Paleo Landscapes Defining Spatial, Temporal, and Environmental Context for Early Native American Sites Around Winona Lake

by Douglas S. Frink

Winona Lake, in Bristol, Vermont, is one of several extant freshwater ponds left behind after the draining of Glacial Lake Vermont, Fort Ann Stage (~14,000 calendar years before present (BP)). The environmental importance of such post glacial freshwater ponds to early Native Americans has been argued from the perspective of being a thermal refugia for plants, animals, and people (Nicholas 1988) during the colder climates of the Younger Dryas at the end of the Pleistocene. This argument assumes that people had moved into an area during this early period, and is supported by the apparent association of Paleo Indian Period sites to Champlain Sea shoreline features (Loring 1980). Melt water from thousands of glacial lakes worldwide resulted in the steady rise of sea levels relative to the land. By about 14,000 years ago, the rising sea levels filled the St. Laurence, Great Lakes, and Champlain Basins to form a large estuary known as the Champlain Sea. As a result of ongoing isostatic rebound of the land after the glaciers receded, the salt water embayment returned to a freshwater lake about 12,000 years ago.

Alternatively, post glacial ponds have been described as high-yield niches within a complex forest mosaic, not dissimilar from that exhibited throughout all periods of Native American culture (Frink and Hathaway 2003). This argument is based on the assumption that the Champlain Valley was not colonized until late in the Paleo Indian Period, after the Younger Dryas and after the draining of the Champlain Sea. Temporally diagnostic projectile points recovered from Paleo Indian Period sites in the Champlain Valley are consistent with later stages of the period as defined in various regional typologies (Spiess, et al. 1998). However, the range of variability allowed for in most typological classes provides room for different interpretations. As of the writing of this paper, only two Paleo Indian Period sites in Vermont have been empirically dated; VT-CH-679 at 10,182±305 (ACT #1710), and VT-CH-900 at 8,811±264 (ACT #5975) calendar years before present, both of which date to the early Holocene Period. While this lack of adequate temporal data leaves the question open, examination of Paleo Indian Period sites located above Champlain Sea shoreline features can contribute to the discourse.

A recent road cut enhancement along Monkton Ridge Road in Bristol (Plate 1) exposed a 3-meter deep soil profile, and provides an opportunity to examine the paleo-landscape and environment during this first period of occupation. The road cut is located adjacent to a USGS benchmark at 525 feet above mean sea level (msl), placing the soil profile between 525 and 535 feet (msl). Based on topographic maps, an elevation of roughly 520 feet (msl) would have represented the highest potential lake level for what we might term "Paleo-Lake Bristol" (Figure 1). Numerous Paleo Indian Period sites are known along the edges of present day Winona Lake, none of which has been systematically excavated or empirically dated. Since all of the identified early Native American sites along Winona Lake are at elevations below 520 feet (msl), the pedogenic history available from this soil profile sheds light on the paleo-landscape at the time before and during the occupation of these sites.

The exposed soil profile consists of an over-thickened plowzone overlying a well developed buried soil that formed within a paleo-dune. Another thin (cambric) paleosol that formed in water-deposited bedded fine sands and silts lies below the dune (Plate 2). OCR Carbon Dating analyses were performed on a column of samples from this profile to determine the age of the paleo-dune. The OCR (Oxidizable Carbon Ratio) procedure measures the degree of biodegradation in organic soil carbon within the dynamic open system evolving soil. Close interval sampling along a vertical soil column helps to define the related components of structural change in actively pedogenic soils as a system, and establishes temporal contexts for archaeological artifacts and associated features (Frink 1992, 1994, 1995, 2003). The maximum age of the soil forming on the dune is 11,271±338 calendar years old (ACT #6326), while the lower paleosol below the dune dates to before 12,215±366 years ago (ACT #6327) (Table 1, page 27). The existence of an active dune overlying littoral sediments suggests that dry, and perhaps cold, conditions existed in Vermont during this period.

