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DOE/BC/14891--2

Interdisciplinary Study of Reservoir Compartments
Contract No. DE-AC22-93BC14891

To: Document Control Center
U.S. Department of Energy
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Date: April 27, 1994

Subject: Quarterly Technical Progress Report

Quarterly Technical Progress Report

INTERDISCIPLINARY STUDY OF RESERVOIR COMPARTMENTS

Contract No. DE-AC22-93BC14891

Colorado School of Mines

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Robert S. Thompson, Program Manager
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Craig W. Van Kirk, Principal Investigator
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Department of Energy

Reporting Period: January 1, 1994 - March 31, 1994

Contract No. DE-AC22-93BC14891

Project Scope:

This DOE research project was established to document the integrated team approach for solving reservoir engineering problems. A field study integrating the disciplines of geology, geophysics, and petroleum engineering will be the mechanism for documenting the integrated approach. This is an area of keen interest to the oil and gas industry. The goal will be to provide tools and approaches that can be used to detect reservoir compartments, reach a better reserve estimate, and improve profits early in the life of a field.

Progress During 1st QTR 1994:

Four tasks either commenced or were ongoing during the first quarter of 1994. Where appropriate, reports by the research professors and the research assistants are included in the appendix. The following is a brief summary of the project status and the attached reports.

Theme 1: Reservoir/Outcrop Selection/Evaluation

Subdivision 1: Reservoir Selection and Evaluation

Task 1.1.1: Reservoir Selection and Data Gathering

The Hambert field was selected for the integrated study during the 1st Quarter of 1994 and the data gathering part of this task also commenced during this quarter. It is estimated that approximately 35% of the data has been gathered. Work will continue into the 2nd Quarter of 1994. The reports by Dwaine Edington and Cynthia Scheiner (Appendix A) highlight some of the database issues. We believe this is an important area to document for an integrated study such as this one. As noted in the Edington and Scheiner reports, the public data such as Dwights and Petroleum information are not always user friendly. One objective of the data gathering phase will be to develop an integrated set of databases that is consistent and can be used by each of the disciplines.

Contract No. DE-AC22-93BC14891

Task 1.1.2: Outcrop/Core/Log Analysis/and Correlations
Task 1.1.3: Internal Architecture Description

The attached report (Appendix B) by Professor Slatt, Dwaine Edington, and Cynthia Scheiner discusses analogous fields, and the core analysis and correlation work done on the Hambert Field. Initial work indicates faulting and compartmentalization as key components for reservoir characterization in the Hambert Field. This task commenced during this quarter and will continue into the 2nd Quarter of 1994. Task 1.1.2 is approximately 40% complete. Since Task 1.1.3 is closely related to Task 1.1.2 some work associated with this task started during the 1st Quarter of 1994.

Task 1.1.4: Seismic Analysis

The 3-D seismic data is being loaded onto a work station for processing. There are no technical contributions to be reported at this point in time. This task is approximately 5% complete.

Subdivision 2: Experimental Investigation

Task 1.2.1: Permeability Experimental Work

This project commenced on 3/1/94. The experimental procedure was designed and is included in Appendix C. This task is approximately 5% complete.

Schedule for 2nd Quarter 1994:

During the 2nd Quarter of 1994, the data gathering phase of Task 1.1.1, the integration of the seismic analysis with the geologic interpretation (Task 1.1.4) will continue. Work commenced on the Internal Architecture description (Task 1.1.3) and will also continue into the 2nd Quarter. The Permeability Experimental Work will continue during the 2nd Quarter.

APPENDIX A

1. Summary of Geologic Database Construction
2. Database Issues

Colorado School of Mines
Interdisciplinary Study of Resevoir Compartments
DOE DE-AC22-93BC14891
1st Quarter 1994 Technical Report

Hambert Field
Task 1.1.1: Reservoir Selection and Data Gathering
Research Associate: Professor Slatt
Research Assistant: Dwaine Edington

Summary of Geologic Database Construction
Hambert Field Study

The basic well and production data used in the Hambert study was derived from Dwight's well history and production CD-ROMs. The Dwight's front end is limited in its selection and sorting capabilities. Furthermore, the front end contains a few bugs that prevent selecting wells using certain combinations of selection criteria. Thus, it was decided to download this data into one or more Microsoft EXCEL for WINDOWS spreadsheets where it is possible to design selection and sorting criteria to suit any situation.

The first step in this process was to extract selected historical well data for all wells in the study area (T3N-R65W, T4N-R65W, T4N-R66W). There is a total of 1974 unique "completions" in the three township area. (A given well or surface location may have more than one unique completion. Each unique completion is assigned a unique number by Dwight's called the "RECORD NUMBER". This will be the basis for linking the various pieces of extracted data.) From these wells, the following records were extracted:

HEADER	Basic Well Information
TOPS	Formation Tops
COR	Core Data
DST	DST Data
PPI	Perforation Data, Perforation Zone, and Initial Potential Data
LL	Latitude and Longitude

This data was extracted into "comma delimited format" files for import into EXCEL. In the comma delimited format, each field on the output record is separated by a comma. This allows for easier parsing into the EXCEL spreadsheet. Ideally, each unique completion should have only one line in any of these output files. However, only the HEADER and LL data files were constructed in this manner. They were imported into EXCEL spreadsheets without difficulty. Each unique completion had two or more lines in the PPI TOPS, COR, and DST files. Because of the number of records that were extracted, the TOPS, COR, and DST information was easy to clean up and import into EXCEL files. However, because of the volume of data in the PPI file, it was decided to return to the Dwight's database and extract this information again. This time however, the completion information was broken into three separate files. Along with the completion data, the permit and completion records were extracted as well.

PER Perforation Data
PZO Perforation Zone Information
IP Initial Potential Data
CMP Permit & Completion Data, including Dates

As extracted, each file had limited usefulness. They needed to be cross correlated between each other, certain data fields needed to be in each file, and some data files were of no use to this project.

The first data that was analyzed was the tops data. As extracted from Dwight's, the comma delimited file consisted of one line per record number and formation top. This data was summarized into an EXCEL spreadsheet called TOPSDATA.XLS (see attached). This file contains a list of all tops recorded from all wells in the three township area. Each formation name is on a single line. The file also contains the number of occurrences of each top, the minimum depth, the maximum depth, and the average depth.

The next data group was the completion and IP data. The PERFS, PERFSZONE, and IP XLS files were combined into a single file called COMPDATA.XLS (see attached). The data from the perfzone information consisted of as many as four lines of data per record (single completion). Thus, the first step in cleaning up this file was to create a single line of information from the multiple lines. Additional columns were created to accommodate the data on one line. The same was true for the data from the perfs and IP files. Multiple lines were reduced to a single line per record. Up to this point the perfs, perfzone, and IP data were treated separately although all data items were in the same file. When the perfzone and perf data was compared, it was discovered that the perfzone information was redundant. Therefore, it was eliminated from the file. The remaining IP and perf data were aligned by record number. The data fields in the final version of COMPDATA.XLS were as follows:

Datafield	Contents	Datafield	Contents	Datafield	Contents
RECNO	Record Number	BOPD	Liquid Rate	LIQTYPE	Oil or Cond
MCFGPD	Gas Rate	BWPD	Water Rate	IP COMMENTS	Text Info
UPPER	Upper Perf Depth	LOWER	Lower Perf Depth	PRODFM	Producing Formation
PERFS COMMENTS	Text Info	CD	Commingle or Dual Completion Flag	PZONE COMMENTS	Retained only if PZONE and Perfs data don't agree

The next group of data that was worked on was the basic well information. Specific data fields from the HEADER, LL, and CMP files were combined. Since there was not a single case of multiple lines per record, combining thin information was rather straightforward. The data was combined into a file called HEADER.XLS (see attached). The data fields in HEADER.XLS are as follows:

Datafield	Contents	Datafield	Contents	Datafield	Contents
LAT	Latitude	LONG	Longitude	API	API Number
RECNO	Record Number	SEC	Section	TWP	Township
RNG	Range	FOOTAGE	from sec lines	OPER	Operator
LEASE/WELL	Lease name & Well Number	ELEV	Well Elevation	EREF	Elevation Reference
FIELD	Field Name	PTD	Proposed TD	TD	Actual Total Depth
PBTD	Plug Back TD	OBJ	Objective	FMTD	Formation at TD
SPUDDATE	Spud Date	COMPLDATE	Completion Date	FC	Final Class
FSTAT	Final Status	WELLTYPE	Wildcat or Development	SPOT	Spot Location

In addition to these data fields, columns called OWWO and SSXPROD were added to the header data file. The OWWO data field indicated duplicate API numbers and the SSXPROD data field is a flag that indicates if a particular well is or was a Sussex test.

The data fields LAT, LONG, API, OWWO, SSXPROD, and RECNO from the header data file were duplicated in the COMPDATA.XLS file. This assures that each and every record in either file has a corresponding record in the other file.

Now that the basic files have been constructed, the next step was to quality check certain key data fields. It was obvious that not every record in the COMPDATA file contained the proper initial potential data. Upon returning to the Dwight's database, it was discovered that the majority of the initial potential information was in a Dwight's data field called IP COMMENTS rather than in the individual data fields. This information was extracted into a text file and imported into EXCEL. Organizing this information was much more complicated than the completion data had been before. In this case, there was as many as eight lines of information per record number. Fortunately, there were identifying data fields in the file that allowed the comments to be grouped together. As before, all information for a single record number was aligned onto a single line. Additional columns were added to accommodate this information. This file is called IPTEXT.XLS (see attached).

The production data must be handled quite differently than the well history data. This is primarily due to the fact that production is recorded on a lease basis for oil wells. There is no easy way to correlate production data to well history data. There is an API number listed within the production data. This number represents the key well for the lease and it may be used to correlate the production data to a single well. However, the production data represents all the wells on a particular lease, not just the key well. Location, lease name, and intuition must be used to identify the other wells on a particular lease. Even if all the wells in a particular lease can be identified, there is no way to proportion the production among the various wells.

The production summary data was downloaded from the Dwight's CD-ROM into comma delimited files. These files were imported into an EXCEL file called PRODSUM.XLS. Some of the data fields in this file are:

Data field	Contents	Data Field	Contents	Data Field	Contents
FIELD	Field and Reservoir	LOCATION	TWP-RNG-SEC	LEASE	Lease & Well Number
OPER	Current Operator	API	API Number	STATUS	Status
GOR	Gas-Oil Ratio	LIQCUM	Cumulative Liquid Volume	GASCUM	Cumulative Gas Volume
LASTMOOIL	Last Month Oil Prod	LASTMOGAS	Last Month Gas Prod		

This file is still being edited and correlated to the well history data.

All the basic data for all wells in the area may now be found in one or more of the following files:

HEADER.XLS	Basic well information
COMPDATA.XLS	Completion information
IPTEXT.XLS	Initial Potential Information
PRODSUM.XLS	Summarized Production Data
TOPS.XLS	Formation Tops

There may be times however, that certain data items will need to be extracted that are not in any of these files. For example, a map of normalized GOR values may help in delineating the separate fault blocks. A normalized GOR is the GOR after a certain amount of Sussex production has occurred, for example, one year. GOR data of this nature is not present in any of the files mentioned above. For this task, it was necessary to return to the Dwight's CD-ROM database. The Dwight's front end is not sophisticated enough to extract the Sussex production data exactly one year after startup. Therefore, it was necessary to download monthly production data from 147 leases that produce from the Sussex. This data was imported into EXCEL spreadsheets. There was so much data involved that each township had to be dealt with separately. EXCEL code was written to search for the line that contained the monthly production data in the thirteenth month after startup. Some basic identification data was also extracted. The data was organized such that each lease was on a separate line in the file called GORALL.XLS (see example). Two GOR's were calculated from the data. The 13GOR represents the gas to oil ratio for the volumes of gas and oil produced in the thirteenth month. The AVGGOR is the gas-oil ratio calculated from the cumulative volumes of gas and oil produced through the thirteenth month.

It was also desired to map the liquid gravity. The best source for this data is the IPTEXT file. EXCELL code was written to search for and extract the liquid gravity and the initial potential GOR as well. At this point it was decided to create a file that contained all of the data from the Sussex wells alone. This file is called SSXDATA.XLS and contains all Sussex related records from the HEADER, COMPDATA, IPTEXT, and GORALL files (see attached). This file will be the basic mechanism for recording and tracking Sussex well data in the future.

FORMATION NAMES, MINIMUM, MAXIMUM, AND AVERAGE				
DEPTH, AND FREQUENCY OF OCCURRENCE				
DWIGHT'S DATABASE				3/1/94
FORMATION	MIN	MAX	AVG	FREQ
Parkman Stst	3665	3665	3665	1
Rocky Ridge Ss	3605	3968	3713	43
Parkman/Rocky Ridge	3682	3877	3750	3
Parkman	3406	4065	3754	220
Bs Parkman	3669	3912	3790	4
Rocky Ridge	3573	4352	3795	43
Rocky Ridge/Parkman	3685	3911	3805	15
Rocky Road	3825	3825	3825	1
Bs Rocky Ridge Ss	3974	3986	3980	2
Minnelusa Red Mkr	4150	4150	4150	1
Sussex Ss	4078	4598	4320	156
Terry Ss	4204	4394	4341	4
Sussex	326	6902	4358	742
Sussex Por	4385	4385	4385	1
Sussex Zn	4202	4506	4396	10
Hambert Facies	4406	4406	4406	1
Hambert Sand Bs	4418	4418	4418	1
Sussex Ss Pay	4286	4597	4429	49
Bs Sandstone	4438	4438	4438	1
Sussex Pay Ss	4409	4461	4438	4
Cretaceous Bent	4444	4444	4444	1
Sussex Mkr	4428	4488	4445	6
Sussex Pay	4292	4618	4458	16
Sussex X Mkr	4459	4459	4459	1
Bs Sussex	4310	4772	4464	71
Basal Sussex	4480	4480	4480	1
Bs Sussex Ss	4405	4630	4513	14
Cretaceous Gn Mkr	4527	4527	4527	1

COMPDATA.XLS						IP	IP	IP	IP	IP	IP	IP	IP
						1-IP	1-IP	1-IP	1-IP	1-IP	2-IP	2-IP	2-I
LAT	LONG	API	OWWO	RECORD	SSX PROD	BOPD	LIQ TYPE	MCFGPD	BWPD	IP COMMENTS	BOPD	LIQTYPE	MC
40.274307	104.693665	0512309686	0000	R1022180	1								
40.270721	104.703156	0512309691	0000	R1022750	1								
40.309448	104.756958	0512309871	0000	R1059910	1								
40.329422	104.748154	0512309876	0000	R1060780	1								
40.274445	104.689362	0512309910	0000	R1067770	1								
40.322327	104.673294	0512309987	0000	R1090440									
40.314209	104.665085	0512309998	0000	R1092030	1								
40.314209	104.669861	0512309997	0000	R1092040	1								
40.266678	104.688980	0512310015	0000	R1093230	1								
40.306854	104.669815	0512310005	0000	R1094920	1								
40.309555	104.680450	0512310013	0000	R1095720	1								
40.323318	104.766815	0512310078	0000	R1108510	1								
40.310486	104.664871	0512310090	0000	R1114250		20	OIL	225		(Codell 7179-7192) -- F 20 BOPD; 225 MCFGPD			
40.310486	104.664871	0512310090	0001	R1114251									
40.277832	104.669922	0512310105	0000	R1116380	1								
40.315231	104.765564	0512310108	0000	R1117270	1								
40.259949	104.698486	0512310134	0000	R1124340	1								

