DEVELOPMENT OF TEXAS MINERALS OTHER THAN PETROLEUM AND SULPHUR

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DEVELOPMENT OF TEXAS MINERALS OTHER THAN PETROLEUM AND SULPHUR

THESIS

Presented to the Graduate Council of the North Texas State College in Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE

Jerry Amos Lumsden, B. S.
168520
Chico, Texas
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PREFACE

The object of writing this thesis was to present a brief history of the development of Texas minerals other than petroleum and sulphur. The supply of petroleum and sulphur, though very valuable at the present time, will probably be exhausted in the not too distant future. The people of Texas must realize that there are more than one hundred other less glamorous but more permanent minerals that are of great potential value. Many of these baser and heavier minerals are known to exist in inestimable quantities beneath the surface of our state. Their development will have much influence on our future economic status.

The material and facts obtained herein were gathered from various sources, including books, magazines, bulletins, and conversations. The libraries of North Texas State College and Texas State College for Women of Denton and Southern Methodist University and Dallas Morning News of Dallas were used in accumulating the greater portion of this material.
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CHAPTER I

EARLY HISTORY AND VALUE OF
TEXAS MINERALS

While nature was prodigal in preparing a great heritage for the people of Texas, it so hid these treasures that it taxes man's intellect and ingenuity to find them, exploit them, and make use of them. It is somewhat widely known in a general sort of way that Texas minerals are more numerous, varied, and have more potential value than the minerals of any other state. Mineral production in Texas began in a small way at a very early time. The American Indians, prior to the coming of Europeans, made some valuable use of mineral resources. The abundance of flint in central Texas encouraged the making of flint implements which are now found in great numbers throughout most of the state. Clay was used in making ceremonial objects, ornaments, pipes, and pottery. Mineral paints, especially the iron oxides, were frequently used. The Spaniards, who established the earliest settlements by white men in Texas, used native stone in building many of the missions. Prospecting for minerals and some attempts at mining by the Spanish have given rise to a rich store of legends about
lost mines, and no part of the state is free of such legendary accounts.¹

Mineral development following settlement of Texas by emigrants from the United States progressed slowly, and it is extremely difficult to obtain reliable records of the activity in the early history of this development. Several geological surveys of the state were made prior to the Civil War. A general geological report by G. G. Shumard, published in 1866, mentions among the known mineral resources of the state, gypsum, salt, road materials, limestone, building material, coal, iron, copper, lead, and silver.

The following figures, giving summary of mineral production in Texas 1882 to 1933, were compiled by E. H. Sellards:²

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Date</th>
<th>Production 1933</th>
<th>Estimated Production 1882 to 1933</th>
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</thead>
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<tr>
<td></td>
<td></td>
<td>Quantity</td>
<td>Value</td>
</tr>
<tr>
<td>Cement</td>
<td>1882</td>
<td>3,091,071 barrels</td>
<td>$5,268,605</td>
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<tr>
<td>Clay Product</td>
<td>1882</td>
<td>1,083,051</td>
<td>125,692,926</td>
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<tr>
<td>Coal</td>
<td>1882</td>
<td>9,393 tons</td>
<td>25,000 tons</td>
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</table>

²Ibid., p. 217.
<table>
<thead>
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<th>Date</th>
<th>Production 1933</th>
<th>Estimated Production 1882 to 1933</th>
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</thead>
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<tr>
<td></td>
<td></td>
<td>Quantity</td>
<td>Value</td>
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<tr>
<td>Copper</td>
<td>1906</td>
<td>2,000</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pounds</td>
<td></td>
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<tr>
<td>Fuller's earth</td>
<td>1907</td>
<td>45,395</td>
<td>411,350</td>
</tr>
<tr>
<td></td>
<td></td>
<td>tons</td>
<td></td>
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<tr>
<td>Gold</td>
<td>1889</td>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Granite</td>
<td>1882</td>
<td>37,120</td>
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<td></td>
<td></td>
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<td>112,106</td>
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<td>tons</td>
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<td>1882</td>
<td>---------</td>
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<td></td>
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<td>tons</td>
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<td></td>
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<td>Lime</td>
<td>1882</td>
<td>36,286</td>
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<tr>
<td></td>
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<td>Lime Stone</td>
<td>1882</td>
<td>687,710</td>
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<td></td>
<td></td>
<td>tons</td>
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<tr>
<td>Manganese</td>
<td>1916</td>
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<td>Marble</td>
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<td>Mica</td>
<td>1920</td>
<td>---------</td>
<td>427</td>
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<tr>
<td></td>
<td></td>
<td>tons</td>
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TABLE 1--Continued

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Date</th>
<th>Production 1933</th>
<th>Estimated Production 1882 to 1933</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Quantity</td>
<td>Value</td>
</tr>
<tr>
<td>Mineral Water</td>
<td>1882</td>
<td>---------</td>
<td>------</td>
</tr>
<tr>
<td>Salt</td>
<td>1882</td>
<td>165,603 tons</td>
<td>560,085</td>
</tr>
<tr>
<td>Sand and Gravel</td>
<td>1891</td>
<td>4,317,312 tons</td>
<td>2,264,905</td>
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<tr>
<td>Silver</td>
<td>1882</td>
<td>160 ounces</td>
<td>65</td>
</tr>
</tbody>
</table>

*Total to 1923. The production and value of mineral water has not been recorded since 1923.

The development of the oil and sulphur industries in Texas has been ably discussed in prior theses of this college by Grace Roberts, 1939, and E. O. Posey, 1937, respectively. For this reason, those minerals will be omitted from this discussion. The above table, though incomplete in that it covers only a partial list of the minerals, does attempt to give an estimate of the date commercial development began, total production for a specific period of time and value of the more important Texas commercial minerals. For those minerals not fully reported by the production companies, Sellards explains that it was necessary in the table to make estimates based on the best possible available data. It is recognized that totals so obtained are necessarily
more or less in error, while others are much more nearly accurate. It is believed that such totals are useful since they indicate the approximate, although not the exact, total production of the various minerals.

Texas produces on an appreciable commercial scale more than thirty different kinds of minerals, and an additional thirty or forty minerals have been produced in commercial quantities from time to time. Because of the relatively undeveloped state of Texas industry, many of its minerals are in an early period of development. The number produced apparently fluctuated from year to year but the trend has been upward in recent years.

The distribution of mineral production in the state is very wide. About 230 of the 254 counties have some mineral production. Practically all of them have minerals of potential value. However, it can be readily seen from the map, page 7, that the more important commercial minerals are concentrated in certain areas. The precious metals of the Trans-Pecos area, Chisos Mountains, and Davis Mountains, the iron ore deposits of east Texas, the salt deposits of the Grand Saline area, and the coal mining areas are typical examples of these regions. Common clays, sand, and gravel are minerals that may be found almost anywhere in the state.

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3 The Texas Almanac, 1947-1948, p. 252.
Since Texas was primarily an agricultural state with the greatest crop value in the union for such a long period of time, it has been difficult to get Texas people to understand that we are in as great, if not greater, degree a mineral state.\(^4\) We have become petroleum conscious, of course, and to some extent sulphur conscious. Sometimes it is stated that King Cotton has been replaced by King Oil. But Texas people are not generally conscious of the greatness of our mineral resources and the production of minerals other than petroleum and sulphur. When the fact of Texas leadership in mineral production is cited, someone usually replies, "Yes, but it is only because of oil." There are two replies to that. One is that every state with a high ranking value is chiefly dependent upon one mineral—as coal in Pennsylvania, Ohio, and West Virginia; iron in Minnesota; and oil in Texas, Oklahoma, California, and Louisiana. The other is that Texas would rank high among the states even if the annual value of petroleum and sulphur were not counted. The mineral production of the state, at the present time, constitutes a greater diversity than that of any other state and Texas probably has a greater diversity of unutilized but apparently potentially valuable minerals than any other state.

\(^4\)Dallas Morning News, October 26, 1941.
Map of Texas showing counties and four great physiographic regions of Texas referred to in this study.
CHAPTER II

DEVELOPMENT OF THE VARIOUS METALLIC MINERALS OF THE STATE

A considerable mineral craze existed in west Texas during the period 1880 to 1900. The people had the idea that minerals, precious and semi-precious, existed in abundance somewhere beneath the surface of the ground throughout the state. It is impossible in this short space of time to list and trace the development of all commercial metals in Texas. The production of many of these metals fluctuates from time to time in relation to their value. The leading commercial metals of five years ago may be of little value today. Moreover some of the leading metals that are of importance today, were of little importance a short time ago. In Texas, as in many other states, hidden treasures are sometimes found where you least expect them.

A great potentiality, though one that is materializing rather slowly, lies in Texas metallic minerals. In the past, production in this classification has been inconsequential. A little iron was produced back in the days of the old Alcalde and Tassie Bell furnaces in Cherokee County.¹ Silver is found extensively in the Trans-Pecos area, and the

¹The Texas Almanac, 1933, p. 212.
Shafer mine in Presidio County has been operating almost continuously since 1880. Quicksilver is produced in the Big Bend territory and also small quantities of lead, gold, and copper in the same area. These metals show little commercial profit except when mined in conjunction with the silver mines. It is believed by many mining engineers that there will be future development of low-grade metal ores in the Permian Basin of north Texas. World War II had a great influence on an increase in the production of critical metals during the emergency period. In remote parts of our state, where many minerals abound, production must wait until transportation and markets are such that a profit may be shown in their production.

**TABLE 2**

**VALUE OF TEXAS METALS OVER FIVE YEAR PERIOD**

<table>
<thead>
<tr>
<th>Year</th>
<th>Gold</th>
<th>Silver</th>
<th>Copper</th>
<th>Lead</th>
</tr>
</thead>
<tbody>
<tr>
<td>1936</td>
<td>$21,455</td>
<td>$1,054,450</td>
<td>$4,876</td>
<td>$43,010</td>
</tr>
<tr>
<td>1937</td>
<td>19,670</td>
<td>1,025,398</td>
<td>38,720</td>
<td>46,610</td>
</tr>
<tr>
<td>1938</td>
<td>15,365</td>
<td>926,389</td>
<td>3,136</td>
<td>31,464</td>
</tr>
<tr>
<td>1939</td>
<td>11,340</td>
<td>910,896</td>
<td>7,072</td>
<td>21,388</td>
</tr>
<tr>
<td>1940</td>
<td>10,920</td>
<td>943,040</td>
<td>6,780</td>
<td>20,500</td>
</tr>
</tbody>
</table>

There is a notable decrease in the value of the above metals caused mainly by the abandonment of the leading silver
mines. Iron ore and manganese have become two of the lead-
ing metal minerals as a result of World War II. The United
States Government spent vast sums of money to supply war
needs. Private capital could not have profitably made these
expenditures for years. An attempt is made below to trace
in more detail the individual development of our leading
commercial metals of today.