A recent study of the style and deposition of humid-temperate alluvial fans in Vermont supports the hypothesized dry conditions at this time in history (Jennings, et al. 2003). Of the five trenched and dated fans sampled, three have basal (sub-fan) sediments that date back to this time period; Eden at 13,320±50, with a formerly pedogenic surface dating to 12,900 ±40, Bristol at 12,980±40, with a formerly pedogenic surface of the same age, and Bridgewater at 11,330, without evident surface pedogenic development (dates from this study are given as calibrated ^{14}C yr. BP)[1]. Fluvial sediments, marking the beginning of these fans, are deposited on top of the eroded paleosols (Jennings, et al. 2003),

1. Radiocarbon analysis conducted by the Center for Accelerator Mass Spectrometry, Lawrence Livermore Laboratory, and calibrations based on CALIB version 4.2.

Plate 1. *Road cut along Monkton Ridge Road near Winona Lake.*

suggesting that the actual age of initial fan development post dates the recorded ^{14}C ages of the two paleosols.

Evidence of a period of stability sufficient for soil development on the initial fan deposit survives only in the Eden fan deposits. This relic paleosol dates prior to 9,500 years ago. A second major event of fan building at both the Eden and Bristol fans occurs around 9,400 years ago. This second event is corroborated by an independent study at Ritterbush Pond, also in Eden, where a date of 9440 cal ^{14}C years BP[2] was obtained from lacustrine sediments marking a series of major flood events (Brown, et al. 2000).

Oxygen isotope ratios obtained from six Greenland Ice cores (Camp Century, Dye-3, GRIP, GISP2, Renland, and North GRIP) have been shown to serve as reliable proxies for temperatures in the Northern Hemisphere (Johnsen, et al. 2001). Based on annual cycles in calcium and ammonium ion records, an absolute date of 11,500 years BP is deduced for the climatic change from the colder Younger Dryas to the warmer and wetter Preboreal. This climatic change took place quickly over just one or two decades (Alley, et al. 1993; Dansgaard 1989; Taylor, et al. 1993).

Dune development at Winona Lake was active during the relatively cold and dry conditions of the Younger Dryas, suggesting a rather bleak, poorly vegetated environment adjacent to Paleo-Lake Bristol. The thin buried soil formed in the post-Glacial Lake Vermont littoral sediments indicates only a brief period of time existed between land emergence (draining of Glacial Lake Vermont, Fort Ann Stage and Paleo-Lake Bristol) at elevations of ~520 feet (present msl), and dune formation. Landscapes at elevations below 520 feet would have likely remained inundated prior to 12,000 years ago, and would not have been sufficiently dried out for plant and human habitation until sometime after 11,500 calendar years ago, when climatic conditions moderated to become similar to those experienced throughout the remaining Holocene Period.

The paleo-environmental and contextual data from Lake Winona adds to a growing body of evidence about the timing of first entry and colonization of the Champlain Valley of Vermont. All identified Paleo Indian Period sites to date, regardless of the nature of occupied landforms, appear to post-date the Younger Dryas Period. This data suggests that the Champlain Valley was settled later than coastal regions of New England, and supports the theory that Paleo Indian Period colonization followed a coastal route up and into the Maritime region where climatic condi-

