6 Production, distribution and exchange

6.1 Introduction

In preceding Chapters, I discussed various stone raw material sources within the northern Lesser Antilles region, including Puerto Rico, followed by a description of stone material use and tool production at numerous habitation sites in the same region. It became clear that the inhabitants of these islands did not solely rely on the availability of local materials, naturally occurring nearby each settlement, but in many cases they obtained rock types from neighbouring, or even more distant islands. Specific source locations for many of these rock types remain unknown. They include some of the igneous and metamorphic rock types used for making axes, fine grained rock used for polishing stones, and igneous rock used for metates, as well as some of the well-known semi-precious stones associated with the Early Ceramic A phase bead and pendant industries (Cody 1991, 1993; Watters & Scaglion 1994; see Chapter 5). However, this does not account for three specific rock types that are discussed in this Chapter, namely flint originating from Long Island and greenstone and calci-rudite, both originating from St. Martin. As this is one of the first studies in the Caribbean that has related artefacts with specific and localized source areas, it is possible to specify the distribution of materials and see which changes occurred from their acquisition to their widest spread. In this way it will contribute to our knowledge of Pre-Columbian inter-insular exchange relationships.

The presence of exotic materials within site deposits is generally seen as indicative of exchange systems. This was not necessarily the case, however. Especially where island environments are involved, relatively large distances could be travelled more easily, and the occurrence of exotics is then explainable by the direct procurement of these non-local materials. Therefore, one of the first key-questions addressed here is to what degree exchange, the actual transfer of items between different communities, and to what degree direct access were responsible for stone distribution. If it can be clearly established that exchange played a role in material transport, the next question is how this exchange was organised, in other words what type of exchange occurred.

As outlined in Chapter 1, different approaches are used to determine the existence of exchange and relevant type of exchange. First the production transport sequence will be specified using the models outlined in Chapter 3. Secondly, fall-off curves are analysed, and thirdly, on-site production procedures are discussed. These three lines of analysis provide us with a view into the organization of production and the type of exchange that were responsible for the spread of these rock materials within the northern Lesser Antilles.

6.2 Distribution of lithic material

6.2.1 Long Island Flint

Introduction

The study of numerous lithic artefact collections from a series of sites in the northwestern Lesser Antilles shows that Long Island was a much used and widely distributed material. In particular for the region from Anguilla to Guadeloupe, it was the main rock type employed in the manufacture of flake tools. This was the case despite the occurrence of many other suitable fine-grained stone materials, notably on Antigua. One of the most obvious physical differences between it and other local cherts and flints on Antigua and St. Kitts, is its superior flaking characteristics, being fine-grained and lacking internal cleavage planes.[1] This may well explain the heavy emphasis on this particular material. Furthermore, its easy accessibility along the shores of Long Island where large cobbles occur in high concentrations may have provided another advantage over other materials occurring at inland locations. Whether any other features may have been significant, for example, the

[1] This has been confirmed by two well experienced flint knappers, Jeffery Flenniken from Washington State University (Jeff Walker, personal communications 1998) and Mikkel Sørensen from Denmark (Yvonne Lammers-Keijzers, personal communication 2001). It should be added that especially the flints within the Antigua Formation region, such as Little Cove, Soldier Point, and Blackman's Point, can also be considered as easily worked. Generally, however, they are coarser grained than Long Island flint.

relatively remote location of Long Island compared to sources on the main island of Antigua, or its distinct colour is open for investigation. At least, from a technological point of view Long Island flint stands out from other materials.

This preference for Long Island flint is also noted during the Preceramic Age. Sites such as Jolly Beach on the western coast of Antigua (Davis 1993, 2000), and more remote localities on Barbuda (personal observation 2001; Watters *et al.* in prep), Nevis (personal observation 1995), Saba (Hofman & Hoogland 2004), and St. Martin (Knippenberg 1995, 1999a,d) predominantly have yielded this material for Preceramic times. It may be argued that the technological superiority of Long Island flint played a more decisive role in its emphasis by the Preceramic Age people for blade manufacture, than was the case for the expedient stone tools of the later Ceramic Age.

Petrographic and geochemical characterisation discussed in Chapter 2 show that chert and flint sources are hard to separate, especially when they originate in similar geological formations. This is markedly different from obsidian sources, for example, which generally exhibit distinguishable trace element compositions (Shackley 1998). However, Long Island flint has a distinctive geochemical composition relative to most of the other sources, despite the presence of flint sources in the same geological setting. On a macroscopic level, this material is also easily recognized, especially when the investigator has some experience with identifying different local materials. Characteristic features are its typical brown colour, usually referred to as "honey brown" (e.g., Haviser 1987), and also a dark grey colour with very small white calcite inclusions dispersed as light haze among the matrix. In Chapter 2, I discussed the procedure that I used to identify artefacts originating from Long Island. This initially involved macroscopic identification, which was supported by geochemical analysis of a small sample of 13 artefacts, originating from a restricted number of sites. In all cases, the geochemical analysis confirmed the initial Long Island identification based on macroscopic analysis.

Other Antigua and St. Kitts chert and flint varieties play an insignificant role in this Chapter, because of their infrequent and highly variable occurrence. The low number of artefacts made from these materials per site in many cases inhibits a reliable macroscopic characterisation of specific rock types in question. As a result, an identification of its origin is speculative because of internal variability within some sources and similarities between others.

In addition to these difficulties with known cherts and flints, the study of the archaeological collections revealed chert varieties, which are unknown to me, particularly among the samples from Anguilla and Puerto Rico. These unknown varieties suggest the existence of other sources not included in the present research. In particular, the region of Puerto Rico and the Virgin Islands seems to host still unknown fine-grained rock sources, for example, a chalcedony and bedded chert. A full understanding of the origin of all fine grained rock materials found among lithic collections is therefore beyond the scope of this study, and needs to be addressed by future systematic search within areas where these materials may have originated.[2]

Transport and Reduction Sequence

Introduction

Data from the majority of studied habitation sites show that Long Island flint material was locally reduced into flake tools. The presence of flake cores, flakes, and shatter, in conjunction with utilized flakes, indicates this. This presence of cores already suggests that this material arrived in large enough pieces to be further reduced, and likely was not transported in the form of (small) flakes or flake tools in most cases. In Chapter 3, cortical count, scar count, and artefact size were introduced as the best parameters to establish which reduction stages took place at a given locality. Since the form in which lithic material was transported to different localities is of primary concern here, cortex count data are used to distinguish whether material was worked or not before its arrival at these sites.

Data from experiments in which unmodified material was reduced suggest that the percentage of flakes bearing cortex on their dorsal faces and platforms varies between 36% and 50% of the total flake assemblage (Amick *et al.* 1988; Shott 1996; Tomka 1989; Walker 1980a). Close examination of these past works reveals that the experiments done by Walker (1980a) were especially aimed at replicating Ceramic Age expedient flake technologies in the Lesser Antilles. Walker used Long Island flint to as closely as possible replicate the Pre-Columbian industries. Therefore, his data can be considered as most comparable to the results from this study. Walker found a mean percentage of flakes bearing cortex of 42%, whereas his median value, out of ten experiments, was 36% (Walker 1980a, 79) (Table 6.1).

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[2] Left out of the present discussion are red and green chert varieties, which commonly occur on La Désirade, Martinique and Puerto Rico (see also Chapter 2).

	Walker 1980a, 79[a]				Tomka 1989		Amick *et al.* 1989	Shott 1996
	Expedient Bipolar reduction Long Island flint nodules (N=10)		Expedient Bipolar reduction St. Kitts flint nodules (N=10)		Multidirectional core (N=1)	Biface (N=1)	Biface (N=1)	Fluted Point (N=1)
Cortex	% mean	% median	% mean	% median	% (N=193)	% (N=184)	% (N=325)	% (N=114)
0%	57.9	64.9	27.3	24.5	54.4	60.3	61.5	49.1
1-100%	42.1	35.1	72.7	75.5	45.6	39.6	38.5	50.9
1-50%	-	-	-	-	*41.5*	*22.8*	*35.1*	*34.2*
51-99%	-	-	-	-	*3.1*	*11.4*		*12.3*
100%	-	-	-	-	*1.0*	*5.4*	*3.4*	*4.4*
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 6.1. Frequency distributions of cortex count on flakes found after experimentally reducing non-modified material. [a] Values from Walker's experiments represent average values found after reducing and counting 10 nodules each. Size range of nodules: Antigua 12.5 x 7 x 6 cm to 14.5 x 12 x 6 cm; St. Kitts 4 x 2.5 x 1 cm to 9.5 x 7 x 4 cm.

Detailed inspection of the cortex count data for the sites from which a large sample of Long Island flint was analysed reveals that the numbers of primary and secondary flakes (flakes with 100% and 1-99% dorsal cortex cover, respectively) are significant. In most cases, they vary between 40 and 60% (Tables 6.2-6.5). This is generally higher than many of the experimentally found values. The Long Island flaked stone material from the Pre-Columbian site at Sugar Factory Pier on St. Kitts studied by Walker as part of his replication work similarly yielded on average higher percentages of cortical flakes than did his experimental data (Walker 1980a, 79, 89, 98). This minimally indicates that lithic material arrived in unmodified form and that it may have been reduced less exhaustively than was the case in the experiments. Another explanation for this higher percentage of cortical flakes in the archaeological samples relative to the experimental ones may have been the use of larger nodules during the experiments. However, this is unlikely, because the size of the Long Island flint nodules used in Walker's experiments can be considered as average. The flint nodule size of blade cores found at the Preceramic Age workshop site at Flinty Bay on Long Island, for example, is generally larger than the average nodule size found on Long Island. That the nodule size is of great significance is shown by the much higher percentages of cortical flakes generated during Walker's experimental reduction of the smaller St. Kitts flint nodules (Walker 1980a, 79).

Apart from a similar abundance of cortical flakes, the presence of flakes with complete cortex cover (100%)[3] is also indicative of transport of unmodified material. They are usually very low in number, between 1 and 4%, and were mostly produced during the initial reduction of the material, as shown in the detailed experimental study of Shott (1996). This is in contrast to secondary flakes, that basically occur throughout the entire reduction sequence, including the later stages. Most of the larger samples used in this study contain low numbers of these primary flakes, demonstrating the arrival of unmodified material.

A few sites form a possible exception to this general pattern, given their lower percentages of cortical flakes, suggesting possible import of largely pre-worked material. In most cases this concerns very small samples, usually not larger than 25 flakes. As shown in Appendix E, these samples may be too small to provide an accurate estimation of the true relevant value, so they have to be treated with caution. Spring Bay 3 and Barnes Bay, however, include higher numbers of flakes: 86 and 40, respectively. Yet, these sites only produced 35 and 33% of flakes with cortex. These values are a little lower than the median value obtained in Walker's study, although the difference is not significant. This small difference makes it hard to disprove the arrival of unmodified material. On the other hand, the relatively low number of true core artefacts, in particular at Spring Bay 3, may indicate that some pre-worked material was transported to these sites in the form of flakes.

[3] In this study, the striking platform is included when estimating cortex count, unlike many other debitage studies (Shott 1996; Tomka 1989). In my case, the presence of a 100% cortex flake within a sample thus may represent the first flake removal from an unmodified flint nodule. It may be hypothesized that after removing the first flake, the following one is flaked using this first scar as the platform, as this would be most easy. This must be especially considered in the case of the expedient character of Caribbean flake tool technology. Therefore, after this first flake, all following flakes will not be 100% cortical ones according to my definition, and the number of 100% cortical flakes will be theoretically equal to the number of nodules reduced.

Cortex All flakes	Vivé N=10	Cocoyer N=16	Morel N=959	Trants N=502	Doigs early[a] N=72	Hichman's N=18	Sorcé N=6
	%	%	%	%	%	%	%
0%	70.0	75.0	48.4	62.7	59.7	50.0	33.3
1-99%	30.0	25.0	50.9	36.9	40.3	50.0	66.6
1-24%	*20.0*	*18.8*	*28.1*	*18.3*			*66.6*
25-49%	-	*6.3*	*12.7*	*11.0*			-
50-74%	*10.0*	-	*6.4*	*5.4*			-
75-99%	-	-	*3.8*	*2.2*			-
100%	-	-	7.3	0.4	-	-	-
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Cortex Complete flakes	N=4	N=5	N=328	N=141	not distinguished	sample too small	sample too small
	%	%	%	%	%	%	%
0%	75.0	60.0	37.8	58.9	-	-	-
1-99%	25.0	40.0	60.7	41.9	-	-	-
1-24%	*25.0*	*40.0*	*34.1*	*23.4*	-	-	-
25-49%	-	-	*11.6*	*11.3*	-	-	-
50-74%	-	-	*9.5*	*5.7*	-	-	-
75-99%	-	-	*5.5*	*0.7*	-	-	-
100%	-	-	1.5	-	-	-	-
Total	100.0	100.0	100.0	100.0	-	-	-

Table 6.2. Early Ceramic A phase. Number and relative amount of flakes by percentage of cortex cover on dorsal face including platform.
[a] The numbers and percentages given for Doigs early include all flint material, that is cores, flakes, and shatter.

Cortex All flakes	Anse à la Gourde early N=48	Doigs late[a] N=158	Golden Rock N=405	Kelbey's Ridge 1 N=41	Anse des Pères not counted
	%	%	%	%	%
0%	64.6	65.8	48.6	56.1	-
1-99%	35.4	33.5	49.4	41.5	-
1-24%	*18.8*		*24.2*	*22.0*	-
25-49%	*12.5*		*13.1*	*9.8*	-
50-74%	*4.2*		*7.4*	*7.3*	-
75-99%	-		*4.7*	*2.4*	-
100%	-	0.6	2.0	2.4	-
Total	100.0	100.0	100.0	100.0	-

Cortex Complete flakes	N=14	not distinguished	N=127	N=19	N=31
	%	%	%	%	%
0%	57.1	-	43.3	42.1	41.9
1-99%	42.9	-	53.5	52.6	58.1
1-24%	*21.4*	-	*23.6*	*26.3*	*35.5*
25-49%	*14.3*	-	*15.0*	*15.8*	*12.9*
50-74%	*7.1*	-	*10.2*	*5.3*	*6.5*
75-99%	-	-	*4.7*	*5.3*	*3.2*
100%	-	-	3.1	5.3	-
Total	100.0	-	100.0	100.0	100.0

Table 6.3. Early Ceramic B phase. Number and relative amount of flakes by percentage of cortex cover on dorsal face including platform.
[a] The numbers and percentages given for Doigs late include all flint material, that is cores, flakes, and shatter.

Flint from Shoal Bay East and Vivé displays a similar low proportion of cortical flakes and the absence of core artefacts. Samples from both sites, however, are very small. Especially in the case of the Vivé lithic material may have arrived in an unmodified form. The fact that all flakes most likely originated from the same nodule, as shown by their close similarity in colour and texture, combined with their concentration and the excellent state of preservation of a related living floor suggests that the reduction of a single nodule there. As such, they represent a snapshot within the complete reduction sequence of this nodule. This contrasts to many other sites, where multiple test-units and test-pits, excavated in dense refuse deposits, are more likely to yield an average picture of flint reduction, comprising material from all reduction stages that took

Cortex All flakes	Anse à la Gourde middle	Claremont[a]	Blackman's Point[a]	Coconut Hall[a]	Jumby Bay	Godet	Smoke Alley	Spring Bay 3	Sandy Ground	Barnes Bay
	N=62	N=30	N=80	N=124	N=535	N=8	N=17	N=86	N=35	N=40
	%	%	%	%	%	%	%	%	%	%
0%	58.1	26.7	55.0	55.6	41.9	75.0	47.1	65.1	57.1	67.5
1-99%	41.9	73.3	45.0	42.7	55.9	25.0	52.9	33.7	40.0	32.5
1-24%	*21.0*				*23.2*	*12.5*	*35.3*	*22.1*	*22.9*	*25.0*
25-49%	*12.9*				*16.3*	-	-	*8.1*	*8.6*	*5.0*
50-74%	*3.2*				*11.8*	*12.5*	*17.6*	*1.2*	*5.7*	-
75-99%	*4.8*				*4.7*	-	-	*2.3*	*2.9*	*2.5*
100%	-	-	-	1.6	2.2	-	-	1.2	2.9	-
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Cortex Complete flakes	N=19	not distinguished	not distinguished	not distinguished	N=201	sample too small	N=8	N=34	N=15	N=11
	%	%	%	%	%	%	%	%	%	%
0%	47.4	-	-	-	37.3	-	50.0	70.6	53.3	63.6
1-99%	52.6	-	-	-	59.7	-	50.0	29.4	40.0	36.4
1-24%	*21.1*	-	-	-	*25.9*	-	*25.0*	*14.7*	*26.7*	*36.4*
25-49%	*31.5*	-	-	-	*16.9*	-	-	*8.8*	*13.3*	-
50-74%	-	-	-	-	*12.4*	-	*25.0*	*2.9*	*6.7*	-
75-99%	-	-	-	-	*4.5*	-	-	*2.9*	-	-
100%	-	-	-	-	3.0	-	-	-	6.7	-
Total	100.0	-	-	-	100.0	-	100.0	100.0	100.0	100.0

Table 6.4. Late Ceramic A phase. Number and relative amount of flakes by percentage of cortex cover on dorsal face including platform. [a] The numbers and percentages given for Claremont, Blackman's Point, and Coconut Hall include all flint material, that is cores, flakes and shatter.

Cortex All flakes	Sugar Mill	Kelbey's Ridge 2	Shoal Bay East
	N=207	N=67	N=6
	%	%	%
0%	40.1	64.2	83.3
1-99%	56.5	34.3	16.7
1-24%	*20.3*	*19.4*	*16.7*
25-49%	*15.0*	*11.9*	-
50-74%	*15.0*	-	-
75-99%	*7.2*	*3.0*	-
100%	3.4	1.5	-
Total	100.0	100.0	100.0

Cortex Complete flakes	N=69	N=29	sample too small
	%	%	%
0%	30.0	48.3	-
1-99%	65.2	48.3	-
1-24%	*30.4*	*20.7*	-
25-49%	*14.5*	*20.7*	-
50-74%	*13.0*	-	-
75-99%	*7.2*	*6.9*	-
100%	5.8	3.4	-
Total	100.0	100.0	-

Table 6.5. Late Ceramic B phase. Number and relative amount of flakes by percentage of cortex cover on dorsal face including platform.

place there. Therefore, it may be possible that the Vivé piece of flint was also reduced in other areas of the site, both before and after the removal of the studied flakes. It is minimally clear that the import of flakes is unlikely in this case.

Apart from these specific sites with small samples, none of the other small samples suggest the arrival of pre-worked material. All the latter produced evidence of local flint working in the form of flakes, shatter, and cores, as well as around 50% cortical pieces. Considering their small sample sizes, interpretations may change as more data become available.[4]

[4] The samples from all sites only represent a part of a larger assemblage. Therefore, the presence of a few artefacts made of distinct varieties of Long Island flint cannot by itself provide evidence that individual flaked pieces were imported.

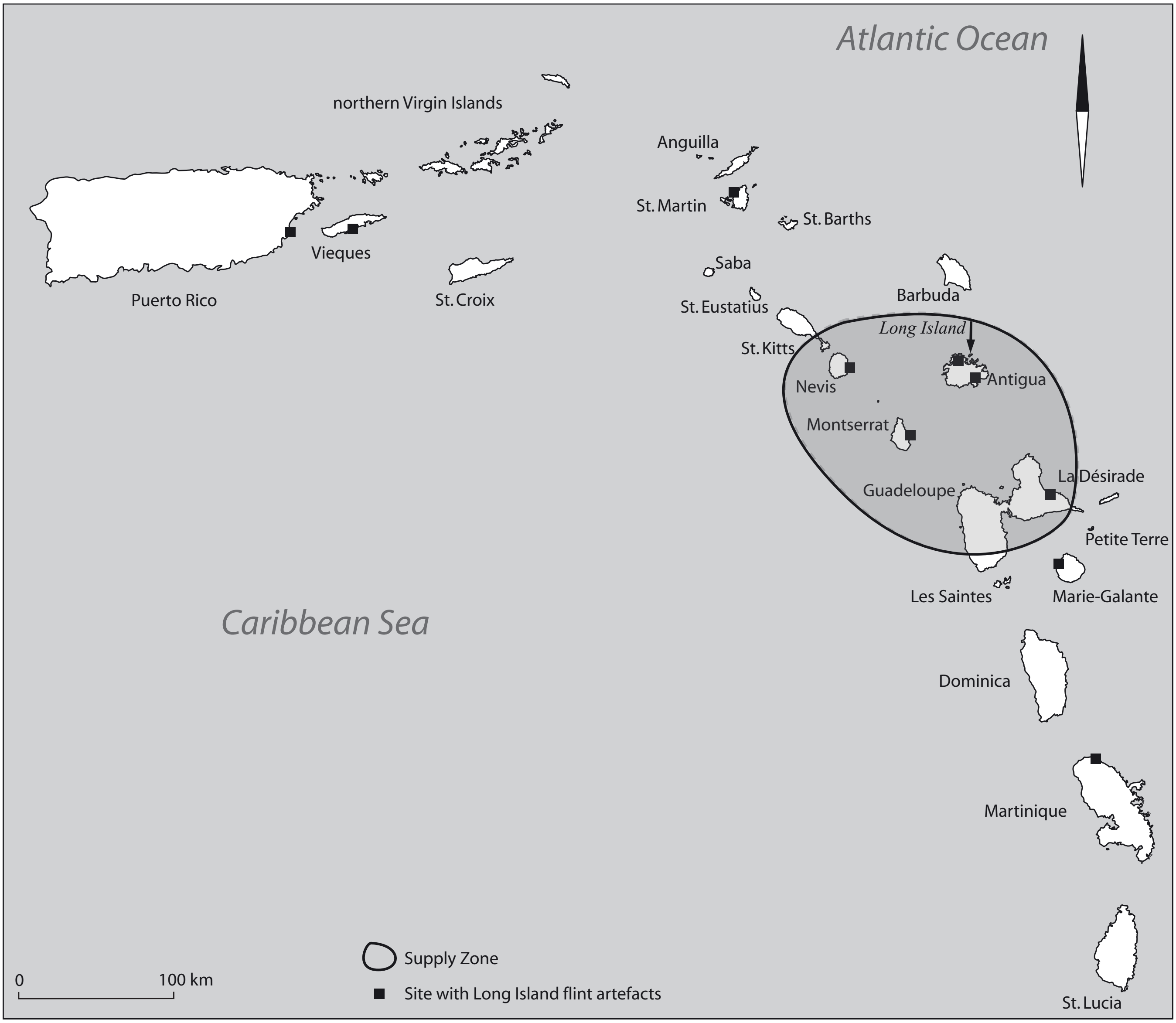

Figure 6.1. Distribution of Long Island flint and the location of the supply zone during the Early Ceramic A phase (400 BC – AD 400).

The Early Ceramic Age

Differentiating the studied sites by phase brings out the following picture. Evidence for the transport of unmodified material is strong for the area of Guadeloupe and Nevis during the Early Ceramic A phase (figure 6.1). The small sample data from sites on Vieques, Puerto Rico, and Martinique equally do not exclude import of unmodified material. Cocoyer, however, may form a possible exception to this pattern, as the percentage of cortical flakes is low, around 25%. A similarly low percentage of cortical flakes is reported for the Hope Estate site (Haviser 1993, 1999). Basing himself on a high percentage (70%) of “non-decortificated” flakes, that he defined as flakes without any cortex Haviser (1999, 195; see Haviser 1993 for definition) states that the lithic material arrived in a pre-worked state. From the discussion above, this frequency is indeed suggestive of the arrival of pre-worked material, and in any case is higher than most of my values for other sites. On the other hand, this value cannot be simply compared to my data, since Haviser does not distinguish between Long Island flint and other chert types in his cortex count. My data from other sites suggest that other chert categories usually have higher percentages of non-cortical flakes, increasing the overall percentage.[5] Golden Rock, for example, produced a value of 49% for Long Island flint in comparison to 71% for the other chert categories. Furthermore, Haviser, did not include patinated surfaces among cortical/outer surface types for the Long Island flint category (see Chapters 2 and 3), as he was less familiar with this flint material. This would also reduce the number of non-cortical flakes. Within the Jumby Bay and Sugar Mill samples, this would account for a 5% decrease. Combining these differences, the percentage of non-cortical flakes may be 5% to 10% lower than the figure Haviser reported, and this produces a value that falls within the range Walker (1980) found experimentally, suggesting arrival of non-modified material.

This leaves Cocoyer as the only exception to the pattern of transport of unmodified flint material. Considering the small sample of artefacts being analysed from this particular site, additional research is needed to prove or disprove the exceptional position of Cocoyer.

During the later Early Ceramic B phase, the arrival of unmodified Long Island flint material has been suggested for sites within the Guadeloupe to Saba area (figure 6.2). The larger samples from Sugar Factory Pier, Golden Rock, and Anse des Pères have produced especially high numbers of cortical flakes. The smaller samples do not differ, and therefore support this pattern. Even for the Paso del Indio site, which is situated at the largest distance from the source considered here, the common occurrence of cortical flakes indicates the arrival of unmodified material (Rodríguez Ramos, personal communication 2001). Only in the case of the Diamant site, does the recovery of a single tertiary flake leave all possibilities open. In contrast to the preceding phase, none of the Early Ceramic B sites have produced clear data that suggest arrival of pre-worked material.

The data from both phases also agree with the absence of any reduction activities attributed to the entire Early Ceramic Age at the Long Island source (see Chapter 4). This implies that the people who had direct access to the Long Island source sent out expeditions to collect unmodified material and bring it back to their settlements. However, from this pattern alone, i.e. the transport of unmodified material, it is difficult to indicate where the direct access zone actually stopped, and where inter-village exchange began. Only the Early Ceramic A phase has produced possible information in this regard. The fact that pre-worked material might have been entering the Cocoyer site points to the existence of an exchange mechanism, as special workshop sites at the source or anywhere else were not encountered or reported. In other words, if sample bias is not blurring the data, the Cocoyer community must have obtained Long Island flint from an intermediate site, where it was (pre-)worked. The fall-off data, which are discussed below, minimally support the beginning of a down-the-line mode of exchange at this distance of ca. 140 km from the source.

