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Geologic Map of the Kenyon Mountain Quadrangle, Douglas and Coos Counties, Oregon

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EXPLANATION

Qal **Quaternary alluvium (Holocene and Pleistocene)**—Unconsolidated clay, silt, sand, and gravel deposited in channels and on the flood plains of modern streams

Qls **Landslide deposits (Holocene and Pleistocene)**—Clay, silt, sand, and gravel chaotically mixed with angular blocks of weathered bedrock. Includes slumps, earth flows, block glides, debris flows, and rock falls. Arrows indicate direction of movement

ANGULAR UNCONFORMITY

EOCENE SEDIMENTARY ROCKS

Tyee Formation of Diller (1898) and Baldwin (1974) (middle Eocene; Ulatisian)—Micaceous sandstone, siltstone, and mudstone interpreted as a regressive sequence in which a deep-water submarine fan or ramp complex is overlain by slope deposits, which are in turn overlain by thick fluvial to wave-dominated delta deposits. The Tyee Formation has been subdivided into the following members:

Ttb **Baughman Member of Baldwin (1974) (middle Eocene; Ulatisian)**—Sandstone interbedded with lesser amounts of siltstone and mudstone. Sandstone is bluish-gray, micaceous, lithic-arkosic wacke that is medium to coarse grained, locally pebbly, moderately sorted, and well indurated. Mottled color due to zeolitization is common. Porosity is low owing to the degree of induration and amount of clay and zeolite matrix cement (typically 20-40 percent). Amalgamated sandstone beds are very thick to massive and channelized to lens shaped. Typically parallel bedded with minor basal scour. Large-scale trough and planar cross-beds are common, as are lateral accretion surfaces. Carbonized wood and plant debris are abundant along bedding planes. Sandstone units are cliff formers. Thin-bedded sequences consist of fine-grained sandstone, siltstone, and mudstone. Maximum thickness of the Baughman Member in the map area (top eroded) is approximately 335 m (1,100 ft). Total thickness of the member is approximately 760 m (2,500 ft) at the type section 24 km (14.9 mi) to the north. Interpreted as a sand-rich prograding deltaic system by Chan and Dott (1983, 1986), Heller and Dickinson (1985), and Molenaar (1985)

LOCAL UNCONFORMITY

Tth **Hubbard Creek Member of Baldwin (1974) (middle Eocene; Ulatisian)**—Dark- to medium-gray mudstone interbedded with micaceous siltstone and lesser amounts of very fine-grained thin-bedded micaceous sandstone. Beds range in thickness from 0.5 mm to 8-9 cm (0.02-3.5 in.). Horizontal lamination is the dominant sedimentary structure, but ripples and small-scale cross-laminations are common in sandstone and siltstone beds. Sandstone beds are composed of base-missing Bouma turbidite sequences (T_{bcde}). Small pelecypod molds and casts occur in the mudstone, but the strata are generally not bioturbated. Carbonized plant debris and mica are abundant along bedding planes. The Hubbard Creek Member at the type section 24 km (14.9 mi) to the north is approximately 120 m (400 ft) thick (Baldwin, 1974). The unit maintains a relatively consistent 183 m (600 ft) thickness throughout the study area. Unit Tth consists mostly of Mutti-Ricci Lucchi turbidite Facies G (Mutti and Ricci Lucchi, 1972, 1975), with lesser amounts of Facies F and minor amounts of Facies D. Unit Tth is interpreted as a slope facies (Molenaar, 1985)

