Award Number G10AP00131

Final Technical Report

National Geological and Geophysical Data Preservation Program
(NGGDPP)

Population of the National Geological and Geophysical Data Catalog with New Mexico Data (Year 3)

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Abstract

From September 1, 2010 through August 31, 2011 the New Mexico Bureau of Geology and Mineral Resources, a Division of the New Mexico Institute of Mining and Technology and the state geological survey of New Mexico, uploaded data/metadata from 5 of our high-priority collections into the National Geological and Geophysical Data Catalog (Table 1). During this period we also developed a *Digital Data Infrastructure* of scanned images of data reports for collection P751 (core analyses), and posted these images online under a searchable database on the website of the New Mexico Bureau of Geology and Mineral Resources. Links to this searchable database were uploaded into the National Geological and Geophysical Data Catalog for each of the records in collection P751.

Table 1. The 5 high-priority geological collections for which metadata were generated and uploaded during 2010-2011.

1. P747 – Petroleum (oil & gas) well logs
2. P753 – Sample description logs
3. P751 – Core analyses
4. P750 – Neil Wills scout tickets
5. P756 – Drillers logs

These 5 collections contain more than 80,000 data elements. Data/metadata have been uploaded into the National Catalog for more than 64% (52,924) of the data elements in these 5 collections. For the first 3 collections, 100% of the data elements in each collection now have entries in the National Catalog.

Work during the project year included completing internal digital (Access format) catalogs for the first 3 collections in Table 1 and adding data/metadata required for the National Catalog which included calculating latitude and longitude coordinates for data elements in these collections. Work on these 3 collections started during the previous (FY2008-2010) NGGDPP project years. For collections 4 through 5 in the above list, we developed internal data catalogs from scratch during FY2010-2011 because internal catalogs did not exist prior to the start of this year's NGGDPP project. After these data/metadata were added to our internal catalogs, the data/metadata entries for each catalog were converted into the NGGDPP flat-file format required by the National Catalog. Once in the flat-file format, the data/metadata were uploaded into the National Catalog. Both before and after uploading, data were checked for errors and omissions as they reside on the NGGDPP website.

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Introduction

The project "Population of the National Geological and Geophysical Data Catalog with New Mexico Data – Year 3" began on September 1, 2010 and ended on August 31, 2011. The work on this project was undertaken under the auspices of the U.S. Department of the Interior, U.S. Geological Survey Assistance Award Number G10AP00131 to the New Mexico Bureau of Geology and Mineral Resources, a Division of the New Mexico Institute of Mining and Technology. The New Mexico Bureau of Geology and Mineral Resources is the state geological survey of New Mexico. Total obligated funds under this award were $61,867.95, of which $30,817.00 is the federal share and $31,050.95 is the non-federal matching share provided by the New Mexico Bureau of Geology and Mineral Resources.

There were two main goals of the work undertaken for this year's NGGDPP Assistance Award project. The first goal of the work performed under this contract was to upload into the National Geological and Geophysical Data Catalog data/metadata for 5 geological and geophysical collections at the New Mexico Bureau of Geology and Mineral Resources. The second goal was to develop a *Digital Data Infrastructure* by placing online in a searchable format images for collection P751 (core analyses) with an online search engine that allows users to access the records; entries in the National Catalog for this collection are now linked to this search engine. The 46 major collections at the New Mexico Bureau of Geology and Mineral Resources were specified in the 2007 NGGDPP Inventory of Geological and Geophysical Data Collections. The construction of the data/metadata catalogs for all of our collections and the upload into the National Catalog is a multiyear project given that we have more than 2 million data elements in all of our geological collections.

For 2010-2011, our third NGGDPP project year for catalog development and data uploading, we chose 2 new high-priority collections (P750 – Neil Wills Scout Tickets; P756 – Drillers' Logs) with more than 33,000 data elements for inclusion into the National Data Catalog. For these 2 collections, no internal data catalogs in either digital or hardcopy format had previously been developed so a significant amount of our effort for the project year was concentrated on developing internal data/metadata catalogs in

Microsoft Access format that could be converted into NGGDPP flat-file format for upload into the National Catalog. Four thousand and three (4003) data elements in these new internal data catalogs were populated with the metadata required by the National Catalog. In addition, we added additional data elements and associated metadata for 3 of the collections that we had uploaded into the National Catalog during the previous (2008-2010) project years (P717 – Petroleum well logs; P753 – Sample description logs; P751 – Core analyses). These represent new data added into our collections during the project year and metadata had to be developed for these new data elements. We generated necessary metadata for these new data elements during the current (2010-2011) project year and completed the internal catalogs for these high priority collections, adding data/metadata required by the National Catalog (for example, latitude and longitude coordinates), converting our internal digital catalogs into the NGGDPP flat file format, uploading the collection data/metadata into the National Catalog, and checking our uploaded data for errors and omissions. During the course of this year's work, 34 previous entries in the National Catalog for collection P747 (Petroleum well logs) were found to be duplicates of other entries and were deleted from the National Catalog.

The Appendix to this report contains examples of data elements for which metadata were entered into the National catalog during the 201-=2011 project year and an example of a core analysis from collection P751 for which digital infrastructure was created.

Methodology

Methodology for creation, preparation and uploading of metadata into the National Catalog

Catalogs of geological and geophysical data collections at the New Mexico Bureau of Geology and Mineral Resources were uploaded into the National Catalog using the NGGDPP flat file template made available on the NGGDPP website at http://datapreservation.usgs.gov/catalog.shtml . Preparation of the flat files and uploading into the National Catalog utilized the following procedure, which was modified and streamlines from previous years during 2009-2010.:

1. Our internal databases are in Access format. A query was made in our Access databases to supply the information required by the NGGDPP flat file template. Metadata fields that are considered optional in the NGGDPP flat file template/National Catalog were also supplied in the query where the optional metadata were available;
2. Checked for and deleted any duplicate Titles;
3. Results of the Access query were exported as an Excel file;
4. Go to Windows Settings
    a. Go to Control Panel and click on Regional and Language Options
    b. Click on "Customize…." Box under Regional Options
    c. Under List Separator, change "," to "|"
    d. Click Apply twice;
5. Open the Excel file;
6. Click Save as a .csv (comma delimited) file;

7. Save. The files are now csv files using "|" delimiters;
8. Upload to http://my.usgs.gov/csc/nggdpp/upload.
9. The newly uploaded file was re-examined on the NGGDPP website for errors and problems which were then rectified, if present.

The NGGDPP requirements for collections include the following required and optional data fields:

1. ***Collection ID***: This is the collection ID number as assigned by the USGS to each of our collections after they were entered into the 2007 NGGDPP Inventory of Geological and Geophysical Data Collections.
2. ***Title***: This is our title for each data element in each of our data collections. For this data period, the titles in our collections were changed to reflect changes in our internal databases. For this contract period, the title was changed for (for example) ***Logs_1*** to ***API_TRS*** *(API number of well followed by Township-Range-Section location of the well, e.g. 30-015-12345_17S28E01).* If the API number is not available or if there is no API number for the data element, then the title consists of the Township-Range-Section location (*e.g. 17S28E01).* If further differentiation is necessary as for multiple entries in the same section, then an additional modifier is added to township-range-section designator *(e.g. 17S28E01_1modifier)*. The modifier can include the name of the operator of the well.
3. ***Alternate title***: This is ***WellID_*0000**, the new well or log ID number found in the newly developed subsurface geology database at the New Mexico Bureau of Geology and Mineral Resources.
4. ***Abstract***: This readable text contains the operator or company name for drill holes, the well name and number, the type of well (e.g. petroleum, mineral water, etc.), oil-gas pool name or mining district, number of related items, and the source of the latitude/longitude coordinates. See Table 2 below for a description of sources and calculation methods for latitude/longitude coordinates.
5. ***Data type***: This is the USGS data type as specified for the NGGDPP.
6. ***Supplemental information***: Primary and secondary contact information for the data element and accompanying collection were entered in this field.
7. ***Coordinates***: This is the geographic location of the sampled site in decimal degrees latitude and longitude. For almost all of the samples in our collections, latitude and longitude coordinates are derived (calculated) from the alternate geometry (described below) and are not coordinates measured in the field with a GPS, although GPS-rendered coordinates are increasingly more available for new and recently acquired samples. The method of calculation or other source of latitude/longitude is described in the Abstract. In most cases, latitude and longitude were calculated from the Federal Public Land Survey System (PLSS) section-township-range coordinates using the Geographix Exploration System and digital land grid. However, relatively large areas of New Mexico have not been surveyed with the PLSS, for example the Spanish Land Grants and many of the Native American Reservations; digital land grids are not available for these unsurveyed areas. Other methodologies were developed or used to calculate latitude/longitude

for these unsurveyed areas and are summarized in Table 2. A portion of our work during the 2010-2011 project year included calculation of latitude and longitude coordinates for data items uploaded into the National Catalog.

8. ***Alternate geometry***: This is the PLSS township-range-section and location within the section given as either surveyed footage from the section lines or in the quarter/quarter/quarter section system. For Spanish Land Grants or Native American Reservations with no PLSS Survey, petroleum and mineral exploration drill holes are formally (officially) located within the non-PLSS area by either a recognized non-governmental survey (for example the Martin and Border Survey for certain areas in northern New Mexico) or by projecting the PLSS survey grid into the unsurveyed area from adjacent surveyed areas. Many large-scale (1:250,000) U.S. Geological Survey and U.S. Bureau of Land Management digital and paper maps indicate projected township and range boundaries (but not section boundaries) in unsurveyed areas and these can be used as authoritative if not official projections.
9. ***Online resources***: As a result of this year's efforts, URL pointers are now available for collection P751 (Core analyses) which will lead the viewer to our online searchable database of scanned images of core analyses. These were made available during this project year through the portion of this project dedicated to development of *Digital Data Infrastructure*. For collections where there are no online graphics to browse, entries are blank. URL pointers are also available for our Petroleum Source Rock Data (collection P1270) entered in previous years. For this collection, the URL pointers will allow for online access and download of data from numerous open-file reports hosted on servers of the New Mexico Bureau of Geology and Mineral Resources.
10. ***Browse graphics***: no entries (see online resources above).
11. ***Dataset reference date***: Metadata is in the format "20100609". This is the data (year – month – day) that the query was run to generate the data for upload. This data field will be used to limit any new entries from our internal catalogs into the National Catalog in the future, thereby eliminating duplicate entries for the same data element.
12. ***Date***: Format is "19541231". This date refers to the test date, completion date of a drill hole, or the date the well log was run.
13. ***Vertical extent***: (ft, max, min). The gross interval for samples within a drill hole or on a measured outcrop section. Well logs are assumed to be from total depth to surface.

Table 2. Methodologies used to calculate or drive latitude and longitude for New Mexico collection elements.

