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MINING HISTORY OF THE CARTHAGE COAL FIELD, SOCORRO COUNTY, NEW MEXICO

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ABSTRACT—The Carthage coal field in east-central Socorro County lies on the east flank of the Rio Grande Rift in a series of small fault blocks which contain the coal-bearing units. The Tres Hermanos and Crevasse Canyon Formations coal-bearing sequences both outcrop in the field but only the Crevasse Canyon has coal of minable thickness. This unit contains two coal seams ranging in thickness from 4 to 7 ft. The lower bed, called the Carthage seam, is the main source of coal extracted in the field, beginning in the 1860s. This seam is an excellent coking coal and relatively high in Btu value (12,531 Btu/lb). The proximity to southwest smelters in the 1880s and development of a rail spur connecting to the main line created the first surge of coal mining activity in the Carthage field. Carthage would experience several pulses of coal development until the late 1960s. Over 2 million short tons (st) of coal were produced from mines within the Carthage field from 1882-1963. The majority of the easily mined coal has been extracted from this field and the structure of the field does not lend itself to today's large-scale mining.

INTRODUCTION

The Carthage coal field is located approximately 12 miles southeast of Socorro and 10 miles east of San Antonio, south of US Highway 380. Little or no mining activity has taken place for the past thirty plus years except for occasional interest by mining companies looking for new opportunities. Carthage is the site of the earliest sustained coal mining in the New Mexico territory and the field continued to have pulses of mining activity into the late 1960s. Many of these operations were plagued by land disputes, legal battles, struggles to maintain rail transportation, economics of the time, and by the complex geologic structure of the Carthage area.

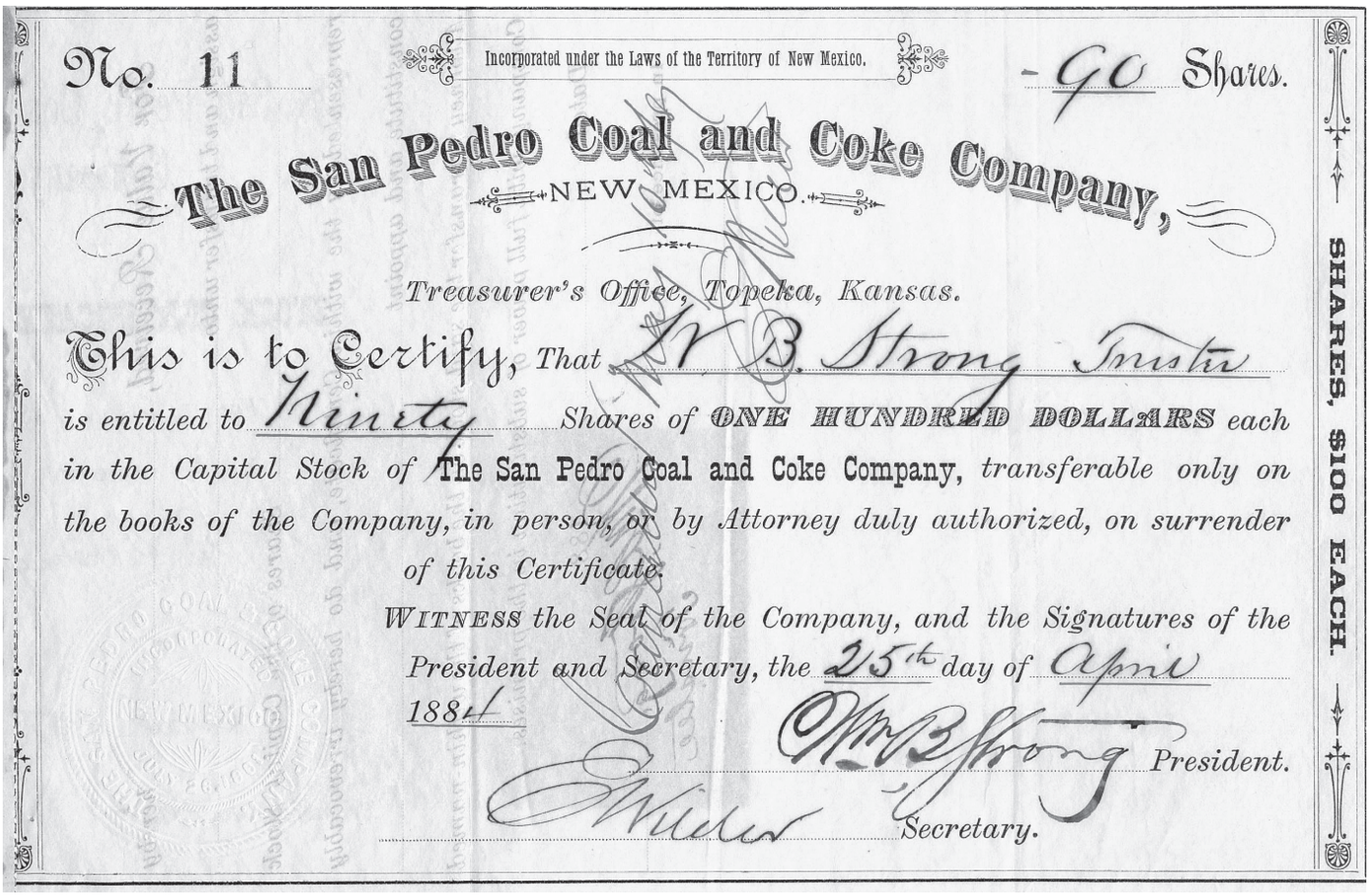
The Carthage coal field encompasses about 10 square miles on the east flank of Rio Grande rift, in a series of small fault blocks containing the coal-bearing units. Coal of minable thickness (4-7 ft) occurs in two seams in the Crevasse Canyon Formation. The Tres Hermanos Formation crops out in this field but the coal seams within this unit are rarely more than 2 ft thick (Osburn, 1983). This coal has excellent coking characteristics and is high-volatile C bituminous in rank (Hoffman, 1996)

