THE SALT PLAINS OF NORTHWESTERN OKLAHOMA

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PREFACE

The author became interested in the Salt Plains of Western Oklahoma after writing a term paper about them in a course in the Geography of Oklahoma. This study revealed relatively little written information on the salt plains most of which was published prior to 1930. A field trip to the Great Salt Plains and the Big Salt Plain to gather data for the term paper inspired the writer to pursue the topic further.

After the subject was chosen for a thesis it was decided the area to be covered should be limited to Northwestern Oklahoma. Nine field trips were made to the four different salt plains in the area. The deposits visited are listed as follows: (1) Great Salt Plain located four miles east of the town of Cherokee in Alfalfa county; (2) Big Salt Plain located on the Cimarron River in Woods, Woodward and Harper counties; (3) Little Salt Plain located in Woods and Harper counties on the Cimarron River about two miles south of the Kansas-Oklahoma border; and (4) Blaine County Salt Plain on Salt Creek three miles south of the town of Southard. Each area studied was written as an individual chapter with the exception of Big and Little Salt Plains which are included together.

The purpose of this thesis is to assemble the available material and to bring this material up to date through field study. The geology of the areas was studied and the specific stratigraphy of each plain investigated. Written accounts and personal interviews traced the history of salt use and production. Facts of the general geography of the area,

gradual depletion of salt deposits being worked, and possible expanding markets were analyzed to assess possible future development in northwestern Oklahoma.

Indebtedness is acknowledged to Dr. Edward E. Koso and Dr. Ralph E. Birchard for their stimulating criticisms and guidance. Dr. Robert C. Fite and Dr. David C. Minslow have aided materially with their constant encouragement. Professor Ray L. Six's criticism has been of invaluable assistance, in verifying and checking information on the geology of the areas studied. The library staff of Oklahoma A. and M. College has been of great help, particularly the assistance of Mrs. Marguarite Howland. The assistance and encouragement given by the writer's wife, Thelma Harris, cannot be repaid by words alone.

C. W. H.

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CHAPTER I

INTRODUCTION

Definition and Kinds of Salt

"Salt is any product, other than solvent molecules, of the reaction of an acid with a base."[1] There are several kinds of salt and probably the most used is common salt or sodium chloride (NaCl) which is composed of the elements sodium and chlorine. Sodium is a soft metal and chlorine by itself is a deadly gas. It seems strange that chlorine should form a basic part of a compound so vitally essential to human and animal life.

Salt and other compounds of sodium are to be found in rock salt deposits, brine deposits, springs, and sea water. Rock salt normally contains gypsum or calcium sulphate ($CaSO_4$), magnesium (Mg), and calcium chloride ($CaCl_2$). Brine and salt springs usually contain soda (Na_2O), potash (K_2O), lime (CaO), magnesia (MgO), chlorine (Cl), sodium bicarbonate ($NaHCO_3$), and iron and aluminum oxides (Fe_2O_3 and Al_2O_3).[2] Sea water which is a natural salt solution contains sodium chloride (NaCl), magnesium chloride ($MgCl_2$), and magnesium sulphate ($MgSO_4$), calcium sulphate ($CaSO_4$), potassium sulphate (KSO_4), magnesium bromide (MgBr), and Calcium carbonate ($CaCO_3$).[3]

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[1] Horace G. Deming and B. Clifford Hendricks, Introductory College Chemistry (New York, 1942), p. 157.

[2] L. C. Snider, "The Gypsum and Salt of Oklahoma," Oklahoma Geological Survey Bulletin No. 11 (Oklahoma City, July, 1913), p. 203.

[3] R. H. Rastall, Physico-Chemical Geology (London, 1927), p. 175.

Uses of Salt

Salt has no less than 1,400 uses ranging from melting ice on sidewalks and streets to its place in the modern medicine cabinet. All human tissue requires salt, and blood can be replaced to a certain extent by a solution of common salt. Salt helps in making hydrochloric acid, which helps man to digest food. Salt acts as an emetic when consumed in large doses and it has a therapeutic effect when applied in the form of baths. An animal or man with insufficient salt in his food grows feeble, and with no salt at all may die. Salt is used in the preparation of caustic soda, sodium carbonate, soda ash, and other sodium and chlorine compounds. Further, some salts can be used for fertilizer.[4]

Salt is essential in soap, paper, steel, oil, tannin, mining and textile industries; it is used by farmers for feeding their livestock; is used by packers and fishermen for preserving meat and fish; is consumed in vast quantities by the dairy industry in making butter and cheese, and is an ingredient which the baker needs to operate his business.[5]

Supply of Salt

There is an adequate supply of salt in the world but man has long been confronted with the problem of securing it at its source and then transporting it to the place of consumption. There are areas in the world where the supply of salt is not sufficient and other areas where there is no salt. Man has gone great distances and undergone much

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[4]Morton Salt Company, "The History of Salt" (Chicago, 1935), p. 29.

[5]Ibid., p. 31.

hardship to secure a supply of salt. It is reported that salt has been used as a medium of exchange in mountain districts in some of the remote South Pacific Islands. These areas are far from the source of salt and consequently salt is difficult to obtain and the natives place a high value on it. Also, a similar condition exists in certain areas in Africa where salt is not readily available. Here salt has been used by explorers to trade with the natives. Not so many years ago it was reported that natives of Sierra Leone, located in west Africa, valued salt so highly that they were willing to sell their wives and children for it. In the United States during the period of westward movement some of the Indians were willing to accept the white man's salt in exchange for food and land.

The largest known supply of salt is found in seas, inland seas, and salt lakes. Here salt has been accumulating for millions of years. The source of this salt comes partially from rocks as they decay. Most of the rocks, geologically speaking, are in the process of weathering due to atmospheric action. These exposed rocks have been weathering for millions of years. Common salt or sodium chloride is carried away in solution by rain-water into the rivers that flow into the seas. The amount of salt in the ocean is enormous. It has been calculated that there is enough salt in the ocean to cover the whole surface of the earth to the approximate depth of four hundred feet.[6] There are many inland salt lakes and seas. One of them is the Dead Sea which lies in Israel and Jordan. The sea covers over 340 square miles in area and it contains about 11,400 million tons of salt. During ancient times most

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[6]Garnett Laidlaw Eskew, Salt The Fifth Element (Chicago, 1948), p. 10.

of the salt used in this area came from salt basins that were operated along the shores of the Dead Sea.[7]

Much of the salt used today comes from deposits or rock salt which is buried under the ground. Such deposits are common and often several of these veins lie one above the other, separated by shale and rock. In New York and Kansas there are solid salt beds over three hundred feet thick. At Sperenberg, Germany there is a deposit of salt known to be over three thousand feet thick. The largest salt mine in the world is at Wieliczka, Poland where the salt is almost one thousand feet in depth.

The Retsof salt mine located in New York is reported to be the largest salt mine in the Western Hemisphere. Another thick vein of salt is found at Avery Island, Louisiana. In the United States the leading salt producing states are Michigan, New York, Ohio, Louisiana, Texas, California, Kansas, West Virginia, and Utah. The United States produces about one-third of the world's yearly consumption of salt. In 1951 the United States produced 20,207,191 short tons of salt valued at $69,735,000. Other important salt producing nations are China, Germany, Great Britain, India, France, and Canada. The world's production of salt in 1951 was 53,500,000 metric tons.[8]

History of Salt

The Phoenicians were early traders who established a regular commerce in salt. Salt from the mines of India was carried to Mediterranean markets by camel caravans more than 2,000 years ago.

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[7] Ibid., p. 12.

[8] F. E. Harris and F. M. Bursigian, "Salt," Minerals Yearbook, 1951 (Washington, 1954), pp. 1105-1114.

Some of the routes that originated as salt roads ages ago are caravan routes today. The Via Salaria, which means Salt Road, is an Italian road which was used in early times to carry salt from the salt pans of Ostia, the port of Rome, into the neighboring areas. The word "salary" indicates the value early man placed on salt. The word is derived from salt and in its original sense it indicated that money was given to buy salt. In other words, a Roman soldier's salt money was his salary. In Belgium relics have been uncovered that reveal cavemen used salt 5,000 years ago.[9]

The first written reference to salt occurs in the Holy Bible. The Bible traces the history of man back to about 4,000 years before the birth of Christ. In the Book of Job, Chapter 6, Verse 6, are found the words, "Can that which is tasteless be eaten without salt?" Another reference made to salt in the book of Genesis, Chapter 19, Verse 26, is quoted, "But Lot's wife behind him looked back, and she became a pillar of salt." The latter scripture is the story of Lot's wife who disregarded God's commandment and turned to look back on the burning city of Sodom and was turned into a pillar of salt.

Salt has been used for many centuries and it is impossible to determine its origin as a seasoning for food. The Chinese, the Egyptians and the Hindus all tried to determine the time and place of the discovery of salt, but salt had been used long before man had learned to record his activities. In Italy, during early times, salt was an important commodity. The Englishman Locke visited Venice in 1553 and is quoted as saying, "Neither may any man in Venice buy more salt than he spendeth in

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[9]Eskew, p. 13.

the city," Locke complained, "for if he be known to carie one ounce out of the city and be accused therefor, he loseth an ear!"[10]

As man migrated north from Italy he developed salt works on the French coast, at Halles in Germany, and at Wieliczka in Poland. The mine at Wieliczka has been in operation for nearly 1,000 years. In early history wild animals instinctively sought out salt pools or rock salt, "salt licks," often traveling many miles to reach them. During early history man used salt that was not processed. He used this raw salt for seasoning his vegetables and meats. As man gained more knowledge he was able to process his salt by solar evaporation near sea coasts or inland seas. By this process he placed salt water in shallow pools and the heat from the sun caused the water to evaporate leaving an incrustation of salt.

