

Radiocarbon Dating the Iroquoian Occupation of Northern New York

Timothy J. Abel , Jessica L. Vavrsek, and John P. Hart 

The results of Bayesian analysis using 43 new high-precision AMS radiocarbon dates on maize, faunal remains, and ceramic residues from 18 precontact Iroquoian village sites in Northern New York are presented. Once thought to span AD 1350–1500, the period of occupation suggested by the modeling is approximately AD 1450–1510. This late placement now makes clear that Iroquoians arrived in the region approximately 100 years later than previously thought. This result halves the time in which population growth and significant changes in settlement occurred. The new chronology allows us to better match these events within a broader Northeast temporal framework.

Keywords: radiocarbon dating, Late Woodland archaeology, Northeastern North American archaeology, Iroquoian archaeology

Nous présentons les résultats d'une analyse bayésienne de 43 nouvelles datations radiocarbones de haute précision effectuées sur du maïs, des restes fauniques et des résidus carbonisés adhérant à des tessons de poterie. Ces datations proviennent de 18 sites villageois iroquoiens situés dans le nord de l'État de New York. Ces sites étaient présumés dater de la période allant de 1350–1500 de notre ère, mais la modélisation suggère plutôt une période d'occupation entre 1450–1510. Ces datations tardives confirment que les Iroquoiens sont arrivés dans la région en question cent ans plus tard que proposé auparavant par les archéologues. Ce résultat réduit de la moitié le temps que nous pouvons allouer à des processus comme l'augmentation démographique ou les changements dans le schème d'établissement. La nouvelle chronologie nous permet ainsi de mieux harmoniser ces événements dans le contexte plus large de la chronologie du Nord-Est.

Mots clés: datation au radiocarbonate, archéologie du Sylvicole supérieur, archéologie du Nord-Est de l'Amérique du Nord, archéologie iroquoise

In the fifteenth and sixteenth centuries AD, Northern New York south and east of the St. Lawrence River headwaters was home to six clusters of Iroquoian village and related settlement sites (Figure 1). This concentration of sites has been variously recognized by the terms St. Lawrence Iroquoians (Pendegast 1991, 1993a; Pratt 1991; Tuck 1971), Jefferson County Iroquoians (Engelbrecht et al. 1990), or Northern New York Iroquoians (Abel 2001). Who these people were, where they originated,

and where they went are topics that have perplexed archaeologists for over 150 years. For much of that time, these sites were known only through a handful of excavations and site reports. Only a few components in the region had been radiocarbon dated (Pendegast 1993b, 1996). The bulk of our knowledge, by far, came from scattered museum collections made by early antiquarians and collectors.

Over the last 30 years, the Iroquoian occupations of Northern New York have received a

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Figure 1. Map with the locations of Northern New York geographical site clusters and sites from which radiocarbon dates were obtained for this study.

renewed research focus. Reanalyses of older data (Engelbrecht 1995, 2004; Engelbrecht et al. 1990), in conjunction with the publication of new excavations and analyses (Abel 2001, 2015, 2016; Baron et al. 2016; Dermarkar et al. 2016; Engelbrecht and Jamieson 2016a, 2016b; Hart et al. 2017; Hart, Winchell-Sweeney, and Birch 2019; Jones et al. 2018; Vavrsek 2010; Wonderley 2005), have greatly increased our understanding of this once-enigmatic region and period (Abel 2019a). As a result of this research, it is apparent that the region and its inhabitants played a far more integral role in the broader social, economic, and political fabric of greater Iroquoia than had been previously acknowledged. Their dispersal in the early sixteenth century AD may have played a role in the development of the Haudenosaunee (Iroquois) and Wendat (Huron) confederacies (Abel 2001; Engelbrecht 1995; Hart, Winchell-Sweeney, and Birch 2019).

A paucity of high-precision radiocarbon dates has prevented a firm chronological understanding of this region's Iroquoian occupations. Inter-regional seriations of pottery have suggested an occupation span of AD 1350–1520 (Abel 2001; Engelbrecht 1995). Here we use a large series of recently obtained, high-precision accelerator mass spectrometry (AMS) radiocarbon dates to

establish a refined chronological framework for the occupation. We do this through Bayesian modeling of 43 radiocarbon dates from 18 sites. The resulting models shorten the occupational span and place the start of the occupation approximately 100 years later than earlier seriation-based estimates.

Iroquoian Settlements in Northern New York

There are more than 65 known Iroquoian village and related sites in Jefferson and St. Lawrence Counties, New York. Six site clusters have been identified in the region, including Sandy Creek (aka Ellisburg), Dry Hill, Rutland Hollow (aka Rutland Hill), Pine Plains, Clayton, and Black Lake (Abel 2002; Engelbrecht 1995; Pendergast 1993a; Figure 1). There are other likely village sites scattered between Black Lake and St. Regis (Abel 2019a), but their relationship to the identified clusters is uncertain given that no artifact collections exist. The clusters are generally interpreted to represent sequential community relocations through time, although the relationship and boundaries between the clusters are in some cases uncertain. Until recently, the sequences of sites in each cluster has been estimated based on ceramic attribute frequency seriation.