Following the Mexican war, (1846-1848) New Mexico became a territory of the U.S. The Army needed fuel for blacksmiths stationed at the nearby territorial forts. The first use of coal from Carthage was in 1862 at Fort Craig, the earliest coal mine in the New Mexico territory operated on a sustained basis (Hereford, 2003). Carthage coal was used at Forts Bayard, Stanton, and Seldon. The mine was managed by Estanislao (spelling differs in references) Montoya, a brigadier-general of the New Mexico militia. He became a sutler (merchant supplying goods to the soldiers) at Fort Craig in 1872 and continued to supply coal in this capacity until 1877 (Haines, 1891). Montoya's family lived in San Antonio and owned the land where the coal mine was located; Estanislao claimed the Carthage coal area was part of the Socorro Land Grant. The 1878 survey of the Socorro Land Grant did not include the coal area. However, the surveyor general was persuaded to order a new survey that did include the Carthage coal area. This decision played a role in coal development of this area in the 1880s.

The Santa Fe Railroad became interested in the Carthage coal area while expanding its railroad lines into the New Mexico Territory after the Civil War. The Santa Fe Railroad sent out surveyors to discover feasible routes for railroads in 1877 and to look for coal and water to supply the trains. The railroad was also interested in coal that could produce coke to supply smelters in the southwest as way to increase their profits. As a source of coal west of Glorieta Pass, the Santa Fe Railroad looked at the Cerrillos area but decided to develop Carthage first (calling it San Pedro at this time) because of its proximity to southern markets and the coking quality of the coal.

SAN PEDRO COAL AND COKE COMPANY

Estanislao Montoya partnered with Thomas J. Peter in March 1881 to market and mine coal from the Carthage field. Thomas Peter was a former director and general manager for the Santa Fe Railroad. Papers were filed on July 26, 1881 to establish the San Pedro Coal and Coke Company as a subsidiary of the Santa Fe Railroad (Hereford, 2003). Montoya and Peter received 45% of San Pedro Coal and Coke Company stock (Fig. 1) and in return, Montoya and family conveyed 6 square miles encompassing the coal area to San Pedro Coal and Coke. To transport the coal from Carthage to the main line in San Antonio, the Santa Fe Railroad created a subsidiary company called the New Mexican Railroad. The New Mexican was incorporated January 12, 1882 but surveying for the branch was already underway. The railroad to Carthage, including a bridge across the Rio Grande east of San Antonio, was completed May 1, 1883 (R.L. Crump Archives, Carthage Branch, 2008). San Pedro Coal and Coke's ultimate goal was to convert all of the coal mined into coke and ship this product to local smelters in Socorro as well as other smelters in New Mexico, Arizona and Mexico (Mineral Resources of the U.S. 1883-1884, p.56).


No. 11

Incorporated under the Laws of the Territory of New Mexico.

60 Shares.

The San Pedro Coal and Coke Company,

NEW MEXICO.

