

Mona Island and the guano industry, 1877-1885

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Resumen

El artículo inquiriere sobre el desarrollo de la industria del guano en su más importante sitio en Puerto Rico: la isla de Mona. Los primeros años de la producción de guano fueron erráticos. Pero las autoridades españolas y medios puertorriqueños percibieron el potencial y siguieron tratando de desarrollar esta exportación prometedora en términos lucrativos. Los primeros intentos de exportar guano a los Estados Unidos fueron exitosos, pero la industria carecía de la experiencia necesaria para expandir suficientemente la producción. Vino entonces un geólogo canadiense experto en guano de nombre John G. Miller, con su asistente Carlos Miguel Iglesias Mons. No solo fueron capaces de expandir la producción, sino también de usar su pericia en cuestión de exportaciones a diferentes mercados, incluyendo los británicos. Miller e Iglesias llegarían a sentar las bases para la exportación de guano que habría de florecer en Puerto Rico hasta convertirse una década después en el tercer artículo de exportación más importante.

Palabras clave: Guano, exportaciones, mercados, Isla de Mona, minería.

Abstract

This article delves into the development of the guano industry in its most important location in Puerto Rico, Mona Island. The initial years of guano production were erratic; but the Spanish and Puerto Rican governments saw potential and continued to try to develop this possibly lucrative export. Initial attempts to export guano to the United States proved successful, but the industry lacked the expertise to greatly expand production. To solve this dilemma came a Canadian geologist and expert in guano extraction John G. Miller and his assistant Carlos Miguel Iglesias Mons. They were not only able to expand guano production, but also to use their expertise to prepare exports for different markets including those in Great Britain. Miller and Iglesias would lay the foundations for guano exports that would eventually flourish into Puerto Rico's third most important export a decade later.

Key Words: Guano, Exports, Markets, Mona Island, Mining

Interest in fertilizer to increase crop production may be an ancient idea, but the potential of guano as a plant nutrient really took root in the nineteenth century. As the fields of Europe,

especially Britain, failed to meet rising expectations, science was vested with the responsibility to revive the lost potential of the soil. To this end, some researchers increasingly labored over the factors

which caused plants to grow and produce. Chemistry, a rapidly growing field, was recruited to further enhance this renewal of the ground. Alexander von Humboldt is credited, if not for the discovery, for the renaissance of the use of guano.

By the 1840s, agricultural chemists, led by Justus Liebig, had done sufficient research to advocate the use of guano as a field enhancing fertilizer. This initial phase of guano as a fertilizer witnessed the direct application of the feces to the fields, with the unsophisticated notion that more is better. As advocated by Humboldt, the first source utilized were the Chincha islands off the coast of Peru. These islands were literal mountains of seabird deposits, or guano, and thus offered the British, who quickly obtained a monopoly, an opportunity to control the guano fertilizer industry.

Ideological motives also fueled the search for increased food production in England. Thomas Robert Malthus, and the generation of his followers known as Malthusians, predicted that food supply could not keep pace with human reproduction. In the face of England's increased concentration on manufacturing they foresaw a bleak future if population growth was not curbed. Malthus' own words from *Population: The First Essay* of 1798 stated:

...the power of population is indefinitely greater than the power in the earth to produce subsistence for man.

Population, when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmetical ratio.¹

This essay does not intend to enter the debate over the correctness of Malthus' suppositions, but simply to indicate that the nineteenth century was influenced by this thinker. Guano could thus lend power to the earth in its struggle to keep up with human reproduction.

In the 1840s, other sources of guano were sought in order to make this fertilizer more available and less expensive for farmers. The race for seabird droppings would result in a scramble that would take prospectors far and wide upon the globe. The southwestern coastal islands of Africa were one such source, as were various Pacific and Caribbean islands. High prices, as well as the prospect of getting rich quickly, lured these guanopreneurs out onto the high seas in search of their odoriferous fortune. The so-called guano rush would last until the 1860s, by which time the interest in guano had dissipated as other fertilizer sources received higher marks from the agronomists.

