Spanish River Lithic Cache, Sudbury Region of Ontario

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The Spanish River lithic cache site (CcHj-2) is located between the Spanish River and Ministic Creek, west of Sudbury. It was reported in 2001 and consists of 68 specimens, mostly leaf-shaped and oval bifaces and other biface tools, as well as 15 uniface tools. The cache assemblage is unusual in that it includes a range of bifacial and unifacial tool types, possibly representing a tool kit. Based on visual criteria, the entire assemblage is formed from Hudson Bay Lowland (HBL) chert. The site is outside the normal geographic range of this material. Fourier Transform Infrared Spectroscopy (FTIR) and Inductively Coupled Plasma Mass Spectroscopy (ICP-MS) testing of several specimens confirmed the material. The site was found by chance, and the assemblage was recovered by a local resident from a disturbed, small, oval pit feature located along a roadway on a flat sand plain, some distance from the two local waterways. Its location is similar to that of the Crane site cache (Ross 2013), and differs from the typical context for boreal forest sites, which is close to waterways. The cache is undated, but appears to be Late Archaic or Middle Woodland based on comparison with metric criteria of other HBL caches. A technological study of the bifaces was undertaken to determine the stage of reduction and presence of wear facets from transportation. This cache is here considered in relationship to other regional caches and to caching behaviours in northern Ontario. The cache is similar to several other HBL chert biface caches reported from across the Canadian Shield, but the bifaces are typically smaller in size than those in some other Archaic caches. A further difference is the location, possibly indicating that the cache was deposited on a portage between two rivers that intersect nearby.

Introduction

In this paper we document and interpret a stone artifact cache from the Spanish River vicinity west of Sudbury, Ontario. Ancient lithic cache sites of various types are relatively common in North America and hold a special interest for archaeologists trying to interpret past human behaviour. We often speculate about ancient behaviours regarding these "time capsules," asking ourselves various questions. Was the cache a lost "treasure trove"? And if so, was it placed with the expectation of retrieval, or simply lost and forgotten? Alternatively, was it left as an offering, as with mortuary caches, possibly for use in the afterlife? Or is it simply reflective of practical ways to store lithic materials (preform blanks, finished tools and entire tool kits) for later use? We have attempted to interpret the level of technological expertise and/or craft specialization of this cache to determine whether it was made by one individual or by several, whether the materials are local or non-local, and whether they indicate a possible manner of exchange or direct procurement. Since caches are often sizeable assemblages, they may help provide distinctive views of often undamaged/unused "type specimen" artifacts (such as cache blades) when compared with the curated, resharpened, broken, lost and discarded items that typically comprise lithic assemblages on most sites.

The Spanish River cache is composed of 68 chert specimens that are characterized by a range of chert types with different visual characteristics. Based on these visual characteristics, most would fall within the known range of Hudson Bay Lowland (HBL) cherts (Fox 2009). Fourier Transform Infrared Spectroscopy (FTIR) and Inductively Coupled Plasma Mass Spectroscopy (ICP-MS) are used here to analyze selected chert samples and to compare their composition with that of different known geological sources. FTIR, which is minimally destructive to artifacts and can be used to identify specific trace minerals in different potential sources (Silveira 1999; Long et al. 2001; Hawkins et al. 2008), has previously been used successfully to characterize and source Hudson Bay Lowland cherts (Long et al. 2001).

HBL chert is a generic term (Fox 1976) for cobble and pebble-sized Paleozoic chert clasts or nodules derived originally from several stratigraphically distinct formations in the Hudson Bay Lowlands. It has been recorded in the Late Ordovician Bad Cache Rapids Group, the Silurian Severn River and Ekwan River formations, the Early Devonian Stooping River Formation, and the Middle Devonian Kwataboahegan Formation (Sanford et al. 1968; Johnson et al. 2002). Abundant nodular chert may be restricted to the Ekwan River and Stooping River Formations. The Ekwan River Formation has the greatest sub-Pleistocene footprint. Survey work along the lower Albany and Moose rivers by Julig (1982) observed abundant high-quality pebble and cobble chert in the Stooping River Formation along the lower Albany River, but little in the Kwataboahegan Formation. However, some HBL chert is present in most James Bay Pleistocene and river gravels.

Observations of strata in drill-cores from the James Bay Lowlands (by Long) indicate that the Ordovician cherts occur predominantly as white to light grey nodules up to 3 cm in diameter, with rare concentric banding. Dark grey and white chert nodules up to 2 cm in diameter are present in Silurian strata from the Severn River Formation, and black, grey, and white chert is common in strata of the overlying Ekwan River Formation. Devonian strata were not examined. When weathered, these cherts often become various shades of brown.

HBL chert in archaeological collections and in nodules collected from secondary (glacial) sources can be yellowish grey to grey, brown, dark grey, or black. In addition, several colours can be present within individual specimens, as bands, patches, or concentric zones. This characteristic of HBL chert makes it difficult to visually distinguish it from other brownish chert materials often found in assemblages, such as Detour chert and Knife River Flint. In addition, many cherts may develop a brownish-reddish patina due to iron staining and weathering following burial.

In addition to applying the FTIR methods developed by Silveira (1999) and Long et al. (2001) for sourcing the Spanish River cache artifacts to geological samples of HBL, we undertook ICP-MS analysis of several samples to confirm the FTIR results. This combination of physical and chemical approaches may later assist in determining the specific formation(s) within the Hudson Bay Basin that could represent the primary source. However, it should be noted that much of the material may have been recovered from (secondary) Pleistocene deposits, such as the Cochrane moraine, derived from the Hudson Bay Lowlands, which are present both north and south of the Great Lakes (see Barnett 1992 and Dyke et al. 2002 for glacial history and dispersal patterns).

Finally, the Spanish River cache assemblage is analyzed from a technological perspective using the methodology presented in Julig (1994) and the lithic technological metrics of the cache are compared with several other caches in the upper Great Lakes region.

History of Site Discovery and Context

The Spanish River cache site is located in Drury Township, east of the outlet of the Spanish River from Agnew Lake, near the west edge of the Regional Municipality of Sudbury, Ontario. It is situated between the Spanish River and Ministic Creek, just upstream from the junction of the two waterways, in an area where the creek runs parallel to the river (Figure 1). This area is one of extensive sand plains, and some sand dune activity is evident in the site vicinity. The site is about 200 m north of the Spanish River in an area where a portage

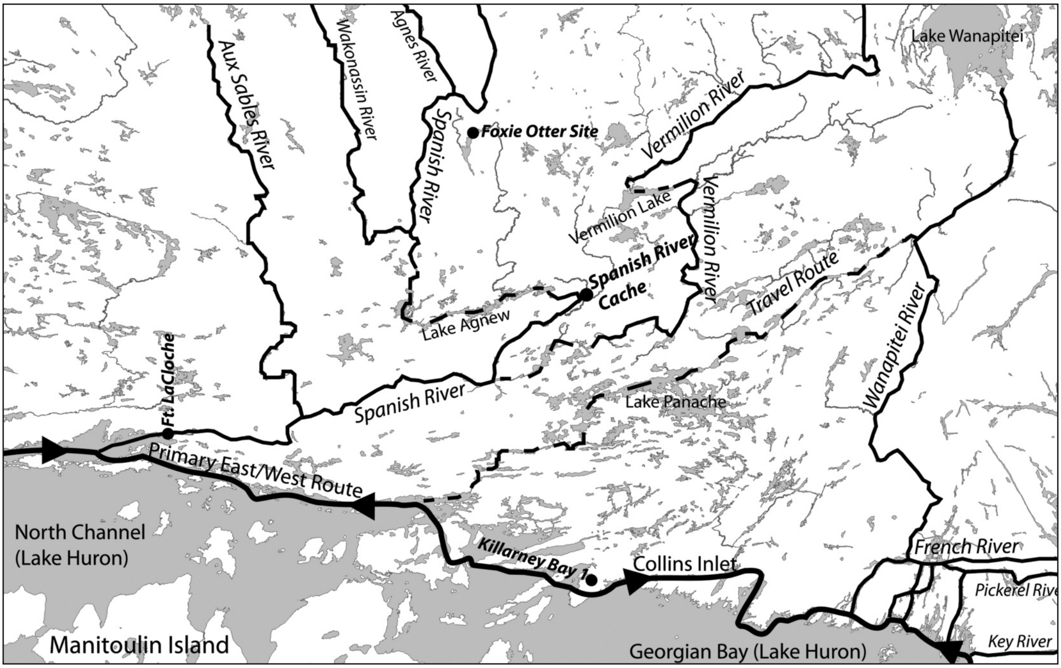

Figure 1. *Spanish River cache site, other sites mentioned in text, and major waterways along northeastern Georgian Bay. The arrows indicate possible ancient trade routes and fur trade era trade routes.*

