

## An historical vignette:

# Stephenson–Bennett mine

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The Stephenson–Bennett mine near Las Cruces is a celebrated part of New Mexico's mining past. However, the names Santo Domingo de las Calzadas or San Augustin are virtually unknown. In actuality, these are but different names for the same locality. Historically, Padre Larue may have known of the deposit nearly 200 yrs ago (indeed the mine is a good candidate for the famous "Lost Padre," the legendary lode said to have been worked by Larue circa 1797 [Kottlowski, 1966; Kelly, 1975]). The deposit was definitely known as early as the 1830's to various Mexicans willing to risk their lives by exposure to the ever present Apache Indians (Sprague, 1858).

Recent research has disclosed fascinating (and heretofore unpublished) details regarding the "discovery" of the mine during American occupation (post-1848) and the subsequent changes in ownership and operation. Like many other famous mines, this one has produced its legends (including its own equivalent of the famed "Bridal Chamber"), heroes, and villains.

The production history of the mine can be conveniently divided into three periods, the first from about 1849 to 1882, the second from 1882 to 1912, and the third from 1912 to the present.

### Santo Domingo de las Calzadas to Stephenson (1849–1882)

Jose Perez, Alejo Carrasco, and **Jose Blas Duran**, three residents of the Las Cruces area during the late 1840's with a flair for prospecting, began exploring the nearby Organ Mountains. They were aware of legends, even in their time, of fabulous lost mines and of earlier attempts to work the lodes somewhere in these mountains. Perhaps they were searching for the "Lost Padre," which was said to be somewhere in the vicinity. Whatever the purpose, the incentive must have been great because these mountains were home to the Mescalero Apaches who repeatedly made it obvious that they wanted no part of the white man and his ways.

How long the three prospected is not known; some accounts peg the discovery as early as 1847. Most likely the discovery was made during 1849 or later (Hilsinger, 1887; Jones, 1904, p. 73; Dunham, 1935, p. 188, 220). By 1852, however, Perez, Carrasco, and **Duran** had discovered and worked, in primitive fashion, the mine which they had named the Santo Domingo de las Calzadas (District Court Records, Carrasco and others vs. Stephenson, 1855). The three miners found silver-rich lead carbonates on the slopes of a low hill called "El Pardo" because of its variegated or speckled appearance. They traced the float back to a massive shear zone, 25–50 ft wide, where the orebody cropped out. Oxidation had considerably enriched the surface ores in silver and may have produced some

chlorargyrite (horn silver). The ores were easily worked with pico and pala (pick and shovel; fig. 1).



FIGURE 1—Silver-rich lead carbonate float was traced up slopes of "El Pardo" to shear zone where Santo Domingo de las Calzadas (later Stephenson) orebody was found. Hypothetical scene depicts miners digging in soft outcrop with "Organ Needles" in background. (Vignette detail, share certificate circa 1895, author's collection.)

At this location approximately 2 mi southwest of San Augustine Pass, the Precambrian granitic basement rocks dip steeply to the west, having been uplifted during the Laramide orogeny and later batholithic intrusion (Seager, 1981). Stratigraphically the Bliss formation lies above the granite and is succeeded by Montoya and Fusselman Dolomites and Percha Shale. Ore-forming solutions, presumably derived from the Organ batholith, rose along fault fractures and shear zones and ore deposits were formed 1) at the contact between Fusselman Dolomite and the overlying Percha Shale, 2) along permeable shear zones in the dolomites, and 3) along contacts between dolomite and a quartz-monzonite porphyry dike. The Stephenson orebody is of the latter type and is the only one to crop out in this area; the ore follows the shear zone down dip for approximately 50 ft and then follows the lower contact of the quartz-monzonite dike (Dunham, 1935).

As was customary in the 1840's, ownership of the mine was divided into 24 shares which subsequently could be bought, sold, or traded. Thus each man owned eight shares. Unfortunately, these were men of limited means, and they were able to provide only ". . . six oxen, two horses, and the necessary implements for working the mine in a desultory fashion . . ." (District Court Records, Carrasco and others vs. Stephenson, 1855). Soon it became apparent that they could not continue mining without material assistance. The three miners made a deal with Hugh Stephenson, a merchant of Concordia (El Paso), who, in exchange for six shares, ". . . agreed to furnish them all the necessary supplies . . . such as oxen, provisions [and] implements . . . deemed of advantage . . ." in developing and working the deposit (District Court Records, Carrasco and others vs. Stephenson, 1855).

Hugh Stephenson obviously knew a good thing when he saw it, for once in possession of the first six shares, he vigorously set out to

gain control of the remaining 18. According to sworn testimony, he withheld delivery of the promised supplies, goods, and equipment. Carrasco, Perez, and **Duran** managed to continue mining until the Indians ". . . came down upon [their] oxen and horses . . . and stole and drove them away, [leaving] them without any means whatever to carry on the mining business . . . [they] were forced to work but feebly on their own inadequate means or abandon the mine . . . [and] sell most of their shares . . ." (District Court Records, Carrasco and others vs. Stephenson, 1855). Only when forced with the spectre of abandonment would they sell out completely.

