Report of Investigations No. 110

GEOTHERMAL POTENTIALS IN SOUTH DAKOTA

by Robert A. Schoon and Duncan J. McGregor

SOUTH DAKOTA GEOLOGICAL SURVEY
DEPARTMENT OF NATURAL RESOURCE DEVELOPMENT
VERMILLION, SOUTH DAKOTA – 1974

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FRONT COVER: Solfatara, southern Italy. The road to Naples once ran past the hot springs of Solfatara, where there was a perpetual bubbling and fuming of sulfurous waters. This early eighteenth century illustration shows the hot springs area. The sheds to the left were used for the extraction of alum. *(McNitt, 1963. Photo courtesy of the California Division of Mines and Geology, San Francisco, California)*

BACK COVER: Geyser steam field seen through expansion bend in 2,000-foot steam line which transports steam from the field to the plant. *(Photo courtesy Pacific Gas and Electric Company)*

STATE OF SOUTH DAKOTA
Richard Kneip, Governor

DEPARTMENT OF NATURAL RESOURCE DEVELOPMENT
Vern W. Butler, Secretary

GEOLOGICAL SURVEY
Duncan J. McGregor, State Geologist

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INTRODUCTION

Throughout history man has been aware of "hot spots" evidenced at the surface of the earth by such naturally occurring phenomena as hot water springs, fumaroles, boiling mud pots, geysers, and volcanoes. In ancient times these events were believed to be exhibitions of temper displayed by angry mythical gods. Today these same phenomena are being investigated as possible sources of geothermal energy.

Geothermal is a term that refers to the natural heat generated within the earth. Commonly when this heat is released it is in the form of visible occurrences such as mentioned in the preceding paragraph. Perhaps there is no greater awe-inspiring sight than that of a volcano or a geyser such as Old Faithful during eruption, but there are other heat losses from the earth's interior that are not so spectacular. These less spectacular phenomena are the subject of this report.

With development of civilization man has increased technology and has probed ever deeper in the surface of the earth. As wells were drilled deeper and mine workings extended downward it became known that temperature increased at a fairly uniform rate. This increase of temperature with increase of depth is known as the geothermal gradient. The geothermal gradient then may be a clue to the conductivity of rocks and in part serves to project distances from heat sources. Data from numerous measurements of temperatures in wells throughout the world show that in normal areas the geothermal gradient is approximately 1.7 degrees Fahrenheit per 100 feet of depth. Lines connecting locations of equal geothermal gradients are known as isogradient contours. An area contoured in this manner is termed an isogradient map. Such a map has been constructed for the State of South Dakota and appears as figure 1.

PURPOSE

The purpose of this report is to consolidate information from previous reports and information from recent field investigations into a single publication that contains all the current basic data known to the South Dakota Geological Survey. In addition an attempt is made to reference such data to geological trends and to evaluate potential sources of geothermal energy.

SOURCES OF INFORMATION

Temperatures of water from wells (for the most part flowing wells) recorded in older publications are included in the study and are properly referenced in appendix I. The bottom-hole temperature that appears on the heading of many commercial well logs of previously drilled oil tests was another important source of data and these measurements are also identified by well name in appendix I. Recently, field trips to different areas of the State were made and temperatures were recorded from numerous flowing wells. It is noted at this point that many scientific journals use the metric system in a study of this nature; however, the bulk of the information in the files of the South Dakota Geological Survey record measured temperature in degrees Fahrenheit and depths in terms of feet. For reasons of expediency the practice of using the measurements in degrees Fahrenheit and depths in feet is continued in this report. Conversion from degrees Fahrenheit to degrees Centigrade is given by the formula, $^{\circ}C = 5/9\ (^{\circ}F - 32^{\circ})$.

MARGINS OF ERROR

The authors are well aware that most of the data used in this report do not reflect true measurements of water temperature at depth. For instance, it is nearly a certainty that the temperature of the water at the wellhead is lower than the temperature at the bottom of the well because the water must cool on the way up the well bore. This cooling effect is more pronounced in a well with a small flow than in a well with a large flow. Thus, the procedure of measuring the temperature of the water at the wellhead and using this measurement as the bottom-hole temperature is in error.

Another source of error is the use of bottom-hole temperatures from oil tests as a true measurement. In nearly all drilling operations drilling muds are used to circulate cuttings out of the hole and to cool and lubricate the bit. This fluid circulates to a mud pit or tank and especially during the winter season gives off heat. This cooled fluid is circulated down hole and certainly cools the formation in the near vicinity of the borehole prior to taking the bottom-hole temperature. However, the reader is advised that these known errors have the effect of making the temperatures in appendix I and the geothermal gradients plotted in figure 1 conservative in nature.

USE OF GEOTHERMAL RESOURCES

For more than a century geothermal resources have been used for the benefit of mankind throughout the world. Such uses include space heating, air conditioning, agricultural heating, extraction of chemicals, therapeutical baths, and energy. Table 1 lists the principal worldwide utilization of geothermal resources excluding that used for the generation of electricity.

Space Heating

The idea of drilling wells to tap hot water for heating purposes is not a new concept. According to Bullard (1971, p. 328) "the September 1885 issue of the *Geological Magazine* . . . J. Starkie Gardner refers

TABLE 1

Principal Utilization (Other Than For Electricity) Of Geothermal Resources
(Modified from Muffler, 1973)

SPACE HEATING

Country: Iceland
Localities: Reykjavik, Hveragerdi, Selfoss, Saudarkrokur, Olafsfjordur, and Dalvik

Country: Hungary
Localities: Various localities

Country: U.S.S.R.
Localities: Caucausus Mountains, Kazakhstan, Kamchatka

Country: New Zealand
Locality: Rotorua

Country: United States
Localities: Klamath Falls, Oregon; Boise, Idaho

AGRICULTURAL HEATING

Country: Iceland
Locality: Hveragerdi

Country: U.S.S.R.
Localities: Various localities

Country: Hungary
Localities: Various localities

Country: Japan
Localities: Various localities

Country: Italy
Locality: Castelnuovo

Country: United States
Locality: Lakeview, Oregon

AIR CONDITIONING

Country: New Zealand
Locality: Rotorua

PRODUCT PROCESSING

Paper

Country: New Zealand
Locality: Kawerau

Diatomite

Country: Iceland
Locality: Namafjall

Salt

Country: Japan
Locality: Shikabe, Hokkaido

BYPRODUCTS

Dry Ice

Country: United States
Locality: Imperial Valley, California

Boron

Country: Italy
Locality: Larderello

Calcium Chloride

Country: United States
Locality: Imperial Valley, California

to an attempt then being made to obtain a supply of heat by drilling. He says: *'. . . the deepest artesian well in the world is being bored at Pesth, already 951 meters . . . The present temperature is 161°F. and they propose to continue until water 178°F. is obtained.' "*

The earth's natural heat is used in many countries for interior heating. For example, in Iceland over 45,000 people live in homes heated by thermal waters. This source of heat is used also to warm greenhouses for the growing of flowers and vegetables.

In New Zealand, geothermal steam heat is used to heat homes and hospitals and to clean farm buildings. Klamath Falls, Oregon, uses natural hot water from some 350 wells to heat 500 schools, industrial buildings, and homes. In Japan natural heat is used to evaporate sea water to produce salt. Chickens in Kenya hatch with the aid of heat supplied by thermal waters. A trading post and a ranch in New Mexico are heated by hot spring water.

At Midland, South Dakota, where the municipal water supply is 160°F at the wellhead (fig. 2) the water is used to heat the public school buildings. Ranchers in the same general area use the hot water from their deep artesian wells to heat their homes, farrowing buildings, garages, and cattle shelters. However, in the vast majority of cases the natural heat of the water is allowed to waste. For example, water from the municipal well at Philip, South Dakota, (fig. 3) has a temperature of 158°F and the heat is allowed to dissipate in Lake Waggoner (fig. 4) before the water is used for a public water supply.

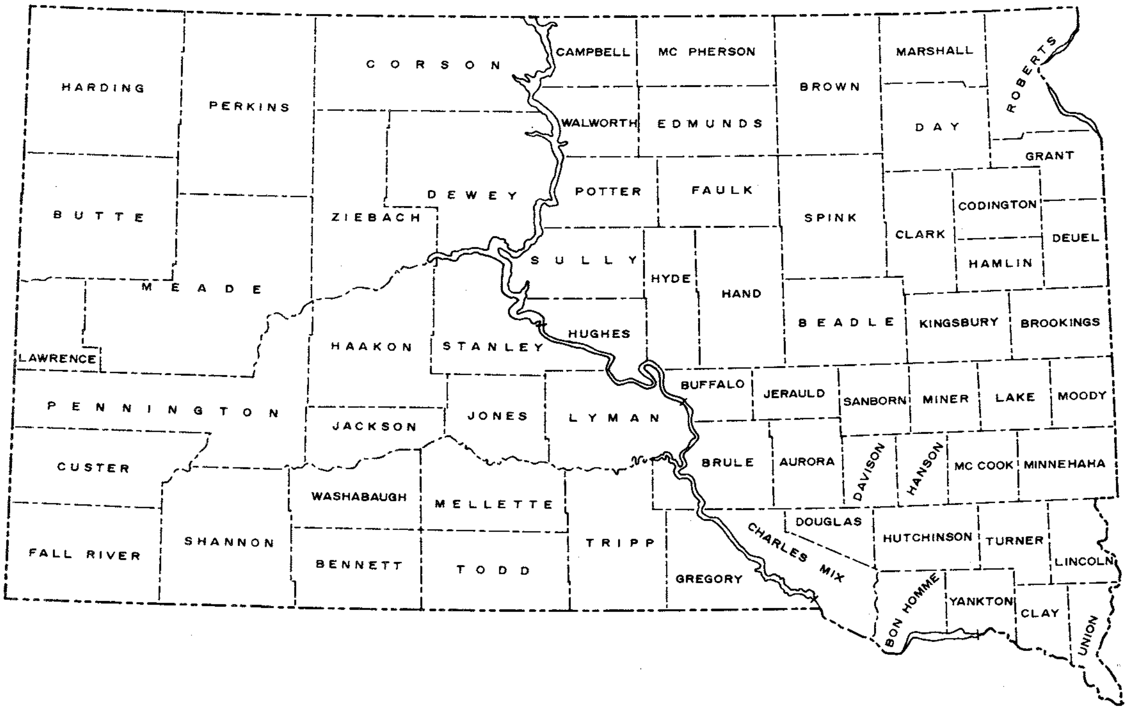

HARDING
PERKINS
CORSON
CAMPBELL
MC PHERSON
BROWN
MARSHALL
ROBERTS
WALWORTH
EDMUNDS
DAY
BUTTE
ZIEBACH
DEWEY
POTTER
FAULK
SPINK
GRANT
CODINGTON
CLARK
DEUEL
HAMLIN
MEADE
SULLY
HYDE
HAND
BEADLE
KINGSBURY
BROOKINGS
HAAKON
STANLEY
HUGHES
LAWRENCE
PENNINGTON
BUFFALO
JERAULD
SANBORN
MINER
LAKE
MOODY
JACKSON
JONES
LYMAN
CUSTER
BRULE
AURORA
DAVISON
HANSON
MC COOK
MINNEHAHA
WASHABAUGH
MELLETTE
DOUGLAS
HUTCHINSON
TURNER
CHARLES MIX
FALL RIVER
SHANNON
BENNETT
TODD
TRIPP
GREGORY
LINCOLN
BON HOMME
YANKTON
CLAY
UNION

Figure 2. Photograph of the municipal well at Midland, S. D. The small building in the foreground houses the Midland city well. Hot water from this well heats the gymnasium in left background and the classroom building in right background.

To illustrate the potential value of a hot water well, the following example is used. If a well yields 160°F water at a rate of 200 gpm (such as the Midland municipal well) and if heat extraction is 100 percent effective from 160°F to 45°F (annual mean temperature) the well should yield 184,000 Btu per minute. This is approximately the equivalent of 12 pounds of coal per minute or about 8 tons of coal per day.

Hot Water

Natural hot water is used for cleaning and for therapeutic purposes. Numerous spas exist in all parts of the world and depend on natural hot water for hydrotherapy that was not available elsewhere. Today modern drugs and availability of hydrotherapy in hospitals have caused the closing of many thermal-water spas. Still some persist, for many people annually visit warm spas because they enjoy bathing and swimming in such waters. Evans' Plunge, Hot Springs, South Dakota, is one such spa. The natural heated water has a temperature of 87°F.

The Stroppel Hotel at Midland is another enterprise that has utilized the hot artesian waters (see fig. 5). Many people have bathed in the mineralized water provided by the Hotel for its therapeutic effect.

Energy

The first attempt to use natural steam and/or hot water to generate electrical power was made by M. Ginori Conti in the Larderello area in northern Italy. During World War II this generating plant was destroyed. It has since been rebuilt and according to Macdonald (1972, p. 338-9) the present generators are capable of producing approximately 3 billion kilowatts of electricity per year. A graph illustrating world electrical generating capacity from geothermal sources is shown as figure 6.

After World War II New Zealand became interested in the potential of geothermal power. In 1950 a project was authorized at Wairakei, North Island, to build a plant complex in two stages having

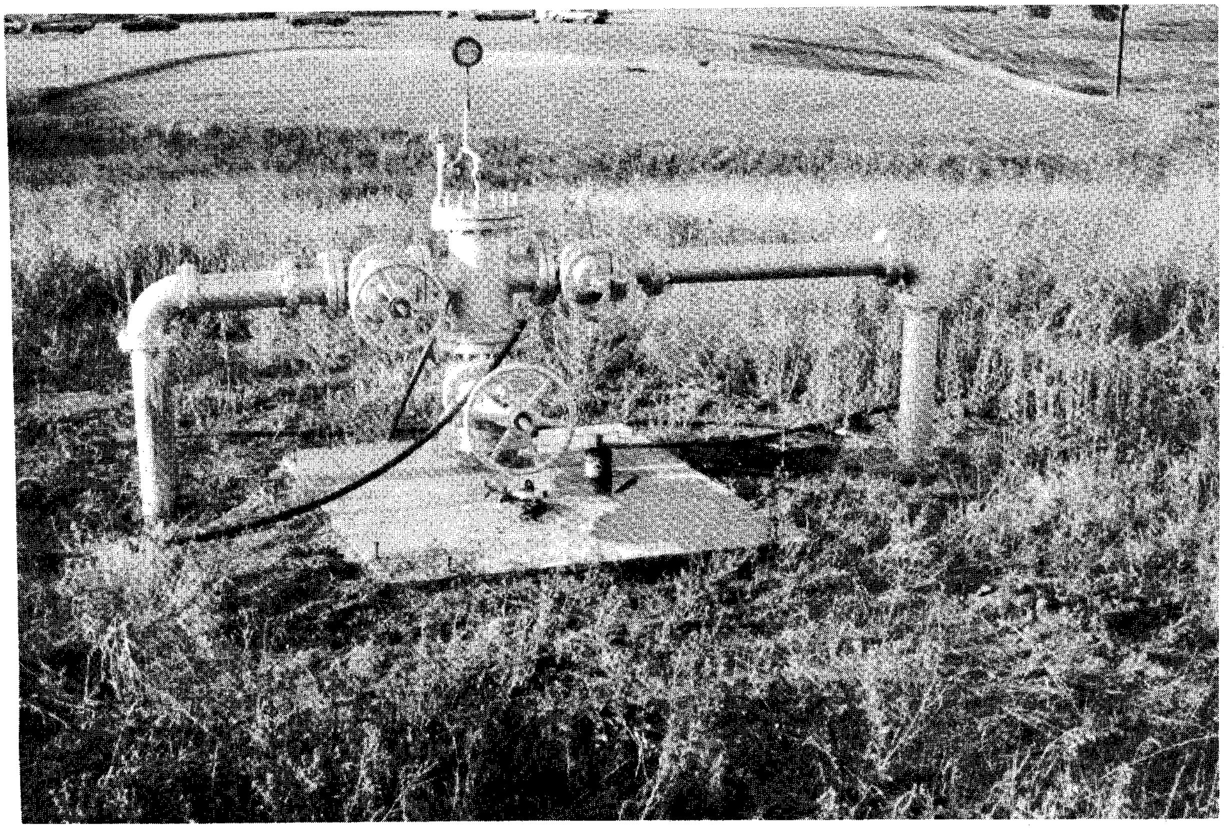


Figure 3. Photograph of the municipal well at Philip, S. D. The well yields water at a temperature of 158° Fahrenheit.

the capacity of 192,000 kilowatts. Construction of the two-stage phase was completed in 1963, and plans are under way to expand the capacity to 282,000 kw (McNitt, 1963, p. 8).

The success in the utilization of geothermal power in Italy and New Zealand prompted the countries of Iceland, Mexico, Japan, El Salvador, Costa Rica, Kenya, Burma, Philippines, Taiwan, Tunisia, Venezuela, Russia, and the western United States to initiate exploration and development projects. The geysers in northern Sonoma County, California, were tapped and a plant was built in 1960 (fig. 7), expanded in 1963, and now generates about 24,000 kw. According to Loehwing (1973, p. 14) this geothermal field will soon be producing 412,000 kw of electricity and be the largest geothermal generating site in the world (see fig. 8). The purchaser of this power, the Pacific Gas and Electric Company, projects 1,300,000 kw by 1980, and geologists are confident the field can produce 2,600,000 kw when fully developed which is four times the current needs of the city of San Francisco. The project appears so successful that future power projects are now being considered elsewhere in California, Nevada, Oregon, New Mexico, and Hawaii (McNitt, 1963, p. 8).

More recently, Utah Power and Light and Geothermal Kinetics formed a joint venture (Utah Steam Venture) to explore for geothermal energy sources in Box Elder County, Utah. Lease acquisition is currently under way and as of January 1, 1974, approximately 600,000 acres of land were leased by the Company (Petroleum Information, 1974).

Geothermal power potential may be an important consideration in those areas where other forms of economical power sources are limited. History shows us that the rise and fall of nations is dependent upon the availability of cheap energy. Thus, if areas of South Dakota show potential of yielding geothermal energy, the state and the nation will be benefited.

Minerals

The initial use of the geothermal steam fields at Larderello, Italy, was to recover boric acid. Now such chemical compounds as sulphur, ammonium sulphate, ammonium carbonate, and carbon dioxide are extracted. In New Zealand thought is being given toward the extraction of sodium chloride, potassium chloride, and lithium carbonate from geothermal brine fields (Summers, 1968, p. 4). Pilot plants are in

Figure 4. Photograph of the Philip municipal well discharging water into Lake Waggoner. The water is allowed to cool and is then used as a public water supply.

operation near the Salton Sea in southern California for the recovery of brine minerals from thermal waters.

The chemistry of natural thermal waters may enhance the utilization of a geothermal area in that recovery of minerals may be economically profitable. On the other hand the water chemistry may also present a pollution problem if discharged into streams. Any developer of geothermal energy should consider the possibility of reinjecting the spent water into its original system or aquifer in order to maintain equilibrium and reduce pollution.

Agriculture

In the vicinity of the hot springs in Iceland mild temperatures permit the growing of many plants not possible elsewhere on the island. In some cases the warm areas are extended by moving hot water through pipes in the soil (Bullard, 1971, p. 354). The approximate annual mean temperature in Iceland is 37°F compared to 45°F in South Dakota. It is quite possible that if this practice were carried out in South Dakota to increase soil temperature in the spring, two short maturing crops could be consistently successful. In the area where much winter wheat is raised many acres are underlain by a high thermal gradient. Perhaps a piped hot water system could be employed to increase germination in the fall and stimulate growth in the early spring. However, it is likely that high-yield orchard operations and greenhouse endeavors would give a greater return on investment and will one day be a common sight in south-central South Dakota.

Legal Problems

Where a natural resource is available for development, legal problems commonly arise and geothermal resources are no exception. Most states, including South Dakota, do not have laws governing the leasing of state-owned lands for geothermal development. Existing federal laws do not adequately cover geothermal development on federal lands. It has not been determined if a geothermal resource is considered a water or a mineral resource. If the former, the geothermal resource would belong to the patented owner of the surface land. If the latter, the rights were reserved by the government when the land

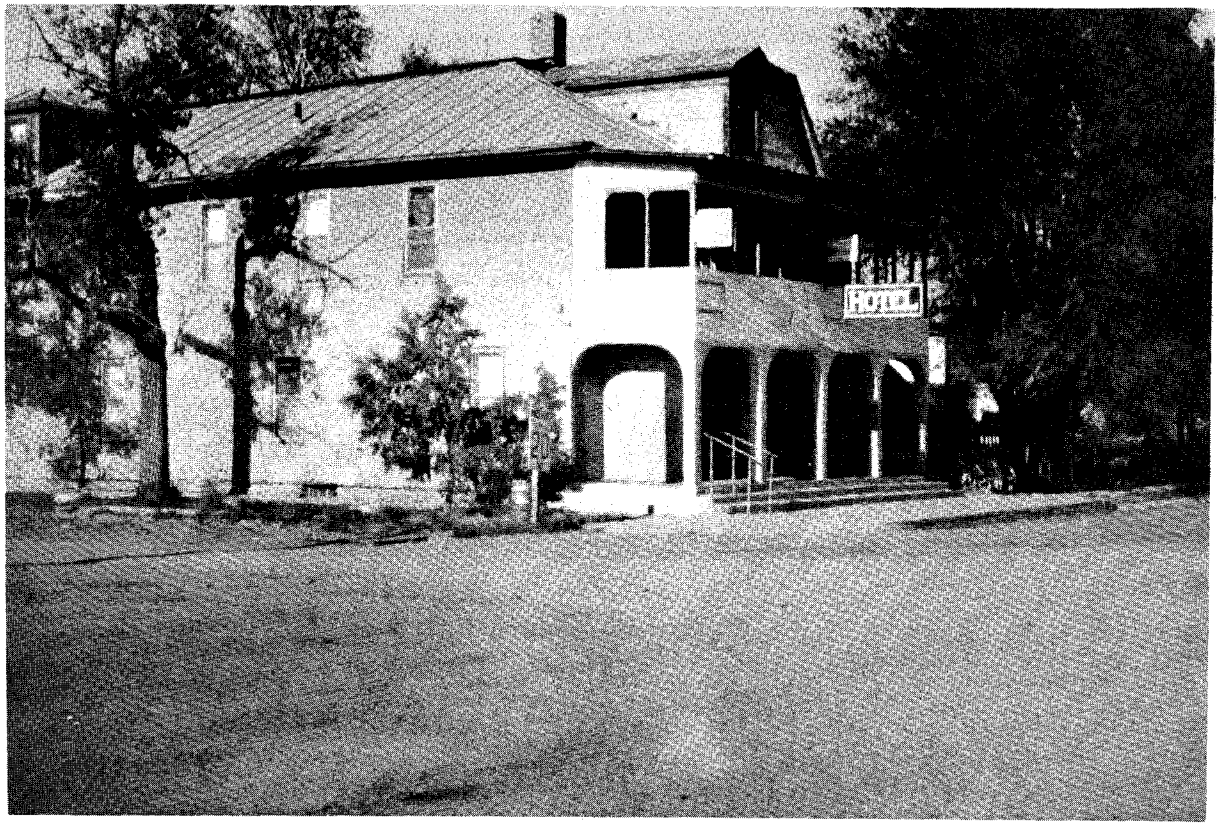


Figure 5. Photograph of the Stroppel Hotel at Midland where the owner utilizes an artesian well to provide hot mineral baths for customers.

was patented. Because of the lack of a legal definition of a geothermal resource (i.e., water or mineral), development of geothermal resources in the United States has been restricted to lands owned by private enterprises or individuals.

The July 23, 1973 issue of the Federal Register states, " *'Geothermal resource province' means an area in which higher than normal temperatures are likely to occur with depth and there is a reasonable possibility of finding reservoir rocks that will yield steam or heated fluids to wells. The classification of such a province is based on geologic inference and a determination that the area possesses one or more of the following characteristics:*

(1) Volcanism of late Tertiary or Quaternary age--especially caldera structures, cones, and volcanic vents;

(2) geysers, fumaroles, mud volcanoes, or thermal springs at least 40°F higher than average ambient temperatures; and

(3) subsurface geothermal gradients generally in excess of two times normal, as reflected in deep water wells, oil well tests, and other test holes.

Paragraph K

> *'Known geothermal resource area' or 'KGRA' means an area in which the geology, nearby discoveries, competitive interests, or other indicia would, in the opinion of the Secretary, engender a belief in men who are experienced in the subject matter that the prospects for extraction of geothermal steam or associated geothermal resources are good enough to warrant expenditures of money for that purpose."*

From the foregoing one can see that the Federal Government's required characteristics for an area to be classified as a Geothermal Resource Province are rather vague. For instance the phrase "or thermal springs at least 40°F higher than average ambient temperatures" indicates an appreciable wide variation depending on whether the spring is located in South Dakota or southern Texas. Also in the phrase "subsurface geothermal gradients generally in excess of two times normal," the term is not defined. If the average world geothermal gradient of 1.7°F/100 feet

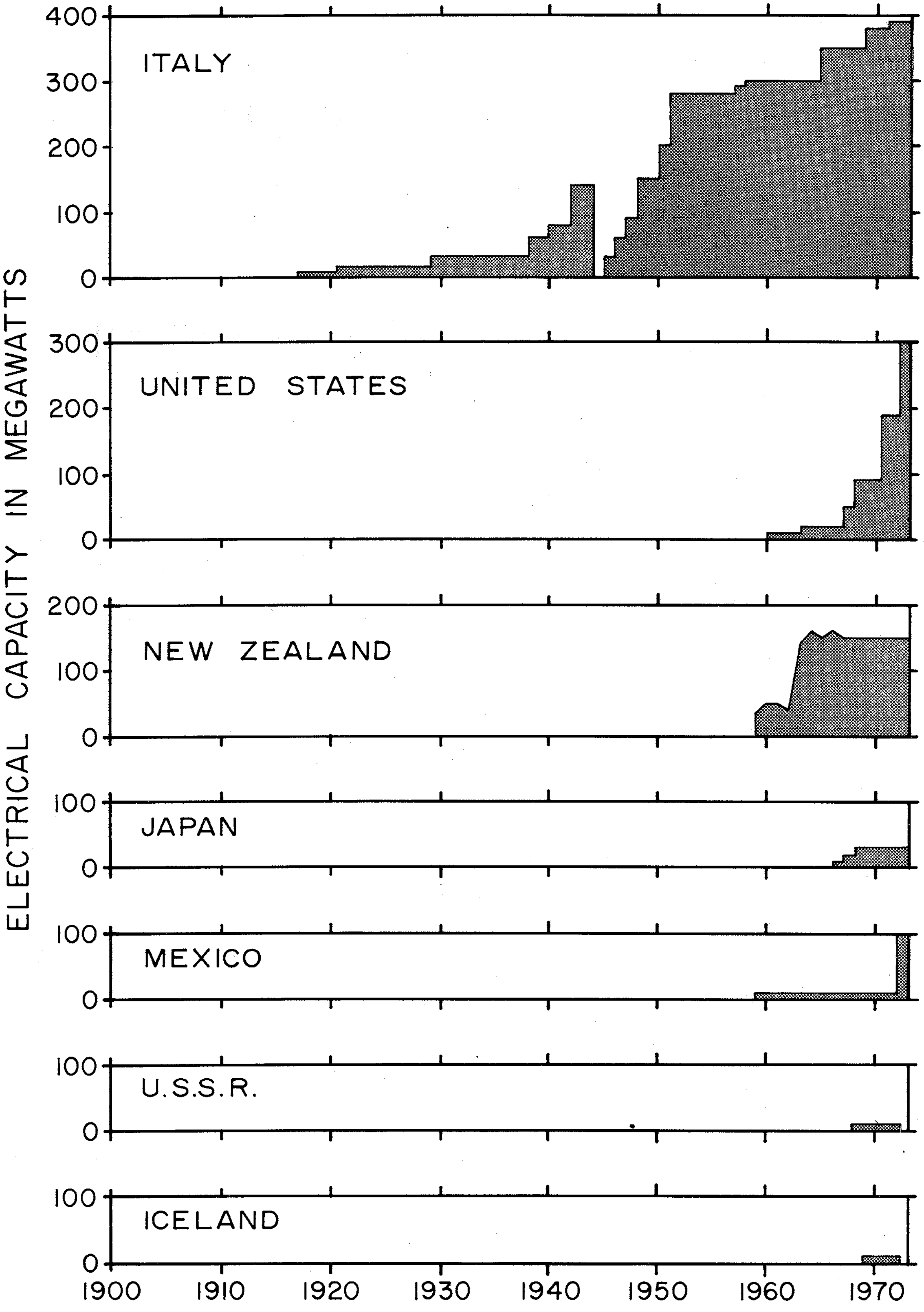


Figure 6. Graph illustrating growth of geothermal generating capacity by countries from 1900–1972. (from Muffler, 1973)

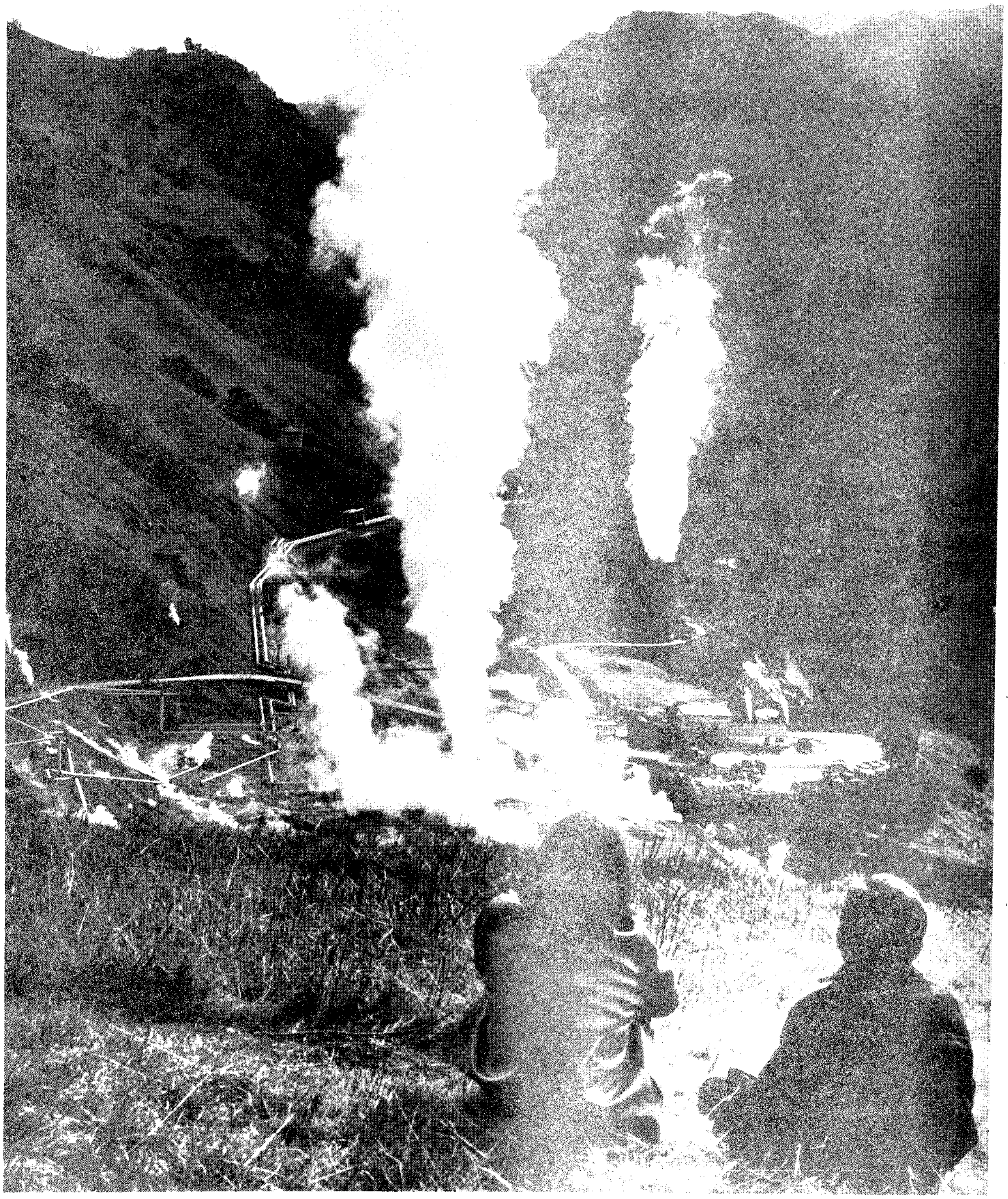


Figure 7. Photograph of Units 1 and 2 of Pacific Gas and Electric Company's "The Geysers Power Plant" in Sonoma County, California. The plant is located about 90 miles north of San Francisco. These two units went into operation in 1960 and 1963 respectively and have a combined capacity of 24,000 kilowatts. *(Photo courtesy of the Pacific Gas and Electric Company.)*

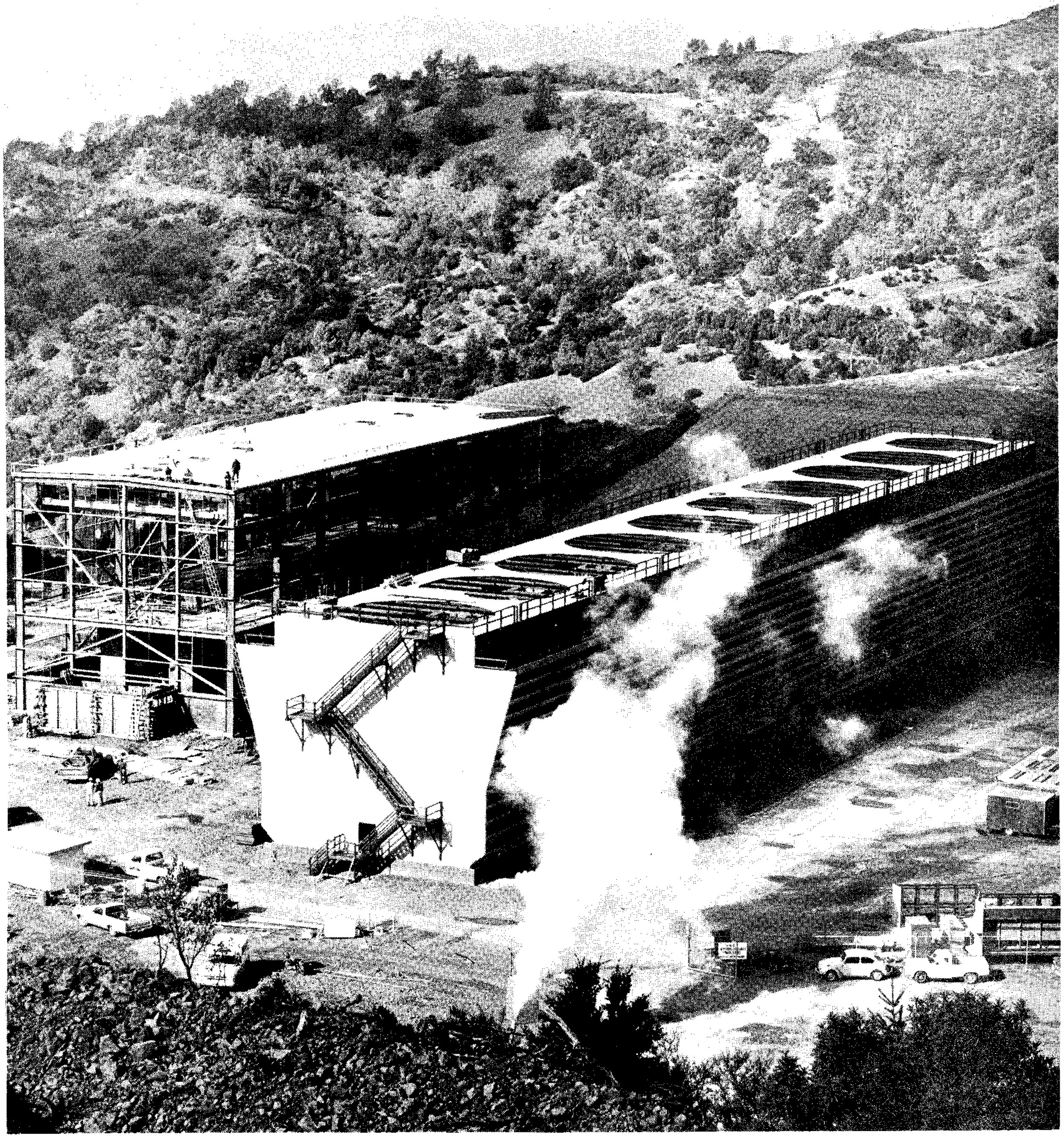


Figure 8. Units 9 and 10 of Pacific Gas and Electric Company's "The Geysers Geothermal Power Plant" in Sonoma County are shown here nearing completion. These two new units, each with a 53,000 kilowatt capacity, increase the capacity to 396,000 kilowatts. With these units operational the Geysers are now the largest geothermal field in the world, surpassing the output of Lardarello, south of Pisa, Italy. *(Photo – Courtesy of the Pacific Gas and Electric Company.)*

(p. 1, this report) is correct then one is justified in classifying all areas with a geothermal gradient higher than 3.4°F/100 feet as a potential geothermal resource area and would certainly include those areas (colored red and pink) enclosed by the 3°F isogradient in South Dakota as shown in figure 1.