may have existed between the two waterways. It was found by chance by Bill Julian in the fall of 2001, while he was walking his dog along a quad trail in the bush just north of the Big Bend of the Spanish River (Figure 1). He spotted several artifacts (bifaces) exposed in the floor of the quad trail, in disturbed fine sand. He exposed and collected several bifaces, and as he continued to dig, he found and recovered a total of 67 chert artifacts, mostly bifaces, all from within a small pit feature. The area along this part of the Spanish River is a mix of crown land and privately owned land. Julian assumed that the site was located on crown land, and it would be okay to collect the artifacts. He also did not realize that he should not collect or excavate artifacts without a licence to do so. Somewhat later Mr. Julian brought the collection to Patrick Julig at Laurentian and explained the situation and context of discovery. He was informed by Julig about the Ontario Heritage Act, and that he did not have the authority to excavate artifacts. They also checked the land records and found out that that the site was actually on private land owned by Rick and Christine Liscum. Julig and Mr. Julian visited the cache site location, and Julig examined the location and cleared out the sand which had filled the cache pit, to view the soil and sandy sediments.

The area includes extensive post-glacial sand plains overlying bedrock. The relatively flat terrain has a forest cover composed mostly of jack pine, with some white pine, birch, poplar, and blueberry bushes. The pit feature was round, with a diameter of about 50 cm and a depth of about 35 cm below the surface of the turf. It had been backfilled by Julian, along with some natural sand movement on the quad trail. The backfilled soil was light coloured and fairly easy to locate and photograph. After the backfill had been removed to determine the depth of the pit feature and the base was trowelled down a bit further, an additional HBL artifact, a uniface, was recovered. This find confirmed the precise recovery location that had been reported by Julian. The site area was not surveyed or test-pitted; hence it is unclear if this cache is an isolated assemblage/feature or part of a larger site. There is another site less than 1 km up the Ministic creek (CcHj-1), and other artifact find spots have been reported along the adjacent Spanish River. The site is in an excellent fishing and blueberry harvesting area, as reported by Ojibwa Elders from the Manitoulin area.

After the site visit and confirmation of location, the collection was left at Laurentian University by Julian. Julig called the land-owners to explain that the site had been found by accident on their property and that it had been excavated due to the discoverer's lack of knowledge of the law. The land owners subsequently visited Laurentian University to view the collections and learn about the history of the Spanish River. Understanding the scientific and historical importance of the site, they agreed that the collections should remain at Laurentian University.

The Spanish River Area

The Spanish River is a major waterway that leads from the North Channel of Georgian Bay to the height of land and the Hudson Bay drainage to the north, which is the geological source of the HBL chert (Figure 1). There are five other rivers that link to the Spanish River, including the Vermillion River. Other waterways, such as the Wanapitei River, are linked to the Spanish River by portages. These portages and travel ways that link the Spanish, Vermillion, and other rivers are shown on the 1827 John McBean map. McBean was Chief Factor of the Hudson's Bay La Cloche post, located at the mouth of the Spanish River (Public Archives of Canada, HBCA, D.5/2fo. 257). One of the main portages on the middle Spanish area existed to avoid the "Big Bend" in the Spanish (it reduced the river trip by about 30 km). Other, shorter portages avoided two major rapids near Espanola and one east of Agnew Lake. There are many known precontact sites along the Spanish drainage, as it is one of the few major waterways in the Sudbury Region that have been fairly intensively surveyed (Hanks 1988). The significance of this river to First Nations and the fur trade is apparent by the establishment of two Hudson's Bay Company posts on this river: Fort La Cloche at the mouth, and Pogamansing HBC post (CfHk-3) near the height of land on Kingsley Island on Pogamansing Lake (Hanks 1988:9; (with the Pogamansing Post situated just north of the area depicted in Figure 1).

Surveys conducted in the lower, middle, and upper reaches of the river have located numerous sites, from the Early Archaic, going back more than 7000 years, to the Euro-Canadian historic period. While the Early Archaic lithic assemblage at the Foxie Otter site (Hanks 1988; see also Figure 1) is made of local quartz, quartzite, and greywacke (most probably an argillite from the Gowganda Formation), the source materials for the later Archaic and Middle Woodland assemblages on this site include HBL chert and other chert. The patchwork of surveys along the Spanish River reveals various non-local exotic materials, including HBL chert, grey and darker cherts (Michigan and possibly Fossil Hill variants, including Detour chert), and even a few flakes of jasper taconite (Hanks 1988). The large numbers of HBL chert artifacts (bifaces and scrapers) in mortuary and habitation areas of the Killarney Bay 1/Speigel site (Hawkins et al. 2013) may have been transported along this route. The existence of numerous sites indicates a widespread trading network developed over thousands of years along this river system, linking to the major east–west travel routes of the historic era (Figure 1).

Raw Material Sourcing

The material from the Spanish River cache was typed visually as being primarily or all HBL cherts. This was confirmed using Fourier Transform Infrared Spectroscopy (FTIR) and Inductively Coupled Plasma Mass Spectroscopy (ICP-MS), using instruments available at Laurentian University.

FTIR

Previous studies using FTIR have demonstrated that HBL chert has a distinctive spectrum (Figure 2; Long et al. 2001), which includes peaks and swales marking the presence of trace amounts of goethite, hematite, and glauconite. Other minerals, including calcite, may be present in some HBL samples and produce distinct depressions in the spectral curve of chert due to selective absorption of specific wavelengths by covalent bonds within each mineral (see Figure 3 and Hawkins et al. [2008]). Knife River Flint, which visually resembles some HBL chert, contains no evidence of absorption by covalent bonds in goethite, hematite, or glauconite (Figure 2). Calcite has been detected in some samples of HBL, but since it can be common in the porcellaneous outer rims of many chert nodules, it is not diagnostic. The absence of swales associated with dolomite adsorption confirms that these cherts from the cache were not sourced in the Lockport, Amabel, Bois Blanc, or Dundee Formations (see Long et al. [2001] and Hawkins et al. [2008] for a more comprehensive review of the methodology). Following the procedures established by Silveira (1999), samples were prepared using <1% finely ground chert in preground (<2 microns) dry potassium bromide (KBr). A sample of 0.1 g of this material was then flattened under 10 tons of pressure for 5 minutes, to produce a thin, clear disc approximately 1 cm in diameter.

