State of Washington ALBERT D. ROSELLINI, Governor

Department of Conservation EARL COE, Director

DIVISION OF MINES AND GEOLOGY

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Geologic Map GM-1

PRELIMINARY GEOLOGIC MAP OF THE HOBART AND MAPLE VALLEY QUADRANGLES, KING COUNTY, WASHINGTON

By

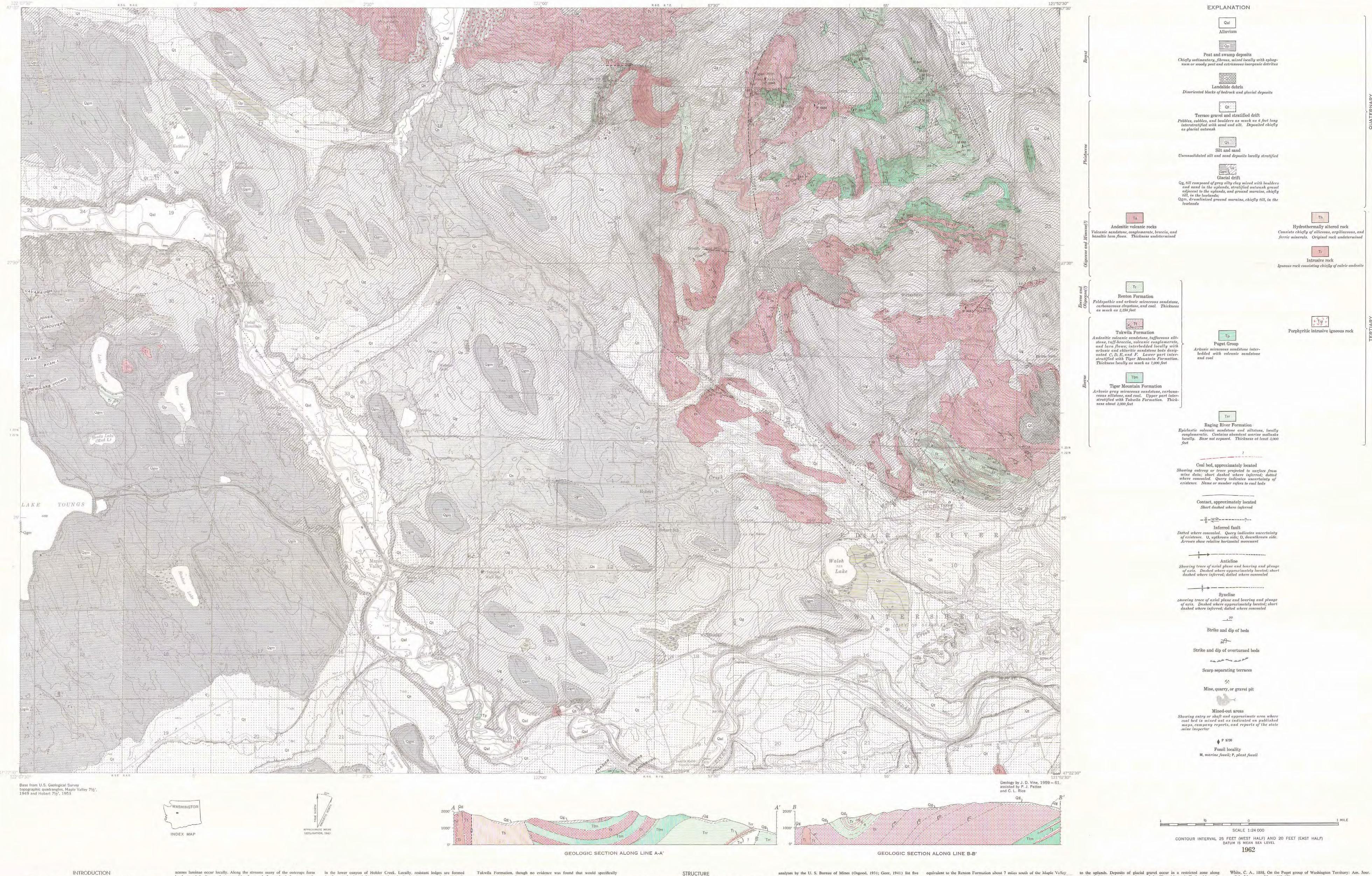
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U. S. GEOLOGICAL SURVEY

