River. In the 1964 flood, the Corvallis sewage treatment plant in the low area just to the west was flooded. The east bank of the river is generally lower along here, except for tributary channels of this sort, and most flood waters flow to the east.

0.7 16.0 Turn left on Van Buren Avenue and cross river on Highway 34. Just across the bridge, turn left across the highway and ride out to the OSU crew docks on the bank of the river.

From this lookout point you can see the main Willamette channel and a portion of the flood plain to the east. The river has not flooded the city of Corvallis to the west since 1861 because that part of the city sits on a higher terrace. The area to the east is frequently covered with water during floods and so is truly part of the flood plain. This is the widest portion of the Willamette flood plain in the Corvallis area, extending almost 2 miles to the east; and a stretch of Highway 34 is covered by flood waters fairly frequently (Figure 5).

During the very high "100-year" flood of December 1964 the Willamette rose to its crest in 4.5 days, at an average of 0.14 feet per hour. For 13 days the river was out of its channel. The velocity of water in the main channel was 13 feet per second. Even east of the highway bridge outside the deep channel, velocities of 5 feet per second were measured in water over 10 feet deep that was flowing across the highway. High-water marks from some of these floods can be seen on the Harrison Street Bridge pillars. Very large floods of this sort occur on the Willamette River from a combination of conditions. First, prolonged winter rains that saturate the soils of the surrounding mountains are followed by a major snow storm. Then a rapid thaw and melt, accompanied by rain, causes a very rapid release of water from melting snow, which promptly raises the rivers above their banks. This pattern is especially common for Coast Range streams.

Even though floods of this magnitude do not occur every year, they represent a serious threat to structures that may be constructed on the flood plain. Accordingly, wise land-planning efforts involve zoning regulations to restrict building on the flood plain. The Benton County Board of Commissioners has passed regulations prohibiting housing tracts of any kind on flood plains in Benton County; and the long-range plan for the county includes careful consideration of flood plain planning. Linn County, where you are at this stop, has even stricter ordinances for the Willamette flood plain than does Benton County. Here only agri-

Figure 5. Aerial oblique view of Willamette River on January 17, 1974 showing flood waters on flood plain east of Corvallis. (Photo courtesy of Western Ways, Inc.)

1.0 cultural use is allowed.

Return to Highway 34 and turn right to Corvallis via the Harrison Street Bridge.

17.0 Turn left on Second Street.

0.6

17.6 Turn right on Western Boulevard. Then turn left onto Third Street and cross the Marys River Bridge on the sidewalk on the left-hand side of the road. Continue on the sidewalk.

0.5

18.1 Turn left on Crystal Springs Drive. The first bridge at Evans Products Company is an old millrace that causes problems because it carries flood waters from the Marys River through this area.

0.4

18.5 Stop at the large gravel piles on the left side of the road and look down at the gravel plant operation, now being phased out.

The Willamette River, with its headwaters located in the recently uplifted Cascade Mountains, carries an abundant coarse sediment load. Following periods of high water, gravel deposits accumulate as point bars on the inside (concave side) of meander loops. The progressive development of such a bar can be followed on Figure 6. In time these accumulations may reach sufficient size to become economically valuable.

Gravel is an important economic resource. The 1974 value of $32.6 million for Oregon's sand and gravel represented well more than one third of the State's total mineral value of $81.5 million for that year. The tremendous bulk of gravel resources means that transportation is crucial in limiting the exploitation of a deposit. If gravel must be carried very far, it cannot be economically used.

The Corvallis area is fortunate in having ongoing gravel extraction operations in very large point bars adjacent to, but not in, the river channel. Elsewhere along the Willamette, quarrying has been carried out by dredging the river itself for its current load of gravel and sand, which unfortunately increases downstream erosion as the river supplies itself with new loads to replace its lost loads. River quarrying also dirties the water downstream with fine sediment, which in turn affects the quality of fishing and drinking water. Here the gravel operation, while not beautiful, is in a safe place and fulfills the gravel needs of the surrounding area.

