Geologic Map of the Coos Bay Quadrangle, Coos County, Oregon

1995

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EXPLANATION OF MAP UNITS

Quaternary Deposits

Qaf Artificial fill (recent)—Sand, silt, and rock fill adjacent to Coos Bay and Isthmus Slough. Strikes and dips in unit Qaf were compiled from Allen and Baldwin (1944), and represent bedrock attitudes measured prior to emplacement of the fill.

Qal Quaternary alluvium and estuarine sediments (Holocene)—Sand, silt, peat, and clay deposited in sloughs and valley bottoms. Generally restricted to elevations below 6 to 9 m above mean sea level. Attitudes depicted in alluvium are from exposures of underlying bedrock too small to be shown at the map scale.

Qls Landslide deposits (Holocene)—Clay, silt, sand, and gravel chaotically mixed with angular blocks of weathered bedrock.

ANGULAR UNCONFORMITY

Qe Quaternary estuarine terrace deposits (Pleistocene)—Weakly consolidated clay, silt, peaty mud, and pebbly mud located in a series of uplifted terraces along Davis Slough and the west margin of Isthmus Slough. Possibly associated with the Whiskey Run marine terraces (Madin and others, 1995).

Qt Quaternary terrace deposits (Pleistocene)—Weakly consolidated unconsolidated sand occurring in two terraces at Graveyard Point. Sands are feldspathic, medium to coarse grained, subrounded and moderately to well sorted. Terraces in the Coos Bay area were originally mapped as “Elk River Beds” by Diller (1902) and Allen and Baldwin (1944). Five distinct terraces were mapped by Griggs (1945). These five terraces have been correlated west of South Slough (in the Charleston quadrangle, due west of the map area) on the basis of relative elevation and soil development (McInelly and Kelsey, 1990). Bockhaim and others (1992) describe a soil chronosequence for the marine terraces west of South Slough. The terraces at Graveyard Point probably correlate with the Whiskey Run marine terraces, which have been dated southwest of the map area at 83.5 ka B.P. (Muhls and others, 1990).

Qmc Metcalf marine terrace (Pleistocene)—Weakly consolidated unconsolidated sand occurring in the extreme northwest corner of the quadrangle. Sands are feldspathic, medium to coarse grained, subrounded and moderately to well sorted. Mica is locally common. Sediments average 3–16 m in thickness. Age speculatively estimated as 200 ka B.P. (McInelly and Kelsey, 1990).

ANGULAR UNCONFORMITY

Tertiary Sedimentary Rocks

Coaledo Formation (upper to middle Eocene; Narizian)—Sandstone, siltstone, and mudstone with minor subbituminous coal and conglomerate. Originally defined by Diller (1899) and divided by Turner (1938) into upper and lower coal-bearing sandstone members and a middle deep-marine siltstone and mudstone member (Baldwin and others, 1973). Dott (1966) reported that the sandstones are “texturally submature to immature: feldspathic, micaceous, and carbonaceous lithic (volcanic) arenites and lithic (volcanic) wackes.” Dott (1966) and Ryberg (1978) interpreted the Coaledo as a prograding, wave-dominated deltaic complex deposited on an open coastline, with a sediment source to the southeast. The Coaledo Formation is divided into:

