ONSHORE

FORMATIONAL

UNITS

Beach and river

deposits

Coastal terraces

innamed siltstone

Empire Fm

Astoria Fm Nye Mudstone

Alsea Fm

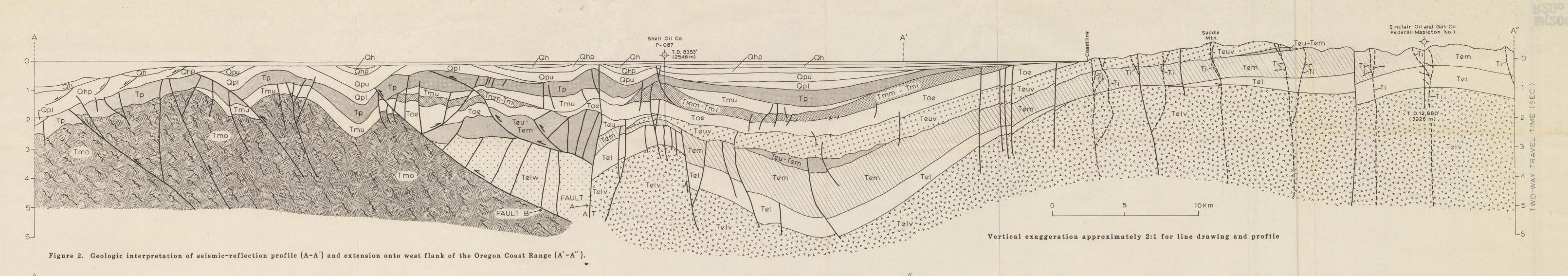


Figure 3. 24-channel seismic-reflection profile A-A'.

GEOLOGIC CROSS SECTION OF THE SOUTHERN OREGON COAST RANGE AND ADJACENT CONTINENTAL SHELF

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Introduction

In order to understand more fully the tectonic and stratigraphic framework of the Oregon and Washington continental margin, a series of landsea cross sections are being prepared. These sections are based upon onshore geologic mapping, the interpretation of 24-channel seismic-reflection profiles, and the correlation of acoustical units with the subsurface stratigraphy encountered in deep exploratory test wells drilled offshore by industry in the mid-1960's (Braislin and others, 1971; Snavely and others, 1977). The first published cross section in the series for the Oregon continental margin using this kind of information (see fig. 1, line MC 28J) was prepared for the U.S. Geodynamics Committee and published by the Geological Society of America in their Map and Chart Series (Snavely and

The geologic cross section A-A" (fig. 2), described in this report, extends generally westward from the Oregon Coast Range to the edge of the continental shelf at latitude 44°12'N (fig. 1). The geology used to construct the onshore portion of this cross section is based upon onshore geologic mapping by Baldwin (1956), unpublished mapping by Snavely in the Heceta Head and Mapleton quadrangles, and on subsurface data in Sinclair Oil and Gas Company's Federal-Mapleton No. 1 well (fig. 6). The interpretation of the offshore geology is based mainly upon a 24-channel seismic-reflection profile (fig. 3) collected aboard the U.S. Geological Survey's Research Vessel S. P. LEE and subsurface stratigraphic data in Shell Oil Company's offshore P-087 well (fig. 5). We express our appreciation to Shell Oil Company for permission to publish the results of our paleontological and petrographic studies of samples made available by Shell from their well. Other data collected along the profile include deep-penetration singlechannel and high-resolution seismic-reflection profiles and magnetic and gravity data. The geologic interpretation, where extrapolated westward from the shoreline to the eastern end of seismic profile A-A', is simplified as it is based on a shallow-penetration single-channel seismic reflection profile collected by Oregon State University (Kulm and Fowler, 1970).

