EVOLUTION OF A LATE PREHISTORIC WINTER VILLAGE ON THE INTERIOR PLATEAU OF BRITISH COLUMBIA: GEOPHYSICAL INVESTIGATIONS, RADIOCARBON DATING, AND SPATIAL ANALYSIS OF THE BRIDGE RIVER SITE

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A common issue for archaeologists who study intermediate-scale societies is defining scale and complexity of occupations across entire villages or towns. This can be a major problem since an understanding of site-wide inter-household occupation patterns can be crucial for accurate reconstruction of village demographics and socio-economic organization. In this paper we present new research at the Bridge River site, a large complex hunter-gatherer village in British Columbia, designed to develop a site-wide history of household occupation patterns. We accomplish this through broad-scale geophysical investigations, test excavations and an extensive program of radiocarbon dating. Results of the study suggest that the village grew rapidly between ca. 1800 and 1250 cal. B.P. expanding from 7 to at least 29 simultaneously occupied houses. Variability in household spacing and size indicate that social organization may have grown increasingly complex parallel with rising numbers of households.

Una cuestión común para los arqueólogos que estudian las sociedades de escala intermedia es definir la escala y complejidad de las ocupaciones a través de pueblos y aldeas enteros. Esto puede ser un gran problema porque la comprensión de modelos de ocupación entre las casas y a través de todo el sitio puede ser esencial para una reconstrucción precisa de la demografía y la organización socioeconómica del pueblo. En este artículo presentamos investigaciones nuevas sobre el sitio Bridge River, una aldea grande de cazadores y recolectores en Columbia Británica. Es el propósito de este artículo proponer una historia de los modelos de ocupación de las casas en el sitio. Realizamos la producción de esta historia con varios medios incluyendo investigaciones geofísicas, excavaciones de prueba, y un programa extensivo de fechamiento por radiocarbon. Los resultados de las investigaciones sugieren que el pueblo creció rápidamente entre aproximadamente 1800 y 1250 años antes de presente y además que el número de casas ocupadas simultáneamente aumentó desde 7 hasta por lo menos 29 casas en aquel tiempo. La variabilidad en el espacio entre las casas y el tamaño de las casas puede indicar que la organización social se volvió más compleja al mismo tiempo que el número de casas aumentó.

The study of complex hunter-gatherers and other intermediate-scale societies has become a central topic to archaeologists interested in the evolution of socioeconomic complexity (Arnold 1996, 2001a; Fitzhugh 2003; Habu 2004; Hayden 1994; Prentiss and Kuijt 2004; Price and Feinman 1995; Sassaman 2004; Wiessner 2002). Explanations for emergent complexity, as marked by social status inequality for example, have varied widely. Some continue to assert the importance of demographic and ecological factors (Binford 2001; Fitzhugh 2003), while others emphasize resource conditions and individual agency (Arnold 1993; Hayden 1994, 1995).

Archaeologists, seeking to warrant and/or test hypotheses, look to the records of occupation at well-preserved villages that developed these complex socioeconomies. One very productive context has been the villages of the Mid-Fraser Canyon on the western interior Plateau of British Columbia (Hayden 1997, 2005; Hayden and Ryder 1991; Kuijt 2001; Kuijt and Prentiss 2004; Prentiss et al.

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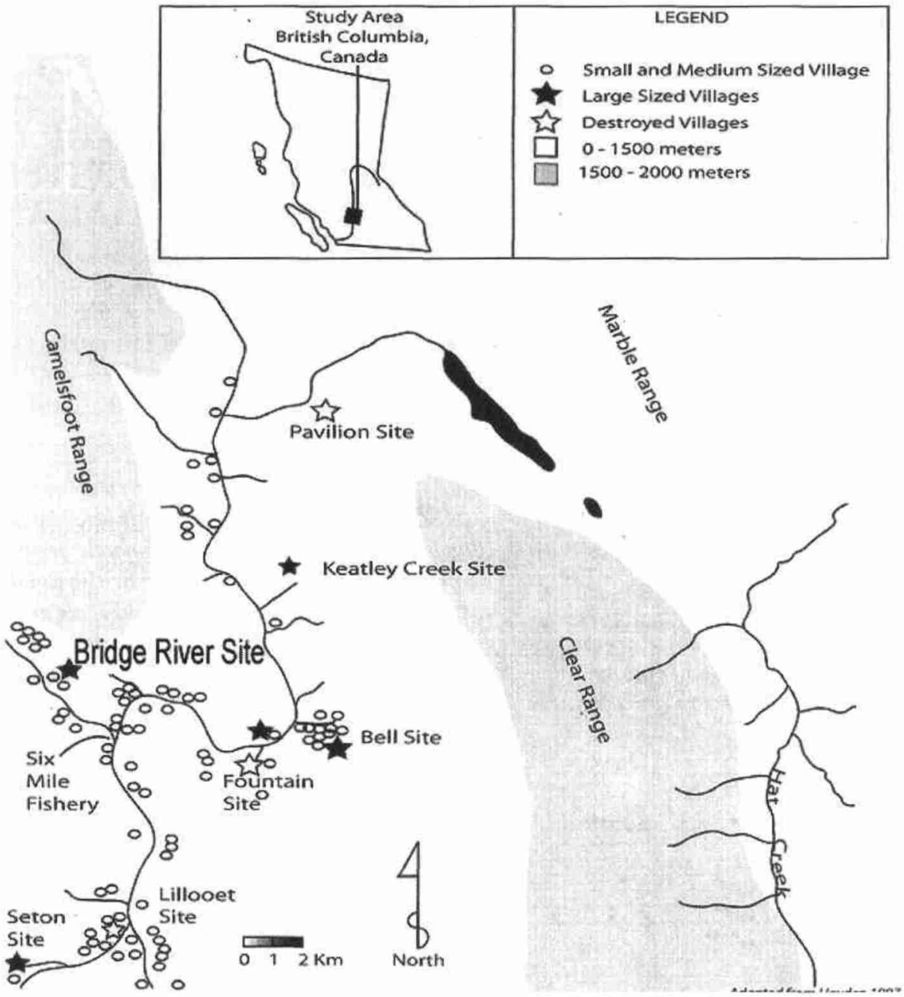

Figure 1. Bridge River site location with other nearby housepit villages and hamlets in the context of the Mid-Fraser Canyon area.

2003; Prentiss, Lenert, Foor, and Goodale 2005; Prentiss, Clarke, Markle, Bochart, Foss, and Mandelko 2005; Prentiss, Chatters, Lenert, Clarke, and C. O'Boyle 2005). This research is important because the mid-Fraser villages are large and contain exceptionally well-preserved histories of cultural changes and thus provide a rare opportunity to examine such processes as the emergence of inequality on a scale more fine grained than is normally possible elsewhere in the greater Pacific Northwest region. Unfortunately, researchers even in the Mid-Fraser context have been hampered by insufficient dating of houses in these villages such that it has been virtually impossible to clarify details of changes in demographics and village-scale residential patterns. This is a significant issue in many other regions as well where depictions of changing village size and interhouse spatial organization are critical to reconstructing elements of social and economic organization (e.g. Archer 2001; Arnold 2001b; Hockett 1998; Mason 1998; Smith 2003).

In this paper, we present a strategy for mapping and dating multiple houses in villages as a first (preliminary) stage in a long-term research program. Our study focuses on the Bridge River site (EeRl4), a large housepit village, located approximately 10 km west of the famous Keatley Creek village (Hayden 1997) (Figures 1 and 2). Our ultimate goal is to build a village occupational history so that we can examine the dating of emergence and abandonment, demographic changes, and assess spatial arrangements of housepits as initial indicators of potential social relationships between village households. We accomplish this through a program of extensive geophysical mapping, test excavations, stratigraphic analysis, and radiocarbon

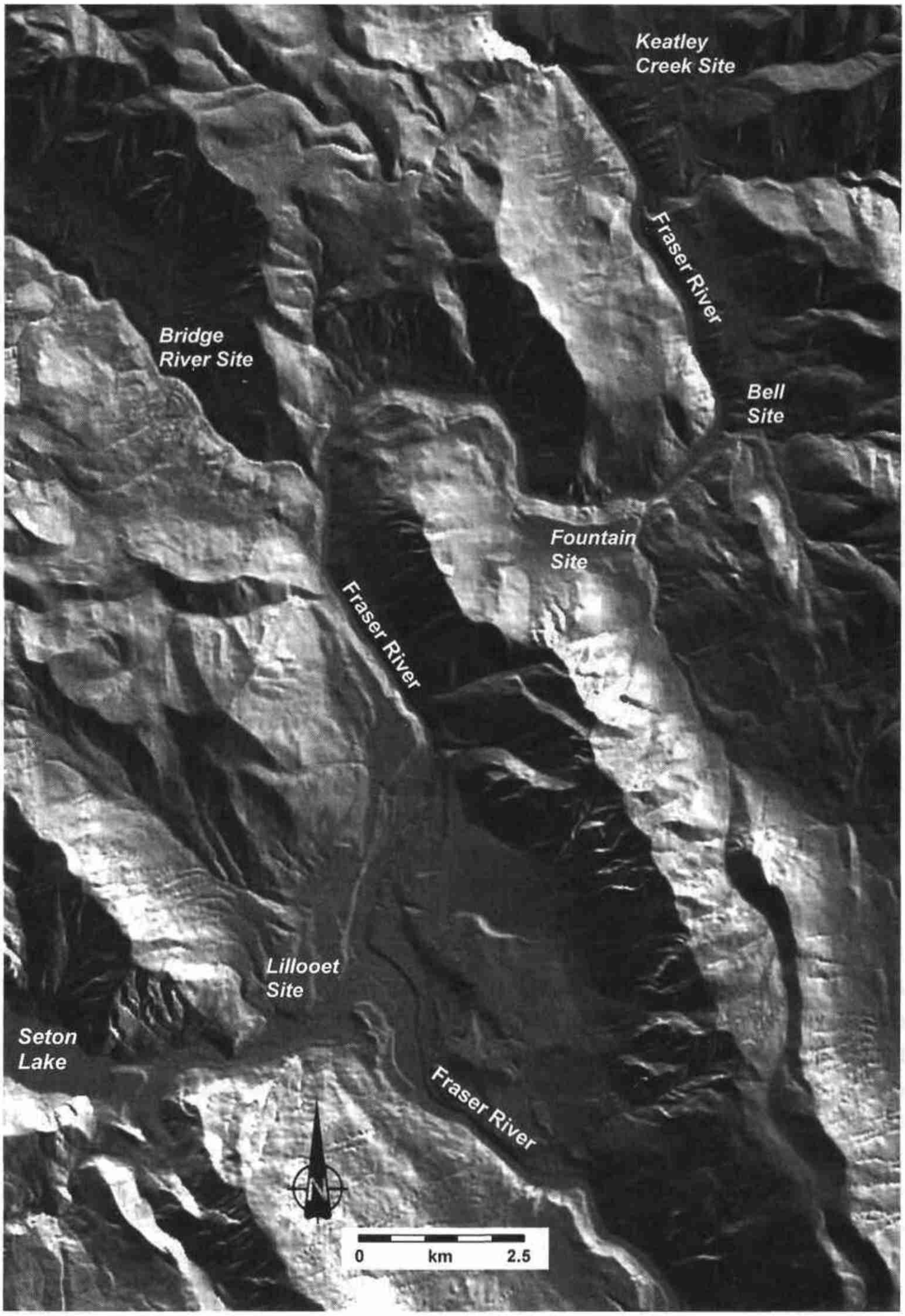

Figure 2. Aerial image of the Mid-Fraser Context illustrating extreme topography in the canyon.

dating that permits us to build maps showing variation in numbers and distributions of housepits across the village during four major periods of occupation. We measure the degree of potential social complexity using broad, site-wide indicators derived from housepit occupation frequencies, size differences, and spatial patterns.