Tecu Upper Member of the Coaledo Formation (upper to middle Eocene; Narizian)—Fine- to coarse-grained lithic feldspathic micaceous sandstone with siltstone, mudstone, coal, and minor conglomerate. Ryberg (1978) and Chan and Dott (1986) reported six to eight upward-coarsening sequences from prodelta-shelf facies through delta-front facies, culminating in either delta-distributary channel facies or delta-margin facies. Common sedimentary structures include planar bedding; hummocky cross-stratification; trough, ripple, low-angle, and planar-tabular cross-stratification; contorted cross beds; liquefaction dikes; intraformational mudstone clasts; burrows; flaser bedding; concretions; flame structures; coquina lags; slump beds; and scour-and-fill. Allen and Baldwin (1944) measured a thickness of 400 m along the coastline west of the quadrangle. Rooth (1974) reported Narizian foraminifera.
Middle Member of the Coaledo Formation (upper to middle Eocene; Narizian)—Mudstone, siltstone, and minor sandstone and tuff. Allen and Baldwin (1944) measured a thickness of 880 m along the shoreline west of this quadrangle. Sedimentary structures are less abundant than in the Upper and Lower Members of the Coaledo Formation and include plane laminated beds and complete to partial Bouma sequences in sandstone beds. Bioturbation is common. Chan and Dott (1986) interpreted the Middle Member of the Coaledo Formation to be prodelta-shelf facies with some shelf to slope deposits. Rooth (1974) reported Narizian upper bathyal to lower neritic foraminiferan assemblages. The Middle Member of the Coaledo Formation pinches out in the eastern part of the quadrangle. For example, east of Green Acres, the Middle Member of the Coaledo Formation is absent, juxtaposing the Upper and Lower Members. Because the lithologically similar, sandstone-dominated Upper and Lower Members of the formation cannot be readily differentiated in the field, the result is a greater apparent thickness of the Lower Member (see cross-section C-C).

Lower Member of the Coaledo Formation (upper to middle Eocene; Narizian)—Fine- to coarse-grained lithic feldspathic sandstone with siltstone, mudstone, coal, and minor conglomerate. Chan and Dott (1986) and Ryberg (1978) reported ten upward-coarsening sequences from prodelta-shelf facies through delta-front facies, culminating in either delta-distributary facies or delta-margin facies in the Cape Arago area. Common sedimentary structures include parallel stratification; hummocky stratification; trough, ripple, low-angle and planar cross-stratification; convolute bedding; clastic dikes; intraformational mudstone rip-up clasts; burrows; flaser bedding; calcareous and pyrite concretions; flame structures; coquina lags; slumped bedding; and scour-and-fill. Robertson (1982), on the basis of drill hole information, informally subdivided the Lower Coaledo Member into three facies: upper "sandy" beds, middle "coaly" beds, and lower "shaly" beds. These facies were not mapped as separate units in the Coos Bay quadrangle, but the lower "shaly" beds, which were encountered in the Northwest Exploration Westport #1 (SW4SE1/4 sec. 16, T. 26 S., R. 13 W.) oil and gas test and U.S. Geological Survey drill holes 1-23 (SE4NE1/4 sec. 23, T. 26 S., R. 13 W.) and 2-23 (SW4SW1/4 sec. 23, T. 26 S., R. 13 W.) (Duncan, 1953) are shown in the cross sections. Mudstone outcrops in Leach Gulch (secs. 4, 9, T. 26 S., R. 12 W.) and a north-northeast-trending drainage in sec. 33, T. 26 S., R. 12 W., and secs. 4, 5, T. 27 S., R. 13 E.) represent these same beds. These "shaly" beds probably correlate with the Sicchi Beach beds described by Madin and others (1995). Allen and Baldwin (1944) measured a thickness of 540 m along the coastline west of the quadrangle. Rooth (1974) reported Narizian foraminifera.

UNCONFORMITY

Tyee Mountain Member of the Tyee Formation of Baldwin (1974) (middle Eocene; Ultratian)—Light-gray to bluish-gray, brown-weathered sandstone beds up to 20 m thick with thin (<15-cm) mudstone interbeds. Sandstone is fine- to medium-grained lithic arkose, which is poorly sorted and well indurated, and contains 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 to 40 percent). Beds are locally graded and amalgamated. Flute, groove, and load casts are present, and mudstone rip-up clasts are abundant in the upper parts of some sandstone beds. Carbonized wood and plant debris are common. Sandstones are deep-marine turbidite deposits. The Tyee Formation is unconformably overlain by the Coaledo Formation. At the type section, on the east flank of the Coast Range, the Tyee Mountain Member was interpreted by Chan and Dott (1983) as a sandy inner-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.

INTRODUCTION

The primary goal of this study was to map bedrock structure and identify Quaternary deformation. No new stratigraphic or paleontologic investigation of bedrock units was done. The ages and characteristics of the bedrock units on this map are drawn largely from the literature and field observations. Geologic maps that include all or parts of the Coos Bay quadrangle have been published at smaller scales several times in the past. Previous studies include those of Diller (1901), Allen and Baldwin (1944), Baldwin (1966), Baldwin and others (1973), Beaulieu and Hughes (1975), and Newton and others (1980).

