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## COPPER GENESIS: THE EARLY YEARS OF SANTA RITA DEL COBRE

BILLY D. WALKER

TODAY, in southwestern New Mexico, in the shadow of a singular peak called the Kneeling Nun, the employees of the Kennecott Copper Corporation are engaged night and day in the creation of a giant hole in the earth more than a mile in diameter and exceeding 1,000 feet in depth. This open-pit copper mine at Santa Rita is the culmination of almost two centuries of discovery and development, and represents one of the most intriguing tales in the history of the American Southwest. First exploited in the early 1800s by Spaniards, the site was worked intermittently by lode mining methods until 1910, when mechanization permitted large-scale operations and brought to an end a romantic saga of intrepid men who sought adventure and riches on the ragged edge of civilization.

The period before 1825 was an important era in the development of the Santa Rita copper mines, encompassing aboriginal exploitation, Spanish discovery, early mining efforts, and initial attempts at the "taming" of the frontier which permitted later operations to proceed. The first mention of the mine in English is Lieutenant Zebulon Pike's off-hand statement in 1806: "It is worked, and produces twenty thousand mule loads of copper annually."<sup>1</sup> This endeavor which Pike labeled "Grand Copper Mines" on his maps had been discovered only a few years previous by Spaniards, but it is certain that the aboriginal tribes of the region knew of the native outcrops for several centuries preceding.

Archaeological excavations of Mound Builder cultures at the Etowah Site, Georgia, have uncovered numerous copper artifacts deposited in a village ceremonial center between A.D. 880 and

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1550. Included in the artifacts is a nugget of native copper which spectrographic analysis reveals had its origin in the Santa Rita copper deposits.<sup>2</sup> The question of how the nugget was transported from the Southwest to the Southeast is problematical, but it is known that there was an aboriginal trade network in Texas which linked eastern New Mexico to the Southeast as early as A.D. 1200.<sup>3</sup> In addition, archaeological findings in New Mexico indicate that pre-Columbian Indians of the Santa Rita region did utilize native copper, perhaps even as early as A.D. 900.<sup>4</sup>

Members of the Mogollon Culture were firmly rooted in the Santa Rita area by A.D. 700, and perhaps some centuries earlier. By 900 they "worked copper," and remnants of small copper bells have been dated *circa* A.D. 1150.<sup>5</sup> This cultural group withdrew from the region between 1150 and 1250 and was superseded by a new group during the period from 1250 to 1400.<sup>6</sup> It is plausible that either of these peoples could have established a limited copper trade with other aboriginal groups, such as those in the Southeast. However, the extent of local utilization of copper was never great. Bandelier related that "it is quite strange that no traces of copper implements should be met with in the Mimbres region, for native copper occurs in the mines of Santa Rita . . . and at other localities."<sup>7</sup>

Perhaps the first Spanish encounter with copper from Santa Rita occurred in 1535, for Cabeza de Vaca related that in that year some Indians in the Rio Grande region gave Andres Dorantes, one of Cabeza de Vaca's companions, a large copper rattle or bell. The Indians, when questioned, told the Spaniards of a large deposit of native copper somewhere to the north of the meeting place.<sup>8</sup> This deposit was quite likely the one at Santa Rita although it is possible that the Indians referred to the long-known copper deposits in the Great Lakes region.<sup>9</sup> The Indians did have the ability to make articles like the bell by hammering the pliable native copper flat and then shaping it around a mold of wood or stone.<sup>10</sup> Despite Cabeza de Vaca's rumination that "there must be foundries,"<sup>11</sup> there is only scant evidence that the pre-Columbian Indians of the Southwest possessed expertise in smelting copper ore.<sup>12</sup> However, there was little need for the Indians to engage in smelting since the extrusions at Santa Rita were remarkably pure in form due to "natural smelting."