In this first wave of discovery the Mona Channel, between the islands of Hispaniola and Puerto Rico, was explored as a viable source. Mona Island, the largest of the islands in this channel, was ignored, as it appeared to hold little potential for guano. Instead, the island of Monito was targeted by the guano hunters as the best possible source of seabird deposits. Captain Jacob Stokely of Baltimore first brought a cargo of the droppings from Monito Island in 1855. Subsequent trips the following year would show the disregard of these guanopreneurs for Spain's rights of ownership.² In 1856, the Spanish authorities would send the warship *Bazán* to put an end to the unauthorized removal of guano deposits from Monito Island.³

In the following decade interest in guano was on the wane. The Civil War in the United States removed the urgency of the Mid-Atlantic States to receive more Caribbean guano. In Europe, other factors, most importantly the advocacy of other fertilizer sources would reduce the demand for bird droppings. The guano potential of the Mona Channel no longer appeared as an important issue in international trade.

By the second half of the 1870s, there was a revival of the guano industry, as it entered the second phase which witnessed the use of more sophisticated fertilizers. With the movement towards chemically mixed fertilizers, later called superphosphates, guano regained a portion of its earlier importance. Seabird droppings once again appeared as a possible means of getting rich quickly for those entrepreneurs who could properly take advantage of the market.

During this second phase of the guano industry, Mona Island reached a period of growth and development. The extraction of guano, due to the changing demands, necessitated greater expertise on Mona Island. Specifically, plans are prepared and carried out as to the most opportune means by which to extract the cave guano. Perhaps its greatest single accomplishment was that this natural resource finally combined with its most desirable market. These fundamental changes enabled the formerly improvised, untechnical development of Mona Island to turn into a professional business better able to increase quantities of guano and extract greater profits simultaneously.

The company in charge of this development, Srs. Porrata Doria y Contreras, sought to turn the Mona Island

concession into a profitable business venture. This would include the obvious need to better evaluate the guano of their concession, the identification of markets, the improvement of regular shipping to and from Mona Island, and the eventual utilization of this knowledge to make the mining venture a success. These were no small tasks, and early indications showed little more promise than the previous concessionaires, but this partnership would reap benefits which had eluded the previous entrepreneurs. Monito Island, although not completely forgotten, would play a secondary role in these years. This period, 1877-1885, will be the first real success story for guano production out of the Mona Passage.

The initial guano deposits enjoyed the benefit of easy access. This meant that with little technology and large amounts of labor the concession could reap benefits. These first deposits required little more than the scraping, drying, and loading of the fertilizer. Such accessibility made the possibility of great profits seem ever so much closer, since the international market still appeared to have an insatiable demand for all the forthcoming guano.⁴ Mona Island's resources thus appeared poised to jump into the international market.

Additional factors, which exceeded simple questions of price and tonnage available, played an important part in the decisions which saw the feces cross the Atlantic Ocean. Spain ultimately would have the final word in the direction and quantity of guano which would leave the Mona Channel. There were also the problems of chemical analysis, extraction expertise, markets, sales contacts, and shipping--all essential to a further understanding of the international

fertilizer industry for this Caribbean source. This essay will also investigate the role of the bird and bat droppings in the development of wider trade from the island of Mona. All told then, this was a crucial period in the development of guano for export from the Mona Channel.

Apparently, the guano concession of Don Manuel Homedes y Cabrera did not appear to be a fruitful contract fairly early in the six year deal. Less than two years after the 1874 concession was finalized there was already a movement afoot to renege on the original deal. Pressure to change the developer of the concession came from the person of Miguel Porrata Doria. In a hurry to develop Mona and Monito along his own more profitable conceptions, he questioned how long he needed to wait in January of 1876.⁵ His wait would not last long as the concession would pass into his hands by March of the following year, when he and Tomás Sáenz de Hermuo were awarded the rights.

Several modifications were made to the original agreement; first, it was to last ten years, and second, the new charge for guano was 4 pesos per ton.⁶ Later that same year, a decision was made to further regulate the export of this fertilizer component. Tonnage would be estimated by cargo space, with 283 cubic meters equaling one ton; and ships were to be from only the specified nations of Sweden, Austria-Hungary, Italy, and England.⁷ The Spanish authorities had placed their bird droppings into new hands for the third time in six years.

