



BIOSTRATIGRAPHY OF EXPLORATORY WELLS, SOUTHERN WILLAMETTE BASIN, OREGON

1985

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
DONALD A. HULL, STATE GEOLOGIST

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
1005 State Office Building, Portland, Oregon 97201

OIL AND GAS INVESTIGATION 13

**BIOSTRATIGRAPHY OF EXPLORATORY WELLS,
SOUTHERN WILLAMETTE BASIN, OREGON**

By
Daniel R. McKeel
1985

This material was prepared with the support of the U.S. Department of Energy (DOE) Grant No. DE-FG51-79R000011. However, any opinions, findings, conclusions, or recommendations expressed herein are those of the author and do not necessarily reflect the views of DOE.



GOVERNING BOARD

Allen P. Stinchfield
Donald A. Haagensen
Sidney R. Johnson

North Bend
Portland
Baker

STATE GEOLOGIST

Donald A. Hull

DEPUTY STATE GEOLOGIST

John D. Beaulieu

NOTICE

The Oregon Department of Geology and Mineral Industries
is publishing this paper because the subject matter is
consistent with the mission of the Department.
To facilitate timely distribution of information,
camera-ready copy submitted by the author
has not been edited by the staff of the
Oregon Department of Geology and Mineral Industries

TABLE OF CONTENTS

SECTION I. OVERVIEW	Page
Introduction	1
Sample Coverage and Processing	1
Fossil Correlations	1
Lithologic Correlations	2
Paleoenvironmental Trends	2
SECTION II. FORAMINIFERAL REPORTS	
American Quasar Petroleum Company, Wolverton No. 13-31	5
Humble Oil and Refining Company, Miller No. 1	6
American Quasar Petroleum Company, Henschel No. 17-34	8
American Quasar Petroleum Company, M & P Farms No. 33-24	9
American Quasar Petroleum Company, Hickey No. 9-12	11
American Quasar Petroleum Company, Kenneth Wetgen et al. No. 26-32	12
Gulf Oil Corporation of California, T. J. Porter No. 1	12
Mobil Corporation, Ira Baker No. 1	14
Reserve Oil and Gas Company, Esmond No. 1	15
REFERENCES CITED	17
ILLUSTRATIONS	
Figure 1. Composite Subsurface Stratigraphy and Paleobathymetric Curve	3
Plate 1. Subsurface Correlation Chart	(back cover)

SECTION I. OVERVIEW

INTRODUCTION

Soon after Oregon's 1979 Mist Field discovery, exploratory drilling dramatically increased in the Willamette Basin as far south as Linn County. Five American Quasar wells, all included in this report, were drilled from late 1980 to fall, 1981. They averaged 3800 ft in depth.

Four older wells also are included in this study. One of them, the Humble Miller No. 1, was previously reported on by this writer in Oregon Department of Geology and Mineral Industries (D.O.G. A.M.I.) Open File Report 0-80-1. The other three, the Gulf Porter No. 1, Mobil Ira Baker No. 1, and Reserve Esmond No. 1, were deep tests, with total depths averaging 9160 ft.

This report provides detailed biostratigraphy of fossiliferous strata in the southern Willamette Basin in or very near Linn County. It is the aim of this investigation to present fossil sequences for contrast and comparison to those in the northern Willamette Basin (see McKeel, 1984).

Section II includes individual foraminiferal reports for the nine wells. Each well report contains an introductory summary, followed by interval listings of fossil and key lithologic highest occurrences. Highest occurrences are listed in descending order within each interval. Primarily only highest occurrences are used here because of extensive downhole contamination in ditch samples. The well reports are concluded by interpretations of age (benthic foraminiferal Stage) and paleobathymetry for each distinctive well interval.

Concluding this report (back cover) is an illustration containing a surface location map and selected subsurface correlations for all but one of the wells in the form of a generally north-south cross section.

The writer is most grateful to A.D. Warren, ARCO Exploration Company, Lafayette, for his careful review of the manuscript. Thanks are also extended to W. G. Bruer, for helpful correspondence on correlation problems with several wells in this study.

SAMPLE COVERAGE AND PROCESSING

Interpretations in this study are based on 987 samples (590 wet ditch, 395 dry ditch, and 2 cores). Sample coverage varies from one ditch sample analyzed for each 30 ft of section to only one 30 ft sample every 90 ft of section. In this study, best sample coverage, and hence the most reliable data, were obtained from the five American Quasar wells. Poorest sample coverage through fossiliferous section is from the Humble Miller and Gulf Porter wells. Therefore, interpretations for these two well sections are more tentative. Although the largely volcanic Mobil Ira Baker and Reserve Esmond

sections were spottily sampled, it is believed that their potentially fossiliferous portions were adequately examined.

Raw material from each sample was boiled for 20 minutes in a 32 to 1 water to Quaternary "0" (Zingula, 1968) solution. Fossils were not concentrated by flotation, thereby eliminating the possibility of losing replaced, infilled, or arenaceous specimens in the tailings.

FOSSIL CORRELATIONS

California benthic foraminiferal Stages of Schenck and Kleinpell (1936), and Mallory (1959) are used in this study. Based on rare but distinctive planktic foraminiferal occurrences, strata recognized herein as Refugian, Narizian, and upper Ulatisian, represent the following regional ages:

uppermost Refugian = early Oligocene
rest of Refugian = late Eocene
upper Narizian = late Eocene
lower Narizian = late middle Eocene
upper Ulatisian = early middle Eocene

Stage boundaries are of little use in correlating wells in the southern Willamette Basin, because fossiliferous well sections in this area are largely of Narizian age. Fossiliferous upper Narizian sediments, so prevalent in the east Nehalem and southwestern portion of the northern Willamette Basins (McKeel, 1983 and 1984, respectively) appear to be missing in all well sections of this study except in the American Quasar Wolverton No. 13-31. Therefore, highest Narizian sediments, based only on highest *Cibicides natlandi*, do not necessarily correlate in the southern Willamette Basin. Additionally, the Ulatisian-Narizian boundary, present only in the Gulf Porter section of this report, is obscured by shallow shelf facies.

Highest occurrences of a few individual Narizian species, and often several in sequence, are useful in correlating the wells of this study. One benthic Narizian "undifferentiated" sequence, in several hundred ft of section, contains (in descending order) *Gyroidina "scalata"* (of Cushman, et. al., 1949, Part VI), *Cassidulina globosa*, ostracod variety (deep median sulcus), and common shell fragments (see Plate 1, back cover). This sequence is present in the four most northwesterly wells in the study area. It also appears to exist, although less well defined, to the south, in the Wetgen and Porter well sections.

Another useful fossil sequence, in this case of lower Narizian age, is present in 2000 ft of section in the American Quasar M & P Farms No. 33-24. Key species making up this sequence, in descending order

of highest occurrences, are: spherical radiolaria, *Gyroidina simiensis*, s.l., *Gaudryina coalingensis*, *Cibicides* sp. (of Mallory, 1959, pl. 23), the genus *Truncorotaloides* (second occurrence), *Baggina teninensis*, *Amphimorphina californica*, and abundant large spherical radiolaria. This sequence occurs only in the M & P Farms well section of this study. However, essentially the same sequence has been identified in three well sections in the northern Willamette Basin (McKeel, 1984, Plate 1).

In this study area, the two above described fossil sequences generally bracket the "Miller Sand Member" considered to be upper Yamhill Formation by Bruer, et. al. (1984) (see Figure 1).

Two other fossil highest occurrences may prove to be useful for correlation of deeper wells, at least throughout the western Willamette Basin. In this study, the Gulf Porter No. 1 yielded a horizon of large Foraminifera at the herein proposed Ulatisian-Narizian boundary. Another 1000 ft down the section, the highest *Planorotalites* cf. *P. planiconica* occurs in the upper Ulatisian. These same two fossil highest occurrences, also essentially 1000 ft apart, occur in the Reichhold Finn No. 1, in the northern Willamette Basin (McKeel, 1984, Plate 1).

A total of 18 highest occurrences of species were selected for illustration on Plate 1. As was found for the northern Willamette Basin (McKeel, 1984), benthic species in the southern Willamette Basin were found to be more useful as a whole for correlation of post-Ulatisian strata, whereas planktic fossils are more reliable in Ulatisian sediments, which were deposited farther from shore.

Most benthic species chosen for correlation in this study lived on the upper to upper middle slope. Highest occurrences of species outside this habitat range appear to be less reliable for correlation in this basin.

Finally, the stratigraphic occurrence of the primarily Narizian planktic genus *Globigerinatheka* is noteworthy. In this study, *Globigerinatheka* was found to be restricted to mudstones of the uppermost Spencer Formation, above Bruer's, et. al. (1984) "Spencer Sand Member" (see Figure 1). It was found only in the Wolverton No. 13-31, from 1380 to 1530 ft. Supporting a restricted range of *Globigerinatheka* in the Willamette Basin is its only known occurrence in the northern part of the basin, in the Quintana Gath No. 1 section, at 3960 and 3990 ft (McKeel, 1984). It is essentially at this depth in the Gath where a maximum upper Narizian transgression occurred, just after deposition of the Spencer Sand. Also in upper Narizian sediments, just above the Clark & Wilson Sand in several Mist area well sections of the east Nehalem Basin, Columbia County, is where *Globigerinatheka* essentially is restricted. One anomaly near Mist is the occurrence of *Globigerinatheka* from 6760 to 6860 ft in the American Quasar No. 25-33, below thick volcanics. This would extend the range of *Globigerinatheka* down into strata considered to be pre-Cowlitz by Bruer, et. al. (1984). However, this occurrence may be down hole contamination from a deep water richly fossiliferous upper Narizian horizon above the volcanics, which contains *Globigerinatheka*.