In this study, six nodules of HBL chert were selected from known geological sources for comparative purposes. Samples were ground with a spherical diamond bit to liberate 8 to 14 mg of

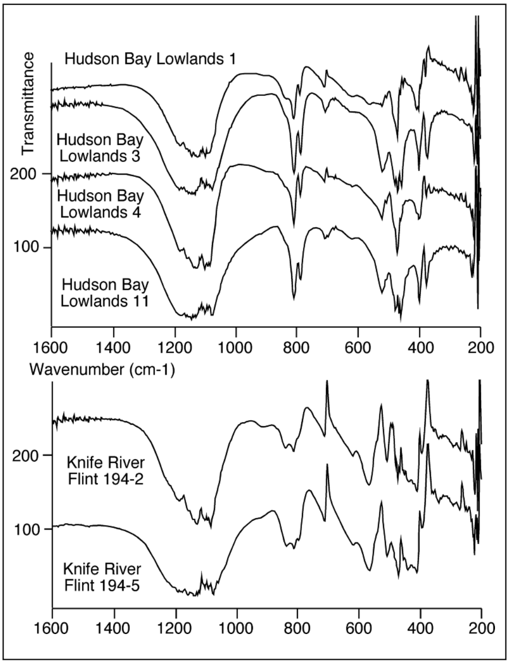

Figure 2. *FTIR spectra of chert from the Hudson Bay Lowlands (top) and Knife River Flint (bottom). Note the similarity among the HBL spectra and difference between HBL and Knife River Flint spectra (from Long et al. 2001).*

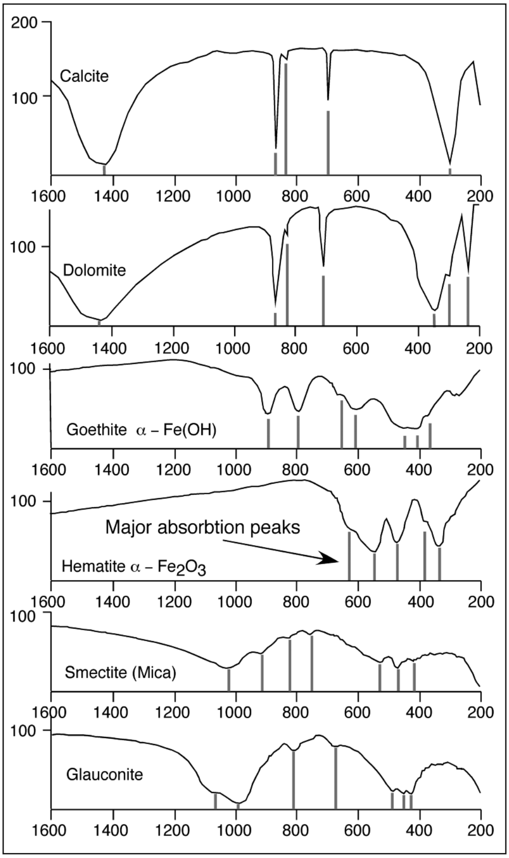

Figure 3. *FTIR spectra of pure samples of common contaminants in chert (Long et al. 2001). The vertical grey lines indicate major absorption peaks, which show up as depressions in the chert spectra even when the contaminant mineral is present in trace amounts (<1%). The exact location of the negative spikes shifts when trace minerals occur in very low concentrations in chert, due to interference with quartz.*

powder. These geological samples included light grey to dark brown and dark grey examples. HBL-05 is of the lightest grey; HBL-01, HBL-03, and HBL-04 become progressively darker; and HBL-02 represents the darkest grey material. HBL-06 is dark brown, and HBL-04 had a mixed colour, composed of grey and brown.

Fifteen artifacts were chosen to represent the range of chert colours present in the Spanish River cache. Using the Munsell colour chart, nine major colour groups were identified in the cache. For most groups, one sample was chosen as representative, and a very small amount (<4 mg) was removed to provide 1 to 2 mg for analysis. For larger groups, two artifacts were sampled. The grinding was performed along step fractures to reduce visible damage to the edges and technological features. When step fractures were not present, the sample was taken from isolated flake scars.

Each pellet of geological and archaeological material was analyzed using 30 scans, and the results were recorded at a resolution of 4 cm^{-1} in the wave number range from 1600–100 cm^{-1}.

FTIR Results. Analysis of FTIR spectra from the geological samples produced similar spectra to those obtained by Silveira (1999) and Long et al. (2001) for HBL cherts, confirming the visual identifications. The dominant peaks (related divalent bonds in quartz) are very similar (Figure 4) to earlier spectra from HBL chert samples, with adsorption peaks indicating the presence of trace amounts of goethite, glauconite, and hematite, and in some samples, calcite.

Quartz (chert) has spectral troughs associated with adsorption at wave-numbers of 1172, 1050, 1084, 798, 780, 697, 512, and 462 (Moenke 1974; Hawkins et al. 2008). These show up in all samples examined. Calcite is known to produce a prominent trough at 877 cm^{-1} (Hawkins et al. 2008) that has a width of ~200 cm^{-1}. Other absorption maxima occur at 2525, 2170, 1798, 1734, 1429, 1162, 1012, 848, 843, 7131, and 482 cm^{-1} (Jones and Jackson 1993; Hawkins et al. 2008). There are no evident calcite troughs in any of the geological or archaeological spectra examined (Figure 4). Goethite is known to produce minor troughs at 630, 605, and 400 cm^{-1} (Cambier 1986; Long et al. 2001). In the new and old geological spectra of HBL cherts, these peaks appear to have shifted due to interference with quartz spectra and are represented by minor reoccurring troughs between 397 and 516 cm^{-1}. Glauconite produces prominent peaks around 810 and 670 cm^{-1}, which are represented by reoccurring troughs in all geological and archaeological spectra. Hematite is known to produce a series of troughs at 620, 541, and 465 cm^{-1} (Silveira 1999). The prominent trough at 467 cm^{-1} in most of the geological samples and in

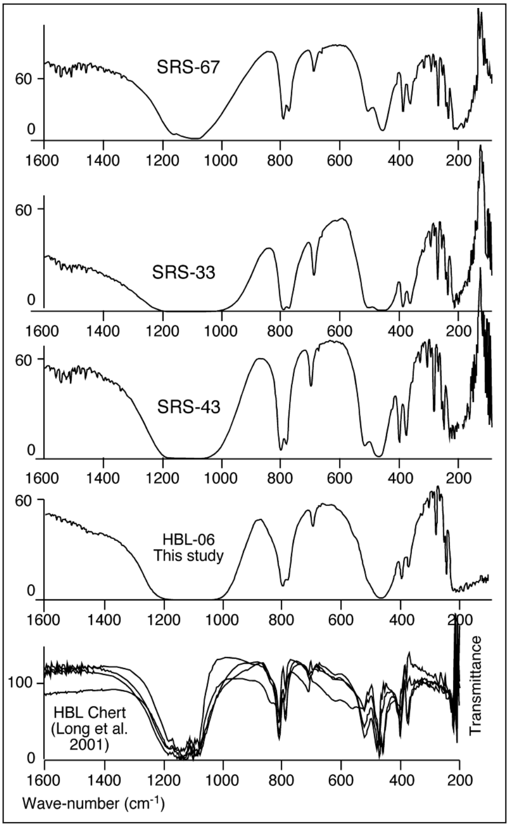

Figure 4. *Comparative FTIR spectra of three representative samples from the Spanish River cache (Top: SRS-67, 33, and 43), and one new (HBL-06) and several older analyses of HBL cherts. Note the coincidence of many of the negative spikes, indicating bands of maximum absorption. For comparison with other potential chert types, see Long et al. (2001).*

the archaeological sample SR-43 at 67 cm^{-1} indicate the presence of trace quantities of hematite. Peaks corresponding to absorption bands produced by dolomite, smectite, phosphates, and organics were not prominent in any of the samples examined.

