OKLAHOMA GEOLOGICAL SURVEY
CHARLES J. MANKIN, *Director*

THE SOUTHWEST DAVIS ZINC FIELD

By

ROBERT O. FAY

(Text to accompany Map GM-20)

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Frontispiece. Gertrude Sober, Oklahoma City, January 28, 1902.
(Photo courtesy of Mrs. Mildred Sober West, Taloga, Oklahoma.)

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THE SOUTHWEST DAVIS ZINC FIELD

ROBERT O. FAY[1]

INTRODUCTION

The Southwest Davis Zinc Field in T. 1 S., R. 1 E., Murray County, Oklahoma (fig. 1), has been mapped in detail, but the work was never published. William E. Ham worked in the area from 1939 to 1954 and recorded the geology upon large-scale aerial photographs (8 inches = 1 mile). The present compilation is based upon his work. The author assumes any mistakes in compilation.

Taff (1904), Reeds (1910), and Decker and others (1931) mapped the Arbuckle Mountains. Ham, McKinley, and others (1954) mapped the area in greater detail. In 1936–37, the Oklahoma Geological Survey conducted a Work Projects Administration (WPA) project for a survey of the mineral resources of Oklahoma. From 1940 to 1943, W. E. Ham, Clifford A. Merritt, A. J. Williams, and Malcolm C. Oakes, of The University of Oklahoma and the Oklahoma Geological Survey, visited the Southwest Davis Zinc Field. They recorded many details on unpublished field sheets for Murray County, adding to the WPA sheets and quoting the older works of Snider (1911, 1912). These sheets were used in the present compilation.

Historical information can be found in the local newspapers of Davis, Sulphur, and Tishomingo, and in courthouse records in Sulphur and Tishomingo. The history of Murray County, by Brown (1977), is an excellent source. Savage (1978) gives a partial account of the Sober family.

Much of the history of the zinc field, however, is lost, and further work is needed to retrieve information relating to Dr. R. C. Hope, who was instrumental

[1] Geologist, Oklahoma Geological Survey.

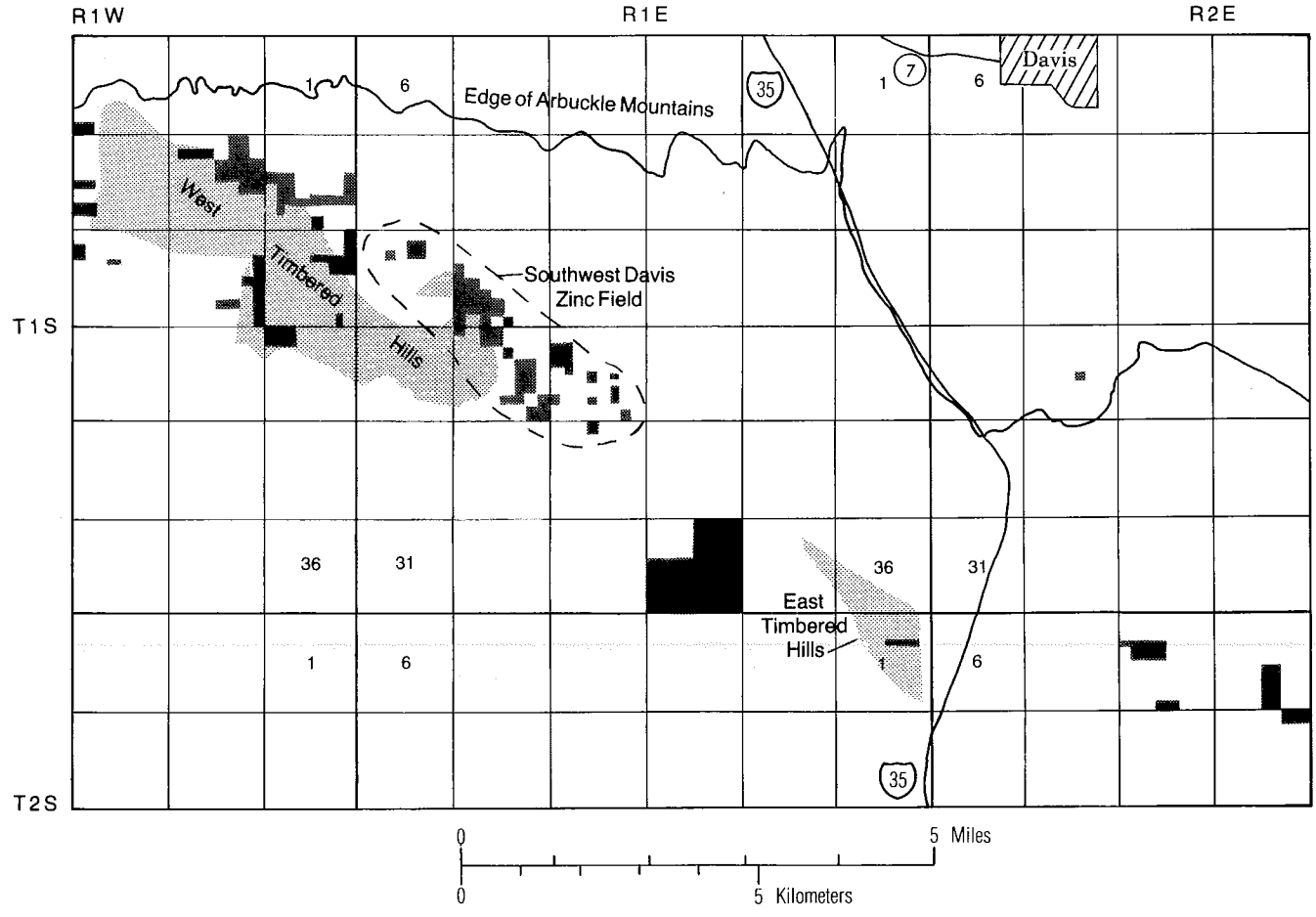

Figure 1. Index map showing Southwest Davis Zinc Field and mineral leases recorded from 1904 through 1912, Murray County, Oklahoma.

in discovering the field, in addition to the early miners, the early diggings, production, land ownership, geology of individual mines, and subsequent company operations. The present work is considered to be a progress report. Recent theses written about the area by Kranak (1978) and Posey (1979) were not examined.

Acknowledgments

Thanks are due George Cole with Comineo-American, St. Charles, Missouri; Robert Handfield, with Texasgulf Western, Inc., of Norman, Oklahoma; and John Warren, formerly with John Hoard and Robert Allen of Ardmore, Oklahoma, who critically reviewed the map. Cartography was done by Marion E. Clark and Roy D. Davis. Any interpretations or mistakes are those of the author.

Mrs. Spurgeon Field, Davis, Oklahoma, sister-in-law to Gertrude Sober-Field, supplied much valuable information. Also, Mrs. Mildred Sober West, Taloga, Oklahoma, Gertrude Sober's niece, kindly supplied photographs of Gertrude Sober and information on the Sober family. The Western History Collections at The University of Oklahoma kindly supplied additional pictures.

HISTORY

Gertrude Sober, "Queen of the Arbuckles" (1869–1949)

Gertrude Selma Sober, discoverer of the Southwest Davis Zinc Field, was born December 26, 1869, near Farragut, Fremont County, Iowa. Her father was Morris Smith Sober, born September 3, 1833, in Northumberland County, Pennsylvania. He was a master carpenter by trade and was also an inventor, with several innovations to his credit, including a horse-drawn cotton chopper. He was a sergeant in the Civil War from August 18, 1861, to August 13, 1864, serving in the Volunteer Light Artillery of the Second Independent Battery of Iowa. He was discharged at Davenport, Iowa.