LITHOLOGIC CORRELATIONS

A few distinctive lithologies are useful for correlation in this study area, but none extend the

full length of the southern Willamette Basin.

Above the "Miller Sand" Member of Bruer's et. al. (1984) Yamhill Formation, a thin Narizian glauconitic sandstone can be traced southwest from the Wolverton well to the M & P Farms (see Plate 1). A lignite/coal horizon just below this glauconitic sandstone is possibly correlative in the Henschel, M & P Farms, and Hickey sections. Finally, a thin layer of rounded rock fragments a short distance below the lignite/coal appears to correlate in the Henschel and M & P Farms.

Also in the northern part of the study area, below the "Miller Sand", are two distinctive lithology changes (going down section) which essentially coincide with key fossil horizons. The upper one is a Narizian gray to olive brown siltstone, which contains highest occurrences of radiolaria, and is present in the Miller, Henschel, and M & P Farms (see Plate 1). The second, and older one, is a brown mudstone, at the top of the proposed lower Narizian, which contains highest *Gyroidina simiensis*, s.l.

In the southern portion of the study area, two correlating lithologies were noted. The younger one is a horizon of rounded coarse sand, close to the Narizian-Refugian boundary in the Wetgen and Porter wells, and possibly also in the Ira Baker section. The older one is the top of Narizian volcanics in the Wetgen and Porter wells.

Finally, a general difference in appearance between the Spencer and Miller Sands of Bruer, et. al. (1984) was noted to the north in the Wolverton through M & P Farms sections. The Spencer Sand (between correlation lines 4 and 5, Plate 1) contains noticeably less volcanic material in it than does the underlying Miller Sand (between correlation lines 6 and 10, Plate 1). However, the two sand bodies were not so distinguishable to the south, due to poorer fossil control between them.

PALEOENVIRONMENTAL TRENDS

A paleobathymetric curve for a composite section in the study area is illustrated in Figure 1. Interpretations of water depth throughout this study are based on Ingle's (1980) southern California framework. Maximum depths for his Paleogene biofacies are: inner neritic 150 ft; outer neritic 470 ft; upper bathyal 1560 ft; upper middle bathyal 4700 ft; lower middle bathyal 6250 ft.

Essentially all strata penetrated by the wells of this study, with the exception of the lowermost portion of the M & P Farms and bottom half of the Porter, were deposited close to shore. An increase in fossil plankton below 3900 ft and 4860 ft in the M & P Farms and Porter wells, respectively, and another below 6060 ft in the Porter, indicate a generally offshore depositional regime during the upper Ulatisian and basal Narizian.

Benthic foraminiferal faunas, and therefore paleobathymetric interpretations, are rather spotty for the southern Willamette Basin, due to extensive sands, particularly of Narizian age. However, an overview of intermittent fossiliferous sediments in the composite section (Figure 1), indicates a net shoaling of the southern Willamette Basin from middle bathyal in the upper Ulatisian to outer neritic-upper bathyal in the Refugian. The thick Narizian sands are much shallower in origin. The Spencer Sand is essentially barren of indigenous marine fossils, and

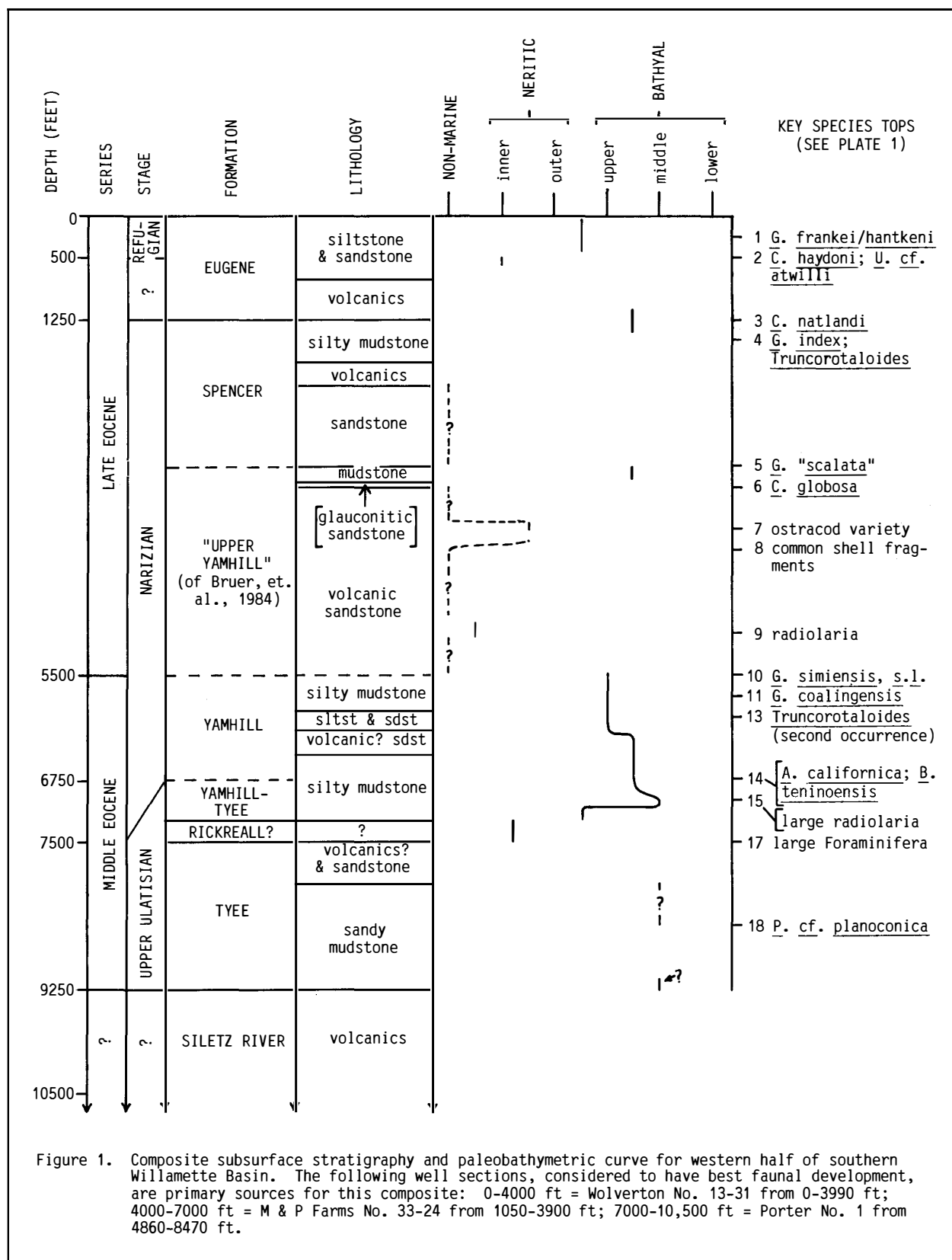


Figure 1. Composite subsurface stratigraphy and paleobathymetric curve for western half of southern Willamette Basin. The following well sections, considered to have best faunal development, are primary sources for this composite: 0-4000 ft = Wolverton No. 13-31 from 0-3990 ft; 4000-7000 ft = M & P Farms No. 33-24 from 1050-3900 ft; 7000-10,500 ft = Porter No. 1 from 4860-8470 ft.

is possibly a non-marine deposit. The older Miller Sand has a glauconitic (marine) layer near its top, and sparse intermittent shallow neritic faunas in both its upper and lower thirds.

A striking marine event, evident in the Gulf Porter section, occurred at or near the proposed Ulatisian-Narizian boundary. A tropical shallow marine shelf deposit is indicated (at 5340 ft) by a thin layer contains large Foraminifera, which rests on volcanics (Figure 1). A similar, concurrent event is preserved in the Reichhold Finn No. 1 (at 3670 ft), more than 40 miles to the north in the northern Willamette Basin (McKeel, 1984). These two fossil occurrences support a long standing proposal (Snively and Wagner, 1963) of a Middle Eocene north-south chain of volcanic islands, in this case forming from bathyal depths, at least along the west-central Willamette Basin. A rather drastic subsequent change in paleobathymetry at these island localities is also indicated by relatively deep bathyal lower Narizian benthic faunas a short distance up section from the "reef" faunas in both wells.

The oldest (Ulatisian) fossiliferous sediments in this study, are from the Tyee Formation in the Gulf Porter well section. Although the deposits are offshore ones, and probably of bathyal or deeper origin, benthic Foraminifera are sparse. It is not immediately apparent to this writer at what depth the Tyee sediments were deposited. Figure 1 shows the Tyee to be questionably middle bathyal, a best guess without more data.

SECTION II. FORAMINIFERAL REPORTS

Note that each ditch sample depth mentioned in the following reports, whether singly or in depth intervals containing more than one sample, represents the bottom of the interval, which generally is 30 ft.

AMERICAN QUASAR PETROLEUM COMPANY
WOLVERTON NO. 13-31
NW¼NE¼ SEC. 13, T10S, R3W
MARION COUNTY

Summary

The well penetrated primarily marine strata representing parts of the Refugian and Narizian benthic foraminiferal Stages. Refugian and Narizian faunas are separated by several hundred feet of volcanics and shallow water sands of indeterminate age.