Approximately two and one-half centuries later the copper deposits at Santa Rita were viewed by a white man for the first time. Traditionally, the date of discovery is given as 1800.<sup>13</sup> In that year an Apache revealed the site to Colonel José Manuel Carrasco, a Spanish officer stationed at the Presidio of Janos, about 150 miles to the south. The Apache's incentive can only be imagined, but the likelihood of self-preservation as a motive is great, for the Spaniards were at that time engaged in a campaign to suppress the Indians of New Mexico to bring protection to the frontier regions of Chihuahua and Sonora.

The year 1800 as the date of discovery is perhaps more traditional than factual. The remote mountainous region encompassing the mines had been subjected to several *entradas* by the Spanish military in the last two decades of the eighteenth century. In 1780, Juan Bautista de Anza, the Spanish governor of New Mexico, passed near, crossing the Mimbres during his trailblazing journey from Santa Fe to Sonora. In November and December, 1780, Captain Joseph Antonio Vildásola led an expedition into the area of the headwaters of the Gila River and along the Mimbres River. He engaged in one major fight with the Apaches, but made no mention of copper in his journal, and the deposits are not shown on one contemporary map of the region.<sup>14</sup>

Captain Francisco Martínez, from the Presidio of Carrizal to the southeast of Santa Rita, also led a punitive expedition into the region in November, 1780; no mention of copper is made in his journal for this *entrada*. Martínez led still another foray in 1784, and in November and December, 1785, two important expeditions entered the environs of Santa Rita del Cobre. One group, led by Captain Antonio Cordero, included a young lieutenant named José Manuel Carrasco. This group explored the Mimbres Mountains during their hunt for Apaches and, judging from Cordero's journal, must have been near the future mines.<sup>15</sup> The other group, commanded by Martínez, traveled along the Mimbres River. Enroute to the river, Martínez recorded that:

During the morning I continued keeping near the slopes of this sierra [Sierra de las Burras, perhaps today's Burro Mountains] the route to El Cobre. . . . At two in the afternoon one could water two horses per man in a canyon of El Cobre which faces towards

Santa Lucía [perhaps San Lucía Springs, about two miles northwest of Santa Rita]. I went no further than the watering place. Here they [Apaches] fired at me but I ignored them because they were very high [in the surrounding mountains]. Then I set out in the direction of Santa Lucía.<sup>16</sup>

Martínez's cryptic mention of "El Cobre" indicates a prior knowledge of the location, and the site could well have been the future Santa Rita del Cobre. Whether the site had been discovered by Martínez on one of his previous expeditions, or whether the location was generally known among the contemporary Spaniards, is problematical. It is reasonable to assume that if Martínez knew of "El Cobre," so did Carrasco and many others, for the journals kept by the Spanish officers were transmitted with their reports to the Commandant General of the Internal Provinces.<sup>17</sup>

Martínez's calmness is enigmatic, but then he was a soldier, not a miner, and the "El Cobre" he mentioned could well have been a lesser *criadero de cobre* and not the Santa Rita deposits. Still another explanation for Martínez's blasé attitude could be that as a *criadero*, a "growing place,"<sup>18</sup> the site summarily belonged to the royal treasury. This principle was established by a decree of Philip V of Spain in 1741 in response to the discovery of the fabulous *Planchas de Plata* in northern Sonora in 1636. The giant silver nuggets discovered there were not to be considered as a mining discovery in the usual sense but as a "curiosity" or "natural wonder" belonging exclusively to the crown. Since this decree had been enforced at the time at the urging of Captain Juan Bautista de Anza, whose son was governor of New Mexico from 1777 to 1787,<sup>19</sup> it is altogether believable that Martínez, or any other Spaniard, would give little personal heed to such a discovery. Moreover, it is likely that the remoteness of the area discouraged any who had visions of a working mine at "El Cobre."

The problem of first discovery of the Santa Rita copper deposits aside, it is commonly held that Carrasco made the first attempts at gleaning the extrusive copper at the site. He resigned his commission and guided about twenty comrades to the deposits, probably

in 1801.<sup>20</sup> It is not known whether José Manuel Carrasco applied for a grant of the property, but subsequent events would seem to indicate that he at least held *dominium utile* to the site.