Three cross sections for the southern Oregon continental margin immediately south of geologic cross section A-A" have already been published (fig. 1). They are based upon geophysical data and subsurface information in Union Oil Company Fulmar P-0130 well and Sinclair Federal-Mapleton No. 1 well (fig. 1). Braislin and others (1971) constructed a diagrammatic regional cross section from Heceta Bank eastward to the Cascade Range which showed the generalized Tertiary structure and stratigraphy. Seely and others (1974) presented an interpretation of a 12-channel seismic-reflection profile that extended from the abyssal plain to a point on the continental shelf about midway between Union P-0130 well and the coastline. In their report they propose that imbricate thrusting accounts for the structural thickening and uplift of sediments on the continental slope of this and other convergent continental margins. The tectonic framework of the Oregon and Washington outer continental margin and slope, as interpreted from our 24-channel seismic profiles (e.g. Snavely and others, 1980), agrees in most respects with the compressional thrusting and folding model proposed by Seely and others (1974). Couch and Braman (1980) presented a regional crustal section from the abyssal plain eastward across Heceta Bank to the Willamette Valley. Their cross section presents a geologic interpretation based chiefly on their gravity data.

Stratigraphy

The discussion of the stratigraphy along cross section A-A" is presented in a time-stratigraphic sense because onshore formations that crop out in the Coast Range cannot be correlated directly with the offshore units. Also, many of the onshore formations lose their characteristic lithologies seaward due to changes in facies that reflect deeper water depositional environments. We have, however, made provisional correlations (fig. 4) between onshore formations in the Oregon Coast Range and the offshore time stratigraphic units indicated in the cross section.

Early to middle Eocene. -- Pillow lavas, breccias, and basaltic sedi-

mentary rocks of early to middle Eocene age, which form the basement rocks in the Oregon Coast Range and on the inner continental shelf, are assigned to the lower and middle Eocene Siletz River Volcanics (Snavely and Baldwin, 1948; Snavely and others, 1968). Tholeiitic pillow lavas of early Eocene age in the lower part of this sequence are considered to be oceanic-ridge basalts which locally are overlain by alkalic and tholeiitic basalt flows with interbedded basaltic sandstone and siltstone that formed oceanic islands or seamounts of middle Eocene age (Snavely and others, 1968, 1980). The Mapleton well in the eastern part of the cross section (figs. 2, 6) penetrated about 2000 m of dark-gray porphyritic and amygdaloidal olivineand augite-bearing pillow basalt of the Siletz River Volcanics of early Eocene age (unit Telv). The basalt is veined by calcite, celadonite, and zeolite minerals. These lavas are inferred to extend westward beneath the inner continental shelf to a point just west of Shell P-087 well (fig. 2) where they presumably terminate against transform fault A (figs. 1, 2). The fault contact between these basalts (unit Telv) and a thick sequence of lower Eocene wackes (unit Telw) to the west occurs along a linear magnetic anomaly with a west facing steep gradient as shown on an aeromagnetic map published by the U.S. Geological Survey (1970). This contact has been interpreted as a transform fault between the Pacific (Farallon) and American plates (Snavely and others, 1980).

The lower Eocene wackes (unit Telw) west of transform fault A (figs. 1,2) were penetrated in both Union P-0130 well and Pan American Oil Company (now AMOCO Production Corporation) P-0112 well south of the cross section (fig. 1). In well P-0130 the strata consist of 2000 m of sheared dense zeolitized, micaceous, arkosic wacke with interbedded siltstone of early Eocene age. More than 900 m of these wackes were encountered in well P-0112. The lower Eocene wacke is interpreted as not extending west of thrust fault B, as it is presumed to have been subducted along this fault during a period of plate convergence in middle late Eocene time (Snavely and others, 1980). The near vertical faults that cut the wacke sequence west of Fault A and those that cut the lower and middle Eocene rocks east of fault A probably are multiple breaks within the broad zone dextral movement along transform fault

A sequence of well-indurated dark-gray finely micaceous siltstone 1280 m thick with minor basaltic sandstone and tuff interbeds (unit Tel) overlies the Siletz River Volcanics in the Mapleton well (fig. 6). The siltstone is commonly veined with calcite and intruded by basalt and diabase(?) dikes or sills. A 200 m basal member of the siltstone sequence was described in the well as a "microconglomerate;" however, based upon the company's description of sidewall cores, we interpret this member as a water-laid vitric and crystal tuff which contains subhedral crystals of augite, feldspar, calcite, and basalt grains set in a calcareous matrix.