The Late Ceramic Age

The Late Ceramic A phase does not show a marked change relative to the preceding Early Ceramic B phase, except for a less extensive distribution (figure 6.3). Sites with relatively large samples, that produced high percentages of cortical flakes, and thus suggest the arrival of unmodified lithic material are Blackman's Point and Coconut Hall on Antigua, Anse à la Gourde on Guadeloupe, and Sandy Ground on Anguilla. In general, however, these percentages are lower than those found at the small settlement of Jumby Bay on Long Island. This may be attributed to a smaller average core size used or the less exhaustive reduction, considering the larger average size of the flakes at Jumby Bay. The small samples that suggest import of unmodified material include Claremont on Antigua and Smoke Alley on St. Eustatius. Only the above mentioned Spring Bay 3 and Barnes Bay sites may represent places where worked material was transported in.

In general, the more limited data associated with the Late Ceramic B phase do not markedly differ from those of the preceding phase (figure 6.4). Arrival of unmodified material was the case for Kelbey's Ridge 2. Possible indications for the import of pre-worked material, likely flakes, are only found at Shoal Bay East. The small sample from Shoal Bay East comprises many tertiary flakes and no cores.

Summarising the data for both late phases, the transport of unmodified material basically occurred within the Guadeloupe and Saba area, although differentiation is noticed for the islands of Saba and St. Eustatius, especially between the Spring Bay 3 and Kelbey's Ridge 2 sites. Unfortunately, data from the islands between Statia and Antigua is not available.

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[5] This higher percentage in general may be attributed to the fact that many of these chert types are not true flints and therefore lack the typical formation of a cortical rind. There are indications that some of these materials were obtained from inland surface scatters, where a very distinctive outer surface did not develop, in contrast to water-worn surfaces in river beds or on beaches, for example. This makes it more difficult to distinguish outer surface from inner surface, thereby potentially over-representing non-cortical surfaces.

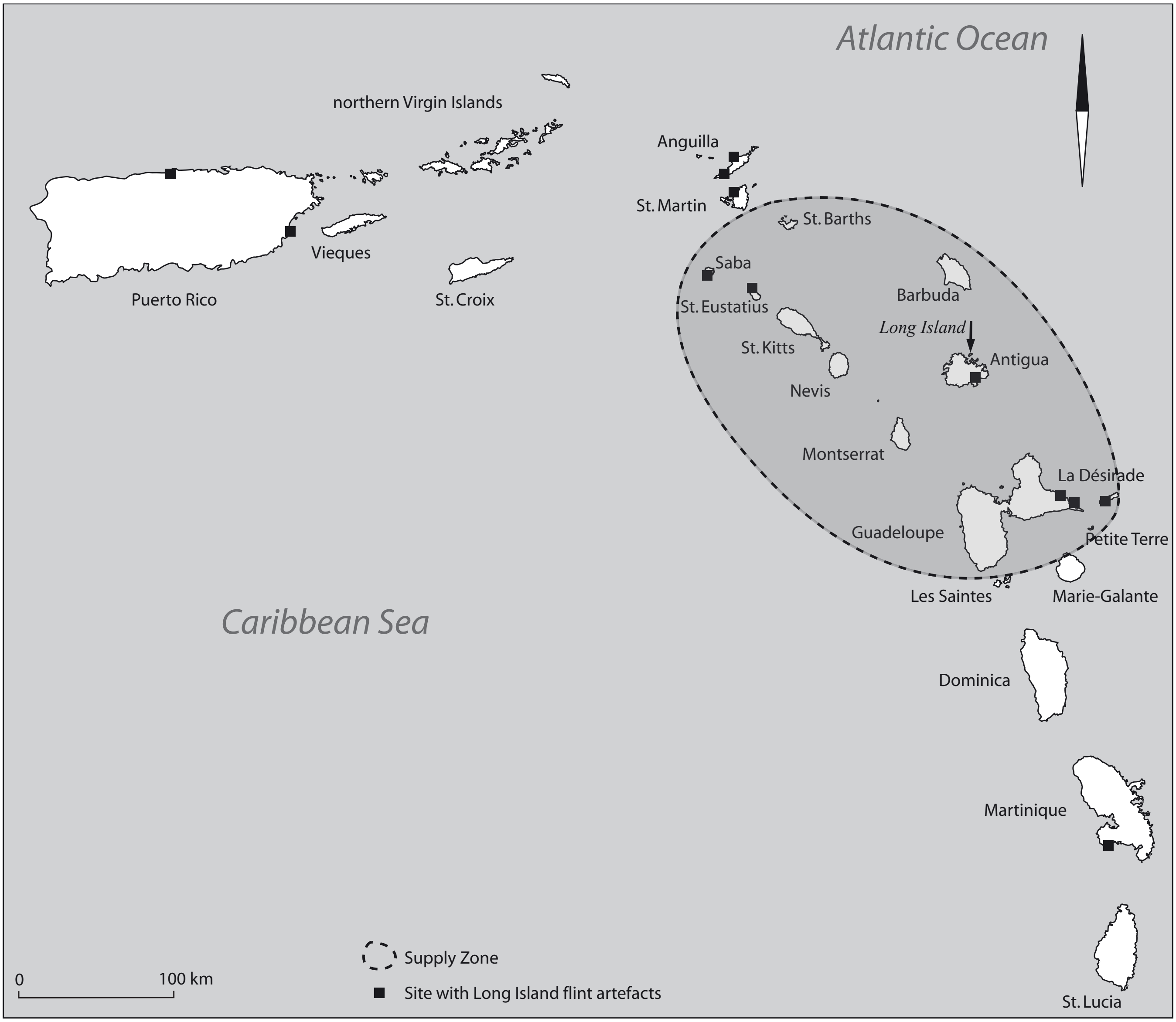

Figure 6.2. Distribution of Long Island flint and the location of the supply zone during the Early Ceramic B phase (AD 400 - 850).

Some sites on the island of Anguilla seem to have obtained material in a pre-worked form and therefore, likely received it through their exchange with neighbouring communities. The presence of exchange relationships is supported by fall-off data discussed below. Still, it is also obvious that importation of material was different on Anguilla. For example, data from the Sandy Ground site suggest import of unmodified material, whereas data from later sites seem to suggest the acquisition of pre-worked material. Whether this is related to a diachronic change is open for further study. In this respect it is interesting to point out that Long Island material was less widely distributed during the Late Ceramic Age than during the Early Ceramic Age. Combined with the possible arrival of pre-worked material at some of the more distant sites, this suggests more restricted access to the Long Island source for these later phases of the Ceramic Age (see discussion of fall-off data below). The existence of small habitation sites on Long Island (see Chapter 4) may be related to this more restricted access, since these settlements may have played a role in the possible control of this source.

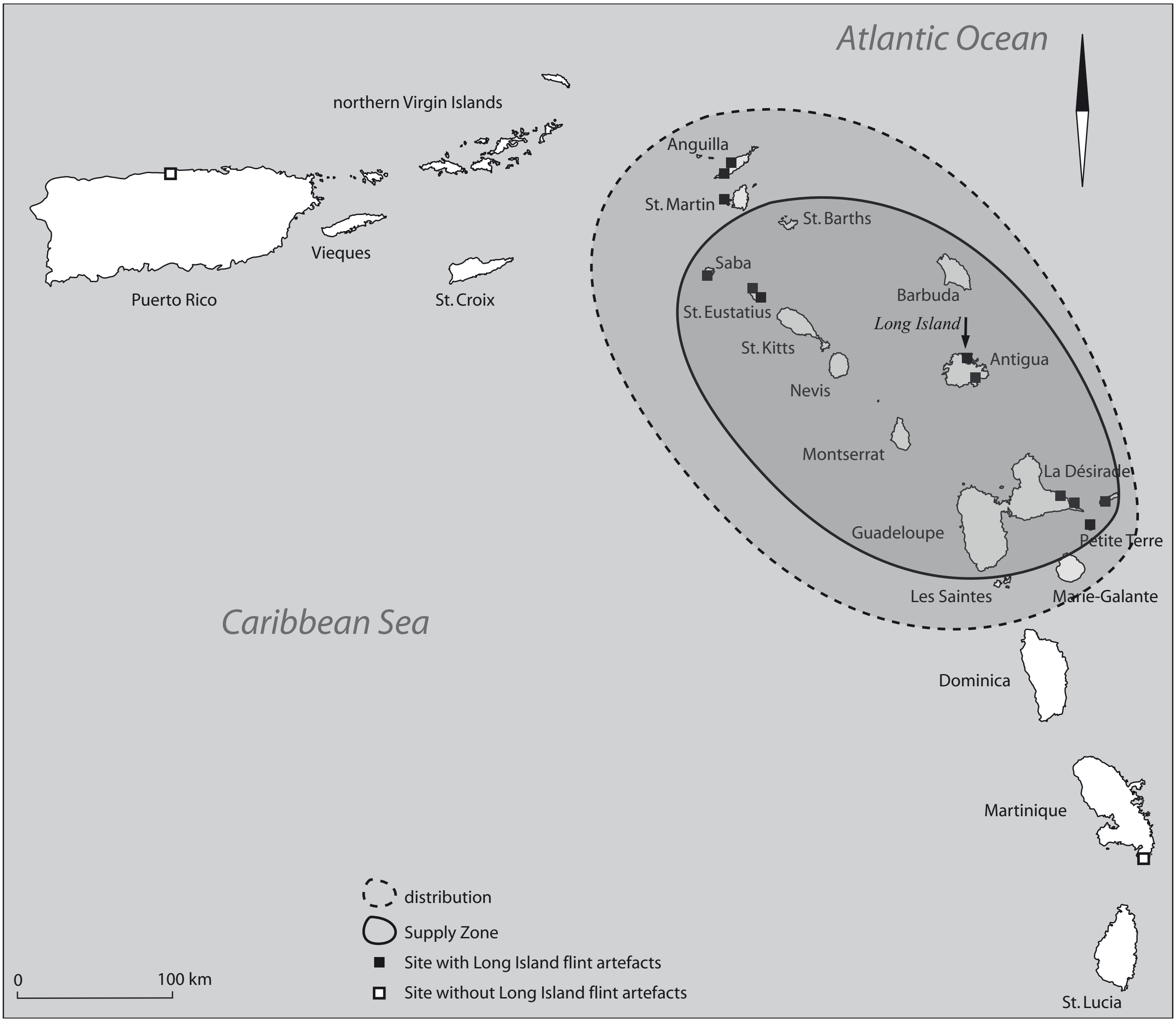

Figure 6.3. Distribution of Long Island flint and the location of the supply zone during the Late Ceramic A phase (AD 850 - 1250).

Fall-off analysis

Introduction

In Chapter 1, the concept of fall-off analysis was introduced as a base-line method for the investigation of the exchange mechanisms that were responsible for the distribution of a particular material. Fall-off curves in this case provide some additional insights, despite the difficulties that are encountered using this form of analysis (see Torrence 1986 for detailed discussion).

Some initial comments need to be made, concerning the study of fall-off. With regard to the distribution of rock materials in the Lesser Antilles, certain conditions simplify the study of fall-off patterns. First, the fact that we are dealing with an island archipelago, comprising relatively small islands, makes it very likely that transport primarily occurred by canoe. This was probably the case for not only inter-island traffic but also for traffic between villages situated on the same island. The predominant coastal location of sites, in many cases mountainous terrain, and typically dense forest cover at the

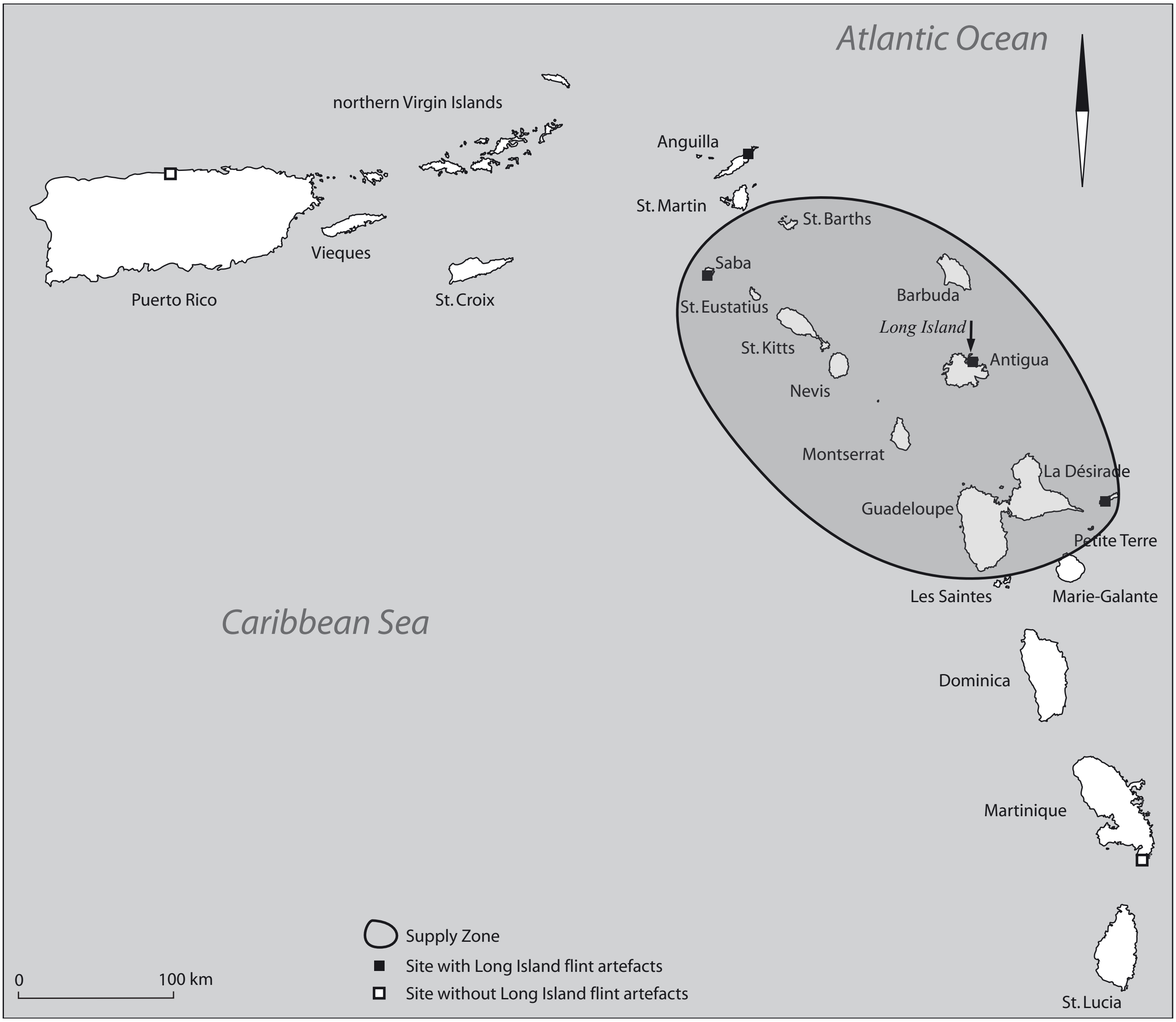

Figure 6.4. Distribution of Long Island flint and the location of the supply zone during the Late Ceramic B phase (AD 1250 - 1492).

time, would have made transport over land difficult and supports a predominant reliance on marine traffic. Therefore, the difficulty of weighing sea transport to land transport is generally not at issue here when calculating effective distance for the fall-off curves.

Furthermore, the specific shape of the Lesser Antilles island chain only leaves room for two main directions over which material can be transported. Seen from Antigua, it is either a (north)western transport in the direction of Puerto Rico or a southeastern one, heading to the Windward Islands and the South American mainland. Only Montserrat to the southwest and Barbuda to the north deviate from these two island chain routes. As such, the fall-off curve can be divided into two separate ones and each one can be considered as closely resembling a one-dimensional situation (see Chapter 1). Finally, the island nature of the study area determined that only discrete transport steps were possible, equal to the distance between the islands. The curve's effective distance is equal to the shortest distance between the islands in this case. In most cases this will be a very good approximation, since sea transport was the form of transportation.

The percentage of Long Island flint as part of the total amount of lithic material associated with a flake tool technology (all cherts and quartz) is taken as the measure of abundance for the construction of the fall-off curve. As such, a percentage is much influenced by the availability of other lithic sources in the region. Therefore, it is not considered to be the best measure. However, a ratio in which ceramics are incorporated, assuming that ceramics were more widely available and therefore were much more constant relative to the number of users, is beyond the scope of the present research. In many cases, the exact number of pottery sherds is not known or reported, or had to be recalculated using unpublished artefact data-bases unavailable to me. A measure using the amount per excavated volume or area, which has been applied by some researchers (see Torrence 1986, 124 table 6 for an overview), is not considered a reliable parameter here, because of the high variability in intra- and inter-site artefact concentrations. In the first place there is a marked difference within individual sites between living areas and refuse areas. Also, differences within refuse area, centres and peripheries, can be distinguished. Secondly, artefact concentrations in refuse areas from different sites appear to vary significantly in material abundance.

Another drawback for the current study is the small number of sites per phase, that have been available for analysis. In many cases, data from specific micro-regions could not be obtained, notably from the area from Dominica to the southwestern portion of Guadeloupe (Basse Terre), as well as the region of the Virgin Islands. In both cases, these regions are relatively distant from the source and it appeared that beyond these areas significant changes occur, thereby hampering good insight into the shape of the fall-off curve.

Results

The fall-off curves for the different phases all conform to the Law of Monotonic Decrement (LMD) (see Chapter 1): overall material abundance clearly declines with distance (tables 6.6-6.9, figures 6.5-6.7)**.** However, some deviations exist in comparison to the curves demonstrated in other areas of the world. Most of the fall-off curves within this study do not correspond to the expected form of high abundance near the source (the "supply zone"), and a monotonic decline with increasing distance, as has been found in the Near East by Renfrew and his colleagues, for example (Renfrew & Dixon 1976; Renfrew e*t al.* 1968; see also Renfrew & Bahn 1991, 326). The deviations are mainly found near the Long Island lithic source, and can be attributed to the use of other locally available fine-grained rocks. Particularly within the Early Ceramic A and Late Ceramic A phases, significant variation exists between sites on the island of Antigua and also to some extent, Montserrat. Within the Early Ceramic A phase, white chert is one of the prevailing materials at Doigs, Trants, Morel, and Hichman's, as mentioned below in Chapter 5, but De Mille (2001) reports a significant occurrence of many other local categories for the site of Royalls as well. The Late Ceramic A phase exhibits variation, since the inhabitants of the Blackman's Point and Coconut Hall sites made significant use of local materials that are found near them. These "other" sources played only a minor role within the wider region, as is shown by predominant use of Long Island flint on Nevis, Guadeloupe, and beyond. This clearly demonstrates the higher value that was given to Long Island flint relative to other fine-grained materials.

Comparison of the different phases reveals some changes. Within the Early Ceramic A and B phases the distribution was at its widest, at least all the way to Martinique to the south and the eastern and middle portions of Puerto Rico to the west. Unfortunately, sites outside of this broad region were not studied for this phase and the full limits of its extent was not established. However, it is likely that this material was not transported any further, considering the steep decline in abundance, especially in the southern direction. For the southern area, this can be attributed to the common local availability of other fine-grained rock on Martinique. These local rocks form the predominant lithic categories at the Martinican sites according to the available information. In the northwestern direction, further distribution also may have stopped at about the limit of the study, although the social situation is believed to be different there as a result of the presence of Preceramic Age groups then (Rodríguez Ramos 2001c; Rouse 1992). These latter people displayed a marked preference for Long Island flint, as noted on sites in the northern Lesser Antilles (Davis 2000; Watters *et al.* in prep.). Rodríguez Ramos (2005) argues that relationships must have existed between both the Ceramic and Preceramic Age people, although archaeological data for this are still scarce. Therefore, a larger zone of distribution of Long Island flint should still be considered in this general area.

Long Island flint did not reach Puerto Rico anymore during the following Late Ceramic A phase. A more contracted distribution is to some extent already noticed for the Early Ceramic B phase, which shows a decrease in Long Island flint at Punta Candelero through time. Whether this more restricted spread of flint continued to manifest itself during the latest phase of Pre-Columbian occupation cannot be tested, as studied samples are lacking for this phase in this area. Late occupation at Anse Trabaud on the other end of the region does not display the use of Long Island flint, however. Available data thus far

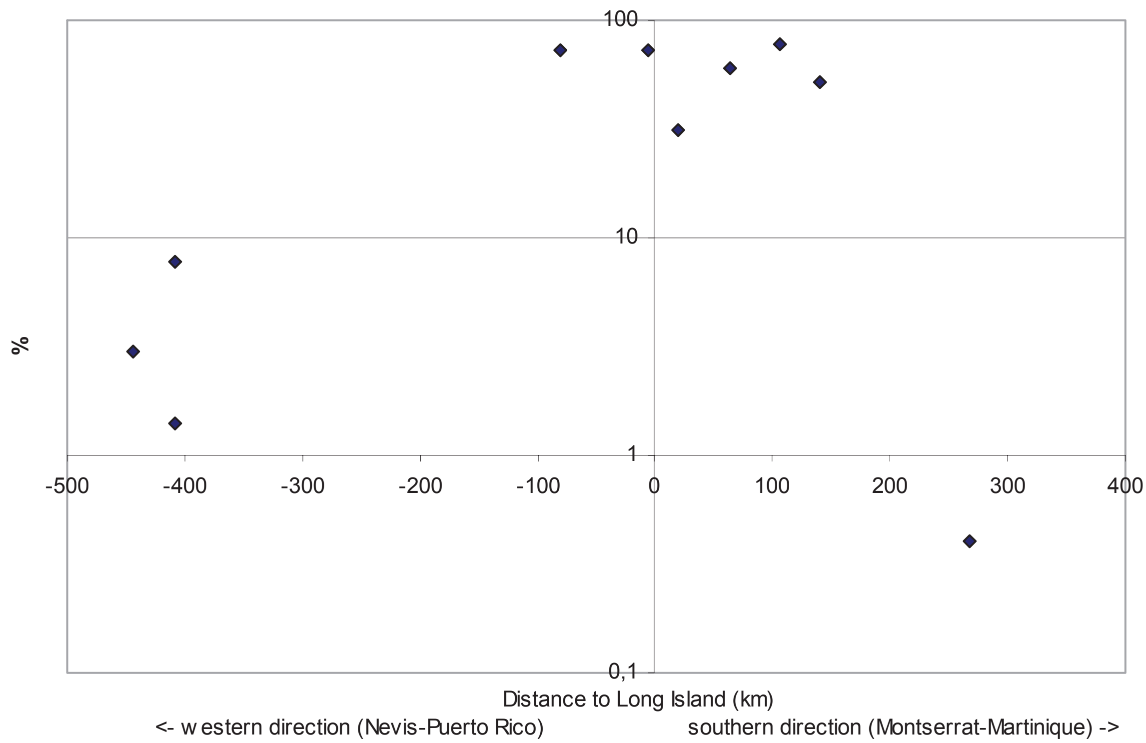

Figure 6.5. Early Ceramic A phase. Fall-off graph (logarithmic scale) showing the percentage of Long Island flint at a settlement site by distance to Long Island.

Site	Island	Distance to Long Island (km)	% Long Island flint	N Long Island artefacts
Punta Candelero[a]	Puerto Rico	444	3.0	31
La Hueca[a]	Vieques	408	7.7	113
Sorcé	Vieques	408	1.4	7
Hichman's	Nevis	81	72.7	24
Royalls[b]	Antigua	6	72.3	523
Doigs early	Antigua	19	31.6	74
Trants	Montserrat	63	60.7	573
Morel	Guadeloupe	107	78.0	1083
Cocoyer	Marie-Galante	141	52.3	23
Vivé	Martinique	268	0.4	1

Table 6.6. Early Ceramic A phase. Percentage of Long Island flint as part of all flake tool related material by site by distance to Long Island.
[a] after Rodríguez Ramos 2001a; [b] after De Mille 2001.

only point out that Long Island flint remained frequently used within the Guadeloupe-Anguilla area during the later phases of the Ceramic Age.