Calculation method for latitude and longitude (abbreviation used in our entries in the	**Brief description of calculation methods or source of latitude/longitude values**

National Catalog)	
GES	The Geographix Exploration System Landgrid and Wellbase modules used to calculate lat/long values based on a digital Landgrid referenced to the 1927 North American datum.
GESest	Same as GES above, but if sample/well locations were not exact the lat/long values were extended to only 3 decimal places.
GESqtr	Same as GES above but the latitude/longitude values mark the center of the quarter section the well sample is in. This method was used if sample/well locations are only specified to a quarter section and if surveyed footages from section boundaries are not available, or if multiple surveyed footages exist in our records that all indicate location within a quarter section but otherwise differed.
GESCntr	Same as GESQtr, but the lat/long location is in the center of a section. This method was used if sample/well location does not specify a location more exact than a section in a specified township and a specified range.
PRRC	The latitude/longitude coordinates for oil and gas wells as made available on the website of the New Mexico Petroleum Recovery Research Center (PRRC) at New Mexico Institute of Mining and Technology. In general, these values agree with ones calculated by our GES system (described above) to four decimal places.
PRRCestQtr	Same as PRRC above, but latitude/longitude accuracy is only to quarter of a section. This method was used if some aspect of the well location (e.g. surveyed footage from section boundaries) by PRRC differed from that in our records, but placed the well in the same quarter section as our records.
PRRCest	As above, but only locations of center of section were used if PRRC data and our data placed the well in different quarter sections.
BLMest	The U.S. Bureau of Land Management's online website (http://www.geocommunicator.gov/GeoComm/index.shtm) was used to estimate the latitude and longitude of a sample or drill hole. The accuracy of this method is the center of a quarter-quarter section.
BLMQter	Same as BLMest except that the latitude/longitude coordinates were estimated only to the center of a quarter section. This method was used most often in unsurveyed areas of the state using the BLM-projected township-range boundaries.
BLMsec	Same as BLMest except that the latitude/longitude coordinates were estimated only to the center of a section. This method was used most often in unsurveyed areas of the state using the BLM-projected township-range boundaries and where data did not warrant using the more exact BLMQtr method.
OCD	Latitude/longitude coordinate data were obtained from the website of the New Mexico Oil Conservation Division at http://www.emnrd.state.nm.us/OCD/OCDPermitting/Data/Wells.aspx
Scoutcard	Latitude/longitude coordinate data was obtained from an oil and gas well scout card. Data source is unknown but is most likely a GPS-

	based survey obtained when the well location was staked.
Hoffman	Latitude/longitude coordinates calculated by New Mexico Bureau of Geology Senior Coal Geologist Gretchen Hoffman for her project work.
Hoffmanest	Latitude/longitude coordinates calculated by New Mexico Bureau of Geology Senior Coal Geologist Gretchen Hoffman for her project work in unsurveyed areas using well spots referenced to USGS topographic maps.
Broadhead	Latitude/longitude coordinates calculated by New Mexico Bureau of Geology Senior Petroleum Geologist Ron Broadhead in unsurveyed areas using well spots referenced to USGS topographic maps.
Calc	Latitude/longitude coordinates calculated for miscellaneous projects at New Mexico Bureau of Geology and Mineral Resources.
NMBGMR	Latitude/longitude coordinates obtained from data files at New Mexico Bureau of Geology and Mineral Resources. Calculation or measurement method unknown.
Other	Unknown latitude/longitude coordinates associated with data files at New Mexico Bureau of Geology and Mineral Resources.

Methodology for creation of digital data infrastructure

The digital infrastructure web page created and developed during this project year resides on the servers of the New Mexico Bureau of Geology and Mineral Resources and hosts images from collection P751 (Core analyses) at the following address: http://geoinfo.nmt.edu/libraries/subsurface/search/. The digital infrastructure web page was constructed using the Coldfusion language. The Coldfusion language was chosen due to its ability to rapidly develop web pages and the ease of which it integrates with our database setup. During the construction of the page security was a top priority. Very stringent input sanitization was setup. This means that a user can not enter invalid characters in an attempt to crash or gain unauthorized access to the database server. The database was originally created in Microsoft Access and was later converted to MySQL in order to accommodate growth of the database and preserve functionality along with growth. Conversion required migration all the Access tables, creation of primary keys the entries of which have a unique identifier, linking the tables back to Access, creation of the relationships between the tables, and then setting the appropriate level of access on the database itself. Digital images of core analyses data hosted on servers of the New Mexico Bureau of Geology and Mineral Resources were created by scanning the original paper records of the core analyses in our collection into Adobe pdf format with an HP Scanjet N6310 scanner that was purchased for this project with matching funds provided by the New Mexico Bureau of Geology and Mineral Resources. For each well (drill hole) with entries, there is a single page or usually multipage pdf document of the core analyses.

Progress and Measures of Success

The data collections that had data/metadata uploaded into the National Catalog during the 2010-2011 project year are listed in Table 3 along with the number of data elements uploaded during the project year, the total number of data elements that have been uploaded and the percentage of data elements in each collection with data/metadata that have been uploaded over the multi-year course of our NGGDPP activities. Detailed information regarding data/metadata fields are described below. We also developed and placed online a fully functional digital data infrastructure for the one collection (P751-core analyses) that was specified in the Assistance Award.

During 2010-2011 we completed uploading of metadata for 100% of the data elements in 3 of our collections (shaded blue in Table 3). Work during the year included:

1. entry of data/metadata into our internal catalogs (where not already done);
2. development of internal data catalogs with metadata for the last 2 collections in Table 3 (shaded yellow);
3. correlation of data records for the last 2 data collections in Table 3 with data records of other collections previously entered to ascertain correct metadata such as API numbers of wells, correct location within sections, etc.
4. calculation and derivation of latitude and longitude geographic coordinates for each data element that was uploaded (required for entry into the National Catalog) where not previously done;
5. verification of data entry and latitude/longitude calculations;
6. translation of our internal catalogs into the NGGDPP flat file format using the method described above;
7. upload of prepared flat files into the National Catalog;
8. verification of correct uploads into the National Catalog.

Given that we have generated and uploaded data/metadata for more than 95% of our highest priority collections, started creating metadata for 2 other data collections, and developed a completely functional digital data infrastructure (linked to the National Catalog) for one priority collection (P751 – core analyses) we believe that we have successfully concluded the 2010-2011 project year.

For some of the data elements in our collections, the drill holes are located in areas without a surveyed and digital land grid (non-PLSS areas – Spanish Land Grants or Native American Reservations) and latitude/longitude must be calculated manually from hand-spotted data locations on paper maps or by manually locating the wells on digital maps provided on the US BLM website. Both are extremely time-consuming processes and this has slowed progress in some instances

For collections P753 (sample log descriptions of cuttings) and P750 (Neil Wills scout tickets), metadata physically written or printed on a large percentage of the logs does either not contain adequate location data to generate latitude-longitude or to easily identify and link the logs to data elements in our other collections so that individual hardcopy records had to be compared to hardcopy records in other collections to get accurate location and other data, such as API numbers of oil and gas wells. For many older wells, API numbers have never been assigned and establishing the absence of an API number required investigating numerous databases, both at the New Mexico Bureau

of Geology and Mineral Resources and through online resources available at state regulatory agencies. This forensic analysis proved executable but time-consuming and slowed progress.

Table 3. Collections with data/metadata uploaded into National Catalog during 2010-2011 project year, number of entries (items) with uploaded data/metadata, and percent of items in collection with entries uploaded into National Catalog. Data/metadata uploading for collections shaded in blue was initiated in previous project years (2008-2010) and work during FY2010-2011 involved completion of internal metadata catalogs and uploading into the National Catalog. For collections shaded in yellow, work during FY2010-2011 involved development of internal data catalogs from scratch and uploading of metadata into the National Catalog.

Data Collection ID	Brief description of collection	Number of entries uploaded during project year 2010-2011	Total number of entries uploaded, including previous project years	Percent of collection items with entries uploaded into National Catalog
P747	Petroleum (oil & gas) well logs	634 drill holes	47790 (34 previous entries into National catalog were discovered to be duplicates and deleted)	100% (not including pending near-term donations not yet incorporated into our systems)
P751	Core analyses	15 drill holes	511 drill holes	100%
P753	Sample description logs of cuttings	994	3620 drill holes (14036 individual logs)	100%
P750	Neil Wills scout tickets	3573 drill holes	3573 drill holes	20%
P756	Drillers logs of oil & gas wells	430 drill holes	430 drill holes	3%

Personnel Employed on the New Mexico NGGDPP Project During 2010-2011

The following personnel were employed on the NGGDPP New Mexico project during the 2009-2010 project year:

1. Ron Broadhead, Principal Petroleum Geologist at New Mexico Bureau of Geology and Mineral Resources and Project PI.
2. Amy Trivitt-Kracke, Petroleum Computer Specialist at New Mexico Bureau of Geology and Mineral Resources
3. Annabelle Lopez, Petroleum Information Coordinator at New Mexico Bureau of Geology and Mineral Resources
4. Ed Munsell, Database programmer at the New Mexico Bureau of Geology and Mineral Resources
5. Adela Magallanes, part-time student employee and undergraduate biology major at New Mexico Institute of Mining and Technology

APPENDIX

Examples of data elements

Figure 1 (below). Example of drillers log (Collection P756) for which metadata was created and uploaded into the National Catalog during 2010-2011. API number and Well ID in lower left researched and added during project year.

Stencil Cut Log No. 24

NEW MEXICO SCHOOL OF MINES
STATE BUREAU OF MINES AND MINERAL RESOURCES
SOCORRO, NEW MEXICO

WELL LOG DIVISION

COUNTY Chaves
FIELD Wildcat
COMPANY McQuigg & McQuigg
LEASE C.J. Neis # 1 Well No.
LOCATION (¼) C NW NW
SEC. 7 T. 5S , R. 29E
feet from line and
feet from line of Section
COMMENCED 10-15-27
COMPLETED 7-25-28
ABANDONED
REMARKS: I.P. Abnd.

CASING RECORD

Diam., in.	Bottom	
12½"	769'	2"
10	1147'	2"
6-5/8"	3165'	

ELEVATION FEET
INITIAL DAILY PRODUCTION:
Open bbls. Oil
Open cu. ft. Gas
Tbg. bbls. Oil
Tbg. cu. ft. Gas

FORMATION	BOTTOM, FEET
Soil & brown sandstone	30
Brown sandstone	40
Hard brown & conglomerate	45
Brown sandstone	65
Red beds	80
Red beds - blue spots	95
Red beds	140
Hard shale	145
Red beds	280
Red beds- streaked with blue	285
Red beds	350
Blue clay & red beds	375
Red beds	480
Red beds & gypsum	490
Red beds	565
Gypsum	590
Red beds	630
Gypsum	635
Red beds	685
Water sand- saline 5 bbl/hr	687
Red beds "Vermillion"	710
Red rock	765
Red rock blue shale & gypsum - 12½" landed and Water shut off 769'2" - 40 joints 42 pieces	770
Red beds	785
Gypsum	790
Red rock	865
Brown sandstone - littler Saline - Water 910' 4 bbls. / hr. at 930'	930
Red rock	950
Gray sandstone - water increased 960' unable to bail down static head 400'	960
Brown sandstone	985
Red rock	990
Brown sandstone	1100
Gypsum & red rock	1130
Red rock - small GAS at 1170' - White anhydrite- landed 10" at 1147'1" - shut off water	1170
Salt	1175
White anhydrite	1195
Vermillion red rock	1200
Red rock & anhydrite	1210
Red rock & blue shale, more gas at 1220-1255	1225
Sandy brown shale	1235
Anhydrite & red rock	1245
Red rock	1250
Anhydrite	1265
Salt & red rock	1315
Anhydrite - showing slat crystals	1505
Red rock - showing salt crystals	1515
Anhydrite	1550
Salt & gypsum	1575
Streaks red rock & salt	1605
Salt	1615
Red rock	1620
Salt	1630
Brown sand	1635
Red rock	1640
Salt	1645
Anhydrite	1650
Salt	1665
Red rock	1670
Salt	1675
Anhydrite	1695
Salt	1710
Shells	1712
Brown sand	1715
Shells	1718
Red rock	1730
Salt	1735
Anhydrite	1740

30-005-04102
well ID 53139

Figure 1 (continued below).

Log No. 24
Page 2.