Narizian faunas indicate bathyal deposition for the central portion of the well section. Fossils in the uppermost and lowermost parts of the well section indicate marginal marine to neritic facies.

Sparse, intermittent plankton suggest a near-shore environment for essentially the entire section penetrated.

BIOSTRATIGRAPHIC RESULTS

The following data were derived from 132 previously unprocessed wet ditch samples.

60-420'

Globobulimina spp. R*, Pseudoglandulina inflata R-C, Quineloculina imperialis R, Q. spp. R, Guttulina cf. hantkeni R, Caucasina schencki R, Spumellaria (spheres) VR-R, Lenticulina spp. R, Cibicides cf. olequaensis? VR, Guttulina irregularis VR, Trifarina cooperensis VR, Cibicides cf. evolutus VR, sponge spicules R, Pseudoglandulina nallpeensis? VR, Nonion planatum, s.l. VR, Uvigerina sp. var. (small) VR, Elphidiella sp. VR, Spongodiscidae (discs) VR, Globigerina spp. VR.

450-510'

Sandstone A-VA. Barren of indigenous Foraminifera.

540-600'

Elphidium sp. R, plus species listed above, including Elphidiella sp. VR-R, Lenticulina sp. VR.

630-1140'

Sandstone C-VA (630-720 ft), rock fragments C-VA

* VR=1-2 specimens per sample; R=2-10; C=11-32; A=33-100; VA=101-320; VVA=320-1000.

(750,780 ft), volcanics VA (810-1050 ft), bentonite R-C (1020-1140 ft), baked? mudstone A-VA (1110 ft), oxidized rock fragments A (1140 ft). Barren of fossils.

1170-1380'

Bathysiphon eocenica R, arenaceous spp. indeterminate R, Bulimina laciniata R-A, Cibicides natlandi VR-R, Pullenia sp. var. (thin) VR, Boldia hodgei VR-R, Eponides mexicana VR, Alabamina sp. VR, Pseudohastigerina micra VR-R, Gyroidina planata VR, Bolivina oregonensis VR, Gyroidina condoni/"scalata" (intermediate form) VR, Vaginulinopsis saundersi VR, Lenticulina cowlitzensis VR, Plectofrondicularia gracilis R, Lenticulina chirana R, Marginulina sp. a (of Beck, 1943) VR, Bulimina sp. var. (costate lower half, small) VR, Vaginulinopsis lewisensis VR, Saracenaria sp. var. (elongate) VR, Cassidulina globosa R-C, Eponides gaviotaensis (small) VR, Karrieriella contorta VR, Eponides mexicana var. (very convex involute side) VR, Globigerinatheka index VR, Truncorotaloides sp. VR, Globigerinatheka tropicalis? VR, Uvigerina sp. var. (finely costate, small) VR, plus species listed above, including Spumellaria R-C.

1410-1500'

Volcanics A-VA, bentonite VA (at 1500 ft). Barren of indigenous Foraminifera.

1530-1710'

Cyclamina sp. VR, Globigerina sp. var. (very large) VR, G. prasaepis (large) VR, Allomorphina sp. R, Uvigerina aff. churchi (small) VR, Eponides minima R, Nonionellina applini VR, Rotalia? sp. VR, Bulimina sp. VR, Truncorotaloides cf. pentacamerata VR, Lenticulina sp. var. (uncoiling) R, Ellipsonodosaria? sp. VR, Alabamina cf. scitula VR, Nodosaria deliciae VR, Cibicidoides? venezuelanus? VR, Bulimina sculptilis VR, plus species listed above, including Spumellaria VA (at 1530 ft).

1770-2040'

No sample received from 1710 to 1740 ft. Volcanics A-VA (1770-1890 ft), rock fragments C (1920 ft), increase in sand (1950,1980 ft). Barren of indigenous Foraminifera.

2070-2370'

Samples not processed, due to illegible labels.

2400-2850'

Barren of indigenous Foraminifera (small sandy samples). The following samples were not processed,

due to illegible labels; 2640, 2700, and 2820 ft.

2880-3180'

Plectofrondicularia spp. R-C, Gyroidina "scalata" (of Cushman, et. al., 1949, pl. 15, fig. 13) R-C, Ellipsonodosaria "cf. cocoaensis" (of Beck, 1943, pl. 108, fig. 10) R, Plectofrondicularia cf. vokesi VR, Lenticulina aff. welchi VR, Plectofrondicularia oregonensis VR, Chilostomella sp. VR, Valvulinaria welcomensis R, V. churchi (small) R, Lenticulina welchi, s.l. VR, Uvigerina beccarii/nudorobusta (intermediate form) VR, Nonionella pauciloba VR, plus species listed above, including Lenticulina spp. C-A, Cibicides natlandi R (at 2970 ft), Cassidulina globosa VA (at 3060 ft), Caucasina schencki R, and Spumellaria (2910 to 3030 ft only) VR.

3210-3660'

Major increase in sand. Medium-grained glauconitic sandstone R (at 3210 ft), rounded rock fragments R (at 3270 ft), volcanics VVA (at 3420 ft), micaceous sandstone C (at 3660 ft). Barren of indigenous fossils.

3690-3750'

Ostracod var. (deep median sulcus) VR, Sigmoilina tenuis VR, Cibicides cf. laurissae (of Mallory, 1959) VR, plus species listed above, including Elphidium spp. R, Elphidium? (Elphidiella?) sp. (poorly preserved) R, Lenticulina spp. R, and Caucasina schencki R.

3780-3870'

Increase in sand. Barren of indigenous Foraminifera.

3900'

Diatoms R, plus species listed above, including Elphidium sp. VR, Lenticulina sp. VR. Possibly barren of indigenous fossils.

3930'; 3960'

Barren of indigenous Foraminifera.

3990'

Lignite VVA, shell fragments R. Barren of indigenous Foraminifera.

4020-4140'

Increase in sand. Barren of indigenous Foraminifera.

4170'

Shell fragments R. Barren of indigenous Foraminifera.

4200-4350'

Increase in sand. Barren of indigenous Foraminifera.

4380'

Arenaceous spp. indeterminate (crushed) R, calcareous sp. indeterminate VR, lignite VVA.

4410-4530'

Lignite VA (at 4500 ft). Barren of indigenous Foraminifera.

CONCLUSIONS

DEPTH (FEET)	STAGE	PALEOENVIRONMENT
60-420	Refugian	Outer Neritic to Upper Bathyal
450-510	Indeterminate	Indeterminate
540-600	Indeterminate	Inner Neritic
630-1140	Indeterminate	Indeterminate
1170-1380	Upper Narizian	Upper to Middle Bathyal, undifferentiated
1410-1500	Indeterminate	Indeterminate
1530-1710	Upper Narizian	Upper to Middle Bathyal, undifferentiated
1740-2850	Indeterminate	Indeterminate
2880-3180	Narizian, undifferentiated	Upper Middle Bathyal
3210-3660	Indeterminate	Indeterminate
3690-3750	Narizian, undifferentiated	Neritic, undifferentiated.
3780-3870	Indeterminate	Indeterminate
3900	Indeterminate	Possibly Neritic, undifferentiated
3930,3960	Indeterminate	Indeterminate
3990	Indeterminate	Marginal Marine?
4020-4140	Indeterminate	Indeterminate
4170	Indeterminate	Marginal Marine?
4200-4350	Indeterminate	Indeterminate
4380	Indeterminate	Marginal Marine?
4410-4530	Indeterminate	Indeterminate

HUMBLE OIL AND REFINING COMPANY
MILLER NO. 1
SE¼ SEC. 10, T10S, R3W
LINN COUNTY

Summary

There are essentially three fossiliferous intervals in this well section, which are separated by rather thick sands. All three fossiliferous intervals are Narizian in age. They were deposited primarily at depths ranging from outer neritic to upper middle bathyal. The younger two (1250 to 1520 and 2510 to 2690 ft) lack planktic microfossils, indicating possible restriction from open ocean circulation.

The oldest fossiliferous interval (3590 to 4790 ft) contains spumelline radiolaria, which indicate open marine conditions, or at least good circulation with the open sea.

BIOSTRATIGRAPHIC RESULTS

The following data were derived from 77 dry ditch samples borrowed from the Oregon Department of Geology and Mineral Industries (D.O.G.A.M.I.) collection. All but seven of the samples already had been laboratory processed for foraminiferal analysis.

80-560'

Barren of marine fossils. Highest sandstone resistant to boiling in Quaternary "0" (at 200 ft); pyrite VVA* (at 260 ft); increase in volcanics on 20 mesh screen (at 380 ft); sand and/or sandstone dominant (at 530 and 560 ft).

590-650'

Haplophragmoides sp. var. (large, crushed) VR, Lenticulina inornata VR, L. spp. R, Trochammina cf. globigerinaformis R, Cibicides olequaensis? VR, Cibicides sp. VR, Bolivina kleinpelli VR, Caucasina schencki VR.

680-1220'

Essentially barren of marine fossils. Primarily sand and sandstone. Minor amounts of reddish-brown (oxidized?) shale (at 1160 and 1220 ft).

