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Using regional chemical comparisons of European copper to examine its trade to and among Indigenous groups in late 16th and early 17th century Canada: A case study from Nova Scotia and Ontario

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ABSTRACT

Basque kettles and distinctive fragments from them have been found in archeological sites dating from the end of the 16th and the beginning of the 17th centuries C.E. all the way from the Canadian Maritimes to the lower Great Lakes. Both kettles and their fragments, as well as tools and ornaments made from them, were extensively traded among the Aboriginal communities, following trade routes established long before the arrival of Europeans. Little is known, however, about how these European copper objects were actually exchanged and distributed among the different Aboriginal communities. In this paper we argue that the establishment of metal chemical groups using instrumental neutron activation analysis (INAA) data can allow us to define groups of artifacts that had been produced using similar raw materials and manufacturing techniques and, thus, provide a refined way to trace similar objects through space and time. The spatial and temporal patterning of group chemistries could then illuminate the nature of the exchange and trade of European copper items, by allowing archeologists to examine which communities were linked through which metal chemistries. In the present study we determine whether or not the same metal chemistries are shared among 59 Basque copper kettle samples found in three burial sites in Nova Scotia and 204 European copper artifacts found at the contemporaneous Ball site, a late 16th century Wendat village. We then explore the implications of the strong chemical connections among these materials for trade among Europeans and the various coastal Aboriginal communities, as well as that between the Wendat of the Ball site and their allies to the east.

1. Introduction

Smelted copper metals appeared in northeastern North America for the first time in the late 16th century of the current era,[1] brought by European fishermen, whalers, and, after 1580, traders. Prized among the contents of the European ship cargoes were kettles, made of copper and brass (Bradley, 1987a: 130–131; Ehrhardt, 2005: 72; Fitzgerald et al., 1993; Martin, 1975; Turgeon, 1990, 1997, 1998, 2001; Trigger, 1987: 360; Van Dongen, 1996). Copper kettles, specifically, were technologically elaborate, made of 'red copper,[2] often with robust iron banding, patterned battery work, and a folded lip or shelf that made them visually distinctive (Fitzgerald

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[1] All dates mentioned in this paper are of the current era, unless otherwise indicated in the text.

[2] There is considerable confusion in the literature when it comes to how archeologists refer to the raw materials from which European kettles were made. In the past, 'copper' was often used archeologically to describe metals that were not gray or white in color (i.e., they were not iron, tin or zinc), so the word encompassed both copper and brass metals. By the mid-1990s, Hancock et al. (1994) had defined four different name groups for copper-based metal samples found at archeological sites in northeastern North America: 'native copper', 'European copper', 'brassy copper' and 'brass'. Yet again, by the late 1990s, Hancock et al. (1999) were using the names 'red brass' to replace 'brassy copper' (higher-tin [Sn], lower zinc [Zn]) and 'yellow brass' to replace 'brass' (low-Sn, higher Zn). In informal communications, it is still common to refer to 'red copper' and 'yellow copper,' with an understanding that 'red copper' means European copper and 'yellow copper' means brass. Notarial records in Bordeaux also mention kettles made of 'red copper' when referring to what archeologically we call 'Basque kettles'. In the present paper we focus only on kettles made of *European copper* (=Cu), rather than on *brass* (*red brass* = $Zn < 20\% \pm 2\%$ and $Sn > 1–2\%$, or *yellow brass* = $Zn > 20\% \pm 2\%$ and $Sn < 1\%$.

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et al., 1993: 50–54). They are known as 'Basque kettles' and were the first to appear on the Atlantic coast of what is modern Canada, between about 1580 and 1600. Similar kettles can be found still in homes and museums in the Landes region and the Basque Country in Europe (Turgeon, 1997: 7). In North America, their spatial and chronological distribution is well understood (Fitzgerald and Ramsden, 1988; Fitzgerald et al., 1993, 1995). Europeans, presumably Basques, traded them directly with Aboriginal groups living along the Atlantic coast of modern day Canada, around the Gulf of St. Lawrence, and along the St. Lawrence River. From there, kettles reached Aboriginal communities westward in southern Ontario, following distribution networks that had been established long before the arrival of Europeans, based on long-term sociopolitical and economic alliances (Fitzgerald et al., 1993:49; Hamell, 1987: 73; Trigger, 1985, 1987:213–214; Turgeon, 1997; Van Dongen, 1996).

Intact copper kettles have been recovered from burial sites in Nova Scotia, New Brunswick, and Ontario. Often, however, kettles would be broken down into individual fragments without having ever been used as kettles. Both whole kettles and their fragments would be traded extensively among Aboriginal communities and used for the production of both utilitarian and ornamental items (Fitzgerald et al., 1993: 55; Bradley, 1987a: 130; Turgeon, 1997: 10; Moreau and Langevin, 1992: 42). As a result of this process, a large percentage of metal objects recovered from late 16th century, northeastern North American archeological sites are actually scrap pieces with no stylistically identifying characteristics. For example, at the Ball site in southern Ontario, only 20 out of an estimated 400–500 copper samples were identified stylistically as Basque (Fitzgerald et al., 1993: 52, Table 4). Although it is probable that all of the copper artifacts belonged to Basque kettles originally, based on the archeologically established chronological and spatial distribution of the kettles (Fitzgerald et al., 1993: 45), this assumption has not yet been confirmed archeometrically.

Basque kettles and their disarticulated fragments spread rapidly and widely from the Atlantic coast into Ontario. After about 1600 only 'heirloom' Basque kettles are found in Ontario cemeteries, while very few, small fragments have been recovered from settlement debris. By the end of the second quarter of the 17th century Basque kettles and their fragments had all but disappeared from the Northeast. (Fitzgerald et al., 1993: 49).

Although our current understanding of the timing, distribution, and use of Basque kettles and their fragments appears to be extensive, a lot remains unclear about the production of the kettles themselves, the people who were bringing them to the Northeast coast, and the particular ways in which these kettles and their fragments were traded among the various Aboriginal communities.

