Origins of Archaeological *Sus Scrofa* From Brimstone Hill, St. Kitts, West Indies

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By

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ABSTRACT

The Brimstone Hill Fortress of St. Kitts, West Indies, a UNESCO World Heritage site, was a British fort that utilized enslaved African labor in the construction and maintenance of the complex. *Sus scrofa* (domestic pig) remains were recovered from the fortress during archaeological investigations of areas used by enslaved Africans. Through the use of stable strontium isotope analysis, this study establishes that pork was raised locally as well as barreled in from abroad to provision those working at the fort.

Introduction

Analyses of faunal remains from archaeological contexts aid in the interpretation of past human lives. Differences in subsistence patterns between different groups can indicate variance in social and economic status, quality of life, and cultural preference. Archaeological investigations at Brimstone Hill Fortress on the eastern Caribbean island of St. Kitts attempt to interpret the lives of enslaved Africans within the context of the British colonial military (Schroedl 1999: 1).

In 1999, Brimstone Hill Fortress National Park was inscribed on the United Nations Educational, Scientific and Cultural Organization's (UNESCO) World Heritage List due to its exceptional preservation, importance in understanding the slave trade, and universal value to the world community (Bandarin 2000: 6). Archaeology conducted at the site seeks to give "a cultural voice to the African people who lived and worked at Brimstone Hill and who would otherwise remain silent" (Schroedl 1999: 3). The labor of enslaved Africans was utilized in the construction and maintenance of the fort, which was controlled by the British from 1690 through 1853, except for a brief occupation by the French from 1782 until 1783 when it was recaptured by the British (Schroedl 1998: 3).

Archaeological Faunal Materials

Excavations performed by the University of Tennessee have focused on an area outside the defensive wall designated BSH 2 (Brimstone Hill 2). BSH 2 is composed of four buildings identified by a 1791 military engineer map as two hospitals, a workshop, and a kitchen. These buildings were used by enslaved Africans at the fortress (Schroedl 2000: 1).

Of the 6222 identifiable animal bones recovered, over 80 percent are domestic cattle, pigs, sheep and goats. Forty-four percent of all identifiable bones are classified as pigs, indicating that pork was a major dietary source for enslaved Africans at Brimstone Hill (Patterson and Klippel 1999: 3-4). Skeletal part frequencies among the domestic animal

remains from the 1996-1997 excavations show variation from the expected utility proportions for some of the species present at Brimstone Hill. A model bovid (i.e. goats, sheep, and cattle) carcass is composed of 50 percent high utility bones. Axial and upper limb parts are defined as high utility due to their greater nutritional value to humans than low utility feet and heads.

In contrast to a model bovid skeleton, cattle bones from St. Kitts are composed of 90 percent high utility parts. However, the caprine (i.e. sheep and goats) remains are much closer to the model bovid frequency at 42 percent high utility. These skeletal part frequencies, along with stable carbon isotope studies of the bovid skeletal remains lead researchers to conclude that much of the cattle bones found at BSH 2 were transported to St. Kitts as barreled beef and that caprines were raised locally. Therefore, enslaved Africans at Brimstone Hill were provisioned with foods from local and foreign markets (Klippel 2001).

The utility categories for suids must be amended to account for the differing nutritional value of certain bones. Greater fat and meat found on the suid head demands that skull bones be included in the high utility classification along with long bones and axial portions. Therefore, the only low utility bones in the pig skeleton come from the feet. Using this utility scheme, the skeletal part frequencies of a model suid skeleton indicate that it is composed of 50 percent high utility bones. The frequencies compiled from the BSH 2 pig remains reveal that 97 percent are high utility. Only three percent of the recovered bones are low utility feet parts (Patterson and Klippel 1999: 9-11).

Historical Background of Barreled Pork

In the nineteenth century, salt-preserved pork barreled into the West Indies was classified as either *prime* or *cargo*. In both of these inspection categories, feet were removed from the carcass before it was barreled and heads, long bones, and axial portions were included in the shipment (Walsh 1982: 32, 36, 122). *Mess* pork was the highest classification of barreled pork, containing only rib pieces of large hogs, and it is unlikely that it was shipped to the enslaved Africans at Brimstone Hill. *Prime* pork barrels consisted of the next best pieces of the hog, with no more than three shoulders, no legs, and less than twenty pounds of head. *Cargo* pork was limited to four shoulders, two heads, and no legs. It is also unlikely that very young pigs of less than 160 pounds would have been included in barreled pork shipments (Moore 1820: 7-8, 10).

