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Procurement and Use of Chert from Localized Sources in Trinidad

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Relatively little is known about the procurement and use of chert as a lithic resource by prehistoric Amerindians in Trinidad. Although not common, chert artifacts are present on both Archaic and Ceramic Age sites throughout much of Trinidad. Recent research in the Central Range has located and documented two previously undocumented localized sources where chert is readily available. Other previously reported localized sources of chert in the Northern, Central, and Southern Ranges were also visited. The chert at each source is described and characterized in terms of suitability for working. Analysis of chert artifacts from ten sites spread across Trinidad, as well as the description of chert artifacts from several other sites, revealed that Malchan Hill, located in the Central Range, appears to have been a primary source for many of the chert artifacts found in Trinidad. The technology that was used to produce the majority of chert artifacts is based on bipolar percussion for the production of simple flake blanks. These sharp unmodified flake blanks appear to have been used for various cutting and scraping purposes in Archaic times, whereas many of the flake blanks were smashed into angular wedge-shaped pieces to be used as teeth in grater boards for the processing of plant foods, especially cassava, in Ceramic times.

Relativamente poco se sabe acerca de la adquisición y el uso del sílex como recurso lítico por los amerindios prehistóricos en Trinidad. Aunque poco comunes, los artefactos de sílex están presentes en sitios de la Época Arcaica y de la Era Cerámica a través de gran parte de Trinidad. Investigaciones recientes en la Cordillera Central han identificado y documentado dos fuentes localizadas y previamente indocumentadas en las que el sílex es fácilmente disponible. Otras fuentes localizadas y previamente reportadas de sílex en las cordilleras Norte, Centro y Sur también fueron visitadas. El sílex de cada localidad es descrito y caracterizado en términos de su idoneidad para ser labrado. El análisis de los artefactos de sílex provenientes de diez sitios a través de Trinidad, así como descripciones de los artefactos de sílex de varios otros sitios, revelan que el Cerro Malchan, ubicado en la Cordillera Central, parece haber sido una fuente principal de muchos de los artefactos de sílex encontrados en Trinidad. La tecnología utilizada para producir la mayoría de los artefactos de sílex se basa en la percusión bipolar para producir láminas pre-labradas. Estas filosas láminas no modificadas parecen haber sido utilizadas en tiempos arcaicos para diversos tipos de cortadura y raspado, mientras que muchas de las láminas eran quebradas para formar piezas angulares en forma de cuña, utilizadas como dientes en los ralladores usados para procesar alimentos de origen vegetal, especialmente de yuca, durante la Era Cerámica.

Nous savons peu sur la méthode d'approvisionnement et l'emploi fait du chert en tant que ressource lithique par les Amérindiens préhistoriques en Trinité. Bien que peu courants, des exemples du chert artéfactuel se présentent dans les multiples sites datant de l'époque archaïque et de l'âge de la céramique en Trinité. Des fouilles récentes dans la Rangée centrale ont révelé et documenté deux sources de chert localisées mais inconnues préalablement, sources où le chert est abondant. Des visites se sont également effectuées sur les lieux d'autres sites déjà signalés et reconnus comme sources de chert. L'analyse des dépôts de chert a été ensuite réalisée en vue de définir leurs caractéristiques et leur potentiel d'exploitation ou d'adéquation. Les résultats des analyses tirées de dix sites en Trinité, ainsi que la description des artéfacts venus de plusieurs autres sites, ont identifié la Colline de Malchan dans la Rangée centrale comme la source principale présumée des artéfacts de chert découverts dans l'île. La technique employée dans la production de la plupart des artéfacts se base dans la percussion bipolaire qui produit des éclats. Ces éclats tranchants semblent s'employer à des tâches diverses de coupage ou de raclage pendant l'époque archaïque, tandis qu'une majorité des éclats ont été débités en biseau pour servir à denteler les planches à raclage utiles à traiter des aliments végétaux, surtout du manioc, pendant l'âge de la céramique.

Introduction

Chert is a versatile lithic raw material that was used by Amerindians in coastal South America, Trinidad, and elsewhere in the Lesser Antilles for a variety of tasks. During Archaic times, chert flakes were used as scrapers, knives, burins, spokeshaves, and perforators to process plant and animal resources, incise wood and bone, plane arrow shafts, and punch holes. During Ceramic times, chert was also used to produce small wedge-shaped flakes that were inserted into grating boards to process cassava (or manioc) (Boomert 2000:324–325; DeBoer 1975:420–431).

Despite more than a century of archaeological work at Amerindian sites in Trinidad, very little has been presented in the literature on chert resources and artifacts made from them. The lack of data on chert artifacts may be related to a primary focus on analyzing the vast quantities of pottery, faunal remains, and shell artifacts that are typically recovered from shell midden sites along the coasts of Trinidad. In comparison, chert artifacts are relatively uncommon and consist of small flakes that are typically referred to only as "chert chips" or "flint chips."

Multiple types and sources of chert have been identified among the islands in the northern Caribbean and the northern Lesser Antilles in particular (Knippenberg 2006, Knippenberg and Zijlstra 2008; Walker 1980). Some studies have succeeded in establishing likely modes of procurement (i.e., direct procurement versus exchange), transportation, and distribution of these cherts between the islands (Knippenberg 2001, 2006, 2011). Other studies have focused on the replication and function of artifacts made from chert (Berman et al. 1999; Lammers-Keijsers 2007; Walker 1980). Although the highest quality and most popular chert (i.e., Long Island chert) circulated widely among the islands in the northern Antilles between Anguilla on the north and Guadeloupe on the south, there is no evidence that any Long Island chert made its way to Trinidad at the southern end of the Lesser Antilles.

Discussions of chert artifacts from sites in Trinidad are rare and references to the sources from which the raw material was obtained to make the chert artifacts are even more rare. The passing references to possible chert sources were sometimes inaccurate because they were assumed to be foreign to Trinidad. This is because chert sources in Trinidad are undocumented. Bullbrook (1953:102, 1960:37) suggested that flint and quartzite artifacts collected from the Crossfield 1 and Crossfield 2 sites were likely derived from a beach source at Los Iros Bay, although there is no description of the physical attributes of the chert. Based on personal communication with Harry S. Kuarsingh, Boomert (2000:49) mentions a major chert source in the vicinity of Four Roads in the eastern portion of the Central Range; however, the specific location of this source and the type of source (i.e., primary outcrop or secondary deposit) was not provided.

Investigations by Missouri State University (MSU) in 2011 at the La Reconnaissance site (SGE-34B) in the Northern Range resulted in the recovery of 23 chert artifacts. The chert artifacts were made from raw materials that range from high-quality fine-grained chert that is predominantly dark bluish gray to black and light gray to low-grade medium-grained chert that is dark gray to light gray weathering to brown. Nearly half (N=12) of these artifacts are cortical artifacts that represent early-stage core reduction. These cortical artifacts have brown patinated surfaces covered with large Hertzian impact cones produced by fluvial transportation. These cortical attributes indicate that the chert cobbles were collected from alluvial sources (i.e., stream deposits). The discovery of the chert artifacts at La Reconnaissance sparked an interest in locating the source or sources of this alluvial chert.

In February of 2011, the author visited with Dr. Brent Wilson, Professor of Palaeontology and Geology at the University of the West Indies in St. Augustine. Dr. Wilson indicated that chert is rare in Trinidad but mentioned a potential source in the Central Range known as Chert Hill, located approximately midway between Biche and Mamon. Shortly thereafter, a reconnaissance trip was made to Mamon, which has the closest road to Chert Hill on the north side of the Central Range. A couple of small cobbles of low-grade chert were collected from a gravel bar of the Cunapo River at Mamon. The Gautier River, which is a headwater tributary of the Cunapo and Rouge rivers, bisects the Chert Hill area. Several cobbles of a high-grade chert were also collected along the gravel road south of Mamon. The chert in the road gravel and the gravel bar were macroscopically identical to the chert artifacts found at the La Reconnaissance site.

Research by MSU in 2012 included an effort to locate the source (or sources) of chert reflected in the lithic assemblage from the La Reconnaissance site. The purpose of this research was to document the source(s) of chert in Trinidad as a first step to create a foundation for later studies that might address larger socio-economic questions regarding how the raw material was acquired and distributed within Trinidad and possibly beyond Trinidad to neighboring Tobago and the South American mainland.

Survey for Chert Sources

In January of 2012, six days were spent investigating selected locations in the Northern and Central ranges of Trinidad in an attempt to pinpoint the specific source(s) of chert represented at La Reconnaissance and briefly sampled in 2011 at Mamon, as well as potential sources of chert indicated on geologic maps and mentioned in geological publications (Ray 2012). Three potential chert sources in the Central Range and one source in the Northern Range were investigated. In March of 2014, a one-day follow-up reconnaissance was made to two previously reported chert sources located in southwest Trinidad.