A recent item in the Water Well Journal (1974, p. 10) reports that, *"The decision by a Federal judge in San Francisco that geothermal steam is 'superheated water' rather than a mineral was the big point in a ruling that the geothermal resources are not the property of the U.S. Government. District Judge George Harris decreed that the resource belongs to the owners or lessees of the land that yields it.*

The action came in a suit filed last year by the U.S. against Union Oil of California, Magma Power, Thermal Power, and some individuals. The Government claimed that a 1916 law dealing with mineral recovery gave it the right to 'prospect, mine and remove' the geothermal steam and associated resources. The Federal Government is expected to appeal the decision."

Muffler (1973, p. 252) states, *"Under present technology rocks with too few pores, or with pores that are not connected, do not constitute an economical geothermal reservoir, however hot the rocks may be."* Admittedly, Precambrian rocks (usually dense) are almost certain to be encountered in the postulated geothermal resource area before a temperature of 600°F is obtained. It is known that the ability of a rock mass to yield heat is governed to a major extent by permeability and to a minor extent by porosity. For instance, a zone of fractured rock may have relatively little porosity but tremendous permeability. The possibility of the existence of a fracture zone in Precambrian rocks is discussed later in this report. The reader is advised that our technology for the utilization of geothermal resources is rudimentary; however, necessity fosters technology and within a few years it is envisioned the hot spots in South Dakota will be utilized more than they are today.

Economics

Where natural thermal waters are used for heating such as in Iceland, the cost at the wellhead per million Btu varies from 5 to 12 cents. This is compared to a range of 8 to 40 cents for an equivalent of natural gas (Summers, 1968, p. 2). In western South Dakota, where wells are drilled primarily for a domestic water supply, the considered cost would be even more economical than in Iceland because the wells might be drilled for the two-fold purpose of heating and a water supply.

In Japan the extraction of salt from thermal waters costs about $25 per ton. The salt produced by conventional methods has a market price of $16 to $22 per ton (Summers, 1968, p. 2). From this it is readily apparent that extraction of salt from thermal waters is not at the present economical. However, technological advances are almost certain to occur which will change that economic picture in the very near future.

The average cost for power development wells drilled for natural steam is about $50 per foot (this includes such items as roads, storage, geologic studies, testing, wellhead equipment, casing, and administration) to put into production. However, in the geyser fields of California, proven field techniques have lowered the cost to about $20,000 per well (Summers, 1968, p. 3). The foregoing indicates that average cost projections are governed by drilling techniques that must be employed to overcome local problems and as local problems are solved, costs will decline.

Individual steam and hot water wells will probably be short-lived. Macdonald (1972, p. 340) estimates that well life will be from 15 to 25 years but goes on to state, *"In contrast to individual wells, most projections indicate that thermal areas will continue to yield large amounts of steam for several centuries."* The rate at which wells become unusable will be determined in large part by the mineral constituents in the water and/or steam that is produced. Analyses of water from underground aquifers in South Dakota appear in appendix II. There is little reason to believe that analyses of water produced from areas with a high thermal gradient would vary greatly locally.

Average estimations of capital investment required to develop a natural steam field for power depend on the size of the field and generating plant but range from $10 million to $100 million. Summers (1968, p. 3) reported that Alvin Kaufman estimated that the annual cost per kilowatt hour of variously powered, privately financed 600/mw plants is as follows:

Coal	$31.32
Oil	$30.33
Gas	$31.68
Geothermal	$30.15

Summers also pointed out that compared to sources of power from sources other than fossil fuels the breakdown is:

Geothermal steam — 3.0 to 7.9 mills/kilowatt hour
Conventional thermoelectric — 5.5 to 7.7 mills/kilowatt hour
Hydroelectric — 5.0 to 11.4 mills/kilowatt hour
Nuclear — 5.4 to 11.6 mills/kilowatt hour

From these comparisons it is apparent that utilization of geothermal resources is competitive with conventional power generating plants.

SOUTH DAKOTA GEOTHERMAL POSSIBILITIES

For a geothermal reservoir to exist, there must be a heat source, a suitable reservoir rock above the heat source, water in the rock to transmit heat in the form of hot water or steam, and usually a cap rock above the geothermal reservoir rock to prevent rapid dissipation of heat. This last requirement does not appear to be absolutely necessary in that Allen and Day (1927) measured temperatures of 101.5°C (214.7°F) at a depth of 3 feet at Steamboat Fumarole in the geyser area of California. In this area there is no apparent cap rock (McDonald, 1972, p. 342).

In areas of active geothermal production, all have some like similarities in that they are found in regions of geologically young mountains, usually associated with active or past volcanic activity or where existence of faults are the rule rather than the exception. This is not to say, however, that every area meeting the above criteria overlies geothermal reservoirs. The relationship between any of the geographic or geologic variable is not all that clear cut. For examples, at Larderello the nearest volcanic rock lies 15 miles to the north and the Hawaiian volcanic areas seem to possess only minimal potentials for geothermal energy. In South Dakota the Homestake Gold Mine has a rather low thermal gradient in that at a depth of 6800 feet the temperature is only 122°F (personal communication, Mr. Olin Hart, Chief Geologist, Homestake Mining Company). This is in a structurally deformed area that exhibits evidence of nearby Tertiary volcanic activity but has some of the lowest geothermal gradients in the State.

SOURCES OF HEAT

Sources of heat to create geothermal reservoirs involve much speculation but there appears to be general concurrence that the reservoir rock must have a direct relationship to a cooling igneous mass. According to McNitt (1963, p. 37) those areas throughout the world where geothermal energy is used are all located in regions where Cenozoic volcanism has occurred. This indicates that a direct relationship exists between thermal areas and processes of volcanism and magmatic intrusions. However, there is not complete agreement on this point. Levorsen (1967, p. 423) deals with aspects of the causes of the phenomenon by stating, *"The source of heat of the upper few miles of the earth's crust may be in the outward flow of heat from the central core of the earth, in the presence of igneous magmas that are cooling, in the disintegration of radioactive elements, or in the heat of subcrustal thermal convection currents. Lesser amounts of heat include the frictional heat formed during diastrophism . . . and exothermal chemical reactions that take place within permeable reservoir rock, both of which sources, if present, are temporary and local in their effects."* Levorsen previously suggested (p. 419) that in some cases change in geothermal gradient is best explained by a change in thermal conductivity of the rocks.

It is a known fact that temperature increases with depth in bore holes and that the rate of temperature increases or the thermal gradient varies considerably from place to place. There are a number of ways to formulate the phenomenon of the geothermal gradient, perhaps the most common is given by:

$$G = \frac{T - tF}{D}$$

where G = geothermal gradient, T = formation temperature (°F), tF - mean annual temperature (°F), and D = depth in hundreds of feet. The formula is self-explanatory and is the same as that used in computing the thermal gradients found in this report with only minor variations.

In this report the mean annual temperature was considered to be a constant 45°F over the entire State. Also, the annual mean temperature affects subsurface temperature down to a depth of 60 feet. Because of this, in computation of thermal gradients, the depth of the well was considered as 60 feet less than factual to account for the influence of the annual mean temperature. The effect of these deviations is minimal and for practical purposes corresponds to the above mentioned formula.

Mr. O. M. Phillips (1968, p. 138) states, *"Gradients as small as 1°C per 140 m are measured in some locations and as large as 1°C per 10 m in others, but in spite of this, the average over many such drillings in many countries of the world is very close to 1°C per 30 m."* If the foregoing is converted into degrees Fahrenheit and feet we find that some localities have geothermal gradients as low as .36°F/100 feet, some as high as 5.1°F/100 feet, with the average world geothermal gradient of 1.7°F/100 feet.

Schuster (1973) reports the average worldwide geothermal gradient is 87°F per mile (1.6°F/100 feet). At this gradient the boiling point of water would be reached at a depth of about 2 miles. Any area having a geothermal gradient several times that of the worldwide average certainly warrants investigation as a potential geothermal area.

A casual inspection of the isogradient map of the State (fig. 1) reveals that large areas have geothermal gradients considerably higher than the world average.

In northern Gregory County the 7°F/100 feet isogradient is present. Theoretically, this isogradient indicates that if one were to drill a hole 2400 feet deep, the temperature at the bottom of the hole (if the annual mean temperature is taken to be 45°F) would be approximately 212°F, the boiling point of water under atmospheric pressure. If this same hole were continued to a depth of 27,600 feet, the temperature should be about 1976°F, equivalent to the temperature of molten lava being ejected from an active volcano.

POSSIBLE CAUSES OF HIGH GEOTHERMAL GRADIENTS IN SOUTH DAKOTA

The study of geothermics is in its infancy, but much attention currently is being focused on the subject. In part this is because our nation is faced with a heating oil and natural gas shortage and additional heating sources are being sought. Then also, the exploration geologist has always been intrigued by the "anomaly" or the departure from the norm. From previous pages it is known that geothermal anomalies do exist in South Dakota. The cause of the hot artesian wells in South Dakota is speculation at this time. However, mechanics or conditions suggested by previous authors are given brief consideration.

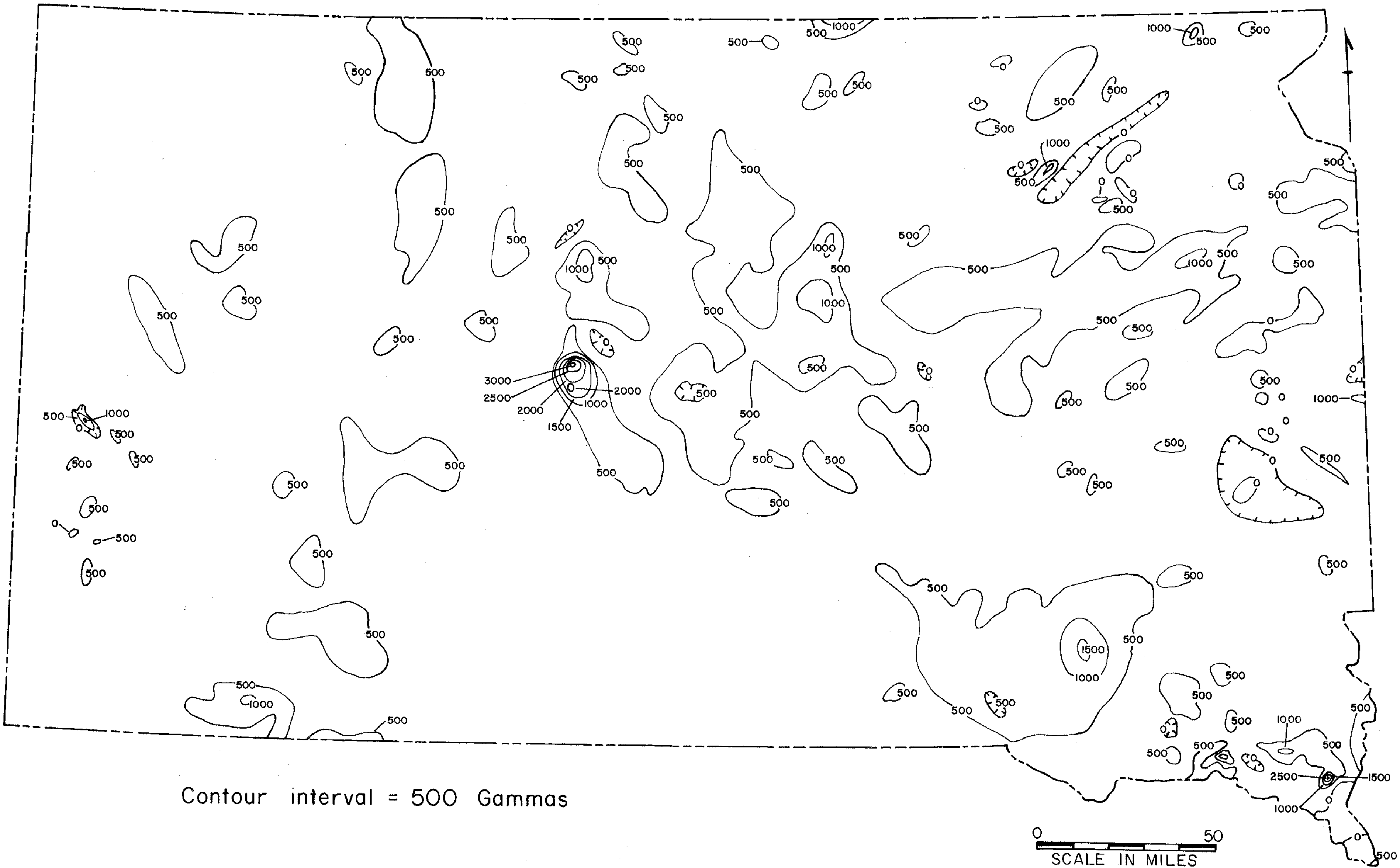
Inspection of the Vertical Intensity Magnetic Map of South Dakota (Petsch, 1967) reveals a marked change in the general configuration of the contours. This change occurs in an area a few miles west of, and parallel to, the Missouri River. Many scientists contend that magnetic maps reflect structural trends or Precambrian rock types and younger magmatic intrusives. In South Dakota the magnetic map (fig. 9) is believed to be a reflection of basement rock types and/or structural trends and may mark a boundary of Precambrian Provinces. In North Dakota Laird (1964) separated these rock types into the Peace River, Superior, and Churchill Provinces of the Canadian Shield area. Similar to North Dakota, much of the structure and sedimentation in South Dakota may be governed by relative movements of two blocks or provinces of the shield area. Any relative movement between these two blocks would generate heat and create fracture zones which are two main requisites for an exploitable heat or power source. If this interpretation, based on the magnetic map, is correct then the logical area to search for geothermal energy is near the boundary of the Peace River and Superior Provinces. This boundary drawn by Laird in North Dakota has been projected through South Dakota and appears as figure 10 of this report.

Unstable areas are often accompanied by volcanic activity and hot thermal waters. It has been shown that the thermal gradient in south-central South Dakota is higher than the national average; however, it is more difficult to establish volcanic activity in the area during or subsequent to Precambrian time. Data concerning Precambrian rocks are limited, but Steece (1961) indicates that extrusive rocks are present in northwestern Hyde County. This extrusive is approximately 40 miles east of the inferred boundary of the Peace River-Superior rock masses, which is a rather extreme distance to postulate for a lava flow. This extrusive rock does strongly suggest the existence of an unstable area during, or subsequent to, Precambrian Time.

A comparison of the isogradient map with the gravity map of the State is less striking. The gravity map of South Dakota is quite generalized but in the area of Murdo (see fig. 11) a negative anomaly of -110 milligals is present in Jones, Mellette, and small portions of northwestern Tripp and southwestern Lyman Counties. Lum (1961, p. 6) in his gravity traverse of the State recognized this negative regional anomaly just east of Murdo, but he also (p. 7) discovered the existence of a broad positive anomaly of 11 milligals superimposed on the regional gravity minimum. He speculated this 11 milligal positive anomaly (fig. 12, this report) is possibly related to the Stanley County magnetic high. The authors do not disagree with Lum but also recognize that the positive anomaly could be a reflection of a post-Precambrian volcanic intrusive body. If this is the case the thermal gradient should be higher than that of the surrounding area. From observation of the isograident map it is apparent that some of the highest recorded temperatures in the State are present near the gravity anomaly east of Murdo. This area may be an early target in the event of future exploration.

An additional reason for singling out the area is to show the reader a difference of 11 milligals does exist between two surveys. If differences such as this do occur on a state-wide basis, the interpretation of the gravity map of the entire State could vary greatly and very conceivably agree quite closely with the magnetometer map in suggesting that the boundary of the Peace River-Superior Provinces exists in South Dakota. If the gravity map does indicate the Peace River-Superior Provinces then the boundary probably occurs along the -70 milligal contour which roughly follows the course of the Missouri River (see figs. 10 and 11).

According to McNitt (1963, p. 41) gravity and magnetic surveys do not appear to be particularly helpful in locating production fissures within structural depressions. He does note that detailed land magnetic surveys reveal magnetic lows over thermal areas due to hydrothermal alteration of magnetite to pyrite. In south-central South Dakota, Petsch (1967) shows two rather extensive magnetic



Contour interval = 500 Gammas

Figure 9. Vertical-intensity magnetic map of South Dakota (adapted from Petsch, 1967.)

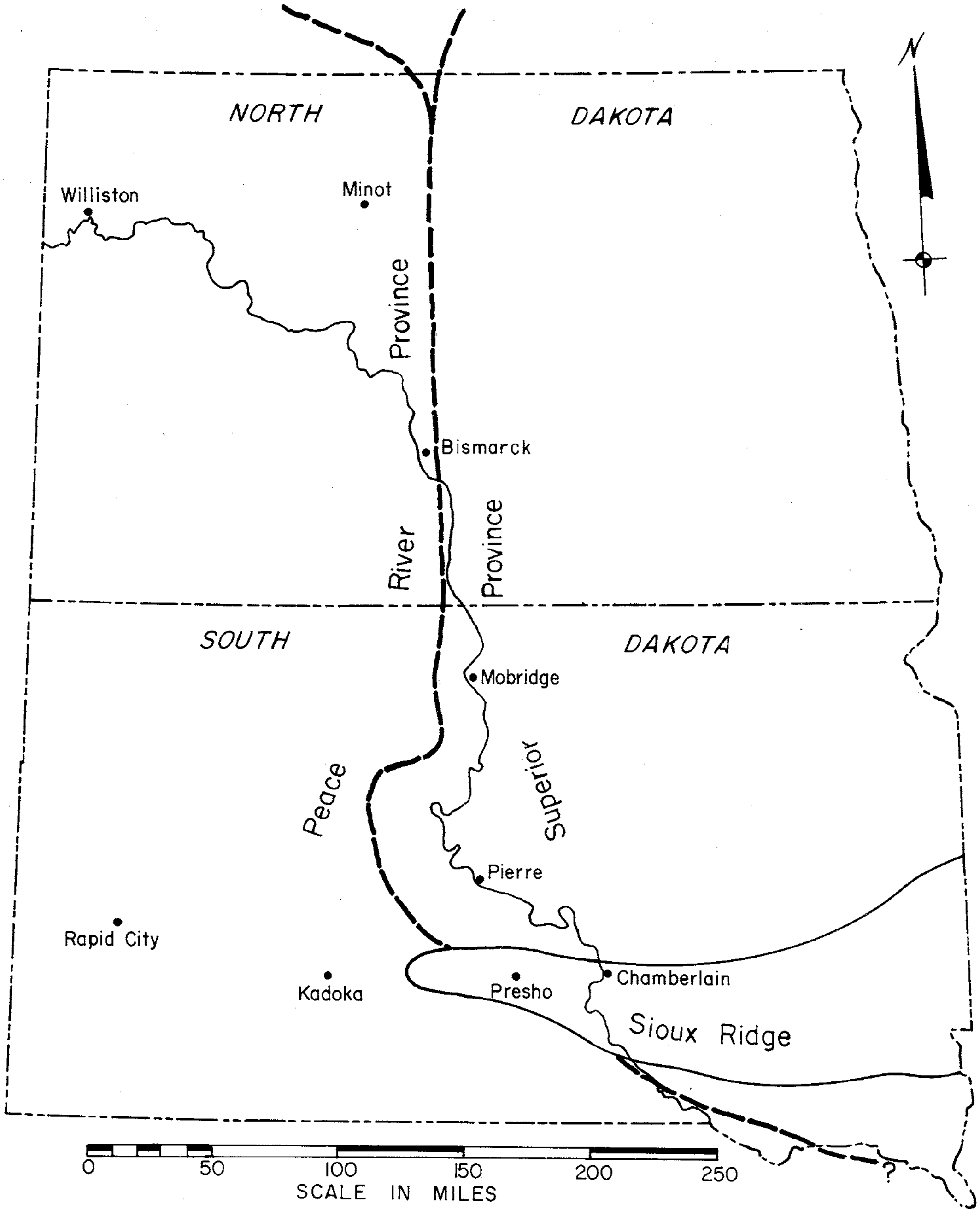
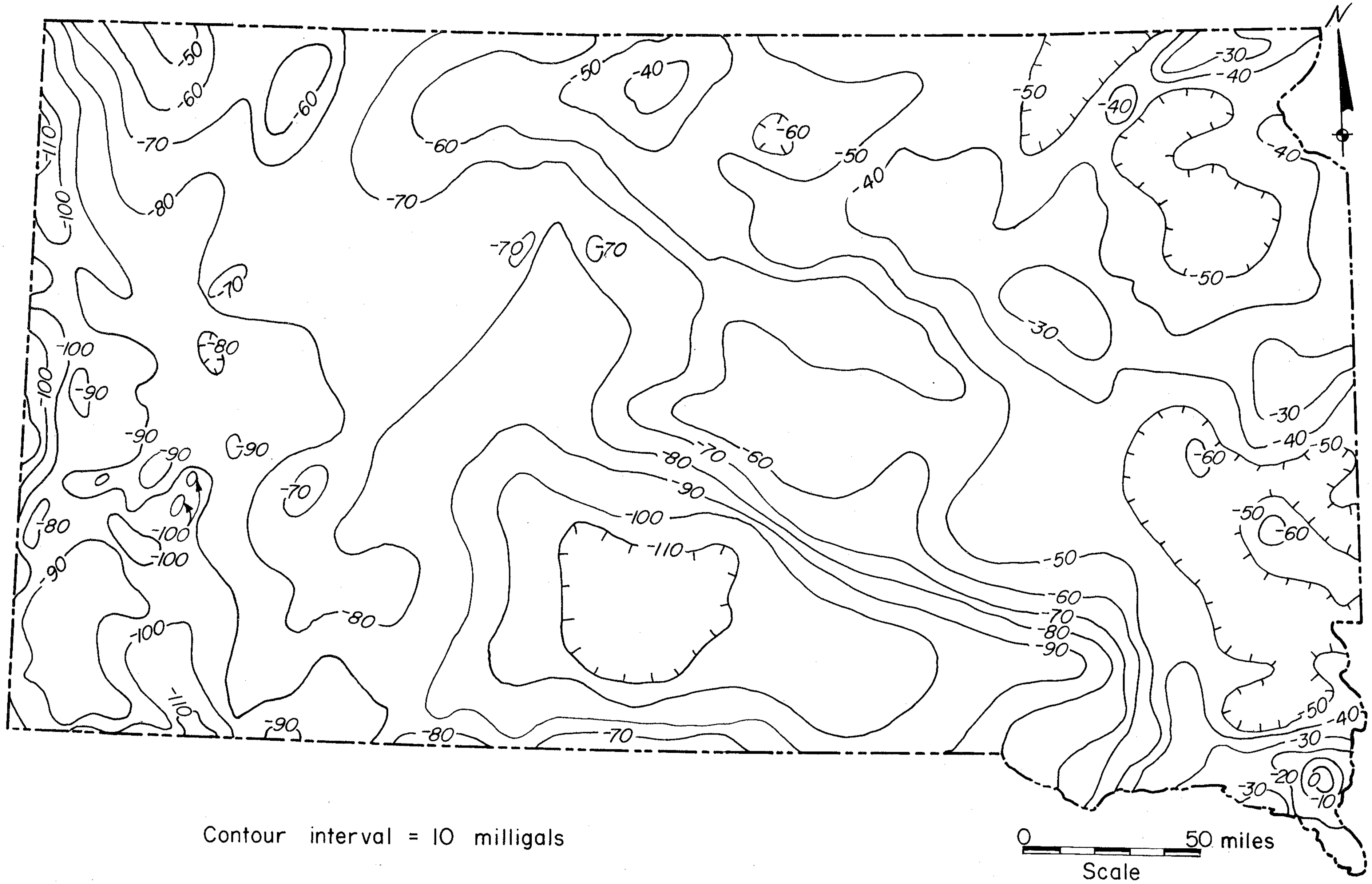


Figure 10. Map of approximate boundaries of provinces of the Precambrian Shield. North Dakota portion slightly modified from Laird (1964) and projected into South Dakota on basis of magnetic and gravity characteristics.



Contour interval = 10 milligals

Figure 11. Gravity map of South Dakota. (from Woollard and Joesting, 1964).

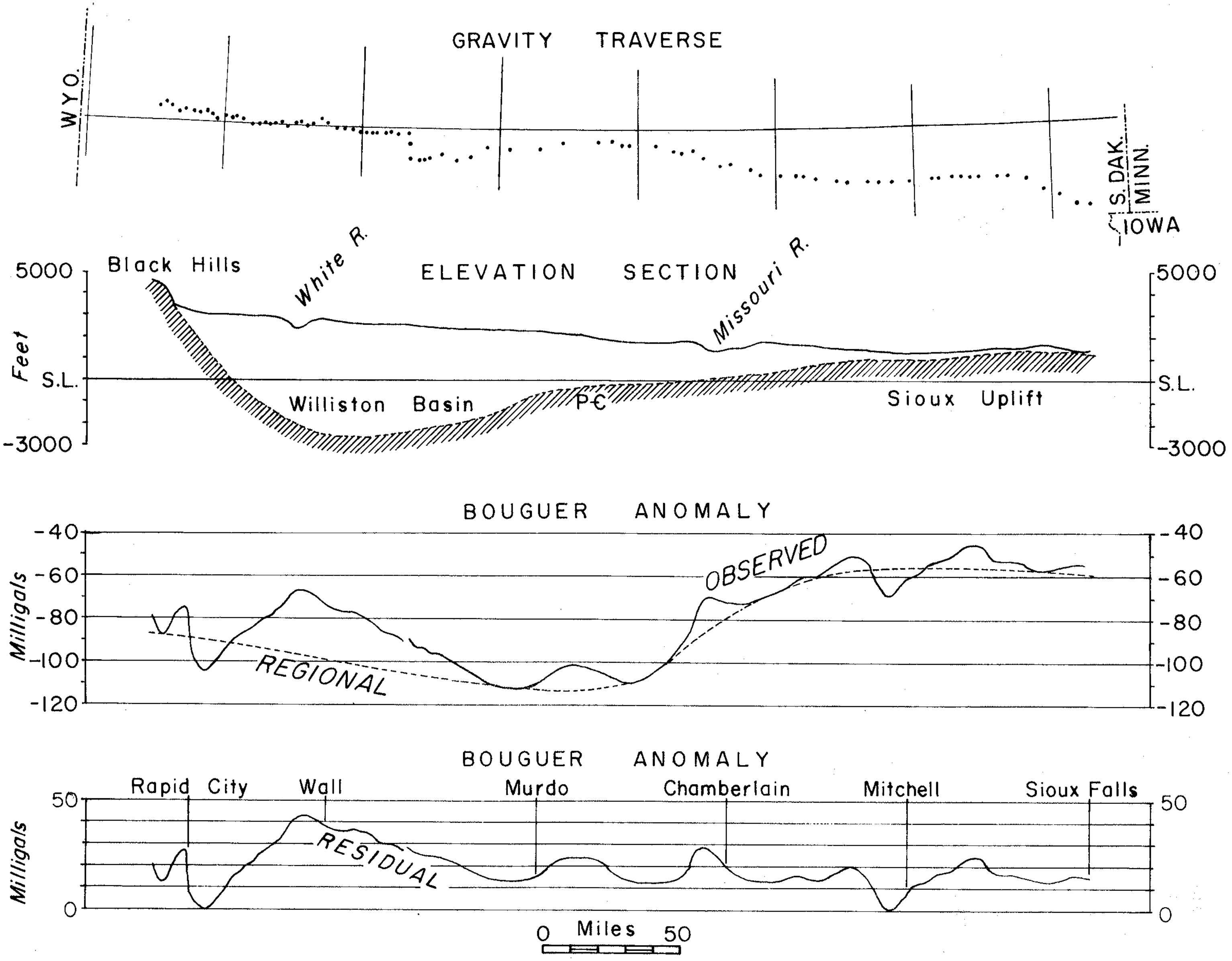


Figure 12. Areal plot and profile of gravity traverse from Rapid City, to Sioux Falls, South Dakota. (from Lum, 1961.)

lows situated in eastern Mellette and Todd Counties and in northern Gregory and southern Brule Counties. Lum (1961, p. 6 and 7) notes that the broad positive gravity anomaly just east of Murdo may be a reflection of basement rock that is more mafic in character than the surrounding basement rock. This gravity anomaly lies just to the north of the magnetic low in eastern Mellette and Todd Counties. Lum's gravity traverse passed to the north of the magnetic anomaly of northern Gregory and southern Brule Counties. However, Lum (p. 5) does state *"a large positive anomaly of 15 milligals is located immediately west of Chamberlain. This anomaly is too large to be caused by either basement topography or by structure in the sedimentary rocks. Therefore, it is probably caused largely by a density contrast in the basement rocks."* The proximity of this gravity anomaly to the magnetic low in southern Brule County warrants additional study.

