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SOME REVISIONS OF THE GEOLOGY OF THE COOS BAY AREA, OREGON

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Introduction

This paper is a progress report on geologic mapping in part of the Coos Bay area (see Plate 1). The writer's interest in this area started in 1943 in connection with the State of Oregon-Coos County coal project (Allen and Baldwin, 1944) and has continued to the present. He is currently working toward a revision of the Coos Bay area, the area encompassed by the Coos Bay 30' quadrangle, as well as the Eocene stratigraphy of southwestern Oregon. The geology is complex and the area is thickly covered by alluvium, terrace deposits, and brush. Thus progress is slow and it may be some time until a more detailed revised map and report are published. The writer has been supported in this study by the Oregon Department of Geology and Mineral Industries, U. S. Geological Survey, and University of Oregon Faculty Research grants, and aided by graduate students at the University of Oregon who have mapped areas near Coos Bay.

Pioneer mapping by Diller (1901) and a later work by Turner (1938) added much to the knowledge of the Coos Bay area. More detailed bibliographic references as well as a revised geologic sketch map is given by Baldwin (1964). A recent paper by Dott (1966) describes the interesting internal structures in the Coaledo Formation and gives petrographic data. Regional mapping by Allen and Baldwin was done prior to detailed microfaunal studies, and such data came later (Detling, 1946; Cushman, Stewart, and Stewart, 1947; and Stewart, 1957). Unpublished data from R. E. Stewart and W. W. Rau have been helpful in dating formations.

Stratigraphy

Pre-Tertiary rocks

Jurassic and Cretaceous strata are present at the southern and southwestern margins of the Tertiary depositional basin. Formations are poorly defined and previous designations may be more confusing than helpful. Many of the strata containing greenstone, chert, and graywacke have been assigned to the Dothan Formation. However, a revised interpretation of coastal geology near Port Orford by Koch (1966) indicates that these beds are likely a northern extension of the Otter Point Formation of late Jurassic age. Koch also describes the lower Cretaceous Humbug Mountain Conglomerate and Rocky Point Formation, neither of which is known to be present in the Coos Bay area.

Rhythmically bedded turbidites of probable late Cretaceous age crop out at Fivemile Point north of Bandon and at the mouth of Crooked Creek south of Bandon. These strata are similar to beds north of Cape Blanco referred to by Dott (1962) in which he found belemnoids, a form that occurs mostly in Mesozoic rocks. Small spherical clay balls encompassed in the sandstone at both Fivemile Point and beds at the mouth of Crooked Creek weather light gray. They were noted in beds along upper Twomile Creek in secs. 33 and 34, T. 29 S., R. 14 W. mapped as lower Umpqua. Late Cretaceous strata such as those at Cape Sebastian (Howard and Dott, 1961) resemble Umpqua strata and are similarly deformed and would be difficult to separate in the field. There was apparently no significant break in deposition at the end of the Cretaceous, and the youngest Cretaceous strata are included in the lowest part of the Umpqua by Baldwin (1965).

Umpqua Formation

The oldest Cenozoic formation is the Umpqua, which has been divided into three mappable formations (Baldwin, 1965). These are to be named and described in a later publication (manuscript in preparation). The oldest of the Umpqua units apparently includes latest Cretaceous beds, Paleocene and early Eocene volcanic flows, and early Eocene eugeosynclinal sedimentary rocks. Although complete sections are not known, at least 10,000 feet is believed to be present where it crops out along Oregon Highway 42 between Coquille and Myrtle Point. A minimum of 8,000 feet of sedimentary rock is present in this section, and the volcanic and prevolcanic rocks probably exceed 2,000 feet. Small isolated patches of Umpqua basalt and tuffaceous sedimentary rocks of the lower unit crop out at the Forks of Coos River and along Willanch and Kentuck Creeks (Pl. 1).

The middle Umpqua unit occurs only along Bear Creek drainage southeast of Bandon and along Catching Creek west of Myrtle Point. It is made up of 5,000 feet of thin, rhythmically bedded graywacke and siltstone, including a variable thickness of basal conglomerate and pebbly sandstone. The basal beds seldom exceed 100 feet in thickness along Bear Creek but total more than 400 feet along Catching Creek. It rests unconformably upon the lower Umpqua at both places.

The upper Umpqua unit is present east of Remote along the Middle Fork of the Coquille River and east of the axis of the Coast Range, but is absent in the Coos Bay area.

Tyee Formation

The Tyee Formation, made up of massively bedded micaceous sandstone, crops out in the central part of the Coast Range and forms the hills in the eastern part of the Coos Bay area along the Coos and Millicoma Rivers. It grades upward into the Elkton Siltstone Member near Elkton northeast of the map area. Massive Tyee was mapped along the western edge of the Coos Bay coal field in Bear Creek drainage southeast of Bandon by Baldwin (manuscript in press). Along tributaries of Bear Creek the beds are overlain unconformably by the lower Coaledo and no siltstone is present. However, micaceous siltstone and thin-bedded sandstone crop out at Sacchi Beach 8 miles north of the nearest known Tyee exposure along the Coquille River. The massive phase of the Tyee does not crop out along the coast but is presumably downdropped against older strata a short distance north of Fivemile Point.

The beds at Sacchi Beach were called the Sacchi Beach Member of the Tyee Formation by Baldwin (1964) and apparently bear the same relationship to the more massive Tyee that the Elkton and Lorane Siltstone Members do at Elkton and west of Eugene. In both instances the massive Tyee sandstone grades upward into the siltstone members.

