

API #15-055-21204

CORE ANALYSIS REPORT

FOR

NORTH AMERICAN RESOURCES COMPANY

RUTH KESTER NO. 24-18 WELL

FINNEY COUNTY, KANSAS

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July 30, 1993

**NORTH AMERICAN RESOURCES COMPANY**

P. O. Box 7007  
Billings, Montana 59101-7007

Attn: Mr. Barron Gimza

Subject: Core Analysis Data  
Ruth Kester No. 24-18 Well  
Morrow Formation  
Finney County, Kansas  
CL File 57182-13674

Dear Mr. Gimza:

Diamond cores taken in the subject well from the Morrow formation were received at the Oklahoma City laboratory for 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 is presented on pages FINAL REPORT 1-1 through 1-3.

A statistical summary, a cross-plot of permeability versus porosity and histograms of porosity, permeability and grain density are included.

It is a pleasure to have this opportunity of serving you. Should you have questions regarding these data call (405) 946-5422.

Very truly yours,

**Core Laboratories, a division of**  
**WESTERN ATLAS INTERNATIONAL, INCORPORATED**



Lynn Antwine

# CORE LABORATORIES

Company : NORTH AMERICAN RESOURCES COMPANY  
Well : RUTH KESTER NO. 24-18 WELL

Field :  
Formation : MORROW

File No.: 57182-13674  
Date : 30-JUL-1993

## A N A L Y T I C A L P R O C E D U R E S A N D Q U A L I T Y A S S U R A N C E

### HANDLING & CLEANING

Core Transportation : Core Laboratories Vehicle  
Solvent : Toluene  
Extraction Equipment : Dean Stark Apparatus  
Extraction Time : 48 Hours  
Drying Equipment : Convection Oven  
Drying Time : 24 Hours  
Drying Temperature : 250 Deg.F.

### ANALYSIS

Grain volume measured by Boyle's Law in a matrix cup using He  
Bulk volume by Archimedes Principle  
Water saturations by Dean Stark  
Oil saturations by weight difference in Dean Stark  
Permeabilities measured on 1 in. diameter drilled plugs  
Core Gamma Composite  
Dean Stark grain densities clean, dry solid mineral phase are measured

### REMARKS

Horizontal permeability measured on plug samples--air and Klinkenberg corrected permeabilities reported.  
A Surface Core Gamma-Log was recorded to aid correlation with downhole electrical surveys.  
Core is temporarily stored in Core Laboratories' Oklahoma City Laboratory for a period of thirty days without additional charge.  
Please notify us as to the disposition of the core within thirty days from date of this report to avoid storage charges of \$15.00 per month.

# CORE LABORATORIES

Company : NORTH AMERICAN RESOURCES COMPANY  
 Well : RUTH KESTER NO. 24-18 WELL  
 Location : SEC 18, T21S; R34W  
 Co, State : FINNEY COUNTY, KANSAS

Field : MORROW  
 Formation : WATER BASE MUD  
 Coring Fluid : WATER BASE MUD  
 Elevation :

