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Investigation of Historic Bequia Lime Kilns

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ABSTRACT

The ruins of three historic lime kilns on the island of Bequia were investigated. The kilns were used to burn coral to make lime for mortar and plaster which were used in 18th and 19th century building construction. Lime was also an essential element in the manufacture of sugar. This study, which mapped and photographed the lime kilns was undertaken with the encouragement of the National Trust of St. Vincent and the Grenadines. As a result of this survey, the author has recommended that one of threatened lime kilns be placed on the National Trust's List of Protected National Heritage Sites so that preservation efforts can be undertaken to protect this national treasure.

Key words : Plantation Archaeology, Bequia, Lime Kiln

RESUMEN

Las ruinas de tres hornos de cal históricos en la isla de Bequia fueron investigadas. Los hornos fueron utilizados para quemar el coral para hacer la cal para el mortero y el yeso que fue utilizado en la construcción de edificios del siglo 18 x 19. Lima fue también un elemento esencial en la fabricación de azúcar. Este estudio, que trazó y fotografió los hornos de cal fue se llevo a cabo con el apoyo del Fondo Nacional de San Vicente y las Granadinas. Como resultado de esta encuesta, el autor ha recomendado que una de las amenazadas hornos de cal se colocara en la lista del National Trust Protegidas del Patrimonio Nacional, para que los esfuerzos de conservacion pueden ser llevadas a cabo para proteger este tesoro nacional.

Palabras clave : Arqueología de las Plantaciones, Bequia, Horno de Cal

RÉSUMÉ

Les ruines de trois fours à chaux historiques sur l'île de Bequia ont été étudiées. Les fours ont été employés pour brûler les coraux pour faire la chaux pour le mortier et le plâtre qui a été employé dans la construction de bâtiments au 18^{ème} et 19^{ème} siècle. La chaux était également un élément essentiel dans la fabrication du sucre. Cette étude des fours à chaux a été entreprise avec l'encouragement de la confiance nationale St Vincent et les Grenadines. A la suite de cette enquête, l'auteur a recommande que l'un des fours a chaux menacé soit inscrit sur la liste du National Trust des sites protégés afin que les efforts de conservation puissent être entrepris pour protéger ce trésor national.

Mots-cles : Archeologie Plantation, Bequia, Four a Chaux

Figure 1. Engraving by Labat



INTRODUCTION

The ruins of several historic lime kilns on the island of Bequia were investigated in March of 2011. A lime kiln is a furnace used to reduce naturally occurring forms of calcium carbonate such as limestone, coral or seashell, to usable lime.

Although one kiln was fairly well preserved, two others were in a more advanced state of deterioration. Using an ethnohistorical method to document this important part of Bequia's Colonial history, the lime kilns were mapped and photographed, knowledgeable local people were consulted and archival research on the early settlement of Bequia was undertaken in order to establish the chronology for the construction of the kilns and learn more about this important component of plantation agriculture.

HISTORY OF LIME USE

Lime is an important chemical with a long history of use by ancient civilizations for construction, agriculture, bleaching, and tanning. The earliest archaeological evidence for lime burning is a kiln from Mesopotamia dating to about 2450 BC (Koegel et al. 2006, 563).

In the Caribbean, during the 18th and 19th centuries, lime was a valued construction commodity since it was crucial ingredient in the mortar used in the construction of stone buildings. It was also a necessary component in sugar making since it was added to the cane juice during the boiling process to raise the pH and remove impurities (Eichholz 1983; Graymont 2012; Singleton Birch). Geographical names in the Windward Islands also allude to the importance of lime; there are "Lime Kiln Bays" on Mustique, St. Vincent, and Montserrat. Although many of the Caribbean lime kilns have been abandoned, an 18th century lime kiln at Coconut Walk Estate on Nevis, which has withstood hurricanes and earthquakes, is still in use (Hubbard 1992, 65). Verrand and Vidal (2004), in their important survey of lime kilns on Martinique confirmed 53 kilns in varying stages of preservation on that island.

LIME BURNING AND PROCESSING

The chemistry of lime burning involves the conversion of calcium carbonate to a more useful calcium oxide. Limestone, coral or shell must be heated in a furnace or kiln to a temperature of at least 880 degrees Celsius – a temperature high enough to drive off carbon dioxide. Because calcium oxide is such a reactive substance, water is usually added to form calcium hydroxide and it is in this form the slaked or hydrated lime becomes practical to use.