Renfrew *et al.* (1968) showed in their work on Anatolian obsidian distribution that in the region surrounding the source, the abundance of obsidian stays relatively high over time. They interpreted this area of high abundance as the supply zone, where people had direct access to the source. In the specific Anatolian case, abundance remained around 80% of the total of obsidian. Beyond a certain distance, however, the amount decreased according to an exponential curve indicative of "down-the-line" exchange. In the present study, the Early Ceramic A phase does not display a constant high abundance of Long

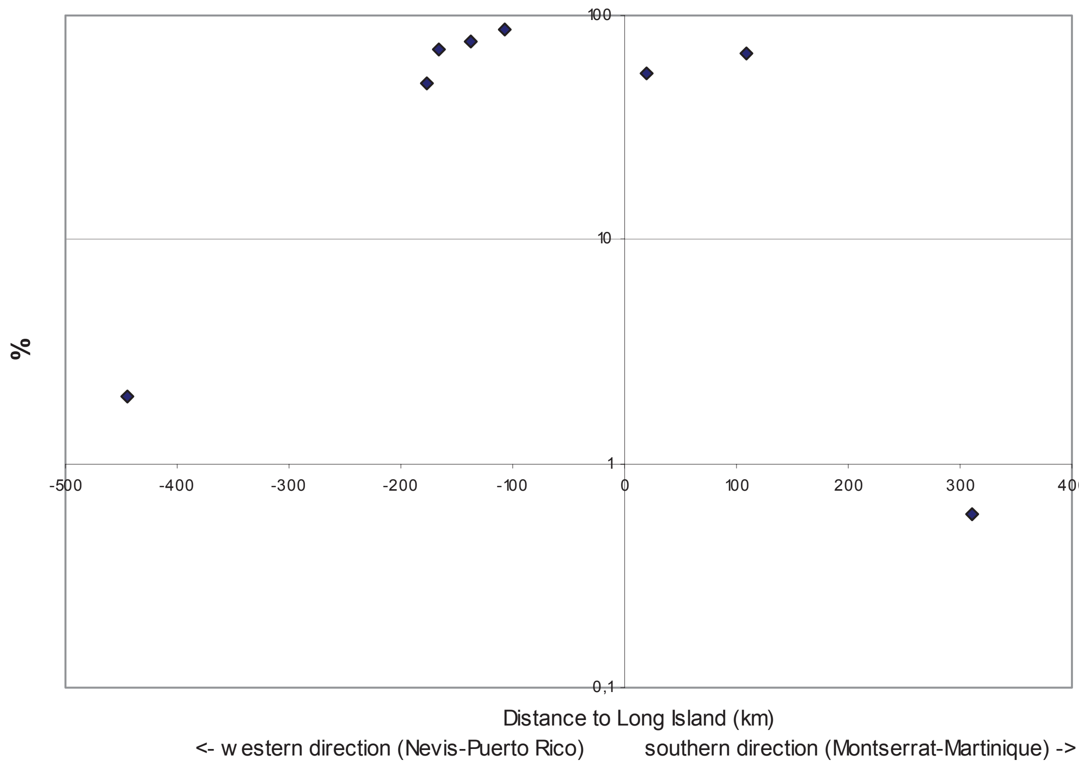

Figure 6.6. Early Ceramic B phase. Fall-off graph (logarithmic scale) showing the percentage of Long Island flint at a settlement site by distance to Long Island.

Site	Island	Distance to Long Island (km)	% Long Island flint	N Long Island artefacts
Punta Candelero[a]	Puerto Rico	444	2.0	n.s.
Anse des Pères	St. Martin	176	50.0	91
Kelbey's Ridge 1	Saba	166	70.4	50
Golden Rock	St. Eustatius	137	75.9	483
Sugar Factory Pier[b]	St. Kitts	107	86.1	896
Doigs late	Antigua	19	54.8	160
Anse à l'Eau early	Guadeloupe	109	67.4	60
Anse à la Gourde early	Guadeloupe	117	100.0	12
Diamant	Martinique	310	0.6	1

Table 6.7. Early Ceramic B phase. Percentage of Long Island flint as part of all flake tool related material by site by distance to Long Island.
[a] Rodríguez Ramos personal communication (2002); [b] after Walker (1980a, 91).

Island flint as a result of the use of other sources on the island of Antigua. However, beyond Guadeloupe in the southern direction and beyond Nevis in the western direction, Long Island percentages exhibit a monotonic decline. Especially in case of the southern fall-off, this decline approximates exponential decay. In the western direction basically only two distance points are present, one on Nevis and one in the Vieques-eastern Puerto Rico area. If it is assumed that between these two points two exchange transactions occurred, one at Hope Estate and one in the Virgin Islands, such as Prosperity, for example, then the 60% found at Nevis becomes 7.5% at Vieques, assuming that half of the quantity is kept and the other half is passed on. This 7.5% equals the amount at La Hueca. Following the fall-off in the southeastern direction reveals that the abundance of flint on Martinique is considerably lower (less than 1%) than would be expected if two or three exchange transactions

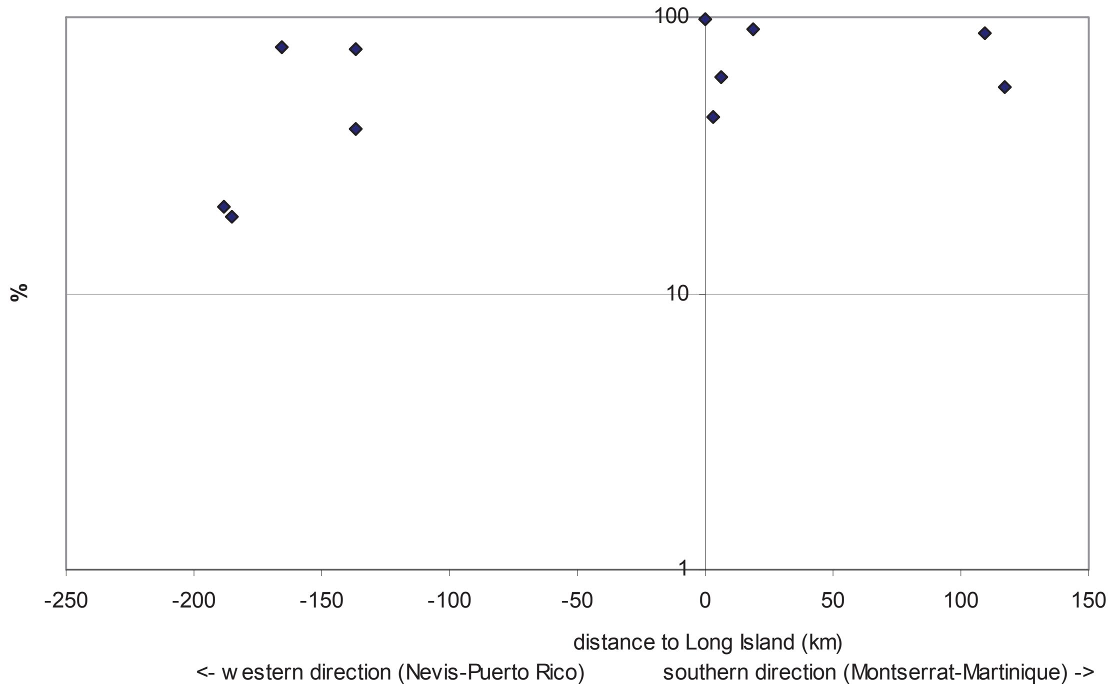

Figure 6.7. Late Ceramic A phase. Fall-off graph (logarithmic scale) showing the percentage of Long Island flint at a settlement site by distance to Long Island.

Site	Island	Distance to Long Island (km)	% Long Island flint	N Long Island artefacts
Barnes Bay	Anguilla	188	20.7	87
Sandy Ground	Anguilla	185	19.0	59
Spring Bay 3	Saba	166	78.0	110
Smoke Alley	St. Eustatius	137	76.9	20
Godet	St. Eustatius	137	39.1	9
Claremont	Antigua	19	90.0	32
Jumby Bay	Antigua	0	98.9	953
Coconut Hall	Antigua	6	61.0	125
Blackman’s Point	Antigua	3	43.6	80
Anse à l’Eau late	Guadeloupe	109	87.5	7
Anse à la Gourde middle	Guadeloupe	117	55.9	85
Anse à la Gourde late	Guadeloupe	117	65.6	21
Anse Trabaud	Martinique	321	0.0	0

Table 6.8. Late Ceramic A phase. Percentage of Long Island flint as part of all flake tool related material by site by distance to Long Island.

Site	Island	Distance to Long Island (km)	% Long Island flint	N Long Island artefacts
Anse Trabaud	Martinique	321	0.0	0
Sugar Mill	Antigua	0	100.0	427
Kelbey’s Ridge 2	Saba	166	78.2	79
Shoal Bay East	Anguilla	185	56.7	17

Table 6.9. Late Ceramic B phase. Percentage of Long Island flint as part of all flake tool related material by site by distance to Long Island.

had occurred. This lower percentage is probably due to the local availability of good flaking materials and less of a need for imports

This suggests that the region between Nevis and the northern coast of Grande Terre (Guadeloupe) represents the supply zone. Does this also mean that the people living in this area all had direct access to the Long Island source? In other words, were the inhabitants of this area able to exploit the Long Island flint source without the interference of another community controlling it?[6] In Chapter 4, I showed that during the Early Ceramic phases Long Island was not occupied in contrast to the later part of the Ceramic Age. People apparently visited the island only to collect flint then, which they brought to their villages without any systematic pre-working. So, the source itself provides no indication of control at this time.

If one searches for the closest residential site during this phase then the Royalls site on Antigua is the best candidate (De Mille 2001; Murphy 1999). Raw material data for this site differs in composition from those of, for example, Trants and Morel, located within the supply zone. At Morel and Trants, Long Island flint makes up the majority of the lithic material, with the white chert variety being the second most abundant. On the contrary, De Mille (2001), reports for Royalls a lower Long Island flint percentage and the occurrence of a number of other local chert varieties, not encountered at Trants and Morel. This means that the Trants and Morel communities did not obtain their material from this site. Otherwise, one would expect to find these other categories as well. Apparently, the Trants and Morel communities directed special trips to the relatively remote lying Long Island source. For them this material may have been more easily approached than some of the other chert sources situated on the main island of Antigua, which may have been controlled by specific villages in the immediate vicinity (figure 6.1).

For the Early Ceramic B phase the situation changes slightly relative to the Early Ceramic A phase. Sites with high percentages of flint have a more extended distribution in the northwestern direction, as data from the sites of Golden Rock and Kelbey's Ridge 1 on the newly populated islands of St. Eustatius and Saba show. Beyond these, the abundance markedly declines at Anse des Pères and Punta Candelero, suggesting down-the-line exchange. In the other direction, sites on the northern coast of Grande Terre, Anse à l'Eau and the small sample of Anse à la Gourde, still demonstrate high numbers of Long Island flint, and the supply zone apparently continued to incorporate this area (figure 6.2). Further to the south, data are very scanty, with only the site of Diamant being studied. However, this site displays an almost identical low abundance of flint as the earlier Vivé settlement. The steep decline is therefore also suggestive of down-the-line exchange in this direction.

Looking more closely at the lithic raw material composition of the sites, it is noticed that Long Island flint is the sole recurrent and predominant material within the supply zone area. This differs from the preceding phase when other materials also occurred in relatively high numbers, particularly the white chert. The only site on Antigua itself for this phase within the present analysis is the late occupation of the Doigs site. This phase produced a different flint and chert composition than sites within the supply zone, as is the case, for example at Sugar Factory Pier on St. Kitts, Golden Rock on St. Eustatius, and Kelbey's Ridge 1 on Saba. Similar to the preceding phase, this difference in composition suggests that sites within the supply zone were exploiting the Long island flint source themselves.

As already mentioned, the Late Ceramic A phase had a more restricted distribution in the western area as compared to the two Early Ceramic phases. Unfortunately, data are scanty for the eastern direction and depend on the dating of the Anse Trabaud site. This site did not produce any Long Island flint, however, although the difference with the Early Ceramic phase is not significant, considering the very low percentages of Long Island flint encountered at Vivé and Diamant, and the smaller sample studied for Anse Trabaud.

Within this less extensive distribution, the frequency pattern resembles the other one characteristic of the Early Ceramic B phase, with high percentages occurring at sites on St. Eustatius and Saba, and significantly lower values at Anguilla. Similar to the Early Ceramic B phase, the supply zone still incorporated Saba and St. Eustatius, beyond which exchange started. On the other end along the northern coast of Grande Terre, the Troumassoid 1 and 2, and Suazan Troumassoid phases of the Anse à la Gourde site produced similar percentages to the earlier sample from the Anse à l'Eau site, suggesting no change in access there as well. The supply zone, therefore, was again positioned between Saba and at least the northern part of Guadeloupe (figure 6.3).

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[6] In both situations, direct access or exchange with a community living next to the source and controlling it, mathematically will not result in different fall-off curves, if one assumes that such a controlling community will have an infinite amount of rock material available for exchange. This means that the amount of material that reaches the supply zone sites will not be dependent on the amount at the source community, but will be dependent on the distance to the source only.

The latest phase marks a slight change relative to the earlier one, as the Shoal Bay East site on Anguilla produced a significantly higher flint percentage compared to the Barnes Bay and Sandy Ground sites from the earlier phase. This suggests that the island of Anguilla may have become part of the supply zone then as well. In case of Saba, the limited data provide a similar picture to the preceding phase (figure 6.4). Kelbey's Ridge 2 has produced an equally high percentage of Long Island flint to Spring Bay 3. Contrary to this, the very small sample from Morne Souffleur on La Désirade, comprising only eight chert artefacts, did not include a single Long Island item. This is markedly different from earlier samples from the neighbouring Grande Terre sites, where Long Island formed the majority of flaked stone. The uncommon location of this La Désirade site on the high central plateau, and its distinct ceramic stylistic features, when compared to other sites in the region suggest that it fulfilled an exceptional role during Pre-Columbian times in this region, which may have also included a different social position (De Waal 2006; Hofman *et al.* 2004). Beyond the Anguilla – Guadeloupe area Long Island material has not been identified to the west or the south as yet, although it needs to be pointed out that the number of sites studied is very small, including only the problematic Anse Trabaud site and the latest occupation phase of Paso del Indio (Rodríguez Ramos personal communication 2001).

Reduction at the site

It has been shown above that the inhabitants of many of the regional sites either obtained non-modified cobbles through direct access to the lithic source, or imported these cobbles through their exchange with intermediate communities. Only in a few cases did the import of pre-worked material seemingly take place. Furthermore, the fall-off analysis indicates a down-the-line mode of flint exchange. In this section a closer look will be taken at on-site reduction to see if differences in the manner of treating the lithic material provides additional information about the degree of access to it. In other words, following Torrence (1986), were certain technological measures taken to increase the efficiency of production as access to material became more restricted?

In Chapter 5, I argued that the production of flake tools was undertaken in an expedient manner and that this type of technology did not change through time. This non-standardised type of flint working by itself does not leave many opportunities to increase the efficiency of its production by application of "cost-control" devices, which were discussed in Chapter 1. It is a fast and easy way to produce a set of quite variable flake tools. The evidence from the technological analysis shows that this production did not become more standardized, or sophisticated over time (see Chapter 5). Furthermore, there are no indications that the manufacture of flake tools became a specialised enterprise. Still, the data suggest that the degree of access had an effect on the efficiency of the production, with respect to flakes produced per amount of material available in particular.

I used different parameters to measure this. The definition of these parameters is complicated by the fact that the final products, the flake tools, are difficult to recognize, as formal tool types are absent. Considering the expedient fashion of the production, it is assumed that every flake is a potential tool. Therefore, the maximum dimension of a flake is taken as the measure for the length of edges, which are the potentially usable entities. This dimension has been divided by the flake weight to obtain a parameter related to the quantity of possible tools generated given a certain lithic mass, thereby indicating how efficiently the knappers used the available material.

To obtain some insight into the degree of reduction a number of variables were recorded. The first relates to the scar-count on dorsal faces of flakes, as mentioned in Chapter 3. The second is more specific to Ceramic Age technology and relates to the degree of modification and the percentage of complete flakes. In Chapter 5, it was said that apart from core reduction in many cases flakes were further modified or reduced to obtain smaller flakes. In this manner, the reduction and modification of flakes can be used as a means to more exhaustively utilize the available stone material. A result of the modification and reduction of flakes is a smaller percentage of complete flakes in the sample, particularly if one considers that complete flakes are often among the larger ones, and in many cases can still function as potential cores for the production of smaller flakes.

With respect to the maximum-dimension/weight ratio, higher values, suggesting more efficient use of lithic material, are generally apparent with increasing distance from the source, particularly if one compares the Long Island sites with the other settlements (table 6.10).[7] Some deviations, however, are present. Within the Early Ceramic A phase, the Trants site produced

[7] When calculating these parameters, mesh-size differences were accounted for, as discussed in Chapter 3 and Appendix E. Data for only a limited number of sites were available.

Site	Island	Distance to Long Island (km)	flakes>11		flakes>14		flakes>19	
			N	ratio	N	ratio	N	ratio
Early Ceramic A								
Trants	Montserrat	63	293	2.32	194	1.81	92	1.00
Morel	Guadeloupe	107	-	-	500	1.37	255	0.91
Early Ceramic B								
Golden Rock	St. Eustaius	137	-	-	-	-	274	0.81
Kelbey's Ridge 1	Saba	166	30	1.78	23	1.16	11	0.95
Late Ceramic A								
Jumby Bay	Long Island	0	-	-	351	1.13	258	0.74
Anse à la Gourde middle	Guadeloupe	117	65	1.39	55	1.26	-	-
Spring Bay 3	Saba	166	55	1.93	41	1.55	-	-
Sandy Ground	Anguilla	185	33	2.96	19	1.61	-	-
Barnes Bay	Anguilla	188	26	1.78	19	1.15	-	-
Late Ceramic B								
Sugar Mill	Long Island	0	-	-	140	1.15	94	0.81
Kelbey's Ridge 2	Saba	166	46	1.78	29	1.33	-	-

Table 6.10. Long Island flint flakes: (Maximum dimension)/(weight) ratio of all flakes by site, and by size class. "flakes>11" represents all artefacts with maximum dimension and width both larger than 11mm, "flakes>14" both larger than 14 mm, etc.

a relatively very high ratio when compared to the more distant Morel site or most of the other sites dating to the later phases. During the following phase, it is also noted that Golden Rock had a relatively low value, when compared to the small sample of Kelbey's Ridge 1 on the neighbouring island of Saba. As both sites produced lower values than Morel or Trants, it seems that lithic material was considered less scarce during this phase than during the earlier phase. The sites from the later two phases, however, conform to the expected pattern of increasing ratio with increasing distance from the source. Only Barnes Bay deviates from this pattern with its relatively low value.

Regarding the second group of variables related to percentages of modified and complete flakes, the analysis is hampered by small sample size of many of the more distant sites. Comparing only the larger samples, it is obvious that the data from the two sites close to the source of Long Island are different from the sites on the islands surrounding Antigua (tables 6.11 and 6.12). This is particularly the case with respect to the modification and reduction of flakes, suggesting that this was an important means of exhaustively using the lithic material. In this respect it is interesting to see that at Trants a high percentage of modification is found along with a relatively high percentage of complete flakes, suggesting a low portion of shatter. If we combine these figures with the high maximum-dimension/weight ratio at Trants, then this means that material was reduced in a very efficient way, i.e. a high number of flakes produced per mass.

Evaluating the scar count data, the Long Island sites exhibit larger percentages among the lower scar numbers than the settlement sites on the surrounding islands (table 6.13). This again suggests that the earlier stages of reduction are better represented than the later ones at the source sites. In other words, at the sites on the surrounding islands the material was reduced more exhaustively. Among these latter sites there is generally little variation, although a good comparison is hampered by the small sample size to some extent. A few other things can be noted, however. The Spring Bay 3 sample produced a relatively large portion of flakes with a high number of flake scars. This finding correlates well with the cortex count data, which suggested the arrival of pre-worked material there, implying that the earlier reduction stage did not occur at Spring Bay 3. Considering the low occurrence of cores and the fact that Spring Bay 3 represents a short-term camp, this may suggest that the occupants took pre-worked cores to this locality. These were further reduced for obtaining flakes to be used for tasks on-site. When leaving the site, they discarded exhausted cores and took the still reducable ones with them to be further worked at another location.

Site	Island	Distance to Long Island (km)	flakes >14		flakes >19	
			N	%	N	%
Early Ceramic A						
Trants	Montserrat	63	77	42.8	38	43.7
Morel	Guadeloupe	107	167	32.9	98	37.8
Early Ceramic B						
Golden Rock	St. Eustaius	137	-	-	84	32.2
Kelbey's Ridge 1	Saba	166	7	31.2	-	-
Late Ceramic A						
Jumby Bay	Long Island	0	88	24.8	74	28.9
Anse à la Gourde middle	Guadeloupe	117	13	27.7	7	26.9
Spring Bay 3	Saba	166	11	28.2	-	-
Sandy Ground	Anguilla	185	4	21.1	-	-
Barnes Bay	Anguilla	188	8	44.4	-	-
Late Ceramic B						
Sugar Mill	Long Island	0	37	26.4	27	28.7
Kelbey's Ridge 2	Saba	166	5	20.8	-	-

Table 6.11. Long Island flint flakes: Amount (N) and percentage (%) of modified flakes by site, and by size class. “flakes >14” represents all artefacts with maximum dimension and width both larger than 14 mm and “flakes >19” both larger than 19 mm.

Site	Island	Distance to Long Island (km)	flakes >14		flakes >19	
			N	%	N	%
Early Ceramic A						
Trants	Montserrat	63	70	36.1	35	37.6
Morel	Guadeloupe	107	195	32.9	109	36.0
Early Ceramic B						
Golden Rock	St. Eustaius	137	-	-	106	36.2
Kelbey's Ridge 1	Saba	166	11	45.5	-	-
Late Ceramic A						
Jumby Bay	Long Island	0	163	39.6	120	39.2
Anse à la Gourde middle	Guadeloupe	117	16	26.9	12	40.0
Spring Bay 3	Saba	166	16	37.2	-	-
Sandy Ground	Anguilla	185	10	47.6	-	-
Barnes Bay	Anguilla	188	5	23.8	-	-
Late Ceramic B						
Sugar Mill	Long Island	0	59	37.8	43	40.2
Kelbey's Ridge 2	Saba	166	16	59.3	16	59.3

Table 6.12. Long Island flint flakes: Amount (N) and percentage (%) of complete flakes by site, and by size class. “flakes >14” represents all artefacts with maximum dimension and width both larger than 14 mm and “flakes >19” both larger than 19 mm.

Discussion and concluding remarks

In the previous sections it was shown, that Long Island material was transported in unmodified form based on the cortex count data. In particular, the larger samples from a number of settlement sites provide good support for this interpretation. The fall-off analysis suggests that most of these larger samples (Morel, Trants, and Golden Rock) are situated on islands, that are located within the supply zone of the Long Island flint source. These results correlate well with the data at the Long Island flint source itself, which indicate that during the Ceramic Age systematic pre-working of cores at the source did not

Site	Anse à la Gourde middle	Trants	Jumby Bay	Sugar Mill	Golden Rock	Spring Bay 3	Kelbey's Ridge 1	Kelbey's Ridge 2	Sandy Ground	Barnes Bay
All complete flakes	N=16	N=135	N=192	N=70	N=121	N=34	N=19	N=29	N=14	N=9
Scar count	%	%	%	%	%	%	%	%	%	%
0	-	0.7	5.2	11.4	3.3	-	5.3	3.4	7.1	-
1	6.3	14.1	16.1	25.7	14.0	8.8	10.5	13.8	-	11.1
2	31.3	30.4	24.5	27.1	17.4	29.4	26.3	13.8	50.0	11.1
3	18.8	30.4	27.1	12.9	28.1	26.5	36.8	34.5	28.6	22.2
4	12.5	16.3	13.5	8.6	18.2	17.6	21.0	31.0	7.1	22.2
5	18.8	5.2	8.3	8.6	10.7	11.8	-	-	7.1	11.1
≥6	12.5	3.0	5.2	5.7	8.3	5.9	-	3.4	-	22.2
total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Complete flakes > 14x14	sample too small	N=72	N=164	N=65	mesh too coarse	N=19	sample too small	N=18	sample too small	sample too small
Scar count	%	%	%	%	%	%	%	%	%	%
0	-	1.4	6.1	10.8	-	-	-	-	-	-
1	-	13.9	18.3	26.2	-	10.5	-	16.7	-	-
2	-	23.6	24.4	26.2	-	21.1	-	11.1	-	-
3	-	27.8	22.6	12.3	-	26.3	-	38.9	-	-
4	-	22.2	12.8	9.2	-	15.8	-	27.8	-	-
5	-	5.6	9.8	9.2	-	21.1	-	-	-	-
≥6	-	5.6	6.1	6.1	-	5.3	-	5.3	-	-
total	-	100.0	100.0	100.0	-	100.0	-	100.0	-	-
Complete flakes > 19x19	sample too small	N=37	N=121	N=49	N=79	sample too small	sample too small	sample too small	sample too small	sample too small
Scar count	%	%	%	%	%	%	%	%	%	%
0	-	-	6.6	10.2	5.1	-	-	-	-	-
1	-	8.1	18.2	28.6	13.9	-	-	-	-	-
2	-	18.9	19.0	22.4	13.9	-	-	-	-	-
3	-	27.0	22.3	10.2	24.1	-	-	-	-	-
4	-	32.4	14.9	12.2	24.1	-	-	-	-	-
5	-	8.1	12.4	10.2	11.4	-	-	-	-	-
≥6	-	5.4	6.6	12.2	7.6	-	-	-	-	-
total	-	100.0	100.0	100.0	100.0	-	-	-	-	-

Table 6.13. Long Island flint flakes: Percentage of complete flakes by site and by scar count, tabulated for different size classes.

occur. So, people were visiting the source and collected cobbles, then, which they immediately transported to their villages (unlike the evidence for Preceramic Age use of Long Island).

The Ceramic Age supply zone basically can be positioned in the Saba – (northern) Guadeloupe area for all of the different phases. This zone is only more restricted to the Nevis – (northern) Guadeloupe area during the earliest phase, the Early Ceramic A. This more restricted zone must be largely ascribed to a lower site density within the northern Lesser Antilles, with small islands such as Saba and St. Eustatius being uninhabited at this time.

Outside this zone the number of Long Island artefacts becomes low, hindering clear insight into on-site reduction. Only the Anse des Pères and the Sandy Ground sites produced relatively large samples, and cortex data for these sites also suggest the arrival of unmodified material. As these sites were beyond the supply zone, this suggests that unmodified material was not only collected by people having direct access to the source in these cases, but that they exchanged it with neighbouring communities.

On the other hand, the technological analysis of samples from the Cocoyer (Marie Galante) and Barnes Bay (Anguilla) sites shows that the percentage of cortical flakes is lower and cores are absent. This either suggests the arrival of flakes or the transport of fully worked cores, which were reduced at the site and transported or exchanged further on. A similar situation exists for the Spring Bay 3 site on Saba as well. Considering the short-term occupation at this site (Hoogland 1996), the second possibility of carrying cores to this campsite, producing flakes when needed, and taking what was left of the core to a new site, is plausible. Many of the samples from the more distant sites are too small to discriminate between the arrival of unworked or pre-worked material. In many cases local reduction could be identified, suggesting that cores, rather than finished flake tools were entering, the settlements.

