PRELIMINARY GEOLOGIC DESCRIPTION

ASHLAND
#1 S.F.O.T.

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Prepared by

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INTRODUCTION

Two intervals of the Travis Peak Formation were cored in the Ashland #1 S.F.O.T. well, Nacogdoches County, Texas. Core was recovered from 9,655.0 to 9,783.1 and from 10,083.9 to 10,155.2 ft. The top of the Travis Peak in this well is at 9,406 ft, so the core begins about 260 ft below the contact with the Sligo Formation.

MACROSCOPIC CORE DESCRIPTION

The Travis Peak cores were described using a hand lens and binocular microscope, and graphic logs of the cores were made at a scale of 1 in = 5 ft (fig. 1). The following features of the cores were noted on the descriptive logs: depth; rock type; accessories such as pyrite, organic matter, and burrows; sedimentary structures; texture (rounding and sorting); induration; grain size; relative amount of carbonate cement; color; and special features such as fluorescence, dead oil, and calcareous clasts (fig. 1). Porosity and permeability values reported by Petrophysical Services, Incorporated, are noted on the graphic logs, as are the depths from which thin sections were made.

The cores consist of intervals of fine to very fine sandstone, siltstone, and mudstone (fig. 1). Clean sandstones range between 5 and 15 ft thick; the interbedded mudstone and siltstone layers are thicker in the upper core than in the lower one.

Two types of sandstones that have been recognized in other Travis Peak cores (Dutton and Finley, 1984) also occur in the Ashland #1 S.F.O.T. cores. The sandstone at 9,750 ft is the best example in these cores of a Type I sandstone, which has a sharp base, an upward decrease in grain size and scale of sedimentary structures, and an upward increase in burrowing (fig. 1).

Within the sandstone there are several smaller cycles, on the order of 5 ft each, with crossbedded sandstones at the base and rippled sandstones above. The cycles within the sandstone suggest that there were several pulses of energy during deposition of this unit. The 9,750-ft sandstone is contained within a sequence of red mudstone that was probably deposited in a floodplain facies of an alluvial or upper-delta-plain environment. Therefore, the 9,750-ft sandstone probably represents a small fluvial channel or a crevasse splay deposited in the adjacent floodplain.

The sandstones in the lower core (10,083 to 10,155 ft) are also interbedded with red and gray mudstones. There is no evidence of marine influence on these deposits, and they probably represent alluvial or upper-delta-plain deposits.

The shallowest occurrence of red mudstone in the cores is at 9,732 ft (fig. 1). Above this depth, the Travis Peak sediments probably were increasingly influenced by the marine transgression that finally resulted in deposition of the Sligo carbonate section. Sandstones above 9,732 ft are finer grained and contain lower energy sedimentary structures compared with the deeper sandstones. The sandstone at 9,695 ft is an example of a Type III sandstone (Dutton and Finley, 1984). Although the bottom of the sandstone was not recovered, logs indicate it has a gradational, upward coarsening base. Ripples and horizontal laminations remain where burrowing has not been intense. Burrows are present throughout the sandstone, but they are more abundant at the top. This sandstone may have been deposited in a relatively low energy, marginal marine setting, such as a mixed-to-sandy tidal flat.

Most of the mudstones in the cores appear structureless, but ripples and burrows can be distinguished in some of the coarser layers. Thin siltstones within mudstone layers are commonly contorted by soft-sediment deformation. Calcareous nodules apparently formed within mudstones shortly after deposition in reducing, poorly drained marsh and swamp environments. Calcareous nodules are present in mudstones in the lower core, but they are more abundant in the upper core. Reworked calcareous nodules form a gravel lag at the base of one of the cycles within the 9,750-ft sandstone, evidence that the nodules formed during early diagenesis.

PETROGRAPHIC DESCRIPTION

Detailed study of the core is being conducted with the scanning electron microscope (SEM) and petrographic microscope.

Grain Size

Analysis of grain size was accomplished by making grain-size point counts of thin sections. Fifty grains per slide were measured along their long dimension, excluding cement overgrowths in order to determine the size of the detrital grains. Mean diameter of sand- and silt-sized grains was calculated for each sample (Table 1); detrital and authigenic clays were not included in the calculation of mean grain diameter.