The Iroquoians of Northern New York shared many traits with neighboring Iroquoian communities across Ontario, Quebec, and New York. They lived in palisaded villages characterized by multifamily longhouses, which averaged approximately 7 m wide and up to 30 m long (Louis Berger Associates 1994). Each village is thought to have contained three to five longhouses, housing an estimated 150 to 250 people, although some villages likely contained upward of a dozen or more longhouses. Subsistence studies document that these villages were supported by mixed economies based on agriculture, which were heavily supplemented by hunting, gathering, and fishing. Floral assemblages document the cultivation of maize, beans, squash, sunflower, and tobacco. Many uncultivated species, including bramble, strawberry, Lamb's quarter, sumac, and St. John's wort were also harvested (Fecteau 2013). Faunal assemblages are dominated by deer, but numerous species of mammals, fish, and reptiles are also represented (Abel 2001; Cottrell 1979; Vavrsek 2010).

The ceramic assemblage is dominated by large, globular, grit-tempered jars with high, flaring, collared, and castellated rims. Decoration is mostly confined to the collar, consisting of alternating parallel obliques, and verticals executed in either dentate stamping or incising. Annular punctates, some forming effigy faces, often adorn the castellations. The collar base is often underlined with one or several horizontal lines, over which large tool impressions are executed at the collar base. The lips are often decorated with interior and exterior ticks or punctates (Engelbrecht 1995). Also prominent is a ceramic pipe assemblage consisting of elbow forms with elaborate collared, ring, or effigy bowls (Wonderley 2005). The lithic assemblage is dominated mostly by expedient flakes and ground stone tools. There are few chipped stone tools (Engelbrecht and Jamieson 2016a, 2016b). The lack of a stone tool assemblage seems mitigated by a rich bone assemblage made up of projectile points, awls, drills, punches, rasps, combs, and needles (Abel 2001, 2002; Gates St-Pierre 2001, 2010, 2015; Jamieson 2016; Louis Berger Associates 1994; Vavrsek 2010). Rolled native copper beads have been found at the Morse (A04520.000053; Dry Hill Cluster) and

Burrville (A04520.000016; Rutland Hollow Cluster) sites (Abel et al. 2019). No artifacts of verifiable European origin have been found in good contexts on any of the sites.

Perhaps the most intriguing aspect of all St. Lawrence Iroquoian research—and the one that has received the most attention over the last century—is the dispersal of populations from the St. Lawrence Valley between 1520 and 1603 (Jamieson 1990b; Pendergast 1993a). Warfare, climate change, and European contact have all been proposed as potential causes of their disappearance (Jamieson 1990a). Pendergast (1991, 1993a) showed that significant population relocations, especially in Jefferson County, had occurred well before European presence in the region. Research has since focused on aspects of demography, warfare, and climate change to explain the St. Lawrence Iroquoian diaspora (Abel 2002; Chapdelaine 2004; Engelbrecht 1995; Jamieson 1990a).

Building a Chronology for Northern New York Iroquoians

Across northeastern North America, late prehistoric chronology-building has, until recently, relied primarily on comparisons of material culture and culture historical systematics. In the early twentieth century, the Iroquoian occupations of Northern New York were thought to be ancestral to the historical Onondaga in the Finger Lakes area to the south. In fact, these occupations were often referred to as “Onondaga-Oneida” (Harrington 1922; Skinner 1921). This view influenced MacNeish's (1952) seriation of four Jefferson County sites into his Onondaga-Oneida ceramic sequence. Tuck's (1971) suggestion of an in situ origin for the Onondaga and Oneida in central New York challenged the idea of Jefferson County to Onondaga-Oneida continuity. Subsequently, the region was regarded as a branch of Iroquoian developments farther down the St. Lawrence Valley (Pendergast 1991, 1993a; Pratt 1991; Tuck 1971).

The practices of framing the Iroquoians of Northern New York as part of external cultural units was in large part due to a lack of published information and detailed analyses. Until recently, only a handful of sites had been excavated, and

even fewer of these had published reports (e.g., Harrington 1922; Sidler 1971). Few detailed assemblage analyses existed (MacNeish 1952; Sidler 1971). There were no syntheses of data that made an independent evaluation possible. The only accessible databases were the collections of professional and avocational archaeologists that resided in museums across the Northeast (Engelbrecht et al. 1990).