The "microconglomerate" member in the Mapleton well probably correlates with the Wilbur tuff lentils mapped by Diller (1898) in the Roseburg area and with a tuff member of the Umpqua Formation described by Hoover (1963) in the Anlauf-Drain area. This water-laid calcareous fine to lapilli vitric and crystal tuff, with an admixture of basaltic sandstone and pebble conglomerate, may represent material eroded from volcanic islands. It was probably deposited along the unconformable contact between the lower Eocene Siletz River Volcanics and an overlying lower to middle Eocene siltstone sequence. Foraminifers in Wilbur tuff equivalents in the Anlauf-Drain area are assigned to the Penutian Stage and coccoliths to the Discoaster lodoensis Zone both of early Eocene age.

Although foraminiferal data were not available from the Mapleton well, a stratigraphic correlation can be made with units dated by Rau (1973a) in the Mobil Oil Company Long Bell No. 1 well drilled about 42 km south of the Mapleton well (fig. 1). This correlation indicates that the siltstone sequence (unit Tel) in the Mapleton well probably ranges in age from the early Eocene Penutian Stage in the lower part to the middle Eocene part of the Ulatisian Stage in the upper part. A siltstone sample from a depth of 1460 m in the Mapleton well contained a coccolith fauna indicative of the Tribrachiatus orthostylus Zone or Discoaster lodoensis Zone of coccoliths (Bukry, 1973, 1975; Okada and Bukry, 1980) of early or late early Eocene age. The lower to middle Eocene siltstone in the Mapleton well (unit Tel) correlates with the siltstone member of the Umpqua Formation mapped by Hoover (1963) in the Anlauf and Drain quadrangles on the east flank of the southern part of the Coast Range.

In cross section A-A" (fig. 2) the lower to middle(?) Eocene siltstone (unit Tel) is interpreted to underlie the shelf as far west as transform fault A and was penetrated in the lower 140 m of Shell P-087 well (fig. 5). A siltstone sample from near the top of this unit, at a depth of 2405 m, was assigned to the late early Eocene Discoaster lodoensis Zone (table 2).

Turbidite sandstone of middle Eocene age, more than 2000 m thick, unconformably overlies the older siltstone sequence or basalt flows in the southern part of the Oregon Coast Range. This micaceous, carbonaceous, arkosic sandstone with minor siltstone interbeds (unit Tem) crops out in the eastern part of the cross section and is assigned to the Tyee Formation (Baldwin, 1956; Snavely and others, 1964b). More than 700 m of Tyee sandstone was drilled in the Mapleton well, but less than 300 m of calcareous-cemented micaceous, feldspathic, quartzose sandstone and siltstone (unit Tem) is present in the Shell P-087 well (fig. 5). The sandstone and siltstone unit in Shell P-087 well is inferred to correlate with the Tyee Formation. Unit Tem apparently does not extend west of transform fault A, as strata similar in age and lithology were not encountered south of the cross section in wells P-0112 and P-0130 west of fault A. (fig. 1). The greatly reduced thickness of the Tyee turbidites across the faulted anticlinal structure, or horst, in the vicinity of Shell P-087 well may be due to the upper part of the sequence having been cut out along an unconformity at the base of the overlying upper Eocene volcanic and sedimentary rocks. Despite these obvious erosional effects, some thinning could have resulted from penecontemporaneous structural growth of the horst fold during deposition of

foraminifers assigned to the upper part of the Ulatisian Stage of middle Eocene age. In Shell P-087 well, siltstone strata (unit Tem), which we correlate with the Tyee Formation, also contains a middle Eocene (upper Ulatisian) foraminiferal fauna (table 1). Sparse coccoliths from a siltstone bed near the base of unit Tem, at a depth of 2405 m, indicate a late middle Eocene or late Eocene age (table 2).