ICP-MS

Solution-based ICP-MS analysis was undertaken by Balz Kamber at Laurentian University using a Thermo X Series 2 quadropole ICP mass spectrometer under clean-room conditions. Samples of chert were digested in HF and then dried, volatizing the bulk of the siliceous matrix as SiF_4 prior to conversion of fluorides to nitrates in 1 mL of HNO3. Residues were then diluted to nominal concentrations of ~1:100 in 5% HNO_3. Details of the analytical procedure, standards, and dilution factors are provided in Baldwin et al. (2011). Data are presented here as spider diagrams, normalized to the average composition of the continental crust, using the MuQ standard of Kamber et al. (2005). In these diagrams, sample concentrations are plotted on a logarithmic scale, with points near the top of the diagrams having similar concentrations of elements to the MuQ standard and those plotting further down having progressively greater dilution. Because the trace element chemistry of cherts largely mimics that of the associated water mass, with minor modification from included terrigenous material and diagenetic processes (Baldwin et al. 2011;

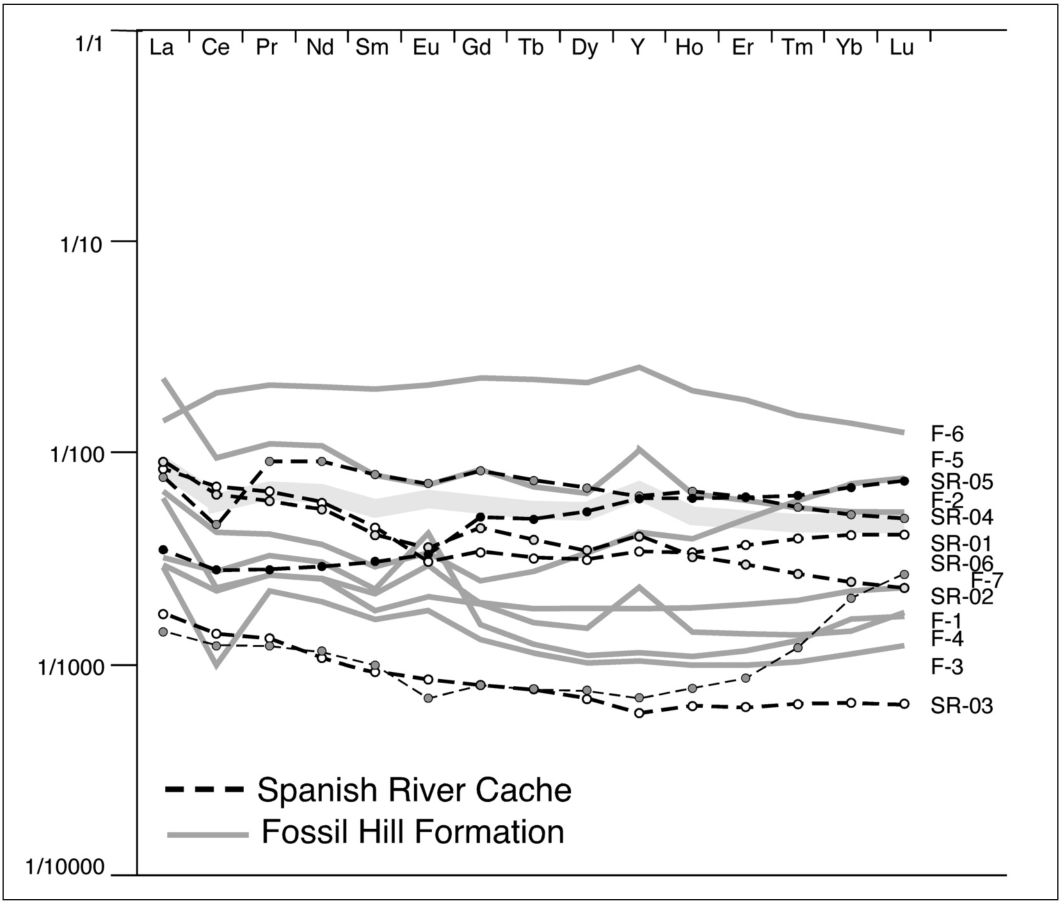

Figure 5. *Spider plot of REE elements from artifacts from the Spanish River cache (black) and the Fossil Hill Formation (grey). The thick grey line indicates average pattern for Fossil Hill cherts normalized to the MuQ shale standard of Kamber et al. (2005).*

Johannesson et al. 2006; Kamber and Webb 2001; Murray et al. 1991, 1992), the spider diagrams can be used to characterize individual chert sources. In the ICP-MS component of the study, six artifacts from the Spanish River cache are compared with six samples from the Fossil Hill Formation from Manitoulin Island sources (Figure 5), seven samples of Knife River Flint from North Dakota (Figure 6), and eight samples of HBL chert (Figure 7). Fossil Hill and Knife River cherts were examined because these can have brown varieties that visually resemble HBL material.

ICP-MS Results. When rare earth element (REE) + yttrium (Y) abundances in artifacts from the Spanish River cache are compared with the abundances in Fossil Hill chert (Figure 5), it is evident that although the relative abundance of REEs is similar (or overlaps), there are marked differences in the shapes of the spider diagrams. Both have slight negative slopes compared with the MuQ standard (Kamber et al. 2005), but there are no positive peaks in Y abundance in the Spanish River cache samples. Likewise, all but one of the Spanish River cache samples (SR-04) lack the strong negative cerium (Ce) anomaly apparent in the Fossil Hill material.

Comparison of the REE+Y ratios from the Knife River Flint (Figure 6) with visually similar material from the Spanish River cache shows that the former have significantly higher concentrations of all elements. In addition, the Knife River

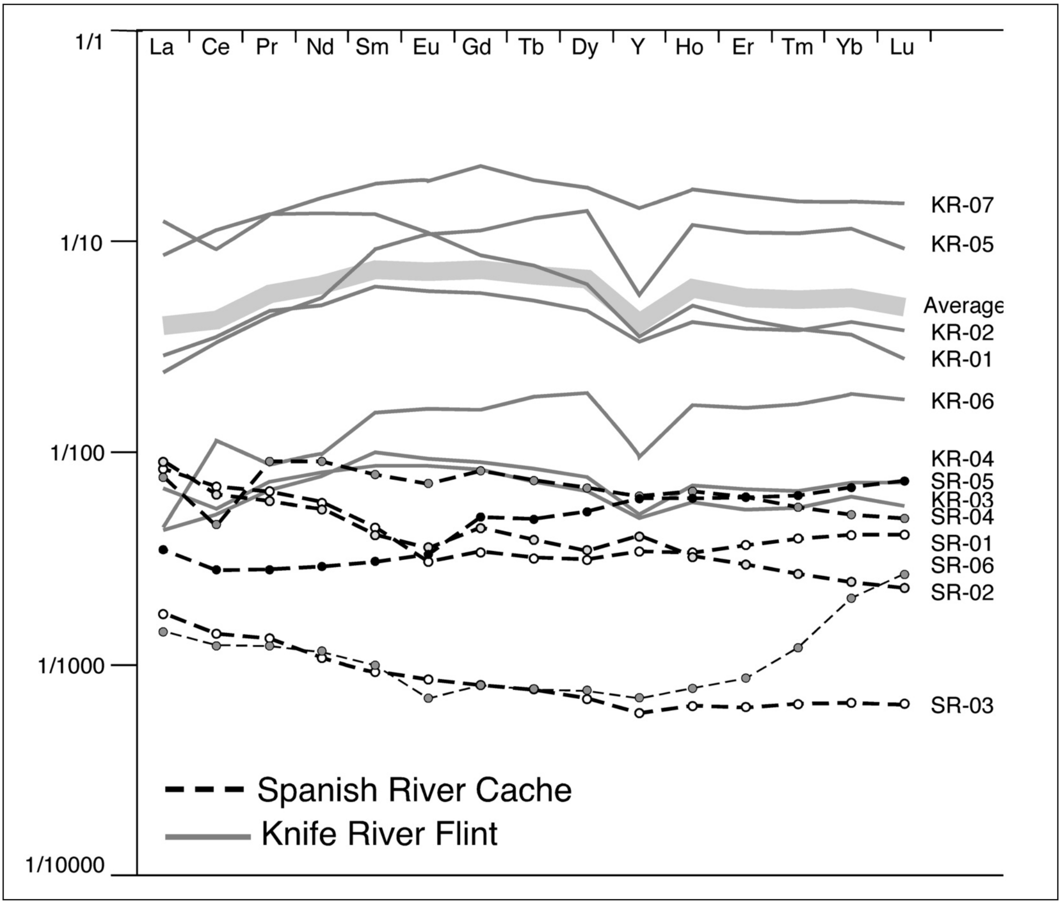

Figure 6. *Spider plot of REE+Y elements from artifacts from the Spanish River cache (black) and Knife River Flint (grey). The broad grey band indicates average composition of Knife River Flint normalized to the MuQ shale standard of Kamber et al (2005).*

samples have moderate to pronounced negative Y anomalies and a generally upward bowed profile not seen in any of the Spanish River cache samples.

