Refined Radiocarbon Chronologies for Northern Iroquoian Site Sequences: Implications for Coalescence, Conflict, and the Reception of European Goods

Jennifer Birch, Sturt W. Manning, Samantha Sanft, and Megan Anne Conger

This article presents results to date of the Dating Iroquoia project. Our objective is to develop high-precision radiocarbon chronologies for northeastern North American archaeology. Here, we employ Bayesian chronological modeling of 184 AMS radiocarbon dates derived from 42 Northern Iroquoian village sites in five regional sequences in order to construct new date estimates. The resulting revised chronology demands a rethinking of key assumptions about cultural process in the region regarding the directionality and timing of processes of coalescence and conflict and the introduction of European trade goods. The results suggest that internal conflict may have preceded confederacy formation among the Haudenosaunee but not the Wendat, as has been previously assumed. External conflict, previously thought to have begun in the early seventeenth century, began more than a century earlier. New data also indicate that the timing and distribution of European materials were more variable between communities than acknowledged by the logic underlying traditional trade-good chronologies. This enhanced chronological resolution permits the development and application of archaeological theories that center the lived experiences and relational histories of Iroquoian communities, as opposed to the generalized thinking that has dominated past explanatory frameworks.

Keywords: radiocarbon dating, Bayesian chronological modeling, Northern Iroquoian archaeology, settlement patterns, conflict, European trade goods

Cet article présente les résultats obtenus jusqu'à présent dans le cadre du projet intitulé «Dating Iroquoia» (Datation de l'Iroquoisie). Notre objectif consiste à mettre au point des chronologies radiocarbone de haute précision dans le cadre de l'archéologie de la partie nord-est de l'Amérique du Nord. À cette fin, nous employons une modélisation chronologique Bayésienne de datations radiocarbone par SMA 184, en provenance de 42 sites villageois Iroquoiens du Nord, selon cinq séquences régionales, dans le but d'établir de nouvelles estimations de dates. Cette nouvelle chronologie incite à revoir les principales hypothèses liées au processus culturel dans la région concernant l'orientation et le calendrier des mécanismes de coalescence et de conflit, ainsi que l'introduction d'échanges commerciaux avec les Européens. Les résultats laissent à penser que les conflits internes peuvent avoir précédé l'établissement de la confédération avec les Haudenosaunee, mais non pas avec les Wendat, comme on a jusqu'à présent pensé. Les conflits externes, censés avoir démarré au début du dix-septième siècle, ont commencé plus d'un siècle auparavant. De nouvelles données indiquent également que le calendrier et la distribution des matières européennes ont davantage varié entre les communautés qu'il n'est reconnu selon la logique sous-tendant les chronologies traditionnelles d'échanges commerciaux. Cette résolution chronologique améliorée permet de développer et d'appliquer des théories archéologiques mettant l'accent sur les expériences vécues et les antécédents relationnels des communautés iroquoiennes, contrairement à la réflexion généralisée qui a dominé les anciens cadres explicatifs.

Mots-clés: datations radiocarbone, modélisation chronologique Bayésienne, conflit, d'échanges commerciaux avec les Européens

Chronologies fundamentally underpin all other aspects of archaeological thought. The time frames we employ structure not only the broad brushstrokes of cultural process at the regional scale but also the questions we are willing to ask of our data and the answers we are

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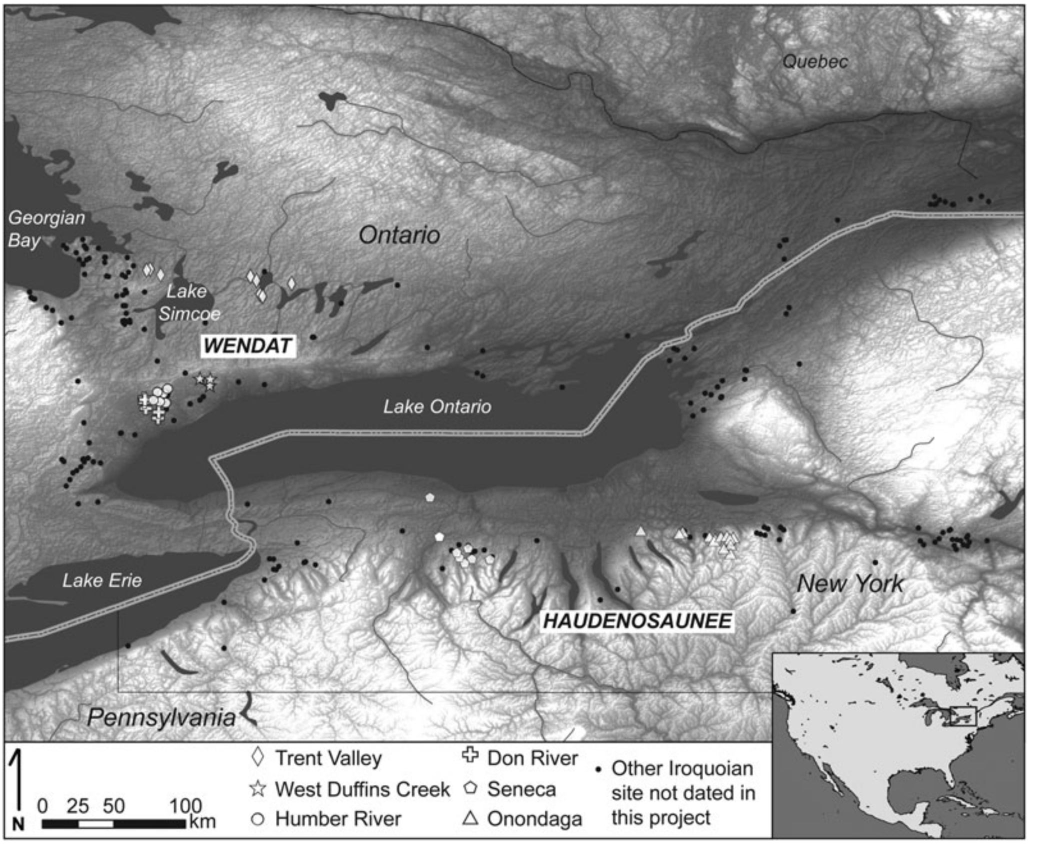

Figure 1. Map of the study region with dated and selected undated sites indicated (undated site locations are intended to be representative as opposed to definitive; dataset follows Hart et al. 2019). Basemap: United States Geological Survey 2017. Waterways and inset basemap: Natural Earth 2019.

willing to accept. The use of Bayesian modeling for the interpretation of radiocarbon dates and the construction of refined archaeological chronologies has had a tremendous impact on the discipline (Bayliss 2009, 2015; Bayliss and Bronk Ramsey 2004; Bronk Ramsey 2009a), resulting in the rethinking of long-held ideas about the historical development of societies in multiple world regions (e.g., Bronk Ramsey et al. 2010; Higham and Higham 2009; Manning et al. 2006, 2018; Needham et al. 1998; Whittle 2018; Whittle et al. 2011). The ability to refine and revise archaeological chronologies forces a critical recontextualization of both regional cultural sequences and the conceptual frameworks we use to explain them.

This article describes the initial results of the Dating Iroquoia project. Our objective has been to construct high-precision radiocarbon chronologies for selected Northern Iroquoian site relocation sequences in eastern North America (Figure 1). Results suggest that in some cases, previous age estimates were in error by some 75–100 years (see also Manning et al. 2018). Given the largely single-component nature of site occupations, estimated to span some 0–40 years, such shifts can be seismic. Although our results should be viewed as a first step toward a refined, radiocarbon-derived chronology for northeastern archaeology, these findings nevertheless require a rethinking of long-held notions about cultural process in Northern Iroquoia. This includes current understandings of the timing and nature of coalescence and conflict as well as the spread of European goods and influences from the fifteenth to seventeenth century. Our discussion of these data and findings stress the importance of using derived insights from enhanced chronological resolution for archaeological interpretation. In particular, we highlight that refined chronologies permit the writing of a new kind of archaeological history that extends beyond generalized cultural processes and focuses on the relational histories of communities, peoples, and places. In doing so, we forefront the agency of Indigenous peoples and the positionality of specific community groups during processes of coalescence, conflict, and early encounters with European objects and persons.

Iroquoian Archaeology

Northern Iroquoian societies inhabited what is now southern Ontario, southwest Québec, upper New York State, and the Susquehanna Valley of Pennsylvania and New York. These populations shared cultural traits, including settlements of bark-covered longhouses sometimes surrounded by palisades; subsistence based on maize horticulture, hunting, fishing, and gathering; and a sociopolitical structure organized around matrilineal descent, clan membership, and decision making based on councils and consensus building (Engelbrecht 2003; Trigger 1976). In the sixteenth and seventeenth centuries, certain of these groups, notably the Wendat (Huron) and Haudenosaunee (Iroquois) were organized into regional confederacies that included nations of allied villages and a confederacy council (Fenton 1998; Trigger 1976), although the specific structure and social networks comprising each were variable (Birch and Hart 2018).

Seventeenth-century European explorers and missionaries left a detailed ethnohistoric record of Iroquoian lifeways. As a result, a great deal of Iroquoian archaeology has involved variants of the direct historical approach. Archaeological remains that include Iroquoian cultural traits or stages of their development are thought to represent ancestral Iroquoian-speaking peoples (Snow 1994; Warrick 2000:417). However, the relationship between what has been interpreted as constituting early forms of longhouses, horticulture, and sociopolitical organization versus historically documented phenomena is less clear than such models assume (e.g., Hart 2011; Hart and Brumbach 2003; Pihl et al. 2008). Contemporary Indigenous peoples have been particularly critical of inferred relationships between material culture and ethnic identity (Gaudreau and Lesage 2016).

Iroquoian Chronology and Cultural Process

Chronological frameworks for Iroquoian archaeology have primarily been based on ceramic seriation (ca. AD 1000–1550; all dates in this article are AD) and European trade goods (ca. AD 1550 through to the historic period), together with small numbers of modern radiocarbon dates and larger numbers of legacy dates (Figure 2). Although archaeologists in Ontario have a basic understanding of long-term cultural process during the Woodland period, it has been recognized for some time that this framework is inadequate for addressing questions related to complex cultural behavior (Ferris and Spence 1995:83; Williamson 1999). It has started to become clear, however, that enhancing our chronological resolution does not serve to clarify existing chronological frameworks. Instead, it renders them obsolete—both in practice and in theory.

Focused effort on ceramic seriation in Iroquoian archaeology began in the mid-twentieth century with the definition of ceramic types and their chronological associations, working backward from documented interactions with Europeans in the early seventeenth century to what was interpreted as early manifestations of Iroquoian culture (Emerson 1954; MacNeish 1952; Wright 1966). Beginning in the 1970s, analytical approaches shifted to seriation based on ceramic attributes rather than types, but they maintained similar relative chronologies (e.g., Engelbrecht 1971; Ramsden 1977). The growth of settlement archaeology led to the construction of inferred site relocation sequences based on ceramic seriation that have been the basis for narratives of cultural development in both Ontario and New York State (e.g., Ramsden 1977; Sempowski and Saunders 2001; Tuck 1971).

From the mid-sixteenth century on, sites are more commonly dated based on the presence or absence of European metal and chronologically diagnostic glass-bead assemblages. It is generally accepted that European metal appears on Iroquoian sites as early as the mid-sixteenth century (Bradley 2005, 2007; Bradley and Childs 1991; Fitzgerald 1990; Loewen and Chapdelaine

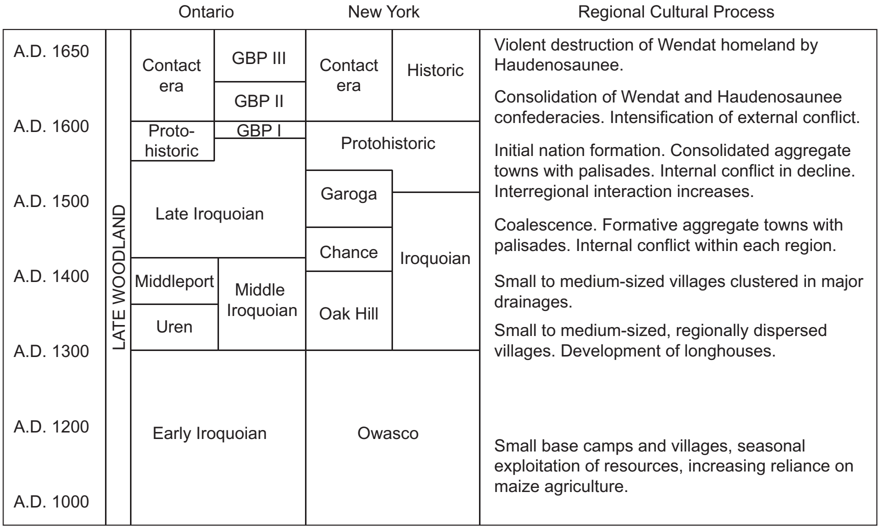

Figure 2. Traditional regional chronology (after Bradley 2005; Ellis and Ferris 1990; Engelbrecht 2003; Wright 1966).

