GEOLOGY OF THE SOUTHEAST ONE-QUARTER OF THE CAMAS VALLEY QUADRANGLE DOUGLAS COUNTY, OREGON

by

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INTRODUCTION

Location and Size

The Camas Valley quadrangle is located in Douglas County, Oregon. Its northeast corner is 15 miles southwest of Roseburg, and 8 miles west of Winston, Oregon.

The 54 square-mile area under condideration is situated in the southeastern one-quarter of the Camas Valley quadrangle and is located between 43° 00' to 43° 7' 30" latitude and 123° 30' 15" to 123° 37' 45" west longitude.

Three small communities are located within the area of study: Tenmile post office near the west central border, Porter Creek near the northeastern corner, and Olalla in the south central part of the area.

Purpose and Method of Investigation

The area is of geologic interest because it is in a previously unmapped and unstudied region between the adjacent Roseburg quadrangle to the east and the Coos Bay quadrangle 22 miles to the west.

Field work was begun June 15, 1956 and completed August 11, 1956, in a total of 8 weeks. The base map on which the geology was plotted is a United States Geological Survey preliminary blue line map of the Camas Valley

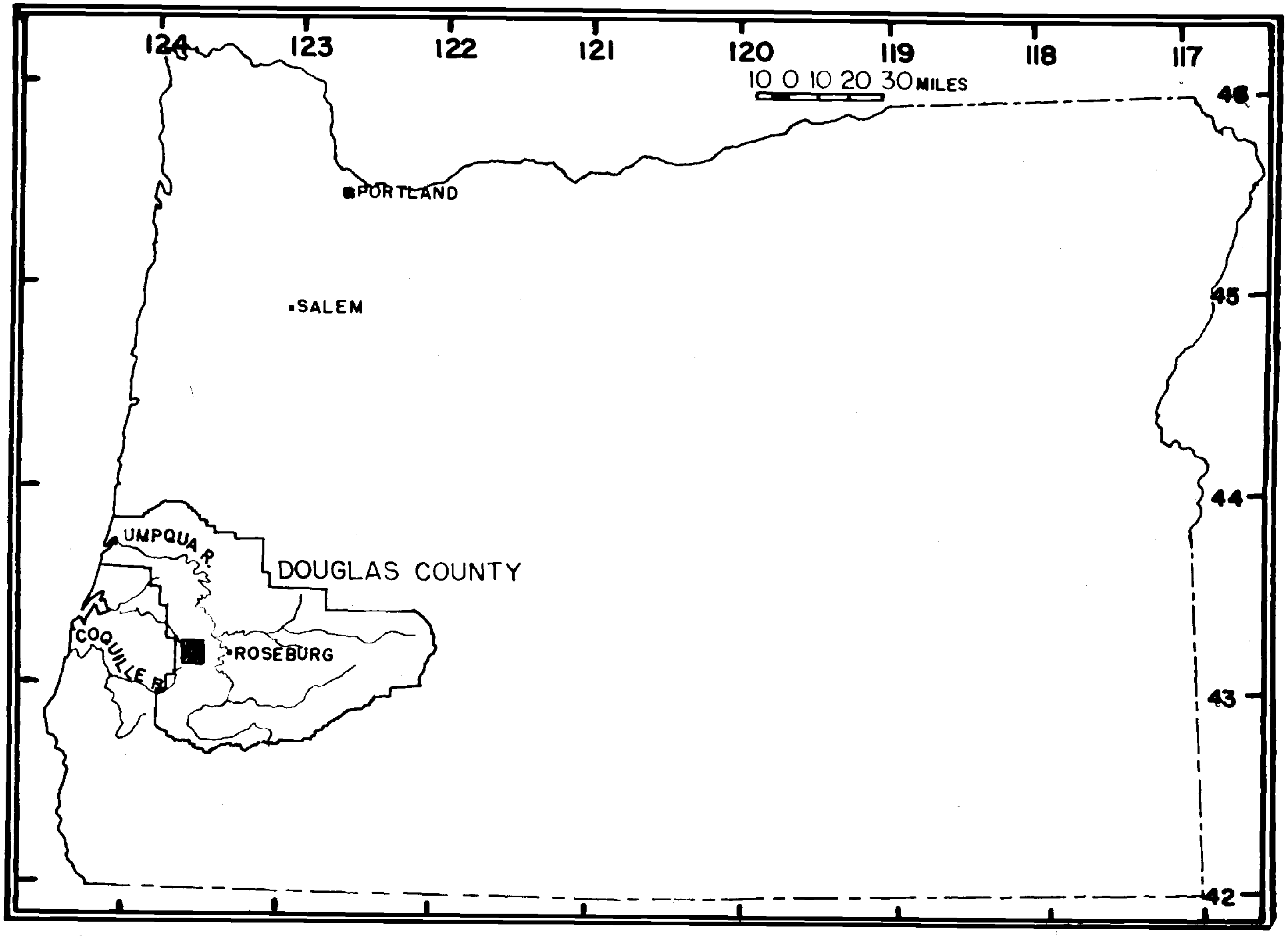

PLATE I MAP OF THE STATE OF OREGON SHOWING AREA COVERED BY THIS INVESTIGATION quadrangle, at a scale of 1: 48,000. All formation contacts and other geologic features were plotted directly on this map. No aerial photographs were available to the writer during the field season.

Accessibility

The area is easily accessible throughout the year. It is traversed from northeast to southwest by U. S. Highway 42. A newly surfaced road from Porter Creek, on U. S. Highway 42, to Olalla, (The Olalla Road) and its southern extension from Olalla (Upper Olalla Road) to the southern border provide access to the southeastern corner of the area. The northwest corner of the area is served by a graveled road extending from Tenmile to Reston. A network of unsurfaced farm and logging roads extends into the remainder of the area so that no point is more than 2 miles from a road.

Previous Work

No published geologic work has previously been done in the area of this report. The earliest investigations in immediately adjacent areas were made by J. S. Diller (7), who mapped the Roseburg quadrangle to the east. The formations described and named by him in the United States Geological Survey folio 49 have been traced by the writer into the Camas Valley quadrangle. Diller (6,p.2) also noted the same formations in the Coos Bay quadrangle to the west.

Louderback (13) and Taliaferro (17) revised the Cretaceous Myrtle formation as described by Diller and subdivided it. Additional work done by Smith (15), Dickerson (5), Smith and Packard (16), Clark (4), Wells and Waters (25), and Allen (1) has contributed to the knowledge of the Eocene Umpqua formation in the Roseburg and Coos Bay areas.

GEOGRAPHY

Topographic Relief

The maximum topographic relief of the area is approximately 1,820 feet. The lowest point, with an elevation of about 620 feet, occurs at the eastern border near Highway 42, where Olalla Creek leaves the Camas Valley quadrangle. The highest point is Chimney Rock in the southwest corner, with an elevation of about 2,400 feet.

The area is characterized by steep-sided valleys and relatively flat-topped ridges that have a general northeast-southwest trend. Exceptions are in the vicinity of Tenmile, directly to the west of Tenmile post office, and in the valley paralleling the Olalla Road, where the topography is characterized by low, rounded hills.

Climate

The nearest United States Weather Bureau station is located at Roseburg, Oregon. No weather statistics are available for the Tenmile area. The mean annual temperature at Roseburg is 53.4°F. August is the warmest month, with a mean temperature of 68.0°F., and January is the coldest, with a mean temperature of 41.2°F. The annual rainfall is 32.91 inches. December is the wettest month, with 5.34 inches of rain, and July the driest, with .32 inches of rainfall (24).

This climate, as classified in accordance with Koppens system, (20,p.359) is of the Csb or Mediterranean type.

Drainage

The area is drained by Olalla Creek, its two main tributary streams, Shields and Tenmile creeks, and many small subsidiary streams of these three.

Tenmile Creek, joined by Shields Creek at Tenmile post office, flows northeast to the junction of the Olalla Road and Highway 42, where it joins with Olalla Creek. The latter continues to the northeast out of the area and empties into Looking Glass Creek, which subsequently joins the South Umpqua River at Dillard, 7 miles south of Roseburg.

High-gradient intermittent streams drain the steeper slopes at times of high precipitation. The highest stream gradient, 1,100 feet per mile, is on the eastern slope of hill 2,073 (southwest one-quarter of area); the lowest, 20 feet per mile, is along Tenmile Creek between Tenmile post office and Porter Creek Store.

Vegetation

The natural vegetation of the area is diverse. The higher ridges support a conifer forest of Douglas fir, ponderosa pine, red cedar, and small patches of madrone. The dominant plants at the lower elevations are manzanita, madrone, poison oak and wild vine and cane berries, where a sparse conifer-deciduous forest with a dense understory of shrubs occurs.

Agriculture is practiced along the larger stream valleys, but the main economic resource is timber (ponderosa pine, Douglas fir and red cedar) and so lumbering is the chief source of income of the local residents.

STRATIGRAPHIC GEOLOGY

The oldest rocks exposed in the area are the graywackes, limestones, greenstones, red, blue, green and brown cherts, intensely fractured and sheared shales, and schists of the Dillard formation. These are locally intruded by masses of peridotite and granite.

Unconformably overlying the Dillard is the Looking Glass member of the lower Eocene Umpqua formation, a sandstone and shale unit. This unit is exposed in only one small area in the extreme northwestern corner of the area. The thickness of this unit at this locality is unknown.

Conformably overlying the Looking Glass member north of the area and unconformably overlying the Dillard formation in the area studied, is the Henry Ranch member of the Umpqua formation. This member has a maximum thickness of 1,200 feet. It has a basal conglomerate which grades upward to a conglomerate-arkosic sandstone unit.

Conformably above the conglomerate is the Tenmile member, a thin-bedded siltstone-mudstone unit with a maximum thickness of 640 feet.