NEW MEXICO SCHOOL OF MINES
STATE BUREAU OF MINES AND MINERAL RESOURCES
SOCORRO, NEW MEXICO

WELL LOG DIVISION

COUNTY Chaves
FIELD
COMPANY McQuigg & McQuigg
LEASE C.J. Neis # 1 Well No.
LOCATION (¼)
SEC. T. , R.
feet from line and
feet from line of Section
COMMENCED
COMPLETED
ABANDONED
REMARKS:

CASING RECORD

Diam., in.	Bottom

ELEVATION FEET
INITIAL DAILY PRODUCTION:
Open bbls. Oil
Open cu. ft. Gas
Tbg. bbls. Oil
Tbg. cu. ft. Gas

FORMATION	BOTTOM, FEET
Anhydrite, salt & red rock	1760
Red rock	1775
Anhydrite	1790
Red rock	1810
Salt	1820
Salt & red rock streaks	1830
Brown sand	1840
Anhydrite	1850
Brown sandy shale	1875
Anhydrite	1880
Brown sandy shale	1910
Red rock	1935
Brown sandy shale	2025
Red rock	2045
Brown sandy shale	2090
Red rock	2100
Brown sand	2115
Red rock	2135
Brown sandy shale	2190
Red rock	2205
Gray lime	2209
Anhydrite	2255
Soft red rock	2270
Salt & red rock streaks	2300
Salt & anhydrite	2320
Hard anhydrite	2340
Gray lime	2350
Gray lime & anhydrite	2400
Anhydrite & salt	2410
Salt & blue shale	2425
Salt	2450
Anhydrite	2460
Anhydrite & salt	2475
Salt	2495
Anhydrite & salt	2510
Anhydrite, shale, salt & lime	2515
Hard gray lime	2530
Brown lime	2580
Lime & anhydrite	2585
Slate & anhydrite	2605
Light brown lime	2610
Lime & anhydrite	2625
White Lime	2630
Gray lime	2655
Gray lime & little dark slate	2660
Dark gray lime	2705
Anhydrite & lime	2710
Gray lime	2720
Fine hard gray lime	2730
Gray lime	2745
Light gray lime	2760
Anhydrite	2775
Anhydrite & slate	2795
Salt & slate	2805
Anhydrite, slate & lime	2815
Hard gray lime	2820
Gray lime	2825
Hard gray lime	2835
Light gray lime	2840
Dark gray lime	2875
Light gray lime	2890
Gray lime	2900
Fine gray lime	2910
Gray lime	2915
Lime & slate	2920
Hard gray lime, dark	2940
Gray lime	2945
Dark gray lime-black scum & Sulphur GAS 2950'	2950'
Light gray lime	2955
Anhydrite & gray lime	2975
Anhydrite	2985
Light gray anhydrite & small amount salt, gray lime and small amount sand	3005
Dark lime	3010
Gray lime	3015
Light gray lime	3025
Dark gray lime	3030
Dark gray lime, trace sand	3045
Dark gray lime 3005-45' OIL stain with chloroform.	3100
Gray lime	3130
Broken lime & slate	3135
Hard dark lime	3165

Figure 1 (continued below).

Log No. 24

Page 3

NEW MEXICO SCHOOL OF MINES
STATE BUREAU OF MINES AND MINERAL RESOURCES
SOCORRO, NEW MEXICO

WELL LOG DIVISION

COUNTY Chaves
FIELD
COMPANY McQuigg & McQuigg
LEASE C.J. Neis # 1 Well No.
LOCATION (¼)
SEC. T. , R.
feet from line and
feet from line of Section
COMMENCED
COMPLETED
ABANDONED
REMARKS:

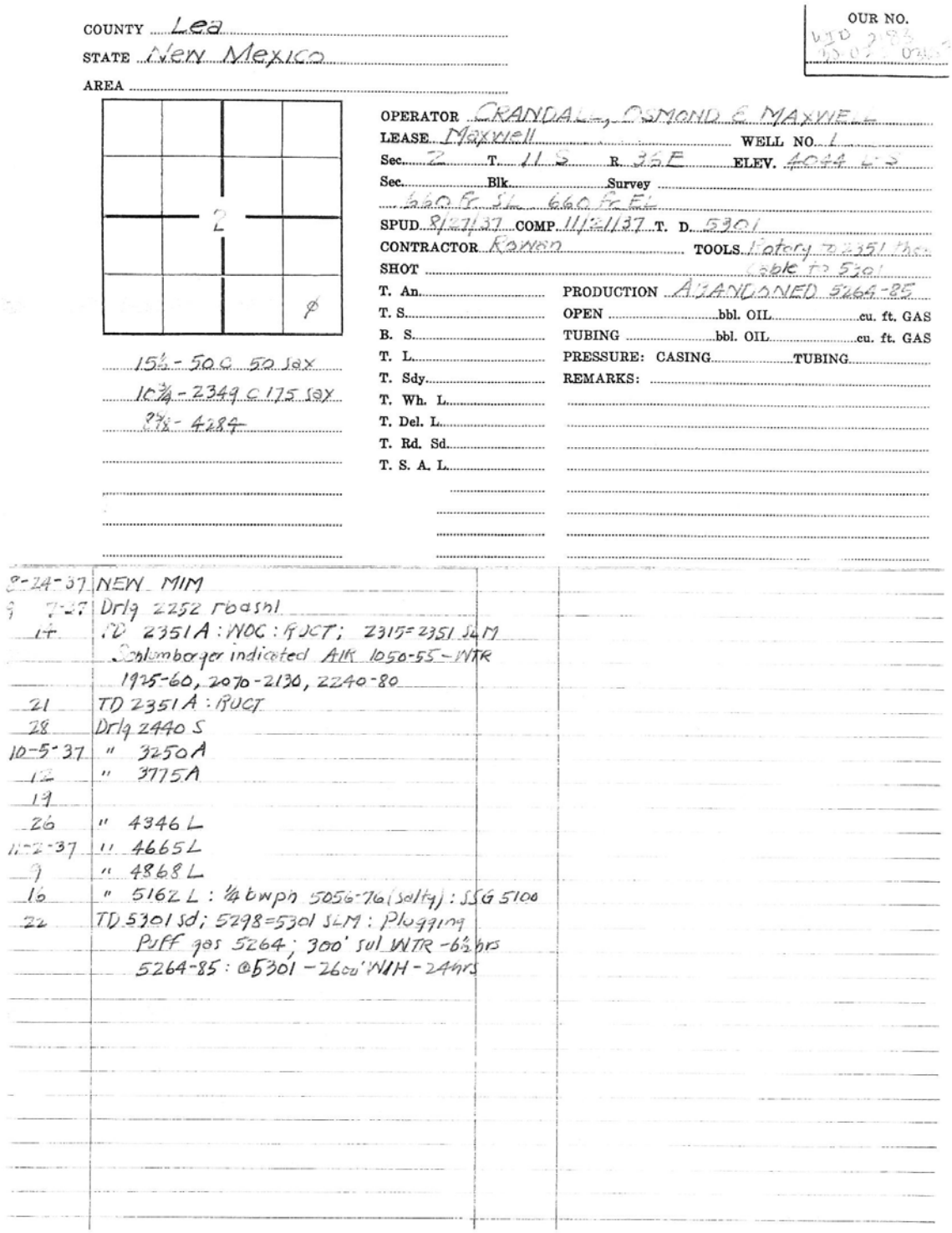
CASING RECORD

Diam., in.	Bottom

ELEVATION FEET
INITIAL DAILY PRODUCTION:
Open bbls. Oil
Open cu. ft. Gas
Tbg. bbls. Oil
Tbg. cu. ft. Gas

FORMATION	BOTTOM, FEET	FORMATION	BOTTOM, FEET
Brown lime	3210		
Gray lime	3275		
Black lime	3285		
Gray lime	3287		
Brown sandy lime	3295		
Light brown lime	3305		
Gray lime	3314		
Gray sandy lime	3319		
Fine gray lime	3325		
2500' water (Sulphur) 3320'			
Fine brownish gray lime	3340		
Light gray lime	3345		
Bluish lime & anhydrite	3350		
~~Gray lime~~, ~~some anhydrite~~	~~3360~~		
Gray lime & anhydrite	3365		
Light gray sandy lime	3368		
Dark gray sandy lime	3375		
Gray lime	3385		
Gray lime & anhydrite	3389		
Gray lime	3400		
White quartzsand - salt water at 3400'	3418		
Sand	3428		
Gray sand some lime	3440		
Gray lime	3454		
Yellow-brown sand	3465		
Brown sand & salt	3468		
Brown sand & lime	3485		
SULPHUR WATER 3105-15'			
Salt & sand	3495		
Brown sandstone	3505		
Red rock	3506		
Salt, red rock & sand	3510		
Salt, sandstone & red rock	3515		
T.D.	3515		

Figure 2 (below). Example of Neil Wills scout ticket (Collection P750) for which metadata was created and uploaded into the National Catalog during 2010-2011. API number and Well ID in upper right researched and added during project year.



COUNTY Lea
STATE New Mexico
AREA

OUR NO.
WID 2[illegible]
30-0[illegible]

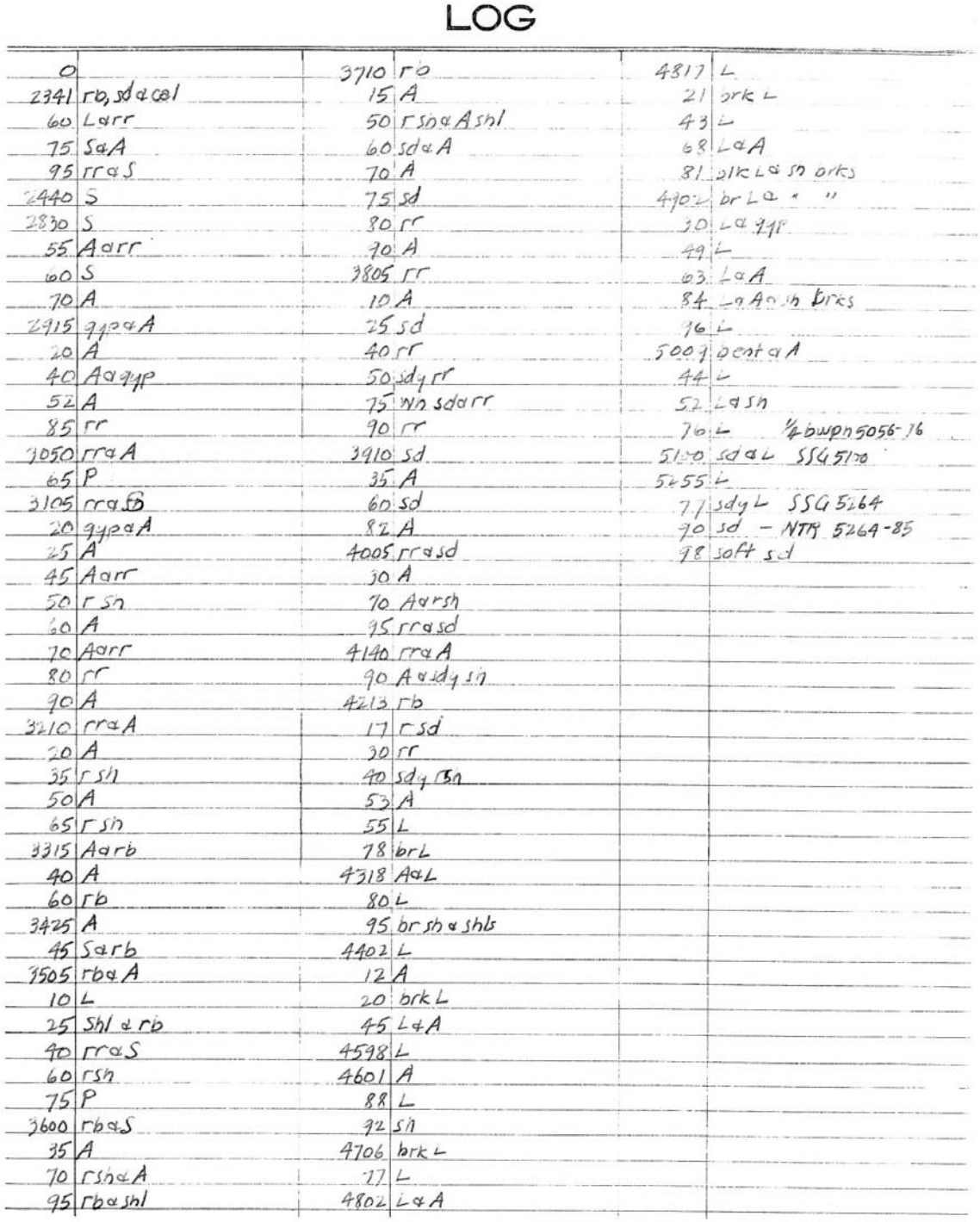
OPERATOR CRANDALL, OSMOND & MAXWELL
LEASE Maxwell WELL NO. 1
Sec. 2 T. 11 S R. 36 E ELEV. 4044 L.S
Sec. Blk. Survey
660 FS & 660 FE
SPUD 8-27-37 COMP. 11-1-37 T. D. 5301
CONTRACTOR Rowan TOOLS Rotary to 2351 then cable to 5301
SHOT
T. An.
T. S.
B. S.
T. L.
T. Sdy.
T. Wh. L.
T. Del. L.
T. Rd. Sd.
T. S. A. L.
PRODUCTION ABANDONED 5264-85
OPEN bbl. OIL cu. ft. GAS
TUBING bbl. OIL cu. ft. GAS
PRESSURE: CASING TUBING
REMARKS:

2

15½ - 500 50 sax
10¾ - 2349 c 175 sax
8⅝ - 4284

8-24-37 NEW MIM
9 7-27 Drlg 2252 rdashl
14 TD 2351A : WOC : RJCT; 2315-2351 SLM
Schlumberger indicated AIR 1050-55-WTR
1925-60, 2070-2130, 2240-80
21 TD 2351A : RJCT
28 Drlg 2440 S
10-5-37 " 3250A
12 " 3775A
19
26 " 4346L
11-2-37 " 4665L
9 " 4868L
16 " 5162L : ¼ bwph 5056-76 (salty) : SSG 5100
22 TD 5301 sd; 5298=5301 SLM : Plugging
Puff gas 5264; 300' sul WTR - 6½ hrs
5264-85 : @5301 - 2600' WTR - 24 hrs

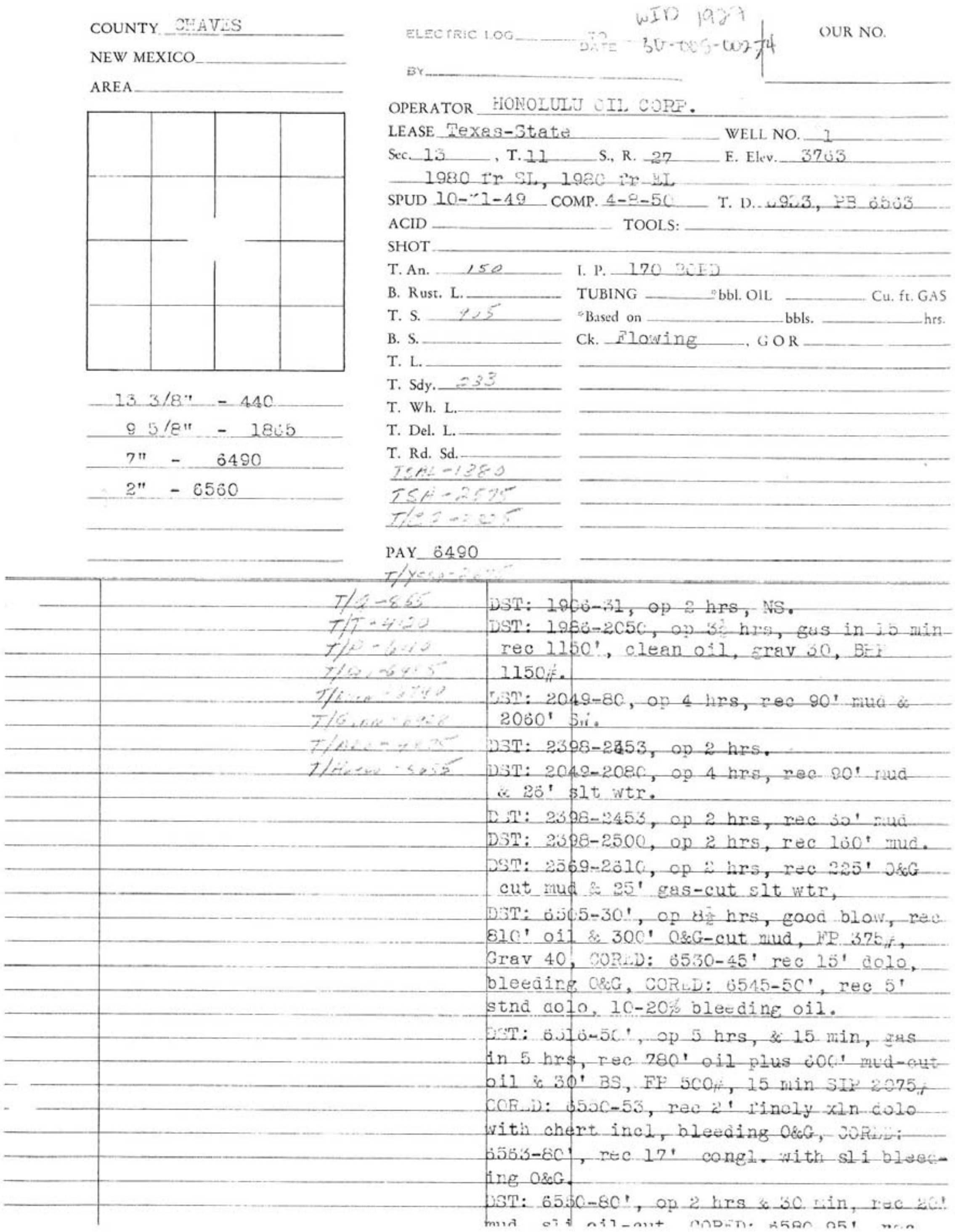
Figure 2 (continued below).



LOG

0		3710	rb	4817	L
2341	rb, sd & cgl	15	A	21	brk L
60	L arr	50	r sh & A shl	43	L
75	S & A	60	sd & A	68	L & A
95	rr & S	70	A	81	blk L & sh brks
2440	S	75	sd	4902	br L & " "
2830	S	80	rr	30	L & ygp
55	A arr	90	A	49	L
60	S	3805	rr	63	L & A
70	A	10	A	84	L & A & sh brks
2915	ygp & A	25	sd	96	L
20	A	40	rr	5009	dent & A
40	A & ygp	50	sdy rr	44	L
52	A	75	wh sd & rr	52	L & sh
85	rr	90	rr	70	L ¼ bwpn 5056-76
3050	rr & A	3910	sd	5120	sd & L SSG 5170
65	P	35	A	5255	L
3105	rr & sd	60	sd	77	sdy L SSG 5264
20	ygp & A	82	A	90	sd - NTM 5264-85
25	A	4005	rr & sd	98	soft sd
45	A arr	30	A		
50	r sh	70	A & rsh		
60	A	95	rr & sd		
70	A arr	4140	rr & A		
80	rr	90	A & dy sh		
90	A	4213	rb		
3210	rr & A	17	r sd		
20	A	30	rr		
35	r sh	40	sdy rsh		
50	A	53	A		
65	r sh	55	L		
3315	A & rb	78	br L		
40	A	4318	A & L		
60	rb	80	L		
3425	A	95	br sh & shls		
45	S & rb	4402	L		
3505	rb & A	12	A		
10	L	20	brk L		
25	shl & rb	45	L & A		
40	rr & S	4598	L		
60	r sh	4601	A		
75	P	88	L		
3600	rb & S	92	sh		
35	A	4706	brk L		
70	r sh & A	77	L		
95	rb & shl	4802	L & A		

Figure 3 (below). Example of Neil Wills scout ticket (Collection P750) for which metadata was created and uploaded into the National Catalog during 2010-2011. API number and Well ID in upper right researched and added during project year.



COUNTY CHAVES
NEW MEXICO
AREA

ELECTRIC LOG
DATE
BY
WID 1937
30-005-00274
OUR NO.

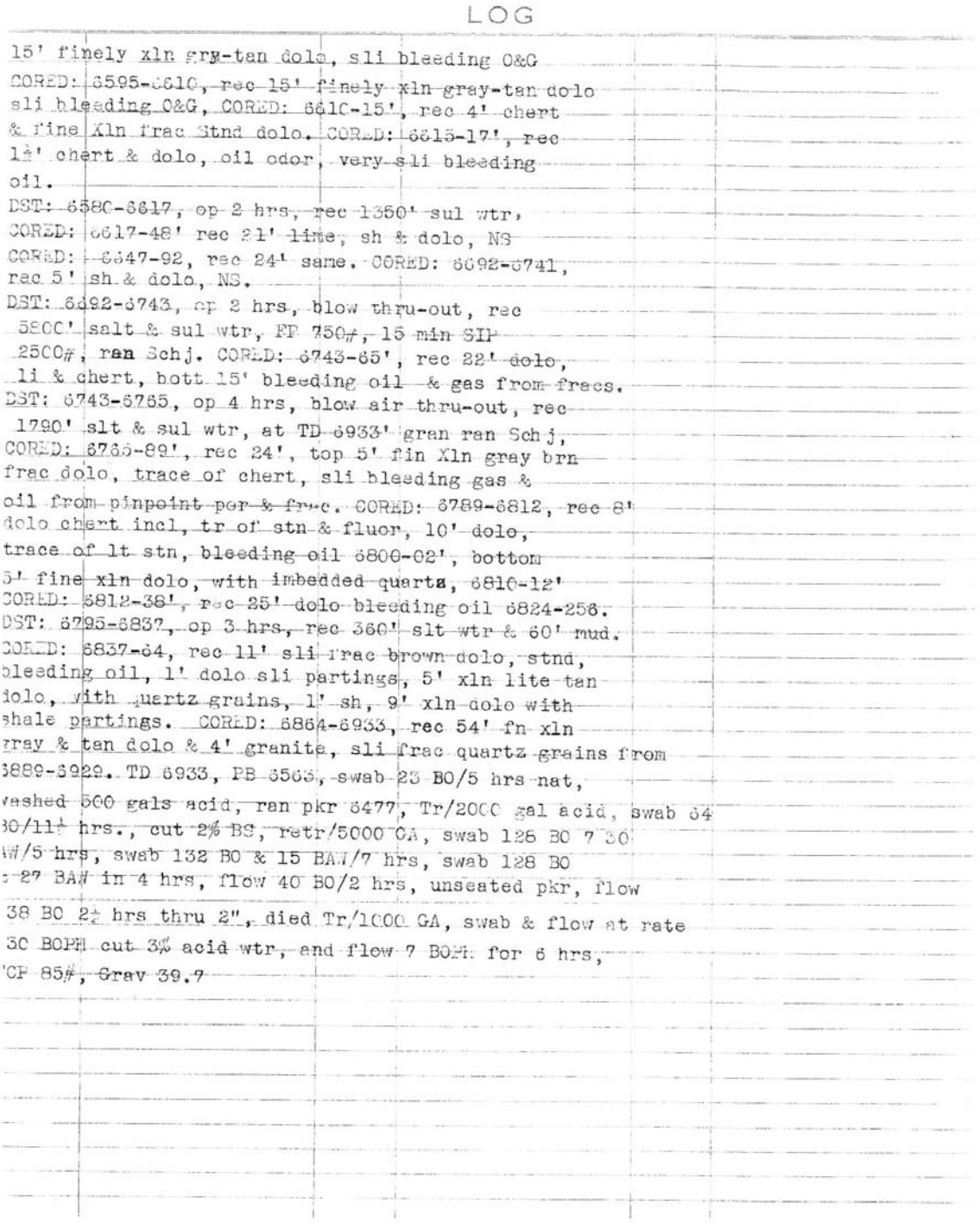
OPERATOR HONOLULU OIL CORP.
LEASE Texas-State WELL NO. 1
Sec. 13, T. 11 S., R. 27 E. Elev. 3763
1980 fr SL, 1980 fr EL
SPUD 10-21-49 COMP. 4-8-50 T. D. 6923, PB 6563
ACID TOOLS:
SHOT
T. An. 150 I. P. 170 BOPD
B. Rust. L. TUBING bbl. OIL Cu. ft. GAS
T. S. 405 Based on bbls. hrs.
B. S. Ck. Flowing, GOR
T. L.
T. Sdy. 233
T. Wh. L.
T. Del. L.
T. Rd. Sd.