	IP	IP	IP	IP	IP	PERFS	PERFS	PERFS	PERFS
IP	2-IP	2-IP	2-IP	2-IP	2-IP	ZONE 1	ZONE 1	ZONE 1	ZONE 1
COMMENTS	BOPD	LIQTYPE	MCFGPD	BWPD	IP COMMENTS	UPPER	LOWER	PRODFM	PERFS COMMENTS
						4607	4638	Sussex	4607-4638 w/1 SPF-fracd
						4562	4612	Sussex	4562-4612 (Sussex) - Frac w/1349 BLO 1288 BLW 407,000# 10/20 sd
						4420	4454	Sussex	4420-4454 - frac'd w/320,000# sd, 159,000 gal gel fluid
						4414	4428	Sussex	4414-4428 w/4 JSPF - frac'd w/1131 bbls gel & 200,000# 20-40 sd
						4586	4632	Sussex	4586-4632 - frac w/10,000 gal prepad, 30,000 gal pad, 15,500# 100-mesh, 180,000# 20/40 sd, 110,000# 10/20 sd, 143,000 gal versagel, 2,000 gal KCL, 60 T CO2
						7618	7652	J Sand	7618-7652 @ 7618-20, 7627-32, 7634-38, 7640-44, 7648-52 w/3 JSPF - frac w/4919 bbl fluid 393,000# prop
						4446	4481	Sussex	4446-4481 @ 4446-50, 4454-64, 4466-81 w/2 JSPF - acd w/1500 gal Clay Acid - frac w/1500 gal MRS acid 289,000# sd 2420 BLS 40# gel wtr.
						4452	4488	Sussex	4452-4488 @ 4452-54 4458-68 4472-76 4478-88 w/2 JSPF - frac w/2200 bbls gel wtr 289,000# sd
						4590	4630	Sussex	4590-4630 w/4 JSPF - frac'd w/125 BC 1953 BW & 333,500# 20-40 sd
						4488	4542	Sussex	4488-4542 w/48 shots - no treatment
						4466	4488	Sussex	4466-4488 (Sussex) w/2 JSPF - frac w/1920 bbl 40# gel wtr 289,000# prop
						4407	4437	Sussex	4407-4437 (Sussex) @ 4407-13, 4433-37 w/1 SPF - acidized - frac w/113,900 gal wtr 225,000# sd
(Codell 7179-7192) -- F 20 BOPD; 225 MCFGPD						7179	7192	Codell	7179-7192 (Codell) w/1 SPF - acid w/1000 gal 15% HCl - frac w/gel wtr & sd
						4305	4570	Sussex	4305-4570 selectively w/total of 76 holes - frac w/sd & wtr
						4409	4451	Sussex	4409-4451 @ 4409-4429 4433-4445 4449-4451 w/1 SP2F - frac w/159,000 gal gelled wtr 275,000# 20/40 sd 80,000# 10/20 sd
						4618	4680	Sussex	4618-4680 w/63 holes - frac w/1818 BW 854 BO 340,000# sd

LAT	LONG	API	OWWO	SSX PROD	RECORD	SEC	TN	RN	SPOT	FOO
40.274307	104.693665	0512309686	0000	1	R1022180	32	4	65	c nw nw	660
40.270721	104.703156	0512309691	0000	1	R1022750	31	4	65	c sw ne	198
40.309448	104.756958	0512309871	0000	1	R1059910	15	4	66	ne se	185
40.329422	104.748154	0512309876	0000	1	R1060780	11	4	66	se nw	153
40.274445	104.689362	0512309910	0000	1	R1067770	32	4	65	ne nw	600
40.322327	104.673294	0512309987	0000		R1090440	9	4	65	sw sw	990
40.314209	104.665085	0512309998	0000	1	R1092030	16	4	65	c sw ne	198
40.314209	104.669861	0512309997	0000	1	R1092040	16	4	65	c se nw	198
40.266678	104.688980	0512310015	0000	1	R1093230	32	4	65	ne sw	180
40.306854	104.669815	0512310005	0000	1	R1094920	16	4	65	c se sw	660
40.309555	104.680450	0512310013	0000	1	R1095720	17	4	65	c sw ne se	165
40.323318	104.766815	0512310078	0000	1	R1108510	10	4	66	c sw ne sw	165
40.310486	104.664871	0512310090	0000		R1114250	16	4	65	e/2 nw se	198
40.310486	104.664871	0512310090	0001		R1114251	16	4	65	e/2 nw se	198
40.277832	104.669922	0512310105	0000	1	R1116380	28	4	65	c se sw	660
40.315231	104.765564	0512310108	0000	1	R1117270	15	4	66	e/2 nw	132
40.259949	104.698486	0512310134	0000	1	R1124340	6	3	65	c ne ne	66
40.177246	104.692810	0512310142	0000		R1126780	32	3	65	c ne sw sw	99
40.199341	104.671417	0512310171	0000		R1132740	28	3	65	se nw	15
40.199341	104.671417	0512310171	0001		R1132741	28	3	65	se nw	15
40.245331	104.679504	0512309336	0000	1	R1135570	8	3	65	c ne ne	66
40.249786	104.633240	0512310192	0000		R1138060	2	3	65	c nw se sw	99

SEC	TN	RN	SPOT	FOOTAGE	OPER
32	4	65	c nw nw	660 fnl 660 fwl	MACEY & MERSHON OIL INC
31	4	65	c sw ne	1980 fnl 1980 fel	CHAMPLIN PETR CO
15	4	66	ne se	1850 fsl 990 fel	NIELSON ENTERPRISES INC
11	4	66	se nw	1530 fnl 1490 fwl	AMOCO PROD CO
32	4	65	ne nw	600 fnl 1860 fwl	MACEY & MERSHON OIL INC
9	4	65	sw sw	990 fsl 1040 fwl	WINTER HAWK LTD
16	4	65	c sw ne	1980 fnl 1980 fel	WINTER HAWK LTD
16	4	65	c se nw	1980 fnl 1980 fwl	WINTER HAWK LTD
32	4	65	ne sw	1800 fsl 1980 fwl	AMOCO PROD CO
16	4	65	c se sw	660 fsl 1980 fwl	ENERGY OIL INC
17	4	65	c sw ne se	1650 fsl 990 fel	WINTER HAWK LTD
10	4	66	c sw ne sw	1650 fsl 1650 fwl	COLTON & COLTON CO
16	4	65	e/2 nw se	1980 fsl 1920 fel	ENERGY OIL INC
16	4	65	e/2 nw se	1980 fsl 1920 fel	SNYDER OIL CORP
28	4	65	c se sw	660 fsl 1980 fwl	ENERGY OIL INC
15	4	66	e/2 nw	1320 fnl 2000 fwl	HOMESTEAD OIL CO-INC
6	3	65	c ne ne	660 fnl 660 fel	MARTIN EXPL MGMT CORP
32	3	65	c ne sw sw	990 fsl 990 fwl	CALVIN PETR CORP
28	3	65	se nw	1570 fnl 1650 fwl	M G F OIL CORP
28	3	65	se nw	1570 fnl 1650 fwl	M G F OIL CORP
8	3	65	c ne ne	660 fnl 660 fel	MACHII ROSS PETR CO
2	3	65	c nw se sw	990 fsl 1650 fwl	EXCEL ENERGY CORP

LEASE & WELL	ELEV	EREF	FIELD	PTD	TD	PBTD	OBJ
MUSICK & MCCLINTOCK #3	4900	KB	UNNAMED	4725	4762	4716	Sus:
RURAL (32-31) #2	4862	GR	HAMBERT	4700	4698	4650	Sus:
ECKHARDT #2	4744	KB	HAMBERT	4550	4572	4534	Sus:
UPRR 21 PAN AM #H-1	4708	GR	HAMBERT	4550	4556	4509	Sus:
MUSICK-MCCLINTOCK #5	4904	KB	HAMBERT	4725	4752	4712	Sus:
REICHERT #9-2J	4739	KB	WATTENBERG	7500	7688	7685	J Sa
MEYER #16-1	4784	KB	HAMBERT	4500	4555	4550	Sus:
HEINLE #16-2	4779	KB	HAMBERT	4500	4565	4560	Sus:
CLYDE MARSHALL #1	4947	KB	HAMBERT	4750	4765	4716	Test
BOULTER #1	4839	KB	HAMBERT	4575	4623	0	Sus:
WALKER #17-1	4782	KB	HAMBERT	4600	4571	4565	Sus:
BROWN-MONFORT #1	4725	KB	HAMBERT	4500	4500	0	Suss
BRUNTZ #1	4795	KB	HAMBERT	4620	7275	0	Suss
BRUNTZ #1	4795	KB	HAMBERT	7071	0	0	Niob
KRAUSE #1	4854	KB	HAMBERT	4650	4669	4634	Sus:
STATLER #1	4740	KB	HAMBERT	4575	4580	4540	Sus:
MCKENNEY - KNAUB #5-6	4985	KB	HAMBERT	4795	4715	0	Suss
MILE HIGH TURKEY FARM #1-32	4914	GR	WATTENBERG	7900	7879	0	J Sa
MOSER #22-28	4840	KB	WATTENBERG	7850	7898	7888	J Sa
MOSER #22-28	4840	KB	WATTENBERG	7850	7898	7580	Code
ARISTOCRAT ANGUS RANCH #41-81	4865	KB	ARISTOCRAT	4600	4643	0	Suss
JEPSEN #1	4775	KB	WATTENBERG	7650	7655	0	J Sa

	PTD	TD	PBTD	OBJECTIVE	FMTD	SPUDDATE	COMPLDATE	FC	FSTAT	WELL TYPE
	4725	4762	4716	Sussex		19790314	19790803	O	OIL	D
	4700	4698	4650	Sussex		19790307	19790722	OG	O&G	D
	4550	4572	4534	Sussex	Sussex	19800129	19800425	OG	O&G	D
	4550	4556	4509	Sussex	Sussex	19800105	19800913	D	P&A	D
	4725	4752	4712	Sussex		19800228	19800524	OG	O&G	D
	7500	7688	7685	J Sand	Skull Creek	19800701	19810110	G	GAS	D
	4500	4555	4550	Sussex	Sussex ss	19800703	19801022	OG	O&G	D
	4500	4565	4560	Sussex	Sussex	19800626	19801025	OG	O&G	D
	4750	4765	4716	Test	Sussex	19800801	19810416	OG	O&G	D
	4575	4623	0	Sussex	Sussex	19800708	19801113	OG	O&G	D
	4600	4571	4565	Sussex	Sussex	19800714	19810110	OG	O&G	D
	4500	4500	0	Sussex		19800929	19810219	G	GAS	D
	4620	7275	0	Sussex		19810604	19810806	O	OIL	D
	7071	0	0	Niobrara		0	0			D
	4650	4669	4634	Sussex	Sussex	19810111	19810506	G	GAS	D
	4575	4580	4540	Sussex		19801031	19810408	G	GAS	D
	4795	4715	0	Sussex	bentonite	19810107	19810716	OG	O&G	D
	7900	7879	0	J Sand		19810102	19811103	G	GAS	D
	7850	7898	7888	J Sand	Lakota	19810122	19810319	G	GAS	D
	7850	7898	7580	Codell	Lakota	19921118	19930112	O	OIL	D
	4600	4643	0	Sussex		19810201	19810625	OG	O&G	D
	7650	7655	0	J Sand	J Sand	19810212	19810625	G	GAS	D

REC	IPTEXT1	IPTEXT2
R1022180	F 135 BO grav 44 340 MCFGPD no wtr GOR 2585:1	
R1022750	F 17 BOPD, 123 MCFGPD, 7 BWPD	
R1059910	F 3 BOPD, 482 MCFGPD, 30/64 ck	
R1067770	68 BOPD grav 49, 312 MCFGPD, 35 BWPD, CP 200, GOR 4588:1	
R1090440	F 150 MCFGPD on 16/64 ck 5 BWPD FTP 100 CP 490	
R1092030	F 25 BOPD grav 42, 90 MCFGPD 15 BWPD CP 375# FTP 150# on 18/64 ck GOR 3.6:1	
R1092040	F 20 BOPD grav 42, 85 MCFGPD, 6 BWPD on 18/64 in ck FTP 160 CP 240	
R1093230	F 23 BCPD grav 54.7, 1350 MCFGPD on 28/64 ck, 10 BWPD	
R1094920	P 17.7 BOPD grav 44, 78 MCFGPD 11 BWPD FTP 200 CP 300	
R1095720	F 17 BOPD grav 42, 50 MCFGPD on 16/64 ck FTP 50 CP 480 GOR 1:3	
R1108510	F 2 BOPD, 100 MCFGPD on 20/64 ck, 26 BWPD, FTP 120 CP 260 GOR 50,000:1	
R1114250	(Codell 7179-7192) -- F 20 BOPD; 225 MCFGPD	
R1116380	F 28 BOPD grav 44, 320 MCFGPD on 18/64 ck, 7 BWPD, FP 40 CP 210	
R1117270	F 2 BOPD grav 60, 158 MCFGPD on 25/64 in ck, 47 BWPD FTP 180 CP 385	
R1124340	F 208 MCFGPD, 108 BOPD, 80 BWPD, CP 190	
R1126780	F 2 BCPD, 140 MCFGPD (Operator Report) 1 BOPD, 156 MCFGPD, 16 BFWPD TP 150 CP 350 (Final Report)	
R1132740	(J Sand 7631-7692) -- F 1 BCPD grav 60; 1755 MCFGPD on 1 3/4 ck; no wtr FTP 1625, FCP 1674	
R1132741	(Codell 7188-7203 01/08/93) -- GL 12 BOPD; 85 MCFGPD; no wtr	(Codell 7188-7203) -- F 7 BCPD gra ck; no wtr FTP 200, SICP 400
R1135570	F 76 BOPD grav 56, 400 MCFGPD on 21/64 ck, CP 500, TP 350	

	IPTEXT2
	0
	0
	0
38:1	0
	0
# on	0
160	0
	0
)	0
GOR	0
260	0
	0
0 CP	0
P	0
	0
PD,	0
3/4	0
wtr	(Codell 7188-7203) -- F 7 BCPD grav 52; 80 MCFGPD on 16/64 ck; no wtr FTP 200, SICP 400
)	0

GORALL.XLS -- 13TH MONTH GOR DATA, SUSSEX LEASES, DWIGHT'S PROD DATA					
NAME	LOC	API	FLD/RES		ZONES
AMOCO PRODUCTION CO LORENZ, CHRIS	26 4N 66W	0512307233	WATTENBERG	SSX-COD	2
AMOCO PRODUCTION CO UPRR #39 PAN AMERICAN /BA	13 3N 65W	0512307244	WATTENBERG	SSX	1
AMOCO PRODUCTION CO WARDELL, J J, /A/	6 3N 65W	0512307265	WATTENBERG	SSX	1
AMOCO PRODUCTION CO STATE OF COLORADO /ZA/	36 4N 66W	0512307290	WATTENBERG	SSX	1
AMOCO PRODUCTION CO ARENS, FRANCES G	15 4N 65W	0512307507	WATTENBERG	SSX	1
CHURCHILL ENERGY INC KINSMAN	18 4N 65W	0512307545	HAMBERT	SSX	1
AMOCO PRODUCTION CO OSTER, DAN, UNIT	10 4N 65W	0512308156	WATTENBERG	SSX	1
BASIN OPERATING CO LTD ECKHARDT #1	15 4N 66W	0512308534	HAMBERT	SSX	1
NIELSON ENTERPRISES INC MONFORT SENW	10 4N 66W	0512308555	HAMBERT	SSX	1
AMOCO PRODUCTION CO UPRR #21 PAN AMERICAN UT	7 4N 65W	0512308925	HAMBERT	SSX	1
COLTON & COLTON ETAL WERNING SW NW	2 4N 66W	0512309002	HAMBERT	SSX	1
MACHII ROSS PETROLEUM CO SEGAL 21 & 41-24, "SAM	24 4N 66W	0512309053	HAMBERT	SSX	1
VESSELS OIL & GAS CO DINNER #1	14 4N 66W	0512309106	HAMBERT	SSX	1
AMOCO PRODUCTION CO CRAVEN, HAROLD, UNIT	17 4N 65W	0512309107	HAMBERT	SSX	1
AMOCO PRODUCTION CO MILLER, L H, UNIT	25 4N 66W	0512309118	HAMBERT	SSX	1
VESSELS OIL & GAS CO MCCARTHY #1 NW NW	12 4N 66W	0512309169	HAMBERT	SSX	1
MACHII ROSS PETROLEUM CO MYRON MARTINSON 14-24	24 4N 66W	0512309281	HAMBERT	SSX	1
CHURCHILL ENERGY INC STROMBERCER #2-12	12 4N 66W	0512309299	HAMBERT	SSX	1