Over the centuries, lime kilns evolved from a low, circular beehive design to the simple, vertical shaft kiln (Koegel et al 2006, 564), the type which was commonly used in 18th century enterprises on Caribbean islands. Most were built into the slope of a hill with an access arch or draft tunnel at the bottom of the kiln. Alternating layers of fuel (usually wood), and limestone or coral were stacked from the top on a grate or lattice of sticks. The load was lighted through the access arch and combustion usually took about three days whereupon the burned lime was shoveled out through the access arch to cool. As soon as the lime was cool it had to be submerged in enough water to completely cover it, a process called slaking. After about four days under water, the slaked or quick lime was sieved to remove large impurities. The lime was stored in tanks under water for a minimum of six weeks before it was ready for use.

HISTORICAL RESEARCH

Several Bequia families had knowledge of the local lime kilns and although the remains of three were located and investigated, in the latter half of the 18th century it is likely there were many more. Bequia historian, Frances Brinkley (n.d.) relates that a traveler stopping at Bequia on his way to Grenada around 1767 observed, "The Grenadine Islets were used mainly to make lime...and people living on what is now Admiralty Bay in Bequia were engaged in this". Shepherd (1831, 216) comments, "All of the Grenadine Islands have coral, which makes excellent lime". Brinkley (n.d.) also recounts the arrival of a Mr. DeL'Isle, sometime before 1763, on Union Island and notes he claimed several of the other Grenadine Islands as well. Although he was a cotton grower, he also specialized in making lime for construction by burning local wood and coral in specially built lime kilns. (Figure 1), an engraving (JCB Archive of Early American Images) by Jean Baptiste Labat, the French missionary who lived in the Windward Islands from 1693 to 1706, shows coral which was used to make lime and also an early lime kiln being loaded with wood.



Figure 2 : location of the three Bequia Lime kiln ruins.

DESCRIPTION OF THE BEQUIA KILNS

The best preserved of the three Bequia kilns is very close to what is now the airport, another is on Friendship Bay and a third one is quite close to the Frangipani Hotel on Admiralty Bay in Port Elizabeth. Since all three were located adjacent to reefs, coral was probably the type of raw material burned in the kilns.

The Airport Kiln was briefly surveyed and photographed by the author in 2008 (Figure 3). At this time, the owner of the small blue rum shop adjacent to the kiln confirmed its historical purpose. By February 2011, further deterioration of the kiln was evident and it was determined that a more complete survey should be undertaken to document this significant structure.

The kiln is located across the road and approximately 200 feet from the Paget Farm Primary School (Figure 4). It is accessible from the road which continues on to Moonhole. The kiln stands about 250 feet from the airport terminal building; however, the kiln is located only about 25 feet from what would have been the edge of the sea before the construction of the airport. When the J. F. Mitchell airport was built in 1992, Bequia's largest reef was filled in to create a flat area for the 3600 foot runway and associated structures.



Figure 3. Airport Kiln and Rumshop

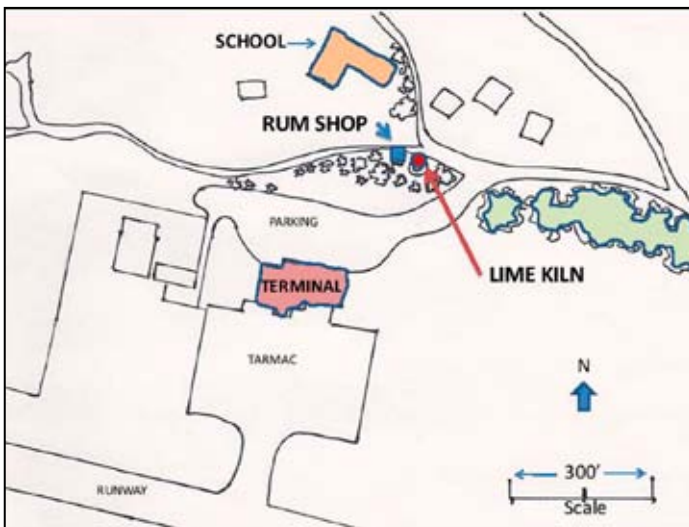


Figure 4. Airport Lime Kiln location

The exterior of the round, tower-like structure was constructed of mortared, volcanic rock (Figure 5). It is about 32 feet in diameter and 15 feet tall and some of the original lime plaster remains on the exterior wall (Figure 6). The walls at the base are 9 feet thick but the interior surface tapers outward to a thickness of 5 feet near the top. The combustion chamber is in the form of an inverted, truncated cone with a volume of about 2100 cubic feet. There are two arched openings at ground level; one on the north side and one on the south side which probably functioned as draw holes (Figure 7). Since these openings narrow as they approach the interior of the chamber, perhaps they functioned as partial venturi tubes, increasing the velocity of the incoming air. The interior walls were constructed of cobbles and mortar and the interior area is partially filled with rubble. On the outside, uphill side of the kiln there is about 3 feet of fill (Figure 8). Possibly this is what remains of an earthen ramp leading to the top opening from which the kiln would have been filled.