Most sand grains are fine or very fine, between .062 and .25 mm. Most silt is coarse silt, between .031 and .062 mm. Clay particles are smaller than .004 mm. The four deepest samples (Table 1) are well sorted (the sample at 10,112.4 ft is very well sorted), but the sample at 9,697.8 ft is moderately well sorted, according to the definition of Folk (1974). The presence of detrital clay in the 9,697.8-ft sandstone is probably a result of burrowing.

Mineral Composition

Five samples have been point counted for a preliminary description of mineral composition (Table 2). The sandstones are mineralogically mature and are classified as quartz arenites and subarkoses, with quartz comprising 91 to 96 percent of the essential framework constituents (quartz, feldspar, rock

Table 1. Grain-size distribution in Ashland #1 S.F.O.T. core.

Depth (ft)	Mean (mm)	Sand (%)	Silt (%)	Detrital Clay (%)	Authigenic Clay (%)	Textural Class*
9,697.8	.070	46	42	12	0	Sandy siltstone
9,750.2	.128	96	4	0	0	Fine sandstone
9,753.0	.130	96	4	0	0	Fine sandstone
9,753.6	.153	98	2	0	0	Fine sandstone
10,112.4	.137	92	4	0	4	Fine sandstone

*Textural class determined only by detrital grains.

Table 2. Petrographic analyses of Ashland #1 S.F.O.T. core, measured in percent.

	Depth = 9,697.8 ft	9,750.2 ft	9,753.0 ft	9,753.6 ft	10,112.4 ft
Framework Grains					
Quartz	64.0	62.9	57.6	62.3	62.1
Plagioclase	2.0	4.4	3.0	4.7	2.0
Orthoclase	0	0	0	0	0
MRF*	0	0	0.5	1.4	0.5
Chert	0.5	0.5	0.5	0	0
Clay clasts	0	1.0	0	0.5	0
Heavy minerals	1.0	0	0	0	0
Other	0	0.5[1]	0	0.5[2]	0
Matrix					
Clay-sized fines	15.3	0	0	0	0
Cements					
Quartz	13.3	21.0	18.7	17.5	20.7
Dolomite	1.0	2.4	8.9	2.4	1.0
Ankerite	1.0	4.4	6.9	7.1	1.5
Authigenic clay	2.0	2.4	1.0	1.9	2.0
Feldspar	0	0.5	0	0	0
Solid organic matter	0	0	0	0	0
Porosity					
Primary porosity	0	0	0	0	2.0
Secondary porosity	0	0	3.0	1.9	8.4
Porosimeter porosity[3]	no data	3.7	5.0	no data	no data

* Metamorphic rock fragments [1] Pyrite [2] Siderite (?)
[3] Measured by Petrophysical Services, Inc.

fragments). Plagioclase feldspar varies from 3 to 7 percent; no orthoclase was observed. Rock fragments, mainly chert and low-rank metamorphic rock fragments, constitute between 0.7 and 2.1 percent of the framework grains. Zircon and tourmaline are the only heavy minerals, and they are another indication of the mineralogic maturity of the Travis Peak sandstones.

Authigenic cements constitute between 17 and 36 percent of the sandstone volume in these five samples (Table 2). Illite and chlorite occur as rims of tangentially oriented crystals around detrital grains and as pore-filling cement (fig. 2); the tangentially-oriented clays were the earliest authigenic cements to precipitate. Authigenic illite and chlorite have a combined volume of 1.0 to 2.4 percent.

Quartz cement is the most abundant authigenic mineral in the Ashland #1 S.F.O.T. cores. Quartz overgrowths fill 13 to 21 percent of the volume, and precipitation of authigenic quartz occluded much of the primary porosity. The sample from 9,697.8 ft has the lowest amount of quartz cement because of the abundant detrital matrix (Table 2). In the clean sandstones, the average volume of authigenic quartz is 19.5 percent. In the Clayton Wiliams #1 Sam Hughes and ARCO #1 Phillips cores, quartz cement has an average volume of 21.3 percent, which is not significantly different than the value for the Ashland #1 S.F.O.T. core.

Dolomite and ankerite cements are present in all the samples (Table 2) and reach a combined abundance of 15.8 percent in the sample from 9,753.0 ft. Both dolomite and ankerite are present mainly as rhombs (fig. 3), and it is common for the crystals to be dolomite in the center and ankerite around the edges. Dolomite and ankerite in the 9,753.0-ft sample appear to occur preferentially along ripple faces (fig. 4) where they replace detrital grains, particularly clay clasts. They precipitated after the quartz overgrowths, and in places they replace quartz cement or occur in secondary pores.