Significantly, the REE+Y patterns from the Spanish River cache show a strong resemblance to all but two of the HBL samples, both in shape, relative abundance, and general absence of marked Ce and Y anomalies (Figure 7) of trace elements, confirming the results of the FTIR analysis.

Average Y/Ho ratios of the archaeological samples from the Spanish River cache are in the order of 1.01 (range 0.91–1.25; SD = 0.31). This is close to the larger group of HBL material, in which Y/Ho = 1.03 (range 0.90–1.21; SD = 0.40); substantially higher than the Y/Ho ratio in the Knife River Flint samples (Y/Ho = 0.69; range 0.46–0.83; SD = 0.14); and lower than the Fossil Hill material (Y/Ho = 1.31; range 1.00–1.64; SD = 0.27). Average Ce/Ce*, Pr/Pr* and Gd/Gd* ratios (Johannesson et al. 2006) are not diagnostic of the chert sources examined, although average Eu/Eu* ratios of the Spanish River artifacts (average 0.006) resemble the ratios from the larger group of HBL material (Eu/Eu* = 0.002). Average values for the Eu/Eu* ratios in the Knife River and

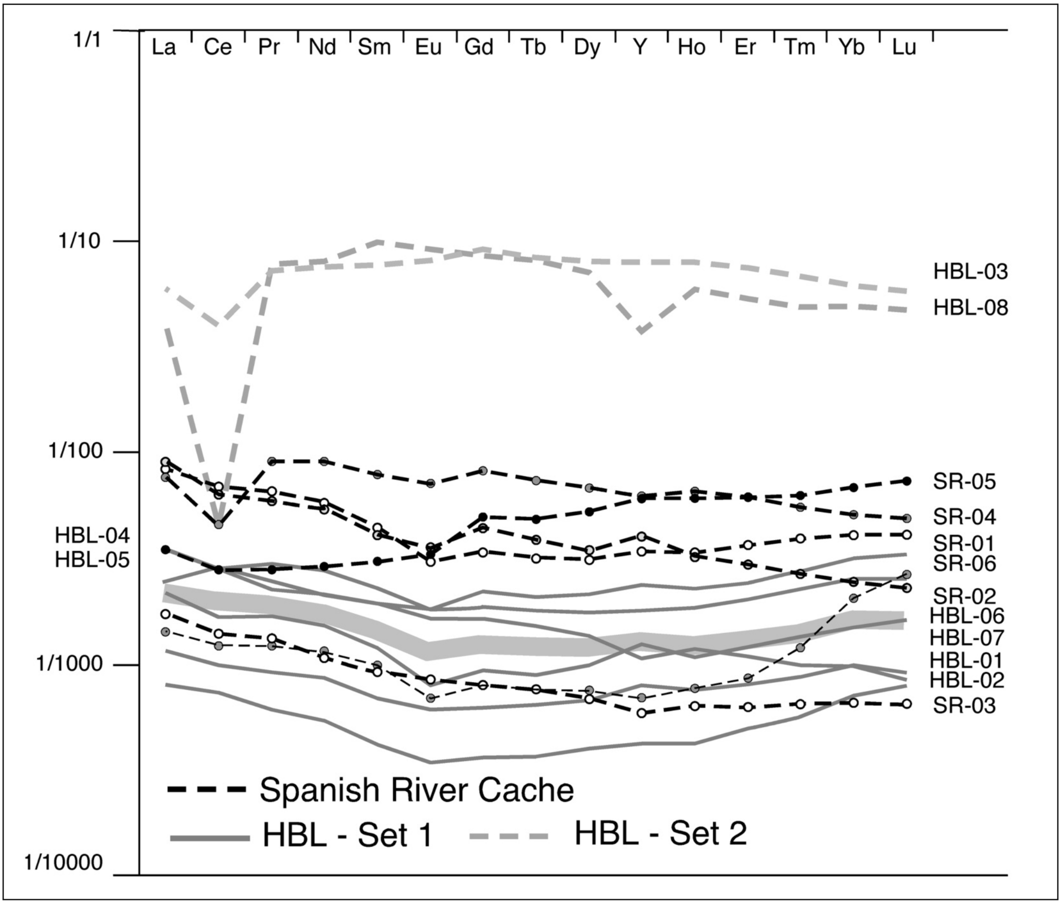

Figure 7. *Comparison of trace element data from artifacts in the Spanish River cache (black) with material from the Hudson Bay Lowlands (grey). Note that HBL material appears to belong to two separate groups, with samples HBL-03 and HBL-08 having significantly higher concentrations of trace elements; pronounced negative Ce; and, to a lesser extent, Y anomalies. The thick grey line represents average values for the larger group of HBL samples.*

Fossil Hill cherts was 0.119 and 0.012, respectively, while the smaller of the two groups of HBL artifacts had an average value of 0.140.

Both the FTIR and ICP-MS results indicate that the Spanish River artifacts represent a restricted assemblage made of material from the Hudson Bay Lowlands (probably from reworked glacial sources such as the Cochrane Moraine). Further research would be needed to determine which specific formations were involved.

Lithic Analysis

The Spanish River cache assemblage was analyzed from a technological perspective using the methodology described by Julig (1994), considering such aspects as the stage of manufacture, based on biface width to thickness ratios, and other parameters. A preliminary paper on this cache was given at the Canadian Archaeological Association conference in 2003 (Julig and Jean 2003). In the current paper, in addition, basic typological descriptions are given for the major types of biface tools identified. The assemblage is composed of both unfinished oval and leaf-shaped bifaces and unmodified flake tool blanks, as well as finished and used bifacial and flake uniface tools. The lithic technological metrics of the cache were compared with those of other caches in the upper Great Lakes region, including the HBL chert Wabatonguishi Lake cache (Storck 1974); the HBL chert Gerlach site cache (Ross 2010); and the Shebaonaning ("Killarney") cache, which was made on Flint Ridge chert, Vanport Formation (Fox 2010).

Based on modification and retouch, we were able to establish that the assemblage is composed of several distinctive types of bifaces, including backed bifaces, denticular bifaces, bifaces with gravers and burins, notched bifaces, leaf-shaped bifaces, and oval bifaces. Some of the bifaces are broken. Some of these breaks look fairly fresh, and may have occurred recently from traffic on the logging/quad trail. Other breaks appear to be older, and some of the broken specimens were made (recycled) into backed bifaces. Indeed, the most striking aspect of this cache is that many of the bifaces have been retouched into various tool forms. They are not simply preforms, as is common in other biface caches, such as the Crane cache (Julig 1994; Ross 2013).