The uppermost member of the Umpqua formation exposed in the area studied is the Barret Ranch member, a sandstone-shale unit with a thin pebbly basal layer in some places. The top of this member is not exposed in the area; the maximum thickness of the part present is 120 feet.

Quaternary alluvium is present in the main stream valleys but is neither of any great areal extent nor more than 10 feet thick.

The stratigraphic sequence of these units is shown in diagrammatic form in Plate 2.

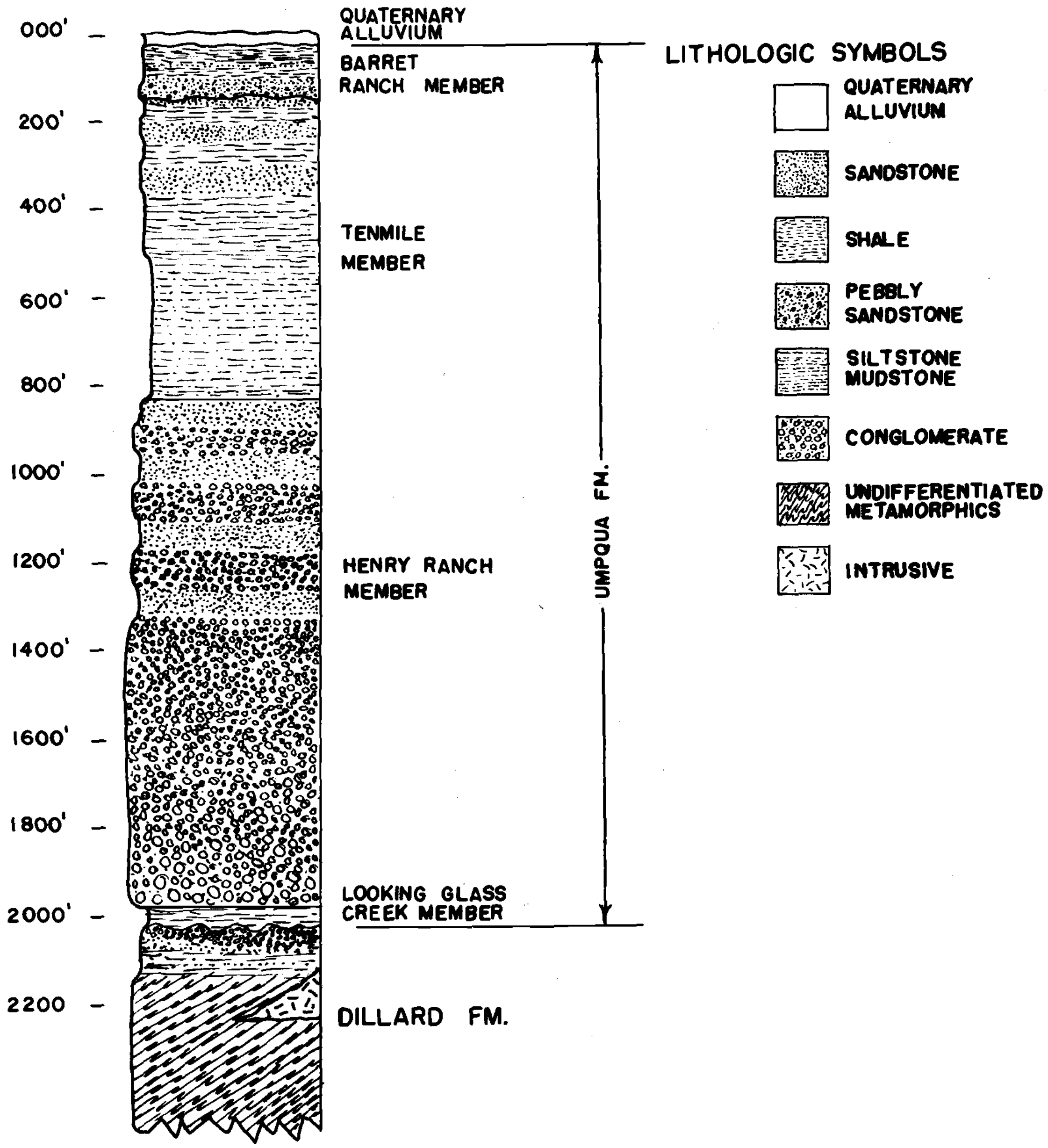

PLATE 2: COLUMNAR SECTION

Dillard Formation

Definition. The Dillard series (sic) as defined by Louderback (13,p.516) includes sandstone, shale, conglomerate lenses, radiolarian cherts and limestone lenses; greenstones, feldspathic granular rocks, ultra-basic rocks, dacite-andesite rocks; and glaucophane and associated schists.

Distribution and Topographic Expression. The Dillard formation crops out in six places and has an areal distribution of about 5 square miles. Two small exposures occur in the extreme northwest corner and include about 0.3 square mile; another exposure of 0.4 square mile is located in the southwestern corner of the area. A strip 0.4 square mile in extent is exposed in the southeastern corner, and a long northeast-southwest trending strip of about 4 square miles is located in the northeastern quarter of the area of study.

Low rounded hills have been developed on these rocks. With rare exceptions, the outcrops of these rocks are associated with oak trees, and the outcrops are found beneath each scattered clump of trees.

Thickness. The thickness of the Dillard formation could not be determined because exposures are scarce and the attitude of the beds was not determined because reliable dip and strike measurements were not available.

Lithology. The lithology of the Dillard formation is extremely diverse and for the purpose of discussion and description the rocks will be grouped as follows:

(1) Shale-Phyllite-Sandstone

(2) Cherts and Limestones

(3) Greenstones

(4) Schists

(5) Metasediments

(6) Granite

(7) Peridotite

(1) Shales-Phyllite-Sandstones

(a) Shale. The shale of the Dillard formation, although more extensively distributed, is exposed in only four places: (1) along the bank of Tenmile Creek, a quarter of a mile south of the Porter Creek Store, (2) at the top of the ridge, parallel to and south of Porter Creek, (3) on the Barret Ranch in the extreme southeast corner of the area, and (4) in the road cut on the Upper Olalla Road, half a mile south of Olalla. Similar shale probably underlies the grass-covered slopes in the belt of Dillard that parallels the Olalla Road, but the rock does not crop out.

The shale has a slaty aspect; the individual layers range from one-half to 2 inches. The color is dark brown to black. The rock is strongly fractured and jointed. The sheared surface have a sub-vitreous lustre. Interbedded with the shale is a dark gray to black siltstone. The shale weathers dark gray and yields chips and flakes, all less than one-fourth inch in diameter. Deep weathering produces a dark gray to nearly black soil.

The appearance of the shale exposed in the stream bank south of the Porter Creek Store differs from that previously described in that it has been tectonically brecciated by movement on the Tenmile fault.

The groundmass of the rock is composed of small chips and fragments of dark gray shale surrounded by a muddy matrix of crushed and sheared mud derived from the original shale. Larger inclusions of lens-shaped masses of black shale, as much as one foot in diameter, are seen in this finer matrix. The exterior of the inclusions of black shale has a slickensided surface. The black shale lenses have no uniform size, and show no pronounced orientation where exposed.

(b) Phyllite. Three outcrops of black phyllite are exposed on the northwest slope of hill 1,234T. The outcrops occur as small, very angular mounds. The rock weathers to small, angular blocks that cover the immeditely surrounding area. The weathered surface of the rock is uneven and angular, due to the weathering out of these blocks. The weathered rock is dark gray, and the size of the weathered blocks ranges up to 2 inches thick and 3 to 5 inches wide and long. The phyllite tends to break along the sheared surfaces into thin plates, some less than one-half inch thick. The surfaces of these plates are colored from blue-black to black. The sub-vitreous lustre and multi-color of the rock surfaces exhibit the effects of heating.

(c) Sandstone. Two types of sandstone are present within the Dillard formation. One of these is a feldspathic quartz wacke (26,p.292) and the other a greywacke.

The feldspathic quartz wacke was observed in seven outcrops in the strip of Dillard rocks that parallels the Olalla Road and occurs also in the vicinity of the Barret Ranch.

The rock typically crops out as small rounded hummocks showing no bedding planes. The jointing and original bedding cannot be separated, so that attitudes for determining structure are not available. The sandstone weathers to produce a light gray sandy soil.

The rock is a jointed and fractured, light gray to buff, fine- to medium-grained sandstone. It is composed essentially of medium- to fine-grained, subangular to subrounded grains of quartz and feldspar. Chlorite, biotite and finer particles of quartz and feldspar occur in uneven bands and veinlets. The minerals of the bands are finer grained than those of the remainder of the rock. The fine-grained fraction shows a roughly parallel alignment of the minerals. The bands may represent incipient schistosity. The biotite is scattered throughout the rock and occurs as small bent tabular grains.

Four thin sections were examined and the modes of these rocks are listed in Table 1.

Table 1. Modes of feldspathic quartz wackes of the Dillard formation.

Sample number	JH56-18	JH56-106	JH56-110	JH56-125
Quartz and chert	70	68	74	70
Feldspar	20	26	15	20
Biotite	2	T	6	2
Chlorite	3	2	2	3
Pyrite	T	T	T	T
Zircon	T	T	T	T
Clinozoisite	0	T	0	T
Green hornblende	0	0	T	0
Muscovite	T	T	T	0

The feldspar present is both potash feldspar and acid plagioclase, the acid plagioclase is the more dominant type. Zircon is present as small subhedral grains and inclusions within the quartz. Small concentrations of pyrite and limonite are disseminated throughout the rock. Clinozoisite and hornblende occur as rare small anhedral grains and the muscovite flakes appear as short prismatic grains in thin section. Lithic fragments are rare.

Graywacke occurs within the Dillard formation in six outcrops. These outcrops are all located in the belt of Dillard rocks occurring west of and parallel to the Upper Olalla Road. The graywacke crops out as large, massive, angular mounds, and the surrounding area is covered by small angular blocks and fragments of weathered rubble. When thoroughly weathered the rock yields a gray sandy soil.