Solid organic matter (also known as reservoir bitumen or "dead oil") was observed in the core (fig. 1), but it was not present in any of the preliminary thin sections (Table 2). In the Clayton Williams #1 Sam Hughes and ARCO #1 Phillips cores, the solid organic matter is in primary pores and coats quartz overgrowths; it probably has a similar distribution in the Ashland #1 S.F.O.T. core. Solid organic matter is less abundant in the Ashland #1 S.F.O.T. core than in the Clayton Williams or ARCO cores, possibly because the Ashland core is from deeper in the Travis Peak section. Preliminary studies of the solid organic matter suggest it occurs mainly in the upper Travis Peak (Dutton, 1985). It appears to have formed by deasphalting of pooled oil after solution of large amounts of gas into the oil (Rogers and others, 1974).

Porosity

The amount of porosity observed in thin section in the five samples is quite variable (Table 2). The highest amount of porosity, 10.4 percent, is in the sample from 10,112.4 ft. Much of the porosity in this sample is secondary, caused by dissolution of framework grains (fig. 5). Secondary pores are approximately the same size as detrital grains, and they may contain fragments of dissolved framework grains, probably feldspar.

In samples with values for both thin-section and porosimeter porosity, thin-section porosity is lower (Table 2). The difference between thin-section and porosimeter porosity is probably caused by microporosity in detrital and authigenic clays; such porosity generally cannot be seen in thin section, but it is measured by the porosimeter.

REFERENCES

Dutton, S. P., 1985, Travis Peak core studies, in Finley, R. J., and others, The Travis Peak (Hosston) Formation: geologic framework, core studies, and engineering field analysis: The University of Texas at Austin, Bureau of Economic Geology, topical report prepared for the Gas Research Institute under contract no. 5082-211-0708, p. 75-123.

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Folk, R. L., 1974, Petrology of sedimentary rocks: Hemphill Publishing Co., Austin, Texas, 182 p.

Rogers, M. A., McAlary, J. D., and Bailey, N. J. L., 1974, Significance of reservoir bitumens to thermal-maturation studies, western Canada Basin: American Association of Petroleum Geologist Bulletin, v. 58, no. 9, p. 1806-1824.

FIGURE CAPTION

Figure 1. Descriptive log of core of the Travis Peak Formation from the Ashland #1 S.F.O.T. well, Nacogdoches County, Texas. Core depths are 9,665.0 to 9,783.1 and 10,083.9 to 10,155.2 ft.

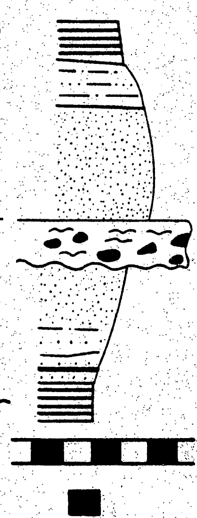
Insert foldout pages 1-3 here

EXPLANATION OF SYMBOLS

CONTACT

Gradational G
Upward fining
Planar
Erosive E
Upward coarsening
Slightly irregular

ROCK TYPE (%)



Mudstone
Siltstone and sandy siltstone (—···—)
Sandstone
Mud clast and mud flake (~~) conglomerate
Interbedded sandstone (····), siltstone (—···—), and
Mudstone
Coal
Porosity

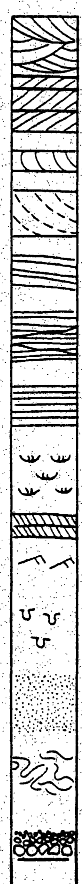
ACCESSORIES

Vertical and horizontal burrows
Organic fragments
Rootlets
Shells
Mica flakes
P Pyrite
Callianassa burrows

TEXTURE

Sorting	Rounding
vp-s Very poor	a Angular
p-s Poor	s-a Subangular
m-s Moderately well	s-r Subrounded
w-s Well	r Rounded

STRUCTURES



Trough crossbedding
Planar crossbedding
Crossbeds with oversteepened foresets
Indistinct cross-stratification
Gently inclined lamination = GI
Gently inclined lamination separated by low-angle discordances
Horizontal lamination
Ripple trough lamination
Planar ripple lamination
Climbing-ripple lamination
Heavily bioturbated sandstone
"Massive" sandstone = M
Contorted bedding
Graded bedding

INDURATION

WI Well indurated
I Indurated
IF Indurated but friable
IS Indurated but shaly

RELATIVE CALCITE CONTENT

1 Slight effervescence
3 Moderate effervescence
5 Strong effervescence
10 Very strong effervescence

COLOR

Abbreviations from Rock-Color Chart, Geological Society of America

Abbreviations from Geological Society of America Rock-Color Chart used on core descriptions.