2. No laboratory numbers or confidence intervals are provided.

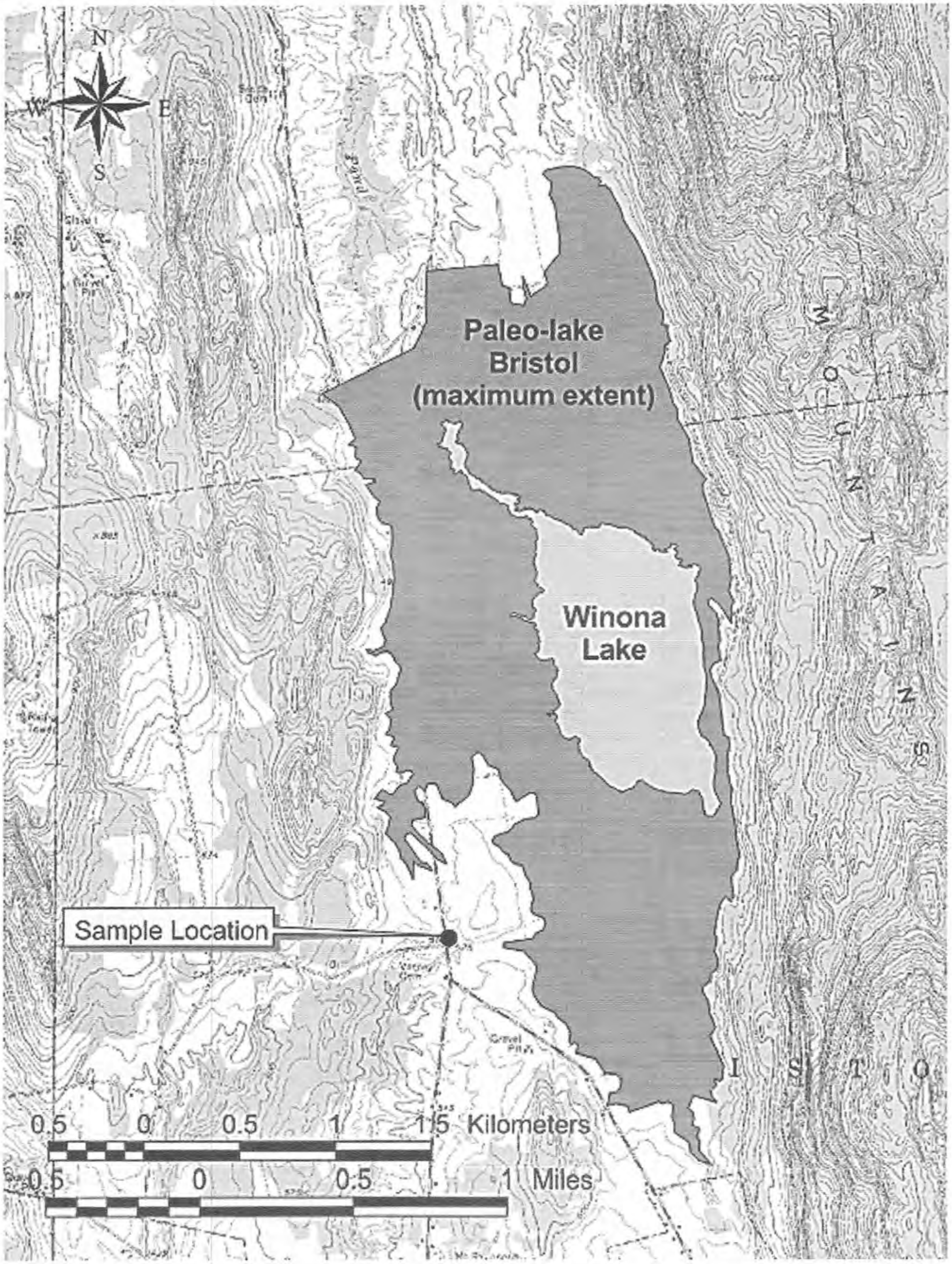

Figure 1. *Location of study area showing the extent of Paleo-Lake Bristol and present day Winona Lake.*