Copper

There has never been more than exploratory production
of copper in Texas, or production in small quantities in
connection with other minerals. The three principal areas
where copper ore had been found are: (1) north central
Texas; (2) the Trans-Pecos area; (3) the Burnet-Llano re-
gion.

Copper was discovered in Baylor County sometime prior
to 1870.² Some attempts had been made to open up what was
known as the Croton copper mines. Lack of transportation
and the Indian menace caused the project to be abandoned.
After the Indians had been subjugated in 1875, a new com-
pany was organized to work the old Croton mines. The party
left Weatherford with implements and equipment in July,
1876. No more was heard of them. Another company of Fort
Worth business men was organized in 1879. This company did
a great deal of advertising but very little mining during

²W. C. Holden, Alkali Trails, p. 158.
the next few years. The mines and the deposits attracted much attention over the United States and abroad. A man from Chicago acquired some copper land in Knox County and began operations. In 1880 an interested French company sent two engineers to inspect copper prospects. These men found favorable prospects in Archer, Baylor, Clay, Hardeman, Wichita, and Wilbarger counties, but nothing was ever done about it. Another noteworthy attempt to develop the copper ores of this area was made in 1884 when General G. B. McClellan became interested in the copper deposits there and organized a company which started development near the Pease River in Foard County. Remains of the old shaft today are known as the old McClellan mine.³ The copper movement never created extensive interest in west Texas outside the circles of copper operators and promoters. The north Texas copper ores are apparently of low grade classification, but some mining engineers believe that they will eventually be developed by modern mining methods.

The records indicate that from 1882 to 1936, 1,309,960 pounds of copper have been mined in Texas, coming largely from Van Horn in Culberson County. The Hazel mine which is on the Culberson-Hudspeth county line has been in operation for more than seventy years. Some of the better known

³The Texas Almanac, 1939-1940, p. 224.
smaller mines in the same area include the Sancho, Panza, Black Shaft, and Pecos. The ore mined in recent years carries silver also and usually averages about one and one-half per cent of copper and seven and sixty-three hundredths ounces of silver per ton. Elsewhere on this region there are areas in which the ores are found in small irregular veins.

Copper carbonates are found in fissure veins in a permian limestone in northern Culberson County and in the central mineral area in Llano and Gillespie counties, where both sulphate and carbonate ores are found but have not been prospected adequately or developed to any appreciable extent.

The total production of copper in Texas was 55,336 pounds in 1936, 316,102 in 1937, 35,740 in 1938, 66,000 in 1939, and 66,000 in 1940. The official report on production for 1940 shows 230,000 pounds produced, valued at $31,050. It can be seen from the above figures that the production of copper in Texas can be increased when there is need for it. Of interest in 1940 was the shipment of three tons of copper ore from an open-cut near Quanah, Hardeman County, where copper ore has been reported for many years.

Gold

There has been no rich strike of gold at any time in the history of the state, although there are many legends to the effect that mines of unusual value were worked by the various early inhabitants of the state. The people loved rumors of
gold. In the spring of 1879, a group of prospectors became convinced that there was gold west of Brownwood and began to dig in that vicinity. The very fact that men were digging for gold caused great excitement among the settlers. People began to go to the region of reported discovery from all sections of the country. The excitement remained at whiteheat for several days, but as time passed and no gold was in evidence it gradually subsided.4

Five years passed before some Texans experienced the thrill of another gold rumor. In March, 1884, news spread that a gold mine had been discovered in Llano County. General attention turned that way with great expectancy, but within a few weeks the people, hearing no more, forgot it. Perhaps more gold rumors were heard in Texas in 1886 than in any other year. The long drought of that year caused the public to think of gold as never before. In desperation many settlers considered digging up their own land to look for gold. A second report of a gold mine's being discovered in Llano County aroused interest as early as February of that year. In December the interest became intense. Rumors flew hither and thither, with very little basis, to be sure, but the people loved to hear and tell them, whether they were true or not.5 Many of these reports came from the vicinity of the old Spanish fort in San Saba County. To the

4W. C. Holden, op. cit., p. 149. 5Ibid.
west Texan the very name, "Spanish" has always been synonymous with gold. To many people, the fact that the Spaniards once had a fort in San Saba was conclusive evidence that there must be gold there. Reports of "traces" of gold kept the public encouraged; people in that area continued to look for the "traces" all winter.

The same year a rumor was started in Burnet County when fine particles of gold dust were reported found in a black sand there. Everybody had heard how gold had first been discovered in California in a somewhat similar manner. This excitement was short lived for after a short time no more was to be heard of the Burnet sand.

In 1887 gold was reported twenty miles above Austin. A "grand rush was expected out of Austin," but it never materialized. In August, 1887, a Mr. D. W. Kirkpatrick, in San Saba County, was digging a well and discovered what he thought to be a gold deposit about fifty feet underground. This, too, was soon forgotten. In March, 1889, a miner from New Mexico was prospecting in Mason County and found what he pronounced as gold. This announcement, coming from a veteran miner, had unusual weight. Mason County enjoyed a land boom for some time. In November, 1891, as a result of a rumor from Llano County, excitement flamed up for the last time. The discovery was reported of gold, which was believed to be the "lost mine" worked by the Spaniards two hundred years before. The tradition of the "lost mine" was
an old one. It has many versions in different sections of the state. Excitement, again, ran high for a short time. After this rumor died away, no more was heard of gold, except for a continuous search for buried treasure, a movement which has continued to the present time.

During the period 1880 to 1900, the desire to find gold and silver became so intense that a large demand arose among the more enthusiastic and superstitious for mechanical mineral locators, such as "mineral rods," and "indicators." Frequent letters were addressed to editors inquiring where such instruments could be purchased. The general demand brought forward a number of inventions. The local newspapers were filled with advertisements of mineral indicators, which were "guaranteed to work."

The following is a fair example of the advertisements of the "indicators":

THE GEOLOGICAL WONDER
Gold and Silver Indicator

The geological wonder of the age, is an electrical gold and silver indicator for hunting gold and silver. The only apparatus of the kind that is entirely reliable, and fully warranted to do all that the proprietor claims for it.

All people who are interested in prospecting or hunting for gold and silver in its natural state, or buried treasure are requested to come and see the curiosity. It is especially adapted to prospecting the beds of creeks, rivers, muddy sloughs, and ponds in which there has been money thrown, and rivers that have gold or silver lodged on the bed rocks, the instrument will immediately tell you by ringing a bell

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6 Ibid., p. 153.
as on dry land. It tells just where the metal is by
ringing a bell.

The bell will ring for the one-hundredth part
of a grain of gold or silver. It will tell you where
gold dust is in the ground, and all placer mines on
land or in water.

No trouble to work the invention. Come and see
it.

The instrument will prospect in water and mud,
eight feet deep.

Patented October 15, 1889.

On exhibition at the fairgrounds during the day,
and at the St. James Hotel, during the evening, Dallas,
Texas.

F. W. Kester, Ballinger, Texas. 7

A total of approximately $125,000 worth of gold has
been produced in the state and almost all of this has come
from the Trans-Pecos area, where it is found associated with
silver and copper ores. A small amount has come from Llano
County. There has been small production during the last two
or three years from a mine in Gillespie County. 8

There are several areas in Texas where geological con-
ditions are favorable for profitable gold mining, but as
this is a matter for intensive prospecting, nothing of any
great value has been discovered. In Texas all mineral rights
belong to the land owner and the prospector who discovers
valuable minerals can acquire only such rights to it as he
can obtain through negotiations with the owner. This fact,
probably, has influenced some prospectors of this type to seek
for more favorable circumstances in other states.

7Ibid., p. 154.

8The Texas Almanac, 1939-1940, p. 223.
Probably more thorough prospecting would develop profitable ores in the Llano up-lift area in Mason, Gillespie, and Llano counties. Similar conditions may be found around Van Horn, in Trans-Pecos, Texas. Ores worked there recently were from a silver mine at Shafter, and from the quicksilver mines in the Terlinqua field. Reports of gold have come from the Edwards Plateau area and Williamson County, but geologist do not consider these favorable, and it is unlikely that any worthwhile deposits can be located in these areas.

Graphite

Texas has the most valuable deposits of graphite known in the United States. Graphite is a grade of carbon between anthracite and diamond. It was first produced in Texas in the 1920's from a quarry and mill located about ten miles west of Burnet. This production was primarily to supply a demand by storage battery manufactures. A change in battery manufacture in the early 1930's reduced the demand for Texas graphite. The mill at Burnet abandoned operations for ten or twelve years. In the early 1940's production at Burnet was revived to meet new industrial needs. Graphite production in Texas was 3,200,000 pounds in 1944, valued at $185,264.

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The ore is found in the pre-cambrian schist of Llano and Burnet counties. At Burnet the graphite schists are upward of seventy-five feet thick, dipping sharply downward. The schist is mined in an open cut worked down the dip into ore averaging five or six per cent graphite. This resource is beginning to be utilized in Texas and offers considerable promise of being developed to a considerable extent. The only competition on this continent is from low grade amorphous graphite from Mexico and from artificial graphite from electric furnaces.\textsuperscript{10} Since the Texas material is of much higher grade and occurs naturally, it should form the basis of an attractive new industrial activity in the state. Graphite is now being used in the manufacture of batteries, electrodes, in lubricants, and in lead pencils.

Iron Ore

The iron ores of Texas are actually of two types and occur in widely separated areas. The first type occurs in the Llano uplift in Llano and Mason counties where there are deposits of magnetite low in phosphorus and sulphur. These ores have not been developed nor have they been prospected enough to form a definite opinion of their possible commercial value. However, they do occur near the Texas coast where fuel and water transportation are available.

\textsuperscript{10}The Texas Almanac, 1947-1948, p. 270.
The second type of ore occurs in the east Texas area in the form of linonite ore on and just below the surface in a tract of approximately 550 square miles. It has been estimated that there are probably 7,000,000 tons of iron per square mile, and that from the best ores, from thirty to thirty-five per cent of metal can be mined by steam shovel.

The smelting of iron ores began in east Texas prior to the Civil War in a small hill-side furnace in the vicinity of Jacksonville, in Cherokee County. During the war several of these small plants were established to furnish iron for domestic use and for the Confederate government. After the war, these plants were operated for a time in connection with foundries where various small articles of iron were made, but with the construction of railroads, affording cheaper transportation from the greater iron producing centers, many of these primitive plants were abandoned.