As the North American Continent was explored and settled several salt springs and rock salt deposits were developed. These areas have been studied and the findings have been recorded in articles and books. At one time a booming salt industry was located at Malden, West Virginia which reached its peak production during the Civil War. Since Malden was located on the Kanawa River the processed salt was shipped by boat down the river to waiting consumers. After the railroads came to Malden the salt industry waned because the local area was unable to meet competition with other salt producing areas.[11]

Over a period of time many salt deposits of the country were discovered. The largest ones near to markets and with good transportation

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[10] Ibid., p. 15.

[11] Ibid., p. 3.

have become the chief producers. The center of production has tended to shift westward although large production remains in the east relative to the large markets. Minor commercial production in Oklahoma in the 1900's was crowded out by production in Kansas and Texas.

Study of the Salt Plains

The Salt Plains of Northwestern Oklahoma present a unique problem when approached from a geographical standpoint. In the areas studied the problem was approached from a geological and historical basis because no recent development is taking place and little written material is available. First it was necessary to determine how and when the salt deposits were laid down. Then the history of the areas was studied to find out if salt had ever been produced on a commercial basis. Also, the facts were found that pertained to the history of salt in the areas studied. After extensive field work the areas were analyzed from a physical and economic standpoint to determine what has been done in the past and which might be the best sites for future development. In this approach the costs of production, available fuel and power, transportation, labor, capital, and markets for development of a salt industry were taken into consideration.

CHAPTER II

LOCATION, ORIGIN, AND CHARACTER OF SALT DEPOSITS

Location of the Salt Plains

The salt deposits in the Great Plains area of the United States were formed mainly in the Pennsylvanian and Permian ages. These salt plains have a wide geographical distribution and vary greatly both in size and the amount of the flow of brine.[1] They are estimated to have an area of about 100,000 square miles and an average thickness of at least 200 feet.[2] These salt deposits are found mainly in Kansas, Oklahoma, New Mexico, and Texas.

Two large deposits are being mined. A deep and thick layer of rock salt lies beneath the earth's surface near Hutchison, Kansas. Salt is mined from it on a commercial basis at Kanopolis, Hutchison, Lyons, and Kingman, Kansas. The salt plains in this area are widely distributed and occur in several forms. Also, salt from an enormous deposit of rock salt located near Grand Saline, Texas is being mined with modern machinery. The salt of this mine contains very little foreign matter.

There are eight salt plains in western Oklahoma. They are located as follows: (1) Great Salt Plain located four miles east of the town of

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[1]Charles N. Gould, "Geology and Water Resources of Oklahoma," United States Geological Survey, Water-Supply and Irrigation Paper Number 148 (Washington, 1905), p. 100.

[2]Raymond B. Ladoo and W. M. Myers, Nonmetallic Minerals (New York, 1951), p. 437.

Cherokee; (2) Big Salt Plain located on the Cimarron River in Woods, Woodward and Harper counties; (3) Little Salt Plain located approximately eight miles upstream and only about two miles south of the Kansas border on the Cimarron River in Woods and Harper counties; (4) Blaine County Salt Plain on Salt Creek three miles south and east of the town of Southard; (5) Carter Salt Plain in southeastern Beckham county near the town of Carter; (6, 7) Two salt plains along Elm Fork of Red River in northern Harmon county; and (8) a small salt plain along Sand Creek in southwestern Jackson county. Most of these plains are fed by salt springs which come to the surface of the salt plains. Geologists believe that these springs are fed from rock salt beds not too far beneath the earth's surface.[3] See Figure 1 for the location of the salt plains in western Oklahoma.

Theories of Origin

General--The salt deposits of the Great Plains are closely associated with gypsum formations. Theoretically these and most of the other formations of the Great Plains were laid down in shallow seas. There are several different theories of salt formations. The theory most generally accepted is that an inland sea covered vast areas of land during the Permian age. The Great Plains of the United States was part of the area once covered by the inland sea. As the sea water evaporated the less soluble minerals settled to the floor of the sea. The most soluble minerals were deposited last, these being gypsum (calcium sulphate)

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[3]A. I. Ortenburger and R. D. Bird, "The Ecology of the Western Oklahoma Salt Plains," Publications of the University of Oklahoma Biological Survey, Volume V (Norman, 1933), p. 50.

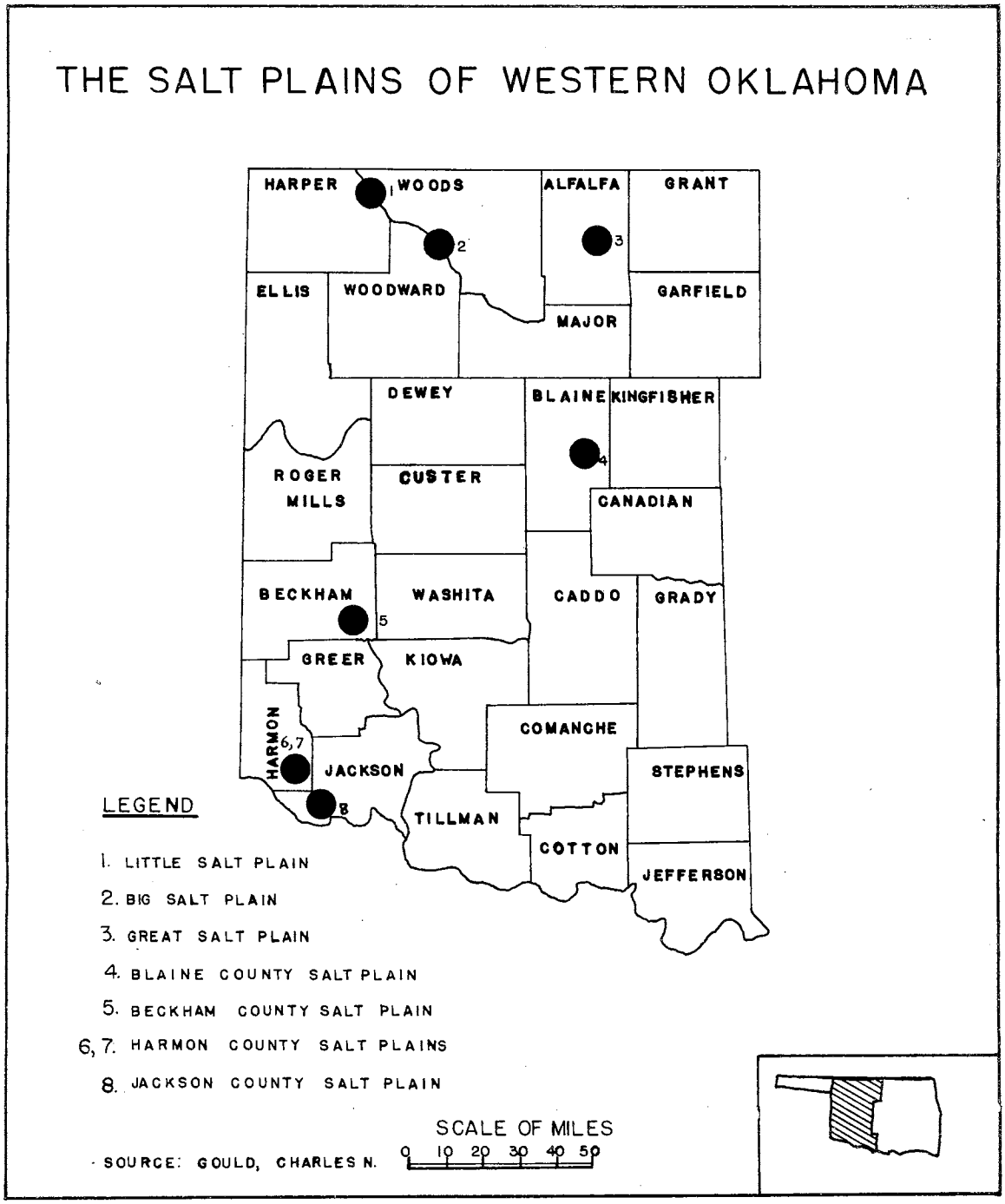
THE SALT PLAINS OF WESTERN OKLAHOMA
HARPER
WOODS
ALFALFA
GRANT
ELLIS
WOODWARD
GARFIELD
MAJOR
DEWEY
BLAINE
KINGFISHER
ROGER MILLS
CUSTER
CANADIAN
BECKHAM
WASHITA
CADDO
GRADY
GREER
KIOWA
HARMON
COMANCHE
JACKSON
STEPHENS
TILLMAN
COTTON
JEFFERSON
1
2
3
4
5
6,7
8
LEGEND
1. LITTLE SALT PLAIN
2. BIG SALT PLAIN
3. GREAT SALT PLAIN
4. BLAINE COUNTY SALT PLAIN
5. BECKHAM COUNTY SALT PLAIN
6, 7. HARMON COUNTY SALT PLAINS
8. JACKSON COUNTY SALT PLAIN
SCALE OF MILES
0 10 20 30 40 50
SOURCE: GOULD, CHARLES N.

Figure 1.

and common salt (sodium chloride). Since gypsum is less soluble than common salt it was deposited before the salt.

A theory, related to the one just mentioned, goes further in the process of gypsum and salt formation. This theory estimates that the inland sea had to be 11,000 feet in depth to contain in solution enough to deposit from eight to nine feet of gypsum.[4] There are deposits of gypsum over twenty feet thick southeast of the city of Southard, Oklahoma, where the United States Gypsum Corporation is mining gypsum. It is possible that the forces of diastrophism caused the seas to appear and evaporate as the earth's crust changed in form. Further, this may account for the coming and going of the seas and the deposition of gypsum and salt as a result of evaporation of the sea water.

Another theory is that a bar of land was located at a point where the sea water over-flowed at different intervals of time.[5] As the sea water over-flowed the bar onto the adjacent lowlands it was evaporated leaving the deposits of gypsum and salt. The sea may have over-flowed many times accounting for the several layers of the gypsum and salt found in the Great Plains area of the United States.

A fourth overlapping theory reveals that the Permian red beds were deposited from a sea, either as deltas or offshore deposits. The basic materials were thought to have come from the land areas to the north, east, and south. Some of the material, such as gypsum and salt, was carried in solution while matter such as insoluble fine particles of

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[4]R. S. Sherwin, "Notes on Theories of Origin of Gypsum Deposits," Kansas Academy of Science, Volume 18 (Topeka, 1903), p. 85.

