CHEMICAL RESEARCH AND DEVELOPMENT DEPARTMENT

HALLIBURTON SERVICES
DUNCAN, OKLAHOMA

LABORATORY REPORT

No. T11-A224-85
Progress Report 1

To Mr. John Ringhisen
Halliburton Services
Wichita, KS

Date December 3, 1985

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We give below results of our examination of eleven boxes of core.

Submitted by Petroleum Management Inc.

Marked Well: Walgreen B-3
Location: Sec. 6-6S-20W; Phillips Co., KS
Formation: Toronto and Lansing
Depth: 3,240-3,271.5 feet
Received: November 8, 1985

Purpose

The core was submitted for analysis and treatment recommendations.

Conclusions

The available data are presented here. We plan to do some etching tests with several acids, which will be covered in a final report in the near future. At that time, the remaining core and logs will be returned as requested.

We have determined that the interval examined is, from top to bottom, limey shale and reddish brown, limey, iron stained mudstone overlying an impure limestone, which overlies a porous, fossiliferous limestone. Note that all of the zone has some solubility in HCl, but only the lower most limestone has high solubility. We hope to be able to better advise you of a suitable stimulation treatment upon completing the acid etching tests. I will use some of the shaley limestone from the middle of the section and the more highly soluble limestone from near the bottom of the zone for this.

An immersion in fresh water, 2% KCl, and 18% NaCl was run on samples from three of the shaley sections. We observed that all of the samples broke up to some extent, but that 18% NaCl limited the dispersion of the shale into mud. This might be a factor in getting good cement bonds through these depths.

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Data

Core Description

Box No.	Depth (feet)	Description
1	3,240-43	Limey, grey mudstone (?graptolite fossil).
2	3,243-46	Limey, grey mudstone, at 45 feet, more reddish-brown.
3	3,246-49	Brown, slightly limey mudstone.
4	3,249-52	Up to 51 feet, more blue-grey limey mudstone. Approximately 51 feet turns to white, vugular limestone.
5	3,252-55	White vugular limestone contacting areas of white, dense ? silicified or dolomitized limestone (plugged).
6	3,255-58	White, vugular to dense limestone with fossils.
7	3,258-61	Disturbed (?bioturbated) bedding - grey limey mudstone interbedded with white, fossiliferous limestone (microcrystalline) large fossils, several healed vertical fractures.
8	3,261-64	Similar to 58-61 feet, vertical fracture, fossils at 63 feet and turns to brown mudstone (limey).
9	3,264-67	Brown, limey mudstone to 67 feet, then grey, limey mudstone.
10	3,267-70	Crumbly, limey mudstone to 68 feet, then white, vuggy limestone.
11	3,270-71.5	One good core - vuggy white limestone, rest bits and pieces.

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Data Cont'd

Qualitative X-ray Diffraction and Acid Solubility Analyses

Purpose: To identify the types and relative quantities of minerals in the formation sample.

Procedure: A pulverized one gram sample is placed in an x-ray beam and rotated through an arc. The x-ray beam is diffracted by the sample and the diffraction patterns are recorded.

Results: The diffraction patterns are used to identify the types of minerals present and their relative quantities. The relative quantities for the submitted samples are as follows:

Sample No.	1	2	3	4	5	6	7
Depth (feet)	3,240	3,248.5	3,252	3,257.5	3,258	3,265	3,270
HCl Solubility*	16.6%	13.0%	34.6%	80.7%	70.2%	17.3%	92.7%
Quartz	35-45%	30-40%	35-45%	5-10%	5-10%	30-35%	2-5%
Feldspar	10-15%	5-10%	0	0.5-2%	0.5-2%	5-10%	0
Calcite	10-15%	5-10%	40-50%	65-80%	65-80%	10-15%	80-100%
Dolomite	2-5%	0.5-2%	2-5%	10-15%	0.5-2%	0.5-2%	2-5%
Kaolinite	0.5-2%	0	0	0	0	0.5-2%	0
Illite	5-10%	5-10%	0	2-5%	2-5%	5-10%	0
Mixed Layer	5-10%	20-30%	0	2-5%	5-10%	20-30%	0
Chlorite	2-5%	2-5%	0	0.5-2%	0.5-2%	2-5%	0
Pyrite	2-5%	0.5-2%	0	0	0	0.5-2%	0
Hematite	0	0	0	0	0	0.5-2%	0

*One gram of sample is added to 0.5N HCl. After reaction, the excess acid is titrated with 0.2N NaOH. The results are calculated and reported as calcium carbonate. (Note: a pure dolomite will be reported as 108%).