Ultimate ownership of all mineral deposits rested with the crown, while the *dominium utile* was conceded to individuals. This provision later carried over into the Mining Code of the Republic of Mexico, with the government keeping the ultimate ownership of all mineral deposits. Under Spanish mining law any person, with some civil and ecclesiastical personnel excepted, was free to discover and to work mines with or without the permission of the owner of the surface. The person's right in the mines he might discover or denounce was a conditional right, dependent upon fulfillment of certain obligations such as registering the discovery or claim before a justice and working the mine more or less continuously. As long as these rules were heeded the subject had a definite beneficial property right in the mine or claim, a right that could be sold, bequeathed, or otherwise transferred like any other property, known as *dominium utile*. The rights of the crown in the mining property were protected by the enforcement of these rules and by the obligation of the miner to pay to the royal treasury the so-called "royal fifth" of all ore produced.<sup>21</sup>

In the rugged, almost inaccessible, area south of the lofty Sierra de Mogollon, near the headwaters of the Gila River, Carrasco found a high mountain valley, varying from 5,800 to 6,300 feet in elevation, which was marked by undulating hills and hemmed by nearly perpendicular mountain walls. Immediately to the southeast was a peak with an 800-foot sheer bluff, the mountain itself measuring more than 7,600 feet in elevation. This mountain was accented by a single monolith, standing apart, which bore a resemblance to a draped female figure kneeling before an altar. This extraordinary peak Carrasco called the Kneeling Nun, and he named the *criadero de cobre* "Santa Rita" after the patron saint of stray members of a flock.<sup>22</sup>

It is not known how much actual mining, if any, Carrasco did at Santa Rita del Cobre. In all probability, little underground mining was required because of the extensive amounts of high-grade cop-

per ore which extruded above the earth's surface. Moreover, it is distinctly possible that Carrasco, a career soldier, did not possess any of the four elements generally necessary for mining success—capital, labor, a ready market, and a means of transporting the ore. In the case of Santa Rita, the copper had to be transported 400 miles to Ciudad Chihuahua, the nearest smelter. It remained for another enterprising Spaniard to draw all of these elements together.

Don Francisco Manuel de Elguea was a wealthy merchant from Chihuahua who held various government contracts to supply goods to frontier presidios during the 1790s and early 1800s.<sup>23</sup> It was perhaps in this capacity that Elguea first made the acquaintance of Carrasco. In 1804 Carrasco related to the Chihuahua entrepreneur the story of the *criadero de cobre* at Santa Rita. Undoubtedly, Carrasco showed samples of the nearly pure copper to Elguea, and Elguea bought Carrasco's interest (*dominium utile*) in the copper deposits. If indeed Carrasco had applied for a conventional land grant of the surface property, these rights were likewise superseded by those of Elguea. Unlike Carrasco, Elguea possessed the requisite capital and connections to effect a profitable venture in the remote country to the north of Chihuahua.

F. M. Elguea subsequently applied for and received, presumably from the viceregal government of Mexico, a title to the Santa Rita del Cobre grant, which encompassed the rich deposits.<sup>24</sup> The extent of the original grant is not known (one square league was the normal size), and no actual copy of a grant has ever been produced. However, Elguea's heirs were recognized by the United States government as the rightful owners until the 1870s, when the ownership controversy was finally resolved in favor of Martin B. Hayes, who paid the Elguea heirs for the mines.<sup>25</sup>

It should be emphasized that Spanish land grants were often made with some informality regarding title papers, so that boundaries of grants were usually vague. Indeed, title papers were often lacking because of time and various revolutions. After 1848, when the territory came under the aegis of the United States, title vagaries caused uncertainty regarding ownership of much land in New Mexico; the *Santa Rita del Cobre* grant received no less than its share of notoriety in the period 1860 to 1883. Even if title

papers had been extant, the boundaries of the grant would have been unclear due to the remoteness of the property. It is unlikely that the usual maps and certification to be proffered by the local *alcalde* to the governor could have been in order since logically there was no *alcalde* in this frontier region.<sup>26</sup>