In the Oregon Coast Range the Tyee Formation (unit Tem) contains

Middle to late Eocene undifferentiated .-- Acoustic unit Teu-Tem, which appears as several complex packets of disrupted reflectors west of transform fault A, overlies the lower Eocene wackes (unit Telw) and, in turn, is overlain by a less internally deformed unit (Toe). This latter unit (Toe) correlates with Oligocene (Zemorrian) and upper Eocene (Refugian) strata penetrated in Shell P-087 well (fig. 5) to the east. Although there is no direct evidence as to the age of unit Teu-Tem on the line of cross section, about 50 m of upper Eocene (Refugian) siltstone, which contains reworked middle Eocene (Ulatisian) foraminifers, was penetrated near the contact with the lower Eocene wackes in Union P-0130 well drilled about 20 km south of the cross section (fig. 1). McKeel (1980, p. 40) reports that more than 200 m of the lower part of the upper Eocene (early Narizian) and the upper part of the middle Eocene (late Ulatisian) strata are present above the lower Eocene wacke (Telw) in Pan American P-0112 well about 100 km south of the cross section (fig. 1). Therefore, we infer that acoustical unit Teu-Tem in the cross section consists of a sequence of middle and lower upper Eocene siltstones and claystones that were deposited on the lower Eocene wackes (Telw) west of transform fault A. These strata probably were intensely deformed during northward transport along dextral fault A to the latitude of cross section A-A' and were later deformed by thrusting that accompanied subduction along fault B.

Unit Teu-Tem does not extend west of thrust fault B as it is presumed to have been subducted along with unit Telw during the initial middle late Eocene movement along this fault. Renewed movement along both transform fault A and thrust fault B in post-late Eocene time is apparent as both faults cut sediments as young as Quaternary.

Late Eocene.--Upper Eocene basaltic rocks of the Yachats Basalt (Snavely and MacLeod, 1974) probably correlate with a distinctive acoustic unit of high-amplitude reflections on profile A-A'. This suite of porphyritic basalt and basaltic andesite (unit Teuv) is about 750 m thick in the Coast Range along the eastern part of the geologic cross section. In the Cape Perpetua area (fig. 1), subaerial flows of Yachats Basalt in places overlie upper Eocene (Narizian) siltstone of the Nestucca Formation (Snavely and others, 1976a); elsewhere the flows overlap the siltstone and rest on the middle Eocene Tyee Formation. North of Cape Perpetua the Yachats Basalt grades laterally into tuffaceous siltstone of the Nestucca Formation. Subaerial flows and associated feeder dikes constitute the bulk of the sequence; however, along the coast near Heceta Head (fig. 1) submarine pillow lava, tuff-breccia, and basaltic sandstone and conglomerate are common in the sequence. Farther seaward (on the continental shelf), therefore, one would expect the Yachats Basalt to consist of products predominantly of submarine volcanism, such as pillow lava, breccia, and water-laid lapilli tuff and basaltic sedimentary rocks. The increased thickness of unit Teuv in the axial part of the deep inner shelf basin (fig. 2), suggests that breccias and volcaniclastic rocks may have filled this structural low. Only about 230 m of basaltic rocks were penetrated in Shell P-087 well in the interval between 1887 and 2118 m. Westward, unit Teuv appears to lens out between Shell P-087 well and fault A. In the well, these rocks have an interval velocity of about 3400 m/sec. Samples from this unit were not available for petrographic study, but sidewall cores were described by company geologists as varicolored tuffs and breccias composed of detrital grains of basalt and olivine, amygdules, and tuffaceous claystone interbeds. The lithology of this upper Eocene water-laid volcanic sequence (unit Teuv) in Shell P-087 well is similar to that of volcanic rocks cored in Union P-093 well located about 30 km to the north (fig. 1). A study of thin sections from the upper Eocene basaltic rocks in Union P-093 well indicates that this facies of the Yachats Basalt consists of conglomerate composed mainly of porphyritic andesite together with coarse- to medium-grained sandstone and tuffaceous claystone containing detrital grains of porphyritic basalt and andesite,