1250-1520'

Globobulimina spp. VR-R, Nonionellina applini VR-C, Gyroidina "scalata" (of Cushman, et. al., 1949, pl. 15, fig. 13) R, Plectofrondicularia oregonensis VR-C, P. packardii VR-R, Pseudohastigerina micra VR, Eponides gaviotaensis R, Cassidulina globosa R-C, Ellipsonodosaria "cf. cocoaensis" (of Beck, 1943, pl. 108, fig. 10) R-A, Quinqueloculina imperialis VR, Plectofrondicularia searsii VR-R, Nodosaria cf. longiscata R, Valvulineria churchi VR-R, Lenticulina welchi R, L. chirana R, Uvigerina nudorobusta? (appears smooth) VR, Anomalina garzaensis VR, Eponides minima R, plus species listed above, including Lenticulina inornata R-A, Caucasina schencki VR-VA.

1610-2420'

Barren of indigenous calcareous Foraminifera. Primarily sand, with distinctively abundant volcanic grains. Arenaceous sp. indeterminate (crushed) VR (1610 to 1970 ft); shell fragments C-A (2060 to 2330 ft). Remark: Rare bathyal Foraminifera throughout this sandy interval are considered to be down hole contamination, as they are the same species present in the richly fossiliferous interval from 1250 to 1520 ft.

2510'

Lenticulina cf. terryi R, Globulina landesi VR, plus species listed above, including Lenticulina spp. C, Plectofrondicularia oregonensis R, P. searsii

* VR=1-2 specimens per sample; R=2-10; C=11-32; A=33-100; VA=101-320; VVA=320+.

R, Ellipsonodosaria "cf. cocoaensis" R, Gyroidina "scalata" R, and shell fragments A. Lithology 60% brown siltstone.

2600'

Probably barren of indigenous Foraminifera. Shell fragments R. Very sandy sample.

2690'

Cyclammina sp. VR, Cibicides cushmani VR, Boldia hodgei VR, Nonion "cf. inexcavatum" (of Cushman, 1947, pl. 7, fig. 7) VR, plus species listed above, including Lenticulina spp. A, L. cf. terryi VR, Plectofrondicularia oregonensis R, P. searsii R, Uvigerina nudorobusta? (appears smooth) VR, Gyroidina "scalata" R, Ellipsonodosaria "cf. cocoaensis" R, Cassidulina globosa R, and shell fragments C.

2780-3500'

Probably barren of indigenous Foraminifera, with one exception. Nonion florinense? (of Cushman, et. al., 1949, pl. 14, fig. 7) R, at 3140 ft, indicates an inner to middle neritic environment at that depth. Shell fragments R, intermittent. Lithology primarily micaceous medium-grained sandstone (2780-3440 ft). A major lithology change occurs somewhere between 3440 and 3500 ft. Below the change, sandstone is very fine to fine-grained, and olive brown. Above the change, sandstone is distinctly coarser and white.

3590-3860'

Eponides mexicana VR (at 3590 ft only), Gyroidina simiensis, s.l.? (broken, poorly preserved, at 3590 ft only), diatoms (pyritized, centrate) R, plus species listed above, including Lenticulina spp. VR-R, Nonion florinense? VR, shell fragments C-A (intermittent), and Cassidulina globosa VR.

3920'

Gyroidina simiensis, s.l. C, Cribrononion cf. roemeri VR, Vaginulinopsis? vacavillensis? VR, Lenticulina pseudovortex VR, Valvulineria welcomensis? (poorly preserved) VR, Globobulimina sp. var. (small, thin test) R, Elphidiella? sp. VR, Subbotina frontosa? VR, plus species listed above, including Nonionellina applini R, Eponides mexicana R, Lenticulina spp. R, and Caucasina schencki VR.

3950-4790'

Highest brown mudstone (at 4040 ft), ostracods (small, through 80 on 100 mesh screen) VR-R, Cibicides baileyi R, Quinqueloculina olequaensis? (costate instead of striate) VR, bivalves (small) VR, Elphidium sp. VR, gastropods VR, Cibicides mcmastersi VR-R, Spumellaria var. (large spheres, on 80 mesh screen) VR-VA, Lenticulina sp. var. (large, obese test with limbate raised sutures) VR, Gaudryina coalingensis VR, Dentalina colei VR, Bulimina aff. cowlitzensis (wall not punctate) VR-R, Valvulineria cf. scrobiculata (of Beck, 1943, pl. 108, figs. 21-23) VR, Cibicides olequaensis VR, C. cf. cooperensis (of Cushman, et. al., 1947, pl. 8, fig. 12) VR, Pullenia cf. salisburyi (small) VR, plus species listed above, including Gyroidina simiensis, s.l. VR-C, Eponides mexicana VR-C, Caucasina schencki VR-C,

Nonionellina applini VR-R, Lenticulina spp. VR-C, and Spumellaria (spheres) VR-VVA.

4820-4940'

Barren of marine fossils. Sandstone, with coal?? C (at 4940 ft).

CONCLUSIONS

DEPTH (FEET)	STAGE	PALEOENVIRONMENT
80-560	Indeterminate	Indeterminate
590-650	Indeterminate	Neritic, undifferentiated
680-1220	Indeterminate	Indeterminate
1250-1520	Narizian, undifferentiated	Upper to Upper Middle Bathyal, undifferentiated
1610-2420	Indeterminate	Intermittently Marginal Marine
2510	Narizian, undifferentiated	Mixed Marginal Marine? to Upper Middle Bathyal
2600	Indeterminate	Indeterminate
2690	Narizian, undifferentiated	Mixed Marginal Marine? to Upper Middle Bathyal
2780-3050	Indeterminate	Indeterminate
3140	Indeterminate	Possibly Neritic
3230-3500	Indeterminate	Indeterminate
3590-3860	Narizian, undifferentiated	Probably Outer Neritic to Upper Bathyal
3920	Lower Narizian	Probably Outer Neritic to Upper Bathyal
3950	Lower Narizian	Mixed Neritic to Upper Bathyal
4820-4940	Indeterminate	Indeterminate

AMERICAN QUASAR PETROLEUM COMPANY
HENSCHEL NO. 17-34
SW¼SE¼ SEC. 17, T10S, R3W
LINN COUNTY

Summary

The well penetrated primarily marine strata which are essentially all Narizian in age. The uppermost 350 ft contain a non-diagnostic shallow shelf fauna, but it, too, is probably Narizian (see Plate 1).

Except for isolated bathyal intervals (380 to 620, 1160 to 1170, and 2610 to 2820 ft), Foraminifera are generally sparse, making it difficult to distinguish indigenous fossils from caved ones. Therefore, most paleobathymetric interpretations in the "Conclusions" section of this report are questionable.

The entire well section was deposited close to shore. There was restriction from open sea circulation down to 2220 ft. Below that depth, conditions were intermittently open marine, with a maximum open

marine influence at 2670 ft. Marginal marine to non-marine environmental interpretations are based primarily on sporadic large abundances of lignite and/or coal.

BIOSTRATIGRAPHIC RESULTS

The following data were derived from 93 previously unprocessed wet ditch samples.

39-170'

Essentially barren of fossils. Primarily sand.

200-290'

Elphidiella sp. var. (acute periphery) VR-R*, Elphidium sp. VR-R, Quinqueloculina sp. VR, arenaceous sp. indeterminate (crushed) VR, shell fragments R, Lenticulina sp. VR.

320'; 350'

Globobulimina sp. R, Caucasina schencki VR, ostracod VR. Also, Lenticulina spp. R.

380-620'

Cassidulina galvinensis/globosa (intermediate form) VR-R, Ellipsonodosaria "cf. cocoaensis" (of Beck, 1943, pl. 108, fig. 10) R-VA, Plectofrondicularia spp. (fragments) R-A, Cibicides natlandi/haydoni (intermediate form) R, Gyroidina "scalata" (of Cushman, et. al., 1949, pl. 15, fig. 13) R-A, Bolivina oregonensis VR-R, Cibicides natlandi, s.l. VR, Plectofrondicularia searsii VR-C, Nonionellina applini VR-R, Marginulina cf. sp. "c" (of Beck, 1943, pl. 105, figs. 15,16) VR, Bolivina basiscurta VR, Quinqueloculina imperialis VR, Eponides mexicana R, Cibicides natlandi, s.s. R, Stilostomella? aff. lepidula? R, Dentalina colei R, Plectofrondicularia oregonensis R-C, Boldia hodgei VR, Globulina cf. landesi R, Eponides gaviotaensis? (juvenile) VR, Cassidulina globosa, s.s. VR, Nodosaria longiscata R, Bolivina kleinpelli VR, Eponides cf. kleinpelli VR, Cibicides sp. var. (attached form) VR, Globobulimina oregonensis VR, Valvulineria churchi R, Trifarina cooperensis VR, Lagenella costata VR, Plectofrondicularia vokesi VR, Lenticulina chirana VR, L. welchi, s.s. R, Uvigerina nudorobusta? (juvenile) (at 620 ft) VR, plus species listed above, including Lenticulina spp. C-VA, and Caucasina schencki R-C.

650-770'

Probably barren of indigenous Foraminifera. Fine to medium-grained glauconitic sandstone VA (at 650 ft), sterrasters VR.

800'; 830'

Inner neritic species listed above, including ostracods VR, Elphidiella sp. VR, and Elphidium sp. VR.

860-1130'

Probably barren of indigenous Foraminifera. Intermittent lignite/coal A-FL, fish? remains VR, translucent volcanic? grains R (1070, 1100 ft), ostracod

* VR=1-2 specimens per sample; R=2-10; C=11-32; A=33-100; VA=101-320; VVA=320-1000; FL=1000+.

var. (deep median sulcus) VR (at 1070 ft), plus rare occurrences of bathyal species listed above, interpreted as cavings. Lithology primarily fine to medium-grained sandstone and rock fragments on 20 mesh screen.