	FLD/RES		ZONES	TYPE	13MO	GAS	CUMGAS	OIL	CUMOIL	PGRAV	13GOR	AVGGOR	#WELLS
307233	WATTENBERG	SSX-COD	2	OIL	MAY	2404	29704	60	577	62.1	40067	51480	1
307244	WATTENBERG	SSX	1	GAS	FEB	2089	36385	82	357		25476	101919	-99
307265	WATTENBERG	SSX	1	GAS	OCT	1707	38166	20	490		85350	77890	-99
307290	WATTENBERG	SSX	1	GAS	FEB	2492	40545	50	459	56.3	49840	88333	-99
307507	WATTENBERG	SSX	1	OIL	XXX	-99	-99	-99	-99	0	-99	-99	
307546	HAMBERT	SSX	1	GAS	JUL	4706	79064	173	1912	59.2	27202	41351	-99
308156	WATTENBERG	SSX	1	GAS	JUN	681	19873	0	419	0	-99	47430	-99
308534	HAMBERT	SSX	1	GAS	FEB	4920	113030	39	1134		126154	99674	-99
308555	HAMBERT	SSX	1	GAS	FEB	78	976	0	86		-99	11349	-99
308925	HAMBERT	SSX	1	GAS	JAN	1054	18171	0	0	0	-99	-99	-99
309002	HAMBERT	SSX	1	GAS	XXX	-99	-99	-99	-99		-99	-99	-99
309053	HAMBERT	SSX	1	GAS	APR	42868	592738	401	4876	63.2	106903	121562	-99
309106	HAMBERT	SSX	1	GAS	JAN	21228	283212	142	1551		149493	182600	-99
309107	HAMBERT	SSX	1	GAS	APR	844	20424	0	0	0	-99	-99	-99
309118	HAMBERT	SSX	1	GAS	APR	7648	167815	0	0	67.3	-99	-99	-99
309169	HAMBERT	SSX	1	GAS	XXXX	-99	-99	-99	-99	51	-99	-99	-99
309281	HAMBERT	SSX	1	GAS	JAN	1146	21413	99	1926		11576	11118	-99
309299	HAMBERT	SSX	1	GAS	MAR	1887	35082	95	2355	52.5	19863	14897	-99

SUBSET OF WELLS THAT ARE SUSSEX PRODUCERS.											
COMPILED FROM DWIGHT'S SCOUT AND PRODUCTION DATA											
UNION OF HEADER.XLS, COMPDATA.XLS, IPTEXT.XLS, AND GORALL.XLS											
1	2	3	4	5	6	7	8	9	10	11	
HEADER	HEADER	HEADER	HEADER	HEADE	HEADER	HEAD	HEA	HEA	HEADER	HEADER	HEAD
LAT	LONG	API	OWWO	SSXPR	RECORD	SEC	TN	RN	SPOT	FOOTAGE	OPER
0.000000	0.000000	0512315357	0000	1	R1647730	2	4	66	se nw se	1650 fsl 1340 fel	AMO
40.295914	104.613297	0512311488	0001	1	R1337611	24	4	65	e/2 ne sw	1980 fsl 2010 fwl	PRIM.
40.303131	104.603928	0512314684	0000	1	R1603960	24	4	65	sw ne ne	668 fnl 711 fel	PRIM.
40.306381	104.641510	0512315428	0000	1	R1651240	15	4	65	se se se	479 fsl 659 fel	SNYD
0.000000	0.000000	0512315427	0001	1	R1651311	15	4	65	ne ne se	1993 fsl 659 fel	SNYD
40.303513	104.622711	0512315352	0001	1	R1647401	23	4	65	nw ne ne	606 fnl 664 fel	SNYD
40.303452	104.627289	0512315350	0000	1	R1647370	23	4	65	ne nw ne	623 fnl 1941 fel	SNYD
40.299255	104.622818	0512315351	0001	1	R1647381	23	4	65	sw se ne	2159 fnl 664 fel	SNYD
40.249298	104.651443	0512312821	0000	1	R1469590	3	3	65	se sw	800 fsl 1880 fwl	MACH
40.245117	104.645950	0512312805	0000	1	R1468490	10	3	65	nw ne	725 fnl 1905 fel	MACH
40.252533	104.646240	0512312719	0000	1	R1463970	3	3	65	c nw se	1980 fsl 1980 fel	MACH
40.249619	104.645630	0512312385	0001	1	R1433531	3	3	65	sw se	915 fsl 1815 fel	MACH
40.245422	104.640610	0512312806	0000	1	R1468500	10	3	65	ne ne	615 fnl 415 fel	MACH
40.256241	104.660538	0512312720	0001	1	R1463981	4	3	65	c se ne	1980 fnl 660 fel	MACH
40.248917	104.641479	0512312762	0001	1	R1465561	3	3	65	c se se	660 fsl 660 fel	MACH
40.248917	104.641479	0512312762	0002	1	R1465562	3	3	65	c se se	660 fsl 660 fel	MACH
40.256332	104.684097	0512309729	0000	1	R2017450	5	3	65	c sw ne	1980 fnl 1980 fel	CHAM
40.241699	104.665512	0512309725	0000	1	R2016850	9	3	65	c sw ne	1980 fnl 1980 fel	CHAM
40.259949	104.679321	0512309682	0000	1	R2022540	5	3	65	c ne ne	660 fnl 660 fel	CHAM
40.248932	104.674698	0512309300	0000	1	R9169480	4	3	65	c sw sw	660 fsl 660 fwl	MACH
40.256454	104.670090	0512313659	0001	1	R1522061	4	3	65	se nw	1920 fnl 1920 fwl	COORS
40.259888	104.664963	0512313661	0001	1	R1522101	4	3	65	w/2 nw ne	660 fnl 1890 fel	NORTH
40.248917	104.655807	0512309328	0000	1	R9169490	3	3	65	sw sw	660 fsl 660 fwl	MACH
40.245300	104.651138	0512309497	0000	1	R9169460	10	3	65	c ne nw	660 fnl 1980 fwl	MACH
40.259903	104.669846	0512309330	0000	1	R9169470	4	3	65	ne nw	660 fnl 1980 fwl	MACH
40.252533	104.651093	0512310323	0000	1	R1167570	3	3	65	c ne sw	1980 fsl 1980 fwl	MACH.
40.252548	104.669922	0512309332	0000	1	R9169440	4	3	65	c ne sw	1980 fsl 1980 fwl	MACHI
40.256226	104.655823	0512309329	0000	1	R1161990	3	3	65	c sw nw	1980 fnl 660 fwl	MACHI
40.256271	104.665268	0512309333	0000	1	R9169430	4	3	65	sw ne	1980 fnl 1980 fel	MACHI
40.248932	104.665253	0512309334	0000	1	R9169420	4	3	65	c sw se	660 fsl 1980 fel	MACHI
40.252548	104.674652	0512309331	0000	1	R9169500	4	3	65	c sw nw	1980 fsl 660 fwl	MACHI
40.259857	104.660553	0512309335	0000	1	R1162000	4	3	65	c ne ne	660 fnl 660 fel	MACHI
40.245331	104.679504	0512309336	0000	1	R1135570	8	3	65	c ne ne	660 fnl 660 fel	MACHI

9	10	11	12	13	14	15
HEA	HEADER	HEADER	HEADER	HEADER	HEADE	HEADE
RN	SPOT	FOOTAGE	OPER	LEASE & WELL	ELEV	EREF
66	se nw se	1650 fsl 1340 fel	AMOCO PROD CO	AGRICULTURAL PRODUCTS #1	4717	KB
65	e/2 ne sw	1980 fsl 2010 fwl	PRIMA O&G CO	ALLISON #24-2RC	4784	KB
65	sw ne ne	668 fnl 711 fel	PRIMA O&G CO	API #24-1	4845	KB
65	se se se	479 fsl 659 fel	SNYDER OIL CORP	ARENS #15-16G	4703	KB
65	ne ne se	1993 fsl 659 fel	SNYDER OIL CORP	ARENS #15-9G	4698	KB
65	nw ne ne	606 fnl 664 fel	SNYDER OIL CORP	ARENS #23-1G	4733	KB
65	ne nw ne	623 fnl 1941 fel	SNYDER OIL CORP	ARENS #23-2G	4714	KB
65	sw se ne	2159 fnl 664 fel	SNYDER OIL CORP	ARENS #23-8G	4733	KB
65	se sw	800 fsl 1880 fwl	MACHII ROSS PETR CO	ARISTOCRAT #24-3C	4804	KB
65	nw ne	725 fnl 1905 fel	MACHII ROSS PETR CO	ARISTOCRAT #31-10C	4800	KB
65	c nw se	1980 fsl 1980 fel	MACHII ROSS PETR CO	ARISTOCRAT #33-3C	4785	KB
65	sw se	915 fsl 1815 fel	MACHII ROSS PETR CO	ARISTOCRAT #34-3C	4796	KB
65	ne ne	615 fnl 415 fel	MACHII ROSS PETR CO	ARISTOCRAT #41-10C	4778	KB
65	c se ne	1980 fnl 660 fel	MACHII ROSS PETR CO	ARISTOCRAT #42-4C	4812	KB
65	c se se	660 fsl 660 fel	MACHII ROSS PETR CO	ARISTOCRAT #44-3C	4784	KB
65	c se se	660 fsl 660 fel	MACHII ROSS PETR CO	ARISTOCRAT #44-3C	4784	KB
65	c sw ne	1980 fnl 1980 fel	CHAMPLIN PETR CO	ARISTOCRAT 32-5 #2	4909	KB
65	c sw ne	1980 fnl 1980 fel	CHAMPLIN PETR CO	ARISTOCRAT 32-9 #2	4854	KB
65	c ne ne	660 fnl 660 fel	CHAMPLIN PETR CO	ARISTOCRAT 41-5 #1	4864	KB
65	c sw sw	660 fsl 660 fwl	MACHII ROSS PETR CO	ARISTOCRAT ANGUS #14-4	4846	KB
65	se nw	1920 fnl 1920 fwl	COORS ENERGY CO	ARISTOCRAT ANGUS #22-4	4844	KB
65	w/2 nw ne	660 fnl 1890 fel	NORTH AMERICAN RES	ARISTOCRAT ANGUS #31-4	4820	KB
65	sw sw	660 fsl 660 fwl	MACHII ROSS PETR CO	ARISTOCRAT ANGUS RANCH #14-3	4815	KB
65	c ne nw	660 fnl 1980 fwl	MACHII ROSS PETR CO	ARISTOCRAT ANGUS RANCH #21-10	4807	KB
65	ne nw	660 fnl 1980 fwl	MACHII ROSS PETR CO	ARISTOCRAT ANGUS RANCH #21-4	4831	GR
65	c ne sw	1980 fsl 1980 fwl	MACHII ROSS PETR CO	ARISTOCRAT ANGUS RANCH #23-3	4779	KB
65	c ne sw	1980 fsl 1980 fwl	MACHII ROSS PETR CO	ARISTOCRAT ANGUS RANCH #23-4	4828	KB
65	c sw nw	1980 fnl 660 fwl	MACHII ROSS PETR CO	ARISTOCRAT ANGUS RANCH #3-12	4780	KB
65	sw ne	1980 fnl 1980 fel	MACHII ROSS PETR CO	ARISTOCRAT ANGUS RANCH #32-4	4814	KB
65	c sw se	660 fsl 1980 fel	MACHII ROSS PETR CO	ARISTOCRAT ANGUS RANCH #34-4	4818	KB
65	c sw nw	1980 fsl 660 fwl	MACHII ROSS PETR CO	ARISTOCRAT ANGUS RANCH #4-12	4840	KB
65	c ne ne	660 fnl 660 fel	MACHII ROSS PETR CO	ARISTOCRAT ANGUS RANCH #41-4	4796	KB
65	c ne ne	660 fnl 660 fel	MACHII ROSS PETR CO	ARISTOCRAT ANGUS RANCH #41-81	4865	KB

16	17	18	19	20	21	22	23	24	25	
HEADER	HEADE	HEADE	HEADE	HEADER	HEADER	HEADER	HEADER	HEA	HEADER	HEADER
FIELD	PTD	TD	PBTD	OBJECTIVE	FMTD	SPUDDATE	COMPLDATE	FC	FSTAT	WELLTY
HAMBERT	4600	4607	4561	Sussex		19911119	0			D
WATTENBERG	4432	7160	7130	Sussex		19901218	19910122	OG	O&G	D
WATTENBERG	7298	7241	7220	Niobrara		19900825	19900927	OG	O&G	D
WATTENBERG	7250	7181	7136	Codell		19911211	19930105	G	GAS	D
WATTENBERG	0	7190	7140	Sussex		0	19921028	OG	O&G	D
WATTENBERG	0	7172	7113	Sussex		19921118	19930116	G	GAS	D
WATTENBERG	7200	7174	7116	Codell		19921111	19930104	G	GAS	D
WATTENBERG	0	7166	7090	Sussex		19920409	19920416	OG	O&G	D
ARISTOCRAT	7250	7276	7210	Niobrara/Codell		19851114	19860208	OG	O&G	D
ARISTOCRAT	7250	7248	7220	Niobrara/Codell		19851121	19851214	OG	O&G	D
ARISTOCRAT	7250	7240	7220	Niobrara/Codell		19851105	19851129	OG	O&G	D
ARISTOCRAT	0	7241	0	Sussex		0	19860328	OG	O&G	D
ARISTOCRAT	7250	7242	7210	Niobrara/Codell		19851129	19851227	OG	O&G	D
ARISTOCRAT	0	0	0	Sussex		0	19860801	O	OIL	D
ARISTOCRAT	4530	7230	4532	Sussex		0	19860726	OG	O&G	D
ARISTOCRAT	4530	7230	7183	Sussex/Niobrara/Codell		0	19861218	OG	O&G	D
ARISTOCRAT	4680	4680	4633	Sussex		19790625	19790712	G	GAS	D
ARISTOCRAT	4620	4620	4633	Sussex		19790619	19790705	OG	O&G	D
ARISTOCRAT	4650	4631	0	Sussex		19790301	19790418	G	GAS	D
ARISTOCRAT	4600	4620	0	Sussex		19771010	19780314	G	GAS	D
ARISTOCRAT	4510	7335	7215	Sussex		19880907	19881022	OG	O&G	D
ARISTOCRAT	0	7300	7246	Sussex		0	19930507	G	GAS	D
WILDCAT	4600	4603	4570	Sussex		19780524	19780528	O	OIL	W
ARISTOCRAT	4630	4575	0	Sussex		19780619	19801205	OG	O&G	D
WILDCAT	4600	4625	0	Sussex		19780624	19800310	OG	O&G	W
ARISTOCRAT	4645	4643	0	Sussex		19810527	19810822	OG	O&G	D
WILDCAT	4600	4534	0	Sussex		19780411	19780525	OG	O&G	W
ARISTOCRAT	4600	4627	0	Sussex	Sussex	19811016	19820218	OG	O&G	D
WILDCAT	4600	4654	0	Sussex		19780613	19800418	O	OIL	W
WILDCAT	4600	4615	0	Sussex		19780408	19781204	O	OIL	W
WILDCAT	4600	4630	0			19770605	19780621	OG	O&G	W
ARISTOCRAT	4600	4577	0	Sussex		19810522	19810816	OG	O&G	D
ARISTOCRAT	4600	4643	0	Sussex		19810201	19810625	OG	O&G	D

22	23	24	25	26	%	28	29	30	31	33	34	35
					%	COMPD	COMPDAT	COMPDATA	COMPD	COMPDA	COMPDA	COMPDATA
	HEADER	HEA	HEADER	HEADER	%	1-IP	1-IP	1-IP	1-IP	ZONE 1	ZONE 1	ZONE 1
	COMPLDATE	FC	FSTAT	WELLTYPE	%	BOPD	LIQTYPE	MCFGPD	BWPD	UPPER	LOWER	PRODFM
119	0			D	%	0		0	0	4426	4465	Sussex
218	19910122	OG	O&G	D	%	9	OIL	580	0	4416	4432	Sussex
825	19900927	OG	O&G	D	%	9	OIL	460	0	4478	4494	Sussex
211	19930105	G	GAS	D	%	5	OIL	155	5	4375	4393	Sussex
0	19921028	OG	O&G	D	%	23	OIL	469	13	4375	4388	Sussex
118	19930116	G	GAS	D	%	10	OIL	286	18	4433	4452	Sussex
111	19930104	G	GAS	D	%	20	OIL	456	16	4368	4386	Sussex
409	19920416	OG	O&G	D	%	38	OIL	503	12	4435	4466	Sussex
114	19860208	OG	O&G	D	%	93	OIL	156	60	4415	4480	Sussex
121	19851214	OG	O&G	D	%	56	OIL	381	60	4388	4448	Sussex
105	19851129	OG	O&G	D	%	18	OIL	328	10	4382	4447	Sussex
0	19860328	OG	O&G	D	%	3	OIL	528	3	4422	4482	Sussex
129	19851227	OG	O&G	D	%	56	OIL	464	20	4412	4479	Sussex
0	19860801	O	OIL	D	%	23	OIL	5	11	4460	4522	Sussex
0	19860726	OG	O&G	D	%	81	OIL	477	30	4377	4445	Sussex
0	19861218	OG	O&G	D	%	58	OIL	364	40	4377	4445	Sussex
25	19790712	G	GAS	D	%	33	OIL	1550	13	4526	4585	Sussex
19	19790705	OG	O&G	D	%	58	OIL	190	10	4475	4538	Sussex
01	19790418	G	GAS	D	%	7	OIL	790	0	4522	4545	Sussex
10	19780314	G	GAS	D	%	18	OIL	1077	0	4470	4520	Sussex
07	19881022	OG	O&G	D	%	10	OIL	368	0	4452	4510	Sussex
0	19930507	G	GAS	D	%	13	OIL	200	5	4426	4484	Sussex
24	19780528	O	OIL	W	%	71	OIL	220	0	4433	4486	Sussex
19	19801205	OG	O&G	D	%	76	OIL	411	0	4422	4482	Sussex
24	19800310	OG	O&G	W	%	11	OIL	875	0	4452	4547	Sussex
27	19810822	OG	O&G	D	%	8	OIL	469	0	4380	4444	Sussex
11	19780525	OG	O&G	W	%	40	OIL	620	0	4460	4527	Sussex
16	19820218	OG	O&G	D	%	5	OIL	207	0	4400	4470	Sussex
13	19800418	O	OIL	W	%	80	OIL	400	0	4502	4560	Sussex
08	19781204	O	OIL	W	%	158	OIL	630	0	4440	4515	Sussex
05	19780621	OG	O&G	W	%	19	OIL	562	0	4453	4518	Sussex
22	19810816	OG	O&G	D	%	43	OIL	256	0	4375	4482	Sussex
01	19810625	OG	O&G	D	%	76	OIL	400	0	4478	4540	Sussex