A number of scholars have described the basic manufacturing steps in the production of Basque kettles (e.g. Bradley, 1987a: 197–199; Fitzgerald et al., 1993: 50–54, Van Dongen, 1996), yet little detail is available about how many workshops were making them, where these workshops were located and from where they procured their raw materials, what specific techniques and operational sequences each workshop was employing, and how standardized these techniques were within individual workshops and across entire regions (Westermann, 1981). A number of large copper mines were active in Central Europe and Sweden in the 16th century (Fitzgerald et al., 1993; Turgeon, 1997; Ehrhardt, 2005: 73, Van Dongen, 1996; Westermann, 1981), and notarial records show that Basque merchants were ordering both central European and Swedish copper (Fitzgerald et al., 1993: 48; Turgeon, 1990: 85). Similarly, it seems that workshops outside the Basque territories were also producing and helping distribute Basque style kettles. Turgeon (1997:6) for example, mentions that "merchants in Bordeaux often had to call on coppersmiths in outlying areas, in the Garonne and even the Dordogne, during the 1580s" unable to fill the great demands on the North American trade (see also Turgeon, 1998: 593–594 for numbers of Basque vessels outfitted in Bordeaux). Furthermore, archeometric evidence (e.g. Whitehead et al., 1998: 290) indicates that different parts of kettles occasionally have different copper chemistries, a pattern that may suggest kettles were sometimes circulating only partly finished. In fact, archival evidence from the mid-17th century shows that kettles were sometimes sold as basins, to be finished by local copper-smiths who would add wrought iron, copper, or brass rims, lugs, and/or handles (Van Dongen, 1996: 125).

It is highly unlikely that the production of Basque kettles, and thus their chemical composition, would have been homogeneous. By focusing only on samples recovered in North America we cannot disentangle the intricacies of Basque kettle production in Europe. As long as the European side of the kettle story is not understood, it should be clear that the term 'Basque kettle' refers to a kettle style (both morphological and, as we establish in this paper, chemical). Archeologists encountering Basque kettles in North America should not assume they were made by or brought over by Basques, unless corroborating archeological evidence supports this interpretation.

By examining how many Basque kettle chemical groups were available in northeastern North America, we could get insights into the chemical diversity of copper that was produced for North America, which could be an indication of the diversity of production techniques in Europe. Furthermore, by examining the spatial and temporal distribution of these chemical groups, we could also explore how exactly these kettles and their parts were then distributed among different Aboriginal groups and communities.

Complicating the story of copper kettles is the fact that we do not know whether there were clear and consistent economic links between particular workshops and ports where ships bound for North America were outfitted. For example, it is not clear whether at the port of Bordeaux one could only find kettles made in the local workshops and, thus, whether chemically we could distinguish a ship outfitted in Bordeaux from one outfitted in St. Jean de Luz, La Rochelle, or St. Malo. Similarly, we do not know what the links were between particular ships and ports. Would a ship use the same port for every trip? It is not clear what factors determined which ports outfitted which ships. Between 1580 and 1600, Dutch, French (Breton, Malouin, and Norman [Turgeon, 1998: 593–598]), and Basque ships (mostly from the French province of Lapurdi, but possibly also from the Spanish provinces of Gipúzkoa and Biskaya during the first half of the 1580s), as well as a few English ones, were all sailing to the Gulf of St. Lawrence (Fitzgerald et al., 1993: 45, Turgeon, 1998: 609, Loewen and Delmas, 2012: 234–240). Would all the ships use the same ports interchangeably, or would broader geo-political factors have influenced which ports a Malouin versus a Biskayan ship could use, for example? Chemical analyses of kettles from the European ports and known workshops might help address these questions. Answers to these questions could then help us understand with greater nuance who exactly – besides the French Basques –

Table 1
Summary of samples used in the present study.

Sample category	Ball	Hopps (Pictou)	Northport[a]	Avonport
Rings	6	–	–	–
Beads	6	–	–	–
Ornaments	2	–	1	–
Rods	1	–	–	–
Projectile points	3	–	–	–
Discs	2	–	–	–
Hooks	1	–	–	–
Sheets/fragments	183	–	–	–
Kettle parts	–	48[b]	1	2
Whole Kettles	–	1	2	–
Armlet fragments	–	–	4	–
Total	204		8	2

[a] The Northport samples used in this study include all the samples published in Whitehead et al. (1998) as well as one sample that was analyzed along material from the Ball site and published in Michelaki et al. (2013).
[b] These samples do not represent individual kettle fragments. Multiple samples were taken from various parts of the same large kettle fragments.

Table 2
Main characteristics of the archeological sites considered in the present study.

Site name and archeological designation	Province	Location	Aboriginal group	Site function	Date (C.E.)
Northport B1Cx-1	Nova Scotia	Cumberland County; Northwestern Nova Scotia	Mi'kmaq	Burial	1580–1600
Hopps BkCp-1	Nova Scotia	Lowdens Beach, near Pictou; North shore of Nova Scotia	Mi'kmaq	Burial	1580–1600
Avonport BgDb-6	Nova Scotia	Kings County, near Bay of Fundy; western Nova Scotia	Mi'kmaq	Burial	1600–1630
Ball BdGv-3	Ontario	10 km west of town of Orillia, Simcoe County, Ontario	Wendat, Arendahronon	Village	1585–1609

was trading with whom in northeastern North America in the last decades of the 16th century.

Finally, not all Aboriginal groups and communities were the same, nor did they have the same relations with Europeans and with each other. Moreover, not all Aboriginal communities had had the same desire for and access to Native copper before Europeans arrived (e.g. Childs, 1994; Levine, 1999). There is no reason to expect that suddenly, after Europeans arrived, European copper goods would be universally and homogeneously desired. Aboriginal actors structured colonial encounters in a variety of ways and for diverse motives (e.g. Ferris, 2009; Silliman, 2012). Chemical data could help us explore these strategies by moving beyond whether a particular archeological site had European copper or not, to examine how particular chemical groups were distributed among communities, showing with greater clarity perhaps who was interacting with whom.