Megascopically the rock is composed of quartz, lithic fragments, mafic minerals, and argillacous matter, with traces of feldspar. Two of the specimens contain clay galls that have been distorted; this distortion is probably due to the strain resulting from shear during deformation or recementation. The rock breaks across the grains with a sub-conchoidal fracture. Attitude could not be measured in the graywacke because the original bedding planes, if any, could not be distinguished in the field.

Microscopic examination of three thin sections reveals that two of them (JH56-68A and JH56-111) are feldspathic graywackes and the third (JH56-32) is a quartz graywacke (26,p.292). The modes of these three rocks are listed in Table 2.

Table 2. Modes of graywackes of the Dillard formation.

Sample number	JH56-68A	JH56-111	JH56-32
Quartz	20	23	40
Chert	12	16	30
Plagioclase	8	4	8
Chlorite	3	2	10
Intergranular matrix	66	53	6
Lithic fragments	5	3	5
Carbonate	T	T	T
Biotite	T	1	T
Pyrite and limonite	T	T	T
Muscovite	T	T	T

The three sections examined are composed mainly of angular to subangular grains of quartz, chert and rock fragments. A few of the quartz grains are of coarse-sand size, but most are smaller. The rock fragments are so altered that their original composition is usually masked. The chlorite present is seen in section as long curved stringers that show anomalous birefringence. The plagioclase occurs as angular subhedral crystals that have been partly altered to antigorite and kaolin; antigorite is the more common alteration product. Carbonate is present as cavity fillings and as veins. Pyrite and limonite appear as anhedral masses.

In specimen JH56-68A, thin needles of actinolite(?) extend from the vein walls into quartz veins. Positive identification of these crystals was not possible because of the very small crystal size. However the associated rock types along with the degree of metamorphism of the surrounding rocks strongly suggest that they are actinolite. The few optical properties of these crystals that could be determined support this conclusion (19).

(2) Cherts-limestones

(a) Chert. Chert occurs in scattered exposures throughout the main belt of the Dillard formation and also in the Dillard rocks exposed in the northwestern corner of the area.

Chert crops out as small mounds that weather to angular blocks and plates, or as resistant massive mounds. A variety of colored cherts was observed, but shades of red and green are the most typical. Both layered and massive varieties are present and are strongly fractured. These fractures have been secondarily filled by vein quartz.

The green cherts have numerous crenulated stringers of chlorite, imparting the green color. The red cherts contain hematite and limonite as minute particles and also as red stain on the quartz grains. The weathered surfaces of the red cherts are darker red than are fresh fractures. Intense weathering of the red chert gives the soil a red color.

Microscopic examination of eight thin sections of chert revealed that red varieties (JH56-33, JH56-40, and JH56-80) are microcrystalline radiolarian cherts with minute particles of disseminated iron oxide. The radiolarian tests have been replaced by clear chalcedony of a slightly greater average grain size than that of the remainder of the rock, and so detail of the original organic structure has been obliterated.

A specimen of brown chert (JH56-75) contains foraminiferal tests in addition to radiolarian remains. Brown algal remains (?) are present and show concentric growth rings. The algal structure is less than a millimeter in diameter and contributes to the brown color of the rock.

White and green cherts present are more coarsely crystalline than those previously described. The green chert derives its color from finely disseminated flakes and stringers of chlorite.

All of the chert specimens have thin (1 to 2 millimeters) veins of secondary quartz that is more coarsely crystalline than the surrounding original rock. One specimen (JH56-34) exhibits four generations of quartz venation, indicated by a sequence of cross-cutting veins.

(b) Limestone. Limestone was encountered at only one locality (the extreme northwestern corner of the area along the Tenmile-Reston Road in the small "inlier" of Dillard rocks) as a small outcrop is association with chert and greenstone.

The limestone is a white fine-grained aphanitic rock that includes small bands of chloritic material. Microscopic examination shows the rock to be approximately 70 percent microcrystalline and 28 percent aphanitic carbonate. Since this material effervesces vigorously in cold dilute hydrochloric acid, it is believed to be calcite. A few secondary veins of microcrystalline quartz cut through the rock.

(3) Greenstone. Exposures of greenstone are limited to a strip of Dillard rocks, parallel to the west of the Olalla Road. It occurs as moss-covered, smooth-surfaced, rounded mounds. The rock weathers gray-brown or light brown in color. The area about the greenstone outcrops is covered with small angular blocks of rubble. On fresh surfaces the greenstone is a dark grayish-green, crystalline, crudely banded rock. The banding is due to align-

ment of the mineral constituents. The rock has a generally aphanitic texture although some white flecks and veins of secondary quartz occur.

Microscopic examination of the greenstone revealed that some possess a relict felted texture but are metamorphosed to such a degree that the composition of the original mineral constituents can no longer be determined. Other greenstones are entirely aphanitic and no relict structure is seen.

(4) Schists. Two types of schists are found within the Dillard formation. These types are (a) glaucophane and (b) garnet-biotite-quartz.

(a) Glaucophane schists. Three suites of minerals are present in the glaucophane schists, clinozoisite-glaucophane-quartz, glaucophane-epidote, and glaucophane-chlorite-quartz. All of these glaucophane-bearing rocks are located along the northeastern border of the area, a quarter of a mile northeast of the junction of the Olalla Road and the Brockway Market Road. The mineralogy of these three schists is listed in Table 3.

Table 3. Modes of glaucophane-bearing schists.

Sample number	JH56-24	JH56-25	JH56-26
Glaucophane	21	15	45
Epidote	74	T	

Sample number	JH56-24	JH56-25	JH56-26
Clinozoisite			12
Sphene	3		
Chlorite	T	10	
Quartz		70	40
Pyrite and magnetite		3	10

The clinozoisite-glaucophane-quartz schist forms small rounded mounds and weathers to a dark gray-black color. The weathering surface lacks apparent schistosity, but a freshly broken piece of the rock shows a definitely schistose character. The outcrops have thin white quartz veins cutting across the schistosity. In spots the quartz veins widen to form patches of white quartz 2 to 3 inches wide.

Thin section examination of this schist (JH56-25) shows the rock to be composed of oriented needle-like crystals of glaucophane, subhedral porphyroblasts of clinozoisite, small anhedral grains of quartz and angular euhedra of magnetite and pyrite. The glaucophane needles are concentrated in thin layers separated by thin laminae of fine-grained quartz.

The glaucophane-epidote schist forms a large massive angular outcrop that exhibits parallel jointing.

Figure 1. Outcrop of epidote-glaucophane schist that displays parallel jointing.

The rock weathers light blue-gray, with a brown stain appearing along the joint planes. Numerous angular blocks of the schist cover the surrounding slope.

The schist is composed of subhedral porphyroblasts of epidote that contain oriented inclusions of glaucophane. The glaucophane also occurs as interstitial euhedral needles. Sphene occurs as both euhedral and anhedral crystals; some of the crystals exhibit a perfectly rhombic cross section. Chlorite occurs as halos around the epidote porphyroblasts.

The quartz-glaucophane-chlorite schist is exposed a hundred yards northwest of the glaucophane-epidote schist outcrop described above. This rock crops out as a rounded massive mound resembling sandstone in gross appearance.

The schistose character of the rock is not apparent in the outcrop, but a crude banding is seen in the hand specimen. The rock is composed of rounded quartz grains and thin laminae of glaucophane.

Thin section examination of the rock reveals a composition of subrounded quartz grains, idiomorphic and xenomorphic crystals of glaucophane, and bent stringers and fibers of chlorite. The schistosity of the rock is more apparent in thin section where parallelism of the grains is seen. Secondary veins of crystalline quartz cut the rock oblique to the schistosity.

(b) Garnet-bearing schists. The garnet bearing schists are all mineralogically similar and are composed of quartz, biotite, and garnet. The variety of garnet was not determined, but the garnets appeared pale red in thin section.

The quartz-garnet-biotite schists are found in three localities; two occurrences are three-quarters of a mile south-southwest of Porter Creek, and the third is one-quarter of a mile east and one-eighth of a mile south of the northwest corner of the area. These schists appear as brown angular mounds, and the schistosity is apparent on the weathered surface. The schistosity is emphasized by the relief of the weathered constituents, as the quartz remains as prominences and the bands of chlorite and biotite form linear depressions. Secondary quartz veins cut the rock obliquely. Biotite, quartz, and chlorite show an augen structure, as these minerals occur as small lenticular masses when viewed normal to the schistosity.

Microscopically the rock possesses a crystalloblastic schistose texture; its mineral constituents are biotite (8%), garnet (10%), quartz (80%), chlorite (2%), and traces of muscovite, epidote, and magnetite and limonite.

(5) Metasediments. Metasediments occur within the Dillard formation at two localities. One locality is on Hill 1,234T, a quarter of a mile north of the summit, which is northwest of the Olalla Road, halfway between U. S. Highway 42 and the Upper Olalla Road. The rocks are exposed here in a trench approximately 6 feet wide and 30 feet long and occur as steeply tilted beds. The other occurrence of metasediments is in the extreme southeast corner of the area, along the east border, one mile north of the southeastern corner.

The beds exposed on Hill 1,234T show the following sequence:

a. A well-indurated, dark gray, massive, poorly sorted sandstone that exhibits occasional jointing; made up of subrounded quartz grains, chlorite and rock fragments, cemented by an argillaceous matrix.

b. A black fissile metashale containing inclusions of black slickensided shale lenses generally less than one inch thick and 4 inches long. The weathered metashale forms small dark brown chips and flakes.

c. A calcareous, gray-green, fissile metasediment weathering to soft grayish-white detritus.