Debating Mid-Fraser Archaeology

Archaeological research in the Mid-Fraser area began in the 1960s with Sanger's (1970) study of the Lochnore-Nesikep locality south of the town of Lillooet. Stryd (1973, 1974, 1980) subsequently tested and mapped many of the large villages of the Lillooet area. Intensive research into the origins of socioeconomic complexity began in 1986 with Hayden's (still ongoing) excavations at Keatley Creek. Recent work has been conducted by Prentiss and her colleagues at Keatley Creek (Prentiss et al. 2003, 2007) and Bridge River. One consequence of these studies has been the emergence of constructive debates over the timing and scale of village emergence, the histories of the villages, and processes of abandonment.

Hayden (1997, 2000; Hayden and Ryder 1991) argues that the large Mid-Fraser villages such as Bridge River and Keatley Creek may have emerged at least as early as ca. 2600 B.P. and persisted until ca. 1000 B.P. when a landslide dammed the Fraser River causing an economic disaster for indigenous groups. Most critically, Hayden (1997) proposes that a high degree of socioeconomic complexity was evident during this time span. As evidence, he cites the presence of very large housepits at Keatley Creek persisting alongside smaller, less-permanent structures, throughout the lifespan of the village (Hayden et al. 1996; see also Prentiss et al. 2003). Hayden and Ryder (1991) argue that size differences between large villages like Keatley Creek (assuming perhaps 50 simultaneously occupied houses) and smaller hamlets (no more than 5 simultaneously occupied houses) in the canyon could even imply a chiefdom-scale settlement hierarchy throughout much of this time. Hayden (1994, 1995, 1997, 1998) believes that these data indicate early emergence of a complex socioeconomic system featuring status inequality at Keatley Creek and likely other villages such as Bell and Bridge River that lasted for over 1,500 years. He suggests that the pattern may have come about through the actions of aspiring aggrandizers under optimal resource conditions of the peak Neoglacial period.

In contrast, Prentiss et al. (2003; Prentiss, Lenert, Foor, and Goodale 2005) suggest that the Keatley Creek village emerged much later (ca. 1600–1700 B.P.) and was abandoned slightly later (ca. 800-900 B.P.). They imply that while some degree of social differentiation may have existed throughout the lifespan of the core village at Keatley Creek, the pattern of peak complexity that probably included control of non-kin labor by hereditary elites (e.g., institutionalized inequality [Wiessner 2002]), likely did not occur until the final period of occupation at ca. 1200–800 cal. B.P. (Prentiss et al. 2007). This implies that the village may not have been characterized by its large size throughout its lifespan, perhaps emerging at a much smaller scale but eventually growing to its maximum size closer to its final occupation period.

Kuijt (2001) disputes the landslide hypothesis for Mid-Fraser village abandonments, pointing out weakness in dating and in the interpretations of sediments on some Mid-Fraser river terraces. Kuijt and Prentiss (2004) and Prentiss et al. (2007) suggest that the demise of large villages like Keatley Creek could have been due to a combination of regional ecological changes and, possibly, local resource depression in some key plant and animal species. One expectation of this hypothesis is that the villages were probably not abandoned in a single catastrophic event.

Housepit Archaeology and the Bridge River Site

The Bridge River site is one of several large housepit villages remaining in the Mid-Fraser Canyon area of south-central British Columbia. It is located several kilometers up the Bridge River valley from the Fraser Canyon and may have had some of the best access to the Mid-Fraser 6-Mile Rapids salmon fishery of all the villages in this region. This was important because some other key resources such as geophytes (roots) may not have been as accessible compared to other large villages such as Keatley Creek (Turner 1992). The site (Figures 3 and 4) was tested previously by Stryd (1974, 1980) and consists of 80 housepits and over 60 external pit features (EPFs), most of which appear to have functioned as fish and meat roasting ovens (Dietz 2004). The housepits of Bridge River have a narrower range of sizes than those of Keatley Creek (e.g., Hayden 1997) spanning approximately 10 to 18 m in diameter (rim crest to rim crest). But, similar to Keatley Creek, the Bridge River housepits are arranged in a tight core area with a few outlying houses. Very few housepits are overlapping implying the possibility that, at some point, many of the houses were simultaneously occupied (see also Hayden 1997). Our testing program has defined similar housepit strata to that found at Keatley Creek that is a consequence of repeated house construction, occupation, refurbishing, and eventual abandonment (e.g., Hayden 1997; Prentiss et al. 2003). Houses typically contain floor deposits con-

Figure 3. Aerial photograph of the Bridge River site (view looking approximately west across the site).

sisting of relatively compact, fine-grained silts imported to the site from elsewhere, covered by collapsed roof sediments that are much darker (charcoal staining), less compacted and often associated with burned roof beams. Floors also contain different kinds of hearths and pit features. Around the rim of each housepit is a thick midden consisting primarily of redeposited roof materials, but probably also consisting of various other dumped materials such as hearth clean-out. Surface and shallow subsurface sediments throughout the site core are most likely heavily anthropogenic in origin.

Geophysical reconnaissance has guided exploratory excavations to acquire samples for radiocarbon dating of individual houses and related development of a preliminary occupation history.

Geophysical Investigations

We initiated a multiphase geophysical investigation of the Bridge River site in June 2003 with site-wide reconnaissance to map known and previously unidentified cultural features and to guide subsequent archaeological sampling and interpretation (Cross 2004). Geophysical remote sensing techniques detect spatially patterned variability in soil physical properties that result either directly or indirectly from prehistoric cultural activities and are subsequently modulated by natural site formation processes. Soil material properties also reflect purely natural variability associated with past and present near-surface geological processes and can yield useful insight on prehistoric geomorphic context. Reviews of geophysical methodology, including specific reference to North American archaeology are provided by Weymouth (1986), Scollar, et al. (1990), Kvamme (2003), and Johnson (2006). Details regarding methods applied during 2003 and 2004 at the Bridge River site are outlined in Cross (2004, 2005).

At the outset of the 2003 field season, a 20-x-20-m reference grid was established relative to an assumed north-south (approximately 20° west of magnetic north) baseline, extending roughly through the midsection of the site. Subsequently, and prior to initiating geophysical surveys, the site was cleared of all substantial brush, deadfall, and

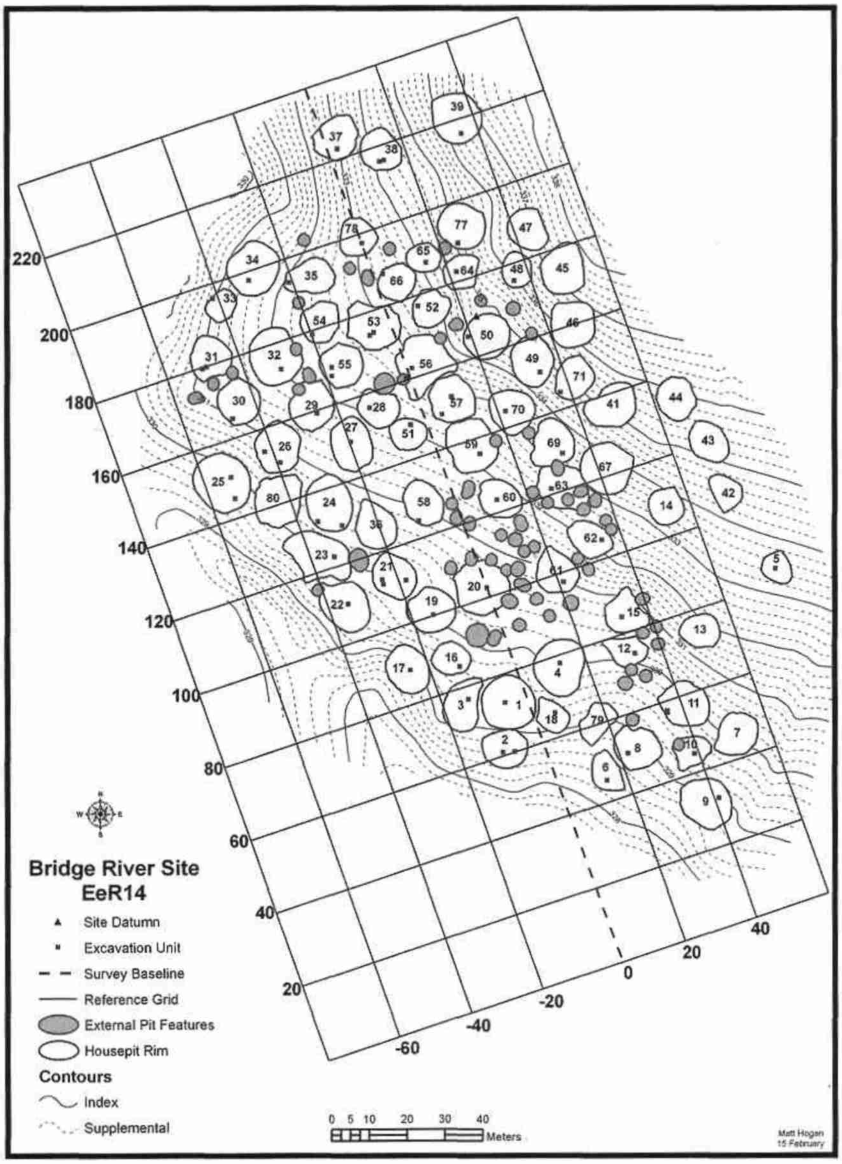

Figure 4. Simplified topographic plan of the Bridge River site with housepits, external pit features, reference grid and excavation units superimposed.

grass, using a combination of hand tools and gas-powered cutters. Temporary reference marks were placed at 2-x-2-m intervals to guide data acquisition. A simplified topographic plan of the site in Figure 4 indicates the approximate juxtaposition of the 20-x-20-m reference grid. Topographic mapping was carried out using a Leica TCRA-1105 total station with automated target tracking capability. Grid-based data were supplemented by delineating the rims of individual housepits and acquiring spot fixes at the centers of smaller-scale external pit features.

