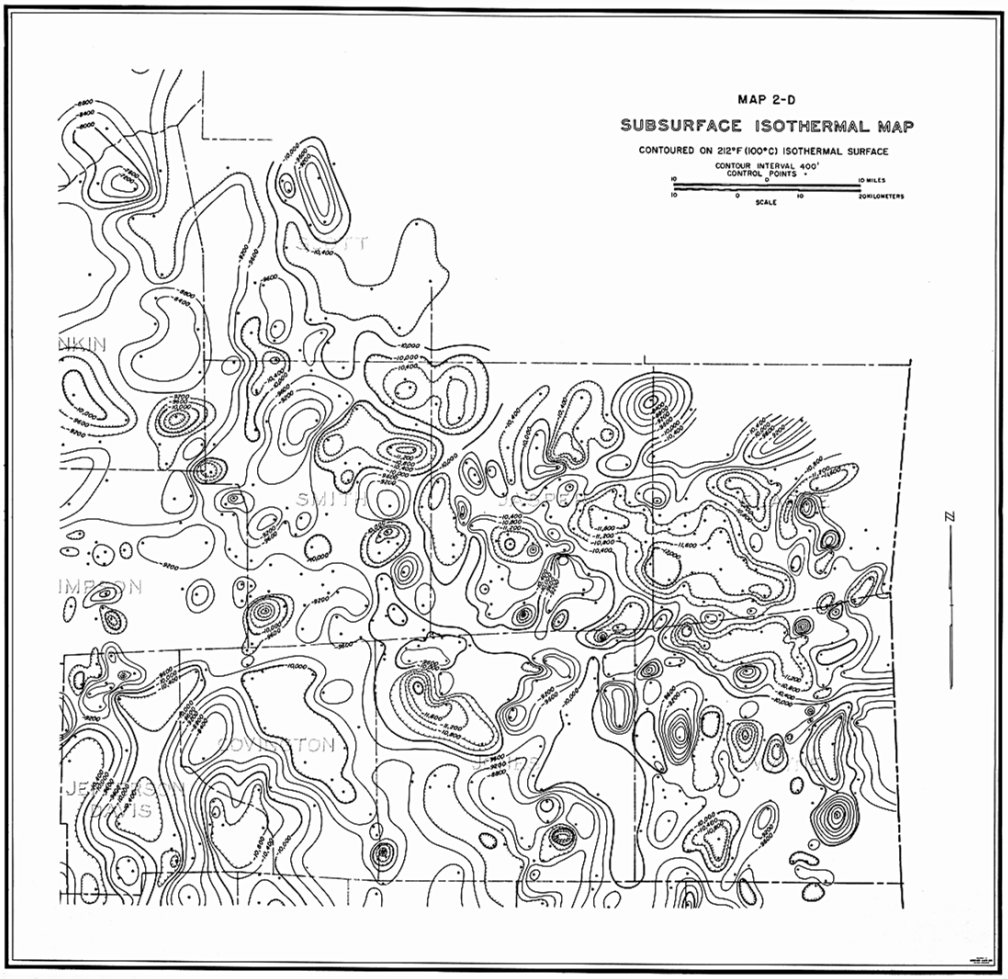
AN INVESTIGATION OF POTENTIAL GEOTHERMAL ENERGY SOURCES IN MISSISSIPPI

Edwin E. Luper

OPEN-FILE REPORT 1



MISSISSIPPI GEOLOGICAL, ECONOMIC AND TOPOGRAPHICAL SURVEY

October, 1978

FINAL REPORT

AN INVESTIGATION OF POTENTIAL GEOTHERMAL ENERGY SOURCES IN MISSISSIPPI

DOE CONTRACT NO. EG-77-S-05-5361

Edwin E. Luper, Principal Investigator

Mississippi Geological, Economic and
Topographical Survey
Jackson, Mississippi

October 31, 1978

AN INVESTIGATION OF POTENTIAL GEOTHERMAL ENERGY SOURCES IN SOUTHERN MISSISSIPPI

INTRODUCTION

In the fall of 1973 when the OPEC Nations imposed a boycott on the exportation of oil to the United States, there was a focusing of attention in this country to finding and developing alternate energy sources. Just prior to this boycott, the Mississippi Geological Survey initiated a comprehensive investigation of the lignite deposits in Mississippi with the view of stimulating interest in the private sector for the development of this energy source. The investigation was completed in 1976 and the results of the findings were published by the Survey.

Following the initiation of the lignite project, a decision was reached to investigate the potential geothermal energy sources within the state. At that time Dr. Paul H. Jones was director of the Gulf Coast Hydroscience Center, United States Geological Survey (U.S.G.S.) located at Bay St. Louis, Mississippi. As Dr. Jones and his staff were engaged in a geotemperature study along the Gulf Coast of Texas, members of the staff of the Mississippi Geological Survey consulted with this group, in order to determine the best approach to a geothermal investigation. We took their recommendations to conduct a geotemperature study. In order to fully explore the geotemperature regime, it was decided that additional funding from outside the agency would be needed; consequently a research proposal was submitted to the National Science Foundation on November 29, 1973. The amount requested in the grant proposal was $46,991 and the duration of the study was to be two years.

Our proposal was reviewed and on October 10, 1974, support for our grant was denied. In August 1975, the director of the Survey made inquiries to the U.S.G.S. as to the possibility of receiving funding to assist the Survey in conducting a geothermal study. The comments from the U.S.G.S. were favorable; consequently a research proposal was submitted to the Energy Research and Development Administration (E.R.D.A.) on December 17, 1975. During the time it took for E.R.D.A. to review and consider our proposal the cost of salaries and services had increased and E.R.D.A. advised us to restructure our proposal. This was done and on June 18, 1976, a revised research proposal was submitted to E.R.D.A. The amount requested was $37,737 with the duration of the study to be 12 months. This proposal was accepted by E.R.D.A. and a contract was signed on February 24, 1977, by E.R.D.A. and the Mississippi Geological Survey. A slight modification to the contract was made whereby the starting date of the period of performance was changed from February 1, 1977, to April 1, 1977. On March 17, 1978, a three-month extension to the contract with no additional funding was requested of and granted by the Department of Energy. The extension was requested due to the need to add five additional counties to the project area. On June 15, 1978 a two-month extension to the contract with no additional funding was requested of and granted by the Department of Energy. The extension was requested because of the inability of the computer personnel of the Mississippi Research and Development Center to deliver to the Survey their portion of the project in sufficient time to complete the final report by June 30, 1978.

On August 22, 1978, an additional two-month extension to the contract was requested of and granted by DOE. The reason this extension was requested was because the computer personnel at the Mississippi Research and Development

Center could not adapt their computers to give us the necessary information to complete the project and arrangements had to be made to have the work done elsewhere.

OBJECTIVE AND ORGANIZATION

The objective of this study was to assess the geotemperature regime in the subsurface of the south-central and southern portion of the state of Mississippi (Figure 1). The area includes the Mississippi Salt Basin, the Jackson Dome, and related minor structural features within the state. (Figure 2).

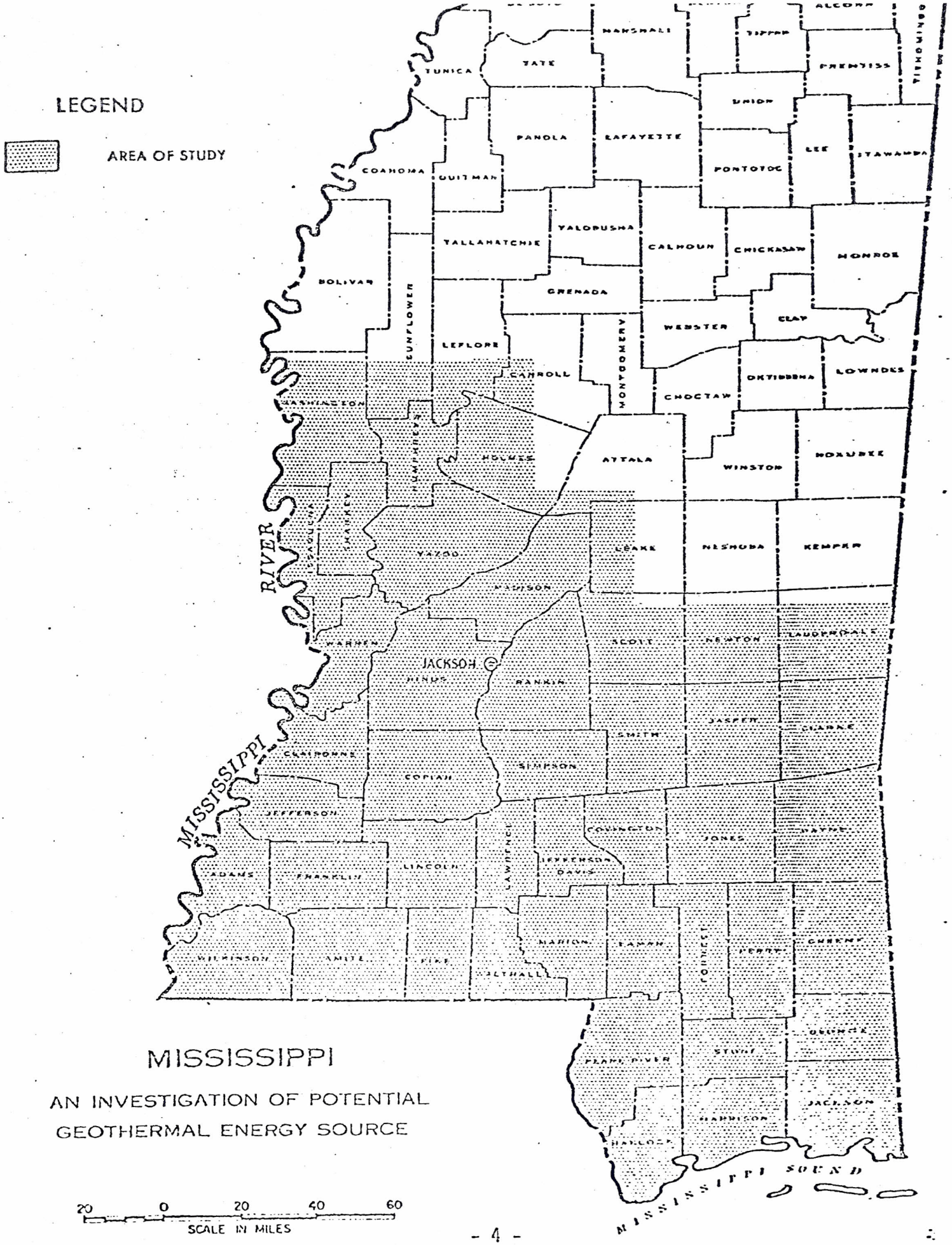
In order to accomplish the objective, it was necessary to accumulate sufficient data to construct isothermal maps on six temperatures. The six isotherms are 158° F. (70° C.), 212° F. (100° C.), 248° F. (120° C.), 302° F. (150° C.), 356° F. (180° C.), and 401° F. (205° C.).