Ttt **Tyee Mountain Member of Baldwin (1974) (middle Eocene; Ulatisian)**—Light-gray to bluish-gray, brown-weathered, micaceous, lithic arkosic wacke in amalgamated sandstone beds up to 20 m (66 ft) thick. Sandstone is fine to medium grained, poorly sorted, and well indurated with ubiquitous coarse sand-sized flakes of biotite and muscovite. Porosity is low owing to the degree of induration and amount of clay matrix (typically 20-40 percent). Beds are locally graded. Flute, groove, and load casts are present, and mudstone rip-up clasts are abundant in the upper parts of sandstone beds. Carbonized wood and plant debris is common. The Tyee Mountain Member is 18 to 24 m (60 to 80 ft) throughout the southern portion of the map area. It thickens abruptly in the upper reaches of Sandy Creek to greater than 130 m (425 ft). This abrupt thickening occurs at about the same latitude as in the Camas Valley quadrangle to the east (Black and Priest, 1993) and represents either a growth fault or the presence of a paleohigh. At the type section 43 km (26.7 mi) to the north, the Tyee Mountain Member is 760 m (2,500 ft) thick (Baldwin and Perttu, 1989). Baldwin (1974) and Baldwin and Perttu (1989) suggested that there is an unconformity between the Tyee Mountain Member and the Camas Valley formation, while Molenaar (1985) interpreted the relationship as conformable. Ryu and others (1992) and Niem and others (1992) placed a local unconformity at the base of the Tyee Mountain Member. The thicker portions of unit Ttt consist of Mutti-Ricci Lucchi Facies B, and the thin portions consist of Mutti-Ricci Lucchi Facies C and D. At the type section, the Tyee Mountain Member was interpreted by Chan and Dott (1983) as an inner sandy submarine fan facies. They noted, however, that there appeared to be a line source for the deposits rather than a single large submarine canyon. Heller and Dickinson (1985) called this facies a submarine ramp turbidite complex

LOCAL UNCONFORMITY(?)

Umpqua Group of Niem and others (1992) is divided into the following informal units:

Tcv **Camas Valley formation of Niem and others (1992) (upper lower Eocene; Ulatisian)**—Largely slope and low-hill-forming unit Tcv consists of massive dark-gray to gray-green mudstone with minor siltstone and very fine-grained sandstone. Increasing amounts of thin-bedded, fine-grained, micaceous, arkosic sandstone occur toward the top of the member. These sandstone beds represent the lower parts of incomplete (base missing) Bouma sequences (i.e., T_{bcd}, T_{cde}). Horizontal lamination is the dominant sedimentary structure. Mudstone is commonly massive, with a tendency to spheroidal weathering. Small calcareous concretions are abundant. Locally bioturbated and slump folded. Contains sparse molluscan fossils. The thickness varies from 366 to 411 m (1,200 to 1,350 ft).

The Rasler Creek tongue (unit Twrc), a tabular body of interbedded pebbly sandstone, sandstone, and siltstone that is completely encased in the Camas Valley formation, has been assigned to the White Tail Ridge formation (see below).

The contact of the Camas Valley formation with the overlying Tyee Formation appears to be gradational, as explained in the section on the Tyee Mountain Member (unit Ttt). The contact with the underlying Coquille River member of the White Tail Ridge formation is conformable.

Most of the Camas Valley formation consists of Mutti-Ricci Lucchi Facies G with minor Facies F and is interpreted as outer shelf to upper slope deposits. The upper part of the member, where base-missing Bouma sequences are more common, is interpreted as an upper slope facies.

The Camas Valley formation was upgraded to informal formation status by Ryu and others (1992) and Niem and others (1992). The Camas Valley formation is equivalent to the Camas Valley Member of the Flournoy Formation of Baldwin (1974)

Tw **White Tail Ridge formation (undifferentiated) of Niem and others (1992) (upper lower Eocene; Ulatisian)**—The White Tail Ridge formation consists of approximately 70 percent medium-grained lithic arkosic arenite and lithic arkosic wacke, 20 percent siltstone and mudstone, and 10 percent conglomerate. Thin coal beds are also present. Undifferentiated White Tail Ridge formation is mapped where the Remote member is absent. The Coquille River and Berry Creek members have identical facies and lithologies and are impossible to differentiate in the absence of the Remote member. One small patch of undifferentiated White Tail Ridge formation is mapped along the western margin of the Kenyon Mountain quadrangle.