Thus, no foot bones would have been included in barreled pork shipments to Brimstone Hill. The paucity of foot bones in the skeletal part frequencies of the suid remains from BSH 2 corresponds with historical methods of pork barreling, suggesting that enslaved Africans at Brimstone Hill Fortress were being provisioned with pork from either foreign markets or local St. Kitts pork that was slaughtered away from BSH 2. In fact, historical documents show that

pork was barreled in to St. Kitts during the British colonial era (Gerald Schroedl, personal communication). However, enslaved Africans were also likely consuming some locally raised pork, as indicated by the few archaeologically recovered foot bones (three percent) and bones of younger animals that would not have been included in barreled pork.

Stable Strontium (Sr) Isotope Analysis

In an attempt to resolve the uncertainty of the origins of the Brimstone Hill *Sus scrofa* bones a stable strontium isotope analysis of these remains was completed. Approaches other than stable strontium isotope analyses were considered and rejected due to the omnivorous subsistence patterns of pigs. Stable carbon isotope analysis cannot be utilized since it depends on variations in the carbon isotope composition of plants and as such can only be applied to the remains of herbivorous animals. Strontium isotope composition is not affected by the type of diet eaten by the organism; it only depends on the underlying bedrock geology of the organism's place of residence.

In nature, Sr is found as four stable isotopes: ^{88}Sr (82.74%), ^{87}Sr (6.96%), ^{86}Sr (9.75%), and ^{84}Sr (0.55%). Sr is absorbed through the diet and incorporated into both bones and teeth by means of ion exchange with calcium (Ca) (Inoue 1981: 11, 18). The relative amounts of ^{87}Sr and ^{86}Sr absorbed from the diet vary with local geology and pass unmodified through the different trophic levels of the food chain (i.e. from primary producers to consumers to predators) (Pollard 1998: 296-297).

^{87}Sr is formed by the beta decay of ^{87}Rb. Consequently, the relative abundance of ^{87}Sr in different geographic regions is dependent on the age and type of rock present. Normalizing the abundance of ^{87}Sr to the nonradiogenic ^{86}Sr avoids the problem of natural variation in absolute amounts of ^{87}Sr. As a result of variations in rock type and age, $^{87/86}$Sr ratios differ by geographic region and are reflected in the tissues of organisms that obtain subsistence from the area. Therefore, the $^{87/86}$Sr ratio in skeletal remains is an indicator of geographic residence (Beard and Johnson 2000: 1049-1051). Dental tissue, which is formed early in the life of an organism, remains unaltered later in life because it does not experience the metabolic turnover that bone does. For that reason, the Sr composition of dental tissue, especially the enamel, reflects the residence of the organism's early life, whereas bone mineral reflects the individual's residence in the last seven to ten years of life (Pollard 1998: 296-297).

Due to the unique nature of Sr, its geographic variability, and its stability at all levels of the food chain, an analysis of the $^{87/86}$Sr composition of archaeological pig remains at Brimstone Hill can indicate the location of origin of these remains. The pig bones at BSH 2 should have the same $^{87/86}$Sr ratio as the geographic region in which they were raised, based on the bedrock geology of that area. Hence, the $^{87/86}$Sr composition of pig bones in animals

raised on St. Kitts will differ from the ratio observed in the skeletal remains of animals raised elsewhere.

However, problems can arise in obtaining accurate $^{87/86}Sr$ ratios in skeletal remains. Bone suffers from post-mortem diagenesis, which can affect the observed $^{87/86}Sr$ ratio. Bone mineral and dentine are composed of small crystals which have large surface areas for experiencing chemical changes. The extremely porous nature of bone allows groundwater to easily penetrate and alter chemical composition. Additionally, the high organic content of bone and dentine make them very susceptible to damage by decomposers living in the soil (Mays 2000: 431). This problem is compounded when the remains are preserved in areas with hot and humid climates such as the Caribbean (Beard and Johnson 2000: 1051). Fortunately, dental enamel does not experience the same high degree of post-depositional diagenetic change as bone mineral and dentine due to its larger crystal size, reduced porosity, and lower organic content. These features make dental enamel a better candidate for $^{87/86}Sr$ analysis (Mays 2000: 431). Therefore, in the study of the BSH 2 pig remains, tooth enamel is the sample type of choice. The use of teeth avoids complications and changes in post-mortem bone chemical composition. Specimens from animals known to have been raised on St. Kitts must also be analyzed as a control group. This group serves as a sample representing the $^{87/86}Sr$ ratio present on the island.

Typical analytical procedures include removal of the pulp and dentine from the tooth, leaving the enamel. This is followed by acetic acid leaching and high-temperature combustion to burn away organic material. Next, the sample is placed in nitric acid for dissolution. The Sr ions are separated by chromatography, and the $^{87/86}Sr$ isotopes are then separated using thermal ionization mass spectrometry (TIMS) (Bentley et. al. 2003: 477).

