Feasibility study of gravitational ore separation, Hansonburg mining district, central New Mexico

Rene S. Steensma

New Mexico Geology, v. 1, n. 4 pp. 55, 58, Print ISSN: 0196-948X, Online ISSN: 2837-6420.
https://doi.org/10.58799/NMG-v1n4.55

This page is intentionally left blank to maintain order of facing pages.

Feasibility study of gravitational ore separation, Hansonburg mining district, central New Mexico

by Rene S. Steensma, Minopco Inc., Socorro, NM

Abstract

In an article on the barite-fluorite-lead mines of the Hansonburg mining district of Socorro County, Kottlowski (1979) indicated that development of new milling techniques would enhance ore recovery in the area. A pulverizer that incorporates the functions of a secondary crusher and a ball mill, along with a newly developed jig combine to make gravitational separation of ore a feasible process. This approach is not only more economical than flotation (the only theoretical alternative), but also avoids pollution and the resultant environmental impact problems.

Introduction

A brief review of concentration methods used in the past on the Hansonburg ores indicates certain problem areas. First, no water was available at the site. The crude ore had to be transported more than 40 km to a site where it could be concentrated. Next, the existing techniques failed to provide a solution to the problem—the separation of the three valuable minerals (galena, barite, and fluorite) from the host rock (limestone and quartz).

A flotation mill obtained good lead recoveries, and limited amounts of barite were recovered from areas where barite concentrations were high. Fluorite could not be recovered by this process.

When Minopco took an interest in the project, a mineral separation study was undertaken. Initially, the study was based on the presupposition that only flotation could provide the desired results. Results, however, were disappointing, for lead recovery was low—possibly due to the presence of lead carbonate in the ore. Barite concentrates were good, with high recovery values. The fluorite concentrate needed to be improved because of a high lead content.

In addition, the flotation process caused the following problems: water pollution, increased water consumption in an area where water is scarce, complexities in plant construction, increased energy consumption due to the use of ball mills, and the need for more highly skilled personnel and management—all factors that increase milling costs.

Gravitational separation

Among alternative methods studied, gravitational separation was the method of choice. My previous work on the separation of ores using magnetic material with a specific gravity adequate for the task had proven efficient. Now, if a suitable magnetic material could be found or manufactured, the following method could be applied. After crushing the ore to minus 3/8-inch in size, it would then be preconcentrated by a jig, thus eliminating the principal waste factor in the process. After regrinding, the material would pass over tables. To separate the fluorite from the quartz and limestone, an artificial magnetic product with a specific gravity slightly lower than fluorite but higher than quartz would be introduced to obtain the required separation.

The Hudson jig

While working on this project, I met Mr. Gene Hudson from Phoenix, Arizona, who had dedicated a substantial part of his career to the development of cost-efficient mining equipment that would provide economical and practical mining machinery to the smaller mines in the southwestern United States. Mr. Hudson seems to have realized his goal in developing a pulverizer and a jig, with outstanding results. Both machines tested have produced excellent recoveries, although the pulverizer has been slightly modified to match our need for higher capacity.

A sketch of the jig appears in fig. 1. Movement of the jigbed can be closely regulated by a stroke adjustment; and

(continued on page 58)