Prepared cooperatively by the U.S. Geological Survey



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The Hobart and Maple Valley quadrangles are located on the eastern margin of the Puget Sound lowland, about 11 to 26 miles southeast of the center of Seattle, and include parts of the Tiger Mountain-Taylor Mountain upland area in the western foothills of the Cascade Range. Altitudes within the quadrangles range from about 115 to 3,000 feet, Except for the small farms in the lowlands and numerous suburban home sites, most of the area is heavily timbered. Maple Valley is located on State Highway 5, between Seattle and Enumclaw. A hard-surface county road between Issaguah, about 2 miles to the north, and Ravensdale, about 2 miles to the south, provides access to the Hobart area. Travel within the timber lands is generally restricted by the private landowners and government agencies who administer the land. Travel restrictions apply to the Washington State Department of Natural Resources roads and the City of Seattle Cedar River Watershed

The coal fields of King County were described by Evans (1912), and the bedrock geology of the area was previously mapped by Warren and others (1945). The area of the present investigation is covered in both these earlier reports, from which many valuable basic data have been incorporated. This map was prepared cooperatively by the United States Geological Survey and the Division of Mines and Geology of the Washington Department of Conservation. The writer is indebted to Mr. E. H. Rogers, former Chief Engineer, Seattle Water Department, for granting permission to work within the Cedar River Watershed area and to Mr. D. H. Dowling, Branch Forester of the Weyerhaeuser Co., and Mr. John Buchanan, District Forester, Washington Department of Natural Resources, for granting permission to work within the area of the Tiger Mountain timber reserve. Field work was done in September 1959, June through August 1960, and part of June and July 1961. The writer wishes to acknowledge the assistance of P. J. Pattee in the summer of 1959 and C. L. Rice during the summer of 1960. The Cumberland quadrangle, which adjoins the Hobart quadrangle on the south, has been mapped by Howard D. Gower and Alexander A. Wanek as a part of this

TERTIARY ROCKS STRATIFIED ROCKS

Raging River Formation

The Raging River Formation of Eocene age is the oldest rock unit that crops out in this area. It is named and described in another report (Vine, 1962). Epiclastic volcanic sandstone, siltstone, and conglomerate of marine origin compose most of the exposures of the Raging River Formation. Though these rocks are probably at least 3,000 feet thick, only the upper 1,000 to 2,000 feet are well exposed. The lower part of the Raging River Formation has been intruded by igneous sills, is partly recrystallized, is broken by faults, and is largely covered by glacial deposits in the valley of the Raging River, so that detailed knowledge is lacking. The dominant lithology of the exposed part of this formation is medium-gray to dark-gray, fine- to medium-grained impure volcanic sandstone that is generally well indurated and very thick bedded. The matrix contains rock and mineral fragments and cement, including calcite, the clay minerals chlorite and montmorillonite, and pyrite. Grains of plagioclase compose at least 50 percent and locally as much as 95 percent of the plus 50-mesh fraction. The outcrops commonly form massive re- more coarsely textured porphyritic andesites than occur lower in the

nard rounded shapes that resemble those of fine-grained igneous rock, Medium- to coarse-grained friable sandstone and chert pebble conglomerate crop out locally in the Raging River Formation, and dark-gray to black massive carbonaceous claystone occurs locally at the top. A marine fauna, including gastropods, pelecypods, scaphopods, echinoids, and Foraminifera is characteristic of the finer grained sandstones and siltstones. During the present investigation, fossils were collected from seven localities in secs. 9, 15, 16, and 17, T. 23 N., R. 7 E. The megafossils were studied by F. Stearns MacNeil, who indicates they are probably of middle Eocene age. Foraminifera about 125 feet below the top of the formation, locality M-648, were identified by W. W. Rau (written communication, 1961) as probably of early late Eocene age. Thus, the Raging River Formation is regarded as middle and late(?) Eocene in age.