Gertrude's mother was Isabel Rebecca Beaston, born December 19, 1842, in McDonough County, Illinois. Morris and Isabel were married June 20, 1867, and the family first lived near Farragut. Several homes built by Mr. Sober are still standing in this area of southwestern Iowa.

Gertrude had one sister, Ethel Bertha Sober, born January 6, 1868, and two brothers, Leslie Morris Sober, born February 19, 1877, and Hugh Wilson Sober, born March 19, 1879. They all attended school in Iowa. Gertrude is said to have shown an interest in geology at an early age (Mildred Sober West, written communication).

The family came to Oklahoma City in 1889 to start a new life after Gertrude's father lost a fortune in unwise investments in the East, and they lived on East Reno Street, then about 4 miles from town. Gertrude's mother cooked for the workers building the Frisco Railroad, and her father worked as a carpenter. Gertrude clerked in stores, taught school, and served as a stenographer and secretary. She became secretary to "Judge" James L. Brown of Tecumseh, a council member for the Second District of the First Legislative Assembly (1890–91), who was the legislator responsible for introducing the bill to transfer the State Capital from Guthrie to Oklahoma City. Later, Gertrude was secretary to Mr. C. J. Wrightsman, a council member for the Thirteenth District of the Second Legislative Assembly in 1893, representing Pottawatomie and Lincoln Counties.

Between 1895 and 1899, Mr. Sober moved to a small farm about 3 miles northeast of McCloud, settling in a two-story log house, which is still standing but is now covered with siding. Ethel Cloud, his daughter, who filed on the land, taught school at the Kickapoo School about 1 mile west of her house in the SW¼ sec. 34, T. 12 N., R. 2 E., Lincoln County. Previously, this daughter had worked at the post office in Oklahoma City.

In October 1899, Gertrude's brother Hugh and their mother filed homestead claims for Leslie and Gertrude on land about 4 miles east of Sweetwater, Roger Mills County. At this time and until 1900, Isabel Sober and her family lived at Dale, Oklahoma. Gertrude lived in a dugout on her homesteaded 160 acres until 1901. She raised kafir corn, and one grim winter her food consisted chiefly of cereal and bread that she prepared from the corn she had grown.

Leslie sold his claim to Hugh in 1901, and Hugh sold the farm in 1919 before moving to Oklahoma City. Hugh married Bessie Lee Scott on December 24, 1913, and they had two children: Mildred Lucile Sober, born October 22, 1914, and Gladys Maurine Sober, born January 29, 1916. Mildred married Clovis Roland West on June 17, 1934, and they are now living near Taloga, Dewey County. Mildred has the Sober family records, including Gertrude Sober's letters and last will, and a model of Morris Sober's cotton chopper. As of July 1977, Mildred's mother was living in Amarillo, Texas.

After 1901, Gertrude moved back to the Oklahoma City area, and this was during the time that Charles N. Gould, founder of the Geology Department (now the School of Geology and Geophysics) at The University of Oklahoma, began conducting field trips to the Arbuckle Mountains twice a year. The week-long trip by horse and wagon to Turner Falls and Price's Falls was popular, including living in tents and eating out of doors. Sometimes as many as 20 women took the trip, staying overnight at Paoli, according to Gould (1959, p. 113–114).

Gertrude heard many stories about the Arbuckles from those who had accompanied Gould. Also, she stated that one day an itinerant peddler painted a picture of fabulous riches in the mountains. She decided this was worth investigating, and she visited the region many times during the next several years, riding back and forth on horseback, with her hammer on the saddle horn. She camped out or lived in a log cabin while prospecting for the "fabulous riches."

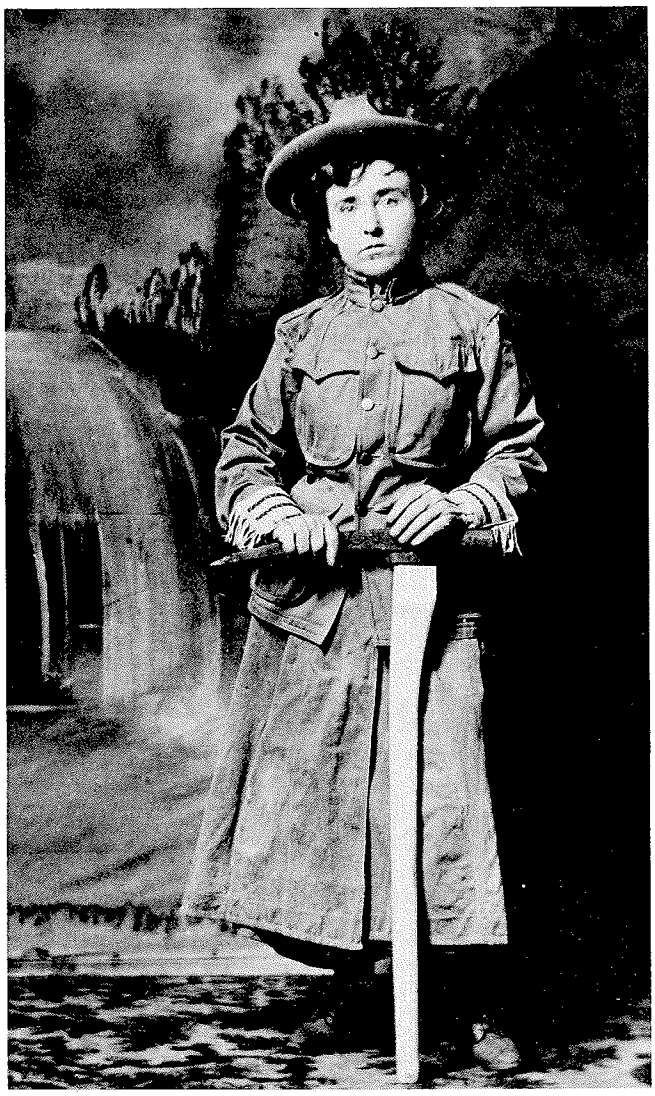

Figure 2. Gertrude Sober, "Queen of the Arbuckles," August 12, 1911. (Photo courtesy of Mrs. Mildred Sober West.)

In 1907, Gertrude and Dr. R. C. Hope, a local medical doctor in Davis whom she called "Dad" because he was close to 80 years old, began prospecting together for minerals in the Arbuckle Mountains. One afternoon in August 1909, while taking a break from exploring, she started pounding idly upon a rock and, in her own words, "I saw what looked like zinc in a fragment that chipped off." They announced their find, and this was the discovery of the Southwest Davis Zinc Field.

Dr. Hope financed a venture and, with capital stock of $1,000,000 and shares $1.00 each, he and Gertrude formed the Indian Mining and Development Co. The heading on the company stationery reads: "Gertrude Sober, President and General Manager, Davis, Oklahoma; D. B. Welty, Vice-president, Oklahoma City, Oklahoma; T. H. Slover, Secretary and Treasurer, Davis, Oklahoma; R. C. Hope, Director, Davis, Oklahoma; and A. J. McMahan, Director, Oklahoma City, Oklahoma." As a result of poor business practices, conflicting claims, bad weather, and other reasons, mining activity declined after 1913.

Gertrude owned many small tracts of land in and near Davis, Oklahoma. She also had an interest in the Bellah Mine, in the SW¼ sec. 27, T. 7 S., R. 32 W., Sevier County, Arkansas. According to Miser and Purdue (1929, p. 166): "The owners of the mine in 1912 were Tyler & Hippach, and the lessees were Sober, Williford & Lynn, who reopened the mine and operated it for several months before the fall of 1912."