Engelbrecht (1995) developed a ceramic seriation based on 24 site assemblages within four proposed clusters based on comparisons to central New York Iroquoian ceramic sequences. A later expanded analysis by Abel (2001) compared Jefferson County ceramics to assemblages in St. Lawrence County, New York, as well as Prince Edward and Leeds and Grenville Counties, Ontario (Figure 1). Engelbrecht's ceramic seriation suggested that the Sandy Creek, Dry Hill, and Rutland Hollow Clusters represented nearly complete early-to-late village sequences. He suggested that the Clayton Cluster was a late village sequence. Abel's seriation suggested that the Black Lake Cluster represents early-sequence components. Engelbrecht did not assign dates to these sequences. Citing the lack of European trade goods, however, he suggested an early sixteenth-century AD end to the sequence. Abel (2001, 2002) suggested the sequence spanned from approximately AD 1350–1500 based on ceramic seriation. Throughout the interior Northeast, the earliest European trade goods are believed to be metal objects present on sites dating from the 1520s (Birch and Williamson 2013; Bradley 1987; Noble 1971; Williamson et al. 2016). However, this date has been recently challenged based on AMS redating of some of those early contact-period sites (Manning et al. 2018).

The first conventional radiocarbon dates for the region were run on bulk charcoal samples from the Potocki site (A04508.000093) in the Sandy Creek Cluster. Marian White obtained two dates that, when calibrated, span the fourteenth to fifteenth centuries AD (Supplemental Table 1; Pendergast 1993b, 1996). Much later, Louis Berger Associates (1994) obtained three bulk charcoal dates from the Camp Drum 1 site (A04511.000337) in the Rutland Hollow Cluster. One late fifteenth-century calibrated date was

obtained while the other two returned questionable seventeenth-century dates. Excavations at the Clayton Cluster St. Lawrence site (A04505.000223/A04547.000041) by the Thousand Islands Chapter of the New York State Archaeological Association resulted in the recovery of bulk maize that produced a late fifteenth-century calibrated date (Abel 2001).

These dates had little impact on chronological models of the region. As broader analyses have shown, the radiocarbon dates from the St. Lawrence Valley made little sense (Chapdelaine 2004; Pendergast 1993b, 1996; Timmins 1985). Some dates are clearly too old—perhaps attributable to the “old wood” problem. Others, such as two from Camp Drum 1, were clearly too recent—a problem attributed to association error. The large error terms prevalent in the conventional assays, which were more than 50 years in most cases, caused dates to overlap considerably. Multiple dates from single components can span more than a century, and they are of little help in determining when a site was occupied, much less in constructing chronologies.

AMS dating requires much smaller samples—ones that could be derived directly from carbonized cooking residues adhering to pottery sherds, small carbonized twigs or outer rings, or single seeds, for instance. This advancement potentially solved both the problems of old wood *and* association. Here, we use 43 high-precision radiocarbon dates on samples of maize, animal bone, and charred cooking residues from 18 Iroquoian sites in Northern New York (Table 1 and Supplemental Table 1). The dated sites are distributed in all six of the geographical clusters, and they include the three previously dated sites (Potocki, Camp Drum 1, and St. Lawrence). The Dry Hill Cluster is the most completely represented, with six of the nine village components dated. The Black Lake Cluster is also well represented, with three of five components dated. For the remaining clusters, only one or two components in each could be dated. Based on ceramic seriation, the dated components span the regional Iroquoian period of occupation. The maize samples were derived from sealed feature and midden contexts. Animal bone and ceramic residue samples were derived from museum site collections, generally

Table 1. Summary of All Radiocarbon Dates Available from Northern New York Iroquoian Sites.