Perez sold his shares for an undisclosed amount. Stephenson made a bid to take **Blas Duran's** shares on the grounds that Duran, being a resident ". . . of the Mesilla valley, at that time believed to be in the Republic of Mexico, could not hold . . . shares in the . . . mine, that the laws in force in the territory of New Mexico, would not permit foreigners to [own mines] and unless [Duran] sold it for the consideration proffered by [Stephenson] he would immediately denounce it . . ." and take possession (District Court Records, Duran and others vs. Stephenson, 1855).

**Duran** finally settled for \$150 in goods from Stephenson's store and an additional \$400 in cash to be taken from profits derived from the mine. The \$150 in goods were eventually paid at "exorbitant (sic) prices," but **Duran** had to sue for the \$400, eventually settling for an additional \$400 in goods (District Court Records, Duran and others vs. Stephenson, 1855).

Carrasco fared much better than his partners, selling his six remaining shares to Lewis Flotte for about \$2,000. Flotte, "a practical and experienced miner," from Texas was hired by Stephenson and induced to move with his family to Las Cruces in order to manage operations at the mine. Stephenson, at this point, owned three-fourths of the Santo Domingo de las Calzadas and maintained tight control over Flotte's one-fourth. Flotte quickly became disenchanted with the way Stephenson handled matters at the mine and soon he too would have his day in court accusing Stephenson of exercising ". . . complete control over the mine in the most arbitrary and tyrannical manner." Flotte was, understandably, anxious to recoup his expenses (such as moving his family) by working the mine but Stephenson ". . . made false his representations . . . and failed to work said mine according to promise . . ." (Flotte vs. Stephenson, 1855). Unfortunately, Flotte died before the case was heard and it was therefore dismissed. Stephenson presumably made a settlement with Flotte's family after his death in which he attained full ownership of the mine. Subsequently, the historic property became known not as the Santo Domingo de las Calzadas but as the "Stephenson."

Carrasco, Perez, and **Duran** were nearly forgotten by history. Just 25 yrs later, a Las Cruces newspaper would report ". . . the mine is known as the Stephenson from its discoverer . . . who found it while searching for

the Lost Padre mine . . ." (Newman's Semi-Weekly, 1881). However, evidence currently on hand suggests that Stephenson played little or no part in the discovery of the mine and rarely even visited the mine or smelting works. Apparently, Stephenson was content to conduct his affairs from his Concordia, Texas, mercantile store.

### Early mining operations

During the first two years of operations (about 1852-54), the mine was worked profitably, although in a most crude and primitive way.

In 1854, Captain Pope stated that even with the "... imperfect manner of smelting [Stephenson] has been compelled to adopt, the results have been exceedingly profitable. The ore is powdered between two stones, and the smelting is done without one convenience common to the states. The refuse probably

contains as much silver as the original ore and, notwithstanding this, from a mule load of three hundred pounds [he] gets \$18 of silver . . ." (equivalent to \$120 per ton; Blake, 1856, p. 37). Fig. 2 illustrates the Stephenson smelter.

After 1854 the mine was worked somewhat more efficiently, a result no doubt of Lewis Flotte's mining abilities. Production figures given in the official notes of the mineral survey and application for patent were from \$80,000 to \$90,000 with a clear profit of \$45,000 to \$50,000. Total production from the time of discovery was recorded at over \$100,000 (Burchard, 1881, p. 377; Wilkinson, 1910).

Mining operations at the smelter were primitive and therefore conducted without the use of explosives. Ore was raised to the surface on the backs of men using ladders made of nothing more than notched poles. Neither a hoist

nor even a simple windlass was used at the mine until 1882. Ore was hand sorted and sacked for transport to the smelting works near Fort Fillmore. Hostile Indians made reduction at the mine impossible (Burchard, 1883, p. 565; Jones, 1904, p. 75; Wilkinson, 1910). Only the highest grade silver ores could be handled.

By 1858, Stephenson, advanced in age, endeavored to sell the mine. Some U.S. Army officers at Fort Fillmore organized the Fort Fillmore Silver Mining Company and purchased the property for \$12,500 (Sprague, 1858). In retrospect, Stephenson's profit of \$50-75 thousand in pre-Civil War dollars was nearly as much as anyone made during future operations.

### Civil War prevents large-scale development

Management of the new company immediately decided to work the mine in a more orderly fashion. In 1860, W. Herman Rittler, a prominent mining engineer from Freiberg, Germany, was hired and placed in charge (Hilsinger, 1887). Rittler made an extensive study of the property which resulted in the Fort Fillmore Company ordering some \$50,000 of modern machinery (which apparently did not include a hoist).