Pre-Coaledo - Post-Tyee beds

Allen and Baldwin (1944) and others have suggested that the sea withdrew and regional erosion occurred prior to the return of the Coaledo seas, and others have postulated a break at the base of Spencer and Cowlitz Formations to the north. Dott (1966) questions this and postulates little if any break at the base of the Coaledo. Yet one need not leave the Coos Bay area to prove the unconformable relationship, because the Coaledo Formation rests on eroded Tyee and in proximity with lower Umpqua basalt at the forks of Coos River and on a much thicker section of Tyee a few miles to the south or north. No trace of the Sacchi Beach or Elkton Siltstone Members is present at the base of the Coaledo other than at Sacchi Beach. At the south end of the basin along the tributaries of Bear Creek the basal Coaledo conglomeratic and pebbly sandstone beds rest in turn from south to north on lower Umpqua, middle Umpqua, massive Tyee, and then, with a terrace-covered gap of 7 to 8 miles, on the Sacchi Beach Member. It is reasonable to carry the unconformity northward to Sacchi Beach, where the break would be of lesser duration.

Baldwin (1961) mapped beds in the center of the Coast Range south of Elkton as Coaledo (?). These beds cap Old Blue, Rainy Peak, and Soup Mountain in the Elkton and Scottsburg quadrangles. Similar strata were found at Bateman Lookout and southward in the Tyee and Ivers Peak quadrangles. Although in many places they are parallel, on the regional basis the beds show some overlapping from the underlying Elkton Siltstone

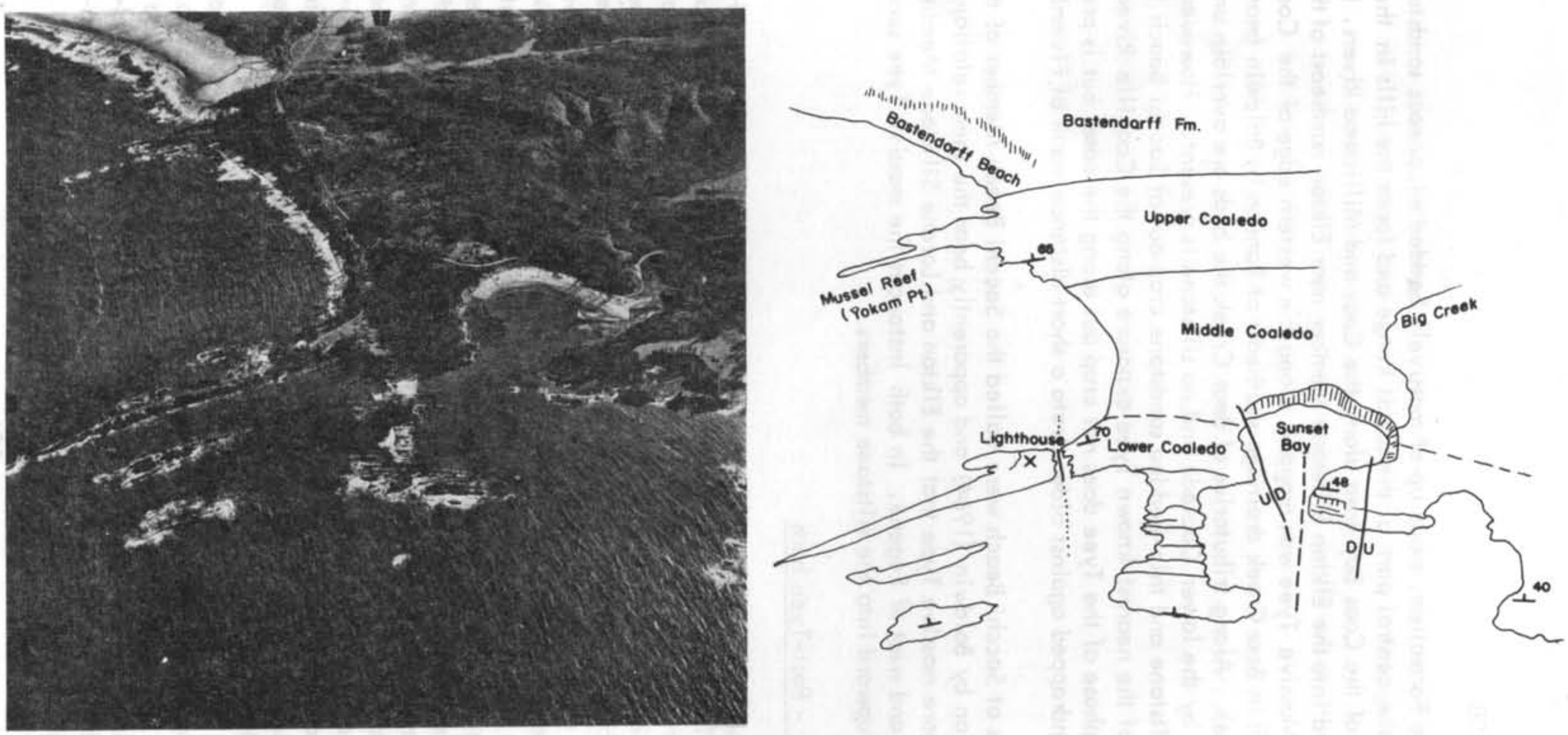

Figure 1. Aerial photograph and sketch of Sunset Bay and vicinity. (Photograph: University of California, Hydraulic Eng. Lab.)

Member toward the more massive Tyee and thus may be slightly disconformable.

Work in the Tyee and Ivers Peak quadrangles has led the writer to consider these beds pre-Coaledo and post-Tyee. The beds, although micaceous, lack the rhythmic bedding of the Tyee and instead include some coal beds. They were evidently laid in deltaic conditions where marine and nonmarine strata interfingered -- conditions similar to those of the Coaledo Formation. The sandstone was probably laid down during an offlap of the Tyee seas. Fossils are not abundant, but Venericardia califia was collected from these beds in the center of sec. 13, T. 25 S., R. 9 W. at the head of the North Fork of Bottom Creek. This distinctive fossil is abundant in the Tyee but has not been reported from the Coaledo. The beds mapped as Coaledo (?) in the Elkton and Scottsburg quadrangles are to be described and named as a new formation. These beds are not recognized in the Sacchi Beach area, where that part of the section is likely missing. R. E. Stewart and W. W. Rau considered the Sacchi Beach fauna to be late middle or early upper Eocene, a part of the B-1A stages of Laiming.