Site	Material	Lab No.	$\delta^{13}\text{C}$	^{14}C Age (BP)	Cal. 2 σ (AD) (IntCal13)	Used in Modeling?	Reference
Sandy Creek Cluster							
Potocki	bulk charcoal	GX-2213	not reported	475 ± 95	1298–1371 (.18) 1378–1637 (.82)	No	Pendergast 1993b:4
Potocki	bulk charcoal	GX-2214	not reported	390 ± 95	1318–1351 (.02) 1390–1674 (.96) 1778–1799 (.02) 1942–1949 (.00)	No	Pendergast 1993b:4
Potocki	maize kernel	UGAMS-30327	-9.3	360 ± 25	1452–1527 (.50) 1553–1633 (.50)	Yes	This study
Potocki	maize kernel	UGAMS-30326	-8.7	310 ± 25	1491–1602 (.77) 1614–1647 (.23)	Yes	This study
Potocki	maize kernel	UCIAMS-205969	-9.6	370 ± 15	1452–1521 (.70) 1577–1583 (.01) 1591–1620 (.29)	Yes	This study
Potocki	maize kernel	UCIAMS-205970	-9.3	365 ± 15	1455–1521 (.65) 1575–1585 (.03) 1590–1623 (.32)	Yes	This study
Durfee	maize kernel	UGAMS-31485	-10.15	315 ± 20	1494–1509 (.04) 1511–1601 (.74) 1616–1644 (.21)	Yes	This study
Durfee	maize kernel	UGAMS-31486	-10.11	335 ± 20	1484–1637 (1)	Yes	This study
Durfee	maize kernel	UCIAMS-205978	-9	345 ± 15	1472–1527 (.40) 1554–1633 (.60)	Yes	This study
Durfee	unarticulated dog bone fragment	UCIAMS-199804	-9.7	460 ± 15	1426–1449 (1)	No	This study
Dry Hill Cluster							
Goodenough	unarticulated deer longbone fragment	UCIAMS-204719	-23.2	410 ± 25	1436–1512 (.93) 1601–1616 (.07)	Yes	This study
Morse	unarticulated dog bone fragment	UCIAMS-199803	-12.1	510 ± 20	1406–1439 (1)	No	This study
Morse	unarticulated deer bone fragment	UCIAMS-199806	-22.3	410 ± 15	1442–1483 (1)	Yes	This study
Morse	unarticulated deer skull bone fragment	UCIAMS-204718	-21	420 ± 25	1430–1495 (.96) 1602–1614 (.04)	Yes	This study
Morse	maize kernel	UCIAMS-205977	-8.8	345 ± 20	1469–1529 (.39) 1543–1634 (.61)	Yes	This study
Morse	maize kernel	UGAMS-37383	-10.24	315 ± 20	1494–1509 (.04) 1511–1601 (.74) 1616–1644 (.21)	Yes	This study
Carlos	maize kernel	UGAMS-37382	-9.06	365 ± 20	1453–1523 (.6) 1559–1563 (0) 1570–1631 (.39)	Yes	This study
Heath	maize kernel	UGAMS-34187	-10.14	340 ± 20	1474–1531 (.35) 1538–1635 (.65)	Yes	This study
Heath	maize kernel	UGAMS-34188	-10.13	320 ± 20	1492–1602 (.79) 1614–1643 (.21)	Yes	This study
Heath	maize kernel	UCIAMS-205979	-9.7	365 ± 15	1455–1521 (.65) 1575–1585 (.03) 1590–1623 (.32)	Yes	This study
Talcott Falls	maize kernel	UGAMS-34445	-8.83	320 ± 20	1492–1602 (.79) 1614–1643 (.21)	Yes	This study
Talcott Falls	maize kernel	UGAMS-34446	-9.55	315 ± 20	1494–1509 (.04) 1511–1601 (.74) 1616–1644 (.21)	Yes	This study
Talcott Falls	maize kernel	UCIAMS-207138	-8.6	415 ± 15	1440–1479 (1)	Yes	This study
Talcott Falls	maize kernel	UCIAMS-205976		345 ± 50	1453–1643 (1)	Yes	This study
Whitford	maize kernel	UGAMS-30328	-9.3	310 ± 25	1491–1602 (.77) 1614–1647 (.23)	Yes	This study

Whitford	maize kernel	UGAMS-30931	-9.55	310 ± 20	1496–1506 (.03)	1512–1601 (.74)	1616–1646 (.23)	Yes	This study
Whitford	maize kernel	UCIAMS-205972	-8.6	335 ± 20	1484–1637 (1)			Yes	This study
Whitford	maize kernel	UCIAMS-205973	-8.8	355 ± 20	1459–1526 (.49)		1555–1632 (.51)	Yes	This study
Whitford	charcoal	UGAMS-30329	-27.5	modern	modern			No	This study
Rutland Hollow Cluster									
Durham	maize kernel	UGAMS-30325	-8.7	350 ± 25	1460–1529 (.44)		1541–1635 (.56)	Yes	This study
Durham	maize kernel	UGAMS-30324	-9.9	345 ± 25	1467–1532 (.4)		1537–1636 (.60)	Yes	This study
Durham	maize kernel	UCIAMS-205971	-9.8	380 ± 15	1449–1515 (.81)		1598–1617 (.19)	Yes	This study
Stewart	charred cooking residue	UGAMS-37384	-17.09	500 ± 25	1406–1444 (1)			Yes	This study
Pine Plains Cluster									
Camp Drum 1	bulk charcoal	not reported	not reported	370 ± 60	1440–1643 (1)			No	LBA 1994:67
Camp Drum 1	bulk charcoal	not reported	not reported	170 ± 80	1524–1558 (.03)		1631–1949 (.97)	No	LBA 1994:67
Camp Drum 1	bulk charcoal	not reported	not reported	210 ± 60	1521–1575 (.07)		1585–1590 (.0)	No	LBA 1994:67
					1907–1949 (.13)				
Camp Drum 1	maize kernel	UGAMS-30323	-10.13	380 ± 25	1446–1523 (.70)		1572–1630 (.30)	Yes	This study
Camp Drum 1	maize kernel	UGAMS-30322	-9.3	350 ± 25	1460–1529 (.44)		1541–1635 (.56)	Yes	This study
Sanford Corners	maize kernel	UGAMS-26745	-8.7	390 ± 20	1445–1516 (.85)		1596–1617 (.15)	Yes	This study
Sanford Corners	maize kernel	UGAMS-26744	-8.7	360 ± 20	1456–1524 (.54)		1558–1631 (.46)	Yes	This study
Sanford Corners	maize kernel	UCIAMS-205974	-9.7	410 ± 20	1438–1493 (.97)		1603–1611 (.03)	Yes	This study
Sanford Corners	maize kernel	UCIAMS-205975	-9.4	360 ± 15	1459–1523 (.58)		1572–1630 (.42)	Yes	This study
No Cluster									
Point Salubrious	unarticulated deer bone fragment	UCIAMS-199805	-22.3	405 ± 15	1443–1488 (.99)			Yes	This study
Point Salubrious	unarticulated dog bone fragment	UCIAMS-199807	-14.7	515 ± 15	1408–1434 (1)			No	This study
Frank	unarticulated dog bone fragment	UCIAMS-199798	-14.3	535 ± 20	1326–1343 (.10)		1394–1433 (.90)	No	This study
Frank	unarticulated dog bone fragment	UCIAMS-199801	-13.2	580 ± 15	1314–1357 (.68)		1388–1409 (.32)	No	This study
Frank	unarticulated deer bone fragment	UCIAMS-199802	.22.9	410 ± 15	1442–1483 (1)			Yes	This study
Clayton Cluster									
St. Lawrence	bulk maize	Beta-148524	-9.8	400 ± 50	1429–1529 (.63)		1541–1635 (.37)	Yes	Abel 2001:70
St. Lawrence	maize kernel	UGAMS-26743	-8.9	400 ± 20	1442–1500 (.90)		1504–1511 (.02)	Yes	This study
St. Lawrence	maize kernel	UGAMS-26742	-9.9	385 ± 20	1445–1520 (.81)		1592–1619 (.19)	Yes	This study