1160'; 1170'

Uvigerina cf. yazooensis? R, U. spp. R, plus species listed above, including Cassidulina globosa R, Valvulineria churchi R, Lenticulina welchi R, L. spp. R-C, and Gyroidina "scalata" R.

1200-1980'

Barren of indigenous Foraminifera, except for inner neritic species Elphidium sp. R, and/or Elphidiella sp. R (at 1200 ft and 1950 ft, only). Shell fragments C (from 1230-1290 ft), pyrite R-VA (1320-1920 ft), coal/lignite, intermittent throughout interval, C-FL.

2010-2190'

Species listed above, including Lenticulina spp. VR-C, Elphidiella sp. VR-R, Cassidulina cf. globosa VR-R, Lenticulina welchi VR. Pyrite VA (at 2040 ft). Rare bathyal species present interpreted to be cavings.

2210-2300'

Spumellaria (spheres) R, Valvulineria willapaensis/menloensis (intermediate form) R (at 2210 ft), plus rare occurrences of species listed above.

2330-2430'

Bulimina? (Globobulimina?) sp. var. (smooth wall, narrow test) R (at 2330 ft), Gyroidina simiensis, s.l. VR-R, Eponides "dorfi" (of Mallory, 1959, pl. 30, fig. 2) VR, plus species listed above, including Spumellaria (spheres) R, Nonionellina applini C (at 2330 ft), and Caucasina schencki R (at 2330 ft).

2460'

Species listed above, including Lenticulina spp. R, Nonionellina applini R, Spumellaria (spheres) R, and Caucasina schencki R.

2490'; 2520'

Elphidiella sp. (encrusted with indigenous sandstone lithology) VR-R.

2550'

Cibicides? felix? (encrusted with lithology) VR.

2580'

Probably barren of indigenous Foraminifera. Lignite/coal VVA.

2610-2820'

Cibicides baileyi VR-R, scaphopod? (fragments) (at 2640 ft) R, major lithology change to brown lignitic mudstone (at 2640 ft), Subbotina spp. VR-R, Nonion florinense VR-R, Subbotina senilis? VR, Alabamina cf. scitula VR, Cibicides natlandi var. (slightly convex

involute side) R, Pseudohastigerina micra VR, Gaudryina coalingensis VR, Cibicides sp. var. (umbilical plug on involute side) VR, Nonion sp. var. (small test, with circular outline) VR, Bolivina "raui" (small, wide test) VR, Marginulina adunca? (of Mallory, 1959, pl. 9, fig. 11) VR, Saracenaria sp. var. (small) VR, pelecypods VR, plus species listed above, including Gyroidina simiensis, s.l. R-A, Caucasina schencki C (at 2640 ft), translucent green volcanic grains A (at 2700 ft), Spumellaria (spheres) R-A, Lenticulina spp. VR-C, and Bolivina oregonensis VR-C. Remark: Bolivina raui is a name used by this writer for a species which is not yet formally described.

CONCLUSIONS

DEPTH (FEET)	STAGE	PALEOENVIRONMENT
39-170	Indeterminate	Indeterminate
200-290	Indeterminate	Inner Neritic
320,350	Indeterminate	Neritic, undifferentiated
380-620	Narizian, undifferentiated	Upper Middle Bathyal
650-770	Indeterminate	Indeterminate
800,830	Indeterminate	Probably Inner Neritic
860-1130	Indeterminate	Non-marine? to Marginal Marine
1160,1170	Narizian, undifferentiated	Upper Middle Bathyal
1200-1980	Indeterminate	Non-marine? to Inner Neritic
2010-2190	Narizian, undifferentiated	Outer Neritic to Upper Bathyal
2210-2300	Narizian, undifferentiated	Outer Neritic?
2330-2430	Lower Narizian	Outer Neritic to Upper Bathyal
2460	Lower Narizian	Outer Neritic
2490,2520	Indeterminate	Inner Neritic?
2550	Indeterminate	Neritic?
2580	Indeterminate	Non-marine? to Marginal Marine
2610-2820	Lower Narizian	Probably Upper Bathyal

AMERICAN QUASAR PETROLEUM COMPANY
M & P FARMS NO. 33-24
SE¼SW¼ SEC. 33, T11S, R4W
LINN COUNTY

Summary

This entire well section, like the Henschel well to the north, is Narizian in age. A unique

feature of the M & P Farms is the thick sequence containing diverse lower Narizian faunas in the bottom 1700 ft of the well section.

Most of the fossiliferous marine sediments in this well were deposited at bathyal depths. A notable exception is an inner shelf environment at 1950 ft. The deepest water (middle bathyal) sediments in the well section occur from 3570 to 3990 ft.

Essentially the entire section penetrated was deposited close to shore. There was restriction from open sea circulation down to 1950 ft. Below that depth, conditions were intermittently open marine.

BIOSTRATIGRAPHIC RESULTS

The following data were derived from 139 wet ditch samples.

90-570'

Lenticulina spp. R-A*, Cibicides natlandi VR-R, Elipsonodosaria "cf. cocoaensis" (of Beck, 1943, pl. 108, fig. 10) R-C, Nonionellina applini VR-R, Lenticulina aff. welchi VR, Plectofrondicularia vauhanii VR-R, Stilostomella aff. lepidula R-C, Trifarina cooperensis VR-R, Bolivina oregonensis VR-R, Nodosaria longiscata VR-R, Bolivina kleinpelli VR-VA, Caucasina schencki VR-C, Cassidulina globosa VR-VA, Gyroidina condoni VR-VA, Plectofrondicularia gracilis VR-R, Gyroidina "scalata" (of Cushman, et. al., 1949, pl. 15, fig. 13) VR-C, ostracod var. (deep median sulcus) VR, Cornuspira lewisensis VR, Cibicides cushmani VR-R, Eponides aff. rosaformis VR-R, Boldia hodgei VR, Eponides gaviotaensis VR, Lenticulina welchi, s.l. VR, Nonion inflatum VR, fine-grained glauconitic sandstone C (at 540 ft).

600-1080'

Barren of indigenous Foraminifera. Well-rounded rock fragments C (720, 750 ft), shell fragments? R (at 780 ft), shell fragments A-VA (at 1050 ft).

1110-1170'

Buliminella elegantissima, s.l. (very thin test) R, Uvigerina beccarii? (crushed) VR, plus species listed above, including Gyroidina "scalata" VR-R, Caucasina schencki R, Plectofrondicularia spp. R, Nonionellina applini R. Lithology primarily fine to medium-grained sandstone and volcanic rock fragments.

1200'

Barren of indigenous Foraminifera. Sub-rounded to well-rounded rock fragments A.

1230-1920'

Barren of indigenous Foraminifera. Intermittent coal C-VVA. Lithology primarily rock fragments.

1950'

Elphidiella sp. R, plus very rare occurrences of species listed above.

* VR=1-2 specimens per sample; R=2-10; C=11-32; A=33-100; VA=101-320; VVA=320-1000; FL=1000+.

1980-2130'

Essentially barren of Foraminifera. Spumellaria (spheres) VR-R (at 2010 ft), and occurring intermittently throughout this interval. A noticeable new gray siltstone lithology also has its highest occurrence at 2010 ft.

2160-2520'

Barren of indigenous marine fossils. Coal and/or lignite R-VA (from 2160 to 2430 ft).

2550-3210'

Gyroidina simiensis, s.l. R-A, Cibicides baileyi VR-R, Gaudryina coalingensis VR-R, Cibicides haydoni/natlandi (intermediate form) VR-R, Ceratobulimina washburnei VR-R, Dentalina dusenburyi VR, Spongodiscidae (discs) VR, Eponides mexicana VR-R, Quinqueloculina imperialis VR, Pseudoglandulina inflata VR, Cibicides haydoni, s.l. VR-R, "Eponides sp." (of Tipton, et. al., 1973, pl. 9, fig. 6) VR-R, Bathy-siphon eocenica VR-R, Cibicides sp. (of Mallory, 1959, pl. 23, fig. 12) R, C. whitei (of Mallory, 1959, pl. 26, fig. 2) VR, Anomalina sp. var. (large umbilical plugs on both sides of test) VR, Cibicides cf. sandiegensis (small) R, Pseudohastigerina micra VR, Spumellaria var. ("spiny" spheres) VR, Pseudoglandulina cf. nallpeensis/conica (intermediate form) VR, Bulimina corrugata? (poorly preserved) VR, Gyroidina octocamerata VR-R, Cibicides haydoni, s.s. R, Marginulina sp. VR, Vaginulina? sp. (of Beck, 1943, pl. 106, fig. 10) VR, Globigerina cf. wilsoni VR, Globorotaloides cf. suteri VR-R, Truncorotaloides sp. VR, Cassidulina cf. globosa var. (uncoiling) VR, plus species listed above, including Nonionellina applini A (at 2580 ft), and Spumellaria (spheres) A (at 2640 ft).

3240-3540'

Faunal decrease. Anomalina garzaensis VR, Nodosaria latejugata VR, Alabamina kernensis VR, plus rare occurrences of species listed above.