The project was divided into three assignments, two to be accomplished through the efforts of the personnel of the Mississippi Geological Survey and the third by the computer personnel of the Mississippi Research and Development Center. The three assignments were (1) Data acquisition, (2) Data Storage, Retrieval and Interpretation, and (3) Geothermal Mapping and Conclusions.

DATA ACQUISITION

Data was acquired for the area shown in Figure 1. This area was selected for study because it was decided that if any geothermal source existed within the state it would be in this province. There are several geopressured gas reservoirs in this section of the state with their attendant high temperatures. Another reason this area was chosen was the availability of numerous electrical logs on dry oil tests as well as field wells from which bottom hole temperatures could be obtained.

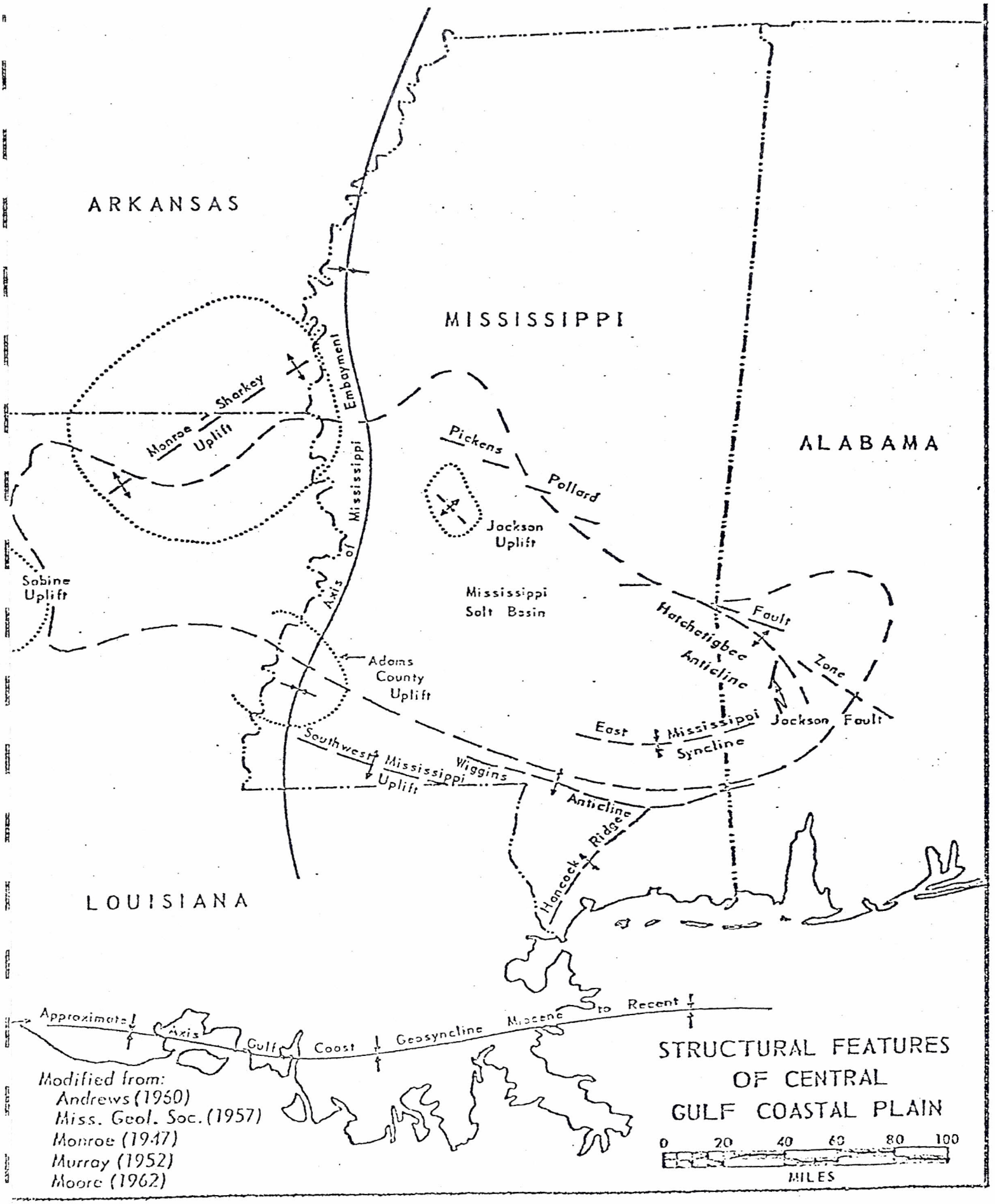
Criteria for determining which logs were to be used are as follows:



MISSISSIPPI

AN INVESTIGATION OF POTENTIAL GEOTHERMAL ENERGY SOURCE

gure 1


ARKANSAS
MISSISSIPPI
ALABAMA
LOUISIANA
Sharkey
Monroe Uplift
Embayment
Axis of Mississippi
Pickens
Pollard
Jackson Uplift
Sabine Uplift
Mississippi Salt Basin
Hatchetigbee Anticline
Fault
Zone
Adams County Uplift
East Mississippi Syncline
Jackson Fault
Southwest Mississippi Uplift
Wiggins Anticline
Ridge
Hancock
Approximate Axis
Gulf Coast Geosyncline
Miocene to Recent
Modified from:
Andrews (1960)
Miss. Geol. Soc. (1957)
Monroe (1947)
Murray (1952)
Moore (1962)
STRUCTURAL FEATURES OF CENTRAL GULF COASTAL PLAIN
0 20 40 60 80 100
MILES

gure 2

(a) Logs on wells with bottom hole temperatures that were 150^{o} F. or warmer.

(b) Logs with multiple runs.

(c) Logs that would give an areal spacing of one every two and a half to three miles where possible.

Base maps showing all drill holes in the study area were purchased from Tobin Research, San Antonio, Texas. These maps were constructed on a scale of 1 inch equal 4000 feet and also show sections, townships and ranges, and county seat towns. The maps were necessary in order to determine the selection of the logs to be used.

Approximately 5,000 logs were examined in 46 Counties, with 2,033 actually being used in the project. The first step in acquiring the data was to list pertinent information from the log heading onto the master sheet shown in Figure 3. The procedure was to copy the township, range, and section in the first column, the log code number in the second column, the operator, fee name, and well number in the third space, and the total depth of the well, as indicated on the log in the fourth column. The purpose of the master sheet was to provide a reference in the event mistakes were made on the data collection sheet shown in Figure 4.

Upon completion of listing the information of the selected wells in one particular county, step two was initiated.

In order to fully utilize the capabilities of the computer, it was necessary to express the location of the selected logs in latitude and longitude to four decimal places. Tobin Research Inc., San Antonio, Texas, offers a well coordinate service, which among other things gives the location of wells in latitude and longtitude to four decimal places. Through courtesy of Tobin, a reproduction of this service is shown in Figure 5. The Survey

T-R-S	LOG NO.	OPERATOR - FEE - WELL NO.	TOTAL DEPTH

purchased this information from Tobin and used it in the project.

The second step in data acquisition was the entering of information on data collection sheet shown in Figure 4 . This was accomplished by taking information from the well coordinate sheet and the electrical log and putting it under the appropriate headings of the data collection sheet.

There are eighty columns with fourteen main headings on this sheet. A description of each main heading, reading from left to right, is given below:

(a) ST - This abbreviation is for state. The American Petroleum Institute (A.P.I.) has assigned a number to each of the fifty states. The number 23 has been assigned to Mississippi.

(b) CO - CO stands for county and each county within the state has been assigned a number.

(c) API - A.P.I., as indicated above, stands for the American Petroleum Institute, but in this particular case it is the heading for the numbers that have been given to each individual well that has been drilled. This assignment of numbers is supervised by the oil and gas regulatory body within the state.

(d) Code - This is the heading for the number that has been given to each individual electrical log. Usually, private companies that reproduce electrical logs assign this number.

(e) RN - This abbreviation is for run and indicates whether or not more than one entry was made in the drill hole with the logging tool in the course of drilling the test.

(f) Depth - This heading indicates the depth in feet to which the electrical log tool was run.