13 3/8" - 440
9 5/8" - 1865
7" - 6490
2" - 6560

PAY 6490

DST: 1906-31, op 2 hrs, NS.
DST: 1988-2050, op 3½ hrs, gas in 15 min rec 1150', clean oil, grav 30, BHP 1150#.
DST: 2049-80, op 4 hrs, rec 90' mud & 2060' SW.
DST: 2398-2453, op 2 hrs.
DST: 2049-2080, op 4 hrs, rec 90' mud & 25' slt wtr.
DST: 2398-2453, op 2 hrs, rec 35' mud
DST: 2398-2500, op 2 hrs, rec 160' mud.
DST: 2569-2610, op 2 hrs, rec 225' O&G cut mud & 25' gas-cut slt wtr,
DST: 6505-30', op 8½ hrs, good blow, rec 810' oil & 300' O&G-cut mud, FP 375#, Grav 40, CORED: 6530-45' rec 15' dolo, bleeding O&G, CORED: 6545-50', rec 5' stnd dolo, 10-20% bleeding oil.
DST: 6516-50', op 5 hrs, & 15 min, gas in 5 hrs, rec 780' oil plus 600' mud-cut oil & 30' BS, FP 500#, 15 min SIP 2075#
CORED: 6550-53, rec 2' finely xln dolo with chert incl, bleeding O&G, CORED: 6553-80', rec 17' congl. with sli bleeding O&G.
DST: 6550-80', op 2 hrs & 30 min, rec 20' mud sli oil-cut CORED: 6580-95' ...

Figure 3 (continued below).



LOG

15' finely xln gry-tan dolo, sli bleeding O&G
CORED: 6595-6610, rec 15' finely xln gray-tan dolo
sli bleeding O&G, CORED: 6610-15', rec 4' chert
& fine Xln frac Stnd dolo. CORED: 6615-17', rec
1½' chert & dolo, oil odor, very sli bleeding
oil.
DST: 6580-6617, op 2 hrs, rec 1350' sul wtr,
CORED: 6617-48' rec 21' lime, sh & dolo, NS
CORED: 6647-92, rec 24' same. CORED: 6692-6741,
rec 5' sh & dolo, NS.
DST: 6692-6743, op 2 hrs, blow thru-out, rec
580' salt & sul wtr, FP 750#, 15 min SIP
2500#, ran Schj. CORED: 6743-65', rec 22' dolo,
li & chert, bott 15' bleeding oil & gas from fracs.
DST: 6743-6765, op 4 hrs, blow air thru-out, rec
1790' slt & sul wtr, at TD 6933' gran ran Schj,
CORED: 6765-89', rec 24', top 5' fin Xln gray brn
frac dolo, trace of chert, sli bleeding gas &
oil from pinpoint por & frac. CORED: 6789-6812, rec 8'
dolo chert incl, tr of stn & fluor, 10' dolo,
trace of lt stn, bleeding oil 6800-02', bottom
5' fine xln dolo, with imbedded quartz, 6810-12'
CORED: 6812-38', rec 25' dolo bleeding oil 6824-25&.
DST: 6795-6837, op 3 hrs, rec 360' slt wtr & 60' mud.
CORED: 6837-64, rec 11' sli frac brown dolo, stnd,
bleeding oil, 1' dolo sli partings, 5' xln lite tan
dolo, with quartz grains, 1' sh, 9' xln dolo with
shale partings. CORED: 6864-6933, rec 54' fn xln
gray & tan dolo & 4' granite, sli frac quartz grains from
6889-6929. TD 6933, PB 6565, swab 23 BO/5 hrs nat,
washed 500 gals acid, ran pkr 6477, Tr/2000 gal acid, swab 64
BO/11½ hrs., cut 2% BS, retr/5000 GA, swab 126 BO 7 30
W/5 hrs, swab 132 BO & 15 BAW/7 hrs, swab 128 BO
& 27 BAW in 4 hrs, flow 40 BO/2 hrs, unseated pkr, flow
38 BO 2½ hrs thru 2", died Tr/1000 GA, swab & flow at rate
30 BOPH cut 3% acid wtr, and flow 7 BOPH for 6 hrs,
FCP 85#, Grav 39.7

Figure 4 (below). Example of core analysis report (from collection P751) for which digital infrastructure was created, developed, and posted on servers of the New Mexico Bureau of Geology and Mineral Resources during 2010-2011. Core analyses reports are accessed through an online search engine and links to the search engine were uploaded into the National Catalog during 2010-2011.

DWS-2

Darrell W. Smith Co.

CORE FOOTAGE SUMMARY

Operator Carper Drilling Company **Lab No.** 468-HA

Well No. 1 Gifford State

Formations Queen Grayburg

Depths 3825 - 3894 4550 - 4700

Field Corbin Abo **County** Lea **State** New Mexico

Location 330' FEL, 2310' FSL, Sec. 32, Twp. 17 S, R 33 E

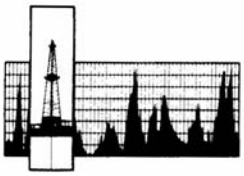
CORE INFORMATION

Intervals cored	**from** 3825 **to** 3894	
	from 4550 **to** 4700	
	from **to**	
Feet of formation cored	219	
Feet of formation recovered	196	
Feet of formation cored but not recovered	23	
Feet of core received at laboratory for analysis	196	196
Number of samples selected for analysis	61	
Feet of core represented by selected samples	60	
Feet of shale and/or dense barren material not analyzed	136	
Total footage of core accounted for in laboratory analysis	196	196

The analyses herein contained have been prepared for sole use by the client ordering same. Any opinions or interpretations based thereon represent the best judgment of Darrell W. Smith Company and its employees, who make no warranty or representation as to productivity or profitableness of any oil, gas or mineral well or sand in connection with which such report is used or relied on, and assume no responsibility in connection therewith.

Figure 4 (continued below).

DWS-1



Darrell W. Smith Co.

Box 1105 • Midland, Texas
Box 455 • Hobbs, New Mexico

August 22, 1961

Carper Drilling Company
200 Carper Building
Artesia, New Mexico

Re: Well No. 1 Gifford State
Corbin Field
Lea County, New Mexico

Gentlemen:

The above described well was cored from 3825 feet to 3894 feet in the Queen formation and from 4550 feet to 4700 feet in the Grayburg formation. All of the cores were cut using a water base mud and diamond coring equipment.

The attached core analysis data are reported in a tabulation and also plotted on a graph having the same depth scale as the detail section of the subsurface logs for your convenience.

All of the recovered core was brought to the Artesia laboratory where the gamma radiation was measured and the intervals selected by a representative for the Carper Drilling Company were analyzed by Full Diameter Core Study.

Yours very truly,

DARRELL W. SMITH COMPANY

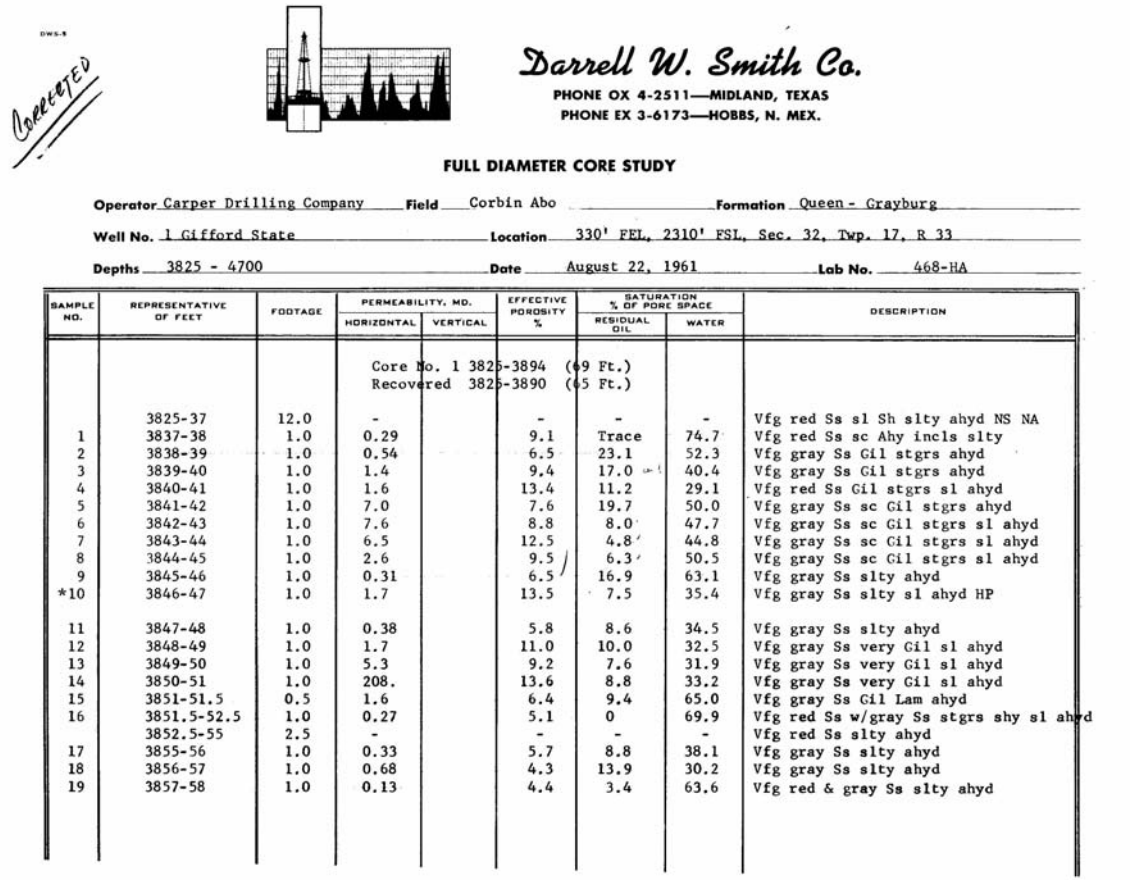
J. M. Glenn

J. M. Glenn
Laboratory Manager
Hobbs and Artesia

JMG:cm

Laboratories in Midland and Hobbs

Figure 4 (continued below).



CORRECTED

Darrell W. Smith Co.

PHONE OX 4-2511—MIDLAND, TEXAS
PHONE EX 3-6173—HOBBS, N. MEX.