3570-3990'

Truncorotaloides aspensis VR, Subbotina eocaena VR, Marginulina "cf. subbullata" (of Beck, 1943, pl. 104, fig. 7) VR, Cibicides cf. "elmaensis" (of Tipton, et. al., 1973, pl. 13, fig. 5) VR-R, Bulimina corrugata VR-C, sterrasters R-VA, Baggina teninoensis VR-R, Amphimorphina californica VR-C, Robertina washingtonensis VR, Karreriella sp. (of Mallory, 1959, pl. 5, fig. 2) VR, Truncorotaloides pentacameratus VR, T. cf. gravelli VR, Bulimina garzaensis VR, Bolivina striatella VR, Globorotaloides sp. (of McKeel and Lipps, 1975, pl. 3, figs. 1,2) VR, Trifarina californica? (very small) VR, Epistomina sp. VR, Lenticulina aff. cowlitzensis VR, Pseudohastigerina lillisi VR, Vaginulinopsis vacavillensis VR-R, Spumellaria var. (large spheres, on 80 mesh screen) R-A, Cibicidoides coalingensis (of Mallory, 1959, pl. 38, fig. 11) R, Eponides minima VR-R, Truncorotaloides collacteus VR, Anomalina umbonata VR, Cibicides alhambrensis (of Mallory, 1959, pl. 38, fig. 8) VR-R, Spiroplectammina richardi VR-R, Clavulinoides californicus VR, Bulimina cf. curtissima VR, plus species listed above, including Cibicides haydoni R (from 3570-3810 ft).

4020-4260'

Bulimina cf. jacksonensis? R, Valvulinaria welcomensis VR, Tritaxilina colei VR, Silicosigmoilina californica VR, plus species listed above, including Gyroidina planata C (at 4020 ft).

CONCLUSIONS

DEPTH (FEET)	STAGE	PALEOENVIRONMENT
90-570	Narizian, undifferentiated	Upper to Upper Middle Bathyal
600-690	Indeterminate	Indeterminate
720,750	Indeterminate	Possible Beach
780-1080	Indeterminate	Intermittent Marginal Marine
1110-1170	Narizian, undifferentiated	Mixed Neritic to Bathyal
1200	Indeterminate	Possible Beach
1230-1920	Indeterminate	Indeterminate
1950	Indeterminate	Inner Neritic
1980-2130	Indeterminate	Intermittent Open Marine
2160-2520	Indeterminate	Indeterminate
2550-3210	Lower Narizian	Upper to Middle Bathyal, undifferentiated
3240-3540	Lower Narizian?	Middle Bathyal?
3570-3990	Lower Narizian	Probably Lower Middle Bathyal
4020-4260	Lower Narizian	Upper to Upper Middle Bathyal

AMERICAN QUASAR PETROLEUM COMPANY
HICKEY NO. 9-12
SW¼NW¼ SEC. 9, T12S, R2W
LINN COUNTY

Summary

The well penetrated two marine sections which are separated by a thick, possibly mostly non-marine section of coaly and volcanic sediments. The higher marine interval (390 to 450 ft) is indeterminate in age due to the shallow shelf facies. The deeper marine interval (3570 to 3900 ft) is Narizian, undifferentiated in age. It was deposited in an upper to upper middle bathyal environment restricted from open sea circulation (planktic microfossils are absent).

BIOSTRATIGRAPHIC RESULTS

The following data were derived from 152 wet ditch samples.

150-360'

Barren of marine microfossils. Coal/lignite R*. One plant fossil seen in coal fragment.

390-450'

Shell fragments VR-R, Cibicides aff. fletcheri (mc-mastersi?) R, Elphidium sp. VR.

480-3060'

Barren of marine microfossils. Lignite C (at 840 ft), bentonite? VVA (at 1140 ft), bentonitic sandstone C (at 1680 ft), coal/lignite A-VA (from 1800 to 1890 ft and at 2910 ft), coal VA (at 2460 and 2490 ft), pyrite-quartz clusters C (at 2760 ft), and VA (at 3000 ft).

3090'

Haplophragmoides sp. var. (large, crushed) VR, arenaceous sp. indeterminate VR, coal A.

3120-3540'

Barren of marine microfossils. Coal A (at 3420 ft).

3570-3900'

Lenticulina spp. VR-C, Eponides? sp. VR, Plectofrondicularia gracilis? (fragments) VR-R, Gyroidina "scalata" (of Cushman, et. al., 1949, pl. 15, fig. 13) VR-R, Nonion? (Nonionella?) sp. VR, Eponides gaviotaensis? VR, Cibicides natlandi R, Nonionellina applini VR, Caucasina schencki VR, pyrite cube clusters R (at 3750 ft), Ellipsonodosaria? sp. (fragments) VR, Plectofrondicularia oregonensis VR, coal/lignite VVA-FL (at 3810, and 3840 ft), Globobulimina? sp. VR.

3930-4530'

Probably barren of indigenous Foraminifera. Lenticulina spp. (listed above) VR. Coal/lignite C-FL.

4560'

Species listed above, including Caucasina schencki R, Lenticulina sp. VR.

4590'

Barren of marine microfossils. Coal/lignite A.

CONCLUSIONS

DEPTH (FEET)	STAGE	PALEOENVIRONMENT
150-360	Indeterminate	Indeterminate
390-450	Indeterminate	Inner Neritic
480-3060	Indeterminate	Indeterminate
3090	Indeterminate	Marginal Marine
3120-3540	Indeterminate	Indeterminate

* VR=1-2 specimens per sample; R=2-10; C=11-32; A=33-100; VA=101-320; VVA=320-1000; FL=1000+.

3570-3900	Narizian, undifferentiated	Upper to Upper Middle Bathyal
3930-4530	Indeterminate	Indeterminate
4560	Narizian, undifferentiated	Outer Neritic or deeper
4590	Indeterminate	Indeterminate

AMERICAN QUASAR PETROLEUM COMPANY
KENNETH WETGEN ET AL. NO. 26-32
SW¼NE¼ SEC. 26, T13S, R4W
LINN COUNTY

Summary

The well penetrated fossiliferous sediments of both Refugian and Narizian age. Approximately 1000 ft of section (480 to 1490 ft) are fossiliferous. This interval contains the Refugian-Narizian contact, which appears to be a hiatus. This hiatus is represented from 740 to 830 ft, where well-rounded coarse sand indicates a high energy environment.

Fossiliferous portions of the well section were deposited in upper to middle bathyal waters. During the Refugian (from 480 to 710 ft) there was restriction from open sea circulation, as there was in the Narizian from 950 to 1490 ft. However, the presence of plankton from 860 to 920 ft in the Narizian indicates a short period of open marine deposition.

BIOSTRATIGRAPHIC RESULTS

The following data were derived from 74 wet ditch samples.

195-450'

Barren of fossils. Subrounded to well-rounded rock fragments C-VA* (at 250 and 280 ft).

480-710'

Globobulimina spp. R, sponge spicules R, Caucasina schencki VR-R, Lenticulina spp. VR-R, Cibicides haydoni VR-R, Nonion halkyardi VR-R, Uvigerina cf. atwilli VR, Pseudoglandulina inflata VR-R, Plectofrondicularia spp. VR-R, Guttulina irregularis VR-R, Nonion cf. planatum R, Melonis pompilioides R, Cibicides evolutus? VR, Guttulina cf. hantkeni VR-R, Trifarina cooperensis VR, Quinqueloculina spp. VR, sterrasters R.

740-830'

Barren of fossils. Well-rounded coarse sand C-VA. Volcanic glass shards FL (at 830 ft).

860-1490'

Bathysiphon eocenica VR-R, Cibicides natlandi VR-R, Eponides gaviotaensis VR, Lenticulina cf. welchi VR-R, Globobulimina oregonensis R, Gyroidina "scalata" (of Cushman, et. al., 1949, pl. 15, fig. 13) VR-C, Bolivina oregonensis VR-C, Ellipsonodosaria "cf. cocoaensis" (of Beck, 1943, pl. 108, fig. 10) VR-R, Spumellaria (spheres) VR-C (from 860 to 920 ft

* VR=1-2 specimens per sample; R=2-10; C=11-32; A=33-100; VA=101-320; VVA=320-1000; FL=1000+.

only), Cyclamina sp. VR-R, Plectofrondicularia gracilis VR, Nonionellina applini VR-C, Lenticulina welchi VR, L. cf. washingtonensis VR, Pullenia quinqueloba R, Cassidulina cf. globosa R, major increase in sand (at 1040 ft only), Marginulina sp. "B", s.l. (of Beck, 1943) VR, arenaceous spp. indeterminate (crushed) R, Bolivina kleinpelli VR-R, ostracod var. (deep median sulcus) VR, Cribronion? cf. roemeri? (small) R, Gyroidina condoni, s.l. VR, Elphidium cf. minutum? VR, Cassidulina globosa R, Valvulineria welcomensis VR, plus species listed above, including Lenticulina spp. C-VA, Plectofrondicularia spp. VR-R, and Caucasina schencki (from 1250 to 1490 ft) R-C.

1520-2000'

Probably barren of indigenous fossils. No samples received from 1550 to 1610 ft.

2030-2600'

Barren of indigenous fossils. Major lithology change to very light colored (off-white) material at 2300 ft.