Site-wide geophysical mapping was undertaken using a combination of electromagnetic conductivity and vertical magnetic gradient methods. Electrical conductivity measurements displayed in Figure 5 were acquired at 1-m intervals utilizing a Geonics EM-31 conductivity meter. Corresponding measurements of the vertical magnetic field gradient (Figure 6) were acquired at staggered 1-x-2-m intervals using a Scintrex OMNI-IV proton precession gradiometer. The contrasting and complementary nature of electrical and magnetic images is evident.

The nominal conductivity signature of individual pithouses is presumably in large part the expression of associated topographic relief (Figure 5). Consistent with expected moisture variation, central floor areas are relatively conductive compared with surrounding rim deposits that are subject to

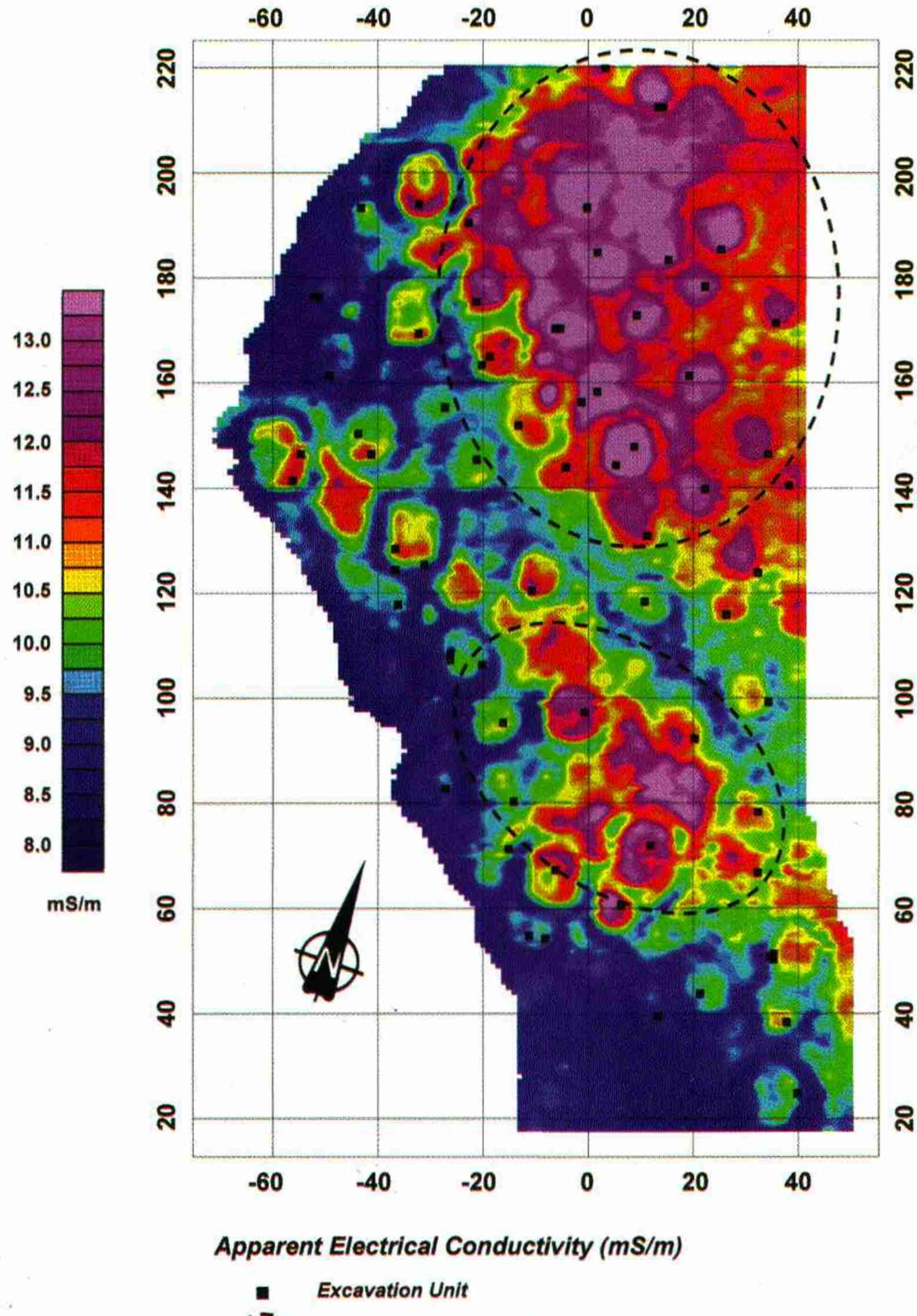

Figure 5. Apparent electrical conductivity plan with anomalously high areas outlined.

preferential evaporation and drying. There is considerable variation in the pattern, however, suggesting possible variability in structure and the general composition of both rim and floor deposits. In addition to detecting anomalous conductivity signatures in connection with known house depressions, soil conductivity reconnaissance revealed a number of larger-scale features that are potentially significant. As identified in Figure 5, anomalously elevated conductivity levels were detected over a considerable area within the site's northeast section and this is notably inconsistent with expectation of dryer and relatively resistive conditions on higher ground (see topographic plan Figure 4). A

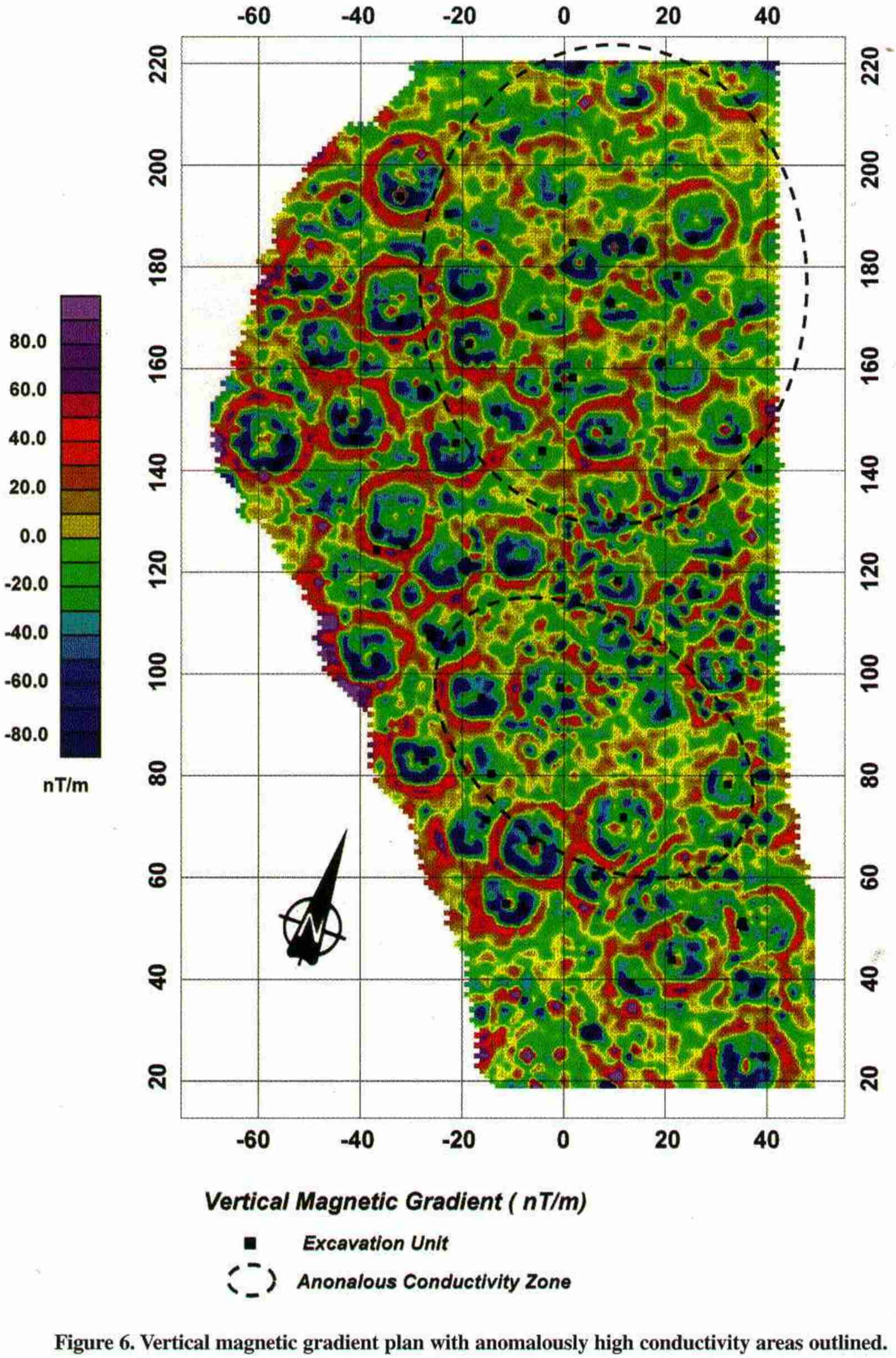

Figure 6. Vertical magnetic gradient plan with anomalously high conductivity areas outlined.

lesser area of similarly conductive conditions is also evident to the south and extending roughly southeast to northwest into the midsection of the site. The focus of this southern anomalous zone is in proximity to Housepit 20 and is potentially associated with a dense concentration of EPFs surrounding and northeast of this housepit (Figures 4 and 6). Comparatively resistive conditions are generally observed along the western margin of the site and are likely attributable in part to preferential drainage and evaporation of soil moisture near the site's exposed bluff.