The district from which these ores were taken extends from about Calvert, in Robertson County, northeasterly to within about sixty miles of Texarkana and is of the formation known as "bog ores." It is the nature of brown hematite ores to occur in pockets, but the peculiarity of the eastern Texas deposits is that it runs in continuous and persistent ledges for many miles, in fact covering the entire mountains of

eastern Texas. The strata range from 22 to 36 inches in depth, and are usually 170 feet above the valleys and about 500 feet above sea level. The ores are frequently exposed so that mining methods may be simple and inexpensive. At an early date, these ores were tested by selection and it was known that they were clearly steel making, coming within the Bessemer limit. For foundry use no selection, washing or preparation of any kind was necessary for the utilization of this ore.

During the 1860's and 1870's small privately owned furnaces operated at several points in Marion, Cass, and possibly other counties in east Texas. In 1883 the state of Texas went into the iron ore business by erecting at New Birmingham, near Rusk in Cherokee County, a furnace, known as "Old Alcalde," which was put in blast, February 27, 1884. It was rebuilt by the state in 1896 and enlarged to a capacity of 10,000 tons annually. It was operated until 1903 as a charcoal furnace, as had been all previous Texas furnaces, but in that year it was changed to a coke furnace and the capacity increased to 23,000 tons annually. The state also owned a cast-iron pipe factory in connection with the furnace. Both furnace and factory were operated for a number of years with convict labor in connection with the Rusk penitentiary.

The Star and Crescent furnace was built near Rusk in 1890 and 1891 by private individuals and operated for a number of years, but usually below its capacity of 18,000 tons of pig iron per year. The Tassie Bell furnace was completed at New Birmingham in 1890, having a capacity of 13,500 tons of pig iron annually. Both of these furnaces were of the charcoal type, the charcoal being supplied by large beehive ovens built near the furnaces. While the three Cherokee County furnaces were operating shortly before 1900 there was also a furnace at Jefferson. The total annual production for the four furnaces was 72,500 tons of pig iron. In addition to this material utilized in connection with the penitentiary system, large quantities of pig iron were sold to plants in Texas and throughout the west, notably to the car wheel foundries at Marshall and Houston. The production of this pig iron became unprofitable about 1909 when coke burning furnaces came into common use in place of the older charcoal burning type.\(^{13}\)

Prior to the present iron production, there was no production of pig iron in Texas after 1909, when the last of these furnaces closed down, although the Old Alcalde furnace was taken over by private interests and attempts were made to operate it as late as 1919.\(^{14}\) Today nothing remains

\(^{13}\) J. L. Clark, *A History of Texas*, p. 467.

of the once flourishing charcoal furnace industry, and New Birmingham is numbered among the "ghost towns."

Lead

Lead is found in a number of areas in Texas, but there has been only a small production and this comes from silver and copper mines to a large extent. The bulk of Texas production has come from the Shafter mine in Presidio County where the lead occurs associated with silver ore.

In the Llano uplift area there are a number of attractive prospects of sufficient promise to justify a thorough investigation. There are four distinct localities that are recommended, and which occur within sixty miles of each other. These are found in Burnet, Mason, and Llano counties. The lead is found in the form of sulphate galena.

Galena also occurs in the roof of a coal bed in Young County, and is disseminated in limestone and sulphate beds in Hardeman, Fisher, and Foard counties. Commonly, the Gulf Coast salt domes have small disseminations of galena and other sulphides but none of these are likely to approach anything of commercial value. The total amount of lead mined in the state prior to 1936 was less than 2,000 tons. The Pavitte mine in western Burnet County was in operation in 1930 and produced 58,000 pounds of ore, containing 66½ per cent lead. Lead production of Texas in 1943 was only 26,000 pounds, valued at $1,950, though it
had been 362,000 pounds, valued at $24,254, the preceding year.\textsuperscript{15} Stoppage of silver production, in association with which most of the Texas lead is produced, was responsible for this decline. It is doubtful that production of Texas lead, under normal conditions, will ever again equal that produced in 1942.

Manganese

Prior to World War II the United States imported almost all of the manganese used in its iron and steel industries. The war created a great need for manganese to be used in manufacture of United States war materials. It was learned that manganese could be extracted from the sea water at Freeport, Texas. The Dow Chemical Company, with aid from the Federal Government, invested $80,000,000 in a chemical plant to be used for this purpose. A plant was also erected at Austin to utilize a dolomitic limestone quarried in Burnet County.

These plants were built mainly to meet the very great increase in demand for metal magnesia in the making of airplanes and other military machines and materials. No official production figures on manganese were issued during the war, though it is known that the volume was very large. The Austin plant was not operating in 1945 and it was believed that the full capacity of the Freeport plant would

\textsuperscript{15} The Texas Almanac, 1945-1946, p. 249.
not be needed to meet postwar demands. However, the great stimulation to the utilization of magnesium as a result of processes discovered during the war apparently assures permanent existence of a large metal magnesium industry in Texas.16

There has been commercial production on a small scale at several points in Texas in recent years. One notable example is near O'Donnell, in the southern part of Lynn County. Production at these points will likely remain small when compared to that of the Freeport plant.

Mercury

Next to silver, the most consistently produced Texas metal has been mercury, which has come from the area around Terlingua on the west side of Los Chisos mountains in the lower part of Brewster County. An interesting story is told of the first discovery of cinnabar ore in this region. A mineralogist recognized the red cinnabar markings with which the cowboys of the region were accustomed to decorate their saddle ponies when riding into Alpine or Marathon.

The presence of this ore in the present Terlingua district, in Brewster County, was known as early as 1850, but real development began about 1896 near California mountain.17 The original settlement called Terlingua was at this place. The name was transferred to the present location farther

16Ibid. 17The Texas Almanac, 1936, p. 276.
east when the post office was moved about 1910. Then the first production campaign at California mountain came to an end. Estimates of the production of the Marfa and Mariposa Mining Company, the principal operator during this campaign, ranged from 17,000 to 30,000 flasks of quicksilver.18

The first discovery near the present locality of Terlingua was made about 1900 and the Chisos Mining Company began operations about 1902. This company has been in almost continuous operation ever since and at several times was the only one active in the district. A little work near the north end of Mariscal mountain was done in 1900 to 1902 by Ed Lindsey. Operations by two companies at Study Butte, near the east end of the district began in 1903 but did not last long.

For sometime after 1910 the Chisos Mining Company was almost the only operator in the area. About 1914 it began to stope a pipe-shaped ore body which proved to be the largest and richest in its history and continued to yield abundantly at least through 1918.19 The Rainbow mine was reopened nearby in 1916 and operated until 1919. A shaft was sunk approximately 624 feet but no ore was found. A new company reopened the Mariposa mine in 1916 and operated


19 Ibid.
until about 1920 with a probable production during this period of 8,000 flasks.

A new company reopened the Rainbow mine in 1927 and has been producing since 1929. Several other companies have been intermittently active in the area since 1925. This small area has yielded approximately one-fourth of the total quicksilver produced in the United States since 1900.

The unskilled labor for the early mines in this area was performed almost entirely by Mexicans who worked for approximately one dollar per day. Among the causes that have held back production in this area may be mentioned the remoteness of the district from adequate transportation facilities, adverse climatic and labor conditions, lack of capital on the part of a number of the owners of good properties, and uncertainties in respect to laws governing the occupation of mineral bearing land, with which was coupled litigation respecting land lines and titles. 20

The official figures of the United States Bureau of Mines for 1943 show Texas as having produced 1,796 flasks (or 76 pounds each), valued at $345,326. All of the Texas mercury in the state has been shipped to outside points to be utilized in industry. However, industrial development of Texas in the future may consume a considerable portion.

Silver

Texas has been a consistent producer of silver since 1880. In Trans-Pecos Texas, silver is the most widely spread of any of the commercially produced metals. It is found in some quantities with other metals in practically all of the areas from which ore shipments have been made except for the mines in the Terlingua mercury area. In 1942 Texas had produced more silver in terms of value than that of any other metal.

According to the University of Texas Bureau of Economic Geology, production of silver has come from five separate areas in Trans-Pecos Texas, namely, the Shafter district of Presidio County, the Van Horn-Allamore district and the Plata Verde mine area in Culberson and Hudspeth counties, the Quitman mountains of Hudspeth County, and Altuda mountains in northern Brewster County. Of these the Presidio mine of the Shafter district has yielded about nine-tenths of the total production.

The Presidio mine, the only extensively developed mine of the Shafter area, was operated from 1880 until September, 1942. The mine is credited with a production during this time of over 2,000,000 tons of ore from which 30,293,606 ounces of silver and small values in lead and gold were extracted. The workings extend over a length of 4,000 feet and to a depth of 1500 feet. Ores have been mined from the surface to as much as 600 feet in depth. Halting of
operations in the mine is attributed in part to difficult water levels and to a general reduction in the value of the ore.

The period immediately following the opening of the Presidio silver mine was filled with rumors and false reports of the discovery of new silver ores throughout the west. In the spring of 1885, the editor of the Taylor County News attempted to start a silver boom in the Abilene area, whether there was silver there or not. Some odd-colored rocks were brought into town by a Mr. Lee. The editor pronounced them silver, and gave the discovery large headlines in his paper. A silver company was immediately organized. In a crude way, mining operations began at once. Fame of Abilene's silver mine spread far and wide. Work went on furiously for a week. Experts were then brought in, but they found very little trace of silver. All mining activity ceased.

In December, 1885, a silver mine was reported as having been discovered in Stonewall County. Some traces of silver were found there. By 1892, two mining companies had begun operations. Interest in the mines continued for more than seven years. Some ore was shipped from these mines to the El Paso Smelter, but the project did not pay and the mines were abandoned.

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Several small mines in the Van Horn-Allamoor area of Hudspeth and Culberson counties have produced silver-bearing ores, and this district has yielded much of the silver not taken from the Presidio mine. The Hazel mine is the oldest and best developed mining property in this area and has been the main producer of silver and copper. Other small mines in the area that have produced silver-bearing ores are the Sancho, Panza, Black Shaft, and Pecos. The general occurrence of precious metals, especially silver, with base metal ores indicates that future silver production in Trans-Pecos Texas will correspond to a large extent with production of the base metals.
CHAPTER III

DEVELOPMENT OF NON-METALLIC MINERALS IN TEXAS

Texas possesses many non-metallic mineral resources that are proving to be of great commercial value. Helium occurs in the Amarillo area. In the salt dome fields of the Coastal Plain, common salt, gypsum, and other minerals occur in commercial quantities. In West Texas large deposits of salt and gypsum occur; commercial development of gypsum resources of the Permian has given rise to a considerable industry. In the southern area of the Permian Salt Basin great quantities of potash minerals are found.