2016; Wray and Schoff 1953). Small amounts of European iron and copper are assumed originally to have passed through Indigenous trade networks, and they were later followed by other goods acquired directly from Europeans, including glass beads, copper and brass kettles, and iron knives and axes. Trade good distributions have been used to construct timelines such as the glass-bead chronology (Kenyon and Fitzgerald 1986; Kenyon and Kenyon 1983; Rumrill 1991) and to chronologically order sites more generally based on frequencies and types of European goods (e.g., Birch and Williamson 2013; Loewen 2016). Contemporary perspectives on processes of cultural entanglement, Indigenous agency, and differential engagements between multiple Indigenous and European actors in the sixteenth and seventeenth centuries prompt critical reflection on the logic of both these frameworks (Jordan 2009, 2013; Loewen and Chapdelaine 2016).

Generally, radiocarbon dating has only been utilized on pre-1550 Iroquoian sites, with trade-good chronologies the preferred dating method on "protohistoric" and "historic" era sites. In the past, radiocarbon dating in Late Woodland Iroquoian archaeology was often employed in order to confirm the assignment of sites to certain cultural phases (e.g., Uren, Chance, etc.; see Figure 2), with dates that did not "fit" the dominant paradigm being dismissed as inaccurate (e.g., Ellis and Ferris 1990). An oft-cited problem in Iroquoian archaeology over the last several decades is the lack of chronological resolution possible from radiocarbon dates. This stems from the combination of short durations of site occupation and multiple possible intercepts in the calibration curve between 1300 and 1650 (e.g., Chapdelaine 2016; Ramsden 2014; Rossen 2015), and it applies especially between 1480 and 1620, where a major plateau and reversal in the calibration curve renders radiocarbon dates ambiguous in the absence of chronological modeling (Figure 3). More precise AMS dating, together with chronological modeling, has demonstrated that we now have the ability to begin to overcome those concerns (Manning and Hart 2019; Manning et al. 2018, 2019, 2020).

Coalescence, Conflict, and Interactions with Europeans

The cultural processes at the center of this investigation are (1) the timing and process of coalescence and conflict, and (2) the entry and distribution of European-manufactured material culture in the region. Both phenomena have been placed in the mid-1400s and mid-1500s, respectively.

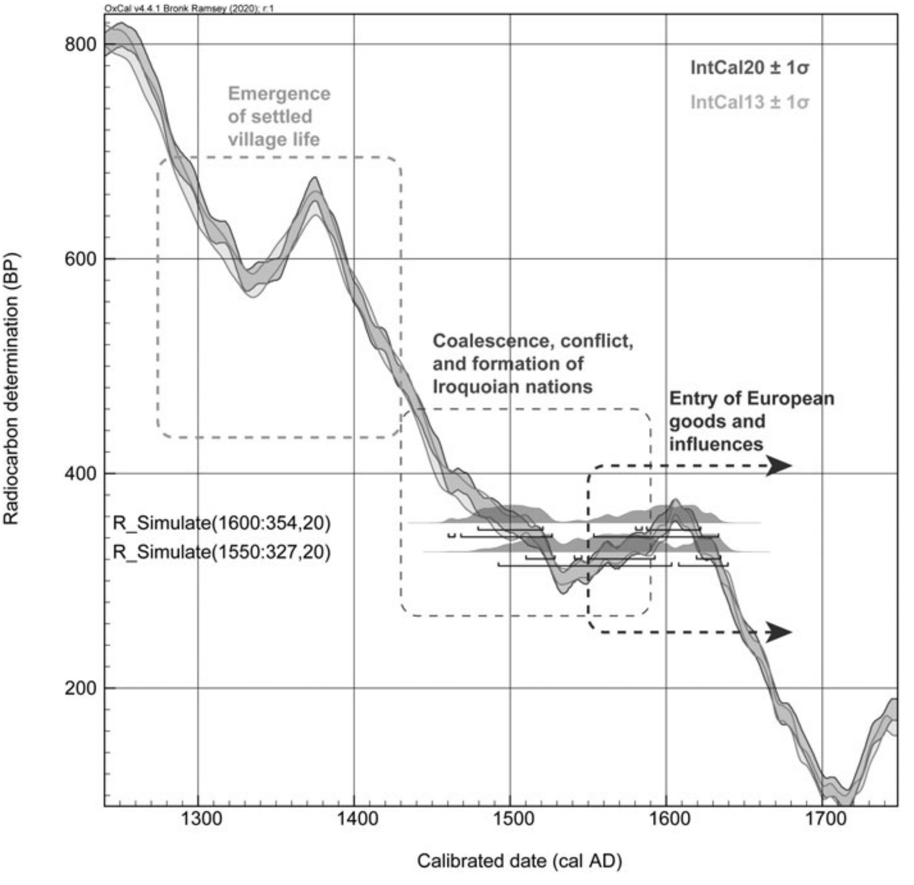

Figure 3. Calibration curve with area of sixteenth-century plateau/wiggle and related cultural phenomena indicated. Simulated dates illustrate the multiple intercepts, long date intervals, and therefore the challenges associated with radiocarbon dating in this period. The new IntCal20 calibration curve (dark gray; Reimer et al. 2020) is shown as well as the previous IntCal13 calibration curve (light gray; Reimer et al. 2013).

At the end of the Late Woodland period in both Ontario and New York State, people came together into heavily palisaded and defensively situated, aggregated village settlements in the context of heightened regional conflict. Some sites also include clear sequences of village expansion where palisades were extended to incorporate newcomers (Birch 2012; Finlayson 1985; Finlayson et al. 1987; Ramsden 2016; Sempowski and Saunders 2001; Snow 1995; Tuck 1971). Palisaded village sites in both regions are often, although not always, found to contain human remains in nonburial contexts—such as midden deposits—with perimortem trauma interpreted as evidence of the torture and killing of captives (Williamson 2007).

It has been assumed that coalescence and conflict in Ontario were occurring as early as approximately 1450 (Birch 2010, 2012; Birch and Williamson 2013). The early onset of conflict, together with analysis of human skeletal remains (Dupras and Pratte 1998; Williamson 2007), led to the inference that conflict in Ontario was primarily occurring between local groups and that it declined in intensity during the very early 1500s (Birch 2010, 2012). In New York State, however, palisaded settlements were thought to appear somewhat later, in the very late 1400s to early 1500s (Engelbrecht 2003; Snow 1994). This pattern was also understood as having developed as the result of intrasocietal conflict, based in part on ethnographic accounts of the founding of the Haudenosaunee confederacy in order to quell intrasocietal violence (e.g., Fenton 1998). It has been assumed that conflict between the Haudenosaunee and Wendat only escalated in the very late 1500s to early 1600s (Trigger 1976). Multiple ethnohistoric accounts also describe external warfare between various Iroquoian and non-Iroquoian nations and tribal groups. Ultimately, the intensification of attacks by the Haudenosaunee eventually led to dispersal of the Wendat and other Iroquoian nations in the early 1650s.

After limited Norse presence approximately AD 1000, direct interaction between Indigenous peoples and Europeans was first recorded by Jacques Cartier in the St. Lawrence River valley in 1535 (Biggar 1929–1936), although Basque fishers and whalers had a presence on the coast some decades earlier (Turgeon 2001). Until the early seventeenth century, when Europeans established a sustained presence in the Northeast, it is assumed that European goods on Indigenous sites in Ontario and New York originated mostly from direct exchanges between Basque or French mariners and Indigenous peoples along the north Atlantic Coast and in the Saint Lawrence Valley. It was assumed that these items were then traded inland through existing Indigenous networks of exchange and affiliation (e.g., Loewen and Chapdelaine 2016). Although archival research has characterized “diagnostic” assemblages of European goods being produced and exported at specific times from specific places (e.g., Bradley 1980; Fitzgerald 1995; Fitzgerald et al. 1993; Turgeon 2001), relative chronologies of European goods—such as glass beads—have largely been constructed using the direct historical method, working backward along site sequences anchored by sites supposedly identified in the ethnohistoric record (e.g., Kenyon and Kenyon 1983; Wray and Schoff 1953). Even though the impact of Indigenous perceptions of, and preferences among, these newly available goods has been explored to a certain extent (Anselmi 2004), such goods are still widely used as temporal markers (e.g., Hawkins et al. 2016; Walder 2018), following the fundamental assumption that once they became available, they would be present in all communities in identifiable quantities. While variability among communities in terms of trade-good assemblages has been acknowledged for some time (Ramsden 1978), it was not until recently that this variability was explicitly demonstrated through independent dating (Manning and Hart 2019; Manning et al. 2018, 2019).

Current narratives about these processes mainly fit into time frames based on tentative associations between sites and rough, approximately 20–50-year phases, making it difficult to associate processes in one sequence or region with another. Figure 2 illustrates the time frames previously assigned to sites in this study. Traditional chronologies do not permit the teasing out of associations between sites and sequences with enough precision to engage meaningfully in relational approaches to archaeological histories (e.g., Kosiba 2019). For example, what does coalescence on the north shore of Lake Ontario have to do with similar processes taking place in the Finger Lakes Region of New York State? How does evidence for the intensification of conflict in one area relate to the co-occurrence or absence of evidence for conflict in others? Does the entry of European goods into communities actually occur at the same time across the region? Alternatively, is there variability between subregions, as recent work on the West Duffins Creek sequence seems to demonstrate (Manning et al. 2018)? What, if any, influence did long-distance trade and the onset of early European interaction have on communities, and how did those events impact processes of coalescence and conflict? These questions are historical in nature—they focus on a fundamental interest in diversity and specific, localized experience. To answer them, we require finer chronological resolution than relative means of dating currently offer.

Village Relocation Sequences

This study focuses on dating village sites that comprise subregional sequences of village relocations. Iroquoian villages were generally single-component, and they were occupied for no more than 40 years. Multiple lines of evidence support this interpretation. Warrick (1988) provides a lengthy and compelling argument for estimating Iroquoian village duration using various methods. He argued that the average density of house wall posts was the most viable means of estimation (Warrick 1988, 2008:125). Counts of excavated posts in longhouse walls, combined with estimated rates of rotting and repair of multiple tree species available to Iroquoian builders, were employed to determine the average length of occupation for village sites in various periods of Iroquoian cultural development. He determined that sites were occupied for an average of 25–30 years in the fifteenth and sixteenth centuries.

Ethnohistoric accounts of Iroquoian village relocation are highly variable. In the writings of Champlain and Sagard, who visited Wendake during the 1610s and 1620s, village durations are reported variously as ranging from 10 to 40 years (Biggar 1929–1936; Wrong 1939 [1632]). In the 1630s and 1640s, Jesuits living among the Wendat reported village abandonment occurring after 8–12 years (Thwaites 1896–1901).

Typically, village duration is stated as a likely maximum duration of no greater than 40 years. There is furthermore a general view that the larger, later sites were typically occupied for much shorter intervals (Birch 2015; Birch and Williamson 2013; Warrick 1988). Consequently, most village durations in the sixteenth to seventeenth century were probably closer to 10–20 years, and only a few were occupied for more than 20 or, at most, 30–40 years. When villages were relocated, they often moved nearby—usually only a few kilometers away—although longer migrations also took place. Explanations for village relocation have been functional or ecological as well as social and political (Jones and Wood 2012; Warrick 2008).

Numerous site relocation sequences have been constructed that represent hundreds of years of activity by contiguous groups (e.g., Birch and Williamson 2013; Bradley 2005; Niemczycki 1984; Ramsden 1977; Sempowski and Saunders 2001; Snow 1995; Tuck 1971). Although in most cases the general sequence of site occupations in each subregion is relatively well established, contemporaneity between sites across sequences has been inferred based on subregional ceramic chronologies and trade-good frequencies. This study is the first attempt to establish largely independent time frames for several known sequences.