5R 6/2	Pale red
5R 4/2	Grayish red
5YR 6/1	Light brownish gray
5B 5/1	Medium bluish gray
N8	Very light gray
N7	Light gray
N6	Medium light gray
N5	Medium gray
N4	Medium dark gray

FIGURE 2.

SEM photograph of pore-lining authigenic clay, probably illite. Depth is 9,753.6 ft. Bar length is 10 m; magnification is 3500x.

FIGURE 3.

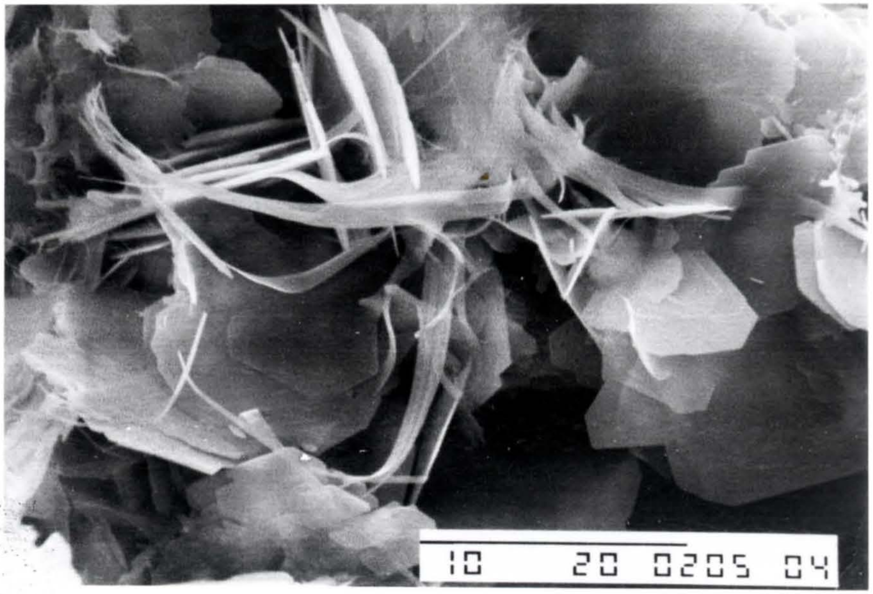
SEM photograph of an authigenic carbonate rhomb, either dolomite or ankerite. Depth is 9,753.6 ft. Bar length is 10 m; magnification is 1500x.

FIGURE 4.

Photomicrograph of dolomite and ankerite cement (C) along a ripple face at a depth of 9,753.0 ft. Long dimension of photo = 3.5 mm; plane light.

FIGURE 5.