The pithouse magnetic signature is also generally consistent and well defined (Figure 6). Rim

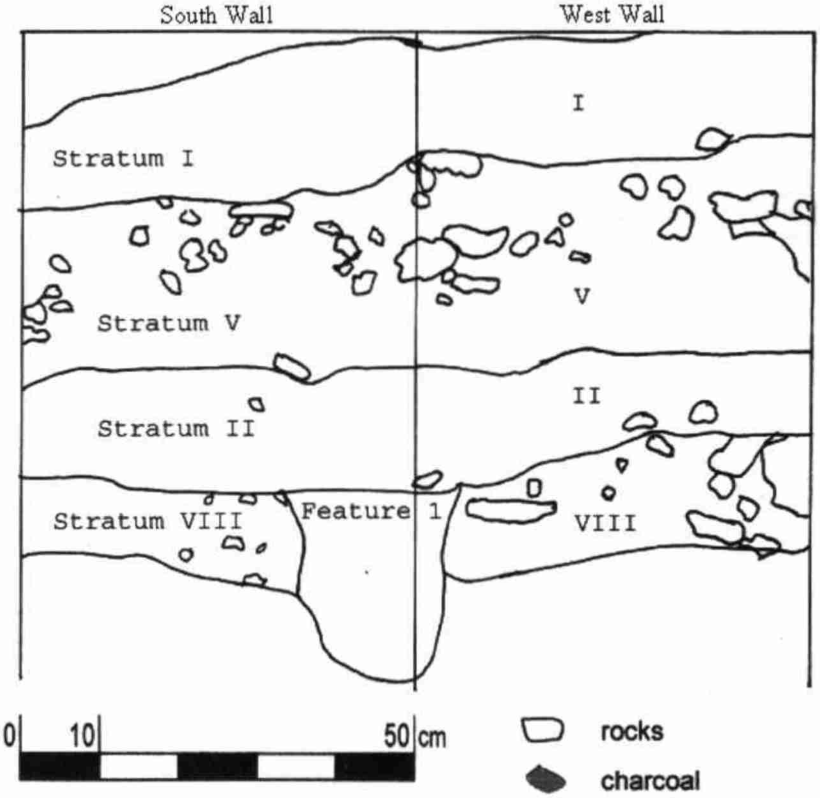

Figure 7. Profile map of a housepit (#52) with a single floor (II) covered by roof sediments (V). This is an example of Stratigraphic Context Code #1 (Table 1).

deposits are clearly delineated by anomalous positive-valued gradients surrounding interior floor areas that are largely characterized by negative-valued gradients. Localized anomalies are observed within individual house floors. Typically, one or more positive magnetic features are indicated within the central area of the house floor, surrounded by mainly negative gradients that are particularly strong over southern-southwestern areas of the house floor and extending into the interior flank of adjacent rim deposits. There are also, however, numerous and substantial deviations from this general pattern, and the nominal signature is clearly more consistent within certain portions of the site compared with others. Numerous, additional localized magnetic signatures appear to coincide with smaller-scale external pit features (EPFs) with a major concentration surrounding and northeast of HP20 (Figures 4 and 6) as previously identified in association with a potentially related conductivity feature. In general, the magnetic signature of individual housepits appears to be diminished and less well defined in areas of anomalously elevated electrical conductivity.

Comparing results of 2003 test excavations with the vertical magnetic gradient map in Figure 6, it was observed (Prentiss et al. 2004) that hearths, EPFs, and other deposits incorporating substantial charcoal, fire-cracked rock and other fire-related features were commonly associated with strong negative gradients. These signatures were effectively exploited during our 2004 field season to guide placement of excavations units on datable features.

Excavations and Stratigraphic Patterns

During the 2003 and 2004 field seasons, we excavated a total of 69 test units (50 cm^2) in 59 housepits (Figure 4). In addition to units located on the basis of geophysical indications, we also cleaned up small looter holes in a number of houses and added small test excavations based upon visible presence of hearth features in side walls. While data collection focused intensively on stratigraphy, features, and some architectural elements, we also recovered a large number of lithic artifacts and faunal and floral remains (Prentiss et al. 2004; Prentiss, Clarke, Markle, Bochart, Foss, and Mandelko

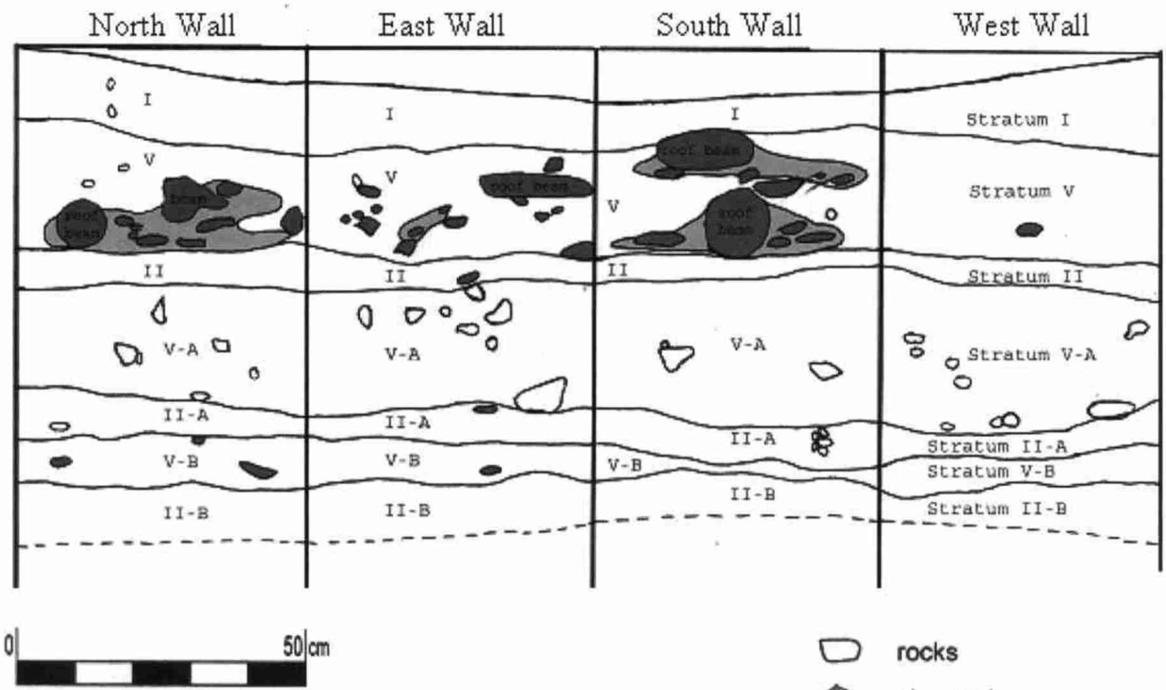

Figure 8. Profile of a housepit (#4) with multiple floors (II, IIA, IIB) covered by several roof layers (V, VA, VB). This is an example of stratigraphy associated with Stratigraphic Context Codes #2 and #3 (Table 1).

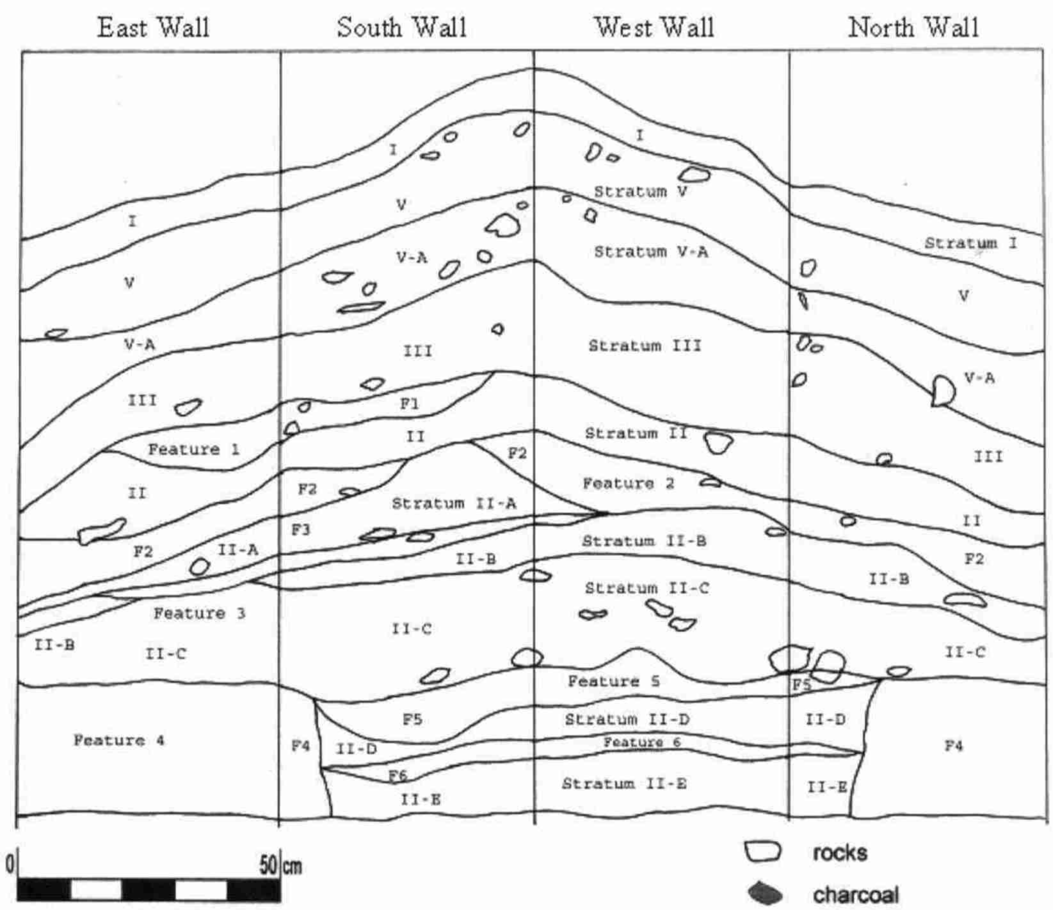

Figure 9. Profile of a housepit (#54) with a single thick and complex floor (II, IIA-IIE) containing hearth (F1-3, F5-6) and cache pit (F4) features covered by roof (V and VA) and Rim (III) sediments. This is an example of Stratigraphic Context Codes #4 and #5 (Table 1).

2005). Most importantly, we obtained enough dating material to run 77 radiocarbon dates from housepit floors and 13 additional dates on EPFs (Dietz 2004; Prentiss et al. 2004). In the remainder of this paper we focus on stratigraphy and dating of housepits.

Housepit floors at Bridge River are highly variable in thickness and vertical distribution, but form three general patterns illustrated in Figures 7–9. Similar to many housepit floors at Keatley Creek, some Bridge River floors and associated roofs or rims reflect short single occupations (Figure 7). Some of these may have longer occupation spans that could only be recovered from excavation of rim sediments (e.g., Prentiss et al. 2003). A second pattern at Bridge River consists of housepits with multiple floors separated by roof sediments (Figure 8). In these houses, an earlier floor was capped by a burned roof probably associated with some period of abandonment at that house. But at some later time a group returned and instead of re-excavating the house, they merely added a new floor over the top of the old roof and erected a new roof. Occasionally the cycle would repeat for a third time resulting in a series of stratified floor and roof deposits. The third pattern appears to mark continuous long-term occupation of housepit floors. Some housepits contained very thick floor deposits often containing hearth and cache pit features at varying depths (Figure 9). They appear to reflect a process of regular reflooring, whereby old floors were not removed, just buried, perhaps to get rid of garbage, pests, and odors. Some housepits have a combination of both stratigraphic patterns. This appears to be particularly true in situations where thick older floors and roofs were capped and more briefly reused by late village peoples.