Tiger Mountain Formation.-The marine rocks of the Raging River Formation are conformably overlain by the Puget Group (White, 1888, p. 447), a sequence of nonmarine rocks including both volcanic and nonvolcanic (sedimentary) types that have an aggregate thickness of nearly 11,000 feet locally. The Tiger Mountain Formation (Vine, 1962) consists of about 2,000 feet of nonvolcanic rocks in the lower part of this sequence. Outcropping rocks of the Tiger Mountain Formation consist chiefly of arkosic and feldspathic micaceous sandstone that is medium grained and cross laminated and weathers gray and brown. Clay minerals constitute the matrix in these rocks and probably represent more than 10 percent of the rock. Montmoril-Ionite is the most abundant clay mineral in sandstone near the base, where hese rocks are transitional with the underlying marine rocks, whereas kaolinite or chlorite is predominant locally above the basal 100 to 200 feet. The upper part of the Tiger Mountain Formation is interstratified with volcanic rocks of the overlying Tukwila Formation throughout an interval of locally, near the top of the lower main body of the Tiger Mountain Forma-

Leaf fossils collected from the zone of coaly rocks in the Tiger Mountain Formation have been identified by Jack A. Wolfe (written communication, 1961) as probably of middle Eocene age, and fossils of late Eocene age have been identified from beds of the Tukwila Formation that are interstratified with the upper part of the Tiger Mountain Formation. The Tiger Mountain Formation is therefore classed as middle(?) and late Eocene age. Tukwila Formation.-The Tukwila Formation (Waldron, 1962) consists of andesitic volcanic rocks about 7,000 feet thick that are wholly equivalent to and interstratified with the nonvolcanic rocks in the Puget Group that are characterized by micaceous sandstone. Epiclastic volcanic sandstone, tuffaceous siltstone, tuff-breecia, volcanic conglomerate, and thin vesicular lava flows or sills compose the bulk of the Tukwila Formation. Quartz- and mica-bearing arkosic sandstone beds (designated C, D, E, and F) are interstratified with the predominantly volcanic sequence on the south slope of Taylor Mountain. Chlorite is an abundant alteration product, not only in the volcanic rocks but also in the nonvolcanic sandstone beds, where both the clay matrix and the mica flakes have been altered to chlorite. In general, the upper part of the Tukwila Formation contains more coarse-grained epiclastic rocks than the lower part. These include tuff-breccia and volcanic conglomerate of

by finer grained and finer textured rocks in the lower part of the Tukwila Formation. Leaf fossils from three localities (secs. 8, 17, and 27, T. 23 N., R. 7 E.) in the Tukwila Formation have been designated by Wolfe and others (1961) as late Eocene in age. Renton Formation.—The Renton Formation is the youngest formation recognized in the Puget Group of this area (Waldron, 1962). It consists of arkosic or feldspathic micaceous sandstone, siltstone, carbonaceous claystone, and coal, as much as 2,250 feet thick, conformably overlying the volcanic rocks of the Tukwila Formation. Sandstone beds in the Renton Formation generally are gray, fine to medium grained, and locally conglomeratic, laminated, cross laminated, or homogeneous, and friable, but contain more quartz and fewer plagioclase feldspar grains than most of the older sandstone beds of the Puget. Clay is the chief cementing material of the sandstone beds, though calcite and other carbonate minerals are locally abundant. Massive weathering, thinly laminated siltstone and carbonaceous claystone are interstratified with the sandstone. These finer grained rocks decompose readily to a soft brown soil and commonly form valleys between ridges of sandstone. The beds formerly mined for coal and clay at Cedar Mountain, Taylor, and in the Fifteenmile Creek area belong to the Renton Formation. The clay matrix of the sandstone and claystone beds in the Renton Formation char-Leaf fossils from the Renton Formation near Taylor, sec. 3, T. 22 N., R.