Photomicrograph of secondary pores (P) at a depth of 10,112.4 ft. Long dimension of photo = 0.89 mm; plane light.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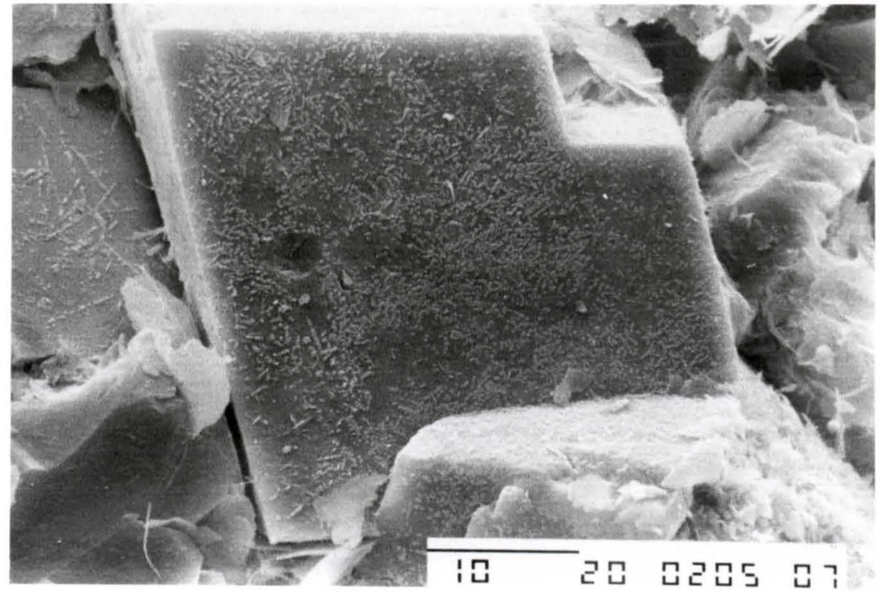
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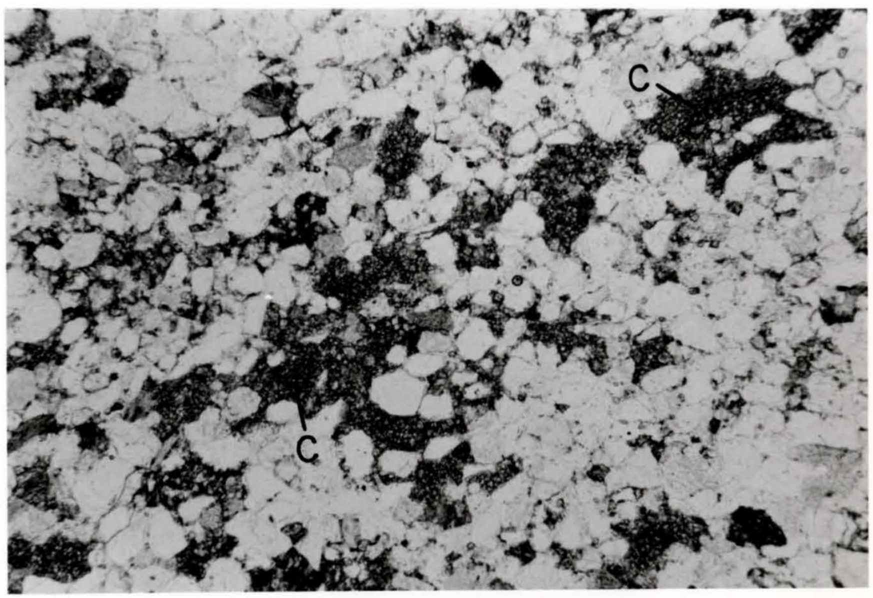
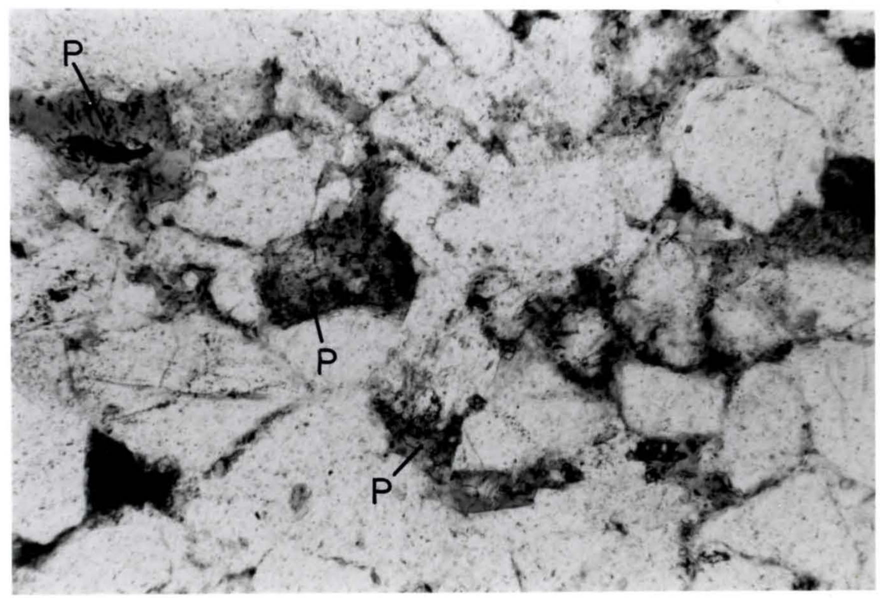

C
C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