File No.: 57182-13674  
 Date : 30-JUL-1993  
 API No. :  
 Analysts: SB/DF

## CORE ANALYSIS RESULTS

| SAMPLE NUMBER            | DEPTH<br>ft   | PERMEABILITY<br>(HORIZ)<br>(Kair)<br>md | PERMEABILITY<br>(HORIZ)<br>(Klinkenberg)<br>md | POROSITY<br>(BOYLE'S LAW)<br>(Helium)<br>% | SATURATION |              | GRAIN<br>DENSITY<br>(Measured)<br>gm/cc | DESCRIPTION                |
|--------------------------|---------------|-----------------------------------------|------------------------------------------------|--------------------------------------------|------------|--------------|-----------------------------------------|----------------------------|
|                          |               |                                         |                                                |                                            | (Oil)<br>% | (Water)<br>% |                                         |                            |
| PLUG DEAN STARK ANALYSIS |               |                                         |                                                |                                            |            |              |                                         |                            |
|                          |               |                                         |                                                | 4800.0 - 4808.0                            | -          | No Analysis  | -                                       | Sh blk                     |
|                          |               |                                         |                                                | 4808.0 - 4810.0                            | -          | No Analysis  | -                                       | Sh gry/rd ferr             |
|                          |               |                                         |                                                | 4810.0 - 4812.0                            | -          | Lost Core    |                                         |                            |
|                          |               |                                         |                                                | 4812.0 - 4813.0                            | -          | No Analysis  | -                                       | Sh gry/tn ferr             |
|                          |               |                                         |                                                | 4813.0 - 4820.0                            | -          | No Analysis  | -                                       | Sh gry/grn                 |
|                          |               |                                         |                                                | 4820.0 - 4820.5                            | -          | No Analysis  | -                                       | Slstst dk gry/grn sh       |
| 1                        | 4821.0 - 22.0 | 0.13                                    | 0.11                                           | 2.4                                        | 0.0        | 85.8         | 2.71                                    | Ls gry v f xln frac Sh lam |

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## CORE ANALYSIS RESULTS

| SAMPLE NUMBER                                         | DEPTH<br>ft  | PERMEABILITY<br>(HORIZ)<br>(Kair)<br>md | PERMEABILITY<br>(HORIZ)<br>(Klinkenberg)<br>md | POROSITY<br>(BOYLE'S LAW)<br>(Helium)<br>% | SATURATION |              | GRAIN<br>DENSITY<br>(Measured)<br>gm/cc | DESCRIPTION                        |
|-------------------------------------------------------|--------------|-----------------------------------------|------------------------------------------------|--------------------------------------------|------------|--------------|-----------------------------------------|------------------------------------|
|                                                       |              |                                         |                                                |                                            | (OIL)<br>% | (Water)<br>% |                                         |                                    |
| 4822.0 - 4823.3 - No Analysis - Ls gry v f xln sh lam |              |                                         |                                                |                                            |            |              |                                         |                                    |
| 2                                                     | 4823.3- 24.0 | 0.13                                    | 0.07                                           | 14.2                                       | 0.0        | 92.0         | 2.68                                    | Sst gry/grn v f gr slty            |
| 3                                                     | 4824.0- 25.0 | 0.03                                    | 0.02                                           | 6.1                                        | 0.0        | 87.7         | 2.68                                    | Sst gry/gr v f grn slty calc       |
| 4                                                     | 4825.0- 26.0 | 230.                                    |                                                | 23.5                                       | 27.0       | 55.1         | 2.65                                    | Sst lt tn v f gr fri               |
| 5                                                     | 4826.0- 27.0 | 283.                                    |                                                | 26.0                                       | 32.9       | 49.7         | 2.65                                    | Sst lt tn v f gr fri               |
| 6                                                     | 4827.0- 28.0 | 0.36                                    | 0.22                                           | 10.6                                       | 0.0        | 86.2         | 2.67                                    | Sst lt gry/grn v f gr calc         |
| 7                                                     | 4828.0- 29.0 | 0.14                                    | 0.08                                           | 11.4                                       | 0.0        | 92.8         | 2.67                                    | Sst gry/grn v f gr calc            |
| 8                                                     | 4829.0- 30.0 | 5.10                                    | 4.20                                           | 14.8                                       | 3.4        | 82.3         | 2.66                                    | Sst lt tn v f gr calc              |
| 9                                                     | 4830.0- 31.0 | 34.0                                    | 32.00                                          | 15.9                                       | 21.9       | 43.9         | 2.66                                    | Sst lt tn v f gr calc              |
| 10                                                    | 4831.0- 32.0 | 26.0                                    | 23.00                                          | 15.4                                       | 26.6       | 42.8         | 2.66                                    | Sst lt tn v f gr calc              |
| 11                                                    | 4832.0- 33.0 | 0.15                                    | 0.09                                           | 6.5                                        | 3.1        | 75.8         | 2.68                                    | Sst lt tn v f gr calc              |
| 12                                                    | 4833.0- 34.0 | 0.39                                    | 0.25                                           | 8.7                                        | 6.2        | 77.2         | 2.67                                    | Sst lt tn v f gr calc              |
| 13                                                    | 4834.0- 35.0 | 31.0                                    | 30.00                                          | 13.3                                       | 25.6       | 37.2         | 2.66                                    | Sst lt tn v f gr calc              |
| 14                                                    | 4835.0- 36.0 | 0.35                                    | 0.23                                           | 9.5                                        | 0.0        | 85.2         | 2.67                                    | Sst lt tn v f gr calc              |
| 15                                                    | 4836.0- 37.0 | 0.09                                    | 0.05                                           | 7.6                                        | 0.0        | 85.8         | 2.67                                    | Sst lt tn v f gr calc              |
| 16                                                    | 4837.0- 38.0 | 0.56                                    | 0.38                                           | 10.7                                       | 0.0        | 80.8         | 2.67                                    | Sst lt tn/grn v f gr calc          |
| 17                                                    | 4838.0- 38.5 | 0.06                                    | 0.04                                           | 6.1                                        | 0.0        | 85.8         | 2.68                                    | Sst lt tn/grn v f gr calc          |
| 4838.5 - 4840.0 - No Analysis - Sh gry/grn            |              |                                         |                                                |                                            |            |              |                                         |                                    |
| 18                                                    | 4840.0- 41.0 | 3.60                                    | 2.90                                           | 16.4                                       | 0.0        | 87.4         | 2.66                                    | Sst gry/grn v f gr slty sltly calc |
| 19                                                    | 4841.0- 42.0 | 23.0                                    | 20.00                                          | 19.9                                       | 0.0        | 87.8         | 2.65                                    | Sst gry/grn v f gr slty sltly calc |
| 20                                                    | 4842.0- 43.0 | 13.0                                    | 12.00                                          | 17.1                                       | 0.0        | 90.0         | 2.65                                    | Sst gry/grn v f gr slty calc       |
| 21                                                    | 4843.0- 44.0 | 0.02                                    | 0.01                                           | 3.3                                        | 0.0        | 76.2         | 2.69                                    | Sst gry v f gr v calc Tr Foss      |
| 22                                                    | 4844.0- 45.0 | 0.01                                    | 0.01                                           | 2.7                                        | 0.0        | 74.3         | 2.69                                    | Sst gry v f gr v calc              |