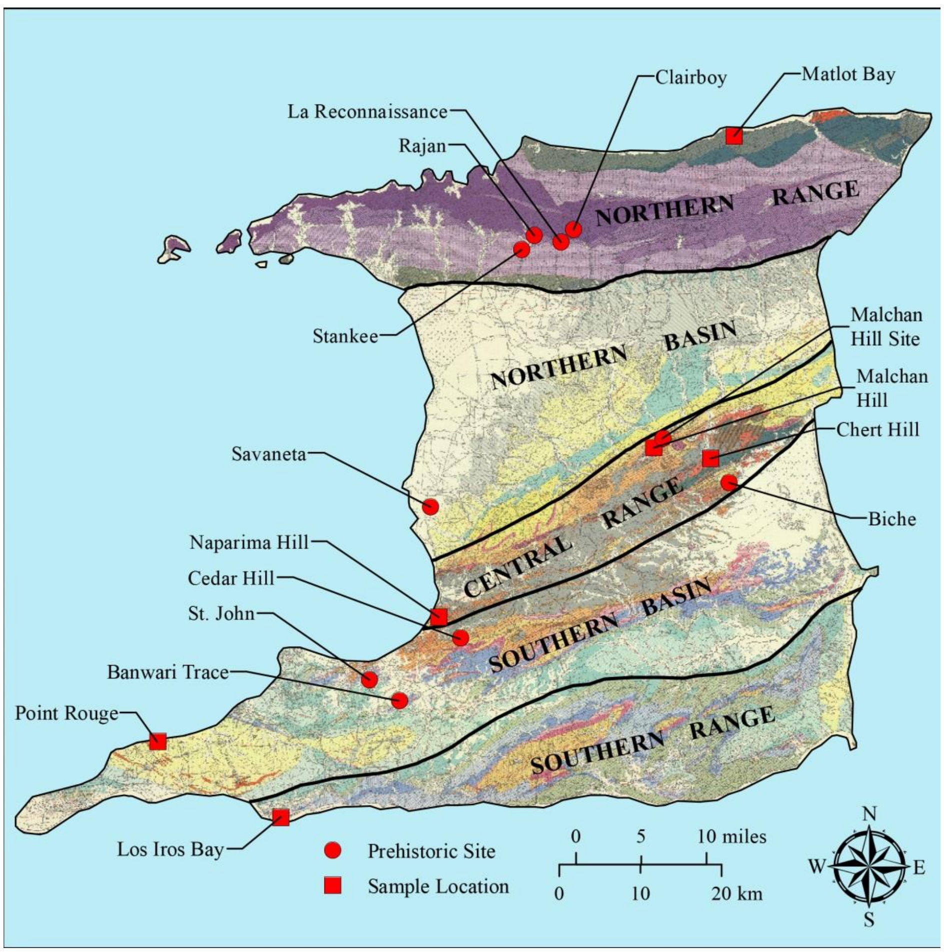

Figure 1. Location of sampled chert deposits and selected Amerindian sites.

Chert Hill

Chert Hill is located in the eastern portion of the Central Range (Figure 1). Although given the rank of formation by some, Chert Hill is now generally considered a member (or lateral facies) of the Cretaceous-age Naparima Hill Formation, composed mostly of shales and siliceous mudstones and siltstones (Donovan 1994:213–214). Liddle (1946:717-718) referred to this unit as the Cunapo-Southern Horizon of the Turure Formation. The Chert Hill member is approximately 150 m thick and is composed of bedded, low-grade argillaceous chert (also known as argillite) (Kugler 1953:37; Suter 1960:18). Chert Hill covers an area of approximately 16 hectares. A few smaller exposures of the Naparima Hill Formation have been mapped 7–8 km to the southwest and northeast of Chert Hill (Kugler 1959). Although these smaller exposures were not investigated, a general lack of chert in the gravels of the Rouge River (see below), which bisects the largest of these outlier exposures, indicates that this exposure of the Naparima Hill Formation is composed primarily of mudstones rather than low-grade chert.

Two days were spent investigating the chert deposits at Chert Hill. Guided one-hour-long (one-way) hikes were necessary to reach an exposure of chert at the heart of Chert Hill. This exposure is composed of an approximately 8-m-high bluff formed by the Gautier River. However, the main exposure was cut into the bluff by a small tributary that formed a waterfall and plunge pool as it bisected the chert deposit. The exposure at this waterfall is composed entirely of bedded chert deposits that vary between 7 cm and 20 cm thick (Figure 2).

Figure 2. Bedded chert deposit at Chert Hill.

The bedded chert at the waterfall is comprised of low-grade argillaceous chert that is laden with internal incipient fracture planes, which inhibit good conchoidal fracture. Cortical surfaces are dark gray (10YR 4/1) and smooth. Although it imparts conchoidal fracture when knapped, edges are not as sharp as fractured edges of high-grade chert. This low-grade argillaceous chert has a Mohs hardness of 6.0 and is, therefore, softer and less brittle than most fine-grained, microcrystalline cherts. In unweathered subsurface deposits, the chert is very dark gray to black due to infiltration of asphaltic oil, but it lightens significantly as the oil dissipates upon weathering (Liddle 1946:718-721). Slightly weathered chert found at the surface is mostly gray (N 6/0) and light gray (N 7/0) with thin gray (N 5/0) and dark gray (N 4/0) wisps, streaks, or discontinuous bands. These dark bands and streaks appear to be biogenic (burrow) structures (Figure 3a-d). Highly weathered deposits are yellowish brown (10YR 5/8) to very pale brown (10YR 7/3), porous, and tripolitic. The texture is predominantly medium grained and luster is dull or low. The chert appears to be nonfossiliferous.

Figure 3. Chert sample from Chert Hill.

Stream-deposited cobbles in the Gautier River were also sampled from the waterfall area to the periphery of Chert Hill more than 1 km downstream. Multiple large gravel bars are located along the channel of the Gautier River (Figure 4). These gravel bars are composed primarily (approximately 85 percent) of low-grade, angular to subangular chert pebbles and cobbles up to 12 cm in diameter. Approximately 90 percent of the redeposited chert cobbles are highly weathered, contain multiple incipient fracture planes and, therefore, exhibit poor to fair conchoidal fracture. Nevertheless, a few higher-quality chert cobbles were found in the stream deposits of the Gautier River, indicating that localized deposits of slightly higher-grade chert also are present in the vicinity of Chert Hill. One cobble contained microcrystalline, semilustrous, fine-grained chert at its core.

Figure 4. Redeposited chert cobbles in the Gautier River.

Cortical surfaces of redeposited Chert Hill chert cobbles are patinated brown (10YR 4/3) and dark yellowish brown (10YR 4/4), smooth, and lack any Hertzian impact cones indicative of high-energy alluvial transport. Cortical surfaces typically, but not always, exhibit light fluvial sheens. Redeposited chert cobbles are similar to the bedded deposits at the waterfall in terms of color, luster, lack of fossils, and texture, with the exception that several cobbles exhibited wider, darker, and more pronounced bands and discontinuous streaks (Figure 3f-h).

Large gravel bars of chert do not extend into the Rouge River beyond the mouth of the Gautier River. A small deposit of redeposited gravel was sampled on the right bank of the Rouge River a short distance upstream of its confluence with the Gautier River. Only about 1–5 percent of the gravel was chert, and these gravels consisted of pebbles with maximum diameters of only 3–6 cm.

Surveys for chert artifacts also were conducted in conjunction with the chert sampling. These included examination of exposed cutbanks and the surface of all gravel bars along the 1-km stretch of the Gautier River, localized bare areas along an approximately 0.6-km-long dirt trail across the flank of Chert Hill, and deposits in and around the plunge pool at the waterfall. One 40-cm-deep shovel probe also was dug on the highest point of the floodplain of the Gautier River opposite the waterfall. No chert artifacts were found at any of these locations.

The lack of chert artifacts in the gravel deposits of the Gautier River and the predominance of low-grade argillaceous chert suggest that Chert Hill was not a quarry location or major procurement source of chipped stone.

Although the chert sampled at Chert Hill resembles low-grade chert exhibited by a few of the flakes found at La Reconnaissance, it does not resemble the finer-grained and more lustrous chert from which the majority of chert artifacts from the site were made. After inquiring about the source of the high-quality chert cobbles found the previous year as road metal south of Mamon and possible gravel quarries in the area, the author was guided to Malchan Hill.

Malchan Hill

Malchan Hill is located 2.6 km south of Four Roads and about 7.5 km west-northwest of Chert Hill in the central portion of the Central Range (Figure 1). An abandoned gravel quarry called St. Georges Estate Quarry has removed a large portion of the hill, leaving a tall central tower or pillar approximately 30 m high and more than 100 m wide at its base (Figure 5).