Table 1. Continued.

Site	Material	Lab No.	$\delta^{13}\text{C}$	^{14}C Age (BP)	Cal. 2 σ (AD) (IntCal13)	Used in Modeling?	Reference
St. Lawrence	unarticulated deer humerus fragment	UCIAMS-204714	-22.9	485 ± 25	1412–1446 (1)	Yes	This study
St. Lawrence	unarticulated dog bone radius	UCIAMS-204715	-12.1	610 ± 25	1297–1374 (.77) 1376–1401 (.23)	No	This study
St. Lawrence	unarticulated deer longbone fragment	UCIAMS-204716	-21.5	155 ± 25	1666–1700 (.17) 1701–1706 (.004) 1719–1784 (.39) 1795–1819 (.11) 1832–1882 (.13) 1914–1949 (.19)	No	This study
St. Lawrence	unarticulated dog ulna fragment	UCIAMS-204717	-14.5	705 ± 25	1263–1301 (.92) 1368–1381 (.08)	No	This study
Black Lake Cluster							
Pine Hill	unarticulated dog ulna fragment	UCIAMS-204721	-12.6	550 ± 25	1317–1354 (.38) 1389–1429 (.62)	No	This study
Pine Hill	unarticulated dog bone fragment	UCIAMS-199800	-10.7	490 ± 15	1416–1441 (1)	No	This study
Pine Hill	maize kernel	UGAMS-37380	-9.17	355 ± 20	1459–1526 (.49) 1555–1632 (.51)	Yes	This study
Pine Hill	maize kernel	UGAMS-37381	-8.96	390 ± 20	1445–1516 (.85) 1596–1617 (.15)	Yes	This study
Washburn	unarticulated dog bone fragment	UCIAMS-199799	-11.5	525 ± 15	1403–1432 (1)	No	This study
Washburn	unarticulated deer longbone fragment	UCIAMS-204722	-22	415 ± 25	1433–1499 (.93) 1505–1511 (.01) 1601–1616 (.06)	Yes	This study
Devendorf	unarticulated deer longbone fragment	UCIAMS-204720	-22.8	445 ± 25	1421–1471 (1)	Yes	This study

with only site-level provenance. Details for all samples, including those not used in the modeling, are presented in Supplemental Table 1.

Methods

Samples were assayed at the University of Georgia Center for Applied Isotope Studies (CAIS) or the W. M. Keck Carbon Cycle Accelerator Mass Spectrometry Laboratory of the University of California, Irvine (KCCAMS). All bone samples were assayed at KCCAMS, where they were decalcified in 0.5N HCl, gelatinized at 60°C and pH 2, and ultrafiltered to select a high molecular weight fraction (>30kDa; Beaumont et al. 2010). $\delta^{15}\text{N}$ was measured to a precision of <0.2‰ and $\delta^{13}\text{C}$ < 0.1‰ on ultrafiltered collagen aliquots at KCCAMS. Maize samples were subjected to standard acid-base-acid pretreatments prior to combustion at both facilities. Pretreated maize sample $\delta^{13}\text{C}$ values were measured at KCCAMS and CAIS to a precision of <0.1‰ relative to standards traceable to PDB. All dates are corrected for isotopic fractionation and reported according to standards established by Stuiver and Polach (1977). More details on each facility's protocols can be found on their websites.