Coaledo Formation

The Coaledo Formation is made up of approximately 6,000 feet of coal-bearing beds of late Eocene age that was first divided into lower, middle, and upper members by Turner (1938). These subdivisions were mapped regionally by Allen and Baldwin (1944), the latest regional mapping of the Coos Bay field. Coal is present in both the lower and upper members, but the middle member is more argillaceous and not coal bearing. Later work in the Coos Bay area has not changed this concept appreciably. It is possible that the base of the upper Coaledo in the coastal area should be drawn somewhat lower at the expense of the middle Coaledo and this is done on Figure 1. The units are transitional and there is a zone about 400 feet thick in which about equal amounts of sandstone and siltstone are present. If encountered inland, the contact would probably be placed lower at the base of the sandstone. Thus some of the differences in thickness cited regionally may be due to interfingering of sandstone and siltstone along strike. An adjusted thickness for the upper Coaledo in the coastal section is 1,715 feet and for the middle Coaledo 2,525 feet.

The middle Coaledo appears to thin at the southern and eastern margins of the basin, as would be expected during an onlap followed by an offlap of seas to the west. The middle Coaledo likely graded laterally into sandstone along the margin of the basin, beds of which are now removed by erosion.

The tip of Cape Arago is labeled as upper Coaledo on the map (Allen and Baldwin, 1944), but this was a mechanical error, for it was considered to be lower Coaledo even at the time of mapping (see page 23).

Turner (1938) considered the channeling in North Cove to represent

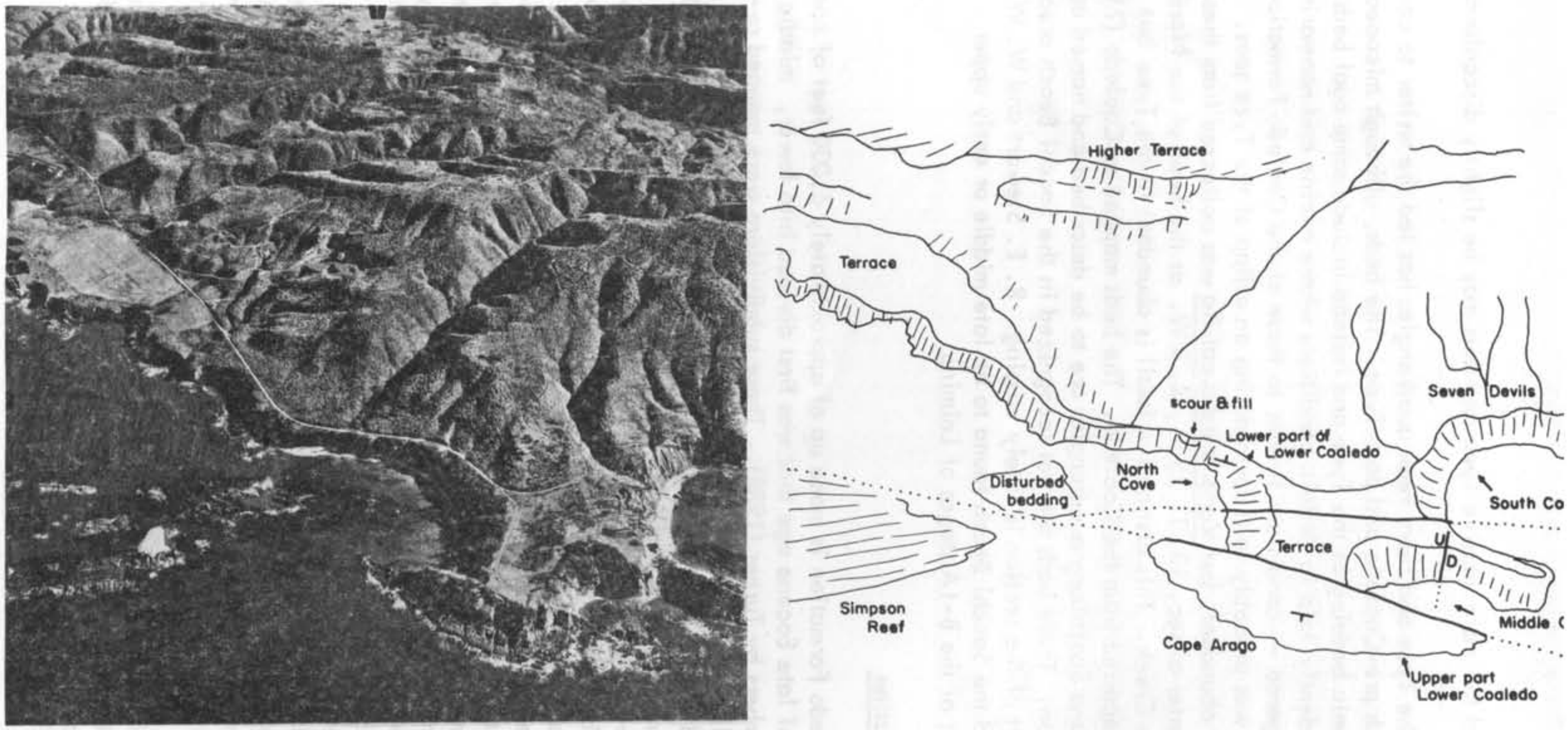

Figure 2. Aerial photograph and sketch of Cape Arago and vicinity. (Photograph: University of California, Hydraulic Eng. Lab.)

the basal unconformity of the Coaledo Formation. Further study of the Cape Arago area (Fig. 2) as well as the Coaledo Formation indicates that the formation was laid down as deltaic shallow-water sediments with swampy margins and interfingering continental beds in which primary sedimentary features such as cross-bedding, scour and fill channeling, and slump structures occurred. Channeling such as that seen in North Cove is now considered by the writer to be intra Coaledo and does not represent the bottom. Beds in the fault zone at Cape Arago, formerly mapped as Umpqua by Allen and Baldwin (1944), are now considered by the writer to be Coaledo, and their greater steepness is attributed to disturbance along the fault or faults. Lithologically they are more similar to the thin-bedded micaceous and carbonaceous sandstone in the Coaledo than to beds in the Sacchi Beach Member of the Tyee.