Figure 5. Quarried face of Malchan Hill chert source.

The deposits at Malchan Hill appear to represent a middle Tertiary (Oligocene-Miocene) facies of either the Nariva, Brasso, or Cunapo Formation. Each of these formations contains conglomeratic deposits, and the strata of all three interfinger in the vicinity of Malchan Hill (Donovan 1994:211-215; Kugler 1959). According to Kugler (1953:54), the conglomerate in the upper portion of the Brasso Formation contains “black Cretaceous cherts,” a description very similar to the dark-colored redeposited chert nodules at Malchan Hill.

The unique deposit at Malchan Hill consists of a coarse, weak conglomerate of redeposited pebbles and cobbles of sandstone, siltstone, quartzite, chert, argillite, hematite, and petrified wood. Redeposited pebbles and cobbles (Figure 6) in a dark brown sandy matrix comprise the lower 18 m on the southeast side of the pillar, whereas the top of the pillar is capped by yellowish brown and reddish brown weak siltstone with very little gravel. Knappable pebbles and cobbles of chert, which range from 4 cm to 18 cm in diameter, comprise approximately 10–15 percent of the gravel conglomerate. Cobbles are subangular to rounded but the vast majority are subrounded. The largest chert cobble measured 18 cm long, 12 cm-wide, and 8 cm thick.

Figure 6. Closeup of in situ redeposited cobbles at Malchan Hill (scale: 1 m).

The chert at the Malchan Hill source, referred to here as Malchan chert, is primarily composed of fine-grained, highly siliceous, lustrous, high-grade chert; however, low-grade argillaceous chert is also present in the gravels. Although some cobbles may grade from high-grade chert in one portion of the cobble (generally at the core) to low-grade argillaceous chert in another portion of the cobble, most of the chert can be divided into two distinct varieties. The two varieties of Malchan chert are described separately below as 1. and 2.

1. Cortical surfaces of the fine-grained, high-grade variety are generally well rounded by corrasion (fluvial abrasion). The cortical surfaces typically are covered with large Hertzian impact cones, indicative of high-energy alluvial transport. They also generally exhibit a prominent fluvial polish or sheen, although the fluvial sheen may be light on the cortical surfaces of some cobbles and sometimes evident only under microscopic examination. The internal structure of the high-grade chert is predominantly a mottling of bluish gray (5PB 5/1, 6/1), dark bluish gray (5PB4/1; 10B 3/1), gray (N 5/0) dark gray (N 4/0) and very dark gray (N 3/0) with minor amounts of light bluish gray (5PB 8/1) and brown (7.5YR 4/2) (Figure 7). Narrow and wide dark bands also may be present in the matrix. No fossils were evident in the chert. Luster is moderate to high. The high-grade variety of Malchan chert exhibits excellent conchoidal fracture with sharp edges. This chert is more siliceous, more lustrous, finer-grained, harder (Mohs hardness of 7.0), and contains fewer

incipient fractures than the low-grade argillaceous chert.

2. The low-grade argillaceous chert at Malchan Hill may exhibit the same dark colors as the high-grade chert, but most of it is gray (10YR 6/1), pale brown (10YR 6/3), light gray (10YR 7/2), and white (10YR 8/1). The matrix may or may not contain narrow dark bands. Texture is medium grained and luster is low. It appears to be nonfossiliferous. Like that at Chert Hill, low-grade chert produces an inferior conchoidal fracture compared to fine-grained, high-grade chert. The cortical surfaces of softer low-grade chert cobbles typically exhibit pock marks instead of prominent impact cones, but fluvial sheens are generally evident macroscopically or microscopically.

Figure 7. Sampled chert cobbles at Malchan Hill.

It is difficult to differentiate artifacts made from the low-grade chert at Malchan Hill from artifacts made from the low-grade chert at Chert Hill due to overlapping internal attributes. The only attributes that differentiate low-grade chert from the two sources are modified cortical surfaces on cores, decortication flakes, and angular shatter. Cortical surfaces on low-grade chert cobbles obtained from Malchan Hill typically exhibit pock marks and light-to-prominent fluvial sheens, whereas cortical surfaces on low-grade chert cobbles from Chert Hill are smooth but lack corrasive pock marks and prominent fluvial sheens produced by dynamic stream action.

Overall, the fine-grained chert at Malchan Hill is homogenous, which suggests that all or a majority of it may have derived from a single rock formation. The low-grade argillaceous chert may have derived from the same or another rock formation. Whereas low-grade chert deposits occur in Venezuela and locally in the Central Range of Trinidad, the original source of the high-grade chert is unknown. Cortical attributes on the well-rounded cobbles indicate high-energy alluvial transport by a mountain stream. A river(s) draining the Northern Range would be a logical source for the redeposited cobbles, but there are no known reports of in situ fine-grained, high-grade chert deposits anywhere in the Northern Range, nor are there relict chert cobbles in the streams that flow out of the Northern Range. If the chert came from bedrock in the Northern Range, then the entire rock formation and inclusive insoluble chert deposits appear to have been removed by erosion during the Tertiary period.

Alternatively, the high-grade Tertiary-age chert may have been deposited by an ancestral Orinoco River or tributary draining an older and higher Coastal Range in eastern Venezuela. Possible sources include Upper Cretaceous formations (i.e., Querecual, La Luna, or San Antonio) of the Guayuta Group in eastern Venezuela, all of which contain layers and nodules of dark chert (Liddle 1946:243-279). High-grade chert could have been stripped from one of these formations during the great Middle Eocene erosional period and redeposited in a conglomerate in central Trinidad (Liddle 1946:726). Whatever the origin, the alluvial chert and other rock types appear to have been deposited into a deltaic environment whereupon subsequent (Pleistocene) stream incision and lateral erosion removed the majority of the deposit, leaving only a large core of redeposited gravel that formed Malchan Hill. Accordingly, Malchan Hill may represent a unique deposit in the Central Range of Trinidad.

Although dense vegetation presented unfavorable survey conditions, a transect was made around the flanks of Malchan Hill, looking in ravines for artifacts. A few tested cobbles and cores were found in small steep ravines on the north, west, and south sides of the hill; however, a light-to-moderate scatter of chert artifacts was discovered on a small ridge that was formerly connected to the northeast flank of the hill (Figure 8). It was recorded as the Malchan Hill site (SAN-10), an apparent lithic workshop. Disturbances to the site include tree clearing, road construction, quarry operations, and trampling by cattle to a depth of approximately 15–25 cm below surface.

Figure 8. Malchan Hill site (SAN-10) on northeast side of Malchan Hill.

A small grab sample of artifacts was collected from the site over a 10-minute period. The artifacts include one ground-stone metate fragment and 27 chipped-stone artifacts. The metate fragment measures 19.5 cm long, 14.6 cm wide, and 9.2 cm thick. This sandstone metate has a shallow concave basin on one face that was ground smooth, although several small pits or divots are scattered across the basin (Figure 9). These small pits indicate that this milling stone also served as an anvil, probably for lithic reduction via bipolar percussion flaking. Experimental bipolar flaking by the author on a sandstone metate produced identical small pits. The chipped-stone artifacts include one core, three primary flakes, 14 secondary flakes, two tertiary flakes, and seven flake fragments (Note—primary flakes are decortication flakes with >50 percent of the dorsal surface covered with cortex; secondary flakes are decortication flakes with <50 percent of the dorsal surface covered with cortex; tertiary flakes are interior flakes with no cortex on the dorsal surface; flake fragments are distal portions of flakes that have missing platforms and are unidentifiable as to flake type.) The flake debitage consists primarily of decortication flakes that represent flake-blank-reduction technology by both bipolar and freehand percussion flaking.

Naparima Hill

Naparima Hill is located at the extreme west end of the Central Range (Figure 1). This hill was called "Anaparima" by historic Amerindians living on the south side of the hill. Today it is commonly referred to as San Fernando Hill. Naparima Hill is the type site for the Naparima Hill Formation. This Upper Cretaceous formation is composed primarily of mudstones, siltstones, and shales; however, the upper part of this formation is locally siliceous and grades to argillite or argillaceous chert (Barr and Saunders 1968:3; Donovan 1994:214; Suter 1960:19). Liddle (1946:717-721) referred to these deposits as the San Fernando Argiline Horizon (of the Turure Formation), a lateral equivalent of the Cunapo-Southern Horizon in the Biche area (i.e., Chert Hill).

Figure 9. Broken sandstone metate fragment from SAN-10 (note pits across the face of the metate produced by bipolar percussion flaking).