The concession of Mona and Monito now faced new possibilities under the direction of Porrata Doria and Sáenz de Hermuo. The new feces dealers made

several requests for improvements that they hoped would make their operations on Mona Island more profitable. Barely two weeks after the Royal Order opened the concession to them, they looked to take advantage of the forest resources on Mona Island as well.⁸ Early the next month, with the goal of making the guano more accessible, they proposed to "cut a path between the undergrowth and thistles of which said islands are covered."⁹ The request for cutting timber was denied; even so the concessionaire had been more active than previous guanopreneurs.

Although the world demand for guano remained high in the late 1870s, the *Sociedad Porrata Doria, Contreras* y Cía.* found it difficult to sell their soil enhancing product, as the markets preferred by the Spanish authorities remained uninterested. Between 1877 and 1878 the first three guano shipments were all sold in Puerto Rico at Mayagüez, Arecibo and Fajardo, respectively.¹⁰ Although this did provide some revenue it was not the large sales hoped for by the concessionaires or the Spanish authorities. Markets needed to be located in order to make the Mona Island resources profitable for all concerned.

The following year a new market opened for Mona Island guano. New York, which would dominate during this period of growth, became the leading market for this fertilizer. The two sales of feces recorded in 1879 would both be to a New York dealership, Theband Bros. The two cargo ships which delivered the guano were registered in England and

*Contreras refers to the retired Spanish General Contreras whose name will regularly appear in information over the Mona Island concession in the decade of the 1880s.

Costa Rica, with a combined tonnage of 323.25 tons.¹¹ The 1879 Record of Sale indicated a slightly different total of soil enhancing product. Theband Bros. received 253.318 long tons (guano was sold in this unit which officially was measured at 2240 pounds) for which they paid \$8.00 per long ton or a total of \$904.71. After all the expenses, the largest of which was shipping at \$3.50 per long ton to New York, the Ponce-based company of Cardosa y Cía. realized a profit of \$269.04.¹² The high demand of the United States fertilizer market presented a profitable alternative to the original group of nations endorsed by Spanish authorities.

Several factors would hamper the ability of the Mona Channel guano to enter the European markets. One reason was that England, still the dominant force in the European fertilizer industry, continued to rely on the Peruvian islands for the lion's share of its guano. Fertilizer demand was also on the rise, but the latest trend was no longer a single source fertilizer like guano, but rather a fertilizer made out of a balance of ingredients. In this new world of soil enhancement, products such as Chilean Nitrates, German Potash Salts, South Carolina Phosphates and others began to take on a greater role in the fertilizer industry.¹³ England and the other European fertilizer producers still refused to deal with the Spanish dominated guano of Mona Island. At least until the end of the decade the United States market appeared to be the only outside interest in Mona Channel guano.

By 1880 it was clear that the Spanish authorities were still not satisfied with the profit resulting from the Mona Channel operations. There was an

investigation conducted in that year to check the Porrata Doria y Cía. concession of Mona and Monito Islands. Although not fully satisfied with the results of this investigation, they did allow the company to continue its concession under the agreement.¹⁴ However, Spanish authorities also hoped to make some additional economic gains by dividing the concession. In 1880, interest in Monito's fertilizer potential offered a new source of possible revenue. Spanish authorities pondered the best means by which to turn their smelly natural resources into profit.

A pair of Baltimore entrepreneurs emerged at the right moment to petition a guano concession on Monito Island. George C. Stewart and Pascal A. Quinass, probably using past success by Baltimore guanopreneurs, sent a petition for the rights to dig "phosphate of lime" and guano on Monito Island. At an earlier time this request would appear to have little, if any, chance for success, especially in light of the incidents of the 1850s. However, these were different times and Spanish authorities sought additional revenues. The Baltimore entrepreneurs received a warmer reception than their predecessors a quarter century earlier.