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Data Cont'd

Immersion Test

Purpose: To observe the effect of various base fluids on core chips from selected representative cores.

Procedure: Freshly broken chips from cores are immersed in test fluids; one chip per fluid in a 30 ml beaker. The samples are then placed in a vacuum for one hour. After that time an observation is made to evaluate the effect of the fluid on the core chip.

Results: Released fines from a core chip may indicate formation sensitivity to the test fluid.

Effects of immersion under vacuum at 125°F (test temp.) for one hour in the following fluids:

Sample No.	Depth (feet)	Fresh Water	2% KCl Water	18% NaCl Water
1	3,240	P	P	P
2	3,248.5	P	P	P
3	3,265	P	P	P

None of the fluids tested prevented the shale from breaking up into fragments. The salt solution was observed to be the least damaging, in that the fragments remained solid, while those in F.W. and 2% KCl tended to hydrate and collapse.

N - No fines released.
V - Very small amount of fines.
S - Small amount of fines.
M - Moderate amount of fines.
L - Large amount of fines.
P - Partially disintegrated.
CD - Completely disintegrated.
GR - Gelatinous residue formed.
PD - Partially dissolved.
C - Completely dissolved.

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Data Cont'd

Scanning Electron Microscope (SEM) Examination and Petrographic Examination

For SEM:

Purpose: To provide a greatly magnified view of a core sample. Minerals present in the sample can be identified and their location observed.

Procedure: A core chip with a freshly broken surface is required for this examination. The sample is coated with a gold palladium alloy and placed in the vacuum chamber of the SEM. The core chip is viewed at a high magnification and a photomicrograph is taken. An associated energy dispersive x-ray (EDX) is used to help identify the mineral content of the sample.

Results: The framework grains can be identified and their size approximated. The location of the clay minerals within the sample can be observed. The SEM can produce, in effect, a pseudo three-dimensional view of formation pore spaces. The area of the sample viewed is very small and may not clearly characterize the entire formation.

For Petrographic:

Purpose: To describe the framework grains, the matrix or the cementing material, and the pore spaces.

Procedure: Core chips are glued to glass slides and then ground to a thin section through which light can be transmitted. The slide is placed under a microscope and viewed using polarized light at high magnification.

Results: The result of this examination is a descriptive and systematic classification of the rock and materials present in the sample. This analysis is a visual observation, thus is somewhat subjective.

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Data Cont'd

Scanning Electron Microscope Examination Cont'd

Sample No: 1
Depth: 3,240 feet

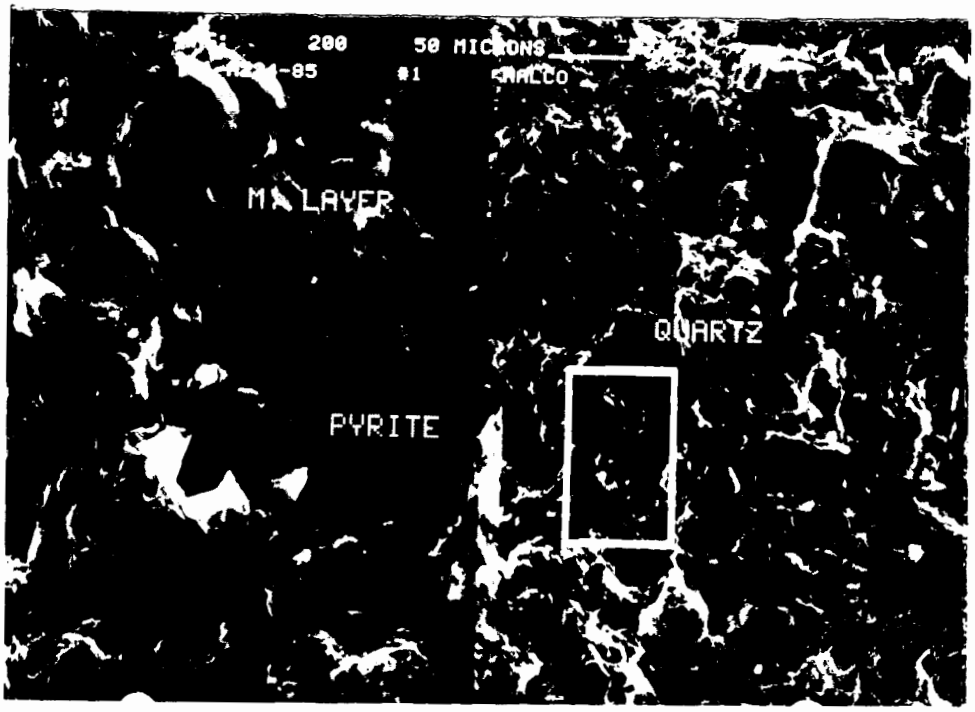

Figure No. 1; Negative No. 21821-2718; Magnification 200X, 1000X

Sample has a framework of very fine sand to silt size quartz, feldspar, calcite, and pyrite grains. The calcite infills and cements along with small amounts of pyrite and mixed layer clay. Poor visible porosity.

