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HISTORY OF THE GUANO MINING INDUSTRY, ISLA DE MONA, PUERTO RICO

EDWARD F. FRANK
Department of Geology and Geophysics, University of Minnesota, Minneapolis, MN 55455 USA

Isla de Mona, Puerto Rico is ringed by hundreds of flank margin caves (Frank 1993; Mylroie et al. *1995). In the late 1800s and early 1900s, ~150,000 metric tons of phosphorite, altered bat guano, were mined from the caves. A high phosphate content made the phosphorite a valuable fertilizer (Wadsworth 1973). Briggs (1974) indicates the guano deposits have been exhausted from seven of the eight largest known cave systems on the island. Many relics from the guano mining days are still present in the caves and surrounding areas today.*

In the mid-1800s, guano deposits in the caves on Isla de Mona were viewed as important economic resources. Numerous applications for exploitation had been received by the Spanish government by 1854. In 1856, two American vessels illegally loaded guano from the island. In response, the Puerto Rico Governor sent the warship, Bazan, to investigate the island later that year. The Bazan returned several times in the next two years, collected samples of guano, Taino Indian relics, and mapped the island, including 17 caves [maps are lost] (Wadsworth 1973). Two concessions granted in the 1870s to mine guano lapsed unused. It was not until the third concession, given in 1877 to Miguel Porrata Doria of Fajaro, Puerto Rico and Juan Contreras Martinez of Spain, that the first legal guano extraction from the island took place. The mining headquarters set up near Cueva de Pájaros (Vasconi y Vasconi 1883) included facilities for sun drying, screening, and processing over 100 metric tons per day (Fig. 1 & 2). The guano was dug with picks, bars, and shovels and transported in wheel barrows to the processing areas. In the largest caves, tramcars on rails were also used. From cave mouths directly above water, such as in Cueva del Lirio, guano was lowered by basket to waiting ships and transported to Playa de Pájaros for processing. The major part of the first mining operation was completed by 1884 with Cueva de Pájaros nearly worked out.

A second mining venture began in 1890 when Anton Mobins of Germany subleased the mining rights. During this period all but the most remote caves on the north coast of the island were mined. These were the first operations to reach the