All house floors were covered by roof and/or rim materials that occasionally produced large beams lying horizontally on floor surfaces. Housepit floors often contained hearth features of several designs. Most common were floor surfaces with oxidation, small clusters of fire-cracked rock (pebble size), and bits of charcoal. Occasionally, deeper, bowl-shaped hearths were located that contained large quantities of charcoal, occasional faunal remains, and often a cap of fire-cracked cobbles. On several occasions, very large hearth or even roasting pit features were located on floors. Some of those large pit features were 20–30 cm in depth; contained substantial amounts of unconsolidated charcoal, food remains, and fire-cracked rock; and completely filled a 50 cm^2 test unit. Given their large size, these features may reflect special functions for some of these houses, perhaps associated with community food preparation events. Distribution of hearths and cache pits follows patterns recognized in Hayden's (1997) more extensive excavations at Keatley Creek with features concentrated around the perimeter of a given house floor. Hearths appear to be focused at the southern and western margins of the floor, consistent with anomalous magnetic gradient signatures.

Radiocarbon Dating

Seventy-seven radiocarbon dates were obtained from charcoal samples excavated by University of Montana archaeologists during the 2003 and 2004 field seasons (Prentiss, Clarke, Markle, Bochart, Foss, and Mandelko 2005). These along with eight dates reported earlier by Arnoud Stryd (Stryd 1980) are listed in Table 1. While Stryd's dates are consistent with those obtained by Prentiss, the specific stratigraphic provenience of Stryd's dates is unclear. Those dates were therefore excluded from this study.

All of the dates (77) were derived from wood charcoal samples (all corrected for $^{13}C/^{12}C$) taken from floor or roof stratum contexts. These included 53 samples from features (51 hearths, one post hole, and one cache pit), 11 from large pieces of charcoal imbedded in the floor itself (we considered only larger samples likely redeposited from in situ hearths), and 13 samples from burned roof beams lying on or near floors. Other than roof beams it was not possible to undertake taxonomic identification of wood for the charcoal samples due to small size and high fragmentation of charcoal within hearth features. Table 1 presents the uncalibrated dates in sequence from the earliest at the bottom to the latest at the top. All dates are coded to housepit, charcoal source (floor, feature, roof beam), and stratigraphic context. Stratigraphic context codes denote samples from housepits with single floors (Type 1; Figure 7), housepits with two or more floors separated by roof deposits (Types 2–3; Figure 8), and housepits with thick floors containing evidence for multiple reoccupations (Types 4–5; Figure 9). The 2003 and 2004 dates were calibrated using Calib 5.0 (Stuiver et al. 2005) to facil-

Table 1. Radiocarbon data (all dates on wood charcoal and include $^{13}C/^{12}C$ ratio calculations) from housepits at Bridge River.

Lab. #	ID #	HP #	Square-Subsq.	Occupation (BR 1–4)	^{14}C Yrs BP	Calibrated Dates Mean yrs B.P.	Calibrated Dates 2 sigma range B.P.	Source	Strat. Context
AA61303†	1	57	B– 3	4	167±34	145	290-0	Floor, F1	1
AA61272†	2	10	A -1	4	181±38	151	302-0	Roof Beam On Floor	1
AA56852†	3	22	A– 3	4	205±29	152	303-0	Floor, F1	1
13609*	4	4	A– 4	4	235±60	232	464-0	Roof Beam On Floor	2
13613*	5	38	B– 1	4	260±40	230	459-0	Floor, F1	1
AA56846†	6	60	A– 2	4	310±31	383	464-301	Roof Beam On Floor	2
AA56847†	7	20	A– 11	4	328±31	390	473-307	Floor, F4	4
AA56857†	8	8	B– 14	4	361±29	408	499-316	Floor, F2	1
AA61294†	9	50	A– 11	4	362±35	409	501-316	Floor, Charcoal	4
AA61286†	10	34	A– 13	4	390±35	415	511-318	Floor, Charcoal	1
AA56849†	11	5	A– 8	4	406±31	422	517-326	Floor, F1	1
AA61323†	12	18	A– 1	4	433±37	434	535-332	Roof Beam On Floor	2
AA61267†	13	3	A -10	4	638±36	610	667-552	Floor, Charcoal 2	
AA61325†	14	31	B– 2	3	1139±38	1067	1170-964	Roof Beam On Floor	1
13611*	15	63	A– 16	3	1165±70	1101	1262-939	Roof Beam On Floor	1
AA61290†	16	37	A– 14	3	1173±48	1103	1237-968	Floor, Bark Roll	2
AA56850†	17	1		3	1202±32	1135	1256-1013	Floor, Posthole (F3)	3
AA61322†	18	19	A– 12	3	1213±38	1160	1263-1056	Floor, Charcoal	4
AA61295†	19	51	A– 13	3	1216±36	1161	1262-1059	Roof Beam On Floor	1
AA61297†	20	54	A– 10	3	1219±35	1161	1261-1061	Floor, F2	5
AA61314†	21	58	A– 3	3	1222±36	1162	1262-1062	Floor, Charcoal	2
AA56854†	22	17	A–7	3	1223±30	1162	1259-1064	Floor, F1	5
AA61321†	23	1		3	1232±38	1165	1264-1066	Floor, F4	3
AA61275†	24	12	A–16	3	1236±36	1167	1264-1069	Floor, Charcoal	4
AA56853†	25	18	A–1	3	1239±30	1170	1263-1077	Floor, F4	5
13614*	26	77	A–11	3	1245±55	1173	1288-1058	Roof Beam On Floor	1
AA61270†	27	4	A–4	3	1253±44	1177	1279-1074	Roof Beam On Floor	3
AA61299†	28	54	A–10	3	1258±35	1182	1280-1083	Floor, F5	5
AA61281†	29	29	A–10	3	1259±35	1182	1281-1083	Floor, F1	1
AA61285†	30	33	A–10	3	1260±36	1183	1282-1083	Floor, F1	3
AA61307†	31	62	A–9	3	1264±43	1183	1285-1081	Floor, Cache pit (F1)	1
AA61313†	32	3	A -10	3	1269±39	1186	1287-1085	Floor, F1	2
AA61306†	33	61	A–1	3	1271±36	1188	1288-1088	Floor, F2	3
AA61269†	34	4	A–4	3	1275±36	1190	1290-1090	Floor, F1	3
AA61317†	35	61	A–1	3	1276±36	1191	1290-1091	Floor, F1	3
AA61309†	36	65	A–11	3	1278±36	1191	1291-1091	Roof Beam On Floor	1
AA61319†	37	20	A–11	3	1284±36	1194	1293-1095	Floor, F6	5
AA61310†	38	70	A–16	3	1284±36	1194	1293-1095	Floor, F1	1
13101*	39	60	A–2	3	1290±55	1190	1299-1080	Roof Beam On Floor	3
AA61278†	40	24	B–10	3	1296±36	1223	1296-1150	Floor, Charcoal	1
AA61276†	41	16	A–4	3	1305±36	1235	1295-1175	Floor, F1	1
AA61298†	42	54	A–10	3	1312±35	1237	1295-1178	Floor, F3	5
AA61305†	43	59	A–6	3	1320±42	1240	1307-1173	Floor, F2	3
AA61288†	44	39	A–1	3	1328±36	1240	1301-1178	Roof Beam	6
AA56848†	45	66	A–5	3	1329±31	1241	1302-1180	Floor, F1	4
AA61283†	46	31	B–2	3	1357±36	1261	1338-1183	Floor, Charcoal	1
AA61301†	47	55	B–12	3	1368±35	1266	1346-1185	Floor, Charcoal	1
13612*	48	28	A–15	3	1375±43	1275	1367-1182	Floor, F1	3
AA61316†	49	23	A–13	2	1414±36	1326	1367-1285	Floor, F1	3
AA61300†	50	54	A–10	2	1438±36	1341	1389-1293	Floor, F6	5
AA61279†	51	26	B–2	2	1445±36	1345	1394-1295	Floor, F1	3
AA61291†	52	48	A–9	2	1445±36	1345	1394-1295	Floor, F1	1
AA56855†	53	15	A–1	2	1466±31	1353	1402-1304	Floor, F2	5
AA61318†	54	28	A–15	2	1471±44	1402	1509-1294	Floor, F1	3

Table 1. Radiocarbon data (all dates on wood charcoal and include $^{13}C/^{12}C$ ratio calculations) from housepits at Bridge River (continued).

Lab. #	ID #	HP #	Square-Subsq.	Occupation (BR 1–4)	^{14}C Yrs BP	Calibrated Dates Mean yrs B.P.	Calibrated Dates 2 sigma range B.P.	Source	Strat. Context
AA61293†	55	50	A–11	2	1488±36	1406	1509-1303	Floor. F2	5
AA61292†	56	49	A–1	2	1496±36	1410	1513-1306	Roof Beam On Floor	1
AA61312†	57	78	A–4	2	1527±36	1432	1519-1345	Floor, F1	1
AA61287†	58	35	A–4	2	1535±36	1436	1520-1351	Floor, F2	5
AA56856†	59	15	A–1	2	1539±30	1440	1519-1360	Floor, F5	5
AA61308†	60	64	A–1	2	1550±36	1443	1526-1360	Floor, F1	4
AA61271†	61	6	A–11	2	1531±37	1453	1533-1373	Floor, F1	5
AA61302†	62	56	B–2	2	1569±37	1459	1537-1381	Floor, F1	1
AA61284†	63	32	A–9	2	1576±36	1464	1539-1388	Floor, F1	4
AA61315†	64	23	A–13	2	1580±36	1466	1541-1390	Roof Beam On Floor	3
AA61268†	65	3	A -10	2	1614±37	1503	1599-1407	Floor, Charcoal	3
AA61273†	66	11	A–3	2	1619±36	1506	1601-1410	Floor, F1	3
AA61311†	67	71	A–1	2	1631±36	1511	1608-1413	Floor, F2	5
AA61277†	68	23	A–13	2	1638±42	1550	1687-1412	Floor, F2	3
AA61274†	69	11	A–3	2	1646±38	1552	1688-1416	Floor, F2	3
AA56851†	70	27	A-10	1	1696+37	1614	1697-1531	Floor, F1	1
AA61280†	71	26	B–2	1	1721±44	1628	1726-1530	Floor, Charcoal	5
AA61304†	72	58	A–3	1	1753±37	1684	1810-1558	Floor, F1	3
13610*	73	9	A–9	1	1770±40	1693	1816-1570	Floor, F1	5
AA61324†	74	38	B–1	1	1770±38	1693	1815-1571	Floor, F2	4
AA61296†	75	52	A–6	1	1779±36	1712	1818-1605	Floor, F1	1
AA61289†	76	25	B–12	1	1864±36	1797	1878-1715	Floor, F1	3
AA61282†	77	30	A–10	Pre–BR	2470±37	2538	2713-2363	Floor, Charcoal	1
Stryd's Dates									
I 9007	Not Shown on Graph of Calibrated Dates	51		3	1150±80	1096	1261-930		
I 8055		65		3	1260±80	1144	1305-983		
I 9571		65		3	1300±80	1181	1350-1012		
I 8052		45		3	1380±85	1294	1508-1079		
I 9008		64		2	1450±80	1358	1530-1185		
		36		2	1495±80	1415	1548-1282		
I 8054		64		2	1680±85	1607	1813-1401		
I 8053		51		1	1760±85	1653	1883-1422		