Petrographic Examination

SHALEY, LIMEY, SILTY CHERT - Framework of moderately sorted, subangular, silt to fine sand size grains of quartz, mica in a chert matrix. Some patchy carbonate. Scattered pyrite. No visible porosity.

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Data Cont'd

Scanning Electron Microscope Examination Cont'd

Sample No: 2
Depth: 3,248.5 feet

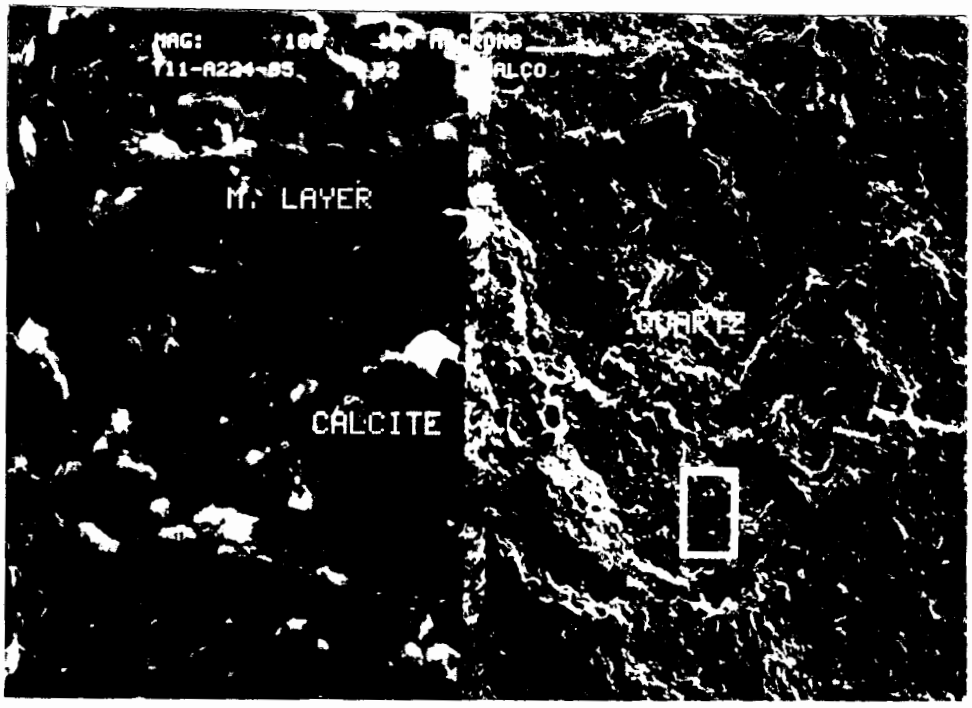

Figure No. 2; Negative No. 21821-2717; Magnification 100X, 1000X

Sample has a framework of silt size quartz grains with a few small feldspar, calcite, and pyrite grains. Mixed layer clay covers all surfaces and fills between the grains. Very poor visible porosity.

Petrographic Examination

SILTY LIMEY SHALE - Patchy carbonate crystals, streaks of silt to fine sand size grains of quartz, rock fragments, and mica. Trace of pyrite. No visible porosity.