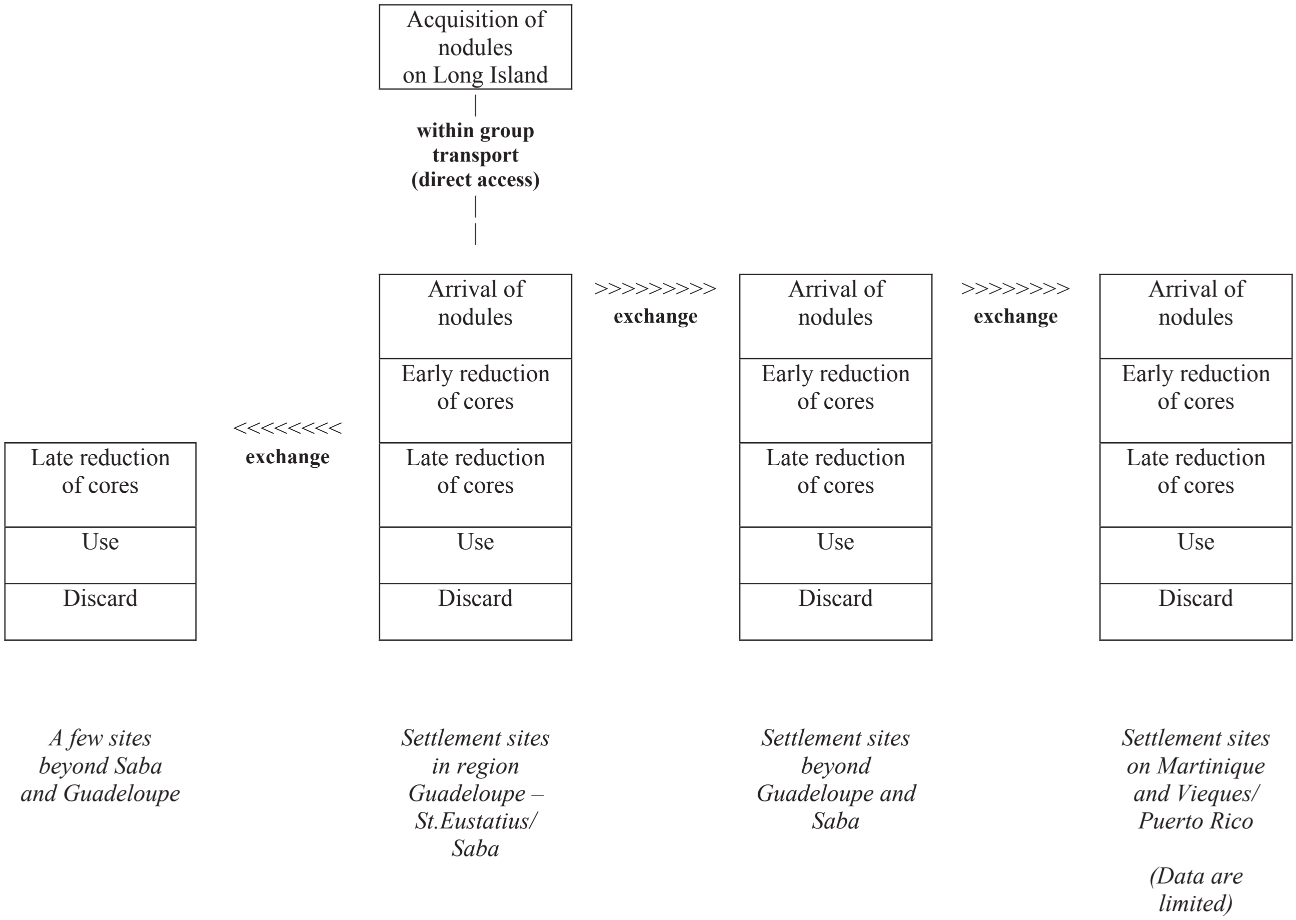

Figure 6.8. Long Island flint reduction, transport and exchange sequence during the Ceramic Age.

The Early Ceramic A and B phases produced the strongest evidence of direct procurement by communities within the supply zone. The later two Late Ceramic phases yielded clear evidence of settlement activities on Long Island itself, likely of a short-term nature. These occupation activities suggest more direct control over the Long Island flint source by communities inhabiting the northern region of Antigua. This means that direct procurement by other villages situated in the supply zone might have been prohibited then, and that these villages needed to exchange with the controlling community. Although this more limited access to the Long Island flint is not clearly visible in raw material abundances at sites within the supply zone, the generally higher efficiency ratios when compared to the Early Ceramic B phase (Golden Rock and Kelbey's Ridge 1) and reduced distribution beyond the supply zone may have been a result.

In particular, during the Early Ceramic phases the exponential decrease of Long Island flint abundance beyond the supply zone strongly supports a down-the-line-mode of exchange. During these phases, the area of distribution included the island of Puerto Rico to the west and the island of Martinique to the south. The later two Late Ceramic phases exhibit a more restricted distribution, flint not being exchanged beyond the Anegada Passage in the west and not reaching Martinique any more in the south.

Returning to the models as outlined by de Grooth (1991, 170-1 fig.9-10; see Chapter 3), the Long Island flint reduction, transport, and exchange trajectory corresponds with model D1 in general (figure 6.8). Flint knappers living in villages within the supply zone visited the Long Island flint source where they collected raw flint nodules (Early Ceramic Age) or had direct contact with the community controlling the source (Late Ceramic Age). They reduced some of the unmodified nodules for their own purposes there and exchanged the remainder with neighbouring villages. In some instance, such as Cocoyer, model D2 better describes the situation. Pre-worked material was probably exchanged, instead of non-modified material. In case of Spring Bay 3, model F0 may be an option as well. Considering the short-term occupation of the site, the transport of pre-worked material may not have involved exchange, but can be explained by the movement of the same people to different sites, where they stayed for temporary periods.

6.2.2 St. Martin greenstone

Introduction

A second widely used and distributed material within the northern Lesser Antilles and beyond is a fine-grained, grey-green mudstone originating from St. Martin. As discussed in Chapter 2 this material can be found in the bedded geological deposits belonging to the Point Blanche Formation. Outcrops are numerous on the island, and still need to be investigated in detail. It has become clear from two inspected rock sections that the bedded sequence consists of many layers, often not exceeding 20 cm in thickness. These layers exhibit a wide variety of rock types, from true igneous rock to almost pure sediments with a minor volcano-clastic component. From these different varieties the Amerindian inhabitants chose specific fine-grained ones, generally grey-green in colour, which produced a conchoidal fracture similar to cherts and flints. In essence, these varieties are made up by a fine-grained matrix, in which a mixture of re-crystallised material with mud occurs, consisting of fine carbonate and clay minerals.

Within this fine-grained group some variation exists, however, as the petrological analysis of eight artefacts in this study pointed out. This variation mainly relates to the occurrence of igneous minerals and the amount of mud versus re-crystallised material. It became also evident that true igneous rock was not present among the analysed samples.

Despite this minor internal variation, this rock can easily be recognised and distinguished as a result of a very characteristic weathering, which turns the outer texture into calcite, giving the rock a chalky and corroded appearance. Very wet conditions can remove this outer surface, thereby exposing non-weathered grey-green rock again. Furthermore, in some cases the rock material that was flaked consisted of layers that exhibited differentiated weathering, leaving parts less weathered or non-weathered, still preserving some of its original texture. The presence of this characteristic carbonate corroded outer surface distinguishes this rock type from other stone materials encountered among artefact samples from Pre-Columbian sites in the region. It must be specifically related to a chemical alteration of this grey-green rock, and is not the result of some general process in Caribbean soils through which carbonate is precipitated on rocks, which is common in some cases (Gardner *et al.* 2001).

Before proceeding to presentation and discussion of the distribution of this particular material, several points need to be first specified. In this work I ascribe the use of this mudstone material mainly to the Amerindian manufacture of axes, although there are indications that it was occasionally used for other purposes. In particular, this accounts for the sites where axe production was identified. These sites exhibit more variability among core artefacts. For example, the Anse des Pères site has yielded one possible pestle and a few round artefacts, that exhibit used faces, in addition to many axe preforms and axe fragments (Knippenberg 1999c, 99 fig. 8.8h,i,j).[8] Although the rounded artefacts in particular point to differential use of the material, the high number of axe related core artefacts clearly indicates that the making of axes was the central purpose behind modifying this particular material. Furthermore, the distribution of axes, restricted only to the surrounding islands, shows that this stone type was primarily valued as a raw material for making these tools, and that the other core tools were only formed in rare exceptions.

Considering the cherty nature of this rock type, making it easy to produce sharp edges, it is theoretically possible that specific flakes within the debitage were used as tools for cutting or scraping, thereby operating as alternatives for flint and other fine-grained siliceous rocks. All available evidence so far, however, suggests that this was not the case. In the first place greenstone debitage is technologically and morphologically different from the flint and other flake tool related samples of debitage. For example, reduction of mudstone flakes to obtain smaller flake did not occur, as well as edge modification on flakes. This suggests that it did not function as a useful alternative to the true flake tool related materials and that, if used, it might have only been utilized to perform a restricted set of tasks, which were usually executed using these other lithic flake tools. In the second place, use-wear has not been identified on any of the non-weathered flakes. However, it should be

[8] It should be noted that apart from its general function as woodworking tool, many examples of axes have been found that were re-used as hammer-stones or active abrading stones, similar to the utilization of water-worn pebbles.

remembered that most of the samples have undergone significant degrees of alteration, making it impossible to identify traces of use-wear. Considering these issues it is assumed that St. Martin greenstone was not used as raw material for producing flake tools and was instead solely used to manufacture axes. Given the limited data that can be obtained from the use-wear analysis of this material, future work should focus on more experimental studies. These studies should help clarify whether this material is suitable for producing flake tools, anyway. The high carbonate content, as shown by the chemical analyses (see Chapter 2), casts serious doubts about whether this material can be used as an efficient material for cutting or scraping purposes.

A considerable draw back related to the study of this material is the absence of knowledge about exploitation sites and related reduction strategies at the source. Contrary to the Long Island flint, for which the actual source has been identified, such specific location(s) is (are) still unknown for the greenstone. As already mentioned, the Pointe Blanche Formation surfaces at different places on St. Martin (see figure 2.30). Good exposures can be found at Little Bay, Point Blanche, Devils Cupper, and Cole Bay, but it is likely that the material can be obtained elsewhere on St. Martin as well. However, two past field-surveys on the St. Martin (Haviser 1988; Stouvenot 1999) have not located any exploitation sites. This may be the result of either incomplete coverage of the island during these surveys[9], or it may suggest an absence of reduction at the exploitation sites, similar to the absence of exploitation debris at Long Island dated to the Ceramic Age (see Chapter 4).

At present, the evidence of greenstone production at settlement sites suggests that they represent the primary places of lithic reduction for this material, considering the recovery of high amounts of debitage at these habitation places. If working at the source occurred, it would have involved only minor pre-working at most, likely related to reducing large blocks to sizeable and transportable pieces.

The limited number of non-weathered artefacts bearing outer surface reveals that secondary material was collected from inland surfaces, as well as local beaches. A more detailed statistical analysis using cortex count as an indicator for the state of reduction at the particular places is impeded by the weathered nature of the artefacts and the less clear formation of typical cortical surfaces, compared to flints, for example. This makes identification of original outer cortical surfaces and counting of its coverage less reliable.

One of the other most striking features of this material is its total absence in any Preceramic Age contexts. Archaeological work at the Norman Estate site on St. Martin did not produce any of this greenstone among a sample of over 250 Preceramic Age artefacts (Knippenberg 1999d), whereas at the Ceramic Age sites on the island, such as Hope Estate and Anse des Pères, this material accounts for around 50% of the total assemblage (Haviser 1999; Knippenberg 1999c). This may relate to the fact that during Ceramic Age times this grey-green rock was exclusively used for making axes, while stone axes during the Preceramic Age are rare, as shell was mainly used to make this type of tool (Brokke 1999b). Furthermore, the reported Preceramic Age stone axes, all made of igneous rock varieties, are in sharp contrast to the Ceramic Age petaloid celts, both in shape and size (Barbotin 1973a, b; Harris 1983). Therefore, scholars doubt whether these actually functioned as tools, considering their large sizes and blunt edges.

Another characteristic, that may explain greenstone occurrence solely within Ceramic Age contexts, relates to its green colour. For example, Boomert (1987) pointed out that the colour green played a special role in the cosmology of horticulturalists in the Amazon, as it was associated with female fertility. This importance was expressed in the making of pendants out of dense green rock, commonly encountered among the indigenous cultures of the Amazon. It is also known from Caribbean archaeological contexts dating to the Ceramic Age, where they are a recurrent feature (Cody 1991, 1993; Haviser 1999; Watters & Scaglion 1994). Although Boomert does not pay particular attention to the use of green rock as raw material for making axes, its frequent occurrence among Ceramic Age archaeological assemblages in the Antilles is striking (Roobol & Lee 1976; see Chapter 5), and thus suggests a very deliberate choice. In this respect, the association of axes as the primary tool used to clear agricultural fields, women being the most important persons working these fields, and the fields' "fertility" being of crucial importance to the community, may have been of significance.[10] If this had been the case, it may also explain the absence of greenstone axes during the Preceramic Age, when agriculture did not play a role, since the people

[9] Haviser (1998) explicitly stated in his survey report that he field-walked areas that would be suitable for habitation, thereby neglecting other types of behaviour such as, for example, exploitation of stone sources. Despite this bias, he surveyed the Little Bay area, a likely place of greenstone exploitation as it is one of the good exposures of this material. He did not find any greenstone workshop sites, there. Stouvenot (1999), working for the French Government, only incorporated the French part of the island in his survey.

[10] Crock (2000) hypothesizes that the petaloid celts may have functioned as digging implements as well, like hoes.

were nomadic foragers at the time.

We can further elaborate on the notion that the appearance of this type of rock had been of importance by incorporating the process of weathering as well. This distinguishes this stone from other greenstone varieties in the region. The relatively fast rate[11] needed to turn it into a crumbly, chalky material makes it very likely that the indigenous peoples were familiar with the weathering process. In this respect, this change may have somehow given the material and the objects made of it additional value, as they might be viewed as “living” objects. Starting as “fertile” green specimens they eventually turn into “old” or “dead” corroded-crumbly rock. As such, they can be considered a metaphor of life. The corrosion in this respect is potentially very meaningful to its users. Hoogland (personal communication 2002) pointed out that within the cosmology of the Amerindians of the Greater Antilles the distinction between a dead but not decayed body and a decayed body is very significant, since the decay represents the departing of the dead person’s spirit from the body, and therefore signifies the departure of this person from the world of the living and the entering into the world of the spirits. In this respect, the recovery of an intentionally deposited pelican decorated vessel on La Désirade containing two corroded axes (De Waal 2006; Hofman *et al.* 2004, 177 fig. 12) may support this relation between greenstone weathering and ideological significance.

In the following sections, the production and distribution of this material will be discussed for four consecutive phases, as was done for the Long Island flint. Unlike chert and flint materials used for making flake tools, the greenstone in many cases is very rare, biasing results when small sample sizes are represented. In many cases, therefore, its absence among analysed samples does not necessarily indicate absence of greenstone usage at that specific site. To partly overcome this sample problem, I collected data from other lithic samples I did not analyse myself.[12] This enabled me to acquire a broader knowledge about the use of this material within different micro-regions in the study area. Considering this sample-size bias, I have not included fall-off analysis in this case, nor any comparison of size dimensions in the discussion of its distribution.

Transport and reduction sequence

Production

In case of the greenstone, inter-site comparison of material reduction sequences has produced much more clear-cut results than was found for the Long Island flint. In contrast to the Long Island flake tool material, the greenstone from St. Martin, was only worked at a restricted number of sites situated in settings near the source. Table 6.14 (see also figures 6.9-6.12) lists all of the sites, that yielded greenstone production remains. In general, such remains consist of large quantities of flakes, preforms, numerous unidentifiable core fragments, and fragments of axes, both the edges as well as the butts.[13]

The large size of the unidentifiable fragment category is a very characteristic feature of this production. In most cases, these pieces are relatively large fragments that were removed or broken from preforms, in different stages of the reduction sequence. Unlike biface and axe production sequences reported from other parts in the world, greenstone reduction seemed to follow a less standardized sequence (see Jones 1984 for a comparable example). From the analysis of preforms, the reduction in many cases only involved a few bifacial flake removals after it was reduced to a preferred size. In some cases, large flakes were also used to manufacture axes, resembling a case reported for New Guinea adze making (Jones 1984). To what degree raw material size influenced the size of the final tools cannot be answered with certainty yet due to the fact that exploited outcrops and the system of quarrying are unknown. Chauviere (1998) notes in his report on the lithic material from Hope Estate that this raw material probably included small blocks. Inspected parts of the Pointe Blanche Formation revealed that greenstone beds occur in varying sizes, and therefore the possibility exists that larger blocks were obtained as well. This would not restrict tool size if primary outcrops were quarried. In case of exploitation of secondary surface scatters, the size of cobbles might well have been more restricted.

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11 François Petit, local citizen of St. Martin, directed a stone quarry company, that exploited parts of the Pointe Blanche Formation at Hope Hill. During the 1993 research on St. Martin, he told a team from Leiden University, working at Hope Estate and other sites, that certain beds within this formation were unsuitable as construction material because of its inclination to weather. He saw house walls, where this material was used that began to crumble due to its expansion within a few years after construction.

12 For this purpose, the reports and theses relating to archaeological research on St. Martin and Anguilla were consulted, as they pay particular attention to this rock type (Crock 1999, 2000; Crock & Petersen 1999; Haviser 1987, 1988, 1991, 1993, 1999). Furthermore, I acquired information from colleagues who are familiar with the material. Reniel Rodríguez Ramos provided me with data from the following sites on Puerto Rico: La Mina, Paso del Indio, La Hueca, and Punta Candelero (see for latter two sites also Rodríguez Ramos 2001). Christy De Mille informed me about Elliot’s on Antigua and Mark Nokkert informed me about the Coconut Walk and Hichman’s sites on Nevis.

13 The refuse context from which most studied lithic samples originates is clearly evidenced by the absence of complete axes.

Site	Island	Distance to St. Martin	Chronometric date	Greenstone
Early Ceramic A				
Hope Estate	St. Martin	0 km	cal 400 – 50 BC (early)	production
			cal AD 255 – 650 (late)	production
Early Ceramic B				
Anse des Pères	St. Martin	0 km	cal AD 750 – 950	production
Rendezvous Bay	Anguilla	9 km	AD 400 – 950	production(?)
Sandy Ground	Anguilla	10 km	cal AD 650 – 1035	production
Golden Rock	St. Eustaius	55 km	cal AD 450 – 850	production
Kelbey' Ridge 1	Saba	44 km	cal AD 655 – 880	possible production
Sugar Factory Pier	St. Kitts	85 km	no chronometric dates	possible production
Late Ceramic A				
Cupecoy Bay	St. Martin	1 km	aprox. AD 1100 – 1300	production
Rendezvous Bay	Anguilla	9 km	AD 400 – 950	production
Sandy Ground	Anguilla	10 km	cal AD 650 – 1035	production
Barnes Bay	Anguilla	11 km	cal AD 775 – 1295	production
Sandy Hill	Anguilla	10 km	cal AD 1000 – 1350	production
Godet	St. Eustaius	62 km	no chronometric dates	production
Smoke Alley	St. Eustaius	62 km	cal AD 1000 – 1160	production
Spring Bay 3	Saba	44 km	cal AD 1000 – 1200	possible production
Late Ceramic B				
Shoal Bay East	Anguilla	14 km	cal AD 1005 – 1640	production
Kelbey's Ridge 2	Saba	44 km	cal AD 1285 – 1400	possible production

Table 6.14. Greenstone axe production sites by period by island.

Diachronic changes are present with regard to the places where production took place (table 6.14). Furthermore, the number of production sites increased significantly from the Early Ceramic B phase onwards. During the Early Ceramic A phase, the only site that yielded clear evidence of production is Hope Estate, situated in the inner part of the island of St. Martin. The production debris and related products form a very significant part of the total lithic artefact inventory. About axe production, Haviser clearly points out that the subsequent stages of the reduction sequence from initial block reduction to final tool finishing all occurred at the site (Haviser 1999; see Chauviere 1998). Therefore, he thinks that this material probably arrived in an un-worked, natural state at Hope Estate, and probably originated somewhere from within or near the site surroundings, as the Pointe Blanche Formation is the underlying bedrock formation in this part of St. Martin. Apart from Hope Estate, no other sites with remains of greenstone production are reported for this early phase. Most of the islands surrounding St. Martin such as Anguilla, St. Eustatius, and Saba were not populated during this early portion of the Ceramic Age, and one of the nearest sites known, Hichman's on Nevis, only yielded finished products.

This localized production region extends itself during the later Early Ceramic B phase. Production has been identified for this phase at Anse des Pères (St. Martin), Golden Rock (St. Eustatius), the early phases of occupation at Sandy Ground and Rendezvous Bay (Anguilla) (Crock & Petersen 1999), and Sugar Factory Pier (St. Kitts) (Walker 1980). In particular, the first two sites produced a significant amount of debris. Different stages of the production sequence, from initially worked preforms to finished items, are represented at these sites. Unworked material, however, is lacking. This does not necessarily suggest that pre-worked material arrived at these sites. Considering the distance of St. Eustatius from St. Martin, some effort was needed to obtain the material, making it likely that material arriving at the site would be as fully used. Some material still possessed outer surface cortex remains, which was worn to some degree, suggesting exploitation of secondary surface scatters. These scatters were probably not situated in the vicinity of streambeds or beaches because water-worn surfaces are scarce.

For the Anguilla sites, the identification of axe production in the Early Ceramic B is only based on artefacts associated with the early occupation deposits of the Sandy Ground site (Crock 2000; Chapter 5). For Rendezvous Bay such an association is not reported, but the common occurrence of greenstone at this site (Crock & Petersen 1999), nonetheless, makes it likely that it was utilized throughout the entire site occupation. In case of Sugar Factory Pier, Walker (1980), at that time not familiar with the source on St. Martin, mentions the occurrence of flakes, core fragments, and axe parts made of a

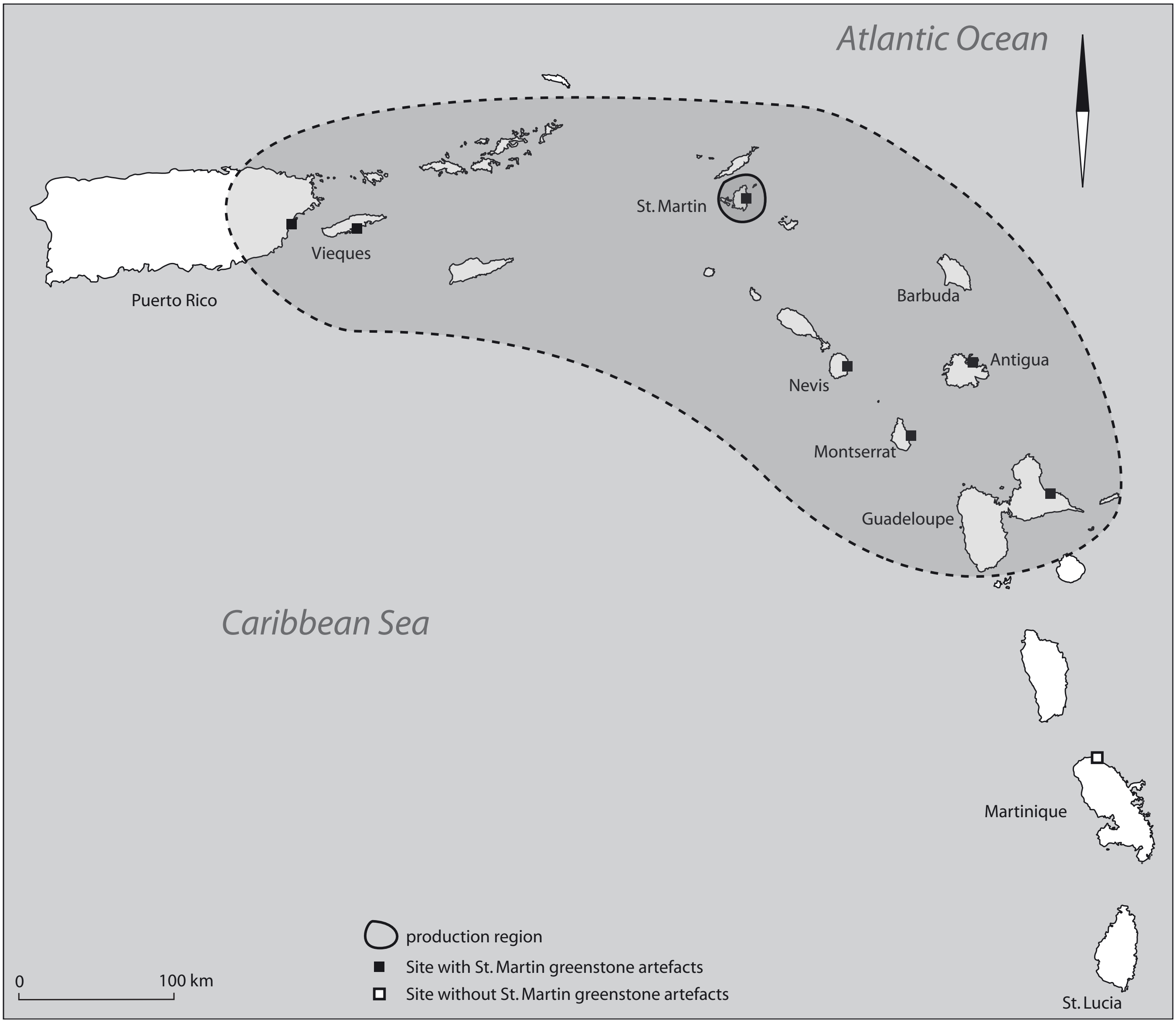

Figure 6.9. Distribution of St. Martin greenstone axes and the location of the production area during the Early Ceramic A phase (400 BC – AD 400).

corroded greenstone. Walker concluded that axes were produced at Sugar Factory Pier made of this corroded stone, although it is not clear for every artefact whether it actually is the greenstone from St. Martin. From his descriptive data, the flake to core ratio appears to be lower than among the Anse des Pères and Golden Rock sites, suggesting that already reduced material entered this site.