FULL DIAMETER CORE STUDY

Operator Carper Drilling Company **Field** Corbin Abo **Formation** Queen - Grayburg

Well No. 1 Gifford State **Location** 330' FEL, 2310' FSL, Sec. 32, Twp. 17, R 33

Depths 3825 - 4700 **Date** August 22, 1961 **Lab No.** 468-HA

SAMPLE NO.	REPRESENTATIVE OF FEET	FOOTAGE	PERMEABILITY, MD. HORIZONTAL	PERMEABILITY, MD. VERTICAL	EFFECTIVE POROSITY %	SATURATION % OF PORE SPACE RESIDUAL OIL	SATURATION % OF PORE SPACE WATER	DESCRIPTION
			Core No. 1 3825-3894 (69 Ft.) Recovered 3825-3890 (65 Ft.)					
	3825-37	12.0	-		-	-	-	Vfg red Ss sl Sh slty ahyd NS NA
1	3837-38	1.0	0.29		9.1	Trace	74.7	Vfg red Ss sc Ahy incls slty
2	3838-39	1.0	0.54		6.5	23.1	52.3	Vfg gray Ss Gil stgrs ahyd
3	3839-40	1.0	1.4		9.4	17.0	40.4	Vfg gray Ss Gil stgrs ahyd
4	3840-41	1.0	1.6		13.4	11.2	29.1	Vfg red Ss Gil stgrs sl ahyd
5	3841-42	1.0	7.0		7.6	19.7	50.0	Vfg gray Ss sc Gil stgrs ahyd
6	3842-43	1.0	7.6		8.8	8.0	47.7	Vfg gray Ss sc Gil stgrs sl ahyd
7	3843-44	1.0	6.5		12.5	4.8	44.8	Vfg gray Ss sc Gil stgrs sl ahyd
8	3844-45	1.0	2.6		9.5	6.3	50.5	Vfg gray Ss sc Gil stgrs sl ahyd
9	3845-46	1.0	0.31		6.5	16.9	63.1	Vfg gray Ss slty ahyd
*10	3846-47	1.0	1.7		13.5	7.5	35.4	Vfg gray Ss slty sl ahyd HP
11	3847-48	1.0	0.38		5.8	8.6	34.5	Vfg gray Ss slty ahyd
12	3848-49	1.0	1.7		11.0	10.0	32.5	Vfg gray Ss very Gil sl ahyd
13	3849-50	1.0	5.3		9.2	7.6	31.9	Vfg gray Ss very Gil sl ahyd
14	3850-51	1.0	208.		13.6	8.8	33.2	Vfg gray Ss very Gil sl ahyd
15	3851-51.5	0.5	1.6		6.4	9.4	65.0	Vfg gray Ss Gil Lam ahyd
16	3851.5-52.5	1.0	0.27		5.1	0	69.9	Vfg red Ss w/gray Ss stgrs shy sl ahyd
	3852.5-55	2.5	-		-	-	-	Vfg red Ss slty ahyd
17	3855-56	1.0	0.33		5.7	8.8	38.1	Vfg gray Ss slty ahyd
18	3856-57	1.0	0.68		4.3	13.9	30.2	Vfg gray Ss slty ahyd
19	3857-58	1.0	0.13		4.4	3.4	63.6	Vfg red & gray Ss slty ahyd

Figure 4 (continued below).

DWS-6

PAGE NO. 2 **OPERATOR** Carper Drilling Company **LAB NO.** 468-HA

SAMPLE NO.	REPRESENTATIVE OF FEET	FOOTAGE	PERMEABILITY, MD.		EFFECTIVE POROSITY %	SATURATION % OF PORE SPACE		DESCRIPTION
			HORIZONTAL	VERTICAL		RESIDUAL OIL	WATER	
20	3858-58.5	0.5	3.3		15.0	14.7	30.7	Vfg gray Ss very Gil sl ahyd
	3858.5-59.5	1.0	-		-	-	-	Dol d Sh ptgs NS NA
	3859.5-63	3.5	-		-	-	-	Dol vfx sdy ahyd NS NA
	3863-69	6.0	-		-	-	-	Ahy sdy slty NS NA
	3869-85	16.0	-		-	-	-	Ahy slty stgrs sc Dol stgr NS NA
	3885-90	5.0	-		-	-	-	Dol d ahyd styo NS NA
	3890-94	4.0	-		-	-	-	NR
			Core No. 2 4550-4625 (75 Ft.) Recovered 4550-4625 (75 Ft.)					
	4550-54	4.0	-		-	-	-	Dol d sc Ahy incls PPP NA
	4554-57	3.0	-		-	-	-	Ss vfg sl dolo slty NA
21	4557-58	1.0	0.77		10.6	4.7	38.5	Ss vfg slty dolo
	4558-59	1.0	-		-	-	-	Ss vfg slty dolo
22	4559-60	1.0	1.3		11.3	15.9	33.3	Ss vfg slty dolo
	4560-81	21.0	-		-	-	-	Dol vfg styo Sh ptgs sl sdy w/ Sd stgrs
23	4581-82	1.0	0.56		9.2	8.7	32.0	Ss vfg sc Ahy incls very dolo
	4582-83	1.0	-		-	-	-	Ss vfg sc Ahy incls dolo
24	4583-84	1.0	0.21		10.5	13.3	34.3	Ss vfg sc Ahy incls very dolo
	4584-85	1.0	-		-	-	-	Ss vfg slty dolo
25	4585-86	1.0	0.13		8.3	15.7	27.7	Dol vfx slty sdy sc Ahy incls
	4586-87	1.0	-		-	-	-	Dol vfx slty sdy sc Ahy incls
26	4587-88	1.0	3.7		14.2	16.9	29.0	Ss vfg slty dolo sc Ahy incls
	4588-89	1.0	-		-	-	-	Ss vfg slty dolo sc Ahy incls
27	4589-90	1.0	4.0		14.4	17.4	29.4	Ss vfg slty dolo sc Ahy incls
	4590-91	1.0	-		-	-	-	Ss vfg slty dolo sc Ahy incls
28	4591-92	1.0	11.		16.0	14.4	32.5	Ss vfg slty sl dolo sc Ahy incls
	4592-93	1.0	-		-	-	-	Ss vfg slty sl dolo sc Ahy incls
29	4593-94	1.0	7.3		14.8	6.8	32.8	Ss vfg slty sl dolo sc Ahy incls
	4594-95	1.0	-		-	-	-	Ss vfg slty sl dolo sc Ahy incls
30	4595-96	1.0	5.8		15.1	10.6	31.5	Ss vfg slty sl dolo sc Ahy incls
	4596-97	1.0	-		-	-	-	Ss vfg slty sl dolo sc Ahy incls
31	4597-98	1.0	5.4		14.5	13.4	28.6	Ss vfg slty sl dolo sc Ahy incls
	4598-99	1.0	-		-	-	-	Ss vfg slty sl dolo sc Ahy incls
32	4599-4600	1.0	67.		15.8	16.4	30.1	Ss vfg slty sl dolo
	4600-01	1.0	-		-	-	-	Ss vfg slty
33	4601-02	1.0	7.2		15.7	15.9	31.0	Ss vfg slty
	4602-03	1.0	-		-	-	-	Ss vfg slty

Figure 4 (continued below).

DWS-8

PAGE NO. 3 **OPERATOR** Carper Drilling Company **LAB NO.** 468-HA

SAMPLE NO.	REPRESENTATIVE OF FEET	FOOTAGE	PERMEABILITY, MD. HORIZONTAL	PERMEABILITY, MD. VERTICAL	EFFECTIVE POROSITY %	SATURATION % OF PORE SPACE RESIDUAL OIL	SATURATION % OF PORE SPACE WATER	DESCRIPTION
34	4603-04	1.0	8.0		15.4	8.4	29.8	Ss vfg slty
	4604-05	1.0	-		-	-	-	Ss vfg slty
35	4605-06	1.0	6.4		14.4	9.7	33.2	Ss vfg slty sl dolo sc Ahy incls
	4606-07	1.0	-		-	-	-	Ss vfg slty sl dolo sc Ahy incls
36	4607-08	1.0	0.54		10.0	6.0	30.0	Ss vfg slty very dolo sc Ahy incls
	4608-09	1.0	-		-	-	-	Ss vfg sc Ahy incls dolo
37	4609-10	1.0	0.53		13.2	10.6	35.3	Ss vfg slty very dolo sc Ahy incls
	4610-11	1.0	-		-	-	-	Ss vfg sc Ahy incls dolo
38	4611-12	1.0	0.38		12.4	16.1	36.9	Ss vfg slty very dolo sc Ahy incls
	4612-13	1.0	-		-	-	-	Dol vfx slty sdy sc Ahy incls
39	4613-14	1.0	0.22		9.4	14.9	35.9	Dol vfx sdy sc Ahy incls
	4614-15	1.0	-		-	-	-	Dol vfx sdy sc Ahy incls
40	4615-16	1.0	0.26		9.3	11.8	38.6	Dol vfx sdy sc Ahy incls
	4616-18	2.0	-		-	-	-	Ss vfg sc Ahy incls very dolo
41	4618-19	1.0	1.1		12.7	9.4	36.3	Ss vfg slty sl Sh sl dolo sc Ahy incls
	4619-21	2.0	-		-	-	-	Ss vfg slty sl shy sl dolo sc Ahy incls
42	4621-22	1.0	3.7		15.0	9.3	38.0	Ss vfg slty sl shy sl dolo sc Ahy incls
	4622-23	1.0	-		-	-	-	Ss vfg slty sl shy sl dolo sc Ahy incls
43	4623-24	1.0	1.7		13.9	8.6	27.3	Ss vfg slty sl shy sl dolo sc Ahy incls
	4624-25	1.0	-		-	-	-	Ss vfg slty sl shy sc Ahy incls sl dolo
			Core No. 3 4625-4700 (75 Ft.) Recovered 4625-4681 (56 Ft.)					
	4625-27	2.0	-		-	-	-	Ss vfg sc Ahy incls sl dolo NA
44	4627-28	1.0	3.7		14.9	10.7	31.5	Ss vfg sc Ahy incls sl dolo slty
	4628-29	1.0	-		-	-	-	Ss vfg sc Ahy incls sl dolo NA
45	4629-30	1.0	1.9		12.7	13.4	29.5	Ss vfg sc Ahy incls sl dolo slty
	4630-31	1.0	-		-	-	-	Ss vfg sc Ahy incls sl dolo NA
46	4631-32	1.0	1.9		13.3	14.3	28.7	Ss vfg sc Ahy incls sl dolo
	4632-35	3.0	-		-	-	-	Ss vfg sc Ahy incls dolo NA
	4635-40	5.0	-		-	-	-	Dol vfx sc Ahy incls sl sdy NA
	4640-44	4.0	-		-	-	-	Ss vfg sc Ahy incls dolo NA
47	4644-45	1.0	29.		16.1	8.7	29.2	Ss vfg sc Ahy incls dolo
	4645-46	1.0	-		-	-	-	Ss vfg sc Ahy incls dolo NA
48	4646-47	1.0	21.		18.8	11.2	31.4	Ss vfg slty
	4647-48	1.0	-		-	-	-	Ss vfg sc Ahy incls NA
49	4648-49	1.0	13.		16.9	16.0	48.5	Ss vfg sc Ahy incls sl dolo
	4649-50	1.0	-		-	-	-	Ss vfg sc Ahy incls sl dolo NA
50	4650-51	1.0	30.		17.5	13.1	56.0	Ss vfg sl dolo
	4651-52	1.0	-		-	-	-	Ss vfg sl dolo NA

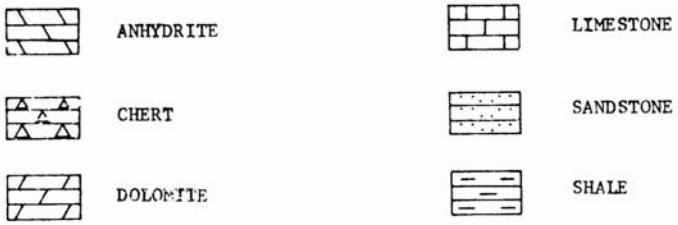
Figure 4 (continued below).