The White Tail Ridge formation (not including the Rasler Creek tongue, see below) has a thickness of approximately 365 m (1,200 ft) at the type section 30.5 km (18.9 mi) northeast of the study area (Black, 1990). Within the study area and in the Remote quadrangle to the west, unit Tw is approximately 945-1,036 m (3,100-3,400 ft) thick. This compares with a thickness of 884 m (2,900 ft) measured in the southern part of the Camas Valley quadrangle (Black and Priest, 1993).

The White Tail Ridge formation was upgraded to informal formation status by Ryu and others (1992) and Niem and others (1992). It consists of four members, listed below. The White Tail Ridge formation is equivalent to the White Tail Ridge Member of the Flournoy Formation and the Olalla Creek Member of the Lookingglass Formation of Baldwin (1974)

Twrc **Rasler Creek tongue of Niem and others (1992) (upper lower Eocene; Ulatisian)**—Unit Twrc is a tabular body of interbedded pebbly sandstone, sandstone, and siltstone that intertongues with the mudstone of the Camas Valley formation. Sandstone is nonmicaceous, medium-grained to granular, lithic arkosic wacke and arenite. Bed thicknesses range from a few centimeters to 1.5 m (4.9 ft). Parallel bedding dominates, but hummocky cross-stratification is relatively common. Coarser beds are burrowed. Siltstones have undergone extensive disruptive bioturbation. Carbonized plant debris is abundant. The transition to overlying mudstone is abrupt. The Rasler Creek tongue is 152 m (500 ft) thick in the southern part of the map area but thins to the north, finally pinching out in the upper reaches of Sandy Creek.

Unit Twrc consists of thickening upward parasequences and was deposited in storm-dominated relatively shallow water. It is interpreted as transitional and lower shoreface delta front facies (Ryu and others, 1992; Black and Priest, 1993)

Twc **Coquille River member of Niem and others (1992) (upper lower Eocene; Ulatisian)**—Several subfacies occur in unit Twc. The most common rocks are medium-blue-gray, brown-weathering, fine-grained lithic arkosic arenite with lesser lithic arkosic wacke. Clay matrix varies from 5 to 15 percent. Lithic rock fragments comprise about 15 percent, and the remainder is quartz and feldspar. Muscovite comprises less than 1 percent of the rock and is present as tiny flakes less than 0.5 mm (0.02 in.) in diameter. The sandstone is moderately well sorted and generally moderately strong, although locally it is friable. Framework grains are angular to subangular, and the porosity is moderate to low. Beds are tabular to slightly lenticular, range from 0.25 to 1 m (0.8 to 3.3 ft) thick, and are commonly amalgamated. Discontinuous mudstone interbeds are generally less than 1 mm (0.04 in.) thick. Vertical burrows, local thin discontinuous broken molluscan shell hash layers, and hummocky cross-bedding are common. Lithologically similar medium- to coarse-grained sandstone beds containing moderate to abundant vertical to subvertical burrows and abundant trough cross-beds form massive beds up to 5 m (16.4 ft) in thickness. These rocks are interpreted as a delta-front shallow-marine assemblage and include transitional, lower and upper shoreface, and foreshore deposits.

Marine siltstone sequences 10-20 m (32.8-65.6 ft) thick are common in the Coquille River member. The siltstone is mottled dark greenish gray and usually is interbedded with lesser amounts of fine-grained lithic arkosic wacke. Beds are locally parallel laminated and ripple cross-laminated with bedding thicknesses from 1 to 4 mm (0.04 to 0.16 in.). Flaser, wavy, and lenticular beds are all abundant, although sedimentary structures are generally destroyed by bioturbation. Calcareous concretions are present. Carbonized wood fragment debris and small molluscan fossils are common. Unit Twc is interpreted as interdistributary bay facies.