In this paper, we use previously published chemical data from the analysis of 59 Basque copper kettle samples, recovered from three late 16th and early 17th century burial sites in Nova Scotia, and 204 European copper artifacts, recovered from the Ball site, a contemporary Wendat village in southern Ontario (Table 1). We use these data to establish chemical groups of metal artifacts that would have been made in Europe using similar raw materials and manufacturing processes. By examining the regional distribution of these chemical groups within Canada we wish to provide preliminary data for answering the following two questions: *1*) *Were the coastal Aboriginal groups, such as the Mi'kmaq of Nova Scotia and the Innu of Québec, accessing the same types and numbers of metal chemistry groups through their trade with the late 16th century European fishermen, whalers, and traders*? And *2*) *Were the inland allies of the coastal groups, in turn, accessing similar numbers of metal chemistry groups by trading with their Aboriginal allies*? For example, if European traders were bringing over metal chemical groups *a*, *b*, *c*, and *d*, how would these be distributed across Nova Scotia and Québec (and hence to Ontario)? Would groups *a* and *b* only appear in Nova Scotia, while groups *c* and *d* only appear in Québec, or would the same chemical groups be present in both regions? Could it be that while *a*, *b*, *c*, and *d* were present in Nova Scotia, only *a* and *b* were present in Québec? Similarly, would all four chemical groups appear in Ontario, or only some of them? Answers to these questions would shed light on whether the coastal Aboriginal groups differed in some way in the way they traded with the Europeans who were present at the time, as well as on whether Aboriginal communities traded evenly or preferentially with their various allies.

1.1. Archeological sites considered

From Nova Scotia, we used three sites with material that would help us establish a clear chemical baseline of what 'Basque' metal chemistries looked like. The sites of Northport, Hopps, and Avonport had been used by the Mi'kmaq, an eastern Algonquian group of semi-nomadic hunter-fisher-gatherers, as burial sites during the end of the second half of the

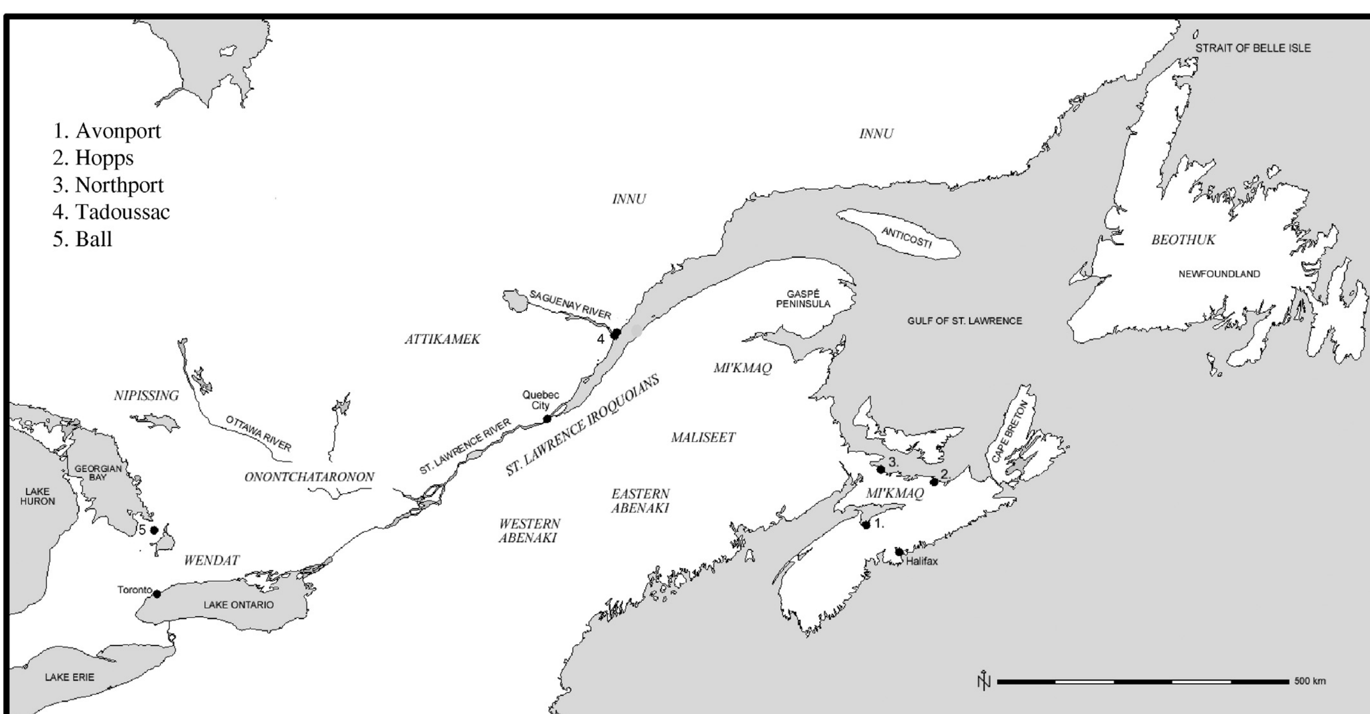

Fig. 1. Map of eastern Canada showing the main sites and landmarks, as well as the territories occupied by the Aboriginal groups discussed in this paper.

16th and the beginning of the 17th centuries (Fitzgerald et al., 1995; Whitehead et al., 1998: 280–281) (Table 2, Fig. 1). While Northport and Hopps, in northwestern and northern Nova Scotia respectively, date to ~1580–1600, Avonport, in the west, dates to ~1600–1630 (Fitzgerald et al., 1995; Knight, 1987; Whitehead, 1987, 1993; Whitehead et al., 1998: 280). These burial sites included complete kettles that were securely identified morphologically as Basque. Moreover, broader archeological and textual evidence also shows that the Mi'kmaq had frequent and strong interactions with the Basques, adopting their shallops, ways of dressing, and even many Basque words in their vocabulary (Bakker, 1989; Loewen and Delmas, 2012: 235). Although we did not sample perfectly preserved kettles, we liberally sampled battered kettles, kettle scraps, and ornaments made from them. The chemical data from our kettle artifacts, thus, can be used with confidence to represent Basque kettle chemistries, against which we can compare other samples, especially pieces of scrap metal with no identifying Basque characteristics.

From Ontario, we selected the Ball site for a number of reasons. Dating to ~1585–1609 (Fitzgerald et al., 1995; Knight, 1987), it is contemporaneous with our three Nova Scotia sites (Table 2, Fig. 1). Furthermore, it is a large site where approximately twenty-two hundred members of the Arendahronon (Rock Nation), the easternmost nation of the Wendat confederacy, lived - approximately 75% of all the Arendahronon (Warrick, 2008: 132). Their access to European goods was impressive. More than a thousand European items were recovered at the Ball site (glass beads, copper and brass tools, ornaments, and scrap, as well as iron knives, axes, awls, etc.) (Anselmi, 2004; Martelle, 2002: 678). The richness and diversity of the assemblage suggests that the inhabitants of the Ball site would have had prime access to the material coming through from their eastern allies. This can allow us to examine how their access compared to what was available at the Atlantic coast.