36	37	38	38.1	39	%	
COMPDATA	COMPDAT	COMPDAT	COMPDATA	COMPDATA	%	
ZONE 1					%	PRODDATA
PERFS COMMENTS	IPGRAV1	IPGOR1	GORCALC	IPTEXT1	%	PRODUCER &
4426-4465 (Sussex) w/8 JSPF 156 holes tot	-99	-999	-999		%	AMOCO PROI
- BP @ 6929 4416-4432 (Sussex) w/65 hole	-99	-999	64444	F 9 BOPD; 580 MCFGPD on 14/	%	PRIMA OIL &
4478-4494 (Sussex) w/63 holes total - frac	-99	-999	51111	F 9 BOPD; 460 MCFGPD on 11/	%	PRIMA OIL &
4375-4393 (Sussex) w/22 holes total - frac w/83,000 gal wtr claytre			31000	(Sussex 4375-4398) -- F 5.3 BO	%	
- BP @ 6400 4375-4388 (Sussex) w/26 hole	-99	-999	20391	(Sussex 4375-4388) -- F 23 BO	%	SNYDER OIL C
4433-4452 (Sussex) w/30 holes total - frac	-99	-999	28600	(Sussex 4433-4452) -- F 10 BO	%	
4368-4386 (Sussex) w/28 holes total - frac	-99	-999	22800	(Sussex 4368-4386) -- F 20 BO	%	SNYDER OIL C
- CIBP @ 7090 4435-4466 (Sussex) w/2 SP	-99	-999	13237	F 38 BOPD; 503 MCFGPD; 12 B	%	SNYDER OIL C
-- Recompletion July 1986: CIBP @ 4590 -- P	-99	-999	1677	F 93 BOPD; 156 MCFGPD; 60 B	%	COORS ENERC
-- Recompletion October 1986: Plugged back t	-99	-999	6804	F 56 BOPD; 381 MCFGPD; 60 B	%	NORTH AMERI
--Recompletion July 1986: CIBP @ 4558 -- Pe	-99	-999	18222	F 18 BOPD; 328 MCFGPD; 10 B	%	COORS ENERC
4422-4482 (Sussex) w/2 SPF - frac w/280,0	-99	-999	476000	F 3 BOPD; 528 MCFGPD; 3 BWP	%	COORS ENERC
-- Recompletion Aug. 1986: Perf 4412-4479 (	-99	-999	8286	F 56 BOPD; 464 MCFGPD; 20 B	%	NORTH AMERI
4460-4522 (Sussex) w/2 SPF - acid w/500 g	-99	-999	217	F 23 BOPD; 5 MCFGPD; 11 BWP	%	COORS ENERG
4377 (Sussex) w/2 SPF - frac w/300,000# 2	-99	-999	5889	F 81 BOPD; 477 MCFGPD; 30 B	%	COORS ENERG
4377-4445 (Sussex) 6817-6946 (Niobrara)	-99	-999	6276	F 58 BOPD; 364 MCFGPD; 40 B	%	
4526-4585 (Sussex) @ 4526-4534 4546-45	-99	-999	46970	F 32/64 ck 33 BOPD 1550 MCF	%	UNION PACIFIC
4475-4538 (Sussex) @ 4475-4488 4502-45	-99	-999	3276	F 58 BOPD; 190 MCFGPD on 26	%	UNION PACIFIC
4522-4545 (Sussex) w/2 JSPF - frac w/2670	-99	112857	112857	F 22/64 ck 7 BLO 790 MCFGPD	%	
4470-4518 w/1 SPF - acid w/300 gal acid	44	59833	59833	F 18 BOPD grav 44, 1077 MCFG	%	
4452-4510 (Sussex) w/2 SPF - treat w/12 bb	-99	-999	36800	F 10 BOPD; 368 MCFGPD; no w	%	
4426-4484 (Sussex) w/4 SPF - frac w/288,0	-99	-999	15385	(Sussex 4426-4484) -- P 13 BO	%	
4433-4486 (Sussex) w/1 SPF - treat w/300 g	48	3	3099	F 71 BOPD grav 48, 220 MCFGP	%	COORS ENERG
4422-82 (Sussex) w/ 1 shot-treat w/296000 l	50	10	5408	F 76 BOPD grav 50, 411 MCFGP	%	
4454-4515 (Sussex) w/1 SPF - treat w/1663	44	795	79545	F 11 BOPD grav 44, 875 MCFGP	%	
4380-4444 w/1 SPF - frac w/296,000 # 20/4	52	-999	58625	P 6 BOPD, 440 MCFGPD (Operat	%	COORS ENERG
4464-4511 (Sussex) w/1 SPF - treat w/300 g	44.5	155	15500	F 40 BOPD grav 44.5, 620 MCF	%	
4400-4470 (Sussex) w/1 SPF - acid w/500 b	52	-999	41400	F 5 BOPD grav 52, 207 MCFGPD	%	COORS ENERG
4502-4560 (Sussex) w/1 SPF-treat w/1726 B	43	500	5000	P 80 BOPD grav 43, 400 MCFGP	%	
4446-4510 w/1 SPF - treat w/300 gal acid 16	43.4	399	3987	F 158 BOPD grav 43.4, 630 MC	%	COORS ENERG
4453-4518 - w/ISPF - treat w/300 gal 19600	-99	29578	29579	F 19 BOPD 562 MCFGPD on 12/	%	
4375-4482 (Sussex) w/1 SPF @ 4375-85 44	51	-999	5953	F 43 BOPD grav 51, 256 MCFGP	%	COORS ENERG
4478-4540 (Sussex) w/1 SPF - frac w/897 b	56	-999	5263	F 76 BOPD grav 56, 400 MCFGP	%	NORTH AMERIC

39	%	63	64
MPDATA	%		
	%	PRODDATA	PRODDATA
EXT1	%	PRODUCER & LEASE	LOC
	%	AMOCO PRODUCTION CO AGRICULTURAL PRODUCTS	2 4N 66W
BOPD; 580 MCFGPD on 14/	%	PRIMA OIL & GAS CO ALLISON 24-2 RC 24-2	24 4N 65W
BOPD; 460 MCFGPD on 11/	%	PRIMA OIL & GAS CO API 24-1	24 4N 65W
ssex 4375-4398) -- F 5.3 BO	%		
ssex 4375-4388) -- F 23 BO	%	SNYDER OIL CORP ARENS 15-9G	15 4N 65W
ssex 4433-4452) -- F 10 BO	%		
ssex 4368-4386) -- F 20 BO	%	SNYDER OIL CORP ARENS 23-2G	23 4N 65W
3 BOPD; 503 MCFGPD; 12 B	%	SNYDER OIL CORP ARENS 23-8G 23 86	23 4N 65W
3 BOPD; 156 MCFGPD; 60 B	%	COORS ENERGY CO ARISTOCRAT 24-3C	3 3N 65W
5 BOPD; 381 MCFGPD; 60 B	%	NORTH AMERICAN RESOURCES ARISTOCRAT ANG 21&31-10S	10 3N 65W
3 BOPD; 328 MCFGPD; 10 B	%	COORS ENERGY CO ARISTOCRAT 33-3C	3 3N 65W
BOPD; 528 MCFGPD; 3 BWP	%	COORS ENERGY CO ARISTOCRAT 34-3C	3 3N 65W
5 BOPD; 464 MCFGPD; 20 B	%	NORTH AMERICAN RESOURCES ARISTOCRAT 41-10C	10 3N 65W
3 BOPD; 5 MCFGPD; 11 BWP	%	COORS ENERGY CO ARISTOCRAT 42-4C	4 3N 65W
1 BOPD; 477 MCFGPD; 30 B	%	COORS ENERGY CO ARISTOCRAT 44-3C	3 3N 65W
3 BOPD; 364 MCFGPD; 40 B	%		
?/64 ck 33 BOPD 1550 MCF	%	UNION PACIFIC RESOURCES AR ANGUS RANCH 41-5,32-5	5 3N 65W
3 BOPD; 190 MCFGPD on 26	%	UNION PACIFIC RESOURCES AR ANGUS RANCH 41-9,32-9	9 3N 65W
?/64 ck 7 BLO 790 MCFGPD	%		
3 BOPD grav 44, 1077 MCFG	%		
0 BOPD; 368 MCFGPD; no w	%		
sex 4426-4484) -- P 13 BO	%		
BOPD grav 48, 220 MCFGP	%	COORS ENERGY CO ARISTOCRAT ANGUS 14-3	3 3N 65W
BOPD grav 50, 411 MCFGP	%		
BOPD grav 44, 875 MCFGP	%		
BOPD, 440 MCFGPD (Operat	%	COORS ENERGY CO ARISTOCRAT ANGUS 23-3	3 3N 65W
BOPD grav 44.5, 620 MCF	%		
BOPD grav 52, 207 MCFGPD	%	COORS ENERGY CO ARISTOCRAT ANGUS 12-3	3 3N 65W
BOPD grav 43, 400 MCFGP	%		
3 BOPD grav 43.4, 630 MC	%	COORS ENERGY CO ARISTOCRAT ANGUS POOL	4 3N 65W
BOPD 562 MCFGPD on 12/	%		
BOPD grav 51, 256 MCFGP	%	COORS ENERGY CO ARISTOCRAT ANGUS 41-4	4 3N 65W
BOPD grav 56, 400 MCFGP	%	NORTH AMERICAN RESOURCES ARISTOCRAT ANGUS 41-8	8 3N 65W

65	66	67	68	69	70	71	72	73	74	75
PRODDATA KEYAPI	PRODDATA FLD	PRODDATA RES	PRODDA ZONES	PRODD TYPE	PRODD 13MO	PRODD GAS	PRODDATA CUMGAS	PROD OIL	PRODDAT CUMOIL	PRODDA PGRAV
0512315357	HAMBERT	SSX	1	GAS	MAR	465	1515	0	10	
0512311488	WATTENBERG	SSX	1	GAS	JAN	5787	85226	72	1047	63.5
0512314684	WATTENBERG	SSX	1	GAS	SEP	4080	108409	58	1514	56.3
0512315428										
0512315427	WATTENBERG	SSX	1	OIL	XXX	-99	-99	-99	-99	56
0512315352										
0512315350	WATTENBERG	SSX-COD	2	OIL	XXX	-99	-99	-99	-99	60
0512315351	WATTENBERG	NIOB-COD-SSX	3	GAS	XXX	-99	-99	-99	-99	63
0512312821	ARISTOCRAT	NIOB-COD-SSX	3	OIL	FEB	7696	53357	362	3651	
0512312805	ARISTOCRAT	SSX	1	OIL	JAN	1138	24635	71	2282	
0512312719	ARISTOCRAT	NIOB-COD-SSX	3	OIL	NOV	12926	64969	528	3339	
0512312385	ARISTOCRAT	NIOB-COD-SSX	3	GAS	APR	0	67856	0	3445	
0512312806	ARISTOCRAT	NIOB-COD-SSX	3	OIL	DEC	4985	120030	345	9411	53.4
0512312720	ARISTOCRAT	NIOB-COD-SSX	3	OIL	NOV	2977	67432	724	6304	
0512312762	ARISTOCRAT	NIOB-COD-SSX	3	GAS	JAN	14699	84203	644	3874	
0512309729	ARISTOCRAT	SSX	1	GAS	JUL	26464	529099	581	12443	56
0512309725	ARISTOCRAT	SSX	1	GAS	AUG	5998	137417	410	12978	50
0512309682										
0512309300										
0512313659										
0512313661										
0512309328	ARISTOCRAT	SSX	1	GAS	JAN	328	6370	24	335	
0512309497										
0512309330										
0512310323	ARISTOCRAT	SSX	1	GAS	JAN	0	4638	0	51	
0512309332										
0512309329	ARISTOCRAT	SSX	1	GAS	JAN	1099	19995	9	965	
0512309333										
0512309334	ARISTOCRAT	SSX	1	GAS	MAR	38531	683265	1073	22714	
0512309331										
0512309335	ARISTOCRAT	SSX	1	OIL	JAN	275	16355	0	2363	
0512309336	ARISTOCRAT	SSX	1	OIL	JAN	856	23833	4	1930	

71	72	73	74	75	76	77	78
OD	PRODDATA	PROD	PRODDAT	PRODDA	PRODDA	PRODDATA	PRODDAT
	CUMGAS	OIL	CUMOIL	PGRAV	13GOR	AVGGOR	#WELLS
465	1515	0	10		-99	151500	-99
787	85226	72	1047	63.5	80375	81400	-99
080	108409	58	1514	56.3	70345	71604	-99
-99	-99	-99	-99	56	-99	-99	
-99	-99	-99	-99	60	-99	-99	
-99	-99	-99	-99	63	-99	-99	-99
596	53357	362	3651		21260	14614	2
38	24635	71	2282		16028	10795	1
26	64969	528	3339		24481	19458	2
0	67856	0	3445		-99	19697	-99
85	120030	345	9411	53.4	14449	12754	2
77	67432	724	6304		4112	10697	2
99	84203	644	3874		22825	21735	-99
64	529099	581	12443	56	45549	42522	-99
98	137417	410	12978	50	14629	10588	-99
28	6370	24	335		13667	19015	-99
0	4638	0	51		-99	90941	-99
99	19995	9	965		122111	20720	-99
31	683265	1073	22714		35910	30081	-99
75	16355	0	2363		-99	6921	2
56	23833	4	1930		214000	12349	1

Colorado School of Mines
Interdisciplinary Study of Reservoir Compartments
DOE DE-AC22-93BC14891
1st Quarter 1994 Technical Report

Hambert Field
Task 1.1.1: Reservoir Selection and Data Gathering
Research Assistant: Cynthia Scheiner

Database Issues

The Geology Department at CSM has been working to establish a databank for Rocky Mountain oil and gas fields for the past year. In January, 1994, Dwight's Energydata, Inc. agreed to let us use production and scout ticket data for the Rocky Mountain area on 2 CD-ROM disks to provide the initial production information concerning the Hambert Field.

As there are approximately 2,000 wells in the study area, these databases were necessary to get information quickly. However, the programs provided with the disks are not sophisticated data managers, so that options for sorting data are very limited. To get the data into a format to be edited or mapped, one must download from the CD-ROM disks to an ASCII or Dwight's proprietary file format and import into another program.

It is possible to import ASCII files into most commercial spreadsheets or databases. However, the ease of which this is done varies considerably. Initial experiences importing these files into Excel and Quattro Pro were time consuming and required a fairly experienced user. We decided to use Exploration Data Manager (EDM), a program designed specifically to manage Dwight's or PI data with a friendly user interface.

EDM is designed to import Dwight's CD-ROM data directly from production and scout ticket CD-ROM disks and merge the two files into one database. It is important to know that these are two very distinct data sets. This has proved to be the most difficult obstacle to overcome with regard to data management. Scout ticket data is provided for each well, while production data is recorded on a lease basis which may include one or more wells. The only way to attach a production figure to an exact well (if there are more than one well in a lease) would be to obtain this information directly from the operator as production is reported to the oil and gas commission by lease.