In 1909, Chester E. Field (born 1892) and Roy A. Field (in his early twenties) began working at the mines and continued to do so until 1918. On January 5, 1918, Chester and Gertrude were married. They had no children. It was a brief marriage, for on September 23, 1918, Private Chester E. Field of Company E, 134th Infantry, died of Spanish influenza at Camp Dix, New Jersey. He was buried at Oak Ridge Cemetery, about 4 miles west of Davis and 1 mile north of Highway 7. Gertrude never remarried.

In 1924, Gertrude moved to Norman, Oklahoma, where she kept a rooming house for boys on College Avenue near Lindsey Street. In the 1930's she lived on South Jenkins in Norman. She could recite poetry quite well and especially liked to offer "The Shooting of Dan McGrew." It is probable that she often entertained the boys in her rooming house with that classic.

As do many Norman citizens, she took advantage of the presence of The University of Oklahoma. She enrolled, then studied toward a degree in a discipline in which she already had a great interest and not a little knowledge. In 1933, she received her Bachelor of Science degree in geology. In 1938 she published a paper in the *Proceedings* of the Oklahoma Academy of Science on some enigmatic rocks she had found in the Permian of Noble County, Oklahoma (Sober-Fields, 1938).

After graduation from OU, she moved to Oklahoma City, where she first lived on Northwest 10th Street, and later moved to 1215 Northeast 10th Street. She managed a number of apartments on Northwest 10th, 11th, and 12th Streets. An enterprising lady, she invested in a venture for raising grapefruit at McAllen, Texas, in 1943; unfortunately, the investment was unsuccessful.

Gertrude's father was killed January 7, 1911, when his wagon was struck by a train at McLoud, Pottawatomie County. He was buried in the Jamison Cemetery about 8 miles northeast of McLoud, in the northeast corner of sec. 13, T. 12 N., R. 2 E., Lincoln County. Her mother lived until March 9, 1925. She was buried in the Abrams Cemetery about 4 miles northeast of McLoud, in the southeast corner of sec. 12, T. 11 N., R. 2 E., Pottawatomie County.

Gertrude's sister, Ethel Bertha Sober (Cloud), died December 13, 1944, in Oklahoma City and was buried in the Jamison Cemetery. Hugh died July 18, 1948, in Oklahoma City, and was buried in the Bethany Cemetery. Leslie died November 18, 1948, in

Norman and was buried in Memorial Park Cemetery in Oklahoma City.

Gertrude Selma Sober Field died November 1, 1949, at a nursing home in Oklahoma City and was buried alongside her father and sister in the Jamison Cemetery, Lincoln County. Her library and collections were donated to The University of Oklahoma.

According to an article printed in a Davis newspaper from about 1909, a Mr. Woodward of the U.S. Department of the Interior proposed that a monument constructed of zinc ore should be raised in honor of Gertrude Sober during her lifetime and that the monument should be inscribed "Queen of the Arbuckles." This proposal was never fulfilled.

We hope this publication will serve as her memorial.

Biographical sources include Brown (1977, p. 370); Savage (1978, p. 542); the Davis News (1908–13); The Daily Oklahoman for October 13, 1918, "Woman whose early love was geology, Gertrude Sober"; The Daily Oklahoman for February 22, 1931, p. 8–B, "Oklahoma's only woman prospector of early days is now geology student"; The Daily Oklahoman for November 2, 1949, for her obituary; Mrs. Spurgeon Field, 601 South 3d Street, Davis, Oklahoma 73030; and Mrs. Mildred Sober West, Route 1, Taloga, Dewey County, Oklahoma 73667, who kindly supplied most of the information.

Also, *The Sooner Magazine* of the University of Oklahoma Association, August 1951 issue, lists Gertrude Sober Field as a 1933 geology graduate. Several photographs from the Western History Collection of The University of Oklahoma, including some showing Gertrude Sober, were published in *Oklahoma Treasures and Treasure Tales* by Steve Wilson (University of Oklahoma Press, 1976, p. 242).

Mining

The early history of mining in the western Arbuckle Mountains centered about prospecting for gold and copper. Taff (1904, p. 46) mentioned: "Many of the dikes, chiefly those of diabase cutting the granite, have been prospected at various times for the precious metals without any show of profit, and the sum of all information obtainable gives no assurance that ore or metal deposits of any value can be found in the region." Local stories persist that soldiers stationed at Fort Arbuckle (1851–69) smelted lead for bullets and that the lead was mined locally, but the mines have never been discovered (Wilson, 1976, p. 241). Old Spanish diggings were reported by Hintze (1962, p. 174), Van Zandt (1935, p. 331), Daily Ardmorite, March 15, 1896, and Daily Oklahoman, November 27, 1910.

Gould (1908, p. 78; 1910b, p. 62) stated: "Prospecting in the Arbuckle Mountains never reached the stage attained in the Wichitas. The structure of the rocks in the two ranges is practically the same and there is as much reason to suspect the presence of gold in one as in the other. A number of shafts have been sunk in the Arbuckles. The greater part of them are in the West Timbered Hills, south of old Fort Arbuckle."

Reeds (1910, p. 60) mentioned: "The green color in the Reagan formation south of the West Timbered Hills and elsewhere is not due to the presence of copper ore, as some prospectors have imagined, but arises from the disseminated green grains of glauconite, which is of organic origin."

The earliest records of mineral leases in the area are for secs. 3 and 10, T. 1 S., R. 1 W., recorded in 1904. Another lease was taken on the SW¼ section 17, T. 1 S., R. 1 E., including the Goose Nest Mine area, in 1906. These documents are on record at the courthouse in Sulphur in the Murray County Miscellaneous Records, which contain mineral leases, articles of incorporation, and miscellaneous contracts for Murray County, beginning in 1902.

Early sources of information are the newspaper files of the Davis News (1908–13) and the Sulphur Democrat (1908–12). Nelson (1908, p. 40), Gould (1910a, p. 55–57), and Snider (1911a,b; 1912, p. 86–90, fig. 16, map) are the earliest geological sources of information regarding lead and zinc prospects. Gould (1910a) had names for individual mines.

William F. Beard of Ardmore had a mineral lease in the Goose Nest Mine area in the SW¼ section 17, T. 1 S., R. 1 E., and in June 1906 he assigned the mineral rights to the Penn Development Co. This may have been the first zinc lease in the Arbuckle Mountains. Beard formed the Arbuckle Development Co. in August 1908 (Mining World, 1908, p. 332). Nelson (1908, p. 40) stated:

> Considerable prospecting has also been done, from time to time, in the Arbuckle Mountains where both lead and zinc occur on the surface. Several shallow shafts have been sunk at various places, and some good specimens of disseminated ore, said to come from Ada, have been sent to the Survey. What ore there may be in this region seems to disappear a short distance below the surface, at least none of the results have been encouraging enough to warrant extensive development.

Two small prospects (iron and pyrite) west of the area were recorded on field sheets by the Oklahoma Geological Survey. One site, in the Reagan Sandstone about 300 to 400 feet south of the center of sec. 18, T. 1 S., R. 1 W., contains glauconite altered to limonite and hematite (OGS field sheet 0373, dated August 12, 1940, observed by C. A. Merritt and A. J. Williams). A second pit is in the Colbert Porphyry in the SW-SE-NE-NE sec. 11, T. 1 S., R. 1 W., where there are two diabase dikes 3 to 10 feet thick, striking east-west, and an open cut in the hill to the southeast of the dikes, with pyrite and orthoclase (OGS field sheet 0557, dated June 16, 1942, observed by C. A. Merritt, W. E. Ham, and C. K. Frazier, Box 85, Davis). These prospect pits probably predated the zinc prospects.