ST	CO	API	CODE	RN	DEPTH	BHT	MDWT	PSI	ELEV	LAT. - LONG.	REMARKS	CWT	CW
										0 . .			
										0 . .			
										0 . .			
										0 . .			
										0 . .			
										0 . .			
										0 . .			
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										0 . .			

Figure 4

(g) BHT - This abbreviation is for the term bottom hole temperature and the number inserted under this heading is the measured temperature expressed in degrees Fahrenheit at the depth shown in the column immediately to the left.

(h) MDWT - MDWT is an abbreviation for the two words mud weight. The drilling fluid used in the course of drilling a test hole is weighed and its weight is expressed in pounds per gallon; this information is shown on the heading of the electrical log.

(i) PSI - This column was not used in this project. The abbreviation stands for pounds per square inch.

(j) ELEV - ELEV. is the abbreviation for elevation. It is in this column that the derrick floor elevation of the test hole is placed. This term is expressed in feet above mean sea level.

(k) LAT-LONG - This term is the abbreviation for latitude and longitude. The numbers placed in this column represent the location of the test hole expressed in degrees of latitude and longitude.

(l) REMARKS - Remarks is a self-explanatory term and will not be discussed here.

(m) CWT - This abbreviation is for county wide temperature. A county wide temperature is used as one of the limits in interpolating the depths to the various isotherms. This figure was determined by averaging water temperatures from water wells throughout the county.

(n) CWD - CWD is the abbreviation for county wide depth. This figure was ascertained by averaging the depths of the water wells from which the temperatures were taken. The CWT and CWD were both determined from information furnished by the Water Resources Division, U.S.G.S., Jackson, Mississippi.

STATE	County	Number	Card No.	OPERATOR	LEASE OR FARM NAME	WELL NUMBER	AREA AND/OR FIELD OR WILDCAT
23	001	00708	1	GERMANY GULMON	BUTLER LAURA	1 C	WC

STATE	County	Number	Card No.	Type Area	Abstract, Tract, Block	Sec.	Twp	Range	Completion Date Mo.	Day	Year	Total Depth	Well Class	Qual. Code	Dist. Code	Tobin Grid No.	Lamb. Zone	Coordinates X	Coordinates Y	Computed Latitude	Computed Longitude
23	001	00708	2			015	005N	003W	12	17	1961	07110	DGA	2	2	12N 069E	2	0163140	0330790	31.4049	091.4131

STATE	County	Number	Card No.	OPERATOR	LEASE OR FARM NAME	WELL NUMBER	AREA AND/OR FIELD OR WILDCAT
23	001	00746	1	KELLY BYRNE	SHIELDSBORO	1	WC

STATE	County	Number	Card No.	Type Area	Abstract, Tract, Block	Sec.	Twp	Range	Completion Date Mo.	Day	Year	Total Depth	Well Class	Qual. Code	Dist. Code	Tobin Grid No.	Lamb. Zone	Coordinates X	Coordinates Y	Computed Latitude	Computed Longitude
23	001	00746	2			027	004N	003W	02	28	1964	06900	DGA	2	2	11N 069E	2	0163150	0330530	31.3438	091.4123

STATE	County	Number	Card No.	OPERATOR	LEASE OR FARM NAME	WELL NUMBER	AREA AND/OR FIELD OR WILDCAT
23	001	00914	1	MARLIN EXPL	USA	1 X	WC

STATE	County	Number	Card No.	Type Area	Abstract, Tract, Block	Sec.	Twp	Range	Completion Date Mo.	Day	Year	Total Depth	Well Class	Qual. Code	Dist. Code	Tobin Grid No.	Lamb. Zone	Coordinates X	Coordinates Y	Computed Latitude	Computed Longitude
23	001	00914	2			004	005N	001W	04	02	1960	07010	DGA	2	2	12N 071E	2	0222080	0326170	31.3937	091.2240

STATE	County	Number	Card No.	OPERATOR	LEASE OR FARM NAME	WELL NUMBER	AREA AND/OR FIELD OR WILDCAT
23	001	00949	1	WILSON PET	NEWMAN LBR	1	WC

STATE	County	Number	Card No.	Type Area	Abstract, Tract, Block	Sec.	Twp	Range	Completion Date Mo.	Day	Year	Total Depth	Well Class	Qual. Code	Dist. Code	Tobin Grid No.	Lamb. Zone	Coordinates X	Coordinates Y	Computed Latitude	Computed Longitude
23	001	00949	2			056	006N	001W	03	07	1958	06610	DGA	2	2	12N 071E	2	0215290	0352080	31.4648	091.2465

STATE	County	Number	Card No.	OPERATOR	LEASE OR FARM NAME	WELL NUMBER	AREA AND/OR FIELD OR WILDCAT
23	001	00956	1	MISS TEX OIL PROD	NEWMAN CENTRAL LBR	1	WC

STATE	County	Number	Card No.	Type Area	Abstract, Tract, Block	Sec.	Twp	Range	Completion Date Mo.	Day	Year	Total Depth	Well Class	Qual. Code	Dist. Code	Tobin Grid No.	Lamb. Zone	Coordinates X	Coordinates Y	Computed Latitude	Computed Longitude
23	001	00956	2			027	006N	001W	10	12	1964	06623	DGA	2	2	12N 071E	2	0239090	0358010	31.4816	091.1703

STATE	County	Number	Card No.	OPERATOR	LEASE OR FARM NAME	WELL NUMBER	AREA AND/OR FIELD OR WILDCAT
23	001	00985	1	OLIN O&G	PARKER J W	1	WC

STATE	County	Number	Card No.	Type Area	Abstract, Tract, Block	Sec.	Twp	Range	Completion Date Mo.	Day	Year	Total Depth	Well Class	Qual. Code	Dist. Code	Tobin Grid No.	Lamb. Zone	Coordinates X	Coordinates Y	Computed Latitude	Computed Longitude
23	001	00985	2			002	003N	005W	06	20	1954	08141	DGA	2	2	11N 068E	2	0103680	0277510	31.2568	091.6017

STATE	County	Number	Card No.	OPERATOR	LEASE OR FARM NAME	WELL NUMBER	AREA AND/OR FIELD OR WILDCAT
23	001	01003	1	OMALLEY	MARSHALL	2	WC

STATE	County	Number	Card No.	Type Area	Abstract, Tract, Block	Sec.	Twp	Range	Completion Date Mo.	Day	Year	Total Depth	Well Class	Qual. Code	Dist. Code	Tobin Grid No.	Lamb. Zone	Coordinates X	Coordinates Y	Computed Latitude	Computed Longitude
23	001	01003	2			017	007N	002W	04	13	1965	06150	DGA	2	2	13N 070E	2	0181330	0396970	31.5873	091.3568

STATE	County	Number	Card No.	OPERATOR	LEASE OR FARM NAME	WELL NUMBER	AREA AND/OR FIELD OR WILDCAT
23	001	01075	1	PETERSEN H O	USA	1 L	WC

STATE	County	Number	Card No.	Type Area	Abstract, Tract, Block	Sec.	Twp	Range	Completion Date Mo.	Day	Year	Total Depth	Well Class	Qual. Code	Dist. Code	Tobin Grid No.	Lamb. Zone	Coordinates X	Coordinates Y	Computed Latitude	Computed Longitude
23	001	01075	2			019	005N	001W	08	08	1961	06600	DGA	2	2	12N 071E	2	0238370	0334320	31.4165	091.1720

STATE	County	Number	Card No.	OPERATOR	LEASE OR FARM NAME	WELL NUMBER	AREA AND/OR FIELD OR WILDCAT
23	001	01087	A	PHILLIPS	ARTMAN VIC	2	PINE RIDGE

STATE	County	Number	Card No.	Type Area	Abstract, Tract, Block	Sec.	Twp	Range	Completion Date Mo.	Day	Year	Total Depth	Well Class	Qual. Code	Dist. Code	Tobin Grid No.	Lamb. Zone	Coordinates X	Coordinates Y	Computed Latitude	Computed Longitude
23	001	01087	6			026	003N	002W	04	04	1947	10276	DGA	2	2	14N 070E	2	0202630	0414160	31.6351	091.2838

STATE	County	Number	Card No.	OPERATOR	LEASE OR FARM NAME	WELL NUMBER	AREA AND/OR FIELD OR WILDCAT
23	001	01101	1	PHILLIPS	STOWERS	1	WC

STATE	County	Number	Card No.	Type Area	Abstract, Tract, Block	Sec.	Twp	Range	Completion Date Mo.	Day	Year	Total Depth	Well Class	Qual. Code	Dist. Code	Tobin Grid No.	Lamb. Zone	Coordinates X	Coordinates Y	Computed Latitude	Computed Longitude
23	001	01101	2			026	004N	002W	01	30	1962	10115	DGA	2	2	13N 070E	2	0192640	0424520	31.6602	091.3018

Upon the completion of entering the information on the data collection sheet, the key punch operators of the Mississippi Research and Development Center computer section took the data collection sheets and input the information from these sheets onto eighty (80) column tabulating cards. After the computer section was unable to perform the interpretive portion of the project, Mr. Ray Wallace with the U.S.G.S. Gulf Coast Hydroscience Center, Bay St. Louis, Mississippi was contacted and permission to utilize their computer program to complete the project was granted.

The computer program that was used in the interpretive portion of the project has been designated AP 235 and was developed by the U.S.G.S. Gulf Coast Hydroscience Center in Bay St. Louis, Mississippi. It was designed to calculate the sub-sea depth of occurrence of seven isothermal surfaces. This program has incorporated the ability to determine the corrected or "equilibrium" temperatures plus the geothermal gradient of the wells used in the study. The geothermal gradient is expressed in degrees Fahrenheit per hundred feet of depth. The seven temperatures are 122^{o} F. (50^{o} C.), 158^{o} F. (70^{o} C.), 212^{o} F. (100^{o} C.), 248^{o} F. (120^{o} C.), 302^{o} F. (150^{o} C.), 356^{o} F. (180^{o} C.), and 401^{o} F. (205^{o} C.).

