

CORE LABORATORIES, INC.  
*Petroleum Reservoir Engineering*  
DALLAS, TEXAS

CORE ANALYSIS REPORT

FOR

PENNZOIL COMPANY

BLUE CREEK TRACT WELL NO. 70  
BLUE CREEK - SKINNER FIELD  
KANAWHA COUNTY, WEST VIRGINIA

039 3650

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.



P. O. Box 131  
Mt. Pleasant, Mich. 48858

Pennzoil Exploration and  
Production Company  
P. O. Drawer 1588  
Parkersburg, W. Va. 26101

File No: 3602-644  
December 9, 1980

Att: Mr. Steven S. Holsclaw

Re: Core Analysis Report  
Berea Sandstone Formation  
Blue Creek Tract No. 70 Well  
Blue Creek-Skinner Field  
Kanawha Co., W. Va.

Gentlemen:

A 4" oriented diamond core from this well has been received in our Michigan laboratory. Upon receipt, the core was oriented and 1" O.D. cylindrical plugs were obtained horizontal to bedding in the NW to SE direction using water as a coolant. These samples were cleaned by refluxing toluene through them and dried in a vacuum oven at 140° C. Air permeabilities, Boyle's Law porosities and grain densities were measured on the clean and dried samples. Results of these analyses are herein submitted in tabular and graphical form.

The plug samples have been shipped to our Dallas laboratory for petrology analysis. Results of this analyses will be reported under separate cover.

This core will be returned to your office via motor freight. The opportunity to be of service on this well is appreciated and please call if you have any questions.

Very truly yours,

CORE LABORATORIES, INC.

A handwritten signature in cursive script, reading "Mabre Maness".

Mabre Maness  
District Manager

er  
encl.

CORE LABORATORIES, INC.  
 Petroleum Reservoir Engineering  
 DALLAS, TEXAS

PENNZOIL COMPANY  
 BLUE CREEK TRACT WELL NO. 70  
 BLUE CREEK - SKINNER FIELD  
 KANAWHA COUNTY, W. V.

DATE: 11-25-80  
 FORMATION: BEREA SANDSTONE  
 DRLG. FLUID:  
 LOCATION:

FILE NO: 3602-644  
 ENGINEER: MCCLURE  
 ELEVATION:

\* INDICATES PLUG PERM

S INDICATES PRESERVED SAMPLE

SMP. NO.	DEPTH	PERM. TO AIR MD. MAXIMUM 90 DEG	VERT.	POROSITY GEX. FLD.	FLUID SATS. OIL WTR.	GR. DEN.	DESCRIPTION
-------------	-------	------------------------------------	-------	-----------------------	-------------------------	-------------	-------------

CONVENTIONAL (PLUG-TYPE) ANALYSIS

NOTE: PERMEABILITIES WERE ORIENTED NW-SE

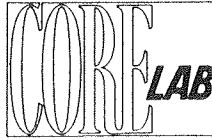
9 FEET ADDED TO CORE DEPTH TO EQUAL LOG DEPTH

1	1942.3-43.0	*	0.2	6.9		2.74	SS, CGL
2	1943.0-44.0	*	2.3	15.0		2.67	SS, CGL
3	1944.0-45.0	*	11.0	8.0		2.68	SS, CGL

DISTRIBUTION OF FINAL REPORTS

5 Copies

Mr. Steven S. Holsclaw  
Pennzoil Exploration and  
Production Company  
P. O. Drawer 1588  
Parkersburg, W. Va. 26101



**CORE LABORATORIES, INC.**

*Petroleum Reservoir Engineering*

COMPANY PENNZOIL COMPANY FILE NO. 3602-644  
 WELL BLUE CREEK TRACT WELL NO. 70 DATE 11-25-80  
 FIELD BLUE CREEK - SKINNER FORMATION BEREA Ss ELEV. \_\_\_\_\_  
 COUNTY KANAWHA STATE W. V. DRLG. FLD. \_\_\_\_\_ CORES \_\_\_\_\_  
 LOCATION \_\_\_\_\_

**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 profitability 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'