As has already been stated, in August 1909, Miss Gertrude Sober and Dr. R. C. Hope announced their discovery of a major zinc deposit in the southwest quarter of section 21 and the northwest quarter of sec. 28, T. 1 S., R. 1 E. From 1909 to 1912, the boom

years, much of the crestal part of the Arbuckle Anticline was leased (fig. 1).

People representing business interests in Coffeyville, Kansas, and New York City visited the field and invested money in its future. Some small operators sold portions of their interests to acquire capital for development expenses. A railroad line through the zinc field was under construction. On October 30, 1911, C. Lincoln McGuire of Ardmore founded the townsite of Robnet near the center of sec. 21, T. 1 S., R. 1 E., not far from the Butterly Ranch House–Ben Franklin Mine area. About six land transactions in the area are recorded, but within a few years the townsite became a ghost town (Brown 1977, p. 243).

By 1912, most of the operations were encumbered with overlapping or contradicting claims, bringing development almost to a standstill. Court injunctions over civil suits tied up some of the properties, including the Hope–Sober mines. In a letter to the editor of the Davis News, dated September 19, 1912, a citizen suggested that a citizens' syndicate under direction of Col. S. W. Wood and C. B. Ramsey, two mining engineers, be formed to develop the zinc fields, but this suggestion was not pursued, and production in the fields declined.

From 1912 to the present time, there has always been some interest in the area by individuals and companies. In 1948, Gill Montgomery of Minerva Oil Co. mapped the area, but the most extensive exploration was conducted by the American Zinc, Lead and Smelting Co. from October 1951 to August 1952. Together with a joint-venture partner, the company leased 4,300 acres under three different mining leases and drilled 110 prospect holes, some reportedly more than 1,000 feet deep. They conducted extensive geological and structural mapping, most of which was done under the direction of Dan R. Stewart, 418 Wall Street, Joplin, Missouri 64801. The company is now owned by Gold Fields Mining Corp., 445 Union Boulevard, Suite 310, Lakewood, Colorado 80228. Until recently, Texasgulf Western, Inc., with local offices in Norman, Oklahoma, held leases on much of the area. The leases were dropped in 1979.

GEOLOGY

General Geology

The main ore bodies in the Southwest Davis Zinc Field are concentrated in the Lower Ordovician Butterly Dolomite and the Upper Cambrian Royer Dolomite, with scattered prospect pits in units ranging from the Colbert Porphyry (Middle Cambrian) to the Kindblade and West Spring Creek Formations (Lower Ordovician).

Most of the significant mines are concentrated along the Washita Valley Fault Zone on the north flank of the Arbuckle Anticline, north and east of the West Timbered Hills, in secs. 17, 18, 21, and 28, T. 1 S., R. 1 E., Murray County. The age of faulting here is Virgilian (Late Pennsylvanian) and later. Ryan (1976, p. 22, 42, 44) showed that a low-magnetic anomaly coincides with the Washita Valley Fault Zone and that a high anomaly exists on the southwest side of the West Timbered Hills, with a crest in sec. 16, T. 1 S., R. 1 W. (figs. 3–5).

The mineralized zone may extend farther southeastward, as is indicated by Snider (1912, p. 88): "Some prospecting has been done two miles east of East Timbered Hills. One drill hole 160 feet deep is reported to have encountered a body of ore 14 feet thick at a depth of 67 feet, which shows 19 to 26 percent of sphalerite, and another body 27 feet thick at 140 feet which is also very rich." This is probably in sec. 4, T. 2 S., R. 2 E. (fig. 1).

Another reference for a locality even farther southeast is that of U. N. Benge (unpublished) on Oklahoma Geological Survey field sheet 59, for Johnston County, dated February 13, 1936.

Sam Ballard of Tishomingo opened many prospects about 1908 and later in sec. 19, T. 3 S., R. 5 E., about 4 miles northwest of Ravia. The oxidized zone here is about 50 feet wide, along the Reagan–Honey Creek contact (Upper Cambrian), and is associated with faults. About 3 tons of ore was shipped from these mines, with the ore assaying 23 percent lead and 25 percent zinc. One of Ballard's main prospects is in the NE-NW-SW of sec. 19, about 1.5 miles west of Mill Creek. The mine was 20 feet deep, with the ore recovered at 6 feet assaying 25.34 percent ZnO; at 20 feet the rock assayed only 1.46 percent ZnO. Two sources of information on this operation are the Johnston County Democrat (1908–10), which is on microfilm

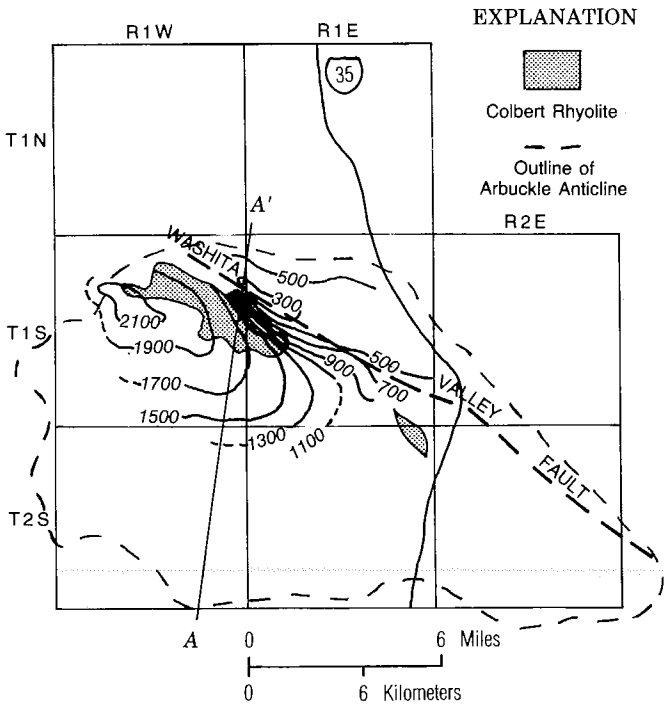

Figure 3. Generalized vertical-intensity magnetic map of regional magnetic anomaly over western part of Arbuckle Anticline, Murray County, Oklahoma. Contour interval, 200 gammas (10^{-5} c.g.s.). (From Ryan, 1976, p. 22.)

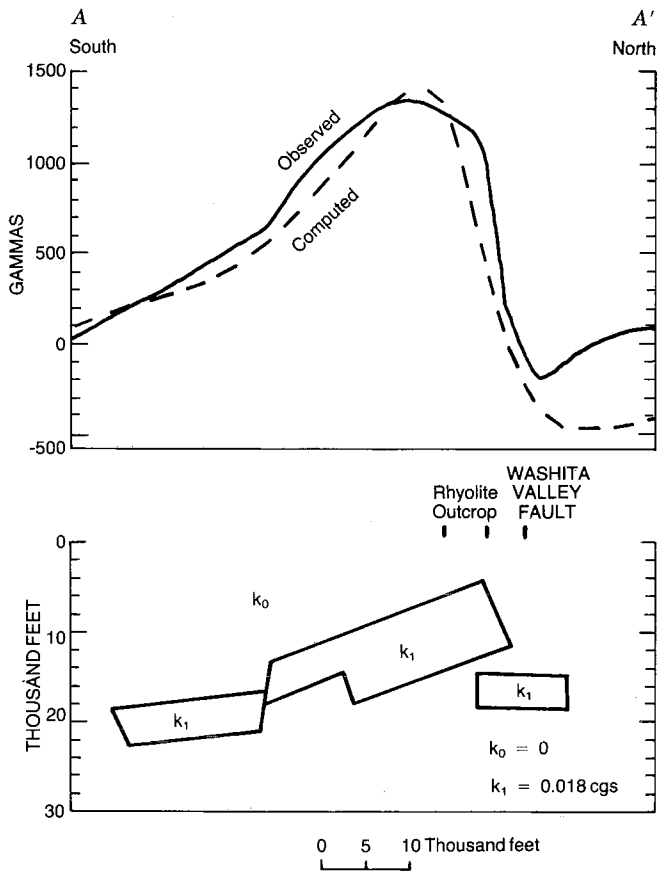

Figure 4. Cross section and possible magnetic model of section *A-A'*; line of section shown in figure 3. (From Ryan, 1976, p. 42.)