The rock is composed of carbonate (35%), quartz (6%), feldspar (3%), chlorite (8%), tremolite (3%), and pelitic matter (44%), and has a fine-grained granular texture. Infrequent occurrences of relict fragments indicate the original rock was probably a feldspathic argillite. Secondary carbonate veins as well as small interstitial masses of carbonate occur throughout the rock. The carbonate contains small unoriented needles of tremolite (?) that are too small for positive identification.

d. A shale similar to that described previously in bed b., but more dense. Varicolored surfaces display blue-black to black color banding that suggests the rock has been subjected to heat.

e. A blue-gray, fractured, soft metasediment cut by small veins of secondary quartz, weathering light blue-gray.

Microscopically this rock is similar to that described in bed c. but contains more carbonate (50%) and the original texture is completely obscured.

f. A dense, hard, jointed, brown-black metasediment weathering to dark gray-brown. The rock contains thin crenulated bands of black material and small inclusions of fine-grained dark sandstone. A thin section of this rock was examined and its estimated composition is quartz (85%), pelitic matter (10%), and chlorite (5%). The specimen examined has small particles of iron oxide scattered throughout, staining all the particles. The rock has a metaclastic texture with approximately 10 percent of the rock retaining its original texture. The original sediment was probably an argillaceous sandstone. The remainder of the rock has been altered and masks the original texture. The grains show strain, and many of them are fractured or even powdered.

The metasediments just described are located approximately 50 yards west of a peridotite intrusive. The rocks originally were probably sandstones and shales that were metamorphosed during the emplacement of the peridotite by heat, tectonic deformation and metasomatic emanations.

The second exposure of metasediments occurs as small gray mounds that form a ridge approximately 200 feet long. The two varieties present, albite-carbonate and quartz-albite, are differentiated in the field by the presence or absence of secondary calcite veins. Calcite veins are present in the albite-carbonate metasediment but not in the quartz-albite type.

The metasediments form small angular, gray-brown outcrops weathering to small angular blocks. The rock is fine-grained and grayish white in color. It has small specks and stringers of chlorite and euhedral crystals of pyrite scattered throughout.

Microscopically the quartz-albite variety possesses a porphyroblastic texture. The porphyroblasts are rare euhedral grains of albite that display carlsbad twinning and occur in a granoblastic matrix of nearly pure albite. The mineralogical composition of the rock is albite (85%), quartz (6%), carbonate (3%), epidote (2%), chlorite (3%) and traces of pyrite.

The albite occurs as porphyroblasts and as nearly parallel oriented euhedral laths. The quartz is seen as interstitial anhedral grains that display anomalous extinction due to strain. Chlorite occurs as small anhedral masses or fibers and the epidote as small subhedral and anhedral grains. Calcite is found both as veins and interstitial anhedral crystals. The pyrite is scattered through the rock as small angular crystals.

The albite-carbonate variety is composed of carbonate (42%), albite (48%), pennine (9%), and pyrite (1%). The albite occurs as euhedral laths that have been partly corroded, embayed and replaced by the carbonate. The feldspar is also partly altered to paragonite. The grain size of this rock is slightly larger than that of the quartz-albite variety and it possesses a granoblastic texture. The carbonate, some of which effervesces in cold dilute hydrochloric acid, occurs as veins and irregular fillings as well as replacement masses. Chlorite (pennine) is seen as small anhedral fibrous masses.

(6) Granite. Granite is exposed along the eastern border, half a mile north of the southeastern corner, in association with the previously described quartzo-feldspathic metasediments. The one outcrop is a small, light grayish-white, low angular mound. The texture of the hand specimen is medium-grained granular and the rock is composed of quartz, potash feldspar, plagioclase, and small amounts of chloritic or mafic material.

Microscopically the rock possesses a medium-grained hypautomorphic granular texture and is composed of quartz (16%), potash feldspar (57%), albite (17%), chlorite (6%), biotite (1%), and traces of epidote, pyrite, augite, sericite and kaolin or illite.

The potash feldspar occurs as subhedral and anhedral crystals, some of them display microcline twinning. The albite is seen as euhedral and subhedral laths, the quartz as anhedral granular interstitial masses, and the biotite and epidote as deformed laths and anhedral crystals. The pyrite is secondary within the chlorite, which occurs as stringers. Microperthitic intergrowth is seen in some of the feldspars and this in some instances resembles microcline twinning.

(7) Peridotite. Serpentinized peridotite was observed in only one locality, half a mile north-northwest of Hill 1,234T. The exposure is in a shallow pit approximately 5 by 8 feet. The rock is a black, massive, altered peridotite. with relict crystals of diopside ranging from microcrystalline grains to nearly a centimeter in diameter. The smaller diopside relicts are thoroughly intermixed in the rock and the larger relicts are layered, alternating with the serpentine, so as to give the rock a stratified appearance. Most of the rock weathers to a gray-black color, but the diopside relicts weather grayish brown.

Microscopic examination of the rock reveals a relict porphyroblastic texture. The rock is made up of relict diopside (40%), serpentine (58%), and limonite (1-2%). The serpentine is antigorite and serpophite and displays beam structure (10,p.203); cross-vein fibers of antigorite surround anhedral bodies of serpophite. The diopside occurs as anhedral crystals and shows polysynthetic twinning along the 100-plane. Some of the pyroxenes are partly altered and small stringers or lenses of antigorite are seen within the relict diopside crystals.

Origin of Metamorphic Rocks. The metamorphic rocks present in the area are products of low-grade metamorphism of the green schist facies (9,p.249). Both acid and basic intrusives were observed; these intrusive bodies were probably the source of some emanations contributing in part to the metamorphism.

Some of the glaucophane-bearing schists in the Fransiscan formation of the California Coast Range are believed by Taliaferro (18,p.164) to have been derived by pneumatolytic alteration of arkosic sandstones. The soda required to form glaucophane could have come from one or more sources, either internal or external. A rock containing a small amount of glaucophane could provide its own soda through the disassociation of the albite molecule from the calcic plagioclase in the sandstone. Calculations to test the validity of this concept were made by the author from estimated percentages of feldspar in the Dillard sandstone. The glaucophane-quartz schist that contains the least percentage of glaucophane has 1.6 percent soda and the maximum calculated soda content of the sandstone is 1.8 percent considering all the feldspar present to be pure albite. Of the feldspars observed some were albite but not all, so the possibility of a purely internal source may be questioned.

A more probable explanation is given by Turner (26,p.225), who states that the glaucophane was produced by the addition of metasomatic solutions of a sodic nature to the sandstone. The glaucophane schists, although closely allied with ultrabasic intrusives, are not in direct contact with them. Sodic solutions may possibly have been derived from this intrusion, but since the intrusives are soda-deficient, this source does not seem likely. The soda may also have been derived from the surrounding sediments by some complex chemical reaction associated with the intrusions. Later migration of the soda may then have occurred to form the concentrations necessary to produce glaucophane. The sphene present in these schists is believed by Turner (26,p.228) to have been derived from pre-existing sphene or from alteration of any titaniferous-bearing amphibole or pyroxene present in the original rock.

The suite of minerals present in the garnet schists indicates low-grade regional metamorphism (9,p.249). Taliaferro (18,p.171-175) describes rocks of this type in California whose formation he attributes to unusual metamorphic conditions of low pressure and moderate temperature in close alliance with ultramafic intrusions. Taliaferro (18,p.177) also believes that the quartz-biotite-garnet schists were derived from pre-existing chert by the addition of a sufficient amount of soda. These schists have garnets of uniform size that are either concentrated within or surrounded by halos of chlorite that was formed during the metamorphism. Turner (26) does not mention any origin for this type of rock.

The quartzo-feldspathic metasediments were probably derived from a pre-existing sandstone or finer-grained sediment that was metamorphosed by heat, shearing, and metasomatic action of soda-rich solutions, during the emplacement of the granite. These metasediments show such shear characteristics as anomalous extinction and broken crystals.

The surrounding sediments are not metamorphosed, so the metasediments evidently were formed at low pressure and temperature levels.

The other metasediments are in association with a peridotite intrusive. The emplacement of this intrusive, accompanied by heat and pressure, probably caused the recrystallization and cataclastic deformation of these sediments so that little or none of the original sedimentary characteristics are recognizable.

Origin and Conditions of Deposition. The source material and the direction of the source of the Dillard sediments would be extremely difficult to postulate from the limited exposures found and the limited area studied by the author. However, a few conclusions may be advanced from consideration of the sediments present. A marine environment may be assumed from the presence in the cherts of radiolarian, foraminiferal, and algal remains. This conclusion is further upheld by comparison of lithologies found in the adjacent area to the east studied by Burnam (3). In addition to radiolarian and foraminiferal cherts seen in this area, Burnam found shell fragments, corals, and algal limestone in the Dillard rocks.

The source of the clastic material probably was relatively close, as shown by the angularity of some of the clastic fragments.

The post-depositional changes of the rocks have been chloritization and low-grade metamorphism in local areas.

The relationship of the intrusives and the metamorphic rocks to the surrounding sediments is very difficult to determine because of the limited exposures of each. The few exposures present reveal that the metamorphic rocks are closely associated with igneous activity. Sediments at very short distances from the intrusives are relatively unaltered.

One small exposure of quartz-biotite-garnet schist shows no apparent relationship with igneous activity but it is the author's opinion that this schist would be seen to be directly related to igneous activity were not the immediately surrounding area covered by later sediments.

A characteristic of the sediments of the Dillard formation is the lack of pyroxenes and amphiboles. Some of the chlorite present possesses relict amphibole or pyroxene cleavage indicating that post-depositional alteration, probably by circulating solutions, has taken place in all of the Dillard rocks.

Umpqua Formation

The Umpqua formation was originally named by J. S. Diller (7,p.1). It has its type locality at Little River in the Roseburg quadrangle adjoining on the east. It was originally defined as a thick series (approximately 12,000 feet) of sediments (conglomerate, shale, local coal seams) and diabasic intrusives.