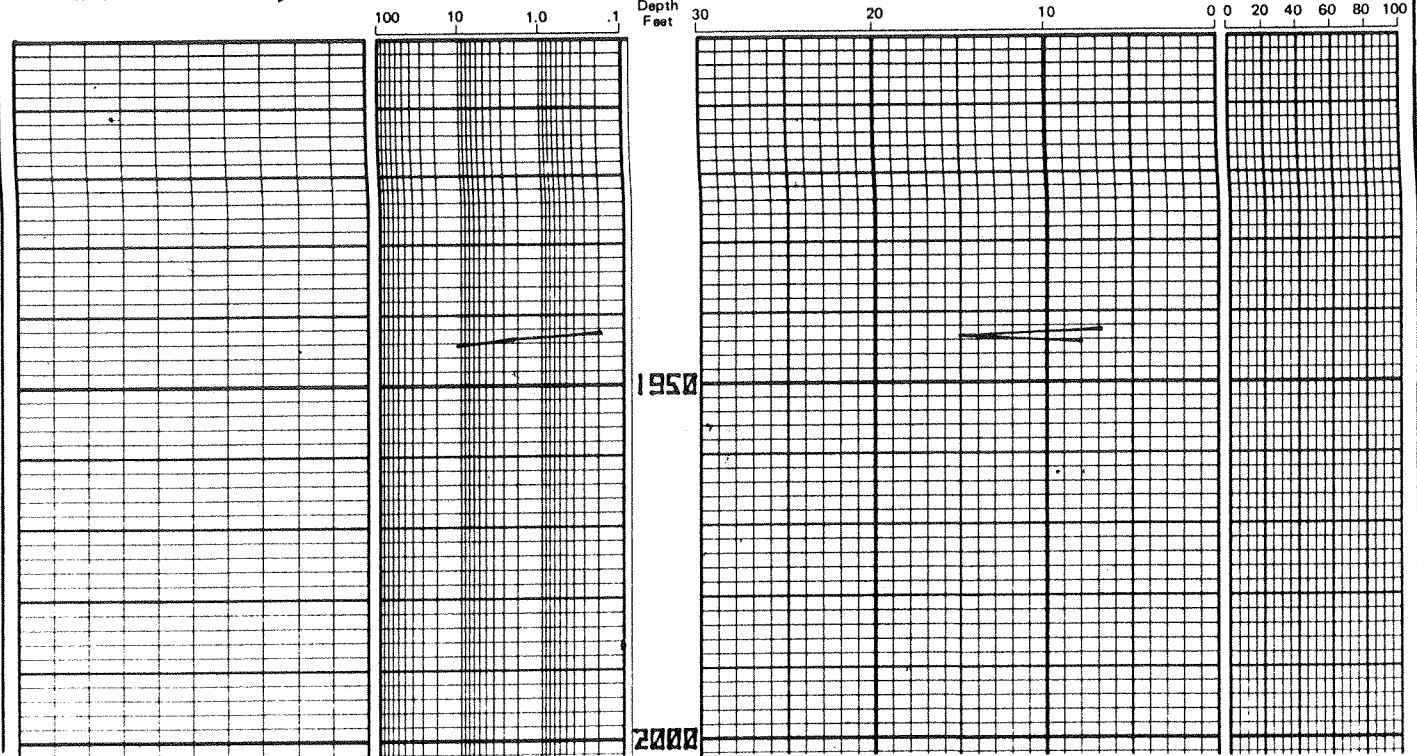
Total Water \_\_\_\_\_  
 PERCENT PORE SPACE  
 100 80 60 40 20 0

Oil Saturation \_\_\_\_\_  
 PERCENT PORE SPACE  
 0 20 40 60 80 100

Gamma Ray  
 RADIATION INCREASE →

Permeability  $K_a$  - HORIZONTAL  
 MILLIDARCIES (NW-SE)

Porosity  $GEX$   
 PERCENT



Special Core Analysis Study

for

PENNZOIL COMPANY

Blue Creek Tract Well No. 70 ✓  
Kanawha County, West Virginia

CORE LABORATORIES, INC.

Special Core Analysis



February 20, 1981

Pennzoil Company  
P.O. Box 1588  
Parkersburg, West Virginia 26101

Attention: Mr. Steve Holsclaw

Subject: Petrographic Analysis  
Blue Creek Tract Well No. 70  
Berea Sandstone  
Blue Creek-Skinner Field  
Kanawha County, West Virginia  
File Number: SCAL-308-80548

Gentlemen:

On or about December 2, 1980, three samples of core material from the subject well were submitted to the Special Core Analysis Department of Core Laboratories, Inc., at Dallas, Texas, with a request for Petrographic Analysis by Thin Section. As requested, special attention was given the orientation of the thin sections which were prepared from the submitted well core material. These thin sections were described in detail with the aid of a petrographic microscope, and the descriptions are presented herein on Pages 1 through 3. Any characteristics associated with the orientation of the core material have been noted in the descriptions.

It has been a pleasure performing this study on behalf of Pennzoil Company. Should there be any questions, or if we could be of any further assistance, please do not hesitate to contact us.

Very truly yours,

Core Laboratories, Inc.