Considering the significant numbers of artefacts found at sites within this region, communities on the islands surrounding St. Martin must have had direct access to natural occurrences of the greenstone. People originating from various directions probably exploited different outcrops, since material can be found on many parts of the island.

With the advent of the first post-Saladoid pottery styles, the island of Anguilla, in particular, displayed a marked increase in the number and size of settlement sites (Crock 2000). The available evidence thus far suggests that the inferred population increase predominantly occurred on the island of Anguilla within the near micro-region, and apparently relates to a change in

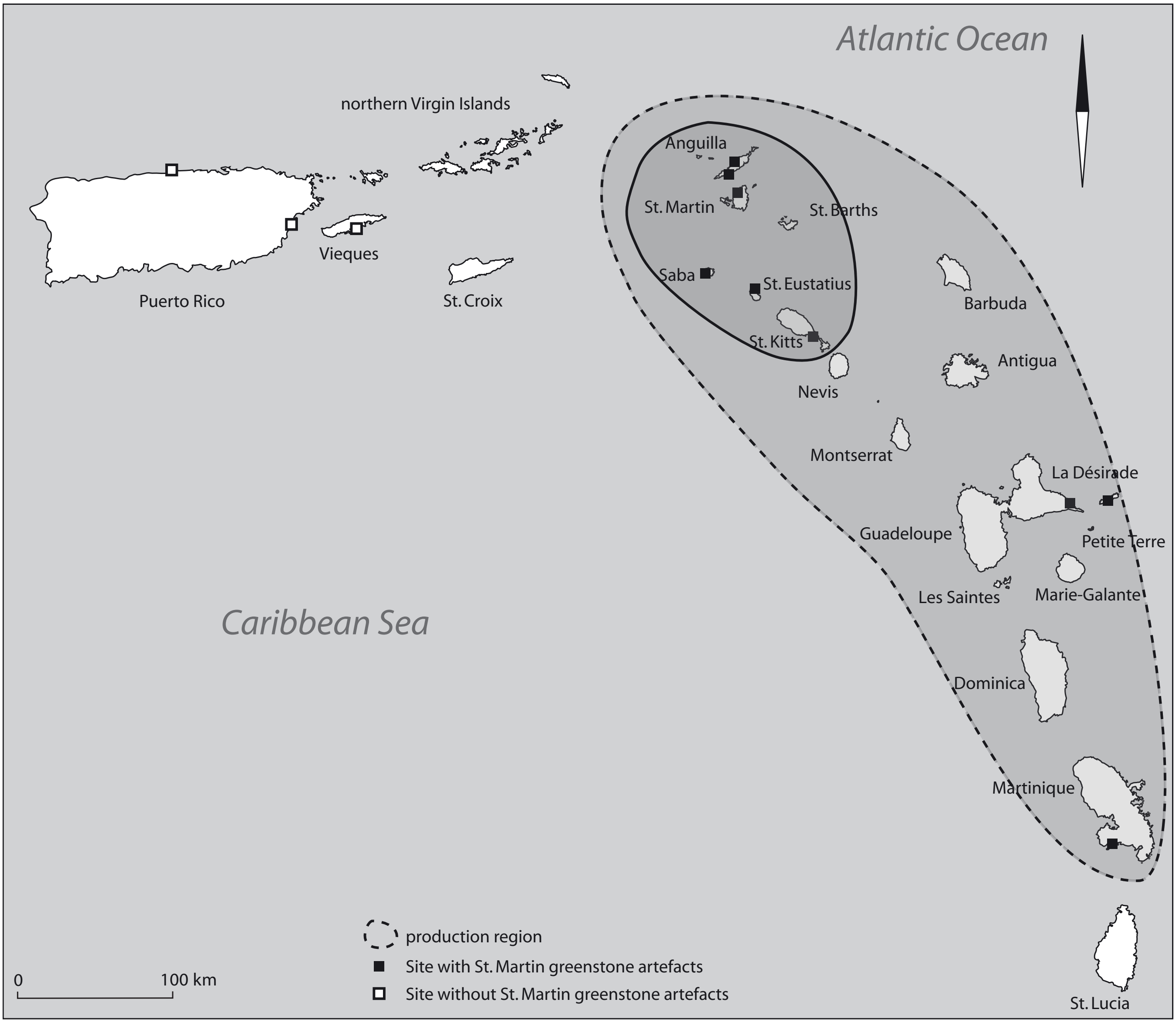

Figure 6.10. Distribution of St. Martin greenstone axes and the location of the production area during the Early Ceramic B phase (AD 400 - 850).

habitation preference towards the low lying carbonate islands. Although habitation sites are still reported on St. Martin, their sizes and probably their number are smaller than on Anguilla (Crock 2000; Haviser 1988, 1991; Stouvenot 1999). Without exception, all reported sites on both islands from this phase yielded production remains of greenstone material (Crock & Petersen 1999; Haviser 1988), clearly pointing to an overall increase in local greenstone axe manufacture. The common occurrence on Anguilla shows that the communities living there had easy and unrestricted access to the sources. Limited data from the Godet and Smoke Alley sites on St. Eustatius and Spring Bay 1b on Saba indicate that the region where axes were being produced incorporated these islands as well. Compared to Golden Rock, however, Godet and Smoke Alley yielded a lower flake to core artefact ratio, and this may suggest that pre-worked material arrived there. The recovery of exclusively finished items at Coconut Walk on Nevis indicates that this island was not included within the area of production. Unfortunately, data from St. Kitts are absent. This latter island probably fell outside the production region as well, if notion is taken of the data from St. Eustatius, that suggest that access became more limited.

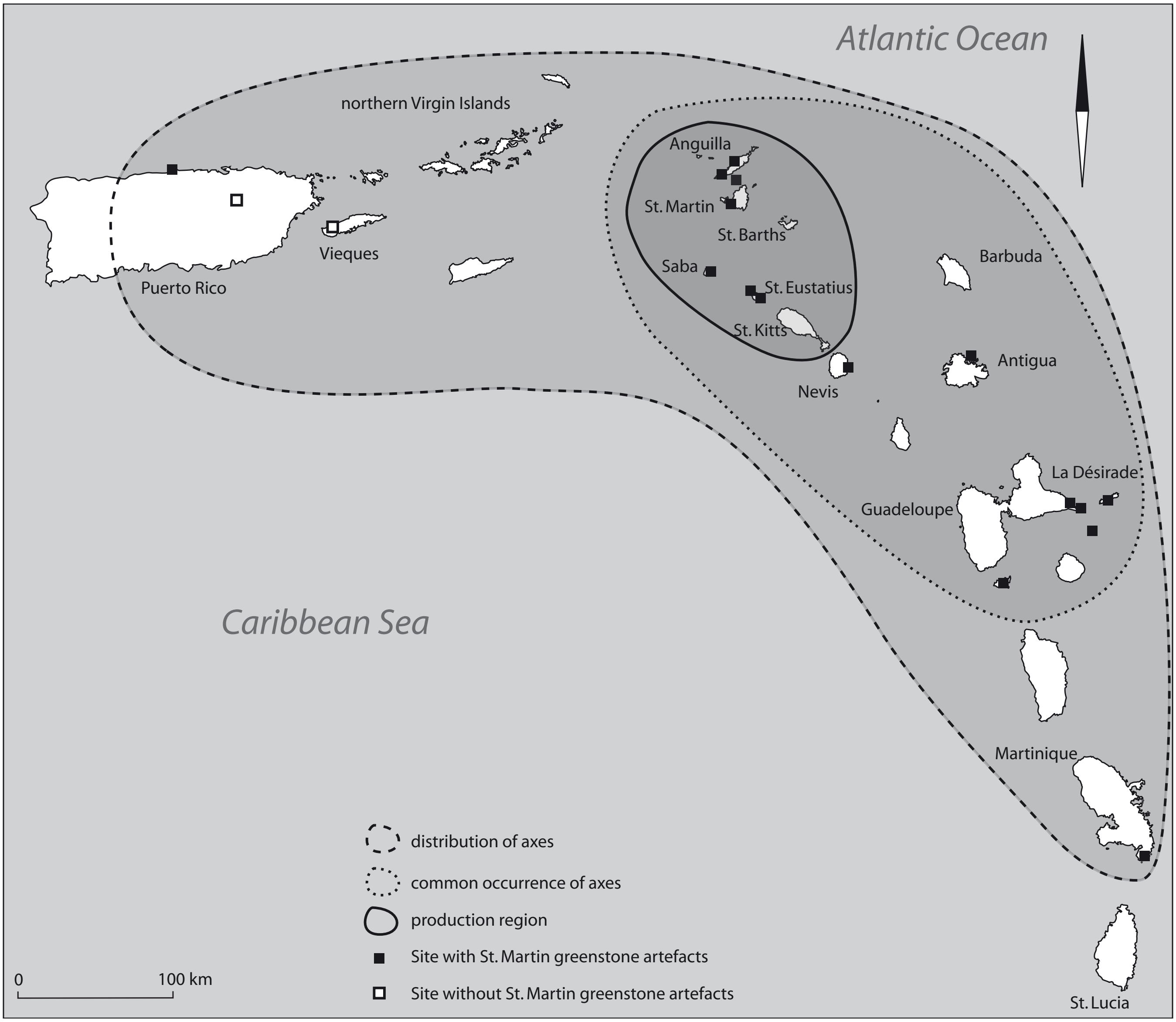

Figure 6.11. Distribution of St. Martin greenstone axes and the location of the production area during the Late Ceramic A phase (AD 850 - 1250).

During the latest phase of Pre-Columbian occupation, Anguilla remained a central place for greenstone celt production. For example, late occupation at Shoal Bay East yielded relatively high amounts of production debris. On St. Martin, the Baie Rouge site yielded late greenstone production as well. Unfortunately, late data on greenstone production from the surrounding islands are not presently available.

Distribution

The sites mentioned above markedly differ from the many sites found in the broader region with respect to the abundance of greenstone material and type of artefacts present. In contrast to the "production" sites, the other sites are characterised by an absence of material that can be associated with manufacture such as flakes, preforms, and unidentifiable core fragments so commonly encountered in the fabrication centres. These other sites only yielded complete ground axes, fragments of ground

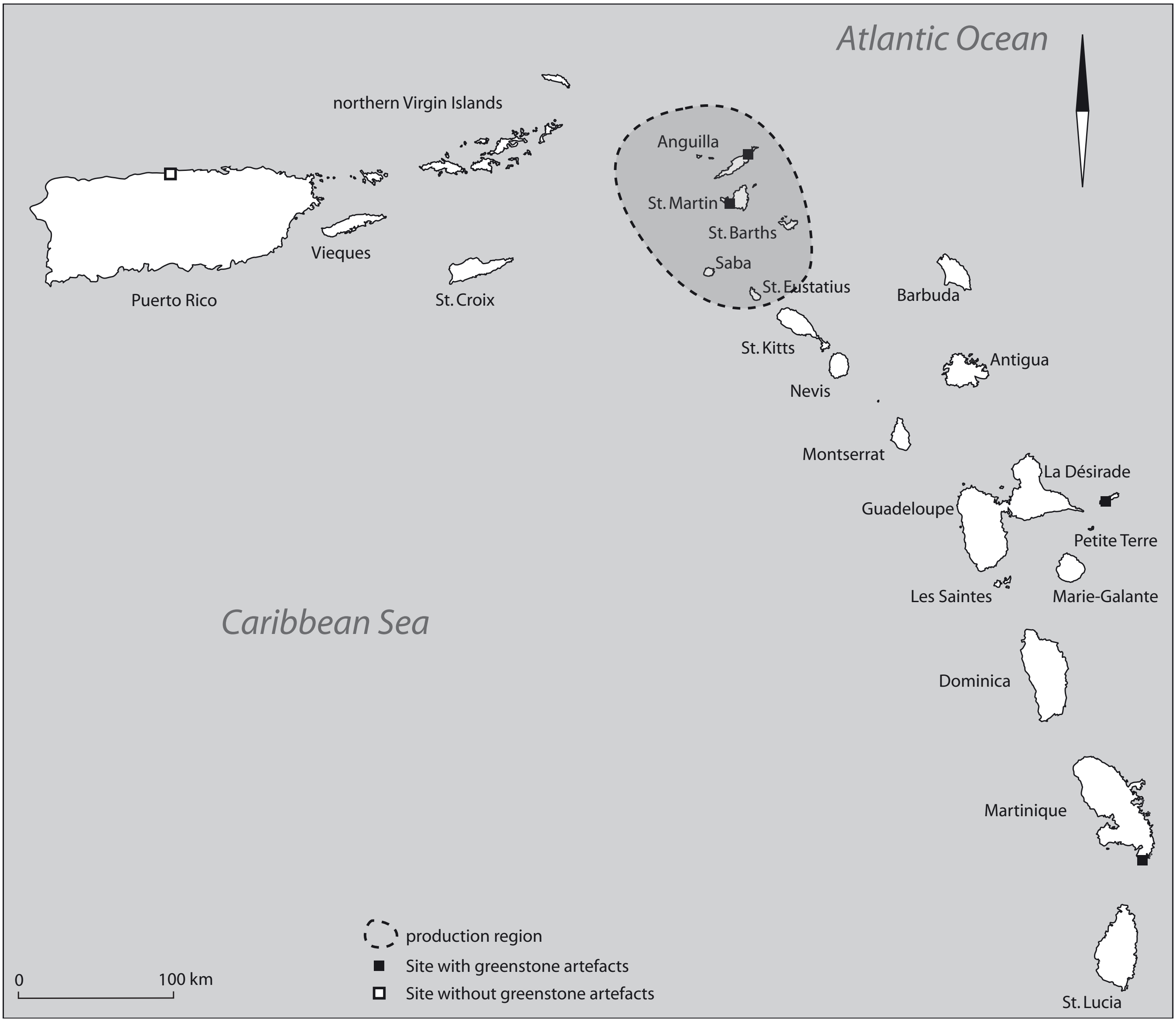

Figure 6.12. Distribution of St. Martin greenstone axes and the location of the production area during the Late Ceramic B phase (AD 1250 - 1492).

ones, or edge flakes. In some cases a very small number of other flakes was encountered as well, e.g. at Trants. These flakes do not point to actual manufacture, but rather should be related to intensive use (accidental spalls) and possible re-sharpening of axes on site, as they often exhibit ground dorsal surfaces. This absence of production related debitage indicates that the greenstone material arrived at these sites in the form of finished axes.

In theory the arrival of flaked preforms, that only needed to be ground may be considered an option as well. In the New Guinea Highlands, for example, axe preforms were commonly being exchanged (Burton 1984, 1989). The extensive evidence of production at settlement sites surrounding the source, where axes were being fully finished, combined with the absence of data on production activities at the sources itself, indicate that the production centres are the only likely candidates from which finished greenstone core tools were obtained. This variability in production and import of finished products, points to the existence of exchange relationships, in contrast to the Long Island flint material for which this is more difficult to prove.

Site	Island	Distance to St. Martin	Chronometric date	Greenstone
Early Ceramic A				
Punta Candelero	Puerto Rico	284 km	cal 100 BC – AD 50	finished items
La Hueca	Vieques	245 km	cal AD 0 – 400	finished items
Sorcé	Vieques	245 km	cal AD 136 – 650	finished items
Hichman’s	Nevis	110 km	cal 5 BC – AD 635	possibly finished items only
Elliots	Antigua	175 km	no chronometric dates	finished items
Trants	Montserrat	167 km	500 cal BC – cal AD 400	finished items (?)
Morel	Guadeloupe	260 km	100 cal BC – cal AD 200	finished items
Cocoyer	Marie-Galante	293 km	no chronometric dates	absent
Vivé	Martinique	406 km	cal AD 144 – 440	absent
Early Ceramic B				
Paso del Indio	Puerto Rico	318 km	AD 570 – 640	absent
Punta Candelero	Puerto Rico	284 km	cal AD 700 – 950	absent
Anse à l’Eau	Guadeloupe	267 km	no chronometric dates	absent
Anse à la Gourde	Guadeloupe	273 km	approx. AD 200 – 600	finished items
Les Sables	La Désirade	282 km	no chronometric dates	finished item
Diamant	Martinique	460 km	cal AD 415 – 725	finished item
Late Ceramic A				
Paso del Indio	Puerto Rico	318 km	cal AD 880 – 1385	finished item
Jumby Bay	Long Island	166 km	cal AD 1050 – 1250	finished item
Muddy Bay	Antigua	173 km	cal AD 1000 – 1300	absent
Anse à l’Eau	Guadeloupe	267 km	no chronometric dates	finished item
Anse à la Gourde	Guadeloupe	273 km	approx AD 1000-1200	finished items (many)
Escalier	La Désirade	281 km	cal AD 1049 – 1243	finished item
Du Phare	Petite Terre	287 km	no chronometric dates	finished item
Grande Anse	Les Saintes	281 km	cal AD 1158 – 1278	finished items
Anse Trabaud	Martinique	465 km	no chronometric dates	finished items
Late Ceramic B				
Paso del Indio	Puerto Rico	318 km	approx. AD 1385 – 1500	absent
Sugar Mill	Long Island	166 km	cal AD 1300 – 1400	absent
Morne Souffleur	La Désirade	166 km	no chronometric dates	finished item
Anse Trabaud	Martinique	465 km	no chronometric dates	finished items

Table 6.15. Greenstone axe distribution by period by site by island.

Comparing the distribution of axes by phase reveals subtle changes over time. Within the Early Ceramic A phase, a number of sites yielded at least one or more finished items (table 6.15; figure 6.9). They include sites on Puerto Rico and Vieques such as Punta Candelero, La Hueca, and Sorcé on the western end, and sites on Nevis (Hichman’s), Antigua (Elliots) and northern Guadeloupe (Morel) on the eastern side. Only the Hope Estate site functioned as a production centre at this time. This community on St. Martin may have had direct relationships with those on the Virgin Islands for which no data are available yet, and perhaps even Vieques on the eastern part of Puerto Rico, considering the low site density during this phase, with many other islands left uninhabited. This may have been the case with Hichman’s on Nevis, for example. The results from the lithic analysis of the Puerto Rican and Vieques sites indicate that this material is relatively common when compared to other axe related lithic materials.

During the following phase the distribution changed and became more oriented toward the southeast (table 6.15; figure 6.10). Material has not been reported within the later occupation phase of the Punta Candelero site on Puerto Rico. Also, the Paso del Indio site, along the central north coast of Puerto Rico did not yield any relevant artefacts. Apart from the sites mentioned here where the Early Ceramic B occupation phase can be separated from other occupations, other sites such as La Mina and Martineau where such distinction is more difficult to make, did not yield greenstone either (Rodríguez Ramos, personal communication 2002). This strengthens the notion that during this phase the inhabitants of Puerto Rico and Vieques, and possibly the Virgin Islands as well, did not have or only rarely had access to these greenstone tools. The difference is especially striking in relation to its common occurrence in the earlier phase of the Punta Candelero site and the La Hueca/ Sorcé locality.

On the other end, a small axe from Diamant is the oldest greenstone find on Martinique. As it is the only artefact made of this material from this phase, future research focussing on both phases of the Early Ceramic Age should make clear whether this marks a significant and structural change with the earlier phase, rather than being a rare occasion in which a single item made it all the way to this southern site. Closer to the source, on Guadeloupe there is no uncertainty regarding the presence of this material, since it was found both at Anse á la Gourde (Grande Terre) and Les Sables (La Désirade).

The Late Ceramic A phase, marking the advent of more localized post-Saladoid pottery styles, displays a more common occurrence of such axes within the Anguilla-Guadeloupe area (table 6.15; figure 6.11). Greenstone axes have been identified at Grande Anse (Les Saintes), Site du Phare (Petite Terre), Éscalier (La Désirade), Anse à la Gourde, Anse à l'Eau (both Grande Terre, Guadeloupe), Jumby Bay (Long Island), and Coconut Walk (Nevis). The Troumassoid 1 and 2 phases of the Anse à la Gourde site especially produced a significant number of greenstone axes and fragments, outnumbering all other axe related materials.

Beyond this region, greenstone axe occurrence is less frequent. So far, only one fragment out of 25 other stone axe pieces was identified within the Elenan Ostionoid occupation phase at Paso del Indio on Puerto Rico with other sites on this island not producing any (Rodríguez Ramos 2005, personal communication 2002.) In relation to the southern distribution, some uncertainties exist about the date of the identified greenstone axes from Anse Trabaud. Their tentative dating between AD 1000 and 1500 leaves open the possibility that these tools can be attributed to either one of the Late Ceramic phases. Dating of greenstone axe finds, recently identified at the Lavoutte site on St. Lucia, suffer from a similarly wide time span within the Late Ceramic Age (Hofman and Hoogland, personal communication 2004).

With regard to the final phase of Pre-Columbian occupation, the available data are scanty. In addition to the possible occurrence at Anse Trabaud, greenstone axe material was only encountered at the small site of Morne Souffleur on La Désirade (table 6.15; figure 6.12).

In summary, the reduction, transport, and exchange trajectories basically conform to a single pattern through time. Looking at the models outlined by de Grooth (1991, 170 fig. 9; Chapter 3), they can be classified as closest to model D3 (figure 6.13). Stone workers in villages nearby the source, either on St. Martin itself or on the surrounding islands, exploited the outcrops and secondary surface scatters, where they collected raw material, generally in blocky form, that they took back to their villages without pre-working or only minimally pre-working it. At their habitations they fabricated axes, which they exchanged with neighbouring villages, who did not have direct access to the raw material source.

Discussion and concluding remarks

It was argued in the preceding section that the differentiation between settlement sites producing greenstone axes and those only receiving finished items provides support for the existence of exchange relationships, the latter sites interacting with the former for the acquisition of the axe blades. A closer look at the areas of production through time shows us that these areas varied in size to some extent as a result of changing population densities. Population was dispersed, in particular, during the Early Ceramic A, with only a limited number of islands inhabited. The only production site thus far identified is the Hope Estate site on St. Martin. The area reached its largest extension during the Early Ceramic B phase, including the islands between St. Kitts and Anguilla. It is assumed that the production area corresponded with the area of direct access to the sources. It is likely that communities living on neighbouring islands were able to exploit the material at the source themselves without having to interact with a local St. Martin village. The common availability of this type of rock on St. Martin makes it very difficult to exercise control over it. The most distant community still being able to exploit the source was situated on St. Kitts, c. 85 km from St. Martin. This distance falls within the range of distances reported for direct access distances in other parts of the world. Compared to the direct access region of the Long Island flint exploitation, however, it is considerably smaller.

Beyond this area of direct procurement, some differences in the area of distribution are noted as well. Within the Early Ceramic A phase, the axes are commonly found on Vieques and the eastern part of Puerto Rico, whereas on the southern end they do not occur on Martinique. Within the following phases, interaction beyond the Anegada Passage appears to diminish, as the material is rarely encountered on Puerto Rico. Only the Late Ceramic A occupation at Paso del Indio yielded such an axe fragment. This rare presence on Puerto Rico is in marked contrast to a common occurrence among sites within the Anguilla - Guadeloupe area and to the appearance of greenstone tools on Martinique from the Early Ceramic B phase onwards.

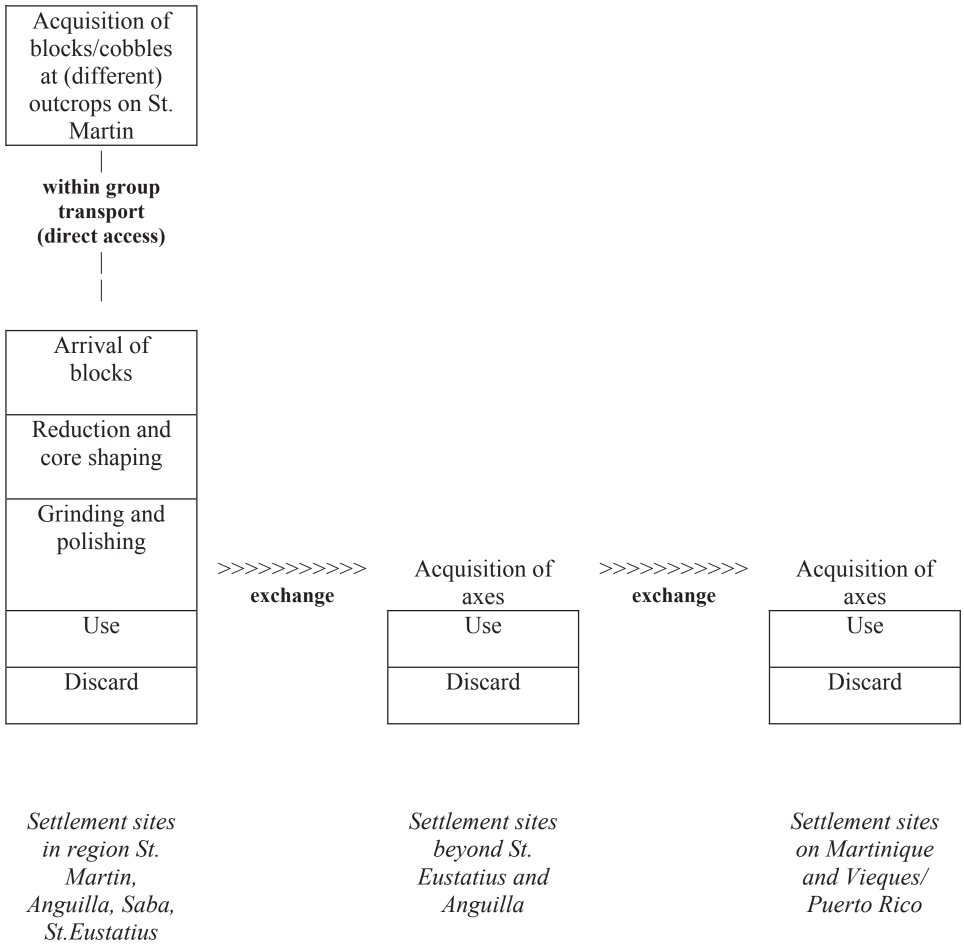

Figure 6.13. St. Martin greenstone axe production, transport, and exchange sequence during the Ceramic Age.