Treasurer's Office, Topeka, Kansas.

This is to Certify, That W. B. Strong Trustee is entitled to Ninety Shares of ONE HUNDRED DOLLARS each in the Capital Stock of The San Pedro Coal and Coke Company, transferable only on the books of the Company, in person, or by Attorney duly authorized, on surrender of this Certificate.

WITNESS the Seal of the Company, and the Signatures of the President and Secretary, the 25th day of April 1881

W. B. Strong President.

Secretary.

SHARES, $100 EACH.

FIGURE 1. Rare trustee's stock certificate for San Pedro Coal and Coke Company issued to W.B. Strong. Strong, the coal company's president, was also president of the Santa Fe Railroad. Courtesy of New Mexico Bureau of Geology Mining Archives and Bob Eveleth.

The San Pedro Coal and Coke Company had an auspicious beginning with economical transportation in place and access to markets. A year before the rail line was completed (1882) the San Pedro mines (sec. 9, T5S, R2E; Fig. 2, Carthage No. 1) produced 16,321 short tons (st). The San Pedro mines extracted coal from a 4 to 4.5 ft seam in the Late Cretaceous Crevasse Canyon Formation. Twelve coke ovens were built in San Antonio in this year, but no production is recorded until 1883 (Mineral Resources of the U.S., Calendar Years 1883-1884). By 1884, 70 coke ovens had been built in San Antonio (Fig. 3) supplying coke to nearby smelters in Socorro and Arizona. The January 1, 1887 (p. 12) Engineering and Mining Journal reported shipments from two mines operating two shifts per day producing 250 st a day at Carthage. That year coke production totaled 13,710 st with an estimated value of $6.00/st (Mineral Resources of the U.S., 1887). Unfortunately 1889 coke production had fallen to half that of the previous year. By 1892, these mines were extracting coal from the pillars and the No. 2 mine closed in 1893. The No. 1 mine continued to operate until August 1893 (Mine inspector for the Territory of New Mexico, 1894-1912). By then the coke ovens had been removed from San Antonio. San Pedro Coal and Coke had yearly production rates over 50,000 st from 1885 through 1892 (Fig. 4). The mine machinery and houses were moved from Carthage to Cerrillos in August 1893. The Santa Fe Railroad had reached an agreement with the owners of the Cerrillos coal field near Madrid, NM to replace the Carthage coal with that from Cerrillos. With this agreement in place, they made plans to abandon the branch line from San Antonio to Carthage.

Several factors led to the closure of these mines; the Carthage area is highly faulted with coal seams being displaced by several feet, making mining difficult (Fig. 2). The mine inspector reports the pillars were being mined, indicating the mine was not being extended; probably the coal seam pinched out due to depositional factors or offset by faulting. To continue producing coal the miners had to start taking coal from the pillars between the existing rooms. These conditions could have led to reports that the economic coal had been exhausted in the Carthage area (Gardner, 1910).

The economic circumstances at the time played a role in closing the San Pedro operation. During the previous decade of expansion, several sectors of the economy became overextended, leading to an economic downturn in 1893. Railroads, including the Santa Fe, major players in this expansion, suffered accordingly when the economy declined. The Santa Fe went into receivership on December 24, 1893. By December 12, 1895, the railroad had been reorganized as the Atchison Topeka and Santa Fe Railway (AT & SF) and the new company acquired San Pedro Coal and Coke's outstanding stock. In March 1897, the AT &