The Iroquoian occupation of the Northern New York is now represented by 61 radiocarbon assays (Table 1 and Supplemental Table 1). For modeling purposes, we eliminated the ages obtained on dog (*Canis lupus ssp. familiaris*) bone, which appear to have offsets relative to ages on maize (*Zea mays ssp. mays*) and/or white-tailed deer (*Odocoileus virginianus*) from the same sites (Hart, Feranec et al. 2019). We also eliminated an erroneous date on white-tailed deer bone from the St. Lawrence site (UCIAMS-204716), bulk sample dates as discussed above, and a modern determination from Whitford (UGAMS-30329). Also, one age from Talcott Falls (UCIAMS-205976) on a partial maize kernel was not included. This sample consisted mainly of humates, producing a very small post-pretreatment amount of carbon, resulting in a large error term. The remainder of the same maize kernel was submitted (UCIAMS-207138), which resulted in a larger amount of post-pretreatment carbon and an

error term in line with other ^{14}C ages obtained for this study.

We first ran a kernel density estimate (KDE) model with the 43 ^{14}C ages using the OxCal default parameters (N (0,1), U(0,1)). The KDE model provides an estimate of the density of dated and undated events when little or no prior quantitative knowledge is available (Bronk Ramsey 2017:1819). We then ran uniform Phase (Bronk Ramsey 2009) and trapezoidal Phase (Lee and Bronk Ramsey 2012) models with all ^{14}C ages assigned to a single Phase in each model. These models provide specific date estimates for the Northern New York occupation. Both models assume that the events (^{14}C ages) in a model are related. In this case, we assume that the ^{14}C ages are related because they reflect the occupation of a region over a specific span of time. The uniform Phase model assumes abrupt Phase boundaries. The trapezoidal model assumes gradual Start and End Boundaries (Lee and Bronk Ramsey 2012). These two models account for the possible range of occupational histories of Northern New York, support abrupt arrival and dispersal to gradual arrival and dispersal, and are therefore complementary.

Following Bronk Ramsey (2017), we use three graphical means of summarizing the uniform and trapezoidal Phase models: within Phase sum of marginal posteriors, within Phase undated event, and within Phase KDE plot. The Start and End Boundaries are used to provide date ranges for the occupation of Northern New York, as is the undated event obtained with the Date() command (Bronk Ramsey 2017:1812; Loftus et al. 2016; Manning et al. 2018). For the trapezoidal model, the reported Start and End Boundaries are t_a and t_b , respectively (Lee and Bronk Ramsey 2012:108–109). The CQL run file for each model is provided in Supplemental File 1.

Results

Details on all ^{14}C ages from Northern New York, including those not used in the models, are presented in Supplemental Table 1. All bone sample C/N ratios for these samples fall within acceptable ranges for radiocarbon dating and isotopic assay (Van Klinken 1999).