For example, a refined chronology for the community relocation sequence representing the Draper, Spang, and Jean-Baptiste Lainé (Mantle) sites has demonstrated this potential and the implications for associated conceptual frameworks. These three sites are understood to be sequential iterations of the same village community (Birch and Williamson 2013). This village sequence was previously thought to date to roughly 1450–1530. However, 67 new radiocarbon dates modeled in keeping with current understandings have shown that it actually dates to approximately 1528–1616 (Manning et al. 2018)—75–100 years later than previous estimates. This independent, radiocarbon-derived chronology is at odds with the long-standing ceramic and trade-good chronologies (Kenyon and Kenyon 1983; Ramsden 1990). If this sequence was so misdated, what then of others in the region?

This investigation focuses specifically on three sequences of village sites ancestral to the Huron-Wendat Nation located in the Humber, Don, and Trent River systems in southern Ontario and two associated with the Seneca and Onondaga Nations of the Haudenosaunee in New York State (Figure 1; see Supplemental Table 1 for detailed site descriptions). These site sequences were chosen because of their centrality in explanatory constructs related to the archaeological histories of Iroquoian peoples in each region and the availability of sample material.

Methods

Sample Selection

All samples selected for radiocarbon dating were acquired from extant collections derived from cultural resource management, research, or avocational field projects. For some villages, only site-level provenience data were available. For others, samples were acquired from intact features such as pits, posts, and midden deposits (Table 1; Supplemental Table 1). When sites included multiple occupational phases, samples were taken from longhouses or other features associated with each phase and used to inform the modeling. In keeping with the wishes of

Table 1. New Radiocarbon Dates Produced by This Project.

Site	Lab Number	Material	CRA ^{14}C Age BP	±	$\delta^{13}C$	^{15}N	C:N	Calibrated Date Range 95.4%	Calibrated Date Range 68.3%
SENECA									
Farrell	GrM-14970	unid. nut	558	20	−24.56			1323–1423	1328–1414
Farrell	UGAMS-34030	maize	588	22	−9.46			1306–1409	1323–1400
Farrell	GrM-14972	unid. nut	518	20	−26.13			1401–1438	1409–1426
Footer	UGAMS-34031	maize	372	21	−8.93			1454–1630	1464–1617
Footer	GrM-13830	maize	384	15	−7.62			1452–1619	1457–1607
Footer	GrM-13832	maize	382	15	−8.41			1452–1620	1458–1610
Footer	UGAMS-34032	maize	374	21	−9.34			1453–1627	1460–1616
Belcher	UGAMS-34024	maize	347	21	−9.96			1472–1635	1490–1626
Belcher	GrM-13829	maize	343	15	−9.33			1478–1634	1495–1628
Belcher	UGAMS-39603	bone collagen	379	20	−22.09	9.10	3.2	1451–1624	1458–1615
Richmond Mills	UGAMS-34033	maize	352	21	−9.90			1460–1635	1482–1623
Richmond Mills	GrM-13756	maize	355	15	−8.30			1472–1632	1483–1620
Richmond Mills	UGAMS-35645	maize	352	19	−8.86			1468–1634	1483–1623
Richmond Mills	GrM-14985	maize	332	18	−8.75			1490–1638	1505–1633
Richmond Mills	UGAMS-35646	maize	332	19	−9.61			1490–1638	1504–1634
Richmond Mills	GrM-14986	maize	328	18	−8.35			1494–1638	1509–1634
Richmond Mills	UGAMS-35647	maize	311	19	−8.49			1500–1645	1522–1639
Richmond Mills	GrM-14987	maize	341	20	−8.69			1478–1635	1495–1631
Alhart	UGAMS-34021	bean	305	21	−28.75			1504–1649	1523–1641
Alhart	UGAMS-34022	bean	316	21	−26.66			1497–1644	1521–1637
Alhart	UGAMS-34023	maize	291	21	−9.34			1516–1656	1524–1648
Alhart	GrM-13828	maize	308	15	−8.29			1515–1644	1524–1639
Tram	GrM-14973	hickory nut	351	20	−24.54			1467–1635	1485–1623
Tram	UGAMS-39607	unid. charcoal	287	20	−24.84			1520–1658	1526–1650
Cameron	UGAMS-34025	maize	338	21	−9.85			1480–1636	1499–1631
Cameron	UGAMS-34027	maize	344	21	−8.54			1475–1635	1491–1631
Cameron	GrM-13759	maize	354	15	−8.71			1473–1632	1485–1621
Cameron	UGAMS-34026	maize	372	21	−8.89			1454–1630	1464–1617
Cameron	GrM-13760	maize	344	15	−8.18			1479–1634	1495–1626
Factory Hollow	UGAMS-34028	maize	372	22	−10.18			1453–1631	1462–1617
Factory Hollow	GrM-13827	maize	347	15	−8.87			1478–1633	1491–1625
Factory Hollow	UGAMS-34029	plum pit shell	355	21	−26.00			1463–1633	1479–1623
Factory Hollow	GrM-13757	plum pit shell	377	15	−24.74			1455–1621	1460–1612
ONONDAGA									
Kelso	GrM-14982	maize	543	20	−8.73			1326–1428	1400–1422
Kelso	UGAMS-35644	maize	576	19	−8.66			1317–1413	1326–1404
Kelso	GrM-14983	maize	624	25	−8.21			1298–1397	1302–1394
Howlett Hill	UGAMS-35637	maize	506	19	−7.94			1406–1440	1414–1433
Schoff	UGAMS-39598	bone collagen	434	25	−26.97	4.00	3.3	1425–1486	1436–1463
Bloody Hill	UGAMS-35640	maize	362	19	−8.14			1458–1631	1475–1620
Bloody Hill	GrM-14990	maize	373	20	−8.70			1455–1625	1460–1617
Christopher	UGAMS-37379	bone collagen	338	20	−22.79	6.01	3.4	1480–1636	1500–1631
Burke	UGAMS-35641	maize	359	19	−9.09			1460–1631	1478–1620
Burke	GrM-14988	maize	363	18	−8.57			1458–1631	1474–1620
Burke	GrM-14980	bean	360	18	−24.45			1459–1631	1477–1620
Cemetery	UGAMS-35642	bean	316	19	−27.18			1499–1644	1521–1637
Cemetery	GrM-14991	bean	359	18	−26.27			1460–1631	1478–1620
Cemetery	UGAMS-35643	maize	335	20	−7.98			1485–1637	1501–1633
Barnes	UGAMS-39589	bone collagen	315	20	−21.18	5.58	3.4	1499–1644	1521–1638
McNab	UGAMS-37377	bone collagen	298	35	−22.43	5.36	3.3	1487–1660	1520–1647
McNab	UGAMS-37378	bone collagen	290	20	−22.83	4.98	3.3	1517–1657	1525–1648
Temperance House	UGAMS-39611	bone collagen	282	20	−22.36	7.22	3.2	1520–1660	1528–1650

Table 1. Continued.

Site	Lab Number	Material	CRA ^{14}C Age BP	±	$\delta^{13}C$	^{15}N	C:N	Calibrated Date Range 95.4%	Calibrated Date Range 68.3%
Temperance House	UGAMS-39612	bone collagen	304	20	−23.33	6.33	3.2	1506–1649	1524–1641
Atwell	UGAMS-39586	bone collagen	312	20	−22.08	6.38	3.4	1499–1645	1522–1638
Atwell	UGAMS-39588	bone collagen	285	20	−21.98	7.04	3.4	1520–1659	1526–1650
Chase	UGAMS-39592C	bone collagen	300	25	−22.09	7.77	3.4	1500–1655	1522–1644
Chase	UGAMS-39592E	bone collagen	388	25	−16.85			1445–1625	1453–1615
Chase	UGAMS-39593	bone collagen	372	20	−23.78	5.15	3.4	1455–1627	1464–1617
Pompey Center	UGAMS-35648	maize	350	19	−8.86			1470–1635	1487–1624
Pompey Center	UGAMS-39595	maize	300	20	−9.73			1510–1650	1524–1643
Pompey Center	UGAMS-39596	maize	306	20	−9.23			1506–1648	1523–1640
HUMBER									
Black Creek	UGAMS-35635	bone collagen	351	21	−22.27	6.126	3.3	1466–1635	1484–1624
Black Creek	UGAMS-35636	bone collagen	400	20	−22.55	5.511	3.2	1444–1618	1450–1483
Parsons	UGAMS-33008	maize	324	21	−9.24			1493–1640	1515–1635
Parsons	GrM-14963	maize	334	20	−8.90			1486–1637	1501–1633
Parsons	UGAMS-33009	maize	342	21	−9.81			1477–1636	1494–1631
Parsons	GrM-14962	maize	353	30	−9.20			1459–1635	1478–1626
Seed-Barker	GrM-14965	maize	297	18	−10.40			1516–1650	1524–1644
Seed-Barker	UGAMS-33003	maize	335	21	−10.27			1484–1637	1500–1633
Seed-Barker	GrM-14966	maize	345	40	−8.93			1460–1638	1485–1631
Seed-Barker	UGAMS-33004	maize	350	20	−10.20			1470–1635	1485–1624
Seed-Barker	UGAMS-33004ha	humic acid	357	21	−10.00			1460–1633	1477–1623
Damiani	GrM-14936	maize	280	20	−8.50			1521–1662	1528–1651
Damiani	UGAMS-33005	maize	295	21	−9.64			1513–1653	1524–1645
Damiani	UGAMS-33005r	maize	272	21	−9.64			1522–1794	1529–1658
Damiani	GrM-14937	maize	305	18	−8.99			1511–1646	1524–1641
Damiani	UGAMS-33006	maize	330	221	−8.89			1300–?	1411–?
Damiani	UGAMS-33007	maize	311	20	−9.09			1500–1645	1522–1639
Damiani	GrM-14938	maize	298	20	−9.26			1512–1650	1524–1644
Mackenzie-Woodbridge	UGAMS-40365	maize	301	21	−9.00	6.86		1506–1650	1524–1643
Mackenzie-Woodbridge	UGAMS-434443	maize	338	21	−9.49			1480–1636	1499–1631
Mackenzie-Woodbridge	UGAMS-40366	maize	287	20	−9.66	4.20		1520–1658	1526–1650
Mackenzie-Woodbridge	UGAMS-34444	maize	339	21	−9.82			1480–1636	1498–1631
Skandatut	UGAMS-42536	maize	350	20	−9.39			1470–1635	1485–1624
Skandatut	UGAMS-42540	maize	351	20	−10.16			1467–1635	1485–1623
DON									
Walkington 2	UGAMS-32989	maize	343	21	−9.93			1476–1636	1493–1631
Walkington 2	UGAMS-32990	unid. botanical	373	21	−26.57			1453–1629	1460–1617
Walkington 2	GrM-14967	maize	359	20	−9.46			1460–1632	1477–1621
Walkington 2	GrM-14968	maize	365	20	−8.93			1457–1631	1471–1620
Baker	GrM-14540	maize	377	20	−10.51			1452–1625	1459–1615
Baker	UGAMS-32992	maize	387	21	−9.31			1447–1623	1455–1611
Baker	UGAMS-32991	maize	364	21	−9.40			1457–1631	1473–1620
Baker	GrM-14538	maize	387	20	−9.09			1448–1621	1455–1610
McNair	GrM-14960	maize	316	18	−9.31			1500–1644	1521–1637
McNair	UGAMS-32995	maize	360	21	−9.70			1459–1632	1476–1622
McNair	UGAMS-32994	maize	343	25	−10.32			1475–1636	1492–1631
McNair	GrM-14961	maize	373	20	−9.56			1455–1625	1460–1617
HopeN	GrM-14943	maize	352	18	−8.88			1471–1634	1483–1623
HopeN	UGAMS-32999	maize	358	21	−10.22			1460–1632	1476–1622

Table 1. Continued.