Other mineral resources include the various quarrying, cement, brick, and tile raw materials which form the bases of important industries. Minerals of lesser general significance though of local importance, such as Fuller's Earth, glass sands, and asphalt rock are found in many areas. Road materials of various sorts are found well distributed over the state. Water, though commonly not thought of as a mineral resource, is one of the most important of the natural resources of the state; it is important, not only as
precipitation, but in the form of river waters for irrigation, and for municipal supplies.\(^1\)

**Carbon Black**

Carbon black is actually a mineral by-product of natural gas, but is usually classified under minerals. Because of the enormous consumption of natural gas its manufacture in Texas was prohibited until 1923, when the Thirty-Eighth Legislature passed a law permitting the use of natural gas for this purpose where waste residue gas was available. Administration of the law relating to production of carbon black is under one of the divisions of the Railroad Commission of Texas, and companies must obtain permits before operating.\(^2\)

In 1925 there were four carbon black plants operating in Breckenridge, Stephens County, producing three-fourths of the carbon black output of the state. A plant located at Pioneer, Eastland County, also was producing a considerable amount during the same period. By 1926 plants were operating at Eliasville, Stephens County, and at two locations in the new gas field of Hutchinson County.\(^3\) During the next twenty years new plants were added mainly in the new gas fields of the Panhandle, where the production of sour gas

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\(^1\)E. H. Johnson, *The Natural Regions of Texas*, p. 84.

\(^2\)The *Texas Almanac*, 1927, p. 245.

\(^3\)Minerals Yearbook Review of 1940, p. 1064.
was unusually high. In 1946 the forty-two carbon black plants were located in the following counties: Hutchinson 14; Moore 9; Gray 8; and one each in Carson, Terry, Gaines, Winkler, Ward, Nueces, Aransas, Brazoria, Harris, Montgomery, and Stephens. In 1927 56,000,000 pounds were produced in the state, while in 1943 the figure reached 407,345,000 pounds. Production in 1945 was 721,438,000 pounds, valued at $30,198,000. This was the highest production on record and about seventy per cent greater than prewar production. The wartime and postwar need for tires furnished the principal demand for the expanded production.

Cement

Portland cement is a substance when wet possesses the property of hardening under water. It is made by mixing together clay and lime stone in proper proportions which mixture is then ground and burned to a clinker in a kiln. The clinker, when cooled is pulverized and the powder constitutes Portland cement.

The production of this material on a commercial basis in Texas began in 1893. By 1903 plants in San Antonio, Austin, and Dallas were producing Portland cement. In 1912 there were four mills in operation. Two of those were located in Dallas, one in San Antonio, and one in El Paso. The Austin mill, mentioned above, had abandoned operations. In the early 1920's, in addition to the above two plants,
one in Fort Worth and one in Houston, began the production of cement. In 1940, there were two plants each at Dallas, Houston, and San Antonio, and one plant each at Fort Worth, Waco, and El Paso.

The gradual increase in the production of Portland cement is shown in the table below.

**TABLE 3**

**PORTLAND CEMENT PRODUCTION 1909-1924**

<table>
<thead>
<tr>
<th>Year</th>
<th>Production (bbls)</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1909</td>
<td>656,351</td>
<td>$808,997</td>
</tr>
<tr>
<td>1910</td>
<td>1,292,445</td>
<td>1,643,729</td>
</tr>
<tr>
<td>1911</td>
<td>1,700,000</td>
<td>1,785,000</td>
</tr>
<tr>
<td>1912</td>
<td>1,762,780</td>
<td>2,062,124</td>
</tr>
<tr>
<td>1913</td>
<td>2,108,737</td>
<td>2,606,063</td>
</tr>
<tr>
<td>1914</td>
<td>2,100,341</td>
<td>2,680,000</td>
</tr>
<tr>
<td>1915</td>
<td>1,939,363</td>
<td>2,500,000</td>
</tr>
<tr>
<td>1916</td>
<td>2,212,825</td>
<td>3,010,000</td>
</tr>
<tr>
<td>1917</td>
<td>2,358,944</td>
<td>3,661,328</td>
</tr>
<tr>
<td>1918</td>
<td>1,918,919</td>
<td>3,297,977</td>
</tr>
<tr>
<td>1919</td>
<td>2,318,747</td>
<td>4,220,977</td>
</tr>
<tr>
<td>1920</td>
<td>2,562,208</td>
<td>5,764,968</td>
</tr>
<tr>
<td>1921</td>
<td>2,668,741</td>
<td>6,171,405</td>
</tr>
<tr>
<td>1922</td>
<td>3,730,477</td>
<td>7,515,932</td>
</tr>
<tr>
<td>1923</td>
<td>4,178,000</td>
<td>8,011,220</td>
</tr>
<tr>
<td>1924</td>
<td>4,566,000</td>
<td>8,482,000</td>
</tr>
</tbody>
</table>

This production had increased in 1945, to 8,288,159 barrels, valued at $14,790,545 which was slightly less than the peak war production. The production of Portland cement is, in 1949, one of Texas' larger industries.

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Clay

Among the natural resources of Texas, probably no other single group of materials offers the attractive opportunities for commercial development as do the wide varieties of the clays that are found in the state. Substantial deposits are known rather well situated with respect to potential markets, and while no ball-clay is found in the state, some of the bontonitic clays have properties which would readily lend themselves to the same purposes, and in view of the enormous supplies of cheap fuel, the excellent transportation facilities, and the favorable climatic conditions providing a maximum of sunlight during the larger portion of the year, Texas undoubtedly has the principal requirements for an extensive ceramics industry.

There are two deposits of high-grade china clay known in the state. They are found in Jeff Davis and Real counties. In Jeff Davis County the clay has the disadvantage of being rather far from rail transportation. This clay is found associated with silicified lavas and volcanic ash beds in the contact zone of a granitic intrusion.

The Real County occurrence is near the town of Leaky. There are two deposits which are more favorably situated with respect to transportation than in the Jeff Davis County.

5R. N. Richardson, Texas the Lone Star State, p. 97.
6Kerr and Spellman, op. cit., p. 11.
7Ibid.
clay. They are found in cavities and fissure openings somewhat resembling sink holes and are composed entirely of silica, alumina, and combined water. The higher type of clay is estimated at 140,000 tons and is of unusual quality; the other clay is a fire clay and the supply is to the extent of several hundred thousand tons and somewhat sandy.

In Texas there are two occurrences of self-fluxing clay containing bontonitic minerals. One of these is in south Brazos County where there is a deposit of six feet of such clay which contains on an average of about 6.4 per cent of flux materials largely in the form of potash and phosphorus.\(^8\) In Polk County, a similar clay has been found to contain about eleven per cent of flux material. The Brazos County clay has small amounts of iron, lime, magnesia, and titania while the Polk County clay averages somewhat higher in iron and lime. Several excellent beds of china clay have recently been located near Plum, Fayette County.

Clay suitable for lower grade products such as tile, refractories and common brick are very widely distributed all over the state. Clay industries have been established in Wilson, Bexar, Medina, Bastrop, and Henderson counties. Some of the principal brick manufacturing towns in the state are Ferris in Ellis County, Thurber in Erath County, Mineral

\(^8\)Ibid.
Wells and Bennetts in Palo Pinto County, Elgin in Bastrop County, Abilene in Taylor County, and Coleman in Coleman County. Tile is manufactured in a large plant at Ginger in Rains County. Pipe and other construction material is made at Saspanco in Bexar County.

In 1911 the value of brick and tile produced in Texas was $2,527,502, the value of pottery was $132,417, fire clay was $5,786, and the total value of clay products was $2,669,399. In 1933 the clay products produced within the state were valued at something over one million dollars and in the fifty year period, preceding 1933, amounted to more than $125,000,000. In 1947 about a million tons of raw clay was being produced annually and the total value of clay products was about six million dollars per year.

Coal and Lignite

Coal was among the first of the many mineral resources of the state to attract the attention of the early settler. A map published in France in 1818 shows a coal mine located in east Texas. This means that in 1818 the east Texas brown coals were known and exploited. Production and use of coal began about 1850 as some published reports indicate. However, this early production was very small and strictly local.

9The Texas Almanac, 1914, p. 159.
Coals are usually formed by geologic processes out of the remains of plants. Thus, the nature and composition of a coal is determined to a large extent by the composition of the original raw materials and the duration and intensity of the geologic processes. Coals then are classified in a continuous series which begins with coals that were affected by geologic processes of short duration and low intensity only and ends with those that were affected for a long time and with high intensity. That series is roughly represented by the following classes of coal: peat, lignite, bituminous, anthracite, and graphite. Of these, lignite and bituminous are of commercial importance in Texas.

Lignite is found in a broad band stretching across Texas approximately from Laredo on the Rio Grande to Texarkana on the northeastern border. Considerable deposits of lignite are found in forty counties in this area. There has never been a thorough survey made upon which to base an accurate estimate of Texas coal and lignite resources, but from available data it is estimated that there are 60,000 square miles of lignite territory with a supply of probably 30,000,000,000 tons of commercially valuable lignite.\(^{10}\) The coal belt is spotty and more difficult to estimate, but it is believed that there are probably 8,000,000,000 tons available.

\(^{10}\)The Texas Almanac, 1945-1946, p. 246.
Bituminous coal in north-central Texas has been found in the following counties:

Archer Montague
Brown Palo Pinto
Coleman Parker
Eastland Stephens
Erath Wise
Jack Young
McCulloch

Until about 1920 there was a thriving coal mining industry in the above counties.\(^{11}\) The principal mine over a long period of time, beginning in the 1890's, was located at Thurber, Erath County, where the population of five or six thousand people was dependent largely on the industry. Strawn in Palo Pinto County, Bridgeport in Wise County, and Newcastle in Young County were all coal mining centers. There was for a considerable period an annual production of more than a million tons each of coal and lignite. It supplied an appreciable part of the Texas industrial needs of that day. With the discovery of an abundance of higher-grade fuels in oil and gas the coal and lignite mining industry declined. The Bridgeport mine was the last bituminous coal mine to cease operations in the state.\(^{12}\)

\(^{11}\) *The Texas Almanac*, 1941-1942, p. 234.

The future production of Texas coals depends on many economic factors. Coal as a fuel for home use likely has a very limited future. At present this field is served by natural gas wherever the market is concentrated in specific areas. These settlements will probably continue to be served by natural gas as long as this fuel is so abundant. This condition will continue to restrict the home fuel market considerably.

The most promising future outlet for the coals as fuel is in the industrial field and in the fuel supply of power plants in such areas where natural gas is not easily available, but where coals are conveniently located. The successful operation of the Trinidad power plant is an example of this sort. This 50,000-KW power plant burning pulverized lignite was completed and put in operation in 1926. Fuel was obtained from lignite deposits lying within a few miles of the plant. A similar plant was erected at New Braunfels at about the same time. Under the boilers of such plants, lignite became an economical fuel. The availability of a bountious supply of natural gas at economical rates caused the plants to change to gas burners about 1940. However, this experiment did prove that lignite can be utilized in power plants where gas is unavailable. Another probable future use of the coals is in conjunction with chemical extraction plants where the coals could be used not only as a fuel but as a raw material for chemical extraction. In the
early 1930's lignite mined about twelve miles southwest of Marshall, Harrison County, was being used by a plant in Marshall for the manufacture of activated carbon.