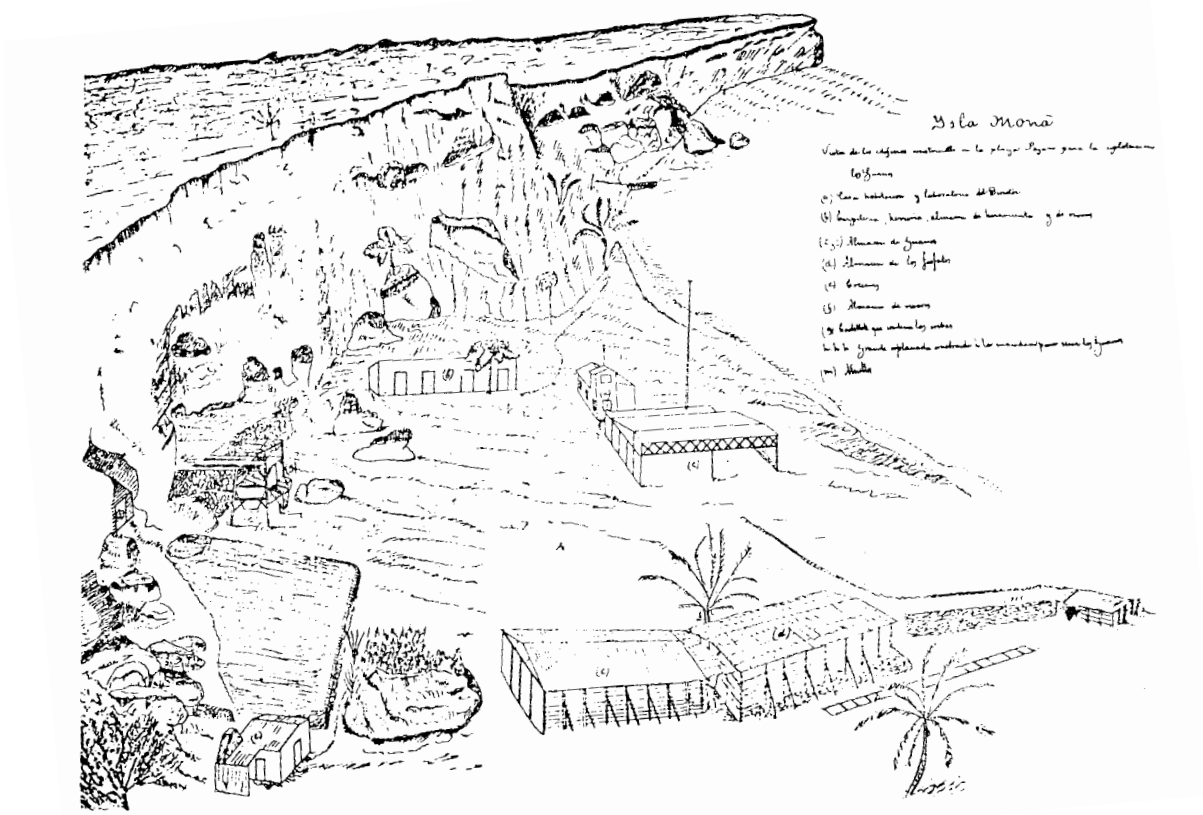

Figure 1. Panorama of the guano processing facilities at Playa Pájaros (from Vasconi y Vasconi, 1883).

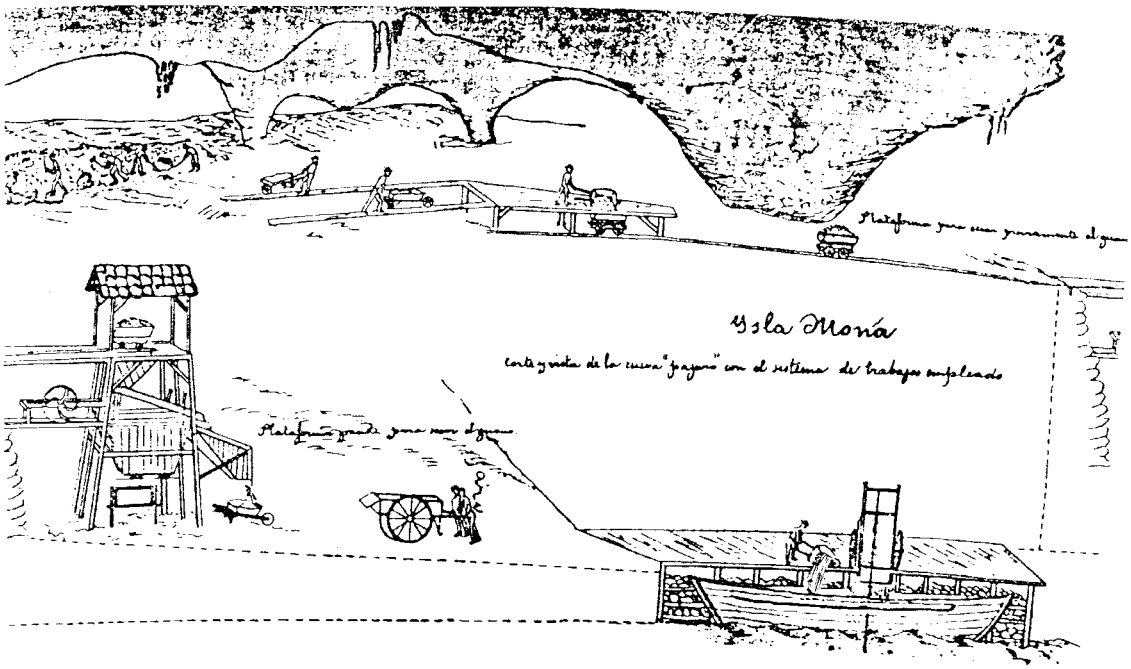

Figure 2. Diagram of the mining operation within Cueva de los Pájaros. The upper side of the figure wraps to the lower left side of the diagram (from Vasconi y Vasconi 1883).