Site	Lab Number	Material	CRA ^{14}C Age BP	±	$\delta^{13}C$	^{15}N	C:N	Calibrated Date Range 95.4%	Calibrated Date Range 68.3%
HopeN	UGAMS-32998	maize	337	21	−9.52			1481–1636	1499–1632
HopeN	GrM-14944	maize	377	18	−8.99			1453–1624	1459–1615
HopeS	UGAMS-33000	maize	373	21	−9.55			1453–1629	1460–1617
HopeS	GrM-14947	maize	388	17	−8.48			1449–1619	1456–1607
HopeS	UGAMS-33002	maize	393	21	−8.01			1445–1621	1452–1607
HopeS	GrM-14948	maize	383	18	−7.80			1451–1621	1457–1611
Orion	UGAMS-35633	bone collagen	330	20	−22.64	3.916	3.2	1490–1639	1505–1634
Orion	UGAMS-35634	bone collagen	385	19	−22.08	6.603	3.3	1450–1621	1456–1612
Murphy-Goulding	UGAMS-34441	maize	358	21	−9.68			1460–1632	1476–1622
Murphy-Goulding	UGAMS-34442	maize	352	22	−9.07			1460–1635	1481–1623
Keffer	UGAMS-32997	maize	288	28	−12.13			1504–1662	1524–1651
Keffer	UGAMS-32997r	maize	278	21	−12.13			1521–1792	1528–1653
Keffer	GrM-14956	maize	324	20	−7.96			1494–1640	1515–1635
Keffer	UGAMS-32996	maize	305	20	−9.43			1506–1648	1524–1641
Keffer	GrM-14955	maize	317	18	−9.48			1500–1643	1521–1637
Keffer	UGAMS-26746r	maize	318	20	−9.58			1497–1643	1520–1637
Keffer	UGAMS-26747r	maize	305	20	−10.17			1506–1648	1524–1641
Jarrett-Lahmer	UGAMS-40355	maize	326	20	−8.52			1491–1640	1510–1635
Jarrett-Lahmer	UGAMS-40356	maize	298	20	−9.86	5.370		1512–1650	1524–1644
Jarrett-Lahmer	UGAMS-40357	maize	272	20	−9.25	4.960		1522–1794	1529–1658
Jarrett-Lahmer	UGAMS-40358	maize	322	21	−7.95	6.430		1495–1641	1516–1636
TRENT									
Jamieson	UGAMS-33014	maize	298	22	−9.41			1507–1653	1524–1644
Jamieson	GrM-14952	maize	353	20	−8.03			1465–1634	1480–1623
Jamieson	GrM-14949	maize	311	18	−8.60			1505–1645	1522–1639
Jamieson	UGAMS-33015	maize	334	21	−8.67			1485–1637	1500–1633
Kirche	GrM-14957	unid. botanical	264	20	−28.76			1525–1796	1636–1661
Kirche	UGAMS-21918	maize	285	21	−8.50			1517–1660	1526–1650
Kirche	UGAMS-33013	maize	315	21	−9.40			1497–1644	1521–1638
Kirche	GrM-14958	maize	293	18	−9.39			1519–1653	1526–1646
Coulter	UGAMS-32755	maize	307	25	−9.47			1496–1649	1521–1642
Coulter	UGAMS-32756	maize	318	25	−9.31			1490–1644	1517–1637
Coulter	UGAMS-32757	maize	345	25	−9.28			1473–1636	1490–1630
Coulter	GrM-14933	maize	276	20	−8.57			1522–1792	1528–1655
Coulter	UGAMS-32758	maize	313	25	−9.64			1495–1645	1520–1639
Coulter	GrM-14934	maize	305	20	−9.39			1506–1648	1524–1641
Coulter	UGAMS-32759	maize	323	25	−8.94			1490–1642	1514–1636
Coulter	UGAMS-32760	maize	296	25	−9.14			1504–1657	1524–1645
Coulter	GrM-14548	maize	298	18	−9.00			1516–1650	1524–1644
Coulter	UGAMS-32761	hawthorn seed	330	25	−26.63			1484–1639	1504–1635
Coulter	GrM-14928	hawthorn seed	391	20	−26.15			1446–1620	1454–1607
Coulter	UGAMS-32762	maize	309	25	−9.03			1495–1648	1521–1641
Coulter	UGAMS-32763	maize	362	30	−9.78			1455–1635	1471–1623
Coulter	GrM-14931	maize	334	18	−8.78			1490–1637	1505–1632
Coulter	UGAMS-32764	maize	296	25	−9.81			1504–1657	1524–1645
Coulter	GrM-14929	maize	335	18	−9.16			1487–1637	1503–1632
Dawn	UGAMS-33010	maize	352	21	−9.59			1460–1635	1482–1623
Dawn	GrM-14939	maize	347	18	−8.20			1474–1635	1491–1626
Dawn	UGAMS-33011	maize	354	21	−8.48			1462–1634	1480–1623
Dawn	GrM-14941	maize	346	20	−8.71			1474–1635	1490–1628

Note: For the complete dataset—including project identification numbers, sample identification to species, taxonomic identification of split and replicate samples, sample provenience, and data for the Warminster, Sopher, Ball, and Benson sites (previously published in Manning et al. 2019)—see Supplemental Table 1. The $\delta^{13}C$, ^{15}N, and C values are reported from separate IRMS measurements.

descendant communities in both Canada and the United States, as well as policies established by the Native American Graves Protection and Repatriation Act (USA), no materials from burials or burial contexts were sampled.

Preference for sample selection was given to carbonized maize, followed by other short-lived annuals (beans, seeds, nutshells, etc.), followed by herbivore animal bone such as deer or other fauna known to follow a nonaquatic diet. All bone was identified to the taxonomic level of species. In some cases, the nature of collections from sites included the possibility of residual and/or more recent material being sampled. In those cases, the derived dates were used to exclude samples deemed too old or too recent.

Radiocarbon Dating

AMS ^{14}C dates were obtained from two laboratories—the Center for Applied Isotope Studies (CAIS) at the University of Georgia and the Center for Isotope Research (CIO) at the University of Groningen. These included a number of split, or replicate, samples to establish that similar results were achieved independent of the individual laboratory (Supplemental Table 1). See Supplemental Material for sample pretreatment and lab methods as well as discussion of the comparability of replicate samples, which were found to be good.

Bayesian Modeling

Calibration and Bayesian chronological modeling used the OxCal software (version 4.4.1 [2020]; Bronk Ramsey 2009a, 2009b), forms of outlier analysis (Bronk Ramsey 2009b; Dee and Bronk Ramsey 2014; Dee et al. 2013), and the IntCal20 ^{14}C calibration dataset (Reimer et al. 2020), with curve resolution set at one year. We employ capitalized forms of words such as Sequence, Phase, Boundary, Date, Interval, Span, and Order to refer to OxCal Chronological Query Language (CQL2) Command Reference terms.

Because the historical contingencies within each site relocation sequence were unique, each was modeled using parameters that best fit current archaeological understandings of those local sequences (supplemental materials for site data and models, including variations on select parameters, as well as discussion in Results are below). We recognize that this means that our assessments of the chronology are not fully independent of other assumptions within each sequence, although each sequence is independent of the others. Consequently, in contrast with previous efforts where we sought to employ the radiocarbon evidence as an entirely independent temporal arbiter or indicator (Manning et al. 2018), here we have necessarily incorporated best current archaeological assessments, and so there is an element of circularity. As a result, the plausibility of a model suggests that it is possible (i.e., all interpretative hypotheses are consistent with the data and constraints available), but with the caveat that by itself it cannot offer entirely independent confirmation of those assumptions. We acknowledge that the assumption of temporal order from this archaeological knowledge is key to the results we obtain (and resolution of the ambiguities otherwise caused by the plateau in the calibration curve). We discuss this issue in the Supplemental Material.

All single-component sites were modeled as Phases. We assume that the dates in a Phase are random examples from a uniform probability distribution, because we have no reason to assume otherwise (e.g., the data do not come from either end-of-Phase destructions or foundation deposits but rather from the random processes of human presence across the few decades of each site and Phase in total). Where internal phasing existed due to village expansion, we considered a Sequence with each component modeled as a Phase. Date estimates were calculated as a summary of each Phase. The Date function in OxCal determines a hypothetical event describing the temporal extent of the Phase between its start and end Boundaries. The Interval function was employed to estimate the duration of each Phase between its start and end Boundaries (in contrast, the Span query quantifies the time period between the first and last dated elements within a Phase, or other parent group). Where we have only a few data and no way to judge whether these are in fact representative of the overall Phase, and yet seek a conservative overall site duration estimate, the Interval query offers the best—or rather, safest (i.e., longer, conservative)—guide. Where we have more data and especially evidence from a range of a site's history, then the available dates may be considered more representative, so a Span query can be considered to indicate approximate Phase duration (e.g., Manning et al. 2018). Where we have closely spaced Phases arranged in a contiguous Sequence, then the before and after constraints within the Sequence restrict the Boundary distributions and Phase duration estimates, and both Interval and Span queries give more similar values.

A key element of prior, expert knowledge for estimating the dates of Iroquoian site Phases in the period we address is the understanding from ethnohistoric reports and archaeological analysis that such village sites were occupied for between approximately 0 and 40 years. As noted before (e.g., Manning and Hart 2019; Manning et al. 2019), however, with no additional constraint, Interval queries applied to models employing the radiocarbon dates available will, to the contrary, often estimate much longer possible durations (and especially across the 1480–1620 plateau in the calibration curve). We therefore apply a prior constraint to an Interval query for each site Phase. Following the discussion in Manning and others (2020), we employ a prior using a LnN distribution: `LnN(ln(20),ln(2))` (for the shape of the probability distribution, see Supplemental Figure 1a). This prior probability distribution gives a peak probability for around a 5–20-year site duration, with much-–reduced probability after 40 years—but it allows for a few possible exceptions. (A benefit of a LnN prior, versus a Uniform prior, is that if the data indicate otherwise, then they can overwhelm the prior.) This prior reflects reasonably the expert knowledge available (see above). It appears slightly better than a Normal Distribution (e.g., 20 ± 10 years) for any single settlement since (1) it places higher probability more to the earlier end of the ranges (e.g., 5–20 years) rather than in the middle of the range, since the ethnohistoric evidence suggests durations typically more in the 10–20-year range, and less than 30–40 years (see above); and (2) it better allows for possible longer-lived exceptions. To illustrate the effect of this prior, we can consider the Middle Humber case. With no such extra constraint, both sites in this model give over-long Interval ranges (Black Creek, Parsons; see Supplemental Figure 1b). Applying the above Interval constraint, however, the two site Phase Intervals are constrained to be more appropriate in length given the expert knowledge available (Supplemental Figure 1c). See further discussion in the Supplemental Material.

The estimated Dates and Intervals for each site and component are listed in Table 2. Unless otherwise indicated, estimated Dates for each site (constructed as one or more Phases) are discussed as "interpretative" 68.3% highest posterior density (hpd) intervals in the text below, with the conservative 95.4% hpd intervals provided in Table 2, along with any subranges. Where there are subranges, we sometimes cite a clearly more likely subrange in the text. It should be noted that results from different OxCal runs can vary slightly. We list the Convergence (C) values for the elements in each model in Supplemental Figures 2–7, all ≥ 95, to illustrate that the models are robust (and where ambiguity remains, it is robust ambiguity).

Results

Humber Valley

Differences in ceramic assemblages suggest that two distinct community groups occupied the Humber Valley in the Late Woodland period (Figure 4). In the Middle Humber Valley, at least two small villages, including the Black Creek site, coalesced at the Parsons site (Williamson and Robertson 1995). There are three sites in the Upper Humber River valley previously thought to date to the late fifteenth to mid-sixteenth century: Damiani, Seed-Barker, and Mackenzie-Woodbridge. All are palisaded, and their sizes suggest that they were the product of settlement aggregation, although the temporal relationships between each is not clear, and this is reflected in the model parameters. Seed-Barker and Mackenzie-Woodbridge were both found to contain small amounts of European metal (Emerson 1954; Fox et al. 1995). Skandatut is another large palisaded village that has been assumed as the latest in the sequence on account of nine pieces of European metal identified from limited excavations in the village

Table 2. Date and Interval Estimates of Sites as per Modeled Site Sequences.