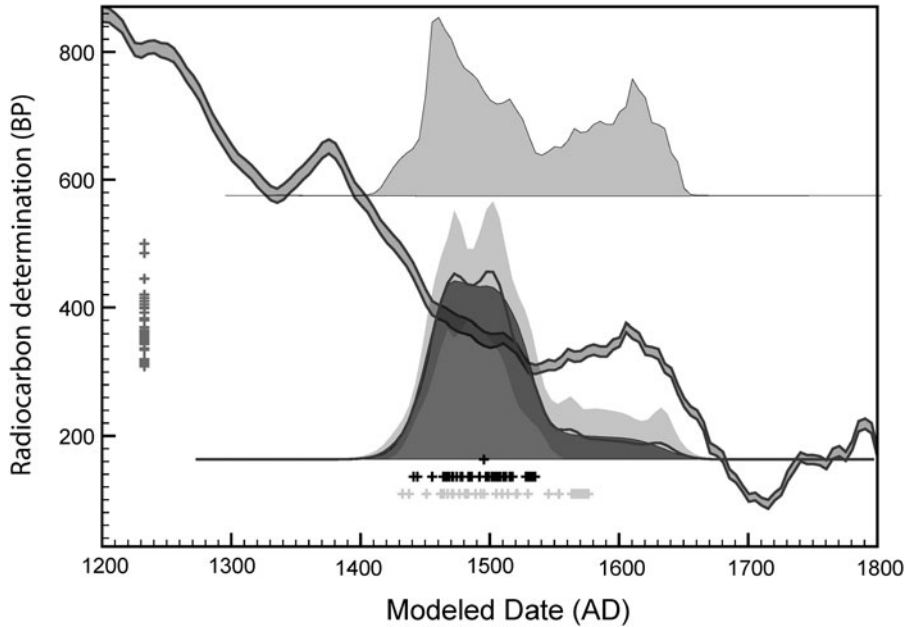


Figure 2. Kernel density estimate (KDE) model (below) and sum of events plots. The KDE distribution is in gray, whereas the black line and light gray shading are mean $\pm 1\sigma$ samples of the KDE distribution that were generated through the MCMC routine. Black crosses are the medians of the marginal probability distributions for each date, and the gray crosses are the medians of the unmodeled, calibrated probability distributions for each date. Note that the probability distribution of the sum of events follows the shape of the calibration curve.

The KDE model (Figure 2) has a span that occupies the fifteenth century and the first half of the sixteenth century AD, with a low probability tail that extends through the sixteenth and seventeenth centuries; 88% of the KDE model marginal posteriors probabilities fall before AD 1540 (Figure 3). It is conceivable that the low probability distribution after AD 1540 in part reflects occupations of the area that postdate AD 1540. However, given the lack of European artifacts on these sites and what is known about the seventeenth-century St. Lawrence valley from the ethnohistorical record (Chapdelaine 2016; Loewen 2016a, 2016b; Trigger 1985), we think it is most likely an artifact of the calibration curve plateau shown in Figure 2. Regardless, the model suggests that primary occupation of the area fell before AD 1540.

The uniform and trapezoidal Phase models are largely in accord (Table 2; Figure 3), although the trapezoidal model distributions extend earlier for the Start Boundary and later for the End Boundary, as expected. The 68.2% Start Boundary

distributions fall in the first half of the fifteenth century AD, and the 68.2% End Boundary distributions extend no later than AD 1550 (uniform) and 1566 (trapezoidal). The 95.4% End Boundary for the trapezoidal model extends to 1632 as a result of a long, low probability density tail (Figure 3), which we assume is an artifact of the calibration curve plateau, although here too, it may reflect later occupations beyond the primary span of occupations. The 68.2% probability undated event distributions span the second half of the fifteenth century AD and the second decade of the sixteenth century AD, while the 95.4% probability distributions range between AD 1427 and 1560 (uniform) or 1551 (trapezoidal). Occupational spans are at most 122 years at 68.2% probability and 182 years at the 95.4% probability. The consistency of results between the two models confirms a short occupation span for the region, which, if confined to the 68.2% probability undated event distributions following Manning and colleagues (2018), is approximately 70 years (Table 2).

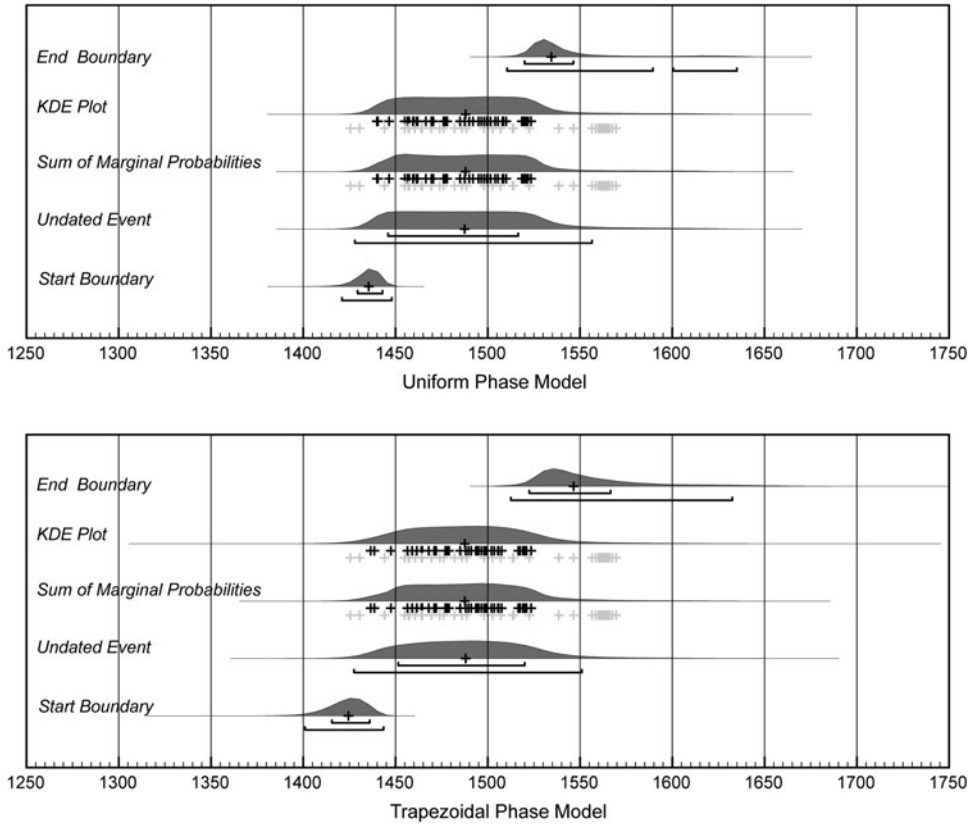


Figure 3. Within-phase summary plots for each model. Black crosses are the medians of the marginal probability distributions for each date, and the gray crosses are the medians of the unmodeled, calibrated probability distributions for each date.