One of the first tasks for this project was to plot a base map of wells in the Hambert Field with associated oil and gas production. Due to the conflicts mentioned above, this took a very long time to accomplish. EDM will output a data set in XYZ format to be directly imported into a mapping program. An XYZ format requires latitude and longitude coordinates, and when requested for leases with multiple wells, sometimes the production data would be dropped. For each lease, the data manager would pick one physical location and depending on the API number this well may or may not have the production number tied to it. Finally, the XYZ file had to be manually edited to insure that oil and gas production was represented as correctly as possible.

Importing the data into mapping programs provided additional problems. Rockware can import many types of files but is very particular about spaces! Because Rockware uses spaces to delimit fields, any extra spaces in the initial Dwight's data fields can cause a data point to be dropped. We have abandoned this program as it is virtually impossible to edit out these spaces by hand. At the current time, we are experimenting with different programs for plotting and mapping.

So far, many of the problems encountered in the management of this data are fairly typical in the handling of any large databases, especially when many different programs are used. The specific problem of lease vs. well data is one that needs to be addressed for the Rocky Mountain area and probably many other areas of the country.

APPENDIX B

1. Geologic Reservoir Characterization

Colorado School of Mines
Interdisciplinary Study of Reservoir Compartments
DOE DE-AC22-93BC14891
1st Quarter 1994 Technical Report

Hambert Field
Task 1.1.2: Outcrop/Core/Log Analysis/and Correlations
Task 1.1.3: Internal Architecture Description
Research Associate: Professor Slatt
Research Assistant: Dwaine Edington
Research Assistant: Cynthia Scheiner
Research Assistant: Muatasam Al-Raisi

Geologic Reservoir Characterization

Introduction

Hambert Field, Colorado produces oil and gas from the Cretaceous Terry Sandstone (alternately referred to as Sussex Sandstone in this area). Sandstones in this field, as well as in analogous fields elsewhere, are elongate, linear bodies which have traditionally been interpreted as having been deposited in an offshore marine setting as discrete sand ridges. Typically, the linear sand bodies are encased in shale and comprised of a series of smaller lenticular sandstone bodies, each separated and isolated by shales; isolation and compartmentalization occur at a variety of scales. These Cretaceous 'shelf sandstones' are prolific hydrocarbon producers along the Cretaceous Western Interior Seaway all the way from Alaska, through Canada, south into the Rocky Mountain basins and down into the Gulf of Mexico. Some example reservoirs along this continent-wide trend are described below.

The Kuparuk River field, north slope of Alaska, has an estimated 5 billion barrels of original oil in place (OOIP), with potential recoverable reserves by routine primary and secondary recovery technologies of 1.6 billion barrels (Gaynor and Scheihing, 1988). The field is divided into a series of isolated, shingled, overlapping shelf ridge sandstones, separated by marine shales. Stratigraphic compartmentalization of productive sandstones has been documented at a variety of scales.

In Alberta, Canada, the Viking Formation shelf sandstone deposit produces hydrocarbons from a number of fields (Beaumont, 1984), many of which are also highly compartmentalized and shingled. Also in the Alberta Basin, the Cardium Formation produces hydrocarbons from a number of fields estimated to contain over 2 billion barrels of oil (Leggitt et al, 1990). Pembina field is the largest field producing from linear shelf sandstones, with an estimated 1.5 billion barrels of recoverable oil.

In Wyoming, the Sussex Sandstone, approximately equivalent in age to the Terry Sandstone in Colorado, produces hydrocarbons from shelf sandstone fields such as House Creek (Berg, 1975, Hobson et. al. 1982). As of 1980, this field had produced almost 15MMBO and 9BCF from 148 wells. House Creek field is one of many linear sand ridges which cover a large geographic area. A Ph.D. dissertation by D. Higley on House Creek field, currently being completed at Colorado School of Mines under the direction of Roger Slatt, indicates this linear sand body is shingled and highly compartmentalized both vertically and laterally.

Also in the Powder River Basin, the older Cretaceous Shannon Sandstone, also a shelf sand ridge deposit, produces hydrocarbons from more than 26 fields (Tillman and Martinsen, 1985). The largest is Hartzog Draw field which contains 350MMBOOIP. Outcrop studies of sandstones that are analogous to those that produce at Hartzog Draw indicate the fields are highly compartmentalized (Hearn, et. al., 1983; Tillman and Martinsen, 1984 and 1985; Gaynor and Swift, 1988).

In the Denver Basin of Colorado, near Hambert field, the Singletree, Spindle, and Surrey fields, all considered as part of the larger Wattenberg field, produce oil and gas from the Terry, as well as from analogous Hygiene sandstones (Moredock and Williams, 1976). A recent summary report by McKinnie (1993) lists Spindle Field Sussex production as 127BCF and Hambert Field Sussex production as over 36BCF of gas; the Sussex is formally designated as a Tight Sand. The area of the active Sussex play in the vicinity of Hambert Field is shown in Fig. 1.

An example from the Texas Gulf Coast is Kurten Field, which is estimated to contain up to 100MMBO (Turner and Conger, 1984).

Although these sandstones are usually thought to have been deposited in offshore shelf settings either as plumes of sand derived from a nearby delta, or as sands reworked into offshore ridge complexes during marine transgression (Slatt, 1984)), Walker and his students (Leggitt, et. al., 1990; Walker and Eyles, 1991; Pattison and Walker, 1992; Hart and Plint, 1994) have proposed that at least some of these ridges are really shoreface deposits sitting atop regional unconformities (which isolate individual sandstones).

Seismic work over Hambert Field (Davis, 1985) indicates a strong structural component to the field, dominated by northeast-trending listric faults. Davis' work also indicates relatively small faults can be observed with 2D seismic, so that the 3D seismic survey being utilized in this study should reveal even more structural detail. 2D seismic in the analogous Cardium Formation, discussed above, can also detect sand ridge reservoirs (Slatt et. al., 1987), so it is anticipated that stratigraphic detail can also be deciphered with the 3D data set.

Latham Bar Trend

At the same time that the Hambert Field study was being initiated, a correlative study of the Latham Bar Trend was being conducted as part of the requirements for a M.S. (Geology) Degree at CSM by Muatasam Al-Raisi. This study is pertinent to the Hambert study because: 1) Latham Bar Trend produces oil and gas from the same Sussex stratigraphic interval as at Hambert, 2) the Trend is only a few miles to the east-northeast of Hambert, in T4/3N, R65/64W, and 3) the trend has a similar northwest-southeast orientation to that of Hambert. Some pertinent results of that study are presented here because they form the test for some of the methods of geologic characterization that are being conducted at Hambert.

Stratigraphy and reservoir quality. Producing sandstones at Latham Bar Trend are interpreted by Al-Raisi as shelf sandstones. Shelf sandstone facies have been identified in cores and detailed permeability profiles have been compiled of each facies using a pressure-decay permeameter housed in CSM's Petroleum Engineering Department. The results (Fig. 2) show a strong facies control on permeability, and thus reservoir quality. The relatively coarsest-grained, and most highly cross-bedded 'central ridge facies' exhibits the best reservoir quality, in the range 1-10md.

Structure. Because the producing sandstones at Latham Bar (and Hambert, Spindle, etc.) field are elongate in the northwest-southeast direction and lenticular, compiling a structure map off of the Top Sussex will provide a representation of a surface resulting partially from subsurface structure and partially from sandstone trends. Therefore, in Latham Bar Trend a structure map was compiled using a bentonite bed, which forms a prominent log marker, as a datum. This datum occurs stratigraphically beneath the Base Sussex Sandstone. This structure map, coupled with well log cross sections constructed to search for faults (missing or repeated section above, within, and/or below the Sussex interval), revealed the presence of numerous northeast trending faults in Latham Bar Trend, as first described by Davis (1985). An isopach of the productive 'central ridge facies', with associated faults is shown as Figure 3. Figure 4 shows an interpreted northwest-southeast structural cross section along the length of the Trend, depicting the nature of fault blocks which compartmentalize it.

Fluid Distributions and reservoir compartmentalization.

Pressure data were not available to evaluate whether the interpreted fault blocks comprise separate reservoir compartments. Two other criteria were used to test this concept: (1) distribution of 13th production-month GOR among the wells(13th month was chosen as a basis for standardization and comparison of GOR's from all the wells along the Trend), (2) distribution of API gravity among the wells, and (3) distribution of EUR among the wells. A map of GOR's revealed that different fault blocks exhibit significantly different GOR's. Further, plotting of GOR's along the cross-section of Figure 4 shows that standardized GOR's increase progressively up-structure within each block. Similarly, API gravity varies from block to block. A plot of EUR across the Trend exhibits considerable scatter, but when EUR is plotted against thickness of the productive 'central ridge facies', the anticipated linear relationship is revealed (Fig. 5). These distributions together suggest that individual blocks are compartmentalized.

The thesis work summarized above suggest: (1) sedimentary facies control on reservoir quality should be evaluated at Hambert Field, (2) structural mapping of bentonite horizons, which occur beneath the Terry Sandstone at Hambert Field, will provide a suitable first-pass method of detecting major faults and fault trends (followed by more detailed analysis of the 3D seismic data set in Hambert Field), and (3) standardization and mapping of GOR's, API gravity, and estimated EUR all provide a method of evaluating reservoir compartmentalization in the absence of pressure and production data.

Hambert Field

Stratigraphy and Reservoir Quality. Cores through the Terry Sandstone have been examined from the following three wells in the study area:

- Mach II-Rossi Petroleum 4-14 Aristocrat Angus (Aristocrat Field, Fig. 1)
  NESWNW Sec. 2 T3NR65W, USGS Library No. R726
- Amoco Prod. 1 Vern Marshall, CNWSW Sec. 32 T4NR65W, USGS Library No. R203
- General Oil 1 Eckhardt, SENENE Sec. 15T4NR66W, USGS Library No. A609

A fourth well, Excel Energy 2 Jepsen, NESWNW Sec. 2 T3NR65W, USGS Library No. R726 contains a core which has not yet been examined.

For each core, sedimentary textures, structures, and stratification sequences were described and facies identified. Permeability measurements were made by Petroleum Engineering with a pressure-decay permeameter at 2" intervals for the Mach II and General Oil cores and at 6" intervals for the Vern Marshall core. At each measurement point, % sand was estimated. Plots of facies (Facies 0.5 = dark, organic-rich shale, Facies 1 = shale with some bioturbated sandstone laminae, Facies 2 = interlaminated bioturbated sandstone/shale, Facies 3 = parallel to cross-bedded, fine-very fine grained, bioturbated sandstone, Facies 4 = massive, bioturbated, fine-grained sandstone with some remnant cross-bedding, Facies 5 = fine-grained, glauconitic, cross-bedded sandstone, and Facies 6 = dolomite or dolomitic sandstone), % sand, pressure-decay permeability, and core plug permeability (squares) are shown on Figure 6, alongside well gamma ray logs. It is apparent that the 'best' sandstone response on the gamma ray log is also the sandiest and most permeable sandstone. Permeability is generally lower, and more variable, in highly interlaminated sandstone/mudstone intervals.

Overall, the vertical sequence seen in all three cores exhibits a fining- and thinning-upward character, with corresponding upward decrease in reservoir quality. This character is distinctive of transgressive intervals, but not necessarily of 'shelf' sandstones, as described in the introduction.

A typical well log (Fig. 7) of the Sussex Sandstone and stratigraphically adjacent intervals exhibit several diagnostic log markers, including, from the base-upward, a high-gamma ray bentonite marker (for structural mapping) (D), Base Sussex Sandstone (C), Top Sussex Sandstone (B), Top unnamed sandstone (A), and at least one internal shale marker (E) that can be traced for long distances. In the coming Quarter, isopachs will be made of each interval. It is anticipated that there is considerable heterogeneity of strata between each marker; this heterogeneity will also be documented.

Structure: For reconnaissance purposes, a preliminary database was developed of Scout Ticket Top Sussex (Terry) for wells in the area T4N R65/66W and T3N R65W. The tops were posted on a map and a structure map of Top Sussex was sketched, bearing in mind that 'structure' on the top of the sandstone really represents a combination of true structural irregularities plus variations in sandstone thickness across the area. This map is shown in Fig. 8. During the next quarter, a refined structure map will be completed, using the bentonite bed described above as datum. This will allow delineation of regional, as well as local structural trends and fault patterns.

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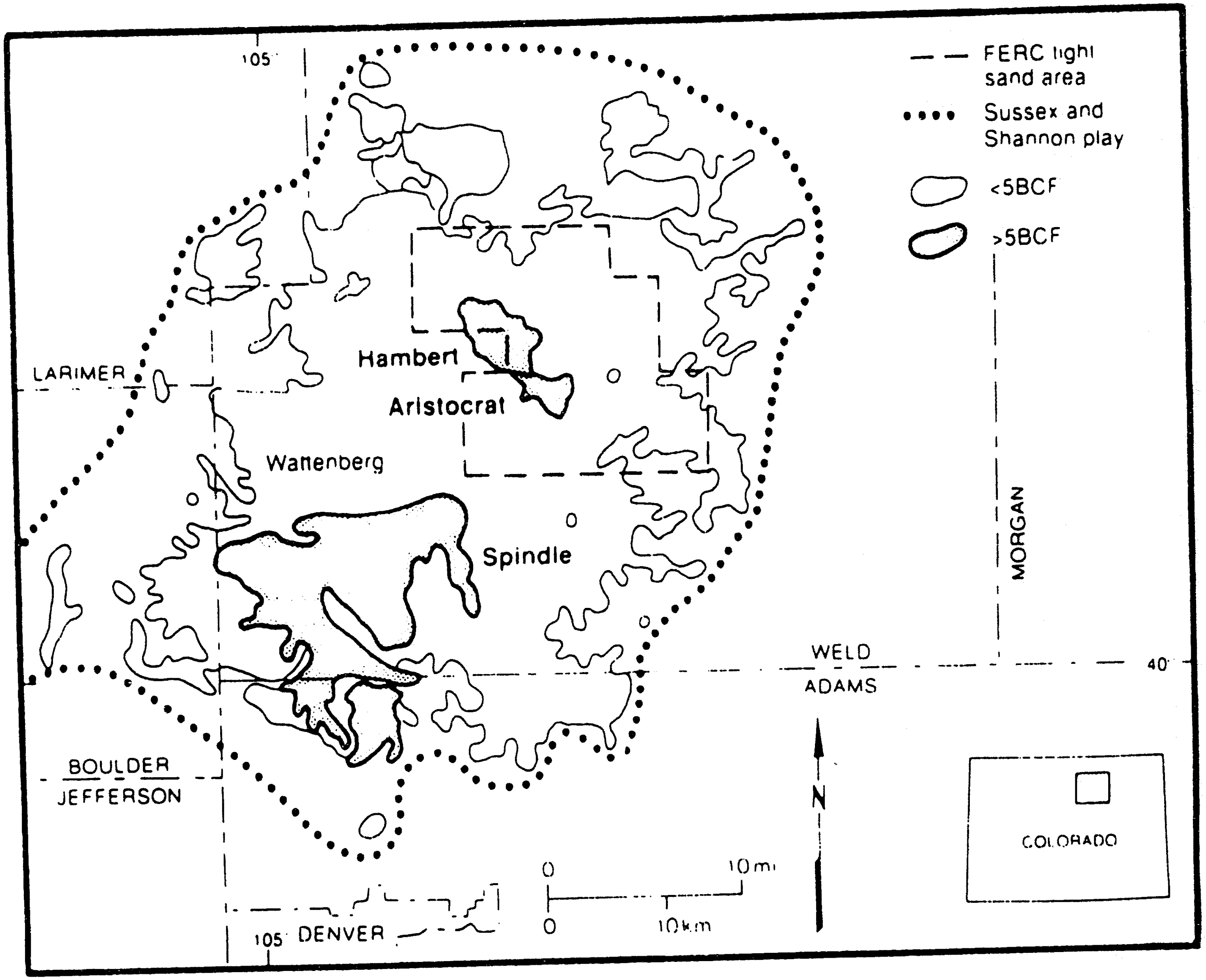


FERC tight sand area
Sussex and Shannon play
<5BCF
>5BCF
105
LARIMER
Hambert
Aristocrat
Wattenberg
Spindle
MORGAN
WELD
ADAMS
40
BOULDER
JEFFERSON
N
COLORADO
0
10 mi
0
10 km
105
DENVER