The logistics of establishing a frontier outpost must have been uppermost in Francisco Manuel de Elguea's mind when he commenced workings at Santa Rita del Cobre in 1804. The valley around Santa Rita Creek was fertile but narrow, allowing little cultivation. However, the creek furnished water, and the hills afforded ample grazing for stock. Moreover, since the area was heavily wooded, there was good timber for building purposes and for fuel, and the mountains were a plentiful source of bear, deer, antelope, turkey, and other game. The outpost depended upon cultivated districts to the south, in the valley of the San Miguel River and near Casas Grandes, for regular supplies of corn, flour, beans, and other foodstuffs, but these locations were over 150 miles away. Larger shipments of provisions and merchandise were taken to the mines by *conductas*, or guarded wagon trains, from Ciudad Chihuahua.

Elguea made two visits to the Santa Rita mines between 1804 and 1809. On his second visit, disturbed by the extreme vulnerability of the mining camp in hostile Apache territory, he built a massive fort in the shape of an equilateral triangle. Each side measured 200 feet, the walls were of adobe three to four feet thick, and a *martello* tower of adobe stood in each of the three corners.<sup>27</sup> Although designed principally for protection from the Indians, the fortress may have had a dual purpose, the second being to confine convict labor obtained from the government.<sup>28</sup>

Mining operations at Santa Rita, as elsewhere on the frontiers of New Spain, were regressive by any standards. The gleaning of extrusive copper required only minimal expertise, but such deposits were depleted rapidly. Subterranean mining demanded technical knowledge which was not generally available, so that at Santa Rita, as in other mines, the methods were comparable to those employed in Europe over 500 years before.

Extracting copper ore by "cold mining" necessitated the exploitation of only the highest grade of ore since the process was both



lengthy and arduous. In general, miners simply followed a promising ore lead until it ran out or they hit water. The shaft was then abandoned and another initiated at a more promising location.<sup>29</sup> During the period 1804 to 1840 about fifteen such shafts were sunk in the area of high-grade ore at Santa Rita.<sup>30</sup>

The chief if not sole tool of the early frontier miner, whether Spaniard, Mexican, or American, was the *barreta*, a long iron bar or gad weighing approximately twenty pounds. One end was flattened and the other was pointed; the bar served as pick, drill, moil, and lever. Miners derived their name (*barreteros*) from this crude instrument.<sup>31</sup> It was not until 1831 that the invention of the Bickford fuse made blasting a practical reality, and not until the 1870s and 1880s did blasting become widespread on the mining frontier of the Southwest.<sup>32</sup> In 1804, and for several decades afterward, the miner's tools were brute muscle and a twenty-pound iron bar.

Once the ore was broken loose with the *barreta*, it was gathered in baskets or in ore buckets made of hide. The ore was then deposited in a pack (*seroni*) or large basket (*teñate*) to be transported to the surface by ore carriers (*teñateros*). The *seronis* used at Santa Rita held about eight *arobas* (approximately 200 pounds) apiece and were strapped on the ore carrier's back.<sup>33</sup> When *teñates* were used they were secured to the *teñatero's* forehead by tumplines, thus leaving both hands free for climbing.<sup>34</sup>

Ore carriers transported their burdens up *muescas*, which were notched tree trunks. At Santa Rita the trunks of juniper trees were used, customarily in lengths of about ten feet. Notches were cut into the trunks at intervals, and the "chicken-ladders" were bound in place with thongs to a platform large enough for a man to stand on to transfer to another ladder of the same size. Often the *teñateros* carried their loads more than 100 feet up the ladder networks to reach the surface. In ascending and descending the ladders they sang *alabanzas*, hymns much like sailor chanties. The miners generally worked naked except for a loin cloth and *guaraches*.<sup>35</sup> A contemporary observer of the mines at Guanajuato noted that workers had to make a certain number of trips during their shift "with the result that they suffer a fatigue which wastes them away and kills them. . . ."<sup>36</sup>