Bastendorff Formation*

The Bastendorff Formation is conformable upon the Coaledo Formation. It consists of 2,900 feet of shale which crops out at Bastendorff Beach. Stewart (1957) shows that the formation is both upper Eocene and lower Oligocene. The upper 700 feet of the section is comparable to the Refugian stage of California, according to Stewart.

Tunnel Point Formation

The Tunnel Point Formation crops out between the Bastendorff Formation and the Empire Formation southwest of the Coos Bay Jetty near the east end of Bastendorff Beach. The upper part of the section is not exposed, but it may grade upward into siltier beds much as the Yaquina Formation of comparable age apparently interfingers and grades upward to the Nye Mudstone at Yaquina Bay (Snavely, Rau, and Wagner, 1964). The cross section of the South Slough syncline (Fig. 3) shows that there may be room for the Nye Mudstone to be present and still leave space for an appreciable thickness of both the Tunnel Point and Miocene beds.

The Tunnel Point Formation on the geological map (Allen and Baldwin, 1944) was shown extending northward under the broad beach to the jetty. Actually, it should not extend north of the cliff line. The eastern margin as shown on the 1944 map is too close to the south end of the jetty, which is against beds of the Empire Formation (see Plate 1 of the current report).

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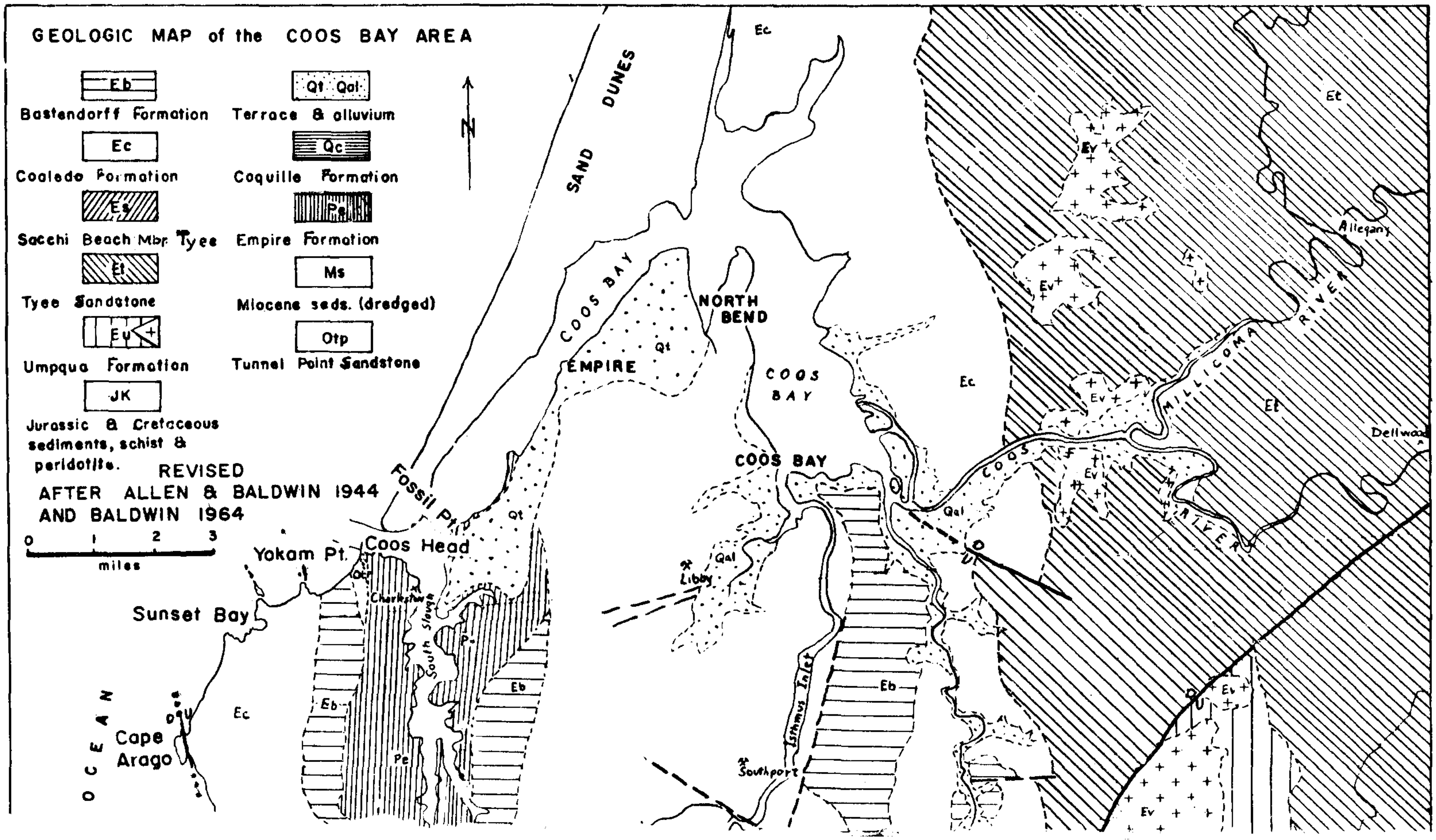
* The correct spelling of Bastendorff, according to the U. S. Board of Geographic Names.