Figure 1

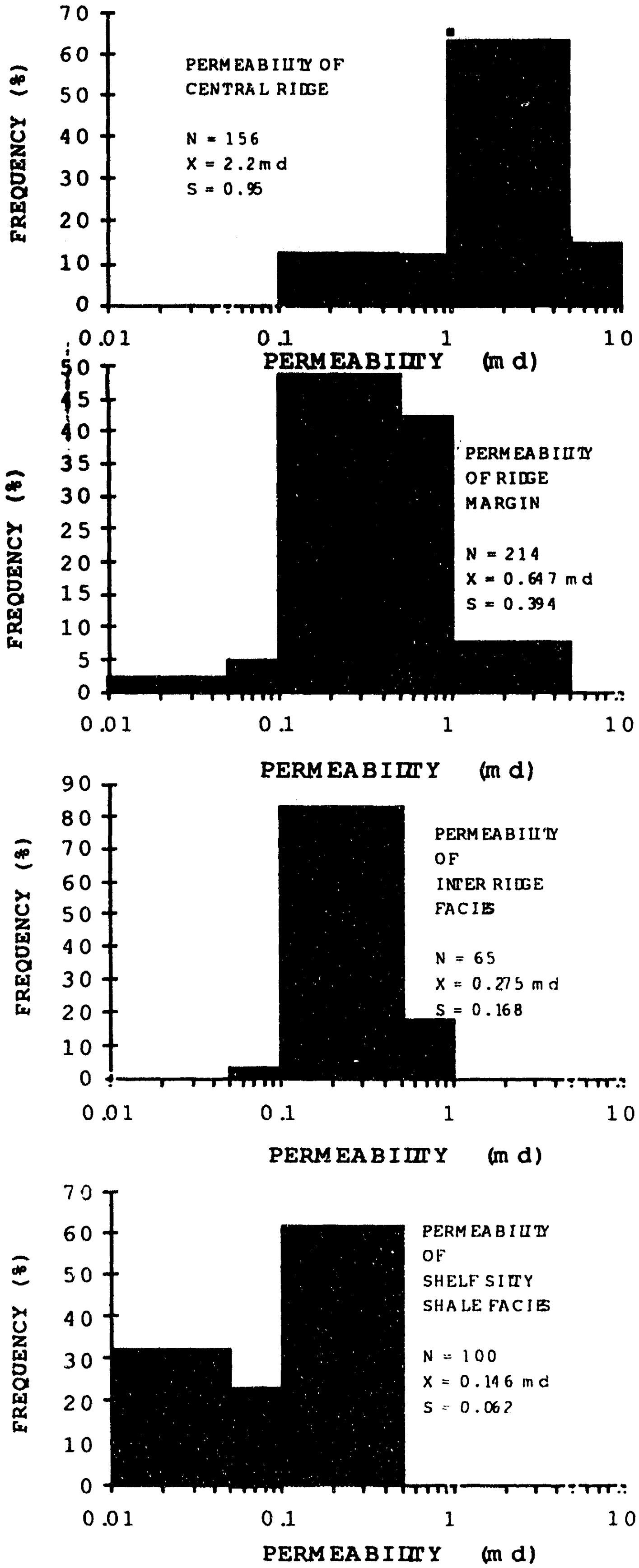

PERMEABILITY OF CENTRAL RIDGE
N = 156
X = 2.2 md
S = 0.95
FREQUENCY (%)
PERMEABILITY (md)
PERMEABILITY OF RIDGE MARGIN
N = 214
X = 0.647 md
S = 0.394
FREQUENCY (%)
PERMEABILITY (md)
PERMEABILITY OF INTER RIDGE FACIES
N = 65
X = 0.275 md
S = 0.168
FREQUENCY (%)
PERMEABILITY (md)
PERMEABILITY OF SHELF SILTY SHALE FACIES
N = 100
X = 0.146 md
S = 0.062
FREQUENCY (%)
PERMEABILITY (md)

Fig. 2

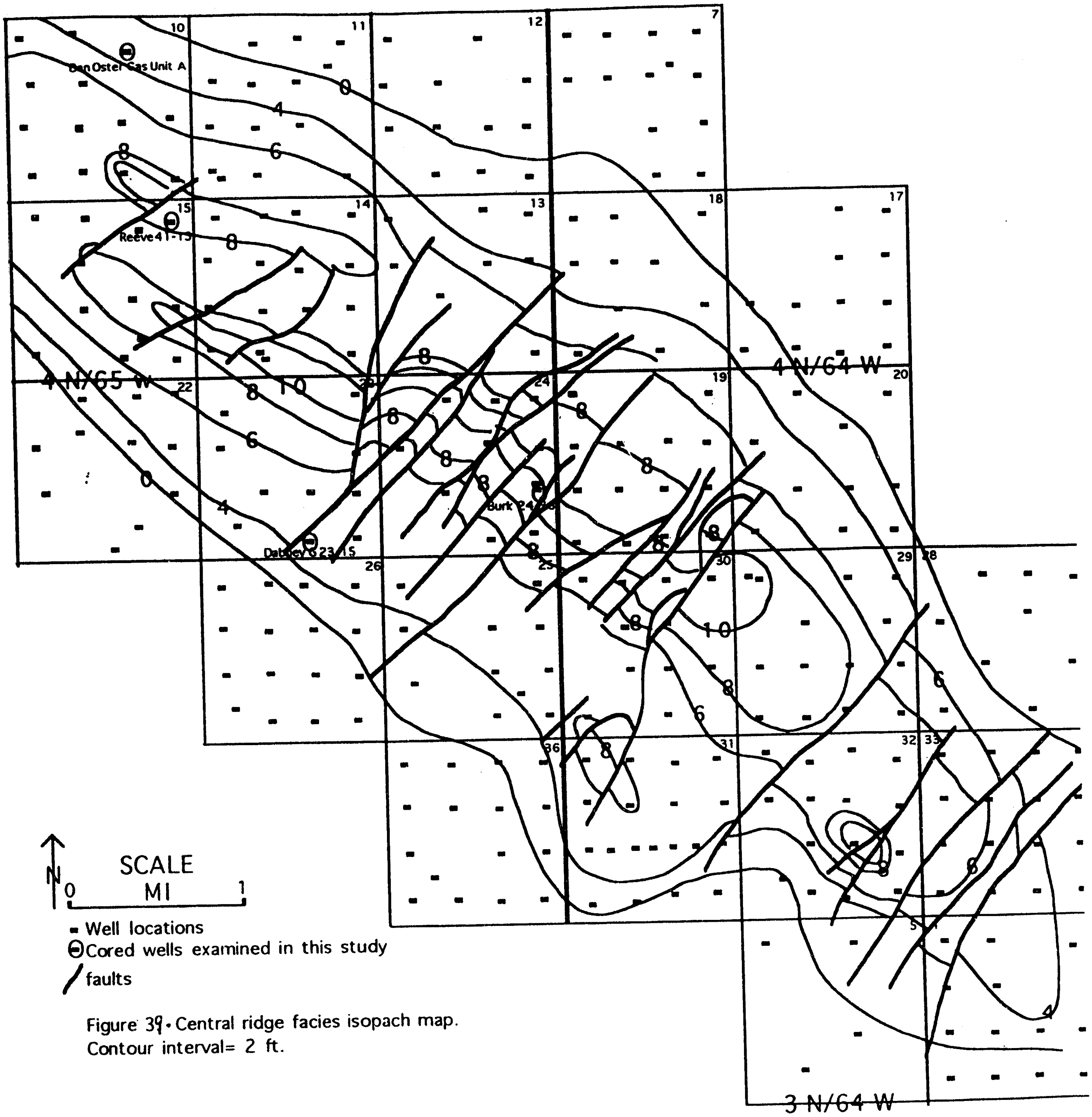
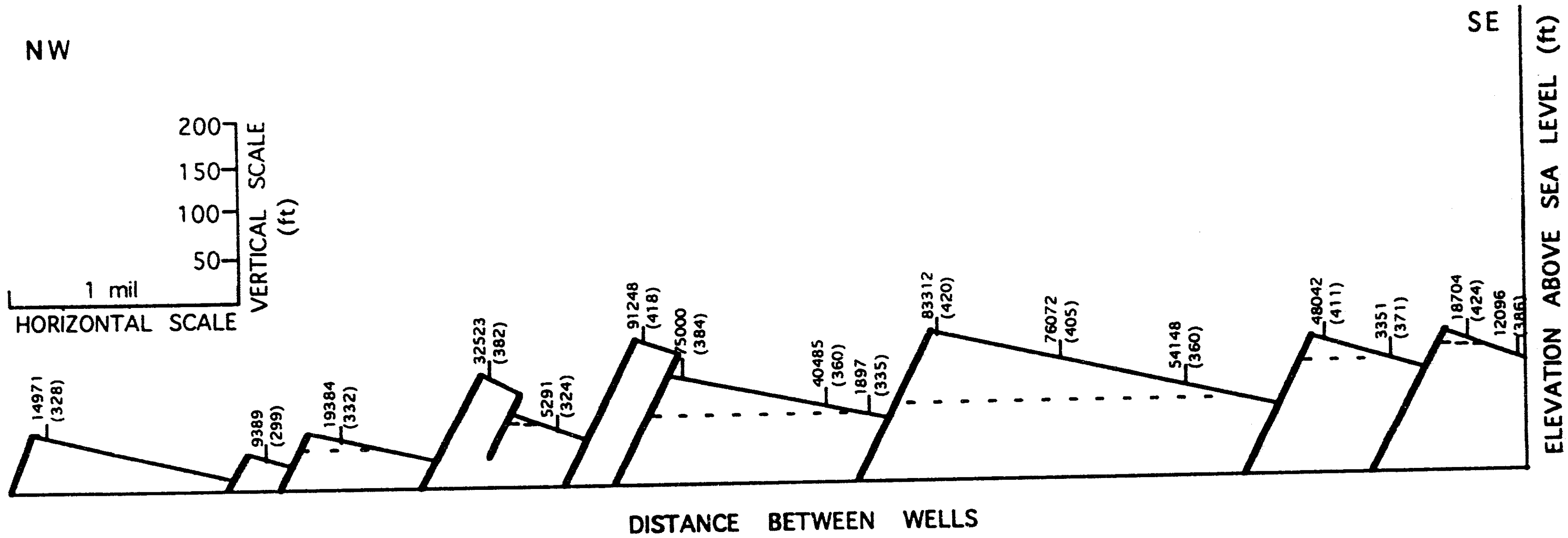


Figure 39 • Central ridge facies isopach map.
Contour interval= 2 ft.

Figure 3



32523: GOR values (cuf/bbl) based on first year of prouduction

(382): Top Terry Sandstone structural elevation above sea level (ft)

-----: Interpreted line for GOR = 15,000cuf/bbl

/ : Fault

Figure 1.

Figure 4

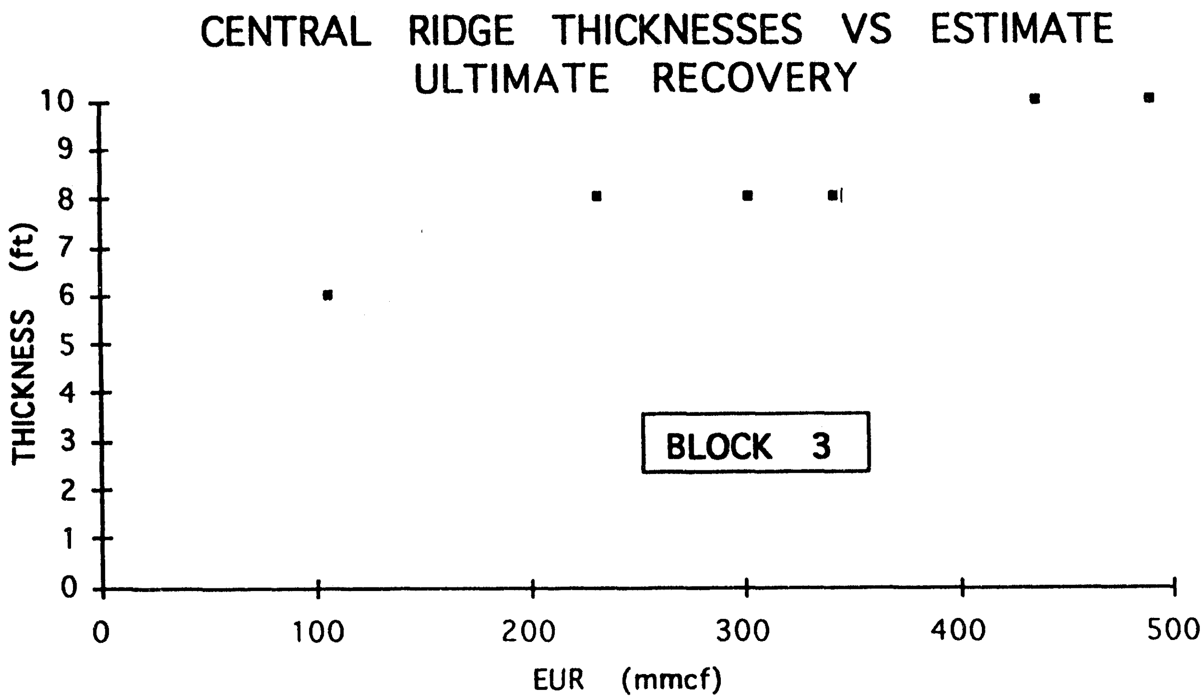


Figure 1. Ultimate Recovery increases with increasing central ridge facies thickness.

Fig-5

Snyder Oil Corp.
UPRC 9-4I
Sec. 9 T3N R65W

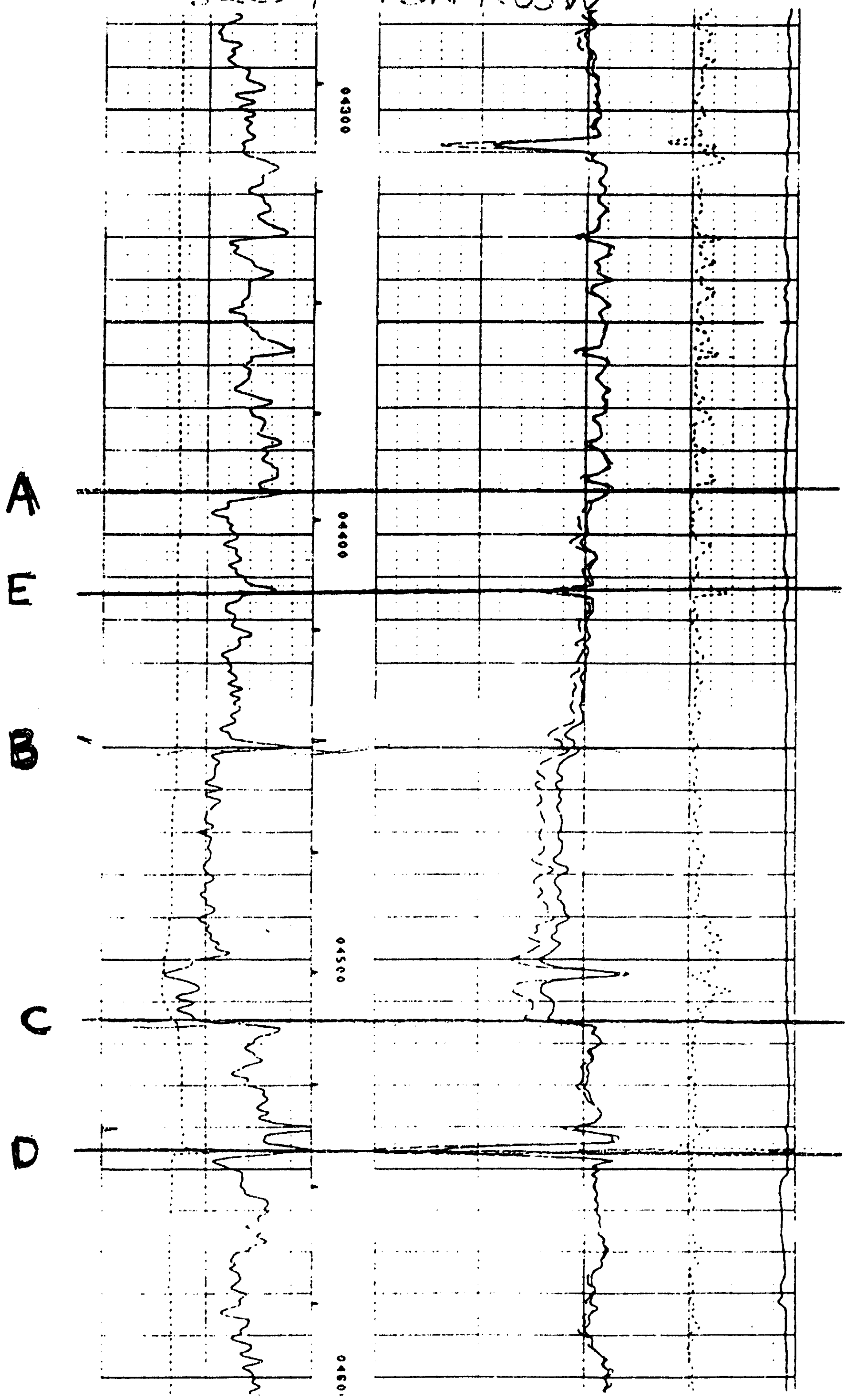
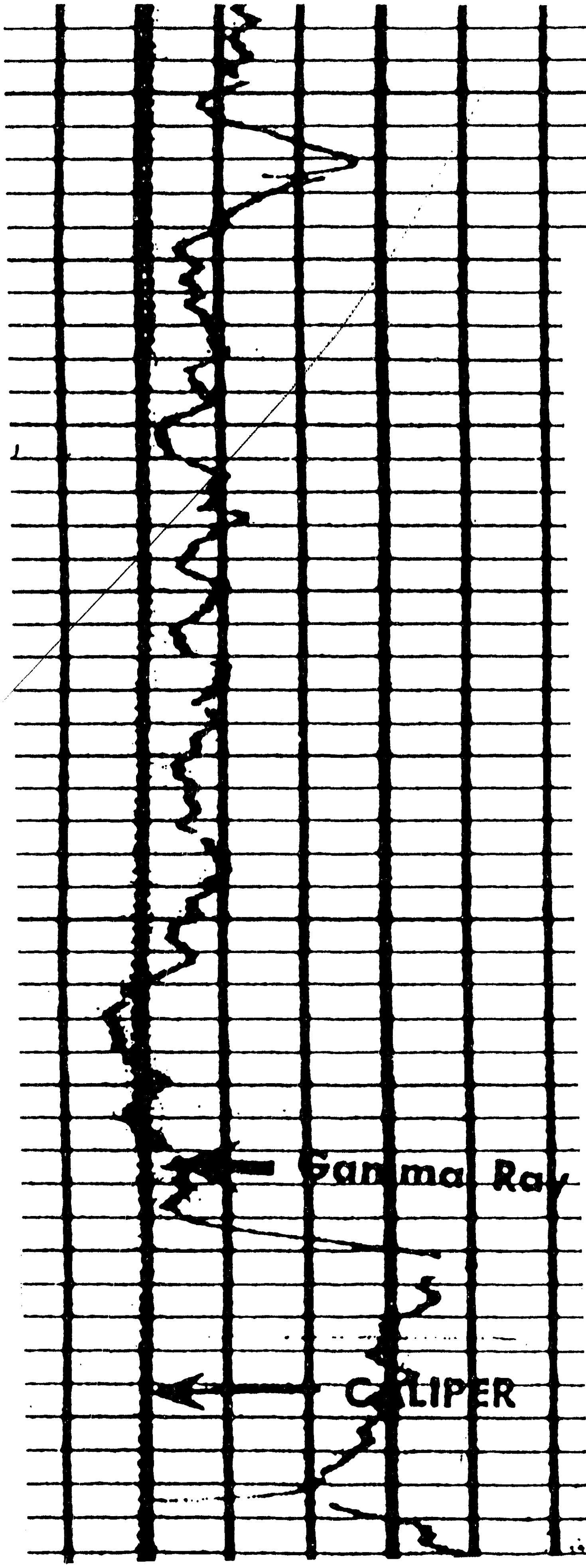