Eocene to Oligocene. -- A sequence, consisting principally of upper Eocene (Refugian) and Oligocene (Zemorrian) tuffaceous siltstone and very fine grained sandstone with interbeds of glauconitic sandstone, light-gray tuff, and pumiceous lapilli tuff, crops out along the west flank of the Coast Range and is widespread on the Oregon continental shelf. These strata (unit Toe) are referred to the Alsea Formation (Snavely and others, 1975). In cross section A-A', strata correlative to the Alsea Formation unconformably overlie older rocks as far west as thrust fault B (fig. 2). Strata equivalent to unit Toe west of fault A were penetrated in Pan American P-0112 well and Union P-0130 well (fig. 1); in P-0130, equivalents of unit Toe rest

plagioclase, and finely crystalline limestone.

unconformably on lower Eocene (Penutian) wackes (Telw).

Strata correlative to the Alsea Formation were penetrated in the interval between 1310 and 1890 m in Shell's P-087 well (fig. 5). This argillaceous unit (Toe), as described from sidewall cores, consists of olive-gray massive silty claystone and siltstone with minor amounts of glauconite, mica, and carbonaceous material. A foraminiferal fauna, typical of the onshore Alsea Formation, occurs in this 580 m interval (table 1). The lower part of unit Toe is assigned to the late Eocene Refugian Stage and the upper part to the Oligocene Zemorrian Stage (fig. 5). These faunas indicate an upper bathyal (150-500 m) environment of deposition for strata assigned to unit Toe in the well.

Late Oligocene and middle Miocene undifferentiated. -- Although no direct evidence is available regarding the nature of the acoustic basement west of thrust fault B. this unit is assumed to be an accretionary wedge of upper Oligocene to middle Miocene melange and broken formation. It is speculated that this acoustic basement (unit Tmo) may be similar to the structurally complex Hoh assemblage of late Oligocene to middle Miocene age which is exposed along the west side of the Olympic Peninsula (Rau, 1973b, 1975). The Hoh forms the acoustic basement on much of the Washington inner continental shelf where it has been penetrated by several test wells. Seismic-reflection profiles there show a pronounced unconformity between upper Miocene and younger strata and an acoustic basement that in the wells and along coastal Washington consists of sheared siltstone containing large blocks of zeo-

litized graywacke of late Oligocene to middle Miocene age.

Early and middle Miocene. -- In the Newport area, north of the cross section (fig. 1), the deep-water Nye Mudstone of early Miocene age and the shallow-water sandstone and siltstone of the Astoria Formation of middle Miocene age form two distinct lithologic sequences (Snavely and others, 1964, 1976b). Seaward, however, the Astoria Formation equivalent is predominantly siltstone (Snavely and others, 1980) and a lithologic distinction between the Nye Mudstone and Astoria Formation is difficult to discern. The lower to middle Miocene argillaceous strata (unit Tmm-Tml) penetrated in Shell P-087 well (fig. 5) is therefore considered to represent an undifferentiated Nye-Astoria sequence. In cross section A-A", unit Tmm-Tml extends from the east flank of the deep inner shelf basin westward to thrust fault B. Midway between Shell's P-087 well and thrust fault B, unit Tmm-Tml was apparently cut out by erosion along the unconformity at the base of the overlying upper Miocene strata (unit Tmu). Erosion at the base of the upper Miocene sequence is also suggested in the inner shelf basin (fig. 2), where unit Tmm-Tml appears to be thinnest in the axial part. The unconformity at the base of the upper Miocene is of regional extent, and, in many places, older strata have been uplifted and truncated along this unconformity (Snavely and others, 1980).