Site	Previous Age Estimate	Date (68.3%)	Date (95.4%)	Interval (68.3%)	Interval (95.4%)
Middle Humber (Humber Model A_{model} 90.3, $A_{overall}$ 102.3)					
Black Creek	1400–1450	*1475–1614*	*1458–1622*	5–24	2–48
		1476–1503 (53.1%)	*1458–1517 (67.0%)*		
		1602–1614 (15.1%)	*1583–1622 (28.5%)*		
Parsons	1450–1500	*1495–1627*	*1480–1639*	5–22	2–44
		1495–1523 (52.8%)	*1480–1539 (66.6%)*		
		1616–1627 (15.4%)	*1597–1639 (28.9%)*		
Upper Humber (Humber Model A_{model} 90.3, $A_{overall}$ 102.3)					
Seed-Barker	1500–1550	*1506–1574*	*1494–1589*	5–31	3–63
		1506–1535 (43.1%)			
		1550–1574 (25.2%)			
Damiani (core)		*1526–1545*	*1518–1559*	0–11	0–27
Damiani (expansion)	1480–1510	*1533–1553*	*1528–1569*	0–11	0–26
Mackenzie-Woodbridge	1500–1550	*1522–1563*	*1507–1583*	5–26	2–52
Skandatut	1580–1600	*1599–1629*	*1579–1639*	5–23	2–44
Don Valley (A_{model} 163.4, $A_{overall}$ 165.6)					
Walkington 2	1400–1450	*1483–1504*	*1471–1519*	5–20	3–33
Baker	1400–1450	*1476–1498*	*1462–1607*	5–19	3–32
			1462–1511 (95.0%)		
			1605–1607 (0.5%)		
McNair	1400–1450	*1488–1510*	*1474–1523*	5–20	3–33
Hope (North)		*1482–1500*	*1472–1512*	4–13	2–20
Hope (South)	1400–1450	*1480–1498*	*1469–1607*	4–13	2–20
			1469–1509 (95.1%)		
			1605–1607 (0.4%)		
Orion–Murphy Goulding	1400–1450	*1485–1506*	*1471–1520*	5–20	3–34
Keffer	1450–1510	*1527–1549*	*1519–1637*	5–18	2–33
			1519–1568 (93.9%)		
			1632–1637 (1.6%)		
Jarrett-Lahmer	1450–1500	*1526–1548*	*1518–1638*	5–19	2–34
			1518–1568 (93.7%)		
			1632–1638 (1.8%)		
Trent Valley (A_{model} 108, $A_{overall}$ 117)					
Jamieson	1450–1500	*1504–1535*	*1485–1562*	6–40	3–85
Kirche (early)		*1525–1537*	*1517–1546*	0–13	0–27
Kirche (late)	1500–1550	*1531–1544*	*1528–1553*	0–8	0–17
Coulter (core)		*1515–1532*	1509–1546	0–8	0–21
Coulter (exp 4)	1500–1550	*1540–1558*	1535–1572	0–2	0–5
Benson (early)		*1528–1546*	*1521–1557*	0–10	0–22
Benson (late)	1550–1600	*1536–1556*	*1528–1568*	0–10	0–24
Dawn	1500–1600	*1505–1604*	*1491–1616*	5–23	2–45
		1505–1521 (18.7%)	*1491–1530 (30.1%)*		
		1571–1604 (49.6%)	*1552–1616 (65.4%)*		
Sopher	1550–1600	*1540–1567*	*1527–1582*	5–21	3–37
Ball	1590–1615	*1570–1620*	*1563–1628*	5–21	3–40
		1570–1601 (67.6%)			
		1620 (0.6%)			
Warminster	1600–1625	*1603–1630*	*1583–1637*	5–26	3–50
Seneca (A_{model} 132.4, $A_{overall}$ 133.4)					
Farrell	1350–1450	*1399–1416*	*1391–1427*	5–23	3–42
Footer	1350–1400	*1461–1482*	*1453–1493*	5–20	3–35
Belcher	1500–1550	*1491–1516*	*1478–1528*	5–23	3–41
Richmond Mills	1500–1550	*1503–1523*		5–22	3–40

Table 2. Continued.

Site	Previous Age Estimate	Date (68.3%)	Date (95.4%)	Interval (68.3%)	Interval (95.4%)
			1487–1565		
			1487–1536 (94.0%)		
			1557–1565 (1.5%)		
Tram	1580–1600	*1553–1584*	*1535–1594*	7–36	4–59
Cameron	1590–1610	*1580–1601*	*1567–1610*	6–23	3–40
Factory Hollow	1600–1620	*1597–1617*	*1587–1628*	5–21	3–38
Alhart (A_{model} 133.2, $A_{overall}$ 129.3)					
Alhart	1440–1510	*1524–1566*	*1514–1644*	5–26	2–51
	or 1525–1550		*1514–1586 (83.9%)*		
			1621–1644 (11.5%)		
Onondaga (A_{model} 112.2, $A_{overall}$ 120.2)					
Kelso	1390	*1399–1417*	*1390–1430*	5–20	2–38
Howlett Hill	1380	*1418–1437*	*1406–1444*	5–21	3–36
Schoff	1410	*1433–1451*	*1424–1460*	5–19	3–32
Bloody Hill	1400–1450	*1463–1485*	*1452–1494*	6–24	3–39
Christopher	1420–1450	*1488–1506*	*1479–1513*	4–14	2–23
Burke	1480	*1487–1504*	*1479–1511*	4–14	2–23
Cemetery	1450–1500	*1508–1523*	*1499–1529*	5–17	3–27
Barnes	1500–1525	*1524–1540*	*1517–1551*	4–13	2–22
McNab	1500–1525	*1526–1540*	*1520–1551*	4–13	2–22
Temperance House	1525–1550	*1545–1568*	*1537–1580*	4–15	2–27
Atwell	1525–1550	*1546–1569*	*1538–1581*	4–16	2–27
Chase	1575–1600	*1574–1606*	*1556–1614*	5–27	3–47
Pompey Center	1600–1620	*1619–1639*	*1570–1647*	5–20	2–37
			1570–1596 (11.2%)		
			1608–1647 (84.2%)		

Note: See Supplemental Tables 3–8 for model specifications. Supplemental Table 9 includes an Order analysis for the Don Valley sequence. Supplemental Figures 8–12 and Supplemental Tables 10–12, 14–15 consider variations on the modeling parameters, including the effects of incorporation of prior archaeological knowledge. Supplemental Table 13 lists the start and end Boundaries for each site. Rounding errors mean that probabilities, when there are sub-ranges, sometimes add up to 0.1% more, or less, than the stated 68.3% and 95.4%.

area (Williamson 2014:25). Skandatut is also associated with the Kleinberg Ossuary that was found to contain a sizable assemblage of European-derived grave goods—including early-style iron trade axes, an iron kettle, shell beads, native copper beads, and a large quantity of glass trade beads—leading to the site being assigned a relative date of 1580–1600 (ASI 2012).

Middle Humber. When modeled as a Sequence the data indicate that Black Creek dates to *1475–1503* (53.1% of the 68.3% hpd) and Parsons to *1495–1523* (52.8% of the 68.3% hpd). This places the precoalescent Black Creek site as being occupied in the later fifteenth to early sixteenth century, as opposed to the previous age estimate of 1400–1450, pushing the site well into what has been understood as the period of widespread community coalescence. Parsons then dates somewhat later than its previous age estimate of 1450–1500. Both sites are palisaded, and Parsons contained more than a thousand scattered skeletal elements (Williamson 2007), suggesting involvement in the hostilities that characterized the later Woodland period.

Upper Humber. Modeled Date estimates for these sites indicate an early to mid-sixteenth-century occupation for Seed-Barker (*1506–1535*, 43.1% of the 68.3% hpd), Mackenzie-Woodbridge (*1522–1563*), and Damiani (*1526–1553*). The lack of European goods and presence of human remains in midden contexts at Damiani has led some to assume that it may have been in the earlier portion of the local sequence (ASI 2015), but that does not seem to have been the

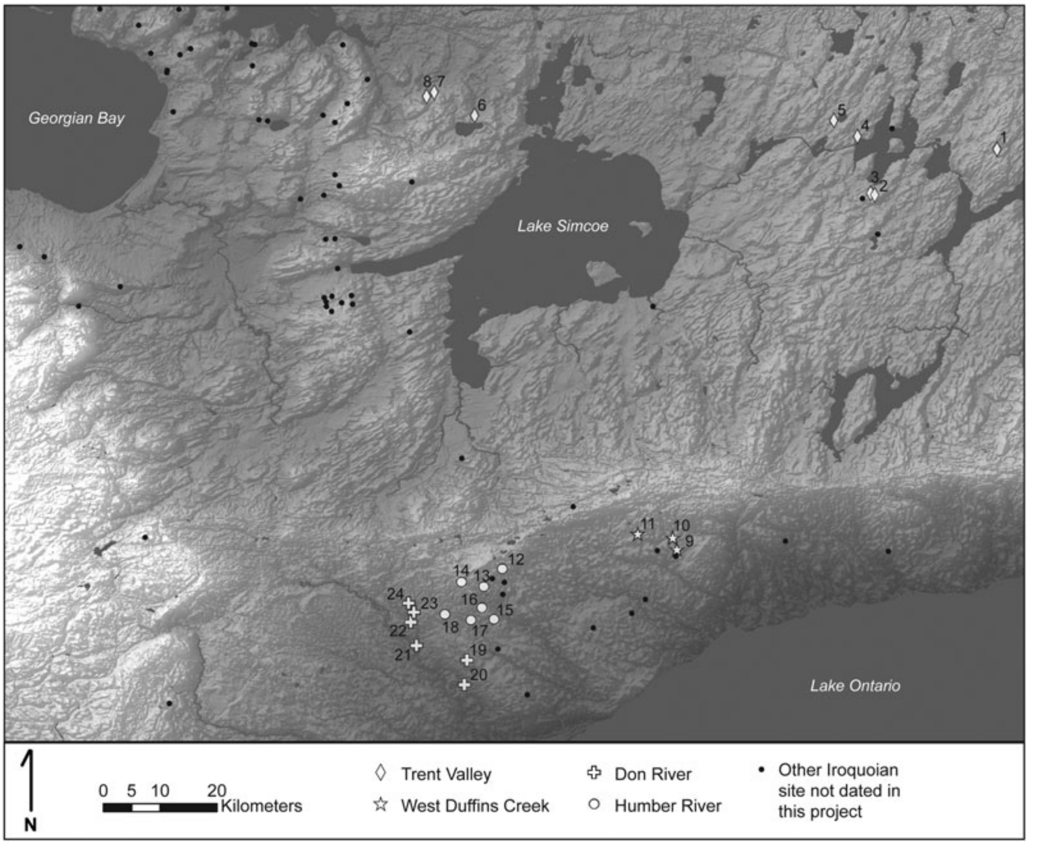

Figure 4. Map of Wendat site sequences, with dated and undated sites indicated. Dated sites are numbered. *Trent Valley:* (1) Dawn, (2) Kirche, (3) Jamieson, (4) Coulter, (5) Benson, (6) Sopher, (7) Warminster, (8) Ball; *West Duffins Creek:* (9) Draper, (10) Spang, (11) Mantle; *Don River Valley:* (12) Orion-Murphy-Goulding, (13) McNair, (14) Hope, (15) Baker, (16) Walkington 2, (17) Keffer, (18) Jarrett-Lahmer; *Humber River Valley:* (19) Parsons, (20) Black Creek, (21) Mackenzie-Woodbridge, (22) Seed-Barker, (23) Skandatut, (24) Damiani. Basemap: United States Geological Survey 2017. Waterways and inset basemap: Natural Earth 2019.

case. Skandatut now has an estimated Date of *1599–1629*—somewhat later than has been previously assumed and coincident with documented direct European contact farther north and east (e.g., Biggar 1929–1936). Even when the 95.4% confidence interval is considered (*1579–1639*), the new date estimate for the Skandatut site creates a gap of some roughly 5–20 years between its occupation and the occupation of those sites believed to predate it in the local sequence (but see Supplemental Table 12 for modeled Boundaries for each site occupation, which serve to close this gap somewhat). Since it is unlikely that there are undiscovered sites located in the Upper Humber Valley, this may be an artifact of the small sample size available for most of these sites such that the dates do not represent the full occupational span of each (see Table 1; Supplemental Table 1). The small sample of material culture available for Skandatut, owing to its history of investigation, hampers further investigation of this disparity in date ranges. Nevertheless, these data, together with the understanding that sites in the West Duffins drainage were occupied longer than previously assumed, suggest that the north shore of Lake Ontario may have continued to be occupied later than 1610. This date has been referenced as marking the abandonment of the north shore region by Huron-Wendat, based on assumptions derived from ethnohistoric accounts (e.g., Trigger 1976:244).