In the area studied in detail by the author, the Umpqua formation is divisible on the basis of lithology into four mappable units. The four units present are:

Barret Ranch Member-Pebbly sandstone, sandstone, siltstone and shale.

Tenmile Member-Siltstone, mudstone, sandstone and shale.

Henry Ranch Member-Conglomerate and sandstone.

Looking Glass Creek Member-Sandstone, shale, and gritty sandstone.

The upper three units were named by the author from localities where these individual members are best exposed and attain their maximum thickness. The lowest member was named by Moore (14), who mapped the area immediately to the north.

Looking Glass Creek Member

Definition. The Looking Glass Creek member is a sequence of interbedded dark sandstone and shale that locally contains a few layers of gritty sandstone. The unit is exposed in the extreme northwest corner of the area.

The type locality of the member is situated immediately to the north of the area studied by the writer.

Distribution and Topographic Expression. In the extreme northwestern corner of the area the areal extent of this member is approximately half a square mile.

The member underlies low rounded hills and the exposures of rocks are few and small.

Lithology. The shale of the Looking Glass Creek member is gray-green, clayey, fissile, and weathers to buff-gray small crumbly chips. The shale beds range from half an inch to 2 inches thick and grade vertically into sandstone.

The sandstone is an argillaceous, carbonaceous, thin-bedded, buff-grey rock, composed of angular fragments of quartz, feldspar, chlorite and lithic fragments. The rock weathers gray-brown, and forms small angular particles.

The beds of sandstone are thicker than those of the shale. Some are nearly 2 feet thick.

The gritty layers within the Looking Glass Creek member are massive, intensely weathered, poorly sorted, and slightly indurated. The gritty particles present are subrounded to rounded lithic fragments. The rock weathers to gray-brown sandy or gritty soil. None of the beds of gritty sandstone is greater than 18 inches. The beds of this unit exhibit extreme variability of dip.

Thickness. The base of the unit is not exposed in the area of this report, and so the thickness is not known. The thickness of this unit in the area to the north has been calculated as not less than 600 feet (14).

Age and Stratigraphic Relation. The Looking Glass Creek member is in fault contact with the Tenmile member in the writer's area. However, when this unit is traced northward, it is found to rest unconformably upon the Dillard formation and conformably beneath the Henry Ranch member. No fossils were found by the writer, but Moore (14) considers the Looking Glass Creek member to be the lowest member of the Umpqua formation in his area, and to be of lower Eocene age.

The stratigraphic position of the unit does not preclude the possibility that this member may be Cretaceous or Paleocene.

Origin and Environment of Deposition. The Environment of deposition of the Looking Glass Creek member was probably marine. The sediments were deposited on an uneven surface. Only the upper part of the member is exposed in the area. Sandstone is the dominant rock type. The alternation of sandstone and shale beds may be due to very slight changes of water level, slight changes of relief of the source area, variations within the transporting medium or turbidity currents. Kuenen and Miggliorini (12) state that when sediments accumulating on the slope of a sedimentary basin have reached a critical angle of repose, some triggering agency causes the sediments to flow down this slope as a turbidity current; the coarser material is deposited first, followed by a slower settling of the finer particles.

Henry Ranch Member

Definition. The Henry Ranch member is a coarse cobble conglomerate that contain local lenses of sandstone as much as 12 feet thick. The thickness of the unit was computed from map and field measurements as about 1,200 feet. The measurement was in a north-south direction. The minimum thickness encountered in the area of this report was 150 feet.

Distribution and Topographic Expression. The Henry

Ranch member occurs in two localities in the area studied: (1) parallel to and on both sides of the northern border of the area, as a prominent ridge about a mile wide, and (2) in the southern half of the area, where the areal distribution of the member forms an inverted U-shaped pattern that includes a centrally located north-northwest trending spur. The member in the southern half of the area is expressed topographically as prominent ridges and hills.

Lithology. The conglomerate is a thick, massive unit, coarse at the base and gradually finer upward. Angular boulders, as much as 4 feet in diameter, that are present in the lower part, tend to become more rounded and smaller upward. Near the top, the unit is made up of nearly equal amounts of sand and pebbles. Contained in the conglomerate unit are smaller units that also show a decrease in particle size from bottom to top. Cross-bedding is found in both the sandstone lenses and the conglomerate. Channel filling is present in the unit, and coarse detritus is concentrated in these fills. The lenses of sandstone are more easily eroded than the conglomerate, so caves roofed by conglomerate are frequently formed. Some of these caves are quite large, as much as 100 feet long and 20 or more feet deep. The weathered conglomerate is relatively smooth, although the surface is pitted where cobbles and pebbles have weathered out. The surface is typically covered by a thin layer of pebbly soil. Small bare patches of conglomerate are exposed in small windows in the soil. The reader is directed to Figure 2, where the cliff-forming character of the conglomerate is displayed.

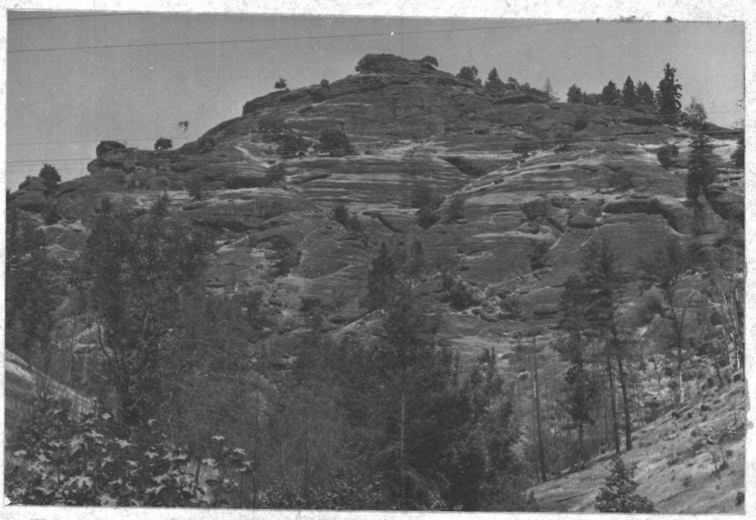

Figure 2. Conglomerate cliff along the northern border.

The matrix of the conglomerate is gray-green, chloritic, argillaceous sand, made up of poorly sorted assemblage of rock and mineral particles. This matrix is quite similar to that found in the sandstone lenses of the conglomerate.

Pebble counts were made at two localities, the type locality at the Henry Ranch and the Barrett Ranch. Pebble size composition and percentages are presented in Table 4.

Table 4. Types of pebbles and cobbles from the Henry Ranch member and their percentage in each of the size ranges. Sample 1 is from the type locality on the Henry Ranch, and Sample 2 is from the Barret Ranch.

Diameter	Less than 3/4 inch		3/4 to 1½ inch		Greater than 1½ inch		Total of all sizes	
Sample	1	2	1	2	1	2	1	2
	Percent							
Graywacke	24	28	28	32	35	61	24	35
Sandstone	14	8	19	24	10	7	17	15
Greenstone	14	12	9	5	5	0	10	7
Shale	28	8	19	5	0	0	17	5
Chert	9	6	14	12	0	0	8	7
Schist	5	9	5	0	5	0	5	4
Clay	5	0	0	0	0	0	1	0
Limestone	0	0	5	0	5	0	3	0
Chert pebble conglomerate	0	0	0	0	10	0	3.5	0
Phyllite	0	0	0	0	10	0	3.5	0
Basalt	0	14	0	5	10	16	3.5	13
Serpentine	0	4	0	5	10	0	3.5	3
Acid igneous	0	12	0	12	0	6	0	11

The sandstone, interbedded within the conglomerate, is a gray-green, argillaceous, medium-grained, poorly indurated, massive, feldspathic lithic wacke that weathers light gray. Severe weathering of the rock produces light-gray sandy soil. Three specimens of sandstone were sectioned and their modes are listed in Table 5.

Table 5. Estimated modes of three samples of sandstone of the Henry Ranch member.

Sample number	JH56-3	JH56-77	JH56-114
Quartz	18	15	10
Chert	44	40	48
Rock fragments	21	15	10
Chlorite	5	4	5
Plagioclase	8	10	12
Carbonate	2	0	0
Epidote	0.7	2	1
Pyrite-limonite	T	T	T
Zircon	0	T	T
Biotite	0	T	T
Muscovite	0	T	T
Hornblende	0	T	0
Argillaceous material	10	14	12

The rock fragments in the sandstone are sandstone, phyllite, serpentine, greenstone, chert, and other fragments altered beyond recognition of the original composition. Chert occurs as rock fragments, but is listed separately because of its importance in naming the rock. Chlorite occurs as stringers and fibrous bands, epidote as small anhedral crystals, pyrite as small anhedral masses within the chlorite, and biotite as short bands and deformed fibers.

Argillaceous material in the sandstone ranges from 10 to 14 percent. The grain size of the particles ranges from silt to medium sand-sized grains.

Age and Stratigraphic Relations. The Henry Ranch member is of lower Eocene age, the date determined for the entire Umpqua formation, by Diller (7,p.1) at the time of his original description of the unit. The author found no fossils in the unit and so he can only accept Diller's conclusion. South of the Reston fault the Henry Ranch member unconformably overlies the Jurassic Dillard formation and conformably underlies the Tenmile member. In Moore's area (14) the Looking Glass Creek member intervenes between the Henry Ranch member and the Dillard formation.

Origin and Environment of Deposition. Poor sorting and the variability of particle size suggest the Henry Ranch member was deposited in a near-shore marine environment. The source may have been a nearby area of relatively high topographic relief.

At the beginning of deposition the surface possessed slight topographic relief, and as the sea lapped onto the area, the low spots were filled first. Continuous deposition and further encroachment of the sea deposited gravel that entirely covered the underlying Dillard rocks.