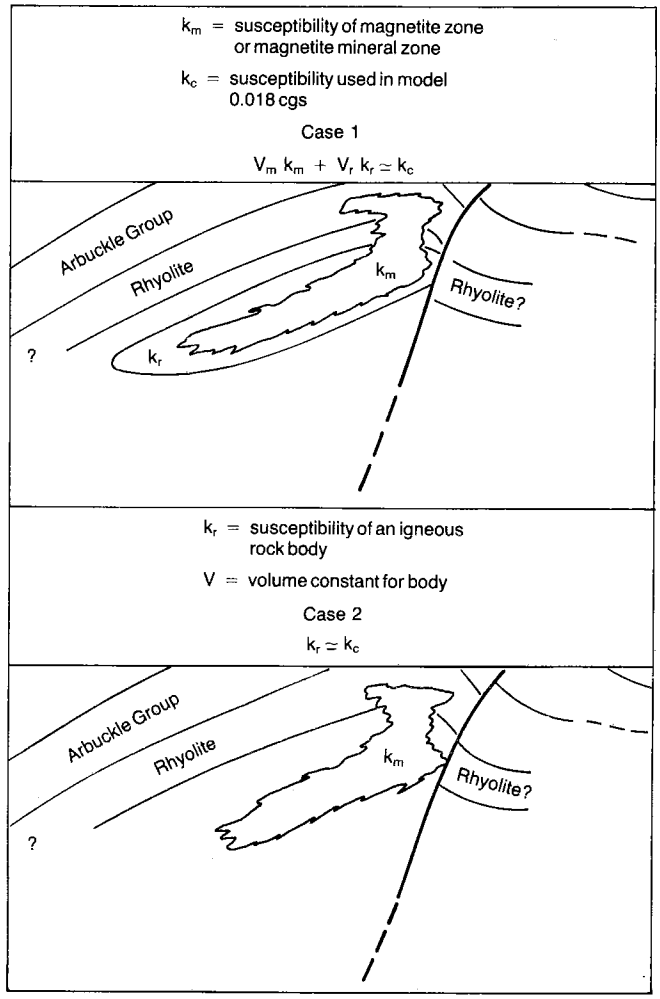

Figure 5. Two possible geologic interpretations of magnetic model of section *A-A'*, shown in figure 4. (From Ryan, 1976, p. 44.)

at the Chickasaw Historical Museum, and the Miscellaneous Records at the Johnston County Courthouse in Tishomingo.

Mineralogy and Ore Deposits

The principal minerals in the Southwest Davis Zinc Field are sphalerite (ZnS) and smithsonite ($ZnCO_3$). Some galena (PbS), cerussite ($PbCO_3$), anglesite ($PbSO_4$), pyrite (FeS_2), chalcopyrite ($CuFeS_2$), greenockite (CdS), malachite and azurite ($Cu(OH)_2 \cdot 2CuCO_3$), hematite (Fe_2O_3), and limonite ($Fe_2O_3 \cdot nH_2O$) are also associated with the zinc ores. Much of the limonite in the ores occurs as pseudomorphs after pyrite and marcasite (FeS_2), and the smithsonite occurs in the upper 8 feet or weathered zone.

The sphalerite occurs as a cement around brecciated dolomite and as blobs within coarsely crystalline vein dolomite (dolorudite). The dolorudite veins (fig. 6) cut the fine-grained micritic dolomite (dololutite), and some sphalerite is finely disseminated in the dololutite. Much of the sphalerite appears to have been deposited along solution channels and collapsed breccias along bedding planes, but some appears to be fault controlled, with the faults predating and postdating ore emplacement.

The shape of the ore bodies is like sheet ground, parallel to the bedding, or the ore bodies can occur as veins cross-cutting the bedding. Sargent (1974, p. 84) showed that ferroan (2–13 percent $FeCO_3$) tectonic dolomites in the western Arbuckles have high concentrations of trace quantities of Zn, Pb, Mn, and Fe, along with O^{18} and C^{13}. A tectonic dolomite is a coarsely crystalline dolomite formed by magnesium-rich solutions moving through a tectonically disturbed belt and cross-cutting bedding planes. The Butterly and Royer Formations in the Arbuckle Mountains are most commonly stratigraphic dolomites, but locally they are tectonic dolomites.

In discussing the zinc ores in the Hope–Sober, Ben Franklin, and Goose Nest Mines of the Southwest Davis Zinc Field, Snider (1912, p. 87) mentioned that these mines "show two layers of the blende bearing rock each 3 to 4 feet thick separated by a layer of 'dead rock,' 5 to 6 feet thick, carrying only thin seams of blende." A well at the Ben Franklin Mine showed that the surface ore extended to a depth of 30 feet, with a 15- to 20-foot ore body 125 feet deep. Snider also noted:

Figure 6. Sphalerite veins in upper Butterly Dolomite on west side of Hope–Sober Mine, looking southeast, in NE-NE-NE-NW sec. 28, T. 1 S., R. 1 E., on Butterly Ranch, Murray County, Oklahoma, March 27, 1973.

An interesting feature is a narrow belt of iron ore (hematite) seldom over one rod in width, which lies near the middle of the dolomite member throughout the length of the outcrop. Boulders of hematite, in part altered to limonite, are strewn thickly along the surface of this belt. Some of them are as much as 10 feet in diameter. In only a few cases does the iron ore extend as much as 10 feet beneath the surface. The richest portion of the zinc ore so far seems to be in close proximity to this iron-bearing horizon. The cause of this segregation of the iron ore into so narrow a belt is problematic but it is entirely possible that it is due to a small fault (p. 88) parallel to the strike of the rocks. Such a fault would be almost impossible to trace in the dolomite unless the belt of ore itself be taken as evidence of its existence. The localization of the ore took place before the formation of the small faults perpendicular to the strike previously mentioned since the iron ore belt is offset by them.

Snider (p. 89) also stated: "The first body of ore does not exceed a depth of 40 feet over most of the area which has been the most thoroughly investigated."

CHEMICAL ANALYSES

Snider (1912, p. 87) made the following statement on original assays:

The prospectors of the region report very good assays on material from practically all the prospect holes, although the appearance of the material does not indicate that much metallic material is present. Analyses of surface samples of carbonate showing as high as 47 to 50 per cent zinc are commonly reported and approximately average samples of blende ore are reported as showing 58 to 60 per cent zinc. However, the highest assay reported on a carload of blende ore is 38.5 per cent zinc.