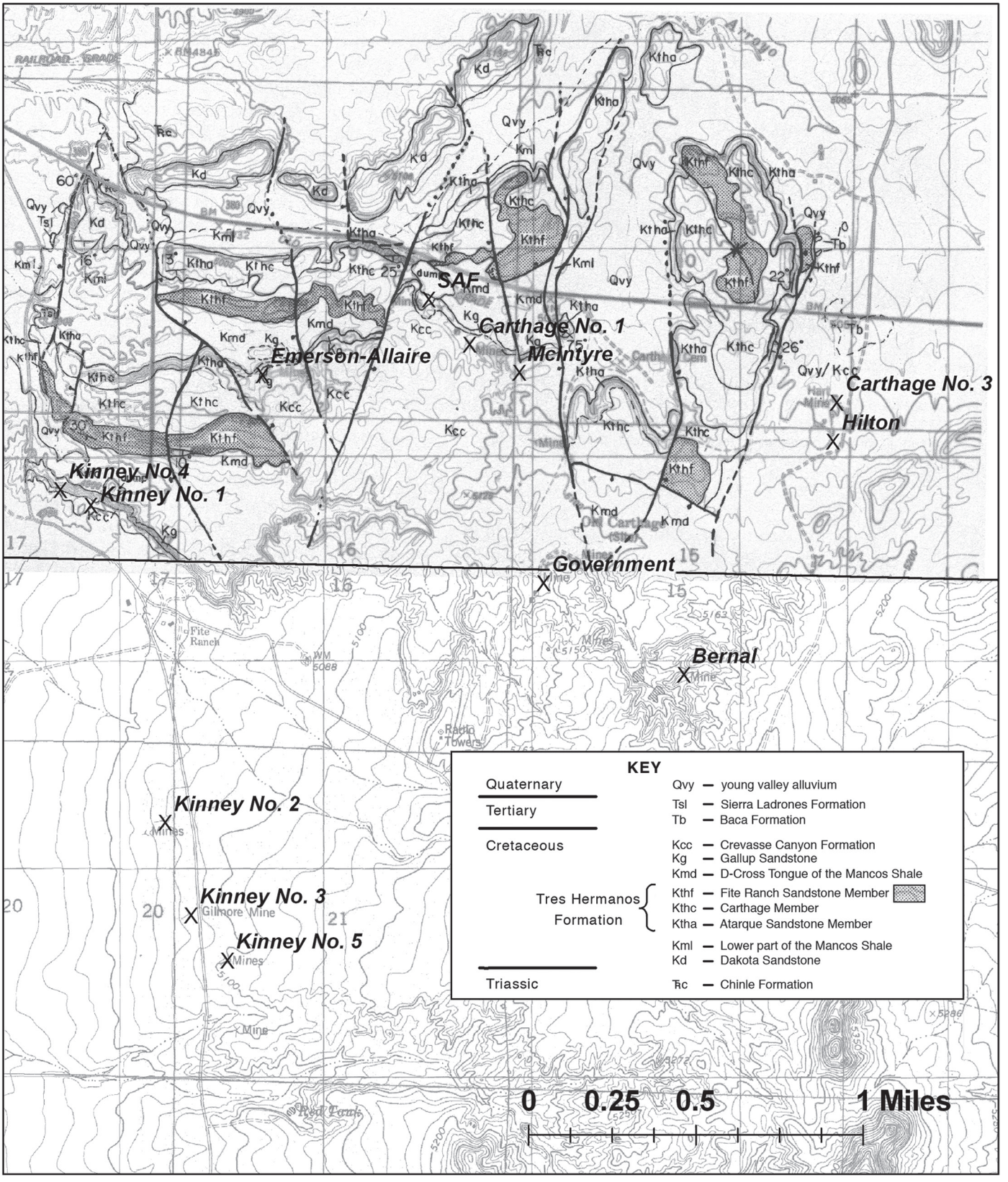


FIGURE 2. Geologic map and location of mines in the Carthage coal field. North half of figure (above line) is from Chapin and Callender, 1983, Figure 1-60.55; geologic mapping by O.J. Anderson and J.C. Osburn. Mine locations are from the 1904 map of Carthage field, Southern Fuel Co. in NM Bureau of Geology mine map archives (1550) and from locations in Nickelson, 1979. Note Carthage No. 3 on map aliases- Hart, Soto, and Baca mine. SAF mine operated in 1902 by San Antonio Fuel Company - no production.

FIGURE 3. Coke ovens at San Antonio, NM. Inscription on back of photo –"Mother's Day, Sunday, May 6th, 1888, was a rare down day for the San Pedro Coal & Coke Co ovens at San Antonio, New Mexico. Company officials, including superintendent Sullivan (center) and Walter Faddis (left), take advantage of the situation to show the ovens to their wives and Mrs. Smith (right). Faddis' two sons and the family dog were also along for the occasion." NMBG&MR Photo No 1867 by Joseph E. Smith, courtesy of Avery Smith.

SF determined San Pedro Coal and Coke should be dissolved (Hereford, 2003). During the time of receivership and dissolution, little had been done to remove the tracks from San Antonio to Carthage. As part of the abandonment agreement with the territorial authorities, the Rio Grande bridge east of San Antonio was deeded to Socorro County (Hereford, 2003: Socorro County Records, Quit claim deed vol 42, folio 377). The rail line was officially abandoned February 20, 1896, but trains continued to operate as needed until May 30, 1897.