The type of exchange by which the material was distributed is difficult to specify from these data. This can be mainly attributed to small sample sizes, as well to the incompleteness of many of the tools, making comparison of metric values unreliable. Following the results of the flint study, a down-the-line mode of exchange seems likely, in particular during the Early Ceramic A phase. There are, however, indications that during later time, a central-place type of exchange, in which large sites operated as pooling centres, had come into existence. The Anse á la Gourde site on the northern shore of Guadeloupe might have been such a site. The large number of greenstone axes, as well as the occurrence of calci-rudite zemis (see next section), along with many other types of zemis, is quite striking. Moreover, the site experienced a long-term occupation, is the largest one in the direct surroundings, and comprised a large burial ground. Together, this suggests that it was a place of regional importance (De Waal 2001, 2006; Hofman *et al.* 2001). Unfortunately, the detailed information from this site is not matched among the smaller sites around it. This hinders sound comparison and leaves its relation with the smaller sites unspecified. It is unclear whether these smaller surrounding sites should be interpreted as permanent occupied settlements, or whether they functioned as special activity localities, that were visited on a temporary basis. A central place type of (re)distribution is more likely in the former case, while the smaller sites are not relevant for the study of exchange systems in the latter case.

6.2.3 St. Martin calci-rudite

Introduction

In Chapter 2, a detailed description was presented for the conglomerate pack-stone, calci-rudite, which was identified as such by Van Tooren (Van Tooren & Haviser 1999). Very characteristic particles cemented by fine-grained carbonate make this rock easily recognisable, even with the unaided eye. The study of several collections as part of the present dissertation showed that this material was exclusively used for making zemis (see Crock 2000; Crock & Petersen 1999; Haviser 1987, 1999; Versteeg 1999), the well-known three-pointed shaped artefact, that was reported by the early Spanish chroniclers as related to veneration of the deified ancestors and magical power in general (Pané 1999; Siegel 1997). The present research has pointed out that several other materials were used for zemi manufacture besides calci-rudite. These include limestone, igneous rock, pumice, calcite, quartz, shell and coral (Chapter 5; see Crock & Petersen 1999; Hoogland 1996; Versteeg & Schinkel 1992).

Calci-rudite's highly characteristic appearance and its exclusive usage for making zemis are striking features and they suggest a deliberate relationship. For the St. Martin greenstone I pointed out above that the green colour and the corrosion might have been characteristics that gave this stone additional meaning and value. In the case of calci-rudite the supposed meaning behind the mottled nature of the rock is still puzzling, especially if one considers that some of other rock types and other materials used for zemi making generally do not exhibit such variety in colour. On the other hand, diorite, displaying a similar mixture of white and dark particles, is rarely reported among zemis as well (Faber Morse, personal communication 2002) and more commonly occurs among beads throughout the whole of the Ceramic Age (Watters & Scaglion 1994; Chapter 5, this volume).

The source location itself was probably of significance as well. Pané (1999) explicitly writes about the making of wooden zemis that the tree needed to make the zemi, will reveal itself to the zemi maker. Unlike other materials, that have an unclear origin or which have a common origin (e.g. coral and shell), this rock type has a very localized source, that was exploited for considerable time.

Thus far there are no indications that zemis were made and used by the Preceramic Age inhabitants of the Caribbean. All evidence suggests that these religious items first appeared during the Early Ceramic Age. Furthermore, careful comparison of different sites shows that the first emergence of zemis within the Caribbean was not contemporary with the first arrival of horticulturalists. Early sites, such as Fond Brulé and Vivé on Martinique, and the La Hueca component on Vieques lack this typical item (Bérard, personal communication 2000; Narganes Storde 1995). Therefore, introduction of the zemis must be considered a later local Caribbean phenomenon, perhaps roughly dated at AD 300. Contemporary with the introduction of zemis, the first calci-rudite zemis turn up as well. Here I discuss in chronological order the usage of this material within the different Ceramic Age phases.

First, I need to make a few comments about my analysis of calci-rudite zemi production and distribution. Similar to the greenstone, information about local exploitation at the source outcrop itself is lacking. In contrast to the greenstone, the calci-rudite conglomerate has a much more restricted occurrence, with only one identified outcrop at Point Arago, on the western coast of St. Martin (see Chapter 2). Despite this single occurrence, no evidence of actual exploitation has been reported for Point Arago. Unlike the greenstone, where the main production occurred at the settlement sites, this could not always be established for the calci-rudite material. This results in an incomplete picture for some Ceramic Age phases, where we have some evidence of zemi-usage, but in which we lack clear identification of actual production localities. Finally, it should be noted that due to the rare occurrence of zemis in general and calci-rudite zemis in particular, similar biases exist as reported for my analysis of the greenstone axe distribution. Therefore, in this case again published site reports and colleagues were consulted for additional data.

Reduction and transportation

Production

The reduction and transport sequence for calci-rudite zemis displays many similarities to the greenstone axe production described above. Again, a clear distinction can be made between habitation sites where zemis were being manufactured, situated close to the source, and those that only imported finished items. The former sites yielded clear manufacturing debris, in the form of small flakes, lots of shatter, and preforms, while the latter sites only yielded finished ground three-pointers, either complete or fragmentary. The calci-rudite case, however, exhibits more variation through time, with a clearly distinct period during the Late Ceramic A phase, marking the peak of its production and usage (tables 6.16 and 6.17).

As mentioned in the introduction, the earliest zemi appearance must be dated somewhere around AD 300. Early calci-rudite examples are reported from Hope Estate, Elliots, and Trants. However, these are finds from undated surface proveniences.[14] Looking for production activities during this phase, we are faced with a lack of data because it has not produced clear evidence of calci-rudite zemi production, despite the occurrence of zemis at a few sites. The most likely place for zemi production would be the site of Hope Estate, which is situated on the source island of St. Martin itself. Haviser speaks of five "raw material" pieces in his 1999 report and thereby suggests local production (Haviser 1999). Chauviere (1998), on the other hand, considers these to be fragments from finished items, as they have ground surfaces, and excludes the possibility of a local production. When compared to later sites with clear production remains, such as Sandy Ground and Barnes Bay, the frequency differences are striking and support Chauviere's statement (see Chapter 5).

During the Early Ceramic B phase, indications for production are again scanty, notably on St. Martin, where the Early Ceramic B Anse des Pères site did not yield any calci-rudite material at all, out of a total of more than a 1000 artefacts (Knippenberg 1999c). The only reported sites, that had late Saladoid occupation and produced calci-rudite zemi manufacture remains are Rendezvous Bay and Sandy Ground on Anguilla (Crock 2000; Crock & Petersen 1999). In particular, the Rendezvous Bay site has been suggested as an important zemi production place, considering the relatively large quantity of calci-rudite material. Notwithstanding the fact that calci-rudite zemis were being made at both sites, the association with the earliest occupation at both localities is less firmly established, thus far. Concerning Rendezvous Bay, the lithic materials from the stratigraphically excavated test-units yielding the earliest deposits have not been analysed. On the other hand, Crock and Petersen argue for early zemi making, as surface collected material from the site yielded a "pedestalled" zemi, which is characteristic for the Early Ceramic Age (Crock & Petersen 1999, fig. 23). This may suggest that zemi-making was associated with the earliest occupation, starting from about AD 400 onwards.

At Sandy Ground, calci-rudite zemi material is mostly associated with the later occupation phases at the site. The test-unit sample that I analysed did not contain any calci-rudite material in the lower levels, and calci-rudite is rare in the deep deposits in general (Crock 2000). Associated dates for the upper levels place the production between AD 775 and 1035. This production may be related to the recovery of zemis at Golden Rock, roughly dated between AD 450 and 850. Furthermore these dates make the zemi-manufacture at least contemporaneous with the Anse des Pères site, which has been dated between AD 730 and 950 (Knippenberg 1999b). This brings to light an intriguing situation where a site situated only a few hundred metres from the source, Anse des Pères, lacks any production debris or zemis in general, but Sandy Ground, and Rendezvous Bay, which lie considerably further from Pointe Arago, demonstrate its production.

The first appearance of calci-rudite zemi production during the late Saladoid/early post-Saladoid transitional phase (Early Ceramic B) developed to an extensive production during the following centuries, notably the period between AD 850 and 1250. True Late Ceramic Age occupation at Sandy Ground, Barnes Bay, and Rendezvous Bay on Anguilla (Crock 2000), and Cupecoy Bay on St. Martin (Haviser 1987) yielded clear manufacture remains. Furthermore, Crock and Petersen present an extensive list of surveyed (but chronometrically undated) post-Saladoid sites on Anguilla assumed to fall within the AD 900-1200 period, and that have yielded remains of calci-ruidte zemi production as well (Crock & Petersen 1999). Close reading of Haviser's survey report on St. Martin (1988) shows that only sites on the western part of the island yielded calci-rudite debitage (see figure 5.33). Among all these sites on both islands, Rendezvous Bay stands out according to Crock and Petersen (1999), by its considerable number of production remains and finished zemis. Therefore, they tentatively interpret this site as a port of entry for this particular stone material.

Interestingly a decline in calci-rudite artefacts is noted though time, as sites, that have been dated to the later parts of the post-Saladoid period yielded considerable lower amounts of this material. For example, the Sandy Hill site, which overlaps with the later phases of occupation at Barnes Bay and Sandy Ground hardly produced any calci-rudite material at all, suggesting that production was not a significant characteristic there. A low occurrence of calci-rudite material is also noted for the Forest North site. The unconvincingly long time span suggested by radiocarbon dating for this site, however, poses difficulties where to place Forest North temporally. In particular, the Shoal Bay East site, with the latest dates for

[14] The zemi from Trants was part of the Howes collection, which was gathered during the late nineteenth century (Watters & Scaglion 1994). While fieldwalking the Elliot's site in 2000, I picked up a calci-rudite zemi fragment in an area that produced a lot of "White-on-Red" Saladoid ceramics.

Site	Island	Distance to Pointe Arago (km)	Chronometric date	Calci-rudite
Early Ceramic A				
unknown				
Early Ceramic B				
Rendezvous Bay	Anguilla	11 km	cal AD 400 – 950	production (?)
Sandy Ground	Anguilla	13 km	cal AD 650 – 1035	production (?)
Late Ceramic A				
Cupecoy Bay	St. Martin	6 km	aprox. AD 1100 – 1300	production
Rendezvous Bay	Anguilla	11 km	Cal AD 400 – 950	production
Sandy Ground	Anguilla	13 km	cal AD 650 – 1035	production
Barnes Bay	Anguilla	12 km	cal AD 775 – 1295	production
Late Ceramic B				
unknown				

Table 6.16. Calci-rudite zemi production sites by period by island.

Anguilla, displays an almost complete absence of calci-rudite.[15]

Crock (2000) does not pay any attention to the lower occurrence of calci-rudite material in the relatively later sites, suggesting disappearance of calci-rudite zemi-production through time. However, this decline is also supported by data from surveyed sites listed in Crock and Petersen (1999).[16] Blackgarden Bottom, one of the few places, that may have had an occupation phase in the later post-Saladoid period (AD 1200 - 1500), is characterised by an absence of calci-rudite material. Notably, all reported sites that did yield calci-rudite debitage, are dated to the earlier half of the late Ceramic Age (AD 900 – 1200). The disappearance or at least significant decline of calci-rudite zemi production must be dated somewhere between AD 1250 and 1300 in view of the radiocarbon dates from Anguilla.

The evidence for production indicates that zemi manufacture locations may have a much more localized occurrence than was the case for greenstone axe fabrication. During its highlight, zemis were only manufactured on the western part of St. Martin and on the island of Anguilla[17], whereas greenstone axe production sites can be found on Saba, St. Eustatius, and incidentally St. Kitts as well.[18] This much smaller production region for the calci-rudite material suggests that fewer people had direct access to the source. This may be attributed to its more localized source on St. Martin when compared to the more broadly available greenstone material, making it easier for neighbouring communities to exercise control over and deny access to it by others. This control and restricted access may have played an important role in increasing socio-political competition within the region, in particular when the religious importance of zemis made from it is considered (Crock 2000; see Chapter 7).

[15] One localized area at Shoal Bay East also yielded evidence of late Saladoid occupation, including one radiocarbon dated sample (cal AD 655 – 890), and White-on-Red ceramics (Crock 2000, 169). Unfortunately, lithic data attributed to this occupation have not been described. Furthermore, in a personal communication, John Crock pointed out that only a small amount of calci-rudite material has been surface collected at Shoal Bay East, and considering its surface provenience it may be placed within the later phases of occupation at the site. According to Crock this relates to a more general problem regarding the later Amerindian occupation on Anguilla and elsewhere, as plough disturbance has made the upper, mostly younger deposits unreliable for radiocarbon dating, biasing our knowledge of site occupation more toward the older phases (Crock, personal communication 2002).

[16] Crock (2000) was mainly focussed on contemporaneity between sites. As many of them were occupied for a considerable period, such co-existence was proven. To compare the sites he treated them as single entities without distinguishing specific occupation phases. Therefore, he was less interested in variation through time.

[17] Data from St. Barths are absent as a result of very limited archaeological work on this island (Gassies 1999). Considering the presence of production remains restricted only to sites on the western part of St. Martin and the island of Anguilla, closely corresponding with the source's location along St. Martin's western coast, suggests that St. Barths may not have been part of the production area.

[18] Considering the wider distribution of greenstone production sites, it is very likely that St. Barths was included within the greenstone production area as well.

Site	Island	Distance to Point Arago	Chronometric date	Calci-rudite
Early Ceramic A				
Punta Candelero	Puerto Rico	285 km	cal 100 BC – AD 50	absent
La Hueca	Vieques	246 km	cal AD 0 – 400	absent
Sorcé	Vieques	246 km	cal AD 136 – 650	absent
Hope Estate	St. Martin	4 km	cal 400/300 – 50 BC (early) cal AD 255 – 650 (late)	finished items
Elliots	Antigua	184 km	no chronometric dates	finished item
Trants	Montserrat	177 km	500 cal BC – cal AD 400	finished item
Morel	Guadeloupe	270 km	AD 200 – 600	absent
Cocoyer	Marie-Galante	302 km	no chronometric dates	absent
Vivé	Martinique	426 km	cal AD 144 – 440	absent
Early Ceramic B				
Paso del Indio	Puerto Rico	320 km	AD 570 – 640	absent
Punta Candelero	Puerto Rico	285 km	cal AD 700 – 950	absent
Golden Rock	St. Eustatius	71 km	cal AD 450 – 850	finished items
Sugar Factory Pier	St. Kitts	98 km	no chronometric dates	absent
Anse à l'Eau	Guadeloupe	277 km	no chronometric dates	absent
Anse à la Gourde	Guadeloupe	283 km	approx. AD 400 – 600	absent
Les Sables	La Désirade	291 km	no chronometric dates	absent
Diamant	Martinique	460 km	cal AD 415 – 725	absent
Late Ceramic A				
Paso del Indio	Puerto Rico	320 km	cal AD 880 – 1385	finished item
Jumby Bay	Long Island	176 km	cal AD 1050 – 1250	absent
Mill Reef	Antigua	183 km	no chronometric dates	finished item
Muddy Bay	Antigua	183 km	cal AD 1000 – 1300	absent
Anse à l'Eau	Guadeloupe	277 km	no chronometric dates	finished item
Anse à la Gourde	Guadeloupe	283 km	approx AD 1000-1250	finished items
Escalier	La Désirade	291 km	cal AD 1049 – 1243	absent
Du Phare	Petite Terre	298 km	no chronometric dates	absent
Anse Trabaud	Martinique	476 km	no chronometric dates	absent
Late Ceramic B				
Paso del Indio	Puerto Rico	320 km	approx AD 1385 - 1500	absent
Shoal Bay East	Anguilla	20 km	cal AD 1005 – 1640	possibly present
Sugar Mill	Long Island	176 km	cal AD 1300 – 1400	absent
Morne Souffleur	La Désirade	294 km	no chronometric dates	absent
Anse Trabaud	Martinique	476 km	no chronometric dates	absent

Table 6.17. Calci-rudite zemi distribution by period by site by island.

Distribution

The distribution of finished calci-rudite zemis rather than debitage, is very similar to that of the greenstone material. Outside the production region, calci-rudite material is only found in the form of complete or fragmented finished zemis. Debitage in the form of unworked raw material, flakes, unidentified fragments and preforms is lacking. Contrary to the greenstone axes calci-rudite zemis are relatively rare within archaeological assemblages, somewhat hampering a sound reconstruction of its distribution, however.

For the Early Ceramic A phase, data are very scanty, with zemis only reported from Hope Estate, Elliots, and Trants (table 6.17). The finished examples all came from surface collections and these pose uncertainties with regard to their precise age, in particular considering the absence of clear production sites prior to AD 400 and the considerable size of the zemis, which are larger than the early zemis found at Golden Rock (see below).

For the following Early Ceramic B phase the distribution is even more localized, with calci-rudite zemis only found at the Golden Rock site on St. Eustatius, thus far. Out of the twelve stone zemis recovered from this site, four are made of calci-rudite material. Furthermore, all of these specimens are small in size, comparable to the other limestone, coral and igneous rock zemis from Golden Rock. This correlates well with the notion that the oldest zemis were small, and that they

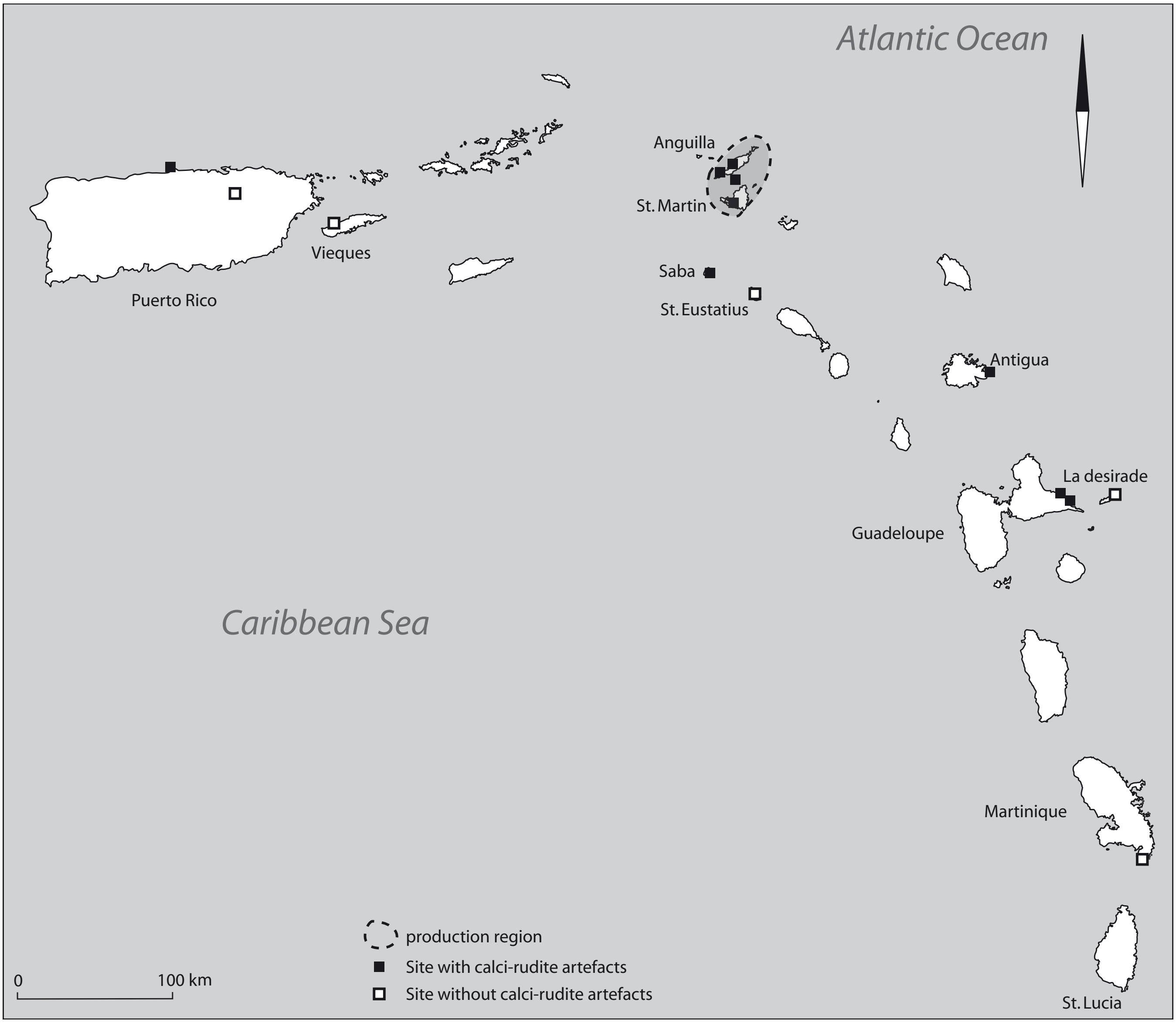

Figure 6.14. Distribution of calci-rudite zemis and the location of the production area during the Late Ceramic A phase (AD 850 - 1250).

gradually become larger through time. The place of production of the Golden Rock zemis, may well have been either at Rendezvous Bay or Sandy Ground on Anguilla, from where the items were obtained through exchange.

During the Late Ceramic A phase, the extensive evidence on the production of the calci-rudite zemis is well correlated with their higher frequency at habitation sites within the surrounding region. Complete or fragmentary items are reported at Anse à l'Eau, Anse à la Gourde (both Grande Terre, Guadeloupe), Mill Reef (Antigua), Spring Bay 3 (Saba), and Paso del Indio (Puerto Rico) (figure 6.14). This suggests a wider distribution than during the preceding phase, and notably the co-occurrence of a greenstone axe fragment and an incomplete zemi at Paso del Indio supports the notion that sites in Puerto Rico were participating in a widespread exchange network during this phase. Still, zemi frequency is generally low when compared to greenstone axes.

Moving toward the final centuries of Pre-Columbian history, reported zemis are absent, but the context sample for excavated sites is very small as well. The previously mentioned occurrence of zemis at Anse à la Gourde, dated to the Late Ceramic A phase (between AD 1200 – 1250), represents the latest known examples within the wider region. Later sites,

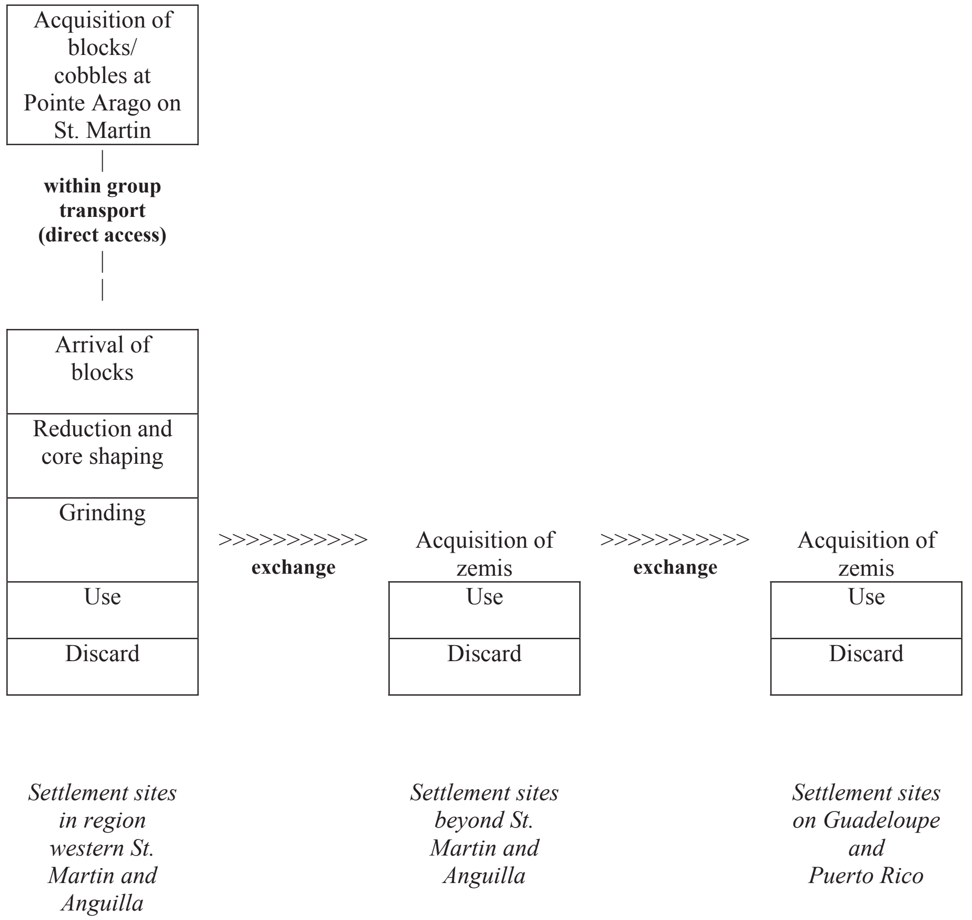

Figure 6.15. St. Martin calci-rudite zemi production, transport, and exchange sequence during the Late Ceramic A phase (AD 850 - 1250).

such as Kelbey's Ridge 2, Sugar Mill, Morne Cybele, Morne Souffleur, and the latest occupation at Paso del Indio have not yielded any examples. However, I should point out that lithic samples from the latter four sites are relatively small too. Notwithstanding this possible sample size bias, the absence of zemis at these late sites corresponds well with evidence for declining or even absent production on Anguilla, as suggested above.