STRUCTURE

The complex structure of the Coos Bay quadrangle results from roughly east-west compression that began in the late middle Miocene (Wells and Eck, 1961) and continues to the present day. This deformation has produced many north-south-trending folds, north-south-trending reverse and thrust faults, and west-northwest-trending steeply dipping reverse (?) and strike-slip (tear) faults. The style of deformation is similar to that depicted for the active Cascadia Subduction Zone fold and thrust belt in Goldfinger and others (1992) and by Madin and others (1995) in the adjacent Charleston quadrangle.

FOLDS

Minor anticlines and synclines occur throughout the quadrangle. Many are associated with drag on adjacent faults. While strike and dip data are locally plentiful, attitudes are sparse throughout much of the area due to thick soils and vegetative cover. Thus it is difficult to trace individual fold axes for any significant distance in the complex structural terrain.

An exception is in the southern part of the quadrangle, where a series of north-northeast-trending folds can be traced for over 6 km. The syncline that is the western-
most of these folds is responsible for the preservation of the Middle Coaledo Member in the axis of the fold near Green Acres (secs. 35, 36, T. 26 S., R. 13 W., and secs. 1, 2, T. 27 S., R. 13 W.). The axes of these folds are offset dextrally along a northeast-trending shear (?) fault. North of this fault, adjacent to the Goat Creek fault, a series of northeast-trending shallow folds probably owes its existence to movement on the Goat Creek fault. Most of these folds cannot be traced much farther north than the central part of the quadrangle, owing to absence of data.

In the north-central part of the quadrangle, near the community of Eastside, a north-northwest-trending syncline axis is offset dextrally along a pair of northeast-trending shear (?) faults. This syncline is responsible for the presence of the Middle Coaledo Member in this area.

**FAULTS**

Most faults in the Coos Bay quadrangle can be assigned to one of two classes, (1) generally north-south-trending reverse faults or (2) one of a conjugate pair of west-northwest-trending and east-northeast-trending thrust (?) and/or strike-slip (tear) (?) faults. Some faults identified in this study had been mapped previously by Allen and Baldwin (1944) and Duncan (1953). Others were identified by direct observation in natural and man-made exposures (rare), or offsets, scarps, and lineaments observed on aerial photographs. Modern satellite imagery available from the U.S. Geological Survey EROS Data Center shows numerous lineations in the Coos Bay area, which were used to aid in mapping faults. It is likely that only a small percentage of the faults actually present in the quadrangle have been mapped. Many of the anomalous steep dips and strikes on the map (when compared to regional trends) may be related to drag along small, unexposed faults and/or landslides.

**North-trending reverse faults**

Two north-northeast-trending high-angle reverse faults (the Westside fault and the Isthmus Slough fault) are mapped in the west-central part of the quadrangle. The Isthmus Slough fault was named by Allen and Baldwin (1944). The Westside fault is named in this report. The Isthmus Slough fault was previously mapped by both Allen and Baldwin (1944) and Duncan (1953). The southern end of the Westside fault was mapped by Duncan (1953). Duncan (1953) assigned down-to-the-west throws to both faults, which is consistent with the compressional tectonic regime. Based on displacement of Lower Coaledo Member "shaly" beds, there is as much as 2,600 ft of vertical displacement on the Westside fault and 1,600 ft of vertical displacement on the Isthmus Slough fault.

The Westside fault appears to have late Quaternary movement, based on the presence of uplifted Pleistocene (?) estuarine sediments west of Isthmus Slough. These sediments dip as much as 15° to the east near the Coos City Bridge. Uplifted estuarine sediments are also present along the north bank of Davis Slough. The reason for the uplift is uncertain, although the northeast-trending reverse (?) fault mapped in sec. 21, T. 26 S., R. 13 W., is a possible explanation.

**West-northwest-trending faults**

The Joe Nye fault (secs. 14, 15, 16, T. 26 S., R. 13 W.) was originally mapped by Madin and others (1995) in the Charleston quadrangle, where it juxtaposes the Upper and Middle Coaledo Members. They found several hundred meters of down-to-the-north displacement of Coaledo strata. They also found that this fault displaces late Quaternary marine terrace sediments.