The reply from Conde de Caspe, Capitán General de Puerto Rico, came in the form of a grant for the sought after concession. The Baltimore pair received "the exclusive right to occupy the island of Monito, and to dig, mine and export any guano or phosphate of lime or other substance which may be found on said Island, on the following terms and conditions...." Up to this point the deal seemed to fit all the desires of the guanopreneurs. Naturally, there would be fees or charges or rent for the concession,

and the royalty of one dollar per long ton (2240 lbs) of guano or phosphate of lime was not excessive. However, the final demand--which called for a 15,000 ton per year minimum or \$15,000 rent for the island per year--was beyond the reach of these guanopreneurs.¹⁵ It was most likely the final demand of the concession which brought the deal to a screeching halt. The Governor's demands proved to be beyond the reach of the Baltimore guanopreneurs and unrealistic in view of other nearby concessions.¹⁶

The year 1880 had also proved to be a difficult year for the Mona Island concession as the slow successes of the previous three years had suddenly ground to a halt. During the entire year there is not a single guano shipment listed for the island. Although no official explanation has been uncovered, there would appear to be a plausible explanation. Mona Island, not noted for mountains of bird droppings, may have come to the end of its most easily extracted supplies. The process would thus be more complicated and expertise would be needed to continue the operations. This lull did not mark the end of Mona Island guano; rather, it became a point of transition for the concession.

The unproductive year was not lost on the Spanish authorities in Puerto Rico. It must certainly have occurred to them that the possibility existed that this concession could closely resemble its predecessors, in that production of guano could become erratic or non-existent. In June of 1880 the customs records of Mayagüez were investigated in order to get a clearer picture of what would be the prognosis for the future of Mona Island and its guano.¹⁷ Although the news up to this point was not the massive production

which they hoped for, it did show that there was at least consistent production which exceeded anything that former concessionaires had been able to produce. The Spanish authorities were most likely caught unaware that production would cease for such a long period of time.

After the year of inactivity, several changes indicated a revival of operations on Mona Island. There was an attempt to utilize professional help in the mining process. This came in the persons of the noted Ottawa geologist John G. Miller and his assistant Carlos Miguel Iglesias Mons.¹⁸ The Canadian geologist was no stranger to the Caribbean or to the guano industry, as his *Alta Vela* experience showed. In 1860 Mr. Miller was working for the guano firm of Patterson and Murguiondo on the aforementioned island off the coast of Santo Domingo. But, the Dominican forces unceremoniously removed Miller and his work crew from *Alta Vela*, jailed them, and then shipped them to Baltimore.¹⁹ Mr. Miller's experiences during the next twenty years are unpublished, but most likely he remained in the guano trade. Their professional expertise was a key element in the revival of activities on Mona Island.

There was also the renewal of the connection with the New York fertilizer markets. Following the tradition of the time, guano applications were either used in the fall after the harvest or in the spring just prior to planting. The 1881 shipments of guano were made just in time to be applied to the fields after the harvest. The two shipments of this year just barely surpassed the 1879 output;²⁰ however, after a year and a half of idleness this was a sign of hope. The New York fertilizer market remained interested in the output of Mona Island.

Renewed shipments and experienced professional supervisors were not the only signs that activities were picking up. John Miller was designing a long range plan to dramatically increase the guano production over the next three years. His budget was submitted to Porrata, Contreras y Co. on August 16, 1881, and it indicated a very ambitious plan. Among the necessities for Miller were nearly \$5,000 worth of explosives, railroad tracks and mining timbers for the caves of Mona Island, and provisions for a constant labor force which he estimated at 100 men.²¹ Miller's vision of Mona Island production far exceeded any previous guano production undertaken on the island.

The flurry of activity at the end of 1881 was just a sign of even larger improvements and shipments to come in the guano production. Miller had in mind to change the Mona concession from an annual producer of hundreds of long tons of guano to a producer of thousands of long tons. The accomplishment of this feat would take more than an increase in equipment; it would also necessitate the opening of new markets for the fertilizer. In this sense the vast experience of Miller in the guano industry would prove a valuable asset in the selling of Mona's natural resources.

One of the significant changes was to target the traditional purchasers of guano and attempt to offer them what they were looking for. In this case the markets of New York, and later Baltimore, were interested in nitrogen and ammonia rich guano for enhancing production in the depleted fields of the Mid-Atlantic States. This product was the traditional one sold by the guanopreneurs. However, there was another market open

to these businessmen in the area of phosphatic guanos. The fertilizer industry in the 1870s and 1880s was moving toward the use of an agricultural chemical product. In the United States there was only limited interest in these guanos, because of vast rock phosphate deposits found in South Carolina.²² Miller realized that there were additional markets for Mona's natural resources, but if he was going to utilize them he would need to fulfill their demands.