Method

The bifaces were measured following standard accepted guidelines for stage analysis established by Callahan (1979; see also Julig 1994). Length, width, thickness, weight, and mean edge angles were measured for each biface. Length was measured along the long axis of the biface, width was measured perpendicular to the long axis, and thickness was measured at the thickest point on the biface. The edge angle is the mean of five measurements taken by goniometer from all the edges of the biface that show evidence of flaking. The width and thickness values of each biface were used to calculate the width to thickness ratio. The bifaces were also examined under a low-power microscope to look at the finer retouch and wear, such as bag polish. Each individual biface was subjected to these measurements. These measurements were then used to differentiate among types and determine the stage of manufacture.

Following Julig (1994), unifacial flake tools, including raclettes, modified debitage, and broken flakes, were considered together in the technological analysis, separate from the bifaces.

Morphological and Functional Types of Bifaces

Leaf-shaped Bifaces. The biface assemblage is composed of a total of 56 specimens that are quite variable with respect to shape and function. Most of them are leaf-shaped or oval, but as noted above, many have been retouched into various tool forms. About half of the bifaces (n=26) can be categorized as leaf-shaped. These look much like other cache biface preforms, and they are not retouched to any extent (Figure 8). Most of these appear lightly polished to some degree. The polish appears to be an overall surface polish, possibly caused by the fine sand matrix they were found in. Polish on some ridges and flake scars may be to the result of bag polish, if they were transported in such a manner. Because HBL material has a waxy appearance, the low-power inspection was not adequate to characterize the various polishes

Figure 8. *Leaf-shaped and oval HBL bifaces. Note waxy sheen and polished surfaces.*

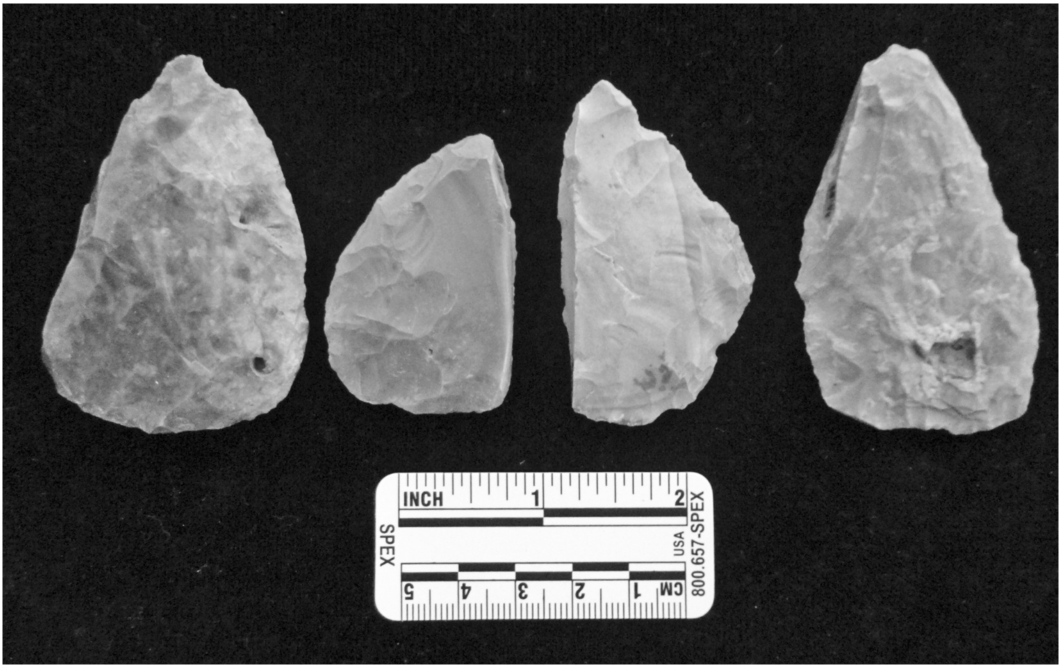

Figure 9. *Backed bifaces. Note inclusions and coarser raw materials in some of these specimens, which may have made knapping more difficult, as well as some failed edges.*

Figure 10. *Backed bifaces with gravers.*

evident on some specimens (Figures 8–10). Many of these leaf-shaped and oval bifaces do have some fine edge retouch, are made of very high quality HBL nodules of a range of colours, and may have been used as cutting and scraping tools (Figure 8). They are not simply Stage 3–4 preforms (sensu Callahan 1979).

Backed Bifaces. The second most common biface morphology in the assemblage is the "backed biface," which is characterized by the presence of a non-utilized edge opposing a used bifacial edge (Julig 1994). This non-utilized thick back edge can be used to apply pressure during use. The backed bifaces typically have a curved used edge and a relatively straight unused edge (Figure 9). There are a total of 12 backed bifaces. The back of these biface tool forms is variable in origin. On some specimens the original flakes may have a thick edge or flawed material that would have been difficult to thin bifacially. On others the "back" may be due to hinge fractures, snaps, or errors in knapping (see Figure 9, two specimens in centre). Most have had some blunting of sharp ridges on the back, presumably to facilitate holding these specimens for use as knives or scrapers. Inclusions and coarser raw material seem to be more common in these types of specimens. The edge retouch opposite the thick back often includes a fine denticulate edge with small notches (Figure 9), similar to the bifaces with multiple employable units that are common on other northern sites, such as Cummins (Julig 1994:164-166, Figures 5.58, 5.61).

Bifaces with Gravers or Burins. Another distinctive functional type of retouched biface in the assemblage includes four specimens with heavily used graver tips, with examples shown in Figure 10. These tools have multiple used edges, typically a cutting edge, and some are also backed bifaces (Figure 10), similar to specimens previously discussed. Some of these used edges and points are rather delicate, and their excellent condition suggests the assemblage is not too damaged by pre- or post-depositional factors. The medium-fine sand matrix was not too affected by freeze–thaw or other natural processes, such as tree throws, that may modify or damage the edges. Also, they must not have been banged around in bags too much or they would have been damaged. These particular specimens appear to have been subjected to only modest use and/or transport since manufacture, and some have fine secondary retouch for use as scrapers and/or knives (Figure 10, middle specimen).

Biface Stage Analysis

Stages of Reduction. The raw material that the cache was manufactured on was HBL pebbles, likely found in secondary glacial deposits and outwash gravels along the northern rivers and lake shores. The glacial transport of HBL chert pebbles reached as far south as the south shore of Lake Superior and north shore of Georgian Bay, but the pebbles in these regions are typically fairly small (Julig et al. 1992), likely too small for specimens the size of these bifaces. These HBL cherts are generally excellent, high-quality raw materials for stone tool manufacture and were in some cases transported long distances (Julig et al. 1992; Fox 2009). Since some of the bifaces have remains of cortex, we were able to determine that many of the pebbles were relatively small. The biface portion of the assemblage includes implements from 28.0 mm to 70.5 mm in length, with a mean of 52.1 mm and standard deviation of 8.8 mm. Width measurements range from 17.4 to 50.0 mm, with a mean of 36.4 mm and standard deviation of 6.4 mm. As mentioned, about half of the cache specimens are medium- to small-size leaf- or oval-shaped bifaces, and the rest are retouched bifaces that have been modified into various tool forms, along with a few uniface flake tools. The stage of manufacture the items were at when they were left in the cache is of particular interest to lithic analysts.