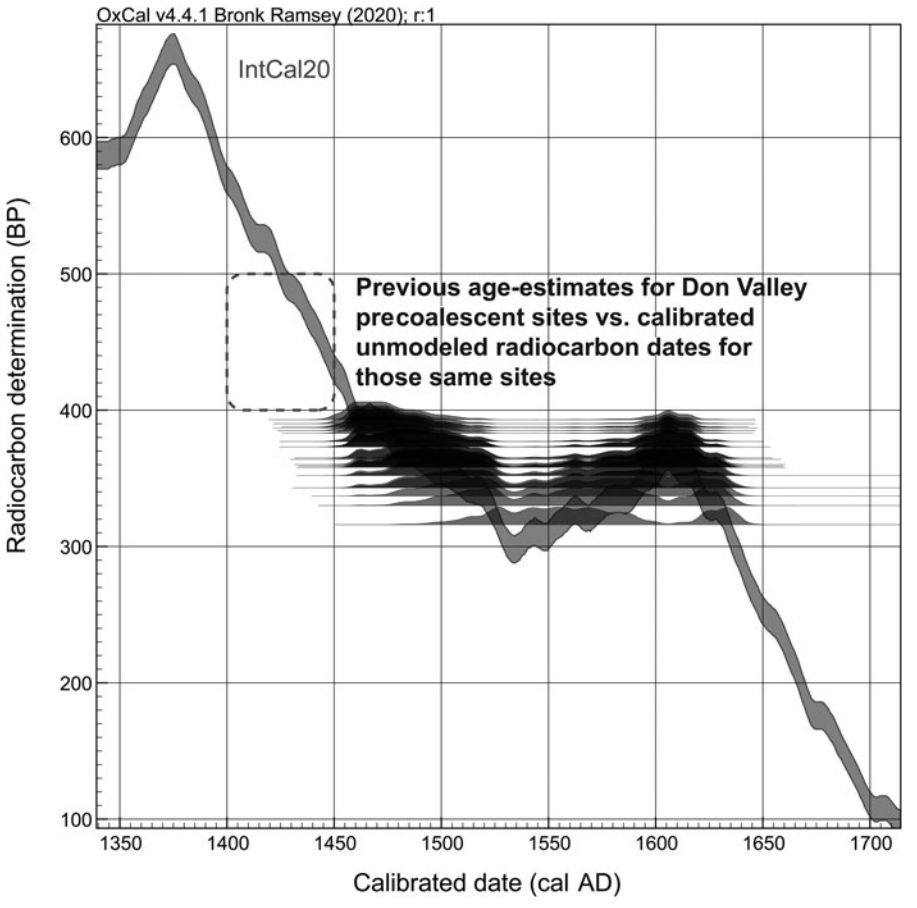

Figure 5. Calibrated, unmodeled radiocarbon dates for Don Valley precoalescent sites, 95.4% hpd range indicated. All were previously thought to date to AD 1400–1450 and now can be shown to postdate that period.

Don River Valley

In the Don River Valley, there are at least 15 small village sites assumed to date to the fifteenth and sixteenth centuries (Birch and Williamson 2013), seven of which were dated for this study (Figure 4; Supplemental Table 2). It has been assumed that at least some of the smaller, unpalisaded sites came together to form the larger Keffer site. It seems likely that another palisaded site in the valley, Jarrett-Lahmer, may have been at least partly contemporary with Keffer. None of these sites was found to contain European materials. An Order query applied to the precoalescent grouping of six sites (with each of the Hope site components considered separately) shows the following likely order (oldest to most recent—but also with some likely substantial overlaps): Baker, Hope South, Hope North, Walkington, Orion–Murphy Goulding, McNair (Supplemental Table 9). This order fits within an overall precoalescent Phase estimated to last about 30–57 years (68.3% hpd) or 21–76 years (95.4% hpd). It is likely several sites overlapped to some extent (especially Hope South and Hope North and Walkington and Orion-Murphy Goulding). An Order query applied to the two coalescent sites, Keffer and Jarrett-Lahmer, does not indicate a clear order ($p = 0.52$ Jarrett-Lahmer older), and the sites may well be approximately contemporary.

Previous assumptions held that none of the unpalisaded sites in the Don Valley postdated 1450. Our results, however, indicate that none of these sites predates 1450 (Table 2). Even when all dates from these sites are calibrated with no additional constraints, the earliest dates calibrate to a start date of not before 1445 (95.4%; Figure 5). When modeled, the earliest Date estimates for precoalescent site occupations start at *1476–1498* and end at *1488–1510*, some 75–100 years later than previously assumed. The effect of these data alone requires the rejection of the inference that conflict on the north shore of Lake Ontario was widespread around 1450, as has previously been assumed (Birch 2012; Birch and Williamson 2013).

The Keffer and Jarrett-Lahmer sites both produced almost identical Date estimates of *1527–1549* and *1526–1548*. When modeled as Phases in isolation with no other constraints, Keffer dates to a very similar range of *1527–1560* as does Jarrett-Lahmer (*1524–1560*, 63.3% of the 68.3% hpd). Before now, it has been unclear where Jarrett-Lahmer should be placed in the local sequence: before, after, or concurrent with Keffer (Birch and Williamson 2013). Our data suggest that Jarrett-Lahmer may have been occupied concurrently with Keffer, but they do not rule out a sequential relationship between the two sites, although the smaller size of Jarrett-Lahmer makes it unlikely that it could accommodate the same population.

Trent Valley

The local sequence in the Upper Trent Valley has been the subject of extensive study by Peter Ramsden and colleagues, resulting in the documentation of multiple village sites thought to span the late fifteenth through late sixteenth centuries (e.g., Damkjar 2009; Nasmith 2008; Ramsden 2009, 2016; Figure 4). This local sequence is understood to represent the genesis of the Wendat Arendarhonon Nation (Trigger 1976) and to have potentially involved the incorporation of eastern Iroquoian and Anishinaabeg peoples (Ramsden 2009, 2016). A historical and radiocarbon intersection for this sequence exists with Samuel de Champlain's likely 1615–1616 stay at the Warminster site (Manning et al. 2018, 2019). This model incorporates dates from the Jamieson, Kirche, Coulter, Benson, Dawn, Sopher, and Ball sites. Short-lived botanical samples and a series of rings on a preserved tamarack (*Larix laricina)* post from the Warminster site (as per Manning et al. 2018, 2019) serve as a TAQ for the sequence.

Current archaeological understandings of the Trent Valley sequence, based on multiple lines of material evidence—including ceramic seriation, the appearance of material culture indicative of populations originating in the St. Lawrence Valley to the east, and the presence or absence of European metals—were used to inform the parameters of the model (as per Ramsden 2009, 2016). Jamieson has been thought to be the earliest-known Iroquoian village site in the present study and is thought to date to the mid to late fourteenth century. Kirche is thought to have been at least partly contemporary with Jamieson. At some point during Kirche's occupation, an additional cluster of longhouses was added outside the palisaded village core. Ramsden (2016) suggested that the Coulter village core might have been established at the same time that Kirche was occupied. Coulter then went on to expand five times. Benson was thought to be among the latest sites in the sequence. St. Lawrence–associated pottery and fragments of European metal (but no glass beads) have been recovered from the Kirche site expansion, Coulter, and Benson. Dawn is the least-known site in the upper Trent Valley, but it has one of the highest percentages of eastern pottery types, suggesting a later date in the sequence. Where sites included expansions or early and later phases of occupation, that information was also used in the model construction (e.g., Damkjar 2009; Ramsden 2009).

Modeled Date estimates for the Trent Valley suggest a significant degree of overlap between site occupations. The modeled age estimate for the Jamieson site is *1504–1535*, coincident with evidence for the onset of conflict on the north shore of Lake Ontario to the west. The early phase of occupation at Kirche is estimated to date to *1525–1537*, with the later addition of houses outside the palisade occurring between *1531* and *1544*. The establishment of the Coulter village core is estimated between *1515* and *1532*, with the final phase of village expansion occurring between *1540* and *1558*. The Benson village early phase is estimated to have been occupied from *1528* to *1546*, with a portion of the houses then abandoned and the remainder continuing to be occupied until approximately *1536–1556*. Dawn most likely dates to *1571–1604* (49.6% of the 68.3% hpd). Sopher is estimated to date to *1540–1567*, Ball *1570–1601* (67.6% of 68.3% hpd), and Warminster *1603–1630* (see alternative model results in Supplemental Table 9). These Date estimates are very similar to those reported in Manning and others (2019; see Supplemental Table 14).

Although the dates for the Trent Valley model do not diverge significantly from what was previously thought about this sequence and indeed incorporate some of those assumptions, the modeled Date estimates suggest that the sites of Kirche, Coulter, Benson, and Sopher may have all been at least partly contemporaneous in the mid-sixteenth century. This suggests that the area was home to a substantial local population and that it corresponds with ethnohistoric accounts of the Arendarhonon being a populous nation (Trigger 1976). It also concurs with understandings about an influx of population from both the east and west in the early to mid-sixteenth century (Ramsden 2016). Although it is possible that Dawn was occupied until the turn of the seventeenth century, the majority of the Trent Valley population may have left the valley before approximately 1560. Ethnohistoric references indicate that the Arendarhonon joined the Wendat Confederacy in about 1590 (Thwaites 1896–1901:16:227–229), postdating Sopher's entire occupation and the establishment of Ball village. These data suggest that more complex or prolonged processes of population movement and alliance building may have taken place in eastern Wendake than has previously been assumed.

Seneca

In New York State, researchers have been somewhat more cautious about assigning dates to sites prior to the arrival of European diagnostic trade goods. This caution derives from limited site-level settlement pattern data and the relatively small sizes of material assemblages, although generalized sequences have been constructed for each subregion (Figure 6; Bradley 2005; Engelbrecht 2003; Sempowski and Saunders 2001; Tuck 1971; Wray and Schoff 1953).

The early portion of the Seneca model was constructed as a Sequence of noncontiguous site occupations. Farrell and Footer are small village sites that were dated to provide a terminus post quem for the later portion of the sequence, which includes the Belcher, Richmond Mills, Tram, Cameron, and Factory Hollow sites. The latter three have been hypothesized as representing sequential iterations of the same village occupied by the Eastern Seneca (Sempowski and Saunders 2001; Wray et al. 1991). The non-Seneca Alhart site, located immediately north of Seneca traditional territory, bears on the timing of regional conflict.

Earlier Seneca Sequence

Farrell and Footer have been loosely estimated to date to approximately 1300–1350 and 1350–1450, respectively (Engelbrecht 2001 [1981]; Niemczycki 1984). The new Date estimates suggest that each, in fact, dates somewhat later and noncontiguously, with Farrell estimated to have been occupied from *1399* to *1416* and Footer from *1461* to *1482*. This shifts the occupation of each site 50–100 years later than previous interpretations, and it may have implications for understandings of early settled village life in this subregion.

Belcher and Richmond Mills are among the first larger village sites in the Seneca region, and they have been postulated as being the start of the eastern and western Seneca sequences (Niemczycki 1984; Wray et al. 1987). Although little is known about Belcher, one decapitated skull was reported as being uncovered in the burial area. Richmond Mills was reported as containing charred human remains (Parker 1918:8) and small amounts of European metal. Our model, with no assumed order between the two, places Belcher at *1491–1516*, slightly earlier than Richmond Mills's Date estimate of *1503–1523*. This is more or less in keeping with the early sixteenth-century dates assumed for both sites.