The primitive nature of these methods, which conjure visions of the Egyptian copper mines of Nubia, necessarily precluded large-scale operations. Pike's unsubstantiated mention in 1806 of 20,000 mule loads per year seems incredible when one considers that an average mule load was 300 pounds. If the mine were to produce 6,000,000 pounds of copper ore annually, at least 130 full-time miners would have been required.<sup>37</sup> This population seems highly unlikely, especially as early as 1806. One report has stated a population of 600 at Santa Rita in the early days; however, if this figure were accurate, the time was probably the 1828 to 1837 period rather than the 1804 to 1809 era.<sup>38</sup>

Despite staggering logistical problems, primitive mining methods, and vulnerability to hostile Apaches, Elguea evidently was able to operate profitably. No doubt this was due, in part, to his government connections. Elguea made a contract to supply the government with copper for coinage. The common copper coin of the period was the *tlaco*, which was one-eighth of a *real*, which in turn was one-eighth of a *peso*.<sup>39</sup> Bartlett later reported: "It is said that the owner [Elguea] had a contract with government to deliver the copper there [Chihuahua] at 65 cents a pound, and that sufficient gold was found in it to pay all the cost of transportation."<sup>40</sup>

Bartlett's price quotation is an additional argument against heavy production figures for the early days, such as Pike's mention of 20,000 mule loads. Production in this amount would have yielded gross profits of approximately \$4,000,000 per year, a completely incredible sum.<sup>41</sup> Bartlett and Pike both, of course, reported second-hand information.

In general, the copper ore was transported to Chihuahua by mule trains. However, some ore was transported by the return wagons of the *conductas* which brought provisions to the mines. The belief that native copper was transported in the wagons in one-ton blocks is unfounded despite the statements of some authorities.<sup>42</sup> The miners had no way to extract such a block, much less load it, since they did not use pulleys, hoists, or windlasses in their daily mining operations.

The trail from the mines to Ciudad Chihuahua followed Santa Rita Creek to its juncture with Whitewater Creek, near where Fort

Bayard would stand. It then followed the Whitewater downstream for a few miles before cutting across country to Patchetahoo (Apache Tejo) Springs, the first watering spot.<sup>43</sup> From there the trail went to Cow Spring (Ojo de Vaca) and Carasalilla Springs, then to the present Mexican border. From there it led to Casas Grandes and on to Ciudad Chihuahua, a total distance of 400 miles. The trail was still plainly visible as late as 1885 even though it was not used after about 1840.<sup>44</sup>

It is quite likely that Elguea constructed some type of rudimentary blast furnace for melting native copper and copper ore into ingots. It would have been awkward for mules to carry the jagged pieces of copper ore, even if some type of packing material were used. Such furnaces were common in Mexico at the time, and it is known that such a furnace was constructed at Santa Rita some time prior to 1846.<sup>45</sup> If the ore indeed was formed into ingots, a good mule could have carried two ingots of 150 pounds each. Again, it is doubtful, even with several furnaces or with no melting at all, that the operations at Santa Rita could have produced more than about 1,000 mule loads per year. The 20,000 mule loads mentioned by Pike would have required the constant use of at least 2,000 mules.<sup>46</sup>

The extent of early workings at Santa Rita del Cobre, though profitable, has probably been overestimated, both by Pike and by later historians. Bancroft stated: "I think there is room for doubt as to the early working of this mine [at Santa Rita], though a beginning was probably made before 1822."<sup>47</sup> Somewhere between the extremes of Pike's unfounded estimate and Bancroft's disregard for Elguea's pioneer efforts lies the true picture of early copper production at Santa Rita del Cobre.

If one assumes that 100 mules were employed, on the average, transporting about 1,000 mule loads of copper ore per year, a reasonable picture emerges in which perhaps two dozen miners and their families lived and worked at Santa Rita. The 300,000 pounds of ore arriving in Ciudad Chihuahua, assuming a 60 percent assay, would have yielded \$117,000 (at 65 cents per pound) in annual gross profits for Elguea. After costs for mules, mule-skinners, and miners, a handsome net profit no doubt was left, as well as income from gold and silver extracted from the ore. Santa

Rita del Cobre was no bonanza, but it was a profitable enterprise judging from its continued operation for about four decades, against heavy odds.