[5]William H. Emmons, The Principles of Economic Geology (New York, 1940), p. 487.

clay, was carried in suspension. The evaporation of the sea water probably went on rapidly in an arid climate.[6]

All of the theories presented rely on the process of evaporation to account for the deposition of both gypsum and salt deposits in the Permian red beds. Sea water contains approximately seventeen times as much common salt as gypsum.[7] It would seem, therefore, that there would be larger deposits of salt in this area. It is probable that there was more deposition of salt than gypsum during the latter part of the Permian age, and that the salt deposits have been completely removed where exposed to surface water erosion. The presence of the gypsum deposits on top of the escarpment in Blaine, Harper, Woods, and Woodward Counties in Oklahoma indicate that the layers of gypsum are more resistant to wind and water erosion than salt deposits.

Source of the Salt--The specific source of salt for the salt plains is of course the deposits laid down by the Permian seas. With the exception of one of the salt plains of northwestern Oklahoma, the sources of salt are rock salt trapped in the Hennessey and Flowerpot formations of the Permian Red beds. The exception is the easternmost one, the Great Salt Plain in Alfalfa county, where the source salt appears to be disseminated through the Hennessey which according to well logs does not contain rock salt in this area. The Oklahoma Geological Survey states that:

Northwestern Oklahoma is underlain by thick beds of rock salt and some of the oil field brines in the state contain large amounts of sodium

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[6]Ortenburger and Bird, p. 50.

[7]Sherwin, p. 87.

chloride, as well as of calcium magnesium chloride, and other minerals of potential value. Salt has been produced from springs and plains for more than 100 years.[8]

The Big Salt Plain, Little Salt Plain, and Blaine County Salt Plain visited by the writer in the summer of 1955, all have their origin from rock salt formations below the earth's surface. These salt plains are associated with gypsum formations which are located at the rim of the escarpments over-looking the salt plains. In all three of these areas the salt plains are fed both by seepage and salt springs that issue forth with their brine water, and by the process of evaporation the salt is left behind as an incrustation on the surface of the plain.

Character of the "Plains"

Anyone not acquainted with the Salt Plains of Northwestern Oklahoma may visualize them as entirely different than they are. It is possible that they are flats or pans slightly lower than the general plain of the area. This is true for one, but only one, the Great Salt Plain.

The other three plains are the relatively flat braided stream beds of the Cimarron River and Salt Creek. The latter is so relatively narrow, steep sided, and deep that it is called a canyon. The two salt plains on the Cimarron River occur where the bed is over a mile wide. It has cut about as deeply as Salt Creek, but being wider and having steep banks only where undercutting, is not a canyon.

The salt areas of all four plains are incrustations on sandy, gravelly stream deposits. The Salt Creek Plain is partly an exception as the floor of the head of the canyon is mainly shale.

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[8]John H. Warren, "Mineral Map of Oklahoma (72-1)," Oklahoma Geological Survey (Norman, 1955).

CHAPTER III

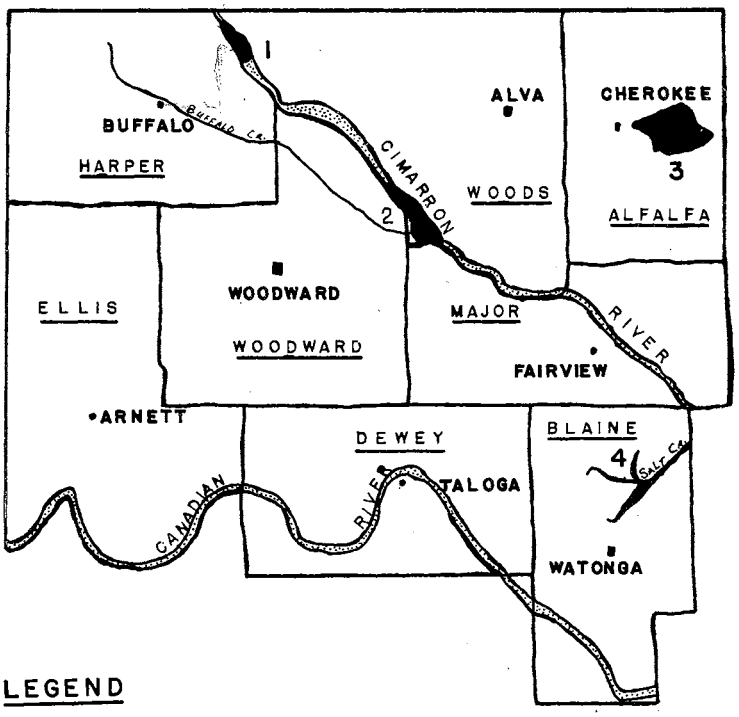
THE GREAT SALT PLAIN

Location

The largest salt plain in Oklahoma lies in the eastern part of Alfalfa county, approximately four miles east of the city of Cherokee, (Fig. 2). The plain is elliptical in shape, and is about 12 miles long, north and south, and six miles wide, east and west. The total area of the plain is about 60 square miles. The plain lies in the basin of the Salt Fork of the Arkansas River in Townships 26 and 27 North, and Range 10 West based on the Indian Meridian. The surface of the plain is level but there is a slight slope from west to east. The plain is devoid of vegetation with the exception of a few mounds that rise above the plain's surface. These mounds support a sparse growth of grass.

The Salt Fork of the Arkansas River enters the plain from the northwest side. The Salt Fork River has its origin in the eastern part of Comanche and Kiowa counties in south-central Kansas, and its main tributary upstream from the plain is the Medicine Lodge River. In the headwater region of the Salt Fork River, the major topographic feature is the gypsum hill, formed by erosion resistant gypsum beds in the Permian red bed formations. The Salt Fork River flows in a general eastward direction through Kansas and Oklahoma to its confluence with the Arkansas River about 50 miles below the Kansas-Oklahoma State Line. The river flows about 202 miles in total of which 99 miles are upstream from

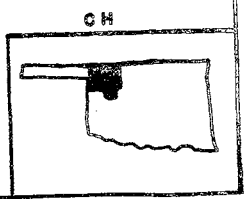
SALT PLAINS OF NORTH OKLAHOMA



LEGEND

1. LITTLE SALT PLAIN.
2. BIG SALT PLAIN.
3. GREAT SALT PLAIN.
4. BLAINE COUNTY SALT PLAIN.

SCALE OF MILES
5 0 10 20 30



SOURCE: GOULD, CHARLES N.

Figure 2.

the Great Salt Plain. The drainage area of the Salt Fork River watershed is about 6,700 square miles. There are about 3,070 square miles above the point where the river leaves the basin of the Great Salt Plain.[1] The plain slopes very gradually into the river from the southwest. There are some large sand dunes near the northeast edge of the plain. Clay Creek flows into the plain from the west and three branches enter the plain from the northeast and flow about a mile before entering Salt Fork River. The salt incrustation at the surface is confined to the plain but salt is also present in the subsoil a few miles away from the plain. Salt water is found in wells on the margin of the plain at depths of 20 to 30 feet.

The plain is slightly lower in elevation than the surrounding land. In places it is 20 feet lower but in general only a few feet lower than the marginal area. A thin veneer of salt is visible on the surface of the plain. A short road has been constructed onto the plain as an eastward extension to a gravel road from the city of Cherokee. The sandy soil of the plain has been graded up into the road bed and salt is visible on top of the road leading to an observation tower at its end.

Stratigraphy of the Area

Alfalfa county lies in the Permian red beds area and in the northeastern portion deposits are 650 feet thick while in the southwestern portion they are 1,600 feet in depth. Tertiary sand and gravel deposits in some small areas in Alfalfa county overlie the red beds. There are

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[1] War Department, United States Corps of Engineers, "Great Salt Plains Dam and Reservoir," Information Pamphlet, Tulsa, Oklahoma (Revision of June, 1947), p. 5.

many sand hills visible on the north side of the Salt Fork of the Arkansas River.[2] The Great Salt Plain is located on the outcrop of the Hennessey formation of the Permian red beds. Charles N. Gould is quoted as describing the area as follows:

> Geologists have long puzzled over the source of this salt. There seem to be no extensive beds of rock salt beneath the surface, at least the drill has not revealed them, but the belief is that the Hennessey at this particular place beneath the surface contains unusual amounts of saline matter and that this material is dissolved out, forming the salt incrustation. As the people in the region express it, the salt "sweats up" from the bottom of the plain. There are, however, no strong springs of salt brine on this plain so far as I know. A core drill hole recently drilled off the north end of the plain is said to be flowing a stream of fairly strong brine. A well drilled about thirty years ago in the vicinity of Jet, just south of the plain, also showed a strong flow of brine.[3]

Field Study

An extensive field study of the Great Salt Plain was made in November of 1954.[4] The party first drove east of Cherokee for about four miles to the observation tower which is located on the western fringe of the plain, (Fig. 3). The tower was climbed by the party to obtain a better view of the plain. The plain is in general a flat surface with a gradual slope to the southeast where the Salt Fork River leaves the plain. From the west side to the east side of the plain, a distance of six miles, there is a drop of 28 feet.[5] A thin veneer of

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[2]R. L. Clifton, "Oil and Gas in Oklahoma," Oklahoma Geological Survey Bulletin No. 40, Volume 2 (Norman, July, 1930), p. 9.

[3]A. I. Ortenburger and R. D. Bird, "The Ecology of the Western Oklahoma Salt Plains," Publications of the University of Oklahoma Biological Survey, Volume V (Norman, 1933), p. 50.

[4]Ralph E. Birchard, thesis adviser.

[5]Ortenburger and Bird, p. 52.