Unit Twc is approximately 244 m (800 ft) thick. The Coquille River member is equivalent to the White Tail Ridge Member of the Flournoy Formation of Baldwin (1974). Black (1990) and Black and Priest (1993) mapped equivalent rocks as the upper part of the White Tail Ridge Member of the Flournoy Formation

Twr **Remote member of Niem and others (1992)**—Unit Twr consists of pebble conglomerate interbedded with pebbly sandstone, granular to medium-grained sandstone, siltstone, mudstone, and minor carbonaceous shale and coal. Sandstone and conglomerate is dark gray to greenish gray when fresh but weathers to brown. Massive mudstone is dark gray when fresh to light gray green when weathered. Most of the coarser rocks are lithic arkosic wackes, but arenites are common. Sorting varies from poor to moderate. Framework grains are angular to subangular, and the porosity is moderate. Clasts in the conglomerate typically range from 2 mm to 2 cm (0.04 to 1 in.) in diameter, are rounded to well rounded, and commonly have a reddish-brown oxidized coating. The clasts consist of approximately 65 percent chert and quartzite, 25 percent metamorphic rock fragments, and 10 percent graywacke. Mudstone rip-up clasts are common. Bed thicknesses range from 2-3 cm to 7 m (1 in. to 23 ft). The thickest beds (conglomerate) tend to be massive, but normal grading and clast imbrication are common. Bases of sandstone and conglomerate beds are often deeply scoured. Both trough and tabular cross-beds are common. Lateral accretion surfaces are present. Beds form thinning- and fining-upward sequences. Siltstone and mudstone intervals are typically poorly exposed slope formers. They are poorly bedded to massive and range in thickness from a few centimeters to 3 m (9.8 ft). Thicker intervals contain thin (to 10 cm [4 in.]) wedge-shaped fine-grained sandstone beds. The poorly developed bedding in the fine-grained deposits may be due to bioturbation by plant roots.

Carbonized plant debris is common, and small rootlets in growth positions occur. Conglomerate and sandstone are interpreted as fluvial channel facies. Massive interbedded siltstone and mudstone are interpreted as overbank deposits.

Thinly laminated carbonaceous mudstone units and lignitic coal beds range in thickness from 0.25 to 1.25 m (0.8 to 4.1 ft) and are interpreted as swamp/marsh facies.

The Remote member is approximately 61 m (200 ft) thick where it is exposed in the Kenyon Mountain quadrangle. It thins and pinches out to the north. East of the study area, in the southern part of the Camas Valley quadrangle, it is 503 m (1,650 ft) thick (Black and Priest, 1993). Reconnaissance mapping and well data south of the quadrangle indicate a thickness of as much as 762 m (2,500 ft) (Ryu and others, 1992). These increased thicknesses south and east of the study area indicate that an axis of deposition is buried beneath the southern part of the Kenyon Mountain quadrangle (see cross-section A-A'). The Remote member is equivalent to the upper part of the Olalla Creek Member of the Lookingglass Formation of Baldwin (1974). It was mapped as part of the White Tail Ridge Member of the Flournoy Formation by Black (1990) and Black and Priest (1993)

LOCAL UNCONFORMITY

Twbc **Berry Creek member of Niem and others (1992) (upper lower Eocene; Ulatisian)**—Lithologies and facies in the Berry Creek member are identical to those in the Coquille River member. The member consists of thickening upward parasequences and is interpreted as a delta-front sequence (Ryu and others, 1992; Black and Priest, 1993). The Berry Creek member is shown only in the subsurface of the Kenyon Mountain quadrangle. An unconformity exists between it and the overlying fluvial Remote member. Based on mapping in adjacent quadrangles, unit Twbc is approximately 640 m (2,100 ft) thick in the subsurface beneath the western margin of the quadrangle and approximately 259 m (850 ft) thick in the subsurface beneath the eastern margin of the quadrangle. These differing thicknesses result from incision by the overlying Remote member. The contact with the underlying Tenmile formation is conformable (Ryu and others, 1992). The Berry Creek member is equivalent to the lower part of the Olalla Creek Member of the Lookingglass Formation of Baldwin (1974)