Table 2. Results of Bayesian Modeling with 43 AMS Dates from Northern New York Iroquoian Sites.

Statistic	Uniform Phase		Trapezoidal Phase	
	68.2%	95.4%	68.2%	95.4%
Start Boundary (AD)	1429–1442	1420–1448	1415–1436	1401–1443
Undated Event (AD)	1445–1517	1427–1560	1451–1520	1427–1551
End Boundary (AD)	1520–1550	1512–1587 (87.3) 1603–1635 (8.1)	1522–1566	1512–1632
Span (years)	78–112	69–151 (87.3) 164–199 (8.1)	82–122	72–182
Agreement model		87.3		87.7
Agreement overall		79.8		78.2

Discussion

It is now apparent that the Iroquoian occupation of Northern New York had a fifteenth-century AD origin. There is currently no unequivocal evidence for a substantial ancestral population in the region (Abel 2019a). The latest well-established pre-Iroquoian cultural manifestation

probably dates before AD 1100 (Abel and Fuerst 1999). It is very likely, then, that the fifteenth-century Iroquoian settlements originated from outside the upper St. Lawrence region. Where those origins lie is an open question.

Earlier ceramic seriation estimates placed the Iroquoian occupation of Northern New York between AD 1350 and 1520—a

170-year span—with a starting date 50 years earlier than the earliest estimate in the two Bayesian models. The Bayesian models suggest spans between approximately 80 and 120 years at 68.2% probability. The 68.2% probability undated events are shorter by more than half of previous estimates, whereas the 95.4% probability undated events are 37 to 46 years shorter. During this time, more than 50 village sites were occupied in the six clusters. Although earlier estimates suggested that some clusters may be derivative from other clusters in the region (Engelbrecht 1995), results of the Bayesian modeling suggest that all of the clusters are roughly contemporaneous (Abel 2019b). To account for that number of villages in this short span, occupations must have been of relatively short duration, perhaps a decade or so. It is also possible that some clusters, such as the Sandy Creek and Dry Hill Clusters, had dual (primary and satellite) village settlement patterns (Abel 2019b).

Almost all these villages were recorded to have been enclosed by earthworks, and those that have been excavated have evidence of single or double palisades (Abel 2019a). Where these features have been recorded, village sizes show a wide size range of <1.0 to 3.2 ha. The two largest villages, Potocki and Morse, rival coalescent communities in neighboring Wendat and Haudenosaunee territories for their size (cf. Birch 2010, 2012; Engelbrecht 2003; Snow 1994). Community coalescence is a phenomenon associated with intensive agriculture, increased warfare, and political realignments throughout the Northeast (Birch 2010, 2012, 2013; Birch et al. 2016; Creese 2016).

The Bayesian models confirm earlier seriation estimates that the Northern New York Iroquoian occupation likely terminated in the first half of the sixteenth century AD. Where these populations dispersed has been a long-term topic of research (Abel 2001; Engelbrecht 1995; Pendergast 1993a). Current interpretations suggest that the dispersal was multidirectional and followed shifting political alliances (Abel 2001, 2002; Engelbrecht 1995, 2004). The directions of this dispersal, however, demand rethinking considering recent AMS dating (Abel 2019a).

Conclusions

Bayesian analysis of 43 recently obtained AMS dates have significantly revised the chronology of the Iroquoian occupation in Northern New York. The Bayesian models place this occupation between AD 1445 and 1517 (68.2% probability) or AD 1427 and 1560 (95.4% probability) for the uniform model and between AD 1451 and 1520 (68.2% probability) or AD 1427 and 1551 (95.4% probability) for the trapezoidal model using the undated event estimate following Manning and colleagues (2018). Although consistent with previous seriation-based estimates for the abandonment of the region, the revised chronology considerably shortens the previously accepted occupation period and minimally moves the beginning of the occupation forward in time 50 years. This will have significant implications for current interpretations of Northern New York Iroquoian origins, settlement growth, and community dispersal.

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Data Availability Statement. All data used in the analyses are provided within the text or supplemental files.

Supplemental Materials. For supplemental material accompanying this article, visit <https://doi.org/10.1017/aaq.2019.50>.

Supplemental Table 1. Data for All Radiocarbon Dates Available for Northern New York Sites.

Supplemental File 1. CQL Run File for Each Model.

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