The flanks of Naparima Hill were extensively quarried in the early-to-middle twentieth century, leaving a central core on which a Trinidad Forestry Office is located. The only exposures that were examined were along road cuts leading up to the Trinidad Forestry Office. Locally siliceous mudstones in the road cuts are relatively soft and exhibit only crude conchoidal fracture. No chert deposits were observed during limited examinations of extant deposits on Naparima Hill. However, former localized deposits of low- or medium-grade chert on Naparima Hill cannot be ruled out since large quantities of the hill were removed during the last century for quarry operations. Several geologists have noted chert deposits on the hill. Waring (1926:44) noted, "There are flinty pebbles and other remnants of this conglomerate on the northeast flanks of San Fernando Hill and Mt. Moriah," and Liddle (1946:717) noted rocks ranging "from argiline to pure chert" in the San Fernando Argiline Horizon. The Naparima Hill Formation has been characterized as "locally cherty" (Barr and Saunders 1968:3), and "abundant chert nodules" have been noted in the top layers (Suter 1960:19).

Matelot Bay

A geological reference noted a chert deposit on the north coast of the Northern Range near Matelot (Figure 1). In a discussion of Lower Caribbean Series (Lower Cretaceous) deposits, Waring (1926:33) mentioned, "In one locality within this lowest part of the series, on the Paria Main Road a mile west of Matelot Bay—cherts 10 to 30 feet thick were noticed." Although the in situ deposits mentioned by Waring were not found, a couple of large 1-m-wide boulders of coarse-grained chert were found in a narrow ravine approximately 1.5 km west of Matelot. This massive coarse-grained chert is very poor quality with little or no expression of conchoidal fracture properties. This deposit can be ruled out as a prehistoric source of knappable chert.

Los Iros Bay

This chert source was pointed out long ago by Rouse (1953:102), who suggested that flint and quartzite artifacts collected from two sites at Point Fortin were likely derived from a source at Los Iros Bay on the south coast of Trinidad. The rock outcrops at Los Iros mark the westernmost end of the Southern Range (Figure 1). The Los Iros Bay source consists of a localized mass (approximately 80-m long) of boulders, cobbles, and pebbles eroding from bedded deposits along the edge of the bay. Only thirty minutes were spent sampling the beach deposits at Los Iros. The majority of the cobbles consisted of various grades of sandstone and quartzite, but 10 cobbles and pebbles of chert were found. Seven of these were composed of low-grade argillaceous chert, two were composed of medium-grade chert grading to argillaceous chert, and one pebble consisted of high-grade chert.

Cortical surfaces of the low-grade argillaceous chert were rounded with pock marks and a light sheen or no sheen. Colors included black (N 2.5/0), very dark gray (N 3/0), dark grayish brown (10YR 4/2), pale brown (10YR 6/3), and gray (2.5Y 6/1). Cortical surfaces of the medium-grade and high-grade chert were subrounded with light localized sheens and Hertzian cones concentrated on subrounded edges. This chert was dark gray (N 4/0), very dark gray (N 3/0), and yellowish brown (10YR 5/6). The single pebble of high-grade chert that exhibited Hertzian cones and a sheen resembles high-grade Malchan chert. Although the Los Iros source does not provide an abundant quantity of chert like the Chert Hill and Malchan Hill sources, chert nevertheless is available at this localized source of beach cobbles and pebbles.

Point Rouge

This location was mentioned as a potential chert source by Boomert (2000:67) in reference to a lithic workshop site at the Pitch Lake 3 site located near the famous tar deposit in southwest Trinidad. Boomert suggested that one of the varied raw materials observed in chert artifacts from this site could be collected at Point Rouge, located 10 km farther to the southwest along the Gulf of Paria. Thirty minutes were spent sampling boulders and cobbles located on the shoreline at the base of the cliff face at Point Rouge. The vast majority of the rounded cobbles consisted of slightly siliceous mudstones that exhibited only crude conchoidal fractures. Only two pebbles could be classified as low-grade argillaceous chert. Cortical surfaces were rounded with pock marks, but they exhibited no sheen. Colors included red (2.5YR 5/6), light red (2.5YR 6/8), brown (10YR 5/3), very pale brown (10YR 8/4), and dark gray (N 4/0). Although Point Rouge may have served as an expedient source for relatively small quantities of low-grade argillaceous chert, it does not appear to have been a source for any high-grade chert.

Other Possible Chert Sources

Other localized sources of chert (not investigated here) may be scattered across certain portions of the Central and Southern Ranges. Waring (1926:49) stated that in the middle portion of the Upper St. Croix formation:

> ... there are occasional well-rounded pebbles of chert and quartzitic sandstone, up to an inch or even more in diameter. Usually such pebbles are present singly; but in a few places they are so plentiful as to form a local bed or lens several yards in extent and a few feet in thickness.

Pebbles of chert also have been found in the Poonah conglomerate of the Mayo Limestone member of the Brasso Formation at Mayo Quarry in the western portion of the Central Range (Brent Wilson, personal communication 2012). A brief visit to this historic quarry found only a few pebbles of quartzite and argillaceous chert. It is unclear whether the chert pebbles at either of the above locations were exposed at the surface and available to precontact Amerindians.

Rouse (1953:99) mentioned “an outcrop of conglomerate” not far from the Savaneta site as a possible source of the chert artifacts found at that site, and citing a personal communication from Bullbrook to Rouse, Boomert et al. (2013:42) noted that “A fault breccia once existed beneath the cliff at Point Bontour, with an outcropping of flint and chert.”

Collections Analysis

In conjunction with the above surveys, the Archaeology Centre in the Department of History at the University of the West Indies (UWI), St. Augustine was visited in January of 2012 to examine collections from three sites in southwest Trinidad that have yielded chert artifacts. In addition to the collections at UWI, chert artifacts from the surface of a fourth site in southwest Trinidad and chert artifacts from four recently discovered sites in the Northern Range and two sites in the Central Range were also analyzed.

The identification of the raw materials represented in the sites below was made by visual (macroscopic and microscopic) observation and comparison of physical attributes such as color, internal structure, luster, inclusions, and texture. Whereas the use of petrographic and geochemical techniques can sometimes help trace chert artifacts to chert sources and differentiate between chert sources (Knippenberg and Zijlstra 2008; Lammers-Keijsers 2007), the use of these expensive and time-consuming techniques was beyond the scope of this initial and preliminary investigation. Additionally, it was relatively easy to distinguish between dark-colored, high-grade, fine-grained, and lustrous Malchan chert (especially those exhibiting relict cortical surfaces with prominent Hertzian cones and fluvial sheens) from light-colored, low-grade, nonlustrous, and argillaceous chert from Chert Hill. Nevertheless, geochemical testing should be considered for future investigations to help distinguish between the low-grade cherts found at Chert Hill, Malchan Hill, Los Iros, and other locations in Trinidad.

Savaneta

Savaneta (CAR-2) is located just north of the western end of the Central Range in the Northern Basin (Figure 1). The site was described by Rouse (1953:99, 108) as “a scattered deposit of flint chips” and a possible workshop of Archaic (Banwarian subseries of Ortoiroid series) Amerindians. However, the workshop characterization was based on the site’s proximity to a possible source of chert rather than a study of existing artifacts.

Four chert artifacts at UWI were examined. They consist of one small bipolar core, one larger amorphous core, one small flake fragment, and a fractured sub-rounded pebble. All four artifacts appear to have been made from Malchan chert. The chert is fine-grained and mottled gray, bluish gray, and very dark gray. Each has a corraded cortical surface and two specimens exhibit light to heavy impact cones.

Cedar Hill

Cedar Hill (VIC-41) is located near Princes Town in the Southern Basin (Figure 1). It is believed to represent an Early Bontour complex Ceramic Age site (Boomert 2000:497). Six chert artifacts were examined (Figure 10). They consist of one core, one primary flake, and four secondary flakes measuring between 25 mm and 45 mm long. Colors include very dark gray, gray, light gray, brown and white, and red (probably burned). Five are comprised of fine-grained, high-grade chert. The cortical surfaces of four are well rounded and three exhibit prominent impact cones. All six artifacts appear to have been made from Malchan chert.

Figure 10. Chert artifacts from the Cedar Hill site.

St. John

St. John (SPA-11) is located approximately 12 km southwest of San Fernando in the Southern Basin (Figure 1). Several flint (or chert) artifacts have been reported from this Early Archaic Banwari Trace complex site (Boomert 2000:504; Boomert et al. 2013:11–15; Reid 2011:50–51). Fifteen chipped-stone artifacts (14 of chert and one of quartzite) are in the collections at UWI. They consist of one core, 10 secondary flakes, one tertiary flake, and three flake fragments.