† ^{14}C dating performed at the Arizona State University– NSF– AMS laboratory.
* ^{14}C dating performed at the Arizona State University Laboratory of Isotopic Chemistry.
Lab. numbers with "AA" are AMS dates; under the category "Source" F1-F6 refer to hearth features unless otherwise marked; Stratigraphic context codes: 1=single occupation housepit floor [e.g. Figure 7]; 2=final occupation floor from stratified housepit deposit featuring two or more floors separated by roof deposits [e.g. Figure 8]; 3=early occupation floor from stratified housepit deposit featuring two or more floors separated by roof deposits [e.g. Figure 8]; 4=late/final floor occupation layer within single thick stratified floor deposit [e.g. Figure 9]; 5=early floor occupation layer within single thick stratified floor deposit [e.g. Figure 9]; 6=no obvious floor

itate the identification and precise dating of significant occupation patterns and phases at Bridge River (e.g. Prentiss et al. 2003). Results are graphically depicted in Figure 10.

Visual inspection of the calibrated dates presented in Figure 10 suggests two major breaks: between samples 76 and 77 (means of 1797 and 2538 cal. B.P.), and between samples 12/13 and 14 (means of 610/434 and 1067 cal. B.P.). The first break could potentially represent a considerable span of time between a possible early occupation and the initial period of village formation. However, we note that sample 77 (Housepit 30) was acquired from a deeply buried floor-like sediment from which no obvious feature could be recognized other than a faint suggestion of heat oxidation. It is therefore possible that the date reflects an "old-wood" bias or even some older noncultural

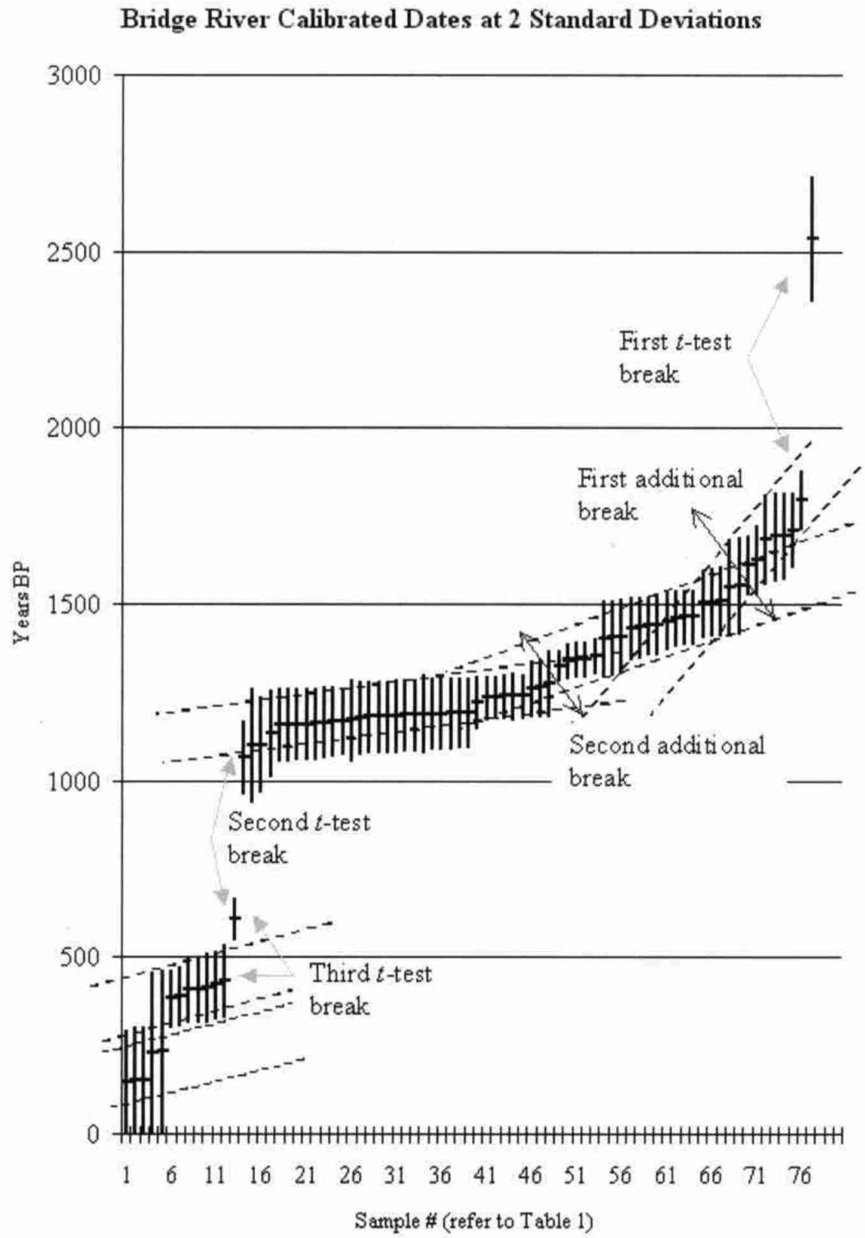

Figure 10. Plot of calibrated radiocarbon dates at 2σ illustrating slope trends and discontinuities.

(e.g., forest fire) event. Thus, beyond the possibility of an earlier occupation, we do not attach a great deal of significance to this date and view the 1797 B.P. date as a preliminary origin of occupation. The second major break is clearly very significant and suggests a likely abandonment of the early village after ca. 1000–1100 cal. B.P. Appropriate interpretation of the 610 cal. B.P. date for sample #13 (Housepit 3) is uncertain. The stratigraphic context of dated material appears to be well constrained and it is certainly possible that the date reflects an isolated, short-term occupation. However, again, the date could also be skewed by an "old wood" bias. Similar problems were recognized at Keatley Creek (Hayden 2000).

These breaks are supported by Student's *t*-tests (Table 2) performed on the adjacent (raw—uncalibrated) dates spanning the apparent breaks (e.g., Prentiss et al. 2003). Student's *t*-test is used to estimate the possibility of two samples having been drawn from the same population. In our case, a commonsense interpretation is whether two radiocarbon determinations are measuring the same event. Application of Student's *t* suggests that in

Table 2. Student's *t* Scores Significant at .05 Level Indicating Breaks in the Bridge River Occupation Chronology.

Sample #		12	13	76
	Date BP	433±37	638±36	1864±36
13	638 ± 36	3.971		
14	1139 ± 38		9.5711	
77	2470 ± 37			11.7388

all three cases, the adjacent dates are not measuring the same event at a significance level of .99 or higher with infinite degrees of freedom.

Excluding the earliest date and with the possibility of an isolated occupation around 600 cal. B.P., results of radiocarbon dating clearly establish two principal occupation periods: an early village period spanning approximately 1800–1050 cal. B.P., and late village period between about 450 and 200 cal. B.P. The early village occupation consists of 63 radiocarbon dates that suggest a continuous occupation. We additionally recognize three separate phases within the early village period as demarcated by discontinuities between dates (e.g., Goodale et al. 2004; Prentiss et al. 2003) and changes in the slope of trend segments (Figure 10). The earliest phase is associated with a relatively rapid progression of dates (high slope trend) spanning roughly 250 years and suggesting relatively unorganized occupation. The middle phase comprises roughly twice as many dates over a similar time span (lesser slope trend—subplateau) with clear evidence of sustained spatial clustering. The number of dates constituting the late phase again approximately doubles over a yet shorter time span (low slope trend—plateau) with clear and stable spatial organization.

Although it is difficult to establish precise transitions between early, middle, and late phases, larger discontinuities between dates and related trending of the radiocarbon sequence suggests that transitions are reasonably defined to occur between dates 70 (1614 cal. B.P.) and 69 (1552 cal. B.P.) and between dates 49 (1326 cal. B.P.) and 48 (1275 cal. B.P.). In a similar fashion, it is potentially useful to identify early and late phases of the late village period between dates 12 (434 cal. BP) and 6 (383 cal. BP), and dates 5 (230 cal. B.P.) and 1 (145 cal. B.P.), respectively. A resulting Bridge River Occupational Sequence based upon these defined and preliminary transitions is outlined in Table 3 and illustrated in Figure 11. Following Goodale et al. (2004) we suggest that these breaks could be the result of brief periods of limited occupation preceding jumps in the number of occupied pithouses.

Beyond a reasonable degree of latitude in defining the transition points between early (BR 1), middle (BR 2), and late (BR 3) phases, our preliminary occupational sequence is also based on a limited sample of dates, with the vast majority of housepits dated by a single sample. Since previous studies (e.g., Hayden 2005; Prentiss et al. 2003) demonstrate that dating of housepit occupations is not a simple undertaking, it is possible that our results could contain some degree of error. However, these same studies also make it clear that a high degree of reliability and validity can be obtained if samples are carefully collected from within either hearth features or roof beams associated with floors. Consequently, given a high degree of confidence in the bulk of our dates and accepting that additional work could yield refinement, we believe that our current chronology is robust and provides a well-constrained framework for further investigations and interpretation.

Building a History of the Bridge River Site

As noted early in this paper, our ultimate goal is to understand the evolution of the Bridge River village from a socioeconomic standpoint. While it is difficult to establish patterns of social organization without considering artifacts and food remains, we argue that, following Hayden (1997), variation in number, size, and spatial positioning of housepits can provide some initial insight into potential patterns of socioeconomic organization.

Table 3. Bridge River Chronology .