GEOLOGIC MAP of the COOS BAY AREA
Eb
Bastendorff Formation
Qt Qal
Terrace & alluvium
Ec
Coaledo Formation
Qc
Coquille Formation
Es
Sacchi Beach Mbr. Tyee
Pe
Empire Formation
Et
Tyee Sandstone
Ms
Miocene seds. (dredged)
Ev
Umpqua Formation
Otp
Tunnel Point Sandstone
JK
Jurassic & Cretaceous sediments, schist & peridotite.
REVISED
AFTER ALLEN & BALDWIN 1944
AND BALDWIN 1964
0 1 2 3
miles
N
SAND DUNES
COOS BAY
EMPIRE
NORTH BEND
COOS BAY
COOS BAY
Fossil Pt.
Coos Head
Yokam Pt.
Sunset Bay
Cape Arago
OCEAN
Charleston
South Slough
Libby
Isthmus Inlet
Southport
COOS RIVER
MILLICOMA RIVER
Allegany
Dellwood

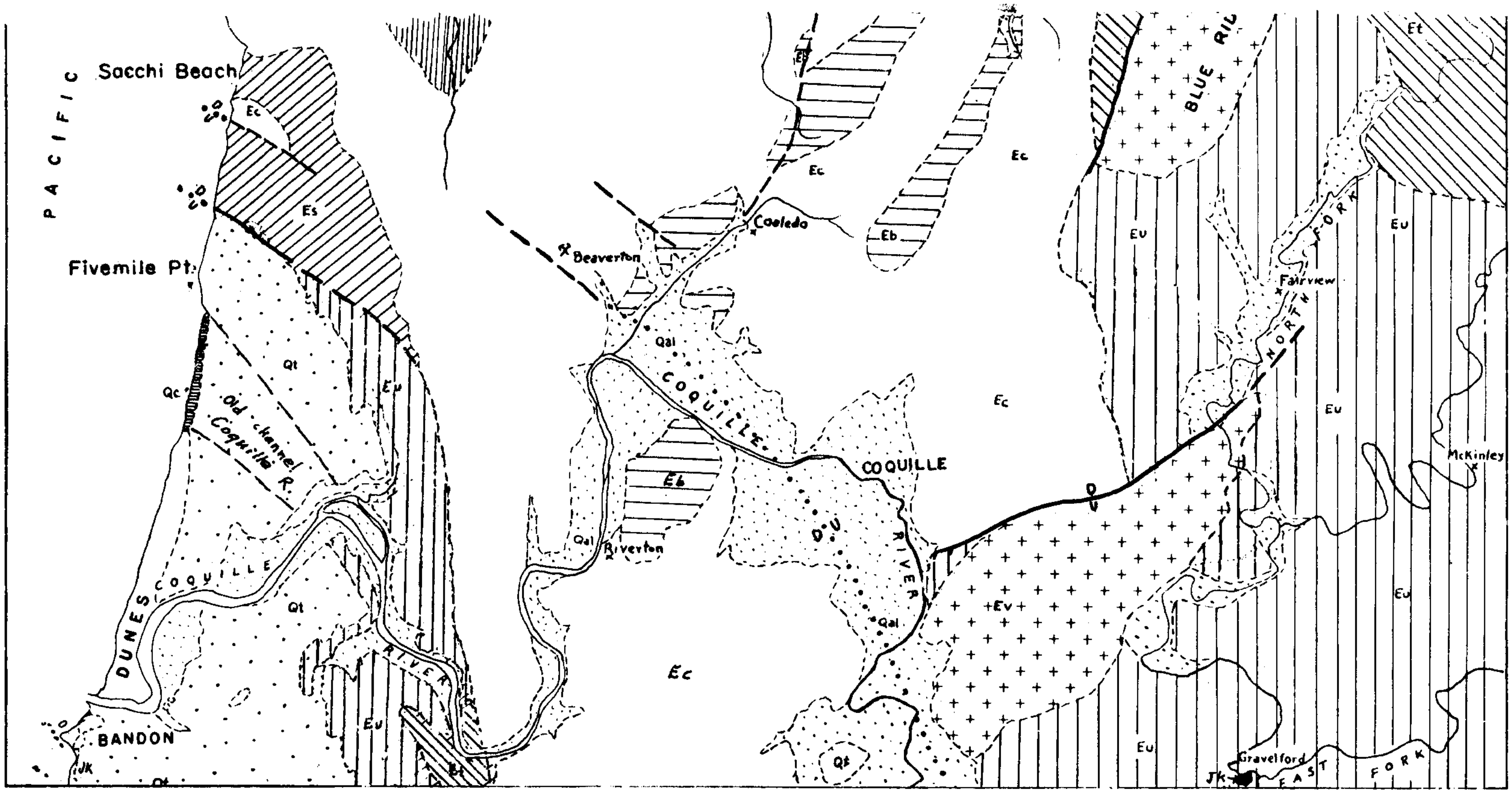
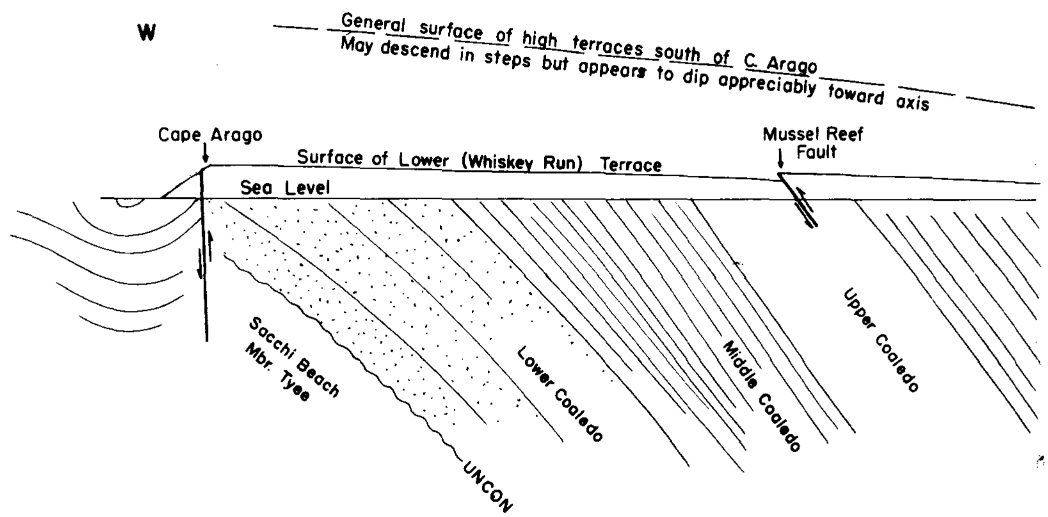