Tt **Tenmile formation of Niem and others (1992)**—The Tenmile formation, shown only in cross-section A-A', consists of a deep-marine turbidite sequence (Black, 1990; Ryu and others, 1992; Black and Priest, 1993). It is equivalent to the Tenmile Member of the Lookingglass Formation of Baldwin (1974)

GEOLOGIC HISTORY

INTRODUCTION

Nearly 1,525 m (5,000 ft) of sedimentary rock of early and middle Eocene age are exposed in the Kenyon Mountain quadrangle. These rocks encompass only a fraction of the geologic history of the southern Coast Range, which includes the following events: (1) a period of submarine volcanism; (2) deposition of a submarine fan (Umpqua Group sedimentary rocks); (3) a compressional event that intensely folded and faulted the pre-existing rocks; (4) formation of a subduction zone accompanied by the development of a forearc basin at the site of previous submarine fan deposition; (5) gradual filling of the forearc basin; (6) a deformational event during the late middle Miocene; (7) tectonic rotation of the entire assemblage; and (8) Pleistocene to Holocene erosion, deposition, and landslides.

STRATIGRAPHIC NOMENCLATURE

Stratigraphic terms used in this report are those described by Niem and others (1992). Interested readers are urged to consult Niem and others (1992) for a complete discussion of terminology and correlations throughout the southern Coast Range.

PILLOW BASALT AND MELANGE

Neither Siletz River Volcanics nor Mesozoic blueschist-bearing melange rocks crop out in the Kenyon Mountain quadrangle, although they are presumed to underlie the entire study area at depth. The nearest exposures occur to the west in the adjacent Remote quadrangle. The basalts consist of pillow lavas and breccia with lesser interbedded turbidites in the upper part of the section. They record a period of submarine volcanism during the Paleocene to early Eocene. These basalts and their equivalents comprise the basement of most of the Coast Range (Snavely and others, 1968). In the southern part of the Coast Range, melange and basalt form the basement. Where they are adjacent, they are in fault contact. Deformation occurred during a compressional event that will be discussed in a later section.

The pillow basalt of the southern Coast Range was assigned to the Roseburg Formation by Baldwin (1974). These volcanic rocks have been correlated with the Siletz River Volcanics of Snavely and others (1968) (Baldwin, 1974; Molenaar, 1985; Baldwin and Perttu, 1989). Niem and others (1992) assigned the basalt of the southern Coast Range to the Siletz River Volcanics.

Potassium-argon dates from five basalt samples in the southern Coast Range vary from 59.2 Ma to 62.1 Ma (Duncan, 1982). These Paleocene dates were measured on basalt that was not interbedded with sedimentary rock. The turbidites interbedded with the basalt yield early Eocene Foraminifera ages (Thoms, 1965; Miles, 1977, 1981).

The origin of the southern Coast Range basalts has been controversial. They are essentially oceanic in character, although locally they grade upward into subaerial basalt (Snavely and others, 1968). Interbedded sedimentary rocks (particularly conglomerate) indicate that the lavas were erupted close to the continental margin (Wells and others, 1984). Several workers have interpreted the origin of the basalt as seamounts that formed on oceanic crust and subsequently were accreted to the continental margin (Snavely and MacLeod, 1974; Dickinson, 1976; Simpson and Cox, 1977; Duncan, 1982). Simpson and Cox (1977) and Duncan (1982) all proposed models in which the basalt was erupted on an oceanic spreading ridge as it moved over the Yellowstone Hot Spot. An alternative origin proposed by Wells and others (1984) suggested that the basalt was erupted in a marginal basin during oblique continental margin rifting, similar to the modern Gulf of California. Recent work by Pyle and others (1991), however, indicates that the trace-element geochemistry of the Siletz River Volcanics is not compatible with either a spreading ridge or a marginal basin setting. They found strong evidence that the Yellowstone Hot Spot did directly influence the formation of the Siletz River Volcanics. Thus it seems most likely that the basalt is the result of near-shore volcanic activity influenced by the Yellowstone Hot Spot.