A handwritten signature in cursive script that reads "John A. Koerner". The signature is written in dark ink and is positioned above the typed name.

John A. Koerner, Laboratory Supervisor  
Special Core Analysis

JAK:CAD:fm  
7 cc. - Addressee

Petrographic Analysis by Thin Section

Pennzoil Company  
Blue Creek Tract Well No. 70  
Blue Creek - Skinner Field  
Kanawha County, West Virginia

Sample Number: 1

Pebbly medium sandstone: litharenite

This sample is a poorly sorted, loosely to moderately packed, pebbly medium sandstone. It consists of 66 percent quartz, 23 percent rock fragments, 7 percent clayey matrix material, 2 percent feldspar and 2 percent calcite. In addition, traces of pyrite, colophane, dolomite, mica, zircon and tourmaline are present. Framework grains are subangular to rounded, subelongate to subequant and show polymodal size distribution. Larger grains range from 1 mm to 6 mm in diameter; however, the majority of the sample is comprised of grains ranging from 0.25 mm to 0.35 mm. Viewed parallel to the plane of bedding, orientation or lineation of the larger grains is not apparent. A section cut perpendicular to the bedding plane shows a slight orientation or imbrication of some larger clasts, with the long axes dipping to the northwest. This would indicate a general flow direction of northwest to southeast. Grain contacts are tangential, planar or concavo-convex.

The predominate framework element is monocrystalline quartz displaying unit or undulose extinction. Polycrystalline quartz is less common and shows undulose extinction. Also prominent as a framework element are large, rounded clasts of quartz, some of which are polycrystalline and show straight to crenulate boundaries between subcrystals, indicating a metamorphic origin. The remainder of the sample is comprised of detrital chert and a minor amount of albite-twinned plagioclase feldspar. The chert fragments are composed of microcrystalline quartz and often show clayey impurities and replacement by pyrite or dolomite. The feldspar grains are relatively fresh, but occasionally show clayey overprints.

Several cementation elements are responsible for a significant reduction of primary intergranular porosity. An early state of authigenic quartz overgrowth development is the predominant cement. In addition, patches of organic-rich clay matrix material are present. Replacement of this matrix by pyrite is locally concentrated and common; however, porosity occlusion in these areas is total. Further porosity reduction is associated with the presence of scattered, pore-filling dolomite and sparry calcite.

Remnant intergranular porosity accounts for 5 percent of the sample.

All percentages were obtained by point count.



CORE LABORATORIES, INC.  
*Petroleum Reservoir Engineering*  
DALLAS, TEXAS 75247

Page 2 of 3  
File SCAL-308-80548

Pennzoil Company  
Blue Creek Tract Well No. 70  
Blue Creek - Skinner Field  
Kanawha County, West Virginia

Sample Number: 2

Sandy pebble conglomerate: lithrudite

This sample is a poorly sorted, loosely packed, sandy pebble conglomerate consisting of 57 percent rock fragments, 24 percent quartz, 14 percent matrix material, 3 percent authigenic kaolinite clay, 1 percent calcite, 1 percent pyrite and traces of feldspar, dolomite and zircon. Framework grains are sub-angular to rounded, subelongate to subequant and show a bimodal size distribution. The framework grains range from 1 mm to 8 mm. The grains in the matrix range from 0.05 mm to 0.20 mm in diameter. When viewed parallel to the plane of bedding, some of the larger clasts show an orientation of their long axes in a northeast southwest direction. A section cut transverse to the bedding shows only a subtle orientation of grains. A general flow direction of northwest to southeast appears to be indicated. The grain to grain contacts are generally tangential or planar and less commonly concavo-convex.

The majority of the sample is composed of large, rounded quartz clasts. Many of these are polycrystalline and display undulose extinction. Extensive suturing of the subcrystals which comprise these grains indicates a metamorphic origin; however, others appear to have originated as vein quartz. Monocrystalline quartz shows straight or undulose extinction. The remaining framework elements include detrital chert, plagioclase feldspar and scattered accessory minerals. This sample is cemented by a matrix of organic-rich clay, silt and fine sand. Primary intergranular porosity has been substantially reduced by this matrix; however, minor remnant porosity exists. Associated with the clay are scattered patches of replacement pyrite. Additional cementation is provided by small amounts of pore-filling secondary calcite, dolomite, and authigenic kaolinite clay.

Remnant intergranular porosity and a trace of microporosity associated with the stacked, pseudo-hexagonal booklets of kaolinite account for 2 percent of the sample.

All percentages were obtained by point count.