Little is known about Indian relations at Santa Rita in Elguea's time, although inferences can be drawn readily from the construction of the adobe fort at the mines. The miners probably provided their own protection without military assistance; the struggle for Mexican independence after 1810 led to a crumbling of what was left of military resistance on the frontier. The Apaches were able to plunder Chihuahua and Sonora almost at will. Presumably, the Apaches preyed upon the burro trains and *conductas* traveling the routes to and from Santa Rita before 1809. Moreover, it must be assumed that an exposed outpost such as Santa Rita was not itself immune from Apache raiding parties.

In later years James Ohio Pattie recorded that a group of Apaches in the region of the mines told him a tale in which the "Spaniards" lured the Indians into the walls of their fort and then undertook to slaughter them. This incident was the purported cause for the unfriendly relations between the Apaches and Mexican miners working the site in Pattie's time. Since Pattie generally used the term "Spaniards" to denote Mexicans, the incident described could have occurred at any time between the construction of the fort around 1809 and 1826, when Pattie met with the aggrieved Indians. The Apaches also told Pattie that some of their number had been sent to the fort in prior years to be baptized and to serve as spies.<sup>48</sup>

Francisco Manuel de Elguea died in 1809, and the *Santa Rita del Cobre* grant, including *dominium utile* to the mines, passed into the hands of his widow and heirs. Little is known about operations in the period from 1809 to 1825 except that the mines were worked continuously, indicating that profits were being made. Elguea's widow, María Antonia Elguea y Medina, subsequently married Francisco Pablo Guerra, who assumed the management of the copper mines, running the enterprise from Ciudad Chihuahua.<sup>49</sup>

A contemporary observer indicated that during his tenure Guerra realized \$100,000 in profits for himself and Elguea's heirs.<sup>50</sup> One superintendent of the mines at Santa Rita was Juan



The Santa Rita underground shaft as it appeared in 1911. The shaft was unused at that time, since the Chino Copper Company had converted to open pit mining the year before. Photo courtesy of Kennecott Copper Corporation.

Oñiz [Ortiz], who operated the mines in late 1825 when a party of Anglo-American trappers, including the Patties, Sylvester and James, suddenly appeared there.<sup>51</sup> In all likelihood, Guerra leased the mines to independent operators, so there probably were several superintendents during the 1809 to 1826 era.

The Santa Rita del Cobre property did, like the rest of the northern provinces, come under the government of the Mexican Republic in 1821, but this change probably had little or no effect on mine operations in the frontier region. Certainly the opening of the Santa Fe Trail in that same year eventually had an impact on the mine. By late 1825 Anglo-American fur trappers were opening the rich Gila River region to exploitation, and the Santa Rita del Cobre mines became a convenient rendezvous and jumping-off point. In time the mines fell into the hands of Anglo-Americans and other *extranjeros*, but this later period, encompassing the years 1826 to 1846, forms another chapter in the history of Santa Rita del Cobre deserving of further research.

#### NOTES

1. Zebulon Montgomery Pike, *The Journals of Zebulon Montgomery Pike*, ed. Donald Jackson, 2 vols. (Norman, 1966), 2:48.
2. Vernon J. Hurst and Lewis H. Larson, Jr., "On the Source of Copper at the Etowah Site, Georgia," *American Antiquity* 24 (1958):177.
3. J. Charles Kelley, "Juan Sabeata and Diffusion in Aboriginal Texas," *American Anthropologist* 57 (1955):993. See also E. O. Miller and Edward B. Jelks, "Archeological Excavations at the Belton Reservoir, Coryell County, Texas," *Bulletin of the Texas Archaeological and Paleontological Society* 23 (1952):168-217.
4. Emil W. Haury, *The Mogollon Culture of Southwestern New Mexico*, Medallion Papers No. 20 (Globe, Ariz., 1936), p. 110.
5. Haury, *Mogollon Culture*, pp. 110, 127-29.
6. Haury, *Mogollon Culture*, pp. 128-29.
7. A. F. Bandelier, *Final Report of Investigations Among the Indians of the Southwestern United States, Carried on Mainly in the Years from 1880 to 1885*, Part 2, Papers of the Archeological Institute of America, American Series (Cambridge, Mass., 1892), 4:352-53.
8. Fanny Bandelier, trans., *The Narrative of Alvar Nuñez Cabeza de Vaca* (Barre, Mass., 1972), p. 114; originally published in 1542.