The equipment used in computation and well plotting was a Data 100 Terminal tied into a 360/91 IBM computer and Calcomp plotter with a thirty (30) inch drum. The AP 235 program converts latitude and longtitude locations into Universal Transverse Mercator Coordinates then outputs a table of pertinent information and a set of punch cards. The punch cards are fed into the Calcomp plotter which plots the location of the wells,

types the well code number over the well spot and types the sub-sea depth to the designated temperature under the well spot. In the event two well spots fall too close to each other the plotter assigns a unique number to the well and prints a table showing this unique number with the well code number and sub-sea depth to its side. This is called a table of over post points.

Geothermal Mapping

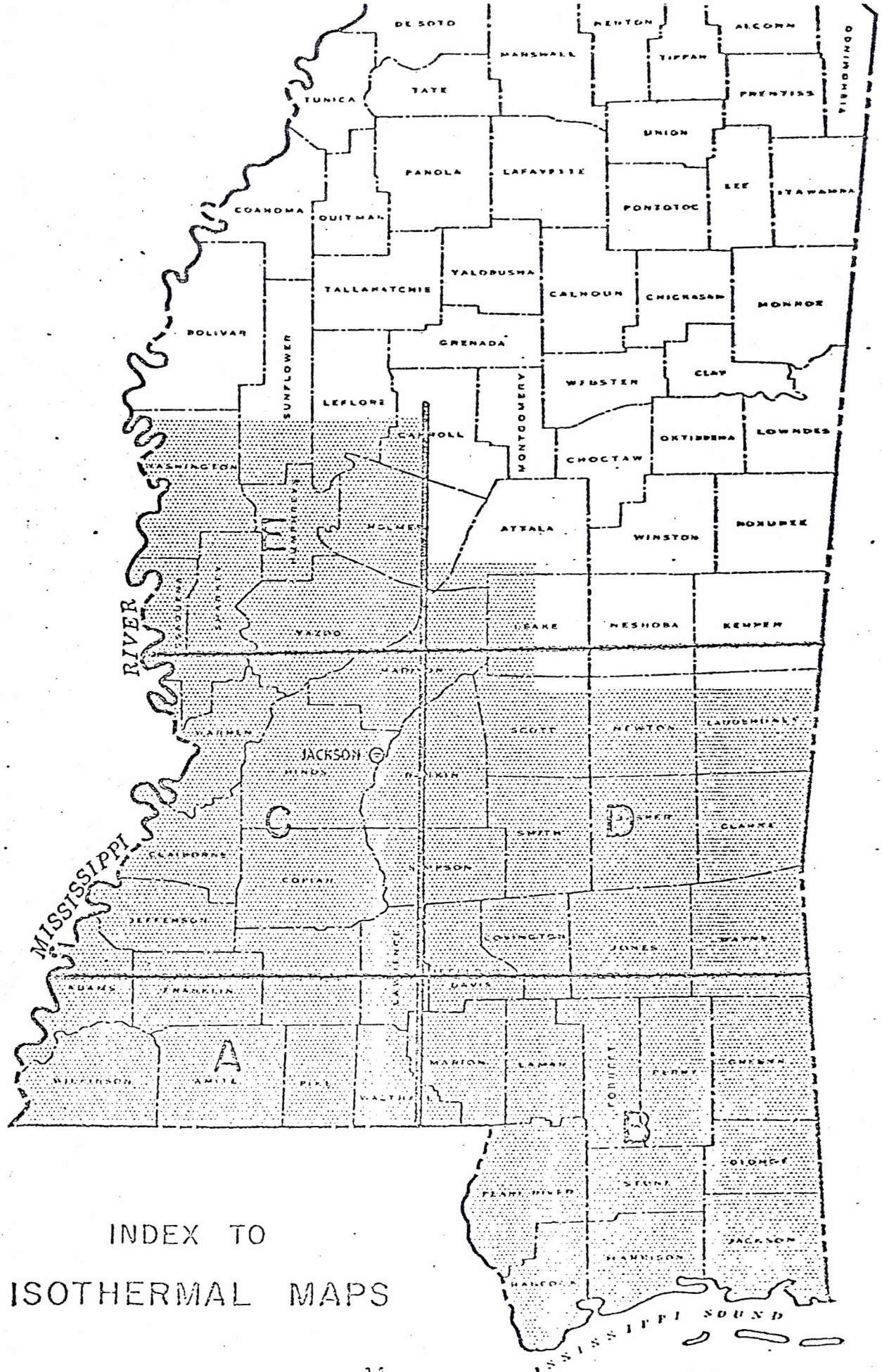
The output from the computer using the AP 235 program provided sufficient data for the construction of six subsurface isothermal maps. The isotherms are as follows: 122° F. (50° C.), 158° F. (70° C.), 212° F. (100° C.), 248° F. (120° C.), 302° F. (150° C.), 356° F. (180° C.). There was insufficient data on the 401° F. (205° C.) isotherm to construct a map as only three wells in the project area were deep enough to reach the aforementioned isotherm. A map has been prepared showing the location, name, total depth and corrected subsea depth to the 401° F. (205° C.) isotherm. In our original proposal we did not intend to include a map on the 122° F. (50° C.) isotherm as the AP 235 program had not been developed to a point where the lower temperature could be calculated.

The isothermal maps that are included with this report have been labeled as follows:

Map 1	158° F. (70° C.) isotherm
Map 2	212° F. (100° C.) isotherm
Map 3	248° F. (120° C.) isotherm
Map 4	302° F. (150° C.) isotherm
Map 5	356° F. (180° C.) isotherm

The location map of the 401° F. (205° C.) isotherm wells is labeled Map 6.

The first three isothermal maps were constructed using an approximate scale of 1 to 250,000. Due to their size, they were divided into five



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ISOTHERMAL MAPS

gure 6

sections as shown in Figure 6. The two remaining isothermal maps, as well as the 401° F. (205° C.) location map, were constructed using an approximate scale of 1 to 500,000.

Various contour intervals were used in interpreting the data and the interval is designated on each individual map.

The subsurface isothermal maps were contoured manually. The U.S.G.S. Hydroscience Center in Bay St. Louis, Mississippi has the capability to do computer mapping but due to the amount of time involved in using their facilities it was decided to do the work manually.

Conclusions

Results of this study have indicated that there are areas in south and south central Mississippi that are favorable for further development of the geothermal resource within the state. The assessment of the geo-temperature regime is the first step in the exploration process and serves to isolate the more prospective areas.

Detailed reservoir studies in the more prospective areas such as net sand thickness, porosity and permeability should follow this project. Elimination of areas where there is oil or gas production may be necessary due to legal considerations.

It may be that the most significant contribution to the development of geothermal energy in this portion of the Gulf Coastal Plain will be in the low to intermediate temperature range. This resource can help meet our ever increasing need for energy.

MAP I-A

SUBSURFACE ISOTHERMAL MAP

CONTOURED ON 158°F (70°C) ISOTHERMAL SURFACE

CONTOUR INTERVAL 200'
CONTROL POINTS •

10 0 10 MILES
10 0 10 20 KILOMETERS
SCALE

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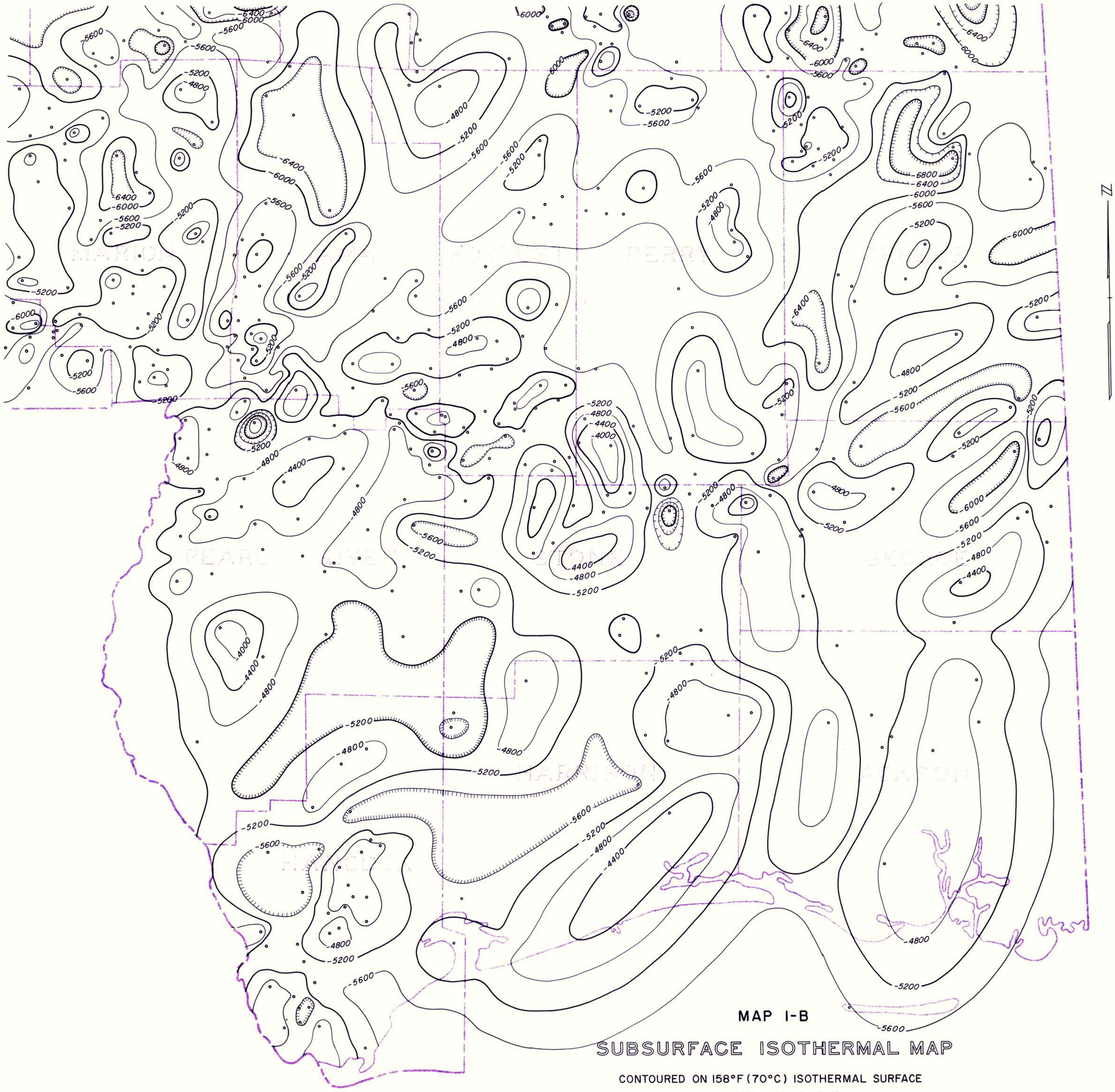
MERCURY MAPS INC