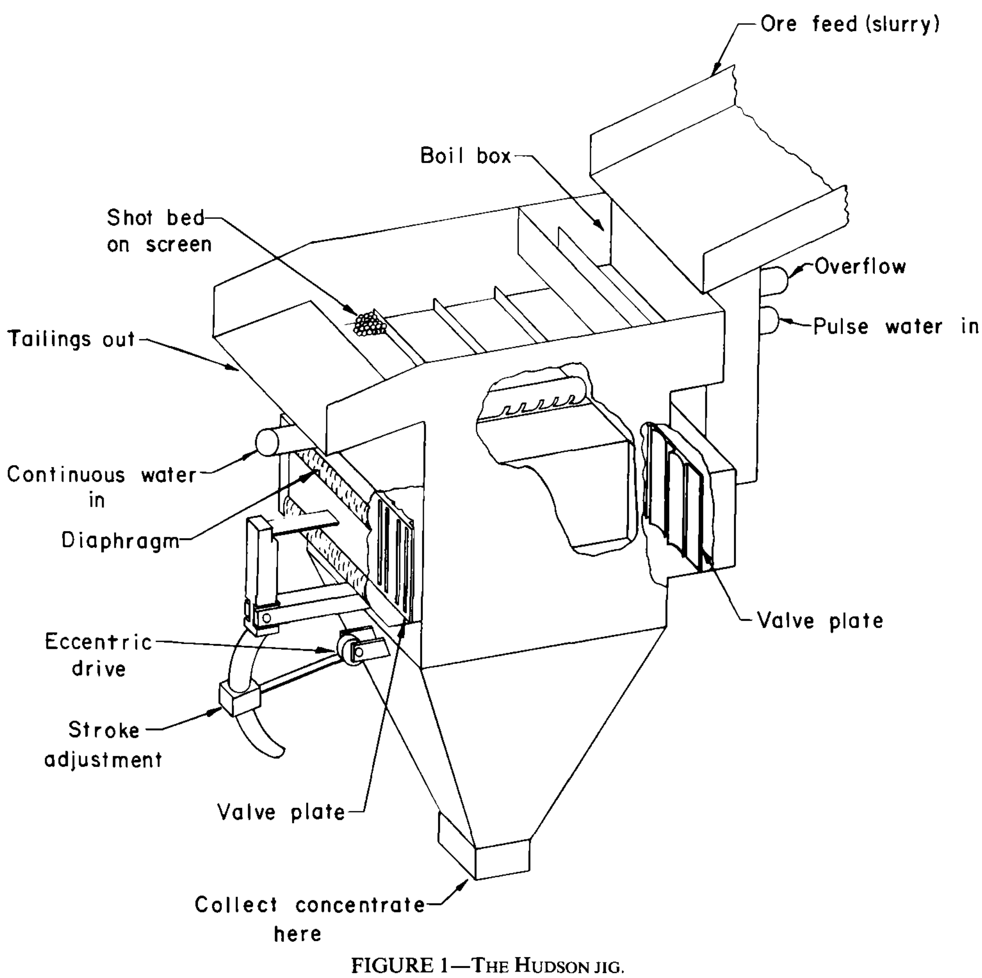

FIGURE 1—THE HUDSON JIG.

20.4 Junction with asphalt road; turn right, go northward. Note sinkholes in varying stages of development along bluff to east.
21.0 Lazy Lagoon on left.
22.6 Junction with upper road; end of loop. Turn left to *Roswell,* 13.4 mi.

Geology

The Pecos Valley near Bottomless Lakes is cut in sedimentary rocks laid down about 230 m.y. (million years) ago in an arm of the vast Permian sea. Periodically, when this area was a huge, shallow baylike feature, the gypsum and reddish siltstones of the Artesia Group of rocks were deposited. The entire area was tilted very gently (2° to 3°) to the east. The Pecos Valley was cut during relatively recent geologic time in these Permian sediments. Originally, the Pecos River flowed several miles west of Roswell, but the tilt of the beds caused the river to shift eastward as downcutting continued.

Sediments deposited in the valley by the river are sand, some gravel, and quantities of clay and silt. The present river channel occupies the lowest area and is bordered by floodplains with oxbow lakes and swamps marking abandoned channels (such as Lazy Lagoon in the northwest part of the park).

Above the floodplain, especially on the west side of the river, are higher terraces comprised of older sands and silts. The upper terrace, the Orchard Park, is about 40 ft above the floodplain. The lower terrace, the Lakewood, is about 20 ft above the floodplain. These terrace sediments were deposited and truncated during varying periods of the Pleistocene Ice Age, 10,000 to 20,000 years ago, as huge volumes of glacier melt-water came roaring down from the Sangre de Cristo Mountains.

Some of these Artesia Group rocks are exposed in road cuts along US-380 at Comanche Hill on the east side of the valley between Bottomless Lakes State Park and Roswell. Here the rocks are pink, green, and red siltstones interbedded with grayish to white beds of gypsum. Similar rock beds occur in the park, along the roads and surrounding lakes.

A notable feature of these beds are the "Pecos Diamonds," small, doubly-terminated quartz crystals found for nearly 100 mi along the east side of the Pecos Valley, from Dunlap in De Baca County to the north, across Chaves County, to just south of Artesia in Eddy County. In areas where the gypsum beds come to the surface, as at several overviews in the park, the sparkle of sunlight from the quartz crystals is quite noticeable. Gypsum crystals also reflect the sunlight. Perfect quartz crystals are difficult to find, but beautiful Pecos Diamonds are prominent in the collections of many mineralogists.