Discussion and concluding remarks

Data on calci-rudite production and distribution have been discussed here through time. Thus far, it is the only zemi rock material for which production and distribution can be clearly identified, in contrast to many other materials used for zemi manufacture. In particular, these other materials include different varieties of limestone, as study of sites on Guadeloupe and Anguilla has shown. A low frequency of zemi related artefacts and large variety of rock types on an intra- as well as inter-site level hinder sound comparison and a proper identification of zemi manufacture and distribution in these cases. The available evidence for calci-rudite zemi production and distribution, however, shows that its main usage can be roughly dated between AD 800 and AD 1250. During this time, the reduction, transport, and exchange trajectory corresponds to De Grooth's model D3, similar to the greenstone case (figure 6.15) (De Grooth 1991, 170 fig.9). A number of settlements near the source had access to the calci-rudite material and were involved in zemi manufacture. These settlements exchanged the finished objects to settlements over a much wider region.

Before AD 800, calci-rudite zemi manufacture and distribution occurred only on a small scale, whereas in the latest phase of Amerindian occupation, after AD 1250, its use seems to have disappeared. During its heyday, however, the area of production remained small, suggesting the deliberate control of access to it. In contrast to the greenstone and Long Island flint, calci-rudite zemis are relatively rare in general, probably owing to their special religious function. Nonetheless, their occurrence at sites on Puerto Rico and Guadeloupe clearly indicates that the indigenous Caribbean inhabitants valued calci-rudite as raw material for these important objects.

This description has revealed two striking features that need additional discussion. One relates to the scanty evidence of actual production during the earliest phases of the Ceramic Age and the other one concerns the small size of the production region during the Late Ceramic A phase, relative to the ones for the greenstone and the Long Island flint. As became evident for the earlier Ceramic periods, in particular for the Early Ceramic A phase, clear calci-rudite zemi production sites have not been identified, despite the occurrence of calci-rudite zemis at early sites. Due to the fact that the data do not strongly favour any particular explanation I want to discuss some possible ones:

1) The Rendezvous Bay site on Anguilla may have functioned as the production locality for all the early zemis. Although major occupation at this settlement must be ascribed to the Late Ceramic A phase, radiocarbon dating as well as White-on-Red ceramics in the lower deposits suggest that occupation started around AD 400, which would make it contemporaneous with the later phases of Hope Estate, and possibly Trants and Elliots as well. This would mean that a settlement on the neighbouring island of Anguilla and not a site on the source island of St. Martin itself was responsible for the introduction of calci-rudite as a zemi raw material for the manufacture of stone threepointers. This situation is intriguing when it is recognized that Anguilla became such an important island for the calci-rudite zemi manufacture. These circumstances may suggest an important aspect of calci-rudite manufacture. It shows that it was not necessarily distance to the source, but rather the relation with the first zemi producing settlement, that was decisive in who was involved in zemi manufacture and who was not. This may also explain the absence of manufacturing activities at the adjacent Anse des Pères site on St. Martin. With regard to the relationship between the Late Ceramic Age habitation sites on Anguilla, several lines of reasoning may be brought forward. These relationships may well have had a primarily social character, in which social and kinship ties between the inhabitants form the main foundation. Another viewpoint would be that the bond was more of a political nature, in which a supra-village authority connected the settlements, or that it should be sought within the spiritual-religious realm, in which a lineage of religious specialists were responsible for a communal involvement in calci-rudite zemi manufacture.

2) Zemis were manufactured at another locality, somewhere outside individual settlements during this early phase, or at another time from which the following options can be suggested:

(a) The source area was the place where calci-rudite was worked. Unfortunately data relating to remains of debitage at the source are not reported. If there are indeed no remains present there, then it is possible that such remains have been eroded away by the ocean, since it is a coastal site, with cliffs and little beach development yet. On the other hand, if we look at Long Island flint in particular, then it is evident that Ceramic Age people did not reduce this material at the source either. All evidence for the greenstone material so far indicates the same thing too, suggesting local acquisition and production were not done at the same place by these people.

(b) A special locality outside the village with "religious" significance was chosen for calci-rudite zemi manufacture. This may be a possibility, but there is no data, however, about this issue, since such sites have not been systematically searched for nor reported on St. Martin. To my knowledge, similar examples elsewhere in the region have not been described. Furthermore, this would contradict with later lithic related behaviour, when habitation sites became the places of reduction, as described above.

(c) Zemis were being made within the settlement site in one specific area, which fell outside the excavated areas at Hope Estate, for example. Although it has been shown at Rendezvous Bay that the concentration of calci-rudite material varies within the site, its presence seems to be continuous there. Considering the relatively extensive excavations at Hope Estate that produced the lithic samples studied by Haviser and Chauviere, it is unlikely that such areas would have been missed, however.

(d) It is possible that he zemis found at different early sites were later intentional deposits made by Late Ceramic Age people visiting their "ancestral" places, and should not be associated with the Saladoid occupation of these sites. Arguments in favour of this possibility include the clear evidence of extensive production of calci-rudite zemis during the Late Ceramic Age, notably on Anguilla, and to a lesser degree on St. Martin itself, as well as the relatively large size of the zemis found at Elliots and Trants, suggesting Late Ceramic Age manufacture. On the other hand, the excavation reports for the Hope Estate and Trants sites do not mention any evidence of post-Saladoid activities at the site. If these activities were solely involved in the intentional burial or placement of zemis, then they may have only minimally disturbed earlier deposits and this has gone unrecognised. Thus far, there are no stratigraphic indications that such was the case and although the idea of post-Saladoid visits is tempting, archaeological evidence is completely lacking.

Comparing these different possibilities, I think that options 1, 2a and 2d should be regarded as the most likely ones, given the scanty evidence. Future research should not neglect the possibility of calci-rudite working and zemi manufacture at the source, as this would be a relatively easy object of study.

Careful reading of Haviser's St. Martin survey (1988) and Crock and Petersen's Anguilla report (1999) shows that Late Ceramic A sites producing calci-rudite debitage and therefore suggesting zemi manufacture either are situated on Anguilla, or on the western part of St. Martin. These areas nicely surround the source locality situated along St. Martin's western coast and these settlements likely had direct access to Pointe Arago. Compared to, for example, greenstone or Long Island flint, this area of production and direct access is much more restricted. This seems to suggest that these nearby communities controlled this source and denied access to it for others. The important nature of the artefacts that were manufactured from calci-rudite, probably formed the primary reason for strict control of it. Furthermore, the single source occurrence of this rock material may have made it relatively easy to exercise such control, standing in sharp contrast to the greenstone, which is more widely available on St. Martin.

There are different possibilities for control and ownership. The source may have been situated within the territory belonging to a single linguistic or culturally related group, or a multi-community lineage, similar to cases found in southeastern Australia, where certain groups once possessed a rock source for centuries (McBryde 1984). Recognizing the special religious meaning of zemis, it is also possible that only certain religious specialists, similar to the *behiques* in Taíno society, were allowed to exploit this material, as they possessed the proper spiritual power and knowledge to handle it. It may well be possible that such specialists in the long run acquired a central ruling social position as the result of their ability to control these items and thus control the supra-natural world. This possibly provided them with the power to ultimately exclude other specialists from it and to keep its production very localised.

In relation to this, it is intriguing to note that the oldest Ceramic Age site on Anguilla, Rendezvous Bay, is also considered to be the most important zemi manufacture settlement on the island. This may imply the existence of a local hierarchy among zemi producing sites, in which the founder settlement is considered to be the most important one, as this may have been where the lineage of the first zemi makers lived.

6.3 Exchange systems in the northern Lesser Antilles: some concluding remarks

The study of the production and distribution of three different lithic materials has clearly shown the existence of exchange networks operating during the Ceramic Age within the northern Lesser Antilles. All three materials proved to be relatively highly valued rock types, relative to alternative materials used for the same purposes. For Long Island flint, none of the other cherts and flints available within the northern Lesser Antilles were so widely used for the making of flake tools. Similar preferences were given to St. Martin greenstone for the manufacture of axes and calci-rudite for the making of zemis. However, it should be stressed that these three rock types were collected for totally different purposes, that is, flake tools versus axes versus zemis, despite their comparable esteem relative to alternatives. This differential use has been mentioned above, but the consequences of how to evaluate the three different exchange and distribution patterns relative to each other have not been exploited yet.

Comparison of the transport and reduction sequences of these three materials through time reveals the following differences and similarities:

(a) Long Island flint was reduced at every site where it has been archaeologically recovered, while greenstone and calci-rudite were only worked into axes and zemis at a restricted number of settlements in the vicinity of the source areas.

(b) Long Island flint was primarily exchanged in unmodified form as nodules, from which flake tools could be produced. In

contrats, greenstone and calci-rudite were exchanged as finished objects.
(c) Greenstone exchange and distribution exceeded Long Island flint exchange and distribution during the Late Ceramic A phase and possibly during the Late Ceramic B phase. For the Early Ceramic phases, the limited data suggest that this was not the case.
(d) Long Island flint and greenstone were used and distributed throughout the entire Ceramic Age, in contrast to calci-rudite, for which its usage and distribution were seemingly restricted to the Early Ceramic B and Late Ceramic A phases only. Moreover, it needs to be stressed that the latter phase clearly marks the heyday of calci-rudite zemi manufacture and distribution.
(e) Preceramic Age foragers used Long Island flint, whereas greenstone and calci-rudite clearly were only introduced by the later horticulturalists of the Ceramic Age.

These points suggest a number of things. First of all it is clear that the lithics were valued differently. This is apparent just by looking at the form of the exchanged material. Long Island flint was primarily seen as a raw material from which implements could be extracted. In this sense, its utilitarian value was emphasized, whereas for the other two materials the finished objects, with all of their associated meanings and values, were part of the exchange transaction. The additional meaning and value both incorporated the time invested in making these artefacts and all connotations surrounding their representation, usage, shape, and size.

With regard to zemis, I need not make a large argument here about the important role and the high value they entailed for their users. We know from the Spanish chronicles that they formed representations of the supernatural entities, and they played a very important role in ceremonies surrounding the fertilisation of the agricultural fields, for example (McGinnis 1997; Pané 1999; Siegel 1997).

Greenstone axes may well also have represented more than just ordinary tools. First of all, the fact that they were widely exchanged suggests something about their special value, which unlike Long Island flint does not seem to be related to the greenstone material's quality as a wood-working tool, but rather may have lain in the ideological realm. The intentionally buried pelican decorated ceramic pot containing two corroded axes found on La Désirade reveals something of the special value or meaning associated with these objects (De Waal 2006; Hofman *et al.* 2004). Before, I argued that the greenstone weathering may have been meaningful to its users and may have stood in relation to the decay of the dead person's body. Any possible association between the burial of the pot, the pelican decoration, and the corrosion is intriguing and awaits further investigation.

This difference in value and meaning attached to the exchanged objects certainly was of issue during the act of exchange, and therefore must have had its effect on when it was exchanged, how it was exchanged, and between whom (i.e. on which level of society). In other words, given these differences, it can be questioned whether the materials at issue were part of different exchange systems. Unfortunately, the generally small scale of most excavations and the refuse contexts from which the majority of artefacts were excavated does not allow a detailed intra-site analysis. Therefore, it is impossible to study any differential use and access to these materials within a particular community. For now, the distribution data on a site level provide the only data source by which this issue can be tackled.

The most striking differences are found when the Early Ceramic phases are set against those of the late Ceramic A phase. The St. Martin greenstone distribution became wider during this latter phase than was the Long Island flint distribution and calci-rudite zemi manufacture experienced its heyday. The first aspect suggests that Long Island flint and St. Martin greenstone had become part of different exchange systems during that period, the latter apparently being more valued and exchanged more widely. This may be an indication that levels within society became more accentuated. The axes may have operated as valuables in an elite exchange network. In the Greater Antilles, this was the period during which the first evidence appeared of growing socio-political complexity (Curet 1992).

This contrasts to the earliest Ceramic Age phase, for which the evidence suggests that the greenstone was not specifically preferred over Long Island flint. Both materials had more or less similar distributions then. Moreover, settlement data reveal a dispersed configuration of only large settlements, which operated in relative isolation. Exchange in the first place fulfilled the need for these settlements to stay in contact as a means to minimize the risks, associated with the exploration and settlement of new environments. The long-distance exchange of semi-precious stone beads and pendants during this early period should be viewed in this light as well. It was a relatively long-lasting stable network, in which each settlement seemingly played an equal role.

The full appearance of calci-rudite zemi manufacture and distribution simultaneous with the more extensive greenstone distribution may be connected to the process of growing complexity as well. An aspect that further supports this view is the much more focussed region of calci-rudite zemi manufacture as compared to that of greenstone axes. If it indeed was the case that the use and manufacture of the zemis was reserved for spiritual specialists, or at least that specialists played an important part in this process, then the appearance of several calci-rudite zemi manufacturing sites and the zemi's distribution among the surrounding islands during the Late Ceramic A phase must be viewed as an indication that this particular social group was more explicitly propagating its position within society. It may even have been the case that these figures had become leaders within society because of their ability to control the supra-natural world, as reflected by the ownership of the calci-rudite material and their ability to create "powerful" objects, i.e. the zemis. Therefore, it may have been of crucial importance to them to keep access to the calci-rudite restricted. In relation to this, the increase in size of the zemi three pointers has been seen as an indication that public display became a more important part of zemiism (e.g. Curet 1996; Siegel 1999). Apparently, this implies that there was room for or, more strongly, there existed a need for the use of these objects in public. This may again be related to the appearance of social stratification, and that zemis were used to sanction the ruling position of the elite (Curet 1996).

It is evident from the differences in distribution patterns for these three lithic materials that despite the exchange value they share, their exchange and their changing regional distribution patterns signify different social processes. The similar spread of Long Island flint and St. Martin greenstone during the Early Ceramic A phase suggests that both materials were part of the same exchange system. This changed during the following phase because during the Late Ceramic A phase the distribution of both materials was different. At the same time, calci-rudite zemi manufacture appeared. These changes suggest that the exchange of these lithic materials took place within different systems, which may have been related to growing socio-political complexity within society, or at least related to the wish of certain social groups to strengthen their position.

7 Inter-island relationships

7.1 Summary of the data

The previous chapters showed that exchange of stone materials and artefacts formed a common means of acquiring non-local lithic materials and products among the communities of the northern Lesser Antilles during the different phases of the Ceramic Age (see table 7.1 for a general summary). It was also pointed out that the recovery of stone exotic to a particular island does not necessarily indicate exchange. In many instances, the acquisition of these exotics only involved within-community transport, in other words direct procurement at the source.

To summarize my research findings, inter-site variation is evident regarding the quantity of non-local rock found. To a large degree this can be ascribed to variation in the geological settings of the sites, varying from pure limestone surroundings, providing little useful material, to diverse settings offering numerous different lithic materials. Ignoring geological variability, local materials in general comprise water-worn rock used for different purposes. If not locally obtained many of the water-worn pebbles originate from sources relatively close to the particular settlements, where they were used. People likely obtained them by visiting the natural occurrences themselves. This may have involved short walking distances to nearby beaches, or boat-trips to nearby islands.

This contrasts to a number of other materials and artefacts, for which exchange between island settlements was responsible for their distribution, at least a part of it. This group of exchanged rock varies in artefact form and material. A low frequency in the archaeological record and unspecified provenance hinders good insight into the exact distribution and the type of exchange responsible for a considerable part of these materials. This does not account for the Long Island flint, St. Martin greenstone and calci-rudite, which were discussed in the preceding Chapter. Knowledge of their source areas, combined with their recurrent presence at a considerable number of sites, over an extensive region, has provided data for formulation of some ideas about inter-island exchange through time.

Long Island flint displays a wide distribution over the island arc, particularly during the Early Ceramic phases. A high abundance of this flint variety occurs at sites on islands surrounding Antigua, comprising the Saba – Guadeloupe region, and it indicates relatively easy access. During the early Ceramic Age, the people inhabiting this region in all probability had direct access to Long Island. From this inner sphere, Long Island flint was also widely exchanged in a down-the-line mode. This probably did not involve more than two to three exchange steps, finally resulting in a distribution from Martinique in the south to the eastern part of Puerto Rico in the west. This distribution contracted during the Late Ceramic Age, and did not transverse the Anegada passage in the west anymore, and probably did not reach Martinique to the south as well. Sites within the Saba – Guadeloupe region continued to produce high quantities, however, indicating they were still situated within the supply zone, but unlike the preceding phases, sites within the supply zone had no direct access to Long Island anymore. They had to obtain the material through exchange with people controlling the source, as suggested by settlement activity on the small islet itself.

The study of the St. Martin greenstone and calci-rudite artefacts has revealed a much clearer distinction between communities having direct access to these sources and other communities who acquired these materials by means of exchange. The former are the ones that were actually involved in the production of axes, whereas the latter interacted with them to obtain solely finished products. Comparison between the different phases shows that greenstone production was very localized during the Early Ceramic A phase, only the site of Hope Estate on St. Martin yielding evidence of axe manufacture. Finished tools, however, were relatively widely exchanged, particularly to the west. During the following phase, greenstone production expanded over the islands immediately surrounding St. Martin. The distribution to Puerto Rico and the Virgin Islands ceased and was directed more to the south. The number of production sites increased in the Late Ceramic A and the material is commonly found within the Anguilla – Guadeloupe region, while beyond this region, items are occasionally identified as well. The latest phase is still poorly known, but limited data minimally suggest that greenstone axes were still made and exchanged.

Evidence for calci-rudite zemi production and exchange is considerably more limited. In particular, the identification of zemi production sites has proven to be a problem for the two Early Ceramic phases. Zemis were definitely manufactured during the Early Ceramic B phase. However, it cannot be established where these objects were fabricated. The Rendezvous Bay site on Anguilla is the most likely candidate. Contrary to these early phases, the Late Ceramic A phase yielded clear evidence of production and distribution, marking the heyday of calci-rudite zemi usage within this region. Production was restricted to the western part of St. Martin and the neighbouring island of Anguilla, "nicely surrounding" the Point Arago source. Finished zemis, less abundant in number than the greenstone axes, were found on many of the surrounding islands,

	Early Ceramic A (400 BC – AD 400)	Early Ceramic B (AD 400 – 850)	Late Ceramic A (AD 850 – 1250)	Late Ceramic B (AD 1250 – 1492)
Beads and Pendants	* Extensive exchange network in which exotic and local varieties were distributed	* Manufacture and distribution of local varieties	* Manufacture and distribution of local varieties	* Manufacture and distribution of local varieties
Zemis	Not in use	* First appearance of zemis * Manufacture of small zemis * Localised calci-rudite distribution	* Heydays of calci-rudite manufacture and distribution * Use of elaborate zemis	* Termination of calci-rudite use * Use of elaborate zemis
Axes	* Localised St. Martin greenstone manufacture and extensive distribution * Limited manufacture of axes made out of other materials	* Extensive greenstone manufacture and extensive distribution * Limited manufacture of axes made out of other materials	* Extensive greenstone manufacture and distribution * Limited manufacture of axes made out of other materials	* Possible continuation of extensive greenstone manufacture and distribution
Flake tools	* Expedient technology * Extensive Long Island flint distribution	* Expedient technology * Extensive Long island flint distribution	* Expedient technology * Limited Long Island flint distribution	* Expedient technology * Limited Long Island flint distribution
Other tools	* Limited usage of metates * Varied usage of pebble tools	* More common usage of metates and local manufacturing sites * Varied usage of pebble tools	* Common usage of metates * Varied usage of pebble tools	Very limited data

Table 7.1. Main trends in stone tool manufacture and distribution among the northern Lesser Antilles during the Ceramic Age by phase.

covering the area between Puerto Rico and Guadeloupe. Limited evidence from the latest phase thus far suggests termination of calci-rudite zemi manufacture and distribution in late prehistoric times.

A down-the-line mode of exchange, in which exchange took place on a reciprocal basis, is supported from a production point of view. Data relating to flint flake tool production suggest on-site working, most likely at the house-hold level. In particular, the overall occurrence of flake tool production, the un-standardised nature of the reduction process, and the relatively simple and ad-hoc means of making flake tools support this view. The more restricted axe and zemi making may indicate initial forms of craft-specialisation, in particular during the Late Ceramic A phase, although the data do not suggest that axes were being made by full-time specialists.

Additional variation among the transport of the different materials is seen in the form in which the rocks were exchanged. Long Island flint was generally traded as unmodified cobbles, whereas the greenstone and calci-rudite went from hand to hand as finished objects. This reveals something about how they were valued. Long Island flint was primarily seen as raw material from which utensils could be extracted. In this sense, its utilitarian value was emphasized, whereas for the other materials the finished object, with all its associated meanings and values, was centred to the exchange transaction. Above it was argued that this difference in value was most emphasized during the Late Ceramic A phase, when the distribution and production data exhibited most variation between the three materials. This Late Ceramic A change logically was associated with socio-political processes.

7.2 Inter-island exchange networks and socio-political organisation

7.2.1 Introduction

In Chapter 1, I discussed the current views about socio-political organisation within the Caribbean, and in particular in the Lesser Antilles. A main issue under considerable debate relates to the formation of a chiefdom level of society during the Late Ceramic Age within the northern Lesser Antilles. Based on the anthropological literature, I further showed the crucial role exchange relationships can play in the processes that lead to greater complexity. Especially within more politically oriented models, much emphasis is placed on the active role people play in forming and manipulating relationships in their wish to acquire power.

The results of my study of the exchange of stone materials within the northern Lesser Antilles can now be used to contribute to the current discussion. Before proceeding, I want to stress that I realize that approaching this debate from an exchange point of view will only have limited explanatory power. The results will initially tell us something about existence of social relations between islands and the possible changes they underwent through time. Additional data in the form of burial practices, settlement patterns, and intra-site organisation are needed to acquire a better insight into the possible existence of socio-political stratification. Still, some of the patterns and the changes they underwent during the different phases reflect changes in the social structure and organisation within the region.

I showed that the production of the flake tools and axes and zemis occurred on a house-hold level of production throughout the whole Ceramic Age. This production may have involved craft-specialists who were stone workers among their local community and they exercised their tasks on a part-time basis. However, the data do not support the existence of full-time specialists who standardized the production process and its outcome. These features do not by themselves point to growing organisational complexity. From the changing distribution patterns through time, however, certain aspects can be elucidated that correspond with some of the views brought forward about growing socio-political complexity within the region.

7.2.2 The Early Ceramic Age

The first agriculturalists, the Saladoid people, rapidly explored the Lesser Antilles and settled the islands. Many have emphasized the short time-span, during which this occurred and the cultural homogeneity of the early Saladoid series over a large geographical area. Considering this, some have argued that the communities must have been organised at a level that surpassed simple egalitarian societies (Hoogland 1996; Siegel 1996; see Chapter 1). In addition, inter-island interaction apparently played an important role. Specifically, frequent inter-community contact is considered as crucial for societies exploring and settling new environments. In this way, social risks in the form of hostile encounters with neighbouring Preceramic Age foragers or keeping the birth-rate high enough in a sparsely populated region without violating any incest-taboo, could be controlled.

In relation to this, Watters (1997a) proposed the homeland model of the Lapita culture in the Pacific as a possible analogy for the Saladoid case. Kirch (1988) reports that the fast and extensive spread of the Lapita culture over the various widely spread Pacific islands coincided with the maintenance of contacts with its place of origin, as evidenced by the extensive distribution of obsidian varieties from the “homeland”, rather than the exploitation of local sources on the newly settled islands. Kirch sees this contact with the homeland as an important feature of the successful Lapita colonization.

In a recent article, J. Moore (2001) tested different colonization models with regard to their success in new surroundings. Using stochastic simulations, he found that one of the crucial factors for successful colonization was the ability of the colonizing community to stay in contact with at least **one** socially related community. Therefore, the “string of pearls” model of colonization is as viable as other modes (J. Moore 2001, 396 fig. 3). In the “string of pearls” model, colonization expands in a line, along a river for example, connecting the communities in a one-to-one relationship, as if they belonged to a string. In most other models, the exploring community stays in contact with several communities at one time, as in a matrix. For the Saladoid case, this is an interesting viewpoint. Transferred to an island environment, this string of pearls mode can be seen as a chain of settlements populating each island, or each of the major islands. This strongly resembles the early Saladoid situation in the Lesser Antilles. Apparently the fact that contact was maintained along this chain of sparsely populated islands contributed to successful colonization.

Keegan *et al.* (1998) presented interesting viewpoints about the first Saladoid migrations into the Antilles, which in light of the above argumentation need some further discussion. They asserted that the first Caribbean horticulturalists were Arawakan speaking people, who had an uxorilocal rule of residence. They derived their main arguments from a theory on matrilocal residence formulated by Divale (1984), and asserted that: (a) Taíno elites had an avunculocal residence rule according to the historical sources; (b) avunculocal residence likely derives from uxorilocal residence; (c) the scanty data on the Taíno language suggest that it belongs to the Arawakan language family; and (d) nowadays Arawakan peoples, living in the Amazon, have a uxorilocal residence rule.

In short, Divale (1984) argued that matrilocal or uxorilocal residence rules only come into existence as a response to a situation of social stress. In normal circumstances, the residence rule is patrilocal, which is found among the vast majority of small-scale societies. One of these stress situations may be migration or frequent waging of external warfare (warfare against communities outside one’s own society, hence with speakers of other languages). The underlying explanation relates to the existence of fraternal interest groups among patrilocal societies, which undermines internal cohesion in such societies. Competition between these interest groups results in internal warfare. In a society that is exploring new environments, or waging external warfare, men tend to be away for long periods and women are forced to cooperate among themselves for protection and to maintain the subsistence production. In such situations they are likely to group themselves with their closest family members, i.e. their sisters and daughters. As a result, internal cohesion is attained because the fraternal interest groups are broken. Brothers are not living together anymore, but are living with their wives, often in separate villages.