Alhart

The non-Seneca Alhart site is located some 50 km north of Seneca territory. The burning of the village and 15 male skulls found in a pit have been interpreted as evidence of violent conflict (Hamell 1977; Niemczycki 1984; Wray et al. 1987). Biodistance markers suggest that Alhart females may have been incorporated

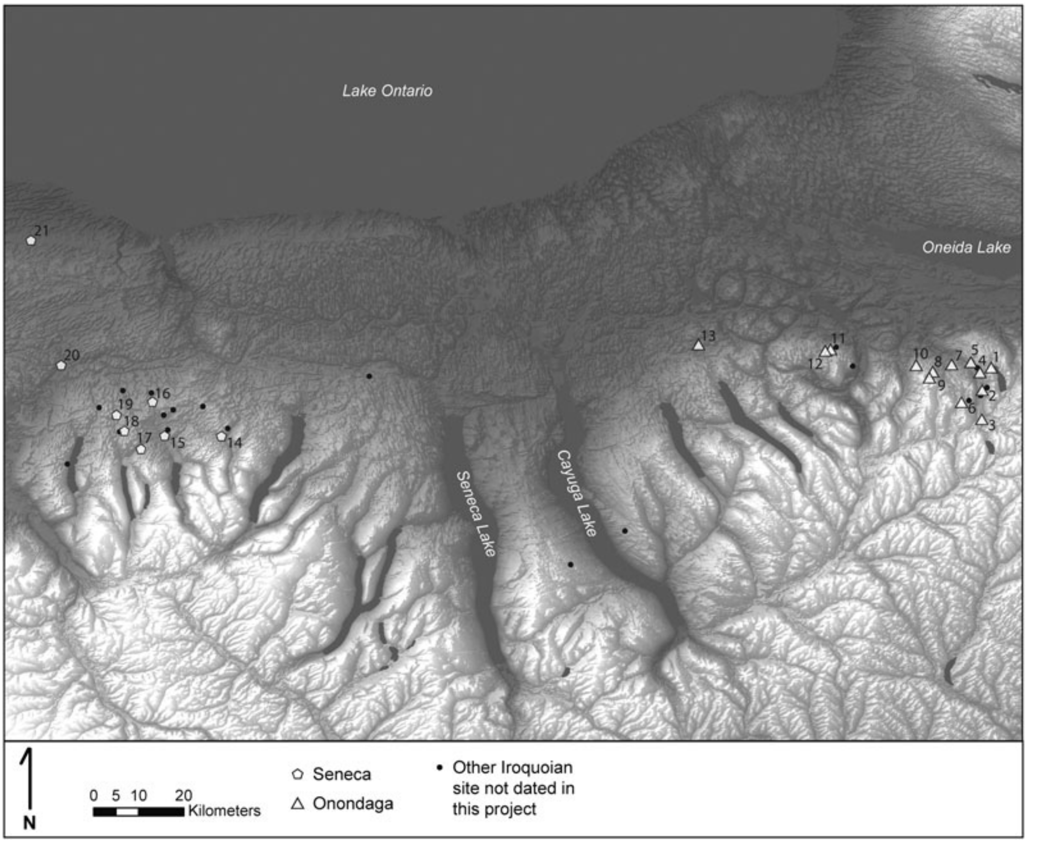

Figure 6. Map of Haudenosaunee site sequences, with dated and undated sites indicated. Dated sites are numbered. *Onondaga:* (1) McNab, (2) Atwell, (3) Chase, (4) Temperance House, (5) Barnes, (6) Pompey Center, (7) Cemetery, (8) Christopher, (9) Burke, (10) Bloody Hill, (11) Howlett Hill, (12) Schoff, (13) Kelso; *Seneca:* (14) Footer, (15) Belcher, (16) Factory Hollow, (17) Richmond Mills, (18) Tram, (19) Cameron, (20) Farrell, (21) Alhart. Basemap: United States Geological Survey 2017. Waterways and inset basemap: Natural Earth 2019.

into the Seneca Adams site population (Wray et al. 1987:248). The community may have been related to populations from further west that were subsequently driven out, destroyed, or absorbed by the Seneca (Engelbrecht 2003:115; Hamell 1977). Dates on short-lived botanicals from this site modeled in isolation from the rest of the sequence suggest a Date range of *1524–1566*.

Later Seneca Sequence

Samples for the Tram, Cameron, and Factory Hollow sites were obtained for the later eastern Seneca sequence. We lack data for the Adams and Culbertson sites that presumably link the earlier and later parts of the eastern and western sequences. One of the challenges we faced in sampling was the avoidance of material from burial contexts, which comprises a large portion of curated Seneca assemblages. Although no dates are available from these sites, it should be noted that at Adams, a large, roughly rectangular palisade enclosing 4 ha was mapped by Squier in 1848 and archaeologically identified, together with male skeletons excavated from the cemeteries that show evidence of combat trauma in the form of “parry fractures” (Wray et al. 1987:13, 31–21). Both Adams and Culbertson are located on hilltops, suggesting a concern for defensive siting.

A postulated sequence of relocations was constructed as Tram to Cameron to Factory Hollow, with some question about Cameron’s place in either the eastern or western sequences, or possible partial contemporaneity with Factory Hollow (Sempowski and Saunders 2001; Wray et al. 1991). Our results are more or less in keeping with the most recent "revised" sequence presented by Sempowski and Saunders (2001): Tram, *1553–1584*; Cameron, *1580–1601*; and Factory Hollow, *1597–1617*. Evidence for conflict continues to be apparent in these later sites: Tram was a reportedly fortified village that also included an earthwork (Wray et al. 1991), and Cameron is not only heavily palisaded but also has a mortuary population that includes evidence of violent death (Engelbrecht 2003; Wray et al. 1991). No palisade has been identified at Factory Hollow, although it is located on a steep promontory.

Onondaga

The Onondaga settlement pattern is characterized by pairs of large and small villages, and these were used to construct a sequence of paired sites that the model assumed to be roughly contiguous (Figure 6; Bradley 2005; Tuck 1971). Few of these have been subject to extensive or professional investigation. A robust independent testing program is hampered by the small collections and lack of documentation for many sites in the Onondaga sequence. For example, only one sample per site was available for dating from the Howlett Hill, Schoff, Christopher, and Barnes sites (Table 1). These small sample sizes also have the result of over-constraining Interval estimates for the occupation of each site (Table 2).

The earliest Onondaga sites we dated are Kelso, Howlett Hill, and Schoff. These were modeled with the inferred relocation of Howlett Hill to Schoff as per Tuck's understanding of the sequence. The model placed Kelso at *1399–1417*, Howlett Hill at *1418–1437*, and Schoff at *1433–1451*. Whereas Kelso is dated only slightly later than Tuck's estimate, Howlett Hill and Schoff are placed some 20–40 years later.

Next, Bloody Hill produced a Date estimate of *1463–1485*, some 40 years later than previously assumed. A roasting pit at the Bloody Hill site was found to contain numerous fragments of human bone interpreted by Tuck (1971:113–114) as evidence for cannibalism.

The Burke site, which follows Bloody Hill, is defensively located and heavily palisaded. Our models place the Burke and Christopher sites in a Phase spanning *1487–1504*. These sites are followed in the sequence by the Cemetery site at *1508–1523*. The Cemetery village occupies a location on a triangular peninsula that drops off very sharply to the east and west and appears to have been selected for its defensibility (Tuck 1971:141).

The McNab site is one of the largest in the Onondaga sequence, and the assumption is that it represents a coalescent village. In our model, the McNab site is placed in a phase with Barnes. The Barnes site assemblage includes one piece of European copper as identified by Sanft using pXRF, charred human remains in middens, and a defensive location and partial palisade (Bradley 2005:35–37). Modeled as a Phase, both fall into a narrow date range at *1526–1540* and *1524–1540*, respectively.

Temperance House and Atwell, considered the first "protohistoric" sites in the sequence, are estimated to date to *1545–1568* and *1546–1569* respectively, followed by the Chase site with a modeled age estimate of *1574–1606*. All are more or less in line with the chronology presented by Bradley and Tuck. Each of these sites were found to contain very small quantities of European goods. The Onondaga sequence ends with the Pompey Center site, which most likely dates to *1619–1639*. An Interval between Chase and Pompey allows for sites in the local sequence, for which material could not be acquired, likely of 0–21 (68.3%) or 0–42 (95.4%) years.

The most significant insights to emerge from the Onondaga sequence are the slightly later dates for the Howlett Hill and Schoff sites early in the sequence, and for Pompey Center at the very end. Incomplete understanding of site-level settlement patterns, small artifact assemblages, and lack of available samples with secure provenience for radiocarbon dating for most sites obscures deeper insight into this local sequence. We note, however, that evidence for conflict first appears here at the Bloody Hill site as early as 1460, some 75–100 years earlier than evidence for conflict on the north shore of Lake Ontario.

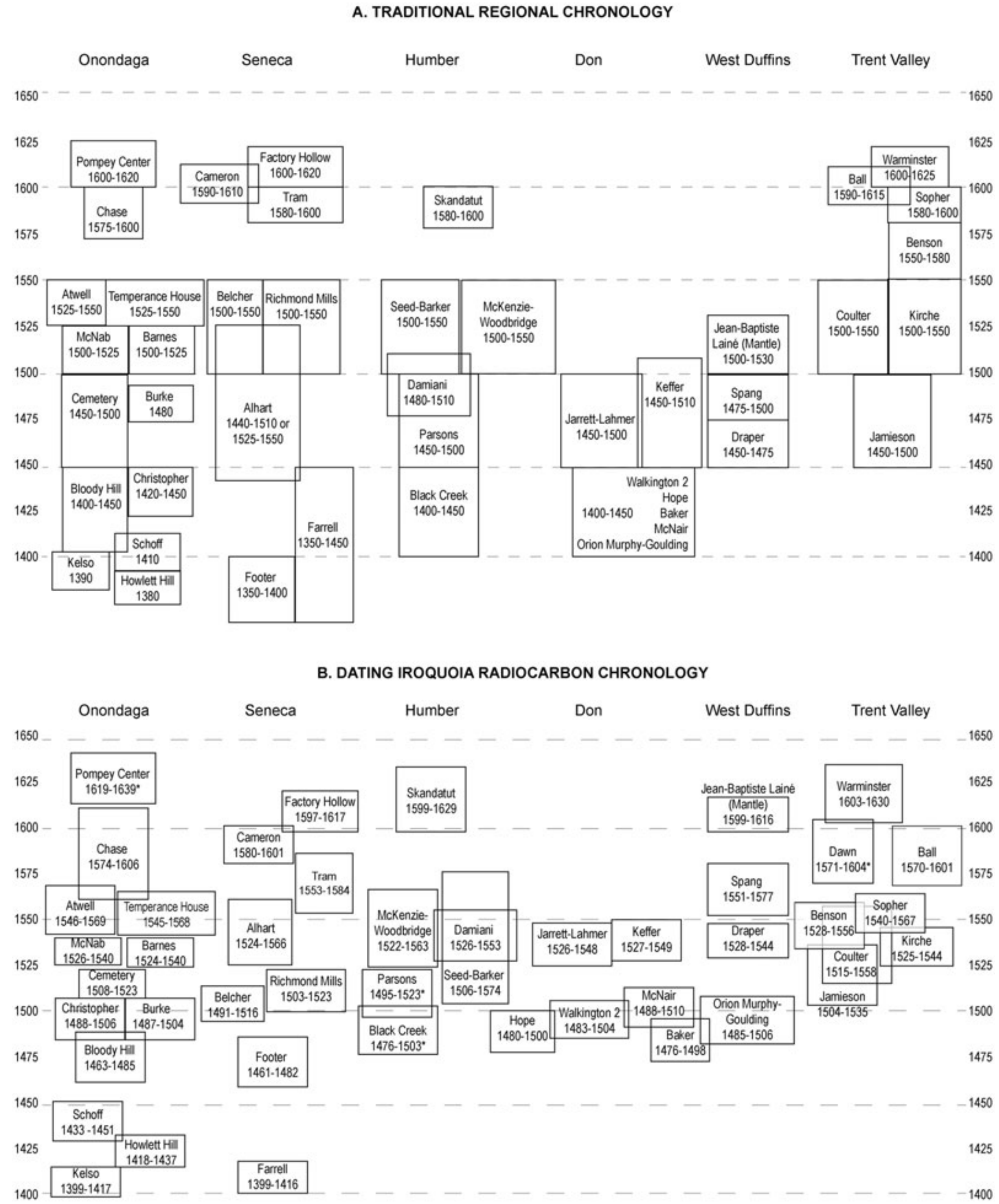

Figure 7. Previously accepted age estimates for Iroquoian village sites dated in this study compared to new, revised chronological associations for those same sites. Previous chronology modeled after Birch and Williamson (2013), Bradley (2005), Engelbrecht (2003), Hamell (1977), Niemczycki (1984), Sempowski and Saunders (2001), Ramsden (2016), and Tuck (1971).

Discussion: A New History for Iroquoia

These new date estimates for key sites and sequences represent a substantial replotting of the historical development of these two Northern Iroquoian societies (Figure 7). We note and accept that the chronologies we have developed and presented are not independent of prior inferences due to the limitations of available data. We have used previous archaeological assessments of site sequences and order in several cases, and we have tentatively accepted these when the radiocarbon data successfully model consistent with these hypotheses. For example, in multiple site sequences, gaps between sites presumed to be sequential are present. These gaps may be real or an artifact of those samples selected or available for dating, and more dates representing the true occupational spans of sites are required in order to evaluate that question. This does not, of course, prove that these assumptions are correct, but it suggests that they are not substantially incorrect. However, placing these new radiocarbon data within models based on current best knowledge of the archaeology of the region, we find that we are nevertheless forced to rethink the basic time frames in which these sequences are placed, as well as the associated explanatory frameworks for processes of sociocultural development. The existing status quo cannot stand. Moving forward, we can then target the need for more independent chronological analysis and reform (since changing the prior assumptions will only make even more of a case for doing this). In the future, with many more ^{14}C dates and additional independent modeling—for example, as per techniques discussed elsewhere (Manning et al. 2020)—we can test even the general previous settlement sequence assumptions and further clarify the relevant time frames and site placements. Our findings indicate that this should be a research priority for the field.