Great Britain was both the leader in European production and consumption of fertilizers, and the nation with the greatest interest in natural fertilizer components. By the second half of the 1880s there was a trend toward the accumulation of guano producing islands in the Pacific, many of which had fallen under the United States Guano Act of 1856 previously. The trend would continue perhaps best exemplified by the firm of John T. Arundel & Co. which in the mid-1880s leased such former American appurtenances as Birnie, Canton, Enderbury, Flint, Gardner, Hull, Mckean, Phoenix, and Sydney.²³ The major interest of the British fertilizer industry was in the area of phosphatic guanos.

Shipping costs were an additional factor which influenced the guano markets, probably to as great an extent as demand. The cost of shipping guano from Mona Island to the United States was approximately half of that to Europe. Accordingly, a shipment to New York or Baltimore would cost 3 to 3.5 pesos per long ton, while that same quantity would cost 7 to 8 pesos to arrive in a European port. For that reason guano could be sold to the first fertilizer dealer offering 12 pesos per ton; while the phosphatic

guanos would require a substantially greater price.²⁴ Miller, the guano engineer, thus had not only to mine the guano, but also to separate it for its specific market.

The government was also worried that their valuable natural resource would be properly handled and marketed. Angel Vasconi, Inspector of Mines in Puerto Rico, was sent to personally investigate the status of the guano production in early 1882. John Miller described his reaction to the forthcoming visit by the governmental official as: "our accommodations you will find very rough, but the welcome you shall have will be a hearty one."²⁵ The visit resulted in the June 1882 report filed by Mining Inspector Vasconi.²⁶ This report was not the only indication of interest by officials in Puerto Rico over the activities and valuable fertilizer materials being extracted on Mona Island. There were also several studies, three in 1882 alone, over the quality and marketability of the guano from the caves of Mona Island.²⁷ From all of this activity in 1882 it was apparent that the government wanted to keep a close eye on Miller and the guano operations.

Such concerns went beyond the simple protection of a natural resource because Miller was also requesting that a substantial amount of equipment be allowed onto the island without the usual import tax. These tools and materials were deemed essential to the rapid expansion of guano output for the island. Among the \$14,287 worth of goods there was one mile of 26-inch gauge rails and 40 dumping cars, 300 various sized shovels, 40 wheelbarrows, 2 boats and 40 oars, and 2 sporting guns with ammunition.²⁸ There was also the need to remove obstructions and make the caves more

accessible. For this purpose Miller had asked for exemption for 550 kegs of various blasting powders and 2000 pounds of dynamite, which he estimated at an additional \$4,970.²⁹ Such large quantities of materials needed close scrutiny. Tax exempt tools, materials, and explosives meant that the government would hope to get back the revenue through increased output of guano and its subsequent royalties.

The large expansion of the mining operations on Mona Island was essential to fulfill the expectations of both Spanish authorities and the Porrata Contreras Company. On the one hand, Spanish authorities had witnessed the failure of the early concessions. They had missed the initial phase of the guano rush when farmers purchased any bird droppings without question, and had been forced to sell their bat droppings in a period (1877-1885), when consumers had become more particular about their guano purchases. Mines, railroad equipment, and blasting materials became essential to make it possible to produce the quantities demanded to make the Mona Island concession profitable. Chemical assays had become the new measure for the value of their product. Porrata Contreras Co. realized the need to expand their operations and increase production in order to become profitable in this period.

Production rose dramatically in the 1880s, beginning with the fall shipments of guano in late 1881. The two shipments at the end of that year, each destined for New York, exceeded the production of 1879. However, Spanish authorities must have remained somewhat uncertain about the guano industry production as the new year began since they closely monitored each ship traveling to Mona Island.³⁰ This

monitoring may have indicated their concern over actual guano production as a tax revenue source, or perhaps their mistrust of the guanopreneurs to report all their shipments. Whichever was the case, each ship passed through the customs station in Mayagüez indicating that not only were the shipments being reported and taxed, but also that production was on the rise. This pattern would continue through 1884.³¹

The year 1882 also marked another important change in the guano industry as the first shipments made their way to the English Channel. The first shipment left Mayagüez in May of that year for the other side of the Atlantic. Miller and his assistant had apparently broken into the European market, by aiming at the largest producer of superphosphate fertilizers--the British chemical industry.³² This implied that the British purchasers received the phosphates, which Miller had begun to separate from the guano during processing on Mona Island.