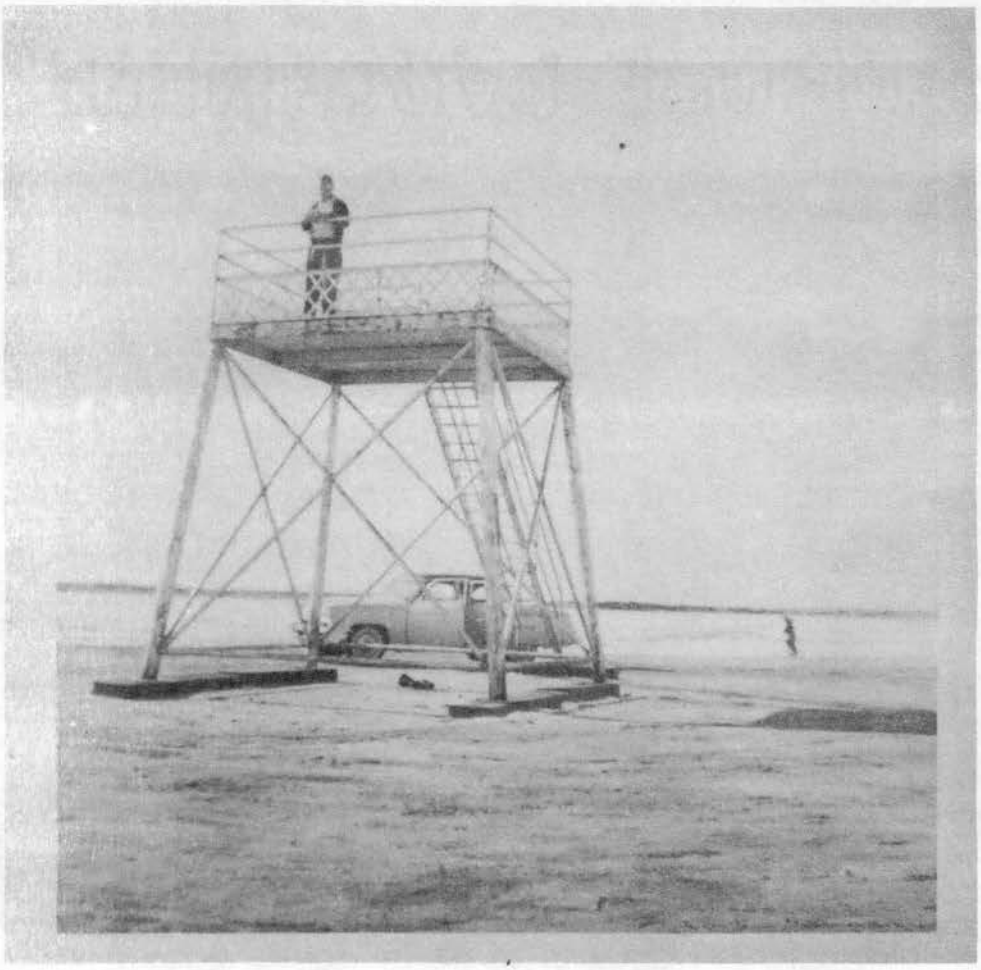

Figure 3.

salt was visible over the complete area of the plain. The incrustation is visible during dry weather but after a rain there is no salt visible-just a sandy area covering many square miles.

The surface of the plain is composed of very fine sand and silt material. There are no salt springs visible on the plain, and during the dry season there is no water in the sandy beds of the streams. When a hole is dug into the sand and silt, salt water rises until the hole is filled to within six inches of the surface. This brine is very strong, nearly is not quite saturated. An analysis of the material dissolved in it is as follows: Soda, Potash, Lime, Magnesia, Chlorine, Sulphates, Sodium Bicarbonate, and Iron and Aluminum Oxides.[6]

On the western part of the plain several mounds, from three to five feet in height, were covered with grass. The smallest mounds were only a few square feet in size, while the largest ones covered from one to three acres. It appears that during a cycle of wet years these mounds support a heavy growth of vegetation. The sand is carried by wind from the bed of the salt plain onto the mounds where the grass holds the loose material. By this process the mounds increase in size. But during a cycle of dry years the grass on the mounds is unable to hold the loose material carried by the wind. The prevailing winds are from the south and southwest, with the result that the mounds are blown out on these two sides, but the mounds are able to hold their own on the north. As the dead grass roots cannot hold the material in place, the wind erosion eats away at the exposed surface of the mounds.[7]

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[6]L. C. Snider, "The Gypsum and Salt of Oklahoma," Oklahoma Geological Survey Bulletin No. 11 (Oklahoma City, July, 1913), p. 203.

[7]Ortenburger and Bird, p. 59.

The plain is bordered on the north by sand hills and on the south by the eroded edge of a gently rolling plain. The land west of the basin is a plain gradually dipping toward the east and it appears to be about 20 feet higher than the surface of the plain. The land was planted in wheat and feed crops both south and west of the plain.

The marginal area east of the plain appears to be but a few feet higher in elevation than that of the basin. Here the soil is sandy and it is partially covered with grass. About a mile north of the point where the Salt Fork River enters the plain there are many cottonwood trees. On the east side of the plain there are cottonwood trees and where the soil showed less evidence of salt there were plots of land planted in feed crops. These plots were planted on land of the wildlife refuge and the land is cared for by the Fish and Wildlife Service. Here the migratory birds from the Great Salt Plains Reservoir have their feeding grounds. These plots of feed crops are to serve as food for the migratory wildlife and to prevent the birds from eating the crops of the farmers in the immediate vicinity of the wildlife refuge.

History of the Plain

The plains Indians that lived near the Great Salt Plain in the days of yesteryear appreciated the value of the plain as a hunting grounds and as a source of salt for human consumption. An abundance of splendid range and good water in close proximity of the salt plain attracted deer, antelope, and buffalo which the Indians hunted for food, clothing, and shelter.

The Indians of the area made use of the salt. While the men hunted, the women of the tribe scooped up the salt and sand from the plain. They

placed the salt and sand into kettles of water. When the sand settled to the bottom the brine water was poured off and boiled down until only the white salt remained.[8]

It is reported that Major George C. Sibley was probably one of the first white men that visited the Great Salt Plain. He was sent to investigate a rumor that there was a "salt mountain" on the plains.

Great Salt Plain's Dam and Reservoir

The Great Salt Plains dam was placed in operation on July 2, 1941 by the United States Corps of Engineer's at an initial cost of $4,485,000. It is an earth-fill structure, about 5,700 feet in length and about 68 feet above the bed of the stream, and a top width of about 25 feet.[9] The dam is located on the Salt Fork of the Arkansas River about two miles southeast of Vining, in Alfalfa county, Oklahoma, immediately down stream from where the river emerges from the basin of the Great Salt Plain, (Fig. 4). The reservoir formed by the dam extends about eight miles upstream from the dam under normal rainfall periods. The pool normally formed by the conservation storage has a surface area of 10,700 acres, and a volume of 58,000 acre-feet. The writer questioned one of the government men about the salt-content of the water in the reservoir. He stated that the salt-content was about four percent. This high salt-content was due to the long dry period and the fact that no fresh water was flowing into the reservoir. Also, he remarked that the fish were dying because of the high salt-content in the water. Dead fish were observed floating in the water above the spillway.

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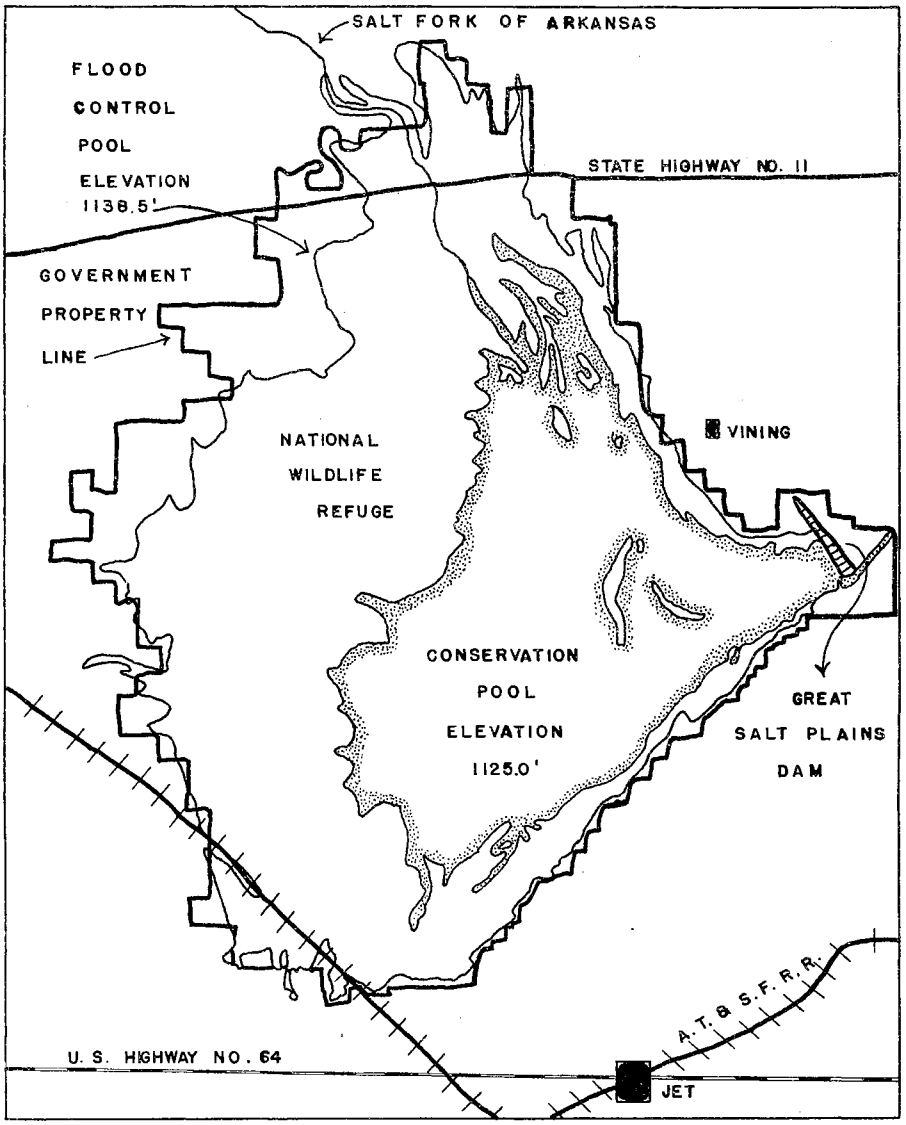
[8]Grant Foreman, A History of Oklahoma (Norman, 1945), p. 55.