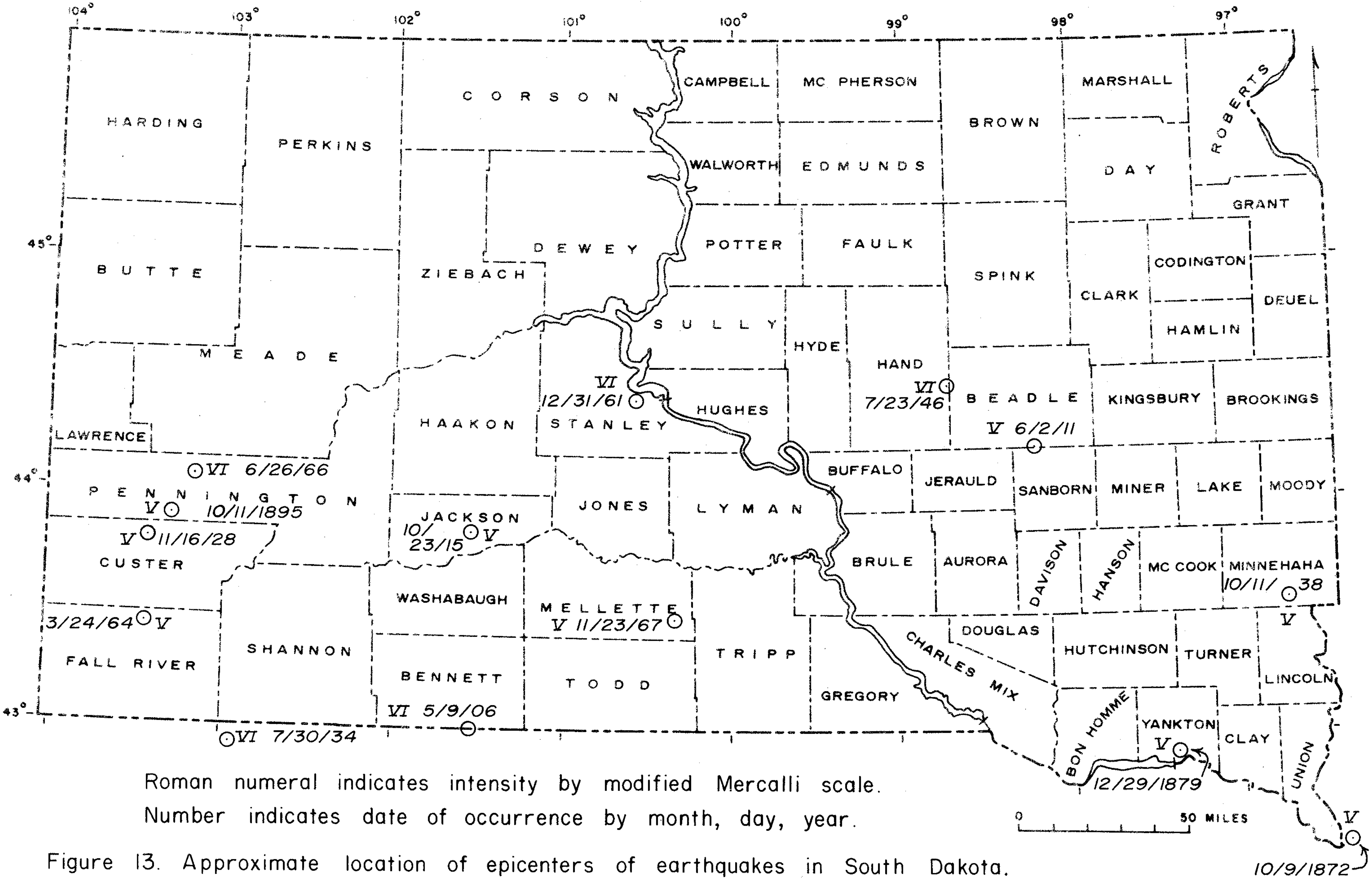
From Levorsen (p. 11, this report) it is stated that heat is evolved from the disintegration of radioactive elements. If such a source is present near the area of Midland, the source must be in rocks of Precambrian Age, because Gamma-Ray logs of sedimentary rocks in the area exhibit no intervals of extraordinarily high gamma activity. However, there is no evidence, such as cores of Precambrian rocks with which to lend credence to the preceding statement. On the other hand, Koenigsberger (1910) states that in the locality richest in radium, the pitchblende deposit in Joachimstal, the temperature gradients are normal. At this time the heating effect that radioactive decay has upon thermal gradients is problematical.

Any evolutionary process that produced structure in South Dakota would no doubt generate heat. Due to the masking effect of the Pierre Shale in the central and south-central part of the State, no structural evidence of sufficient intensity to generate a great amount of heat has been recognized in the area of higher thermal gradients. However, earthquakes are results of structural adjustments. Inspection of the earthquake locations in South Dakota (fig. 13 and table 2) suggests that structural adjustments are occurring in the vicinity where high thermal gradients are present. Heck and Eppley (1958, p. 39) reported an earthquake on May 9, 1906, in eastern Washabaugh County that was noted all along the Niobrara Valley from Rushmore (Nebraska) to Valentine (Nebraska). This quake was felt over an area of 7,000 to 8,000 square miles. The preceding authors also reported an earthquake occurring on July 23, 1946, at Wessington, South Dakota. This quake was generally felt from Pierre to DeSmet eastward and northward to Redfield, South Dakota. Agnew and Tullis (1962) report the occurrence of an earthquake 6 miles west of Pierre that had its focus at a depth of 10 miles. This report of the earthquake near Pierre is interesting in that the depth of origin or focus was located at a depth of 10 miles or 52,800 feet. From the isogradient map (fig. 1) the thermal gradient is at a rate of approximately 3.5°F/per 100 feet of depth. Multiplying the thermal gradient by the depth in hundreds of feet (3.5°F x 528) the temperature at the focus of the quake is projected to be 1848°F. This compares quite closely with the temperature of molten lava (1976°F). Thus, if the geothermal gradient is correct, and if this gradient is projected downward to a depth of 10 miles it is readily apparent that the temperature of the rocks is sufficient to cause these rocks to be in a plastic state and to yield to structural adjustment by flow rather than by rupture with subsequent shock. Perhaps a knowledge of the geothermal gradient of an area may enable one to accurately forecast the focus of earthquakes in any given area.

At any rate, the foregoing examples do not constitute a complete history of earthquakes in South Dakota, but do indicate that the State is not a totally stable area. These structural adjustments may be, in part, a cause of the warm artesian waters.

Another type of heating mechanism which may be the cause of the hot spots in South Dakota is that produced by convection cell currents existing in the mantle. Figure 14 shows the possible correlation between the stages of an orogenic cycle and a hypothetical convection current cycle. If convection currents were responsible for creating the energy that elevated the Black Hills area, the general fall-out of data becomes simple to explain. For instance, in stage 2 of figure 14, cooler temperatures exist below mountainous areas than in surrounding plains areas which is the reverse of what one would expect if high temperatures were evolved from structural deformation. Data in appendix I and plotted on the isogradient map indicate that the thermal gradients are indeed lower in the Black Hills area than in the plains area in south-central South Dakota. Stage 2 of figure 14 may also lend credence to the high geothermal gradient in northern Gregory County as being a true gradient and not a result of migrating hot water as discussed in the following paragraphs.

Closely related to the stages of orogenic cycle and the hypothetical convection current cycle illustrated by Bullard (see fig. 14, this report) is the idealized cross-sectional view of a geothermal reservoir (fig. 15, this report) illustrated by Schuster (1973). The illustration by Schuster shows a smaller convection cell with the currents flowing counter to the illustration in figure 14. This type of smaller convection cells may in practice be superimposed on a convection cycle such as illustrated in figure 14. Due to the masking of structures in South Dakota by glacial drift and Upper Cretaceous Shales, faults such as illustrated in figure 15 are not known to occur outside of the Black Hills area. However, it is possible



Roman numeral indicates intensity by modified Mercalli scale.

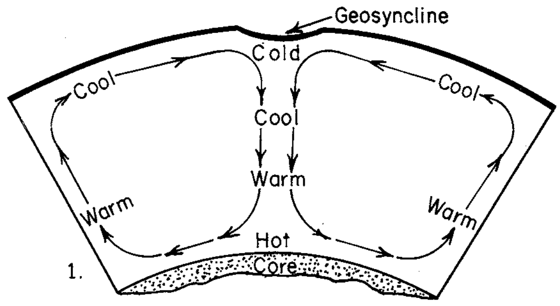
Number indicates date of occurrence by month, day, year.

Figure 13. Approximate location of epicenters of earthquakes in South Dakota.

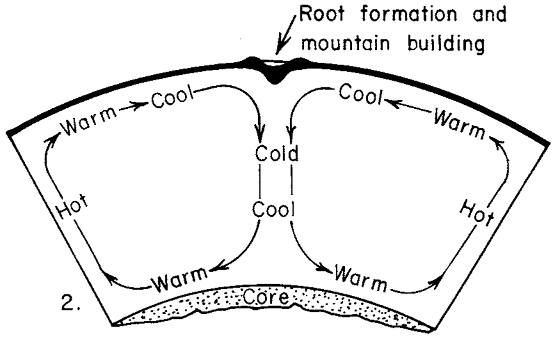
TABLE 2. Earthquake History of South Dakota (Modified Mercalli Scale)

Date	Locality	Maximum Intensity	Felt Area (Square Miles)	Effects in South Dakota
1872, October 9	Sioux City, Iowa	V	3,000	Severe at Yankton and White Swan
1877, November 15 (2)	Eastern Nebraska	VII	140,000	Felt
1879, December 29	South Dakota	V	Local	Felt at Yankton and Fort Scott
1895, October 11 (2)	Black Hills, South Dakota	IV-V	------	Felt at Rochford, Keystone and Hill City
1902, July 28	Eastern Nebraska	V	35,000	Felt strongly at Yankton
1906, May 9	South Dakota - Nebraska Border	VI	8,000	Felt from Rushville to Valentine, Nebraska
1909, May 15	Saskatchewan, Canada	VI-VII	500,000	Felt
1911, June 2	South Dakota	V	40,000	Felt in James River Valley
1915, October 23	Kadoka, South Dakota	V	Local	Felt
1928, November 16	Black Hills, South Dakota	V	2,000	Felt at Custer and Rochford
1934, July 30	Chadron, Nebraska	VI	23,000	Felt in southwestern portion
1938, October 11	Sioux Falls, South Dakota	V	3,000	Felt
1946, July 23	Wessington, South Dakota	VI	------	Water mains cracked at two points
1959, August 17	Hebgen Lake, Montana	X	600,000	Felt at Buffalo, Ludlow, and Rapid City
1961, December 31	Central South Dakota	VI	------	Strongest at Murdo and Pierre
1964, March 24	Hot Springs, South Dakota	V	Local	Felt
1964, March 27	Van Tassel, Wyoming	V	------	Felt
1964, March 28	Nebraska	VII	90,000	Magnitude 5.1 slight damage at Martin and Deadwood
1966, June 26	South Dakota	VI	------	Magnitude 4.1 slight damage at Rapid City
1967, November 23	South Dakota	V	------	Magnitude 4.4 felt in Winner-Rosebud-White River areas

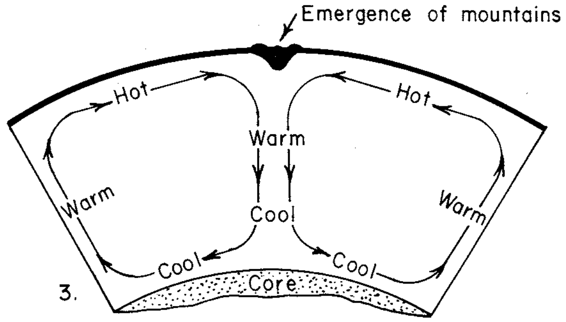
Source: Written communication, Carl A. von Hake, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service, Earthquake Information, Boulder, Colorado 80302



STAGE 1. Initiation of convection currents. Cold material of the core sinks to replace hot substratum material. The geosyncline slowly sinks as it is filled with sediment.



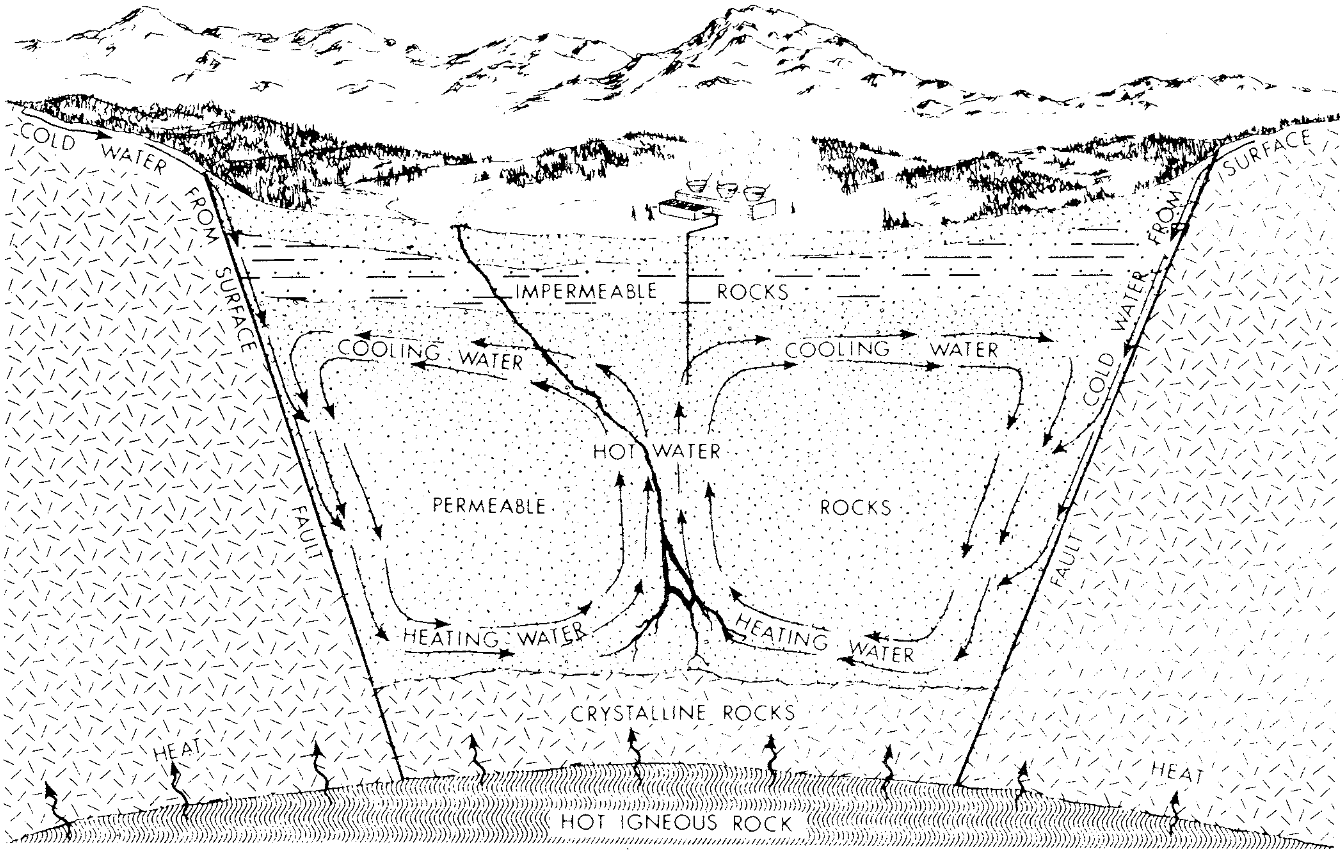
STAGE 2. More rapid currents drag a root of sial into the sima. In the process of "root formation" the geosynclinal sediments are crushed by lateral pressure.



STAGE 3. Currents slow down as hot material spreads out on the surface and cold material moves along the bottom. The root, because of buoyance, is uplifted.

Figure 14. Possible correlation between the stages of an orogenic cycle and those of a hypothetical-current cycle. (from Bullard, 1971.)

Figure 15. Cross section of northern California's geothermal electrical generating plant. (from Schuster, 1973.)



Idealized cross-sectional view of a geothermal reservoir. Hot igneous rocks at depth supply heat to the water-filled reservoir rock above. The hot water is less dense and rises until the impermeable cap rock is reached. If fissures are present in the cap rock, part of the geothermal fluid may escape and form hot springs or fumaroles at the surface. When the water reaches the area of the cap rock, it begins to move outward, cool, and become more dense. The greater density or weight causes the cooler water to move downward and be recycled, along with recharge water that might enter the reservoir along faults or fractures. A power plant is shown, drawing steam and/or hot water from the upper part of the reservoir.

that differences in geothermal gradients in small areas are clues to the discovery of such structures.

As previously mentioned it is surprising that the periphery of the Black Hills, an area of deformation, does not exhibit as high geothermal gradients as the area in the eastern south-central part of the State which in the opinion of most geologists has been a relatively stable area throughout geologic time. The preceding discussion of convection currents in the mantle appears a logical explanation of the high geothermal gradients in the eastern south-central part of the State.

It is apparent from Schoon (1971; fig. 16, this report) that the 7°F isogradient is suspiciously near the area where the Madison-Red River recharge to the Dakota Formation takes place. If the two do in fact coincide then it is logical to assume that the water from the Madison-Red River is heated by a thermal gradient of 3°F/100 feet a distance of 20 miles to the west of the recharge area and upon rising to the Dakota Formation increases the thermal gradient of the area that is characterized by the 7°F thermal gradient.

The majority of geologic opinion holds that water movement is generally from west to east in sedimentary rocks in the southern half of South Dakota. Therefore, it is logical to search for a source of heat in a westward direction from the Kucera No. 1 Bartels Oil Test (SW SE section 23, Township 100 North, Range 77 West). From the isogradient map (fig. 1) of the State there is another large area with a 5°F thermal gradient which surrounds the 6°F and 7°F gradients and it logically follows that this area should be discussed further. This area is located in northwestern Tripp County and northeastern Mellette County. For instance, at the Kucera No. 1 Bartels Oil Test (for location, see fig. 17) the thermal gradient is 3.1°F, approximately 28 miles to the east the thermal gradient is 7°F. At the location of the Kucera No. 1 Bartels Oil Test the bottom-hole temperature was 117°F at a depth of 2387 feet. If it is assumed the water from near the bottom of the test is transferred to the area of high thermal gradient with no heat loss, and using the average depth of 1100 feet in the wells located in the area of high thermal gradient, the new assumed thermal gradient would be 7°F/100 feet. If the foregoing assumptions are true then perhaps the effect of circulating water on the thermal gradient should also be added to Levorsen's list of heat sources that contribute to thermal gradients.

The weak point of the foregoing assumption is, why should the temperature remain relatively constant between the Kucera No. 1 Bartels Oil Test and the area of the high thermal gradient and suddenly cool from the area of the high thermal gradient in an eastward direction? It is possible the area of recharge of the Madison-Red River interval to the Dakota Formation is quite restricted areally and as this warmer water enters the Dakota Formation and fans out in all directions the effect of warm waters soon becomes negligible.

According to Heald (1930, p. 4) some students of earth temperatures feel that variations in these temperatures are in large part due to another means of circulating ground water. This school of thought believes that as the sediments pack down, water is squeezed out of the clays and shales and enters porous sandstones and limestones. The water thus released moves updip through these porous beds until it finally escapes where the beds crop out at the surface. Thus, waters deeply buried in a syncline would move updip and result in the temperatures in the updip areas being somewhat higher at a given depth below the surface of the ground than in the lower limbs of the syncline from which the water originated. Although this has been observed in Oklahoma and the regional picture seemed to support the conception, Heald noted that measurements of individual oil fields and individual wells seem to refute this theory.

Examination of the isogradient map of South Dakota tends to convince the observer that the theory is not at work in the State. For example, the axis of the Williston Basin passes through central Jackson and central Perkins Counties. If the theory were at work in the State the isogradient contours would be steeper on the west side of the axis of the Williston Basin than on the east side because the flanks of the basin are steeper on the west than on the east. Thus, the hotter fluids should migrate faster to the west. A cursory review of figure 1 shows the reverse to be true.

Unfortunately the data in the area of this high thermal gradient come from water wells which have not been logged. Thus, reliable data points upon which to base a structure are not numerous. About all that can be stated is that the possibility does exist. If a structure exists, the western end of the structure may be located in section 2, Township 4 South, Range 28 East. At this point, the sea level elevation of the top of the Minnelusa is -290 feet (see fig. 17). A well immediately to the south has the Minnelusa at -440 feet and another well approximately 7 miles to the northeast the Minnelusa is at 415 feet below sea level. However, there are two reasons against postulating structure on this data: (1) the Minnelusa has been quite severely eroded in this area, and (2) the structure, if present at all, is more subdued on the Precambrian surface.

In view of the aforementioned possibilities it is not possible with present data to identify the cause of the high geothermal gradients that exist in east

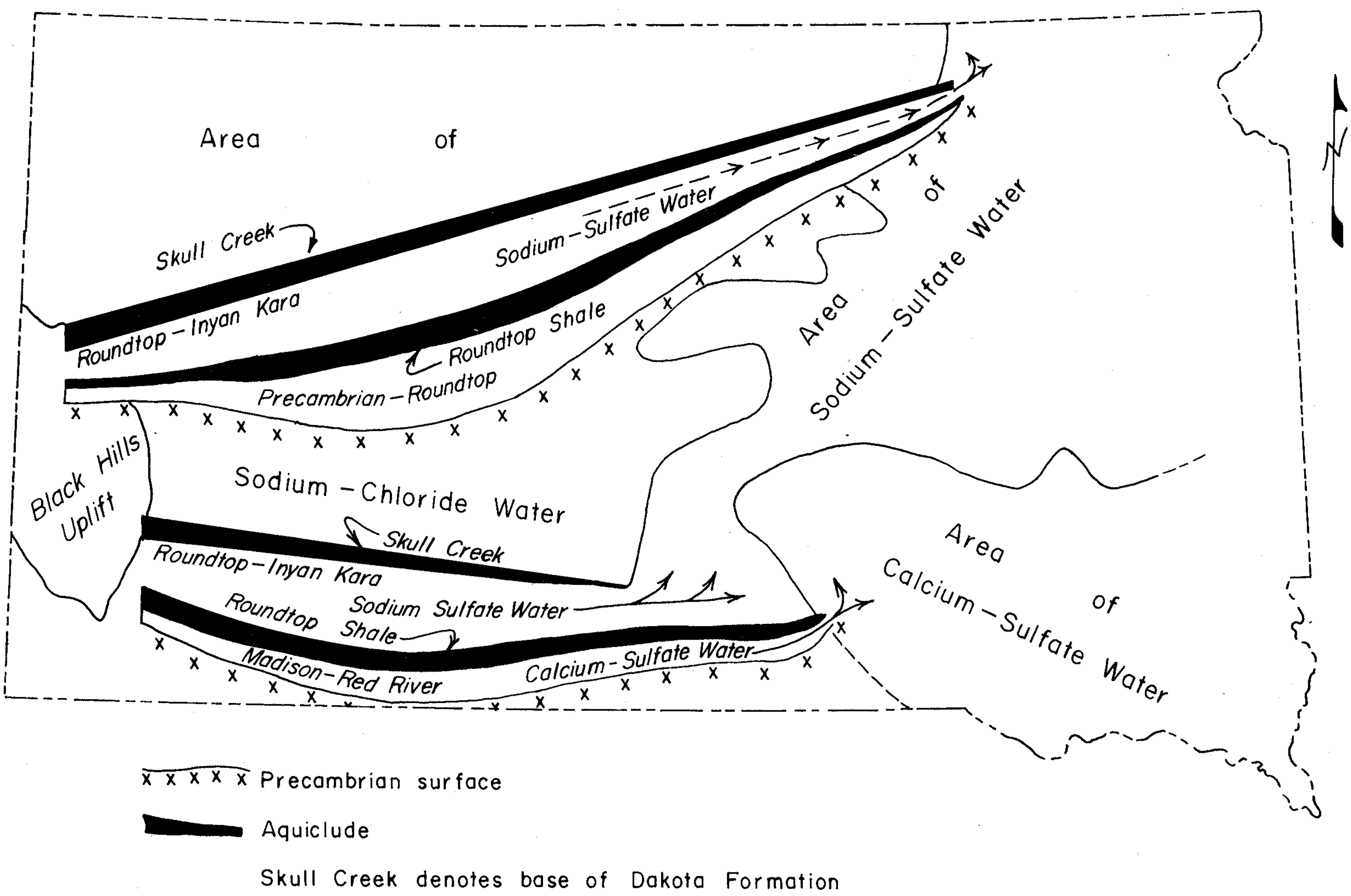


Figure 16. Schematic drawing illustrating the proximity of recharge to the Dakota Formation to the area of high geothermal gradient shown in Figure 1. (after Schoon, 1971)

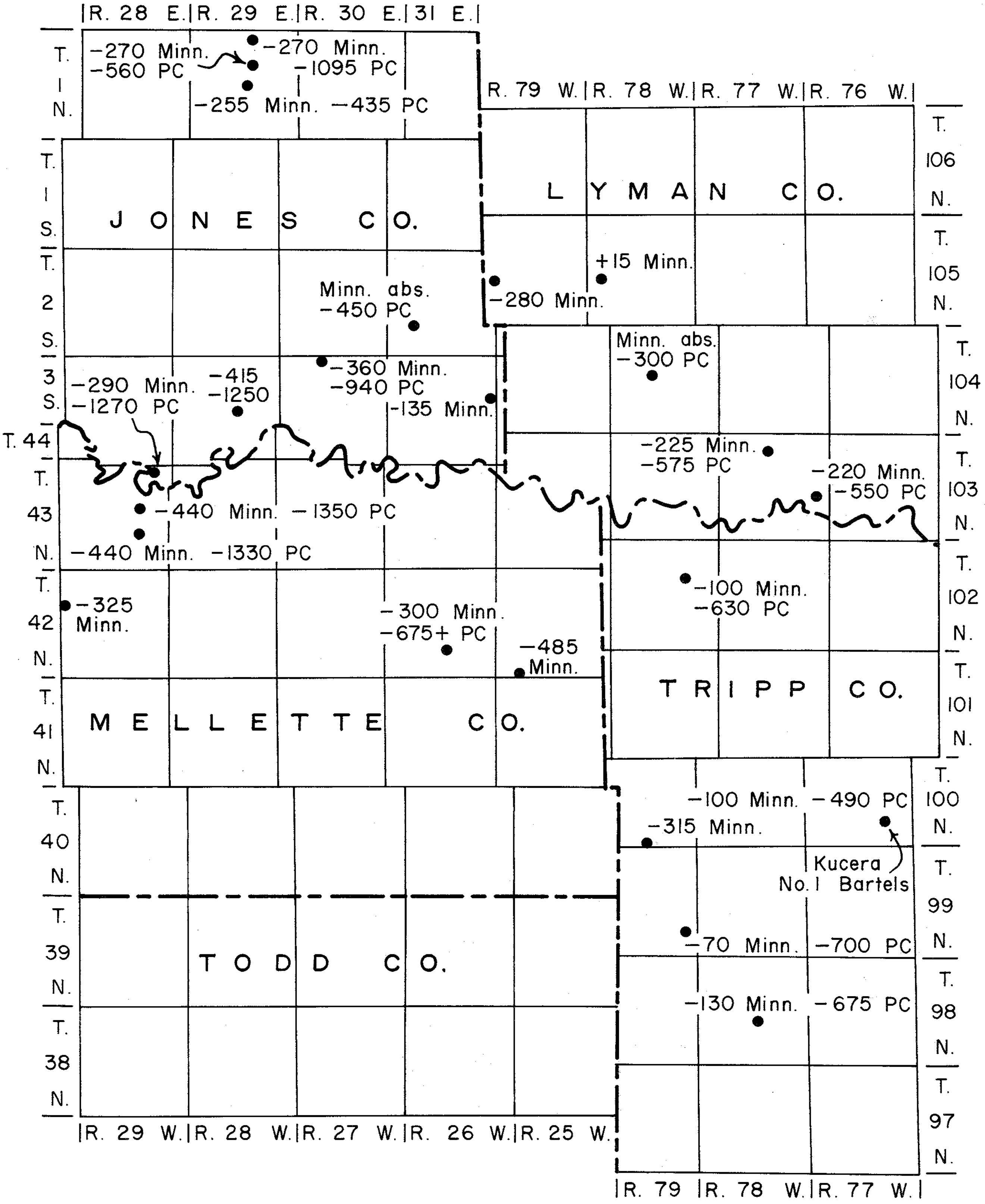


Figure 17. Sea level elevations of the Minnelusa and Precambrian surfaces in south-central South Dakota.

south-central South Dakota. Perhaps the theory involving convection currents originating at depth is most plausible.

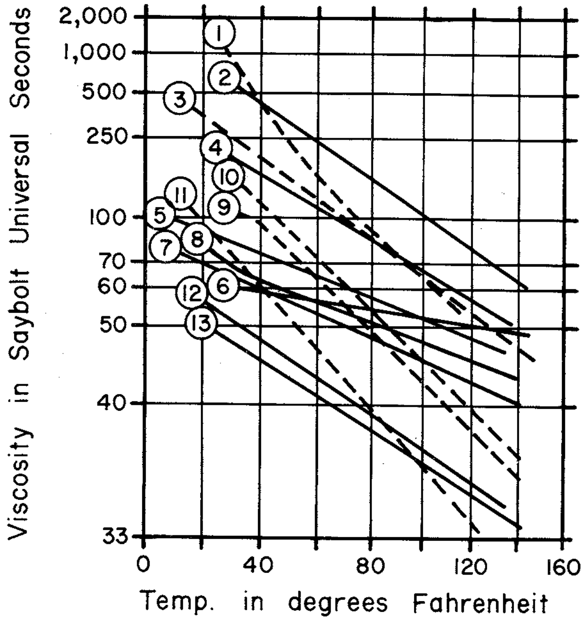
Farther west, in the area of the Black Hills, the thermal gradient is consistently quite low. However, the reader is advised that the condition may be true only at comparatively shallow depths. From the isogradient map it is clear that there is virtually no data in the crystalline area of the Black Hills. Also, the number of wells that penetrate to the Precambrian rocks in the periphery of the Hills are few. These two facts in conjunction with the belief of numerous geologists that outcrops of younger sedimentary rocks take on significant quantities of surface runoff may explain the lower than expected thermal gradient. If the conjectured recharge of warm water from the Madison-Red River interval in Gregory County is responsible for an increased thermal gradient in that area then, conversely, cool water in the form of surface runoff could lower the thermal gradient in the area of the Black Hills.

OTHER APPLICATIONS

In the search for oil, Levorsen (1967, p. 423) states that the crests of anticlines appear to have a small but measurable increase in thermal gradients in relation to the flanks of these same anticlines. Data points on known structures in South Dakota are not sufficient to confirm Levorsen's statements. The thermal gradients appear quite uniform in deeper portions of the Williston Basin. However, if Levorsen's statement holds true in South Dakota, undue attention should not be given to areas with contours at the expense of large areas with no contours. Because of the selection of the designated contour intervals it is quite possible that small areas within contour intervals exhibit greater variations than that suggested by wide spaced contour intervals. For this reason all data points in appendix I are plotted in areas that are considered to have oil potential.

Increased temperature lowers the viscosity (resistance to flow) of liquids. With this in mind the isogradient map may be instrumental in locating migration paths of oil.

In northwestern Haakon, northeastern Pennington, and southeastern Meade Counties, there is an area with a geothermal gradient in excess of 3°F/100 feet (fig. 1). Immediately to the west, in an updip direction, the geothermal gradient is 2°F or less per 100 feet. Although the variation is not great it is sufficient to give a 5000-foot oil test a temperature differential of 50°F (195°F - 145°F). From Levorsen (1964, fig. 5-33; fig. 18, this report) an accumulation of 32 API gravity oil subjected to a change in temperature from 90°F to 140°F could decrease in viscosity from 75 to 50 Saybolt Universal seconds.



1. Allen, Oklahoma
2. Walters, Kansas – 29.3
3. Healdton, Oklahoma
4. Vaughn, Kansas – 32.1
5. Cress, Kansas – 34.4
6. Bemis, Kansas – 36.0
7. Sullivan, Kansas – 37.7
8. Burrton, Kansas – 34.5
9. Aylesworth, Oklahoma – 37.4
10. Aylesworth, Oklahoma – 36.5
11. Fargo, Oklahoma – 41.0
12. Bloomer, Kansas – 41.6
13. Silica, Kansas – 44.2

Figure 18. Relationship of viscosity to temperature in different crude oils of Oklahoma and Kansas. (from Levorsen, 1967)

Given the right combination of viscosity, pressure, and permeability this temperature variation could conceivably halt migration. Because permeability is affected inversely with the viscosity, and temperature increases result in a decrease in viscosity the possibility of geothermal trapping mechanisms are very apparent. Perhaps additional study may find that some so-called permeability traps are in reality thermal traps or viscosity traps.

CONCLUSION

The cause of high geothermal gradients in South Dakota is not fully understood. Dutcher et al. (1972, p. 25) gives criteria for distinguishing between conduction and convection by saying that a rule of thumb is, if the gradient is uniform, thus permitting an extrapolation to a reasonable mean surface temperature, heat flow is assigned to conduction. Whereas, if high temperatures with small gradients extrapolate to high surface temperatures, heat flow is attributed to convection. Whether this rule of thumb holds true in an area of extensively water flushed formations at depth is not known.