west side of the island. Captain Kuhfal (Kuhfal 1892) of the ship *General Contreras* describes the mining in his log and provides a contemporaneous map of the island (Fig. 3). Briggs (1974: 87-88) translates freely the following passage from that log:

> The removal of the guano from the caves is accomplished easily. The entrance to the cave to be exploited is enlarged and where necessary, supported. Gangways or paths are prepared, and frequently tracks are laid down. The guano, which is commonly found in layers thicker than a meter, frequently also must be freed from the underlying rock by blasting. It is then shoveled into pushcarts or tramcars and taken to the cave exit where it is poured through screens into tramcars waiting beneath. These carry the guano to drying ovens. Following drying in the ovens, the guano goes through a mixing mill which produces an homogeneous guano mixture. A small part of the guano is dried in the sun and then mixed. Guano thus prepared for shipping has a very low moisture content. The guano then is put in sacks and loaded onto lighters which are pulled by a small tugboat to ships lying in the roadstead. The lighters hold 5 to 6 tons, and they can deliver as much as 120 tons on board each day. For the working of the guano of the island, aside from large machines and horses, there are 300 to 400 workers busy daily. Supervision is in the hands of Germans stationed there.

Wadsworth (1973: N-10) states, "Loading was a precarious operation. Ships lay anchored or moored to buoys and exposed to the open sea just outside the reef off Playa Pájaros. Using 5 to 8 men from ashore as well as the ship's crews, loading required up to a month, even in favorable weather." To resolve some of the ship loading problems (Wadsworth 1973: N-12), "The reefs at Playa Pájaros were blasted out to facilitate lightering to ships anchored outside. During the period 1890-92 at least 30 ships were loaded in this way. In rough weather not only was lightering impossible but at times the ships were

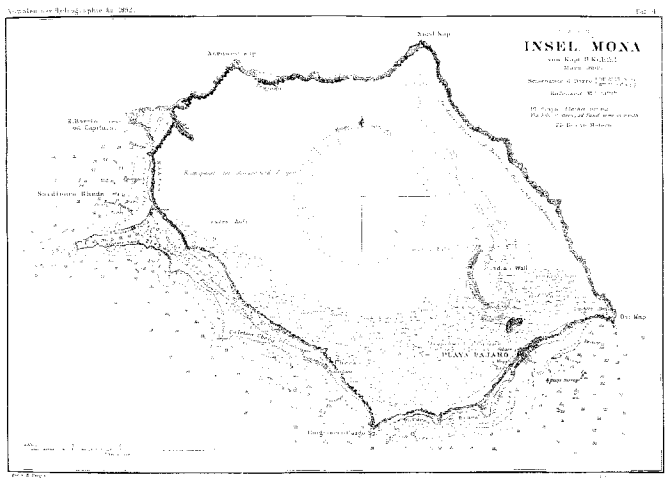

Figure 3. Map of Isla de Mona by Kuhfal (1892). The map is distorted but major topographic features of the island are depicted. The text in the southern portion of the mesata indicates brush, cactus, and good lumber. At Playa Pájaros: the word Schornst refers to a skylight in the cave, while Magazin refers to a storage facility. Also the location marked as Lirio is at the entrance to the cave known today as Cueva de los Pájaros. Cañada marked just north of K. Barrio Nuevo corresponds to the location of Cueva de Esperanza.

forced to put to sea, and both ships and lighters were lost."