[9]War Department, United States Corps of Engineers, p. 11.

GREAT SALT PLAINS RESERVOIR



SOURCE: CORPS OF ENGINEERS

SCALE OF MILES

1 0 1 2

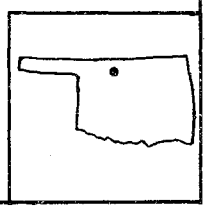


Figure 4.

The United States Corps of Engineers has jurisdiction over about 860 acres of land and water in the immediate vicinity of the dam. About 31,075 acres are controlled and administered by the Fish and Wildlife service.[10]

The Great Salt Plain Dam was constructed basically as a flood control project. The reservoir and the marginal areas are used as a migratory bird refuge. Part of the area near the dam has been converted into a public park and other recreational facilities. Hunting is not permitted in the reservoir area because of the wildlife refuge. Boating and fishing are permitted in accordance with the Federal, State, and local laws for protection of game and fish. The enforcement of the hunting and fishing laws is by the game rangers of the State of Oklahoma and the United States Fish and Wildlife Service.[11]

Future of the Great Salt Plain

No salt has been processed on a commercial basis from this plain. However, the conditions are favorable for development whenever the need arises. The transportation problem would not be a serious one because the Santa Fe Railway at Cherokee, Oklahoma is only four miles west of the Great Salt Plain. Railroad spurs could be constructed into the plain because the surface of the plain is very level. Also, there are two highways in close proximity to the plain. United States Highway Number 64 is located both south and west of the plain, while Oklahoma State Highway Number 11 is located just north of the salt plain.

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[10] Ibid., p. 7.

[11] Ibid., p. 12.

It would be difficult to estimate the amount of salt available on the plain. When holes are dug in the plain they fill up rapidly but no pumping tests seem to have been made. Since no pumping tests have been made it would be a problem to determine whether or not the level of the water could be lowered. When the size of the Great Salt Plain is taken into consideration, however, it seems probably that there is enough salt water available in sufficient quantities to produce a large volume of salt. Wells would have to be drilled in the sandy material and be encased with pipe because of the caving nature of the sand and silt. A major problem in processing the salt would be the silt because it remains in suspension and settling basins would have to be provided for the water as it is pumped from the wells.[12]

Under the present economic conditions it is doubtful if the plain will be utilized for commercial salt production in the near future. Because salt is being produced on a commercial basis both in Kansas and Texas, and as long as the present supply of salt in these two states is not depleted, there will probably be no development in adjacent areas. Another factor to consider is the capital outlay that would be needed to produce salt from the plain on a commercial basis. Salt companies and investors will probably first look to other areas for development.

There is one area in Oklahoma which might be developed before the Great Salt Plains. At the mouth of Buffalo Creek in Woodward County, Oklahoma there is a supply of salt available that would not have to be evaporated. The salt here is already formed as an incrustation on top of the salt springs that issue forth on the creek bed of Buffalo Creek which empties into the Cimarron River.

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[12]Snider, p. 204.

CHAPTER IV

BIG AND LITTLE SALT PLAINS

Location of the Big Salt Plain

The Big Salt Plain is the second largest salt plain in northwestern Oklahoma. It is located on the Cimarron River in Woods, Woodward and Harper counties, (see Fig. 2 in Chapter III). The plain lies in Township 27 North, and Range 18 and 19 West based on the Indian Meridian. In width the plain varies from one-half mile to over two miles and it extends in a northwest-southeast direction about eight miles. The down stream boundary of the plain lies south and west of the city of Freedon, Oklahoma.

The plain lies in a broad canyon of the Cimarron River enclosed on two sides by gypsum capped bluffs of red shale. On the south bank of the river the bluffs of red shale capped with gypsum rise directly from the edge of the river bed to the height of 100 feet or more. While on the north side of the river the bluffs are not so steep and these bluffs are about one half mile or more from the salt plain.

One major accumulation of the salt is at the mouth of Buffalo Creek where it empties into the Cimarron River from the south. The mouth of Buffalo Creek is about eight miles west and one mile south of Freedon. There are approximately 100 acres here where a salt incrustation, from one inch to over six inches in thickness, forms. There are some open water spots in the area of salt incrustation, the water of

which is crystal clear. However, upon tasting the water, the high concentration of salt is readily noted. The source of this water is from brine springs that issue forth from the bed of the creek. Of the four plains visited, this particular area at the mouth of Buffalo Creek had the thickest incrustation of salt.

On the north side of the Cimarron River at Edith, Oklahoma the Big Salt Plain is visible as a thin veneer of salt on the sandy river bed. At Edith the salt plain is at least two miles wide and on the south side the gypsum capped escarpment is about 150 feet above the river bed. North of Edith about one-fourth mile the escarpment has been badly eroded and here one gypsum capped mesa rises above the plain to the height of about 75 feet and just north of this mesa is the main gypsum capped escarpment.

Stratigraphy of the Plain

The Cimarron River has cut its bed down through the Permian red beds to the Flowerpot shale formation. It is from the Flowerpot shale that the brine springs issue forth at the mouth of Buffalo Creek. The brine water from the same shale seeps up through the sand of the river bed to form the salt veneer that is visible near Edith on the Big Salt Plain. The sand in the river bed is primarily from the Tertiary sand and gravel which covered the great plains and some of the sand is derived from sandstone that outcrop along the escarpment.[1]

The high escarpment on the south side of the Cimarron River is capped with Shimer gypsum which has an average thickness of about six

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[1]The author checked with Professor Ray L. Six of the Geology Department at Oklahoma A. and M. College to confirm the material just described on the Stratigraphy of the Big Salt Plain.

feet. Below the Shimer gypsum is a stratum of red and grey mottled shale. Under this stratum of shale is the Medicine Lodge gypsum which has an average thickness of about eight feet. Another stratum of red and grey mottled shale lies below the Medicine Lodge gypsum. Directly under this layer of shale is the Ferguson gypsum which is reported to be the thickest of the three formations described.[2]

The Shimer gypsum has been eroded off the escarpment on the north side of the Cimarron River and here the gypsum cap is the Medicine Lodge. It has been weathered to the extent that in places it has slumped over the side of the escarpment. In general the Medicine Lodge gypsum has an average thickness of eight feet and below this formation is a layer of red and grey mottled shale. The second stratum of gypsum is the Ferguson formation which outcrops on the face of the escarpment.[3]

In 1918 Cosden Oil and Gas Company drilled a well in Section 8, Township 27 North, and Range 16 West based on the Indian Meridian. This well was located about three miles north and 16 miles east of Edith. The well log shows that several layers of rock salt was encountered with other formations between 1,020 feet and 2,100 feet. The thickness of the various salt layers total 358 feet.[4]

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[2]Albert L. Burwell, "An Investigation of Industrial Possibilities of Oklahoma Gypsum and Anhydrite," Oklahoma Geological Survey Mineral Report 29 (Norman, 1955), p. 3.

[3]Charles N. Gould, "Index to the Stratigraphy of Oklahoma," Oklahoma Geological Survey Bulletin No. 35 (Norman, 1925), p. 91.

[4]R. L. Clifton, "Oil and Gas in Oklahoma," Oklahoma Geological Survey Bulletin No. 40, Vol. II (Norman, 1930), p. 7.

Field Study

A reconnaissance trip to the Big Salt Plain was made in November, 1954. The trip started from the north side of the Cimarron River about one-half mile down stream from Edith. The basic material of the Big Salt Plain which is part of the bed of the Cimarron River is composed of sand and silt. There is evidence that livestock is permitted to roam on these sand plains because fresh animal tracks were seen on the sand of the river bed. There is no vegetation growing on the salt plain itself. However, on the outer edges where small low mounds rise above the surrounding plain there is some native grass. The Big Salt Plain in general has a thin crust of salt on its surface.

At the mouth of Buffalo Creek which is on the south side of the Cimarron River, there is an area where several brine springs are flowing. Here there is an area covered with a thick incrustation of salt. The farmers living in the immediate area break the salt up into slabs which vary in size from one to two feet in length and in thickness from two to four inches. These slabs of salt are stacked in piles on the plain to permit the water to drain from the salt. If this salt was hauled before drying, the corrosion of the equipment would be much greater than waiting until after it dried. After the slabs have dried completely, they are hauled by the farmers to their individual pastures where the salt is placed on the ground for livestock consumption.

A local resident of this area was questioned about the salt production in the salt plains area.[5] He stated that at the present he knew of no

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[5] Mr. Wait, a farmer living about one and one-half miles south and three miles west of the mouth of Buffalo Creek.

commercial use of salt from this area of concentration, but had been told by a friend who flew over the area that salt was stacked in places along the river. He further states that some farmers in the immediate vicinity use this salt as a source of supply for their livestock. Some farmers had previously mined this salt and sold it to ranchers and to farmers in the vicinity at fifty cents a bushel, compared to seventy-five cents a block for commercial salt. A number of the largest ranch owners often purchased at least a truck load of this salt. He also stated that after working on the salt beds all day a person's eyes were affected by the reflection of light from the salt.

Another trip was made to the Edith area on November 27, 1955 to check the area not covered by the first field study.[6] Edith is located on the north side of the Cimarron River and has all but disappeared. There is a section house south of the Santa Fe Railroad track and on the north side of the railroad there is one house. About one-quarter of a mile west of the section house is the home of Ezra S. Blackmon who is taking salt from the Big Salt Plain. Just west of Mr. Blackmon's home is the site of the former salt processing plant. There is an old rusted boiler lying on the ground south of the remains of a boiler house. The boiler house walls are still standing and there are some fire brick scattered on the floor. About 100 feet north of the boiler house is a concrete evaporating vat where the brine water was evaporated by steam heat. About 300 feet south and east of the boiler house there is a concrete encased well with a rusty pump attached. It appears that this brine well has not been used for several years.