If in the future the production of petroleum and natural gas does not keep pace with the continuously rising demand for these products, then conditions for production of coals would change so much that a new era of economic exploitation of the coals might arise. Under such conditions coals might be produced again in quantities comparable to those taken from the ground in the years 1917 to 1920 when 1,200,000 tons were mined annually.

**Fuller's Earth and Bentonite**

In common usage these materials are often confused since they are largely used for the same purpose, and accordingly are often grouped together under the general classification of bleaching clays. Texas has a very wide variety of these materials ranging from clays that have been used extensively in bleaching vegetable oils to clays containing the usual bentonite minerals and which are used in bleaching mineral oils. This material is sometimes used with but often used without activation by acid treatment. Fuller's Earth is also suitable for many of the uses in the ceramic industry as ball clay.

The Fuller's Earth Company of Houston and the Commercial Pulverizing Company of Houston were pioneer companies in
producing Fuller's earth on a commercial scale. In 1912 these companies were active in Burleson and Fayette Counties. In 1930 the main production came from operations at Riverside in Walker County, where two large oil companies maintained their own pits and mills.

In 1922 Texas produced 12,285 tons of bleaching clays valued at $123,136; in 1927, 26,938 tons valued at $283,400; in 1932, 49,881 tons valued at $463,374; and in 1937, 49,500 tons valued at $473,408. This production came largely from Walker, Grimes, Burleson, Fayette, Washington, Gonzales, Karnes, Live Oak, Bexar, and Colorado counties.

Glass Sand

Sand of desirable chemical purity for use in manufacturing glass is a mineral of particular value and interest. The average price of $1.87 a ton for glass sand in 1942 exceeded the price of any other industrial sand.13 Glass sand is the major constituent in glass, forming from fifty-two to sixty-five per cent of the original mixture. High grade glass sands are over ninety-nine per cent silica (SiO₂).14 The highest grades are crushed, washed, dried, and screened

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before using. The most exacting and important specification is the purity of the material.

Texas has a variety of materials suitable for the manufacture of glass products including deposits of vein quartz in Llano, Mason, and Burnet counties suitable for making optical goods and other glass materials where essentially pure forms of silica are required.\textsuperscript{15} There are deposits of novaculite in Brewster County that are probably suitable for plate glass. Thus far no deposits of sandstone have been located in Texas suitable for higher types of glass products but there are sands that are entirely suitable for making bottles, jars, and colored glass. These sands are located in Montague, Grayson, Bexar, Wilson, Coleman, and Atascosa counties. In some cases in these counties the possibilities are unusually attractive in that immediately above the glass sand there is a high grade limestone that is very suitable for fluxing material. One such location is found in Montague County where these materials have the advantage of being located near rail transportation.

In 1911 there were four glass factories located in Texas—three at Wichita Falls and one at Texarkana. In recent years, the largest production has been from Santa Anna Mountain in Coleman County, but there also has been considerable production from Atascosa County. The principal consumption of

\textsuperscript{15} Kerr and Spellman, \textit{op. cit.}, p. 3.
glass sand in Texas, at the present time is by a large glass industry at Waco which manufactures glass containers and other glass products. There is a large glass plant at Three Rivers, Live Oak County, but it has not operated full time in recent years. At one time a small glass bottle factory operated at the site of the Santa Anna deposit, but in recent years production from this point has been shipped to Waco. While there is a large supply of glass sand in Texas, the chief advantage to the industry is the abundance of cheap natural gas.

Granite

True granite and other igneous rock which are classed commercially as granites occur extensively in the central mineral area in Llano, Mason, Burnet, and Gillespie counties. Some of them have been quarried, but they are not developed to anything approaching their full possibilities.16

This stone varies widely in color and occurs in beds of sufficient size to justify large scale quarrying. Much of the better material is located rather far from railroad points, but Texas holds forth a wonderful opportunity to stone industries with the capital, experience, and training to utilize these materials that are within reach of more populated areas. Stone in the remote sections must await a

shift in populated areas and an extension of transportation facilities.

The development of this building and ornamental stone has been hindered by the fact that until recently the local market for building materials has been inclined to use lumber which formerly was abundant close to the more populous areas of the state. There are a number of quarries now in operation in the state, but of those only three do so continuously.\textsuperscript{17} Limestone is quarried and dressed at Austin and Lueders. Marble is produced at Marble Falls. At intervals, granite quarries are operated near Llano. Whereas, the larger cities are located in areas where lumber was formerly abundant nearby, they are unfortunately situated with respect to the best building stones.

One of the earliest and largest quarries in the state is the one on Granite Mountain at Marble Fall, Burnet County. This quarry was opened by The Texas Pink Granite Company in 1883 to procure stone for the State Capitol. During the first fifty years of activity, this company produced approximately four million tons of granite. By 1900 several smaller quarries had been opened in Burnet, Llano, and Gillespie counties. The largest volume of this stone has been used in jetty construction at Sabine Pass, Galveston, Freeport, Aransas Pass, and Port Isabel. Rock used in this

\textsuperscript{17}Kerr and Spellman, \textit{op. cit.}, p. 2.
manner is mostly to prevent erosion of the jetties. This granite is very resistant to the action of sea water.

This stone has also been used in the construction of many buildings in Texas as well as throughout the United States. In addition to the state Capitol building, several court houses of Texas are constructed entirely, or in part, of this stone. Many of the hotels, office buildings, and passenger stations of the larger cities of Texas have polished base courses, platforms and steps of this stone. An example of this is the Post Office building at Austin. This rock has been used extensively outside Texas. It was used in New York City to construct the east and Whitney wings of the museum of Natural History, the Grand Central Terminal Building, and a number of banks, schools, and office buildings. In Los Angeles, California, it was used to erect the Los Angeles Times building. In Seattle, Washington, the Life Insurance building was erected of this stone. A number of smaller buildings throughout the United States have used this material.

A considerable volume is used in the construction of memorials, monuments, and mausoleums, especially where large sized blocks are needed. This material has been shipped to several points outside the United States. An example of this is the Leif Erickson Memorial, comprising a large
sculptured block, which was recently shipped to Reyjivik, Iceland.¹⁸

Guano

Heavy deposits of bat guano are found in the caves of central and southwest Texas. [It is estimated that in 1926 some caves contained as much as 2,000 tons of guano. One of the most notable caves lies in the northwest part of Burnet County.] In the caves of Blanco, Comal, Gillespie, Hays, Llano, Shelby, Austin, Uvalde, and Williamson counties other deposits have been found. It is quite valuable as a fertilizer, ranking second only to peruvian guano.

Gypsum

Gypsum when pure contains 20.9 per cent by weight of water and 79.1 per cent of calcium sulphate. Its specific gravity is 2.3. When free from moisture it weighs approximately 150 pounds per cubic foot. This material is used in the manufacture of plaster of Paris, hard wall plasters, and cold water paints. In northwest Texas this mineral occurs in the form of rock gypsum, calcabaster, and gypsite or gypsum earth. The gypsum earth is the particular form of gypsum most commonly used in Texas. Hard wall plaster and plaster of Paris are manufactured from it. In 1912 gypsum mills

were operating at Quanah and Acme in Hardeman County and at
Hamlin in Jones County.

In 1929, the value of gypsum produced in Texas amounted
to $3,440,000; in 1930 the value of the gypsum produced in
the state was $3,521,000 and in 1931 the value had fallen
to $2,120,000.\textsuperscript{19} The depression had a great influence on
the decline in the total value of Texas minerals for the
ten year period beginning in 1929. Although Texas is one of
the largest producers of gypsum products in the United States,
the value in 1933 had fallen to $1,058,569. The five plants
operating in the state in 1936 were located at Sweetwater,
Nolan County; Quanah, Hardeman County; Hamlin, Jones County;
and Rotan and Roby in Fisher County.

The Texas gypsum beds are found as deposits of rock and
dirt gypsum of gypsite in the Permian Basin of west Texas,
in the Gulf Coast salt domes, and as a solid mass of sele-
nite in Brewster County. Although many thousands of tons
of gypsum have been mined in Texas, the supply has not been
appreciably diminished. The beds in the Permian Basin ex-
tend from Nolan County to Red River northwest of Wichita
County to Red River northwest of Wichita Falls. In this
area beds of both gypsum and rock gypsum are found close to-
gether. The gypsum in the salt domes lies above thick beds

\textsuperscript{19}\textsuperscript{19}E. H. Johnson, \textit{The Basis of the Commercial and Industrial Development in Texas}, p. 108.
of anhydrite which in turn are above salt. It is of the rock type and must be mined rather than quarried.

Helium

Helium is one of the chemical elements. Its symbol is He., possessing ninety-two per cent of the buoyancy of hydrogen, the lightest known gas. The element was discovered in 1868 and verified in 1895. This discovery, conversion to useable form, and research into the possibilities of helium provide one of the most romantic stories of our time.²⁰ It is of interest to every American because it is now used in the inflation of balloons and dirigibles, and provides the nation with an effective war weapon. It is inflammable and will not unite with oxygen or any other element.

Before World War I it cost from $2,000 to $3,000 per cubic foot, because no practical method of extracting it from the natural gas where it is found had yet been discovered.²¹ During this war the lighter-than-air craft used the highly explosive hydrogen and a search was begun for a non-inflammable gas. Helium was suggested by scientist, but the practicability of extracting it from the known sources could not be demonstrated. It was found to occur in small quantities in natural gas wells in Kansas, and a search

²⁰Kerr and Spellman, op. cit., p. 4.
was begun for gas reserves high enough in helium to make its recovery practical.

In 1917 the Federal government built a helium plant at Petrolia, Clay County, Texas. Natural gas containing helium, had been discovered there as early as 1902. This was the first field discovered and the first plant ever operated in the United States. In 1920 this plant was moved to Fort Worth, Texas, where it continued to extract the helium from the natural gas piped there through a specially constructed line from the Clay County field.\(^{22}\) This Fort Worth plant operated until 1929 when, because of the decline in gas pressure from Petrolia, and because no other supplies of suitable gas could be obtained nearby, it was abandoned.

After testing over three thousand samples of natural gas, it was found that a large undeveloped field near Amarillo contained about 1.8 per cent of helium. The Federal government acquired 50,000 acres on this gas structure and built a second plant there in 1927.