CONCLUSIONS

DEPTH (FEET)	STAGE	PALEOENVIRONMENT
195-450	Indeterminate	Indeterminate
480-710	Refugian	Upper to Middle Bathyal, undifferentiated
740-830	Indeterminate	Possible Beach
860-1490	Narizian, undifferentiated	Upper to Upper Middle Bathyal
1520-2600	Indeterminate	Indeterminate

GULF OIL CORPORATION OF CALIFORNIA
T. J. PORTER NO. 1
SW¼NE¼ SEC. 27, T13S, R4W
LINN COUNTY

Summary

The well penetrated strata of Refugian, Narizian, and probably upper Ulatisian age. The uppermost Narizian appears to be missing at a hiatus somewhere between 1080 and 1230 ft. Also, the Ulatisian-Narizian boundary is not easily recognizable. The top of the Ulatisian is tentatively placed at a horizon of large, shallow water Foraminifera, at 5340 ft. This same convention was used for the Reichhold Finn No. 1, to the north (see McKeel, 1984).

With the exception of shallow neritic deposits close to the proposed Ulatisian-Narizian boundary, fossiliferous sediments formed generally at upper or middle bathyal depths throughout the well section.

Plankton distribution indicates that fossiliferous sediments above 6060 ft were deposited close to shore, whereas those below that depth are off-shore deposits.

BIOSTRATIGRAPHIC RESULTS

The following data were derived from 108 samples (107 dry ditch and one core). The samples,

already processed for foraminiferal analysis, were borrowed from the D.O.G.A.M.I. collection.

80-530'

Barren of fossils. Lithology multicolored sand and rock fragments.

600-1080'

Pseudoglandulina inflata R-C*, *Uvigerina beccarii* R, *Plectofrondicularia robusta* VR, *Guttulina franki* VR-R, *Uvigerina cf. atwilli* R, *U. cocoaensis* VR-R, *Cibicides evolutus* VR-R, *Guttulina irregularis* VR-R, *Cibicides haydoni* VR-R, *Cyclamina* sp. VR, *Caucasina schencki* VR-A, *Uvigerina atwilli*, s.s. R, *U. cf. gallowayi* VR, *Melonis pompilioides* R, *Nonion halkyardi* R, *Elphidiella* sp. VR-R, *Eponides yeguaensis* VR, *Cassidulina galvinensis*? R. Lithology primarily siltstone; siltstone is glauconitic from 780 to 870 ft.

1110-1200'

Barren of indigenous Foraminifera.

1230-2490'

Allomorphina cf. macrostoma VR-R, *Eponides gaviotaensis* R, *Lenticulina welchi*, s.s. VR-R, *Cibicides natlandi* R-C, *Plectofrondicularia searsi* VR-C, *Subbotina* spp. R, *Nonionellina applini* R-VA, *Spumellaria* (spheres) R-C, *Gyroidina "scalata"* (of Cushman, et. al., 1949, pl. 15, fig. 13) R, *Bolivina oregonensis* VR-R, *Bathysiphon eocenica* VR-A, *Lenticulina alato-limbata* VR-R, *Vaginulinopsis lewisensis* R, *Anomalina costiana* VR, *Cassidulina globosa* R, *Pseudoglandulina conica* R, *Globobulimina oregonensis* VR-R, *Plectofrondicularia oregonensis* VR-R, *Trifarina cooperensis* VR, *Marginulina* sp. "B" (of Beck, 1943) VR, *Stilostomella aff. lepidula* R-C, *Lenticulina chirana* VR, *Quinqueloculina imperialis* VR, *Cibicides olequaensis* VR, *Gyroidina condoni* R-C, *Bolivina kleinpelli* R-C, *Bolivina oregonensis* R-A, *Cassidulina globosa/galvinensis* (intermediate form) VR-R, *Anomalina garzaensis* VR.

2550-4780'

Essentially barren of indigenous Foraminifera. *Lenticulina* spp. R (at 3890 and 3920 ft) possibly are indigenous.

4860-5120'

Spumellaria var. (large spheres, on 80 mesh screen) R, *Gyroidina cf. soldanii* R-A, *Lenticulina cf. terryi* VR, *Alabamina kernensis* VR, plus species listed above. Remark: Large *Spumellaria* are probably abundant in this sample, but are diluted due to poor sample processing, probably without Quaternary "0".

5220-5320'

Barren of fossils.

5340'

Large Foraminifera (*Operculina cushmani*?, of Mallory,

* VR=1-2 specimens per sample; R=2-10; C=11-32; A=33-100; VA=100+.

1959) C, plus *Lenticulina* spp. (listed above) R.

5360'

Ostracod VR, fecal pellets? C.

5440-5860'

Barren of fossils.

5920-6020'

Gastropods VR, plus species listed above, including *Quinqueloculina imperialis* R-VA, ostracods R-A, *Elphidiella* sp. R-C, *Lenticulina* spp. C-VA, *Gyroidina cf. soldanii* R-VA, and *Caucasina schencki* R-C.

6040'

Barren of indigenous Foraminifera. Dark greenish-gray sporbo (?) VA (flood). The sporbo (?) may represent a hiatus within this interval.

6060-6440'

Subbotina eocaena VR-R, *Spongodiscidae* (discs) VR-R, *Subbotina frontosa* VR-R, arenaceous spp. indeterminate R, *Gyroidina simiensis*, s.l. VR, *Virgulina cf. bramlettei* R, *Truncorotaloides collacteus* A-VA, *Planorotalites cf. planoconica* R, *Subbotina linaperta* R, *Planorotalites capdevilensis* R, *Pseudohastigerina micra* R, plus species listed above, including *Spumellaria* (spheres) R-VA.

6560-7000'

Probably barren of indigenous marine fossils. Primarily sand.

7040-7100'

Globigerina wilsoni? VR, *Stichocassidulina cf. thalmani* VR, *Asterigerina crassaformis* R, *Oridorsalis umbonata* R, *Tritaxilina colei* VR-R, *Subbotina cf. yeguaensis* VR, *Parrella "midwayana"* (of Mallory, 1959) VR, *Marginulina "subbullata"* (of Mallory, 1959) VR, *Cibicides malloryi* R, *Nodosaria deliciae* R, *Bulimina macilenta*? VR, plus species listed above, including *Spumellaria* (spheres) A-VA, *Subbotina* spp. R, *Gyroidina* spp. VR-R, *Pseudohastigerina micra* VR, *Subbotina eocaena* VR, and *Lenticulina* spp. VR-R.

7120-7380'

Barren of indigenous fossils.

7860'

Barren of indigenous fossils.

8113-8120' (core)

Barren of fossils.

8460'

Barren of fossils.

CONCLUSIONS

DEPTH (FEET)	STAGE	PALEOENVIRONMENT
80-530	Indeterminate	Indeterminate

600-1080	Refugian	Upper Bathyal
1110-1200	Indeterminate	Indeterminate
1230-2490	Narizian, undifferentiated	Upper to Upper Middle Bathyal
2550-4780	Indeterminate	Indeterminate
4860-5120	Probably Lower Narizian	Upper to Middle Bathyal, undifferentiated
5220-5320	Indeterminate	Indeterminate
5340	Probably Upper Ulatisian	Inner to Middle Neritic
5360	Indeterminate	Inner Neritic?
5440-5860	Indeterminate	Indeterminate
5920-6020	Probably Upper Ulatisian	Mixed Inner Neritic and Upper to Middle Bathyal, undifferentiated
6040	Indeterminate	Indeterminate
6060-6440	Probably Upper Ulatisian	Bathyal, undifferentiated
6560-7000	Indeterminate	Indeterminate
7040-7100	Probably Upper Ulatisian	Bathyal, undifferentiated
7120-7380	Indeterminate	Indeterminate
7860	Indeterminate	Indeterminate
8113-8120	Indeterminate	Indeterminate
8460	Indeterminate	Indeterminate

MOBIL CORPORATION
IRA BAKER NO. 1
NE 1/4 SEC. 28, T15S, R3W
LINN COUNTY

Summary

Only one definitely age-diagnostic fauna was found in this deep well section. It occurs from 1660 to 1810 ft, and is Narizian in age. A sparse fauna occurs from 10260 to 10350 ft, which contains a single specimen of *Caucasina schencki*. *C. schencki* has been reported from California sediments as old as upper Ulatisian, according to Mallory (1959).

Generally shallow water benthic Foraminifera plus sparse plankton indicate both a nearshore environment and at least partial restriction from open sea circulation during deposition of all fossiliferous sediments in the well section.

BIOSTRATIGRAPHIC RESULTS

The following data were derived from 113 previously unprocessed dry ditch samples. The samples were borrowed from the D.O.G.A.M.I. collection.

690-1080'

Elphidium sp. VR*, shell fragments VR, Elphidiella sp. VR-R, sponge spicules VR-R.

1100-1140'

Elphidiella sp. var. (large) VR (at 1120 ft), well-rounded coarse sand and rock fragments C-A (at 1100 and 1120 ft), coal/lignite VA (at 1140 ft).

1160-1630'

Barren of fossils. Volcanically derived? rock fragments (from 1160 to 1400 ft), off-white tuffaceous sandy mudstone? (from 1460 to 1530 ft), volcanic? sandstone (from 1570 to 1630 ft).

1660-1810'

Cyclammina sp. R, Lenticulina spp. R, arenaceous spp. indeterminate (crushed) VR-R, Nonionellina applini R, Cibicides natlandi R, Spumellaria (spheres) R-C, diatoms (pyritized, centrate) R, Eponides mexicana VR, Globobulimina sp. (pyritized) VR-R, Bathysiphon eocenica R, Bolivina oregonensis VR, Epistominella? aff. capitansensis? VR, Caucasina schencki (at 1810 ft only) R.

1840'

No new species. Globobulimina? sp. VR. Off-white tuffaceous? mudstone?.