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[6]Accompanied by Professors Birchard and Six.

Behind the boiler house other equipment used in the processing plant is stacked in piles. The equipment is rusty and appears to have been there for several years. Parked in front of the boiler house were four Ford dump trucks. These trucks are obviously used to haul salt because the fenders, running boards, and bodies were corroded from hauling salt. It was observed that the dump bodies of the trucks were corroded where the salt came in contact with steel.

Mr. John Icke related that Ezra S. Blackmon bought the second hand equipment for the salt processing plant in Kansas. He stated that the plant was erected in 1935 and operated until 1936 or 1937.[7] There were two brine wells that furnished the brine for the salt processing plant. One well was south and east of the plant and the second well was located north and west of the plant. The wells were about 35 feet deep and were cased with eight inch pipe. There were three boilers and three evaporating vats at the salt processing plant when it was in operation. The salt plant was dismantled in 1945.[8]

On the salt plain, about a mile south of the abandoned salt processing plant, there is a broad trench which has been graded down to a depth of about five feet. It is about 125 feet wide and about a quarter of a mile long. The brine water seeps into the trench and a salt incrustation forms on the surface of the water. At the east end of the trench there is an overflow pipe where some of the water from the trench flows out onto the salt plain. An incrustation of salt from three to

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[7]Mr. Icke, operates a Continental Oil Company service station at Waynoka, Oklahoma. He worked for Ezra S. Blackmon when the salt processing plant was in operation.

[8]F. E. Harris and E. M. Tucker, "Salt," Minerals Yearbook 1945 (Washington, 1947), p. 1518.

four inches thick forms in the trench. A skimmer machine scrapes up the salt and a conveyor elevates the salt from the scraper above truck level. Here the salt is conveyed into dump trucks and hauled back toward the edge of the plain where the salt is piled to dry and cure.

Two large piles of salt were observed and the salt in the two piles was very hard. A bulldozer tractor was parked on one salt pile and it appeared that the tractor was used to scrape the dried salt loose from the pile, (Fig. 5). There was a set of platform scales, three scoop shovels and some burlap bags lying at the edge of the salt pile. Evidently some of the salt is sacked before it is sold.

Mr. Icke was questioned about the salt now being gathered by Mr. Blackmon. He stated that the salt is sold on a local basis. Farmers and ranchers come in with trucks and pickups and haul away salt for their own use. The farmers use this salt for livestock consumption.

History of the Area

The Big Salt Plains was the source of salt supply for deer, antelope and especially buffalo before the white man made his appearance on the scene. Because the game was here the plains Indians very early appreciated the value of the plain as a hunting ground and a source of salt for human consumption. From the standpoint of history, Gould's description of the Big Salt Plain is considered to be a classic one. Gould wrote as follows:

> Perhaps the most noted of the salt plains, from the standpoint of a historian, is the Big Salt Plain of the Cimarron. The first white man to visit this place was probably Coronado, in his journey across the plains in search of the seven cities of Cibola. In regard to this event Mr. J. R. Mead says: 'The route or trail of Coronado, in his famous expedition from the Pueblos of New Mexico across the praries of Kansas to the populous tribes of the Missouri, will ever remain an open question. The only point we can locate with reasonable certainty is the salt plain

of the Cimarron, just within the Kansas line--the only place where rock salt can be obtained on the surface in all the plains country. This salt was known and used by the Indians, and as an article of trade from the Gulf to the British line, and this locality was a well-known geographical point, from which distance were reckoned.' The presence of a dozen or more trails, now nearly obsolete, radiating from the plain like spokes of a wheel, bears testimony to the fact that this place was long used as a source of supply of salt to the various forts and settlements of the surrounding regions. Indeed, it is but a few years since salt from this plain was hauled for hundreds of miles in all directions, and not until time of discovery of extensive beds in central Kansas did this industry wane.[9]

Future of the Plain

Salt from the Big Salt Plain is now being gathered on a limited basis for livestock use. It had a salt processing plant in operation in the 1930's but due to a competitive market for salt the plant was unable to maintain a profitable return on the fixed investment. This was due to the fact that the salt producers in Kansas could produce salt on a larger scale and undersell the local salt processor.

It appears that salt formed by solar evaporation will continue to be gathered for local livestock use but it is very unlikely that any large scale production of salt will develop here in the near future. There is sufficient salt for a large scale industry here on the Big Salt Plain and it probably will be developed when the proper time arrives.

The Little Salt Plain

The Little Salt Plain is located in the bed of the Cimarron River about seven or eight miles upstream from the Big Salt Plain. The topography of the upland here is similar to the Big Salt Plain although the river is not quite as deeply entrenched.

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[9]Charles N. Gould, "The Oklahoma Salt Plains," Kansas Academy of Science, Vol. 17 (Topeka, 1901), pp. 182-183.

Figure 5.

Figure 6.

One field trip was made to the Little Salt Plain. Although a thin veneer was visible over quite a large part of the area no distinct incrustations were found, (Fig. 6). The salt in evidence here is certainly dwarfed by that in evidence on the Big Salt Plain. The salt here appears to be coming up through the sand as seepage with no distinct spring areas in evidence.

As far as is known no commercial salt gathering has taken place here. It appears that any development in this area would take place at the Big Salt Plain due to the factors just brought out.

CHAPTER V

THE BLAINE COUNTY SALT PLAIN

Location

The Blaine County Salt Plain is located three miles south of Southard, Oklahoma, (see Fig. 2, Chapter III). It lies in the valley of Salt Creek in Sections 15, 22, 23, and 24, Township 18 North, and Range 12 West based on the Indian Meridian. The geography of the plain is to be found in the geology and history of the area. There has been no economic exploitation of the salt in recent years. However, there were two salt plants in operation just before Statehood in 1907.

The Salt springs are located at the base of a gypsum capped escarpment. On both valley flanks the bluffs of red shale covered with Shimer gypsum rise directly from the edge of the salt plain to an approximate height of 175 feet. Three branches form the main Salt Creek canyon down stream from the salt springs. One branch extends west and branches join it from the north and south to form Salt Creek canyon. Below the junction of the three branches the Creek flows east in a canyon about 150 yards wide for a short distance.

The canyon gradually widens down stream to about one-fourth mile where the Creek flows east out onto the plain at the foot of the generally north-south trending gypsum cuesta face. Farther down stream, Salt Creek is joined by creeks that do not carry salt water. About

five and one-half miles east of the salt springs the sandy creek bed shows only a trace of salt.

All three canyon branches have springs flowing with brine water. The south branch appears to have the greatest concentration of salt in the water. The sandy bed of the Salt Creek canyon has a thin veneer of salt and in most places it did not exceed one-half inch in thickness, (Fig. 7). The salt crust of this plain is much thinner than that formed on the Big Salt Plain. This salt plain covers less area than either the Big Salt Plain or the Little Salt Plain both of which are located on the Cimarron River.

Stratigraphy of the Area

The Salt Creek canyon escarpment is capped with Shimer gypsum. This formation has an average thickness of 14 feet. Below this formation is a stratum of gypsiferous shale about 26 feet in depth. Next is the Medicine Lodge gypsum formation which has an average depth of 25 feet. A layer of red clay with an average depth of 20 feet lies between the Medicine Lodge and Ferguson formations. The Ferguson gypsum has an average thickness of five feet. Below the Ferguson stratum is a band of red clay with green spots and white selenite. It is from this red and green shale formation that the springs of brine water issue forth on the south branch of Salt Creek. Gould's description of the Blaine County Salt Springs is as follows: "A ledge of red and blue mottled cross-bedded sandstone outcrops along the heads of several branches of the main canyon, and from it issue the springs, the waters of which form a small creek."[1]

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[1]Charles N. Gould, "Geology and Water Resources of Oklahoma," United States Geological Survey, Water-Supply and Irrigation Paper Number 148 (Washington, 1905), p. 103.

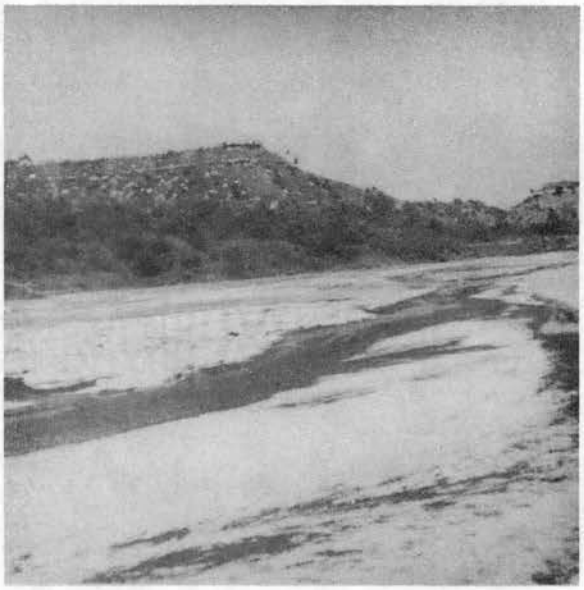

Figure 7.

Figure 8.

No evidence of a sandstone formation on the creek bed of the south branch of Salt Creek was noticed. However, it is possible that some sandstone outcrops on the west and north branches of Salt Creek.

Field Study

The Salt Creek canyon was visited in August of 1955.[2] The tour started from the Henry Boeckman ranch four miles down stream from the junction of the three branches of Salt Creek.[3] The party traveled upstream on the south branch after leaving the main canyon. This branch is formed by a narrow canyon with cedar covered slopes. The rim of the canyon is covered with jack oak and cedar. On the creek bed no algae was visible and dead frogs were seen floating on the salt water.

At one point on the creek bed a spout of water was being forced up from a joint in the red and green mottled shale. The water tasted like brine and it was cold in comparison to the stream that the spring was flowing into. Here the red shale dipped upstream. A layer of green shale was above the red shale on the valley side which appeared to correspond with the shale from which the springs were originating. In the area of the salt springs the water was very clear and there was no scum visible on the water.