Some of the samples collected by this Survey show the following results: Four samples consisting of chips from surface blocks in different parts of the field show respectively, trace; .17 per cent; .77 per cent; samples of carbonate from near the surface and from shallow prospects in different localities show respectively .55 per cent, .45 per cent, .77 per cent, and 5.4 per cent. A sample composed of chips of a large number of blocks in a pile of blende ore selected for milling show 25.46 per cent; a sample of blende from one of the deeper prospects shows 8.88 per cent; a sample from all parts of one of the most widely advertised mines shows 8.08 per cent. The concentrate from the only mill which has been installed (Ben Franklin) shows 45.96 per cent. The mill was not run long enough to get the tables and grinding machinery properly adjusted so that the showing of the concentrate is probably not so good as can be obtained.

Two boreholes drilled at the Hope–Sober Mine in sec. 28 showed variations from 0.3 to 5.81 percent zinc down to 39 feet, as recorded by W. E. Ham (OGS field sheet 0372, June 1, 1943, Murray County).

On March 27, 1973, I collected a sample of the ore from the stockpile in sec. 28 (Hope–Sober). On May 12, 1975, David Foster, at that time analytical chemist for the Oklahoma Geological Survey, ran a spectrographic analysis that showed (in parts per million): Ag < 20, Al–major, Ca–major, Cu–200 to 666, Fe > 2000, Ge–66 to 200, Mg–major, Mn–66 to 200, Pb–666 to 2000, Si–major, and Zn–major. ("Major" means greater than 1 percent.) Analysis by atomic absorption shows Cu–0.015 percent, Pb–0.08 percent, and Zn–24.15 percent.

Sargent (1969; 1974, table 22) showed that in the southwestern Arbuckle Mountains, in Lower Ordovician rocks of the Arbuckle Group (Butterly through West Spring Creek), Zn, Pb, Mn, and Fe are in high concentrations as trace elements in ferroan (2 to 13 percent $FeCO_3$) tectonic dolomites. Also, O^{18} and C^{13} are more highly concentrated in tectonic dolomites

than in stratigraphic dolomites and limestones. His summary is given in table 1.

PRODUCTION

Production from individual mines is unknown. On field sheet 0372 (Oklahoma Geological Survey, dated August 12, 1940, by C. A. Merritt, A. J. Williams, and W. E. Ham), the investigators quoted a chapter on lead and zinc (Mershon, 1934, p. 23) from an Emergency Relief Administration report on "Construction Materials of Oklahoma":

> Production began in 1909 and continued until 1914. The concentrates were a mixture of about 80% sphalerite and 20% zinc carbonate, the mineral content recovered being 45.96%. The total production of the field was approximately 550 short tons of sphalerite valued at $27,399, and 899 tons of zinc carbonate valued at $24,592, or a total of $51,991.

Dr. C. W. Tomlinson of Ardmore wrote in a letter to the Survey on June 18, 1942: "One of the men who mined zinc ore southwest of Davis many years ago, told me about 1937 that they had shipped about $10,000 worth of ore in a year, but merely made wages. The veins worked were very narrow."

In 1909, 20 tons of ore was shipped from the Hope–Sober mines to Bartlesville, Oklahoma, and this paid $175 above costs. Snider (1911b, p. 1230) mentioned that production has been almost all from zinc carbonate, with 148 tons produced in 1909 and 215 tons in 1910. Two carloads of unmilled sphalerite were shipped early in 1911, and the first carload of concentrates was shipped early in November 1911.

HISTORY AND DESCRIPTIONS OF MINES

Hope–Sober Mines (SE-SE-SW sec 21; NE-NE-NW sec. 28, T. 1 S., R. 1 E., in Butterly Dolomite):

In August 1909, Gertrude Sober and Dr. R. C. Hope announced their discovery of this deposit (fig. 7). Dr. Hope financed the initial development, and the two formed the Indian Mining and Development Co., with $1,000,000 of stock at $1.00 per share. They sent 20 tons of ore to the Layon Star Smelting Co. of Bartlesville, and this paid $175 above costs (fig. 8). They contracted for the construction of a $50,000 smelter on the property but broke the contract, and later in 1909, the contractor had them enjoined from working their mines. They had other ventures within the zinc field and in western Arkansas.

In July 1911, they leased the Southwest Davis Zinc Field property to the United Mining and Milling Co. of Independence and Coffeyville, Kansas, operators of the Ben Franklin Mine about 1,400 feet to the north. Early in 1912, production stopped because of heavy rains, and no further development is reported after that date. In late 1913, Hope and Sober assigned their mineral rights and royalties in sec. 28, due them from United, to I. E. Powell. Later, E. L. Hutchins obtained the mineral lease. In July 1939, L. Cole, R. S. McGill, and B. F. Cochran obtained a mineral lease from E. L. Hutchins; this was voided in April 1943. In July 1943, T. J. Pate of Oklahoma City obtained the lease and assigned his lease to the Arbuckle Mining Co. In July 1945, the Arbuckle

TABLE 1. GROUP MEANS OF TRACE ELEMENTS AND ISOTOPIC CONCENTRATIONS

Numbers in parentheses are numbers of samples analyzed. From Sargent (1974, table 22).

	Trace elements (parts per million)										Isotopic concentration	
	Pb	Zn	Na	K	Li	Ni	Cu	Sr	Mn	Fe	δO^{18}	δC^{13}
Limestones												
$\bar{x}$ (25)	4.36	5.80	139.36	108.56	3.64	32.04	7.16	251.80	39.32	535.84	-6.9(3)	-2.4(3)
S.D.	3.72	11.80	38.63	62.07	4.29	7.82	2.54	130.95	19.70	228.36	0.7	0.7
Stratigraphic dolomites												
$\bar{x}$ (17)	1.00	0.12	222.24	206.18	0.24	0.94	3.12	26.65	176.24	1,231.24	-6.8(5)	+0.2(5)
S.D.	4.12	0.49	51.15	143.95	0.44	1.43	0.93	17.02	191.61	1,000.58	2.0	0.8
Low-iron tectonic dolomites												
$\bar{x}$ (28)	0.21	1.46	169.61	162.68	2.50	6.46	6.57	40.25	94.57	858.11	-4.3(5)	-1.8(5)
S.D.	0.96	3.67	68.83	90.76	4.26	4.82	2.36	24.32	72.70	760.13	1.2	0.4
High-iron tectonic dolomites (ferroan)												
$\bar{x}$ (26)	14.54	15.46	269.62	117.31	0.27	1.88	5.04	41.42	2,300.08	10,587.73	-3.9(4)	-2.3(4)
S.D.	43.47	29.26	128.48	55.99	0.60	2.89	1.89	19.69	933.83	3,292.62	1.2	1.4
Tectonic vein dolomites												
$\bar{x}$ (5)	0.6	0	192.20	63.00	0	9.60	7.00	46.20	210.00	1,612.20	-1.5(3)	-1.7(3)
S.D.	1.3	0	66.73	26.60	0	7.80	2.55	40.60	113.11	1,144.50	3.4	0.5

$\bar{x}$, group mean values of samples.
S.D., standard deviation.

Mining Co. assigned its rights to the Arbuckle Exploration and Development Co. which extended the lease for 5 years in April 1946. From October 1951 to August 1952, American Zinc, Lead and Smelting Co., together with a joint-venture partner, leased the area and began mapping and drilling. In the late 1960's, John Hoard and Robert Allen of Ardmore obtained a lease on sec. 21, with an option to lease on the remainder of the property, and carried out a soil-sampling program. John H. Warren did some field work for them. They attempted to interest New Jersey Zinc Co., but they finally dropped their lease in 1973. Eagle–Picher, Cominco–American, and a company from Salt Lake City have shown interest in the area by doing some stream sampling. Texasgulf Western, Inc., obtained leases in 1976 but dropped the leases in 1979. Much of the land is owned by the Butterly Estate.