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 Formation : MORROW

File No.: 57182-13674  
 Date : 30-JUL-1993

C O R E A N A L Y S I S R E S U L T S

| SAMPLE NUMBER | DEPTH<br>ft   | PERMEABILITY<br>(HORIZ)<br>(Kair)<br>md | PERMEABILITY<br>(HORIZ)<br>(Klinkenberg)<br>md | POROSITY<br>(BOYLE'S LAW)<br>(Helium)<br>% | SATURATION |              | GRAIN<br>DENSITY<br>(Measured)<br>gm/cc | DESCRIPTION                  |
|---------------|---------------|-----------------------------------------|------------------------------------------------|--------------------------------------------|------------|--------------|-----------------------------------------|------------------------------|
|               |               |                                         |                                                |                                            | (Oil)<br>% | (Water)<br>% |                                         |                              |
|               |               | 4845.0 - 4847.0                         | 4847.0                                         |                                            |            |              |                                         |                              |
|               |               | 4847.0 - 4861.0                         | 4861.0                                         |                                            |            |              |                                         |                              |
|               |               | 4861.0 - 4871.0                         | 4871.0                                         |                                            |            |              |                                         |                              |
| 23            | 4871.0 - 72.0 | 0.02                                    | 0.01                                           | 4.4                                        | 0.0        | 72.3         | 2.71                                    | Ls lt gry v f xln slily foss |