The machinery did not arrive until late July 1861 because New Mexico was so far from eastern markets and all supplies had to be transported by team and wagon. One week later Fort Fillmore fell to the Confederate forces and all the property and machinery was seized (Wilkinson, 1910).

Exactly what took place during Confederate occupancy (1861-63) is largely unknown. The mine would have been a ready source of lead and silver—both commodities critically needed by the South. Some evidence suggests that the mine was indeed worked during this period (Rio Grande Republican, 1/14/1888).

In 1867, after the war, the Fort Fillmore Company sold their pre-war investment to an English firm for a reported \$250,000. However, another group calling themselves the San Augustine Mining Company had come upon the scene during the time the mine lay virtually abandoned and had staked the ground under the authority of the newly legislated 1866 mining law (Newman's Semi-Weekly, 1881; Wilkinson, 1910). Before this law, title, such as it was, to a deposit had been only loosely held by a vague "right of discovery" and constant working. Therefore, the 1866 mining law nullified the Fort Fillmore Company's unofficial claim to the property.

The new claimants, headed by H. Lesinsky, another El Paso merchant, understandably refused to relinquish possession. In fact, they occupied fortifications at the mine and were prepared to hold the property by force, if necessary (Hilsinger, 1887). Three years of litigation followed. The Fort Fillmore Company must have convinced the court that they retained a valid right to the property by arguing that they had been prevented from working the mine by the Confederates. Eventually a compromise was reached whereby the new claimants agreed to secure patent to the prop-

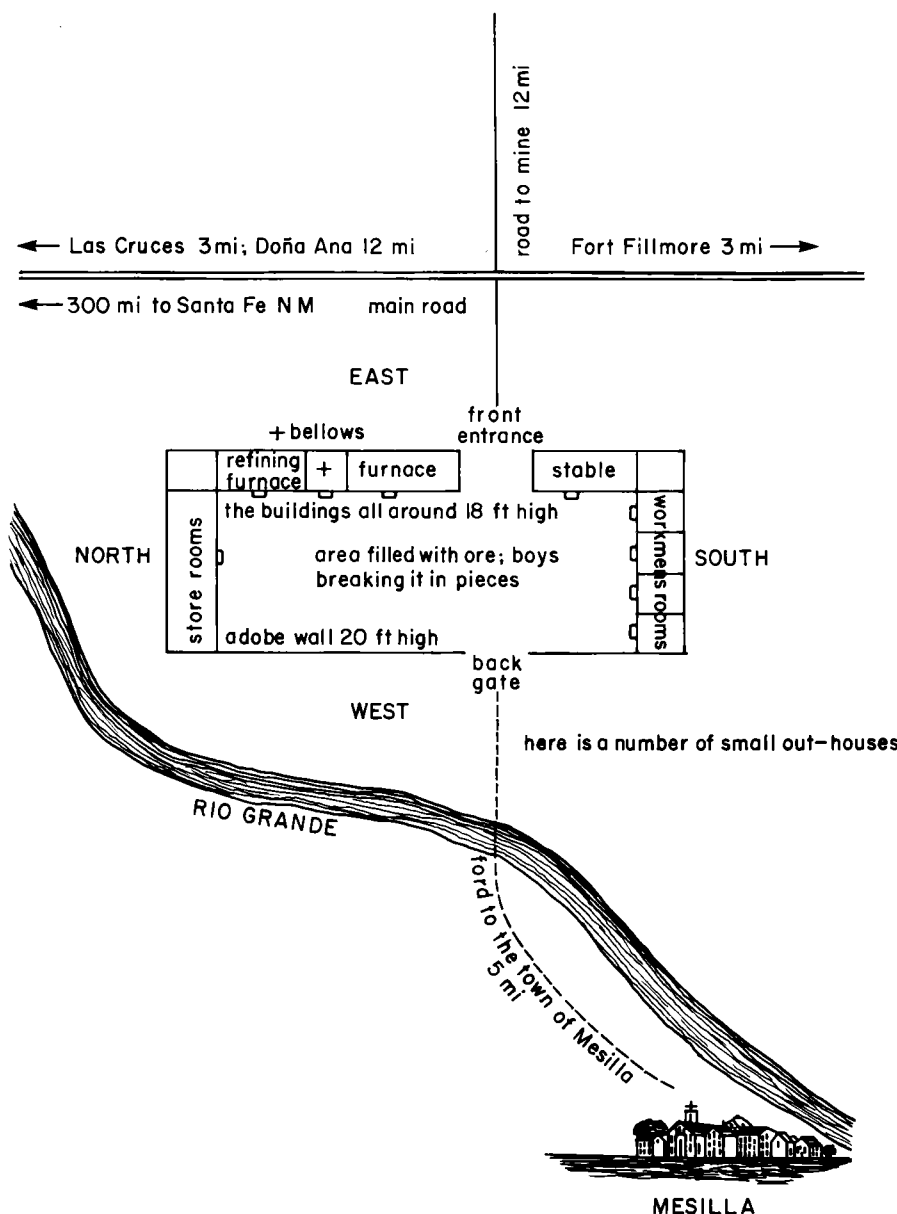


FIGURE 2—Ground plan of Stephenson's smelting house near Fort Fillmore, New Mexico. Pair of bellows "aided by a mule and a boy" delivered a "feeble blast" to the furnace, the ore for which was crushed between two stones by children. "The lead, or flux, is thrown away with the slag, both of which contain a portion of silver . . ." (after Sprague, 1858).