Approximately 48,000,000 cubic feet of helium were produced at Fort Worth, and up to March 1, 1935, a total of more than 66,000,000 feet were produced at Amarillo. The gas is shipped in special tank cars and containers to various army and navy air bases. Because of the unique

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value of helium for military purposes and the reduced cost to three cents per cubic foot, the Federal government since 1925 has developed a conservative program to prevent waste and conserve available supplies.\textsuperscript{23}

Because of the vital importance of helium as a war material, production figures have not been released since 1940, when the production for that year was 9,450,855 cubic feet, valued at $85,061. At that time practically the entire United States production was at the Amarillo plant. In 1944, a total of 2,187,205 cubic feet went to commercial distributors from the United States Bureau of Mines as against 1,059,655 cubic feet in 1943. This indicates a growing use of helium in welding magnesium and other industrial uses, medical uses in hospitals, and use in laboratories for physics and chemistry experimentation. Since early in 1945, in addition to the Amarillo plant, four other helium plants have been put into operation in the United States. They are located at Exell, Texas, Cunningham and Otis, Kansas, and Shiprock, New Mexico.

Limestone

Good limestone is fairly abundantly distributed over an area comprising about two-fifths of Texas.\textsuperscript{24} Some of it

\textsuperscript{23}The World Book, op. cit.
\textsuperscript{24}N. F. Drake, "Report on the Colorado Coal Field of Texas," University of Texas, Bulletin No. 1752, 1917, p. 74.
is suitable for building stone, the best being to the central and western parts of the state. There are important limestone quarries in Wise, McLennan, Williamson, Travis, Callahan, Jack, and Runnels counties. In many other places limestone is quarried for local use, Many of the limestones are suitable for burning to make lime, which is important in the manufacture of Portland cement.

The largest body of asphaltic limestone in the world is located in south Texas and extends from the western boundary of Bexar County to Kinney County, a distance of nearly one hundred miles. It has filled the open spaces with a soft porous limestone which can be crushed, heated and used without further processing for highly satisfactory pavements. On an average this rock contains about ten per cent asphalt and the workable beds range in thickness from ten to fifty feet.

Limestone has a greater variety of uses than any other metallic or non-metallic mineral substance. The main uses of limestone are:

Riprap
Crushed stone (for roads, railroads, ballast, etc.)
Fluxing stone
Glass manufacture
Paper
Agriculture lime
Alkali manufacture
Calcium carbide manufacture
Carbonic acid
Coal-mine dusting (to prevent explosions)
Fertilizer filler
Sewage filter beds
Mineral food
Poultry grit
Road base
Roofing gravel
Stucco, terrazzo, and artificial stone
Portland cement
Lime

Marble

Marble of exceptional quality and great variety of color is found in Texas, mainly in the two great mineral belts, the Central Mineral region and in the mountains of Brewster and Presidio counties. Prior to 1925 there was no commercial production of marble except on a limited scale. Many Texas marbles are of satisfactory crushing strength and of great beauty, but in some instances it is said that the capacity for absorption of water is too high to make this stone suitable for outside building purposes.

Since 1925 there has been rapid development of marble quarrying in the Burnet-Llano area. During 1926 a power transmission line was built into this territory partly for the purpose of furnishing power to marble works. In 1945 quarries existed in Burnet, Llano, Mason, San Saba, Hudspeth, and Brewster counties. In this year Texas produced 7,000 tons valued at $90,000.

Mica

In the border area of Culberson and Hudspeth counties, a small area of pegmatic and enclosing metamorphic rocks is

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exposed in the Van Horn mountains. The locality known as the Mica Mine is about six miles from the loading station of Mica on the Southern Pacific Railroad. The pegmatic area was discovered about 1895, but no attempts at development were made until approximately 1915. In this vicinity clusters of mica books occur scattered at intervals through otherwise barren rocks.

In 1942 development at this locality was being done by Texas Mica and Feldspar Company under the direction of P. S. Hoyt. The property of this company consisted of 1280 acres of land in the form of a rectangle. Approximately fifty quarries, many of them small, were located within this area. This company produces high grade feldspar, scrap mica, and quartz. A small pilot mill having a capacity of about fifty tons per day was erected and in 1945 was continuing in operation.

Mica is utilized for electrical insulation purposes and in heavy duty spark plugs. Clear, transparent sheets are used for windows in ovens, kilns, stoves, lamp chimneys, lenses of goggles, helmets, gas masks, and for glazes and ornamental purposes. Ground mica is used as a coating and filler material, in paints, wall paper, stucco, concrete, asphalt roofing, and Christmas tree "snow." It is sometimes used as a lubricant and in munitions.

Mineral Water

There are many mineral springs and wells in Texas. The production and sale of this water is an important industry. The water is sold in bottles and other larger containers for the attraction of tourists and health seekers. This business began development about 1900. Table 4 gives summary of early production over an eight year period.

TABLE 4
MINERAL WATER PRODUCTION 1904-1911

<table>
<thead>
<tr>
<th>Year</th>
<th>No. Of Springs</th>
<th>Gallons</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1904</td>
<td>14</td>
<td>1,142,500</td>
<td>$ 64,923</td>
</tr>
<tr>
<td>1905</td>
<td>28</td>
<td>1,526,970</td>
<td>144,421</td>
</tr>
<tr>
<td>1906</td>
<td>28</td>
<td>1,045,315</td>
<td>122,085</td>
</tr>
<tr>
<td>1907</td>
<td>23</td>
<td>1,146,279</td>
<td>152,233</td>
</tr>
<tr>
<td>1908</td>
<td>36</td>
<td>1,586,634</td>
<td>151,032</td>
</tr>
<tr>
<td>1909</td>
<td>34</td>
<td>1,033,476</td>
<td>98,499</td>
</tr>
<tr>
<td>1910</td>
<td>31</td>
<td>1,241,248</td>
<td>128,549</td>
</tr>
<tr>
<td>1911</td>
<td>40</td>
<td>1,637,932</td>
<td>158,367</td>
</tr>
</tbody>
</table>

In 1914 resorts were located at twenty of the above springs, accommodating nearly 25,000 patrons, and the water at eighteen of the springs was reported as being used for bathing. (The two best known of the resorts are, Mineral Wells, Palo Pinto County, and Marlin, Falls County.)
The town of Mineral Wells became famous for its waters early in the twentieth century. From June 1, 1902, to June 1, 1903, the railroad handled 45,000 tickets to Mineral Wells. The great majority of these people came to visit the wells. By 1940 this city had become one of the South's leading health resorts. Curative qualities of its mineral water have a national reputation and attract 200,000 tourists annually.

Marlin became known for its mineral water at approximately the same time as Mineral Wells. In 1902 this city boasted of having the deepest and hottest artesian well of mineral water in the world. With a depth of 3350 feet, it flowed 200,000 gallons of water daily at a temperature of 147 degrees Fahrenheit. In 1940 this city was attracting 150,000 tourists annually.

In 1949 mineral wells were located in Lampasas, Brown, Hill, Cass, Bexar, Bowie, Brewster, Burnet, Callahan, Dallas, Denton, Eastland, El Paso, Ellis, Falls, Galveston, Grayson, Gregg, Harrison, Hopkins, Hunt, Kaufman, Lamar, Lavaca, Nacogdoches, Smith, Titus, Tom Green, Travis, Williamson, and Wilson counties. Many of these have never been developed on a commercial scale.

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27 *The Texas Almanac*, 1904, p. 341.

Natural Gas

Gas was first produced and consumed in Texas at Corsicana. This was in 1901. Marshall was using gas a short time later. Production was from local fields. The first long pipeline was built in 1910 connecting the Petrolia field in Clay County with Fort Worth. During the next fifteen years, natural gas was made available to all the principal consuming centers of Texas.

In 1926 a pipeline was constructed connecting the Texas Panhandle with Denver, Colorado. By 1934, pipelines had been laid to carry Texas natural gas to practically all the larger cities of the upper Mississippi and Ohio valleys. The depression caused a halt in pipeline building. Shortage of gas in many industrial centers created a new need for pipelines during World War II. During 1944 a total of 3,012 miles of natural gas pipelines was constructed in the United States.\(^2\) The largest of these was a 1,265 mile, twenty-four inch diameter line connecting Corpus Christi, Texas to Cornwell, West Virginia.

Natural gas in some quantity is produced in every principal region of Texas. About forty-three per cent of the state's total production is from the coastal belt, thirty-five per cent from the Panhandle, thirteen per cent from east Texas, and the remaining nine per cent is scattered

widely throughout central, north central, west, and southwest Texas.

In 1944, the Federal Petroleum Administration for War estimated that 52.2 per cent of the natural gas reserves of the United States were in Texas. The value of natural gas production varies according to the basis upon which it is made. Average Texas value at points of consumption, in 1945, was 14.8 cents a thousand cubic feet, indicating a total value of about $253,000,000, according to the United States Bureau of Mines. Many economic factors influence the price of gas at the well; therefore causing the price to vary greatly among the states.

Some of the many uses that are being made of natural gas are:

Technologic research has shown that natural gas is the greatest source of synthetics. Synthetic rubber, plastic substitutes for rubber and silk; ammonia, glycerin, toluene, and nitroparaffins for use in explosives; chemical products for use in antiknock fuels and additives in aviation gasoline manufacture are some of the new uses, according to a report of the Bureau of Mines early in 1947.30

Potash

Geologists for many years suspected the existence of potash deposits from the potash salts found in the shallow lakes of the Great Plains area, and in 1909 a boring near Spur, Dickens County, confirmed the existence of the mineral in the

30 Ibid.
lower Permian strata. However little was known of the extent of the deposit until extensive drilling for oil in West Texas brought to the surface numerous evidences.

The acute situation created in this country during World War I, because of the cutting off of the supply of potash from Germany, intensified interest in the possibility of developing an American source of supply. It was decided at the time that development of commercial production from any definitely known area would be prohibitive except under war time market conditions, but notice was taken of the Texas area, to which attention had been called by the researches of the Bureau of Economic Geology at the University of Texas. Work done by this Bureau and by geologists of the Texas University Land Survey have indicated that polyhalite may occur in commercial quantities in Crane and Upton counties. Another area of promise is in northern Crockett County where an oil well found about twenty feet of polyhalite analyzing 10.9 per cent potassium oxide.\(^{31}\) Ector, Glasscock, Irion, Midland, Upton, and Pecos counties all have possibilities of potash beds that may prove of profit commercially.

The pioneer researches of the late J. A. Udden of the University of Texas brought to the attention of the United States Geological Survey the possibilities of the occurrence

\(^{31}\text{Kerr and Spellman, op. cit., p. 8.}\)
of potash minerals in commercial quantities in the Permian Basin country of west Texas. In June 1926 the Federal government authorized a five year program of potash exploration and granted the sum of $500,000 to carry out this program. This plan resulted in the drilling of twenty-four holes in southeastern New Mexico and adjacent areas in west Texas. This exploration proved the existence of extensive beds of polyhalite, which is a complex sulphate of potash, lime, and magnesia.