Figure 7. Hope–Sober Mine in NE-NE-NE-NW sec. 28, T. 1 S., R. 1 E., Murray County, Oklahoma. View looking east, showing pit 15 feet deep in upper Butterly Dolomite. Dip is gently northeastward. C. Lincoln McGuire on left, Gertrude Sober in middle, and Dr. R. C. Hope on right. Taken in Fall 1909. (Photo courtesy of Western History Collection, Bizzell Memorial Library, The University of Oklahoma.)

Individual areas are numbered on the large map, with the numbers corresponding to numbers below:

1. The main open pit (fig. 9), an excavation 12 to 15 feet deep and 75 feet in diameter, in the NE-NE-NE-NW sec. 28, T. 1 S., R. 1 E., was examined in June 1943 for Mr. T. J. Pate by W. E. Ham and M. C. Oakes of the Oklahoma Geological Survey. Analyses were made by Eagle–Picher Mining and Smelting Co. of Henryetta, Oklahoma (OGS field sheet 0372, for Murray County). The ore minerals are smithsonite ($ZnCO_3$), which occurs in the upper 5 to 8 feet, and sphalerite (ZnS), which occurs deeper. The ore occurs as breccia

Figure 8. First wagonload of ore from Hope–Sober Mine. Gertrude Sober is on lead wagon. (Photo courtesy of Mrs. Mildred Sober West.)

cement and replacement of dolomite, with one bed 1 to 3 feet thick, 10 feet below the top, occurring as sheet ground, dipping northeast. There is another similar bed a few feet higher on the west side of the pit. Ham and Oakes estimated the ore beds to be about 40 percent zinc and interpreted mineralization as being related to an east–west fault, stating that "mineralization took place after faulting and fracturing." In the surrounding area, mineralization is most intense in incipient fault zones that trend N. 30 E., but stratigraphic sheet grounds in the upper Butterly are connected between the fault zones. Two core holes were drilled: (1) 20 feet south of the pit (53 feet deep), and (2) 100 feet west of the pit (97 feet deep). Analyses showed (1) 0–8 feet (5 percent Zn); 8–15 feet (5.81 percent Zn); 15–24 feet (about the same; remainder not analyzed at that time); (2) 0–7 feet of soil, 7–15 feet (0.3 percent Zn); 15–21 feet (0.5 percent Zn); 21–39 feet (0.9 percent Zn); remainder not then analyzed.

2. Area 2 is about 300 feet north–northwest of the main pit, in the SE-SE-SE-SE-SW sec. 21, and is the other original Hope–Sober Mine. There is a small dump on the east side, with a storage shed 100 feet to the north, a shaft 50 feet to the southwest, and another shaft about 200 feet to the south–southwest. About 200 to 300 feet to the southwest are several stockpiles, extending into sec. 28.
3. Area 3, in the SW-SW-NW-NE sec. 28, is an incline trending N. 35° E., 50 feet long, 5 feet wide, and possibly 12 feet deep, with water in the lower part. The ore is 1.5 to 3 feet thick, occurring as breccia veins of sphalerite. The underlying and overlying beds are weakly mineralized, and some smithsonite occurs in the upper 5 feet. The rocks dip 15° N. to NW. There are four other adits or pits several hundred feet to the north and northwest, in the northwest part of sec. 28.
4. Area 4 is near the C-SW-NW-NE sec. 28. The main part consists of two trenches, one trending N. 60° W., and the other, N. 20° E. Each trench is about 30 feet long, 10 feet deep, and 5 to 20 feet wide, with other smaller cross cuts in the area. Here also smithsonite is found in the upper 5 feet. The ore occurs in a bed of brecciated dolomite and sphalerite about 3 feet thick that dips 20° NW. like a sheet ground and is about 4 feet lower stratigraphically than the ore bed in area 3.
5. Area 5 is in the NE-NW-SW-NE sec. 28 and consists of at least 12 small pits less than 10 feet deep

Figure 9. Hope–Sober Mine pit in upper Butterly Dolomite, NE-NE-NE-NW sec. 28, T. 1 S., R. 1 E., on Butterly Ranch, Murray County, Oklahoma, as it appeared March 27, 1973. View looking northeast.

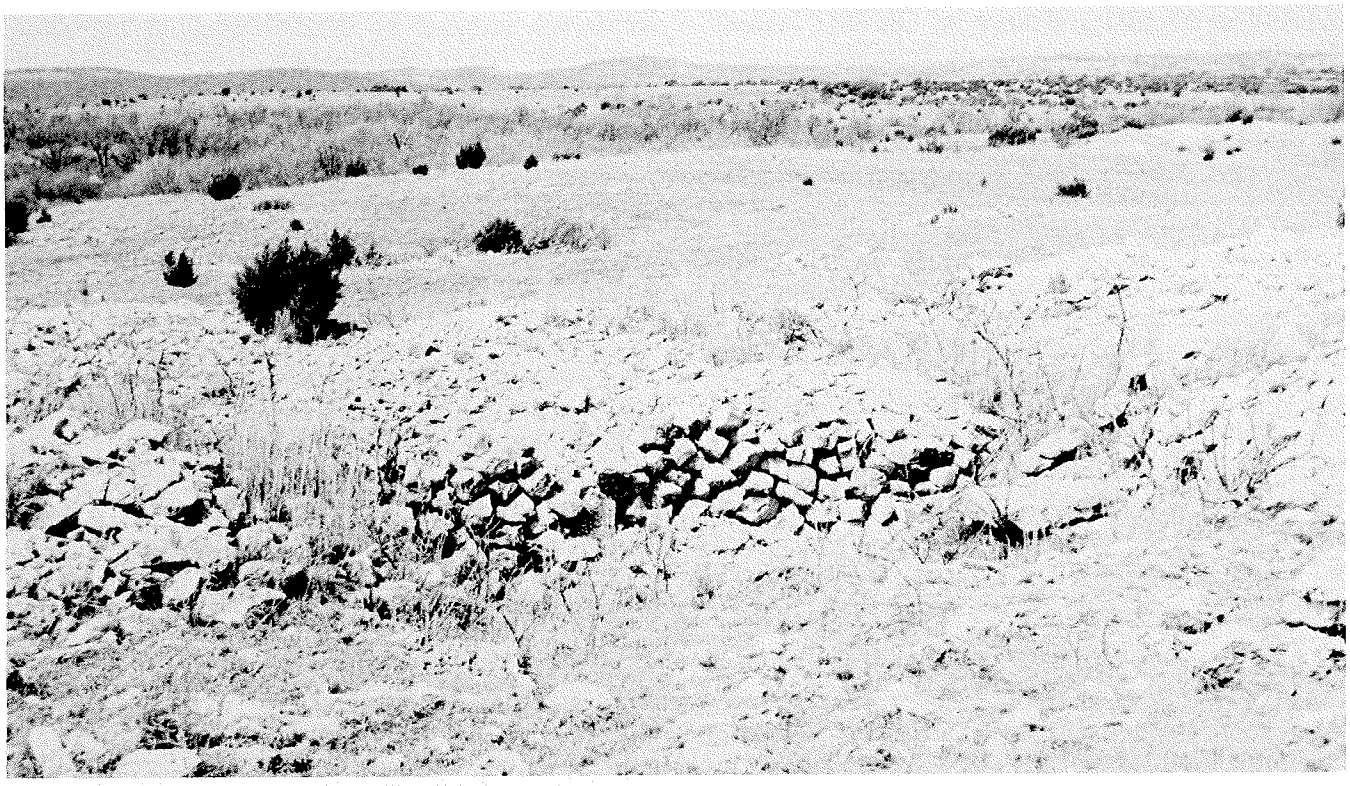

Figure 10. Small zinc prospect pits in upper Butterly Dolomite on Butterly Ranch, NE-NW-SW-NE sec. 28, T. 1 S., R. 1 E., Murray County, Oklahoma. View looking north.