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Data Cont'd

Scanning Electron Microscope Examination Cont'd

Sample No: 3
Depth: 3,252.5 feet

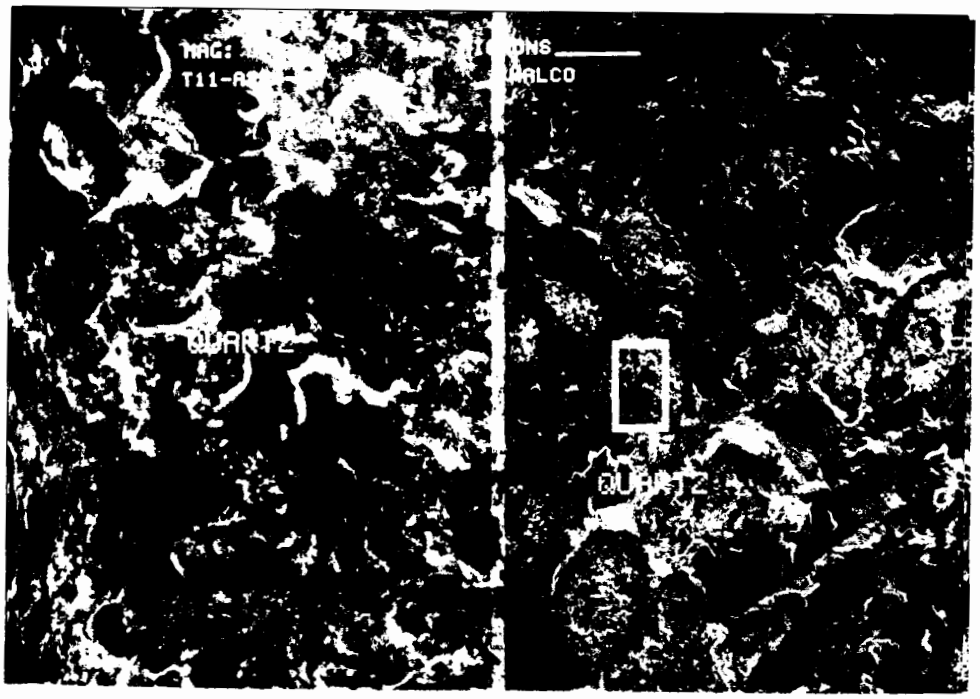

Figure No. 3; Negative No. 21821-2716; Magnification 20X, 2000X

Sample No. 3 consists of microcrystalline quartz with no visible porosity.

Petrographic Examination

PACKED BIOSPARITE - Packed fossil fragments in a sparry matrix. Some quartz replacement of fossils. Very good vugular porosity.

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Data Cont'd

Scanning Electron Microscope Examination Cont'd

Sample No: 4
Depth: 3,257.5 feet

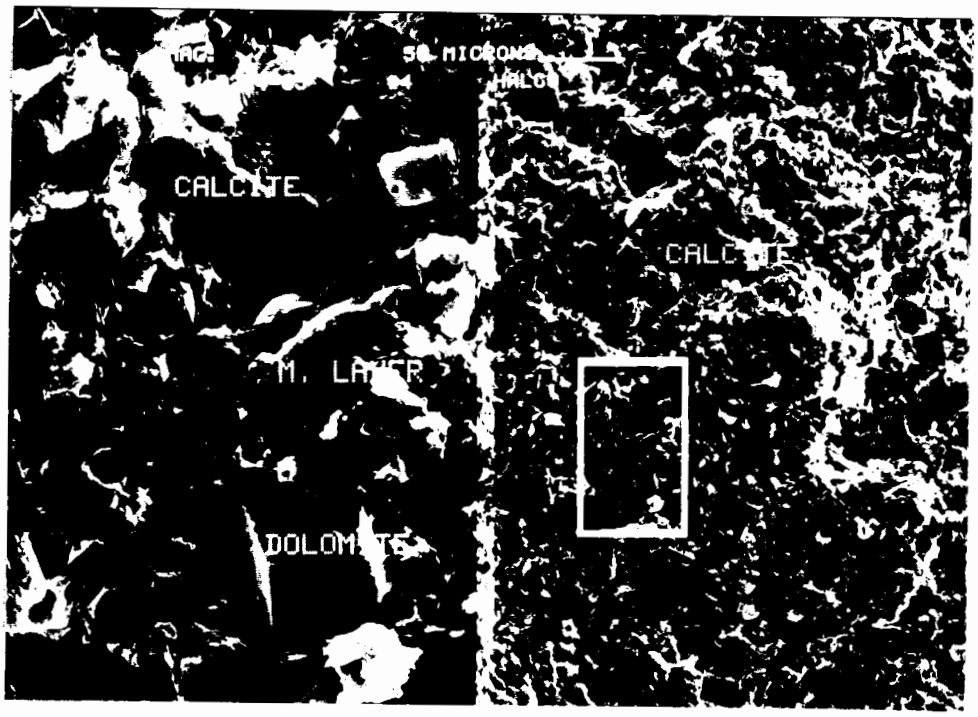

Figure No. 4; Negative No. 21821-2715; Magnification 200X, 1000X

Sample consists of microcrystalline and coarser calcite with some dolomite infill. Mixed layer clays lightly cover surfaces. No visible porosity.