MAP I-B

SUBSURFACE ISOTHERMAL MAP

CONTOURED ON 158°F (70°C) ISOTHERMAL SURFACE

CONTOUR INTERVAL 400'

CONTROL POINTS •

10 0 10 10 MILES

10 0 10 20 KILOMETERS

SCALE

DRAWN BY MERCURY MAPS INC. JACKSON, MISSISSIPPI

FILE NO. 1

N

MAP I-C

SUBSURFACE ISOTHERMAL MAP

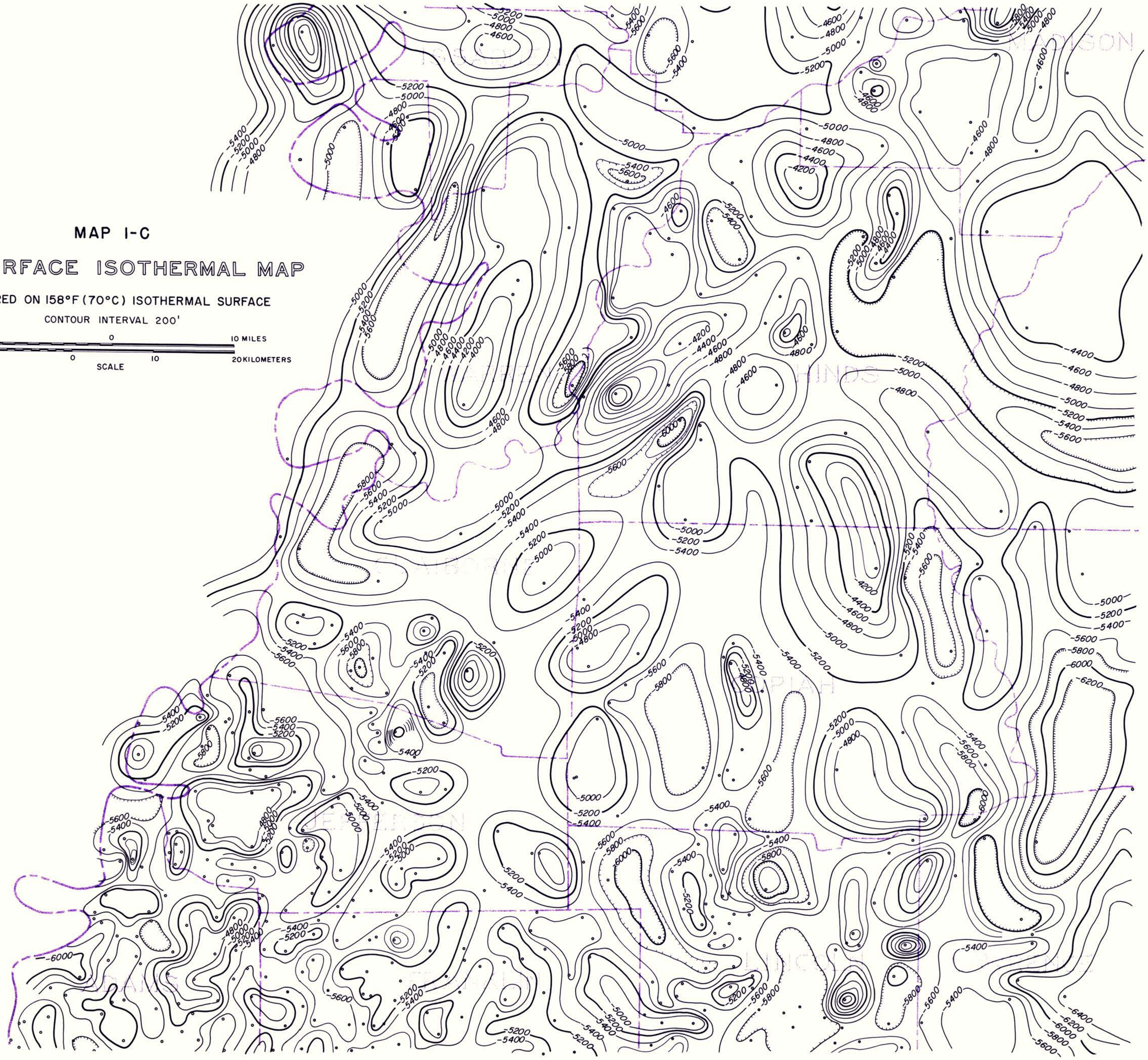
CONTOURED ON 158°F (70°C) ISOTHERMAL SURFACE

CONTOUR INTERVAL 200'

10 0 10 MILES

10 0 10 20 KILOMETERS

SCALE



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JACKSON, MISSISSIPPI

MAP I-D

SUBSURFACE ISOTHERMAL MAP

CONTOURED ON 158°F (70°C) ISOTHERMAL SURFACE

CONTOUR INTERVAL 400'
CONTROL POINTS •

10 0 10 MILES

10 0 10 20 KILOMETERS

SCALE

N

FILE NO. 1

MAP I-E

SUBSURFACE ISOTHERMAL MAP

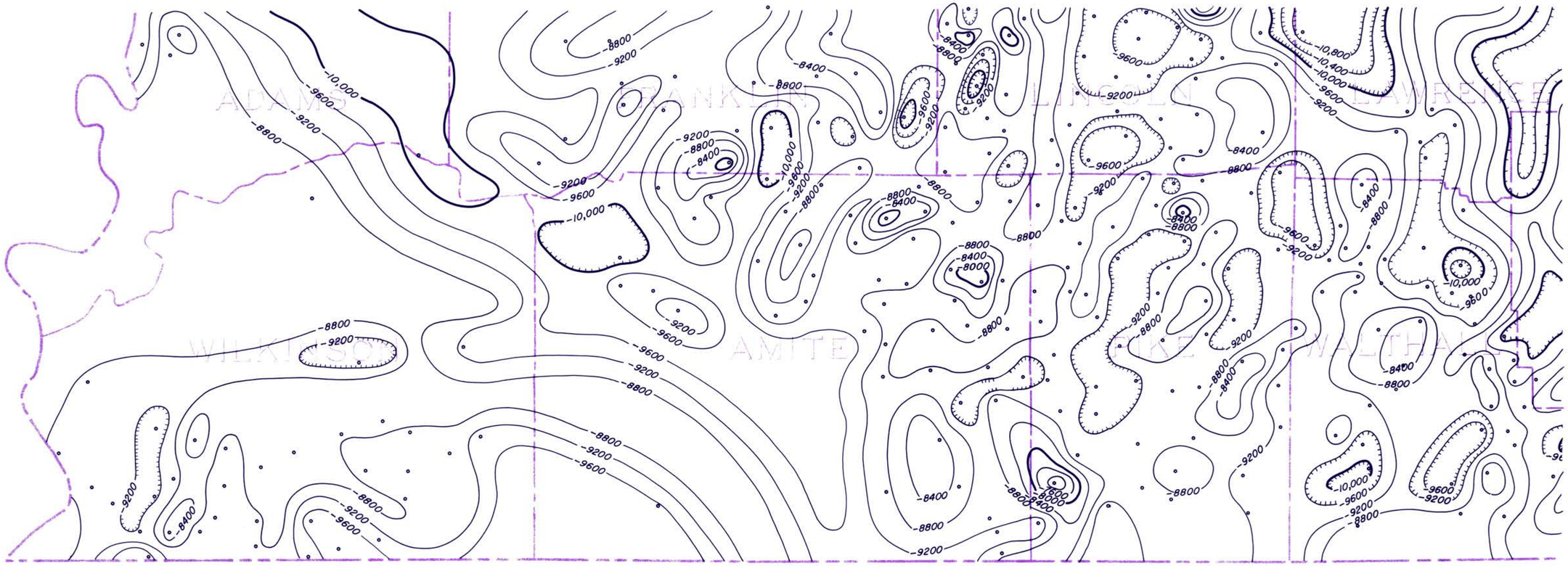
CONTOURED ON 158°F (70°C) ISOTHERMAL SURFACE

CONTOUR INTERVAL 200'
CONTROL POINTS •

10 0 10 MILES
10 0 10 20 KILOMETERS
SCALE

FILE NO. 1

N



MAP 2-A

SUBSURFACE ISOTHERMAL MAP

CONTOURED ON 212°F (100° C) ISOTHERMAL SURFACE

CONTOUR INTERVAL 400'
CONTROL POINTS •

10 0 10 MILES
10 0 10 20 KILOMETERS
SCALE

FILE NO. 1

MAP 2-B

SUBSURFACE ISOTHERMAL MAP

CONTOURED ON 212°F (100°C) ISOTHERMAL SURFACE

CONTOUR INTERVAL 400'
CONTROL POINTS •

10 0 10 MILES
10 0 10 20 KILOMETERS
SCALE

N

MERCURY MAPS INC.