In Shell's P-087 well, from a depth of 655 to 1310 m, the lower and middle Miocene unit (Tmm-Tml) is described as chocolate-brown or olive-gray firm siltstone with calcareous concretions and a few beds of well-sorted, fine-grained friable sandstone. The siltstone is finely micaceous and some of the sandstone contains glauconite grains. For aminifera from this sequence indicate an early to middle Miocene (Saucesian Stage) age (table 1) and an upper bathyal (150-500 m) depositional environment. Diatoms and silicoflagellates from siltstone near the top of the unit, at a depth of 865 m, are of late middle Miocene age (table 2).

Late Miocene. -- The presence of upper Miocene strata (unit Tmu) along the line of cross section is conjectural, but is based upon the presence of an acoustic unit that unconformably overlies older strata (units Toe and Tmm-Tml) and is, in turn, overlain by Pliocene sedimentary rocks (unit Tp). Although upper Miocene strata are interpreted to occur both east and west of Shell P-087 well, they were not encountered in the well, possibly because the strata were either not deposited across the anticlinal high or were removed by erosion prior to deposition of the Pliocene sedimentary rocks. The presence of unit Tmu west of the well is supported by the occurrence of about 230 m of siltstone of late Miocene age in Union P-0130 well drilled west of transform fault A about 20 km south of the cross section (fig. 1). The nearest onshore exposure of upper Miocene rocks is about 100 km south of the cross section at Coos Bay. There, shallow-water sandstone of the upper Miocene Empire Formation is exposed at Coos Head (Diller, 1896; Addicott, 1976: Armentrout, 1980).

Pliocene. -- Strata of Pliocene age (unit Tp) are interpreted to be present across the entire shelf, but are of variable thickness due to episodic vertical tectonic movements during deposition and, in places, to erosion along channels. In Shell P-087 well this unit is about 300 m thick (fig. 5) and consists of olive to gray massive claystone with minor amounts of very fine grained sandstone.

Samples were not available from Shell P-087 well for age determinations; however, a tenuous correlation of the acoustic unit assigned a Pliocene age on cross section A-A" can be made with Union P-0130 well about 20 km south of the cross section. In this well, about 200 m of Pliocene strata disconformably overlies upper Miocene strata.

Pleistocene and Holocene deposits. -- The four uppermost acoustic units differentiated on the cross section are interpreted to represent a thick sequence of Quaternary sediments (units Qpl, Qpu, Qhp, Qh). Essentially continuous sedimentation appears to have taken place in the inner shelf basin between Shell P-087 well and the coastline. West of the Shell well, on the outer shelf, unconformities occur at the bases of Quaternary units Qpl and Qpu reflecting youthful tectonic activity in this area. These unconformities occur in the syncline west of thrust fault B and are readily apparent on the seismic profile (fig. 3). They are interpreted to reflect erosion and deposition in young synclines related to warping during subduction.

The three younger Quaternary units (Qpu, Qhp, Qh) that are interpreted as having been penetrated in Shell P-087 well (fig. 2) can not be differentiated on lithologic or paleontologic grounds. The general lithology of these sediments in the well is medium-gray massive semi-consolidated siltstone and very fine grained well-sorted sandstone. Near the shelf edge and on the upper slope the Quaternary deposits appear to be involved in mass movement as their internal structure is complex. Ages of these four acoustic units (Qpl, Qpu, Qhp, Qh) were interpreted solely from superposition and relation to unconformities, as no age data were available.