9. William H. Holmes, "Copper," in *Handbook of American Indians North of Mexico*, ed. F. W. Hodge, 2 vols. (Totowa, N.J., 1975), 1:343.
10. Holmes, "Copper," in Hodge, *Handbook*, 1:344.
11. Bandelier, *Narrative*, p. 114.
12. T. A. Rickard, *A History of American Mining* (New York, 1932), pp. 250-51.
13. Rickard, *History*, p. 253; T. A. Rickard, "The Chino Enterprise—I," *Engineering and Mining Journal* 116 (1923):754; Fayette A. Jones, *New Mexico Mines and Minerals* (Santa Fe, 1904), p. 35; Rossiter W. Raymond, *Statistics of Mines and Mining in the States and Territories West of the Rocky Mountains* (Washington, D.C., 1870), p. 403; Hubert Howe Bancroft, *History of New Mexico and Arizona, 1530-1888* (San Francisco, 1889), p. 303. The source for these authors was probably John Russell Bartlett, *Personal Narrative of Explorations and Incidents in Texas, New Mexico, California, Sonora, and Chihuahua, Connected with the United States and Mexican Boundary Commission, During the Years 1850, '51, '52, and '53*, 2 vols. (New York, 1854), 1:227.
14. Alfred B. Thomas, ed. and trans., *Forgotten Frontiers: A Study of the Spanish Indian Policy of Don Juan Bautista de Anza, Governor of New Mexico, 1777-1787* (Norman, 1932), pp. 37, 207 ff. See also "Rocha's Map of the Gila River Basin, 1784," p. 252.
15. Thomas, *Forgotten Frontiers*, pp. 217 ff., 285-90.
16. Thomas, *Forgotten Frontiers*, p. 279.
17. Thomas, *Forgotten Frontiers*, *passim*.
18. The notion that minerals and metals grew in an organic sense was still held by many, even into the nineteenth century. See Rickard, *History*, pp. 259-60.
19. Rickard, *History*, p. 259.
20. Kennecott Copper Corporation, Chino Mines Division, *This Is Chino* (Hurley, N.M., n.d.), p. 1.
21. Walter Howe, *The Mining Guild of New Spain and Its Tribunal General, 1770-1821* (Cambridge, Mass., 1949), pp. 3-4, 67.
22. Rickard, "Chino—I," p. 754.
23. Max Moorhead, *New Mexico's Royal Road: Trade and Travel on the Chihuahua Trail* (Norman, 1958), p. 53n.
24. Rickard, "Chino—I," p. 757.
25. Santa Rita del Cobre deed filed for record, November 10, 1873, Grant County (New Mexico) Courthouse.
26. For an explanation of land grant procedures, see Marc Simmons, *Spanish Government in New Mexico* (Albuquerque, 1968), p. 179.
27. The site of the fort is now a void in the center of the great open pit at Santa Rita. For a contemporary description, see Bartlett, *Personal Narrative*, p. 235. A contemporary drawing appears in William H. Emory, *Notes of a Military Reconnaissance, from Fort Leavenworth, in Missouri, to San Diego, in California, including Part of the Arkansas, Del Norte, and Gila Rivers* (Washington, D.C., 1848), p. 58.

28. The latter purpose seems unlikely in view of the fact that there was a salaried labor pool; moreover, the Apache menace would provide motivation enough for the fortification. John M. Sully, "The Story of the Santa Rita Copper Mine," *Old Santa Fe* 10 (1916):135; Rickard, *History*, p. 254; Rickard, "Chino—I," p. 754.