MAP 2-C

SUBSURFACE ISOTHERMAL MAP

CONTOURED ON 212°F (100°C) ISOTHERMAL SURFACE

CONTOUR INTERVAL 400'
CONTROL POINTS •

10 0 10 MILES

10 0 10 20 KILOMETERS

SCALE

PREPARED BY MERCURY MAPS INC. VICKSBURG, MISSISSIPPI

FILE NO. 1

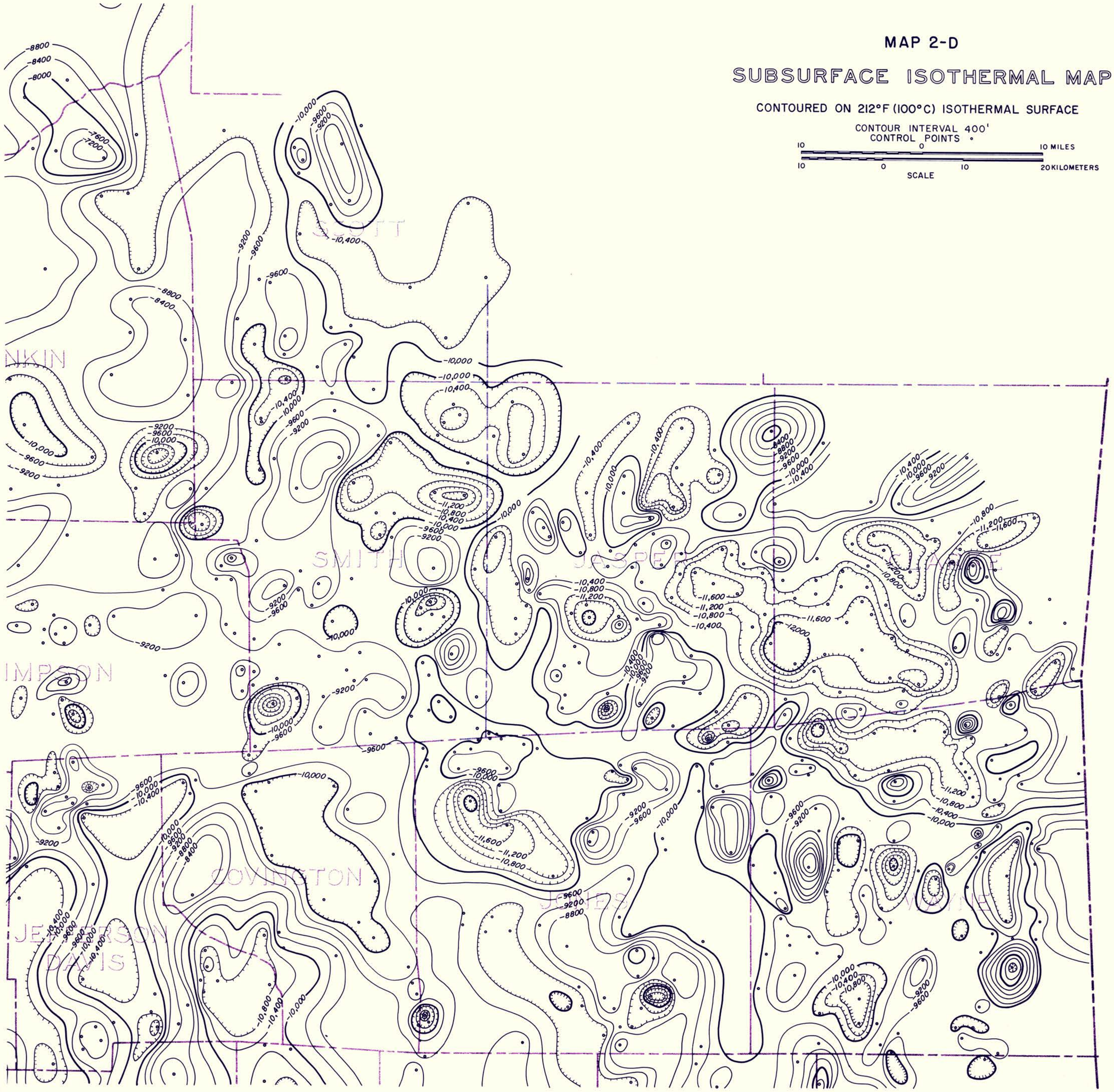
MAP 2-D

SUBSURFACE ISOTHERMAL MAP

CONTOURED ON 212°F (100°C) ISOTHERMAL SURFACE

CONTOUR INTERVAL 400'
CONTROL POINTS •

10 0 10 MILES
10 0 10 20 KILOMETERS
SCALE



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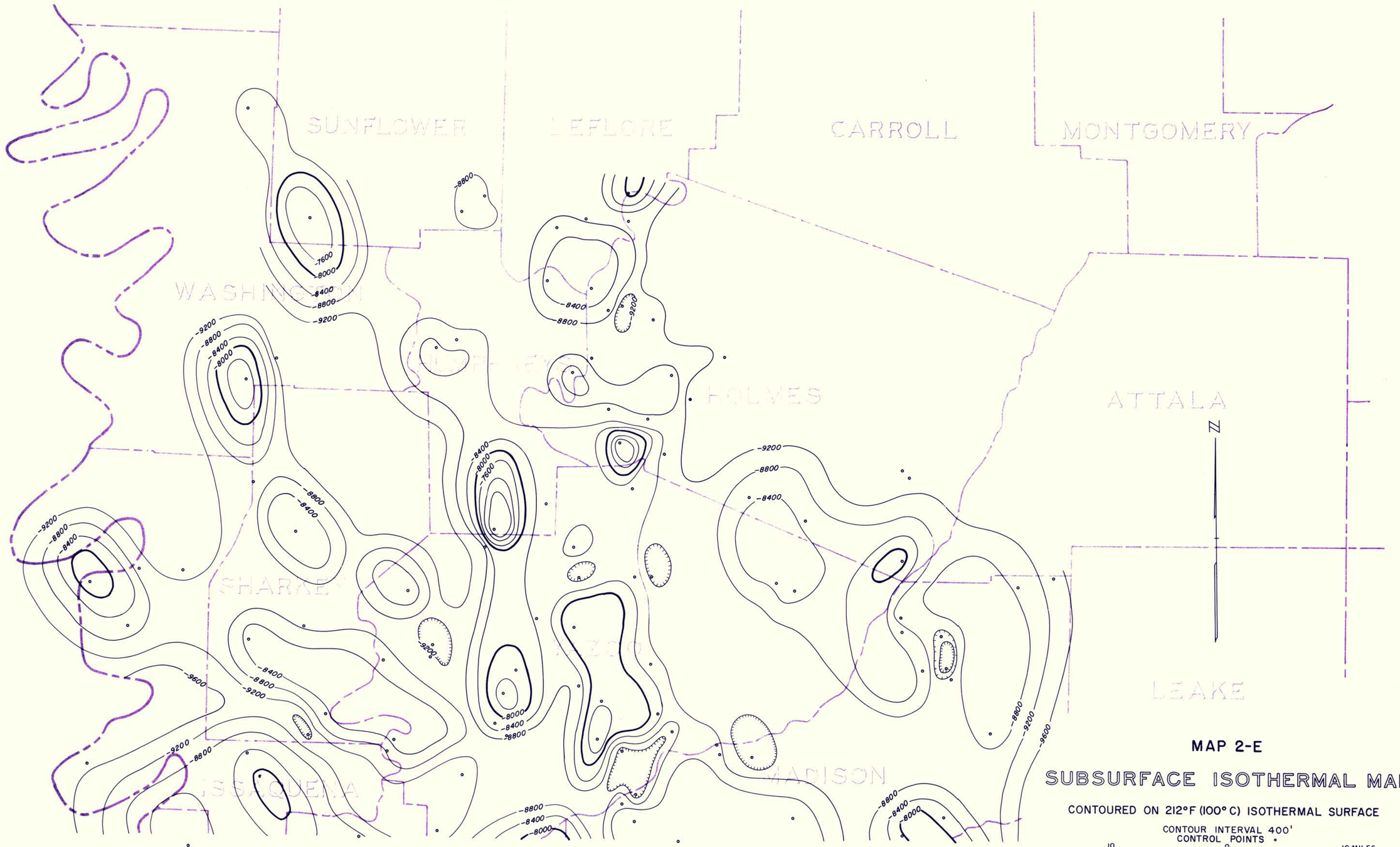
FILE NO. 1