SUBMARINE FAN DEPOSITION

Overlying and intercalated with the upper part of the basalt pile is a sequence of turbidites assigned to the Umpqua Group (undifferentiated) by Niem and others (1992). Overlying the undifferentiated Umpqua Group turbidites are the Bushnell Rock and Tenmile formations (Niem and others, 1992). These units do not crop out in the Kenyon Mountain quadrangle but are presumably present in the subsurface.

The turbidites have been interpreted as a submarine fan by Ryberg (1984). The Bushnell Rock formation has been interpreted as a fan delta to deep-sea canyon fill or channelized facies (Kugler, 1979; Niem and others, 1992; Ryu and others, 1992). The Tenmile formation has been interpreted as both lower slope deposits (Heller and Ryberg, 1983; Ryberg, 1984) and upper slope deposits (Molenaar, 1985).

The relationship between turbidites of the undifferentiated Umpqua Group and the Tenmile formation is problematic. The units are lithologically identical and very similar in age. In practice, assignment of either of these units to specific formations within the Umpqua Group is possible only where stratigraphic position is indicated by presence of the Bushnell Rock formation. Umpqua Group turbidites were assigned to the early Eocene Penutian Stage by Thoms (1965). Miles (1977, 1981) found the planktonic Foraminifera of the units to be indistinguishable. He assigned the two units to Zone P7/8 (early Eocene, late Penutian to early Ulatisian) of the standard tropical zonation. Bukry and Snavely (1988), using coccolith assemblages, were also unable to differentiate between the two units. They assigned them both to coccolith zone CP11 (early Eocene, Ulatisian).

Baldwin (1974) and Baldwin and Perttu (1989) suggested that the undifferentiated Umpqua Group turbidites and Bushnell Rock and Tenmile formations represent distinct depositional episodes separated by an regional angular unconformity. Miles (1977, 1981) noted that the unconformity between the two formations must represent a very short time interval of less than 1 Ma.

An alternative model based on the identical lithologies and similar ages of the sedimentary rocks of the formations was proposed by Ryberg (1983, 1984), Heller (1983), and Heller and Ryberg (1982, 1983). They envisioned a continuous depositional system with a sediment source in the Klamath Mountains. An active subduction system was present at the site of what is now the Coast Range. In their model, the undifferentiated Umpqua Group turbidites represent a prograding deep-sea fan system. The fan was filling a trench underlain by subducting oceanic crust and seamounts. The Bushnell Rock formation represents fan-delta deposits, and the Tenmile formation represents the outer shelf to upper slope deposits of this depositional system. In their interpretation, local unconformities between the undifferentiated Umpqua Group turbidites and the overlying rocks are the result of syntectonic deposition. Molenaar (1985) reached a similar conclusion.

COMPRESSION DURING THE EARLY EOCENE

The deep marine depositional system discussed above continued until about 52.8 Ma. At that time, a strong compressional event occurred, which resulted in the juxtaposition of folded and thrust-faulted pillow basalt, blueschist-bearing melange, and submarine fan turbidite. This complexely deformed assemblage now makes up the basement of large portions of the southern Coast Range.

Heller and Ryberg (1983) ascribed the deformation to the collision of a Coast Range microplate (the seamount terrane of Simpson and Cox, 1977; and Duncan, 1982) with North America. Alternatively, Wells and others (1984) suggested that the deformation could record the northward passage of the Kula-Farallon oceanic ridge as it was being obliquely subducted beneath the North American Plate.

INITIATION OF MIDDLE EOCENE SUBDUCTION

Following the compressional event mentioned above, subduction was initiated in a zone offshore from the present coastline of western Oregon (Heller and Ryberg, 1983). In the Heller and Ryberg (1983) model, this "jump" to the west of the subduction zone resulted from the jamming of the old subduction zone by the collision of the seamount terrane. In the Wells and others (1984) model, the new subduction zone records the initiation of more orthogonal convergence following the northward passage of the Kula-Farallon ridge.