Andesitic Volcanic Rocks Volcanic rocks, including dark-gray epiclastic volcanic sandstone, platy andesitic flow rocks, and pumiceous volcanic breccia, lie stratigraphically above the Puget Group in two isolated outcrops. One outcrop is located in sec. 14, T. 23 N., R. 6 E., on Fifteenmile Creek, the other in sec. 23, 800 feet or more. A zone of carbonaceous shale and coal occurs, at least T. 22 N., R. 6 E., in the Cedar River valley. Rocks in a similar stratigraphic position are several thousand feet thick in the adjoining Cumberland quadrangle and contain leaf fossils of late Eocene or earliest Oligocene age in their lower part, according to Wolfe and others (1961). These rocks were mapped by Warren and others (1945) as part of the Keechelus Andesitic Series. However, on the basis of recent work in the vicinity of Mount Rainier (Waters, 1961; R. S. Fiske, C. A. Hopson, and A. C. Waters, written communication, 1961) it is evident that more work is needed to establish a relationship between the andesitic volcanic rocks in this area and the Keechelus Andesitic Series of Smith and Calkins (1906). The age of the andesitic volcanic rocks has not been determined, but it is thought that they are Oligocene and possibly as young as Miocene.

7 E., and near Cedar Mountain, sec. 29, T. 23 N., R. 6 E., are late Eocene

in age, but locally, west of Issaquah, the Renton is of possible late Eocene

or earliest Oligocene age, according to Wolfe and others (1961).

An intrusive igneous rock is exposed on both sides of the canyon of Issaquah Creek, in sec. 10, T. 23 N., R. 6 E., where a massive greenish-gray porphyritic intrusive underlies part of the Tukwila Formation but is discordant with the attitude of the Tukwila. Phenocrysts of hornblende and zoned plagioclase as much as 5 mm long characterize the intrusive igneous rock. The plagioclase phenocrysts are much altered and appear white. Replacement of original rock minerals by chlorite is common. The igneous rock is almost identical in texture and general appearance with some of the volcanic conglomerate and tuff-breccia boulders of the Tukwila Formation. The sistant ledges that are devoid of visible bedding or lamination, though carbon- formation. Tuff-breccia and volcanic conglomerate beds form resistant ledges intrusion is thought to be genetically related to the volcanic rocks in the

suggest that this locality was a volcanic vent. Younger igneous rocks intrude the Eocene sedimentary and volcanic rock sequence, notably in the vicinity of South Tiger Mountain, Fifteenmile Creek, and Raging River, where several sills form resistant ridges and peaks. They also form the resistant knobs that project through the glacial drift near Cedar Mountain. These rocks generally have a porphyritic texture and consist of phenocrysts of labradorite and augite 1 to 3 mm long in an intergranular to glassy matrix. They have the average composition of a calcic andesite in which plagioclase constitutes more than half the volume of the rock. Many of the original mineral grains of these igneous rocks have been altered to calcite, which may constitute as much as 30 percent of the volume of the rock locally.

HYDROTHERMALLY ALTERED ROCKS Local hydrothermal alteration has produced siliceous, kaolinitic, and ferric rocks in which the original constituents have been partly to completely obliterated. The contact with surrounding rocks is generally transitional. Hydrothermally altered rocks are characteristic of the area of major structural deformation between Tiger and South Tiger Mountains.

QUATERNARY DEPOSITS

Much of the surface in the Hobart and Maple Valley quadrangles is thickly mantled by Quaternary deposits, including till, ground moraine, lacustrine silt and sand, stratified outwash, gravelly river terrace deposits, landslide debris, peaty swamp deposits, and modern alluvium. Most of these deposits were formed during Pleistocene glacial stages and furnish evidence of occupation by continental glaciers thick enough to override all but the highest peaks in the area. The youngest, or Vashon drift (Willis, 1898), is exposed over most of the area. Locally, however, deposits of sand, peat, and other materials representing one or more older drift sheets may be seen below the Vashon drift along the walls of the Cedar River canyon in the Maple Valley quadrangle (D. R. Mullineaux, oral communication). Till is found as high as 2,700 feet on Tiger Mountain (elevation 3,004) and forms the highest ridge of Taylor Mountain, the peak of South Tiger Mountain, and the peak of the unnamed mountain about a mile west of Tiger Mountain, all of which are above 2,000 feet in elevation. The lowlands in the western part of the area are characterized by drumlinized ground moraine that is partly buried by later proglacial stratified drift formed by outwash streams during the retreat of the ice. The ground moraine is scarred by spillway channels and stream terraces formed as melt-water streams occupied successively lower routes along the northwestward-retreating margin of ice. The terraces are covered by a variable thickness of stratified fluvial deposits composed of sand and pebble to cobble gravels. Locally, the glacial drift is covered by deposits of silt and sand. A lacustrine silt and sand deposit occupies the valley of Issaquah Creek, extending as far south as Hobart, where it is locally interstratified with fluvial silt and sand. Two large landslide areas are mapped, one west and another south of Taylor Mountain. Peat deposits are scattered over the surface of the morainal deposits. Most of these peat deposits, according to Rigg (1958, p. 69-95), are composed of sedimentary and fibrous varieties with local concentrations of sphagnum, woody peat, and extraneous inorganic matter. Further classification of the peat deposits is given on the soil map by Poulson and others (1952). Recent alluvium is present along Cedar River and in the lower part of the valley