Petrographic Examination

SHALEY, FOSSILIFEROUS LIMESTONE - Fossil fragments in a limestone matrix with some shale streaks and some quartz replacement of fossils. No visible porosity.

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Data Cont'd

Scanning Electron Microscope Examination Cont'd

Sample No: 5
Depth: 3,258 feet

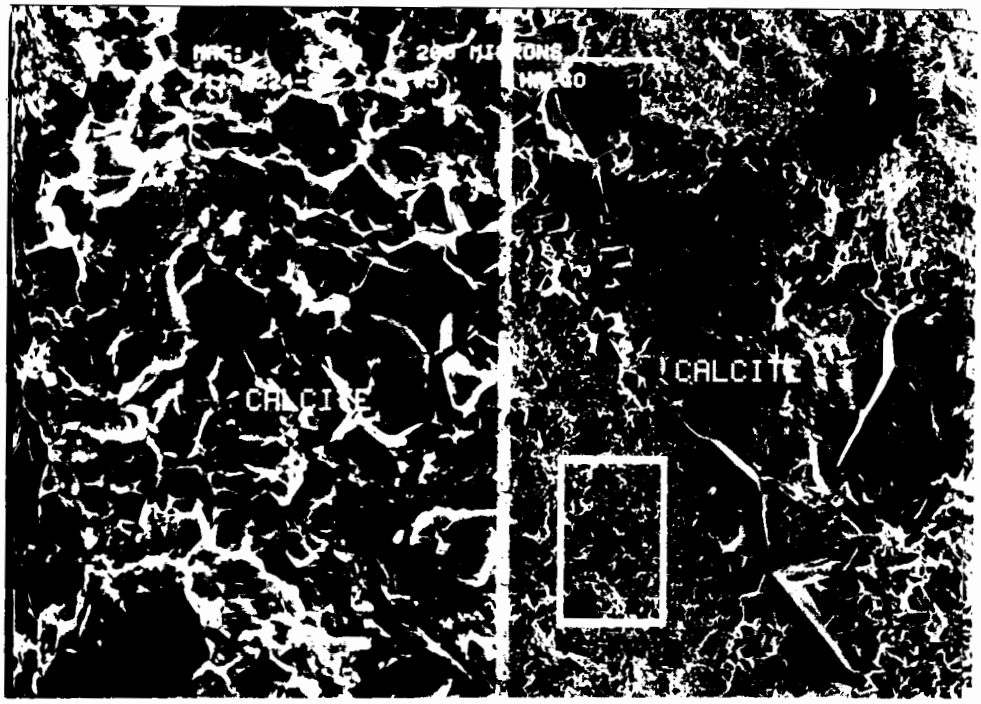

Figure No. 5; Negative No. 21821-2714; Magnification 60X, 300X

Sample No. 5 consists of calcite crystals from >600 microns to <5 microns. Trace amounts of quartz, feldspar, and mixed layer clay. Very poor visible porosity.

Petrographic Examination

SHALEY, FOSSILIFEROUS LIMESTONE - Similar to Sample No. 4 with some glauconite and pyrite.