Whatever the reason, the initiation of subduction at the new site resulted in the formation of a forearc basin farther inland, near the site of previous submarine fan deposition. Subduction zone development must have concluded prior to about 52 Ma, when the White Tail Ridge, Camas Valley, and Tyee formations began to overlap the rocks of early Eocene age (Heller and Ryberg, 1983).

FILLING OF THE FOREARC BASIN

The transition from shallow marine through fluvial to deltaic facies in the White Tail Ridge formation to outer shelf/upper slope facies in the Camas Valley formation records deposition in the newly created subsiding forearc basin.

The change from slope deposition (represented by the Tenmile formation) to forearc-basin deposition (represented by White Tail Ridge formation) is abrupt. Bukry and Snavely (1988) assigned the White Tail Ridge formation to coccolith zone CP11, the same zone as the Tenmile formation. Miles (1977, 1981) noted that the unconformity between the Bushnell Rock and Tenmile formations and the White Tail Ridge formation represents a period of no more than 1-2 Ma.

A change of provenance occurs at the onset of Tyee Formation deposition. The lithic arkosic sandstone of the Camas Valley formation and older units is characteristic of a Klamath Mountains provenance (Heller and Ryberg, 1983; Heller and others, 1985). At the top of the Camas Valley formation near the contact with the overlying Tyee Formation, the sandstone changes character to a micaceous arkosic petrofacies indicative of a continental-plutonic provenance. Peterman and others (1981), Heller and Ryberg (1983), and Heller and others (1985) postulated that the source of the potassium feldspar and large muscovite flakes in these rocks may be an eroded Jurassic-Cretaceous plutonic complex (e.g., the Idaho Batholith) exposed in Idaho.

The onset of deposition of the Tyee Mountain Member, which began about 52 Ma, corresponds to a sharp eustatic drop in sea level recorded by Vail and others (1977) and Haq and others (1988). This sea-level fall may have been responsible for the sand-rich submarine fan deposits of the Tyee Mountain Member, although rapid subsidence in the forearc basin may have obscured any eustatic effects. The Hubbard Creek Member represents slope deposits associated with the above fan. A prograding deltaic facies (the Baughman Member) represents the last depositional event in the Kenyon Mountain quadrangle. Farther to the north, deposition of the slope mudstone of the Elkton Formation and the deltaic rocks of the Bateman Formation record the final filling of the middle Eocene forearc basin (Bird, 1967; Baldwin, 1974; Niem and Niem, 1990).

MIDDLE MIOCENE DEFORMATION

During the late middle Miocene, the Oregon Coast Range was uplifted and deformed into a series of open folds and normal and reverse faults with north- to northeast-trending axes (Wells and Peck, 1961; Dott, 1966; Niem and Niem, 1990). This deformational event was caused by renewed subduction of the Juan de Fuca Plate beneath the North American Plate and resulted in the formation of the Coast Range syncline, the dominant structural feature in the Kenyon Mountain quadrangle.

TECTONIC ROTATION

The Siletz River Volcanics have been rotated as much as 80° in a clockwise sense since their accretion to the continental margin approximately 50 Ma (Wells and Heller, 1988). The overlying White Tail Ridge, Camas Valley, and Tyee formations have been rotated nearly as much (Wells and Heller, 1988). Dextral shear associated with oblique subduction along the Oregon continental margin since the middle Eocene (mostly post middle Miocene) may be responsible for approximately half of the total rotation. The remainder may be due to Basin and Range extension and small block rotation that began in the late Miocene (Wells and Heller, 1988) and continues through present times.

RECENT EVENTS

Recent geologic events in the Kenyon Mountain quadrangle include erosion, the deposition of minor alluvial fill, and landsliding.