More importantly, however, the Ball site could act as a proxy for the material available in Québec. Its inhabitants could have not accessed European goods through the Mi'kmaq in Nova Scotia. Based on archeological evidence and the description by Champlain of 16th century oral history about the relationship among Aboriginal groups in the Maritime provinces, Québec, and Ontario (Trigger, 1985: 144–148 and 172–178), the Wendat were allied with the Ottawa Valley Algonquians (the Kichesipirini of the upper valley and the Onontchataronon of the lower valley) to their east, and with the St. Lawrence Iroquoians at the St. Lawrence valley, before their dispersal around 1580. They also had military alliances with Algonquian groups to the north and south shores of the St. Lawrence River, such at the Attikamek and the Innu, as well as with the Abenaki, in their long-term war with the Five Nations Iroquois (Trigger, 1990: 42–48).

The Mi'kmaq, on the other hand, not only played a role in the dispersal of the St. Lawrence Iroquoians, but were also at war with neighboring Algonquian groups, the Abenaki and the Maliseet (Tremblay and Chapdelaine, 2006; Trigger, 1985: 146–147; Warrick, 2008: 201–203). Thus, at the time that the Ball site was occupied, the Mi'kmaq were engaged in war with Wendat allies.

Furthermore, one of the key trading posts through which the Wendat allies would have received European goods was located at Tadoussac, near the confluence of the St. Lawrence and Saguenay Rivers. There the Innu, an Algonquian group who occupied the north shore of the St. Lawrence River, had monopolized the Basque and French trade until 1608 (Turgeon, 2001: 74). At least by Champlain's time, at the very beginning of the 17th century, there is no mention of Mi'kmaq traders operating at the Tadoussac trading post (Trigger, 1985: 137–

Table 3
Summary data for major and trace elements close to detection limits.

Group	N	Co ppm	Cu %	In ppm	Mn ppm	Ni ppm	Sn ppm	Zn ppm
E1	10	27 ± 10	95 ± 1	28 ± 6	<15 ± 8	<150 ± 40	530 ± 100	<150 ± 070
E2	25	39 ± 13	95 ± 2	<33 ± 9	<19 ± 18	<150 ± 50	590 ± 470	250 ± 350
E3	71	<25 ± 15	96 ± 2	26 ± 9	<15 ± 16	<170 ± 60	910 ± 4600	<140 ± 080
E3a	38	<16 ± 12	96 ± 2	19 ± 8	<12 ± 6	<170 ± 73	<490 ± 340	<130 ± 100
E3b	33	33 ± 15	96 ± 2	32 ± 9	<19 ± 15	<180 ± 60	1370 ± 4500	<150 ± 080
E4	24	<9 ± 5	97 ± 2	<17 ± 6	<13 ± 8	230 ± 110	<500 ± 210	<170 ± 100
E5	36	<6 ± 4	96 ± 2	12 ± 13	<11 ± 5	450 ± 20	<490 ± 190	<130 ± 060
E6	35	<9 ± 8	96 ± 2	<12 ± 8	<13 ± 5	700 ± 410	<500 ± 280	200 ± 190
E7	31	<5 ± 7	97 ± 2	<3 ± 10	<14 ± 11	730 ± 240	650 ± 270	<230 ± 350
E8	8	<4 ± 1	96 ± 2	<1.1 ± 0.4	<23 ± 17	860 ± 240	630 ± 500	410 ± 350
E9	21	<3 ± 2	97 ± 2	<0.9 ± 0.4	<14 ± 11	440 ± 120	<500 ± 300	<130 ± 90
Isolate samples (single–member chemical groups)								
NP52	1	<5	99	<1	280	<150	680	340
B374	1	10	1000.7	<6	900	680	310	–

Note: Shading indicates samples with higher values of a given element.
Note: A '<' sign in front of a group indicates detection limit data.
Note: The letter 'E' is used for group names to indicate that the samples are of European and not native copper.

Table 4
Summary data for well measured and potentially diagnostic trace elements and their ratios.

Group	N	Ag ppm	As ppm	Au ppm	Sb ppm	Au/As	Au/Sb	Au/Ag	As/Sb
E1	10	1040±140	61 ± 13	46 ± 4	67 ± 8	770 ± 100	690 ± 70	45 ± 4	0.92 ± 0.12
E2	25	1130±210	120 ± 30	46 ± 6	110 ± 30	400 ± 70	440 ± 130	42 ± 5	1.1 ± 0.4
E3	71	1100±270	140 ± 50	42 ± 10	330 ± 180	320 ± 140	140 ± 40	39 ± 4	0.49 ± 0.20
E3a	38	1120±230	150 ± 50	42 ± 10	410 ± 170	300 ± 110	110 ± 20	38 ± 4	0.43 ± 0.27
E3b	33	1140±270	150 ± 50	45 ± 10	310 ± 180	340 ± 140	160 ± 40	39 ± 4	0.57 ± 0.18
E4	24	980±130	270 ± 100	34 ± 4	890 ± 230	137 ± 46	40 ± 11	35 ± 4	0.31 ± 0.09
E5	36	890±130	360 ± 110	25 ± 4	1490 ± 260	73 ± 19	17 ± 2	28 ± 4	0.25 ± 0.07
E6	35	980±430	710 ± 310	22 ± 5	2270 ± 910	35 ± 14	11 ± 3	25 ± 8	0.35 ± 0.19
E7	31	470±170	1060 ± 260	15 ± 3	3530 ± 670	15 ± 2	4.4 ± 0.9	34 ± 10	0.31 ± 0.06
E8	8	720±60	800 ± 80	8.6 ± 0.8	2120 ± 20	11 ± 1	4.1 ± 0.6	12 ± 1	0.38 ± 0.02
E9	21	680±100	5070 ± 430	0.3 ± 0.1	390 ± 40	0.05 ± 0.02	0.7 ± 0.3	0.4 ± 0.1	13 ± 1
Isolate samples (single–member chemical groups)									
NP52	1	170	62	5.4	28	0.09	0.19	0.03	2.2
B374	1	740	599	3.4	1410	6	2.4	4.6	0.42

Note: Shading indicates the aberrant Au values of the two isolate samples.