In the Brimstone Hill *Sus* scrofa analysis, if the $^{87/86}Sr$ ratios differ significantly between the control and archaeological groups, then a reasonable conclusion is that the pig bones recovered from BSH 2 are not from animals raised on the island, and they probably were barreled in from overseas. If the $^{87/86}Sr$ ratios between the two groups of samples correspond to each other, then a likely inference is that the large percentage of high utility bones seen in the skeletal part frequencies is due to the pigs being raised on St. Kitts but slaughtered on another part of the island, away from the BSH 2 archaeological site.

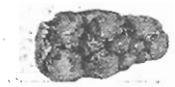
Materials and Methods

Six samples were sent for $^{87/86}Sr$ analysis to Alex Bentley at the University College London. As a control sample, dental enamel from a modern mongoose mandible from St. Kitts was used (BSH2-1). From the archaeological sample from Brimstone Hill, four lower right third molars were sent for analysis (BSH2-3, 4, 5). Since third molars do not erupt until later in life,

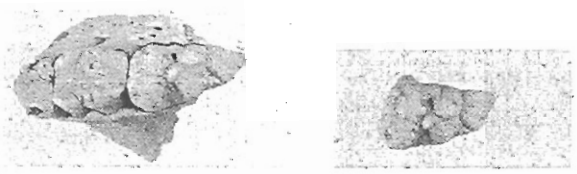
these teeth most likely came from adult animals. A lower right first molar was also analyzed to determine the Sr signature of this younger animal, whose youth is indicated by size, wear patterns, and eruption stage of the teeth (BSH2-6). Photographs of these specimens are shown below.

Mongoose Mandible (BSH2-1)

Sus scrofa right M_3 (BSH2-2)



Sus scrofa right M_3 (BSH2-3)



Sus scrofa right M_3 (BSH2-4)

Sus scrofa right M_3 (BSH2-5)

Sus scrofa right M_1 (BSH2-6)

Please see Appendix I for specimen details and provenience data for the archaeologically recovered specimens.

Results

The results of the analysis are shown below.

Sample Number	$^{87/86}$Sr Signature
BSH2-1	0.70664 (0.00001)
BSH2-2	0.70878 (0.00001)
BSH2-3	0.71073 (0.00001)
BSH2-4	0.70754 (0.00001)
BSH2-5	0.70868 (0.00001)
BSH2-6	0.70876 (0.00001)

The results indicate that the mongoose signature has an extremely different signature, and this is likely due to differences in its feeding and ranging habits. However, from the remaining pig samples, the local $^{87/86}$Sr signature seems to be approximately 0.7087 +/- 0.00001 as indicated by BSH2-2, 5, 6. The other *Sus scrofa* results (BSH2-3, 4) suggest that these pigs were imported from a foreign market and barreled into St. Kitts.

Discussion and Conclusion

The Sr isotope analysis indicates a result consistent with the origins of bovid faunal remains from Brimstone Hill. Similar to cattle, some pork was raised locally, while some was barreled in from abroad. As was expected the specimen from the young animal retained a local Sr signature, due to the fact that young animals likely were not shipped as barreled pork. The analysis also corresponds to skeletal part frequencies for suid remains, which show the presence of a few low utility parts that likely came from local animals and a large amount of high utility parts that could be local or foreign. Thus, enslaved Africans were provisioned with a mixture of foreign and local foods.

Ascertaining the strontium isotope composition of archaeological pig remains from St. Kitts allows researchers to place the lives of the enslaved Africans at Brimstone Hill Fortress within the broader context of colonial slavery, Caribbean culture, and the British military. For this reason, it is significant to know whether the enslaved Africans of Brimstone Hill were provisioned with barreled pork from abroad or locally raised meat. This study contributes to the understanding enslaved African subsistence and can provide insights about cultural attributes, relative social and economic status, and standards of living amongst British soldiers, enslaved African soldiers, and enslaved Africans working on plantations.

Appendix I

Specimen #	Specimen Type	Length
BSH2-1	Mongoose mandible	41.00 mm
BSH2-2	*Sus scrofa* upper 3rd molar	28.44 mm
BSH2-3	*Sus scrofa* upper 3rd molar	33.91 mm
BSH2-4	*Sus scrofa* upper 3rd molar	24.66 mm
BSH2-5	*Sus scrofa* upper 3rd molar	27.23 mm
BSH2-6	*Sus scrofa* upper 1st molar	15.15 mm

Provenience Data for Archaeologically Excavated Specimens

Specimen #	**BSH2-2**	**BSH2-3**	**BSH2-4**
Catalog #	98-131	98-162	99-159
Square	22-223N/101-102W	207-207N/100-101W	202-203N/100-101W
Level	6	3	10
Depth	97.90-97.80	98.40-98.30	98.90-98.80

Specimen #	**BSH2-5**	**BSH2-6**
Catalog #	98-117	98-225
Square	222-223N/101-102W	207-208N/100-101W
Level	4	9
Depth	98.10-98.00	98.80-98.70

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