Kaye (1959: 156) provides a less idyllic assessment of the mining operation based upon the nature of the deposits, remains of equipment, and workings still visible in the cave:

> The deposits were probably worked by painstaking hand labor. The pockets of phosphorite on the floor of the cave had to be felt out through the dripstone crust, presumably by prodding with picks. The dripstone crust was then stripped and the underlying pockets of ore excavated by hand. Much digging was done in close quarters, where men must have felt their way along bent nearly double beneath the low roof. From the litter of narrow-necked bottles in many caves it is evident that the mining lamps consisted of bottles of kerosene provided with thick wicks.
>
> A single-track line was laid along the main trunk chambers of the cave. Ore was probably hauled from the diggings to the rail line by hand, either in sacks or by drags. The ore was then hauled by rail to the mouth of the caves, where there are signs it was temporarily stockpiled. The ruins of what resembled a small drying plant at Playa Pajaro, and it seems evident that some of the ore was thus treated.
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> The gathering of the ore from many caves probably presented a particularly difficult problem and apparently was done by various means, depending on the location and setting of the cave. In some places wagons were used, in others rail; and in some caves, such as Cueva del Gato at Cabo Barrionuevo [likely Cueva de Esperanza as located on Briggs & Seiders 1972], ore was loaded directly onto ships precariously tied up against the unprotected sea cliffs. The rusted remains of several rail lines associated with the mining are to be seen today around the island. There were signs of exploration and some mining in all of the caves visited by the writer, and it is probable that most of the caves on the island have been explored to some degree.

The island came under United States sovereignty in 1899. In 1903, all of the island except for the 235-acre lighthouse reservation was transferred to the Government of Puerto Rico. At that time, the Porrata-Doria guano mining concession was terminated and a new 40 year franchise was granted to Percy Saint. This was in turn transferred in 1904 to the Mona Island Phosphate Company, Limited, Louisiana, of which Saint was Vice President and General Manager (U.S. Congress 1906). The last commercial guano extraction took place from 1909 until 1927. The estimated total guano shipped from Isla de Mona was: 1877-1889: ~31,410 metric tons; 1890-1899: ~113,493 metric tons; 1900-1927: ~3,000 metric tons (Wadsworth 1973). Minor amounts of guano were also reported to have been extracted from a cave on Isla Monito, but no specific figures are available (Wadsworth 1973).

PRESENT STATUS OF GUANO MINING ARTIFACTS

Evidence of the guano mining could be seen on the island from 1992 through 1996. The pervasiveness of the guano mining on the island is a striking characteristic. Every moderate to large cave examined from Cueva del Lirio on the eastern corner of the island around the cliffs clockwise to Cueva de Esperanza on the northwestern corner of the island showed evidence of guano mining. A large percentage of the smaller caves in this area had also been actively mined or contained test pits in the guano deposits.

Trails constructed by the miners to facilitate guano removal are prominent in these caves. Typically, a low gradient rail bed for mine carts extends the length of a cave. A series of side spurs feed into this main pathway. Cuts dug through higher areas of the floor and raised rock rail beds built in low areas maintain a low gradient. These raised rail beds average a meter wide and were carefully constructed with obvious effort to maintain a continuous surface along their length (Fig. 4). Rail impressions are commonly seen in the surface of these beds. Most of the rails have been removed from the caves. The only rail found in place is a segment in Cueva del Lirio. A handful of individual sections of rail, 0.5 m wide and four meters long are in several other caves unattached to the floor (Fig. 5). Badly rusted remains of mine carts can be found in Cueva del Lirio (Fig. 6) and Cueva de los Pájaros. These appear to have deteriorated beyond any hope of preservation.

On the surface near Cueva de Esperanza, a short section of rail leads to the cliff edge where apparently guano was lowered down the cliff face. Several other pieces of mechanical equipment are on a raised stone platform adjacent to this track. This equipment includes several pulleys, metal cable, braking devices, and what may be pieces of a steam driven winch (Fig. 7).

Figure 4. Raised rail beds found in Cueva de Aleman.

Figure 5. A segment of mine track found alongside of the trail in Cueva del Diamante.

Figure 6. Rusting remains of a mine cart found in Cueva del Lirio.