About 1932 a company sank two core tests in the southwestern part of Midland County, discovering thick strata of polyhalite at several levels. Several years of research by E. P. Schoch, chemistry professor at the University of Texas, developed processes in 1930 for utilizing polyhalite for commercial production. However, no actual development has been effected.

In the meantime, the development of potash resources in New Mexico has been underway since 1926. In that area the better known forms of potash compounds are mined. Reliable authorities believe that this development will eventually extend across the state line into adjacent Texas areas.

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Salt

Salt was first discovered in Texas in Shackelford County in 1861. W. H. Ledbetter took up the matter of manufacturing salt on a commercial scale. \(^{34}\) Between 1862, and 1866, the Ledbetter Salt Works turned out several tons of salt a month. This production was partially consumed by the Confederate Army. However, a considerable amount was sold to cattlemen and merchants throughout the western part of the state. The company discontinued operations at the end of the war. In 1879 an attempt was made to operate the plant again. By 1881 competition and lack of railroad facilities made further operations impracticable, and the works were abandoned.

In the early 1880's salt was discovered at Colorado City. A vein of solid salt rock eighty feet thick was struck while drillers were boring for artesian water. A company was organized in 1885 to work the salt. A second deposit was found in 1889, and a company was organized to work it. The two companies continued to operate until about 1914 when competition drove them out of business. Since 1890, a number of extensive salt deposits have been found in various parts of west Texas, but no attempt has been made to work them commercially.

Grand Saline, Van Zandt County, has been the center of salt production in Texas since about 1870. The production,

from the three plants located there in 1903, was approximately 1500 barrels daily. Five hundred thousand dollars was spent in sinking a new shaft and erecting new structures there in 1930.\textsuperscript{35} As a result, this production increased to more than 6,000 car loads in 1935. The development of the salt industry in the state during the period 1892 to 1945 is shown in the table below.

\begin{table}[h]
\centering
\caption{SALT PRODUCTION 1892-1945}
\begin{tabular}{|c|c|c|}
\hline
Year & Production & Value \\
\hline
1892 & 121,250 Barrels & $99,550 \\
1895 & 125,000 " & 55,000 \\
1898 & 254,284 " & 119,700 \\
1901 & 330,000 " & 140,000 \\
1904 & 376,695 " & 149,246 \\
1907 & 356,086 " & 226,540 \\
1910 & 382,164 " & 272,568 \\
1913 & 355,529 " & 278,008 \\
1916 & 75,762 Tons & 427,119 \\
1920 & 91,103 " & 667,835 \\
1931 & 103,040 " & 468,562 \\
1934 & 208,979 " & 612,586 \\
1937 & 364,780 " & 623,037 \\
1945 & 1,100,791 " & 3,490,820 \\
\hline
\end{tabular}
\end{table}

The major portion of the above production through the entire period came from the mine and wells at Grand Saline. Anderson, Harris, and Duval counties also made considerable contributions to this production.

\textsuperscript{35}The Texas Almanac, 1931, p. 195.
CHAPTER IV

RECENT DEVELOPMENT OF TEXAS IRON ORE

The early history of the development of the iron ore industry in Texas has been treated in a previous chapter, page 18, of this study. The Old Alcalde furnace had been taken over by private interests and attempts were made to operate the plant as late as 1919, but no pig iron was produced on a commercial scale in the state after 1909.¹

The urgent need of iron ore for war needs caused the Federal government to become interested in the east Texas iron ore areas in the early 1940's. After a thorough investigation and survey of the area, the government constructed three plants for the utilization of east Texas iron ore in filling war needs. These plants were located at Rusk, Houston, and Daingerfield.

The Rusk Plant

One of the earlier attempts on the part of the government to utilize a new source of raw material, in the form of iron ore, was to construct a blast furnace and sintering plant at Rusk, Cherokee County, near the site of former New Birmingham. This plant, constructed in the early 1940's,


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turned out a considerable volume of pig iron from the east Texas ore during the emergency period. The plant was constructed with an allotment of $2,379,000 by the Federal Defense Corporation which removed a charcoal blast furnace and sintering plant from Pembroke, Florida, and a carbonizing and charcoal by-products plant from Wells, Michigan. Capacity of the plant was 100 tons of pig iron plus charcoal, glacial acetic acid, methanol, sintered iron ore, and blast furnace slag for mineral wool. This plant ceased activity shortly after the end of the war and was not in operation in 1949.

Sheffield Steel Corporation

The sprawling plant of the Sheffield Steel Corporation on Houston's ship channel, which in 1949 is producing 50,000 tons of steel each month, is the first major attempt to utilize the east Texas iron ore in post war industry. Conceived as a peace time industry to supply a portion of the tremendous demand for steel in Texas, the plant was completed just in time to begin producing ship plates and shell forging early in World War II. This company surveyed the Houston and Gulf Coast region in 1939 with a view of building a steel mill to operate principally on scrap iron.


In 1940, a six hundred acre plot was purchased on the ship channel. In 1941 the plant was under construction and began operation in 1942. By 1944, Sheffield was operating five open-hearth furnaces, three owned by Sheffield and two, as well as other facilities, under lease from the government.

For double safety, Sheffield leased 245 acres of iron ore property at Jacksonville and sixty-four acres at Linden, about 150 miles from the Daingerfield iron ore properties of the Lone Star Steel Company. Sheffield's peak production during the war was 500,000 tons, with Texas pig iron from the blast furnace accounting for about fifty per cent of the melt. In 1946 the company spent $2,500,000 for additional facilities at its plant on the ship channel at Houston in order to add barbed wire, road mesh, and other wire products to its then present line of nails, wire structural, reinforcing steel bars, and plate steel. In July, 1947, this plant turned out the first peace time production of Texas pig iron produced on a major scale from a modern blast furnace in the history of the state.

In 1949, after almost four years of peace time operation, the plant is larger and busier than ever. Sheffield's steel production for peace is one of the leading industries in the state, employing more than 3,500 persons. The more than

50,000 tons of steel per month it produces is well in excess of its wartime peak.

Since the end of the war Sheffield has purchased outright the government open-hearths, and acquired through long lease or purchase other government facilities, including the blast furnace. Reconversion to peace time operation is complete. In February 1948, the busy plant on the 600 acre ship channel site was the only fully integrated steel mill between the Rocky Mountains and the Mississippi River and between the Gulf of Mexico and the Canadian Border. The Houston plant and other Sheffield plants at Kansas City, Missouri, and Sand Springs, Oklahoma, constitute the entire steel industry of the Southwest, since Lone Star Steel Company at Daingerfield produces only pig iron.

Adding economic importance to the Sheffield operation from the Texas standpoint, is the fact that the Houston Sheffield Mill for the first time in the state's history is carrying on a completely integrated operation, starting with Texas iron ore and producing at the end of the manufacturing process in a single plant, such finished steel products as reinforcing rods, wire mesh, and nails. W. E. Leo, district manager, Dallas, Texas, emphasized in a personal interview with the writer that the Houston plant is not a "war baby". It was planned in peacetime for peacetime operation. It is now valued at $65,000,000 and has been very

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influential in an ever increasing utilization of Texas minerals, as coke is the only non-Texan raw material that goes into the manufacture of Sheffield steel.

The importance of steel and allied products received major stress in the 1949 Centennial Show at Fort Worth. A dramatic display by Sheffield Steel traced the manufacture of steel from raw materials to the finished product to emphasize the company's use of Texas minerals.

Termed a "Tree of Steel", the exhibit measured sixteen feet in length and was eight feet high. The mammoth tree, painted in attractive colors, dominated the exhibit. The trunk of the tree had been cut out, forming a series of transparent windows in which the progressive steps taken in the manufacture of steel and finished products were shown.

The roots of Sheffield's "Tree of Steel" were used to show samples of Texas minerals, basis of the company's large Houston operation which obtains iron ore from large Texas deposits at Linden and Jacksonville, and limestone from central Texas. An ingot occupied the next window of the tree, and other window displays showed billets, rounds, structural bars, reinforcing bars, and other heavy products manufactured at the Houston plant. Branches of the trees were used to show finished products, such as wire, nails, and fence, which are fabricated by Sheffield Steel Corporation from Texas minerals.
The Lone Star Steel Company

After extensive surveys of the availability of iron ore in Morris County, the third east Texas plant was located at Daingerfield. This war-born, government-built plant has now passed into private hands and taken a position among successful enterprises.

For decades the immense iron ore deposits in the vicinity had beckoned, but it was not until April of 1942 that the company was formed actually to utilize the ore in the manufacture of pig iron and steel. Lone Star Steel Company, like other government financed and build undertakings, was constructed due to the proximity of highly marketable natural resources. However, the operation of this plant was a "community undertaking".

The people's part in this great undertaking is well described in Time Magazine as follows:

In Daingerfield, Texas (population 1,700), the townspeople were as excited as if a 10,000 barrel gusher had just blown in. But this time the excitement was not over oil. It was over steel—the $24,000,000 Lone Star Steel Company blast furnace and plant which the government had built during the war right next to the Texas vast iron ore deposits. It was the first—and only—blast furnace in Texas. Texans thought then that their fondest industrial dream of a native steel industry would come true. But at War's end, Lone Star was closed. If Texas wanted a steel industry, Texas would have to take over Lone Star from WAA.

While they discussed ways and means, they got bad news. U. S. Steel made a bid for the government-owned

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Oklahoma mines, which supplied coal to Lone Star (there was no suitable coal in Texas). If Big Steel, which wanted the coal for its Sheffield fabricating plant in Houston got the mines, Lone Star was done for. Was Big Steel bigger than Texas?

One Texan who didn't think so was Dallas' yippy yeasty J. W. Carpenter. . . . In 1942, it took him just one month to organize the company which had operated Lone Star for the government . . .

Already they had an option to buy Lone Star for $7,500,000 (with no initial down payment), and three of the Oklahoma mines. But WAA insisted on additional operating capital of $1,000,000 to be raised within ten days. So Carpenter and friends organized a financial posse, struck out for the red clay hills around Daingerfield. At crossroads gatherings and town rallies, they sold thousands of shares of stock. . . . In all Carpenter says they have raised close to $1,500,000, got a promise from RFC to lend them an equivalent amount when the money has been spent.

The Federal government through the Defense Plant Corporation, spent about $30,000,000 beginning in 1942, for the facilities deeded to Lone Star for $6,300,000 in July, 1948. Replacement value, as estimated by outside engineers in 1949, was $53,000,000.