# =Core Very Friable - Unable To Measure Klinkenberg Corrected Permeability

CORE LABORATORIES

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Formation : MORROW

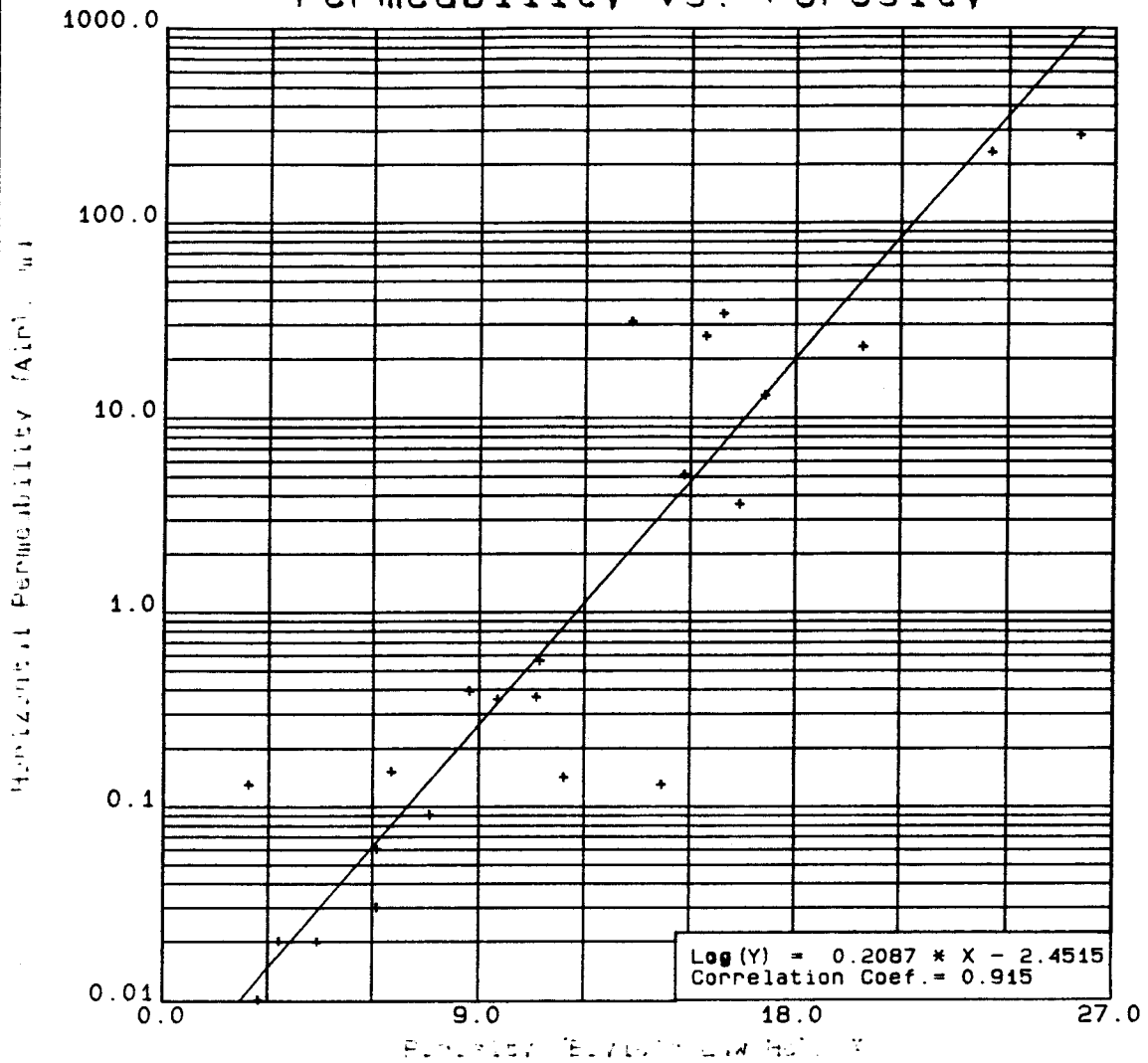
File No.: 57182-13674  
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TABLE I  
SUMMARY OF CORE DATA