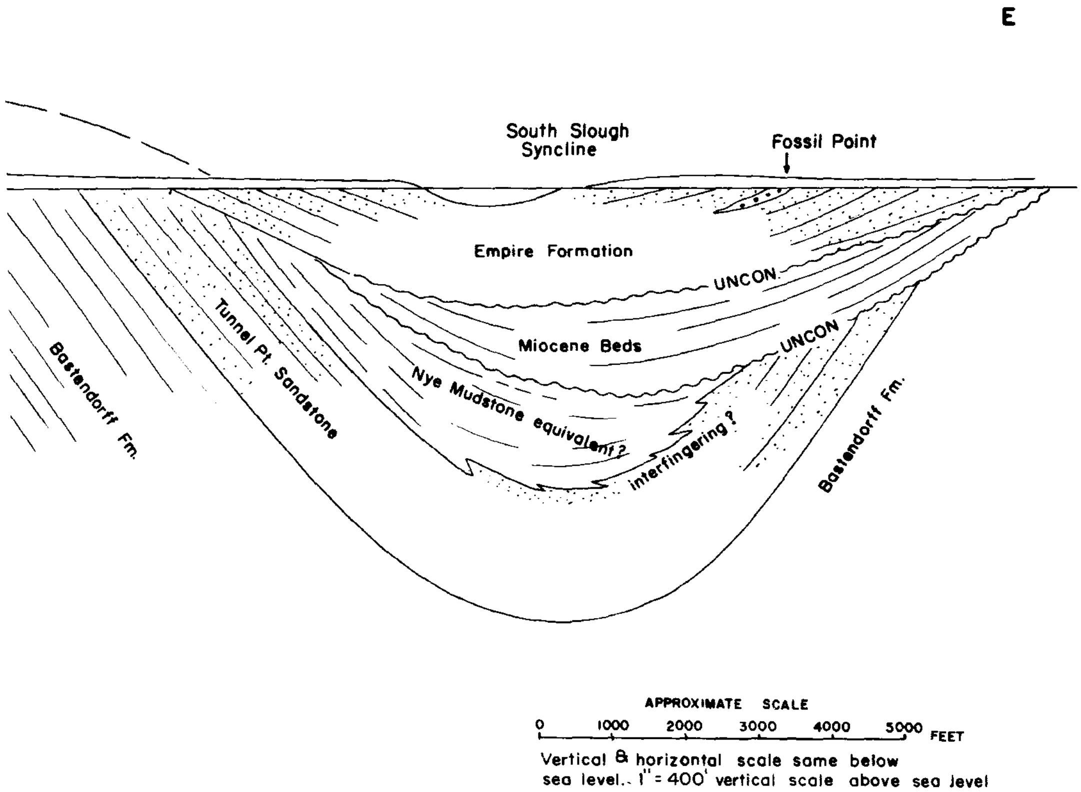
PLATE 1. GENERALIZED GEOLOGIC MAP OF PART OF THE COOS BAY AREA, OREGON.



igure 3. Schematic cross section through a part of the South Slough syncline from vicinity of Cape Arago to a point near Empire, showing progressive deformation along axis of syncline.

1. Late Oligocene to early Miocene deformation involving Tunnel Point and older Eocene beds.
2. Implied deformation during late Miocene involving Miocene beds.
3. Post Empire Formation deformation during middle and late Pliocene.
4. Deformation of older terraces with dip toward axis (may be in part steplike withdrawal of sea).
5. Inclination of Whiskey Run terrace toward axis during late Pleistocene.
6. Post terrace (late Pleistocene) fault at Mussel Reef indicating continued compression.

As shown, there is ample room in center of syncline for beds equivalent to the Nye Mudstone which may interfinger with the upper part of the Tunnel Point Sandstone and for a thickened section of Miocene beds which are not exposed at the western edge of the basin but which have been found in restricted area by Armentrout at eastern margin.



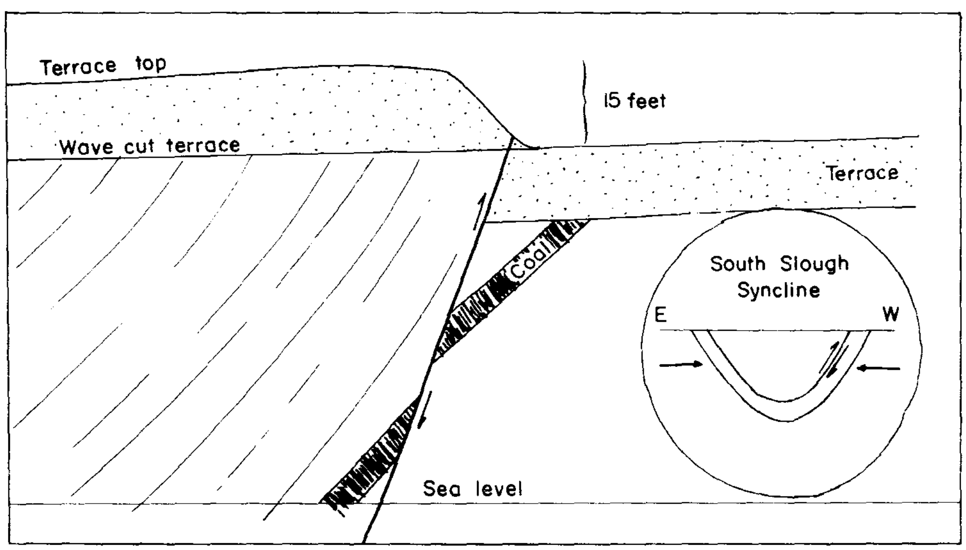


Figure 4. Small fault at Mussel Reef offsetting the late Pleistocene terrace. Continued compression is implied. Relation to South Slough syncline is shown in inset.