After external warfare ceases, or a society becomes settled in newly colonized surroundings, men will attempt to acquire internal control again. This will change matrilocal residence into an avunculocal one, in which descent remains matrilineal, but the residence rule groups matrilineal related men together, creating a new internal interest group, similar to fraternal interest groups in patrilocal societies. Further evolution will create virilocal residence, before society finally becomes patrilocal again. According to Keegan *et al.* (1998), Saladoid society corresponded with the matrilocal stage of this presented sequence. This society was externally oriented, and focussed on exploration and settlement within a new environment. As a result, the men were making long trips often with uncertain outcomes due to the threat of accidents on sea or hostile encounters with the existing population on the islands (external warfare).[1]

In this light, the documented long-distance semi-precious bead and pendant exchange network is typically related to the earliest phase of Saladoid occupation on the islands and it extended from the South-American mainland, the homeland, along the Lesser Antilles towards Puerto Rico. It seems to reflect existence of this important inter-community contact during the initial settlement of the islands (figure 7.1). Exchange would have been facilitated or initiated by the wish of related men (brothers), perhaps living in separate communities (i.e. with their wives family), to keep in contact.

The relatively wide distributions of Long Island flint and greenstone during this early period correlate well with the long-distance semi-precious bead and pendant exchange network. Flint and greenstone exchange likely occurred simultaneously with the handing over of the semi-precious stone items. Furthermore, it should be stressed that the population density was relatively low compared to later times, since many islands were still uninhabited. In such a situation, exchange transactions involved longer distances and a down-the-line movement of a rock material among a few communities easily produced this extensive distribution.

In regard to the homeland model introduced to the Caribbean by Watters, it has to be stressed that the Saladoid communities were not solely looking backwards to their place of origin for stone resources. They also rapidly adjusted to new island environments, shown by the very early appearance at Trants and Hope Estate of local Lesser Antilles Long Island flint and St. Martin greenstone.

7.2.3 The Early to Late Ceramic Age transition

From the Early Ceramic B phase onwards, the described rock materials became less common with greater distance from their sources. This is particularly evident for materials moving in a western direction to the Virgin Islands and Puerto Rico. Among the Puerto Rican sites, we see a decline in the abundance of the Long Island flint and greenstone. In case of Long Island flint, even a total disappearance may have been the case eventually from Late Ceramic A onwards. Apparently, the large stretch of ocean between Anguilla and the Virgin Islands, the Anegada Passage, corresponded with a social boundary during the later phases of Amerindian occupation. In the southeastern direction, the decline was less sharp. Data suggest that Long Island flint did not reach Martinique anymore after the Early Ceramic Age, whereas the island's inhabitants may have still obtained greenstone axes on a regular basis. On the other hand, frequency differences in Martinique compared to Guadeloupe are significant.

This less extensive distribution relates well to the disappearance of the long-distance exchange of semi-precious materials. In Chapter 5, I showed that the occurrence of stone beads and pendants was diminishing during the Early Ceramic B phase, including the disappearance of certain materials pointing to long-distance contacts. Beads and pendants become predominantly made of varieties local to the region. Furthermore, the use of commonly available shell for making decorative artefacts became more predominant later in time. This is particularly evident at the Late Saladoid and mainly post-Saladoid site of Anse à la Gourde.

It is noticed at the same time that the number of settlements increased in the region, notably during the Late Ceramic A phase, suggesting a significant population increase (e.g. Crock 2000; De Waal 2001, 2006; Wilson 1989). Alongside this

[1] There is an additional aspect, not touched upon by Keegan *et al.* (1998), that deserves mention in relation to Divale's theory, as it provides a feature that can be tested archaeologically. Apart from a correlation between external warfare/exploration and matri/uxorilocal residence, Divale also found a correlation between larger house size and matri/uxorilocal societies, as well as the existence of men's houses among matrilocal societies. With regard to men's houses, the excavations at the Saladoid site of Golden Rock have revealed an example of such a large structure (Versteeg & Schinkel 1992). This provides additional evidence for the existence of the matrilocal residence rule among Saladoid society.

Figure 7.1. The area of the semi-precious stone bead and pendant exchange network during the Early Ceramic A phase (400 BC – AD 300).

increase, habitation became more evenly spread. This not only included settlements on previously unsettled islands, but also within already occupied islands as all available coastal areas became populated. Anguilla, for example, experienced the settlement of its first agriculturalists during the start of Early Ceramic B phase, after which it evolved towards a regionally important centre during the following Late Ceramic A phase (Crock 2000; Crock & Petersen 1999). St. Eustatius, Saba, and Barbuda became populated as well (Hofman 1993; Hoogland 1996; Versteeg & Schinkel 1992; Watters *et al.* 1991). This populating of uninhabited islands, co-occurred with the abandonment of certain long-term occupied sites, such as Hope Estate and Trants. At the same time, many of the sites, that later would become large settlements, came into existence, such as Anse à la Gourde on Guadeloupe, and Rendezvous Bay and Sandy Ground on Anguilla (Crock 2000; Crock & Petersen 1999; Hoogland 1999; Hofman *et al.* 2001; Petersen 1996; Petersen *et al.* 1999; Watters and Petersen 1999).

Along with this population increase, the appearance of local pottery styles was notable, which clearly distinguishes different micro-style areas. Hofman and Hoogland (2004) in their synthesis of the northern Lesser Antilles speak about the formation of micro-regions during this period, including a limited number of neighbouring islands. The data of stone material distribution and exchange certainly correlate with these findings. One such micro-region can be specified for the area extending from Anguilla to Guadeloupe, as the three stone materials in this study have a relatively common occurrence there. Apparently, the increasing population on the islands resulted in the formation of sub-regions, that acted independently with respect to resource procurement, as well as social matters. Allen (1985), explaining a similar situation in Pacific history where population increased and networks became more localized over time, speaks of changing social distances in relation to geographical distances. In the earlier situation, which would correspond to the Early Ceramic A phase in this study, the social distance between geographically widely separated communities was small. During later phases, starting in the Early Ceramic B, populations expanded on the islands and socially related communities were living closer by (see Allen 1985, fig. 2).

Bringing the evidence together for stone distribution during the Late Ceramic Age, it is possible to distinguish four levels of interaction on a regional scale. The smallest region of interaction corresponds with the direct access area of the calci-rudite stone material (figure 7.2). This region included Anguilla and the western part of St. Martin. It may have hosted closely related social communities, for example, all members of a certain lineage. These communities could have fallen under the leadership of one headman and probably were operating in close cooperation, as they were controlling the calci-rudite source. The following level of interaction corresponds with the direct access area of the greenstone material and included those communities that were regularly making trips to St. Martin. Considering the larger area of direct access, it may be assumed that either control and ownership of the greenstone outcrops did not play a role, or that such control was difficult to accomplish in case of this material, which was widely available across the island. This may have facilitated direct access by communities coming from different islands. The third level of interaction included the area of common abundance of the stone material, as obtained through exchange. This suggests that within this area inter-island contact was occurring on a relatively regular basis. For the Late Ceramic phases, this was the Anguilla – Guadeloupe region. The fourth level of interaction included the entire area of a rock material's distribution and corresponds with rare inter-island contact. This was likely the Martinique – Puerto Rico area, or even beyond.

For the Early Ceramic Age, the regions for levels 3 and 4 are less clearly defined, at present. Furthermore, direct access to sources was apparently related more to distance to the source, than to definite ownership rules. For example, Hope Estate was the only Early Ceramic A phase site with greenstone production remains, as sites on most surrounding islands did not exist yet.

In line with the theory of Divale (1984), Keegan *et al.* (1998) argue that the transition from Early Ceramic B to Late Ceramic A may have been the time when the uxorilocal residence rule of the first settlers started to change toward an avunculocal residence rule. In this view, the formation of more densely populated micro-regions altered the perspective of society from an outward oriented one focussed on exploration toward an inward one, in which settled communities started to form multi-village polities, which competed for control over land and resources. According to Keegan *et al.,* this new rule of residence offered great opportunities for a strong village headman (mother's brother) to easily bond a number of men to him. These were not only the sons of his sister who were living with him, but also his own sons who were living with their mother's brother family. If clever and powerful enough, the headman may have exercised rule over several communities and thereby become a man with regional leadership (a chieftain), opening the way to the development of a chiefdom proper.

The stone use and distribution data provide some additional features to support the idea of increasing internal competition between these micro-regions during the late phases of Amerindian occupation of the islands. Curet (1992, 1996) previously argued that the development of social complexity in the Greater Antilles was not a result of population pressure,

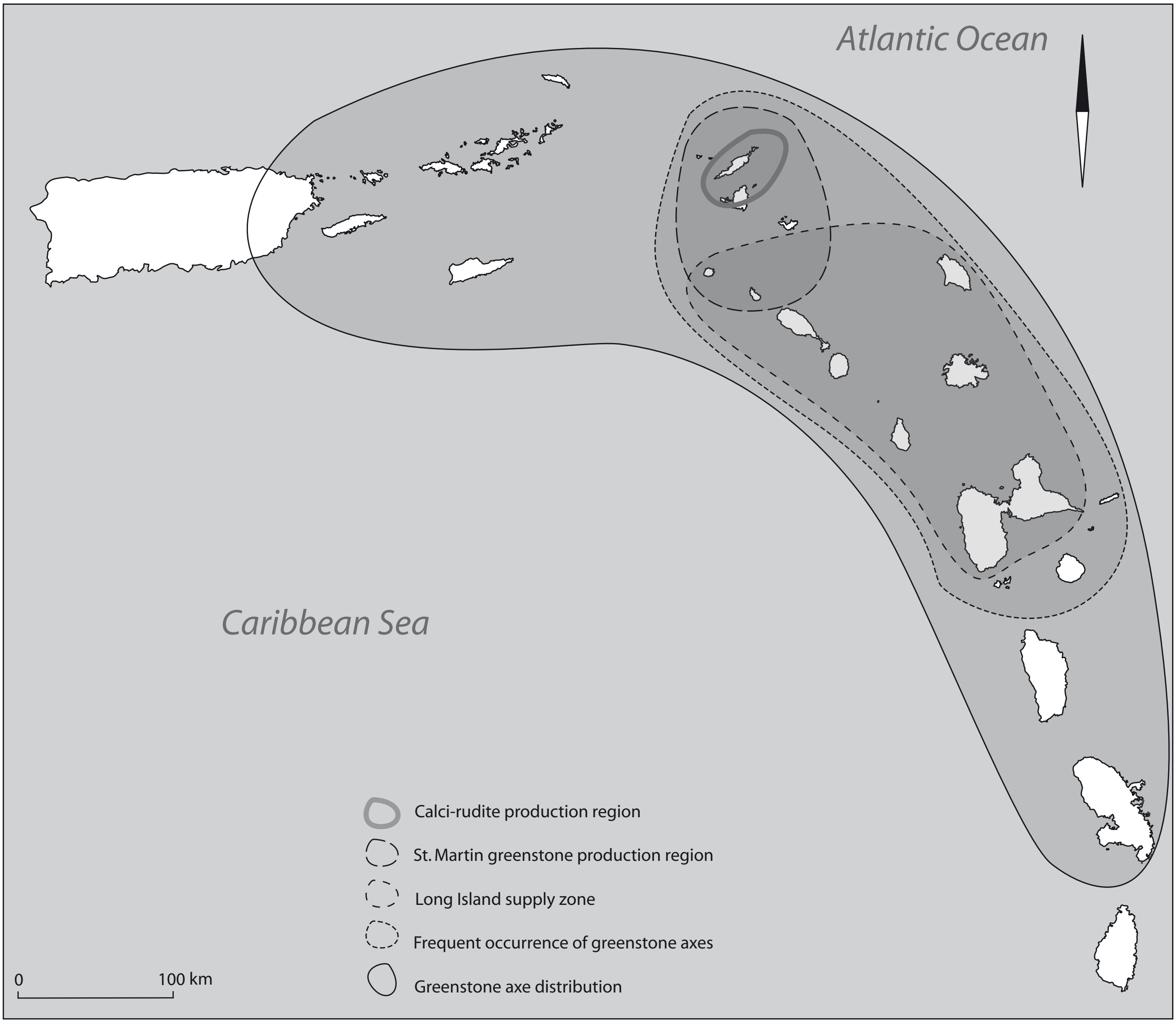

Figure 7.2. Different interaction regions among the northern Lesser Antilles during the Ceramic Age.

but rather followed a more politically motivated path, in which local leaders were able to gain regional power through the manipulation and control of ideology. In this respect, the control of the manufacture of the calci-rudite zemis, representing important religious objects, may have played a role. I demonstrated above that access to the calci-rudite source was only possible for sites on Anguilla and a few on St. Martin. Considering the very localized occurrence of this source, it must have been relatively easy for communities living nearby to exercise control over the locality and deny others access to it. By doing so, they were able to appropriate these powerful objects, which may have given them a renowned position within the region. In Chapter 1 I pointed out that within present-day Amazonian societies, the spiritual or religious specialists have the ability to become powerful figures in their society. The special place that the shaman, or *behique* fulfilled in Taíno society, as described in the historical documents, further supports this.

Archaeological evidence from Anguilla correlates well with the special position that the island was given during the later phases of the Ceramic Age, as the work of Crock and Petersen has shown (Crock 2000; Crock & Petersen 1999). They demonstrated that the island hosted some of the largest sites in the near Lesser Antilles region, which produced a number of high-status artefacts. Access to the calci-rudite material and to a lesser degree access to the greenstone along with the island's location closest to the Greater Antilles chiefdoms, may have given the inhabitants a crucial advantage over their northern Lesser Antilles neighbours (Crock 2000). Study of the Haida and Tlingit in the Northwest Coast region of North America and the Trobianders of the Melanesian archipelago has shown that superior locations with respect to resources were crucial in the development of chiefdom societies. These locations enhanced competition among these peoples over who was the controlling figure of this superior access in relation to the neighbouring societies (Rosman & Rubel 1989; see Keegan *et al.* 1998).

There is one aspect of the greenstone axe making that deserves more detailed discussion in relation to the regional importance of the island of Anguilla, and possibly the western part of St. Martin as well. The number of axe making settlements increased markedly during the Late Ceramic A (see Chapters 5 and 6). This increase was already present during the Early Ceramic B phase, when sites on the islands surrounding St. Martin became involved in greenstone axe manufacture. The number of sites per island, however, remained small, indicating that greenstone axe production was still performed in relative isolation, mirroring the Early Ceramic A phase situation. This contrasts with the Late Ceramic Age situation on Anguilla. Numerous simultaneously occupied sites there have yielded significant amounts of greenstone material, suggesting a continuously high production of greenstone tools. From the general appearance of finished greenstone axes within the wider region, it is evident that these particular settlements did not solely work to fulfil their own demands, but were also producing more widely for extensive inter-island exchange.

This structural involvement in greenstone tool manufacture among closely neighbouring villages, intended for exchange with villages on the neighbouring islands, suggests some internal cohesion between these settlements. This situation is clearly different from that in the Early Ceramic A phase, when only the Hope Estate site was seemingly involved in greenstone axe production. Rather than seeing these as communities operating on an individual basis, it can be assumed that they were organised or tied together by some supra-village level of authority (see Cobb 2000 for discussion on communal activities). This supra-village authority may have been a chieftain who was able to gain regional control by his own endeavours, or it was possibly a true ascribed chief. In this light, the small number of settlements where calci-rudite zemis were being made may have represented villages higher in the settlements hierarchy. These villages then likely hosted powerful ritual specialists (the Lesser Antilles equivalent of the Taíno *behiques*), or members of a chiefly lineage.

The first appearance of small settlement sites on Long Island during the Late Ceramic A phase, can be also interpreted from this perspective. In Chapter 4, I suggested that they may have represented (short-term) controlling camp sites, which were occupied by people from communities on Antigua who controlled access to the Long Island flint. Whether the more restricted distribution of Long Island flint among the surrounding islands then is a result is still open for debate. If it is true that social networks became more localized, as argued above, then this more limited distribution could be explained by the shift of social boundaries, rather than by greater difficulty in obtaining Long Island flint. The data on flint reduction at the local settlements, however, favour the scenario of more restricted access, although the proof of this is thin. Compared to sites from the Early Ceramic B phase, the following phases yielded higher efficiency ratios for sites lying at a similar distance. This would mean that flint was considered scarcer, as a result of greater difficulty of acquiring it. On the other hand, it should be pointed out that the Early Ceramic A phase sites produced the highest values in this respect. This indicates that although material abundance was relatively high during this period, material was perceived to be scarcer than during the later phases. This may be attributed to less frequent inter-island traffic and material transport between different communities, relative to later phases.

There are other features that support growing socio-political complexity. The first one relates to the finding of a St. Martin greenstone axe and calci-rudite zemi within the Late Ceramic A phase of the Paso del Indio site. It is probably one of the few sites on Puerto Rico from this phase that yielded these exotic items. The large size of this settlement and the large number of burials suggest that we are dealing with a site of regional significance. Such was the case for Anse à la Gourde as well (Hofman *et al.* 2001). This latter site yielded a significant number of greenstone axes and some calci-rudite zemis. Given the presence of these artefacts at these two large sites and the fact that only these two valuables from the Lesser Antilles were found at Paso del Indio and not the more commodity-like Long Island flint suggest that we are dealing with gift exchanges of highly esteemed objects, which likely occurred between the leaders of these regional centres. Wilson (1990) has mentioned the well-known case of chief Caonobo's wife, Anacaona, the sister of chief Behecchio on Hispaniola, as an example of an elite person. She accumulated numerous valuables through gift-exchanges with other chiefs. Apparently, the circulation of these valuables did not take place simultaneously with the Long Island flint distribution any more and became part of another exchange network, which extended beyond the local micro-region. This suggests that local village leaders from the Lesser

Antilles were interacting with chiefs from the Greater Antilles. The involvement of the Lesser Antilles in one or more of the Greater Antilles elite networks may support the appearance of status variation among the Lesser Antilles.

7.24 The Late Ceramic B phase

Entering the latest phase of indigenous occupation of the islands, some changes occurred. In the first place, the small number of reported sites is striking. Secondly, most of the sites markedly differ from their predecessors in the ceramic styles encountered and site locations chosen, as work at Kelbey's Ridge 2, Morne Cybèle, and Morne Souffleur has shown (De Waal 1999a, 2006; Hofman 1993, 1999; Hoogland 1996). Thirdly, some long-term occupied sites, such as Anse à la Gourde were abandoned (Hofman *et al.* 2001). These facts suggest that the social and cultural situation of the northern Lesser Antilles islands changed, although it has to be stressed that the data are still limited as detailed knowledge for many islands is missing. Hofman and Hoogland argue on the basis of ceramic styles, foreign to the region, that new groups were entering and settling the islands, from a western as well as a southeastern origin (Hofman 1993, 1999; Hoogland 1996). Apparently, the northern Lesser Antilles micro-polities (Hofman & Hoogland 2004), which were formed during the Early Ceramic B phase and experienced their heyday during the Late Ceramic A phase, collapsed at the time, and the central sites were abandoned, leaving room for new people to enter. Although not everyone shares this view (e.g., Crock 2000), and as data for many islands is still lacking or scanty, it may well explain the marginal position the northern Lesser Antilles received in the accounts of the Early Spanish chronicles.

The decline and possible disappearance of the calci-rudite zemi production and use during this latest phase is in accordance with this notion. Detailed analysis of calci-rudite zemi abundance on Anguilla showed that they diminished at the younger sites, being almost absent at Shoal Bay East, which has produced the latest dates for the island. The presence of these artefacts is not reported after approximately AD 1350 in the surrounding region as well. Apparently, with the collapse of Anguilla's central position, which it fulfilled during the Late Ceramic A phase, the role of calci-rudite zemi manufacture as an important means and token to acquire power faded.

In contrast to the decline and possible disappearance of calci-rudite zemi usage, greenstone and Long Island flint continue to be important materials for stone tool production during the Late Ceramic B phase. This suggests that these materials were less sensitive to socio-political or cultural changes. Probably their utilitarian value formed an important feature in addition to their religious or cognitive value, whereas the value of the zemis was primarily related to the ideological realm. Therefore, the greenstone and flint exchange was not primarily or totally dependent on gift-exchange networks between chief(tain)s or spiritual specialists, who were operating in the political arena of competing micro-polities.

Another interesting aspect is the abundance of Long Island flint at Kelbey's Ridge 2 on Saba. Hofman and Hoogland (1999; Hofman 1993; Hoogland 1996) affiliate this site with the Boca Chica ceramic style from Hispaniola and therefore, argue that Saba became part of a Taíno interaction sphere during this late phase. Notwithstanding this stylistic similarity, the abundance of Long Island flint at this site points to interaction within the northern Lesser Antilles itself, rather than maintaining contact with the presumed region of the inhabitants' origin. This favours a scenario in which the small community at Kelbey's Ridge 2 abandoned Hispaniola, for which fissioning may have been the reason, after which it settled on Saba, as this small island was not inhabited then and therefore provided enough room for occupation in contrast to, for example, Puerto Rico or the Virgin Islands, where chiefdom societies resided. Given their social affiliation with distant Hispaniola, contact with their relatives faded, and the community at Kelbey's Ridge sought interaction within its new surroundings.

This relatively abrupt change from a dynamic region where population expanded, and social complexity increased towards a marginal region where sites were abandoned and an "invasion" of new groups occurred seems to provide room for the re-opening of the "Island Carib debate" again. The causes for this change need to be addressed first, before the situation in the last phase of Amerindian history can be fully understood. Important in this respect is whether the change can be explained from processes occurring within the northern Lesser Antilles societies themselves or whether outside forces or even invasion by foreign groups were the main reasons for the decline.

7.3 Concluding remarks

I attempted here to link some of the exchange and distribution patterns found within the scope of this research with some of the issues about socio-political organisation currently at stake within the northern Lesser Antilles. One of these issues is focussed on the possible development of stratified societies during the Late Ceramic Age. I have not explicitly expressed myself in favour of the existence of chiefdoms on one hand, or chieftaincies on the other. In my opinion, the data for lithic production and exchange do not necessarily prove or disprove one or the other. However, it has become clear that the Late Ceramic A phase displayed some changes relative to the Early Ceramic A phase. During the early phase, dispersed villages operating on an individual basis were involved in a long-distance interaction network that was necessary for the successful colonisation of the archipelago. By the Late Ceramic A phase, this long-distance network had disappeared and the more densely populated islands became part of relatively independent micro-regions. It was noted that competition over resources increased within the micro-regions. Furthermore, multiple villages on the same island became engaged in artefact manufacture of items with a regional significance, involving part-time craft-specialists. It was suggested that this was a communal enterprise organised by a supra-village level of authority. This contrasted notably with the single village producing greenstone axes during the earliest phase.

These changes apparently were related to increasing complexity during the Late Ceramic A phase, in particular, communal activities and competition over resources. These facts by themselves, however, do not prove stratification, as chieftaincies may be capable of accomplishing communal activities, although on a temporary basis. Furthermore, the fact that full-time specialists were not necessarily making the objects suggests that stratification likely had not (fully) developed. On the other hand, there are indications that the situation as sketched for the Late Ceramic A phase may have lasted for a few centuries at least (Crock 2000). In such a case, a supra-village level of authority cannot be explained by the presence of a chieftaincy only. Power within these societies was fluid because it was dependent on achievement and therefore, it may have alternated relatively quickly between headmen of different villages. As Redmond (1998c) has argued, a stable chieftaincy, which is ruled for a considerable period by the same lineage, will likely transform into a chiefdom over time.

These points make it clear that if chiefdom societies had come into existence within the northern Lesser Antilles during the Late Ceramic A phase, the data at least suggest that it did not evolve into a fully developed one. Considering the situation during the Late Ceramic B phase, which displays an abandonment of many central sites and intrusion from outside groups, any multi-village polity had likely disappeared at that time.

Let me end by making a few final comments on the study of stone tool production and exchange within the Caribbean. My work has clearly demonstrated that this is a fruitful line of research in this region. The presence of many small islands providing different stone resources offers a great setting for identifying stone material distributions. Within my research, I concentrated on the use and distribution of three different materials. I showed that they were widely used and exchanged among the northern Lesser Antilles throughout the major part of the Pre-Columbian era. Apart from these three materials, it is evident that the Amerindians exploited several other lithic sources. For a number of them, I was able to pinpoint possible provenances that in many instances proved to be relatively nearby sources. Still, the origin of a portion of the stone artefact assemblages remains unspecified. These include many of the semi-precious rock materials used for bead and pendant manufacture, as well as a various stone types used for making axes. Many of these materials most probably originated from very distant sources outside the present study area. Concentrating on these materials in the future may provide information on long-distance relationships, which are additional to the data obtained in this research. In this light the St. Martin greenstone exchange network needs further elaboration as well, in particular with regard to the Late Ceramic A phase. Recent identification of greenstone axes at sites on St. Lucia suggests that the distribution of this material went even further than was specified during this research (Hofman and Hoogland, personal communication 2003).

With regard to stone tool and artefact production, it is now evident that the habitation sites formed the primary places of manufacture. Still, additional research focussing on the exploited greenstone and calci-rudite source areas is needed. In relation to the greenstone axe manufacture, it is of special interest to find out whether a single source area or whether multiple outcrops on St. Martin were exploited during the different Ceramic Age phases. For the calci-rudite material, future research should attempt to identify the places of Early Ceramic Age zemi manufacture. Analysis of material from the excavations at Rendezvous Bay site, currently being done by the University of Vermont (Petersen and Crock, personal communication 2004), should receive a central role in this matter. Additionally, larger samples from both lithic materials need to be studied to obtain more accurate data on production behaviour. In combination with more accurate chronological assignment of the places of manufacture, this will provide a more complete view on the organisation of production through time. As such, it will first further elaborate and help close the gaps within our current picture of calci-rudite zemi manufacture and secondly, it may provide better insight into the interpretation of the involvement of different villages in the production of both artefacts.