ZONE AND CUTOFF DATA CHARACTERISTICS REMAINING AFTER CUTOFFS

|                            |            |                        |             |                                    |             |                      |                           |
|----------------------------|------------|------------------------|-------------|------------------------------------|-------------|----------------------|---------------------------|
| ZONE:                      |            | MORROW                 |             | 23                                 |             | PERMEABILITY:        |                           |
| Identification             | 4812.0 ft  | Number of Samples      | 23          | Flow Capacity                      | 651.1 md-ft | Arithmetic Average   | 29.3 md                   |
| Top Depth                  | 4872.0 ft  | Thickness Represented  | 22.2 ft     | Geometric Average                  | 0.97 md     | Harmonic Average     | 0.08 md                   |
| Bottom Depth               | 23         |                        |             | Minimum                            | 0.01 md     | Maximum              | 283.                      |
| Number of Samples          |            |                        |             | Median                             | 0.36 md     | Standard Dev. (Geom) | K·10 <sup>±1.354</sup> md |
| DATA TYPE:                 |            | (BOYLE'S LAW) (Helium) |             | HETEROGENEITY (Permeability):      |             |                      |                           |
| Porosity                   | 0.0 %      | Storage Capacity       | 259.2 φ-ft  | Dykstra-Parsons Var.               | 0.966       | Lorenz Coefficient   | 0.736                     |
| Permeability               | 100.0 %    | Arithmetic Average     | 11.7 %      | AVERAGE SATURATIONS (Pore Volume): |             |                      |                           |
| Permeability (Minimum)     | 0.0100 md  | Minimum                | 2.4 %       | Oil                                | 10.5 %      | Water                | 71.5 %                    |
| Permeability (Maximum)     | 100000. md | Maximum                | 26.0 %      |                                    |             |                      |                           |
| Water Saturation (Maximum) | 100.0 %    | Median                 | 10.7 %      |                                    |             |                      |                           |
| Oil Saturation (Minimum)   | 0.0 %      | Standard Deviation     | ±6.5 %      |                                    |             |                      |                           |
| Grain Density (Minimum)    | 2.00 gm/cc | GRAIN DENSITY:         |             |                                    |             |                      |                           |
| Grain Density (Maximum)    | 3.00 gm/cc | Arithmetic Average     | 2.67 gm/cc  |                                    |             |                      |                           |
| Lithology Excluded         | NONE       | Minimum                | 2.65 gm/cc  |                                    |             |                      |                           |
|                            |            | Maximum                | 2.71 gm/cc  |                                    |             |                      |                           |
|                            |            | Median                 | 2.67 gm/cc  |                                    |             |                      |                           |
|                            |            | Standard Deviation     | ±0.02 gm/cc |                                    |             |                      |                           |