Unlike the chert artifacts from Savaneta and Cedar Hill, all of the artifacts from St. John have calcium carbonate deposits on dorsal and ventral surfaces. Most of the artifacts exhibit a dull light gray color, although a few are pale yellow and two are gray. The flaked surfaces of the core are light gray, but a fresh fracture on one edge revealed a dark gray color beneath a thin light gray rind. It appears that the light gray surfaces are patinas produced by long-term chemical weathering. Chemical weathering of chert is most severe in warm humid climates and in coastal deposits where alkaline soils and salt accumulations accelerate patination (Sheppard and Pavlish 1992). The St. John site is located on a small rise on the southern edge of the Oropuche Lagoon and the Godineau Swamp.

The texture and luster of most of the specimens is difficult to determine due to well-developed patinas, but the fresh fracture on the core revealed a fine grain and high luster. Eight chert artifacts have well-rounded cortical surfaces. Three artifacts exhibit heavy impact cones, one does not, and eight are indeterminate due to calcium carbonate deposits. Most of these chert artifacts presumably are made from Malchan chert, but some could be made from chert from Los Iros Bay or other undocumented chert sources in the southern portion of Trinidad.

Banwari Trace

Banwari Trace (SPA-28) is located near the Coora River not far northwest of Penal in the Southern Basin. This site is the type site for the Early Archaic Banwari Trace complex and Early Banwarian shell middens (Boomert 2000:55). Boomert (2000:61) reported that many of the flakes and cores from this site had remnant cortical surfaces of the original pebble and that very few of the flakes appear to have been shaped by intentional retouch after detachment from a core.

During a brief visit in 2014, a grab sample of 11 chert artifacts and one quartzite artifact was collected from the surface of the small hill at Banwari Trace. The chert artifacts consist of one primary flake, six secondary flakes, one flake fragment, and three pieces of angular shatter. The majority of the unbroken flakes exhibit prominent bulbs of percussion at a single point of impact, indicative of direct-freehand percussion.

Four flakes and three pieces of shatter are comprised of high-grade chert, whereas four flakes are comprised of low-grade argillaceous chert from a source(s) other than Malchan Hill. Of the seven artifacts made from high-grade chert, three knapped from Malchan chert exhibit large Hertzian cones and light sheens. The remaining chert flakes are unidentified as to source. Two specimens exhibit limited impact cones restricted to angular cortical edges and no sheens, whereas the other two have limited cortical surfaces on a very narrow platform.

Biche Point

A contracting-stem, bifacially-flaked projectile point/knife at the Archaeology Centre of the University of the West Indies was also examined. This point was found by a boy in 1988 near the village of Biche (NAR-9) in the eastern portion of the Central Range (Figure 1) (Boomert 2000:49). This point has a relatively wide blade with a width of 37.9 mm at the shoulders. The shoulders are slightly rounded and unbarbed. The blade is recurved from the shoulders to the distal end, resulting in a relatively narrow tip (Figure 11). It is biconvex in cross section. The stem (or tang) is narrow, contracting, and long (24.6 mm). The base is slightly rounded to pointed. This point has a length of 92.4 mm and a maximum thickness of 13.5 mm. The blade and stem appear to have been thinned and shaped by soft hammer percussion and finished by pressure flaking.

Figure 11. Contracting-stem, bifacially flaked Biche point from NAR-9.

This point represents the only known bifacially worked stone projectile point and the oldest artifact that has been found in Trinidad. Boomert (2000:49) affiliated this specimen with the Canaiman subseries of the Joboid series, which dates to Late Pleistocene or Early Holocene times when Trinidad was still connected to the South American mainland. The Biche specimen appears to be a variety of the Paijan complex of projectile points that spans much of northern South America, including northern Peru, Columbia, Venezuela, Guyana, and northern Brazil (Barse 2003; Boomert 2000; Chauchat 1975; Maggard 2010; Meggers and Miller 2003; Szabadics-Roka 1997). More specifically, the Biche specimen appears to be a Contracting Narrow Stem variety of Paijan points, which have a maximum age range of ca. 9,500-8,500 B.P. in northern Peru (Maggard 2010:364-377). This places the Biche specimen in the late Early Archaic period of the Early Holocene, which is at least 1,000-2,000 years earlier than the deposits at Banwari Trace.

The specific chert from which the Biche point was made is indeterminate based on visual observations. The point is heavily patinated, which obscures the original color and complicates raw material identification. It is brown with a few faint dark gray bands across the blade. Proximity and coloration suggest that it was made from chert obtained from nearby Chert Hill. However, the chert exhibits a higher luster and is harder (finer grained) and more brittle than the vast majority of low-grade chert found at Chert Hill. These attributes suggest that the point may have been made from high-grade Malchan chert. On the other hand, it is possible that the point was made from a chert source in Venezuela and transported to Trinidad. Chert artifacts from the Late Pleistocene-Early Holocene Cayude site in the Coastal Range of Venezuela are typically heavily patinated like the Biche specimen (Joshua Ream collection, personal observation 2013).

La Reconnaissance

The La Reconnaissance site (SGE-34) is located on the west side of the Arouca River in the village of Lopinot in the central portion of the Northern Range (Figure 1). This site is early Late Ceramic in age (Lopinot 2012). Limited test excavations (two 1-x-1 m units) at the north end of the site in 2012 yielded 24 chipped-stone artifacts. These artifacts consist of five primary flakes, two secondary flakes, seven tertiary flakes, six flake fragments, and four pieces of angular shatter (Figure 12a-j). All of the flakes and angular shatter appear to have been produced by percussion flaking (predominantly bipolar). Thirteen artifacts have patinated, corraded cortical surfaces, indicative of alluvial transport and redeposition (Figure 12d-e). Only two flakes are reddened and appear to have been exposed to heat; however, attributes (e.g., potlids) suggest these flakes were accidentally burned, not intentionally heat treated.

None of the flakes appear to have been intentionally retouched after detachment from a core. However, several (37.5 percent) of the smaller, trianguloid and wedge-shaped specimens appear to be fragments of flake blanks that were smashed and fragmented into smaller pieces by bipolar percussion (Figure 12e-j). These small angular flake fragments may have been produced as teeth to be inserted into cassava grater boards. Use wear appears to be minimal. Eight flakes exhibit near-microscopic irregular nicks on either side of the sharp edge of the flake. High-power or low-power microwear analysis would be necessary to determine how the flakes were used.

One of the chipped-stone artifacts from La Reconnaissance was knapped from quartzite, whereas the rest were made from chert. Of the 23 chert artifacts, 15 are composed of fine-grained, lustrous, high-grade Malchan chert (Figure 12c-j) and eight artifacts are composed of low-grade, nonlustrous, argillaceous chert (Figure 12a-b). Cortical surfaces on six of these specimens indicate that the low-grade chert appears to have come from two separate sources. Two decortication flakes that exhibit large, localized impact cones indicate that they derive from the chert source at Malchan Hill.

The remaining four decortication artifacts lack multiple impact cones and prominent fluvial sheens as is typically evident on redeposited cobbles at Malchan Hill. These artifacts exhibit only light fluvial sheens identical to cobbles sampled in the Gautier River, and one primary flake exhibits a subangular, lightly corraded cobble edge (unlike subrounded to rounded edges found on cobbles at Malchan Hill). The cortical attributes on these four decortication flakes indicate that at least some of the low-grade chert found at La Reconnaissance was obtained from the chert source at Chert Hill.

The 24 chert artifacts were size graded in 1-cm increments to determine relative percentages of large flakes (>4 cm^2) to medium flakes (>2 cm^2 and <4 cm^2) and small flakes (<2 cm^2). All artifacts found at La Reconnaissance were recovered from one-quarter-inch screens. Although artifacts <0.6 cm were not recovered, artifact size >0.6 cm is unbiased. In contrast, chert artifacts in the Savaneta, Cedar Hill, and St. John collections are all larger than 2 cm and appear to be size biased (i.e., unscreened). Small- and medium-sized flakes in the La Reconnaissance assemblage each comprise 45.8 percent, whereas large flakes comprise 8.3 percent.

Figure 12. Chert artifacts from the La Reconnaissance (a-j) and Clairboy (k) sites.

Clairboy

The Clairboy site (SGE-44) is located on the east side of the Arouca River approximately 400 m northeast of the La Reconnaissance site (Figure 1). Limited test excavations at this mostly late Late Ceramic Age site (Lopinot 2013) in 2013 yielded one flake fragment of Malchan chert (Figure 12k). This small (13 mm long) wedge-shaped specimen is a fragment of a smashed flake blank. The left edge of the flake fragment exhibits moderate crushing and rounding.