Pennzoil Company  
Blue Creek Tract Well No. 70  
Blue Creek - Skinner Field  
Kanawha County, West Virginia

sample Number : 3

Medium sandstone: sublitharenite

This sample is a moderately sorted, moderately to tightly packed medium sandstone consisting of 75 percent quartz, 8 percent rock fragments, 6 percent calcite, 5 percent pyrite, 4 percent feldspars, 2 percent kaolinite clay and traces of zircon. Framework grains are subangular to subrounded and subparallel to subequant. The average grain size is about 0.28 mm. Viewed both parallel and perpendicular to the plane of bedding, no apparent orientation of the grains is evident. Grain contacts are predominately planar or concavo-convex.

Monocrystalline quartz showing straight or undulose extinction is the most abundant framework element. In addition to vacuole or microlite inclusions, these grains commonly show "dust rim" inclusions which outline the original detrital grain from secondary overgrowth material. Polycrystalline quartz showing undulose extinction is less common. The lithic portion of this sample includes detrital chert and stretched quartz of metamorphic origin. Clay overlays and replacement by pyrite are common in the chert grains. The feldspar present consists of albite-twinning plagioclase. Although most of these grains appear relatively fresh, dissolution along cleavage traces or twin planes was noted in some.

This sample is cemented by an early to intermediate state of authigenic quartz overgrowth development. As a result, primary intergranular porosity has been significantly reduced. Additional cements include patches of secondary, poikilotopic calcite spar and pyrite. Encroachment by these cements upon framework grains is extensive. Although insignificant as a cement, pore-filling booklets of authigenic kaolinite are scattered throughout the section.

Remnant intergranular and minor secondary porosity account for 6 percent of the sample.

All percentages were obtained by point count.

Special Core Analysis Study

for

PENNZOIL COMPANY

Blue Creek Tract Well No. 70  
Kanawha County, West Virginia

February 20, 1981

CORE LABORATORIES, INC.

Special Core Analysis



Pennzoil Company  
P.O. Box 1588  
Parkersburg, West Virginia 26101

Attention: Mr. Steve Holsclaw

Subject: Petrographic Analysis  
Blue Creek Tract Well No. 70  
Berea Sandstone  
Blue Creek-Skinner Field  
Kanawha County, West Virginia  
File Number: SCAL-308-80548

Gentlemen:

On or about December 2, 1980, three samples of core material from the subject well were submitted to the Special Core Analysis Department of Core Laboratories, Inc., at Dallas, Texas, with a request for Petrographic Analysis by Thin Section. As requested, special attention was given the orientation of the thin sections which were prepared from the submitted well core material. These thin sections were described in detail with the aid of a petrographic microscope, and the descriptions are presented herein on Pages 1 through 3. Any characteristics associated with the orientation of the core material have been noted in the descriptions.

It has been a pleasure performing this study on behalf of Pennzoil Company. Should there be any questions, or if we could be of any further assistance, please do not hesitate to contact us.

Very truly yours,

Core Laboratories, Inc.

A handwritten signature in cursive script that reads "John A. Koerner".

John A. Koerner, Laboratory Supervisor  
Special Core Analysis

JAK:CAD:fm  
7 cc. - Addressee

Petrographic Analysis by Thin Section

Pennzoil Company  
Blue Creek Tract Well No. 70  
Blue Creek - Skinner Field  
Kanawha County, West Virginia

Sample Number: 1

Pebbly medium sandstone: litharenite

This sample is a poorly sorted, loosely to moderately packed, pebbly medium sandstone. It consists of 66 percent quartz, 23 percent rock fragments, 7 percent clayey matrix material, 2 percent feldspar and 2 percent calcite. In addition, traces of pyrite, colophane, dolomite, mica, zircon and tourmaline are present. Framework grains are subangular to rounded, subelongate to subequant and show polymodal size distribution. Larger grains range from 1 mm to 6 mm in diameter; however, the majority of the sample is comprised of grains ranging from 0.25 mm to 0.35 mm. Viewed parallel to the plane of bedding, orientation or lineation of the larger grains is not apparent. A section cut perpendicular to the bedding plane shows a slight orientation or imbrication of some larger clasts, with the long axes dipping to the northwest. This would indicate a general flow direction of northwest to southeast. Grain contacts are tangential, planar or concavo-convex.

The predominate framework element is monocrystalline quartz displaying unit or undulose extinction. Polycrystalline quartz is less common and shows undulose extinction. Also prominent as a framework element are large, rounded clasts of quartz, some of which are polycrystalline and show straight to crenulate boundaries between subcrystals, indicating a metamorphic origin. The remainder of the sample is comprised of detrital chert and a minor amount of albite-twinned plagioclase feldspar. The chert fragments are composed of microcrystalline quartz and often show clayey impurities and replacement by pyrite or dolomite. The feldspar grains are relatively fresh, but occasionally show clayey overlays.