In the area of the 7°F isogradient the Precambrian surface is approximately at sea level, or depending upon drilling site, at a depth of 1500 to 2000 feet. If a test hole were continued a few hundred feet into the Precambrian rocks a temperature log could be run to determine whether or not the high geothermal gradient continues below the Cretaceous sands. If the geothermal gradient decreases, one could assume a false geothermal gradient is caused by hot water moving into the area from another area. On the other hand, if the geothermal gradient is continuous, a geothermal reservoir suitable for generating power might be present at a depth of 7800 feet.

Burnham and Stewart (1971) report that an ideal power site should have rock temperatures above 600°F at depths ranging from 6,000 to 10,000 feet, large quantities of surface water and an area remote from population centers. Using these criteria as requirements for a power site, the nearby Lake Francis Case and the rural nature of the area satisfy two requirements and there is left only one questionable requirement. This is determination of a completely reliable measurement of the geothermal gradient.

One possible requisite not mentioned in the preceding paragraph is the existence of a permeable interval at sufficient depth to insure a means to utilize high temperatures. Many wells drilled to and in Precambrian rock in South Dakota fail to yield water. However, if the change of the character of the contours on the magnetic and gravity maps of South Dakota represent the Peace River-Superior Provinces, it is quite possible that fractured Precambrian rocks are present in the area.

In view of the projected fuel shortage faced by our nation, the area of high geothermal gradients should be researched as a potential power supply. Along the same line more attention should be given by exploration geologists to the possible effects that subsurface changes in temperatures have on the migration and accumulation of oil.

Perhaps there are other areas in South Dakota with high geothermal gradients. These may in time be discovered by carrying out an extensive drilling program. However, a drilling program is a relatively expensive means of exploration. In south-central South Dakota including the area of Shannon, Washabaugh, Bennett, Mellette, and Todd Counties, there is a scarcity of data. The fact that all geothermal data points plotted in this area (with one exception) are higher than the world-wide average, suggests that this rather large area merits further study.

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APPENDIX I

Thermal Gradients in Wells Drilled in South Dakota

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Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
AURORA COUNTY					
13-105N-64W	727	60	Water Well	U.S.G.S.	2.2
34-101N-66W	953	66	Water Well	U.S.G.S.	2.4
SE SE 15-103N-64W	740	62	Water Well	Darton (1920)	2.5
NE NE 14-103N-66W	850	64	Water Well	Darton (1920)	2.4
NW NW 28-104N-63W	1082	61	Old Oil Test	Davis, Dyer & Powell (1961)	1.4
BEADLE COUNTY					
NW NW 6-112N-60W	1000	63	Water Well	U.S.G.S.	1.9
NE SW 19-112N-65W	1350	67	Water Well	U.S.G.S.	1.7
NW NE 34-113N-63W	1045	65	Water Well	U.S.G.S.	2.0
NE NE 19-113N-64W	1160	75	Water Well	U.S.G.S.	2.7
SW NE 4-113N-65W	1000	71	Water Well	U.S.G.S.	2.8
NE 13-113N-62W	800	63	Water Well	SDSM&T (1954)	2.4
SW 36-111N-62W	960	70	Water Well	Darton (1920)	2.8
NW NW 24-111N-64W	878	76	Water Well	Darton (1920)	3.8
SE 8-113N-65W	950	70.6	Water Well	Darton (1920)	2.9
SE 11-113N-65W	971	71.5	Water Well	Darton (1920)	3.0
NE 1-113N-65W	950	71.5	Water Well	Darton (1920)	3.0
SW 14-113N-65W	955	72.5	Water Well	Darton (1920)	3.1
SW 30-113N-64W	980	71.5	Water Well	Darton (1920)	2.9
SW 28-113N-64W	880	75	Water Well	Darton (1920)	3.8
NE 11-113N-64W	925+	71.5	Water Well	Darton (1920)	3.0±
NE 21-113N-63W	800	66	Water Well	Darton (1920)	2.8
NE 23-113N-63W	860	67.7	Water Well	Darton (1920)	2.9
SW 31-113N-62W	815	64.4	Water Well	Darton (1920)	2.6
SE 5-113N-61W	766	62.5	Water Well	Darton (1920)	2.5
SW 9-113N-60W	810	63.3	Water Well	Darton (1920)	2.4
NE 14-112N-63W	600	58.3	Water Well	Darton (1920)	2.4
NW 7-112N-62W	793	66.7	Water Well	Darton (1920)	3.0
SW 2-112N-62W	774	65	Water Well	Darton (1920)	2.8
C 13-112N-63W	825	66.7	Water Well	Darton (1920)	2.9
SW 7-112N-61W	704	63.8	Water Well	Darton (1920)	3.0
SW NE 33-109N-64W	818	65	Water Well	U.S.G.S.	2.6
NW NW 9-110N-62W	1200	75	Water Well	U.S.G.S.	2.7
SE SW 9-109N-59W	875	61	Water Well	U.S.G.S.	2.0
NW NW 15-109N-60W	800	62	Water Well	U.S.G.S.	2.3

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
SE SE 4-109N-65W	915	66	Water Well	U.S.G.S.	2.4
SW NW 10-110N-60W	860	57	Water Well	U.S.G.S.	1.5
NE NE 7-110N-64W	870	65	Water Well	U.S.G.S.	2.5
NE NW 8-109N-63W	1080	73	Water Well	U.S.G.S.	2.8
SW NW 9-112N-64W	975	71	Water Well	U.S.G.S.	2.8
NE NE 5-111N-64W	900	72	Water Well	U.S.G.S.	3.2
SE SE 16-111N-65W	1045	74	Water Well	U.S.G.S.	3.0
SW SW 7-110N-63W	875	68	Water Well	U.S.G.S.	2.8
SW SE 16-110N-65W	893	63	Water Well	U.S.G.S.	2.0
SW NW 5-111N-61W	832	60	Water Well	U.S.G.S.	2.0
SW NW 18-111N-63W	1108	70	Water Well	U.S.G.S.	2.4
SE SE 3-112N-59W	900	65	Water Well	U.S.G.S.	2.4
NE NE 3-112N-61W	795	61	Water Well	U.S.G.S.	2.2
NE SE 11-112N-62W	783	62	Water Well	U.S.G.S.	2.3
SW NW 8-109N-62W	1095	70	Water Well	U.S.G.S.	2.4
SW SE 18-111N-60W	1035	67	Water Well	U.S.G.S.	2.2
SE SE 18-109N-64W	870	64	Water Well	U.S.G.S.	2.4
SW SE 13-112N-63W	950	62	Water Well	U.S.G.S.	1.8
SW NE 19-113N-61W	820	62	Water Well	U.S.G.S.	2.3
SW SW 19-113N-62W	865	62	Water Well	U.S.G.S.	2.1
NE NW 6-109N-61W	905	58	Water Well	U.S.G.S.	1.6
SE NE 10-110N-59W	1013	61	Water Well	U.S.G.S.	1.7
SW SW 3-110N-61W	965	64	Water Well	U.S.G.S.	2.1
NE NW 26-111N-59W	925	60	Water Well	U.S.G.S.	1.7
SW SW 6-111N-62W	1020	60	Water Well	U.S.G.S.	1.6
6-109N-61W	905	62	Water Well	U.S.G.S.	2.0
16-113N-65W	1010	70	Water Well	U.S.G.S.	2.6
NE 8-112N-61W	764	62.8	Water Well	Darton (1920)	2.6
NE 4-113N-63W	950	71.5	Water Well	Darton (1920)	3.0
NE SW 31-112N-60W	779	62	Water Well	Davis, Dyer & Powell (1961)	2.3
SW NW 22-112N-64W	900	59	Water Well	Davis, Dyer & Powell (1961)	1.7
SW SW 22-112N-64W	932	64	Water Well	Davis, Dyer & Powell (1961)	2.2
SE NE 28-113N-61W	881	64	Water Well	Davis, Dyer & Powell (1961)	2.3
21-109N-65W	956	61	Water Well	Schoon (1971)	1.8
7-110N-62W	822	67	Water Well	Schoon (1971)	3.0
14-112N-61W	1000	66	Water Well	Schoon (1971)	2.2
14-112N-61W	770	61	Water Well	Schoon (1971)	2.1
4-113N-61W	1000	71	Water Well	Schoon (1971)	2.8
12-113N-59W	1002	54	Water Well	Schoon (1971)	1.0
SE 14-109N-62W	760	62	Water Well	SDSM&T (1954)	2.4

1-110N-62W	1000	67	Water Well	SDSM&T (1954)	2.3
3-113N-63W	953	70.1	Water Well	SDSM&T (1954)	2.8

BENNETT COUNTY

SW SW 30-37N-36W	3370	119	English No. 1 Kocer Oil Test		2.2

BON HOMME COUNTY

SE NW 6-94N-59W	815	62.6	Water Well	Darton (1920)	2.4
SE SE 23-93N-60W	550	65	Water Well	Darton (1920)	4.1
19-94N-58W	578	60	Water Well	Darton (1920)	2.9
34-95N-59W	734	61	Water Well	Darton (1920)	2.4
31-94N-58W	645	62	Water Well	Darton (1920)	3.0
5-92N-61W	601	65	Water Well	U.S.G.S.	3.7
6-94N-59W	733	64	Water Well	U.S.G.S.	2.8
5-93N-58W	665	62	Water Well	Darton (1920)	2.8
1-93N-59W	646	62	Water Well	Darton (1920)	2.9
NE NW 3-92N-60W	705	65	Water Well	Davis, Dyer & Powell (1961)	3.1
NW SE 4-92N-60W	719	65	Water Well	Davis, Dyer & Powell (1961)	3.0
SE SE 23-93N-60W	640	63	Water Well	Davis, Dyer & Powell (1961)	3.1
SW NE 23-93N-62W	500+	64	Water Well	Davis, Dyer & Powell (1961)	3.0±
SE SE 6-94N-59W	733	62	Water Well	Davis, Dyer & Powell (1961)	2.5

BROWN COUNTY

NE SE 6-128N-65W	1120	59.5	Water Well	U.S.G.S.	1.4
SW NE 4-128N-64W	1193	62.5	Water Well	U.S.G.S.	1.6
SW SE 8-128N-63W	1100	62.5	Water Well	U.S.G.S.	1.7
NE SE 5-128N-62W	1180	68	Water Well	U.S.G.S.	2.0
NW NW 12-123N-64W	1242	72	Water Well	U.S.G.S.	2.3
SW SE 23-128N-60W	880	59.5	Water Well	U.S.G.S.	1.8
NW NW 3-127N-65W	1300	63	Water Well	U.S.G.S.	1.5
NE NE 7-127N-63W	1325	66	Water Well	U.S.G.S.	1.7
NE NE 14-127N-60W	900	59.5	Water Well	U.S.G.S.	1.8
NE NE 7-126N-65W	1150	64.5	Water Well	U.S.G.S.	1.8
SE NE 2-125N-64W	1090	57	Water Well	U.S.G.S.	1.1
SE SE 15-125N-63W	1200	64	Water Well	U.S.G.S.	1.7
SW SW 15-124N-65W	1360	70	Water Well	U.S.G.S.	1.9
NE NW 1-122N-65W	1020	65	Water Well	U.S.G.S.	2.1
SE NE 2-122N-62W	920	62.5	Water Well	U.S.G.S.	2.0
SW SW 3-122N-60W	1040	64.5	Water Well	U.S.G.S.	2.0

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
NW NE 11-127N-64W	1045	69	Water Well	Darton (1920)	2.4
NW NW 14-125N-64W	1000	66.2	Water Well	Darton (1920)	2.1
SW NW 28-125N-62W	964	63	Water Well	Darton (1920)	2.0
NW SW 31-124N-60W	942	63	Water Well	Darton (1920)	2.0
SE SE 13-123N-64W	1100	66.9	Water Well	Darton (1920)	2.1
NE 10-123N-65W	1000	65	Water Well	Darton (1920)	2.1
SE 10-123N-65W	1000	64	Water Well	Darton (1920)	2.0
SE 12-123N-65W	980	65	Water Well	Darton (1920)	2.2
S½ 30-123N-65W	1000+	65	Water Well	Darton (1920)	2.1
NE 32-123N-65W	1020	65.5	Water Well	Darton (1920)	2.1
NW 15-123N-64W	800	60	Water Well	Darton (1920)	2.0
SE 27-123N-60W	920	63	Water Well	Darton (1920)	2.1
8-123N-60W	977	62	Water Well	Darton (1920)	1.9
SW 11-122N-65W	1075	66	Water Well	Darton (1920)	2.1
S C 22-122N-65W	1070	65	Water Well	Darton (1920)	2.0
NW 19-122N-64W	931	64	Water Well	Darton (1920)	2.2
SE 21-122N-63W	1000	67	Water Well	Darton (1920)	2.3
SE 30-121N-64W	945	75	Water Well	Darton (1920)	3.4
SE 17-121N-64W	340	52	Water Well	Darton (1920)	2.5
NE 2-122N-61W	915	64	Water Well	Darton (1920)	2.2
SW 32-122N-60W	940	67	Water Well	Darton (1920)	2.5
NE 24-121N-61W	394	67	Water Well	Darton (1920)	2.7
NW 27-121N-61W	920	67	Water Well	Darton (1920)	2.6
SW 33-121N-61W	900	66.5	Water Well	Darton (1920)	2.6
NW 34-121N-61W	910	69 +	Water Well	Darton (1920)	2.8
15-123N-63W	1300	66.9	Water Well	SDSM&T (1954)	1.8
7-125N-64W	1030	66.2	Water Well	SDSM&T (1954)	2.2
SE NE 14-126N-65W	1385	72	Water Well	U.S.G.S.	2.0

BRULE COUNTY

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
NW 30-101N-68W	900	80	Water Well	Darton (1920)	4.2
NE NW 1-101N-68W	882	52.5	Water Well	Davis, Dyer & Powell (1961)	1.0
NW NW 12-102N-67W	1000+	64	Water Well	Davis, Dyer & Powell (1961)	2.0
NE NW 6-102N-71W	780	76	Water Well	Davis, Dyer & Powell (1961)	4.3
SE NE 35-102N-71W	850	84	Water Well	Davis, Dyer & Powell (1961)	5.0
SE NW 2-102N-72W	850	79	Water Well	Davis, Dyer & Powell (1961)	4.3
NE SE 14-103N-70W	840	61	Water Well	Davis, Dyer & Powell (1961)	2.1
NW NW 17-103N-70W	890	70	Water Well	Davis, Dyer & Powell (1961)	3.0

SW SW 17-103N-70W	1010	73	Water Well	Davis, Dyer & Powell (1961)	3.0
SW SW 18-103N-70W	811	73	Water Well	Davis, Dyer & Powell (1961)	3.7
SE SE 18-103N-70W	935	72	Water Well	Davis, Dyer & Powell (1961)	3.1
SW SW 19-103N-70W	850	72	Water Well	Davis, Dyer & Powell (1961)	3.3
SE SW 19-103N-70W	800+	69	Water Well	Davis, Dyer & Powell (1961)	3.3
NE NW 28-103N-70W	956	69	Water Well	Davis, Dyer & Powell (1961)	2.7
NW SW 30-103N-70W	875	64	Water Well	Davis, Dyer & Powell (1961)	2.3
SE NW 7-103N-71W	850	77	Water Well	Davis, Dyer & Powell (1961)	4.0
NW NW 13-103N-71W	970	60	Water Well	Davis, Dyer & Powell (1961)	1.7
NW NW 13-103N-71W	1170	71	Water Well	Davis, Dyer & Powell (1961)	2.3
SW SE 14-103N-71W	881	69	Water Well	Davis, Dyer & Powell (1961)	2.9
SW SE 20-103N-71W	1121	77	Water Well	Davis, Dyer & Powell (1961)	3.0
SW SE 22-103N-71W	1000+	75	Water Well	Davis, Dyer & Powell (1961)	3.0
NW NE 25-103N-71W	750	60	Water Well	Davis, Dyer & Powell (1961)	2.2
NE NE 9-104N-69W	940	58	Water Well	Davis, Dyer & Powell (1961)	1.5
NE SW 9-104N-69W	850	63	Water Well	Davis, Dyer & Powell (1961)	2.3
NE SE 11-104N-69W	780	65	Water Well	Davis, Dyer & Powell (1961)	2.8
SE NE 17-104N-69W	860	68	Water Well	Davis, Dyer & Powell (1961)	3.0
NE NW 20-104N-69W	815	65.5	Water Well	Davis, Dyer & Powell (1961)	2.6
NW SW 31-104N-69W	855	64	Water Well	Davis, Dyer & Powell (1961)	2.4
NE SE 17-104N-70W	900	61	Water Well	Davis, Dyer & Powell (1961)	1.9
SW NE 26-104N-70W	900	62	Water Well	Davis, Dyer & Powell (1961)	2.0
SW SW 33-104N-70W	905	60	Water Well	Davis, Dyer & Powell (1961)	1.8
NE SE 34-104N-70W	865	67	Water Well	Davis, Dyer & Powell (1961)	2.8
SW SE 35-104N-70W	907	68	Water Well	Davis, Dyer & Powell (1961)	2.7
NW NE 10-104N-71W	940	72	Water Well	Davis, Dyer & Powell (1961)	3.1
SE SE 13-104N-71W	785	67	Water Well	Davis, Dyer & Powell (1961)	3.0
NE NE 7-105N-68W	800+	62	Water Well	Davis, Dyer & Powell (1961)	2.3
SW SW 11-105N-68W	900+	60	Water Well	Davis, Dyer & Powell (1961)	1.8
NE NE 15-105N-68W	1020	62	Water Well	Davis, Dyer & Powell (1961)	1.8
NE SW 30-105N-68W	900	66	Water Well	Davis, Dyer & Powell (1961)	2.5
SE SE 31-105N-68W	840	62	Water Well	Davis, Dyer & Powell (1961)	2.2
SE SE 33-105N-68W	900	61	Water Well	Davis, Dyer & Powell (1961)	1.9
SE SE 5-105N-69W	801	62	Water Well	Davis, Dyer & Powell (1961)	2.3
SE NW 7-105N-69W	870	62	Water Well	Davis, Dyer & Powell (1961)	2.1
NE SW 7-105N-69W	850	62	Water Well	Davis, Dyer & Powell (1961)	2.2
11-105N-68W	1000	60	Water Well	U.S.G.S.	1.6
34-104N-70W	865	68	Water Well	U.S.G.S.	3.0
26-104N-70W	1018	70	Water Well	U.S.G.S.	2.6
7-101N-70W	840	78	Water Well	U.S.G.S.	4.2
NW SE 7-105N-69W	850	63	Water Well	Davis, Dyer & Powell (1961)	2.3
SE SE 7-105N-69W	860	64	Water Well	Davis, Dyer & Powell (1961)	2.4

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
NE SE 15-105N-69W	870	68	Water Well	Davis, Dyer & Powell (1961)	2.8
NE SE 11-105N-69W	860	70	Water Well	Davis, Dyer & Powell (1961)	3.1
NW NW 13-105N-70W	1100	72	Water Well	Davis, Dyer & Powell (1961)	2.6
NE NE 31-105N-70W	900	66	Water Well	Davis, Dyer & Powell (1961)	2.5
NE SE 10-105N-71W	900	70	Water Well	Davis, Dyer & Powell (1961)	3.0
SW SE 11-105N-71W	860	68	Water Well	Davis, Dyer & Powell (1961)	2.9
SW SE 12-105N-71W	650	68	Water Well	Davis, Dyer & Powell (1961)	3.9
NE SE 14-105N-71W	900	68	Water Well	Davis, Dyer & Powell (1961)	2.8
NE NE 24-105N-71W	933	68	Water Well	Davis, Dyer & Powell (1961)	2.6
NW SW 24-105N-71W	630	65	Water Well	Davis, Dyer & Powell (1961)	3.5
15-104N-71W	600	71.6	Water Well	SDSM&T (1954)	5.0
NE SW 25-103N-67W	860	60	Water Well	U.S.G.S.	1.9

BUFFALO COUNTY

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
NW NE 15-106N-69W	835	65	Water Well	U.S.G.S.	2.5
SE SE 35-108N-73W	1070	71	Water Well	U.S.G.S.	2.6
SW NE 12-108N-72W	1240	78	Water Well	U.S.G.S.	2.9
NW NW 13-107N-72W	860	69.5	Water Well		3.0
NW NW 13-107N-72W	1470	66	Water Well	Davis, Dyer & Powell (1961)	1.5
NW SE 22-107N-72W	1350	69.5	Water Well	Davis, Dyer & Powell (1961)	1.9
NW NW 23-107N-72W	860	69.5	Water Well	Davis, Dyer & Powell (1961)	3.1
SE NW 23-107N-72W	780	63.5	Water Well	Davis, Dyer & Powell (1961)	2.6
35-108N-73W	1070	71	Water Well	U.S.G.S.	2.6
15-106N-69W	835	64	Water Well	U.S.G.S.	2.4
12-108N-72W	1240	71	Water Well	U.S.G.S.	2.2

BUTTE COUNTY

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
SE SW 19-9N-4E	1417	94	Water Well	Darton (1920)	2.9
SW SE 11-8N-3E	600	69	Water Well	Davis, Dyer & Powell (1961)	4.4
SE SE 25-8N-3E	600	66	Water Well	Davis, Dyer & Powell (1961)	4.0
NE NE 7-8N-5E	2250	90	Nisland Water Well	Davis, Dyer & Powell (1961)	2.1
SW SW 28-8N-6E	2300	82	Vale Water Well	Davis, Dyer & Powell (1961)	1.7
SE NE 27-9N-3E	4016	126	Harmon Oil Test	Davis, Dyer & Powell (1961)	2.0
NE 24-9N-5E	4400	115	Water Well	Davis, Dyer & Powell (1961)	1.6
NE 24-9N-5E	2200	81	Water Well	SDSM&T (1954)	1.7
NE 30-9N-6E	2741	101	Newell Water Well	SDSM&T (1954)	2.1

SE NW 13-11N-1E	2608	86	Water Well		1.6
SW SW 27-10N-5E	2710	83	Water Well		1.5
SW SW 11-11N-7E	3272	114	Water Well		2.15
NE NE 16-14N-3E	3155	100	Texas Gas No. 1-16 State Oil Test		1.8
NE NE 7-9N-9E	7140	154	Mobil No. 1 Mickelson Oil Test		1.55
NW NW 14-9N-8E	6004	148	Mobil No. 15 Sipilia Oil Test		1.73
SW SW 23-10N-7E	2729	104	Banks No. 1-23 Fed. Richards Oil Test		2.2
SW SW 27-14N-2E	7028	141	Pure No. 1 Govt. Oil Test		1.4
NE SW 23-10N-1E	4532	97	Shell No. 23-23 Johnson Oil Test		1.25
SW SW 15-12N-2E	6456	135	Sojourner No. 1 Widdoss Oil Test		1.4
NW SE 12-8N-5E	5759	138	Seylor No. 1 Anderson Oil Test		1.6
SE NW 2-8N-3E	2225	103	Water Well	U.S.G.S.	2.7
NE NE 12-7N-1E	1121	68	Water Well	U.S.G.S.	2.2
SE NE 11-7N-1E	1004	68	Water Well	U.S.G.S.	2.6
SW SW 33-8N-3E	2340	94	Water Well	U.S.G.S.	2.1
SW SW 6-13N-4E	3122	103	Texas Gas No. 1-6 Duncan Fed. Oil Test		1.9
NW NW 29-14N-4E	3240	100	Texas Gas No. 1-29 Duncan Fed. Oil Test		1.7
NW NW 4-14N-4E	7772	150	Amerada No. 1 State Oil Test		1.38
SE SE 16-12N-9E	5201	131	Beer No. 1 State Oil Test		1.31
SW SE 22-11N-8E	4956	128	Beer No. 1 Govt. Oil Test		1.7
SE NE 25-10N-7E	4661	128	Beer No. 1 Norsworthy Reges Oil Test		1.8
NE NE 2-8N-8E	4265	123	Beer No. 1 Stirling Govt. Oil Test		1.9
NW NW 9-11N-7E	3250	110	Christie-Stewart No. 1 Eickler Oil Test		2.0
NE NW 8-13N-5E	3630	103	Harrison No. 1 Fed. Wheatley Oil Test		1.6
SE SE 17-13N-5E	3350	105	Harrison No. 1-17 Fed. Wheatley Oil Test		1.8
SE SE 30-10N-6E	2687	86	Two-Top No. 2 Kayras Oil Test		1.6
SW SW 2-14N-4E	3650	119	Harrison No. 1 US Smelting Oil Test		2.1
NW NW 2-13N-7E	3665	109	Koch No. 1 Aztec-State Oil Test		1.8
NE SE 14-14N-6E	3645	108	Koch No. 1 Olson Oil Test		1.75
SW SW 3-9N-7E	2842	100	Koch No. 1 Swan Fed. Oil Test		2.0
SW SW 25-10N-6E	2900	95	Koch No. 1 Richards Fed. Oil Test		1.8
SE SE 30-10N-8E	2975	99	Mallonee No. 1 Warwick Oil Test		1.86
SW NE 1-9N-7E	2920	100	Mallonee No. 1 USA Oil Test		1.9
NE NE 7-14N-5E	3650	104	Harrison No. 1 Fed. Wheatley Oil Test		1.6

CAMPBELL COUNTY

SE SW 2-128N-79W	2505	70	Moser Water Well	1.1
SW SE 20-127N-78W	2412	84	Diebert Water Well	1.7
SW NW 21-127N-77W	2266	84	Diebert Water Well	1.8
NW NE 3-126N-78W	2515	78	Sjomling Water Well	1.3

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
SW SW 3-125N-78W	2200	77	Nelson Water Well		1.5
5-127N-78W	2367	85	Water Well	U.S.G.S.	1.7
SE SE 13-126N-77W	1780	80	Wilhite No. 1 Ritter Oil Test		2.0
NE NE 22-125N-76W	1696	80	Wilhite No. 1 Brockel Oil Test		2.2
NW NE 30-125N-77W	1814	80	Wilhite No. 1 Thompson Oil Test		2.0

CHARLES MIX COUNTY

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
8-96N-63W	672	61	Water Well	U.S.G.S.	2.6
SW SW 26-94N-64W	651	70	Water Well	Darton (1920)	4.2
SE SE 4-96N-65W	773	70	Water Well	Darton (1920)	3.5
17-98N-66W	860	70	Water Well	Darton (1920)	3.1
33-99N-66W	840	70	Water Well	Darton (1920)	3.2
NW NE 5-94N-64W	994	68	Water Well	Davis, Dyer & Powell (1961)	2.5
SE NE 35-95N-65W	575	72	Water Well	Davis, Dyer & Powell (1961)	5.4
SE SE 3-96N-63W	614	62	Water Well	Davis, Dyer & Powell (1961)	3.1
SE SE 9-96N-63W	680	66	Water Well	Davis, Dyer & Powell (1961)	3.4
NE SE 30-96N-63W	930	59	Water Well	Davis, Dyer & Powell (1961)	1.6
NE SE 5-96N-64W	982	70	Water Well	Davis, Dyer & Powell (1961)	2.7
NW NE 7-96N-64W	964	69	Water Well	Davis, Dyer & Powell (1961)	2.7
SW SE 9-96N-65W	800	70	Water Well	Davis, Dyer & Powell (1961)	3.4
NW NW 29-96N-65W	740	74.5	Water Well	Davis, Dyer & Powell (1961)	4.3
NW NE 27-96N-66W	800	73	Water Well	Davis, Dyer & Powell (1961)	3.8
SW NE 27-96N-66W	792	75	Water Well	Davis, Dyer & Powell (1961)	4.1
SW SW 16-95N-62W	548	76	Water Well		6.3
NW NE 1-94N-64W	994	68	Water Well		2.5
SE SW 27-96N-66W	905	72	Water Well	Davis, Dyer & Powell (1961)	3.2
NE SE 4-96N-67W	700	74	Water Well	Davis, Dyer & Powell (1961)	4.5
NW NE 1-96N-68W	635	76	Water Well	Davis, Dyer & Powell (1961)	5.4
SW SW 34-97N-63W	900+	64	Water Well	Davis, Dyer & Powell (1961)	2.3
SW NW 16-97N-64W	746	66	Water Well	Davis, Dyer & Powell (1961)	3.0
SW SW 27-97N-64W	860	62	Water Well	Davis, Dyer & Powell (1961)	2.1
NW NE 5-97N-68W	650	74	Water Well	Davis, Dyer & Powell (1961)	5.0
NW NW 25-97N-68W	995	79	Water Well	Davis, Dyer & Powell (1961)	3.6
1-99N-68W	738	56	Water Well		1.6
SW 24-100N-70W	890	72	Water Well		3.2
SE SE 31-98N-68W	640	62	Water Well	Davis, Dyer & Powell (1961)	3.0
SW NE 10-98N-69W	725	82	Water Well	Davis, Dyer & Powell (1961)	4.0

NW SE 17-98N-69W	644	79	Water Well	Davis, Dyer & Powell (1961)	5.9
SE SE 26-98N-69W	960	81	Water Well	Davis, Dyer & Powell (1961)	4.0
NW NE 35-98N-69W	960	79	Water Well	Davis, Dyer & Powell (1961)	3.6
NW NW 19-99N-68W	840	77	Water Well	Davis, Dyer & Powell (1961)	4.1
SE SE 13-99N-69W	900	78.5	Water Well	Davis, Dyer & Powell (1961)	4.0
SE SW 8-96N-63W	672	61	Water Well	U.S.G.S.	2.4
NW SE 26-94N-64W	680	70	Water Well	U.S.G.S.	4.0
SE SE 10-99N-70W	735	83	Water Well	Davis, Dyer & Powell (1961)	5.6
NE SE 15-99N-70W	700+	76	Water Well	Davis, Dyer & Powell (1961)	4.8
SW NE 30-100N-70W	770 est.	86	Water Well Platte Colony	Davis, Dyer & Powell (1961)	5.8±
NW SE 18-100N-71W	770	82	Water Well	Davis, Dyer & Powell (1961)	5.2
NE SW 20-100N-71W	770 est.	89	Water Well	Davis, Dyer & Powell (1961)	6.2
NW SE 26-100N-71W	688	89	Water Well	Davis, Dyer & Powell (1961)	7.0
SW NE 28-100N-71W	700 est.	90	Water Well	Davis, Dyer & Powell (1961)	7.0
NE NE 29-100N-71W	785	88	Water Well	Davis, Dyer & Powell (1961)	6.0

CLAY COUNTY

7-92N-52W	500	58	Water Well	U.S.G.S.	3.0

CORSON COUNTY

NW SW 11-22N-19E	8445	150	Shell No. 1 Winter Oil Test		1.2
SW 23-22N-19E	5823	144	Youngblood No. 1 Winter Oil Test		1.5
SE SE 20-23N-22E	7470	161	Youngblood No. 1 Drascovich Oil Test		1.56
SW SW 8-21N-19E	5820	130	Youngblood No. 1 Macheel Oil Test		1.5
SW SE 4-18N-23E	3100	92	Koch No. 1 Bickel Oil Test		1.5
NE NW 26-18N-21E	6128	135	Kilroy-Swindler No. 1 Scholl Oil Test		1.5
SE NW 12-18N-19E	6469	149	Shell No. 22-12 Everidge Oil Test		1.6
NW NW 23-19N-18E	5775	132	Shell No. 11-23 Govt. Oil Test		1.5
SE SW 38-22N-21E	6684	138	Wilhite No. 1 State Oil Test		1.4
SW SW 8-21N-24E	5230	112	Cayman No. 1 State "A" Oil Test		1.3
NW SE 16-20N-25E	3561	99	Cayman No. 1 State "B" Oil Test		1.6
SE NE 7-18N-29E	2300	83	Love Water Well		1.7
SW NW 34-20N-26E	2336	75	Thurston Water Well		1.3
SW SW 16-21N-30E	2688	84	Claymore Water Well		1.5
NW SE 16-22N-23E	4424	110	Cayman No. 1 State "C-2" Oil Test		1.5
SW NW 32-20N-18E	7510	149	Consolidated No. 1 Tribal Oil Test		1.4

CUSTER COUNTY

SE SW 29-6S-7E	725	65.5	Water Well	Darton (1920)	3.1

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
SE SE 25-4S-7E	2824	103	Palensky No. 1 Smith Oil Test	Davis, Dyer & Powell (1961)	2.1
NW NW 15-6S-6E	939	108	Water Well	SDSM&T (1954)	7.2
NE SE 2-3S-10E	2500	102	Gary No. 1 Bohling Oil Test		2.3
NW SW 30-3S-10E	2529	105	Gary No. 1 Wilsey Oil Test		2.4
NE NW 21-4S-8E	1605	95	Gary No. 1 Young Oil Test		3.2
SW NW 23-3S-11E	2561	105	Gary No. 1 O'Neill Oil Test		2.4
SW SE 24-3S-8E	1535	80	Continental No. 1 Harrison Oil Test		2.4
SW SE 33-2S-8E	961	61	Continental No. 1 Larson Oil Test		1.8
NE NE 20-3S-10E	2619	108	Benedum No. 1 Govt. Oil Test		2.45
SE SW 26-3S-10E	2666	95	Phillips No. 1 Govt. Oil Test		1.9
NW SW 33-2S-10E	2124	100	Pure No. 1 Keliher Oil Test		3.06
NE SE 19-3S-11E	2912	107	Samedan No. 1 Norris Grain Oil Test		2.2
NE NE 35-2S-9E	2602	120	Shell No. 1 Evans Oil Test		3.0
SW SW 24-6S-8E	2880	110	Shell No. 1 Englebrecht Oil Test		2.3
NW SE 5-3S-11E	2892	118	Shell No. 1 Flier Oil Test		2.6
NE NE 28-2S-11E	3412	105	Sterling No. 1 Ireland Oil Test		1.8
SW NW 29-2S-11E	3243	104	Sterling No. 1 Flier Oil Test		1.9
NE NE 25-2S-10E	3330	98	Sterling No. 1 Kosturas Oil Test		1.3
SE NW 13-3S-10E	3048	96	Sterling No. 1 Scism Oil Test		1.7
SE SE 3-4S-10E	4126	128	Benedum No. 1 Kaiser		2.4
NE NE 15-6S-6E	939	66	Water Well	U.S.G.S.	2.6