Period	Date Range	Number of Housepits
Bridge River 4 (BR4)	610 – 145 cal. B.P.	13
Bridge River 3 (BR3)	1275–1261 cal. B.P.	29
Bridge River 2 (BR2)	1552–1326 cal. B.P.	17
Bridge River 1 (BR1)	1797–1614 cal. B.P.	7
Pre-Bridge River (Pre-BR)	2538 cal. BP	1

Dates are presented as calibrated means.

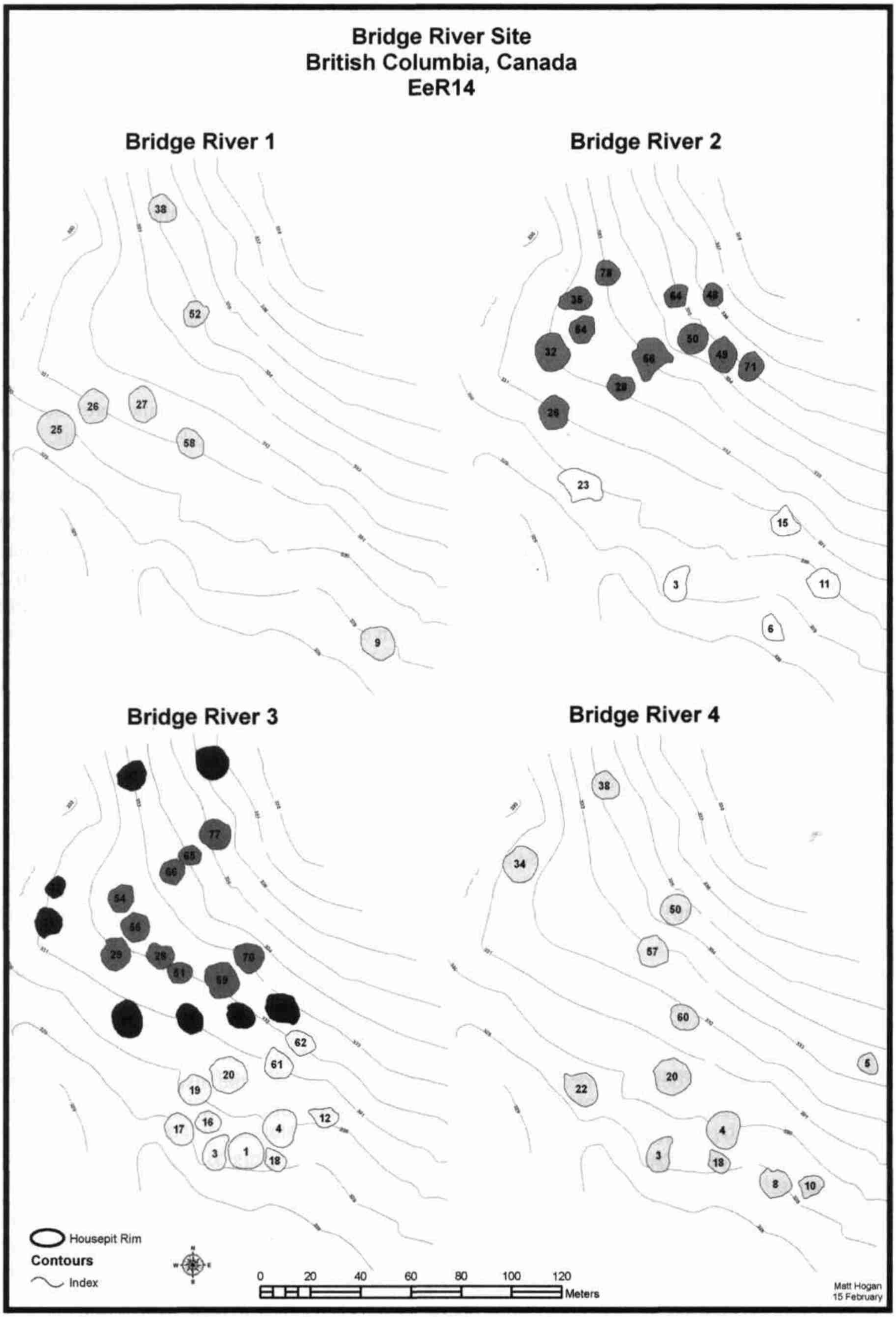

Figure 11. Map of housepit distributions at the Bridge River site, plotted by occupation period. Shading in the BR 2-3 maps demarcates the north versus southern housepit groups (dark north; light south). Extra shading within the north group of BR 3 indicates two arc forms in that area.

Archaeologists who work in the Pacific Northwest region are very well aware that the size and the spatial position of houses within historic period villages often coded for social relationships (Matson and Coupland 1995). Northwest Coast groups typically organized their villages as one or more parallel rows of houses along beach fronts. Highest-ranking houses were generally largest and placed near the center of the front row (e.g., Mackie and Williamson 2003). In contrast, there is significantly less information from the ethnographic record on village sizes and house distributions as markers of social organization on the Plateau. Ethnographic Plateau villages are typically described as clusters of lodges, generally pithouses at winter occupations. The more socially complex societies tended to aggregate in larger groups as indicated by villages with greater numbers of houses and disparities in house sizes. For example, reflecting some of the most socially complex groups, Upper and Lower Lillooet villages ranged up to 25 houses (Teit 1906) that were inhabited, presumably, by well over 200 persons. Some of these villages were also fortified and many featured interhousehold ranking indicated by distinctions in house size and construction (Hill-Tout 1905; Teit 1906). In contrast, many Plateau groups were less affluent in material goods and subsistence resources and tended to live in smaller, less structurally complex, winter villages. For example, Teit (1900, 1930) describes village clusters of about 10 housepits (occasionally up to 20 in resource rich contexts) associated with the less socially complex Okanagan, Lakes, and Thompson peoples, populated by groups averaging around 50 persons. Despite the possibility of achieved status differentiation between individuals in these communities, there is little in the ethnographic record to suggest formal ranking between households marked by major distinctions in house size or construction.

Although the Plateau ethnographic record is sparse on details, it does suggest that we may be able to begin exploring demographics and social organization from the standpoint of village size and housepit distribution patterns. With this in mind, and recognizing the limitations of our radiocarbon data, we examine apparent changes in population size as indicated by changing frequencies of simultaneously occupied housepits. We then assess potential changes in social organization, viewed from the standpoint of variation in housepit spatial relationships and size distributions.

The Bridge River village appears to have been established at 1797–1614 cal. B.P. (BR 1) and was steadily occupied through 1275–1067 cal. B.P. (BR 3). This was followed by a period of apparent abandonment that lasted several hundred years prior to a final occupation period at 610–145 cal. B.P. (BR 4) within which the village was probably most heavily populated ca. 400–200 cal. B.P. This means that the Bridge River village was established approximately 200 years earlier than Keatley Creek (per dating by Prentiss et al. 2003) and was abandoned about 300 years earlier.

Frequencies of dated housepit floors suggest steady growth in households, with numbers actually more than quadrupling between BR 1 and 3 (Table 3). Although we only dated 29 components to BR 3, it is possible that many more housepits (possibly 40) were also occupied at that time (Prentiss, Clarke, Markle, Bochart, Foss, and Mandelko 2005). Assuming 2 m^2 space per person in each household (e.g., Hayden et al. 1996), we estimate populations rising from around 235 in BR 1[1] to 923 in BR 3 (even at 3 m^2 per person the number jumps by nearly 400 percent from 157 to 616). So, while the village began relatively small, it grew substantially across the 700 years associated with BR 1-3. At its peak it was of a nearly equivalent size to nearby Keatley Creek (assuming Hayden's 1997 estimates are accurate).

Early occupation of the site during BR 1 was apparently limited to a succession of one or more isolated pithouses with no clear indication of a consistent or organized settlement pattern (Figure 11a). During BR 2, there is simultaneous and sustained occupation of multiple pithouses and the vast majority of these dwellings appear to have been concentrated toward the north end of the site (Figure 11b). A few houses were located near the southern extreme early on. With subsequent and very substantial growth of the village this early pattern appears to have evolved by BR 3 into two separate arrangements on roughly north and south sides of the site (Figure 11c). It does not appear that housepit placement paralleled land topography. Rather, the two principal pithouse clusters seem to be arranged in horseshoe or arc-like patterns opening to the east[2] and surrounding central communal areas or plazas. The northern group appears to fea-

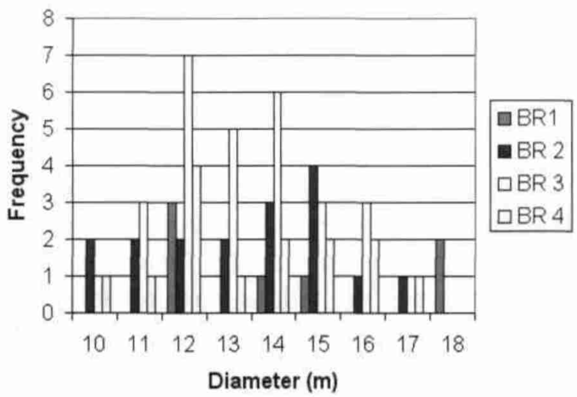

Figure 12. Distribution of Bridge River housepit sizes through time.

ture dual parallel arcs while the southern cluster consists only of one arc. It is also notable that this occupation pattern appears to be correlated with anomalous soil conductivity zones (identified in Figure 5), suggesting that these features could potentially reflect local soil modification associated with concentrated cultural activity in these areas. In particular, coincident and surrounding concentrations of external pit features and related magnetic signatures (Figure 6) suggest that among other activities, central communal areas might have been the focus of food and other resource processing.

Given foregoing evidence for a sustained and organized occupation, it appears reasonable to surmise that a complex pattern of sociopolitical integration may have developed in the Bridge River village by BR 3. Population estimates can be used to make theoretical projections regarding aspects of social organization. Hayden (1997) argues that human populations at nearby Keatley Creek may have crested at over 1,200 persons. Relying upon correlations between population size and social complexity described by Carneiro (1967) and Naroll (1956), Hayden (1997) expects Keatley Creek to have had about 20 occupational specialties and 10 social organizations. If Bridge River grew to nearly the same size, then it is entirely possible that similar scales of social complexity could have developed during the BR 3 period.

Population size hints at the potential for complex society and this is also suggested by variability in housepit sizes across the site. Hayden (1997) argues that a bimodal distribution in housepit diameter across a village could reflect social status inequality. However, we must be careful with such distinctions since for most of the village's history house size distributions[3] were approximately normal (Figure 12) and could equally reflect variability in house group size rather than status (Hayden 1997). Further, recent studies of the nearby Keatley Creek site (Prentiss et al. 2007) suggest that house disparities could exist without other archaeological indicators of status differentiation. While our research suggests that the Bridge River village did feature, from its inception, simultaneously occupied medium to larger diameter housepits, we have not found the strong bimodal pattern of housepit sizes recognized by Hayden (1997) at Keatley Creek. Thus, the significance of house size at Bridge River is uncertain.