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Data Cont'd

Scanning Electron Microscope Examination Cont'd

Sample No: 6
Depth: 3,265 feet

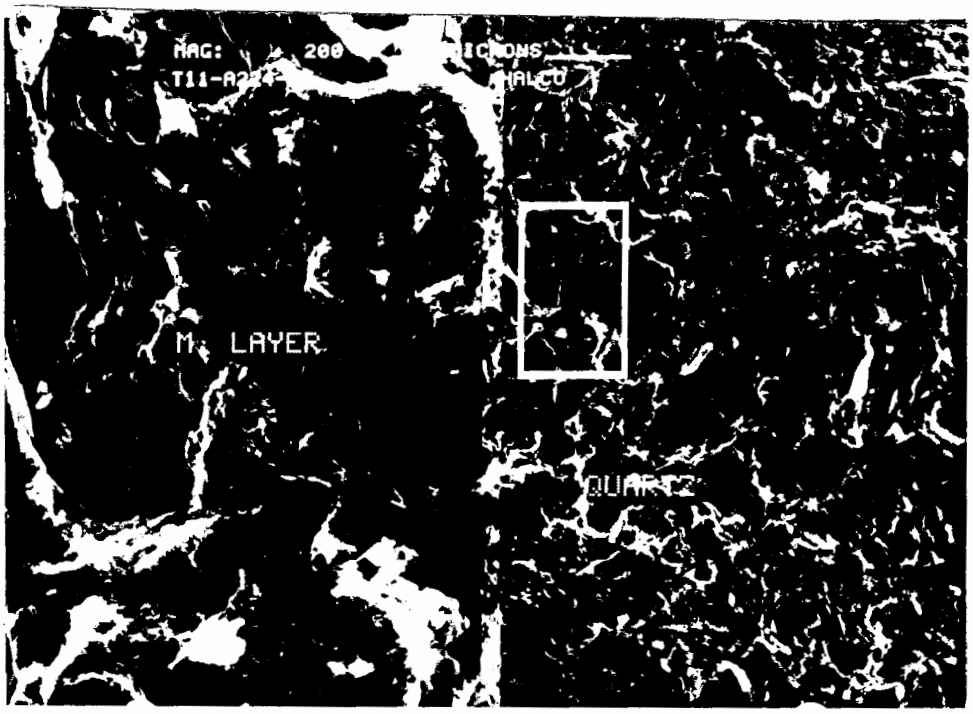

Figure No. 6; Negative No. 21821-2713; Magnification 200X, 1000X

Sample No. 6 has a framework of very fine sand or silt size grains of quartz, feldspar, calcite, and mixed layer clay. Very poor visible porosity.

Petrographic Examination

SILTY, LIMEY, SHALE - Scattered silt size quartz and mica flakes, carbonate crystals, in a shaley matrix. Trace pyrite, no visible porosity.

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Data Cont'd

Scanning Electron Microscope Examination Cont'd

Sample No: 7
Depth: 3,270 feet

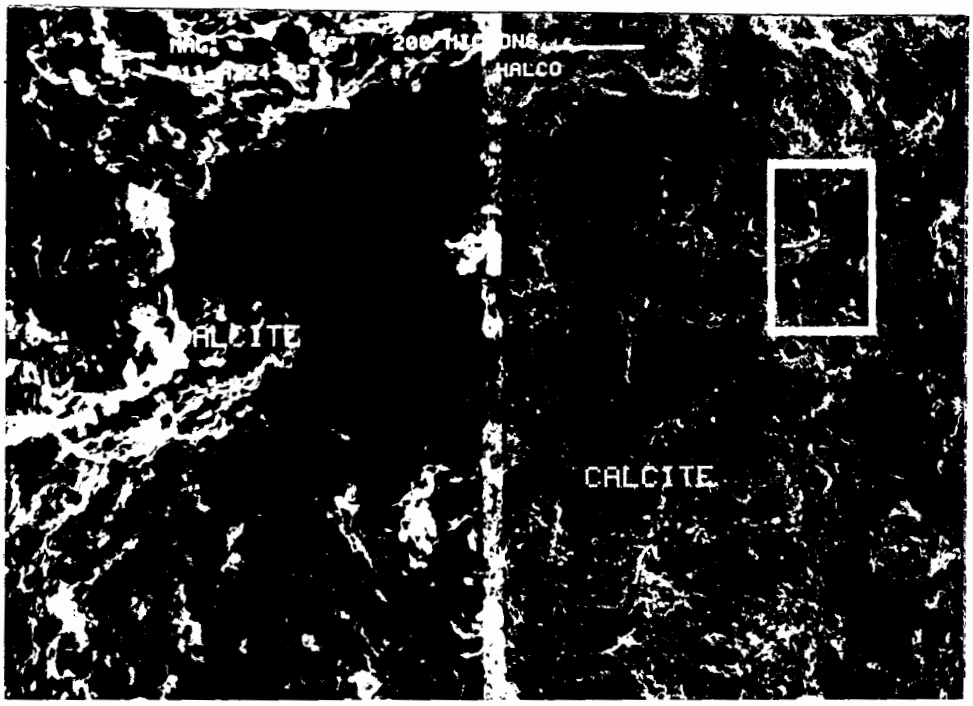

Figure No. 7; Negative No. 21821-2712; Magnification 60X, 300X

Sample No. 7 has a framework of calcite crystals ranging from 300 microns to 5 microns. Good visible porosity.

Petrographic Examination

PACKED BIOSPARITE - Packed fossil fragments in a sparry matrix of calcite crystals, trace quartz replaced fossil fragments, trace pyrite, fair to good vugular porosity including secondary porosity.

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Core Sample Disposition

The remaining core samples will be returned to the Wichita Office as requested.