Rajan

The Rajan site (SGE-49) is located in the middle reach of the Caura Valley in the central portion of the Northern Range (Figure 1). This Late Ceramic Age site was recently discovered during a brief reconnaissance of the Caura Valley in 2013 (Lopinot 2013). The Rajan site produced a large chert core made of fine-grained, dark bluish gray and brown, high-grade Malchan chert. A relict patch of cortex that exhibits multiple large impact cones and fluvial polish is present on one face. This amorphous core, which is 108 mm long and 41 mm wide, exhibits flake scars on every face. Flakes may have been removed from this large core whenever they were needed as replacement teeth in cassava graters.

Stankee

The Stankee site (SGE-50) is also located in the Caura Valley less than 0.5 km southwest of the Rajan site. A surface survey of this Archaic site in 2013 (Lopinot 2013) and a revisit in 2014 yielded 25 chert artifacts, which consist of three cores, two pieces of shatter, 11 secondary flakes, seven flake fragments, and two tertiary flakes. Most of the chert artifacts (87.5%) were knapped from Malchan chert (20 high-grade variety and 2 low-grade variety). Those with cortical surfaces all exhibited prominent Hertzian impact cones, and the majority exhibited light-to-moderate fluvial sheens (some evident only under microscopic examination). The remaining three specimens were knapped from Chert Hill chert. Careful examination of the edges of each artifact and other attributes revealed that 14 (63.6%) were apparently produced by direct freehand percussion, whereas eight appear to have been produced by bipolar percussion.

Malchan Hill

The Malchan Hill site (SAN-10) is located approximately 3 km west-southwest of Tamana Hill in the central portion of the Central Range (Figure 1). It is situated on the northeast flank of the source of redeposited cobbles of chert and other raw materials that comprise Malchan Hill. After its discovery in 2012, the site was revisited in 2013, and two 1-x-1-m units were excavated. The test units were placed 12 m apart, approximately 30–42 m east of the east wall of the abandoned quarry pit that appears to have truncated an unknown portion of the ridge on which the site is located.

Test Units 1 and 2 were excavated to depths of 30 cm and 20 cm, respectively. The western one-third of Test Unit 1 was disturbed by a burned tree stump. Artifact-bearing deposits are relatively shallow (10–15 cm) in undisturbed areas and confined to a grayish brown (10YR 5/2), very gravelly A1 soil horizon. Approximately 50 percent of the A horizon is comprised of subrounded to rounded pebbles and cobbles. The A horizon is underlain by a sterile Bt1 soil horizon, which is a mottled yellowish brown (10YR 5/4, 5/6) clay devoid of gravel.

A substantial amount of core and flake debitage (N=585) was obtained from Test Unit 1, whereas Test Unit 2 contained only 67 pieces of core and flake debitage. A historic component is also indicated by the recovery of three fragments of green and brown bottle glass, one stoneware sherd, and two pieces of unidentified metal. All of these artifacts are less than 50 years old, and most are probably associated with a squatter's cabin located approximately 20 m to the south.

Of the 652 chipped-stone artifacts recovered from SAN-10, four are tested cobbles, 26 are cores, 97 are angular pieces of shatter, and 525 are flakes. The cores, which range in maximum dimension from 18.5 mm to 60.5 mm, are typically amorphous or blocky in form with flakes removed from one or multiple platforms (Figure 13a-b). Much of the angular shatter appears to have been produced by bipolar flaking, but a significant portion may have been produced by intense heat. Two-thirds of the shatter is fire reddened, and at least one-third (which exhibits heat spalls, crazing, and/or burned surfaces) appears to have been produced by direct contact with fire. The flakes are comprised of 50 primary flakes, 261 secondary flakes, 66 tertiary flakes, and 148 flake fragments (flakes without platforms). Cortex was recorded only for artifacts with intact platforms. Of 377 flakes with intact platforms, more than three quarters (82.5 percent) are decortication (i.e., primary and secondary) flakes, whereas the remaining tertiary flakes represent interior flakes removed from decorticated cores. No biface flakes (indicative of biface reduction technology) were recovered from the site.

All of the chipped-stone artifacts from SAN-10 were made from redeposited cobbles from the Malchan Hill source. More than 90 percent of the artifacts are comprised of dark, high-grade Malchan chert (Figure 13b, d-h), 9.4 percent are comprised of argillaceous low-grade Malchan chert, and 0.1 percent is comprised of quartzite. A significant portion of the chert artifacts (44.6 percent) from Test Unit 1 is discolored red and appears to be heat altered. Many of these exhibit heat spalls and crazing indicative of direct contact with fire. Other flakes are only partially reddened indicative of uneven exposure to heat. The high percentage of heat-altered chert in Test Unit 1 can be directly associated with a burned stump encountered in the western portion of the unit. Incidental or unintentional burning of chert artifacts in Test Unit 1 is supported by the recovery of very few (3 of 67) heat-altered artifacts from Test Unit 2.

Figure 13. Chert artifacts from Malchan Hill site: (a-b) bipolar cores; (c) utilized flake; (d-h) ventral face of decortication flakes (all artifacts made from Malchan chert).

A single chert tool was recovered from Test Unit 1. It is classified as a utilized flake, or a flake that was modified during use (not intentionally shaped prior to use for a specific task). It is a long blade-like flake (49.7-x-23.2 mm) with one slightly convex edge and one slightly concave edge (Figure 13c). Small uniform flake scars removed from each edge have formed small alternate bevels. This utilized flake presumably was used for scraping or planing and was modified by repeated contact with a hard object(s). Three nonchert items also were recovered from Test Unit 1. These consist of three pieces of unmodified hematite (one hard and two soft). No Amerindian pottery was recovered from the test excavations at SAN-10.

The reduction of cores and the production of large quantities of flake blanks was clearly the primary activity at the Malchan Hill site. The entire chipped-stone assemblage from the site represents a lithic technology in which unmodified flake blanks removed from cores were the intended product. Some of the flake blanks appear to have been produced by bipolar percussion flaking.

Bipolar percussion flaking involves the placement of a pebble or core on a hard anvil and striking the core with another cobble or hard hammer, initiating a compression force that splits the pebble or core, or removes a flake (Crabtree 1972:42; Odell 2003:49). Flakes often exhibit a bulb of percussion at one end and crushing at the opposite end or crushing at both ends. Striking platforms are generally small to nonexistent, and bulbs of percussion are often diffuse and may occur at the proximal end or distal end of a flake (Odell 2003:61). Flakes may be relatively thick (often wedge shaped), and angular shatter (without bulbs or negative flake scars) is often produced during the process. Crushing at both ends of a flake (or core) or a weak bulb of percussion at one end and crushing at the opposite end are diagnostic of bipolar flaking, but unfortunately these attributes are not always present on flakes and cores in a bipolar assemblage (Odell 2003:61).

Four cores, 15 decortication (primary and secondary) flakes, and two tertiary flakes exhibit crushing attributes diagnostic of bipolar flaking. Although this technique results in the expedient production of lots of flakes in a short period of time, it is wasteful and results in much less control over the flaking, especially in terms of the shape and size of the product and direction of flake removal.

Some of the debitage was produced by direct freehand percussion, which involves striking flakes from a core with a hammer while holding the core in the opposite hand or supporting it on a leg (Odell 2003:59). Flakes typically exhibit prominent striking platforms and bulbs of percussion only at the proximal (impact) end of the flake and an occasional eraillure scar on the bulb of percussion. Cores exhibit prominent negative bulbs of percussion with concentric rings, narrow points of impact with uncrushed platforms, and reverse hinge fractures that do not extend to the opposite end of the core. The flakes from the Malchan Hill site were size graded into small flakes (<2 cm^2), medium flakes (>2 cm^2 and <4 cm^2), and large flakes (>4 cm^2). More than two thirds (67.8 percent) are small flakes, nearly a third (30.2 percent) are medium flakes, and 2 percent are large flakes.

Practically all of the artifacts obtained during the limited test excavations at the Malchan Hill site indicate that it served primarily as a lithic workshop for the production of chert flakes to be used elsewhere. The vast majority are complete flake blanks (with intact proximal and distal ends). Less than 6 percent are wedge-shaped flake fragments that were smashed by hammerstone. The lone artifact that may indicate domestic activity is the sandstone metate fragment with a shallow grinding basin found during the 2012 survey. However, based on multiple small pits on the face of the metate, this artifact appears to have served as an anvil for bipolar flaking and, thus, its use was directly related to workshop activity. The metate fragment may have been broken at a nearby habitation site and subsequently carried to the Malchan Hill site and recycled as an anvil stone. Alternatively, a complete metate that served multiple purposes may have been transported to the site and subsequently broken during its use as an anvil. A sandstone metate (4.5 cm thick) used in a bipolar flaking experiment also broke in half while hammering on a bipolar core.