The source of the clastic material is unknown, but detrital particle size as well as thickness decreases southward, and suggests a possibly northern source.

The conditions necessary to provide material for the accumulation of a conglomerate are areas of high topographic relief, high gradient streams, and short distances of transportation.

The finer-grained sandy conglomerate in the upper part of the member was probably derived from an area of lower relief.

Tenmile Member

Definition. The Tenmile member is a siltstone, mudstone, sandstone and shale unit named by the author. It consists of gray to gray-green mudstone and interbedded, gray-green to black, fine-grained sandstone and siltstone. Its type section extends in an east-west direction through the saddle on the west limb of the Barret Ranch anticline a quarter of a mile north of Mount Shep. Here the thickness is about 680 feet.

Distribution and Topographic Expression. In the northern half of the area the Tenmile member is exposed as a strip approximately 1½ miles wide that follows a synclinal axis in an east-west direction. Beginning at Tenmile, the strip widens to the west, curves around the area of exposure of the Henry Ranch member and extends to the western border. A north-south belt approximately a quarter of a mile wide begins one mile south of Tenmile and extends across the Barret Ranch to the southwest corner of the area. In the south central part, the Tenmile member is exposed as a southward broadening semi-elliptical area, that is approximately 3 miles wide and 3 miles long.

Exposures of the Tenmile member are confined mostly to the valleys. It is an easily eroded unit that forms low rolling hills, except where it is overlain by a more resistant unit. Small slumps of the rock are observed where the exposures are protected by a resistant layer.

Lithology. The lower part of the member consists of thin alternating layers of siltstone and mudstone. Higher in the section this lithology grades into thin-bedded sandstone and shale. Still higher, the sandstone beds become thicker than the shale beds. In the uppermost part of the member a few pebbles appear in the sandstone.

The siltstone part is a gray-green, poorly indurated, soft, laminated rock. It weathers to a buff-brown color, and forms small angular chips and fragments. Concentrations of chloritic material and organic particles give the siltstone a laminated appearance. Individual layers of the siltstone are seldom greater than 3 inches thick.

The mudstone is fine-grained, light gray-green, poorly indurated, well-bedded, and contains small fragments of carbonized organic material. It weathers to a buff-gray color and forms small angular fragments. The individual layers of mudstone are slightly thicker than those of the siltstone, but few are thicker than 5 inches, and most are less than 3 inches.

The mudstone and siltstone differ in that the mudstone is slightly coarser-grained and has carbonized organic material included. The mudstone is lighter colored than the siltstone. The contacts between the individual layers are abrupt and undulatory, so the beds vary slightly in thickness within short distances.

Stratigraphically above the sequence of siltstone and mudstone beds is a series of interbedded sandstone and shale layers. The thickness of individual shale beds range from less than one inch to approximately 5 inches. The shale is gray-black in color, fissile, thin-bedded, and organic. It weathers to small, thin, angular, gray-black flakes.

Figure 3 shows thin-bedded sandstone and shale typical of the unit near the center of the section. The sandstone layers are hard, well indurated, gray-black in color, distinctly bedded, and contain organic fragments. Their thickness ranges from 1 to 7 inches. The rock weathers to a dark-gray color and forms small angular fragments.

Figure 3. Thin-bedded Tenmile sandstone and shale.

Two thin sections of sandstone (JH56-50, a feldspathic quartz wacke, and JH56-120A, a quartz wacke) were examined and their estimated modes are given in Table 6.

Table 6. Estimated modes of two samples of Tenmile sandstone.

Sample number	JH56-50	JH56-120A
Quartz	18	32
Chert	34	28
Rock fragments	18	11
Argillaceous material	14	12
Plagioclase	16	7
Chlorite	3	9
Carbonate	0	T
Epidote	1	2

Sample number	JH56-50	JH56-120A
Pyrite-limonite	T	T
Zircon	0	T
Biotite	T	1

The quartz and chert are small sub-angular to sub-rounded grains; the chert grains are generally more rounded than the quartz. Rock fragments occur as subrounded grains and the determination of rock type is difficult because of the small particle size. The plagioclase occurs as partly altered, angular crystals. The chlorite is a brown fibrous variety and occurs as small anhedral crystals, pyrite and limonite as small angular grains, and biotite as small bent plates. The zircons in specimen JH56-120A occur as small euhedral crystals.

The upper quarter of the Tenmile member consists of beds of gritty sandstone separated by thin layers of shale. The shale is gray-black, fissile, and sparsely fossiliferous. The beds of shale are usually less than 4 inches thick. Some of the thicker layers contain casts and molds of pelecypods and gastropods. Identification of the fossils was attempted, but because of the poor preservation, no positive identifications were made.

The sandstone is gray-brown, medium- to coarse-grained and argillaceous. Individual beds may be as much as 4 feet thick. Spheroidal weathering is observed in the sandstone in the uppermost part of the unit.

Figure 4. Spheroidal weathering of upper Tenmile sandstone.

The upper sandstone, in hand specimen, is a medium-grained, moderately sorted, well-indurated feldspathic wacke composed of sub-angular to sub-rounded grains of quartz, feldspar and rock fragments.

A thin section, JH56-89, of this sandstone was examined, and the estimated composition is quartz (15%), chert (23%), feldspar (17%), rock fragments (17%), argillaceous material (11%), chlorite (6%), carbonate (11%), epidote (1%) and pyrite (T). The feldspar has been partly replaced by carbonate. The rock fragments are composed mostly of chert and metamorphic rocks. Chlorite occurs as bent fibers, and epidote as euhedral and subhedral grains. Pyrite occurs as small anhedral masses within the chlorite.

Age and Stratigraphic Relations. Fossils indicate the Tenmile member is Eocene. Casts and molds of several pelecypod, gastropod, and a few echinoid species occur in the member. One abundant form was tentatively identified as Turritella uvasana; the other forms were too poorly preserved for identification. Turritella uvasana is a characteristic fossil of the Eocene of western Oregon.

The Tenmile member conformably overlies the Henry Ranch member, and conformably underlies the Barret Ranch member, except in the northwest corner of the area, where it is in contact with the Dillard formation.

Origin and Environment of Deposition. The Tenmile member probably was deposited in a relatively stable marine environment. Basin depth was maximum at the beginning of deposition. The sediments that accumulated early in the Tenmile geochrone are fine-grained and nearly uniform in grain size. The unit is thin-bedded and unfossiliferous in this part. Later, the grain size increased, either because the accumulated sediments reached a shallower depth, or because a slight regression of the sea took place. The uppermost part of the member was deposited in the shallowest water, as indicated by the increase in particle size, and in these shallow waters marine life of the time was most abundant.

Upward coarsening of the sediments, as found in the

Tenmile member, indicates either a gradual regression of the sea took place throughout the time of deposition, or a concurrently rising source area existed and contributed to the increase of coarseness of the sediments.

Barret Ranch Member

Definition. The Barret Ranch member is a sequence of alternating sandstone, siltstone, and carbonaceous shale beds. Its base is marked by a pebbly sandstone layer. In some outcrops this basal unit approaches a pebble conglomerate.

The type locality of the Barret Ranch member is in the southwest one-quarter of the area, west of the Barret Ranch house, beginning at the contact of the Barret Ranch and Tenmile members, and extends west to the edge of the area. The member is thickest at this point, approximately 130 feet. The total thickness is not known because the remainder of the unit is not present in the area of this report.

Distribution and Topographic Expression. The Barret Ranch member is almost limited to the southern half of the area, and occurs there along the western border, on top of Mount Shep, and in the ridge half a mile north of Mount Shep. Erosional outliers cap two hills three-quarters of a mile east of Tenmile. The total areal distribution of this member does not exceed 4 miles. The basal pebbly layer is a ridge- and cliff-former that locally exhibits cavernous weathering. Above this basal layer the sandstone and shale beds are exposed in small local outcrops.

Lithology. The lowermost unit is pebbly sandstone and pebble conglomerate. These are interfingered so that the rock in contact with the underlying Tenmile member may be either facies. This unit exhibits cross-bedding in some outcrops. The pebbles in the lower unit are commonly concentrated parallel to the cross-bedding. The pebbly sandstone and pebble conglomerate are clean, poorly indurated and quartzose. The size of the pebbles typically ranges from one-quarter of an inch to 1½ inches in diameter, although a few are greater than 2 inches in diameter.

The sandstone of the Barret Ranch member is gray-green to gray-brown, medium-grained, thin-bedded and argillaceous. Six thin sections of this sandstone were examined and the estimated modes are given in Table 7. These samples are also plotted on Plate 3. The sandstones have very nearly the same mineral content. The individual rocks vary in grain size, angularity of clastic particles, and the presence of notable quantities of argillaceous matter. The modes are arranged in Table 7 with the samples from left to right in order of increasing stratigraphic elevation above the base of the member.

Table 7. Estimated modes of six samples of Barret Ranch sandstone.

Sample number	JH56-72	JH56-93A	JH56-95	JH56-110	JH56-122	JH56-124C
Quartz	43	51	41	65	55	58
Feldspar	23	14	14	8	10	12
Chlorite	5	7	7	2	5	4
Argillaceous material	4	2	3	7	14	12
Rock fragments	22	21	31	8	12	12
Biotite	T	1	1	0	1	2
Zircon	T	0	0	0	T	0
Pyrite-limonite	1	T	1	0	2	1
Epidote	3	2	2	0	T	1

The four samples from the lower part are JH56-72, 93A, 95,(lithic arenites) and 110(feldspathic arenite). The grains are typically of medium- to coarse-sand size except in sample JH56-110, which is a gritty sandstone. The grains are angular to subangular, and have an argillaceous matrix. The quartz, feldspar, chert, and rock fragments occur as subangular grains. Chlorite occurs as anhedral masses and fibers, biotite as small bent grains, and zircon and epidote as small euhedral an subhedral grains.