One problem associated with population growth in an area is the tendency for urban developments to grow over potentially valuable gravel deposits that will soon be needed; another problem is the tendency to zone completely against gravel operations. This valuable industry may then be smothered by its own success in supplying building materials for a growing area. This loss of gravel resources is unnecessary; planning that first identifies gravel resource areas and then zones them for aggregate use can be combined with regulations requiring mined-land reclamation. Numerous mined-out quarries and gravel pits have been used as parks with lakes; and some gravel pits have been leveled and filled for residential construction.
1.0

Continue down Crystal Springs Drive.

19.5 Turn left on S.E. Park Avenue.

0.2

19.7 Turn left on Goodnight Road, then turn right on Clearwater Road and ride out to the Corvallis Water Treatment Plant. Ride to the bank of the Willamette River.

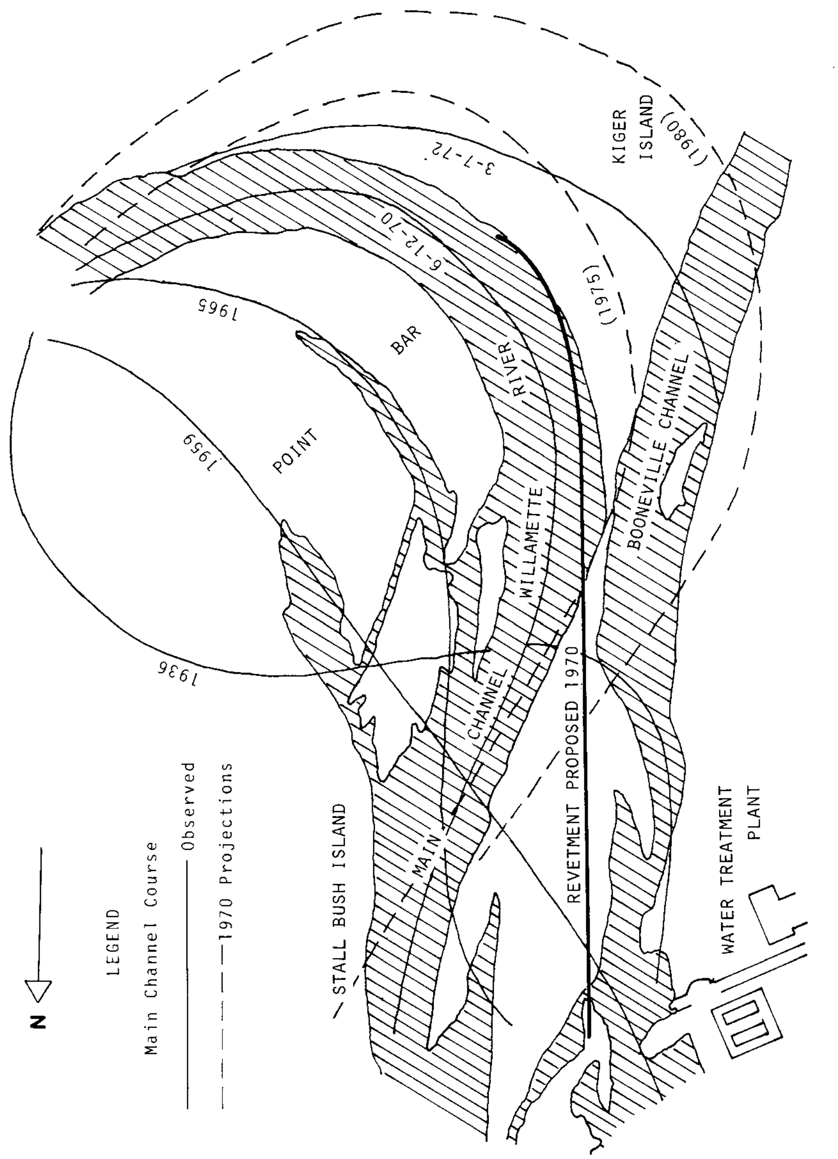


Figure 6. Channel changes in Willamette River near Corvallis water treatment plant showing revetment proposed in 1970 to maintain channel east of plant. Note growth of point bar from 1959 to 1972.