As Inspector of Mines, Angel Vasconi, pointed out the guano was less valuable and therefore was sent to the United States market; while the higher priced phosphates were more desired in Europe. This was influenced both by the market value of each product and the shipping costs which were significantly higher to get to Europe.³³ As production increased, so did the number of shipments to Europe, and it appeared to be this combination which greatly increased the production output from Mona Island.

The period of 1877 to 1884 can be interpreted in several ways. However, an analysis of the changing quantities of guano being sold and its destinations

seems to be the most sensible interpretation.

However, all guano sales were made in Puerto Rico in the years 1877-78, at the earliest stage of production. The United States then dominated all sales from 1879 to 1881. This pattern began to change in the last three years, 1882-84, when the British market was added to the purchasers.

The changes in markets were an important aspect of the development of Mona Island's guano production. The addition of the English markets, particularly for phosphates, stimulated growth under the expertise of John Miller.

The Mona Island case is not unique in the area of guano and chemical fertilizer production and demand. Two other studies focused on the United States have pointed to similar trends in guano production. That is, as the demand of the United States declined, European, especially British, demand increased.³⁴ This trend appears to be the same for Mona Island and its production of guano and phosphatic guano.

There is one last piece of evidence that gives us a view into the world of Mona Island and guano during this period. In 1884 Juan Brusi y Font sailed aboard the *Guadalupe* to the aforementioned island. Circumstances and reasons for this trip are unclear, although the publication in Mayagüez of a book about the trip may indicate that it had at least a small relation to government business.³⁵ The Spanish authorities remained vigilant over what they perceived as a valuable natural resource.

The report by Brusi y Font discussed various aspects of the Mona Island operations. Mr. John G. Miller was described in some detail. Miller was of medium height, blond ("rubio como todos los de su raza"), of healthy color, strong build, and 46 years of age. Living on a ranch on the east end of the island, the observer appeared surprised that he dressed modestly (working clothes), but decently, and even spoke a little Spanish.³⁶ Miller's operation also included some machinery which impressed the observer, for instance a sifter which Brusi y Font estimated could sift 100 tons of guano per day. He also took note of the workers, mainly Dominicans and Puerto Ricans, who varied from skilled machine operators and carpenters to unskilled laborers.³⁷ All in all, the 25 page book included a fairly complete description of the Mona Island operation at the end of this period.

The development of Mona Island's guano production until 1884 is based largely on the growth of the industry under the direction of John Miller. However, time and events would dramatically change the activities on Mona Island. On April 17, 1885, John Miller and four members of his crew were lost at sea.³⁸ This loss put a stunning end to the rapidly expanding guano production of Mona Island, as production and shipments of guano completely stopped from 1885 to 1887. This shows that John Miller, with his lengthy experience in the guano trade, was the key to the Mona Island operations.

Conclusion

The period from 1877 to 1884 was an important time in the development of guano production on Mona Island.

Although Peru's guano boom was over, and the era of the Great Guano Rush of the United States had petered out by the 1860s, production and demand for Mona Island's natural resource continued to grow.³⁹ The importance of this production was not that it fit into the initial wave of production, but rather that it exemplified the second wave of production. In this period the purchasers were more refined and scientific and their demands were more specific. No longer was it possible to just show up at port with a load of guano to sell, now entrepreneurs were dealing with the chemical fertilizer industry. Because of these changes, men like John Miller became more important than in the earlier period. Miller's skills and knowledge, accumulated over 25 years in the guano game, made him an invaluable asset in the development of Mona Island's production. For this reason it hardly seems surprising that his untimely death would result in a long dearth for Mona's guano industry. The development and production of guano from Mona Island thus illustrates an important change in both expertise and markets within the fertilizer industry. The untimely death of John Miller did not mark the end of Mona's guano production, as the 1890s would show. But at that time other actors were waiting in the wings.