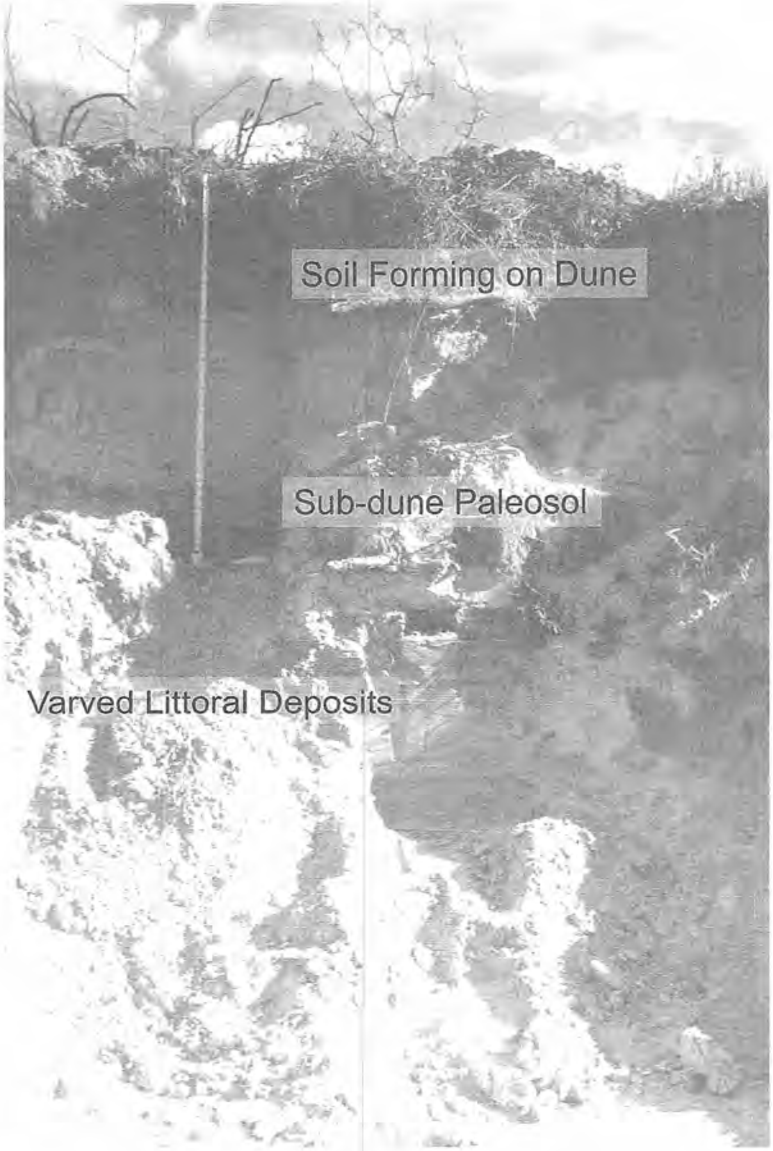

Plate 2. *Soil profile at Winona Lake.*

tions were likely modified by ocean currents during the Younger Dryas Period (Anderson and Gillam 2000). As the continental climate ameliorated during the early Holocene Period, people then moved up the St. Lawrence River Valley and from there down into the Champlain Valley and other inland reaches of New England and Quebec. This route of incursion into northern regions of the continent would be spatially and temporally independent of that evidenced in the mid continental, Great Lakes and Western New York regions (Ellis and Deller 1997; Tankersley 1998).

Additionally, this hypothesized settlement strategy implies that Paleo Indian Period people had an established and well developed broad spectrum procurement strategy that could best be implemented within temperate hardwood and mixed hardwoods and evergreen forest environments, but one that would have been marginal within the boreal forest environment. The growing number of very early, and perhaps even pre-Paleo Indian Period cultures, in the Mid Atlantic and Southeastern Regions of the United States (Adovasio, et al. 1998; Goodyear and Steffy 2003; McAvoy and McAvoy 1997) suggests that there would have been sufficient time for the development and subsequent dependence on such a procurement strategy. Although colonizing new areas, people of the Paleo Indian Period would have been moving into familiar environments, requiring few changes or adjustments to procurement strategies both during the initial period of colonization and the subsequent Early Archaic Period.

Table 1. OCR Data for Winona Lake road cut soil profile. Shaded data depict related pedogenic events.

Soil Depth	pH	% Organic Carbon (LOI)	Ocr Date	Very Coarse	Coarse	Medium	Fine	Very Fine	Coarse Silt	Fine Silt	Sample Id	% Oxidizable Carbon (WB)	OCR Ratio	Mn
5	6.2	4.002	202	4.140	2.377	2.983	8.027	14.395	26.233	41.846	6317	1.40	2.86	10.85
15	5.8	2.409	1105	6.812	2.750	2.661	6.511	16.148	25.892	39.227	6318	0.705	3.42	7.8
25	5.3	2.104	1997	6.666	2.630	2.377	6.246	14.844	31.806	35.431	6319	0.65	3.24	7.0
30	5.4	1.934	2511	7.762	2.303	2.428	6.070	16.162	32.370	32.905	6320	0.58	3.33	5.2
35	5.5	2.19	2817	10.096	3.042	2.633	6.529	13.158	26.288	38.252	6321	0.62	3.53	5.8
40	5.5	2.854	3191	7.768	3.180	2.634	6.778	14.706	24.816	40.119	6322	0.80	3.57	6.25
45	5.6	1.993	3796	4.792	1.845	1.626	4.435	12.578	40.010	34.715	6323	0.545	3.66	4.22
50	5.7	0.294	8377	.	.	.080	.623	18.941	55.826	24.530	6324	0.06	4.90	1.56
55	5.6	0.306	9573	.	.	.050	1.061	29.442	50.248	19.199	6325	0.09	3.40	1.39
60	5.7	0.341	11271	.	.	.080	3.573	42.113	41.215	13.018	6326	0.03	11.37	3.225
103	5.3	0.676	12215	.	.	.057	2.937	27.367	41.094	28.545	6327	0.18	3.76	6.3

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