PAGE NO. 4 OPERATOR Carper Drilling Company LAB NO. 468-HA

SAMPLE NO.	REPRESENTATIVE OF FEET	FOOTAGE	PERMEABILITY, MD.		EFFECTIVE POROSITY %	SATURATION % OF PORE SPACE		DESCRIPTION
			HORIZONTAL	VERTICAL		RESIDUAL OIL	WATER	
51	4652-53	1.0	45.		22.4	9.4	47.8	Ss vfg sl dolo
	4653-54	1.0	-		-	-	-	Ss vfg sl dolo NA
52	4654-55	1.0	27.		21.1	11.4	40.3	Ss vfg sl dolo
	4655-56	1.0	-		-	-	-	Ss vfg sc Ahy incls sl dolo NA
53	4656-57 (14')	1.0	6.8		16.1	9.9	46.0	Ss vfg sc Ahy incls sl dolo Cil
	4657-58	1.0	-		-	-	-	Ss vfg sc Ahy incls sl dolo Cil NA
54	4658-59	1.0	0.43		10.5	7.6	32.9	Dol vfx sc Ahy incls sl sdy PPP
55	4659-60	1.0	0.37		9.0	17.8	31.2	Dol vfx ahyd sl shy PPP
56	4660-61	1.0	0.33		10.1	5.0	37.2	Dol vfx ahyd sl shy PPP
	4661-64	3.0	-		-	-	-	Dol d-vfx sc Ahy incls styo PPP NA
57	4664-65	1.0	0.50		10.5	18.1	36.1	Dol vfx sc Ahy incls sl sdy PPP
	4665-66	1.0	-		-	-	-	Dol vfx sc Ahy incls sdy NA
58	4666-67	1.0	0.32		9.4	14.9	35.0	Ss vfg sc Ahy incls dolo
	4667-68	1.0	-		-	-	-	Ss vfg sc Ahy incls dolo NA
59	4668-69	1.0	0.34		9.0	5.6	51.1	Ss vfg sc Ahy incls dolo
60	4669-70	1.0	1.6		13.5	4.4	47.8	Ss vfg sc Ahy incls sl dolo
	4670-71	1.0	-		-	-	-	Ss vfg sc Ahy incls slsdolo NA
61	4671-72	1.0	1.1		12.0	6.7	33.3	Ss vfg sc Ahy incls sl dolo
	4672-75	3.0	-		-	-	-	Ss vfg sc Ahy incls dolo NA
	4675-81	6.0	-		-	-	-	Dol vfx sc Ahy incls sl sdy NA
	4681-4700	19.0	-		-	-	-	NR

Figure 4 (continued below).

LITHOLOGY



DESCRIPTION OF CORE

Dol	Dolomite	oo	Oolitic
Ls	Limestone	PPP	Pin Point Porosity
Ss	Sandstone	incls	Inclusions
Ch	Chert	ptgs	Partings
Ahy	Anhydrite	St	Stain
Sh	Shale	NS	No Stain
Sulf	Sulphur	sc	Scattered
Ca	Calcite	stgr	Stringer
Carb	Carbonaceous	sl	Slightly
gil	Gilsonite	Tr	Trace
dolo	Dolomitic	NA	Not Analyzed per Operators Instructions
lmy	Limy		
sdy	Sandy	NR	Not Recovered
ahyd	Anhydritic	NSL	Not Sent to Lab
shy	Shaly	SV	Small Vugs
slty	Silty	V	Vugs
Lam	Laminations	F	Fracture
Sol Cav	Solution Cavity		
Sol Chan	Solution Channels		C Cemented
Sty	Stylolite		H Horizontal
styo	Stylolitic		I Inclined
Trip	Tripolitic		M Multiple
Fs	Fossiliferous		R Random
Gyp	Gypsum		V Vertical

TEXTURE

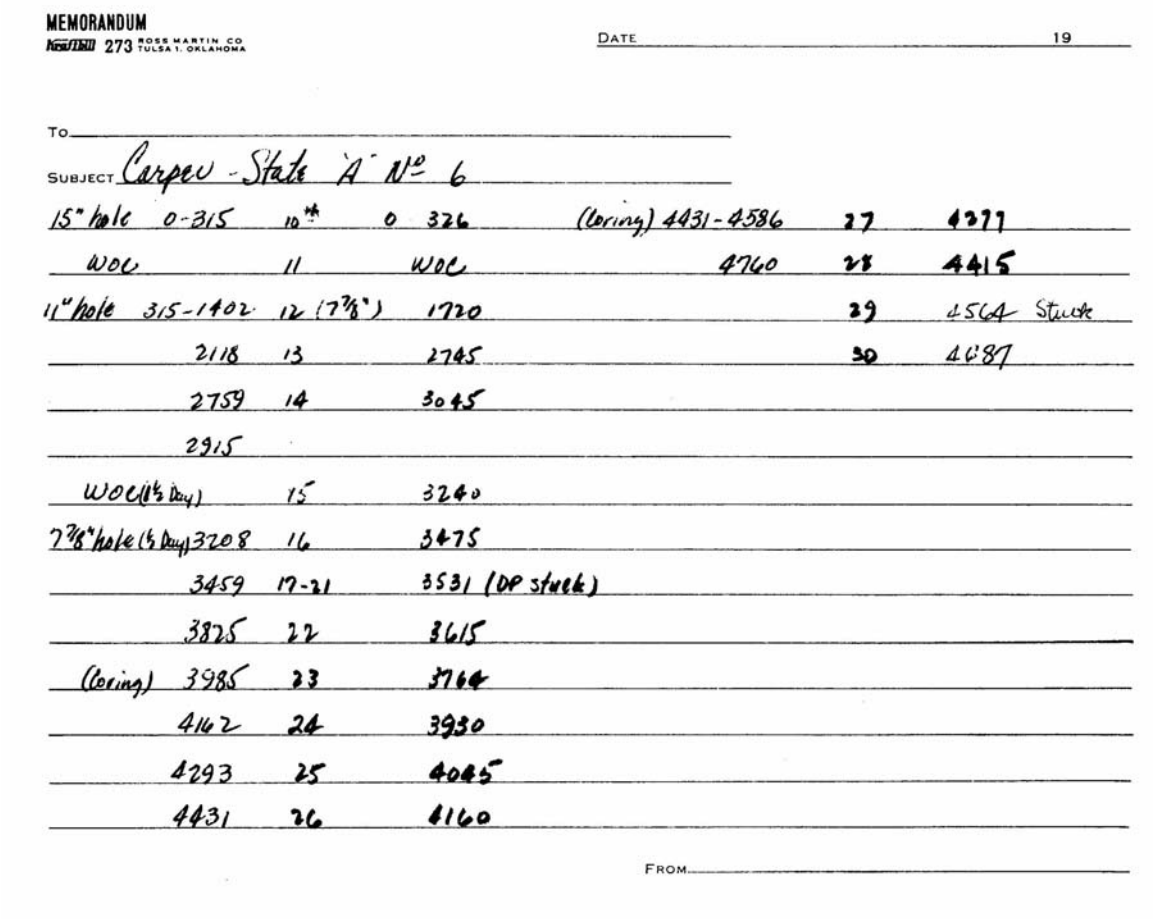
cg	Coarse Grain	d	Dense
fg	Fine Grain	fx	Fine Cryst.
FQG	Frosted Quartz Grains	mx	Medium Cryst.
gran	Granular	cx	Coarse Cryst.

FLUORESCENCE

G	Good
F	Fair
Dl	Dull
Tr	Trace
Sc	Scattered

* Matrix permeability
** Sample not suitable for analysis

Figure 4 (continued below).



MEMORANDUM
ROSS MARTIN CO. 273 TULSA 1, OKLAHOMA

DATE 19

TO

SUBJECT Carper - State "A" No 6

15" hole	0-315	10	0	326	(coring) 4431-4586	27	4377
WOC		11	WOC		4760	28	4415
11" hole	315-1402	12 (7 7/8")	1720			29	4564 Stuck
	2118	13	2745			30	4687
	2759	14	3045				
	2915						
WOC (1½ Day)		15	3240				
7 7/8" hole (½ Day)	3208	16	3475				
	3459	17-21	3531 (DP stuck)				
	3825	22	3615				
(coring)	3985	23	3764				
	4162	24	3930				
	4293	25	4045				
	4431	26	4160				

FROM

Figure 4 (continued below).

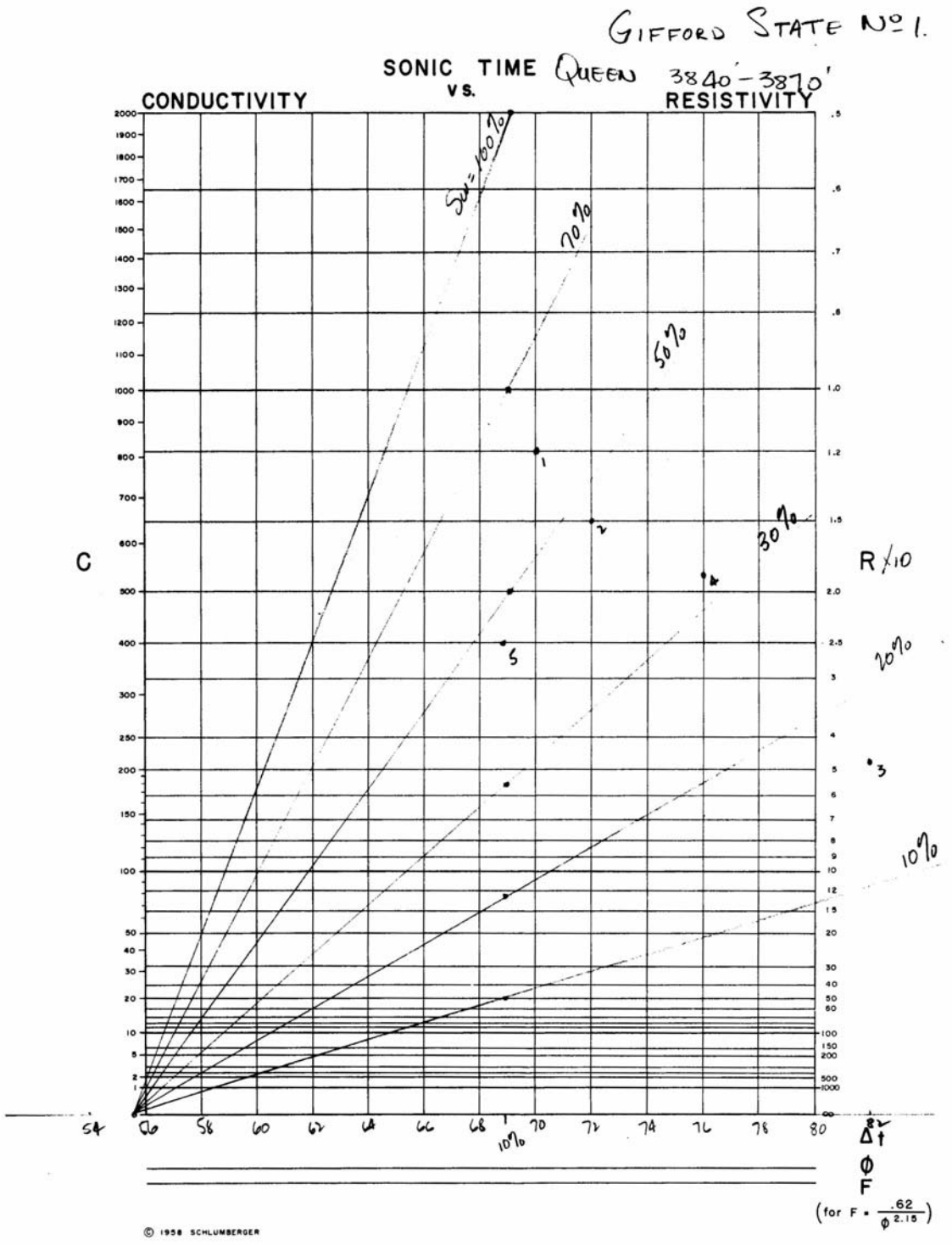


Figure 4 (continued below).