CARTHAGE COAL COMPANY

The next phase of coal mining at Carthage began in early 1894 with Austin Goodall and Felipe Portigliatti forming the Carthage Coal Company. They developed a mine 12 miles southeast of San Antonio in (NE ¼ sec. 15, T5S, R2E; location of Hilton mine on Fig. 2), east of the San Pedro Coal and Coke mines, and filed for a coal tract with the government. Because the Socorro Land Grant was under review, their filing was not approved. The validity of the Socorro Land Grant containing the coal acreage E. Montoya had claimed to be within the land grant was overturned in August 1899. The Surveyor General limited the boundaries of the confirmed grant to land actually settled and cultivated prior to Feb. 2, 1848 (Hereford, 2003). With this ruling, the Carthage coal area was added to the public domain.

During 1894, 486 st were mined at the Carthage Coal Company mine. Portigliatti and Goodall sold their interests in Carthage Coal Company (1895 or 1896) to Giacoma Lovera (Luerra) and Mary Hilton (August Hilton's wife; their son, Conrad, later prospered in the hotel industry). According to the Territorial Mine Inspector reports (Mine Inspector for the Territory of New Mexico, 1894-1911), the Carthage Coal Company mine was named the Carthage or Carthage No. 3 mine. This mine extracted coal from a 4.5 ft thick seam, probably the same seam mined at the San Pedro Coal and Coke mines within the Crevasse Canyon Formation. The territorial mine inspectors call this seam the Carthage coal seam. Coal from the Carthage Coal mine was transported by wagon 12 miles to the main railroad line at San Antonio. The New Mexico market for this coal included Socorro, Magdalena, Belen and Silver City; coal was also sent to El Paso, Texas, Arizona and Mexico. The Territorial mine inspector reported a weak market for Carthage coal in 1902 particularly in Texas because fuel oil from Beaumont Texas was being used in its place.

The Carthage Coal Company mine became the Hilton mine in 1903 (Fig. 2). This company operated two other mines, the Government mine (SW ¼, NW¼ sec. 15 T5S, R2E and NW ¼,

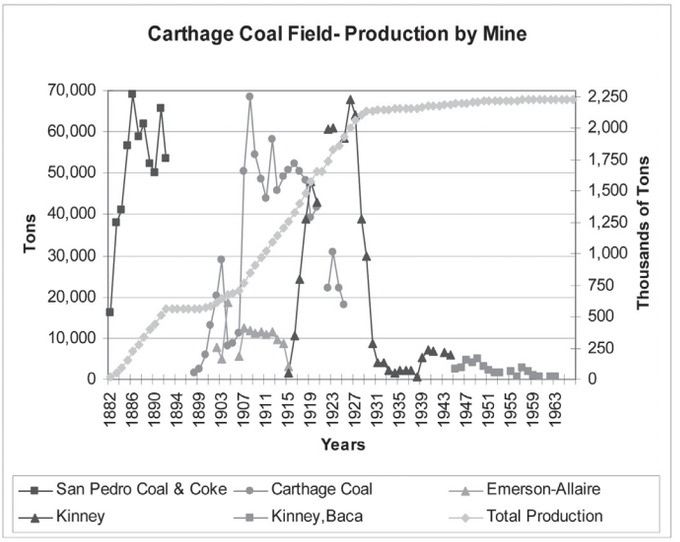


FIGURE 4. Carthage coal field production, individual mines and total production. Data from Mine Inspector for the Territory of New Mexico, 1894-1911 and State Inspector of Mines, 1912-1968.

SW¼ sec. 15 T5S, R2E; Fig. 2) and the Bernal mine (W½, SE¼ sec.15 T5S, R2E) located between the Government and Hilton. The Government mine was originally the Duffy mine opened by Robert Duffy in 1901 on a 5 ft 9 inch seam. Carthage Coal disputed Duffy's land ownership of this mine and took their dispute to the Socorro County District Court to eject Duffy from the property. Duffy produced 2,507 st during 1901 and 1902 before the final decree in 1904 settled in favor of Carthage Coal (Hereford, 2003). The Government mine was named for its proximity to the original mine operated by the U.S. Army.