Figure 7



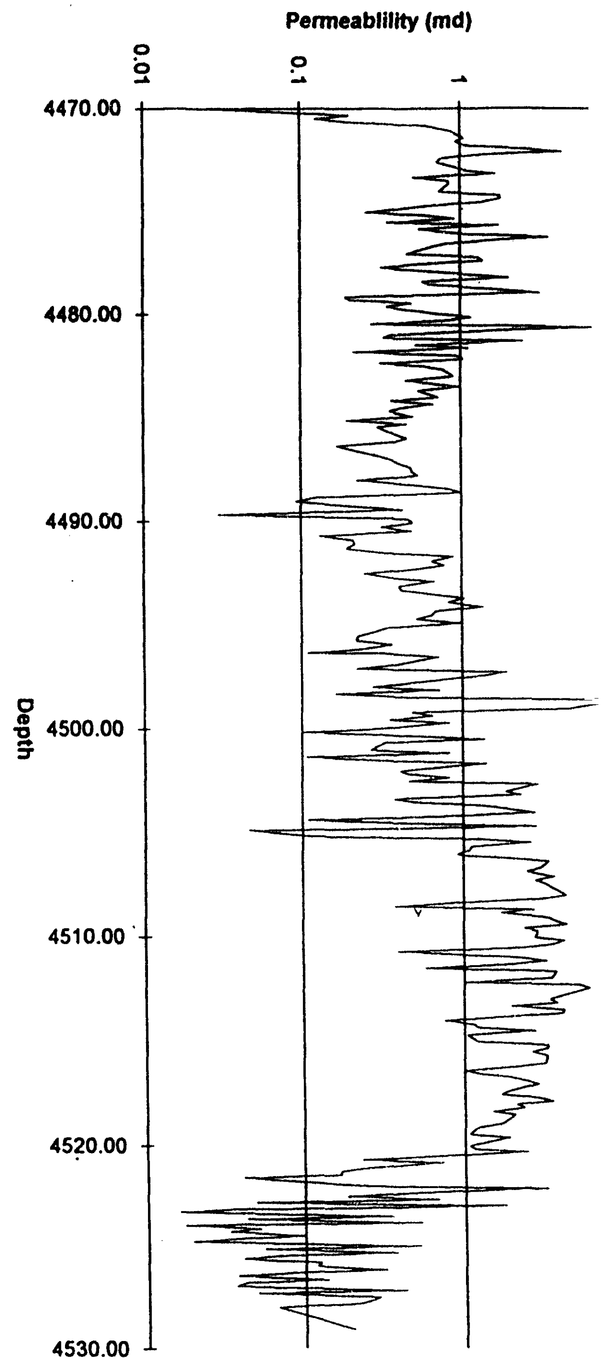
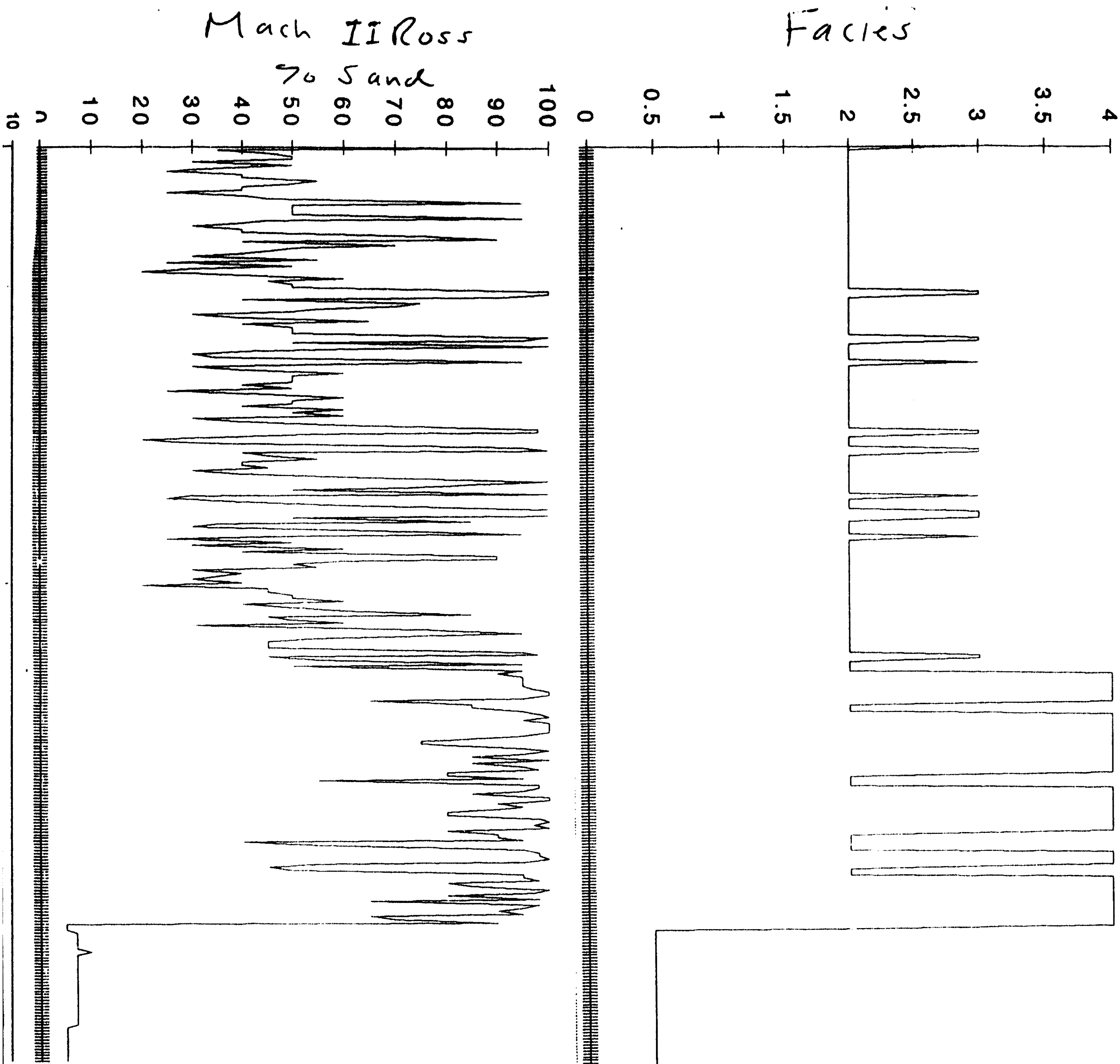


Fig. 6A Mach II


Mach II Ross
% Sand
0
10
20
30
40
50
60
70
80
90
100
Facies
0
0.5
1
1.5
2
2.5
3
3.5
4

Ross

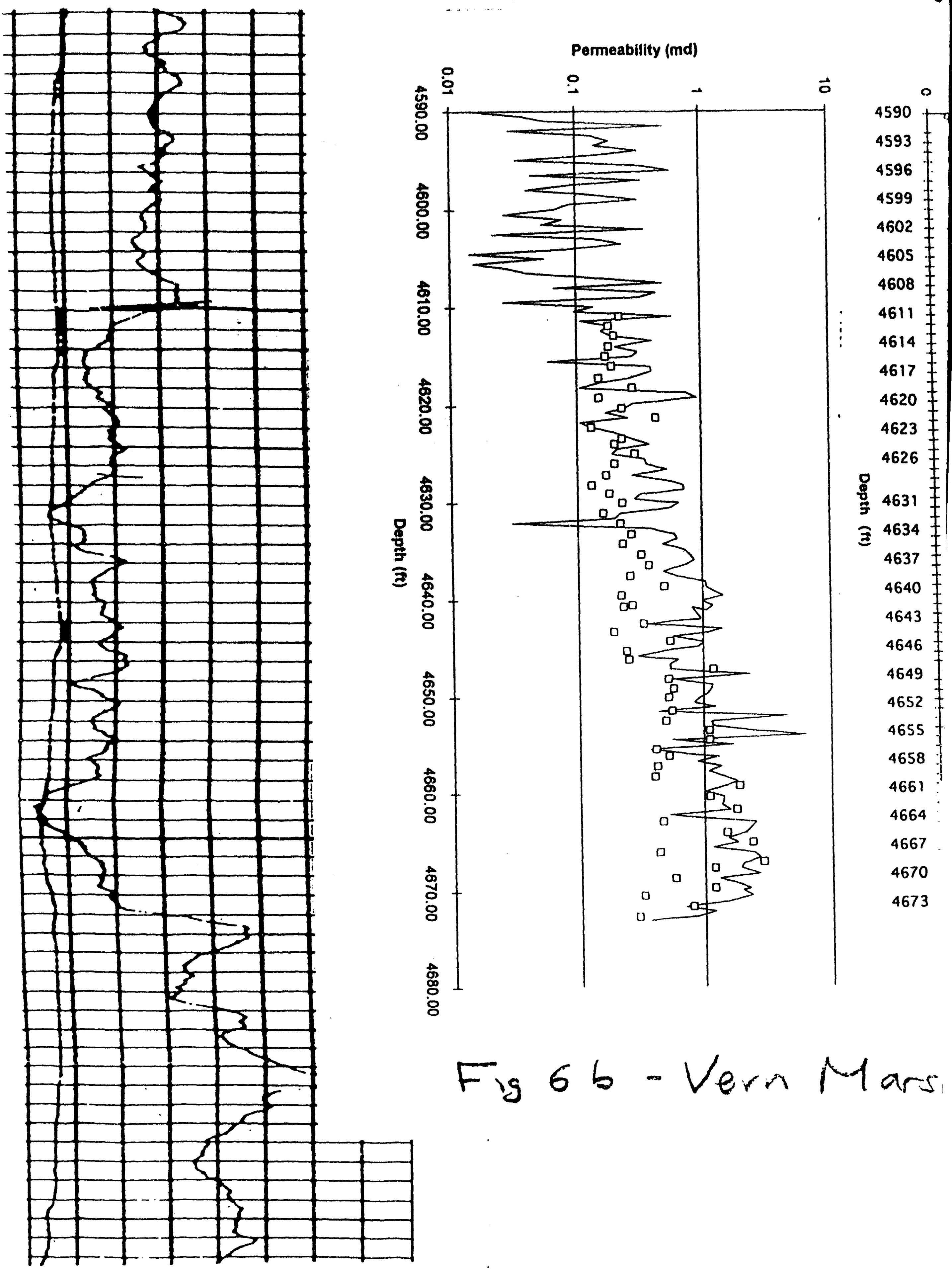
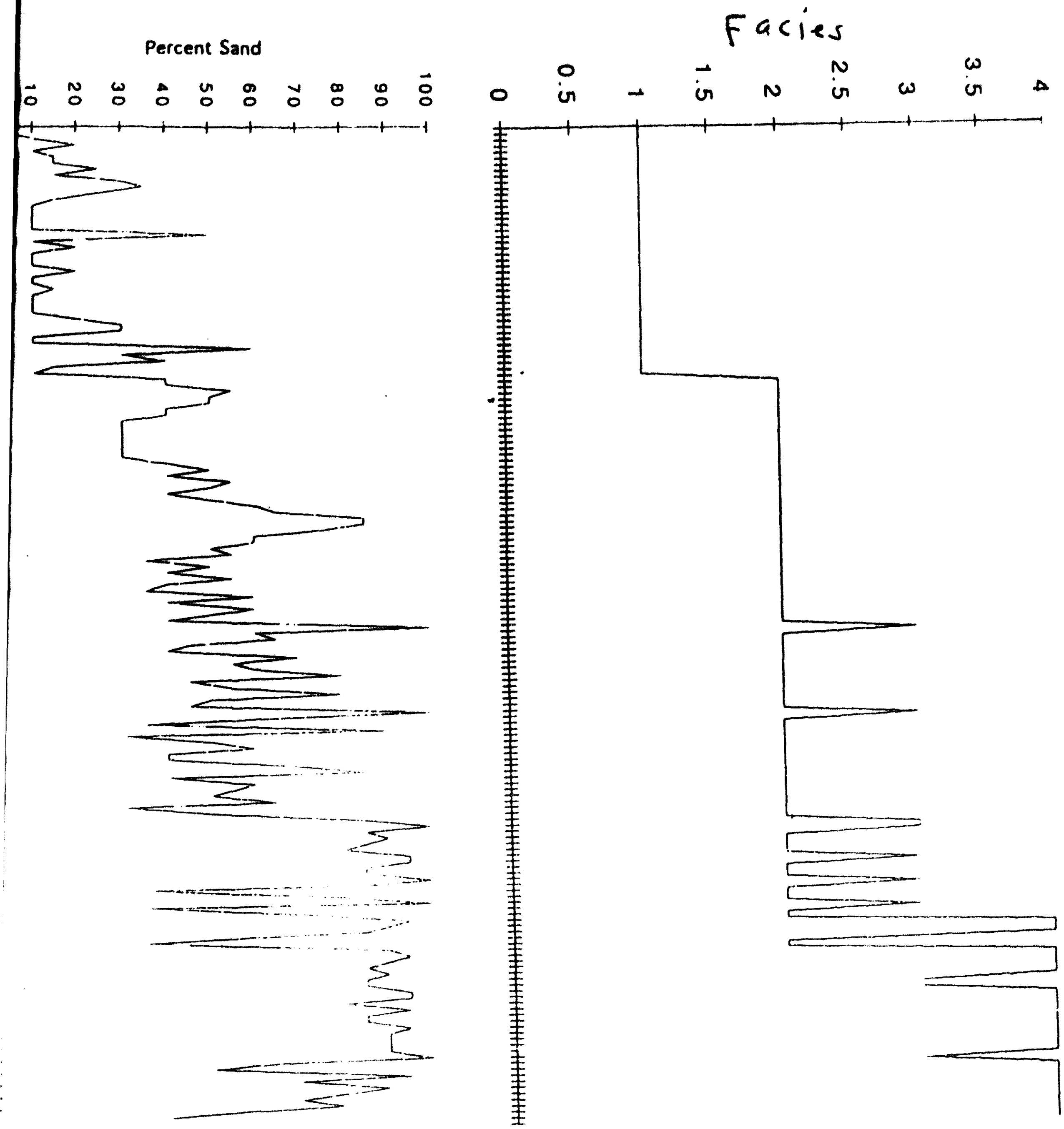