According to the 1776 Byres map found in the Oxford Rhodes House Library, the land where the kiln is located was owned by a person named Labord. Fifty years later, the Paget Farm Plantation, the former Labord Land, consisted of 220 acres and was owned by William Stowe, Esq. In 1829, the plantation produced 141,000 pounds of sugar, 6,400 gallons of molasses and 1,500 gallons of rum.



Figure 6. Mortared East Wall Airport Lime Kiln



Figure 5. Exterior wall Airport Lime Kiln



Figure 7. Draw Hole North Side of Airport Lime Kiln



Figure 8. Airport Lime Kiln Ramp Remain ?

The Friendship Bay Lime Kiln is near the home of Tom and Pam Stewart, the last house on the road at the east end of Friendship Bay. When they bought the property, the Stewarts were told that the remains of a circle of stone blocks on the beach and adjacent to their home (Figure 9) had once been a lime kiln. Although the walls of the kiln have collapsed, a half circle of stones about five feet tall still exists. This photo



Figure 9. Friendship Bay Lime Kiln

illustrates how lime kilns were often built into the side of a hill to make loading them with coral and wood easier. The walls are about 3 feet thick and the outside diameter of the kiln would have been about 20 feet. The beach is littered with coral and the reef is visible from the kiln where the photograph was taken (Figure 10). The Byres map from 1776 shows the kiln was located on land owned by St. Hillary although it is bordered by and may actually have been located on Crown Land which was set aside by the King for a fort if necessity dictated. In the 1827-9 Report on the Names of the Bequia Owners and Amount of Produce Made (Shephard, 1831 Appendix xxiii-xxiv), Friendship Estate contains 483 acres of land and was owned by the Warner Family.

The Frangipani Lime Kiln is located on property belonging to Sir James (Son) Mitchell, the former Prime Minister of St. Vincent and the Grenadines. It is on the beach just to the north of the Mitchell's Frangipani Hotel on Admiralty Bay in Port Elizabeth. Mrs. Pat Mitchell was able to identify the location. Unfortunately, very little remains of it except for some stones hidden in the bush in the flat spot just down from the wall and adjacent to the large Tamarind tree. It was also probably built into the side of the hill. The presence of coral on the beach in front of it suggests there would have been adequate supply of raw material close at hand. The 1776 Byres map shows the land, plot No. 13 belonged to Monsiur Aquart although it was incorporated by 1827 into the 105 acre Belmont plantation owned by W. T. Dickenson.



Figure 10. Friendship Bay Reef

CONCLUSION

In the 18th and 19th centuries, lime mortar and plaster were used to construct the durable stone buildings required by a booming plantation industry on Bequia. Lime was also added to the cane juice during the boiling process to clarify it. Although the 17th century sugar refining recipe isn't known, today's processing requires an average of 7.7 pounds of lime per ton of sugar produced (Singleton and Birch). If the total sugar production from the nine existing plantations in 1828 on Bequia was 454 tons (Shephard 1831: appendix xxiii-xxiv), then sugar production in 1828 alone would have required almost 3500 pounds of lime. Together with the lime required for building construction, it would have been a significant amount. Since the kilns of this period were typically "batch" and not "continuous-burning", and lime could only be produced in the dry season, this might suggest that more than the three identified kilns were required to support the needs of the plantation community on Bequia. Perhaps each plantation found it expedient to process its own lime if there was a close source of raw material.

Of the three lime kilns investigated, all were at what would have been the water's edge near coral reefs, a convenient source of raw material. All of the kilns were constructed with large, mortared stones. The largest kiln (with a 30 foot diameter) was at the airport, the smaller

(with a 20 foot diameter) was at Friendship. Unfortunately, the Frangipani kiln remains were reduced to a small pile of stones.

Although sugar production in St. Vincent and the Grenadines began later than in the rest of the Caribbean, this study confirmed that by 1776 there were four working sugar plantations on Bequia and by 1827, this number had expanded to nine

(Shephard 1831, appendix xxiii-xxiv). If the lime kilns were built to provide lime for sugar processing and construction then they were likely operational by 1776, the date of the Byres map, which shows the locations and owners of the plantations.

RECOMMENDATIONS

This study, which documents the existing remains of the Bequia lime kilns, was undertaken with the encouragement of the National Trust of St. Vincent and the Grenadines. The Airport Lime Kiln is on the Trust's

"Short List of Sites Being Considered for Placement on the Historic Buildings List". As a result of this survey, the author has strongly urged the National Trust to preserve and protect this treasure by placing it on its "List of Protected National Heritage Sites" so preservation efforts can focus on structure stabilization and interpretive signage.

tegic supplies exported back to the U.S. and all building materials sold off to local merchants, what remained were the structural foundations.

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