Sample JH56-122, from the middle part of the Barret

Ranch member, is a medium-grained, subfeldspathic lithic wacke, composed of subangular to subrounded clastic grains of chert, quartz, feldspar and rock fragments. Chlorite occurs as anhedral masses, biotite as bent laths, and zircon and epidote as small euhedral crystals. JH56-124C, the sample highest in the section, is a fine-grained, friable, feldspathic wacke composed of subangular and subrounded particles of quartz, chert, rock fragments and feldspar. Some of the feldspars have been partly altered to kaolin and sericite, and some are bent or broken, and display anomalous extinction. Chlorite occurs as anhedral masses and stringers, biotite as small bent fibrous laths, and epidote as small subhedral crystals. Pyrite and limonite occur in all the sections as small anhedral grains usually within the chlorite.

The siltstone in the Barret Ranch member is gray-green, fine-grained, and poorly indurated. It is exposed in recent road cuts and stream banks. It is only a minor constituent of the member. The siltstone crops out as thin buff-gray beds and weathers to small buff-colored chips and flakes. Small fragments of organic material are scattered through the rock.

The shale is of two types. One type is gray-green, medium-grained, and fissile, displays concretionary weathering, and contains black, flinty, fossiliferous concretions. The rock weathers to a gray-brown color, and forms small angular flakes and chips. The concretions are hard, black, flinty shale that break with a subconchoidal fracture and contain small gastropods and pelecypods. The fossils break with the rock and are not recoverable as complete specimens. This type of shale is exposed in a series of road cuts that begin 150 yards northwest of the Barret Ranch house and continues to the west for a short distance. The other type of shale is best exposed at a quarry on the Barret Ranch road 3½ miles north and three-quarters of a mile east of the southwestern corner of the area. This shale is blue-black in color, thin-bedded, fissile, and displays concretionary weathering. It weathers to very small buff-colored flakes and chips. Some beds of shale are as much as 14 inches thick.

Age and Stratigraphic Relation. The sandstone and shale, at a locality on the Barret Ranch road 3½ miles north and three-quarters of a mile east of the southwest corner of the area, contain mega- and microfossils. This is Oregon State College fossil locality number 4235. The microfossils are preserved as molds and casts, but many of the megafossils are preserved with their original shell material intact. The megafossils of the Barret Ranch member compare closely to an assemblage in the paleontologic collections of Oregon State College, from the type locality of the Umpqua formation at Little River.

The forms listed in Table 8 were identified by the author.

Table 8. Pelecypods and Gastropods from the Barret Ranch member. (Oregon State College locality number 4235).

Pelecypoda

Acila decisa
Eomeretrix martini
Gari hornii var. umpquaensis
Glycimerus sagittata
Lucina packi
Lucina cf. roseburgensis
Macrocallista conradi
Marcia (Mercinomia) bunkeri
Nemocardium linteum
Pitar uvasana var. coquillensis
Scaphander sp.
Solen sp.
Venericardia sp.
Volsella sp.
Yoldia morsei

Gastropoda

Ampullina andersoni
Neverita globosa
Siphonalia bicarinata var. monospira
Turritella uvasana var. hendoni

This assemblage is indicative of Capay (or lower Eocene) age in the California megafauna chronology.

A diastem may exist between the Barret Ranch member and the underlying Tenmile member. The contact, where observed, is one of conformity, but there is an abrupt change in lithology from the sandstone and shale of the Tenmile member to one of either pebbly sandstone or pebble conglomerate at the base of the Barret Ranch member. The beds above and below the contact have approximately the same attitude. A diastem in the words of Krumbein and Sloss (11,p.97) is "a minor interruption in sedimentation, which may represent merely a cessation of deposition." The break between these two members may have been caused by a short interruption of deposition, an increase in the competency of the medium of transportation, an increase of relief of the source area, a shoaling of the sea and a lowering of wave base, or a combination of two or more of these factors.

Figure 5. Concretionary weathering of fossiliferous beds of the Barret Ranch member at Oregon State College locality number 4235.

Origin and Mode of Deposition. The lower Barret Ranch member probably was deposited in a shallow water environment subject to wave action, as indicated by poor sorting, cross-bedding, and an increase of size of the clastic particles. The alternating sandstone and shale beds may be due to slight changes of sea level as the sea deepened, or to turbidity current deposition.

Umpqua Basalt

Two outcrops of basalt occur at a locality one mile east and a quarter of a mile south of the northwest corner of the area. The rock is weathered, gray-brown in color, fractured, jointed, and stained black on joint surfaces. Coarse-grained and fine-grained varieties are present.

Both the fine-grained (JH56-139) and coarse-grained (JH56-138) specimens were examined in thin section. The estimated modes are listed in Table 9.

Table 9. Estimated modes of two Umpqua basalts.

Sample number	JH56-138	JH56-139
Labradorite	26	28
Augite	65	50
Glass	5	20
Sericite	T	T
Chlorite	2	0
Magnetite	2	2

Sample JH56-139 is a fine-grained basalt with a porphyritic intergranular texture. Plagioclase feldspar occurs both as phenocrysts and as an abundant constituent of the groundmass. The crystals are euhedral and subhedral. The phenocrysts are partly resorbed and partly altered to paragonite. They show strain as indicated by anomalous extinction. The feldspars in the groundmass occur interstitially and within the augite crystals. Chlorite is present as an alteration of augite, and unaltered glass and devitrified glass occur in the groundmass.

JH56-138 is a medium-grained basalt of subophitic texture. The specimen, by grain size, approaches a diabase but lacks a true ophitic texture.

The augite in both specimens of basalt is titaniferous and displays a purplish color in transmitted light.

The relationship of the basalt to the layered rocks was obscured by soil and vegetation. The author is unable to decide whether the basalt is a part of the layered sequence or is an intrusive. As this doubt could not be resolved either in the field or by petrographic studies, the author prefers to describe these rocks separately rather than including them in one of the clastic units of the Umpqua formation. These rocks are very similar to some studied by Moore (14), who finds them to be interbedded with sediments of the Looking Glass Creek member.

STRUCTURAL GEOLOGY

Fold axes and fault traces in the area are generally aligned in a northeast-southwest direction. Proceeding from the northwest to the southeast corner of the area, the folds are: the Reston anticline, the Tenmile syncline, the Barret Ranch anticline, and the Mount Shep syncline. Two major faults, the Reston fault and the Tenmile fault follow the same trend as the fold axes.

The nature of the structural complexity within the Dillard formation is unknown, but the author observed intense local deformation, especially in the proximity of the intrusive bodies. The attitude of the rocks of the Dillard formation is generally obscure, so the nature of the local structure was not interpreted.

The compressive forces generated during the Nevadian orogeny are believed by Taliaferro (18) to have been responsible for much of the deformation of the Dillard formation in the Roseburg area.

Folds. The Henry Ranch member, exposed along the northern border of the area, is included in the northern limb of the Tenmile syncline. The Reston anticline plunges rather steeply (about 40°) southwest as indicated by attitudes measured in the western exposures of the Henry Ranch member. Near the north border of the area the position of the anticlinal axis cannot be located with certainty.

The trend of the Tenmile Creek-Porter Creek valley corresponds to the axis of the Tenmile syncline. This synclinal trough broadens to the southwest and narrows to the northeast.

The Barret Ranch anticline is the longest fold observed in the area. Its axis extends from the southwestern corner to the northeastern border of the area studied. Two areas of exposure of the Dillard formation occur along the anticlinal axis, one in the vicinity of the Barret Ranch, and the other northwest of and parallel to the Olalla Road. The Henry Ranch member is exposed along the flanks of the fold except in the north central part where the northwestern limb is interrupted by the Tenmile fault. This structure is more sharply folded in the southwestern one-quarter of the area, where the attitude of the beds approaches 50 degrees. The intensity of the folding decreases to the northeast.

The Mount Shep syncline, a southwesterly plunging syncline, is located in the southeastern quarter of the area. The axis of this fold curves from a north to a northeasterly direction.

<u>Faults.</u> The Tenmile fault, a northeast-southwest trending fault, has a trace approximately 5 miles long. In the northern half of the area, it is located one mile southeast of and parallel to Highway 42. The fault crosses to the southern half of the area south of Tenmile 1½ miles and curves gradually to the south.

The author observed gouge at two localities along the fault; one locality is half a mile south of Porter Creek, and the other, in the southwestern quarter of the area, at the intersection of the fault and the Barret Ranch road. Prominent ridges lie on both sides of the fault in the northern half of the area. The rocks on the northwestern side, the downthrow block, are capped by the Barret Ranch member. The Henry Ranch member and Dillard metamorphic rocks from the ridge on the upthrow block. No prominent topographic features are associated with the southern end of the fault; here the fault is marked only by an abrupt change of attitude of the beds.

The Reston fault, is located in the extreme northwestern corner of the area, on the northern flank of the Reston anticline. The fault trace is approximately 1½ miles long. Fault gouge was seen in three places along this fault: half a mile, five-eighths of a mile, and three-quarters of a mile south of the intersection of the fault and the Tenmile-Reston road.

In addition to larger faults mentioned above, some slips too small to map occur within the fine clastic units. Figure 6 shows one such slip plane in the Tenmile member.