Fig 6b - Vern Mars

ern Marshall



hall

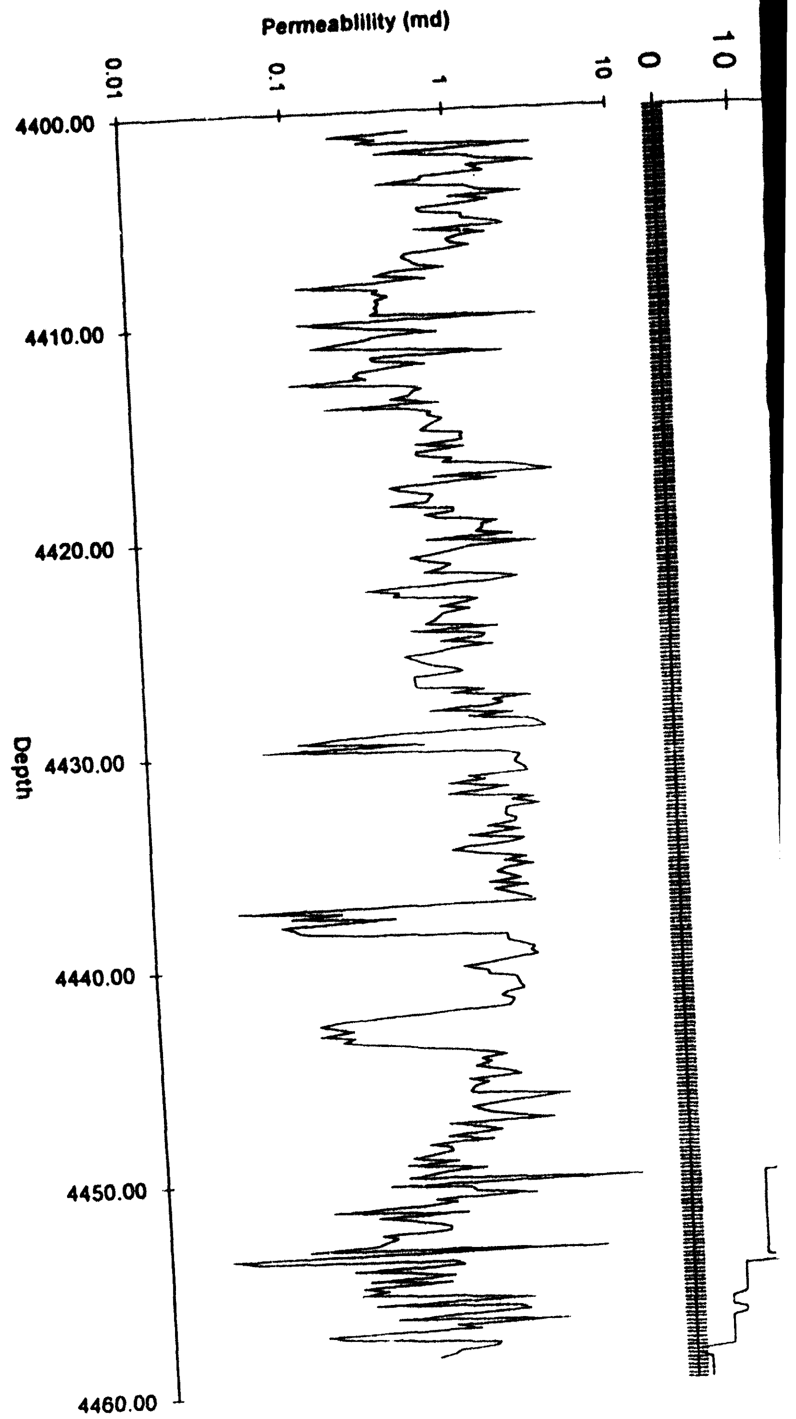
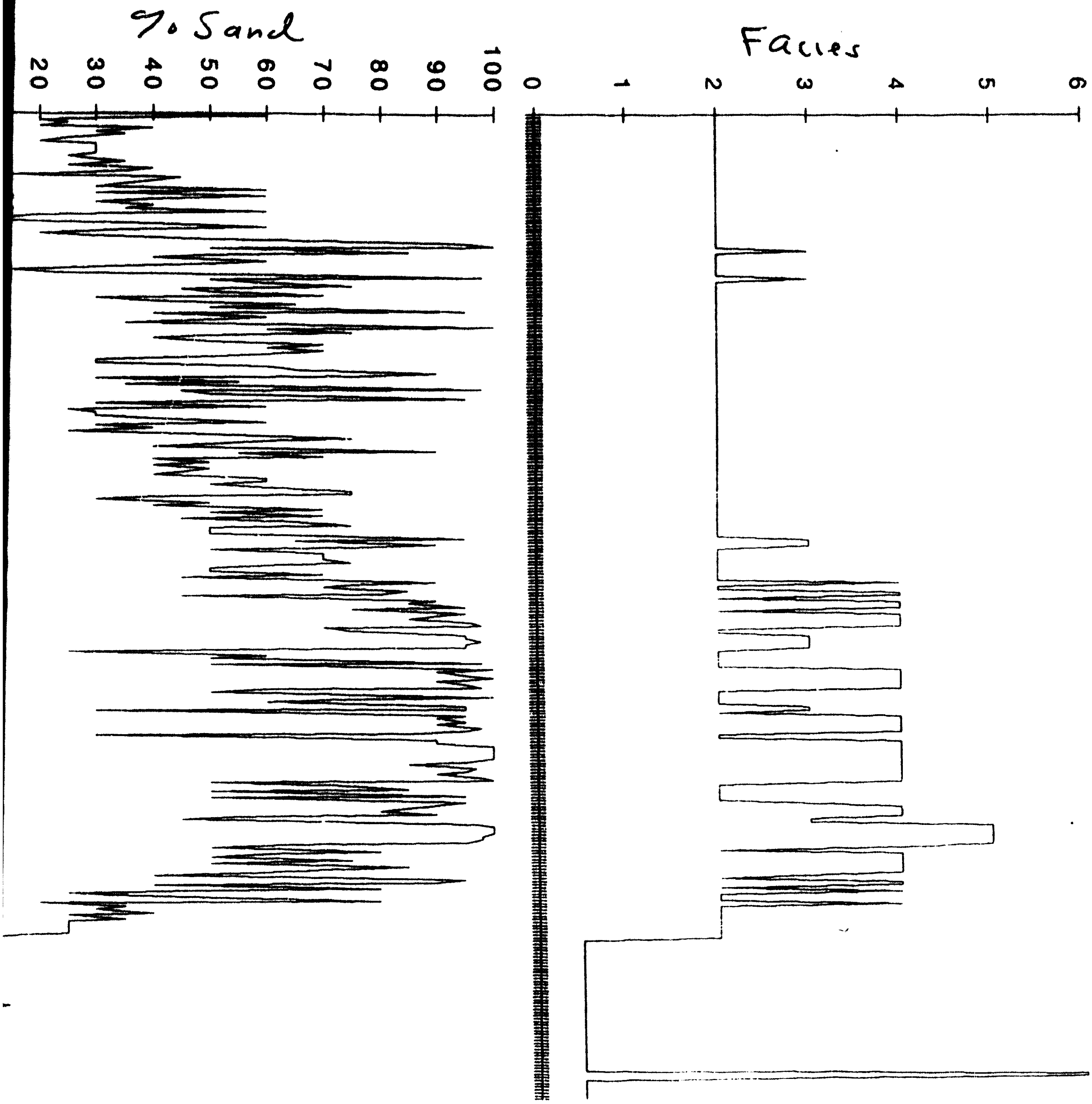


Fig 6c Eckerdt

Eckerdt #1



#1

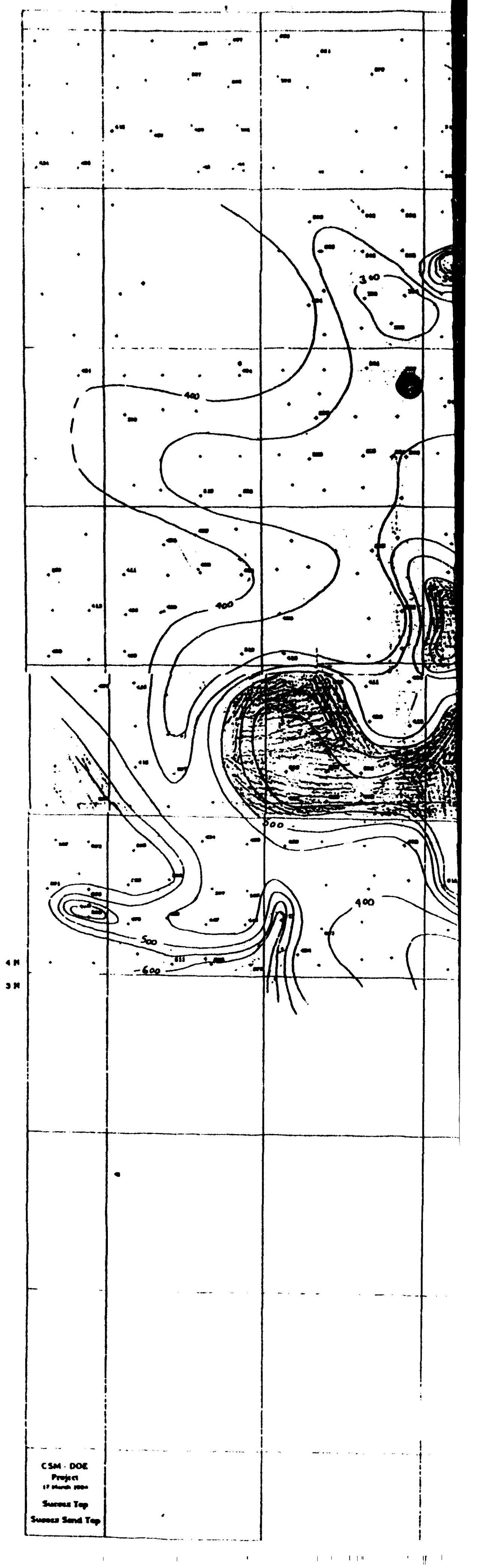
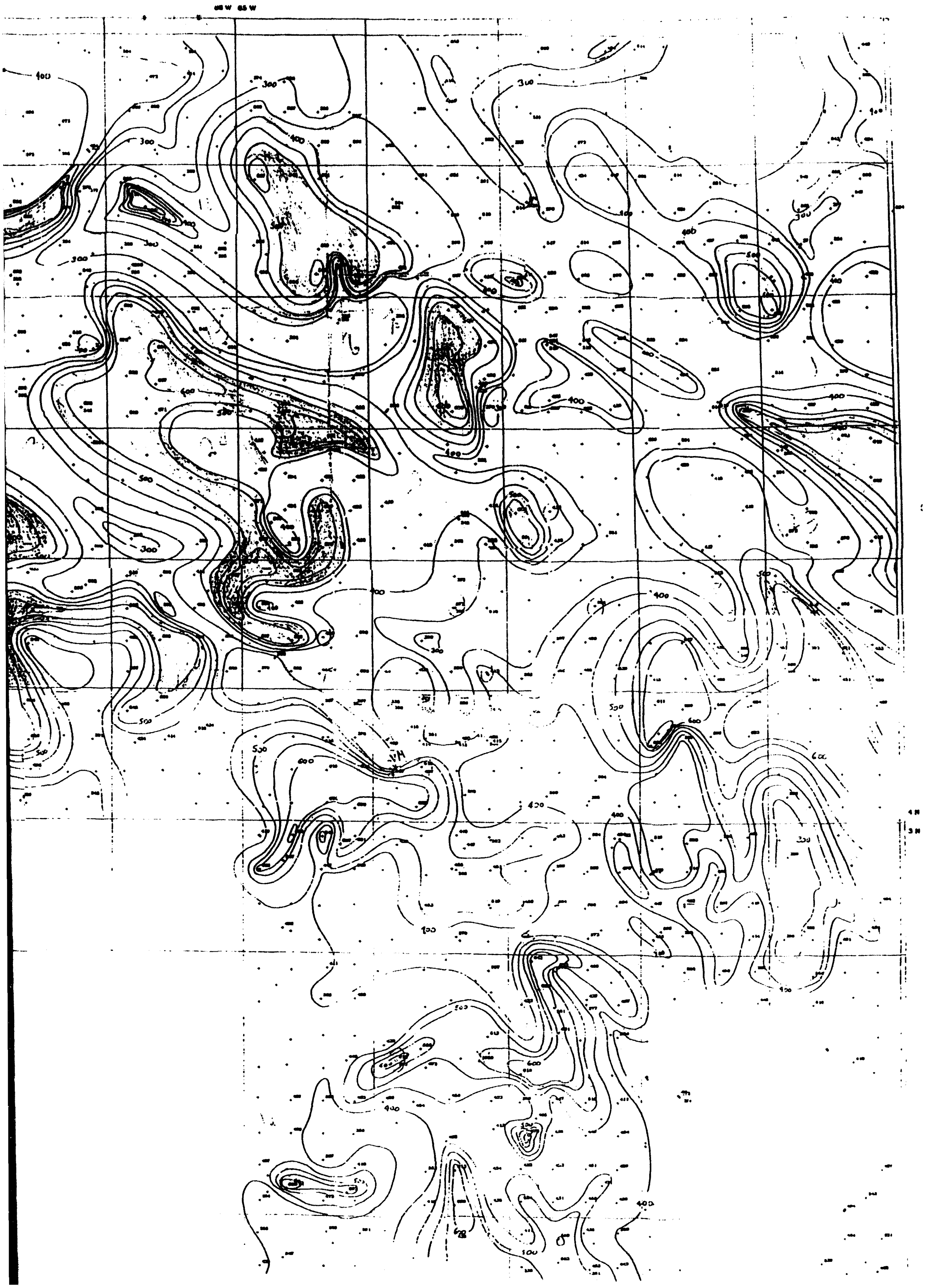


Fig. 8


300
400
500
600
4 N
3 N

APPENDIX C

1. Experimental Procedure for Permeability Measurements

Colorado School of Mines
Interdisciplinary Study of Reservoir Compartments
DOE DE-AC22-93BC14891
1st Quarter 1994 Technical Report

Hambert Field
Task 1.2.1: Permeability Experimental Work
Research Associate: Professor Graves
Research Assistant: Hugo Araujo

Experimental Procedure for Permeability Measurements

Experimental procedure was designed. It will consist of:

1. Pressure Decay Profile Permeameter Measurements

   Obtain permeability-depth profile on the available cores from wells; Vern Marshall #1, Machi 1 Rossi, and Eckardt #1.

2. Based on the geological core description and the permeability profile obtained, cut 20 core plug (16 horizontal and 4 vertical) for special core measurements. Vern Marshall #1 initially looks the most suitable because of its location and the condition of the core. Core plugs will be 1 inch diameter by 3 inch length.

3. CMS-300 Porosity, Permeability, and Compressibility Measurements

   With the CMS-300 equipment, measure porosity, permeability and compressibility at lab conditions and at different net confining pressure conditions. The confining pressure values selected are: 500, 1000, 2000, 3000, 4000, and 4500 psig.

4. Relative Permeability Measurements

4.1 Fabricate relative permeability flow apparatus capable of taking measurements at lab conditions and at reservoir confining pressure and temperature conditions.

4.2 Based on results of experiments conducted in 1 and 3 above, select the most suitable core plugs (3 or 4) and perform oil/water relative permeability measurements at:

4.2.a Lab Conditions
4.2.b Maximum net confining pressure and lab temperature
4.2.c Maximum net confining pressure and reservoir temperature.

Intermediate experimental conditions needs will be based on the above results.

5. Capillary Pressure Measurements

Select some of the previously tested core plugs to perform mercury injection capillary pressure measurements.

DATE

FILMED

7/22/94

END