Lone Star's principal assets consist of approximately 32,070 acres of nearby owned and controlled iron ore land, an ore beneficiation plant, a battery of seventy-eight Kopper coke ovens, a twenty-seven foot blast furnace, three hot blast stoves, having a rated capacity of 356,600 gross tons of pig iron per year, three coal mines for coking coal near McAlister, Oklahoma (approximately 220 miles from Lone Star), the power plant, railroad, and numerous appurtenances. 7

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7"Texas Comes of Age," Time, September 29, 1945, pp.27-8.
The blast furnace produces high silicon foundry iron and the capacity for this production is 1850 gross tons per day or 283,000 gross tons on an average yearly basis.

Employees number over 1,000 including the small general office in Dallas. In addition there are over 400 coal miners in the mines near McAlister. The production of coke and by-products has been continuous since June, 1947; the blast furnace was blown in on October 25 of that year and has operated continuously except for a few weeks in the fall of 1948, when it was closed for the installation of a new hearth lining. Production per day, early in 1949, was averaging 850 gross tons of foundry pig iron and 1,100 tons of coke. In addition there is a monthly average output of by-products as follows: ammonium sulphate, 500 tons; coal tar, 300,000 gallons; toluol, 23,000 gallons; benzol, 90,000 gallons; and xylol, 5,000 gallons.

Most of the ore lands are within a twelve mile radius of the Lone Star plant. Ore being used in 1948 was from an open pit about twenty acres in area.\(^9\)

That Lone Star's pig iron is of high quality has been substantiated by testimonials from outstanding metallurgists of the Chicago, Detroit, and Birmingham areas.

Two metallurgists expressed this viewpoint while visiting the plant early in 1948. William Redhead, an executive

\(^9\)Lone Star News, July 1, 1948.
of the Cleveland Malleable Casting Company, Cleveland, Ohio, is one of the outstanding metallurgists in the United States, and his company produces exceptional high quality alloyed castings.

He stated that he came to learn just what the company was doing to be able to make such high quality pig iron. That by using Lone Star pig iron his company was able to reduce finished castings loss to approximately two per cent, where as in the past this loss has amounted to as high as fourteen per cent. 10

The other visitor was E. R. Erchler, an executive and metallurgist of the Chicago Alloys Company, Chicago, which sells alloys used in connection with production of castings in the automotive industry in Detroit, Chicago, and elsewhere.

He said that he was particularly eager to obtain a first-hand picture of the Lone Star operation because many of his automotive accounts have had such unusual good results with Lone Star pig iron. He stated that the foundry men had found the iron far superior to any iron they have been able to obtain from the famous lake ores. In addition, he said that the use of Lone Star pig iron enabled the production of castings without the use of large quantities of alloys, such as manganese, silicon, vanadium, chrome, etc. This saves money as a result of reduction in finished casting losses. 11

Officials of Ford Motor Company in 1948 expressed the opinion that Lone Star pig iron was the best pig iron they had ever used, including the pig iron they produced in their own blast furnaces.

In 1949, Lone Star Steel Company requested a loan of $74,000,000 from the Reconstruction Finance Corporation.

10 Ibid. 11 Ibid.
This loan was refused, though RFC expressed willingness to make a loan of fifty per cent of the request, if Lone Star could raise the rest privately.

F. G. Stark, veteran steel man who is Lone Star's blast furnace superintendent, estimated that sufficient ore to feed the yawning mouth of Lone Star's blast furnace, "The Flossie Bell", for 100 years, lies within a few miles of the plant. So plentiful is the ore in this area that no mining has been done where more than seven feet of earth had to be removed to reach the ore. Linonite and siderite, the two ores used by Lone Star, are found throughout the area in veins up to sixty feet in thickness.

The first iron was poured from the furnace in Daingerfield in November 1947. Production has averaged between 800 and 900 tons per day since then, and for December 1948, it was 903 tons daily. A report in January 1949 quoted the current average price at $72 per ton despite substantial tonnage sold under contracts for a much lower price.

For those who like big figures, Lone Star has produced: 546,000 tons of coke from July, 1947, through December, 1948; 261,544 tons of pig iron through December, 1948; 15,300,000 pounds of ammonium sulphate, 1,100,000 gallons of benzol, 98,000 gallons of light oil, 108,000 gallons of

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motor fuels, 4426,000 gallons of coal tar, 229,000 gallons toluol, and 71,000 gallons of xylol from July 1947 through November 1948.\textsuperscript{13}

It is the beneficiation plant which has made possible the use of low grade East Texas iron ore. This ore as it comes from the rolling hill land is about thirty per cent iron; three tons of raw ore go into the beneficiation plant to turn out one ton of usable ore, and the usable ore will run from forty to forty-eight per cent iron, depending on the refinery processes it has undergone.

The blast furnace is a huge, brick lined steel tower resembling in shape the chimney of an old-fashioned kerosene lamp. Two "skip buckets" run on inclined rails to the top of the furnace, carrying a total of 38,000 tons of ore, stone, coke, and manganese every twenty-four hours. Air which has been heated to 1,200 degrees Fahrenheit in the blast furnace stoves is blown into the furnace through tiny openings near the bottom.

More than half of the outstanding 1,098,717 shares of nopar common stock of the company are owned by residents of Dallas; the remainder is owned mostly by people in various other towns in north and east Texas.\textsuperscript{14} Successful and profitable production of iron from east Texas is reflected

\textsuperscript{13}Shreveport Times, February 13, 1949.

\textsuperscript{14}Harland Mayes, "Lone Star Steel moves Forward," The Investment Dealer's Digest, January 3, 1949, p. 32.
by the price range on this stock. It increased from $1.50 in 1947 to $10.25 per share in 1948. As late as November 25, 1947, it was offered to stock holders at $1.75. Beginning in April 1948, the price started a steady climb until it reached a high of $10.25 in June, 1948.\textsuperscript{15} Subsequently, the stock has ranged from $6.50 to $9.50 per share.

After almost two year successful production of pig iron, the cash profits which have poured into the company's treasury have been fully up to expectations.

As a result of the extensive surveys of the Lone Star Steel Company, the quantity and quality of proven iron ore reserves of Texas has been greatly increased. Under normal conditions in the beginning, this ore could not have been profitably mined in 1949. The construction of the plant by the government due to the emergency created by shortage of raw materials for war needs and the purchase of this plant by the Lone Star Steel Company at such a great saving has made possible the profitable production of pig iron in East Texas. It is believed that the plant can now operate in competition with other American plants because of the increasing market in the southwest and its freight rate advantage in this territory.

\textsuperscript{15} Ibid.
CHAPTER V

PROBABLE FUTURE DEVELOPMENT OF
TEXAS MINERALS

In 1936, during the Texas Centennial at Dallas, 150
developed and undeveloped Texas minerals were on display.
This display was interesting to Texans in that it did show
some of the potential wealth of the state. Texas has been
aptly called the last frontier of undeveloped minerals since
many mineral resources of the state have been merely
scratched.

In 1943, a war year, the value of all mineral products
yielded in the state was about $1,400,000,000, with crude
petroleum counting for $721,000,000. ¹ Texas in 1947 pro-
duced an estimated total mineral value of $2,000,000,000,
which was considerably more than that of any other state.²
All except $250,000,000 was derived from oil and gas. If
such allied petroleum-gas products as natural gasoline and
liquefied petroleum gases are subtracted, the remainder is
cut to about $130,000,000. All minerals outside this group
account for less than ten per cent of the total. Yet, it
is to these heavier basic minerals that Texas may have to

¹Fort Worth Star Telegram, August 30, 1945.
²Dallas Morning News, April 11, 1948.
look in the long run for an enduring mineral industry. Construction materials and iron ore are good examples of these heavier minerals.

The period immediately following World War II will likely determine to what extent the Texas iron and steel industry will be able to compete with the larger industries of the north and east. The larger steel companies in the United States are having trouble too. In 1949 Bethlehem Steel Corporation was preparing to haul iron ore from Venezuela, a distance of 3,000 miles. The company spent fifty million dollars in setting up transportation facilities to move the ore to their plant. At the same time, U. S. Steel was also taking concessions in South America. The Texas plants have an advantage in that they have plenty of iron ore near their plants that can be mined at little cost and are favorably located to supply a market throughout the southwest.

Few regions on earth can compare favorably with Texas in high grade construction materials. In 1945, these vast resources had been utilized comparatively little, which is probably one of the reasons why investigation into their possibilities has lagged so far behind that of some of the other natural resources of the state.

Building stones are unequally distributed in Texas. The Llano uplift contains a diversity of first-class building and

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ornamental stone. Mountainous Trans-Pecos Texas has great wealth in first-class stone, but little demand for it because of sparseness of population.

The people of the United States, as compared to the rest of the world, live in very poor houses. The people of Texas, as compared to those in the United States, live in very uncomfortable houses. We have been content to live in wooden houses which are actually the costliest of all because of high charges for repairs, paintings, insurance, and depreciation. Texas, with \( \frac{4}{3} \) per cent of the total population of the United States in 1931, used less than one per cent of the stone and clay products sold in the United States. This indicates that Texas ranks very low in comparison with the United States and the rest of the world in the use of permanent building materials. Influenced to a large extent by the growing scarcity of Texas lumber, there is a definite trend in the 1940's to the more permanent construction materials. Of course building materials, because of their weight, are usually developed in accordance with regional need. Yet Texas has among its stone products some that might be developed to the market dimensions of Indiana limestone. Undoubtedly there are both the resources and the market opportunities for considerable expansion. The production of Burnet-Llano quarries in 1946 was reported to be more than a year behind orders.\(^4\)

\(^4\)Dallas Morning News, July 17, 1947.
In the final analysis, Texas mineral production in the future will be increased through three lines of development.

In the first place, continual probing under the surface of the earth will bring to light great resources unknown at the present time, just as probing during recent years has brought to light hundreds of millions of dollars in valuable minerals unknown a few years ago. There has not yet been sufficient exploration work to ascertain the exact location of the mineral wealth of Texas. It is significant that the two regions which for many years had held out the greatest promise of mining development, the Burnet-Llano area and the Trans-Pecos, in 1926 were not among the principal producing areas. This shows that much of the great mineral wealth of the state is being discovered where it is not expected.5

In the second place, better transportation and power facilities in some parts of Texas, especially in the central mining area centering around Burnet and Llano counties and in the mountains of the Trans-Pecos, will greatly facilitate mining activity. The silver and quicksilver of Brewster and Presidio counties are produced fifty miles from railroad transportation. This is possible where minerals are very valuable in comparison to their weight, but

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5The Texas Almanac, 1927, p. 244.
there are many other minerals available in these regions that must await better transportation facilities.

In the third place, there is a vast amount of mineral wealth in Texas that is known and that lies near transportation facilities, that must await the development of a market. An increase in Texas manufacturing industries and a greater population will eventually be the stimulating factor.
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