138) where Basque fishermen and whalers were trading as early as ~1550.

Because the Wendat could have only accessed European material through allies, such as the Innu, and because the Mi'kmaq would have not traded with them, if we find metal chemistries at the Ball site that match those from our three Mi'kmaq sites, we will know that whatever the Europeans were trading with the Mi'kmaq in Nova Scotia, they were also trading with the Innu at the north shore of the St. Lawrence.

2. Analytical method and samples

The chemical analyses of the copper based metals from all sites were undertaken at the SLOWPOKE Reactor Facility at the University of Toronto and papers about them have been previously published, along with descriptions of the analytical conditions (Ball site: Michelaki et al., 2013; Northport, Hopps and Avonport: Whitehead et al., 1998). Copper, red brass (Zn < 20% ± 2% and Sn > 1–2%) and yellow brass (Zn > 20% ± 2% and Sn < 1%) were recovered from the four sites.

In the present study, we focus exclusively on 263 copper artifacts. At the Mi'kmaq sites (Hopps n = 49; Northport n = 8; Avonport n = 2), most samples come from the body (including rim and/or base) of incomplete iron-banded kettles and copper scraps, along with a few that come from lugs, or armlets (Table 1). At the Ball site (n = 204), samples come mostly from unidentifiable metal scrap, as well as a few ornaments and tools. Both Fitzgerald et al. (1993: 52, Table 4), and L.A. Pavlish (pers. comm. to R.G.V.H. 1993), when selecting the samples for instrumental neutron activation, had noted among the scraps the presence of pieces that stylistically seemed to belong to Basque kettles.

3. Results and discussion

A previous analysis of the Ball site copper artifacts (Michelaki et al., 2013) showed that they were made of European – rather than native – copper and could be sorted into nine distinct chemistries (E1–E9) and an isolate, using inter-element ratios and principal component analysis. The copper samples from the Mi'kmaq sites were also made of European copper and were sorted into four distinct chemistries (Groupings 1–4) – two with multiple subgroups (Groupings 2i–iii and Groupings 3i–v) – and two isolates (Whitehead et al., 1998), based primarily on their arsenic (As) and antimony (Sb) concentrations.

Re-analysis of the elemental data from all 263 samples confirmed, reassuringly, that the samples were made indeed of European copper, very low in zinc (Zn) and tin (Sn) (see Table 3). Table 3 also shows summary data for the elements cobalt (Co), indium (In), manganese (Mn) and nickel (Ni) that often produced detection limit data. Although these trace elements are poorly measured, they still give interesting information. Except for Mn, which is not helpful in this dataset, Co, In, and Ni show qualitative differences. Cobalt and In concentrations are higher in groups E1–E3b and lower in groups E4–E9, while the concentrations of Ni show the reverse pattern (lower in groups E1–E3b and higher in groups E4–E9). These tentative differences indicate that multiple, chemically distinctive ore sources were used to produce the copper that was made into different kettles. This interpretation is further supported by the data from the more precisely measured elements of silver (Ag), As, gold (Au), and Sb (Table 4).

The primary, diagnostic, summary data for the concentrations of Ag, As, Au, Sb, and their ratios are presented in Table 4. They show that our re-analysis of all the elemental data together, produced nine broad chemical groups (E1–E9) and two isolates — sample NP52 from Northport and sample B374 from Ball (Fig. 2). Silver and Au tend to behave similarly, being stable in groups E1-E3b and decreasing in groups E4-E9. Antimony and arsenic (As) behave quite differently: their concentrations increase from groups E1 to E9, with the exception of low Sb in group E9. Group 3 may potentially be subdivided into 3a and 3b.

If, as Pernicka (1999: 169) has argued, metal composition may be used to group together artifacts that were produced from the same ore applying similar techniques, then it is possible that what we are