Miocene beds

Miocene beds were discovered during dredging of Coos Bay by the U.S. Corps of Engineers. The dredgings contained abundant fossils which were described by Moore (1963). She concluded that the fossils are lower to middle Miocene and in beds generally equivalent to the Temblor of California but not closely resembling Oregon Miocene faunas. The fauna in the dredgings contained numerous specimens of the genus Dosinia. None of this genus has appeared in the younger Empire Formation at Fossil Point where fossils in blocks are obviously reworked. It seems evident that the reworking is within the Empire Formation and did not affect older Miocene beds. A projection of older formations in the South Slough syncline indicates that there is room for a considerable thickness of Miocene strata in the center. John Armentrout (oral communication, September 1966) has found a thin section of the Miocene beds cropping out along the northeastern margin of the basin. The beds are only a few feet thick where exposed and dip gently at about the same angle as the overlying Empire beds.

Empire Formation

The Empire Formation occupies the center of the South Slough syncline, and is made up of as much as 3,000 feet of massive sandstone. It contains the well-known Fossil Point locality. The Empire Formation was dated as lower and middle Pliocene with a possibility of uppermost Miocene (Weaver, 1942, 1945). Armentrout is currently restudying the Empire fauna. Loose fossils similar to those in the Empire Formation are relatively common along the beach at the mouth of the Coquille River. One of the few outcrops of the Empire Formation between Coos Bay and Cape Blanco occurs at the mouth of China Creek 3 miles south of Bandon. Poorly exposed beds at the Fish Hatchery on Ferry Creek a mile east of Bandon are tentatively considered to be Empire by the writer.

Coquille Formation

The Coquille Formation of late Pleistocene age was named and described by Baldwin (1945, 1964). It is best exposed north of the present mouth of the Coquille River between the mouths of Whiskey Run and Cut Creeks and it represents the position of the river mouth at the time of deposition. The formation contains semiconsolidated conglomerate, sandstone, and mudstone with numerous stumps and logs, all of which were deposited in a bay during a stage of alluviation similar to that taking place today.

Pleistocene terraces

Pleistocene events were confined largely to terrace formation. A series of terraces reaching as high as Blue Ridge at 1,500 feet has been described by Griggs (1945). In the South Slough area higher terraces are almost 600 feet high south of Cape Arago but dip noticeably toward the axis of the syncline, pointing to definite tilting eastward. The latest terrace, the Whiskey Run terrace of Griggs (1945), has been warped (Baldwin, 1945). It is 125 feet at Cape Arago, lower at Shore Acres and Sunset Bay, and approximately 25 to 30 feet at Fossil Point (Fig. 3).

Structural Geology

Faulting

Several prominent faults have been discovered since 1944. Baldwin (1964) has shown a fault contact between the lower Coaledo and the Umpqua along Hall Creek west of Myrtle Point and another northeast-trending fault paralleling the north side of the Umpqua basalt east of Coquille, where the Coaledo is faulted against the basalt. He would now add a prominent parallel fault along the northwest side of Blue Ridge and continue it northeast to Coos River about a mile east of the margin of the Coos Bay 15' quadrangle (Pl. 1).

Geophysical work by H. R. Blank (U.S. Geological Survey open-file report, 1965) indicates that a northwesterly trending fault is buried beneath the Coquille River sediments. The basalt mass south of Coquille drops abruptly to the southwest. This fault is parallel to smaller faults in the Beaver Hill area and along the coast at the south end of Sacchi Beach and with the larger one a short distance north of Fivemile Point.

A prominent fault through Cape Arago with a branch in Middle Cove was mapped by Allen and Baldwin (1944). The block between Middle and South Coves has many subsidiary fractures with small displacement. In the cape there is little evidence for other than simple dip slip. However, where the fault zone cuts diagonally northwest across Simpson reef, at the north tip of the cape, considerable brecciation and drag on beds suggest that there may be some strike slip (Fig. 2).

Nearly all small coves are located where erosion has been aided by existing faults, many of them with only a few feet of displacement. The entrance to Sunset Bay represents erosion along an intersection of several parallel and intersecting faults (Fig. 1). On an areal photograph the various resistant beds may be traced across the entrance to the bay even though offset by faulting. Vertical movement on dipping beds can give an apparent horizontal offset, but this is often more apparent than real, and that is perhaps the case at Sunset Bay where small horizontal separation may be seen.

Terraces in the Cape Arago area are particularly well displayed, for many of the bays give a three-dimensional view of both the terrace surface and the wave-cut platform upon which the terraces lie. Several post-terrace faults have been observed. The most distinctive is at the coal bed along the west side of Mussel Reef (Yokam Point). At this place the strike of the fault is parallel to the beds, although the dip may be somewhat steeper. It appears to be a steep reverse fault roughly parallel to the beds (Fig. 4).

Folding and warping

The principal structure in the Coos Bay area is the north-plunging coal basin that extends from Grigsby Rock west of Myrtle Point to the Coos Bay area. Within it are subsidiary folds of which the South Slough syncline is one of the best known (Pl. 1 and Fig. 3). Cape Arago is on the western limb in an area of the best exposures. Folding followed the build-up of more than 10,000 feet of late Eocene to middle Oligocene strata. The Coaledo Formation commonly dips 60° to 70°, much steeper than the older Tyee Formation a short distance to the east in the Coast Range. The Bastendorff and Tunnel Point Formations share this steep dip. An unconformity between the Tunnel Point and the Miocene beds is implied and still another is indicated beneath the Empire Formation, for it laps onto the Tunnel Point, Bastendorff, and Coaledo Formations (Pl. 1 and Fig. 3).

The evidence suggests that there has been intermittent folding along the South Slough synclinal axis ever since deposition of the thick section of Eocene and Oligocene beds. Recurrent folding is shown by progressive deformation of each succeeding formation, by tilting of the terraces, and by the small dip-slip fault offsetting the youngest terrace. Folding is attributed to continued, although intermittent, compression.