Rocks in the Tiger Mountain-Taylor Mountain upland area are folded and faulted into a series of arcuate structural features that trend northwest in the area east of Hobart and curve to the north in the northeastern part of the area. The radius of the arc centers on the faulted Raging River anticline, whose axial trace is inferred to underlie glacial deposits in the valley of the Raging River. A fault is shown to coincide with the axial plane in order to explain the relatively low position of the Tiger Mountain Formation east of the Raging River. The Taylor syncline lies to the south and west of the Raging River anticline and plunges continuously from north to south. The trace of its axial plane curves sharply from a northwest trend at its south end near Taylor to north-northeast and back to north again on Tiger Mountain. The Sherwood anticline lies approximately parallel to the Taylor syncline

on its southwest side. The Tiger Mountain fault lies between these two fold axes and probably has a stratigraphic displacement of at least 4,000 feet. Near the north end of the fault, upper beds of the Tukwila Formation are faulted into contact with hydrothermally altered rock thought to be derived from the Tiger Mountain Formation. Minimum displacement for the fault is estimated from the fact that at least 9,000 feet of strata should occur between the outcrop of the Raging River Formation at Tiger Mountain and the outcrop of the Renton Formation I mile to the west. The Hobart fault is postulated on the apparent duplication of tuff-breccia beds between Holder Creek and the west flank of South Tiger Mountain, on the isolated exposure of coal on Holder Creek, and on the apparent abrupt termination of the Renton Formation at the axial trace of the Sherwood anticline. Several transverse faults, nearly perpendicular to the trend of the arcuate structures previously described, occur on South Tiger Mountain and north to the Fifteenmile Creek area. One such fault is inferred to pass between the two peaks of South Tiger Mountain because of the abrupt lithologic change between altered and unaltered rocks. Several such faults of a few feet displacement are reported on the mine maps of the abandoned coal workings on Fifteenmile Creek, and this coal field terminates abruptly northward against a major transverse fault that brings the Renton Formation on the south against the Tukwila Formation on the north. The south boundary of Squak Mountain and the range of hills that extends nearly to Lake Washington may reflect a westward continuation of this trend. The bedrock structure in the lowland area is poorly known because of the extensive cover of Quaternary deposits. Locally, in the Cedar Mountain area, coal mine records indicate the structural attitude. In general, the rocks in this area dip 20°-40° SE., but the strike curves to the north and northwest east of the Cedar River. Numerous west-northwest-trending faults of small displacement are indicated by the mine records, and the mine area directly north of Lake Desire is probably separated from the area near the Cedar

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River by a major fault having this same trend.

Coal occurs in many stratigraphic zones throughout the Puget Group. Most of the coal that has been produced came from the Renton Formation at Cedar Mountain, Taylor, and the Tiger Mountain mines in the Fifteenmile Creek area. These mines are all abandoned and the entryways caved or closed. The Taylor area produced bituminous coal, whereas the Cedar Mountain and Fifteenmile Creek areas produced chiefly subbituminous coal. A number of coal beds are reported in each of these areas. Tables of coal clay (Glover, 1941, p. 128-130) has been produced from rocks stratigraphically