DAVISON COUNTY

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
3-101N-62W	565	56	Water Well	Darton (1920)	2.2
35-104N-60W	507	56	Water Well	Darton (1920)	2.4
22-103N-60W	530	56	Water Well	Darton (1920)	2.3
NE SW 30-102N-61W	460	58	Water Well	U.S.G.S.	3.2

DAY COUNTY

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
NE NE 3-122N-29W	1070	71.6	Water Well	Darton (1920)	2.6
NW NW 30-123N-59W	950	60	Water Well	U.S.G.S.	1.7
5-123N-59W	1000	59.5	Water Well	U.S.G.S.	1.6

DEWEY COUNTY

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
SE SE 2-12N-31E	1337	79	Water Well	Darton (1920)	2.7

SW SW 17-12N-24E	4322	128	Water Well	Davis, Dyer & Powell (1961)	2.0
36-14N-29E	2505	90	Water Well	Schoon (1971)	1.8
8-15N-31E	2266	84	Water Well	Schoon (1971)	1.8
12-15N-26E	2021	85	Water Well	Schoon (1971)	2.0
26-15N-30E	2215	90	Water Well	Schoon (1971)	2.1
29-15N-30E	2200	91.5	Water Well	Schoon (1971)	2.2
SE SE 27-17N-27E	4322	126	Herndon No. 1 Merkel Oil Test		1.9
NW SW 32-13N-22E	5992	138	Kerr-McGee No. 1 Cook Oil Test		1.6
NW NW 4-12N-22E	5056	150	Bueno No. 1 State Oil Test		2.1
SW NW 34-13N-24E	4897	108	Herndon No. 1 State Oil Test		1.3
NW NW 13-13N-27E	5336	120	Gulf No. 1 Jewett Oil Test		1.4
SE SE 21-13N-22E	5700	137	Pendak No. 1 Cowan Oil Test		1.6
SE SE 25-16N-22E	6324	118	Youngblood No. 1 Galvin Oil Test		1.2
SE SW 13-15N-23E	5146	121	Herndon No. 1 O'Leary Oil Test		1.5
NE SW 11-12N-22E	5144	120	Inv. No. 1 Williams State Oil Test		1.5
NE SE 30-13N-22E	5083	132	Inv. No. 2 F. Brings Your Horse		1.7
NE NE 6-12N-22E	5200	130	Inv. No. 1 Brooks Oil Test		1.6
NE SW 32-13N-22E	5073	139	Inv. No. 1 Wallace Cook Oil Test		1.9
SE SW 32-13N-22E	5069	121	Inv. No. 2 Wallace Cook Oil Test		1.5
SE SE 20-13N-22E	5832	156	Inv. No. 1 Cowan Oil Test		1.9
NE NW 4-12N-22E	5066	120	Inv. No. 1 Holloway Oil Test		1.5
SW NE 4-12N-22E	5019	120	Inv. No. 2 Holloway Oil Test		1.5
NW SE 8-12N-22E	5117	121	Inv. No. 1 M. Cook Oil Test		1.5
SE NE 4-12N-22E	5036	120	Inv. No. 3 Holloway Oil Test		1.5
SE NW 4-12N-22E	5068	119	Inv. No. 6 Holloway Oil Test		1.5
NW SW 4-12N-22E	5078	130	Inv. No. 7 Holloway Oil Test		1.7
SW SW 29-13N-22E	5083	139	Inv. No. 1 Little Skunk Oil Test		1.9
NW NW 29-13N-22E	5101	130	Inv. No. 3 Little Skunk Oil Test		1.7
NE NW 17-12N-22E	5126	134	Inv. No. 2 McCellan Oil Test		1.8
SE NE 30-13N-22E	5122	144	Inv. No. 1 A Redbird Oil Test		1.9

DOUGLAS COUNTY

SW NW 7-98N-63W	757	68.3	Water Well	Darton (1920)	3.3
SW NW 30-98N-63W	736	65	Water Well	Darton (1920)	3.0
5-98N-64W	1311	85	Oil Test		3.2
NE 24-98N-64W	736	65	Water Well		3.0

EDMUNDS COUNTY

SE NE 17-121N-69W	1660	68	Water Well	U.S.G.S.	1.4

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
SW SW 10-122N-66W	1380	67	Water Well	U.S.G.S.	1.7
NE NE 14-122N-69W	1610	72	Water Well	U.S.G.S.	1.7
NW NE 25-123N-66W	1390	70	Water Well	U.S.G.S.	1.9
NE NW 20-123N-67W	1260	68	Water Well	U.S.G.S.	1.9
NW NW 27-123N-68W	1540	75	Water Well	U.S.G.S.	2.0
NW NE 21-123N-69W	1700	75	Water Well	U.S.G.S.	1.8
NW NE 24-124N-66W	1490	85	Water Well	U.S.G.S.	2.8
SE NW 20-124N-67W	1605	76	Water Well	U.S.G.S.	2.0
SE SW 3-124N-68W	1620	75	Water Well	U.S.G.S.	1.9
15-123N-68W	1400	61	Water Well	U.S.G.S.	1.2
NE NE 17-121N-67W	1390	71	Water Well	U.S.G.S.	2.0
NW NW 29-124N-72W	2005	76.5	Water Well	U.S.G.S.	1.6
SE SE 24-123N-71W	1470	78	Water Well	U.S.G.S.	2.0
SE 17-122N-71W	1526	56	Water Well		.8
SE NE 28-123N-68W	1265	71.6	Water Well	Darton (1920)	2.2
SE 22-123N-68W	1195	73	Water Well	Darton (1920)	2.5
SE 23-123N-68W	1125	70.5	Water Well	Darton (1920)	2.4
SE 8-123N-67W	1140	63	Water Well	Darton (1920)	1.7
NW 10-123N-67W	1185	69	Water Well	Darton (1920)	2.1
SW 10-123N-67W	1115	69	Water Well	Darton (1920)	2.3
SW 11-123N-67W	1135	68	Water Well	Darton (1920)	2.1
NW 20-123N-67W	1160	69.5	Water Well	Darton (1920)	2.2
SW 23-123N-67W	1140	67	Water Well	Darton (1920)	2.0
NE 3-123N-67W	1078	67	Water Well	Darton (1920)	2.1
C 8-123N-66W	1100	66	Water Well	Darton (1920)	2.0
SE 20-123N-66W	1100	69.5	Water Well	Darton (1920)	2.4
NW 16-122N-67W	1140	65.5	Water Well	Darton (1920)	2.0
SE 26-122N-67W	1060	65	Water Well	Darton (1920)	2.0
SE 4-122N-66W	1080	65.5	Water Well	Darton (1920)	2.0
SW 10-122N-66W	1070	65.5	Water Well	Darton (1920)	2.0
NE 19-122N-66W	1038	66.5	Water Well	Darton (1920)	2.2
NE 29-122N-66W	1045	65	Water Well	Darton (1920)	2.0
SE 30-122N-66W	1050	65.5	Water Well	Darton (1920)	2.1
SE 32-122N-66W	1060	67.5	Water Well	Darton (1920)	2.3
SE 33-122N-66W	1030	66	Water Well	Darton (1920)	2.2
SE 8-121N-67W	1050	64	Water Well	Darton (1920)	1.9
NW 32-121N-67W	1125	66	Water Well	Darton (1920)	2.0
SE 26-121N-67W	1155	65	Water Well	Darton (1920)	1.8

SW 10-121N-66W	1000	65	Water Well	Darton (1920)	2.1
SE 29-121N-66W	1000	64.5	Water Well	Darton (1920)	2.1
NE 32-121N-66W	967	64	Water Well	Darton (1920)	2.1
NW NW 10-121N-68W	1120	56	Water Well	Davis, Dyer & Powell (1961)	1.0
SE NE 22-123N-66W	1400	66	Water Well	Davis, Dyer & Powell (1961)	1.5

FALL RIVER COUNTY

NE NE 1-9S-2E	2965	122	Water Well	Darton (1920)	2.7
SE NE 9-7S-1E	550	56	Water Well	Davis, Dyer & Powell (1961)	2.2
SE SE 16-7S-1E	640	57	Water Well	Davis, Dyer & Powell (1961)	2.2
NW NW 19-7S-1E	700	69	Water Well	Davis, Dyer & Powell (1961)	3.7
SE SE 32-7S-2E	600	55	Water Well	Davis, Dyer & Powell (1961)	1.9
NE NE 5-8S-2E	600	55	Water Well	Davis, Dyer & Powell (1961)	1.9
NW SE 8-8S-3E	500	64	Water Well	Davis, Dyer & Powell (1961)	4.1
NE NE 1-9S-2E	2955	125.5	Water Well	Davis, Dyer & Powell (1961)	2.8
SW NE 1-9S-2E	2983	126	Water Well	Davis, Dyer & Powell (1961)	2.8
SW NE 1-9S-2E	3183	127	Water Well	Davis, Dyer & Powell (1961)	2.6
SW NE 3-10S-2E	3846	138	Water Well	Davis, Dyer & Powell (1961)	2.5
NE NW 4-12S-4E	3170	102	Woodword No. 4 Schmidt Oil Test		1.8
SE SE 27-9S-5E	2360	90	Weir No. 1 State Oil Test		2.0
SW SE 35-11S-5E	3050	107	Webb No. 35-15 State Oil Test		2.1
NE NE 8-10S-4E	2770	104	Tenneco No. 1 USA Ideen Oil Test		2.2
SW NE 30-8S-3E	2500	103	Tenneco No. 1 Mertinson Oil Test		2.4
SE SE 12-9S-1E	3250	108	Sun No. 1 Wollway Govt. Oil Test		2.0
NE SE 21-7S-1E	3050	100	Sun No. 1 Nelson Oil Test		1.85
SE SE 15-7S-1E	910	84	Superior No. 1 Peterson Oil Test		4.6
NW NW 19-11S-6E	4710	127	Sinclair No. 1 State Oil Test		1.76
SW NE 2-8S-8E	2720	117	Shell No. 1 Thompson Oil Test		2.7
SE NW 34-8S-9E	2735	123	Shell No. 1 Sides Oil Test		2.9
SW SW 28-11S-1E	1510	110	Raymond No. 1 Mitchell Oil Test		4.5
NW SW 23-11S-9E	1590	102	Raymond No. 1 Goodnick Oil Test		3.7
SW SW 5-11S-2E	1920	85	Phillips No. 1 Govt. "B" Oil Test		2.2
SE NW 20-7S-9E	2660	90	Phillips No. 1 A Govt. Oil Test		1.75
NW SW 4-8S-9E	2370	98	Pure No. 1 Barta Oil Test		2.3
SW NW 22-7S-1E	2540	88	Petro-Lewis No. 5-22 Peterson Oil Test		1.77
SE SW 14-8S-2E	2430	104	Petro-Lewis No. 14-14 Childers Oil Test		2.5
NE NW 7-9S-2E	3250	112	Petro-Lewis No. 3-7 Trotter-Fed. Oil Test		2.1
NW NW 6-12S-1E	4190	117	Pan Am No. 1 Govt.-Dorough Oil Test		1.73
NW NW 29-11S-1E	4130	120	Pan Am No. 1 Socony Mobil Oil Test		1.85
NW SW 10-11S-1E	4080	120	Pac. West No. 1 Govt. Christiana Oil Test		1.86

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
NE NE 16-10S-8E	4310	118	Gary No. 16-1 State Oil Test		1.7
SW SW 12-7S-2E	1526	80	Ozark No. 1 Robinson Oil Test		2.4
SE NE 25-9S-7E	4040	124	Ohio No. 1 Hendrick Oil Test		2.0
SE NE 26-9S-7E	2100	112	North Cent. No. 1 Roll Oil Test		3.3
SW SE 32-8S-8E	2450	118	North Cent. No. 1-32 Fed. Oil Test		3.1
SE SE 10-8S-9E	2870	107	Mule Creek No. 1 Clark Oil Test		2.2
SW NE 34-9S-5E	2530	95	Lakota No. 1 Houghton Oil Test		2.0
NE NW 21-11S-4E	1140	85	Phillips No. 1 Madson Oil Test		3.7
SE SW 30-10S-8E	4090	123	Interior No. 1 Putnam Oil Test		1.9
SE SW 33-11S-4E	1800	92	Hughes No. 1 Anderson Oil Test		2.7
NE NW 3-10S-9E	2180	102	Gary No. 1 White Oil Test		2.7
NW NW 16-9S-9E	2185	88	Gary No. 16-4 State Oil Test		2.0
SE SE 25-10S-5E	4750	117	Gary No. 1 State Oil Test		1.5
SE NE 12-8S-1E	2760	97	Gary No. 12-8 Fed. Oil Test		1.5
NE NE 21-8S-8E	2565	105	Gary No. 1 Rasmussen Oil Test		2.4
SW SE 30-11S-7E	3160	112	Gary No. 1 Pettigrew Oil Test		2.1
SW NE 14-8S-3E	2390	96	Gary No. 14-7 McKnight Oil Test		2.2
SW NE 28-11S-6E	2800	108	Gary No. 1 Lounsberry Oil Test		2.3
NW NE 2-12S-8E	3090	111	Gary No. 1 Kimblom Oil Test		2.2
SW SW 34-11S-4E	1800	87	Rainbow-Echo No. 1-34 State Oil Test		2.4
SW NE 23-8S-4E	2370	90	Gary No. 23-7 Fed. Oil Test		2.0
SE SE 9-7S-9E	2560	95	Gary No. 9-16 Fed. Oil Test		1.6
SE NE 33-7S-1E	2880	102	Gary No. 8-33 Gary Oil Test		2.0
SE SE 16-8S-4E	2040	103	Gary No. 6-16 Fed. Oil Test		2.9
SW SE 16-12S-4E	2615	96	Gary No. 16-15 State Oil Test		2.0
SW NE 10-7S-2E	2110	94	Gary No. 10-7 Gary Oil Test		2.4
NW NW 7-9S-4E	2000	90	Gary No. 7-4 Fed. Gary Oil Test		2.3
SW NE 31-7S-2E	2340	88	Gary No. 7-31 Dodson Oil Test		1.9
NE SW 17-8S-3E	2270	106	Gary No. 17-11 Cleveland Quarries Oil Test		2.8
NW NE 17-8S-3E	2300	95	Gary No. 17-2 Bell Oil Test		2.2
SE SW 22-10S-6E	1900	92	Fremont No. 1 State Oil Test		2.6
SW SE 24-10S-6E	1890	76	Fremont No. 1 Muhm Oil Test		1.7
NW NE 26-10S-6E	1675		Fremont No. 1 Jones Oil Test		1.7 est.
SW SW 31-11S-2E	2250	108	Echo-Rainbow No. 1-31 Ind. Crk. Oil Test		2.9
NE NW 3-12S-4E	1960	94	Echo-Rainbow No. 1-3 Ind. Crk. Oil Test		2.6
NW NE 14-11S-1E	2150	93	Echo-Rainbow No. 1-10 Ind. Crk. Oil Test		2.3
SE SE 32-11S-4E	1850	94	Echo-Rainbow No. 1-32 Holmes Oil Test		2.7
SE SE 2-7S-1E	2450	98	Dolezal No. 1 Darrow Oil Test		1.8

NE NE 27-10S-6E	1630	150	Cramer No. 1 Wilkinson Oil Test		6.6
NE SW 28-10S-9E	2240	110	Cont. En. Corp. No. 1 Govt. Oil Test		3.0
NE SW 35-10S-9E	2420	102	Cont. En. Corp. No. 2 Govt. Oil Test		2.4
SE SE 25-9S-3E	2473	86	Conroy No. 1 Helsel Oil Test		1.7
NE SE 9-8S-2E	1064	82	Conroy No. 1 Childers Oil Test		3.7
NE NE 15-8S-2E	2470	100	Conroy No. 1 Wulf-Ideen Oil Test		2.3
SW NE 21-7S-2E	2207	87	Conroy No. 1 Trotter-Lane-Fed. Oil Test		1.9
SE SE 10-9S-2E	2909	112	Conroy No. 1 USA Superior Oil Test		2.3
NW SW 24-7S-1E	2480	78	Conroy No. 1 State Oil Test		1.4
NE SE 22-7S-1E	2398	105	Conroy No. 1 Peterson Oil Test		2.5
SW SW 15-9S-2E	3070	112	Conroy No. 1 Ideen Fed. Oil Test		2.2
SE SW 18-9S-6E	2690	88	Colonial No. 1 Bailey Oil Test		1.6
SW NW 32-7S-7E	1136	90	Atlantic No. 1 Emick Oil Test		4.2
SW SE 16-9S-2E	3095	106	Amarillo No. 1-16 State Oil Test		2.0
NW NE 8-12S-6E	3550	79	Amerada No. 1 Moody Oil Test		1.0
SE SW 15-7S-9E	2450	85	Ackman-Schulein No. 15-14 Fed. Oil Test		1.7
NE NE 21-8S-9E	2310	90	Ackman-Schulein No. 21-1 Fed. Oil Test		2.0
SW SW 9-12S-1E	3870	121	Ackman-Schulein No. 9-13 Fed. Oil Test		2.0
NW NW 30-11S-5E	1740	90	Ackman-Schulein No. 30 Gary State Oil Test		2.7
SE SW 29-10S-4E	2680	110	Ackman-Schulein No. 29-14 Fed. Oil Test		2.5
NW SW 5-12S-5E	2369	108	Webb No. 5-11 Fed. Oil Test		2.7
NE SW 25-10S-8E	4130	130	Amerada No. 1 Voorhess Oil Test		2.1
SE SW 1-9S-1E	3296	127	Haywood No. 1 Govt. Oil Test		2.5
NE SE 16-9S-7E	4338	122	North Central No. 1 State Oil Test		1.8
NW SE 24-9S-2E	991	80	Webb No. 24-10 Hudson Oil Test		3.8
SE SW 4-12S-5E	2489	90	Webb No. 4-114 Moody Oil Test		1.6
NW NW 16-11S-5E	2168	99	Webb No. 16-4 State Oil Test		2.5
NW NW 22-11S-5E	2348	102	Webb No. 22-4 State Oil Test		2.5

FAULK COUNTY

NW NE 24-117N-70W	2050	80	Water Well	U.S.G.S.	1.7
NW NW 36-117N-69W	1350	73	Water Well	U.S.G.S.	2.2
NW NW 3-117N-72W	2010	71	Water Well	U.S.G.S.	1.3
NE NE 10-118N-66W	1080	57	Water Well	U.S.G.S.	1.1
NW NW 23-118N-68W	1480	73	Water Well	U.S.G.S.	2.0
NW SW 15-118N-69W	1580	78	Water Well	U.S.G.S.	1.8
SW SW 18-118N-70W	1840	75	Water Well	U.S.G.S.	1.7
NE SW 3-118N-71W	1890	77	Water Well	U.S.G.S.	1.7
NE NE 27-119N-67W	1160	64	Water Well	U.S.G.S.	1.8
NE SW 36-119N-71W	1860	75	Water Well	U.S.G.S.	1.7

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
SW NE 31-120N-66W	1300	66	Water Well	U.S.G.S.	1.7
SW NW 8-117N-66W	1000	66	Water Well		2.2
16-118N-67W	1020	67	Water Well	U.S.G.S.	2.3
15-120N-67W	1056	61	Water Well	U.S.G.S.	1.6
11-119N-66W	1080	59.5	Water Well	U.S.G.S.	1.4
SE 13-120N-68W	1125	66	Water Well	Darton (1920)	2.0
NE 19-120N-67W	1140	68	Water Well	Darton (1920)	2.1
SE 21-120N-67W	1040	67	Water Well	Darton (1920)	2.2
SW 1-120N-67W	1120	66	Water Well	Darton (1920)	2.0
SE 26-120N-67W	1050	69.5	Water Well	Darton (1920)	2.5
NW 24-120N-67W	1038	67	Water Well	Darton (1920)	2.2
NW 6-120N-66W	1066	67.5	Water Well	Darton (1920)	2.2
SW 2-120N-66W	1001	66.3	Water Well	Darton (1920)	2.3
NE 26-120N-66W	965	65.5	Water Well	Darton (1920)	2.2
SW 1-119N-67W	980	69	Water Well	Darton (1920)	2.6
SW 9-119N-67W	1050	69.5	Water Well	Darton (1920)	2.5
C 15-119N-67W	1060	68	Water Well	Darton (1920)	2.3
SW 18-119N-67W	1257	71	Water Well	Darton (1920)	2.2
SW 17-119N-67W	1120	69	Water Well	Darton (1920)	2.3
SW 21-119N-67W	1050	65	Water Well	Darton (1920)	2.0
SW 24-119N-67W	1162	69 +	Water Well	Darton (1920)	2.3
SE 25-119N-67W	1031	69 +	Water Well	Darton (1920)	2.5
SW 25-119N-67W	1035	68	Water Well	Darton (1920)	2.3
NW 30-119N-67W	1000	70	Water Well	Darton (1920)	2.7
NE 31-119N-67W	910	70	Water Well	Darton (1920)	2.9
NE 34-119N-67W	950	67	Water Well	Darton (1920)	2.5
SE 9-119N-66W	988	66	Water Well	Darton (1920)	2.3
NW 15-119N-66W	1010	66	Water Well	Darton (1920)	2.3
NW 20-119N-66W	1002	67	Water Well	Darton (1920)	2.3
SE 23-119N-66W	1020	64	Water Well	Darton (1920)	2.0
NW SW 14-118N-69W	1032	74.5	Water Well	Darton (1920)	3.0
SE 24-118N-68W	1050	69	Water Well	Darton (1920)	2.4
SE 18-118N-67W	1067	71	Water Well	Darton (1920)	2.6
NW 20-118N-67W	1020	66.5	Water Well	Darton (1920)	2.2
NW 28-118N-67W	1029	69	Water Well	Darton (1920)	2.5
C 22-118N-67W	1010	69	Water Well	Darton (1920)	2.5
SW 13-118N-67W	1002	69	Water Well	Darton (1920)	2.5
SW 34-118N-67W	980	67.8	Water Well	Darton (1920)	2.6

NW 15-118N-66W	1029	68.5	Water Well	Darton (1920)	2.4
NW 25-118N-66W	972	67.3	Water Well	Darton (1920)	2.5
SW 31-117N-68W	1095	68.8	Water Well	Darton (1920)	2.3
SE SE 1-117N-68W	1095	68.3	Water Well	Darton (1920)	2.3
C 31-117N-67W	1010	69.6	Water Well	Darton (1920)	2.6
SW 6-117N-67W	1095	68.8	Water Well	Darton (1920)	2.3
NE 31-117N-66W	1030	69.6	Water Well	Darton (1920)	2.5
SE NE 31-117N-66W	1010	69.6	Water Well	Darton (1920)	2.6
SE 11-117N-66W	913	66.7	Water Well	Darton (1920)	2.6
NW SE 36-117N-69W	1215	75	Water Well	Darton (1920)	2.6
NW NW 31-120N-67W	1150	67	Water Well	Davis, Dyer & Powell (1961)	2.0
NE NE 20-118N-72W	2740	90	Hunt No. 1 Gutenkauf Oil Test		1.7

GREGORY COUNTY

NE NE 17-95N-65W	576	80	Water Well	Darton (1920)	6.7
SE SE 29-96N-67W	834	82	Water Well	Davis, Dyer & Powell (1961)	4.9
NW NE 16-97N-68W	603	78	Water Well	Davis, Dyer & Powell (1961)	6.1
SW NE 17-97N-68W	800	81	Water Well	Davis, Dyer & Powell (1961)	4.9
NE NE 34-97N-69W	672	81	Water Well	Davis, Dyer & Powell (1961)	6.0
NE SE 22-99N-72W	840	100	Water Well	Davis, Dyer & Powell (1961)	7.1
SE 35-99N-72W	1080	78	Water Well	Davis, Dyer & Powell (1961)	3.2
36-95N-66W	980	79	Water Well	U.S.G.S.	3.7
SE SW 36-95N-66W	980	80	Water Well	U.S.G.S.	3.8
NW NW 11-98N-70W	850	92	Water Well	U.S.G.S.	6.0

HAAKON COUNTY

SW 13-1N-20E	2293	110	Water Well	SDSM&T (1954)	2.9
NW 13-1N-23E	1842	121	Water Well	SDSM&T (1954)	4.2
SE SW 6-1N-25E	1880	116	Water Well	SDSM&T (1954)	3.9
NW 11-6N-21E	2090	104	Water Well	SDSM&T (1954)	2.9
SE NE 13-1N-22E	2006	117	Water Well	Davis, Dyer & Powell (1961)	3.7
NE NE 8-5N-18E	2383	70.5	Water Well	Davis, Dyer & Powell (1961)	1.1
SW NW 12-5N-18E	2370	77	Water Well	Davis, Dyer & Powell (1961)	1.4
NW NE 31-6N-18E	2334	119	Water Well	Davis, Dyer & Powell (1961)	3.3
SE SE 2-6N-22E	1900	102	Water Well	Davis, Dyer & Powell (1961)	3.1
SW NE 13-6N-22E	1950	113	Water Well	Davis, Dyer & Powell (1961)	3.6
SE NE 21-7N-22E	1910	112	Water Well	Davis, Dyer & Powell (1961)	3.6
SE NW 8-7N-24E	2000	105	Water Well	Davis, Dyer & Powell (1961)	3.1
NE SW 1-1N-20E	3730	158	Philip Water Well		3.1

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
SE SE 14-1N-20E	2525	120	Kroech Water Well		3.1
NE NE 16-5N-22E	2685	108	Exeter No. 16-1 State Oil Test		2.4
NE SE 16-6N-19E	2770	125	Exeter No. 16-9 State Oil Test		3.0
NE NW 10-6N-20E	2635	117	Exeter No. 1 LeFee Oil Test		2.8
NW NE 11-5N-19E	2710	119	Exeter No. 11-2 State Oil Test		2.8
SW NE 10-5N-20E	2710	120	Exeter No. 10-7 Newmiester Oil Test		2.9
NW SW 29-7N-23E	2530	115	Exeter No. 29-12 Hudson Oil Test		2.8
NW SE 13-6N-22E	2230	102	Exeter No. 13-10 State Oil Test		2.6
SW NE 9-5N-23E	2460	100	Exeter No. 9-7 Norris Grain Oil Test		2.3
NW NW 30-7N-21E	2530	115	Exeter No. 30-4 Norris Grain Oil Test		2.8
SW SW 29-6N-21E	2575	116	Exeter No. 29-13 Bierwagon Oil Test		2.8
NE NW 27-4N-20E	2760	82	Exeter No. 27-3 Pearson Oil Test		1.4
NE NW 28-4N-19E	2800	85	Exeter No. 28-3 Williams Oil Test		1.46
SW NW 12-8N-24E	2080	100	Exeter No. 12-5 Federal Oil Test		2.7
NW SE 36-8N-22E	2360	115	Exeter No. 36-10 State Oil Test		3.4
NW NW 26-8N-23E	2460	110	Exeter No. 26-4 Hamilton Oil Test		2.7
SW NE 16-4N-18E	2580	100	Pohle No. 1 State Oil Test		2.2
SE NW 5-3N-22E	4500	122	Carter No. 1 Danielson Oil Test		1.73
SW SW 6-4N-21E	5040	147	Exeter No. 6-13 Norris Grain Oil Test		2.1
SW SW 33-3N-19E	5485	135	Kee McGee No. 1 Chute Oil Test		1.67
NE NE 31-4N-24E	3890	142	Gulf No. 1 Fenwick Oil Test		2.53
SW SW 4-3N-23E	4630	138	Gulf No. 1 Harry Oil Test		2.0
SW SW 1-6N-21E	4320	125	Plum Creek No. 1 Berry Oil Test		1.9
NE SE 21-4N-18E	4650	102	Pohle No. 1 May Oil Test		1.24
NW SE 36-6N-21E	4820	150	Texaco No. 1 State "B" Oil Test		2.2
SW SW 27-3N-20E	2960	118	Water Well		2.5
NE SE 18-3N-24E	2532	114	Inv. No. 1 Lee Oil Test		2.8
NW NE 29-1N-25E	2800 ?	136	Jones Water Well		3.3
N½ 24-7N-21E	2763	123	Jetters Water Well		2.5
NW NE 11-5N-21E	2600	130	Water Well	Oral Report	3.3
			HAND COUNTY		
SW SE 10-112N-68W	1139	79.8	Water Well	Darton (1920)	3.2
NE 10-116N-66W	951	73	Water Well	Darton (1920)	3.1
NE 7-115N-68W	1150	74	Water Well	Darton (1920)	2.6
SE 22-115N-68W	1065	74.5	Water Well	Darton (1920)	2.9
SE 12-115N-67W	955	71	Water Well	Darton (1920)	2.9

NE 22-114N-66W	880	68.6	Water Well	Darton (1920)	2.9
NE 12-113N-68W	1040	78.9	Water Well	Darton (1920)	3.5
SE 3-113N-67W	1008	71.5	Water Well	Darton (1920)	2.7
SE 18-113N-66W	1105	76.5	Water Well	Darton (1920)	3.0
SE 25-113N-67W	1129	78.5	Water Well	Darton (1920)	3.1
NW 22-113N-66W	967	73.5	Water Well	Darton (1920)	3.1
NW 31-113N-67W	1133	78.5	Water Well	Darton (1920)	3.1
SE 3-112N-68W	1100	78.9	Water Well	Darton (1920)	3.3
NW 5-112N-67W	1165	76	Water Well	Darton (1920)	2.8
SE 4-112N-67W	1165	76.6	Water Well	Darton (1920)	2.9
NE 2-112N-66W	892	75.7	Water Well	Darton (1920)	3.7
NE SE 12-112N-69W	1177	58	Water Well	Davis, Dyer & Powell (1961)	1.2
SE SE 23-113N-70W	1365	66	Water Well	Davis, Dyer & Powell (1961)	1.6
NE NE 30-114N-68W	1221	60	Water Well	Davis, Dyer & Powell (1961)	1.3
SE SE 22-115N-68W	1150	70	Water Well	Davis, Dyer & Powell (1961)	2.3
SW NE 31-116N-67W	1130	59	Water Well	Davis, Dyer & Powell (1961)	1.3
SE SE 6-113N-69W	1358	72	Water Well	U.S.G.S.	2.1
SE SE 31-116N-67W	1143	70	Water Well	U.S.G.S.	2.3

HARDING COUNTY

SW NW 1-20N-3E	8440	180	Mid-America No. 1 Gardner Oil Test		1.6
NE SE 17-21N-4E	8653	168	Mid-America No. 1-17 State Oil Test		1.43
SW NE 16-21N-4E	8717	174	Shell No. 32-16 State Oil Test		1.5
SE SE 24-17N-1E	3237	110	Amerada No. 1 Govt.-Ellis Oil Test		2.0
SE NW 19-16N-2E	3863	127	Amerada No. 1 Short Pine Hill Oil Test		2.2
NE NE 31-16N-2E	3640	119	Amerada No. 2 Short Pine Hill Oil Test		2.1
SW SW 8-15N-2E	3455	105	Amerada No. 1 USA Holland Oil Test		1.8
NE NE 1-16N-1E	3999	113	Amerada No. 1 State Oil Test		1.7
NW SW 2-20N-3E	9052	176	Carter No. 1 Hendriks Oil Test		1.5
SW SW 21-15N-5E	3900	116	Wheatley No. 1 Junek Oil Test		1.8
SW SW 17-15N-1E	3960	96	Gulf No. 1 Custer Fed. Oil Test		1.3
SE SE 8-19N-4E	4250	132	Harrison No. 1 Blair Oil Test		2.1
SW SE 23-16N-4E	4022	100	Harrison No. 1 Clanton Oil Test		1.4
NE NE 26-16N-5E	3958	109	Harrison No. 2 Clanton Oil Test		1.6
NE NE 21-16N-4E	4108	115	Harrison No. 1 Fox Oil Test		1.7
SW SW 26-15N-5E	3856	118	Harrison No. 1 Hollister Oil Test		1.9
NW SW 32-15N-5E	3840	114	Harrison No. 1 Johnson & Sons Oil Test		1.8
NW NW 14-19N-6E	4870	134	Harrison No. 1 Ludlow Grezing Oil Test		1.85
SE SE 32-20N-6E	4325	122	Harrison No. 1 Norris Grain Oil Test		1.8
SE NE 18-16N-5E	4075	109	Harrison No. 1 Matson Oil Test		1.6