# Permeability vs. Porosity



**NORTH AMERICAN RESOURCES COMPANY**  
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 FINNEY COUNTY, KANSAS

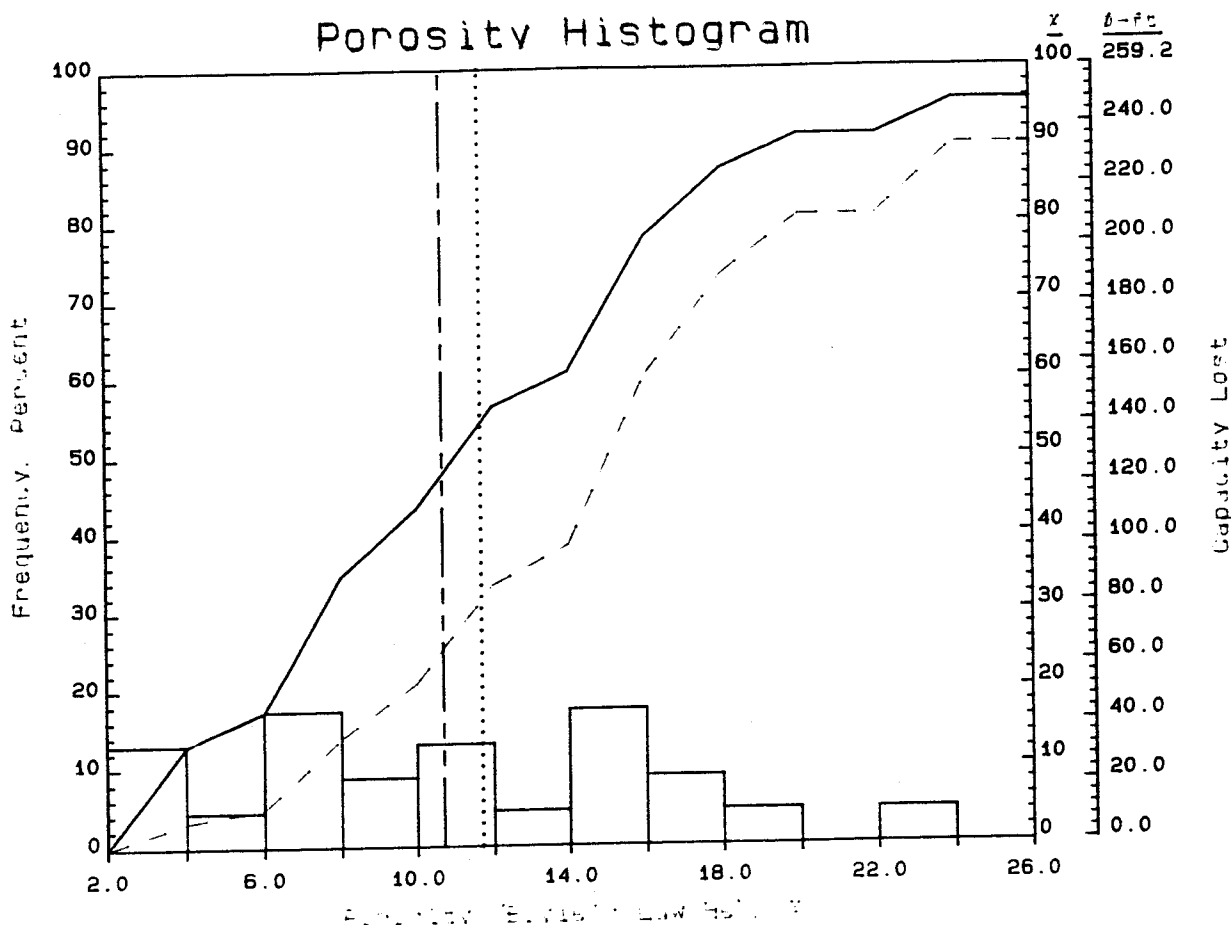
MORROW (4812-4872 feet)

Core Laboratories

30-Jul-1993

- LEGEND -  
 MORROW

# Porosity Histogram



## NORTH AMERICAN RESOURCES COMPANY

RUTH KESTER NO. 24-18 WELL  
FINNEY COUNTY, KANSAS

MORROW (4812-4872 feet)