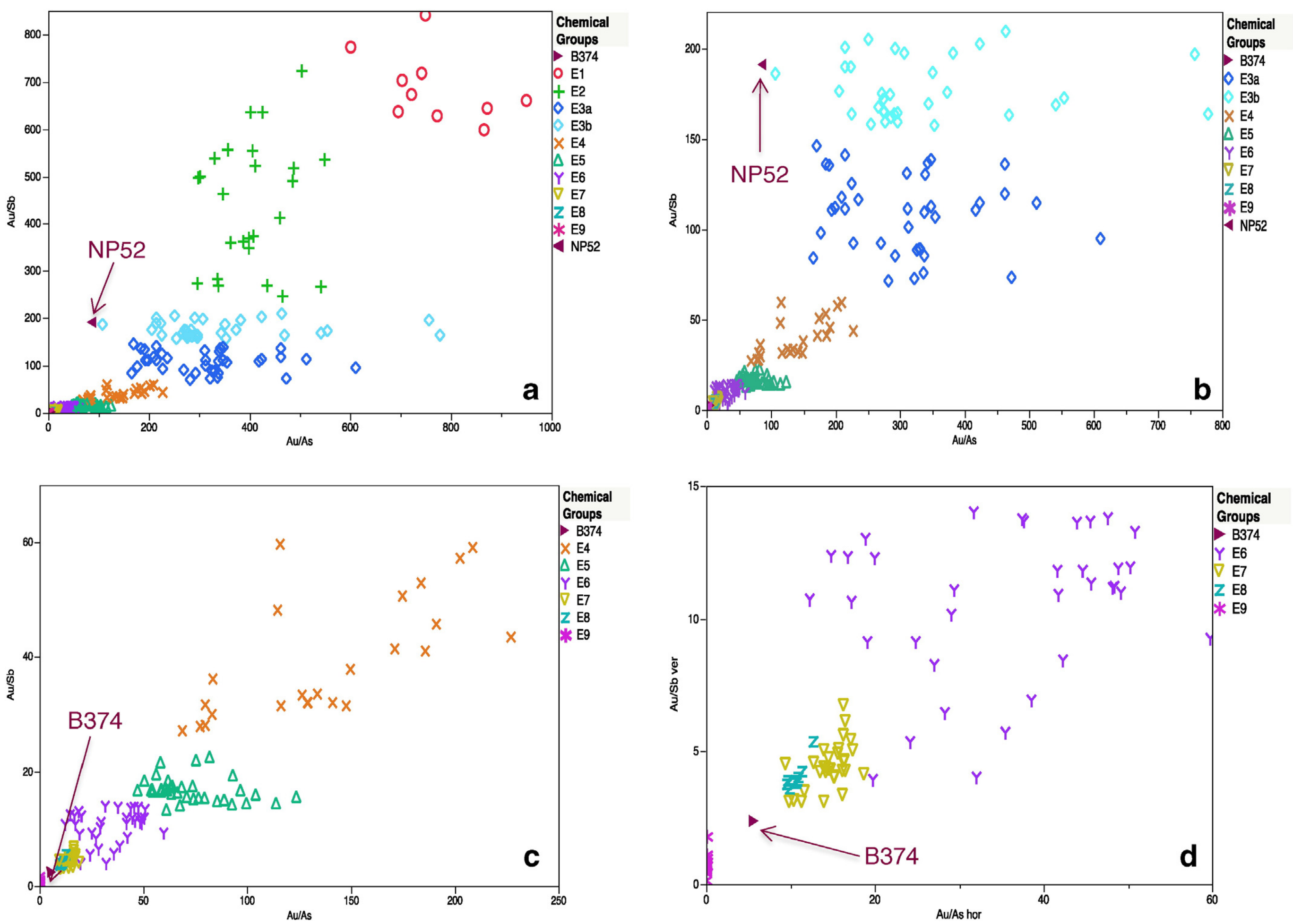

Fig. 2. Scatterplots of Au/As versus Au/Sb used to establish chemical groups among the Ball, Hopps, Northport, and Avonport sites. a. All samples present; b. E1 and E2 removed; c. E3a and E3b removed; d. E4 and E5 removed.

dealing here with kettles of only about a dozen different source chemistries that came to North America over a couple of decades.

3.1. Are the same types and numbers of metal chemistry groups found both at the Wendat Ball site and at the Mi'kmaq Northport, Hobbs, and Avonport sites?

Table 5 unequivocally shows that the same *types* of metal chemistry groups are found in Ontario and Nova Scotia. Interestingly, a greater *number* of chemical groups are present in Ontario in comparison to Nova Scotia. While groups E4 and E8 are present at the Ball site, they are not found in Hopps, Northport, or Avonport.

The probability that these groups are also connected to the east coast is great, especially for group E8, which includes samples with Basque-like stylistic characteristics (from L.A. Pavlish's sampling notes). Based on our current sampling, however, it is not possible to know whether this pattern suggests that the Innu in Québec, and by extension their allies in Ontario, were getting access to a greater number of metal chemistries than the Mi'kmaq in Nova Scotia, or whether a larger copper sampling from Nova Scotia would allow a complete match of metal chemistry groups.

Similarly, it is not possible to know currently whether the Wendat were accessing the same numbers of metal chemistry groups as their allies in Québec. It is possible that the Innu were in possession of kettles of an even larger number of metal chemistries, only some of which were traded westwards. Analyzing material from sites in Québec should allow us to answer this question.

It is important to remember that, at the moment, the *archeological* meaning of ‘a metal chemistry group’ is not completely clear. We do not know whether a particular shipment would only include goods of a single chemistry group or not (unlikely, given that a single complete kettle might include multiple chemistries [e.g. Moreau and Hancock, 2005]), or how exactly a shipment correlated to a particular European group of fishermen/whalers/traders, port, or metal workshop. We also do not know whether the Aboriginal people who received the Basque kettles, and the ones who received their fragments would have any way of telling apart two kettles of different chemistries; whether a

Table 5
Summary of samples from each site belonging to the metal chemistries defined in this study.

Group	Hopps (Pictou)	Northport	Avonport	Ball	Total
E1	3	–	–	7	10
E2	3	1	–	21	25
E3a	3	4	–	31	38
E3b	11	–	–	22	33
E3	14	4	–	53	71
E4	–	–	–	24	24
E5	4	–	–	32	36
E6	18	–	2	15	35
E7	6	1	–	24	31
E8	–	–	–	8	8
E9	1	–	–	20	21

Note: Shading and bold characters indicate the chemical groups found only at the Ball site.

metal chemical group corresponded to particular color, style, or texture characteristics for example.

Nevertheless, even with all this uncertainty, focusing on metal chemistries and tracing them geographically has allowed us some preliminary observations that can become testable hypotheses. To begin with, we were able to test archeometrically that indeed the majority of the European copper materials present in late 16th and early 17th century Ball site in Ontario were associated with Basque kettles. While the assignment of complete kettles to Basque trade goods can be clear, given their appearance and technology, the assignment of metal scrap, fragments, ornaments or tools is not always apparent, especially if they come from parts of the kettle that do not bear any Basque stylistic markers. Now we see clearly that most (171 out of 204 samples) of the copper pieces from the Ball site have clear chemical connections to essentially all of the Basque kettle samples in Nova Scotia (58 out of 59 samples), when previously only 20 pieces had been recognized as coming from Basque kettles (Fitzgerald et al., 1993, Table 4).

Based on our case study, we were also able to show that only a relatively small number of metal chemistry groups were present in Canada in the end of the 16th century, suggesting possibly a relatively small number of European workshops producing for the North American market. A larger sample from the Maritimes, Québec, Newfoundland, and Labrador would allow us to test whether indeed only a relatively small number of metal chemical groups were present in late 16th century Canada.

Our preliminary results also show that the same types of chemical groups were present in Nova Scotia and Ontario, and by extension in Québec, although a larger number of chemical groups were present in Ontario. A larger copper artifact sampling from sites in Nova Scotia, Ontario, and Québec is required to confirm this hypothesis. The resulting pattern should reveal whether metal chemistry groups were relatively homogeneously distributed throughout the Atlantic coast of Canada and all the way inland to Ontario, or whether certain areas were accessing more, fewer, or different types of kettles of differing chemical groups. The ability to answer such questions will aid recent attempts to de-colonize narratives of the early Aboriginal-European contact period (e.g. Ferris, 2009; Scheiber and Mitchell, 2010; Oland et al., 2012). Such analyses have shown how diverse the responses to European goods actually were (e.g. Bradley, 1987b,; Bradley and Terry Childs, 1991), and have argued for the need to examine at the village level how local and regional interaction played out from an Aboriginal perspective (e.g. Ferris, 2006).