Along the southern coast of the island a surface roadbed runs from Cueva de Playa Brava to Cueva de Pozo Erickson passes several mined caves. This road is ~1.5 to 2 m wide and made of carefully laid local stone (Fig. 8). A similar appearing feature, remains of a rail line used to supply the El Faro lighthouse, is unrelated to guano mining.

There are also several structures in the area below Cueva de Aleman. One is the foundation of a ranch that raised cattle to help feed the miners in the early 1900s. Just east of this foundation is a large hollow boulder, a fragment of the cave fallen from the cliff (Fig. 9). Remains of a brick doorframe can be seen around a 1.2 m high entrance into the chamber within the boulder. This chamber may have been used as a explosive storage shed during the mining operation (José Jimenez, verbal communication 1996).

Figure 7. Miscellaneous equipment related to mining found on the mesata surface near Cueva de Esperanza. Items include pulleys, some wire cable, a braking mechanism, and miscellaneous strapping on a rock platform. Guano was lowered down the vertical, 60 m cliff face to ships waiting below.

Figure 8. Rock roadbed running along the southern coast of the island between Punta Ingleses and Cueva de Playa Brava.

Other items related to the mining operations include a ladder inside one of the entrances to Cueva de los Pájaros and a wooden wheelbarrow inside of Bat Cave (Fig. 10). The guano mining period represents an significant episode in the history of the region. If efforts are not made to preserve historical items and localities representing the mining activities, the arti-

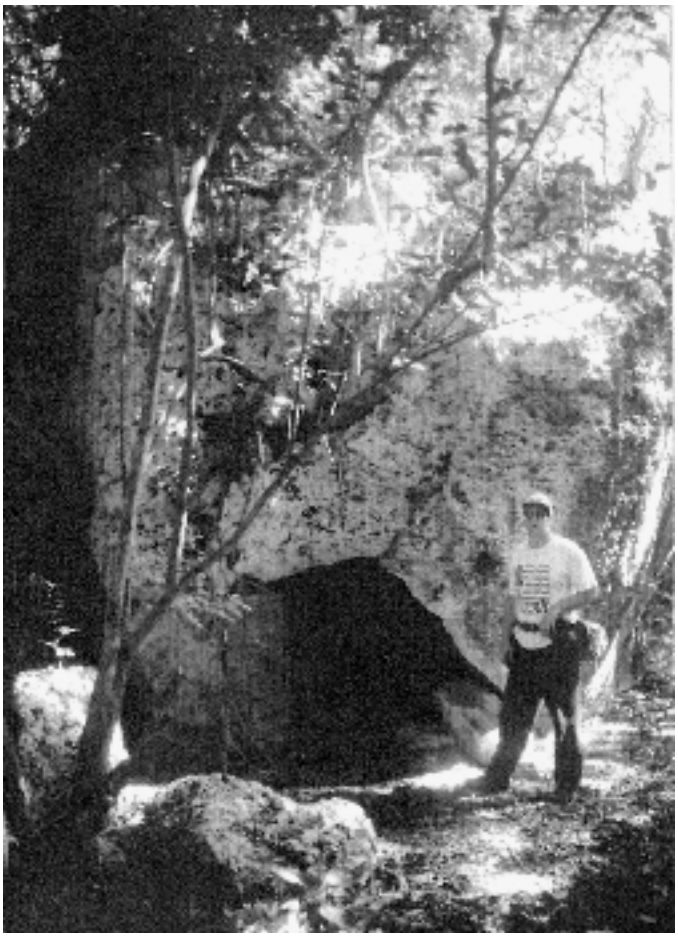

Figure 9. Hollow boulder and remains of a brick doorway on the coastal plain below Cueva de Aleman. This may have been used as an explosive storage facility during the mining operation.

facts will decompose or be removed. At the present time because of funding and personnel limitations, the Puerto Rico Department of Natural and Environmental Resources has only limited resources available to pursue the preservation effort.

ACKNOWLEDGMENTS

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Figure 10. Wooden wheelbarrow from the guano mining operations found in Bat Cave.

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