Core Laboratories

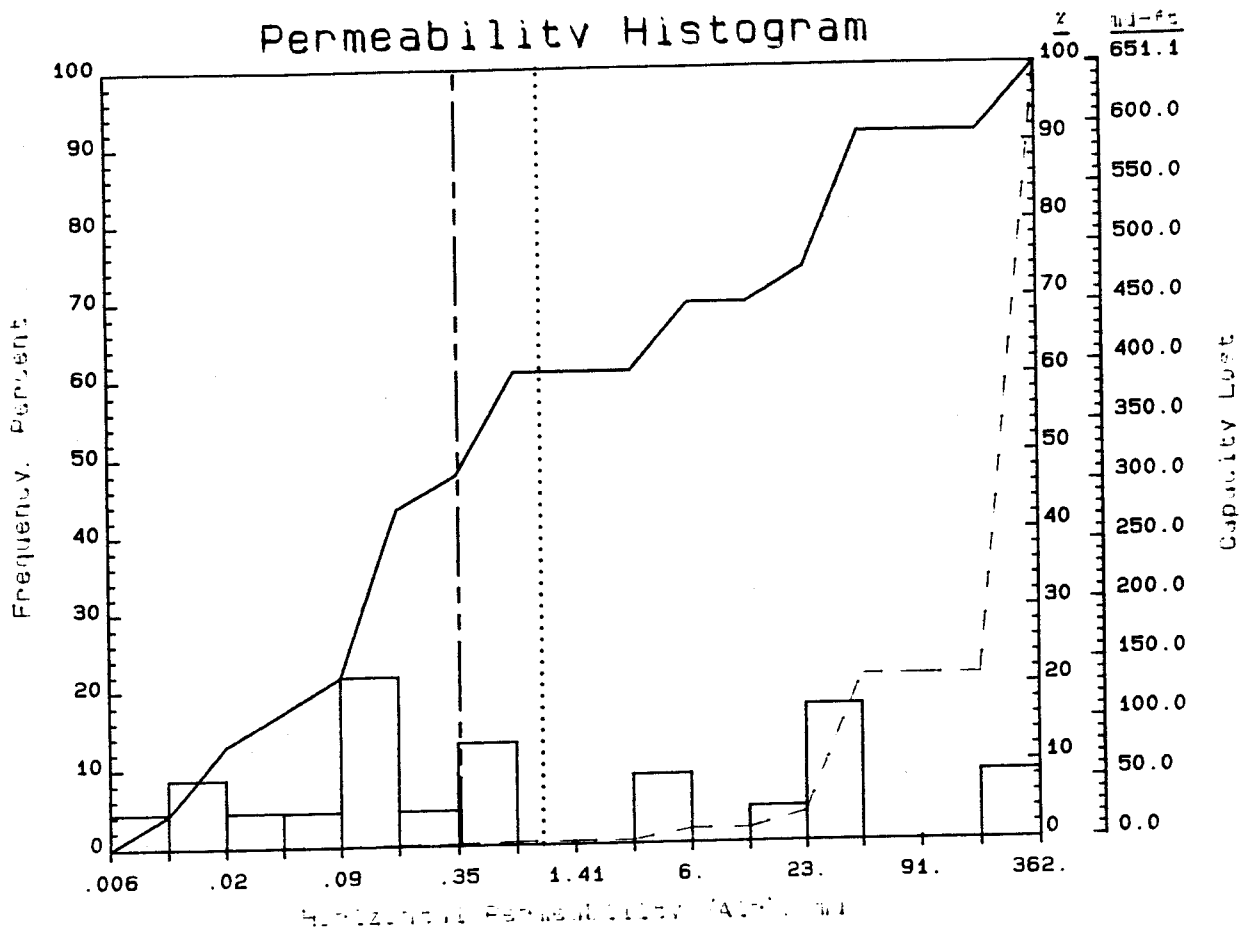
30-Jul-1993

### - LEGEND -

- Median Value (10.7)
- ..... Arith. Average (11.7)
- Cumulative Frequency
- - - Cumulative Capacity Lost