During 1904 August Hilton, now one of the owners of Carthage Coal Company, considered the possibility of rebuilding a rail spur to Carthage to lower the cost of transportation. Hilton, lacking the resources needed to develop the mines and rebuild the rail spur to Carthage, gave Daniel McMillan, a Socorro attorney, an option on the coal properties. McMillan began seeking investors for this deal and ultimately negotiated a sale to Powell and Grace Stackhouse of El Paso, Texas. Stackhouse was an associate of Charles B. Eddy, promoter of the New Mexico Railway and Coal Company that built a series of railroads from El Paso to Dawson located southwest of Raton, New Mexico. On June 1, 1904, McMillan organized a railroad company to rebuild the track to Carthage. Two other railroads were incorporated with the same objective. One, the New Mexico Midland Railway was formed by parties associated with the Victor Fuel Company of Colorado. This group also contracted to operate the Carthage mines, subject to McMillan's option (Hereford, 2003). The result of all these competing interests in the railroad and mines led to nearly two years of litigation and idling of the mines.

In an effort to develop a competing coal source the Colorado group organized the Southern Fuel Company and opened the McIntyre mine near the original Carthage coal mine operated by San Pedro Coal and Coke (SW¼ sec. 10, T5S, R2E; Fig. 2). The McIntyre or Manilla mine, leased to John McIntyre for operation, (Gardner, 1910) never reported any production, possibly because of the significant dip (25°) of the seam making mining extremely difficult. (Mine Inspector for the Territory of New Mexico, 1906; Hereford, 2003).

Eventually the lawsuits were settled out-of-court in early 1906 and Stackhouse and Eddy emerged owning the New Mexico Midland Railroad and the Carthage Coal Company. The coal land assets were conveyed to a new corporation, the Carthage Fuel Company. Stackhouse and Eddy (1906) resumed operations at the Hilton, Government and Bernal mines. The New Mexico Midland branch was completed from San Antonio to Carthage in 1906 and new tipples were built at the Carthage Fuel mines for loading the coal into the rail cars. Production from all the Carthage Coal/Carthage Fuel mines was significantly lower than the previous two years (1904-1905) caused by the delay of building the railroad and land ownership disputes. By 1907, production increased considerably (Fig. 4) with the availability of rail transportation and 50 new houses were built for the miners by the company.

On December 31, 1907 an explosion killed eleven men at the Bernal mine. The mines at Carthage were not gaseous but the coal dust was highly flammable (Mine Inspector for the Territory of New Mexico, 1907). Blasting powder had been used in the mines up to this time, but after 1909, the mine inspector reported that very little explosives were used in the mines and most of the coal was mined by hand methods (pick, shovel; Mine Inspector for the Territory of New Mexico reports, 1909). The following year (1908), the mine inspector reported water coming in along the faults in the Hilton mine resulting in installation of a steam pump to handle the flow. By 1909, fuel oil was taking a greater toll on the Carthage coal market, particularly in El Paso, Texas and Oklahoma. Even with this market downturn, Carthage Fuel built a central power plant at the Government mine and the following year built a school house at Carthage employing two teachers. The Mexican revolution of 1911 curtailed the market for this coal in Mexico. However, Carthage Fuel was able to ship coal to Chino Copper in Santa Rita, New Mexico and other towns in the southwest. Three years later Carthage Fuel supplied electricity to all their mines as well as other mines nearby from the central power plant, fueled with coal from their mines (State Inspector of Mines report, 1914).

Disaster struck Carthage Fuel a second time when a fire began due to coal dust ignition in the Government mine on February 22, 1918. The mine inspector called in the U.S. Bureau of Mines safety team who had a rail car in Raton. The mine was sealed to contain and extinguish the fire by the time the safety team arrived on February 26. When the safety team along with the Dawson mine manager and two other experienced miners from Raton tried to enter the mine, they found the air was unsafe, killing a sparrow they carried with them within 25 ft of the portal (State Inspector of Mines, 1918). One of the team (David Murphy, mine inspector for Phelps Dodge at Dawson) that entered the mine to determine the condition of the mine disarranged his breathing apparatus and died from carbon monoxide poisoning (State Inspector of Mines, 1918, p. 18). It was not until March that the air was determined to be safe and May 5 before the seal could be broken into the fire area.

The Hilton and Bernal mines were mined out and closed in 1918. Finlay (1922) estimated that 40 acres of coal had been removed at each of these mines. Finlay (1922) also stated that it was difficult to extend the mine workings for these mines because of the complex faulting in the area, the dip of the seam (15°), and the cost of exploratory work to locate the minable seam in a new fault block.