MAP 2-E

SUBSURFACE ISOTHERMAL MAP

CONTOURED ON 212°F (100°C) ISOTHERMAL SURFACE

CONTOUR INTERVAL 400'
CONTROL POINTS •

10 0 10 MILES
10 0 10 20 KILOMETERS
SCALE

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N

ADAMS FRANKLIN LINCOLN LAWRENCE

WILKINSON AMITE PIKE WALTHALL

MAP 3-A

SUBSURFACE ISOTHERMAL MAP

CONTOURED ON 248°F (120°C) ISOTHERMAL SURFACE

CONTOUR INTERVAL 400'
CONTROL POINTS •

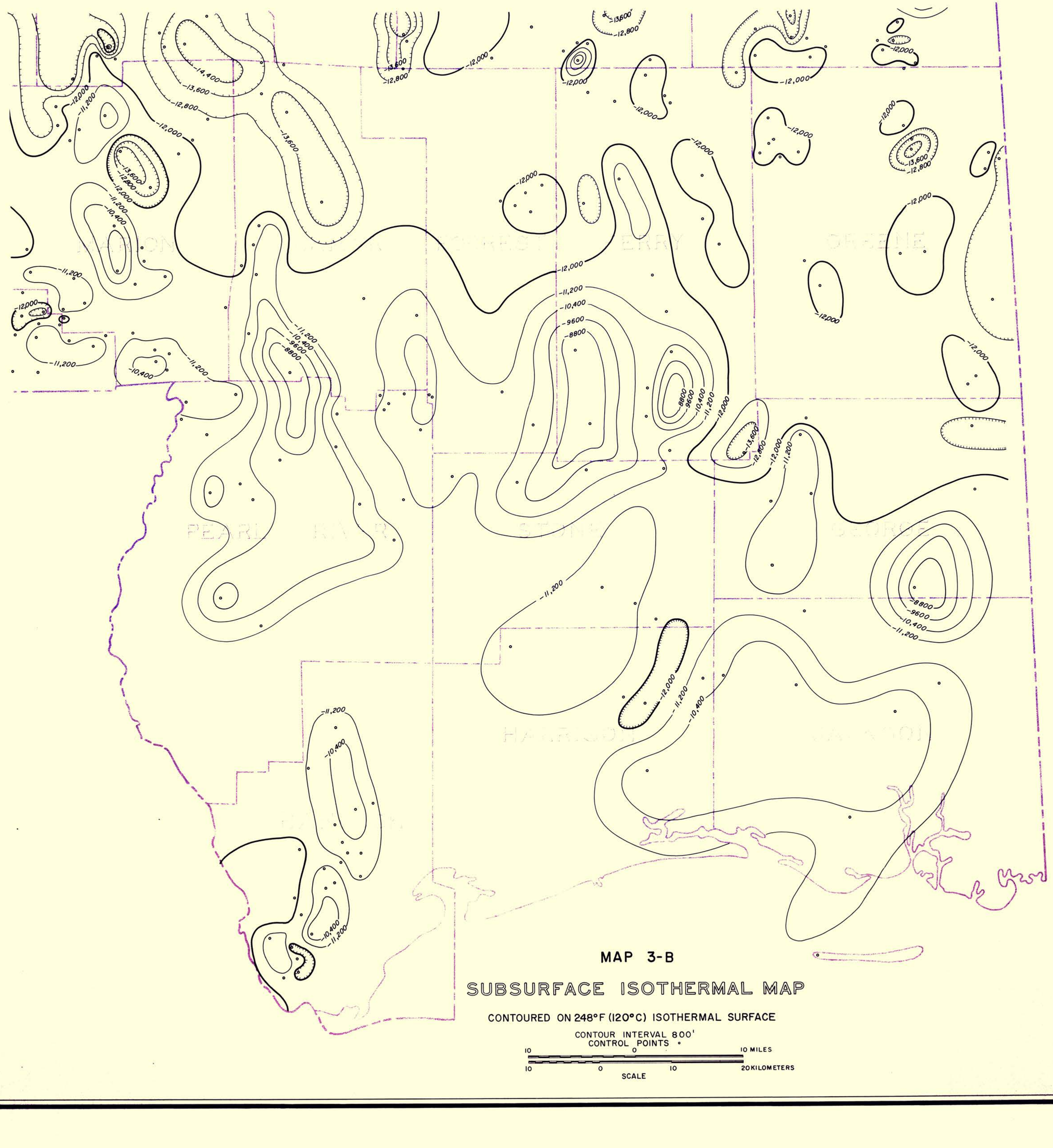
10 0 10 MILES

10 0 10 20 KILOMETERS

SCALE

PREPARED BY MERCURY MAPS INC.

FILE NO. 1



MAP 3-B

SUBSURFACE ISOTHERMAL MAP

CONTOURED ON 248°F (120°C) ISOTHERMAL SURFACE

CONTOUR INTERVAL 800'
CONTROL POINTS •

10 0 10 MILES

10 0 10 20 KILOMETERS

SCALE

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MERCURY MAPS INC.