beds ranging from about 41/3 to 10 feet in thickness in the Cedar Mountain quadrangle in the Green River area, but similar rocks have not as yet area, six beds ranging from about 21/2 to 6 feet in thickness in the Taylor been recognized in the Hobart and Maple Valley quadrangles. Glover (1941, area, and three beds ranging from about 3 to 71/2 feet in thickness in the p. 122) mentions that a white altered "rhyolite sill" in the Taylor area was Fifteenmile Creek area. Evans (1912, p. 78-80) describes several prospects also mined for use as clay. This material is of especial interest because it west of the Raging River, including one containing 7 feet of coal, that are remains light colored after being fired. Altered rock of similar appearance probably located near the top of the lower main body of the Tiger Mountain is present at least locally on the northeast side of South Tiger Mountain, in Formation. It is possible that coal might be found in this zone by drilling the area mapped as hydrothermally altered rock. Another rock that may have along the north slope of Taylor Mountain. Evans (1912, p. 68) also describes somewhat similar characteristics is the altered tuff that occurs at many places a prospect on Holder Creek (SW1/4NE1/4 sec. 31, T. 23 N., R. 7 E.), where in the Tukwila Formation. a bed of coal that is probably about equivalent to bed F of the Tukwila Formation is exposed in an anomalous structural position, here interpreted to be a fault slice. Evans (1912, pl. I) also shows a coal prospect in the Experiment Station, Seattle, Washington, for clay testing, and they reported SW1/4 NW1/4 sec. 28, T. 23 N., R. 7 E., that may be in the carbonaceous it had a low refractory rating (cone 23-26), a light fired color (tan), and. material associated with bed C of the Tukwila Formation, Much additional coal in the Renton Formation is inferred to lie below the mantle of Quaternary deposits adjacent to the uplands extending south from the Fifteenmile Creek area to the vicinity of Hobart and thence eastward to connect with the Taylor area. Coal almost certainly underlies most of the lowland area, but the has been mined by the Cavanaugh Molding Sand Co. for use as a molding or thickness of overburden is unknown. The area believed to be underlain by coal-bearing beds is so large that the amount of undiscovered coal may exceed by far the original reserves that are known from mining. South of the Cedar River and west of Landsburg, a series of five coal beds ranging from about 5 to 10 feet in thickness and of bituminous or subbituminous rank are known to extend a short distance into the Hobart quadrangle from the south. Each of these beds has been mined at some time in the past. In 1961 the Palmer Coking Coal Co. was mining coal from the Rogers bed is by actually testing the bloating characteristics of the rock in a high-temin the SE1/4 sec. 24, T. 22 N., R. 6 E. This series of coal beds is probably offset by a fault somewhere near the Cedar River, and the position north of the fault has not been determined. These beds are probably older than most of the beds mined elsewhere in the Hobart and Maple Valley quadrangles, but their correlation with beds to the north is not specifically known. Fossil eaves collected from locality 9695, about three-quarters of a mile south of the Hobart quadrangle, between the Landsburg and Rogers coal beds, were identified by Wolfe (in Wolfe and others, 1961) as of probable middle Eocene age. These rocks are probably pre-Tukwila and may be equivalent to a part of the lower main body of the Tiger Mountain Formation. The coal reserves for the area are tabulated in a report by Beikman and others (1961). Coal mines that have produced and other nonmetallic mineral

resources in the area are listed and briefly described by Valentine (1960). Carbonaceous claystone and siltstone beds interbedded with coal in the Renton Formation and equivalent rocks in the upper part of the Puget Group have been a major source of the raw materials for the clay industry in the Seattle region. The mines at Taylor produced both coal and clay for use in making tile and brick. The characteristic of the fine-grained rocks in the Renton Formation that makes them suitable for use in baked-clay products is apparently the widespread predominance of kaolinite over montmorillonite and chlorite in the clay matrix. Kaolinite also occurs locally as the principal