erty and deed a one-half interest to the Fort Fillmore Company (Hilsinger, 1887). Patent proceedings were initiated under the 1866 mining law. Delays resulted in the necessity of a second survey when the mining law was rewritten in 1872. The claim was finally patented in 1873 (no exact date shown on the plat) as the San Augustine lode (General Land Office, 1873); this name was retained by the new compromise company (Burchard, 1883, p. 567). The only production recorded during this period was in 1872 when "... a small amount of work was done to secure the patent, and the mining report of the government for that year shows a bullion production of \$6,000" (Hilsinger, 1887).

After this flurry of (nonproductive) activity, the mine apparently sat idle for another ten years. According to Albert J. Fountain (1882, p. 17) the mine was idle right up to 1882, and although it was said to be "... worked to a considerable extent during [1882]" (Burchard, 1883, p. 567), no production is recorded. Despite the compromise agreement, the San Augustine Silver Mining Company and the Fort Fillmore Company could never come to terms. The 10-yr period of virtual inactivity is evidence that differences serious enough to prevent mining existed.

#### Bennett orebody—unexpected bonanza

The second period of productivity began about 1882. During the following decade the Stephenson and the Bennett would be consolidated under one ownership for the first time; however, little has been written regarding this important period in the development of the mine. In 1882, a new company, the Organ Mountain Mining and Smelting Association, Limited, was organized. The officers of the association were prominent businessmen of Philadelphia, Pennsylvania, and William H. Skidmore in Las Cruces was superintendent of mines.

The association had already quickly established itself as a major force in the district by purchasing or locating many promising mines and prospects including most of the ground surrounding the San Augustine lode (Hysinger, 1881). This property did not include the Bennett, however; the Bennett lode fortuitously had been located on November 16, 1880, by J. F. Bennett, one of the stockholders in the San Augustine Company.

Work by Skidmore was concentrated in the northern part of the district on the Short Cut and Black Quartz prospects during 1882–84, but the Stephenson area was the center of attention by 1885 (Skidmore Papers, no date). Both the Stephenson and the Bennett mines were under lease to Skidmore and his partner, probably mine foreman John Dougher, shortly thereafter. They had sunk a 90-ft shaft and were shipping Bennett ore by August 1885 (Skidmore Papers, no date). While developing an incline from this shaft, they broke into the fabulous Bennett cave ("Crystal Cavern"; fig. 3) and found additional carbonate ore behind stalagmites and stalactites (El Paso Times, 8/15/1885; Rio Grande Republican, 8/1/1885). However, later events tend to suggest that

Skidmore and Dougher were unaware of the magnitude of the orebody.

The cave was so spectacular, it became an immediate public attraction and overnight sensation. Fortunately, the cave was described in detail by various area newspapers: "On every hand the walls are frosted over with the most delicate work of nature, on one side a dazzling whiteness and on the other tinted a delicate pink or green where the mineral from the vein had aided in making a beautiful effect . . . [S]hapes of trees, shrubbery, ferns, and grasses jutted out from the wall . . . as if they were all coated over with ice and snow. . . . Miniature groves with branches intertwining are bunched together eight and ten feet high and of the same virgin whiteness or tinted with the most beautiful color" (Rio Grande Republican, 12/26/1885, p. 3). The Bennett miners christened the fantastic formations with descriptive names—the grove of treelike crystals was called the "Silver Forest." Farther on were "... four chalcedony trees ornamented and arranged like those of the Silver Forest, only on a more elaborate scale. They stand equidistant from each other and the . . . miners . . . have named them Cleveland, Grant, Garfield, and Arthur. Close to the foot of the Grant tree is a strange freak of nature. The accumulating calcite . . . has assumed the form of a snow white lamb lying peacefully at rest, and being as true to nature as if it had sprung from the sculptor's chisel. . . . The whole of the cave territory as explored so far is 275 feet long and 207 feet wide" (Rio Grande Republican, 8/1/1885).