During the Pleistocene Epoch, when sea level was significantly lower than at present, the Sandy Creek valley was eroded into the poorly indurated mudstone of the Camas Valley formation. The subsequent rise in Holocene sea level raised base level and resulted in the deposition of patches of Recent alluvium on the valley floor.

SUMMARY

During late Paleocene to early Eocene times, the Farallon Plate was being obliquely subducted beneath the western margin of North America (Atwater, 1970). A volcanic pile, probably influenced by proximity to the Yellowstone Hot Spot, was accumulating near the continental margin. Toward the end of the volcanic episode, a submarine fan started to form. Deposition continued until late early Eocene, when a compressional event ended fan development. Following the deformational event, subduction began west of the present coastline of North America, and a forearc basin developed farther inland. This forearc basin was gradually filled with fluvial and marine sedimentary rocks. Minor deformation corresponding to the onset of subduction of the Juan de Fuca Plate occurred in the middle Miocene. Clockwise rotation (occurring mostly from middle Miocene to present times) and erosion and deposition resulting from Pleistocene to Holocene sea-level changes complete the story.

MUTTI-RICCI LUCCI FACIES ASSOCIATIONS

[Summarized from Mutti and Ricci Lucci (1972, 1975) and Nilsen (1984)]

Facies A: Conglomerate with lesser, very coarse-grained sandstone. Mudstone, if present, as thin discontinuous partings. Poorly sorted in lenticular beds from 1 to 10 m. Abrupt lateral changes in bed thickness are common. Beds are commonly amalgamated with variable bedding contacts. Lateral continuity of beds limited to tens or hundreds of meters. Sedimentary structures are scarce to absent. The sand/shale ratio is very high to infinite.

Facies B: Medium- to coarse-grained sandstone with some granules and pebbles. Thin discontinuous mudstone breaks are common. Bedding is plane parallel and horizontal to subhorizontal. Broadly undulating current laminae with wavelengths of several meters to tens of meters are abundant. Beds are typically 0.3-2 m in thickness. Amalgamated beds are common. Sand/shale ratio is high to very high. Grading within beds is subtle. Fluid escape structures occur. Mudstone clasts (often very large) are very common. Sole markings, mostly load casts and tool casts, are not easily detectable. Medium- to large-scale cross-stratification can occur.

Facies C: Medium- to fine-grained sandstone with lesser interbedded mudstone. Bedding surfaces are even, parallel, and laterally continuous. Characterized by complete T_{abcde} Bouma sequences generally <1 m thick. Sand/shale ratio is high to very high. Sole marks (load casts, flute casts, and tool marks), graded bedding, and small mudstone clasts are common.

Facies D: Fine- to very fine-grained sandstone, siltstone, and mudstone. Beds have marked lateral continuity. Composed of incomplete (base-missing) Bouma sequences. The typical Facies D layer is a sandstone/mudstone couplet in which the basal sandstone is completely laminated. Beds are 3-40 cm in thickness. Sand/shale ratio is variable but generally ranges from 1:2 to 1:9. Sole marks are relatively abundant. Ripple drift, micro-cross lamination, convolute lamination, and trace fossils are common.

Facies E: Medium- to coarse-grained, poorly to moderately sorted sandstone with discontinuous mudstone partings. Bed geometry is irregular. Beds are commonly thin (<30 cm, usually 3-20 cm), not graded, not laterally continuous, and not plane parallel. At outcrop scale, beds are markedly lenticular to wedge shaped and often pinch and swell. High-angle cross-lamination is common. Sand/shale ratio is high to very high (typically 1:1 or greater). Amalgamated beds are common. Often spatially related to Facies B.

Facies F: Includes clastic sedimentary rocks of all types that have been deformed by mass movement, resulting in chaotic deposits. Commonly intercalated with other facies. Result from gravity sliding and slumping.

Facies G: Fine-grained clastic sedimentary rocks (shale, siltstone, and mudstone) that include both pelagic and hemipelagic deposits. Thin-bedded (maximum bed thickness ~60 cm) with indistinct even, parallel bedding.

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