The Government mine continued to operate until 1926 when all the pillars had been pulled within a few hundred feet of the portal and the equipment was removed (Mine Inspectors report, 1923, 1926). From 1922 to 1924, the mine inspector reported development work at a new mine called the Carthage No. 3 owned by Carthage Fuel. According to Nickelson (1979), the Carthage No. 3 mine is located in the SW ¼ sec.10 T5S, R2E (Fig. 2) and produced 25,000 st. This mine and all Carthage Fuel Company operations ceased after 1925 (State Inspector of Mines, 1926).

OTHER MINES IN THE CARTHAGE FIELD

A few mines operated by other individuals or companies produced coal in Carthage and later Tokay, to the southwest of Carthage. E.O. Emerson and Charles Allaire opened the Emerson alias Emerson-Allaire mine (sec. 9 and sec. 16, T5S, R2E; Fig. 2) in 1902. This mine opened a slope on a 6 ft-thick coal seam with a 20°dip in the Carthage coal seam in the Crevasse Canyon Formation. Production began in 1902 and coal was hauled by wagon to San Antonio for shipment by rail to towns in New Mexico and El Paso, Texas. In 1904, the Emerson mine closed the main slope because of a "squeeze". This indicated a problem with the roof and or floor expanding into the mined out area, probably because the supporting pillars or timbering were inadequate to hold the weight of the unsupported roof. This condition could have been complicated by the type of rock and or existing faults that diminished the competency of the rock. After closing the main slope two new slopes were opened, one driven in sandstone overlying the old main slope (Mine Inspector for the Territory of New Mexico, 1907). By 1908, the Emerson-Allaire mine installed a tram connecting to the New Mexico Midland railroad. The mine operated for a few more years, closing in 1916 with a total production of 128,036 st (Fig. 4).

The Kinney mine (sec. 17, T5S, R2E; Fig. 2) operated by B.H. Kinney opened in 1914 southwest of the Carthage Fuel Company mines. The dip of the coal seam was significantly less here (6° SW) than at the Carthage mines. Production began in 1915 with 1,600 st. A rail spur was laid from the mine to the New Mexico Midland line in 1917. Tipple and chutes were constructed and a water system installed the same year. In 1918, more dwellings for the miners were built near the mine and a post office was built establishing Tokay. Tokay was on the mesa above the Kinney mine, held up by resistant beds of the Gallup Sandstone. Coal from this mine like many others in the area was sold in El Paso. In 1925, Mrs. Mabel Kinney applied for a prospecting permit for parts of secs. 20 and 21, T5S, R2E (Nickelson, 1979) to develop the No. 2 mine. This mine was developed on a 4 to 4.5 ft thick coal seam. This mine started producing coal in 1926; all production for the Kinney mines came from the No. 2 the following year. The pillars in the No. 1 mine had been pulled in the preceding year. Kinney opened three other mines, numbered 3-5. No. 4 was in sec. 17 (SE¼ NW¼, T5S, R2E) and No. 3 and 5 were in sec. 21 (SW¼ NW¼ T5S, R2E, Fig. 2). According to Nickelson (1979), No. 3 was a northeast continuation of the No. 2 mine. The Kinney No. 4 mine was opened in a wedge-shaped fault block near the boundary of the No. 1 mine. Approximately 8,600 st of coal were extracted from the No. 4 (Nickelson, 1979). The No. 5 mine was the last one to be owned and operated by Kinney. It was opened by driving two slopes through alluvium to intersect the coal along the eastern edge of the No. 3 mine workings.

Fuel oil and natural gas as well as hydroelectric power were taking the place of coal for home heating and power generation for many industries at this time (1928). El Paso now had oil and gas pipelines bringing fuel in from other parts of Texas significantly decreasing the demand for coal. These factors along with the Depression cut production by over 50% from 1927 to 1929(63,968 st, 29,761 st respectively). Production for the Kinney mine dropped further (8,676 st; Fig. 4) in 1930. J.E. Gilmore acquired the Kinney mine in late 1930 (Hereford, 2003). Coal from the Gilmore mine was sold in Albuquerque and the Socorro area and shipped by truck after the rail spur to Carthage stopped running trains. With the low production of coal from the Carthage field, the New Mexico Midland Railroad decided to cease operations August 28, 1931. They had been losing money since Carthage Fuel closed their mines in 1926 (Hereford, 2003). Gilmore continue to operate the mine through 1937 but Kinney repossessed the operation in 1939 and continued working the mine until December 1949 (State Inspector of Mines, 1949; Hereford, 2003).