Notes

¹. Thomas R. Malthus, *Population: The First Essay* (Ann Arbor, MI: University of Michigan Press, 1959), p. 5. Additional comments on Malthus and his followers from William Petersen, *Malthus* (Cambridge: Harvard University Press, 1979). The discussion of the development of the guano industry can be found in Fred Afilion, *A History of the Chemical Industry* (Philadelphia, 1991) pp. 25-26.

² The full activity of these guano hunters can be found in the "Monita" file of the *Records of the State Department Relating to the Guano Islands 1852-1905*. Roll #4.

³ Frank H. Wadsworth, "The Historical Resources of Mona Island," p. N-9.

⁴ Wines, *Fertilizer in America*, see Chapters 3 and 4 entitled "Guano" and "The Guano Island Maria," respectively. This period around the date of 1880 is the transition period for the fertilizer industry to move from organic/natural fertilizer to chemical fertilizers made of a number of sources. This change, however, appeared to little affect the demand for sources of natural chemicals. The demand for Mona Island's guano seems to be affected very little by this philosophical change in the fertilizer industry.

⁵ Letter dated 15 January 1876 from Miguel Porrata Doria to the Governor General of Puerto Rico, *Obras Públicas*, Propiedad Pública, Caja 307.

⁶ Royal Order #126, dated 10 March 1877, *Ibid*.

⁷ Letter from Miguel Porrata Doria to the Governor General of Puerto Rico, dated 26 March 1877, *Ibid*. As this was not part of the concession, the Spanish authorities refused to add this to their claim.

⁸ Letter to the Governor General of Puerto Rico, dated 6 April 1877, *Ibid*.

⁹ Letter to the Governor General of Puerto Rico, dated 6 April 1877. *Obras Públicas*, Propiedad Pública, Caja 307.

¹⁰ Administración Local de Rentas y Aduana de Mayagüez, Report dated 9 September 1887. *Obras Públicas*, Propiedad Pública, Caja 307.

¹¹ *Ibid*.

¹² 1879 record of a sale of guano, sent to the Governor General de Puerto Rico, dated 6 September 1880. *Obras Públicas*, Propiedad Pública, Caja 307. For a more detailed explanation of the transaction and its expenses see the transcribed document .

¹³ Wines, *Fertilizer in America*, pp. 159, 168-9.

¹⁴ Governor General de Puerto Rico, Negociados de Obras Públicas #13,172, dated 5 June 1880. *Obras Públicas*, Propiedad Pública, Caja 307.

¹⁵ Letter to Conde de Caspe, Capitán General de Puerto Rico, dated November 30, 1880 and the Puerto Rican Governor's attached response. *Obras Públicas*, Propiedad Pública, Caja 307.

¹⁶ This is probably not surprising in light of the fact that the guano concession on Mona Island had

only netted about 470 tons of guano in its first three years of operation.

¹⁷ Letter from the Office of Mountains and Mines to the Governor General of Puerto Rico. Included in this report is the full record of guano shipments as reported from the concession of Porrata Doria and Company, dated 5 June 1880. *Obras Públicas*, Propiedad Pública, Caja 307.

¹⁸ Letter dated 1881 from John G. Miller to the Puerto Rican Governor, *Obras Públicas*, Propiedad Pública, Caja 307; and Wadsworth, "Historical Resources," p. N-9. See also Juan Brusi y Font, *Viaje la Isla de la Mona*, pp. 16, 22-23, 25.

¹⁹ Jimmy M. Skaggs, *The Great Guano Rush: Entrepreneurs and American Overseas Expansion*, pp. 108-109. Although this is the only mention found of Miller prior to reemerging on Mona Island, it is very probable that he continued to practice guano extraction during the twenty year hiatus. His career would make an interesting biography for someone interested in the guano industry in the Caribbean.

²⁰ The 1881 output was officially recorded as 329.75 tons compared to 323.25 tons two years earlier. These figures are taken from the official report covering 1877 to 1884 of Rentas y Aduana de Mayagüez, dated 9 September 1887. *Obras Públicas*, Propiedad Pública, Caja 307.