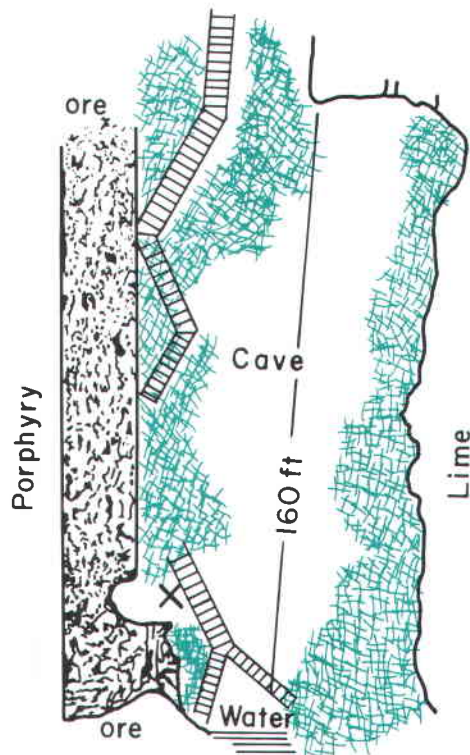


FIGURE 3—Sketch of a section of Crystal Cavern, approximately 15 ft wide at this point, showing ladders precariously suspended down to water level. Small cut at lower left is one of several places FitzGerald opened up Bennett orebody (after FitzGerald, April 21, 1888).

Skidmore and Dougher realized that the cave could not be saved if the ore were to be mined. A local artist was therefore invited to sketch some of the formations; additionally, arrangements were made with A. F. Randall, a prominent photographer of the day, to immortalize the formations on film (Lone Star, 1885; Republican, 12/26/1885). None of these photographs are known to still be in existence.

In addition to the ore produced from the shaft, further development of the orebody was planned by Skidmore and Dougher. For this purpose a tunnel had been driven, after a year of hard labor and considerable trouble, to within a few feet of the vein. At this point Skidmore inexplicably leased this part of the development on "advantageous" terms to Carrera and Wood, who immediately went to work, intersecting the vein after advancing only 6 ft (Republican, 11/3/1887). Because of these fortuitous circumstances, Carrera and Wood are credited with the discovery of the main Bennett orebody. To be sure, shows of ore had been found in the cave, but the magnitude of the orebody was totally unexpected. In fact, the Bennett proved to be much larger, although lower in silver content, than the Stephenson—a real windfall (Dunham, 1935, p. 220).

Carrera and Wood are reported to have mined and shipped over \$250,000 in lead-silver ore during 1887–88, then selling their lease just sixty days prior to its expiration for \$20,000 (1913; Dunham, 1935, p. 189, 220). This story is, however, only partially correct. Carrera and Wood obtained their lease in November 1887; the lease was to terminate 14 months later on January 1, 1889. C. C. Fitzgerald, however, purchased their lease (for the reported \$20,000), bonded Skidmore's half interest for \$30,000, and took possession of the property January 10, 1888 (FitzGerald, 1888; El Paso Times, 1/7/1888). Thus Carrera and Wood had possession for only two months. Could they have produced the \$250,000 worth of ore traditionally accredited to them in this short a time? Not likely—one account pegs their proceeds at \$25,000 which includes the \$20,000 purchase price (Republican, 1/7/1888). More likely, as presented in table 1, the \$250,000 represents the total amount produced by all the operators and lessors from 1885 through 1888. Carrera again may have held the lease after Fitzgerald, but this has not been verified.

Many paradoxes exist in the history of this mine, but one important unanswered question remains: Why, faced with this veritable bonanza, would Carrera and Wood sell their lease? The value of the ore had been proved—they had shipped several hundred tons to the Socorro smelters and realized a handsome profit (FitzGerald, 1888). The most obvious answer seems to be that Carrera and Wood, like Skidmore and Dougher before them, failed to realize that the ore shoot they had exposed would continue on downward well over 100 ft below them at an equal or better grade, as it was one and the same as that found in the Crystal Cavern behind the stalagmites and stalactites.

The FitzGerald, however, suffered no such illusions. C. C. FitzGerald was an old experienced mining engineer and owner of the newly constructed International Smelting Works in El Paso. Along with his son George, a recent engineering graduate from Columbia and already the "possessor of a first class reputation" (Adams, 1887), FitzGerald immediately set out to vigorously work the mine. They further opened up the cave and spent a week prospecting, thus disclosing the existence of an immense body of carbonate ore measuring at least "235 ft by 81 ft" with an assay value of over \$200,000 (El Paso Times, 2/14/1888; FitzGerald, 4/21/1888).

Penciled cross sections fortuitously sketched at this time (one of which is reproduced in fig. 2) show the cave beginning a few feet above the Carrera tunnel and extending downward well over 100 ft. The ore was soft and easily brought down with nothing more than a miners' pick. Truly a bonanza, just this ore in sight would be worth about \$1½ million in terms of today's market.

Word of the discovery spread rapidly and created two problems for the lucky leaseholders. First, the Stephenson owners to the east immediately claimed rights of apex. They claimed that the new found orebody was actually a continuation, or off-shoot, of the Stephenson vein. Had this proved true, the Stephenson people would have owned that part of the orebody below the junction of the two veins. The FitzGerald carefully surveyed all the workings, mapped ore exposures, dips, strikes and so on, and found that the Bennett and the Stephenson veins actually dip in opposing directions. They therefore concluded that one vein could not, except perhaps at a much greater depth, be a continuation of the other (FitzGerald, 4/19/1888). The apex argument was not put to rest completely until consolidation of the two properties later in 1889.