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
SW SW 12-15N-4E	3842	110	Harrison No. 1 Van Horn Oil Test		1.7
SW SW 16-20N-6E	4181	130	Harrison No. 16-1 State 20-6 Oil Test		2.0
SE SE 29-15N-5E	3781	103	Harrison No. 1 Junek Oil Test		1.6
SE SW 16-15N-2E	3690	105	Harrison No. 16-1 State McBride Oil Test		1.8
NW NE 10-16N-2E	4480	119	Harrison No. 1-10 State 16-2 Oil Test		1.7
NW NW 7-20N-3E	5590	124	Hunt No. 1 Peterson Oil Test		1.4
NE NW 28-18N-1E	7900	154	Hunt No. 1 State Oil Test		1.4
SW NE 35-18N-1E	7891	169	Jone No. 1 State Oil Test		1.6
NE NE 11-17N-7E	8374	178	Ladd No. 1 Laflin Oil Test		1.6
NE NW 9-22N-1E	5216	130	Mobil No. F-21-9-G Oil Test		1.7
NW NW 16-22N-3E	8864	170	Mule Creek No. 1 State 1116 Oil Test		1.4
NW NE 15-18N-1E	4080	115	Miller-Shelley No. 1 Catron Oil Test		1.75
SE SW 12-16N-1E	4380	106	Murfin No. 1 Davis Oil Test		1.4
NE NW 30-15N-2E	3950	117	Murfin No. 1 Johnson Lund Oil Test		1.85
NE NE 25-18N-1E	4020	120	Murfin No. 1 State Oil Test		1.9
NE SW 32-16N-4E	3910	111	Murfin-Harrison No. 1 Truman Oil Test		1.6
NE NW 27-22N-5E	9366	206	Occidental No. 1 Govt. Norreg Oil Test		1.75
NW NW 28-21N-1E	5260	106	Ohio No. 1 Evenson Oil Test		1.54
SE SE 23-15N-6E	3900	110	Placid No. 23-16 Orwick Oil Test		1.7
NE NW 28-16N-6E	3850	107	Placid No. 28-3 Schuck Oil Test		1.6
SW SW 15-17N-5E	4100	109	Placid No. 15-13 State Oil Test		1.6
NE NE 17-17N-6E	4176	110	Placid No. 17-16 State Oil Test		1.6
NW NW 27-18N-5E	4250	110	Placid No. 27-4 State Oil Test		1.6
SW SW 30-17N-5E	4200	112	Placid No. 30-13 Van Horn Oil Test		1.6
SE NW 16-17N-4E	3910	114	Richfield No. 1-A State Oil Test		1.8
SW NE 27-20N-5E	5360	129	Shell No. 32-27 Govt. Oil Test		1.6
NE NE 23-18N-8E	8817	195	Shell No. 41-23 State Oil Test		1.7
SW SW 4-21N-8E	5352	139	Shell No. 14-4 Johnson Oil Test		1.8
NE NE 28-21N-3E	5270	122	Shell No. 1 Clarkson-Hansen Oil Test		1.5
SW SE 9-21N-4E	5250	132	Shell No. 1 State "A" Oil Test		1.7
SW NE 34-15N-7E	7885	168	Sinclair No. 1 White Oil Test		1.6
NE SE 8-15N-4E	3900	110	S. Min. No. 1-8 Orwick Oil Test		1.7
NW SE 21-22N-5E	9360	182	Sun No. 1 Govt. Gregg Oil Test		1.5
SW SE 36-15N-6E	3960	111	Union No. 1 State 217 Oil Test		1.7
NE SE 35-18N-4E	4600	121	Texaco No. 1 State Oil Test		1.7
NW SE 29-15N-2E	3796	110	Union No. 1 USA 664 Oil Test		1.75
NE NE 16-15N-5E	3950	111	Harrison No. 1 State Oil Test		1.7
SW SW 35-16N-4E	3860	101	Harrison No. 1 Bullington Oil Test		1.47

NE SE 26-21N-2E	8600	178	Miami No. 1 Painter Oil Test		1.56
NE SE 4-21N-2E	4675	123	Schlaikjer No. 1 Painter Oil Test		1.7
SE SE 25-15N-2E	3620	108	Harrison No. 1-25 Matchett Oil Test		1.8
NW SE 25-15N-11E	3878	112	Harrison No. 1 M. Counts Oil Test		1.8
SW SE 4-15N-7E	4241	128	Texaco No. 1 White Oil Test		2.0
NW SE 6-19N-4E	4300	120	Harrison No. 2 Blair Oil Test		1.8
NW SE 28-23N-4E	9342	211	Quad-West No. 33-26 Buckley Oil Test		1.8
NE NE 7-19N-6E	4320	121	Harrison No. 1 Brengle Oil Test		1.8
SW SW 11-20N-4E	8440	179	Pennzoil No. 14-11 A Tilus Oil Test		1.6
NW SW 21-23N-4E	9404	203	Natol No. 1 Arithson Oil Test		1.7
SE NW 10-20N-4E	8417	172	Pennzoil No. 32-10 Tilus Oil Test		1.5
NE SW 22-20N-5E	8486	188	Depco No. 23-22 Fed. Oil Test		1.7
SW NW 17-21N-4E	8574	196	Pennzoil No. 12-17 Little Graves		1.8
SE NE 27-22N-5E	9138	183	Depco No. 42-27 Fed. Oil Test		1.5
SW SE 23-18N-1E	3528	116	Murfin-Biggs No. 1-23 State Oil Test		2.0
C½ NE 5-22N-5E	9134	189	Depco No. 41-5 Janvrin Oil Test		1.6
NW NW 35-20N-5E	4450	138	Harrison No. 1 L. B. Smith Oil Test		2.1
NW SE 11-15N-3E	3800	113	Harrison Murfin No. 1-11 State 15-3 Oil Test		1.8
NE SW 11-15N-3E	1458	95	Murfin Harrison No. 2-11 State 15-3 Oil Test		2.9
NE SE 36-15N-4E	3761	113	Harrison No. 1-36 State 15-4 Oil Test		1.8
SE NW 10-20N-4E	4687	121	Hunt No. 1 USA Oil Test		1.6
SW NE 11-21N-3E	4644	118	Hunt No. 1 USA Chilicoat Oil Test		1.6
NE NE 30-21N-4E	4749	128	Hunt No. 1 Travers Oil Test		1.8

HUGHES COUNTY

19-110N-76W	1450	90	Water Well	U.S.G.S.	3.2
33-111N-79W	1192	91.8	Water Well	SDSM&T (1954)	4.1
NE 35-111N-79W	2370	110	Water Well	SDSM&T (1954)	2.8
9-112N-74W	1453	94.9	Water Well	SDSM&T (1954)	3.6
NW SW 17-108N-75W	1400	74.5	Water Well	SDSM&T (1954)	2.2
NE SE 3-109N-76W	816	72	Water Well	SDSM&T (1954)	3.5
NE NW 4-110N-79W	1225	95	Water Well	SDSM&T (1954)	4.3
SE SW 33-111N-79W	1500	94	Water Well	SDSM&T (1954)	3.4
SW NW 4-112N-74W	1457	92	Water Well	SDSM&T (1954)	3.4
NE NE 27-112N-76W	2565	95	Ohio No. 1 Reinschmidt Oil Test		2.0
NW NW 12-111N-75W	2411	82	Shogrin No. 1 Kleinschmidt Oil Test		1.6
SW SW 36-110N-75W	1825	91	O'Dea Water Well		2.6

HUTCHINSON COUNTY

NW NW 17-97N-60W	824	63	Water Well	Darton (1920)	2.4

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
NW NE 10-97N-58W	420	54	Water Well	Davis, Dyer & Powell (1961)	2.3
SE NE 2-97N-59W	558	56	Water Well	Davis, Dyer & Powell (1961)	2.2
NE NE 4-99N-61W	565	56	Water Well	U.S.G.S.	2.2
			HYDE COUNTY		
18-116N-72W	1970	70	Water Well	U.S.G.S.	1.3
NW NW 12-112N-72W	700	63	Water Well	Darton (1920)	2.8
SW NW 31-116N-73W	2707	100	Hunt No. 1 School Land Oil Test		2.1
SW NE 24-116N-73W	2593	88	Hunt No. 2 School Land Oil Test		1.7
NW NW 4-110N-71W	2100	95	Water Well	U.S.G.S.	2.5
SE NE 18-116N-72W	1960	71	Water Well	U.S.G.S.	1.4
NW NE 11-109N-73W	2140	84	Water Well	U.S.G.S.	1.9
			JACKSON COUNTY		
NW NE 32-2S-22E	2956	130	Water Well	Davis, Dyer & Powell (1961)	2.9
NW NW 32-3S-22E	3640	110	Water Well	Davis, Dyer & Powell (1961)	1.8
SE NW 5-2S-23E	3334	124	Cities Svc. No. 1 Renning Oil Test		2.4
NW NW 34-1S-22E	2917	103	Water Well		2.0
SW NW 25-1S-24E	2394	140	Addison Water Well		4.1
NE SW 17-2S-25E	4210	136	Cities Svc. No. 1-A Vilhaur Oil Test		2.2
SW NE 32-2S-24E	2410	112	Belvidere Water Well		2.9
SW SW 1-1S-22E	3930	110	Campbell No. 1 Dale Oil Test		1.7
NW NE 19-1S-22E	2700	126	Water Well	U.S.G.S.	3.1
19-1S-22E	2705	123	Young Water Well		3.0
NW SW 4-2S-23E	4430	138	Cities Svc. No. 1-A Phipps Oil Test		2.1
NE NW 16-1S-22E	4780	146	Sorrelle No. 1 State Oil Test		2.1
			JERAULD COUNTY		
20-108N-63W	700	59.5	Water Well	U.S.G.S.	2.3
SW SW 2-108N-63W	785	75	Alpena Well		4.1
SW SW 18-107N-63W	850±	60	Water Well		2.0
SE SE 20-107N-63W	800	60	Water Well		2.0
NW NE 1-107N-64W	740	60	Water Well		2.2
SW SW 4-107N-64W	828	64	Water Well		2.5
NW NW 9-107N-64W	800	65	Water Well		2.7

SW SW 6-108N-64W	889	67	Water Well		2.6
SW SW 33-108N-64W	840	66	Water Well		2.7
NW NW 11-108N-63W	785	75	Water Well	Darton (1920)	4.1

JONES COUNTY

22-2N-26E	1690	118	Water Well	SDSM&T (1954)	4.5
NW NE 3-1N-29E	3220	106	Shell No. 2 Herman Oil Test		1.9
NW SE 14-1N-29E	2690	126	Herman Well		3.1
SW SE 10-1N-29E	2650	108	Tenneco No. 1 Herman Oil Test		2.4
SW SW 15-1N-29E	2572	114	Shell No. 1 Herman Oil Test		2.75
NW SE 8-2N-26E	3528	105	Shell No. 1 Olson Oil Test		1.7
SE SE 15-3S-29E	3340	128	Gulf No. 1 Hight Oil Test		2.5
SW SE 13-3S-31E	2042	112	Booth Water Well		3.4
NW NW 31-2N-29E	2204	111	Olson Water Well		3.1
NW NW 4-3S-30E	2960	122	Gulf No. 1 Dahlke Oil Test		2.65
SE NW 2-4S-28E	3180	140	Gulf No. 1 State Oil Test		3.05
NW NW 29-2S-31E	2580	110	Gulf No. 1 Hulse Oil Test		2.6
NE SE 21-2S-27E	3728	137	Gulf No. 1 Sandy Oil Test		2.5
SE SE 17-2N-27E	1828	115	Water Well	U.S.G.S.	4.0
NE NE 3-3S-28E	2280	140	Water Well	U.S.G.S.	4.3

KINGSBURY COUNTY

NW NW 6-110N-58W	855	71.5	Water Well	Darton (1920)	3.3

LAWRENCE COUNTY

SW SW 14-7N-1E	460	55	Water Well	Davis, Dyer & Powell (1961)	2.5
SE SW 20-7N-1E	580	53	Water Well	Davis, Dyer & Powell (1961)	1.5
SW SE 21-7N-1E	400	53	Water Well	Davis, Dyer & Powell (1961)	2.5
SW NW 23-7N-1E	585	53	Water Well	Davis, Dyer & Powell (1961)	1.5
NE NE 29-7N-1E	411	52	Water Well	Davis, Dyer & Powell (1961)	2.0
SW NW 30-7N-1E	406	54	Water Well	Davis, Dyer & Powell (1961)	2.6
SW SW 19-7N-2E	412	55.5	Water Well	Davis, Dyer & Powell (1961)	3.0
SW SW 22-7N-2E	680	53	Water Well	Davis, Dyer & Powell (1961)	1.1
SW SE 30-7N-4E	3144	115	Weller No. 1 Weisman Oil Test		2.3
NE NE 7-7N-3E	1620	71	Water Well	U.S.G.S.	1.7
5-5N-3E	6800	122	Homestake Mine	Olin Hart, pers. communication	1.1

LINCOLN COUNTY

NE NE 23-98N-49W	518	54.5	Water Well	SDSM&T (1954)	2.1

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
LYMAN COUNTY					
21-108N-77W	1380	88	Water Well	U.S.G.S.	3.3
27-105N-73W	1215	80	Water Well	U.S.G.S.	3.0
1-103N-78W	1370	110	Water Well	U.S.G.S.	4.9
25-103N-73W	990	88	Water Well	U.S.G.S.	4.6
NW NW 17-105N-75W	1301	96 ±	Water Well	Darton (1920)	4.2
SW SW 22-101N-73W	980	99	Water Well	Davis, Dyer & Powell (1961)	5.9
SW NW 28-101N-73W	1200	101	Water Well	Davis, Dyer & Powell (1961)	4.9
SE SE 29-101N-73W	1000	96	Water Well	Davis, Dyer & Powell (1961)	4.4
NW NW 1-102N-73W	650	70	Water Well	Davis, Dyer & Powell (1961)	4.2
NE SE 5-103N-72W	750	83	Water Well	Davis, Dyer & Powell (1961)	5.5
SW NW 10-103N-74W	860	88.5	Water Well	Davis, Dyer & Powell (1961)	5.4
NW SW 10-103N-74W	860	90	Water Well	Davis, Dyer & Powell (1961)	5.6
NE NE 4-104N-71W	480	59	Water Well	Davis, Dyer & Powell (1961)	3.3
NW NE 23-104N-72W	680	73	Water Well	Davis, Dyer & Powell (1961)	4.5
SW SE 23-104N-72W	650	77	Water Well	Davis, Dyer & Powell (1961)	5.4
SW SE 28-104N-74W	1205	95	Water Well	Davis, Dyer & Powell (1961)	4.4
SW NW 5-105N-71W	612	66	Water Well	Davis, Dyer & Powell (1961)	3.8
SW NE 34-105N-71W	960	66	Water Well	Davis, Dyer & Powell (1961)	2.3
SE SE 34-105N-77W	2352	106	Water Well	Davis, Dyer & Powell (1961)	2.7
NW NE 34-105N-77W	1352	110	Water Well		5.0
SE NW 17-106N-71W	800	71.5	Water Well	Davis, Dyer & Powell (1961)	3.6
SW SW 12-106N-72W	1000	75	Water Well	Davis, Dyer & Powell (1961)	3.2
NE SE 20-108N-76W	1100	82	Water Well	Davis, Dyer & Powell (1961)	3.6
NE SE 10-107N-73W	894	70	Water Well	Davis, Dyer & Powell (1961)	3.0
SE SE 4-103N-77W	2460	135	Gulf No. 1 G. K. Hutchinson Oil Test		3.7
SW SW 16-104N-78W	2178	102	Gulf No. 1 Wolf State Oil Test		2.7
NW NW 24-103N-77W	2410	136	Gulf No. 1 Hutchinson Oil Test		3.9
NW NW 22-105N-72W	1445	83	Gen. Crude No. 1 Straka Oil Test		2.4
McPHERSON COUNTY					
SE SE 33-125N-67W	1160	67	Water Well	U.S.G.S.	2.0
NW SE 14-125N-68W	1580	69	Water Well	U.S.G.S.	1.6
NE SE 27-126N-66W	1160	64	Water Well	U.S.G.S.	1.7
SE NE 17-126N-67W	1570	79	Water Well	U.S.G.S.	2.2
NE NW 14-128N-67W	1780	81	Water Well	U.S.G.S.	2.1

23-125N-66W	1400	70	Water Well	U.S.G.S.	1.9
NW NE 23-125N-66W	1400	72	Water Well	U.S.G.S.	2.0
NW SW 31-125N-68W	1781	77	Water Well	U.S.G.S.	1.9
NE NE 32-125N-67W	1185	66	Water Well	Davis, Dyer & Powell (1961)	1.9

MARSHALL COUNTY

SE SE 23-127N-58W	1000	64	Water Well	Darton (1920)	2.0
SW SW 3-128N-59W	1043	59	Water Well	U.S.G.S.	1.4
SE NE 11-128N-58W	930	56	Water Well	U.S.G.S.	1.3
NE NE 9-127N-58W	940	59	Water Well	U.S.G.S.	1.6
SW SW 33-126N-59W	880	57	Water Well	U.S.G.S.	1.5
SW SW 35-125N-59W	930	60	Water Well	U.S.G.S.	1.7
SE SW 3-125N-59W	1000	54	Water Well	U.S.G.S.	1.0
24-128N-59W	1047	61	Water Well	U.S.G.S.	1.6

MEADE COUNTY

NW 11-5N-5E	600	50	Water Well	SDSM&T (1954)	1.0
SW 16-6N-6E	690	58	Water Well	SDSM&T (1954)	2.0
SE NW 5-2N-7E	616	54	Water Well	Davis, Dyer & Powell (1961)	1.7
SE NE 8-2N-7E	775	53	Water Well	Davis, Dyer & Powell (1961)	1.1
NW SW 3-4N-6E	515	53	Water Well	Davis, Dyer & Powell (1961)	1.7
NE NW 9-4N-6E	440	51	Water Well	Davis, Dyer & Powell (1961)	1.6
NW SE 10-4N-7E	840	57	Water Well	Davis, Dyer & Powell (1961)	1.5
NE SW 17-5N-6E	558	51	Water Well	Davis, Dyer & Powell (1961)	1.2
SW SE 18-5N-6E	390	50	Water Well	Davis, Dyer & Powell (1961)	1.8
SE SE 22-6N-5E	920	54	Water Well	Davis, Dyer & Powell (1961)	1.1
NW NW 19-6N-6E	915	56	Water Well	Davis, Dyer & Powell (1961)	1.3
SW SW 5-6N-17E	2412	123	Water Well	Davis, Dyer & Powell (1961)	3.3
NE NE 20-7N-17E	2445	110	Water Well	Davis, Dyer & Powell (1961)	2.7
SE SW 32-7N-17E	2383	125	Water Well	Davis, Dyer & Powell (1961)	3.4
NE NE 18-6N-13E	5700	111	Amerada No. 1 Corwin Oil Test		1.2
NW NW 35-10N-10E	4686	127	Beer No. 1 Morrell Oil Test		1.8
NW NW 35-9N-11E	3300	109	Jones-Pellow No. 1 Jensen Oil Test		2.0
NE NE 19-9N-13E	3350	114	Jones-Pellow No. 1 Kolby Oil Test		2.1
NE SE 20-10N-17E	5640	135	Herndon No. 1 Oakland Oil Test		1.6
SE SE 26-8N-13E	6190	149	Herndon No. 1 Shinost Oil Test		1.7
SE SE 15-9N-13E	6250	168	Herndon No. 1 Price Oil Test		2.0
SW NE 9-4N-11E	4280	137	Lion-Libertin No. 1 Govt. Oil Test		2.2
NW SW 32-7N-10E	2410	109	Mid-Am. No. M8993 Fed. "D" Oil Test		2.7

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
NE SE 31-4N-11E	2876	82	Midland No. 1 State "B" Oil Test		1.3
NE SW 12-4N-10E	2210	94	Midland No. 1 Fed. "A" Oil Test		2.3
NW SE 3-3N-11E	2488	95 est.	Midland No. 1 State "A" Oil Test		2.1
NW SW 16-7N-9E	2350	90	Mid-Am. No. 1 State "D" Oil Test		2.0
NW SE 8-6N-9E	2395	95 est.	Mid-Am. No. 1 Fed. "E" Oil Test		2.1
NE SW 23-6N-10E	2600	91	Mid-Am. No. 1 Fed. "C" Oil Test		2.0
SE NW 20-5N-8E	2134	96	Morton No. 1 Carlson Oil Test		3.1
NW NW 9-2N-9E	2405		Morton No. 1 Bartelson Oil Test		2.9 est.
NE SW 4-2N-10E	2476	97	Morton No. 1 Brehm Oil Test		2.6
SE SE 20-5N-9E	2420	106	Morton No. 1 Snyder Oil Test		3.0
NE SE 34-7N-13E	6500	144	Phillips No. 1 Ferguson Oil Test		1.6
NE SE 19-4N-9E	2592	82	Phillips No. 1 Harrington Oil Test		1.5
NW SE 13-6N-14E	3230	100	Phillips No. 1 Norris Oil Test		1.75
NW NW 14-3N-8E	1935	98	Phillips No. 1 Harrington Oil Test		2.8
SW NW 24-3N-8E	2000	90	Phillips No. 2 Harrington Oil Test		2.3
NE NE 11-4N-8E	2182	84	Phillips No. 1 Reinhold Oil Test		1.8
SW SW 3-8N-17E	3190	114	Phillips No. 1 Richardson Oil Test		2.2
SE NW 7-2N-10E	2342	86	Pure No. 1 Wolken Oil Test		1.4
NE NE 35-3N-9E	2255	109	Morton No. 1 Olson Oil Test		2.9
NE SW 23-5N-7E	1776	84	Continental No. 1 Thompson Oil Test		2.3
SW NE 34-5N-7E	1554	83	Continental No. 1 May Oil Test		2.6
SW SW 5-4N-7E	868	68	Continental No. 1 Jordan Oil Test		2.9
SW NE 33-5N-7E	1246	84	Continental No. 1 Jeffery Oil Test		3.3
NE NE 29-5N-7E	1464	84	Continental No. 1 Ketelson Oil Test		2.8
NW NW 27-4N-8E	2030	80	Continental No. 1 Harrington Oil Test		1.8
SE NW 31-4N-8E	1505	78	Continental No. 1 Ham Oil Test		2.3
SW NW 25-7N-6E	2146	71	Water Well		1.2

MELLETTE COUNTY

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
NW SW 12-42N-30W	1940	104	Jenson Water Well		3.1
NW SE 27-42N-26W	2920	149	Kosken Water Well		3.7
NE SW 1-42N-25W	1342	111.5	Water Well	Davis, Dyer & Powell (1961)	5.2
NE SW 32-42N-25W	2690	147	Nelson Water Well		4.0
SW SW 20-42N-26W	2710	140	Bachman Water Well		3.6
NE SW 16-43N-26W	1515	113	Water Well	Davis, Dyer & Powell (1961)	4.7
NE NE 33-43N-26W	2170	130	Till Water well		4.0
SE NW 20-43N-26W	1700	115	Edwards Water Well		4.4

SE NE 11-43N-27W	1700	122	Water Well	Davis, Dyer & Powell (1961)	4.8
NW SW 14-43N-29W	3193	142	Gulf No. 1 Olson Oil Test		3.1
NW SW 14-43N-29W	2065	137	Olson Water Well		4.6
SW SE 23-43N-29W	3274	97	Gulf No. 1 Rosebud Oil Test		1.6
NE NW 36-45N-32W	2320	145	Iwan Water Well		4.4
SE SE 30-41N-26W	1804	93	Water Well	U.S.G.S.	2.8

PENNINGTON COUNTY

NW NW 7-4N-7E	2195	71	Water Well	Davis, Dyer & Powell (1961)	1.2
SW SE 3-5N-17E	2335	121	Water Well	Davis, Dyer & Powell (1961)	3.3
SW SW 15-1S-11E	2717	110	Gary No. 1 Hopkins Oil Test		2.4
NW SE 28-2N-9E	1917	93	Superior No. 1-23 Kogg Oil Test		2.6
NE NE 14-2N-9E	2820	98	Sterling No. 1 Moden Oil Test		1.9
NW NW 29-5N-17E	5575	127	True No. 1 Govt. Knox Oil Test		1.5
NE SW 22-1N-12E	2997	134	Shell No. 1 Stromer Oil Test		3.0
SW SW 10-1N-11E	2820	104	Gary No. 1 Boydston Oil Test		2.1
NW NW 15-2S-9E	2170	95	Gary No. 1 Harrington Oil Test		2.4
NW SE 32-1N-10E	2809	122	Shell No. 1 Wisehart Oil Test		2.8
NW SW 34-1N-9E	2220	83	Phillips No. 3 Dunn Oil Test		1.8
NW SE 30-2N-9E	2160	93	Phillips No. 1 Dunn Oil Test		2.3
SE SE 5-1N-9E	2395	95	Phillips No. 2 Dunn Oil Test		2.1
SE NE 5-1N-10E	2300	92	Royal Res. No. 1 Spevak Oil Test		2.1
SE NW 5-4S-17E	2655	121	Wheless No. 5 Federal Oil Test		2.9
SE NW 16-4S-16E	2700	108	Wheless No. 16-5 State Oil Test		2.4
SE SW 35-3S-16E	2697	122	Wheless No. 35-14 Fed. Oil Test		2.9
NE NE 27-2N-17E	3030	120	Peno Water System		2.5
NE SW 6-1N-15E	3000	80	Anderson Water System		1.2
NE SE 35-4N-17E	3100	96	Water Well		1.7
SE SW 31-4N-16E	3485	90	Babcock Water Well		1.3
SE NE 10-4S-16E	4804	158	Wheless No. 10-8 Fed. Oil Test		2.4
NW SE 6-1S-17E	2990	96	Quinn Water Well		1.4
SE SW 31-1N-16E	2845	100	Wall Water Well		2.0
SE NW 25-5N-16E	2666	98	Gabriel Water Well		2.0
NE NW 10-5N-17E	2100	112	McIlravy Water Well		3.1
NE SE 25-5N-13E	2700	105	Anderson Water Well		2.3
NW NW 7-4N-17E	2380	71	Water Well	U.S.G.S.	1.1

PERKINS COUNTY

NE NE 34-13N-12E	4009	121	Texaco No. 1 Diamond "F" Oil Test		1.9

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
SE NW 7-15N-16E	6770	159	Shell No. 22-7 Bastian Oil Test		1.7
NW SE 13-20N-12E	9343	225	Shell No. 1 Homme Oil Test		1.9
SE SE 7-17N-15E	8318	185	Shell No. 1 Veal Oil Test		1.7
NW SE 8-22N-11E	9433	185	Hunt Brooks No. 1 Fed. Oil Test		1.5
NW NW 9-13N-16E	7318	149	Evans-Querbes No. 1 Capp Oil Test		1.4
SW NW 11-14N-12E	3957	121	S. Minerals No. 1-11 Blomberg Oil Test		1.9
SW SW 23-13N-13E	3840	121	S. Minerals No. 1-23 Marks Oil Test		2.0
NE NE 13-13N-11E	5330	142	S. Minerals No. 1-13 Fed. Oil Test		1.8
NE NE 33-13N-10E	4740	128	Mule Creek No. 41-33 State Oil Test		1.8
NE NE 26-21N-14E	8570	204	Youngblood No. 1 Anderson Oil Test		1.9
SE SW 20-14N-11E	4280	133	Texaco No. 1 Crawford Oil Test		2.1
NE SE 5-14N-16E	6466	148	Inv. No. 1 Miller Oil Test		1.6
NW SE 22-14N-16E	3491	100	Inv. No. 2 Baxter Oil Test		1.6
			POTTER COUNTY		
NE NE 10-120N-77W	2315	81	Hoover Water Well		1.6
NW SE 27-119N-78W	3720	115	Dakota-Texas No. 1 Thompson		1.9
SE NW 34-120N-77W	2700	84.5	Hollzwarth Water Well		1.9
NW NW 7-120N-75W	3030	112	Independent No. 1 Hinckley Oil Test		2.3
			ROBERTS COUNTY		
NE SW 23-126N-51W	735	55	Water Well	U.S.G.S.	1.4
NW NW 29-127N-49W	530	52	Water Well	U.S.G.S.	1.5
			SANBORN COUNTY		
SE SW 105N-61W	577	58	Water Well	Darton (1920)	2.5
SE SW 22-107N-62W	725	61.5	Water Well	Darton (1920)	2.5
SE NW 28-107N-62W	742	65	Water Well	Darton (1920)	3.0
SE 33-105N-60W	425	58	Water Well	Darton (1920)	3.5
NE NE 2-108N-61W	870	66	Water Well	Davis, Dyer & Powell (1961)	2.6
NE SE 18-105N-61W	836	58	Water Well	U.S.G.S.	1.8
NW SE 16-106N-60W	812	60	Water Well	U.S.G.S.	2.0
NW NW 30-106N-62W	945	62	Water Well	U.S.G.S.	2.0
SE NE 3-107N-60W	930	62	Water Well	U.S.G.S.	2.0
SE SW 25-107N-62W	700	59	Water Well	U.S.G.S.	2.2

SW SW 16-108N-59W	694	59	Water Well	U.S.G.S.	2.2
SW SE 18-108N-62W	875	61	Water Well	U.S.G.S.	1.9
20-108N-59W	730	59.5	Water Well	U.S.G.S.	2.1
30-106N-62W	945	61	Water Well	U.S.G.S.	1.8
SE SW 27-107N-61W	735	62	Water Well	U.S.G.S.	2.5
NE NW 29-105N-59W	680	53	Water Well	U.S.G.S.	1.3
NE NW 17-105N-60W	650	57	Water Well	U.S.G.S.	2.0
NW SW 17-105N-62W	674	55	Water Well	U.S.G.S.	1.7
SW SW 8-106N-59W	688	58	Water Well	U.S.G.S.	2.0
SE SE 10-106N-61W	553	57	Water Well	U.S.G.S.	2.4
SE SW 18-107N-59W	890	61	Water Well	U.S.G.S.	2.0
NW NW 14-107N-61W	700	60	Water Well	U.S.G.S.	2.3
SE SE 21-108N-60W	735	60	Water Well	U.S.G.S.	2.2
SW SE 15-108N-61W	807	60	Water Well	U.S.G.S.	2.0

SHANNON COUNTY

SE SE 30-37N-45W	3596	119	Webb. Res. No. 30-16 Linehan Oil Test		2.1

SPINK COUNTY

NE SE 13-116N-62W	1020	62	Water Well	U.S.G.S.	1.8
SW SW 1-117N-61W	930	60	Water Well	U.S.G.S.	1.7
SE NE 20-117N-62W	1016	61	Water Well	U.S.G.S.	1.6
NE NE 10-118N-61W	1012	64	Water Well	U.S.G.S.	2.0
SE SE 2-118N-62W	975	61	Water Well	U.S.G.S.	1.6
SE SW 11-119N-62W	990	62	Water Well	U.S.G.S.	1.8
SW SW 8-120N-62W	1104	61	Water Well	U.S.G.S.	1.5
NE NE 2-120N-64W	1080	59	Water Well	U.S.G.S.	1.4
SW 5-116N-62W	938	66	Water Well	U.S.G.S.	2.4
C 6-120N-65W	990	65.5	Water Well	Darton (1920)	2.2
NE 7-120N-64W	948	65.7	Water Well	Darton (1920)	2.2
C 29-120N-64W	912	64.5	Water Well	Darton (1920)	2.3
SW 30-120N-63W	908	70	Water Well	Darton (1920)	3.0
SW 32-120N-63W	920	65.5	Water Well	Darton (1920)	2.4
NW 33-120N-63W	960	67	Water Well	Darton (1920)	2.4
NW 27-120N-63W	913	66	Water Well	Darton (1920)	2.5
NW 3-120N-63W	904	64	Water Well	Darton (1920)	2.3
SE 1-120N-63W	842	65	Water Well	Darton (1920)	2.5
SW 13-120N-63W	920	67	Water Well	Darton (1920)	2.6
SW 14-120N-62W	925	67.5	Water Well	Darton (1920)	2.6