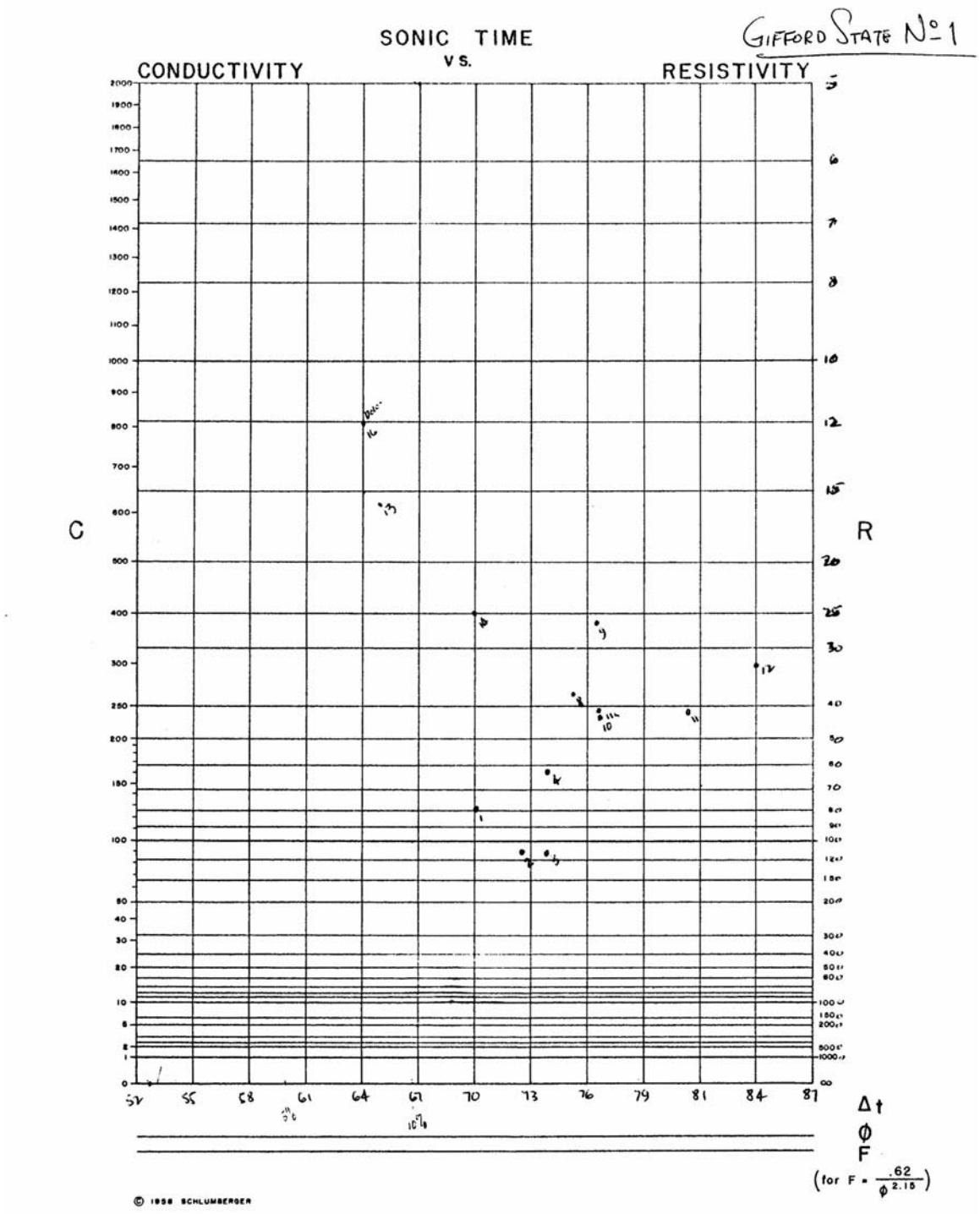


Figure 4 (continued below).

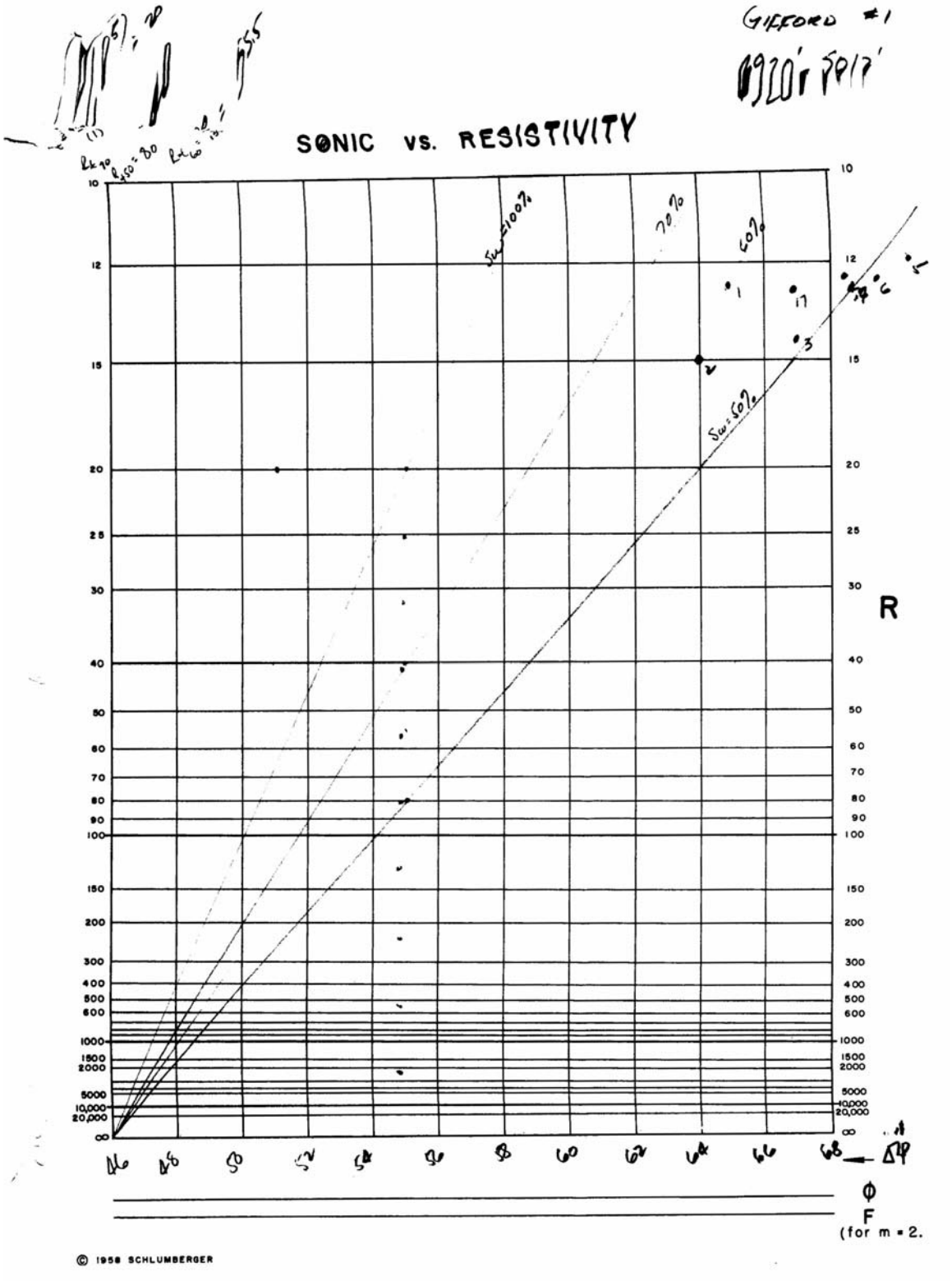


Figure 4 (continued below).

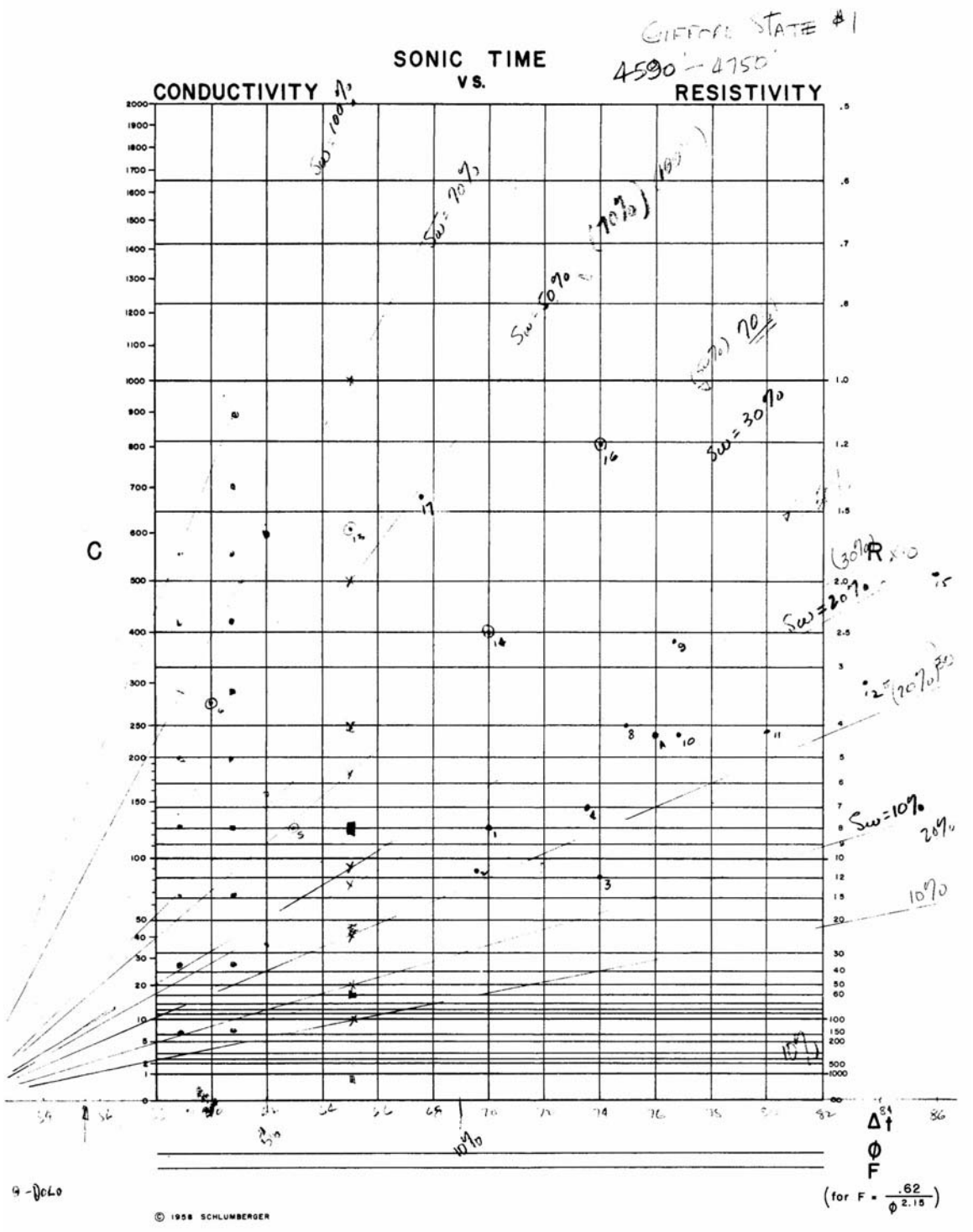


Figure 4 (continued below).