A second, and much more serious, problem involved Skidmore who, no doubt after observing the massive carbonate orebody the FitzGerald had exposed in the cave, succeeded in breaking the lease on the grounds that the mine was improperly worked (Adams, 1889) and that FitzGerald was "... gutting it to the detriment of the owners interest ..." (El Paso Times, 3/6/1888). Skidmore applied for and was granted the appointment of a receiver, an action which FitzGerald considered a 'barefaced outrage' (El Paso Times, 3/6/1888); he refused to work the mine "... at the dictation of a receiver ..." (El Paso Times, 3/6/1888) and abandoned his lease. In retrospect, Skidmore seems to have been very difficult to work with as a mine superintendent. He was, however, looking after the best interests of the Association regardless of what methods he chose to use.

The Stephenson and Bennett properties were ultimately consolidated, probably in early 1889, and the newly organized Stephenson Bennett Consolidated Mining Company began their operations immediately thereafter, experiencing a banner year. Hadley (1889, p. 189) reported "... the output of the Organ District is figured at 4,000 tons [of ore], containing 70,000 ounces of silver and 1,500,000

pounds of lead (averaging 17.5 ounces silver per ton and nearly 19 percent lead). The major portion of this was produced by the Bennett mine."

Some of the world's finest wulfenite and cerussite specimens were found in the upper Bennett orebody at this time (Jones, 1904 p. 77, Anon., 1913). One cerussite specimen in the Harvard Mineralogical Museum is an arrowhead twin said to be 3½ inches wide and 7 inches long (Northrop, 1959, p. 176). Skidmore would produce crate after crate of these fine specimens, shipping them out to Eastern mineral dealers over the following decade (Skidmore Papers). Oxidation of the primary sulfides galena and sphalerite has produced, in addition to cerussite and wulfenite, many other interesting mineral species including (in increasing degrees of rarity) smithsonite, anglesite, hemimorphite, pyromorphite, phosphogentite, linarite, and caledonite (Northrop, 1959).

The Consolidated Company constructed a new mill of 50 tons per day capacity and operated it sporadically, through good times and bad, until 1908. Managerial problems seem to have been responsible for most of the "bad" (Jones, 1903, p. 171; Jones, 1904, p. 77). Mill capacity then was increased to 300 tons per day. This increase turned out to be a fatal mistake as the company was in immediate financial difficulty and went into receivership May 4, 1909 (Citizen Press, 1915). Whether the new mill was ill designed or poorly managed, or a combination of both, is not known. Certainly a shortage of ore was not the problem, even though no further production would be seen until 1914.

#### The Organ Mountain Mining Company

The property was reorganized as the Bennett-Stephenson Mining and Milling Company. Under new management, an admirable

effort was made to liquidate the debts of the former owners and place the property back in a workable condition. By February 1912, however, the new company was still \$50,000 in debt. Yet another company, the Organ Mountain Mining Company, was incorporated June 1912 and acquired the assets of the former companies (Citizen Press, 1915). F. M. Hayner, who would ultimately be the last to mine underground on the property (Dunham, 1935, p. 221), became president of the new company October 4, 1912 (fig. 4). Under the Organ Mountain Mining Company, the mine would enter its third, and to date, final, period of productivity.

Plans were made to initiate large-scale operations based on the sulfide ores known to exist below the water level. In order to raise the necessary capital a lease was given to J. W. Writer and George Leving on January 6, 1914. Their activity was restricted, by terms of the lease, to "... the old workings of the mine above the water line; royalties to be paid as ore was shipped" (Citizen Press, 1915). John H. May held the lease the following year; both leaseholders were only moderately successful. Then in 1916 the Phelps Dodge Copper Corporation leased several properties in the district including the Memphis, Torpedo, Excelsior, and Stephenson-Bennett and completed a considerable amount of development work. The future of the district once again seemed bright, but suddenly Phelps Dodge relinquished its lease, producing nothing (Dunham, 1935, p. 190). The exact reason for the sudden pullout is unclear but the following story may provide a partial answer.

Phelps Dodge had a string of bad luck, particularly at the Torpedo property. While sinking from the 300 to the 500 ft level they encountered considerable water. Later while drifting out on the 500 ft level, they were literally flooded out of the mine.