The Malchan Hill site represents a major lithic-reduction workshop. The presence of direct percussion flakes and bipolar percussion debitage suggests that chert procurement and reduction occurred at the site during both Archaic and Ceramic times. Although the site appears to be primarily a lithic workshop, short-term intermittent habitation at the site while restocking on chert flakes cannot be ruled out. However, larger and more permanent habitation sites are probably located in nearby river valleys. Likely locations are terraces in the headwaters of the Tumpuna River where it meets the northern edge of the Central Range approximately 1 km to the northwest and in the headwaters of the Cumuto River approximately 3 km to the northeast.

Reports of Chert Artifacts from Other Sites in Trinidad

Although not examined for this study**,** flint and chert artifacts have been reported from a number of sites across Trinidad. Five special activity sites are referred to as "flint deposits," which Boomert (2000:66–67) characterizes as "small surface accumulations of scattered flakes and cores of flint, chert or other rock materials." These sites are Savaneta, Fyzabad (SPA-13), Point Fortin 1 (SPA-16), Pointe d'Or 1 (SPA-3), and Pitch Lake 3 (SPA-27), all located in the southwest portion of Trinidad. Boomert (2000:67) notes that these sites (presumably Early Archaic or Banwarian in age) are partly workshop sites for the production of multifunctional flake and core tools, but that they also may have functioned as temporary hunting or fishing camps.

The chert artifacts from Pitch Lake 3 are described best. Hundreds of flakes of various sizes (but predominantly 3–7 cm in length) were reportedly found in an area measuring approximately 8-x-15 m (Boomert 2000:67). Analysis of the chert artifacts indicated that they were produced by bipolar flaking and that about half were used as scrapers, knives, perforators, and other tools. Boomert (2000:67) indicated that some of the chert at Pitch Lake 3 derives from southern Trinidad but that the majority of the chert appears to be foreign to Trinidad. The latter unidentified chert is probably dark, lustrous, high-grade chert from Malchan Hill.

The most detailed description of chert artifacts comes from recent excavations at the Manzanilla site (SAN-1), located on the east coast of Trinidad (Dorst et al. 2003). This site contains Saladoid and Arauquinoid series ceramics and has yielded more than 150 chert artifacts consisting primarily of flakes and shatter but also flaked pebbles, unmodified pebbles, and small hammerstones. Some of the chert artifacts have been differentiated into a brown and gray "very fine-grained mudstone" or chert and a black flint-like material "foreign to the Manzanilla region." The former brown and gray chert is probably the low-grade argillaceous chert found at Chert Hill, whereas the latter black chert is probably dark-colored high-grade Malchan chert. In one instance in which chert artifacts were consistently described as to color (Dorst et al. 2003:Table 3.1.2.1), more than half (53.1 percent) was described as black (probably Malchan) chert. Although the size of the chert artifacts generally was not provided, at least four small rectangular flakes were assessed as probable grater board teeth.

In addition to the above sites, small quantities of flint or chert and quartzite artifacts have been mentioned (generally only briefly) from several other sites. These include the Cedros (Morse 2007:298), Quinam, Bontour, and Mayo sites (Boomert et al. 2013:35, 45, 57, 63), and the Crossfield 1 and Crossfield 2 sites (Rouse 1953:101–102), all located in southwest Trinidad; the St. Joseph 2 site in northwest Trinidad (Boomert et al. 2013:51); and the Ortoire site located on the Atlantic coast in southeast Trinidad (Boomert et al. 2013:16). Small chert flakes, presumably used as teeth in grating boards, have been found at the Saladoid/Barrancoid sites of Erin, Lagon Doux 1, Palo Seco, Quinam, San Fernando-Carib Street, and St. Bernard in southwestern and southeastern Trinidad (Boomert 2000:324–325). Bullbrook (1960:37) reported hundreds of chert artifacts from midden sites in southern Trinidad. He stated that few of the chert flakes exhibited secondary flaking and that the chert "is of poor quality and full of flaws" (probably low-grade argillaceous chert). More detailed analyses of the chert artifacts (i.e., type and number) from these sites could provide information on specialized activities, subsistence, and patterns of raw material acquisition and exchange.

Discussion and Conclusions

A survey of selected locations in 2012 and a follow-up reconnaissance in 2014 revealed at least three sources of workable chert. Table 1 summarizes the predominant attributes found in the chert at each source. The Los Iros source is localized to an outcrop on the shoreline of Los Iros Bay. Although most of the beach cobbles are composed of nonchippable rocks, this source does contain a small quantity of argillaceous chert and an even smaller quantity of high-grade chert. The Chert Hill source contains large quantities of a low-grade chert that is relatively soft with abundant incipient fractures. Although an intensive survey failed to locate redeposited artifacts in the Gautier River or a lithic workshop at the primary outcrop, at least some exploitation of the deposits at Chert Hill did occur based on the recovery of a few flakes of this low-grade material from the La Reconnaissance and Stankee sites.

	Chert Sources		
	Malchan Hill	Chert Hill	Los Iros Bay
Context	In situ cobble conglomerate	In situ bedded chert and redeposited alluvial cobbles	Eroded beach deposit
Color	Mottling of bluish gray, dark bluish gray, gray, dark gray, and very dark gray	Gray and light gray with occasional thin gray and dark gray streaks	Homogenous black, very dark gray, gray, dark grayish brown, pale brown
Texture	Fine	Medium	Medium
Composition	Highly siliceous	Argillaceous	Argillaceous
Luster	High	Low	Low
Grade	High	Low	Low
Fossils	None	None	None
Cortex	Subrounded with large Hertzian impact cones and prominent fluvial sheen	Angular to subangular and smooth with no impact cones and light fluvial sheen	Rounded with pock marks and a light sheen or no sheen

Table 1. Context and predominant attributes of chert at localized sources.

The source at Malchan Hill consists of a major localized deposit of large and small alluvial chert cobbles. Much of the chert is fine-grained and high quality. It is harder than the chert at Chert Hill, more lustrous, and lacks incipient fracture planes. Detailed comparisons of physical attributes (e.g., color, luster, texture, internal structure, hardness, and Hertzian impact cones on cortical surfaces) of chert artifacts from multiple sites in the Northern Range, Northern Basin, Central Range, and Southern Basin with the redeposited chert at Malchan Hill revealed that Malchan Hill was exploited as a primary source for high-quality chert for a long period of time. Other localized sources of cobbles of redeposited high-grade chert (like that at Malchan Hill) in the Central Range cannot be ruled out at this time, but they are likely to be smaller and less significant than the Malchan Hill source.

Additional sources of “flint or chert” have been reported at other locations in the western portion of the Central Range and the Southern Basin; however, no detailed descriptions of these source areas or the physical characteristics and quality of the chert deposits have been provided. Based on the geology in these areas, it is probable that most of these purported chert deposits are comprised of relatively soft, low-grade argillaceous cherts (argillites) that are inferior to Malchan chert in terms of producing sharp cutting edges.

A general absence of tools and large quantities of discarded flake debitage and cores found at the Malchan Hill site revealed that it served primarily as an intensive lithic workshop for on-the-spot production of unmodified flake blanks. These flake blanks were subsequently transported or traded elsewhere for use. Flaked cores found at several sites indicate that whole cobbles also were transported or traded to other locations. Although no ceramics or other diagnostic tools were found at the Malchan Hill site, this workshop appears to have been used during both Archaic and Ceramic times. Flakes and cores made from Malchan chert have been identified at Archaic sites such as Banwari Trace, St. John, Savaneta, and Stankee. Based on cortical attributes and other chert descriptions, it appears that some (if not the majority) of the chert artifacts from Pitch Lake 3 were made from Malchan chert. Chipped-stone artifacts made from Malchan chert also have been identified at Ceramic Age sites such as Cedar Hill, La Reconnaissance, Clairboy, Rajan, and Manzanilla. Although the collections have not been studied at this time, it appears likely that many other Ceramic Age sites in southeast and southwest Trinidad contain lithic artifacts made from fine-grained, high-grade Malchan chert.

Although it typically does not occur in large quantities at any one site, Malchan chert is widely distributed across Trinidad from the Northern Range to the Southern Basin. Only the south coast, north coast, and Toco side have yet to yield sites with artifacts made from Malchan chert. The method of distribution of Malchan chert in unknown, but it probably varied through time. The earliest procurement during Archaic times may have been direct on as needed or seasonal-round basis. As population density, food production, and sedentariness increased during the Ceramic Age, down-the-line exchange may have been the primary avenue of chert distribution. Knippenberg (2006, 2011) provided evidence from the northern Lesser Antilles that supports direct procurement of chert as a mode of raw material acquisition during the Ceramic Age; however, this was inter-island procurement, not intra-island procurement. Although possible, there currently is no evidence that Malchan chert was transported and traded to the South American coast, Tobago (Boomert and Rogers 2007:284; Mones 2007:761), or other islands in the southern Lesser Antilles.