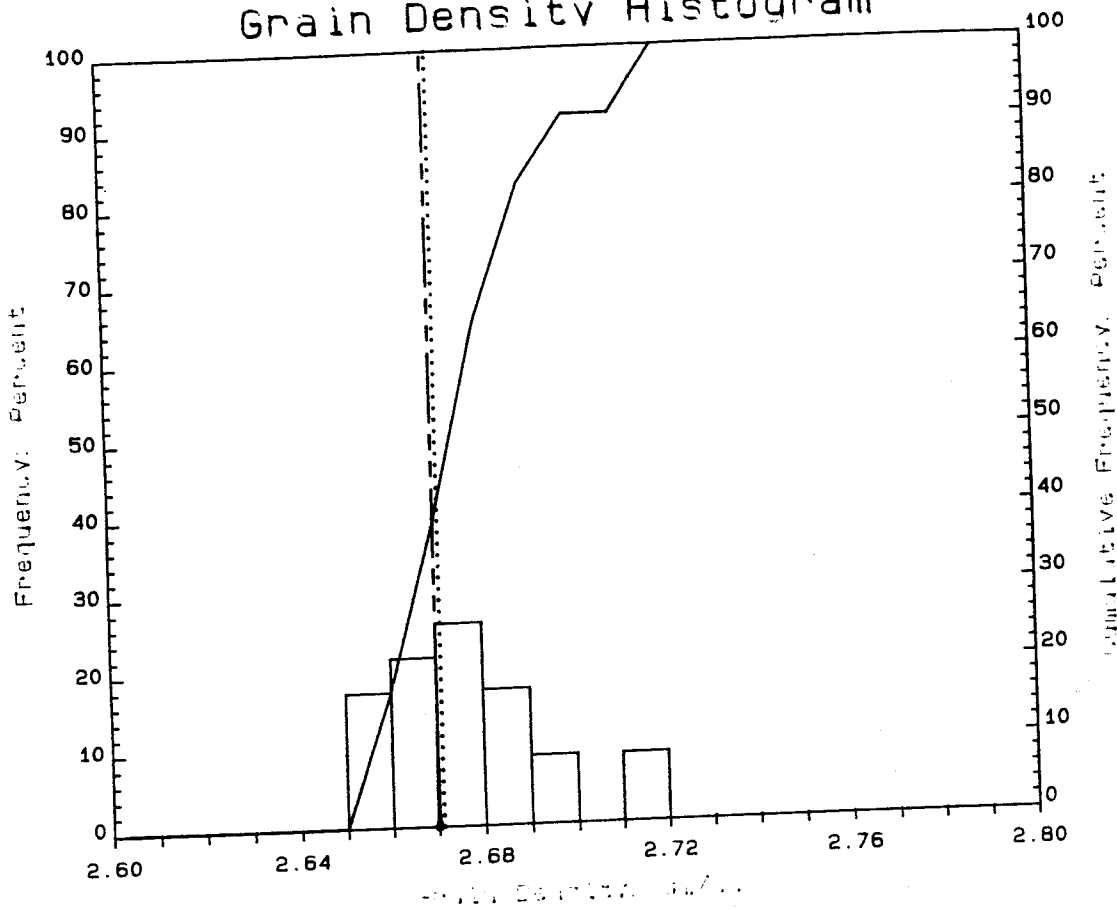
23 Samples

# Permeability Histogram



|                                                                                                                                                                                                                                                  |  |                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>NORTH AMERICAN RESOURCES COMPANY</b><br/>                 RUTH KESTER NO. 24-18 WELL<br/>                 FINNEY COUNTY, KANSAS</p> <p>MORROW (4812-4872 feet)</p> <p>Core Laboratories <span style="float: right;">30-Jul-1993</span></p> |  | <p>- LEGEND -</p> <p>— Median Value (0.360)</p> <p>..... Geom. Average (0.966)</p> <p>— Cumulative Frequency</p> <p>- - - Cumulative Capacity Lost</p> <p>23 Samples</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

# Grain Density Histogram



**NORTH AMERICAN RESOURCES COMPANY**

RUTH KESTER NO. 24-18 WELL  
FINNEY COUNTY, KANSAS

MORROW (4812-4872 feet)

Core Laboratories

30-Jul-1993

- LEGEND -

- Median Value (2.67)
- ..... Arith. Average (2.67)
- Cumulative Frequency

23 Samples