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
SE 14-120N-62W	914	68	Water Well	Darton (1920)	2.6
SW 18-120N-62W	914	68	Water Well	Darton (1920)	2.6
NE 9-120N-61W	900	68.2	Water Well	Darton (1920)	2.7
SW 15-120N-61W	880	66.5	Water Well	Darton (1920)	2.6
SW 21-120N-61W	884	66	Water Well	Darton (1920)	2.6
NE 23-120N-61W	980	68	Water Well	Darton (1920)	2.4
NE 34-120N-61W	900	65	Water Well	Darton (1920)	2.4
NW 28-120N-60W	1000	69	Water Well	Darton (1920)	2.6
NW 2-119N-62W	912	66	Water Well	Darton (1920)	2.5
SW 25-119N-62W	907	66	Water Well	Darton (1920)	2.5
NE 15-119N-63W	948	67.5	Water Well	Darton (1920)	2.5
SE 28-119N-63W	925	65	Water Well	Darton (1920)	2.3
NW 32-119N-64W	842	64	Water Well	Darton (1920)	2.4
SE 3-119N-60W	1000	68	Water Well	Darton (1920)	2.4
NE 2-119N-64W	920	65	Water Well	Darton (1920)	2.3
NE 31-119N-61W	964	67.5	Water Well	Darton (1920)	2.5
SE 29-119N-61W	896	68	Water Well	Darton (1920)	2.7
SE 3-119N-60W	1000	68.5	Water Well	Darton (1920)	2.5
SW 30-118N-65W	939	64	Water Well	Darton (1920)	2.2
SW 18-118N-65W	940	67.5	Water Well	Darton (1920)	2.6
SW 3-118N-63W	927	63	Water Well	Darton (1920)	2.1
SW 10-118N-65W	1032	67	Water Well	Darton (1920)	2.3
NE 32-118N-64W	960	64.4	Water Well	Darton (1920)	2.2
SW 10-118N-63W	895	62.5	Water Well	Darton (1920)	2.1
SE 11-118N-65W	930	65	Water Well	Darton (1920)	2.2
NE 20-118N-63W	893	62	Water Well	Darton (1920)	2.1
NE 6-119N-64W	980	66.1	Water Well	Darton (1920)	2.3
SW 24-118N-63W	945	64	Water Well	Darton (1920)	2.1
NE 30-118N-63W	976	69	Water Well	Darton (1920)	2.6
C 2-118N-62W	920	67	Water Well	Darton (1920)	2.6
NW 7-118N-60W	850	67	Water Well	Darton (1920)	2.7
NW 15-118N-60W	943	68	Water Well	Darton (1920)	2.6
NW 10-118N-60W	986	64.5	Water Well	Darton (1920)	2.1
NE 26-118N-60W	985	68.5	Water Well	Darton (1920)	2.5
SW 35-117N-65W	967	67.7	Water Well	Darton (1920)	2.5
SW 20-117N-64W	955	66.7	Water Well	Darton (1920)	2.4
NE 29-117N-64W	951	66.7	Water Well	Darton (1920)	2.4
SW 31-117N-63W	866	66.7	Water Well	Darton (1920)	2.7

C 7-117N-63W	1020	68.7	Water Well	Darton (1920)	2.5
NW 32-117N-62W	810	64.4	Water Well	Darton (1920)	2.6
SE 27-117N-61W	900	62.2	Water Well	Darton (1920)	2.0
SW SE 31-117N-60W	895	69	Water Well	Darton (1920)	2.9
NW 33-116N-65W	900	67.2	Water Well	Darton (1920)	2.6
SE 13-116N-65W	890	66.7	Water Well	Darton (1920)	2.6
SE SW 3-116N-65W	964	70.1	Water Well	Darton (1920)	2.8
SE SW 10-116N-65W	920	70.1	Water Well	Darton (1920)	3.0
NE 35-116N-64W	949	64.4	Water Well	Darton (1920)	2.2
NW 31-116N-64W	912	66.7	Water Well	Darton (1920)	2.6
SE 9-116N-63W	851	62.2	Water Well	Darton (1920)	2.2
C 35-116N-63W	900	64.2	Water Well	Darton (1920)	2.3
C 25-116N-63W	880	62.2	Water Well	Darton (1920)	2.1
SW 4-116N-62W	875	64.5	Water Well	Darton (1920)	2.4
C 34-116N-61W	915	62.5	Water Well	Darton (1920)	2.0
SE 13-115N-64W	942	64.4	Water Well	Darton (1920)	2.2
NW 9-115N-64W	930	65.2	Water Well	Darton (1920)	2.3
SW 10-115N-64W	935	65.4	Water Well	Darton (1920)	2.3
SW 33-115N-63W	867	54.4	Water Well	Darton (1920)	2.5
SE 1-115N-63W	988	62.2	Water Well	Darton (1920)	1.9
NW 29-115N-62W	936	64.5	Water Well	Darton (1920)	2.2
NE 22-115N-61W	885	62.5	Water Well	Darton (1920)	2.1
NE 23-115N-61W	885	65.3	Water Well	Darton (1920)	2.4
NW 27-115N-61W	450	56.2	Water Well	Darton (1920)	2.9
C 6-115N-60W	940	66.7	Water Well	Darton (1920)	2.5
SW 9-115N-60W	886	67.7	Water Well	Darton (1920)	2.7
SE 3-115N-60W	900	67.0	Water Well	Darton (1920)	2.6
NE 29-114N-65W	1029	71.5	Water Well	Darton (1920)	2.6
NE 30-114N-62W	840	67.0	Water Well	Darton (1920)	2.8
SW 5-114N-62W	835	64.5	Water Well	Darton (1920)	2.5
SW 7-114N-61W	770	62.2	Water Well	Darton (1920)	2.4
NW 19-114N-61W	800	66.7	Water Well	Darton (1920)	2.9
SW 27-114N-61W	744	64.4	Water Well	Darton (1920)	2.8
NE 23-114N-61W	790	65.4	Water Well	Darton (1920)	2.8
C 28-114N-61W	735	65.3	Water Well	Darton (1920)	3.0
NW 11-114N-60W	884	69.6	Water Well	Darton (1920)	3.0
SE 18-114N-60W	860	68.7	Water Well	Darton (1920)	3.0
SE 17-114N-60W	848	67	Water Well	Darton (1920)	2.8
NE 23-114N-60W	835	67.5	Water Well	Darton (1920)	2.9
SW 27-114N-60W	850	62.2	Water Well	Darton (1920)	2.2

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
STANLEY COUNTY					
5-3N-29E	1395	108	Water Well	SDSM&T (1954)	4.7
SW NE 10-4N-28E	1500	92	Water Well	Davis, Dyer & Powell (1961)	3.3
SE SW 24-4N-28E	1400+	95	Water Well	Davis, Dyer & Powell (1961)	3.7
SW SE 26-4N-30E	2000	86	Water Well	Davis, Dyer & Powell (1961)	2.1
SE NW 4-5N-28E	1500	84	Water Well	Davis, Dyer & Powell (1961)	2.7
NW NW 35-5N-28E	1530	95	Water Well	Davis, Dyer & Powell (1961)	3.4
SW SW 3-5N-29E	1900	91	Water Well	Davis, Dyer & Powell (1961)	2.5
NW NE 33-5N-31E	1169	91	Water Well	Davis, Dyer & Powell (1961)	4.1
SW NW 10-7N-27E	3508	86	Water Well	Davis, Dyer & Powell (1961)	1.2
NE NE 14-109N-76W	1000	71	Water Well	Davis, Dyer & Powell (1961)	2.8
NE SW 14-109N-76W	1000	71.5	Water Well	Davis, Dyer & Powell (1961)	2.8
SW NE 16-109N-76W	1000	74.5	Water Well	Davis, Dyer & Powell (1961)	3.1
SW NE 26-109N-76W	900	71	Water Well	Davis, Dyer & Powell (1961)	3.1
SE NW 26-109N-76W	1000	72	Water Well	Davis, Dyer & Powell (1961)	3.2
SE SE 12-9N-27E	3890	118	Carter No. 1 Loucks Oil Test		1.9
SW NE 18-7N-28E	4000	122	Cities Svc. No. 1 "A" Barrick Oil Test		2.0
NE NE 9-4N-27E	2740	117	Shell No. 1 Abbott Oil Test		2.7
NW NW 23-3N-25E	4012	132	Shell No. 1 McCrone Oil Test		2.2
SW NE 11-3N-27E	2800	104	Tenneco No. 1 Hall Oil Test		2.15
NW NW 10-4N-28E	2725	112	Tenneco No. 1 Rankin Oil Test		2.5
NW SE 36-5N-27E	2750	95	Phillips No. 1 Stanley Oil Test		1.5
NW NW 26-6N-27E	3900	120	Benedum No. 1 Shaffner Oil Test		2.0
SE NW 22-8N-26E	3983	115	Gulf No. 1 Stanley-Fed. Oil Test		1.8
NW NW 13-5N-29E	3310	114	Cities Svc. No. 1 Wagner Oil Test		2.1
SE SE 29-8N-27E	3930	130	Shamrock No. 1 Barrick Oil Test		2.2
SULLY COUNTY					
SW NE 6-116N-77W	2300	80	Schreiber Water Well		1.6
NW NE 31-113N-76W	1400	68	Water Well	Davis, Dyer & Powell (1961)	1.7
NE NE 14-115N-80W	2525	86	Water Well		1.7
SW SE 22-113N-81W	1375	86	Water Well	Davis, Dyer & Powell (1961)	3.1
SW SE 2-114N-77W	2111	85	Water Well	Davis, Dyer & Powell (1961)	2.0
SW SE 2-114N-77W	1650	78	Water Well	Davis, Dyer & Powell (1961)	2.1
SW NE 5-114N-80W	3150	90	Water Well	Davis, Dyer & Powell (1961)	1.5
SE NE 21-115N-80W	2240	90	Water Well	Davis, Dyer & Powell (1961)	2.1

SE SE 28-115N-80W	2300	69	Water Well	Davis, Dyer & Powell (1961)	1.1
NE SE 22-116N-79W	2200	84	Water Well	U.S.G.S.	1.8

TODD COUNTY

27-38N-30W	2500	153.5	Water Well	Darton (1920)	4.4

TRIPP COUNTY

SW SW 33-100N-79W	2865	130	Schlaikjer Water Well		3.0
SE NW 33-100N-78W	1562	94	Witten Water Well	Derr	3.3
8-102N-77W	1381	110	Water Well	U.S.G.S.	4.9
SE SW 28-102N-74W	1200	117	Water Well	U.S.G.S.	6.3
NW SW 8-102N-77W	1381	110	Water Well	U.S.G.S.	5.0
NW NW 16-101N-75W	1370	127	Water Well	U.S.G.S.	6.3
NW NE 3-101N-74W	1200	110.5	Water Well	Davis, Dyer & Powell (1961)	5.7
SW NW 3-101N-74W	2000	111.5	Water Well	Davis, Dyer & Powell (1961)	3.4
NW NE 6-101N-74W	1225	105.5	Water Well	Davis, Dyer & Powell (1961)	5.1
SE NE 28-101N-77W	1490	84	Water Well	Davis, Dyer & Powell (1961)	2.7
SE SE 6-101N-75W	1360	125	Jorgensen Water Well		6.1
SW SW 7-102N-74W	1220	110	Water Well	Davis, Dyer & Powell (1961)	5.6
SE SW 31-102N-74W	1195	106	Water Well	Davis, Dyer & Powell (1961)	5.4
NW SW 34-102N-74W	1245	110	Water Well	Davis, Dyer & Powell (1961)	5.5
SW NW 12-102N-75W	1100	105	Water Well	Davis, Dyer & Powell (1961)	5.8
SW SW 15-102N-76W	1400	85	Water Well	Davis, Dyer & Powell (1961)	3.0
SW NW 5-102N-77W	1460	95.5	Water Well	Davis, Dyer & Powell (1961)	3.6
SE NE 23-102N-78W	1280	112	Water Well	Davis, Dyer & Powell (1961)	5.5
SE NE 22-98N-78W	3022	128	Gen. Crude No. 1 Assman Oil Test		2.8
SW NE 22-96N-79W	3010	128	Gulf No. 1 Keyapaha State Oil Test		2.8
SW SW 11-102N-78W	2590	106	Gulf No. 1 Swedlund Oil Test		2.4
SW SE 23-100N-77W	2390	117	Kucera No. 1 Bartels Oil Test		3.1
SW NW 5-96N-75W	2750	129	Gen. Crude No. 1 Shippey Oil Test		3.1
NE SE 33-95N-77W	2890	111	Gen. Crude No. 1 Rural Credit Oil Test		2.4
NE SE 25-99N-79W	2885	124	Gen. Crude No. 1 Vogt Oil Test		2.8
SW SE 36-97N-76W	1550	85	Batts No. 1 State Oil Test		2.7

WALWORTH COUNTY

19-121N-77W	1930	56	Water Well	U.S.G.S.	.6
NE NE 18-123N-77W	2405	77	Zabel Water Well		1.4
NE SE 36-123N-76W	3920	97	Pepper No. 1 State Oil Test		1.35

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
SW SE 17-123N-77W	2366	78	Barens Water Well		1.4
NW NW 14-121N-77W	3810	99	Pray No. 1 Kranzler Oil Test		1.4
NE NE 28-122N-77W	2500	77	Schilling Water Well		1.3
NW NE 34-121N-77W	2240	81	Goetz Water Well		1.7

YANKTON COUNTY

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
SE SE 36-94N-56W	672	64	Water Well	Darton (1920)	3.1
NE NE 17-93N-56W	500	64	Water Well	Darton (1920)	4.3
22-96N-57W	550	53.5	Water Well	U.S.G.S.	1.7
12-93N-56W	375	60	Water Well	Darton (1920)	4.7
11-93N-56W	380	60	Water Well	Darton (1920)	4.7
19-93N-56W	400	60	Water Well	Darton (1920)	4.4
SW NE 14-93N-54W	601	57	Water Well	Davis, Dyer & Powell (1961)	2.2
SW 18-93N-55W	526	64	Water Well	Davis, Dyer & Powell (1961)	4.0
SE NW 12-95N-56W	480	56	Water Well	Davis, Dyer & Powell (1961)	2.6
SW SE 28-96N-56W	428	54	Water Well	Davis, Dyer & Powell (1961)	2.4
SW NW 29-96N-56W	250	54	Water Well	Davis, Dyer & Powell (1961)	4.7
SE SW 4-96N-57W	420	55	Water Well	Davis, Dyer & Powell (1961)	2.8
NW NW 11-96N-57W	420	54	Water Well	Davis, Dyer & Powell (1961)	2.5
NE SE 22-96N-57W	550	55	Water Well	U.S.G.S.	2.0
NE NE 4-93N-55W	407	60	Water Well	U.S.G.S.	4.3
SW SW 6-93N-54W	386	60	Water Well	U.S.G.S.	4.6

ZIEBACH COUNTY

Location	Depth (feet)	Temperature (°F)	Source	Reference	Thermal Gradient °F/100 Feet
SW NE 26-16N-18E	6410	144	Amerada No. 1 Trent Oil Test		1.6
SE SW 25-15N-21E	5580	136	Norris No. 1 Cheyenne Oil Test		1.65
SW SW 18-17N-18E	5700	134	Shell No. 14-18 Dries Oil Test		1.6
NE NE 21-12N-19E	5590	137	Herndon No. 1 Butler Oil Test		1.7
NE NW 20-11N-23E	3000	107	Phillips No. 1 State Oil Test		2.1
NW SE 18-13N-18E	3310	103	Phillips No. 1 Nelson Oil Test		1.8
SE NW 20-13N-20E	6300	152	Kerr McGee No. 1 Brammer Oil Test		1.7
NW NE 1-16N-20E	5960	140	Herndon No. 1 Young Oil Test		1.6
NW NE 21-12N-22E	5300	133	Cities Svc. No. 1 "A" Jensen Oil Test		1.7
SE SW 20-14N-18E	3610	99	Amerada No. 1 Cheyenne River Oil Test		1.25
NE NE 33-16N-18E	5160	132	Amerada No. 1 Briscoe Oil Test		1.7
NE SE 35-12N-20E	5320	144	Ward Dayton No. 1 Olson Oil Test		1.9
NW SE 14-13N-21E	5247	132	Inv. No. 1 Eulborg Oil Test		1.7

APPENDIX II

PART A

Water Analyses From Wells Drilled East of the Missouri River

Only those wells listed in appendix II which show a temperature under the column headed **Producing Formation** are listed in appendix I.

Location	Total Solids	Na	Cl	Ca	SO_4	Mg	Mn	Fe	Fl	Well Name	Depth	Producing Formation
AURORA COUNTY												
5-102-66	2343	---	112	414	1299	93	0.0	1.7	3.0	Gillon Farm	810	Dakota
11-103-66	2286	131	103	405	1291	90	0.2	3.0	3.0	White Lake City	860	Dakota
28-104-63	2385	---	122	396	1319	88	0.4	4.6	3.0	Hoefort Oil Test	1082	Dakota
25-105-64	2181	---	72	341	1249	82	0.3	0.0	3.0	Larson Farm	750	Dakota
BEADLE COUNTY												
14-109-62	2050	593	128	50	1150	15	---	.65	2.4	Schumaker Farm	760	Dakota
19-109-63	1960	362	94	177	1180	53	---	.6	2.8	Barbe Farm	860	Dakota
22-109-59	2030	676	119	8.7	1100	1.8	.10	2.1	1.8		784	Dakota
21-109-65	2040	318	105	230	1210	64.0	.03	1.1	2.0		956	Dakota -- Temp 61°F
1-110-62	2090	285	136	269	1210	65.0	---	1.2	36.0	State Fairgrounds	1000	Dakota
1-110-62	2010	400	132	170	1130	44.0	---	5.1	22.0	Courthouse Well	1000	Dakota
7-110-62	1990	410	136	166	1130	49.0	.06	1.2	1.7		822	Dakota -- Temp 67°F
32-110-63	2355	324	151	258	1225	71	0.0	0.9	2.2	Virgil City	800	Dakota
6-110-58	2520	630	100	143	1430	34	0.6	2.9	2.6	Iroquois City	1008	Dakota
6-110-58	2200	736	150	10	1130	2	0.0	.2	4.2	Iroquois City	980	Dakota
1-111-66	2196	319	154	251	1162	61	0.0	0.6	2.8	Wessington City	1100	Dakota
12-111-60	2159	731	135	14	1143	4	0.0	0.6	2.5	Yale City	850	Dakota
4-111-62	1990	368	117	184	1150	51	---	1.3	3.2	Smith Farm	800	Dakota
24-111-64	2083	478	158	140	1119	35	0.1	3.3	2.7	Wolsey City	930	Dakota
24-111-64	2120	178	108	364	1301	74	.10	1.4	2.7	Wolsey City	1220	
14-112-61	2090	326	122	231	1230	58	.09	1.2	1.7		1000	Temp 66°F
14-112-61	2000	650	182	16	985	2.4	.03	.23	1.9		770	Dakota -- Temp 61°F
24-112-63	2110	217	121	308	1250	78	---	.08	2.8	Abramson Well	750	Dakota
24-112-64	2140	417	139	228	1210	21	---	.05	2.8	Kalure Well	800	Dakota
3-113-63	-----	261	96.8	266.9	1256	88.5	---	11.0	---	Hitchcock City	953	Dakota
4-113-63	2080	201	89	316	1280	82	---	2.8	1.2	Hitchcock City	1150	
4-113-65	2110	154	98	369	1280	85	.14	2.3	2.7		1000	Temp 71°F
12-113-59	2430	862	294	6.9	965	2.9	.07	6.3	8.0		1002	Temp 54°F
BON HOMME COUNTY												
4-93-59	1960	113	145	389	1130	73	0.14	3.2	2.7	Nauratil Farm	460	Dakota
23-93-60	2497.5	329	143	335	1450	71.8	---	---	---	State Normal	680	Dakota
23-93-60	2032	120	138	364	1095	70	0.2	2.2	2.9	Springfield City	620	Dakota
31-95-59	-----	128.3	148	365.5	1180.4	81.5	---	---	---	Tyndall City	736	Dakota
31-95-59	2226	125	148	125	1209	75	0.1	3.6	2.0	Tyndall City	800	Dakota
BROWN COUNTY												
4-121-62	2219	667	290	56.9	1059	17.5	0.0	0.3	1.6	Stratford City	1140	Dakota
6-121-60	2228	758	173	11.0	1111	3.0	0.0	0.6	4.0	Ferney City	1100	Dakota
28-121-61	-----	835	350	4.0	950	2.0	---	.37	3.7	Knickrehm Farm	1120	Dakota
33-121-64	1962	724	485	14.0	609	3.0	0.0	0.0	2.2	Mansfield City	1180	Dakota
19-123-60	2192	598	110	78.0	1252	21.0	0.0	1.0	2.3	Groton City	1000	Dakota
	-----	585	174	63	995	12.0	---	---	2.5	Aberdeen City	1250	Dakota

15-123-63	-----	634.09	144.83	35.16	1117.97	23.36		6.57	---	Aberdeen City	1300	Dakota
13-123-64	1971	643	271	40.02	848.24	.69				Aberdeen City	1101	Dakota
21-124-65	-----	600	100	20.0	1150	12.0	---	.29	3.0	County Well	1120	Dakota
25-124-65	2136	----	67	79.0	1236	23.0	0.0	1.2	2.8	Arlt Farm	1285	Dakota
1-125-60	2543	----	321	17	1186	2	---	.5	5.	Claremont City	975	Dakota
2-125-60	2560	849	322	18	1188	0.0	0.0	0.8	4.8	Claremont City	975	Dakota
29-125-62	2334	----	----	----	479	---	---	---	4.5	Columbia City	965	Dakota
7-125-64	-----	963.6	912.4	8.0	282.4	11.1	---	8.2	---	Westport City	1030	Dakota
6-126-61	1820	607.46	574.03	32.49	310.14	1.43	---	---	---	Houghton City	1081	Dakota
20-128-61	2454	810	282	23.0	1088	2.0	0.0	1.2	4.8	Hecla City	1000	Dakota
	2374	880	87	28	1224	6.0	0.0	0.7	2.4	Walter (Walker) Daily		

BRULE COUNTY

3-103-68	2299	102	109	412	1293	86	0.1	3.4	3.2	Kimball City	1200	Dakota
15-104-71	2082.6	187.7	109.3	324.2	1255.2	95.7	---	8.1	---	Chamberlain Mill	600	Dakota
15-104-71	-----	187.9	199.3	325.3	1252.3	95.6	---	---	---	Chamberlain City	815	Dakota
26-104-70	2518	112	118	407	1268	89	0.2	14.0	3.0	Pukwana City	1018	Dakota

BUFFALO COUNTY

22-107-72	2191	112	97	372	1248	88	0.0	0.6	3.0	Peck Farm	1350	Fall River
30-107-71	2006	----	92	243	1115	59	0.0	3.8	3.0	Christenson Farm	775	Dakota
30-107-71	3962	----	2057	48	101	25	0.0	14.0	1.0	Christenson Farm	575	Greenhorn
36-108-72	2173	----	105	416	1298	97	0.0	1.0	3.0	Knippling Ranch	1150	Dakota

CAMPBELL COUNTY

5-127-78	-----	----	58.4	242.1	1298	---	---	---	---	Ronald Dienert Farm	2362	Inyan Kara
21-127-77	-----	----	66.8	273.2	1400	---	---	---	---	C. Diebert Farm	2226	Inyan Kara
35-128-78	-----	----	1055.8	12.9	2.5	---	---	---	---	A. Dienert Farm	2250?	Dakota

CHARLES MIX COUNTY

-94-64	1633	38	99	308	867	58	---	2.0	3.2	Bobcock Farm	712	Dakota
4-95-65	1358	516	354	17	171	6	---	.06	3.1	Ft. Randall	854	Dakota and Codell
7-96-61	1849	106	141	317	930	57	---	.6	---	Rest Haven	-----	Dakota
1-99-68	1323.7	----	----	----	----	----	---	7.7	---	Smit Farm	900	Dakota
13-99-68	1893	----	606	21	255	6.0	---	1.0	3.2	Platte City	464	Codell
13-99-68	2142	----	308	37.7	1093	157	---	3.2	3.4	Platte City	815	Dakota
13-99-68	2034	140	206	33	1034	71.0	0.1	10.0	2.8	Platte City	930	Dakota

CLARK COUNTY

17-114-59	2430	830	262	5.7	1080	2.9	---	1.2	4.5	Iverson Farm	943	Dakota
18-115-59	-----	840	230	12.0	1100	1.0	---	.23	4.0	Helkenn Farm	980	Dakota
20-115-59	-----	860	265	8.0	1100	7.0	---	.07	4.0	Arne Farm	954	Dakota
-116-57	2245	774	22.0	11.2	1046	1.6	---	---	---	Mann Farm	1100	Dakota
15-117-59	-----	825	225	0.0	950	----	---	0.0	3.0	Hurlburt Farm	1073	Dakota
29-117-59	2274	791	220	8.0	984	2.0	0.0	0.2	5.6	Raymond City	1000	Dakota
9-119-59	2320	791	231	15.0	1012	4.0	0.0	2.6	4.0	Dubs Farm	1260	Dakota
9-119-59	2210	750	228	11.0	995	2.6	---	4.0	4.0	Lederman Farm	1200	Dakota

Location	Total Solids	Na	Cl	Ca	SO_4	Mg	Mn	Fe	Fl	Well Name	Depth	Producing Formation
						CLAY COUNTY						
7-92-52	1200	50	52	257	689	41.0	0.17	4.6	1.7	Mathis Farm	500	Dakota
						DAY COUNTY						
3-122-59	-----	774.3	201	9.9	1120.4	12.9	---	4.2	---	Andover City	1075	Dakota
5-123-59	2230	742	163	9.0	1110	2.8	---	2.7	4.8	Hansmier Farm	1000	Dakota
6-123-58	1816	589	188	27.0	779	10.0	0.1	1.0	2.9	Pierpont City	1165	Dakota
25-124-59	2300	772	172	8.6	1150	3.3	---	2.4	4.1	Salens Farm	1200	Dakota
						DOUGLAS COUNTY						
12-98-64	-----	152	175	372	865	10.1	---	---	---	Armour City	757	Dakota
						EDMUNDS COUNTY						
3-121-66	-----	820	750	12.0	375	7.0	---	0.5	3.1	Anderson Farm	1020	Dakota
27-123-68	2167	304	60	237	1257	69.0	0.2	1.0	3.0	Ipswich City	1196	Dakota
27-123-68	2261	137	53	359	1264	80.0	---	1.0	3.4	Ipswich City	1400	Dakota
28-123-68	-----	789	491	9.6	343	16.0	---	4.34	---	Ipswich City	1265	Dakota
30-123-70	2343	814	440	9.0	480	5.0	0.0	0.7	3.0	Roscoe City	1500	Dakota
						FAULK COUNTY						
21-117-72	-----	62	105	429	1200	72	---	0.06	---	Baloun Farm	2038	Paleozoic
31-117-66	2004	702	329	6	627	2	0.0	0.0	3.4	Rockham City	1100	Dakota
33-117-67	2378	747.7	324	17.6	750	8.7	---	---	---	C. F. Bues Farm	975	Dakota?
1-117-68	1759	609	287	8.4	593	8.8	---	---	---	Miranda City	1162	Dakota
36-117-69	1801	639	340	24	538	9.0	0.0	0.7	2.9	Orient City	1365	Dakota
9-118-70	-----	540	170	36	750	17.0	---	0.6	2.5	Faulkner Farm	1526	Dakota
14-118-69	2007	699	378	22	541	7.0	0.0	0.2	2.8	Faulkton City	1281	Dakota
14-118-69	1966	----	387	25	529	19.0	---	0.8	2.8	Faulkton City	1400	Dakota
16-118-67	2030	717	408	19.0	557	5.7	---	6.1	3.0	Bierman Farm	1020	Dakota
19-118-68	-----	155	55	345	1350	87	---	0.2	---	Lenhoff Farm	1500	Dakota
20-118-72	2130	----	68	255	1225	91	---	0.5	---	Hunt No. 1 Gutenkauf	2500-2575	Ordovician
20-118-72	2200	----	67	339	1272	103.0	---	0.5	---	Hunt No. 1 Gutenkauf	2334-2418	Devonian
11-119-66	1780	500	272	68	770	19.0	---	0.4	1.9	Steward Farm	1080	Dakota
31-120-67	2147	586	----	25	348	11.0	---	3.3	2.4	Cresbard City	1100	Dakota
23-120-72	-----	697	600	25	52	8.7	---	---	1.1	C. Duckell	1300-1800?	Dakota
						HAMLIN COUNTY						
17-113-55	3004	1004	421	14	1226	4.0	0.1	0.6	4.8	Bryant City	1360	Dakota
						HAND COUNTY						
7-112-67	2127	491	157	117	1138	36.5	---	1.0	3.2	St. Lawrence	-----	Dakota
10-112-68	2155	363	95	215	1222	57	0.0	1.5	2.4	Miller City	1100	Dakota

18-112-67	1958	568.6	102	53	1135	15.9	---	3.9	---	Humphrey	1296	Dakota
6-113-67	2038	235	113	324.8	1080	19.7	---	---	---		1200	Dakota
32-113-66	2351	453	315	215	1125	52.0	0.0	1.4	2.8	Snodgrass Farm	1263	Dakota or Fall River
21-116-69	2108	460	158	76	824	9	0.0	0.0	2.8	Dvorak Farm	1050	Greenhorn? Dakota?

HUGHES COUNTY

3-109-76	3131	1182	1445	21	7	11.0	0.0	Trace	0.6	Schmidt Farm	816	Greenhorn
6-109-75	3172	1092	1203	26	8	20	0.0	0.0	1.2	Etzkorn Farm	836	Greenhorn
13-111-76	-----	82	90	384	1200	83	---	0.17	3.3	Dromey Farm	1850	Madison?
33-111-79	3464	1303	1902	41	----	19	---	---	---	State Capitol No. 2	1260-1385	Dakota
33-111-79	3479	1350	1702	30.8	Trace	1.4	---	3.8	---	Indian School	1192	Dakota
35-111-79	2238	112	88	368	1232	95	---	3.0	2.8	Airport Well	-----	Fall River -- Temp 109°F
35-111-79	2466	56	95	329	1014	91	---	1.0	4.0	Airport Well	-----	Minnelusa
35-111-79	2386	59	91	340	1040	91	---	---	4.0	Airport Well	-----	Madison
8-112-76	2129	630	837	102	324	33	0.0	0.0	1.2	Blunt City	1400	Dakota
9-112-74	1746	629	487	11.4	306	16.6	---	---	---	Harrold City	1453	Dakota
16-112-76	2102	688	774	68.4	301	19.9	---	---	---	C&NW Railroad	1335	Dakota
-112-78	2082	1087	1056	42	699	14	---	2.4	---	Brown Well	1600	Dakota

HUTCHINSON COUNTY

1-97-58	2080	122	138	411	1220	76	0.25	3.0	3.1	Schoenfish Farm	308	Dakota
3-97-57	2411	133	127	395	1230	82	0.0	8.2	2.8	Menno City	530	Dakota

HYDE COUNTY

11-109-72	2011	286	76	225	1120	57	0.0	6.8	2.7	Stephan Mission	1456	Dakota
12-112-72	4487		2136	22	116	14	---	---	2.0	Highmore City	1500	Dakota
12-112-72	1707	601	290	18.2	498	9	---	---	---	Highmore City	1566	Fall River
23-113-73	4487	----	2136	21.5	116	14	---	---	2.0	Larson Farm	1500	Dakota
28-114-71	1967	513	297	40.3	700	15.5	---	---	---	King Farm	1417	Dakota
31-116-73	2218	----	79	325	1178	101	0.0	0.0	1.6	Hunt No. 3 School Land	2300-2400	Madison
31-116-73	2324	299	101	266	1289	48	---	---	---	Hunt No. 1 State		Ordovician

JERAULD COUNTY

21-106-64	-----	140	70	332	1250	75	---	1.96	2.7	Hinrichs Farm	890	Dakota
4-107-65	2076	----	65	257	1217	68	0.0	0.7	4.5	Shyrock Farm	841	Dakota
17-107-63	2077	----	----	----	1232	----	---	---	2.6	Lane City	870	Dakota
17-107-63	2136	332	71	208	1223	67	0.0	2.2	2.2	Lane City	830	Dakota
20-107-64	-----	180	60	288	1200	63	---	1.7	2.6	Easton Farm	900	Dakota
1-108-64	2131	----	91	143	1245	48	0.0	2.0	2.5	Neumeyer Farm	921	Dakota
11-108-63	2047	----	84	176	1233	57	---	1.0	2.2	Alpena City	790	Dakota
11-108-63	2149	357	90	214	1233	59	0.0	3.0	2.3	Alpena City	900	Dakota
11-108-63	2147	352	90	204	1245	56	0.1	1.2	2.3	Alpena City	975	Dakota

KINGSBURY COUNTY

3-109-54	2195	762	167	10	1130	2	0.0	0.7	4.0	Esmond City	850	Dakota
21-109-54	2448	853	242	7	997	4	0.0	1.8	8.5	Oldham City	1050	Dakota
1-110-55	2254	796	180	13	1122	2	0.0	0.3	6.8	Lake Preston City	830	Dakota

Location	Total Solids	Na	Cl	Ca	SO_4	Mg	Mn	Fe	Fl	Well Name	Depth	Producing Formation
1-110-55	2210	----	----	----	----	----	---	---	6.0	Lake Preston City	1175	Dakota
31-111-58	2215	736	150	10	1125	2	0.0	0.2	4.2	Iroquois City	980	Dakota
22-111-56	2208	810	214	12.8	930	21.4	---	---	---	DeSmet City	1100	Dakota
24-112-59	2185	736	215	10	959	3	0.0	0.0	4.5	Bancroft City	1065	Dakota

LAKE COUNTY

Location	Total Solids	Na	Cl	Ca	SO_4	Mg	Mn	Fe	Fl	Well Name	Depth	Producing Formation
29-108-53	1875	589	93	46	877	13	0.0	1.3	1.9	Ramona City	850	Dakota

LINCOLN COUNTY

Location	Total Solids	Na	Cl	Ca	SO_4	Mg	Mn	Fe	Fl	Well Name	Depth	Producing Formation
32-96-50	954	165	80	115	391	30	0.0	0.7	3.2	Beresford City	735	Dakota
13-97-49	776	211	22	42	263	17	---	---	.4	Newton Hills Park	502	Dakota
4-98-50	400	77	9	60	75	9	0.0	0.2	1.2	Worthing City	470	Dakota
18-98-48	800	----	36	----	329	----	---	---	---	Indian Asylum	322	Dakota
23-98-49	706	181	25	61	222	21	0.0	0.2	1.3	Canton City	430	Dakota
23-98-49	705	----	33	86	241	30	---	0.8	---	Canton City	448	Dakota
32-99-51	2272	----	10	399	1136	99	---	0.2	---	Lennox City	487	Dakota
36-100-50	2783	152	11	433	1382	151	0.2	1.8	0.4	Harrisburg City	550	Dakota-Pleistocene contamination