Tectonic Framework

The interpretation of the stratigraphy and structure along cross section A-A" across the Oregon continental margin is speculative as the unmigrated 24channel seismic profile varies in quality and, except for Shell's P-087 well, critical subsurface stratigraphic data are absent. Despite these limiting factors, the cross section clearly indicates that the continental margin has been subjected to both compressional and extensional tectonics during between the Pacific (Farallon) and North American plates to have been episodic with periods of underthrusting in early middle Eocene, middle late Eocene, late middle Miocene, and Pleistocene-Holocene times. These periods of underthrusting were interrupted by major dextral transcurrent faulting in late middle to early late Eocene time and by periods of extension during late Eccene to middle Miccene time. Fault A on the cross section (fig. 2) reflects the period of late middle to early late Eocene dextral faulting that juxtaposed the lower Eocene wackes (unit Telw) and the lower and middle Eocene volcanics (unit Telv). The major movement along fault A occurred prior to the deposition of late Eocene and Oligocene strata (unit Toe) which overlap the fault. Minor renewed transcurrent movement apparently occurred along this zone of weakness, however, as faults probably related to fault A cut sediments as young as Quaternary. Movement along transcurrent fault A appears to have produced an outer shelf high that defined the western border of an inner shelf basin during middle to middle late Eocene time. About 68 km north of cross section A-A", a similar high was formed by lower and middle Eocene basalt and middle Eocene sedimentary rocks (Snavely and others, 1980). On an unpublished USGS 24-channel profile 45 km south of cross section A-A", a high is also present along the western margin of the inner shelf basin. It is therefore speculated that in middle to middle late Eocene time a shelf edge high existed east of transcurrent fault A (fig. 1) and that this high may have extended from near Coos Bay at least as far north as latitude 45°N.

The major period of underthrusting is considered to have taken place in middle late Eocene time along thrust fault B (fig. 2) when middle and lower Eocene strata (units Telw and Teu-Tem) were subducted. Renewed movement along fault B in late middle Miocene resulted in the subduction of units Toe and Tmm-Tml. Regional unconformities at the bases of upper Eocene and of late Miocene rocks mark these periods of deformation. Movement along fault B may have continued into Holocene time with slip at depth being expressed as a fold at the surface (fig. 2). Underthrusting, which is presently active along the base of the continental slope of Oregon and Washington, reactivated many of the earlier imbricate thrust faults on the outer shelf and slope along section A-A'. Many high-angle faults, some with normal and others with reverse offsets, displace the strata and are particularly common on anticlinal structures such as that drilled by Shell Oil Company.

The cross section indicates several zones of major vertical crustal movements. Uplift and folding along a group of landward-dipping imbricate thrust faults dominate the outer shelf, episodic but essentially continuous downwarping characterizes the inner shelf basin and uplift since post middle Oligocene time dominates in the Coast Range (Snavely and others, 1980). The broad and gentle folds in post lower Eocene strata in the southern Oregon Coast Range may reflect a greater distance of this sequence above the down-

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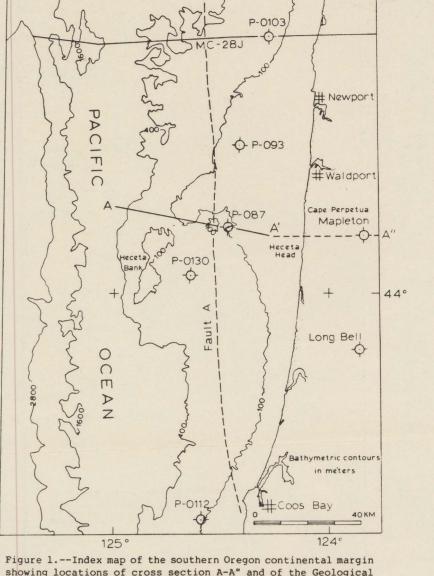
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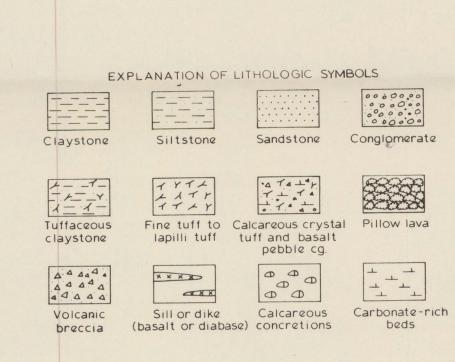
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Teu-Tem Tem River Volcanics * Equivalents of Telw not recognized onshore Figure 4.--Chart showing inferred correlation of offshore timestratigraphic units and onshore formations. - R R F F - F - R F Buccella mansfieldi oregonensis Cushman, R. E. and K. C. Stewart.