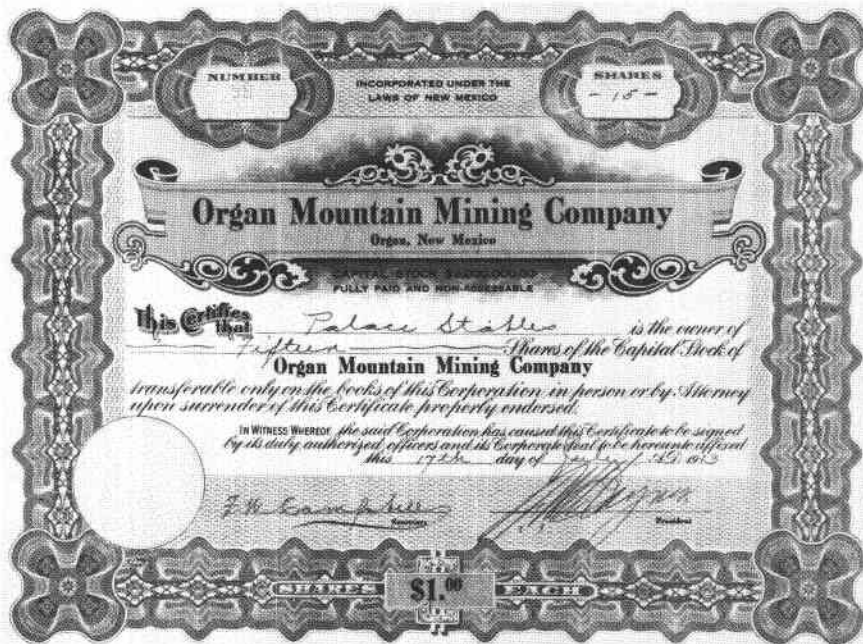


FIGURE 4—Share certificate of Organ Mountain Mining Company, with F. M. Hayner's signature as president. This organization would guide the Stephenson-Bennett mine through its third period of productivity (author's collection).

One can imagine the company at this point carefully weighing the pros and cons: should they go ahead and clean out the workings and replace timber and damaged equipment, or should they abandon the lease before further mishap? The decision to go ahead was made: a new electric pump was purchased and delivered to the mine. During installation, however, the new pump was accidentally dropped to the shaft bottom (probably removing a good portion of the timber on the way down) and completely ruined. That incident was enough, apparently; Phelps Dodge soon thereafter moved out, abandoning the district (Bentley, no date). Such is the luck of the miner, for Asarco (American Smelting and Refining Company) immediately leased the Stephenson-Bennett and, with little or no additional development work, took out a considerable amount of ore. Of the \$500,000 produced between 1900 and 1920, Asarco would produce nearly half during their lease (New Mexico Bureau of Mines and Mineral Resources files) which expired July 29, 1918 (McCullough, 1923). Finally the pumps were pulled for the last time after expiration of ASARCO's lease (Bentley, 1953).

Reworking the dumps accounted for the small production thereafter, the last of which was recorded in 1934. The property has on many occasions been drilled, mapped, and otherwise examined. The International Smelting and Refining Company drilled one hole in 1941 for assessment work, and the New Jersey Zinc Company drilled extensively during 1946-48, however no production resulted.

TABLE 1—Production figures for Santo Domingo de las Calzadas-Stephenson-Bennett mine from 1852 to 1934; production data prior to 1904 estimated (Burchard, 1881, 1883; Jones, 1904; Lindgren and others, 1910; Dunham, 1935; New Mexico Bureau of Mines and Mineral Resources file data; U.S. Bureau of Mines production records).

Period	Value in dollars	Owner/Operator-Lessor
before 1854	10,000 <sup>3</sup>	H. Stephenson and others
1854-57	90,000 <sup>3</sup>	H. Stephenson and others
1858-1865	<sup>1</sup>	Fort Fillmore Silver Mining Co.
1866-1871	<sup>1</sup>	Lesinsky, Shedd, and others
1872	6,000 <sup>3</sup>	San Augustine Silver Mining Company
1873-1882	<sup>1</sup>	San Augustine Silver Mining Company
Subtotal 1852-1882	150,000 <sup>3</sup>	
1883-84	<sup>1</sup>	San Augustine Silver Mining Co., Meadows and Sleas <sup>2</sup>
1885-88	250,000 <sup>3</sup>	Organ Mountain Mining and Smelting Association, Skidmore and Dougher, Carrera and Wood <sup>2</sup> , FitzGerald and Son <sup>2</sup>
1889-1900	200,000 <sup>3</sup>	Stephenson Bennett Consolidated Mining Co.
1900-1917	300,000 <sup>3</sup>	Stephenson Bennett Consolidated Mining Co. Bennett-Stephenson Mining and Milling Co. Organ Mountain Mining Co.
1918-1934	250,000 <sup>3</sup>	Organ Mountain Mining Co.; ASARCO <sup>2</sup> , plus small leaseholders
Total	\$1,150,000 <sup>3</sup>	

<sup>1</sup>Production, if any, unknown

<sup>2</sup>Operator-Lessor

<sup>3</sup>These production statistics are in reverse order from those quoted by Dunham; they are derived from more detailed information.

Is this famous property "worked out?" Doubtless the large carbonate bonanzas are gone, but sulfide ore (over 35,000 tons according to Dunham, 1935) is known to remain in the mine below water level. Mining this ore could become economically feasible in the future, particularly if additional reserves are found.