McPHERSON COUNTY

Location	Total Solids	Na	Cl	Ca	SO_4	Mg	Mn	Fe	Fl	Well Name	Depth	Producing Formation
22-125-66	2536	934	880	10	307	7	0.0	0.1	2.5	Wetonka City	1300	Dakota
20-126-67	2196	764	530	20	384	9	0.0	1.6	2.2	Leola City	1375	Dakota
35-127-73	2305	152	64	342	1321	103	0.0	1.5	3.6	Eureka City	2085	Fall River

MARSHALL COUNTY

Location	Total Solids	Na	Cl	Ca	SO_4	Mg	Mn	Fe	Fl	Well Name	Depth	Producing Formation
3-125-59	2683	----	310	38	1329	10	0.0	2.2	5.0	Hartberg Farm	1300	Dakota
17-125-58	2540	835	222	13	1240	5.5	---	.17	7.2	Jones Farm	-----	Dakota
32-125-58	2601	865	223	13	1225	4.0	0.0	1.6	8.0	Langford City	1000	Dakota
23-127-58	2547	842	318	20	1207	5.0	0.0	0.3	6.7	Britton City	1000	Dakota
23-127-59	2629	902	397	21	1093	1.0	0.0	---	9.0	Mockly Farm	920	Dakota
3-128-58	-----	777	278	31	1115	7.5	---	---	---	Newark City	940	Dakota

MINER COUNTY

Location	Total Solids	Na	Cl	Ca	SO_4	Mg	Mn	Fe	Fl	Well Name	Depth	Producing Formation
19-105	2246	----	140	288	1224	74	0.0	0.5	2.0	Schave Farm		
8-106-57	2169	524	153	135	1158	36	0.0	1.0	2.8	Roswell City	611	Dakota
30-106-56	2134	470	214	163.9	1139	50.6	---	---	---	Vilas City	515	Dakota?
8-108-57	2173	745	245	36	1212	10	0.0	0.5	3.0	Carthage City	1140	Dakota

POTTER COUNTY

Location	Total Solids	Na	Cl	Ca	SO_4	Mg	Mn	Fe	Fl	Well Name	Depth	Producing Formation
25-118-76	2010	742	482	8.5	384	4.6	0.01	0.1	2.7	Gettysburg City	1928	Dakota-Inyan Kara Recharge
27-118-76	2215	371	61	215	1281	57	---	---	---	Williams Farm		Fall River
25-118-76	2108	750	665	8	185	4	0.1	1.2	2.4	Gettysburg City	1950	Dakota-Inyan Kara Recharge
12-119-76	2009	----	2592	21	0	11	0.0	0.6	0.0	Unknown		Dakota-Well produced much gas

ROBERTS COUNTY

24-126-52	-----	1160	700	32	1250	15.0	---	0.14	4.0	Rath Farm	900	Dakota
10-127-51	7001	2469	1257	86	1033	52.0	0.0	1.2	1.0	Peterson Farm	660	Dakota-Pleistocene contamination

SANBORN COUNTY

23-105-61	2086	418	62	259	1219	2.0			3.0	Letcher City		Dakota??
1-106-61	2082	----	72	167	1222	49.0	0.0	0.4	1.0	Forestburg City	705	Dakota
2-106-61	2173	335	77	164	1028	46.0	0.0	2.0	2.4	Forestburg City	700	Dakota
4-106-59	2011	----	----	----	1132	----	0.0	---	2.8	Artesian City	800	Dakota
28-107-61	2040	422	86	158	1230	45.0	---	3.3	2.4	Peterson Farm	750	Dakota
21-107-62	1970	316	74	212	1200	58.0	---	0.95	2.8	Woonsocket City	775	Dakota
22-107-62	2010	302	68.5	223	1211	74.8	---	5.0	---	Woonsocket City	725	Dakota
6-108-62	2201	----	104	241	1249	69	0.0	1.4	2.0	Jensen Farm	1200	Dakota
20-108-60	1870	694	162	1.4	556	.5	---	.92	3.6	Unknown	500	Greenhorn
18-108-61	2100	653	98	28	1170	8.2	---	2.9	2.8	Unknown	800	Dakota
27-108-61	2273	216	136	275	1255	72	0.0	1.3	3.0	Loring Farm	950	Dakota

SPINK COUNTY

29-114-62	2110	663	203	30	1050	10	---	.49	2.8	Unknown	850	Dakota
22-114-64	2230	638	189	66	1190	18	---	.91	2.8	Unknown	975	Dakota
27-115-64	2090	506	139	114	1180	32	---	.06	2.4	Tulare City	850	Dakota
35-115-64	2135	525	132	117	1179	30	0.0	1.2	2.0	Tulare City	1200	Fall River
4-116-62	2102	676	200	26	1029	8	0.0	0.3	2.2	Frankfurt City	1000	Dakota?
10-116-61	2188	751	190	10	999	4	0.0	7.9	4.0	Remily Farm	1070	Dakota
10-116-63	2110	716	225	12	939	4	---	2.8	3.6	Unknown	900	Dakota
10-116-64	2232	736	226	31	1097	9	0.0	0.2	3.0	Redfield City	1080	Dakota?
30-117-60	2149	745	226	10	1033	1	0.0	0.2	3.4	Doland City	1000	Dakota
35-118-64	2358	584	198	99	1137	29.0	0.0	1.1	2.6	Ashton City	1006	Dakota
2-119-64	1985	685	320	6	773	2.0	0.0	1.2	3.0	Mellette City	1010	Dakota
6-119-64	2041	745	408	5	585	1.0	0.0	0.1	3.4	Northville City	1095	Dakota
11-119-63	2122	722	315	16	824	9.0	0.0	0.0	3.5	Hammer Farm	968	Dakota
20-120-63	2070	710	358	20	728	4.9	---	3.0	3.3	Geiser Farm	1042	Dakota
31-120-60	2384	800	273	10.0	1078	3.0	0.0	0.5	4.3	Conde City	1000	Dakota
32-120-62	2220	736	195	18	1155	4.0	0.0	0.9	3.0	Brentford City	1000	Dakota

SULLY COUNTY

23-113-77	2027	729	404	58	806	19	0.0	Trace	1.4	Johnson Farm	1495	Dakota
?-113-81	5537	1915	2900	48	26	43	0.0	---	1.2	Marks Ranch	?	Dakota
2-114-77	2268	60	67	417	1323	109	0.1	1.7	3.6	Onida City	2139	Fall River-Paleozoic recharged?
2-114-77	2009	501	205	107	1002	35	0.1	0.3	2.2	Onida City	1700	Dakota
23-116-77	1981	713	526	10	355	2.0	0.0	0.2	2.8	Agar City	1800	Dakota

TURNER COUNTY

5-98-53	1418	184	106	179	702	42	0.0	2.1	2.4	Viborg City	720	Dakota
27-99-52	3127	186	22	449	1641	156	1.7	1.9	1.5	Chancellor City	560	Dakota

Location	Total Solids	Na	Cl	Ca	SO_4	Mg	Mn	Fe	Fl	Well Name	Depth	Producing Formation
UNION COUNTY												
13-90-49	1414	----	60	244	780	52	---	1.6	2.5	LaFleur Oil Test	835	Paleozoic
19-91-49	1355	113	53	236	720	39	0.0	1.4	2.3	Elk Point City	560	Dakota
YANKTON COUNTY												
4-93-55	1320	64	69	267	745	52	.22	2.4	2.8	Frick Farm	407	Dakota
13-94-54	2258	110	116	270	1112	72	0.2	3.1	2.8	Volin City	500	Dakota
7-94-56	2040	94	111	370	1107	71	0.0	3.2	3.0	Utica City	760	Dakota
36-94-36	2036	106	120	377	1137	67	0.2	3.2	3.0	Mission Hill City	600	Dakota
9-95-55	1690	110	117	325	956	61	.18	4.0	2.5	Gunderson Farm	468	Dakota
WALWORTH COUNTY												
19-121-78	4963	----	2592	21	0.0	11	0.0	0.6	0.6	Eiteneier Farm	?	
25-122-78	5219	----	2696	17	0.0	10	0.0	0.7	0.6	Wilson Farm	?	

APPENDIX II

PART B

Water Analyses From Wells Drilled West of the Missouri River

Location	Total Solids	Na	Cl	Ca	SO4	Mg	Mn	Fe	Fl	Well Name	Depth	Producing Formation
						BUTTE COUNTY						
2-8N-3E	2530	58	61	582	1610	92.0	---	.74	2.7	Dusing Farm	2000+	Minnelusa
7-8N-5E	567	192	5.0	6.8	237	2.2	0.0	0.9	0.45	Nisland City	1000	Greenhorn?
7-8N-5E	708	251	8.0	2.0	321	0.0	0.0	0.2	1.0	Nisland City	2050	Inyan Kara
32-8N-6E	532	185	6.0	5.6	199.5	1.46	0.02	1.4	0.58	Vale City	2300	Inyan Kara?
14-9N-8E	5685	680	541	428	1877	75.0	---	---	---	Sipila Ranch	4100	Minnelusa (Broom Creek)
19-9N-4E	1167	86	3.5	183	640	57.0	---	2.7	---	Orman	1417	Dakota?
24-9N-5E	816	261	39	.8	87	2.4	---	---	2.2	U.S.D.A.	2200	Inyan Kara
24-9N-5E	1061	393	14	----	337	2.0	---	0.4	4.0	U.S.D.A.	2580	Inyan Kara
27-9N-3E	2018	41	40	600	700	50.0	---	4.0	---	Olson Test	3240	Madison
27-10N-5E	688	234	48	2.5	180	0.5	5.02	2.4	0.0	U.S. Govt.		Inyan Kara
11-11N-7E	1140	408	130	2.5	120	0.5	0.38	1.5	0.68	U.S. Govt.		Inyan Kara
13-11N-1E	680	203	21.5	1.6	298	0.25	1.0	0.9	0.54	U.S. Govt.		Inyan Kara
						CORSON COUNTY						
26-18N-21E	-----	16592	25440	1540	4740	312	---	---	---	Kilroy No. 1 Schull	4470-4558	Madison (Charles)
26-18N-21E	-----	1744	1917	700	2996	192	---	---	---	Kilroy No. 1 Schull	4583-4743	Madison (Charles-Mission Canyon)
26-18N-21E	-----	1936	3815	860	1478	204	---	---	---	Kilroy No. 1 Schull	5873-5897	Red River (Upper Unit)
8-21N-19E	17300	4380	----	1050	9000	129	---	---	---	Youngblood No. 1 Macheel	5820	Madison (Mission Canyon)
11-22N-19E	4599	1702	1600	11.9	25	1.7	---	---	---	Shell No. 1 Winter	3793-3825	Inyan Kara
11-22N-19E	140637	51000	83600	2920	2400	540	---	---	---	Shell No. 1 Winter	5175-5196	Minnelusa (Fairbank)
11-22N-19E	7238	1280	----	696	2250	322	---	---	---	Shell No. 1 Winter	5606-5659	Madison (Mission Canyon)
11-22N-19E	13438	3570	6290	1060	2000	198	---	---	---	Shell No. 1 Winter	5758-5820	Madison (Mission Canyon-Lodgep
11-22N-19E	76680	24000	43600	4210	3800	730	---	---	---	Shell No. 1 Winter	7182-7305	Red River (Upper part of DST)
11-22N-19E	130740	42400	79500	5510	950	1160	---	---	---	Shell No. 1 Winter	7182-7305	Red River (Lower part of DST)
11-22N-19E	39670	13630	22300	1370	1950	156	---	---	---	Shell No. 1 Winter	7980-8010	Deadwood
23-22N-19E	12740	3060	3160	1010	4600	165	---	---	---	Youngblood No. 1 Winter	5455-5479	Madison (Mission Canyon)
						CUSTER COUNTY						
9-3S-8E	447	115.4	4.98	26.4	149.4	11.4	---	1.4	---	Unknown	905	Inyan Kara
25-4S-8E	2174	45.7	10.0	492.1	1336.9	71.7	---	---	---	Palensky Oil	-----	Minnelusa
15-6S-6E	198	----	24.7	41	9.0	15.5	---	---	---	Palensky No. 1 Streeter	939	Madison
32-6S-7E	579	34	3.0	92.9	91.6	25.3	0.1	0.0	0.6	Buffalo Gap City		
34-6S-2E	18814	5572.0	1940	592	9800	120.0	---	0.0	---	Ozark No. 2 Coffing	1338-1375	Minnelusa (Hayden)
34-6S-2E	10430	2740	1054	538	5430	59.0	---	0.4	2.0	Seppala No. 1 Hey Govt.		Minnelusa (Wendover-Meek)
34-6S-2E	-----	731.4	126	548.8	3438	194.2	---	0.67	---	Evans Hotel	1300	Minnelusa
						DEWEY COUNTY						
2-12N-31E	5404	2090	2374	7.1	20.2	9.4	---	---	---	Cheyenne Agency	1337	Dakota-Gas-Temp 79.5°F
17-12N-24E	2263	97	71	373	1281	102	0.0	1.4	4.4	Eagle Butte City	4322	Madison
21-13N-22E	2856	329	204	382.5	1535	62	---	4.8	2.8	Pendak No. 1 Cowan	5133	Red River (Upper unit)
36-14N-29E	4460	699	650	435.0	23	120		.35	3.5	V. E. Ranch	2505	Inyan Kara-Temp 90°F
8-15N-31E	2110	400	73	159.0	1170	45	---	1.8	3.3	Bartells Ranch	2266	Inyan Kara-Temp 84°F
12-15N-26E	6400	2400	3550	28.0	2.5	15.0		0.4	.8	Whitehorse	2021	Dakota-Temp 85°F
13-15N-23E	2804	----	150	----	1555	----	---	---	1.0	Herndon No. 1 O'Leary	5050	Red River (Upper Unit)

26-15N-30E	2800	753	274	94.0	1310	26.0		.63	4.8	V. E. Ranch	2215	Inyan Kara-Gas-Temp 90°F
29-15N-30E	5730	1460	1100	299.0	2290	74.0	---	1.1	3.2	V. E. Ranch	2200	Inyan Kara-Dakota-Temp 91.5°F
25-16N-22E	5000	947	894	433	2000	107	---	---	---	Youngblood No. 1 Galvin	4589	Madison (Mission Canyon)

FALL RIVER COUNTY

1-9S-2E	1109	186	250	127	316	35	---	0.9	1.4	Edgemont City No. 1	2250	
1-9S-2E	1111	----	265	123	351	35	---	---	1.6	Edgemont City No. 2	3357	
1-9S-2E	1123	----	250	125	314	35	---	---	1.8	Edgemont City No. 3	3200	
25-9S-7E	4706	468	151	695	1932	94	4.0	56.0	---	Ohio No. 1 Hedrick	4047-4042	Minnelusa (Hayden)
3-10S-2E	1070	213	270	114	315	31	---	0.25	1.2	B. H. Ord. Depot No. 2	3955	Madison
12-10S-2E	1280	247	340	126	345	34	0.0	0.3	1.3	B. H. Ord. Depot No. 1	3990	Madison

HAAKON COUNTY

6-1N-25E	2686	----	850	6.5	2.0	1.5	---	1.0	2.5	Stroppel Well	1880	Dakota-Temp 116°F
6-1N-25E	-----	1578	311	428	3887	168.0	---	7.0	---	Midland City	----	Inyan Kara
6-1N-25E	1724	26	31	292	861	67	0.0	Trace	2.8	Midland City	3311	Madison
13-1N-20E	1733	720	259	8.8	8.1	2.0	---	---	---	Philip City	2293	Dakota
13-1N-23E	981	385	410	6.4	23	1.5	---	---	---	Nowlin City	1842	Dakota-Temp 120°F
1-1N-20E	1210	21	22	232	650	58.0	---	---	2.2	Philip City	3784	Madison
24-1N-20E	2055	----	456	6.0	54	3.0	0.0	1.4	3.0	Philip City	2300	Dakota
27-3N-20E	3578	1115	153	17.3	1860	3.2	.12	2.8	0.0			Inyan Kara
8-5N-23E	6769	2680	3200	14.3	----	8.44	---	2.09	---	Chicago Cattle Co.		Dakota
11-6N-21E	7870	2512	632	70	4554	23	---	---	---	Bierwagen Est.	2090	Dakota-Greenhorn?
31-6N-18E	2022	836	234	9.0	3.0	----	---	---	---	McIlravy		Dakota-Temp 102°F
15-7N-22E	4998	1830	1835	28	4.0	----	---	---	---	Allen Towne		Dakota-Temp 109°F
20-7N-20E	5916	2115	2273	16	5.0	----	---	---	---	Bart Parson		Dakota-Temp 122°F
20-7N-22E	5717	2300	2470	6.8	4.3	2.9	0.0	---	1.6	Parson Well		Dakota-Yields gas
21-7N-22E	6147	2452	2857	22.0	14.0	4.0	0.0	1.7	2.4	Pohle No. 1 Govt.	1790-1910	Dakota-Yields Gas
24-7N-21E	3702	1250	323	21	1529	----	---	---	---	Jetter Brothers		Inyan Kara-Temp 113°F
28-7N-22E	2910	1000	270	9.0	1152	----	---	---	4.4	Buckholtze Well	2665	Inyan Kara
6-9N-19E	5477	2197	2417	9.6	1.4	4.5	---	---	2.8	Norbeck Well	2385	Dakota

HARDING COUNTY

1-17N-1E	3332	874	595	242	1461	23.0	---	---	---	N. Ord. State	7960-7971	Winnipeg Sand
35-18N-1E	4097	596	63	542	2394	83.8	---	---	---	St. Roy. Pet. No. 1		Madison
7-20N-3E	21300	6160	7890	1254	5400	146	---	---	---	Hunt No. 1 Peterson	7160-7300	Madison (Mission Canyon)
36-23N-2E	7326	1871	2426	624	2185	75	---	---	---	Signal No. 1 State	6807-6873	Madison (Charles)
36-23N-2E	3765	748	827	480	1477	46	---	---	---	Signal No. 1 State	6987-7054	Madison (Mission Canyon)
36-23N-2E	28321	8733	12597	1516	5169	151	---	---	---	Signal No. 1 State	8528-8550	Red River (Upper Unit)
36-23N-2E	25837	8264	12054	1210	4013	111	---	---	---	Signal No. 1 State	8464-8479	Red River (Upper Unit)
23-21N-3E	14212	4254	7600	646	1050	122	---	Trace	---	Clarkson-Schlaikjer No. 1 Graves	8481-8495	Red River (Upper Unit)
11-20N-4E	5527	1611	1600	185	1750	27	---	Trace	---	Shell No. 12-11 Tilus	8365-8367	Red River (Upper Unit)
4-21N-4E	19590	6380	10850	618	1050	122	---	Trace	---	Shell No. 14-4 State	8575-8576.5	Red River (Upper Unit)
28-21N-4E	7233	2124	2450	259	1930	48	---	Trace	---	Shell No. 14-28 Haivala	8601-8603	Red River (Upper Unit)
8-21N-4E	13315	4338	6300	388	1825	61	---	Trace	---	Shell No. 32-8 State	8530-8537	Red River (Upper Unit)
11-20N-4E	4987	1426	1440	191	1540	34	---	Trace	---	Shell No. 32-11A Seppala	8331-8338	Red River (Upper Unit)
17-21N-4E	14348	4417	7700	584	1000	112	---	Trace	---	Shell No. 32-17R Graves	8630-8636	Red River (Upper Unit)
6-21N-4E	11828	3655	5600	416	1650	85	---	Trace	---	Cardinal-Sun No. 1 State	8657-8667	Red River (Upper Unit)
			2214	18	10-	5	---	---	---	Harrison No. 1 Johnson	3463-3470	Newcastle

Location	Total Solids	Na	Cl	Ca	SO_4	Mg	Mn	Fe	Fl	Well Name	Depth	Producing Formation
						JACKSON COUNTY						
34-1S-22E	2616	1100	132	5.4	930	1.0	0.1	---	0.95	--------	-----	Inyan Kara
4-2S-23E	32002	10885	13000	620	6800	137.0	---	Trace	---	Cities Svc. No. 1 Phipps	3370-3378	Minnelusa (Hayden)
4-2S-23E	10605	2877	420	575	6200	27.0	---	0.0	---	Cities Svc. No. 1 Phipps	3801-3838	Minnelusa (Fairbank)
4-2S-23E	9756	2791	300	400	5700	19.0	---	---	---	Cities Svc. No. 1 Phipps	4367-4420	Winnipeg Sand
16-2S-18E	1280	408	22.5	2.4	202	0.5	0.38	4.7	0.88	--------	-----	Inyan Kara
32-2S-22E	1798	561	76.0	32.8	968	5.4	.1	1.2	1.35	Kadoka City	2730	Inyan Kara
32-2S-22E	1775	----	67.0	47.0	1005	4.0	---	2.0	1.6	Kadoka City	2640	Inyan Kara
32-3S-22E	1873	675	74.5	11.6	647	----	---	1.7	---	Weaver No. 1 Granger	3640	Inyan Kara-Yielding flow?
28-2S-22E	-----	-----	29.0	13.4	1200	---	---	---	---	Jeff's Frontier Svc.		Inyan Kara
						JONES COUNTY						
3-1S-27E	-----	630	95	24	1250	10	---	0.07	3.0	Wilson Well	2395	Inyan Kara
27-1S-30E	1992	801	436	7.1	3.0	2.4	0.0	7.0	2.7	Draper City	-----	Dakota
13-3S-31E	2250	108	181	402	1230	73	---	.16	2.0	Booth Well	-----	Inyan Kara
1-1N-29E	1938	574	84	42	881	10	---	---	---	Shell No. 1 Herman	2339-2385	Minnelusa (Upper)
3-1N-29E	2108	210	170	406	1109	25	---	---	---	Shell No. 2 Herman	2868-2969	Madison (Lodgepole?)
3-1N-29E	2376	216	250	364	1001	45	---	---	---	Shell No. 2 Herman	3050-3210	Ordovician Sandstone
6-2N-28E	3230	1300	1110	9.5	0.0	.4	.01	.16	2.2	VanMeter City	1500	Dakota
8-2N-26E	10484	2917	1930	666	4304	----	---	---	---	Shell No. 1 Olson	2514-2619	Minnelusa (Upper)
8-2N-26E	2624	116	243	406	1026	87	---	---	---	Shell No. 1 Olson	3480-3522	Ordovician
22-2N-26E	2848	----	762	6.2	3.0	3.0	---	---	---	C&NW Railroad	1690	Dakota-Temp 118° F
22-2N-26E	2897	1180	778	8.3	21.2	1.8	---	---	---	C&NW Railroad	1690	Dakota
						LAWRENCE COUNTY						
15-7N-2E	1300	2.5	1.4	325	781	51	---	.17	.4	Perkins Well	965-1218	Minnelusa (Lower)
32-7N-1E	410	2.5	.6	80	119	31	---	.05	.4	Tullock Well	488-495	Minnelusa (Lower)
						LYMAN COUNTY						
6-104N-74W	2084	----	120	374	1124	65	0.3	0.3	2.5	Burkhardt Oil Test		Inyan Kara
9-104N-72W	2192	----	----	346	988	80	---	2.0	---	M. Q. Sharpe	893	Dakota
24-104N-72W	1950	103	128	370	1150	80.0	.17	1.9	2.7	Oacoma City	630	Dakota
3-105N-79W	1857	747	630	9.2	2.8	2.3	---	0.6	0.7	Vivian City	1706	Dakota
15-105N-77W	1573	265	174	159	722	38	0.0	1.2	2.7	Presho City	1500	Dakota
17-105N-75W	1807	----	94	290	992	65	0.0	1.2	2.8	Kennebec City	1300	Dakota
19-105N-79W	2288	111	235	390	1046	70	---	0.05	4.0	Oller Ranch		Inyan Kara
19-105N-78W	2370	144	247	392	1136	94	.48	.15	3.0	Williams Ranch		Inyan Kara
20-105N-73W	2149	131	104	359	1196	77	0.2	2.1	3.0	Reliance City	1188	Dakota
-107N-73W	1910	378	83	154	1130	41	---	---	2.0	Ind. School	894	Dakota-Temp 70° F
						MEADE COUNTY						
19-3N-7E	644	47.3	4.1	108.5	223	35.9	---	---	---		-----	Unkpapa
19-3N-7E	1044	41.1	39.0	170	628	75.4	---	---	---	Kucera No. 2 Gingras	985	Minnelusa
19-3N-7E	624	108	225	63.8	92.4	34.8	---	---	---	Kucera No. 2 Gingras	1642	Madison

19-3N-7E	485	38.9	122	72.9	48	51.3	---	---	---	Kucera No. 2 Gingras	1626-1897	Madison
24-3N-17E	4791	1715	2680	111	109	31	---	---	---	Phillips No. 2 Harrington	1584-1689	Dakota
11-5N-5E	1060	45	4	210	605	56	---	1.7	.7	Vet Administration	1800	Minnelusa
18-6N-6E	1213	2.3	5.3	288	752	61	---	---	.6	Bear Butte No. 1	690	Minnelusa
18-6N-6E	1604	----	2.5	256	814	62.2	---	---	---	Bear Butte No. 1	830	Minnelusa
20-6N-11E	728	260	46	1.2	145	0.7	.32	1.2	0.0			Inyan Kara
25-7N-6E	664	234	16	1.7	180	1.0	.06	0.39	0.6			Inyan Kara
16-9N-17E	4315	----	1706	40.5	1.9	35	---	0.3	---	Cosden No. 1 Zeal	2065	Dakota?
16-9N-17E	2118	250	159	8.8	626	2.6	---	0.3	---	Cosden No. 1 Zeal	2970	Inyan Kara

MELLETTE COUNTY

8-40N-29E	1846	630	259	11	351	.2	---	2.1	---	Krogman Ranch	-----	Dakota
12-40N-25W	1727	516	120	71	768	9.8	---	---	---	Mosher City	1680	Dakota
25-41N-27W	1744	687	372	10	172	4.9	---	---	---	Wood City	1836	Dakota

PENNINGTON COUNTY

6-1S-17E	994	363	13	2.4	308	0.0	0.0	---	3.0	Quinn City		Inyan Kara
6-1S-16E	671	250	8.0	3.2	225	0.97	0.0	0.6	2.0	Wall City		Inyan Kara
8-2S-14E	10587	4261	1090	90.4	42	45.2	---	43.0	---	Kuirna Farm	1312	Niobrara
10-1N-8E	1031	281	84	21	250	10.0	---	0.3	1.0	Keliher	1197	Inyan Kara
7-2N-9E	904	----	10.6	24	450	9.4	---	---	---	RCAFB		Inyan Kara
7-2N-9E	434	21	2	84	153	22.0	0.0	0.2	0.4	RCAFB	4336	Minnelusa (Lower)
7-2N-9E	393	6	4	73.0	134	29	0.0	0.2	0.5	RCAFB	4645	Madison
13-2N-8E	898	172	55	5.5	386	27.3	---	---	---	RCAFB	2400	Inyan Kara
31-2N-11E	481	151	4.0	10.0	158	2.0	0.1	0.7	0.7	New Underwood City	2680	Inyan Kara
35-4N-17E	1138	400	26.7	1.6	236	0.5	0.32	0.5	0.68			Inyan Kara
25-5N-16E	1836	730	274	8.0	55	----	---	---	4.6	Gabriel Ranch	2740	Inyan Kara-Dakota contamination

PERKINS COUNTY

7-17N-15E	3857	1230	804	6.0	5	2.1	---	---	---	Shell No. 1 Veal	3854-3855	Inyan Kara
7-17N-15E	30336	10000	12660	917	6000	139	---	---	---	Shell No. 1 Veal	5368-5418	Minnelusa (Fairbank)
7-17N-15E	69340	22040	40320	3400	2350	790	---	---	---	Shell No. 1 Veal	5479-5655	Madison (Charles)
7-17N-15E	4386	487	697	833	2100	129	---	---	---	Shell No. 1 Veal	5752-5795	Madison (Mission Canyon)
7-17N-15E	3624	430	648	585	1550	94	---	---	---	Shell No. 1 Veal	5949-5973	Madison (Lodgepole)
7-17N-15E	150000	46400	91400	9180	1550	1650	---	---	---	Shell No. 1 Veal	6569-6633	Devonian
7-17N-15E	7411	1760	3180	648	1250	163	---	---	---	Shell No. 1 Veal	6851-6895	Silurian
7-17N-15E	30874	9660	17630	1580	1180	244	---	---	---	Shell No. 1 Veal	7131-7166	Red River (Upper Unit)
7-17N-15E	8738	2320	2430	578	3850	63	---	---	---	Shell No. 1 Veal	7901-7977	Deadwood
13-20N-12E	3660	1270	1190	8	110	1	---	---	---	Shell No. 1 Homme	4276-4305	Inyan Kara
13-20N-12E	6542	1120	970	890	3200	72	---	---	---	Shell No. 1 Homme	6440-6483	Madison (Charles-Mission Canyon)
13-20N-12E	4157	936	955	398	1560	38	---	---	---	Shell No. 1 Homme	6140-6230	Madison (Charles)
13-20N-12E	19140	6410	9780	730	1850	50	---	---	---	Shell No. 1 Homme	7596-7660	Silurian
13-20N-12E	6148	830	780	935	3030	113	---	---	---	Shell No. 1 Homme	7666-7894	Silurian
13-20N-12E	32975	9600	18090	2390	2350	320	---	---	---	Shell No. 1 Homme	8069-8134	Red River (Upper)
13-20N-12E	199500	61000	122300	15900	700	1370	---	---	---	Shell No. 1 Homme	8141-8191	Red River (Upper)

STANLEY COUNTY

5-3N-29E	-----	1272	1383	11.5	----	5.5	---	---	---	C&NW Railroad	1395	Dakota-Temp 108°F

Location	Total Solids	Na	Cl	Ca	SO_4	Mg	Mn	Fe	Fl	Well Name	Depth	Producing Formation
32-3N-25E	3264	1145	219	25	1306	----	---	---	---	Ernest Nemec		Inyan Kara-Temp 90°F
9-4N-27E	2372	108	111	395	1185	83.0	---	---	---	Shell No. 1 Abbott	2637-2740	Minnelusa (Reclamation)
13-5N-29E	1666	263	120	175	970	56.0	---	0.0	---	Cities Svc. No. 1 Wagner		Minnelusa and Inyan Kara
30-5N-26E	4727	1865	2014	11.2	4.5	2.0	---	---	2.0	Hayes City	2000	Dakota
-5N-31E	-----	1438	1831	26.9	5.0	14.9	---	0.9	---	Ft. Pierre City		Dakota
6-6N-28E	5094	2530	----	32.0	3.0	20	---	0.2	0.4	Lacy Well		Dakota
16-6N-27E	-----	192	95	238	827	48	---	---	---	Phillips No. 1 State	2565-2787	Minnelusa (Fairbank)
18-7N-28E	2485	739	150	73	1300	19	---	0.0	---	Cities Svc. No. 1 Barrick	2420	Minnelusa (Upper)
18-7N-28E	2009	71	80	367	1250	116	---	0.0	---	Cities Svc. No. 1 Barrick	3350-3461	Madison (Lodgepole)
18-7N-28E	2063	70	90	372	1275	120	---	0.0	---	Cities Svc. No. 1 Barrick	3574-3660	Red River
18-7N-28E	2029	117	50	344	1275	94	---	0.0	---	Cities Svc. No. 1 Barrick	3848-3906	Red River
ZIEBACH COUNTY												
32-8N-22E	4600	1810	1840	9.0	.8	2.6	---	0.5	2.9	Cherry Creek School	1878	Dakota-Gas-Temp 106°F
6-9N-19E	4990	2000	2900	7.3	1.3	2.7	---	0.4	3.3	Red Scaffold School	2385	Dakota-Gas-Temp 119°F
13-10N-23E	7820	2990	4150	26.0	2.5	11.0	---	3.1	.8	Clavel Well	1800	Dakota-Gas-Temp 100°F
21-12N-22E	3363	495	270	454	1925	79.0	---	0.0	---	Cities Svc. No. 1 Jensen	5042-5079	Red River (Upper)
27-12N-24E	7590	1520	2140	744	2400	86.0	---	21.0	3.2	Boarding School	3020	Inyan Kara-Temp 107°F

About the South Dakota Geological Survey

The South Dakota Geological Survey is a research and public service agency for the State of South Dakota. Since 1893 the State Geologist has been authorized to "make an actual geological survey of the lands, the earth, and the area beneath the surface of the lands . . . . " of the State. The purpose of the State Geological Survey is to conduct field and laboratory studies of South Dakota's geology and mineral deposits, which are the metals and non-metals, the mineral fuels including oil and gas, and ground water. The results of these studies are published in reports such as this.

The work of the South Dakota Geological Survey is continuous – its research and services are adjusted to the changing economy in order to serve South Dakota most effectively.

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