Jack Hart acquired the old Hilton mine property (parts of sec. 10 and 15, T5S, R2E) opened as the Hart mine in 1935, and continued mining until 1939. Rafael Soto obtained the same mine in 1947 and operated it for one year at which time the property was sold to A.B. Baca. Baca mined coal at this location until 1968 (State Inspector of Mines, 1968). Coal from the Baca mine provided home heating fuel to the surrounding communities, and the public schools in Socorro (F. E. Kottlowski, personal commun. 1993) These operations, the Hart, Soto, and Baca, mined the coal left by the Carthage Fuel Company in between the faults and it appears the mine was north of the old Hilton mine (Nickelson, 1979, p.64; Fig. 2, Carthage No. 3). From 1945 to 1963, only 37,000 st were produced from the Carthage mines. The mine operated by Baca was called the Carthage mine or the Carthage No. 3 mine (State Mine Inspector reports, 1954-1966). Both of these names were originally used for the Hilton mine location when it was first opened by Carthage Coal Company, creating confusion in the location of these two mines. On Figure 2, The Carthage No. 3 is the location of the Baca, Soto, and Hart mine.

The last significant interest shown in the Carthage coal field occurred when Cactus Industries opened a coal mine, the Tres Hermanos, in 1980 (Martinez, 1981). However by 1981 it was no longer operating. The mine was to be a strip mine with 60,000 st production per year for eight years (Albuquerque Journal, December, 1979). Once development began, it was realized that the reserves had been overestimated (Martinez, 1981) and operations ceased.

SUMMARY

From 1897-1944, 1.7 million st of coal were produced from the Carthage coal field; the San Pedro Coal and Coke, Carthage Coal/Carthage Fuel Company, and the Kinney mines all had years where production was over 60,000 st (Fig. 4).Total recorded production for the field is about 2.23 million st. This is a significant amount given the coal field's limited extent and complex geology. The quality of the coal, access to rail facilities during most of the producing years and proximity to markets not served by any other coal areas created the opportunity for coal development in the Carthage area.

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REFERENCES

Albuquerque Journal, December 18, 1979, State OKs Strip Mine Proposal, New Mexico Press Clipping Bureau, Albuquerque, NM.

Chapin, C.E., Callender, J.F., 1983, Socorro Region II: N. M. Geological Society, 34th Field Conference Guidebook, p. 24.

Engineering and Mining Journal, January 1, 1887, General Mining News: New Mexico, Socorro County: Scientific Publishing Company, No. 27 Park Place, New York, NY, p. 12.

Finlay, J.R., 1922, Report of Appraisal of Mining Properties of New Mexico, Santa Fe, New Mexico, p.122-127.

Gardner, James H., 1910, The Carthage coal field, New Mexico, U.S. Geological Survey Bulletin 381-C, p.452-460.

Haines, H., 1891, History of New Mexico: from the Spanish Conquest to the Present time 1530-1890, New York, New Mexico Historical Publishing Co., p.591.

Hereford, J.P., December 2003, Report on Carthage Coal field, San Pedro Coal and Coke Co., and New Mexico Midland Railway, private report.

Hoffman, G. K., 1996, Coal resources of New Mexico: New Mexico Bureau of Mines and Mineral Resources, Resource Map 20, p. 17.

Martinez, L.B., 1981, Coal in Arnold, E.C. and Hill, J.M., comps. New Mexico's energy resources '81: annual report of the Bureau of Geology in the Mining and Minerals Division of New Mexico Energy and Minerals Department, Santa Fe, New Mexico, p. 43-44.

Mine Inspector for the Territory of New Mexico, 1894-1911, Annual reports to the Secretary of the Interior.

Mineral Resources of the U.S., Calendar Years 1883-1884, Albert Williams, Jr., Washington Government printing offices, p 56, 170.

Mineral Resources of the U.S. Calendar year 1887, 1888, David T. Day Chief of Division of Mining and Statistics and Tech., Washington Government printing offices, p. 385.

Nickelson, H., 1979, Memoranda to the New Mexico Bureau of Mines and Mineral Resources, Reclamation evaluation for OSM, Abandoned Mine Lands Survey, Carthage field, unpublished notes, vol. 2, p. 56-93.

Osburn, J.C., 1983, Coal resources of Socorro County, New Mexico, Socorro Region II: N. M. Geological Society, 34th Field Conference Guidebook, p. 223-226.

R.L. Crump Archives, 2008 Selections from Meade's Manual, Carthage Branch: http://www.atsfry.com/easternarchive/meades/mead128a.htm (Accessed April 21, 2009).

State Inspector of Mines, 1912-1968, Annual reports to the Governor of the State of New Mexico.