²¹ Schedules 1, 2, and 3 prepared by John G. Miller, Mining Engineer for Porrata Contreras Co. All documents dated 16 August 1881. *Obras Públicas*, Propiedad Pública, Caja 307.

²² The deposits were discovered in 1867, and by 1869 South Carolina production had already exceeded that of the guano islands. By 1880 the domestic production amounted to approximately ten times the production of the bird dropping islands. Wines, *Fertilizer in America*, pp. 81-82, 159.

²³ Skaggs, *The Great Guano Rush*, pp. 137-138.

²⁴ Angel Vasconi, "Reseña de las Islas Mona y Monito," p. 17 of the report found in the *Obras Públicas*, Propiedad Pública, Caja 307, dated 9 June 1882. In the 1882 yearly report over the guano industry on Mona Island, a similar observation is made by John Miller in *Obras Públicas*, Propiedad Pública, Caja 307.

²⁵ Letter from John Miller to Angel Vasconi, dated February 11, 1882. *Obras Públicas*, Propiedad Pública, Caja #307.

²⁶ Angel Vasconi, "Reseña de las Islas Mona y Monito" in the *Obras Públicas*, Propiedad Pública, Caja #307.

²⁷ George E. Hutchinson, *The Biogeochemistry of Vertebrate Excretion*, p. 327.

²⁸ Schedule Report #1 by John Miller for Porrata Contreras Co. to Mayagüez Aduana dated August 16, 1881. *Obras Públicas*, Propiedad Pública, Caja #307.

²⁹ *Ibid.* This information can be found in the Schedule Report #2. The exact tax status of these materials was not uncovered by this author, but it seems fair to assume the Spanish authorities accepted the requests.

³⁰ See two letters from Comandancia Principal de Marina de la Provincia de Puerto Rico and one anonymous letter. The dates of this correspondence were January 18, February 13, and March 31, 1882. The apparent idea was to closely monitor all the ships that arrived and left Mona Island.

³¹ See the Admon. Local de Rentas y Aduana de Mayagüez, a record of guano ships (date, flag, destination, and tonnage) from 1877 to 1884. This report is dated 9 September 1887 and written by Justo Sánchez Taboada. *Obras Públicas*, Propiedad Pública, Caja #307.

³² D.W.F. Hardie & J. Davidson Pratt. *A History of the Modern British Chemical Industry* (Oxford: Pergamon Press, 1966), p. 52. These authors point out that the English chemical industry held a virtual European monopoly over the production of superphosphate fertilizers until about 1890.

³³ Angel Vasconi, "Reseña de las Islas Mona y Monito," p. 17. In this report he stated that transportation costs to New York were 3 to 3.5

pesos per ton; and 7 to 8 pesos per ton to Europe. He also pointed out that guano would be sold to the first offer of 12 pesos per ton, while phosphates are sold at a "higher price." *Obras Públicas*, Propiedad Pública, Caja #307.

³⁴ Nichols, *Advance Agents of American Destiny*, p. 205; and Skaggs, *The Great Guano Rush*, pp. 134-137.

³⁵ Juan Brusi y Font, *Viaje a Isla de la Mona*, 1884. Mayagüez was the aduana (tax) station utilized by all guano ships going to and from Mona Island. It had also been the location of the last official investigation of the Porrata Contreras y Co. in 1880. For this reason it may indicate that the government, or perhaps the aduana agency, was doing some additional checking on the operations on Mona Island.

³⁶ *Ibid.*, pp. 16, 23

³⁷ *Ibid.*, pp. 22, 25.

³⁸ Letter from the Comandancia Principal de Marina de la provincia de Puerto Rico to the Governor General, dated 3 May 1885. *Obras Públicas*, Propiedad Pública, Caja #3.

³⁹ To the aforementioned studies by Skaggs, Wine, and Nichols should be added Lawrence G. Green, *Panther Head: The full story of the bird islands off the southern coasts of Africa, the men of the islands, and the birds in their millions*, 1955. Although this last study is the least scholarly, it does give some insights into the extent of the guano mania which once gripped European and American guanopreneurs.