The two west-trending faults in the southwest part of the quadrangle (sec. 22, T. 26 S., R. 13 W., and sec. 3, T. 27 S., R. 13 W.) were mapped previously by Duncan (1953). He showed down-to-the-south displacement on both faults. They probably represent tear accommodating differential compression on either side of the faults.

The queried northwest-trending fault in sec. 7, T. 26 S., R. 12 W., is based on (1) a satellite image lineament; (2) the change from a strong strike-slip controlled topography to the south to a more hummocky, more homoclinal topography to the north; and (3) a change in fold axis trend to a more northeastly course.

The north-northwest-trending down-to-the-north faults in secs. 4, 21, T. 26 S., R. 12 W., were mapped by Allen and Baldwin (1944), and both are consistent with high-angle reverse faults.

**Northeast-trending faults**

The queried northeast-trending fault in the central part of the quadrangle was discussed briefly in the section on folding. It is apparent as a satellite-image lineament and appears to offset the axes of a series of large folds.

South of the community of Eastside, a pair of northeast-trending faults offset a synclinal axis. These faults are also prominent satellite-image lineaments, and they appear to offset coal seams of the Coaledo Formation mapped by Allen and Baldwin (1944). They probably represent dextral tear faults.

**GEOLOGIC HISTORY**

The sedimentary rocks exposed in the Coos Bay quadrangle represent a fraction of the Tertiary history of the southern Oregon Coast Range. This history is discussed in more detail in Ryu and others (1992) and Black (1994).

Major events in the geologic history of the quadrangle include (1) gradual filling of a middle Eocene forearc basin with sedimentary rocks representing several marine transgressions and regressions; (2) deposition of sedimentary rocks of the Coos Basin (Coaledo Formation and younger rocks); (3) a period of nondeposition during the Oligocene and early Miocene; (4) the commencement of deformation in the late middle Miocene; (5) continuing clockwise tectonic rotation during the Tertiary; (6) continuing east-west compressional deformation resulting from oblique subduction on the Cascadia Subduction Zone; (7) a series of Pleistocene marine transgressions; and (8) Holocene erosion, alluvial and estuarine deposition, landsliding, and possibly minor active faulting (?)

A forearc basin formed at the location of the southern Oregon Coast Range during the middle Eocene, a result of subduction initiated offshore from the modern coastline. Pillow basalt encountered in the Northwest Exploration Westport #1 well represents Coast Range basement rock. At the time the seabed in the basin to the east of the quadrangle, younger members of the Tyee Formation (the slope mudstones of the Hubbard Creek Member and the fluvial Baughman Member) represent further filling of the basin in progressively shallower water. There followed a marine transgression, represented

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RESOURCE GEOLOGY

The Coos Bay area has a long history of mineral resource production. Coal mining in the Upper and Lower Coaledo Members began in 1854 and continued for about 100 years. Over 3,000,000 tons of coal were produced (Baldwin and others, 1973) from the Coos Bay region. Detailed studies of the coal occurrences and workings are available in Allen and Baldwin (1944), and Duncan (1953). A history of coal mining in the area is given by Beckham (1985).

Several oil and gas exploration wells have been drilled in or adjacent to the Coos Bay quadrangle over the years, most recently in 1993 (Steve Pappajohn, Carbon Energy International, personal communication, 1993). Only one well, the Northwest Exploration Company Westport #1, is located in the Coos Bay quadrangle. No oil or gas shows were reported (Olmstead, 1989). A second well, the Phillips Petroleum Company Dobyns 1, was drilled in the Charleston quadrangle, 5.5 km west of the quadrangle boundary (SW 1/4 sec. 28, T. 26 S., R. 13 W.). Gas sand was encountered at 1,040 ft, but no oil or gas shows were reported (Newton and others, 1980; Olmstead, 1989). Newton and others (1980) summarized oil and gas prospects in the Coos Bay area. Olmstead (1989) summarized the results from commercial oil and gas drilling through 1989. No commercial deposits of gas or oil have been found.