Upstream from the outcroping layer of red and green shale from which the seepage and small springs issued the water was fresh. Live tadpoles

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[2]Ralph E. Birchard, thesis adviser and David Weidman, a farmer living three miles west and seven and one-half miles south of Okeene, Oklahoma. The Weideman farm is located five miles east and one-half mile south of the salt springs on Salt Creek.

[3]Henry Boeckman, a business man who owns and operates the John Deere and Chevrolet agency in Okeene, Oklahoma. The Boeckman ranch is located on the north bank of Salt Creek.

were seen in the water and green algae was visible on the rocks and in the water. A scum was visible on some stagnate water above the outcrop. It appears that the fresh water comes from several small springs or seepages above the layers where the salt water seeps from the joints in the red and green shale. The fresh water was tasted and there was no evidence of brine but the water had a "gyp" taste. This may be due partially to the large boulders of gypsum lying both in the water and on the creek bed.

The Shimer gypsum formation is being dissolved by surface water seepage. This is obvious by the sink holes that are visible on top of the escarpment. Huge boulders of gypsum are strewn from just below the rim of the escarpment to the creek beds. These boulders have broken off from the gypsum cap on top the escarpment. While walking around the rim of the escarpment on the west branch it was observed that in places along the edge of the bluffs huge blocks are sagging with large crevices between them and the solid gypsum formation. The party walked to the head of the south branch of Salt Creek. On the creek bed where the fresh water springs were located, the area was covered with huge boulders of gypsum which were piled over 20 feet above the creek bed.

Below the salt springs the remains of steel salt pans were lying on the edge of the stream bed on the north side of the south branch of Salt Creek, (Fig. 8). The salt pans were full of holes caused by rust. Near-by there was evidence of ashes where fires had burned under the salt pans. David Weideman related that several of these salt evaporating pans were used in the past. The brine water from the salt springs of the south branch was poured into the pans. Fires were built under the pans to evaporate the water and as the brine water evaporated the salt

was deposited on the bottom of the pans. The fuel for the fires was obtained by cutting the cedar trees from the bluffs of the canyons and jack oak trees off the top of the escarpment. After the salt was processed it was sacked and hauled by wagon down stream to the point where Salt Creek flowed onto the plains. Here the wagons traveled from the valley to the nearby towns to sell their salt. He said that the salt evaporating process in the Salt Creek canyon almost depleted the cedar trees.[4] This was probably correct as the cedar trees growing on the bluffs of the canyon were not very large.

David Weideman was questioned concerning water wells in the Salt Creek valley. He stated that most of the farmers encountered salt water at the approximate depth of 50 feet. There are two water wells on the Weideman farm. One well is 42 feet deep and has soft water while the other is 52 feet deep and has salt water. The water from the latter has a reddish color. Water was tasted from both wells and the water from the second well had both a brine and a "gyp" taste. There is a possibility that the water from this well is coming from the same formation as the salt from the Salt Creek Springs.

History of the Plain

In 1900 the Choctaw, Oklahoma and Northern Railway Company started construction on a railroad through Blaine County from Geary to Alva, Oklahoma. This railroad was later purchased and operated by the Chicago, Rock Island and Pacific Company until 1926 when it was abandoned and the tracks removed from Geary to Homestead, Oklahoma.

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[4]David Weideman.

The town of Salton, Oklahoma Territory, was platted in 1901. It was located on the railroad at the mouth of Salt Creek canyon and was named after the salt plant that was located there. Bitter Creek ran through the western part of Salton. The water of Bitter Creek was tasted and it had a "gyp" taste but there was no evidence of brine in the water. A statement made by David Weideman is quoted as follows:

> In the early days, Salton had the first electricity in Blaine County. Street lights, business buildings and residences were lighted by electricity from the salt plants. The town had a depot, section house, three general mercantile stores, a drug store, post office, two barber shops, three saloons, four grain elevators, the Star restaurant, and hotel, a pool hall, two lumber yards, a cotton gin and a livery barn.[5]

In 1907, R. H. Hopkins, the postmaster of Salton, had the name of the town changed to Ferguson. This was in honor of the last territorial Governor, the late Thomas B. Ferguson.

The Oklahoma Salt Company had a salt plant with a daily capacity of 450 barrels at Ferguson. This was the nearest railroad connection to the Blaine County Salt Plain. The brine water was pumped from wells on the south bank of Salt Creek. The brine was carried over two miles in a 2 1/2 inch wrought iron pipe line. Steam from the boilers at the plant furnished the power to operate the rakes, elevators, and conveyors. The salt pans were made of cement and measured 12 by 150 feet and 20 inches deep.[6] The remains of the salt pans are still on the Weideman farm.

The Oklahoma Salt Company operated the plant for a few years. During this time the demand for the product was greater than they could supply. Later commercial salt firms from Kansas started shipping salt

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[5]David Weideman, "Rubey Stucco Mill Near Ferguson Was Thriving Concern," Watonga Republican, Thursday, September 10, 1953.

[6]Gould, p. 103.

to the area at reduced prices. David Weideman was questioned about the Oklahoma Salt Company. He stated that the original owners went broke and The Morton Salt Company bought the plant and the land. Weideman bought the land from The Morton Company in 1935. This land is part of his farm at the present time.

Augusta Henquenet and his brother Cassy came to Salton in 1901. He purchased land both west and south of Salton. A gypsum capped mesa outlier west of the site of Salton is on the Henquenet's ranch. He later named this Mt. Henquenetville. At the present time the name is still used when the mesa is referred to. In 1902 Henquenet had 40 acres platted for a townsite which he named Henquenet. Many people came to the site with hopes of making a new home. They had heard of the townsite with the salt plants and the Rubey Stucco Mill being a place that would support more people. The poeple lived in tents while they were in Henquenet. Due to rattlesnakes and not enough work to support the settlers, the town of Henquenet never materialized.

A second salt plant was owned and operated by the Henquenet Brothers. This salt plant was located on the Henquenet ranch one mile south of the site of Henquenet. The brothers dug a salt well on the south bank of Salt Creek. Here the salt was processed and hauled by wagon to Salton, Cooper, Omega, Cheeryvale, Catawba, Homestead, Darrow, Okeene, Hennessey, Loyal, and Kingfisher. The salt sold for fifty-cents for one hundred pounds.[7] The Henquenet plant like the Oklahoma Salt Company plant operated for only a short period of time. This is just another case of

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[7]David Weideman, "Henquenet, Blaine County, Was a Platted Townsite; Development Never Materialized," Watonga Republican, Thursday, September 10, 1953.

small business being unable to adjust to the changing economy. The larger salt producers in Kansas could ship their products to Oklahoma and sell them at a lower price. After the death of the two brothers the ranch was sold. David Weideman said that the ranch is now owned by the following parties: Henry Boeckman of Okeene, Cord B. and C. F. Kimbrel of Carleton, and Theodore Graalman of Watonga.

Salton was a thriving community with its two salt plants and the gypsum plant, Rubey Stucco Mill. This mill was located three miles west and one mile south of Salton, later Ferguson. The mill was built in 1902 and was situated about 600 feet north of the hill where the gypsum was quarried. The hill was about 150 feet high and a double, narrow gauge track was used on it. Six loaded cars of gypsum were let down by a steel cable and in the same operation six empty cars were pulled to the top of the hill on the other track. One man operated the cars on both tracks. From 10 to 12 men worked at the quarry, mining the gypsum and loading the cars. At the mill the gypsum was crushed, processed into plaster and sacked. Local farmers hauled the sacked plaster by wagon from the mill to Salton. There the plaster was loaded in box cars for shipment to many points in the United States. In 1915 the mill burned and was not rebuilt. At the present time the United States Gypsum Corporation is mining gypsum from the Shimer and Medicine Lodge formations about one mile north of the west branch of Salt Creek.

David Weideman was questioned about the location of the former town of Ferguson. He said, "Ferguson was right here on what is now my farm, just about one-quarter of a mile west of my house."[8] The only visible

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[8]David Weideman.

evidence is the cement pans of the former Oklahoma Salt Company plant. The area that Ferguson once served is now served by the towns of Hitchcock and Okeene. Hitchcock is located three miles south and one-quarter mile east, while Okeene is seven and one-half miles north and three miles east of the Weideman farm.

Future of the Blaine County Plain

Since World War II the population of the United States has been increasing at a rapid rate. As the population increases it is logical to assume that more salt will be consumed. Salt is being produced on a commercial basis in Michigan, New York, Ohio, Louisiana, Texas, California, Kansas, West Virginia, and Utah. These areas of commercial salt production will expand their output as additional supplies are needed. This in turn will cause a more rapid rate of depletion of the salt supply. However, the depletion of salt is a minor problem, because the potential source from sea water can be utilized if it is needed. It appears that as long as the leading areas of salt production can continue to produce salt, and the salt companies can make a reasonable profit other areas will not be developed. However, if the population centers of the United States shift farther westward it may cause the salt producing companies to re-evaluate their shipping policies and if feasible to open new plants in Kansas, Oklahoma, or Texas.

The Blaine County Salt Plain has sufficient brine water that can be converted into salt. There are adequate highways and railroads in close proximity to the Blaine County Salt Plain for transportation. There is a large natural gas line that crosses Salt Creek that could be tapped for fuel. The labor problem would not be serious. Farmers in

the area could work for the salt processors during the winter months when they were unable to work in their own fields. The Blaine County Salt Plain has the raw materials, fuel, adequate transportation, and labor available for immediate development.

CHAPTER VI

SUMMARY AND ECONOMIC PROSPECTS OF THE PLAINS

Physical Factors

Since no recent tests have been made it would be a difficult task to determine the amount of salt available in the various deposits located in northwestern Oklahoma. The incrustation of salt found on all of the areas visited is tangible evidence that a salt supply is located below the earth's surface either in the form of rock salt or disseminated salt. From these deposits the salt is carried in solution to the surface either by seepages or springs and salt is formed as an incrustation when the transporting water evaporates.