The bulk of the chert artifacts from Malchan Hill, La Reconnaissance, Savaneta, Cedar Hill, and St. John sites are small cores and decortication flakes produced by bipolar percussion flaking. Biface flakes are nonexistent in these collections and, except for the Biche point, evidence of biface reduction is entirely lacking in Trinidad. Biface thinning as a reduction strategy and the production of projectile points from chipped stone may have been short lived in Trinidad and come to an end approximately 8,500 years ago.

Bipolar flaking is a form of expedient core technology. The implementation of this technology results in several common patterns (Parry and Kelly 1987:287). First, the bipolar technique (i.e., smashing a cobble with another rock) requires little or no training or practice, and relatively little physical effort is expended during the process. Second, there is no single formal tool that is the intended product. Each flake or piece of shatter is viewed as a potential usable item. Third, the selected pieces are seldom modified. If the piece has an unsuitable shape or if the piece dulls or breaks, it is discarded and a new piece is selected for use. Bipolar percussion is not restricted to cobble on cobble, but may be cobble on flake. This technique results in fragmenting a flake blank into several smaller angular wedge-shaped pieces.

Bipolar flaking is often cited as an expedient and economizing technique for the production of flake tools in areas where raw materials may be in short supply and/or in areas where only pebbles or small cobbles too small to be effectively held in the hand are found (Goodyear 1993; Hayden 1980; Odell 2003:49, 59; Shott 1989). Neither factor appears to apply to the Malchan Hill source where cobbles are abundant and many are relatively large. The use of the bipolar flaking technique in Trinidad appears to be related to intended function and the production of simple expedient flake blanks rather than to the size or abundance of local raw materials.

The flakes found at the above sites were used in their unmodified (unretouched) state for a variety of functions. These functions probably changed through time. At Archaic sites, unmodified flakes and cores appear to have been used as scrapers, knives, burins, spokeshaves, perforators, and for prying tools, functioning to remove and scrape skins, cut meat, peel and slice cassava, incise wood and bone, plane arrow shafts, punch holes, pry open shell fish, scale fish, and process vegetable fibers. Although conclusive evidence is lacking, some pointed chert specimens also may have been used as arrowheads (Boomert 2000:61; Dorst et al. 2001:Figure 10). Many of the above activities performed on soft materials (e.g., cutting meat, peeling and slicing cassava, scaling fish, and processing vegetable fibers) would leave little or no macroscopic use wear. In contrast, activities performed on hard materials (e.g., wood working) produces small to microscopic use wear oriented perpendicular to the length of the working edge and parallel to each other (Miller 1979:406). The relatively small number of larger flakes made by direct-freehand percussion were probably produced during Archaic times.

Small chert flakes are common at Ceramic Age sites in Trinidad (Boomert et al. 2013:118; Bullbrook 1960:37). Most of the small flakes found at habitation sites were likely used to process tropical root and tuber crops, especially bitter cassava which is one of the most important tuber crops that was domesticated by Amerindians. Boomert (2000:96–97, 324–325) and DeBoer (1975) provide excellent descriptions of how cassava was processed and how small "sharp stone chips" and other materials were used as teeth in the manufacture of cassava grater boards. Such chips or small flakes have been reported ethnographically (DeBoer 1975:420) and recovered from archaeological sites scattered throughout Trinidad, as well as the Lesser Antilles and the middle and lower Orinoco River valley (Boomert 2000:323–326; Cruxent and Rouse 1958:219, 226; Rouse and Cruxent 1963:58–59). The production of large quantities of flake blanks and angular pointed chips via bipolar flaking appears to reflect a gender-based craft specialization. Among many historic Indian groups of lowland South America, these chert artifacts are associated with cassava processing, a labor-intensive activity that is almost always undertaken by females (Boomert 2000:323; DeBoer 1975:420; Roth 1924:279). Although men typically carved out wooden grater boards, women manufactured the grater teeth (Bommert 2000:324; DeBoer 1975:427–430; Roth 1924:277–280).

Many of the above interpretations of the use of chert (e.g., as cutting, scraping, incising, and perforating tools in Archaic times and as manioc grating teeth in Ceramic times) are based on *a priori* assumptions instead of experimentation and verification through detailed microscopic use-wear studies. Some micro-wear studies (e.g., Walker 1980) appear to support some of these assumptions, whereas others (e.g., Lammers-Keijsers 2007) do not. Clearly, more micro-wear analyses and plant-residue studies need to be conducted on chert artifacts throughout the Caribbean region for proper and accurate identifications of the use and functions of chipped-stone tools.

In the absence of plant-residue analyses and detailed use-wear analyses on chert artifacts in Trinidad, the size of recovered chert flakes may be indirectly related to function. Flakes removed from cores for expedient use as scrapers, knives, burins, spokeshaves, perforators, and/or prying tools typically would be greater than 20 mm. In contrast, smashed chert flakes used as grater teeth in cassava grating boards are typically small. However, when flakes were initially removed from cores as flake blanks, they varied considerably in shape and size. The Taruma would remove flakes 25.4–38.1 mm in length and these were subsequently smashed to produce the small grater teeth (Roth 1924:279). In a prehistoric assemblage from Los Mangos del Parguaza in the Orinoco basin, grater teeth ranged in size between 6 mm and 30 mm, but the vast majority were only 7–10 mm (Perry 2004:1072). At the Three Dog site, they ranged from 4 mm to 38 mm with a mean of 11 mm (Berman et al. 1999:Table 1). Ethnographical documented grater teeth in Waiwai grater boards had a modal length of 8 mm with no chip exceeding 10 mm (DeBoer 1975:430). Typically, three-quarters or more of the length of grater chips were sunk into slotted wooden grater boards with only about one-fifth of the chip exposed above the board's surface for grating (DeBoer 1975:431, Figure 4).

Flakes recovered from the workshop at Malchan Hill ranged from small to large. Although two thirds were less than 20 mm in length, very few of these flakes appear to have been smashed by bipolar percussion. All of the examined chert flakes from the Archaic sites of Savaneta, Banwari Trace, and St. John and the majority (72%) of chert artifacts from Stankee are greater than 20 mm in length, and most could have been used effectively as scrapers, knives, etc. As for Ceramic Age sites, all of the examined Cedar Hill chert flakes exceed 20 mm in length, and more than half (N=13) of the flakes from La Reconnaissance exceed 20 mm in length.

The majority of the chert flakes from these two Ceramic Age sites are too large to have served as effective grater teeth. Additionally, very few of these flakes exhibit an ideal shape (i.e., at least one pointed end) for use in a grater board. Three explanations could account for the relatively large size of the flakes found at Ceramic Age sites. First, they could be from earlier Archaic occupations. Second, the large chert flakes could have been flake blanks intended for later processing into grater teeth but were never smashed into angular fragments. Third, none of the large chert flakes were actually intended for use in grater boards. There may have been a preference for producing grater teeth from abundant local quartz cobbles, whereas many of the larger sharp flakes made from nonlocal high-grade Malchan chert were used for nongrater-board functions such as pealing and slicing cassava tubers, cutting meat, and smoothing arrow shafts. Perhaps a wide range in flake size is not all that unusual at Ceramic Age sites. At the late prehistoric Palo

Seco site, Bullbrook (1953:45) noted that chert artifacts exhibited "great irregularity in size."

Finally, a few suggestions are offered in terms of future studies of lithic artifacts in Trinidad. First, chert artifacts are often lumped with other "stone artifacts" or "lithic artifacts." Artifacts that are chipped from chert (i.e., chipped-stone artifacts) should be differentiated and quantified separately from quartz or quartzite artifacts, ground-stone artifacts, and unmodified rocks. Second, chipped-stone cores and flake debitage should be classified as to specific core and flake type and quantified, not simply noted as present. Third, fine-grained, dark, lustrous, high-grade Malchan chert should be differentiated from medium-grained, nonlustrous, argillaceous, low-grade chert like that found at Chert Hill, Los Iros, and possibly other locations in southern Trinidad. Fourth, size measurements of chert artifacts would potentially differentiate small fragments possibly used as grater teeth in cassava boards from larger flakes used expediently for cutting, scraping, planing, and other nonplant-processing purposes. Fifth, detailed microscopic use-wear studies and plant-residue studies need to be conducted on chert specimens to accurately demonstrate the use and function(s) of specific chipped-stone tools. Finally, promising geochemical analytical methods (such as X-ray fluorescence and laser ablation inductively coupled mass spectrometry) should be used to potentially help distinguish between soft low-grade argillaceous cherts found at multiple sources in central and southern Trinidad and between hard high-grade siliceous chert at Malchan Hill from small quantities of look-alike fine-grained cherts at Chert Hill and Los Iros Bay. Nondestructive geochemical analysis also could potentially identify the chert source from which the patinated Biche point was made.

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