Once a larger sample of well provenanced and dated European copper kettles and fragments from across the Maritimes and Ontario has been analyzed, a chronological pattern may also appear that could suggest shifts in the production or provisioning of Basque kettles from Europe as well as in their distribution across Northeastern North America.

4. Summary and conclusions

The primary goal of our paper was to probe deeper into the late 16th century trade of Basque kettles and their fragments by providing preliminary data towards answering two questions: *1*) *Were the coastal Aboriginal groups, such as the Mi'kmaq of Nova Scotia and the Innu of Québec, accessing the same types and numbers of metal chemistry groups through their trade with the late 16th century European fishermen, whalers, and traders*? And *2*) *Were the inland allies of the coastal groups, in turn, accessing the same numbers of metal chemistry groups by trading with their Aboriginal allies*?

We examined previously published instrumental neutron activation data from the analysis of 59 samples of Basque copper, recovered from three late 16th and early 17th century burial sites in Nova Scotia, and 204 European copper artifacts, recovered from the Ball site, a contemporary Wendat village in southern Ontario to establish chemical groups of metal artifacts that would have been made in Europe using similar raw materials and manufacturing processes. The kettles from the Nova Scotia burial sites, being confidently defined as 'Basque' based on their stylistic characteristics, provided a chemical baseline of what 'Basque chemistries' would look like. The material from the Ball site acted as proxies for material that would have been available in Québec, since the Wendat inhabitants of the Ball site, could have only obtained access to European goods in the end of the 16th century through their eastern allies, and not through the Mi'kmaq of Nova Scotia or their allies.

We showed that the vast majority of the fragmented material recovered at the Ball site, including pieces that lacked any stylistically diagnostic information, matched 'Basque' kettle chemistries. The same types of chemical groups are present in Ontario, at the Ball site, and in Nova Scotia, at Hopps, Northport, and Avonport sites. The implication is that the same types of metal chemistry groups would also be present in Québec. Two chemical groups (E4 and E8), although present at the Ball site, were not found among the chemical groups present at any of the Nova Scotia sites. Broadly, these preliminary results suggest that European traders delivered similar, but not identical, ranges of copper kettles all around Nova Scotia and the St. Lawrence River, and that some Ontario communities (in our case the inhabitants of the Ball site) had access to the same ranges. These results should be seen as testable hypotheses that will allow us to shed light on how copper goods moved among Aboriginal communities at the end of the 16th century once a larger sample from throughout the Maritimes, Québec, Newfoundland, Labrador, and Ontario has been tested. Rather than assuming that suddenly all Aboriginal communities homogeneously desired and accessed European goods, tracing metal chemistry groups through space and time can contribute towards recent attempts to uncover the diverse ways in which these communities would have responded to the presence of Europeans and their goods.

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References

Anselmi, L.M., 2004. New Materials, Old Ideas: *Native Use of European-introduced Metals in the Northeast*. Unpublished PhD dissertation, Department of Anthropology, University of Toronto, Toronto, Ontario, Canada.

Bakker, P., 1989. The language of the coast tribes is half Basque': a Basque-American Indian pidgin in use between Europeans and Native Americans in North America, ca. 1540–ca. 1640. Anthropological Linguistics 31 (3/4), 117–147.

Bradley, J.W., 1987a. Evolution of the Onondaga Iroquois: Accommodating Change, 1500–1655. Syracuse University Press, Syracuse.

Bradley, J.W., 1987b. Native exchange and European trade: cross-cultural dynamics in the sixteenth century. Man in the Northeast 33, 31–46.

Bradley, J.W., Terry Childs, S., 1991. Basque earrings and panthers's tails: the form of cross-cultural contact in 16th century Iroquoia. In: Ehrenreich, R. (Ed.), Metals in Society: Theory Beyond Analysis. Research Papers in Science and Archaeology, Vol. 8, Part 2. MASCA, Philadelphia, pp. 7–17.

Childs, T., 1994. Native copper technology and society in eastern North America. In: Scott, D.A., Meyers, P. (Eds.), Archaeometry of Pre-Columbian Sites and Artifacts. Proceedings of a Symposium Organized by the UCLA Institute of Archaeology and the Getty

Conservation Institute, Los Angeles, California, March 23–27, 1992. The Getty Conservation Institute, Los Angeles, pp. 229–253.

Ehrhardt, K., 2005. European Metals in Native Hands: Rethinking the Dynamics of Technological Change 1640–1683. University of Alabama Press, Tuscaloosa.

Ferris, N., 2006. In Their Time: Archaeological Histories of Native-Lived Contacts and Colonialisms, Southwestern Ontario A.D. 1400–1900. Unpublished PhD Dissertation, Department of Anthropology, McMaster University, Hamilton, Ontario, Canada.

Ferris, N., 2009. The Archaeology of Native-Lived Colonialism: Challenging History in the Great Lakes. The University of Arizona Press, Tucson.

Fitzgerald, W.A., Ramsden, P.G., 1988. Copper-based metal testing as an aid to understanding early European interactions: scratching the surface. Can. J. Archaeol. 12, 153–161.

Fitzgerald, W.A., Turgeon, L., Whitehead, R.H., Bradley, J.W., 1993. Late sixteenth century Basque banded copper kettles. Hist. Archaeol. 27 (1), 44–57.

Fitzgerald, W.A., Bain, A., Knight, D., 1995. Untanglers of matter temporal and cultural: glass beads and the early contact period Huron Ball site. Can. J. Archaeol. 19, 117–138. URL: http://www.jstor.org/stable/41102573.

Hamell, G., 1987. Strawberries, floating islands, and rabbit captains: mythical realities and European contact in the Northeast, during the sixteenth and seventeenth centuries. J. Can. Stud. 21 (4), 72–94.