Following Callahan (1979) and Julig (1994), Stage 1 corresponds to obtaining a blank, such as a suitable nodule or flake. Stage 2 corresponds to the initial edging, Stage 3 involves primary thinning, and Stage 4 is defined by secondary thinning. Stage 3 and Stage 4 bifaces correspond to thinned bifaces and preforms, respectively. These are typically found in many caches, according to Andrefsky (1998:181) and Callahan (1979:30). A thinned biface is described by Andrefsky (1998) as having flakes removed from the centre and having most of the cortex removed. Additional stages defined by Callahan (1979:9) include Stage 5, final shaping of the biface and also small finished bifaces, such as points. Based on his experimental replication studies, Callahan enumerates 20 criteria for stages 2 through 4 (1979:30-31, Table 10). Width to thickness ratio is the main criterion for assignment to a specific stage, followed by optimum edge angles, nature of cross-section, and other criteria (Callahan 1979:18, Table 5). While many technological criteria and definitions have been proposed based on experimental stage analysis studies, only basic data is provided here for the Spanish River cache. Included are typical basic measurements, width to thickness ratios, and mean edge angles, allowing for comparison with other HBL caches with respect to stages of production or manufacture. The published data on certain caches allow for only limited stage analysis, but some useful insights were gained (as noted in the data tables).

Biface Data and Analysis

The bifaces were first sorted by type by Julig. The mean values, including length, width, thickness, and edge angles, for each type of biface were determined (Table 1). The backed bifaces have a mean length of 53.1 mm; denticular bifaces, 55.0 mm; bifaces with graver tips, 45.1; notched bifaces, 43.2 mm; leaf-shaped bifaces, 55.6 mm; and broken bifaces, 39.7 mm (reduced in size by snap or an another type of failure). An ANOVA test resulted in $p<0.05$; there is therefore a statistical difference in length among the different types. This is not unexpected, as those that are broken or retouched (such as the notched bifaces) are reduced in size, and the frequency distribution is bimodal.

There is, likewise, variability in mean width values for the various types, ranging from 41 mm to 28 mm (Table 1), and there is a statistically significant difference (p<0.05) in width among the different types. The backed and denticulate bifaces were significantly wider.

Despite these differences, the various biface types are probably derived from a single population of biface preforms, and potentially may have been made by a single individual. Some specimens (such as backed and denticulate types) have raw material flaws and fossil inclusions, which may have affected completion as a typical oval or leaf-shaped specimen; if thinning an edge was difficult, it may have been made into a backed biface. Broken specimens were also recycled into other tool forms.

Thickness measurements of the biface assemblage range from a minimum of 5.15 mm to a maximum of 15.15, with a mean of 9.08 mm and a standard deviation of 2.13 mm. There are four bifaces types, some represented by only two or three specimens each. Overall there are only small differences in mean thickness among the different types found in the assemblage (Table 1), and the statistics indicate (p>0.05) that there is no statistical difference in thickness among the different types found in the assemblage.

The mean width to thickness (W/T) ratios for the various types, excluding the broken bifaces (Table 1), range from 3.7 to 4.7 mm. These data show close similarity in W/T ratios, with most types around 4/1 (4.0). The observations suggest that most bifaces are all found within one or two stages of production, namely Stage 3–4. There is a reasonable spread, or continuum, of W/T ratios even within specific types, ranging from about 3.0 to >4.5 (Table 2), and a weak bi-modal distribution, with one peak at 3.5–4.0 and another at >4.5. This distribution displays similarities to other biface collections—for example, the Biloski site (Julig 1994:198-199), which has a tri-modal distribution of W/T ratios for bifaces. In contrast, the smaller of the two Late Palaeo-Indian Crane caches from near Thunder Bay have a more normal distribution, with a peak

Table 1. *Mean metrical values of Spanish River site biface types.*

	Length (mm)	Width (mm)	Width/Thickness Ratio	Angle of Used Edges
Backed Biface (n=12)	53.1	41.2	4.1	50.1
Denticulate Biface (n=9)	55.0	41.5	4.3	51.5
Biface Graver (n=2)	55.0	35.2	3.7	48.1
Biface Burin (n=2)	45.1	31.7	4.7	46.2
Notched Biface (n=2)	43.2	28.5	4.2	40.4
Leaf-Shaped and Oval Biface (n=26)	55.6	35.6	4.2	45.4
Broken Biface (n=3)	39.7	34.6	3.3	58.8

Table 2. *Width to thickness ratios of Spanish River site biface types.*

	2.5–3.0	3.0–3.5	3.5–4.0	4.1–4.5	>4.5	Total
Backed Biface		2	3	3	4	12
Denticular Biface			3	2	4	9
Biface Graver	1				1	2
Biface Burin			1		1	2
Notched Biface			1	1		2
Leaf-Shaped Biface	2	3	7	6	8	26
Broken Biface		2	1			3
Total	3	7	16	12	18	56

at 3.5–4.0 (for additional data on the Crane cache, see Ross [2013]).

The edge angles of the various biface types show a rather similar range of variation (Table 3). The mean edge angles range from about 40 degrees for the notched bifaces to 58.8 for the backed bifaces. The majority of the typical leaf-shaped and oval bifaces have edge angles of about 45 degrees, and these show a fairly normal distribution. The distributions of the edge angle categories for these typical cache biface types, as shown in Table 3, indicate overall a normal distribution. In contrast, the clearly retouched and modified biface tools (such as denticulate, notched, and backed bifaces) show a greater range of mean edge angles, as might be expected. When we comparing all the types, we see that the edge angles do differ significantly among types at a 95% significance level, where p=0.005.

As mentioned above, Stage 3 bifaces have a lenticular cross-section and a width to thickness ratio of between 3.0 and 4.0 according to both Andrefsky (1998) and Callahan (1979), with edge angle measurements between 40° and 60°. Only 10 percent of the bifaces from the Spanish River cache have edge angles of <40°. The remainder of bifaces fall into categories of >40°, with 22.4% between 40° and 45°, 34.3% between 45° and 50°, 16.4% between 50° and 55°, 10.4% between 55°and 60°, and only 6% of the assemblage greater than 60° (Table 3).

At first glance, the majority of the bifaces in this assemblage could be classified as Stage 3–4 preforms. Some of the bifaces (n=26) appear to be preforms that would normally be shaped later to make specific tools. In fact, about half have been retouched into specific tools, possibly representing an HBL "tool kit." Typical HBL tools, such as end scrapers, are absent in the assemblage, despite the presence of some unifaces. The 26 oval and leaf-shaped bifaces or preforms may have been destined to be traded or placed in the types of mortuary or other contexts where similar specimens have been recovered, such as at the Killarney Bay 1 site (Hawkins et al. 2013).

To summarize, various types of bifaces, including some specific tool forms, are present, and some larger groups (leaf-shaped and oval

Table 3. *Edge angles of Spanish River site biface types.*

	<40°	40.1–45°	45.1–50°	50.1–55°	55.1–60°	60.1–65°	60.1–65°
Backed Biface	1	1	4	4	1	1	1
Denticular Biface	1	1	3	0	2	2	2
Biface Graver	0	1	0	0	1	0	0
Biface Burin	0	1	1	0	0	0	0
Notched Biface	1	1	0	0	0	0	0
Leaf-Shaped Biface	3	8	11	4	0	0	0
Broken Biface	0	0	0	0	2	1	1
Total	6	13	19	8	6	4	4

Table 4. *Summary of biface metrical data from Gerlach (Ross 2011), Wabatonguishi Lake (Storck 1974), Spanish River, and Shebahoaning (Fox 2010) caches.*

	n	Total Weight (g)	Average Weight (g)	Average Length (mm)	Average Width (mm)	Average Thickness (mm)	Width/ Thickness Ratio
Gerlach	49	5,400.0	110.2	98.9	61.5	16.6	3.7
Wabatonguishi Lake	11	1,626.0	147.8	110.5	68.2	16.0	4.4
Spanish River	41	767.6	18.7	54.3	36.8	8.9	4.3
Shebahoaning	46	_	_	74.2	41.2	7.6	5.4

types) appear to represent a normal distribution. As such, the assemblage appears to represent a continuum of the manufacture of bifaces.