clay mineral in sandstone and finer grained rocks in the Tiger Mountain

Formation, whereas montmorillonite or chlorite is the principal clay mineral

in the rocks of the Raging River Formation and these, together with ver-

miculite, occur in most of the Tukwila Formation. High-alumina refractory

CONSTRUCTION STONE In the Seattle region, broken rock has a wide variety of uses as construction stone ranging from fine aggregate and decorative garden stone to riprap, depending on the size of the fragments. Rock units suitable for some of these uses should be slabby to massive, hard, and resistant to weathering, and rock used for decorative stone should also possess a pleasing color and texture. In the Hobart and Maple Valley quadrangles, volcanic rock, intrusive igneous rocks, and possibly sandstone may be useful for construction stone. Massive ledges of volcanic rock that may be suitable for this purpose occur at many places in the upper part of the Tukwila Formation and locally in the lower part of the Tukwila Formation. A large mass of intrusive igneous rock that is probably suitable for construction stone lies in the area directly east of Fifteenmile Creek, Although sandstone generally is more friable than fresh igneous rock, the fine texture and bedding-plane fracture may be desirable for special construction purposes. Slabs of feldspathic and micaceous sandstone as much as 3 feet thick were formerly quarried from bed F of the Tukwila Formation in the NE1/4 sec. 4, T. 22 N., R. 7 E., near Taylor. Massive fine-grained well-indurated volcanic sandstone is obtainable from some parts of the Raging River Formation.

Sample AW-1 from the Tukwila Formation in the SE1/4NW1/4 sec. 27.

T. 23 N., R. 7 E., was submitted to the U. S. Bureau of Mines Northwest

according to differential thermal analysis, probably consisted of medium

Renton Formation in the NE1/4 sec. 30, T. 23 N., R. 6 E., near Cedar Mountain.

foundry sand in the Seattle area.

A plastic mixture of clayey sandstone, siltstone, and claystone from the

Carbonaceous claystone and siltstone from the nonvolcanic rocks in

the Puget Group as well as the underlying Raging River Formation have been

under recent consideration by several private organizations for possible use

as a bloating clay in the manufacture of expanded aggregate and similar

light-weight products. Bloating clay has been identified in the Cedar Mountain

area, but no laboratory tests have been made by the Geological Survey.

The most reliable method of identifying material suitable for this purpose

SAND AND GRAVEL Although sand and grayel deposits are plentiful in the Puget Sound lowland, locally their use in the upland parts of the Hobart and Maple Valley quadrangles may be restricted by the high cost of transportation. In general, the best sources of sand and gravel are terrace deposits adjacent to the Raging and Cedar Rivers and deposits of stratified glacial outwash adjacent

much of the south and west slopes of the Tiger Mountain-Taylor Mountain upland area. In general, the 1,000-foot contour line may be regarded as the upper limit of this gravel, and the lower limit is concealed by later deposits at altitudes that range from about 800 feet east of Hobart to about 500 feet north of Hobart. The deposits of till are inferior for use as sand and gravel because they contain too much silt and clay, and they also contain many boulders more than 3 feet in diameter.

OIL AND GAS POSSIBILITIES Speculation regarding the possibilities of finding commercial accumulations of oil and gas in the Hobart and Maple Valley quadrangles is of interest because of the presence of a possible source for organic material in the marine rocks of the Raging River Formation. Furthermore, there are numerous possibilities for identifying structural features such as anticlines and tilted strata terminated updip against a fault where oil and gas may be expected to accumulate. One difficulty, however, is the apparent lack of permeability in many of the outcrops of the Raging River Formation. The occurrence of a deposit of secondary black material containing organic carbon that coats the grains of sand in the Tiger Mountain Formation in the S½SW¼ sec. 17, T. 23 N., R. 7 E., suggests the possibility of adequate permeability at least locally in these rocks.

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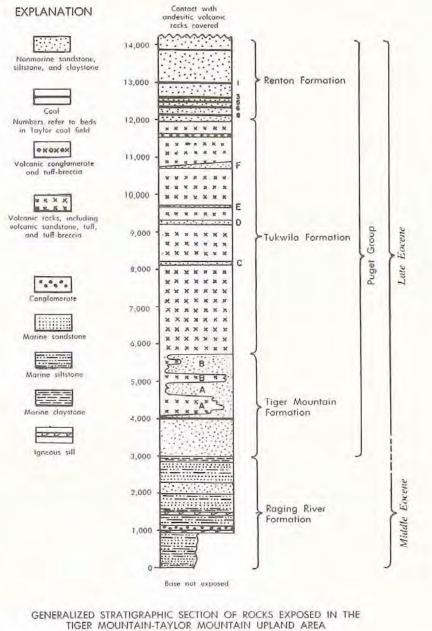
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GEOLOGIC MAP

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U.S. Geological Survey