Data Book Reference

The data presented in this report are recorded in Analytical Book No. 5870, page 14; Analytical Book No. 5858, page 49; and Analytical Book No. 5855, page 52.

cc: Mr. B. A. Matthews
Mr. K. W. McKown
Mr. C. E. Kirby
Mr. R. M. Lasater
Mr. A. B. Waters
Dr. L. E. Harris

Respectfully submitted,

Laboratory Analyst
Phelps-Pyeatt-Arrington
Simon-Black-Lovett

rdf

HALLIBURTON SERVICES

By Martin Halterman

Martin Halterman

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CORE ANALYSIS REPORT

FOR

PETROLEUM MANAGEMENT, INC.
WALLGREN "B" NO. 3 WELL
ROOKS COUNTY, KANSAS

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

November 12, 1985

REPLY TO
SUITE 133
400 SOUTH VERMONT
OKLAHOMA CITY, OK
73108

Petroleum Management, Inc.
400 North Woodlawn
Suite 201
Wichita, Kansas 67208

Attn: Mr. R. D. Reber, Jr.

Subject: Core Analysis Data
Wallgren "B" No. 3 Well
Rooks County, Kansas
CLI File 3402-12541

Gentlemen:

Cores taken in the subject well in the Lansing-Kansas City formation were received at the Oklahoma City laboratory for special analytical testing described on the Procedure Page.

The accompanying Coregraph presents the Surface Core-Gamma Log and binomially averaged core analysis data in graphical form to aid correlation with downhole electrical surveys.

Tabular presentation of the measured physical properties may be found on page one of this report.

It is a pleasure to have this opportunity of serving you.

Very truly yours,

CORE LABORATORIES, INC.

J. Michael Edwards

J. Michael Edwards
District Manager

JME:jk

6 cc - Addressee

Petroleum Management, Inc.
Wallgren "B" No. 3 Well
CLI File 3402-12541

Procedure Page

Handling and Analytical Procedures

Diamond coring equipment and water base mud were used to obtain 3.0 inch diameter cores between 3,240.0 and 3,272.0 feet.

The cores were preserved at the well site in a CO_2 atmosphere by CLI personnel.

The cores were transported to Oklahoma City by CLI personnel.

A Core-Gamma Log was recorded for downhole electric log correlation.

Core analysis was made in the intervals requested on right cylinder full diameter samples.

Fluid removal was accomplished using low temperature extraction.

Porosity was determined by Boyle's law method.

Air permeability in two horizontal directions was measured without Klinkenberg correction.

Cores were picked up by Halliburton Services in Duncan, Oklahoma.

CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

DALLAS, TEXAS

PETROLEUM MANAGEMENT, INC.
WALLGRN "B" NO. 3 WELL

ROOKS COUNTY, KANSAS

DATE : 11-12-85
FORMATION : LANSING-KANSAS CITY
DRLG. FLUID: WATER BASE MUD
LOCATION : SEC. 7-6S-20W

FILE NO. : 3402-12541
API NO. :
LABORATORY: OKLAHOMA CITY

FULL DIAMETER ANALYSIS

SAMPLE NUMBER	DEPTH FEET	PERM MAXIMUM	PERM 90 DEG	FLD POR	OIL% POR	WTR% POR	GRAIN DEN M	DESCRIPTION
	3240.0-3251.0	NO ANALYSIS - SH						
1	3251.0-52.0	981.	923.	14.4	9.9	65.9	2.71	LS BRN VUGGY FOSS
2	3252.0-53.0	261.	241.	12.8	8.2	70.0	2.76	LS BRN VUGGY FOSS
3	3253.0-54.0	*	36.	14.9	24.8	51.2	2.71	LS BRN VUGGY FOSS
4	3254.0-55.0	19.	15.	13.6	23.7	51.4	2.71	LS BRN VUGGY FOSS VERT FRAC
5	3255.0-56.0	39.	13.	12.3	19.3	48.9	2.71	LS BRN VUGGY FOSS VERT FRAC
6	3256.0-57.0	1.1	1.0	9.5	19.0	65.7	2.71	LS BRN VUGGY FOSS VERT FRAC
7	3257.0-58.0	621.	2.4	5.2	8.2	83.6	2.73	LS BRN VUGGY FOSS VERT FRAC
	3258.0-3268.0	NO ANALYSIS - SH						
8	3268.0-69.0	116.	31.	6.9	6.4	76.6	2.73	LS BRN VUGGY FOSS
9	3269.0-70.0	455.	325.	14.8	15.0	52.2	2.71	LS BRN VUGGY FOSS
10	3270.0-71.0	185.	181.	13.2	8.2	58.1	2.71	LS BRN VUGGY FOSS

* INDICATES PLUG PERMEABILITY

These analyses, opinions or interpretations are based on observations and materials supplied by the client to whom, and for whose exclusive and confidential use, this report is made. The interpretations or opinions expressed represent the best judgment of Core Laboratories, Inc. (all errors and omissions excepted); but Core Laboratories, Inc. and its officers and employees, assume no responsibility and make no warranty or representations, as to the productivity, proper operations, or profitableness of any oil, gas or other mineral well or sand in connection with which such report is used or relied upon.