(fig. 10). Smithsonite occurs in the upper 8 feet, with some brecciated sphalerite. It is reported that 6 wagonloads of smithsonite ore were shipped to Fort Worth, Texas, for making paint pigments.

Other small prospect pits were excavated in the southeast part of sec. 28 and the southwest part of sec. 27. These are less than 10 feet deep and are associated with limonite.

Ben Franklin Mine (SE-NE-SW sec. 21, T. 1 S., R. 1 E., in Butterly Dolomite):

In late 1910, A. B. Augustine assigned the mineral rights at this locality to United Mining and Milling Co. Others mentioned in documents involving these mineral rights are C. Lincoln McGuire of Ardmore, a Mr. Wright, and B. F. Cochran. An early drill site is shown in figure 11.

United erected a four-table mill on the property, but the mill was idle almost all of 1911 because of a lack of water. The ore selected for milling was 25.46 percent zinc, and the mill concentrate was 45.96 percent zinc. Activity at this mine ceased sometime between 1912 and 1914. American Zinc did mapping

Figure 11. McGuire Mine, later named Ben Franklin Mine, SE-NE-SW sec. 21, T. 1 S., R. 1 E., Murray County, Oklahoma. View looking east, showing cable-tool rig that drilled test holes 125 feet deep. Results showed two thin ore beds in upper 30 feet and one bed 15–20 feet thick at depth of 125 feet. Dr. R. C. Hope on left, Gertrude Sober in middle, and C. Lincoln McGuire on right. Taken in Fall 1909. (Photo courtesy of Western History Collection, Bizzell Memorial Library, The University of Oklahoma.)

and drilling in 1951 and 1952. As has been stated, John Hoard and Robert Allen of Ardmore acquired the mineral rights in the late 1960's, sampled soils, and attempted to interest New Jersey Zinc, but they dropped their leases early in 1973. The lessee from 1976 to 1979 was Texasgulf Western, Inc. C. Lincoln McGuire is still the owner of small acreages, but much of the land is owned by the Butterly Estate.

The mine consists of an east–west shallow trench 150 feet long, with two inclined adits that drift northward. North of the adits are several drillholes in the Butterly Dolomite, which dips about 32° NNE. in this locality. The surface ore continues to a depth of 30 feet, and another bed, 15 to 20 feet thick, occurs at 125 feet. The main shallow ore body consisted of two beds, each 3 to 4 feet thick, separated by 5 to 6 feet of dolomite.

NW 21 Mine (near C-NW sec. 21, T. 1 S., R. 1 E., in Butterly and McKenzie Hill formations):

In May 1911, A. B. Augustine transferred the mineral rights for the area directly north of the workings at this location to United Mining and Milling Co. Other documents recorded during this period indicate negotiations between Augustine and C. Lincoln McGuire on other properties in sec. 21. In July 1945, V. E. Sloan leased the mineral rights on the SW-NW sec. 21 and the S½-NW-NW sec. 21 to the Arbuckle Exploration and Development Co. In 1951 and 1952, American Zinc acquired land around the area and drilled a few holes. A recent lessee was Texasgulf Western, Inc., but this company dropped its leases in 1979. Most of this land also is owned by the Butterly Estate.

The opening at this mine consists of two elongate pits about 200 feet apart. The first pit, about 150 feet southwest of the C-NW sec. 21, is a 50-foot-long trench oriented slightly northeast of north, with several adits striking slightly north of west. The Butterly Dolomite here dips about 22° NNW. The second pit, about 200 feet south-southeast of the C-NW sec. 21, is about 50 feet long in a northeasterly direction, with several adits striking northwest. All the workings are partly covered and flooded. American Zinc drilled 3 holes at this locality. Almost all the ore is in the upper Butterly Dolomite, but some may extend into the lower McKenzie Hill, as is shown on the geologic map.

Goose Nest Mine (near C-SW sec. 17, T. 1 S., R. 1 E., in Royer Dolomite):

The earliest recorded mineral lease in the Southwest Davis Zinc Field is that of William F. Beard of Ardmore, who assigned his mineral rights to Penn Development Co. in June 1906. In March and August 1910, the Arbuckle Mining and Milling Co. acquired mineral leases from W. L. Wilmar and Beard, including the Goose Nest Mine area. In March 1911, the mine was managed by a Judge Benge. A 200-ton-a-day boiler was in operation about April 6, 1911 (fig. 12), and in 1912, machinery was on the ground to erect a four-table mill, according to Snider (1912, p. 88).

The principal mine is about 25 feet deep and 50 feet across, cut into the side of a northwest-facing slope. Another pit and some smaller prospects are to the northeast, with a dump to the west and remains of an old mill farther west. Smaller prospects are on the hill to the southeast and south, with many small dumps along a southern haulage road and a small dam to the west on Colbert Creek. Some limonite is present in the clay above the dolomite at the workings. Small prospect pits to the south, southwest, and northwest are in the Fort Sill, Honey Creek, Reagan, and Colbert Porphyry formations.

Figure 12. First mill boiler going to Goose Nest Mine from Davis, Oklahoma. Taken April 6, 1911. (Photo courtesy of Mrs. Mildred Sober West.)

Rumley or Incline Mine (near C-NW sec. 18, T. 1 S., R. 1 E., in Signal Mountain and Royer Dolomites):

In August 1910, G. M. Rumley leased the property to the Indian Mining and Development Co. (Gertrude Sober, president). As part of the contract, the company made an agreement with Rumley to construct a boiler on the property. There is, however, no record or physical evidence that it was constructed. Most of the adjacent property was leased by the Pennington Mining and Development Co. and the Interstate Mining Co., with most of these leases apparently made for recovery of iron ore.

The mine here consists of a tunnel in the side of a hill of lower Signal Mountain Limestone and upper Royer Dolomite. Snider (1912, p. 88) stated: "The track in the tunnel dips at about 20° to the southeast, while the rocks dip 30° to 35° to the north. In the summer of 1911 the tunnel had reached a length of about 150 feet. A sample selected from the dump was analyzed but showed no metallic value." There is a dump to the northwest along the creek. A windmill now stands above the adit. On August 12, 1940, C. A. Merritt and A. J. Williams sampled rock from the site but found no zinc mineralization. They saw several hundred tons of iron ore, in masses 3 feet thick, lined

up seemingly "along the strike" and commented that some of the limonite was in the form of pseudomorphs after pyrite (OGS field sheet 0371, Murray County). They mentioned an Elm Spring to the northwest of the mine and other iron ore prospects to the west and south. They also stated that the shaft was sunk by Joe Marrs of Davis.

Unnamed Iron Mine (NE-NE-NE sec. 13, T. 1 S., R. 1 W., in upper Butterly and lower McKenzie Hill formations):

This mine is just northwest of the Rumley Mine and consists of a shaft 70 feet or more deep on the southwest side of a low hill. The hill has a large quantity of limonite scattered over an area measuring 450 feet east–west by 300 feet north–south, with much of the limonite in the form of pseudomorphs after pyrite. The mineralization is bedded east–west, and the rocks dip about 45° N. A report on this deposit was made June 26, 1942, by C. A. Merritt, W. E. Ham, and C. K. Frazier (OGS field sheet 0522, Murray County). No zinc mineralization was reported.

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