The greatest potential for undiscovered ores lies to the north of the Stephenson-Bennett mine along the Torpedo-Bennett fault zone. Mineralization occurs in the Stephenson-Bennett area in lower Paleozoic sediments, specifically in the Fusselman and Montoya Dolomites. North of the property, approximately 2,000 and 3,500 ft, respectively, two east-west trending faults have dropped these beds to depths of approximately 450 and 1,000 ft (Seager, 1981). Exploratory drilling should therefore be targeted to these depths.

Throughout its history, the Stephenson-Bennett group has produced at least \$1,150,000 in precious and base metals (table 1). A favorable change in the commodities markets and discovery of new ore could precipitate a fourth period of productivity in the Stephenson-Bennett mining district.

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rent owners of the Stephenson-Bennett group) and Robert M. North, geologist, New Mexico Bureau of Mines and Mineral Resources.

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(continued on p. 15)



CLIFFS OF TRIASSIC FORMATION OVERSHADOW DOCK AREA AT NORTH END OF LAKE.

below the dry crust are saturated with water. Caution should be used in approaching the lake and in driving most of the dirt roads during or after rain storms. □

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### Cross sections available

The Roswell Geological Society announces the availability of its new Pecos Slope Abo Cross Section. Stretching from De Baca County to Eddy County, New Mexico, this set of N-S and E-W cross sections detail electrical-log and lithologic relationships of this important new play. To our knowledge, the Abo play is the first in which hydrocarbons in economic amounts have been found in nonmarine redbeds. With over 300 producing wells, this Abo play is indeed of major significance.

The cross section is available in two scales: 1" = 40' at \$60.00 per set, and 1" = 60' at \$40.00 per set. Requests for copies or information about this cross section can be sent to Roswell Geological Society, P.O. Box 1171, Roswell, New Mexico 88201.

## Gallery of Geology



Photo by Sam Thompson III

*Muleshoe mound* is one of the more spectacular limestone buildups seen in the Lake Valley Formation (Mississippian) along the western escarpment of the Sacramento Mountains in Otero County, New Mexico (NW¼ SW¼ sec. 28, T. 17 S., R. 10 E.). This bioherm (reef), 350 ft high and 1,000 ft in diameter, was deposited 5 mi seaward (south) of the shelf edge in water depths up to 100 ft or more during a relative rise of sea level. Note in this northward view that the massive core interfingers downward and eastward with clastic material derived from the core, that this eastern flank facies thins down to approximately 70 ft, and that younger Mississippian units of deep-marine deposits overlapped and buried the bioherm. Various theories of origin consider the main biohermal framebuilders to be crinoids, fenestrate bryozoans, filamentous algae (inferred from lime-mud deposits), or some combination.

Six of the geologists who have made significant contributions to the study of Muleshoe mound are shown, left to right, in chronological order of their work: 1) Arthur L. Bowsher (Yates Petroleum Corporation), who with Lowell R. Laudon (University of Wisconsin, not shown) discovered the mounds while they were establishing the regional stratigraphic framework of the Mississippian in the late 1930's-1940's; 2) Lloyd C. Pray (University of Wisconsin), who during the late 1940's-1950's mapped the Sacramento Mountains, studied the entire stratigraphic section, and discovered the presence of fenestrate bryozoans in the core facies of the bioherms; 3) William J. Meyers (State University of New York, Stony Brook), who by petrographic analysis and other techniques in the 1970's determined that the bioherms were cemented initially in at least three episodes of fresh-water diagenesis, probably during brief eustatic falls of sea level in late Mississippian time; 4) H. Richard Lane (Amoco Production Company, Research Center), who in the 1970's demonstrated by tracing stratigraphic units and dating them precisely with conodont zonation that a wedge-on-wedge relationship existed between the Lake Valley shelf margin and the later basin fill; 5) Thomas L. De Keyser (Texas Tech University), who in the late 1970's-1980's described several Mississippian sections in detail, sampled the bio- and lithofacies, traced depositional units, and analyzed mound development; and 6) William D. Jackson (Texas Tech University, graduate student of De Keyser), who recently measured and sampled a detailed section of the Muleshoe mound while dangling from a rope anchored at the top!

This group was assembled for the photograph during an international field seminar last March. A field guide for the trip was prepared by Lane and others on p. 115-182 (see p. 143-158 on Muleshoe mound) of: "Symposium on the environmental setting and distribution of the Waulsortian facies," published jointly by the El Paso Geological Society and the University of Texas at El Paso and edited by Keith Bolton, Lane, and David V. LeMone.

In the north Texas area, such bioherms contain sufficient porosity to be important reservoirs of oil and gas. However, these bioherms in the Sacramento Mountains have been so thoroughly cemented that practically all of the original porosity has been occluded. The Mississippian reservoirs of southeastern New Mexico have yielded relatively minor amounts of oil and gas.

—Sam Thompson III