How did the lakes form? One of the best places to comprehend their origin is at the overlook above Lea Lake where the bluffs coincide with a sharp flexure in the Artesia Group beds. The regional dip is gentle and to the east, yet along this river-valley escarpment, the dip is rather steep to the southwest. The pronounced reversal of dip is probably due to the solution of gypsum and consequent slumping of overlying beds. Underground channels and caverns were dissolved out by circulating ground water, resulting in deep, steep-walled depressions now filled by the lakes. These collapse structures caused by ground-water solution of rocks are called sinkholes.

The lake water, fed from salty underground flow, is high in sulfates (4,000 to 14,000 ppm) from the gypsum beds. Thus the necessity of piping in water from Roswell—to make the swimming more enjoyable.

Flora and fauna

Among the vegetation in the valley are mesquite, creosote bush, salt brush, salt grass, snake weed, salt cedar (tamarisk), yucca, and cactus. Sparse grass and scattered shrubs conserve the sandy soil of the uplands.

Roadrunners and jackrabbits rule the brush. Rare fish, such as the zebra killifish and Texas cyprinodon, inhabit the salty lake waters. □

—F. E. Kottlowski
NMBM&MR

Gravitational ore separation

(continued from page 55)

various water inlets and the overflow, which evacuates air from the pulse water, allow a very subtle bed movement. The patented valve system regulates the suction of the movement. These three variables allow concentration of material down to 325 mesh. In the Hansonburg district, our material will be concentrated in three carefully screened groups: 50-150 mesh, 150-200 mesh, and material passing 200 mesh.

Results with the jig have been highly satisfactory on our ore, with galena and barite recoveries well above 90 percent. Fluorspar recovery is somewhat lower (70-80 percent). The remaining tailings will be treated by gravity separation, using magnetic material as previously mentioned. The price of fluorspar at the moment does not warrant recovery from the tailings. It will be stockpiled until better prices justify further processing.

The pulverizer (fig. 2) is basically similar to any other pulverizer. The most significant differences lie in the design of the breaking plates, the rotor outlet, and the rotor itself. The use of special wedge-shaped steel plates and the curvature of the ore-breaking plates maintain the impact force perpendicular to the plates, thus holding plates wear to a minimum. The lid can be lifted hydraulically and easily swung aside. The ring containing the breaking plates can be removed in 5 minutes; the rotor is similar in design—the tungsten-carbide plates are attached with a few bolts, enabling their replacement in a matter of minutes.

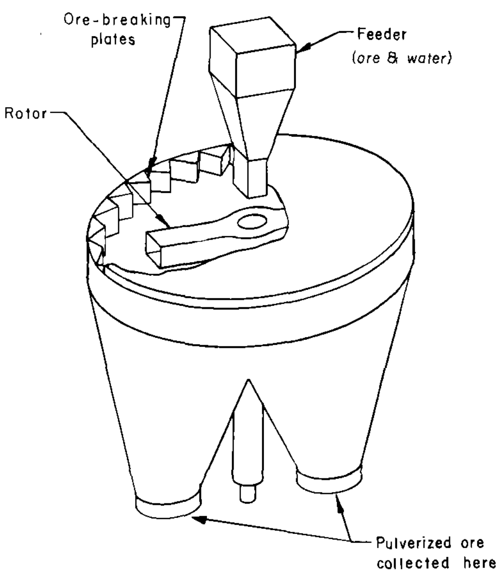

FIGURE 2—THE PULVERIZER.

This system has the following advantages. 1) Power consumption for processing copper ore was 35 percent less than a secondary crusher and a ball mill would have required. 2) Capital cost savings as a result of the elimination of secondary crushing and milling when these operations are combined into a single process. 3) Reduced maintenance costs due to reduced wear and less down time. 4) Machine operates on a limited water supply, and at low pollution levels. 5) Minimal skills are required for operation.

Because these advantages may encourage successful mining ventures in more remote areas, the development of this type of machinery is both economically sound and essential.

Acknowledgments

My thanks to Dr. Frank Kottlowski, Director; Robert W. Eveleth, Mining Engineer; and Neila MacDonald, Associate Editor, NM Bureau of Mines & Mineral Resources, without whose help this paper would not have been possible.

Reference cited

Kottlowski, F. E., 1979, Barite-fluorite-lead mines of the Hansonburg mining district in central New Mexico, *in* New Mexico Geology: NM Bureau of Mines & Mineral Resources, v. 1, no. 2, p. 17-20
□