Several cementation elements are responsible for a significant reduction of primary intergranular porosity. An early state of authigenic quartz overgrowth development is the predominant cement. In addition, patches of organic-rich clay matrix material are present. Replacement of this matrix by pyrite is locally concentrated and common; however, porosity occlusion in these areas is total. Further porosity reduction is associated with the presence of scattered, pore-filling dolomite and sparry calcite.

Remnant intergranular porosity accounts for 5 percent of the sample.

All percentages were obtained by point count.

CORE LABORATORIES, INC.  
*Petroleum Reservoir Engineering*  
DALLAS, TEXAS 75247

Page 2 of 3  
File SCAL-308-80548

Pennzoil Company  
Blue Creek Tract Well No. 70  
Blue Creek - Skinner Field  
Kanawha County, West Virginia

Sample Number: 2

Sandy pebble conglomerate: lithrudite

This sample is a poorly sorted, loosely packed, sandy pebble conglomerate consisting of 57 percent rock fragments, 24 percent quartz, 14 percent matrix material, 3 percent authigenic kaolinite clay, 1 percent calcite, 1 percent pyrite and traces of feldspar, dolomite and zircon. Framework grains are sub-angular to rounded, subelongate to subequant and show a bimodal size distribution. The framework grains range from 1 mm to 8 mm. The grains in the matrix range from 0.05 mm to 0.20 mm in diameter. When viewed parallel to the plane of bedding, some of the larger clasts show an orientation of their long axes in a northeast southwest direction. A section cut transverse to the bedding shows only a subtle orientation of grains. A general flow direction of northwest to southeast appears to be indicated. The grain to grain contacts are generally tangential or planar and less commonly concavo-convex.

The majority of the sample is composed of large, rounded quartz clasts. Many of these are polycrystalline and display undulose extinction. Extensive suturing of the subcrystals which comprise these grains indicates a metamorphic origin; however, others appear to have originated as vein quartz. Monocrystalline quartz shows straight or undulose extinction. The remaining framework elements include detrital chert, plagioclase feldspar and scattered accessory minerals. This sample is cemented by a matrix of organic-rich clay, silt and fine sand. Primary intergranular porosity has been substantially reduced by this matrix; however, minor remnant porosity exists. Associated with the clay are scattered patches of replacement pyrite. Additional cementation is provided by small amounts of pore-filling secondary calcite, dolomite, and authigenic kaolinite clay.

Remnant intergranular porosity and a trace of microporosity associated with the stacked, pseudo-hexagonal booklets of kaolinite account for 2 percent of the sample.

All percentages were obtained by point count.

CORE LABORATORIES, INC.  
*Petroleum Reservoir Engineering*  
DALLAS, TEXAS 75247

Page 3 of 3  
File SCAL-308-80548

Pennzoil Company  
Blue Creek Tract Well No. 70  
Blue Creek - Skinner Field  
Kanawha County, West Virginia

sample Number : 3

Medium sandstone: sublitharenite

This sample is a moderately sorted, moderately to tightly packed medium sandstone consisting of 75 percent quartz, 8 percent rock fragments, 6 percent calcite, 5 percent pyrite, 4 percent feldspars, 2 percent kaolinite clay and traces of zircon. Framework grains are subangular to subrounded and subelongate to subequant. The average grain size is about 0.28 mm. Viewed both parallel and perpendicular to the plane of bedding, no apparent orientation of the grains is evident. Grain contacts are predominately planar or concavo-convex.

Monocrystalline quartz showing straight or undulose extinction is the most abundant framework element. In addition to vacuole or microlite inclusions, these grains commonly show "dust rim" inclusions which outline the original detrital grain from secondary overgrowth material. Polycrystalline quartz showing undulose extinction is less common. The lithic portion of this sample includes detrital chert and stretched quartz of metamorphic origin. Clay overlays and replacement by pyrite are common in the chert grains. The feldspar present consists of albite-twinned plagioclase. Although most of these grains appear relatively fresh, dissolution along cleavage traces or twin planes was noted in some.

This sample is cemented by an early to intermediate state of authigenic quartz overgrowth development. As a result, primary intergranular porosity has been significantly reduced. Additional cements include patches of secondary, poikilotopic calcite spar and pyrite. Encroachment by these cements upon framework grains is extensive. Although insignificant as a cement, pore-filling booklets of authigenic kaolinite are scattered throughout the section.

Remnant intergranular and minor secondary porosity account for 6 percent of the sample.

All percentages were obtained by point count.