Bibliography

Allen, J. E., and Baldwin, E. M., 1944, Geology and coal resources of the Coos Bay quadrangle: Oregon Dept. Geology and Mineral Industries Bull. 27, 153 p.

Baldwin, E. M., 1945, Some revisions of the Late Cenozoic stratigraphy of the southern Oregon Coast: Jour. Geology, vol. 52, p. 35-46.

__________, 1961, Geologic map of the lower Umpqua River area, Oregon: U.S. Geol. Survey Oil and Gas Inv. Map OM-204.

__________, 1964, Geology of Oregon, 2nd ed.: Eugene, Oregon, 165 p.

__________, 1965, Geology of the south end of the Oregon Coast Range Tertiary Basin: Northwest Sci., vol. 39, p. 93-103.

Cushman, J. A., Stewart, R. E., and Stewart, K.C., 1947, Five papers on foraminifera from the Tertiary of western Oregon: Oregon Dept. Geology and Mineral Industries Bull. 36, Pts. III and IV, p. 57-93.

Detling, M. R., 1946, Foraminifera of the Coos Bay lower Tertiary, Coos County, Oregon: Jour. Paleont., vol. 20, p. 348-361.

Diller, J. S., 1901, Description of the Coos Bay quadrangle: U.S. Geol. Survey Geol. Atlas, Coos Bay folio, No. 73.
Dott, R. H. Jr., 1962, Geology of the Cape Blanco area, southwest Oregon: Oregon Dept. Geology and Mineral Industries The ORE BIN, vol. 24, p. 121-133.
__________, 1966, Eocene deltaic sedimentation at Coos Bay, Oregon: Jour. Geology, vol. 74, no. 4, p. 373-420.
Griggs, A. B., 1945, Chromite-bearing sands of the southern part of the coast of Oregon: U.S. Geol. Survey Bull. 945-E, 150 p.
Howard, J. K., and Dott, R. H., Jr., 1961, Geology of Cape Sebastian State Park and its regional relationship: The ORE BIN, vol. 23, p. 75-81.
Koch, J. G., 1966, Late Mesozoic stratigraphy and tectonic history, Port Orford-Gold Beach area, southwestern Oregon coast: Am. Assoc. Petroleum Geologists Bull., vol. 50, p. 25-71.
Moore, E. J., 1963, Miocene marine mollusks from the Astoria Formation in Oregon: U.S. Geol. Survey Prof. Paper 419, 100 p.
Snavely, P. D., Jr., Rau, W. W., and Wagner, H. C., 1964, Miocene stratigraphy of the Yaquina Bay area, Newport, Oregon: The ORE BIN, vol. 26, no. 8, p. 133-151.
Stewart, R. E., 1957, Stratigraphic implications of some Cenozoic foraminifera from western Oregon: The ORE BIN, vol. 19, p. 11-15.
Turner, F. E., 1938, Stratigraphy and mollusca of the Eocene of western Oregon: Geol. Soc. America Spec. Paper 10, 130 p.
Weaver, C. E., 1942, Paleontology of the marine Tertiary formations of Oregon and Washington: Univ. Washington Pub. in Geol., vol. 5, Pts. I, II, III, 790 p.
__________, 1945, Stratigraphy and paleontology of the Tertiary formations at Coos Bay, Oregon: Univ. Washington Pub. in Geol., vol. 6, no. 2.

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LUNAR CONFERENCE TRANSACTIONS PUBLISHED

The Department of Geology and Mineral Industries has published "Transactions of the Lunar Geological Field Conference," a companion publication to the Lunar Geological Field Conference Guide Book which was printed a year ago. The Transactions volume contains 11 papers and 7 abstracts prepared by lunar geologists and geophysicists who attended the conference. The 100 pages of articles are illustrated with 46 photographs, tables, and line drawings. The publication was sponsored by the University of Oregon Department of Geology and by the New York Academy of Sciences. Copies of the Transactions are available from the Department of Geology and Mineral Industries for $2.00 postpaid.

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U. O. MUSEUM ISSUES THIRD BULLETIN

The University of Oregon Museum of Natural History has issued Bulletin No. 3 entitled "A New Archaic Cetacean from the Oligocene of Northwest Oregon," by Douglas Emlong. The author discovered this unusual fossil whale in March 1964 in the Yaquina Formation near Seal Rock State Park, Lincoln County. The bulletin may be obtained from the Museum of Natural History, University of Orégon, Eugene, Oregon. The price is $1.50.

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GUIDE TO MINERAL INDUSTRY EDUCATION PUBLISHED

The American Mining Congress has published a guide to mineral industry education in American universities entitled "Profiles in Mineral Industry Education." It describes university programs in 21 American mining schools. Purpose of the publication is to help increase the enrollment in the technologies which serve the mining industry -- mining engineering, geology, metallurgy and others. Presently there is a critical shortage of university-trained technical personnel but, while the demand is rising for people with this training, enrollment has declined.

Copies are available without cost to high school and university guidance counselors and industry officials engaged in counseling young people for a future in the mineral industry; write to the American Mining Congress, 1100 Ring Building, Washington D.C. 20036.

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MOUNT VERNON QUADRANGLE MAP FOR SALE

"Geologic Map of the Mount Vernon Quadrangle, Grant County, Oregon," by C. Ervin Brown and T. P. Thayer, has just been issued by the U.S. Geological Survey as Map GQ-548. The multicolored map is accompanied by cross sections and a descriptive text outlining the geologic history of the area. It may be obtained from the U.S. Geological Survey, Federal Center, Denver, Colo. The price is $1.00.

The Mount Vernon quadrangle lies in the west-central part of Grant County between long 119°00'-119°15' and lat 44°15'-44°30'. The southern half of the area is underlain almost entirely by Paleozoic and Mesozoic rocks of late Permian to Early Jurassic age which, in some places, have been intruded by diorite or granodiorite stocks of Late Jurassic or Early Cretaceous age. In the northern half of the quadrangle, these older rocks are overlain unconformably by Cenozoic non-marine sediments and volcanics.

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