29. Otis E. Young, Jr., *Western Mining* (Norman, 1970), p. 64.

30. Emory, *Notes*, p. 58.

31. Young, *Western Mining*, pp. 61-62.

32. Otis E. Young, Jr., "Fire in the Hole! Evolution and Revolution of the Western Mining Frontier," *American West* 7 (1970):18-19.

33. Rickard, "Chino—I," p. 758. A number of artifacts from early mining operations were housed at Santa Rita when Rickard penned this article in 1923.

34. Young, *Western Mining*, p. 62.

35. Young, *Western Mining*, p. 62; Rickard, "Chino—I," p. 758.

36. Fausto de Elhuyar, "Reflections on the Working of the Mines and Refining Operations in the Real de Guanaxuato, 1789," trans. Walter Howe, *Mining Guild*, p. 487.

37. James Fresh, mine superintendent in the early 1870s, related that two Mexican miners working in tandem (one picking and one carrying) could average 300 pounds of ore per day. See Rossiter W. Raymond, *Mineral Resources West of the Rocky Mountains* (Washington, D.C., 1874), p. 337. If we suppose that each man could produce 45,000 pounds of ore per year (150 pounds per day times 300 working days), then approximately 133 miners would be required.

38. Bartlett, *Personal Narrative*, 1:227. Bartlett's source was Mexicans who purportedly labored in the mines in the period 1828-1837.

39. A. Wislizenus, *Memoir of a Tour to Northern Mexico, Connected with Colonel Doniphan's Expedition in 1846 and 1847* (Washington, D.C., 1848), p. 141.

40. Bartlett, *Personal Narrative*, 1:228.

41. The "fortune" amassed by the most successful operators of the mines, Robert McKnight and Stephen Courcier, amounted to only \$500,000 between 1828 and 1837. See Rickard, *History*, p. 255; Rickard, "Chino—I," p. 755; Wislizenus, *Memoir*, pp. 57-58; Raymond, *Statistics*, p. 403; Bartlett, *Personal Narrative*, 1:228.

42. Rickard, *History*, p. 254; Arthur F. Wendt, "The Copper-Ores of the Southwest," *Transactions of the American Institute of Mining Engineers* 15 (1887):26.

43. Bartlett, *Personal Narrative*, 1:242.

44. Rickard, "Chino—I," p. 758.

45. Abraham R. Johnston, "Journal of Captain A. R. Johnston, First Dragons," in Emory, *Notes*, pp. 577-78. Johnston visited the abandoned mines in October 1846, with General Stephen Watts Kearny's Army of the West.

46. The average distance for a fully loaded mule (200 to 400 pounds) was ten to fifteen miles per day in hilly terrain and fifteen to twenty-five miles per day over regular ground. Giving the mules the benefit of any doubt, a round trip



from Santa Rita to Ciudad Chihuahua would require thirty-five days; therefore, one mule could transport only about ten mule loads per year. M. W. von Bernewitz, *Handbook for Prospectors and Operators of Small Mines*, 4th ed. (New York, 1943), p. 21.

47. Bancroft, *History of New Mexico and Arizona*, p. 303.

48. James O. Pattie, *Personal Narrative . . .*, ed. Timothy Flint, in *Early Western Travels, 1748-1846*, ed. Reuben Gold Thwaites, 32 vols. (Cleveland, 1905), 18:113-15; originally published in 1831.

49. John S. Watts to James K. Proudfit, United States Surveyor General, November 18, 1872; Survey General Record, Reel 31, File 107 (Santa Rita Copper Mine). Microfilm in the Department of the Interior, Bureau of Land Management Regional Office, Santa Fe, New Mexico.

50. Dr. Willard, "Inland Trade with New Mexico," *Western Monthly Review* 2 (1829):597; reprinted in Thwaites, *Travels*, p. 350.

51. Pattie, *Personal Narrative*, p. 111.