There are no significant gravel or rock resources in the Coos Bay quadrangle, largely because the sedimentary rocks present are too weathered or poorly consolidated for use as aggregate, road metal, or rip-rap.

Ground-water resources are likely to be highly variable in both quantity and quality in the Coos Bay quadrangle. The Coaledo Formation as a whole is poorly permeable (Brown and Newcomb, 1963; Newton and others, 1980), and where moderate permeability might be encountered in thick sandstone beds, the intense folding and faulting and interbedded mudstones might limit production. The Middle Member of the Coaledo Formation would be expected to be a poor aquifer because it is composed largely of mudstone, which results in poor permeability, and because it is areally restricted.

Alluvial units in the quadrangle will have the best porosity and permeability; but when near sea level, they may have water quality problems due to brackish water intrusion during pumping. Water quality in the Coaledo Formation may be impacted by the presence of numerous coal beds and carbonaceous sands.

GEOLOGIC HAZARDS

Geologic hazards and engineering geology of the Coos Bay quadrangle were described and mapped by Beaulieu and Hughes (1975). The major geologic hazards in the area are landslides, flooding, tsunamis, and earthquakes.

Minor surficial landslides and slumps occur on steep slopes, regardless of the underlying bedrock unit. These small landslides were not mapped. Because the sandstones in the area are fairly well indurated, there are relatively few large or deep-seated landslides, in spite of the many steep slopes cut parallel to bedding.

Flooding of low-lying alluvial floodplains and swamps is clearly a risk, and care should be taken to site structures above flood-prone areas.

In the adjacent Charleston quadrangle, there is a serious risk of tsunami inundation. In the Coos Bay quadrangle, the risk is less serious but still not trivial. Pre-
dicted runup elevations at the open coast from distant earthquakes that occur on average every 100 or 500 years are 8 ft and 16 ft, respectively, for North Bend-Coos Bay (Charland and Priest, 1995). The predicted runup elevation for a moment magnitude (Mw) 8.8 Cascadia Subduction Zone earthquake is between 12 and 22 ft at the open coast immediately to the west of the quadrangle (G.R. Priest, Oregon Department of Geology and Mineral Industries, unpublished data). These hypothesized numbers are the result of a reconnaissance-level assessment of the tsunami hazards along the Oregon coast, and apply only to the open coast. The barrier spit and bay will greatly reduce the runup height of any tsunami. The actual runup elevations will therefore be less than those cited above, but still significant. Local tsunamis originating from subduction zone earthquakes immediately offshore may arrive within minutes of the earthquake. When combined with coseismic subsidence (Briggs, 1984) in the bay, the tsunami effects may be significant. Residents and visitors to the area should consider a strong earthquake to be their only tsunami warning and should seek higher ground immediately.

The earthquake risk in the Coos Bay quadrangle is significant. Local earthquakes of magnitude Mw 5.5 are possible, based on minimum mapped fault lengths of up to 6 km and empirical relationships between fault length and magnitude (Wells and Coppersmith, 1994). In addition, the Coos Bay quadrangle, like all of coastal Oregon, would experience damaging shaking from subduction earthquakes occurring immediately offshore along the Cascadia Subduction Zone (Atwater, 1987, 1992; Darienzo and Peterson, 1990, 1995; Atwater and Yama-guchi, 1991; Nelson and Personius, 1991; Savage and Lisowski, 1991; Adams, 1990; Clarke and Carver, 1992). Liquefaction of unconsolidated sediments is possible due to shaking created by seismic activity.

To emphasize further the earthquake and tsunami risk in the Coos Bay quadrangle, Charland and Priest (1995) found that 19 of a total of 24 critical facilities (hospitals, fire and police stations, emergency vehicle shelters, communications centers, hazardous sites, major structures, and schools) are at risk from either ground shaking or tsunamis during a Mw 8.8 event on the Cascadia Subduction Zone. In North Bend, 16 of a total of 19 critical facilities are at risk. These numbers are typical for the Oregon coast. Since the chances of a great subduction zone earthquake in the next 50 years (Darienzo and Peterson, 1995) is between 10 and 20 percent, it is probable that the earthquake threat is the most serious geologic hazard facing the residents in the Coos Bay quadrangle.

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