Hancock, R.G.V., Pavlish, L.A., Farquhar, R.M., Julig, P.J., Fox, W.A., Wilson, G.C., 1994. Chemical seriation of northeastern North American archaeological sites using copper artifacts. In: Scott, D.A., Meyers, P. (Eds.), Archaeometry of Pre-Columbian Sites and Artifacts: Proceedings of a Symposium Organized by the UCLA Institute of Archaeology and the Getty Conservation Institute, Los Angeles, California, March 23-27, 1992. The Getty Conservation Institute, Los Angeles, pp. 255–265.

Hancock, R.G.V., Pavlish. L.A., Farquhar, R.M., Knight, D.H., 1999. The analysis of brass samples from the Ball and Warminster sites in southern Ontario, Canada. In: Young S.M.M., Pollard A.M., Budd P., xer R.A. (Eds.), Metals in Antiquity , BAR Interational Series 792. Arcaheopress, Oxford, pp. 341–347.

Knight, D.H., 1987. Settlement patterns at the Ball site: a 17th century Huron village. Archaeol. East. N. Am. 15, 177–188.

Levine, M.A., 1999. Native copper in the Northeast: an overview of potential sources available to indigenous peoples. In: Levine, M.A., Sassaman, K.E., Nassaney, M.S. (Eds.), The Archaeological Northeast. Bergin & Garvey, Westport, Connecticut, pp. 183–199.

Loewen, B., Delmas, V., 2012. The Basques in the gulf of St. Lawrence and adjacent shores. Can. J. Archaeol. 36, 213–266.

Martelle, H., 2002. *Huron Potters and Archaeological Constructs*: *Researching Ceramic Microstylistics*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Toronto, Toronto.

Martin, C., 1975. The four lives of a Micmac pot. Ethnohistory 22, 111–133.

Michelaki, K., Hancock, R.G.V., Warrick, G., Knight, D.H., 2013. 17th century Huron village life: insights from the copper-based metals of the Ball site, southern Ontario, Canada. J. Archaeol. Sci. 40, 1250–1259. http://dx.doi.org/10.1016/j.jas.2012.08.048.

Moreau, J.-F. et Langevin, É. 1992. Premières Manifestations Européennes en Pays Amérindien. Recherches Amérindiennes au Québec 22(4): 37–47.

Moreau, J.-F., and Hancock, R.G.V., 2005. Nested copper cauldrons from Maison Milot. In: Kars, H. and Burke, E. (Eds.), Vieux Québec, Proceedings of the 33rd International Symposium on Archaeometry, Vrije Universiteit, Amsterdam, The Netherlands, pp. 363–367.

Oland, M., Hart, S., Frink, L. (Eds.), 2012. Decolonizing Indigenous Histories: Exploring Prehistoric/Colonial Transitions in Archaeology. University of Arizona Press, Tucson.

Pernicka, E., 1999. Trace element fingerprinting of ancient copper: a guide to technology or provenance? In: Young, S.M.M., Pollard, A.M., Budd, P., Ixer, R.A. (Eds.), Metals in Antiquity, BAR International Series 792. Archaeopress, Oxford, pp. 163–171

Scheiber, L.L., Mitchell, M.D. (Eds.), 2010. Across a Great Divide: Continuity and Change in Native North American Societies, 1400–1900. University of Arizona Press, Tucson.

Silliman, S.W., 2012. Between the longue durée and the short purée: postcolonial archaeologies of indigenous history in colonial North America. In: Oland, M., Hart, S., Frink, L. (Eds.), Decolonizing Indigenous Histories: Exploring Prehistoric/Colonial Transitions in Archaeology. University of Arizona Press, Tucson, Arizona, pp. 113–131.

Tremblay, R., Chapdelaine, C., 2006. End of an era, beginning of a mystery: encounters, disappearance and hypotheses. In: Tremblay, R. (Ed.), The St. Lawrence Iroquoians: Corn People. Montréal Museum of Archaeology and History, Montreal: Pointe-à-Callière, pp. 99–130.

Trigger, B.G., 1985. Natives and Newcomers: Canada's "Heroic Age" Reconsidered. McGill-Queen's University Press, Montreal, Québec.

Trigger, B.G., 1987. The Children of Aataentsic: A History of the Huron People to 1660. Reprinted. McGill-Queen's University Press, Montreal and Kingston. Originally published 1976, McGill-Queen's University Press, Montreal.

Trigger, B.G., 1990. The Huron: Farmers of the North. Second edition. Holt, Rinehart and Winston, New York.

Turgeon, L., 1990. Basque-Amerindian trade in the Saint Lawrence during the sixteenth century: new documents, new perspective. Man in the Northeast 40, 81–87.

Turgeon, L., 1997. The tale of the kettle: Odyssey of an intercultural object. Ethnohistory 44(1): 1–29.

Turgeon, L., 1998. French fishers, fur traders, and Amerindians during the sixteenth century: history and archaeology. The William and Mary Quarterly, Third Series 55 (4), 585–610.

Turgeon, L., 2001. French beads in France and northeastern North America during the sixteenth century. Hist. Archaeol. 35 (4), 58–82.

Van Dongen, A., 1996. 'The inexhaustible kettle': the metamorphosis of a European utensil in the world of the North American Indians. In: van Dongen, A. (Ed.), *One Man's Trash Is Another Man's Treasure*. Museum Boymans van Beuningen, Rotterdam, pp. 115–171.

Warrick, G.A., 2008. A Population History of the Huron-Petun, A.D. 500–1650. Cambridge University Press, New York.

Westermann, E., 1981. Tendencies in the European copper market in the 15th and 16th centuries. In: Kellenbenz, H. (Ed.), Precious Metals in the Age of Expansion. Papers of the XIVth International Congress of the Historical Sciences, Klett-Cotta, Stuttgart, pp. 71–77.

Whitehead, R.H., 1987. Plant fiber textiles from the Hopps site, BkCp-1. The Nova Scotia Museum Curatorial Report 59, Halifax, Nova Scotia, Canada.

Whitehead, R.H., 1993. Nova Scotia: The protohistoric period 1500–1600. The Nova Scotia Museum Curatorial Report 75, Halifax, Nova Scotia, Canada.

Whitehead, R.H., Pavlish, L.A., Farquhar, R.M., Hancock, R.G.V., 1998. Analysis of copper-based metals from three Mi'kmaq sites in Nova Scotia. North American Archaeologist 19 (4), 279–292.