Implications for Coalescence and Conflict

Arguably, the most significant shift in our understanding of the archaeological history of Iroquoia is the change in the timing of coalescence and conflict. Previously, the approximately 1450–1500 period in Ontario and the early to mid-1500s period in New York were understood to have represented the onset of settlement aggregation and endemic violence. Now, the earliest sites with clear signs of violent conflict (defensive siting, human remains bearing traumas) come from Onondaga (Bloody Hill) and Seneca (Belcher, Richmond Mills) territory sites and the Humber Valley (Black Creek) at the west end of Lake Ontario in the later 1400s to early 1500s. Small, unpalisaded sites to the northeast in the Don River sequence previously thought to date to roughly 1400–1450 are now understood as dating to as much as a century later—this same later 1400s to early 1500s interval. Conflict does not come to the Don Valley until approximately 1525, perhaps after the Middle Humber is abandoned. Date ranges for heavily palisaded sites in the Upper Humber similarly cluster around the early to mid-1500s. Previous work on the West Duffins Creek sequence (Manning et al. 2018) determined that the aggregated Draper community likewise formed in the mid-1500s—not around 1450, as previously assumed. Together, the new data suggest that heightened conflict occurred first in western New York and around the west end of Lake Ontario in the late 1400s, and it then spread east by approximately 1525. The palisading of sites in the Trent Valley occurred around and after the first decade of the 1500s. Another potentially earlier Trent Valley site with evidence for conflict, Quackenbush, could not be dated for this study. We acknowledge the need to consider how similar processes were playing out around the east end of Lake Ontario. Additional research has begun to provide new insights into how the defensive positions and eventual dispersal of St. Lawrence Iroquoian populations by around 1550 factor into the regional scene (Abel 2019; Abel et al. 2019).

All of the available data from the west end and north shore of Lake Ontario, however, are pointing to conflict within ancestral Haudenosaunee territory and between ancestral Haudenosaunee and ancestral Wendat communities—*not* internal conflict between ancestral Wendat communities, as has previously been understood. Although internal conflict between some Wendat communities is possible, the radiocarbon and settlement data strongly suggest that shifts in Wendat settlement patterns north along major drainages and the eventual consolidation of population in the Simcoe Uplands (historic Wendake) occurred with the intent of creating a buffer zone between the Wendat and the Haudenosaunee. The escalation of both internal and external conflict on the part of the Haudenosaunee coincides with the formation of village clusters associated with the formative Seneca and Onondaga nations.

In short, based on the data presented here, coalescence and conflict can now be understood as beginning in the Finger Lakes region and around the west end of Lake Ontario between populations ancestral to the Haudenosaunee and Wendat confederacies in the late 1400s and early 1500s. By the second decade of the 1500s, communities around the west end of Lake Ontario were abandoned, creating a buffer zone between these emergent political entities. Conflict then spread to the rest of the region, such that by around 1525, all communities in both Ontario and New York had assumed a defensive posture in the context of heightened regional hostilities. The "traditional" hostilities between the Haudenosaunee and Wendat did not begin shortly before direct engagement with Europeans, as previously assumed (Trigger 1976). Instead, they had their roots as early as the late 1400s, with widespread intersocietal conflict characterizing the region from about 1525 onward.

New understandings about the timing and directionality of conflict suggest that hostilities with the Haudenosaunee influenced the relocation of ancestral Wendat settlement northward in the sixteenth century and, ultimately, the formation of the Wendat Confederacy. The variability in the timelines between community sequences highlights that these relocations were not a discrete event but rather a protracted process that played out over more than two centuries. We acknowledge that a complex mix of internal and external factors were at work during processes of Wendat and Haudenosaunee politogenesis, and as such, no single "cause" led to the development of the allied Nations that came to identify themselves as confederacies. This revised timeline, however, provides a step toward an enhanced understanding of the different positionalities and dispositions of individual communities vis-à-vis coalescence, conflict, and initial processes of confederacy formation.

Implications for Entry of European Goods

Modeled dates both confirm and complicate current understandings of the timing and nature of Indigenous use of European goods. The first European-manufactured materials incorporated into Indigenous societies were fragments of copper and brass from kettles, along with iron from axes and nails, as early as the first half of the 1500s (at the sites of Richmond Mills, Barnes, Seed-Barker, Mackenzie-Woodbridge, Coulter, Kirche, and Benson). These items are found in small numbers, and they are often worked into Indigenous cultural forms, illustrating how individuals indigenized European objects by repurposing them to fit their own desires and needs (e.g., Bradley and Childs 1991). Toward the end of the 1500s, assemblages on sites began to include European glass beads as well as European metals, first in small quantities (as seen at Tram and Chase), with numbers of both glass beads and metal objects increasing exponentially after approximately 1600 (as seen at Factory Hollow, Pompey Center, Skandatut, Warminster, and Ball).

It has also become clear that there was considerable variability among communities in terms of the initial appearance and use of European materials and, by proxy, engagement with European settlers. Although much of the trade goods data fit previously understood patterns, it is perhaps more interesting to discuss the sites that do not. The Jean-Baptiste Lainé (Mantle) site in the West Duffins Creek sequence was occupied at the turn of the seventeenth century, and it contained only three pieces of European metal (Birch and Williamson 2013; Manning et al. 2018), in contrast to sites now known to be contemporaneous—such as at Factory Hollow, Pompey Center, Skandatut, Warminster, and Ball—from which hundreds of metal and glass objects have been recovered. Mid-sixteenth-century sites in the Don Valley (Jarret-Lahmer and Keffer) have no trade goods at all, contrasting with contemporaneous sites such as Mackenzie-Woodbridge and Seed-Barker, which are located only 10 km to the west. These latter sites were occupied at the same time as the neighboring Damiani site, which was fully excavated and yet produced no European-manufactured objects.

The variable distribution of European trade goods in space and time highlights the flawed nature of artifact frequency seriation. For the majority of the 1500s, European goods were not evenly distributed across the region and therefore can no longer be used as "horizon" markers. Results suggest that there was not synchronous access to and/or adoption of European goods throughout the 1500s Northeast. This erases the idea that Indigenous peoples were passively accepting European goods, and it foregrounds Indigenous agency in trade-related decision-making processes. Although this complicates regional histories, it also arguably creates the space to ask questions that are more interesting. Perhaps the occupants of sites such as Jean-Baptiste Lainé, Jarrett-Lahmer, Keffer, and Damiani were intentionally choosing not to participate in the long-distance exchange networks operating at this time. Alternatively, perhaps they were being excluded from these networks for political or cultural reasons by virtue of who controlled those connections (as per Chapdelaine 2016). From the data presented, we can no longer safely assume that the timing of the introduction of European materials—and by proxy, the entry of Indigenous peoples into European politico-economic networks—was homogenous. We suggest that other factors relating to geography, political alignment, and/or Indigenous agency influenced the timing and tempo of those processes.

Conclusions

Past formulations of Iroquoian culture-history were based on imprecise—and in some cases, inaccurate—time frames that resulted in interpretations of processes of coalescence, conflict, and the introduction of European goods that flattened out variability in how these processes were actually enacted "on the ground." This is especially true in the context of traditional versus new understandings of early trade-good chronologies among ancestral Wendat peoples and assumptions about the timing and directionality of conflict. The effect of relying on such imprecise formulations is that history becomes presented as something that happens to people, as opposed to something that people actively produce as agents in their time.

Enhanced chronological resolution permits us to understand the past in a way that privileges relational histories (sensu Robb and Pauketat 2013). It forces us to acknowledge persons and communities as active decision makers, bound up in social and political networks, with specific social, geographic, and ecological contexts influencing their actions and reactions. These data make it clear that to say "the Wendat or Haudenosaunee did X or Y" is erroneous. There were more complicated processes playing out within local communities that were not a microcosm of some greater cultural phase, but rather speak to distinct actions and responses to local contingencies and dispositions. More work remains to flesh out how this revised chronology will allow us to reposition communities in the social contexts that led to the development of tribal nations and confederacies in northeastern North America.

In redating the sites and sequences presented here, it was not our intent to simply reframe the culture-historical building blocks of northeastern archaeology—instead, we have sought to eliminate them. In this way, radiocarbon-based site-sequence chronologies allow us to appreciate the texture of local and regional histories. Rather than presenting a definitive revision, however, this work should be understood as a first step and call for further action (sensu Whittle 2018:248). It is our hope that the methods and results presented here will be met with additional efforts toward chronology building in eastern North America.

Supplemental Material. For supplemental material accompanying this article, visit https://doi.org/10.1017/aaq.2020.73.

Supplemental Figure 1. A. The OxCal LnN(ln(20),ln(2)) prior probability distribution for site Phase duration. B. The Middle Humber model run without Interval constraints on the site Phase durations showing the (much longer) Interval estimates that result. C. The Interval estimates for the Middle Humber sites with the model using the LnN(ln(20),ln(2)) prior for each site Phase duration-compared to those from B.

Supplemental Figure 2. A. Humber River Sequence plot and B. Date estimates with previous age-estimate indicated.

Supplemental Figure 3. A. Don Valley Sequence plot and B. Date estimates with previous age-estimate indicated by red line.

Supplemental Figure 4. A. Trent Valley Sequence plot and B. Date estimates with previous age-estimate indicated by red line.

Supplemental Fig 5. A. Seneca Sequence plot and B. Date estimates with previous age-estimate indicated by red line.

Supplemental Fig 6. A. Alhart site Phase plot and B. Date estimate.

Supplemental Figure 7. A. Onondaga Sequence plot and B. Date estimates with previous age-estimate indicated by dashed red line.

Supplemental Figure 8. Hope site modelled in isolation. A. with no site Phase duration constraint. B with the site Phase duration constraints in the Supplemental Table 4 model.

Supplemental Figure 9. Intervals calculated from the models in Supplemental Figure 8. A. The Hope site modelled in isolation with no site Phase duration constraints. B. The

Hope site modelled in isolation but including the site Phase constraints in Supplemental Table 4. C. The results of the Difference query applied to the period between the start and end Boundaries for the overall Hope site with a N(20,10) prior.

Supplemental Figure 10. Re-run of the Seneca model (Supplemental Table 6) without the assumed site relationships used there-i.e. all sites treated as independent.

Supplemental Figure 11. The effect of incorporating prior expert knowledge for the Seneca model. A. Site Date estimates for the Seneca model from Supplemental Figure 10 with no prior expert knowledge. B. Site Date estimates for the Seneca model if we do incorporate prior expert knowledge about site relationships.

Supplemental Figure 12. Comparison of the 34 instances where the identical sample was split between the University of Georgia (UGAMS) and the Groningen (GrM) radiocarbon laboratories.

Supplemental Table 1. All 184 Radiocarbon Samples and Conventional Radiocarbon Ages (CRA) used in this study.

Supplemental Table 2. Descriptive information for all sites dated in this study.

Supplemental Table 3. OxCal runfiles for Middle and then Upper Humber Valley sequences.

Supplemental Table 4. OxCal runfile for Don Valley sequence.

Supplemental Table 5. OxCal runfile for Trent Valley sequence.

Supplemental Table 6. OxCal runfile for Seneca sequence.

Supplemental Table 7. OxCal runfile for the Alhart site.

Supplemental Table 8. OxCal runfile for the Onondaga sequence.

Supplemental Table 9. Order analysis from the Don Valley model for the precoalescent site Phase.

Supplemental Table 10. Comparison of the dating ranges for the Sopher, Ball and Warminster sites from the Trent model depending on whether or not an approximate contiguous order of Ball then Warminster is used.

Supplemental Table 11. Comparison of Date estimate results for the Humber model using no prior, versus several different priors.

Supplemental Table 12. Comparison of date ranges for the Hope site considering three different prior assumptions for the overall duration of the site versus no prior assumptions for any of the site Phase durations in the Don Valley model.

Supplemental Table 13. The start and end Boundaries calculated for each of the sites from the modelled site sequences.

Supplemental Table 14. Comparison of the Date estimates for the Benson, Sopher, Ball and Warminster sites from the models in this paper versus those from the Manning et al. (2019) paper re-run with IntCal20.

Supplemental Table 15. The results from the model for the Onondaga Sequence in Table 2 and Supplemental Tables 13 run, as in Supplemental Table, and applying the OxCal outlier models, compared to running the same model with the 4 outliers included but with the outlier models applied.

Supplemental Table 16. The results from the model for the Onondaga Sequence in Table 2 and Supplemental Tables 13 and 15 run, as in Supplemental Table 8, applying the OxCal outlier models, are compared to running an example of the same model minus the same four outliers but with no outlier models then applied.

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