Unifaces

Although some of the remaining artifacts exhibit bifacial flaking on at least one edge, these cannot be labelled as bifaces. These are mostly uniface flakes that possess natural narrow edge angles of <50°, except for specimen SR-47, which has a mean edge angle of 55.6°, and two broken flakes. Seven other specimens are examples of uniface flakes from the cache. Some of these have edges with cortex. These represent large primary flakes that were removed early in the manufacture of bifaces from chert pebble cores. Three of the unifaces are broken, and one is flaked to a specialized shape. It is a unifacial borer with a drill-like implement at its tip. The specimen also has one bifacial edge retouched at the base.

The parameters used to establish a typology of retouched unifaces include edge angle, where an angle >60° is assumed to be the basic attribute of a scraper edge. Because the average edge angle of unifaces is <50° and many are not continuously retouched, it is safe to propose that the majority of the flake unifaces are not typical scrapers and could be classified as retouched flakes or raclettes. Most specimens possess a modified edge along more than one side, and some have also been bifacially modified.

The unifaces provide some evidence for an early stage of biface manufacture. These flake artifacts were probably abandoned as potential bifaces during production because of small size and some failures, but were kept as part of the cache assemblage. These artifacts would make efficient cutting tools due to their narrow edges, and some could be used as utilized flakes or scraper-like tools.

In the Spanish River cache, most of these unifaces could be defined as raclettes, which are defined as being continuously retouched along an axis on one or more edges with narrow angles (Julig 1994). Modified debitage includes all small flake specimens that show evidence of retouch on any edge and could potentially be used as a tool. Comparable raclette unifaces made on brown cherts, such as HBL and Knife River Flint, have been reported in other caches, including the McCollum cache near Nipigon River (Julig et al. 1991). McCollum is a Late Archaic or Middle Woodland cache that also includes copper items. Other regional caches are discussed below.

Regional Comparisons

As noted above, other regional biface caches on HBL cherts have been reported in the Upper Great Lakes region, including at the Wabatonguishi Lake site (Storck 1974) and the Gerlach site (Ross 2010). These caches have some available metric data for comparative purposes, as shown in Table 4. The Wabatonguishi Lake and Gerlach sites are considered to be Shield Archaic sites. The Wabatonguishi and Gerlach cache artifacts are about twice as long and twice as wide as material from the Spanish River cache and are much heavier. Despite these size differences, the W/T ratios are roughly similar to those of the Spanish River cache (Table 4). For additional comparison, the Shebahoaning cache biface data are presented. While this cache is made from Ohio Flint Ridge (Vanport Formation) chert, it was found in the Killarney region, just to the south (Fox 2010). Fox (2010) considers this cache to be a typical one of Robbins blades of Middle Woodland affiliation. Middle Woodland cache bifaces are more comparable to those from the Spanish River cache in terms of thickness, yet they are wider on average and, with a W/T ratio of 5.4, represent Stage 4–5 rather than Stage 3–4 preforms (Table 4). The Flint Ridge (Vanport Formation) material appears to have been excellent for knapping, and this characteristic may be a controlling factor in the greater thinness and W/T ratios. An additional factor may be that individual knappers who specialized in biface blades that were traded widely, such as the Robbins blades, may have been more skilled in their craft.

Conclusions

It is apparent that the population who manufactured, and who may have used and/or exchanged, the Spanish River cache bifaces had a preference for a specific size and specific shapes. They appear to have preferred bifaces with Stage 3–4 W/T characteristics, with mean edge angles of about 50 degrees. Other features, such as the lenticular cross-section, the presence of thinning scars that reach the centre of the biface, and very minimal amounts of cortex, are further evidence for Stage 3–4 bifaces. These features are characteristic of this assemblage. About half of the bifaces were made into specific tool forms, indicating that the assemblage may have been a biface tool kit. It is unusual that 100 percent of the assemblage is manufactured from one group of chert material (HBL chert, possibly from the Stooping River or Ekwan River Formations). The range of chert types indicated by FTIR and ICP-MS analysis of the artifacts indicates that they may have been sourced from several different formations within the Hudson Bay succession. This feature, and the presence of cortex on some of the preforms and unifaces, suggest that the bifaces may have been manufactured from chert pebbles and cobbles collected from secondary glacial sources. Further delineation of bedrock sources would require extensive collection of in situ geological material and/or geochemistry of the core chert samples; this is beyond the scope of this paper.

Some of the debitage was used and transformed into unifacial tools, including raclettes, other modified debitage, and one borer. These artifacts were not flaked extensively during manufacture; most were simply pressure-flaked along their edges to create a cutting edge.

There are no formal end- or side scrapers. The bifaces and unifaces were found in a discrete cache along the Spanish River, and both FTIR and ICP-MS confirm that they were made from Hudson Bay Lowland chert. Such detailed chemical analysis has the potential to reveal some trading and movement patterns of the population in question and suggests that the makers and depositors of this cache may have spent some time near the headwaters of the Spanish River, where HBL pebbles and small cobbles of appropriate size may be obtained. Since a wider context is lacking, we do not know if the cache is part of a larger site or what other artifacts and features may be present. Based on the comparison with other HBL caches, we suggest this cache is Middle Woodland in cultural affinity and that it represents an unusual HBL tool kit and a biface preform cache. The 26 biface preforms that were carefully manufactured, but not retouched and used, may have been destined for trade to other groups, possibly along the coast of nearby Lake Huron, where similar HBL cache bifaces are found in mortuary contexts (for example, at the Killarney Bay 1/Speigel site). An alternative view is that the cache may have been made and left by an individual craftsperson, or as a ritual offering. What is needed for such an interpretation is further survey of this site area to determine context.

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Le site de la cache lithique de la rivière Spanish (CcHj-2) est situé entre la rivière Spanish et le ruisseau Ministic à l'ouest de Sudbury. Il a été signalé en 2001 et il se compose de soixante-huit échantillons, principalement de bifaces en forme de feuille et de forme ovale et d'autres outils bifaces, ainsi que quinze outils unifaces. L'assemblage de cette structure d'entreposage est inhabituel puisqu'il comprend une gamme d'outils de types biface et uniface, ce qui pourrait suggérer une trousse d'outils. En se basant sur des critères visuels, il paraît que l'assemblage entier est formé à partir de matériel des Basses-terres de la baie d'Hudson, ce qui est à l'extérieur de l'aire de répartition normale de ce matériel. Les essais par spectroscopie ITFR et ICP-MS de divers échantillons ont confirmé que ces derniers sont bel et bien du silex de la période des Basses-terres de la baie d'Hudson. Le site a été trouvé par hasard et l'assemblage a été récupéré par un résident local des vestiges d'une fosse ovale perturbée le long d'une route et sur une plaine de sable plate, à une certaine distance des deux cours d'eau locaux. À ce titre, son contexte est similaire à celui de la cache du site Crane (Ross 2013), mais diffère du contexte typique des sites de la forêt boréale à proximité de cours d'eau. La cache n'est pas datée, mais, en se basant sur des critères métriques comparatifs d'autres structures d'entreposage de la période des Basses-terres de la baie d'Hudson, elle semble être de la période du Sylvicole Moyen ou de la période Archaïque supérieure. Une étude technologique des bifaces a été entreprise pour déterminer le stade de réduction et la présence d'usure due à la transportation. Cette cache est ci-considérée par rapport à d'autres caches régionales et à l'organisation des caches dans le Nord de l'Ontario. La cache est similaire à plusieurs autres caches de bifaces de silex de la période des Basses-terres de la baie d'Hudson signalées à travers le Bouclier canadien, mais les bifaces sont généralement de plus petite taille que d'autres de la période Archaïque. Une autre différence est qu'ils ont été retrouvés sur une plaine de sable, plutôt que le long d'un rivage ou d'une voie d'eau, indiquant qu'ils auraient possiblement pu être situés sur un portage entre deux rivières se croisant.

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