N

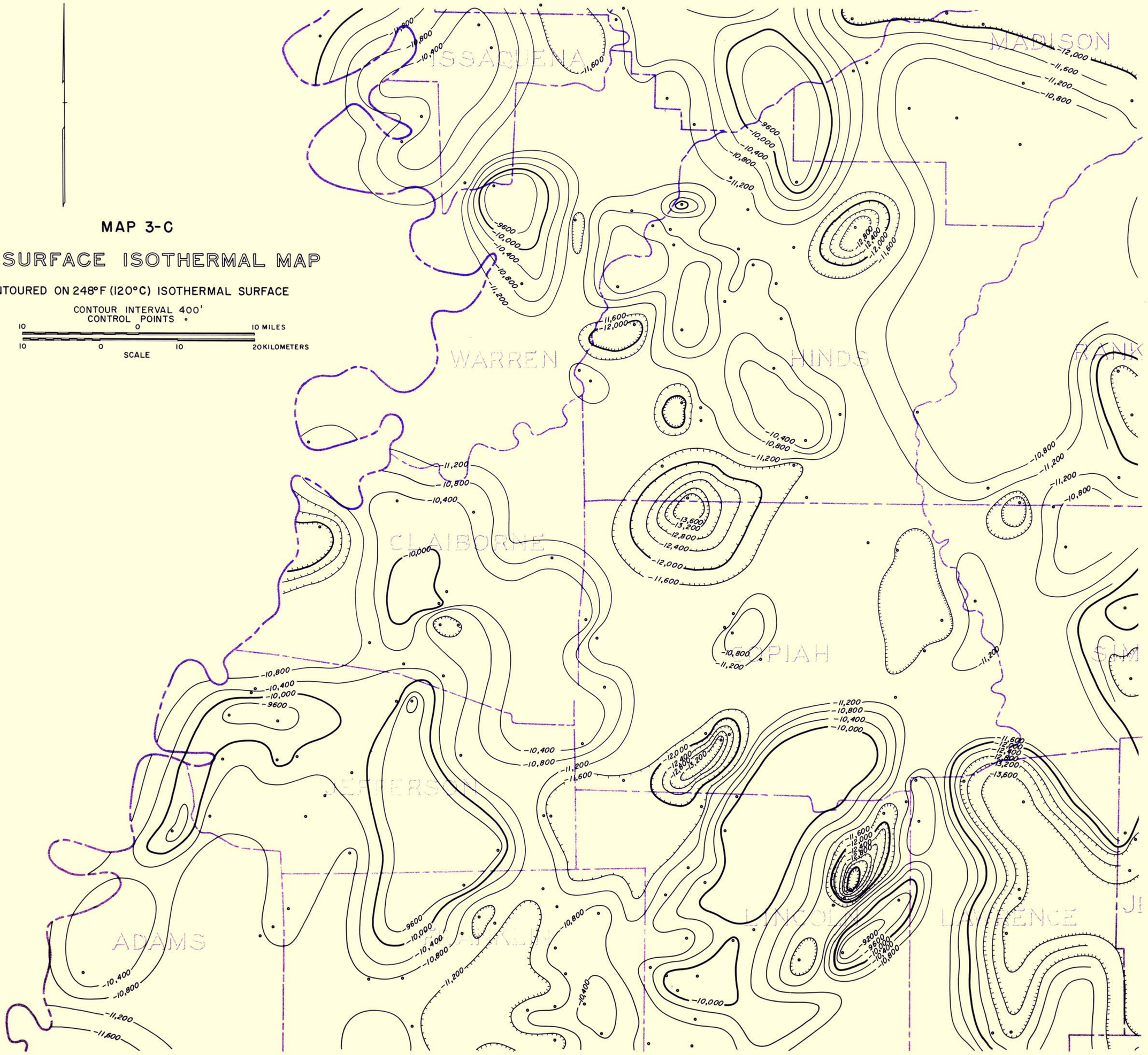
MAP 3-C

SUBSURFACE ISOTHERMAL MAP

CONTOURED ON 248°F (120°C) ISOTHERMAL SURFACE

CONTOUR INTERVAL 400'
CONTROL POINTS •

10 0 10 MILES
10 0 10 20 KILOMETERS
SCALE



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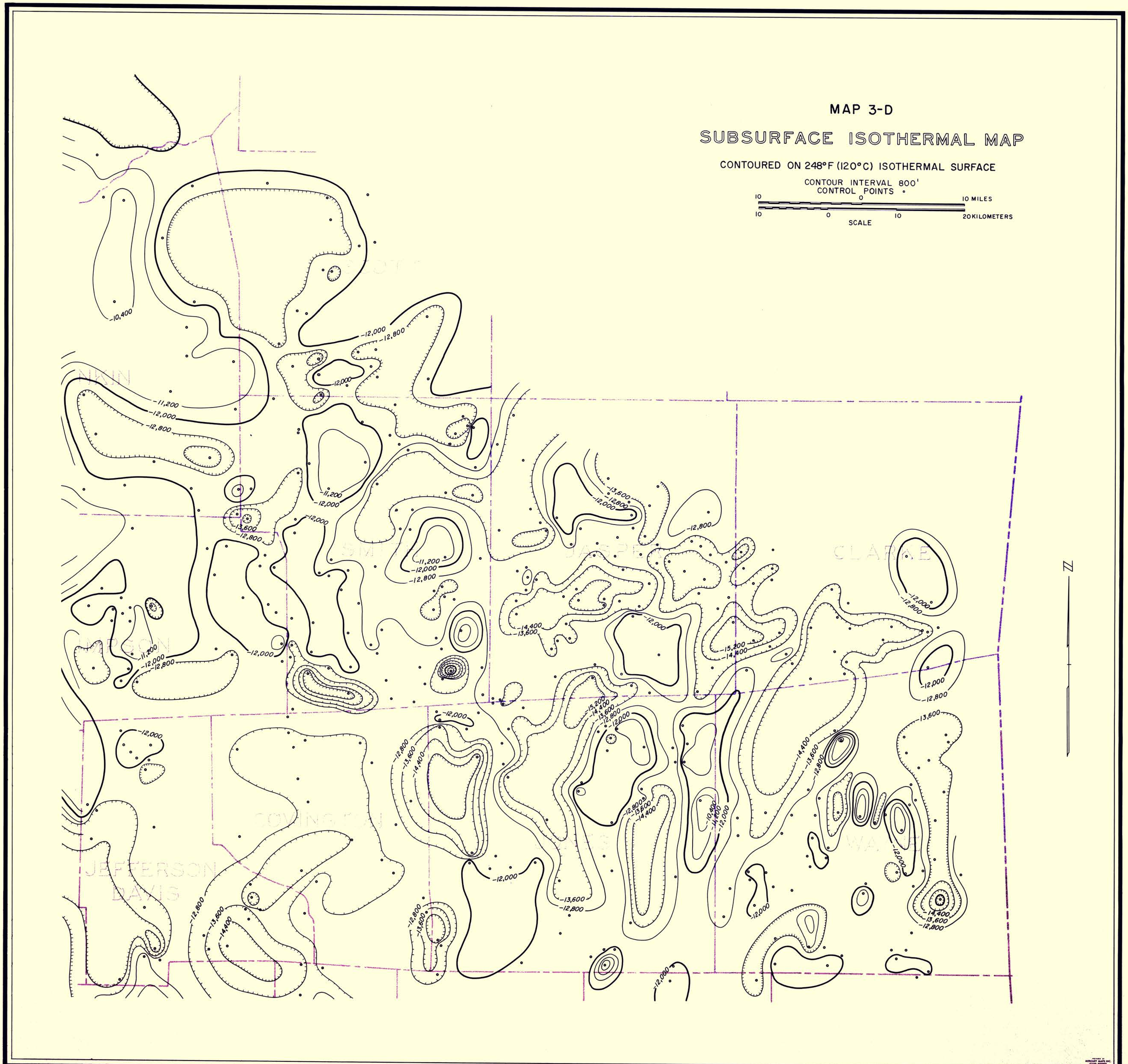
JACKSON, MISSISSIPPI

FILE NO. 1



MAP 3-D
SUBSURFACE ISOTHERMAL MAP
CONTOURED ON 248°F (120°C) ISOTHERMAL SURFACE
CONTOUR INTERVAL 800'
CONTROL POINTS
10 0 10 MILES
10 0 10 20 KILOMETERS
SCALE
N
NKIN
CLARKE
COVINGTON
JEFFERSON DAVIS

FILE NO. 1

N

MAP 3-E

SUBSURFACE ISOTHERMAL MAP

CONTOURED ON 248°F (120° C) ISOTHERMAL SURFACE

CONTOUR INTERVAL 400'
CONTROL POINTS •

10 0 10 MILES

10 0 10 20 KILOMETERS

SCALE

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MERCURY MAPS INC.
DENVER, COLORADO

MAP 4

SUBSURFACE ISOTHERMAL MAP

CONTOURED ON 302°F (150°C) ISOTHERMAL SURFACE

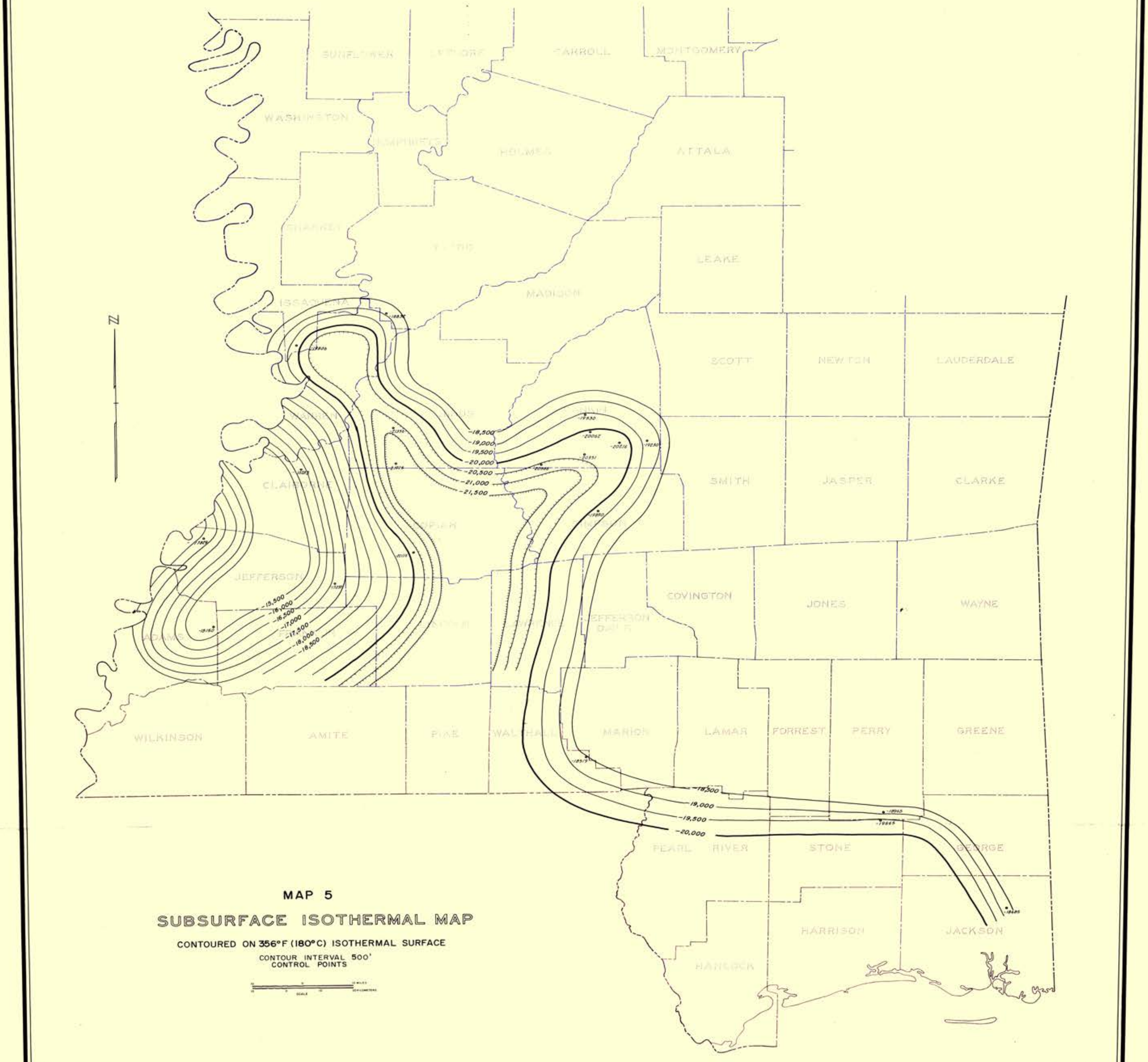
CONTOUR INTERVAL 1000'
CONTROL POINTS •

SCALE 10 0 10 MILES
10 0 10 20 KILOMETERS

N

SUNFLOWER LEFLORE CARROLL MONTGOMERY
WASHINGTON HOLMES ATTALA
SHARKEY YAZOO LEAKE
MADISON
WARREN HINDS RANKIN SCOTT NEWTON LAUDERDALE
CLAIBORNE COPIAH SIMPSON SMITH JASPER CLARKE
JEFFERSON COVINGTON JONES WAYNE
ADAMS FRANKLIN LINCOLN LAWRENCE JEFFERSON DAVIS
WILKINSON AMITE PIKE WALTHALL MARION LAMAR FORREST PERRY GREENE
PEARL RIVER STONE GEORGE
HARRISON JACKSON

FILE NO. 1



MAP 5

SUBSURFACE ISOTHERMAL MAP

CONTOURED ON 356°F (180°C) ISOTHERMAL SURFACE

CONTOUR INTERVAL 500'
CONTROL POINTS

SCALE

FILE NO. 1

N

PLACID
● No. 1 - Owen 25-8
-24096
T.D. 25,460

PENNZOIL
● No. 1 - Piazza Heirs
-20,698
T.D. 20,704

TOMLINSON INT.
● No. 1 - L.G. Radcliffe
-17,127
T.D. 20,190

MONTGOMERY
ATTALA
LEAKE
SCOTT
NEWTON
LAUDERDALE
SMITH
JASPER
CLARKE
COVINGTON
JONES
WAYNE
LAMAR
FORREST
PERRY
GREENE
PEARL RIVER
STONE
GEORGE
HARRISON
JACKSON
HANCOCK
WILKINSON
AMITE
PIKE
WALTHALL
MARION
ADAMS
FRANKLIN
JEFFERSON
CLAIBORNE

MAP 6

LOCATION MAP

SUBSEA DEPTH

401° F. (205° C.) ISOTHERM

FILE NO. 1