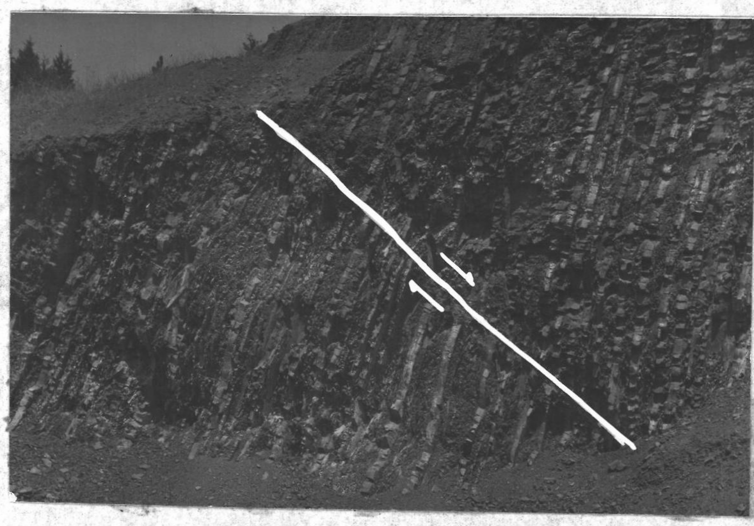

Figure 6. Small slip plane in the Tenmile member.

PHYSIOGRAPHY

Steep-sided valleys separated by ridges that locally preserve flattened crests, generally characterize the area. The stage of physiographic development of the area is estimated to be late youth or early maturity. A three-fold subdivision of the area based on variations of stream drainage patterns and topography is made.

(1). The southeastern quarter of the area is characterized by a barbed drainage pattern that suggests stream piracy. The subsequent streams in this area empty into the main drainage streams at right angles, and in a few instances, the angle may exceed 90 degrees. Thornbury (20,p.123) refers to these as boathook bends and considers them to be indicative of stream piracy. This type of drainage has developed on the rocks near the axis of the Mount Shep syncline. Former drainage may have been to the south, but lack of information of that area prohibits any definite conclusions concerning the subject. Two subsequent streams follow the limbs of the Mount Shep syncline and join near the axial trace, half a mile south of hill 1,529T, to form Upper Olalla Creek. This stream flows across the strike of the Henry Ranch member, forming a series of riffles where the stream crosses resistant layers of the conglomerate.

The southeastern quarter of the area is more thoroughly dissected by streams than the remainder of the area investigated.

Mount Shep, a narrow flat-topped ridge, and a corresponding ridge slightly to the north, are capped by the resistant basal pebbly sandstone unit of the Barret Ranch member.

(2). The drainage in the southwestern quarter is partly obsequent and partly subsequent. The ridges in this sector are slightly wider than those of the southeastern quarter, and have been less dissected by streams. The main drainage stream approximately follows the strike of the fold over most of its course, except in two places where it cuts across the strike; one of these is near the Barret Ranch house, and the other is 2½ miles north of there. This stream originally may have followed its present course to the point where it flows from west to east across the strike of the Barret Ranch anticline. Immediately to the west of this point, a wind gap occurs outside the area mapped, and the stream probably left the area through this gap. Headward erosion of the lower half of the present stream was along the Tenmile fault zone to where the stream now turns west. This stream turned to the west away from the crest of the fold, and for reasons not discerned, cut across the strike of the beds and captured the ancestral stream.

(3). Tenmile creek is the main stream in the northern half of the area. It follows the axis of the Tenmile syncline and flows to the northeast. Only a few streams flow into Tenmile Creek from the southwest limb of the fold. The streams flowing south on the northwest limb of the syncline form a subtrellis drainage pattern on the Henry Ranch member. Two streams, Henry Creek and the upper part of Tenmile Creek, have incised through the conglomerate and now drain a small part of the area to the north of the area of this report. The lower part of Tenmile Creek flows out of the area, across the conglomerate unit, in the extreme northeast corner.

HISTORICAL GEOLOGY

Clastic and organic sediments were deposited in a Jurassic eugeosyncline, and the Nevadian orogeny subjected the sediments to low-grade regional metamorphism, subsequently, but before the Eocene, ultrabasic and granitic magmas were emplaced in the sediments and caused some local metamorphism.

Topography produced by Nevadian deformation appears to have been reduced to a surface of subdued relief by Cretaceous time. Cretaceous sediments are present in considerable thickness in the adjoining area immediately to the east (3). During late Cretaceous or earliest Tertiary time the area was exposed to erosion, stripping away the Cretaceous sediments and leaving an uneven topographic surface.

At the beginning of the Eocene, the area was inundated by a shallow sea, and the sands and muds (Looking Glass Creek member), followed by a thick deposit of coarse detritus (Henry Ranch member) is laid down. The source of the conglomerate is not known, but the unit thins in the southern part of the area, and attains its maximum thickness along the northern border hence a source area to the north is suggested. As the conglomerate was deposited, the sea became shallower and the source area decreased in relief, as indicated by a decrease of particle size of the sediments. Shallow waters and lessened relief of the source area produced a deposition of progressively finer clastics (upper Henry Ranch and Tenmile members).

The area was relatively stable during the accumulation of the sediments of the Tenmile member, and the unit characteristically has a fine-grained lithology. Then the sea began a retreat that is reflected in the increase of grain size of the sediments(upper Tenmile member).

A diastem may occur between the Tenmile and Barret Ranch members. Either the sea retreated and caused a short interruption of sedimentation, or possibly the accumulated sediments reached wave base level and were affected by wave action. A thin layer of cross-bedded and pebbly sediments accumulated, (basal Barret Ranch member) and then, as the sea deepened the sediments became finer and marine life flourished. It was in the latter type of environment that most of the Barret Ranch member was deposited.

Post-depositional erosion and undated orogenic activity are responsible for the present day topography.

ECONOMIC GEOLOGY

There are no economic mineral deposits in the area that have been developed. Two localities were seen by the author where some type of prospecting had been undertaken. Both of these prospects were in the Dillard formation. One is a shallow trench approximately 15 feet long in a serpentine body, and the other is a shaft sunk about 20 feet into a granite intrusive.

Rock has been quarried for road material in two places. The Douglas County Road Department has quarried Dillard graywacke a quarter of a mile south of the Olalla-Upper Olalla Road junction, and are presently using it for road material in the immediate vicinity. A small quarry is present on the Barret Ranch road, where Tenmile sandstone and shale are quarried for road ballast.

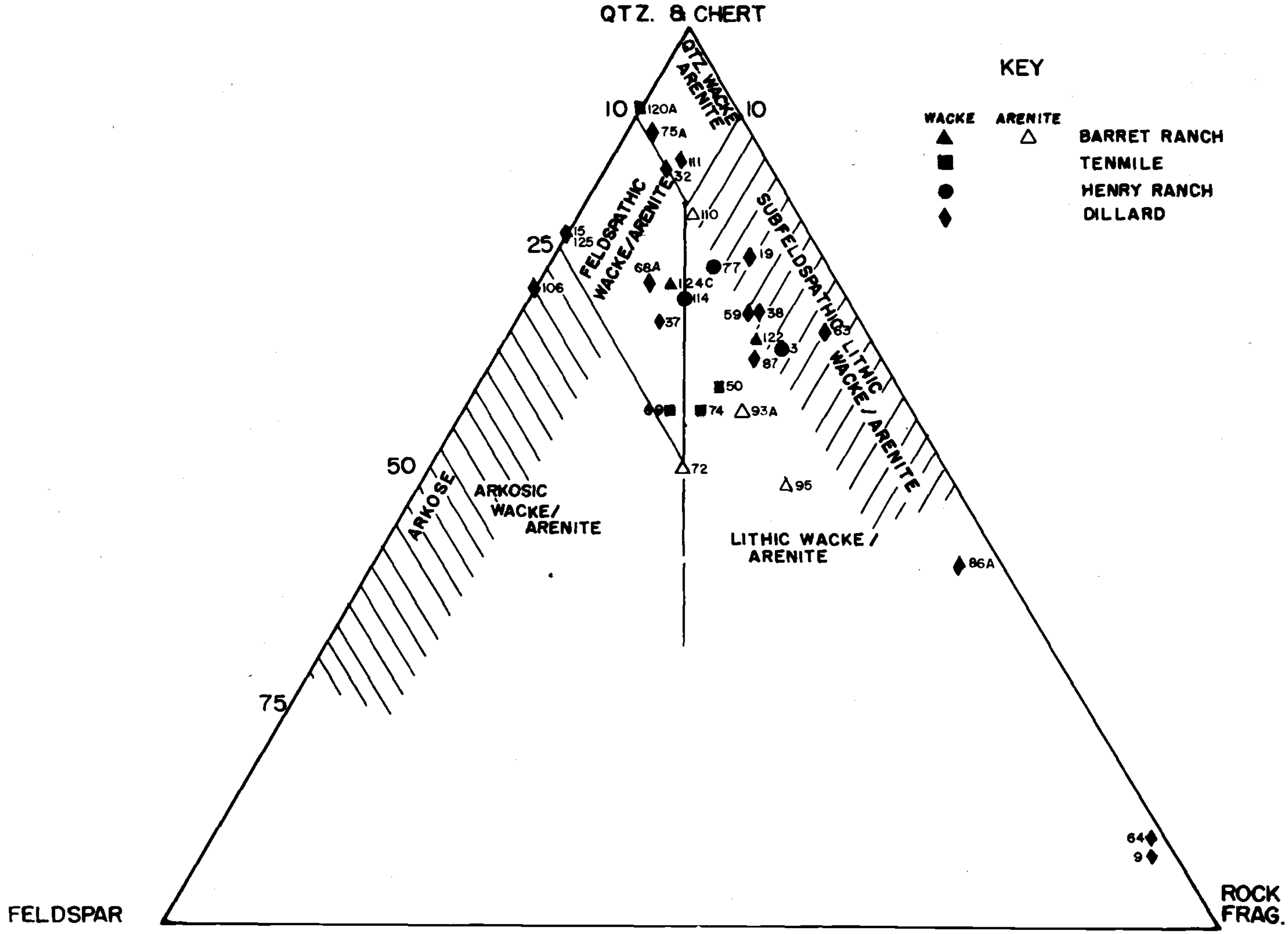

PLATE 3 SANDSTONES OF THE DILLARD & UMPQUA

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