1870-3450'

Interval not examined or processed. Lithology mostly conglomerate with some volcanics from 1860 to 2000 ft and almost entirely volcanics from 2030 to 3450 ft, according to mud log.

3480-3850'

Barren of fossils. Lithology primarily volcanically derived. Common gray sandy siltstone? (at 3550 ft only).

3880-4100'

Interval not examined or processed. Lithology almost entirely volcanics according to mudlog.

4130-4190'

Barren of fossils. Lithology primarily volcanically derived.

4220-4550'

Interval not examined or processed. Lithology almost entirely volcanics according to mudlog.

4580-4640'

Barren of fossils. Lithology primarily volcanically derived.

4670-8700'

Interval not examined or processed. Lithology

* VR=1-2 specimens per sample; R=2-10; C=11-32; A=33-100; VA=101-320; VVA=320-1000.

virtually entirely volcanics according to mudlog.

8730-9270'

Barren of fossils. Lithology volcanics and/or volcanically derived.

9300-9810'

Barren of fossils. Lithology fine sandstone and/or volcanically derived.

9840-10020'

Barren of fossils. Lithology primarily volcanics and/or volcanically derived.

10050-10320'

Ostracod VR, calcareous spp. indeterminate (crushed) VR-R, Nonion? sp. (small, thin test) VR, Epistomina? sp. (poorly preserved) VR, Nodosaria? longiscata? (fragment) VR, plus species listed above, including Elphidium sp. R, Lenticulina sp. VR, Caucasina schencki? (poorly preserved) VR.

10350'

No new species. Caucasina schencki VR.

10380'

Barren of fossils. "Red grains" VA.

10410'

No new species. Calcareous species indeterminate (crushed) R, arenaceous? sp. indeterminate (crushed) R, Lenticulina sp. VR. Remark: This interval may be barren of indigenous fossils. Circulating on bottom may have caused contamination from above.

CONCLUSIONS

<u>DEPTH (FEET)</u>	<u>STAGE</u>	<u>PALEOENVIRONMENT</u>
690-1080	Indeterminate	Inner Neritic
1100-1140	Indeterminate	Non-marine to Marginal Marine (possible beach)
1160-1630	Indeterminate	Indeterminate
1660-1810	Narizian, undifferentiated	Outer Neritic to Upper Bathyal
1840	Indeterminate	Marine, undifferentiated
3480-3850	Indeterminate	Indeterminate
4130-4190	Indeterminate	Indeterminate
4580-4640	Indeterminate	Indeterminate
8730-10020	Indeterminate	Indeterminate
10050-10110	Indeterminate	Probably Neritic, undifferentiated
10140-10230	Indeterminate	Indeterminate

10260-10320 Indeterminate Possibly Neritic, undifferentiated

10350 Upper Ulatisian to Narizian, undifferentiated Probably Outer Neritic or deeper.

10380 Indeterminate Indeterminate

10410 Indeterminate Marine, undifferentiated?

RESERVE OIL AND GAS COMPANY
ESMOND NO. 1
SW 1/4 SEC. 7, T12S, R1W
LINN COUNTY

Summary

All of the samples examined by this writer were found to be barren of marine fossils. The intervals from 2920 to 3880 ft, and one sample at 4420 ft, may be of non-marine or marginal marine origin, based on lithology.

BIOSTRATIGRAPHIC RESULTS

The following data were derived from 99 samples (98 dry ditch and one core) borrowed from the D.O.G. A.M.I. collection.

30-485'

Barren of fossils. Lithology primarily volcanic? sandstone.

485-870'

Interval not examined for microfossils. Lithology primarily volcanics (see Newton, 1969).

900-2170'

Barren of fossils. Lithology largely volcanically derived. Bentonitic shale (at 960 ft). Major increase in "red grains" (at 2110 ft).

2170-2680'

Interval not examined for microfossils. No sediments reported in volcanics (Newton, 1969).

2710-2890'

Barren of fossils. Lithology primarily sandstone. Remark: R. E. Thoms, in Newton (1969) reported unidentifiable Foraminifera from one sample, at 2875 ft. This writer did not find any fossils in the ditch sample from 2860 to 2890 ft.

2920-3880'

Barren of marine fossils. Lignite and/or coal (at 2920, 2950, 3190, 3340, 3430, 3460, 3550, 3640, 3670, 3790, 3820, and 3850 ft).

3910-4000'

Barren of fossils. Major lithology change (at 3910 ft); lignite/coal and mica (both common above) were

not noted below this depth, with one exception, at 4420 ft (see below).	2920-3880	Indeterminate	Possibly intermit- tently Non-marine to Marginal Marine
Note: Intervals which are omitted below are volcanic, and were not examined for microfossils.	3910-4000	Indeterminate	Indeterminate
<u>4420'</u>	4420	Indeterminate	Possibly Non-marine to Marginal Marine
Barren of marine fossils. Lignite locked in siltstone lithology.	4450,4480	Indeterminate	Indeterminate
<u>4450'; 4480'</u>	5020	Indeterminate	Indeterminate
Barren of fossils. Lithology primarily siltstone.	5200	Indeterminate	Indeterminate
<u>5020'</u>	5980	Indeterminate	Indeterminate
Barren of fossils. Lithology mudstone? to very fine-grained sand.	6460	Indeterminate	Indeterminate
<u>5200'</u>	6790	Indeterminate	Indeterminate
Barren of fossils. Lithology well-consolidated brown silty mudstone?.	7000	Indeterminate	Indeterminate
<u>5980'</u>	7540	Indeterminate	Indeterminate
Barren of fossils. Lithology volcanic? siltstone?.	8110	Indeterminate	Indeterminate
<u>6460'</u>	8601	Indeterminate	Indeterminate
Barren of fossils. Lithology volcanic? siltstone?.			
<u>6790'</u>			
Barren of fossils. Lithology volcanic? siltstone and rock fragments. Increase in "red grains".			
<u>7000'</u>			
Barren of fossils. Lithology approximately 50% brownish-gray mudstone.			
Note: According to Newton (1969), the section from 7000 ft to total depth is solid volcanics.			
<u>7540'</u>			
Barren of fossils. Lithology volcanic? mudstone and siltstone.			
<u>8110'</u>			
Barren of fossils. Lithology volcanic rock fragments.			
<u>8601'</u> (core)			
Barren of fossils. Lithology volcanic rock fragments.			

CONCLUSIONS

<u>DEPTH (FEET)</u>	<u>STAGE</u>	<u>PALEOENVIRONMENT</u>
30-485	Indeterminate	Indeterminate
900-2170	Indeterminate	Indeterminate
2710-2890	Indeterminate	Indeterminate

REFERENCES CITED

- Beck, R. S., 1943, Eocene Foraminifera from Cowlitz River, Lewis County, Washington: *Journal of Paleontology*, v. 17, no. 6, p. 583-614.
- Bruer, W. G., Alger, M. P., Deacon, R. J., Meyer, H. J., Portwood, B. B., and Seeling, A. F., 1984, Correlation Section 24, northwest Oregon: Pacific Section, American Association of Petroleum Geologists.
- Cushman, J. A., Stewart, R. E., and Stewart, K. C., 1947, Upper Coaledo (Upper Eocene) Foraminifera from Yokam Point, Coos County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 36, Part III, p. 57-69.
- - - 1949, Upper Eocene Foraminifera from Toledo Formation, Toledo, Lincoln County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 36, Part VI, p. 126-145.
- Ingle, J. C., Jr., 1980, Cenozoic paleobathymetry and depositional history of selected sequences within southern California continental borderland: Cushman Foundation for Foraminiferal Research, Special Publication 19, p. 163-195.
- Mallory, V. S., 1959, Lower Tertiary biostratigraphy of California coast ranges: Tulsa, Oklahoma, American Association of Petroleum Geologists, 416 p.
- McKeel, D. R., 1983, Subsurface biostratigraphy of east Nehalem Basin, Columbia County, Oregon: Oregon Department of Geology and Mineral Industries Oil and Gas Investigation 9, p. 1-34.
- McKeel, D. R., 1984, Biostratigraphy of exploratory wells, northern Willamette Basin, Oregon: Oregon Department of Geology and Mineral Industries Oil and Gas Investigation 12, p. 1-19.
- McKeel, D. R., and Lipps, J. H., 1975, Eocene and Oligocene planktonic Foraminifera from central and southern Oregon coast range: *Journal of Foraminiferal Research*, v. 5, no. 4, p. 249-269.
- Newton, V. C., Jr., 1969, Subsurface geology of lower Columbia and Willamette Basins, Oregon: Oregon Department of Geology and Mineral Industries Oil and Gas Investigations No. 2, p. 1-121.
- Schenck, H. G., and Klempell, R. M., 1936, Refugian stage of Pacific coast Tertiary: American Association of Petroleum Geologists Bulletin, v. 20, no. 2, p. 215-225.
- Snively, P. D., Jr., and Wagner, H. C., 1963, Tertiary geologic history of western Oregon and Washington: Washington Division of Mines and Geology Report of Investigations No. 22, p. 1-25.
- Tipton, A., Klempell, R. M., and Weaver, D. W., 1973, Oligocene biostratigraphy, San Joaquin Valley, California: University of California Publications in Geological Sciences, v. 105, 81 p.
- Zingula, R. P., 1968, A new breakthrough in sample washing: *Journal of Paleontology*, v. 42, no. 4, p. 1092.