The H.D. Taylor Water Treatment Plant is used for municipal and irrigation water services by the City of Corvallis and the surrounding area during the summer months. Peak intake for the plant is approximately 20 million gallons per day. Recently the meandering of the Willamette River has seriously affected the outlook for the future usability of the plant.

In 1970 the U.S. Corps of Engineers undertook a survey of the Willamette River in the vicinity of the water treatment plant. The study revealed that the river was about to change the course of its main channel. At that time the plant obtained its water from the relatively quiet waters of the Booneville channel, a side channel for the river. The Corps predicted that about 1975 this channel would become the main course for the river. The rapid water of the main channel and the accompanying rapid erosion would threaten the effectiveness of the plant. A revetment was proposed to hold the river in its existing channel (see Figure 6). In the fall of 1971, 3 years ahead of schedule, the Willamette River cut through to the Booneville channel before the revetment could be constructed (Figure 7). Looking to the south, you can see the extensive erosion along Kiger Island that is a result of this change of channels. Two undesirable consequences may follow: First, the Willamette River may erode its west bank and undercut the treatment plant; second, the river may be deflected from the west bank and bypass the plant. Alternative revetments have been established along the new channel to try to prevent either of these events and to keep
0.5 the river in its present location

Return to Goodnight Road.

20.2 Turn right into Willamette Park on Goodnight Road. As you enter the park, you drop down onto the flood plain of the Willamette River from the terrace. At the base of the terrace scarp, notice the lowland area with large cottonwood trees growing in it. This is the low zone at the back of the flood plain behind the levee. By the riverside you can see part of the protective measures that have been taken along the
2.2 banks of the river.

Return to Goodnight Road. Turn right and return to S.E. Park Avenue. Continue on S.E. Park Avenue to Highway 99W. Turn right on Highway 99W.

22.4 Beyond the school crossing, you drop down into a lowland area containing the millrace, mentioned at mile 18.1, which is frequently flooded by the Marys
0.4 and Willamette Rivers combined.

22.8 Turn left on Avery Road and follow the bike route through Avery Park. By now you should be able to re-

Figure 7. Aerial oblique photo looking north across the Corvallis water treatment plant on January 5, 1971, after the Willamette River began using part of the Booneville channel as a main channel. (Photo courtesy of Western Ways, Inc.)

cognize the presence of numerous meander scrolls of
0.7 the Marys River in the park area.
23.5 Take the bridge across the Marys River and cross
1.2 Highways 20 and 34. Continue straight.
24.7 Turn left on Monroe Boulevard and return to the Earth Sciences Building.

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MARGARET STEERE RETIRES

Margaret L. Steere

Nearly 30 years ago Margaret Steere came to the Department to organize the rock and fossil collection. Before long, all specimens were labeled and either carefully stored or neatly displayed.

Soon Margaret, who has a master's degree in geology from the University of Michigan, was producing articles and editing the manuscripts of would-be authors into Department publications.

The "Fossil ORE BINS," on which Margaret worked as editor and writer, were probably the most popular items the Department ever published. Margaret's last work before retiring was preparation of ORE BIN articles on fossil plants and animals of Oregon for publication as a bulletin.

During her long tenure with the Department, Margaret edited and assembled 55 bulletins and more than 300 issues of the ORE BIN, all camera-ready for the printer. She put forth this effort without fuss or bother. She came and left quietly, but she will be missed.

* * * * *

STEVE RENOUD TAKES TO THE WOODS

Steve Renoud

Steve Renoud, the Department's chief cartographer, has left to become assistant Director of the mapping section in the State Forestry Department in Salem.

During his 8 years in the Department, Renoud developed the technique for in-house production of camera-ready color-separated negatives for multi-colored geologic maps. The procedures he perfected are now in use by various other agencies.

Steve turned out numerous multicolor maps, charts, graphs, tables, and illustrations for the Department. In addition, he worked on state-wide job descriptions for classifying cartographers.

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