OFFSHORE

TIME-STRATIGRAPHIC

UNITS

Qhp

Qpu

Qpi

Holocene

Pleistocene

Pliocene

Miocene middle

Oligocene

Table 1.--Checklist of Foraminifera in Shell Oil Company P-087. Identifications by W. W. Rau. [Symbols of frequency of occurrence: C, common; F, few; R, rare; ?, questionable identifications; (R), contamination (?)]

Gyroidina condoni Cushman and Schenck(?)..........

Cassidulina globosa Hantken(?)...............

Cibicides martinezensis Cushman and Barksdale - -

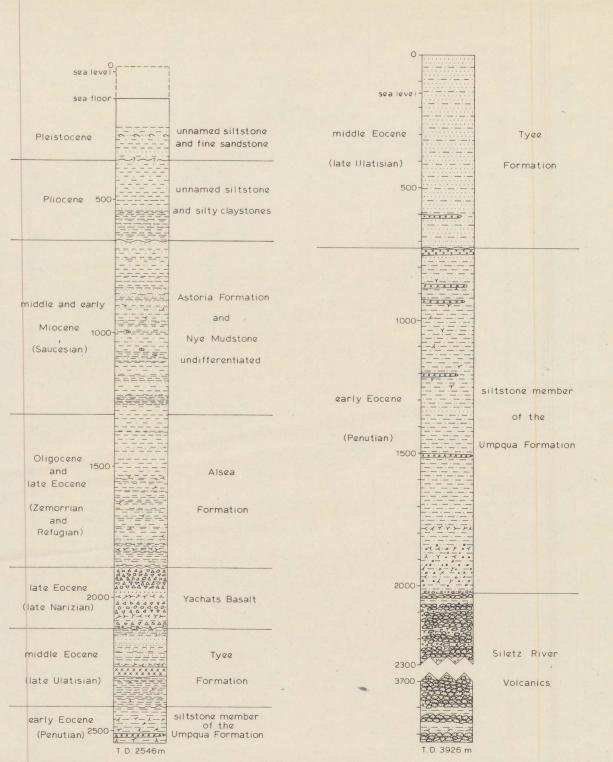


Figure 6. -- Lithologic log of Sinclair Oil and

Gas Company Federal-Mapleton No. 1 well show-

ing ages of formations penetrated. Depth in

meters measured from ground surface 147 m

above sea level.

Figure 5. -- Lithologic log of Shell Oil Com-

trated and inferred correlation of onland

formations. Depth in Meters measured from

kelly bushing 21 m above sea level.

pany P-087 well showing ages of units pene-

Actinocyclus sp. cf. A. ingens Rattray Denticula hustedtii Simonsen & Kanaya. x Rhaphoneis amphiceros Ehrenberg; varieties x Mesocena circulus (Ehrenberg).....x Calcareous nannoplankton-Braarudosphaera bigelowii (Gran & Braarud) Chiasmolithus grandis (Bramlette & Riedel) Coccolithus eopelagicus (Bramlette & Riedel) Cyclicargolithus pseudogammation (Bouche)..... C. sp. cf. C. pseudogammation (Bouche) Dictyococcites bisectus (Hay, Mohler, & Wade). Discoaster barbadiensis (Bramlette & Riedel) D. sp. cf. D. nodifer (Bramlette & Riedel) Discoasteroides kuepperi (Stradner)...... Discolithina plana (Bramlette & Sullivan). Ellipsolithus lajollaensis Bukry & Percival. Helicosphaera lophota Bramlette & Sullivan R. samodurovii (Hay, Mohler, & Wade) Table 2.--Checklist of Phytoplankton in Shell Oil Company P-087. Identifications by

GEOLOGIC CROSS SECTION OF THE SOUTHERN OREGON COAST RANGE AND ADJACENT CONTINENTAL SHELF

1981

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