CORE LABORATORIES, INC. *Petroleum Reservoir Engineering*

COMPANY PETROLEUM MANAGEMENT, INC. FILE NO. 3402-12541

WELL WALLGRN "B" NO. 3 WELL. DATE 11-12-85

FIELD ____ FORMATION LANSING-KANSAS CI ELEV. ____

COUNTY ROOKS COUNTY STATE KANSAS DRLG. FLD. WATER BASE MUD CORES ____

LOCATION SEC. 7-6S-20W

CORRELATION COREGRAPH

These analyses, opinions or interpretations are based on observations and material supplied by the client to whom, and for whose exclusive and confidential use, this report is made. The interpretations or opinions expressed represent the best judgment of Core Laboratories, Inc., (all errors or omissions excepted); but Core Laboratories, Inc., and its officers and employees, assume no responsibility and make no warranty or representations as to the productivity, proper operation, or profitableness of any oil, gas or other mineral well or sand in connection with which such report is used or relied upon.

VERTICAL SCALE: 5" = 100'

Total Water ____
PERCENT PORE SPACE
100 80 60 40 20 0

Gamma Ray
RADIATION INCREASE →

Permeability ____
MILLIDARCIES
1000 100 10 1

Depth Feet

Porosity ____
PERCENT
30 20 10 0

Oil Saturation ▤
PERCENT PORE SPACE
0 20 40 60 80 100

3200
3250
3300

```
      integer TI, PI, FIC
C
C
C      the following is necessary so that the call to function
C      interpol is not too cumbersome
c
c
      t1 = prmt(RHONO,FIC,TI)
      T2 = PRMT(RHONO,FIC,TI+1)
      P1 = PRMP(RHONO,FIC,PI)
      P2 = PRMP(RHONO,FIC,PI+1)
c
c
c       the compressibility is set to 0.67 if the'
c       end of the table has been reached
c
c
      if ((t2.eq.0).or.(p2.eq.0)) then
         comprw = 4.8e-10
      else
         r11 = PHSPRM(RHONO,FIC,TI, PI)
         r12 = PHSPRM(RHONO,FIC,TI,PI+1)
         r21 = PHSPRM(RHONO,FIC,TI+1,PI)
         r22 = PHSPRM(RHONO,FIC,TI+1,PI+1)
         if (r11*r12*r21*r22.eq.0.) then
            COMPRW = 0.0
         else
         cn = INTERPOL(T1,T2,P1,P2,R11,R21,R12,R22,T,P2)-
     &        INTERPOL(T1,T2,P1,P2,R11,R21,R12,R22,T,P1)
         p12 = (p1+p2)/2.
         rhp12 = INTERPOL(T1,T2,P1,P2,R11,R21,R12,R22,T,P12)
          COMPRW = CON*cn/(rhp12*(p2-p1))
        end if
      end if
      return
      end
c
c
      double precision function KAV(FTOP, LAB, LERODE, PDTHICK,
     &EPTHICK, TGAV, FERODE, SURFT, PHSPRM, PRMT, PRMP,
     &FI, PRESPOR)
C
C
C     This function computes the average thermal conductivity
c     from surface to basement at the present day
c
c
c     a call to function kest is made to compute the average
c     thermal conductivity of a formation.
c
c
      implicit real*8 (A-H, O-Z)
      integer CONDNO
      parameter (MAXF=14,MAXTI=30, MAXPI=30, CONDNO=4)
      logical FOUND
      integer FTOP, F, F2, FERODE, FI(5,0:MAXF)
      character*15 LAB(0:MAXF),LERODE(MAXF)
      double precision KEST
      dimension D(MAXF), PHSPRM(5,0:MAXF,MAXTI,MAXPI),
     &PRMP(5,0:MAXF,MAXPI), PRMT(5,0:MAXF,MAXTI), PDTHICK(MAXF),
     &EPTHICK(MAXF), PRESPOR(MAXF)
C
C
```