The amount of saturated brine going to waste on these plains is very large. This is especially true of the Big Salt Plains. At the mouth of Buffalo Creek where it empties into the Cimarron River, there is an area of about 100 acres which is covered in dry weather with a thick incrustation of salt. This area was visited in November of 1954 and there was a crust of salt over six inches thick on part of the sandy creek bed. The water is perfectly clear and would not require settling before evaporation. Also, the salt content of the water is about fifty-percent. At one time the Blaine County Salt Plain which is located in Salt Creek canyon furnished enough brine for commercial production and salt was produced there prior to 1907.

The salt plains of northwestern Oklahoma have their origin from rock salt formations with the exception of the Great Salt Plain where the source of salt appears to be salt disseminated through the Hennessey formation. No test wells seem to have been drilled on the Big Salt Plain, the Little Salt Plain or the Blaine County Salt Plain to determine if there are rock salt deposits directly under them. A well drilled near the Big Salt Plain was cited in Chapter IV. There has been at least one other well drilled in western Oklahoma where rock salt was encountered. Shell Oil Company drilled a well on the J. I. Long farm located in the Elk City field of Beckham and Washita Counties and rock salt was found at a depth of 1,139 feet. A core of 311 feet of rock salt was recovered out of a gross salt section of 320 feet.[1] At the Great Salt Plain two wells have been drilled and in both wells brine water was encountered but there was no evidence of rock salt found in the drilling operations.

The individual salt plains in northwestern Oklahoma differ in the amount of salt concentration. Both the Big Salt Plain and the Blaine County Salt Plain are fed by salt springs and the brine from these two plains is nearly if not quite saturated. The brine could be processed into salt by evaporation without first settling because there is no silt in the water. The thin salt veneer visible on both the Little Salt Plain and the Great Salt Plain comes from seepage. On these two plains wells would have to be drilled to obtain salt in large quantities. Also, silt is encountered on the Great Salt Plain when wells are dug in the sand and silt material.

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[1]Joseph A. Kornfeld, "100-Percent Recoveries in Diamond-Coring Salt," Oil and Gas Journal, Vol. 50, No. 43, Tulsa, Oklahoma (March _, 1952), pp. 81-82.

A favorable factor for commercial development of salt is the climate of Oklahoma which is conducive to year round production of salt. Where the brine water is exposed on the plains it evaporates and leaves an incrustation of salt. The incrustation in some places is several inches thick when there is a long dry period in the summer. During the winter months there is an incrustation visible on most of the areas. Northwestern Oklahoma has a low annual average of precipitation which is favorable for the evaporative concentration of salt. Of course after rains there is a certain amount of salt washed away in solution. Insuing dry periods form new salt incrustations.

Cost of Salt Production

To process salt from the salt deposits in northwestern Oklahoma the cost would vary because each salt plain presents different problems to consider. The Great Salt Plain appears to have a vast reserve of brine water below the earth's surface. But to obtain and process this brine into salt would require a large capital investment for equipment. Wells would have to be drilled on the salt plain and the brine water pumped to the surface. The brine water has silt in it and settling vats would need to be constructed to remove the silt.

The Little Salt Plain appears to have about the same problems except no silt is encountered in the brine water. When the Little Salt Plain was visited there was a thin veneer of salt on the plain. This plain appears less favorable for development than the Big Salt Plain because there is less brine water visible on the Little Salt Plain. Wells would have to be drilled on the Little Salt Plain to obtain brine for salt production. Both the Big Salt Plain and the Blaine County Salt Plain

appear to be better adapted for development as far as costs of development are concerned.

At the mouth of Buffalo Creek where the Big Salt Plain has part of its source of salt, several large springs issue forth with brine water that would furnish enough salt for commercial production. Wells could be drilled to obtain additional brine water in case a producer of salt wanted to expand production over the amount the springs could produce.

The Blaine County Salt Plain has produced salt in the past and it was obtained in two different ways. One method of processing salt was performed on the floor of the south branch of Salt Creek where the brine water from the springs was placed into steel evaporating pans and the water was evaporated leaving the salt. By another process wells were dug on the south bank of Salt Creek about three miles down stream from the brine springs. There the brine water was pumped by pipe line to a plant where the brine was processed by evaporation into salt.

Since brine is readily available from springs on both the Big Salt Plain and the Blaine County Salt Plain it would not be necessary to drill wells on the plains to secure brine water. It is believed that salt could be produced at a lower initial cost because less equipment would be needed in comparison to the Little Salt Plain and the Great Salt Plain where wells would have to be drilled to obtain the brine water.

Availability of Fuel and Power

At the present time the availability of fuel would not be a serious problem in planning for a salt processing plant. There are natural gas fields in the panhandle of both Texas and Oklahoma and the gas is

transported by pipe lines to refineries and market areas. Consolidated Gas Utilities has a 14 inch natural gas line that crosses Salt Creek valley below the salt springs in Blaine County. This gas line is a potential source of fuel for a salt processing plant. There are two electric high lines that cross the Salt Creek valley about two miles west of the former town of Ferguson. Either one of these electric lines might be tapped for electricity.

The Big Salt Plain and the Little Salt Plain are not as well situated for fuel and power as the Blaine County Salt Plain. There is a possible source of fuel in the form of natural gas located approximately four miles north of the Big Salt Plain. Cities Service Oil Company has a 26 inch natural gas line that lies just south of United States Highway Number 64 where both the highway and the pipe line cross the Cimarron River about 21 miles east of Buffalo, Oklahoma. This would be an adequate supply of fuel if a large enough volume of gas could be consumed by a salt processing plant to warrant connecting onto the pipe line. There is a railroad on the north side of the Cimarron River which is about three miles north and east of the salt plain which is located at the mouth of Buffalo Creek. There are good country roads on the gypsum capped escarpment above the Big Salt Plain on the south side of the Cimarron River.

The Great Salt Plain is near enough to all weather highways and railroads that fuel could be transported to the plain when the need arises. Also, the Cities Service Oil Company's 26 inch natural gas line is located just north of the salt plain and here too natural gas is a possible source of fuel. The city of Cherokee located west of the salt plain is a possible source of electricity for a salt producing industry.

There is sufficient oil and coal produced in Oklahoma that all four salt deposits could draw from these sources for fuel. In all areas of northwestern Oklahoma if salt plants were placed in operation the brine water would have to be evaporated to secure salt. Heat is required to evaporate the salt from the brine water. Boilers could be used to produce steam to evaporate the salt from the brine and the steam from the same boilers might be used for power to turn generators which would produce electricity.

Transportation Facilities

Transportation would not be a major problem in northwestern Oklahoma because both railroads and highways are in close proximity to the salt plains. The Little Salt Plain is farther from railroad transportation than the other three salt plains but adequate highways and country roads are available to within a few miles of the plain.

Labor Supply

Northwestern Oklahoma is an area of sparse population and labor would be a factor to contend with in planning for the development of a salt industry. However, the highways in the area are adequate for laborers to travel several miles to and from the place of their employment. The individual producers of salt could draw labor from towns in close proximity to the local salt deposits. Also, farm labor might be recruited to work in the salt plants. Many farmers living in the immediate areas of the salt plains do not need to work full time on their farms during the winter months and might be willing to work part time for the salt processors. If a large salt industry were developed

workers would migrate to the area seeking employment provided the wage scale was sufficient to attract laborers.

Availability of Capital

There is sufficient capital available for development of the salt plains of northwestern Oklahoma when the proper time arrives. The leading salt producers in the United States probably have sufficient reserves for new development. Also, investors are continually seeking new business to make safe investments. This problem will have to be approached both on a short run and a long run business cycle.

In the short run it appears that the reserves of salt in northwestern Oklahoma will not be developed because the areas now producing salt can supply the needs for the available markets. Salt is being produced and marketed both in Kansas and Texas. Kansas has many million tons of rock salt reserves.[2] There are many salt domes below the earth's surface in the Texas Gulf area that are available for development. These salt domes constitute a large reserve of salt. As long as there are sufficient reserves of salt in the commercial producing areas the major salt producers are probably not planning to open new areas for production. If a producer of salt started a plant in one of the four areas in northwestern Oklahoma he would have to compete with the prevailing prices charged by other producers of salt. The larger processors of salt now in operation can probably produce salt at a lower cost on a large volume basis. Also, the present producers of salt have established markets which a new producer would be forced to encroach upon.

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[2] F. E. Harris and K. G. Warner, "Salt," Minerals Yearbook 1942 (Washington, 1943), p. 1481.

It is possible that the salt plains might be exploited in the long run. There are several factors that could evolve during a long run business cycle. The population of the United States is increasing and there will be an increase in salt consumption. It is of interest that "table salt" is responsible for less than three percent of the salt consumption in the United States. As the reserves of the older salt producing areas are depleted producers will seek new reserves. The population distribution pattern is changing and bringing about a shift westward in markets. It is also possible that new uses for salt might be discovered by research chemists. At the present time, in the United States approximately 70 percent of the salt output is consumed in the manufacture of chemicals.[3]

The salt plains of northwestern Oklahoma are not apt to be developed until salt can be processed and sold on the markets in competition with the existing salt producers. The writer believes it will be many years before these salt deposits are developed. However, there are factors that cannot be forseen or forecast such as another world war. In case of another war the demand for salt would probably increase many times. Salt production of the world increased during World War II from 31,972,000 metric tons in 1939 to 41,186,000 metric tons in 1943.[4]

If the salt deposits in northwestern Oklahoma were developed now, they would have to compete not only with Kansas and Texas producers but also producers from other states. There is always a possibility that new

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[3]J. C. Arundale and F. B. Mentch, "Salt," Minerals Yearbook 1952 (Washington, 1955), p. 857.

[4]F. E. Harris and E. M. Tucker, "Salt," Minerals Yearbook 1946 (Washington, 1948), p. 1044.

types of industry will locate in Oklahoma which could utilize salt products for industrial use.

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