Discussion

Dating of the emergence, history, and abandonment of the Bridge River village has implications for understanding processes of human aggregation, disaggregation, and social differentiation when considered in light of local and regional variability in climate, resources, and cultural developments. While the Bridge River site may have had sporadic short-term occupations at early dates (e.g., the ca. 2500 cal. B.P. date on Housepit 30), the village-scale occupation does not appear to have come until shortly after 1800 cal. B.P. This sets its emergence earlier than the Keatley Creek aggregated village, dated by Prentiss et al. (2003) to ca. 1600–1650 cal. B.P. While marine fisheries production was probably relatively high at this time (Tunnicliffe et al. 2001), dry conditions in the interior Plateau and Rocky Mountains (e.g., Chatters and Leavell 1995; Hallett and Walker 2000) may have adversely affected salmon numbers to some degree (e.g. Chatters et al. 1995). However, many Canadian Plateau terrestrial resources associated with higher elevations were probably producing at higher levels. Dry conditions meant larger and more productive dry meadow geophyte (root) grounds (e.g., Lepofsky and Peacock 2004; Turner 1992). It probably also meant abundant berries and ungulates, particularly in mid- to higher-elevation forest margins (Prentiss, Chatters, Lenert, Clarke, and O'Boyle 2005; Prentiss et al. 2007). Salmon numbers were probably high and relatively predictable in the Mid-Fraser canyon, but potentially substantially reduced in upstream localities (e.g. Kew 1992). This made the Mid-Fraser context extremely valuable and an ideal target for developing villages large enough to control this fishery. This could not have happened in centuries prior to at least 2200 cal. B.P. as cooler and wetter conditions probably suppressed access to geophytes, berries, and ungulates in many areas while increasing numbers of salmon throughout the Fraser and Thompson drainages. Indeed, the largest regional settlements prior to ca. 1800 cal. B.P. were probably to the east in the drier country at the confluence of the North and South Thompson rivers (Rousseau 2004).

After the Bridge River village emergence, populations throughout the Mid-Fraser area appear to have grown rapidly (Lenert 2001; Prentiss, Chatters, Lenert, Clarke, and O'Boyle 2005). This is indicated by the appearance of new villages (e.g., Keatley Creek) and growth in numbers of housepits within the Mid-Fraser villages (Prentiss et al. 2007). Bridge River appears to have grown steadily peaking by ca. 1200 cal. B.P. with at least 29 (if not many more) simultaneously occupied housepits of a wide range of sizes (Figure 13). The growth of Bridge River parallels data from several independent paleoenvironmental studies (Reyes and Clague 2004; Hallett et al. 2003; Lepofsky et al. 2005; Tunnicliffe et al. 2001) that suggest conditions were cooler and wetter for a short time between ca. 1600 and 1200 cal. B.P. Salmon fishing was probably optimal though access to other terrestrial resources was probably somewhat suboptimal. Not surprisingly, mid-Fraser villages during this time appear to have had a diet heavily weighted toward salmon (Bochart 2005; Prentiss et al. 2007). The rise in mid-Fraser populations thus appears to closely correlate with improved salmon fishing conditions in the mid-Fraser area as well the greater Northwest Coast region (Lepofsky et al. 2005).

Spatial distribution of housepits at Bridge River suggests two separate groups of simultaneously occupied housepits, organized in arcuate or possibly circular arrangements, implying the possibility of at least two distinct social groups (e.g., Hill-Tout 1905), or perhaps clans (e.g., Teit 1906), cohabiting the village at least by BR 3 times. This pattern is unique in the mid-Fraser area, though a series of linear housepit arrangements is evident at the Keatley Creek site, again suggesting the possibility of residentially distinct social groups (Harris 2007). Finally, it is clear there was a major disparity in mid-Fraser village sizes and organization by ca. 1200–1300 cal. B.P. This suggests that we would be wise to give serious consideration to Hayden and Ryder's (1991:53) idea that some form of multivillage polity could have existed during the "Classic Lillooet period." These kinds of organizations have now been identified in the Lower Fraser Canyon (Schaepe 2006) associated with far smaller villages and there is no reason why they could not have existed in the mid-Fraser, at least for a short time.

The Bridge River village was abandoned at ca. 1150 cal. B.P. and not reoccupied in a serious way for at least 600 years. The ca. 1150 cal. B.P. abandonment came at a time of rapid interior Plateau terrestrial warming and probable rising sea-surface temperatures on the Northwest Coast. The impact of these climatic changes appears to have been a dramatic decline in marine resource productivity (Finney et al. 2002; Tunnicliffe et al. 2001) that appears to have also adversely affected salmon populations (Chatters et al. 1995). Faunal data suggest that Bridge River populations were more heavily dependent upon salmon than those at Keatley Creek; and if access to salmon diminished rapidly after ca. 1200 cal. B.P. it may have been enough to trigger the breakup of the village (Bochart 2005). Changes also occurred at nearby Keatley Creek, where residents likely expanded their diet to a far higher proportion of mammalian resources after ca. 1200 cal. B.P., household group sizes appear to have increased, and signs of wealth based inequality appeared (Burns 2003; Prentiss et al. 2007) before its abandonment by ca. 800 cal. B.P. (Prentiss et al. 2003).

Given these patterns, we suggest that a sequence of abandonments probably occurred in the mid-Fraser rather than all being vacated in a single catastrophic event as argued by Hayden and Ryder (1991). Villages, whose economies were most specialized and who had the fewest subsistence options (like Bridge River) were the first, followed later by villages like Keatley Creek whose residents were able to hold together longer possibly due to better access to geophytes and ungulates in nearby locations such as Hat Creek Valley. It may be that institutionalized inequality only came to these latter villages in and around this final period when relatively affluent households in the surviving villages

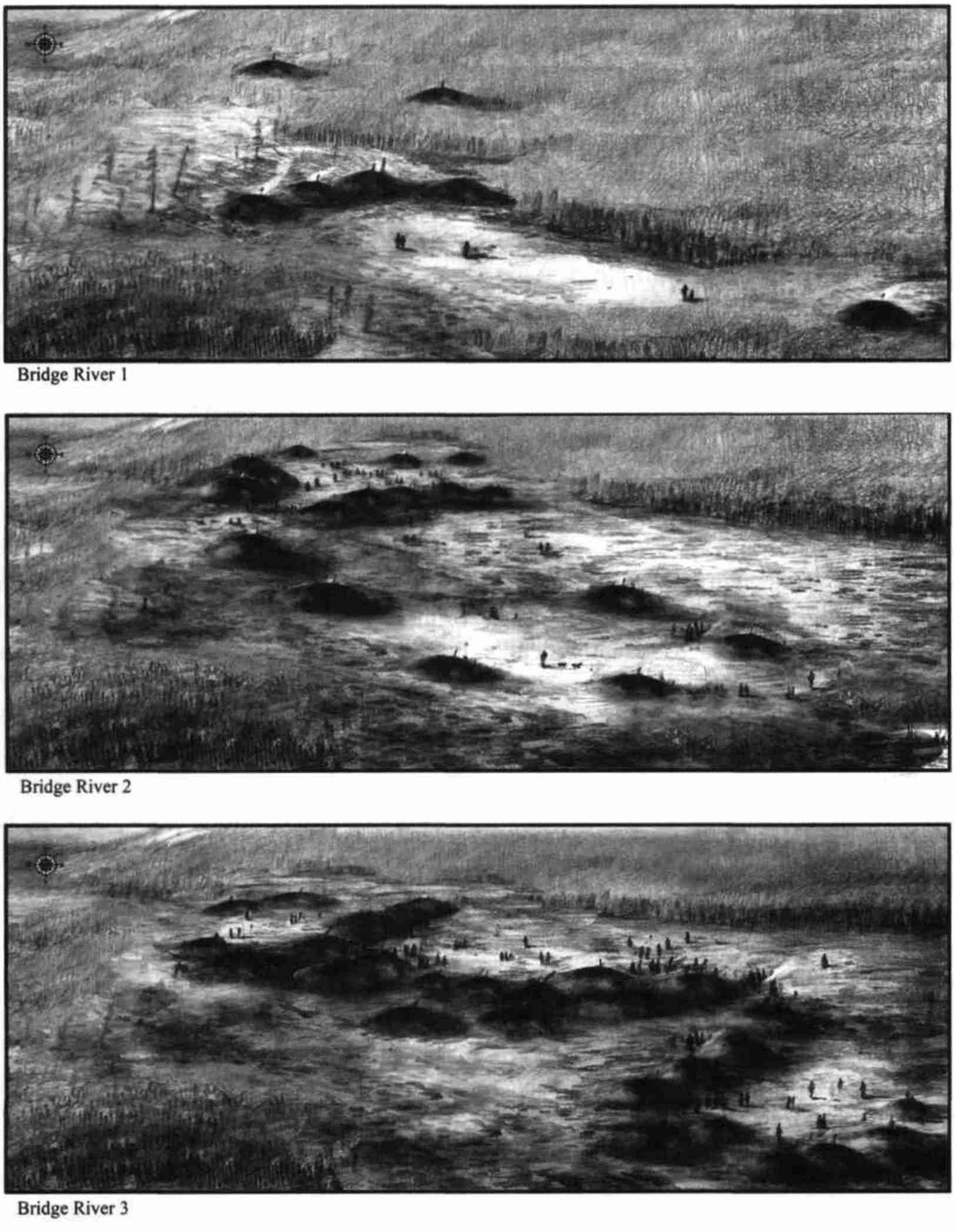

Figure 13. Artist's reconstruction of the Bridge River village during three periods (BR 1-3) looking northeast from the southwest. The drawing is by Eric Carlson.

asserted greater control over dwindling resources and leveraged this power to attract new household members, perhaps from failed villages elsewhere in the region. Ultimately, these villages were also abandoned under what appear to be conditions of local resource depression and subsistence extensification perhaps in part deriving from implementation of aggrandizing strategies that demanded more than the land could produce (Prentiss et al. 2007). Many of the abandoned villages were reoccupied after 500 cal. B.P., but often at smaller scales compared to the peak patterns of ca. 1200–1300 cal. B.P. At this time, social and economic organization was probably very close to that described in the Lillooet ethnographies of Teit (1906) and Hill-Tout (1905) in which social organization was complex featuring clan-like groups and hereditary ranking of individuals.

Results of our initial investigations at Bridge River suggest that archaeologists who study intermediate-scale societies via excavations of villages would strongly benefit from research designs permitting extensive dating of houses. In the absence of adequate dating, archaeologists must make assumptions about reoccupation rates to calculate village size often concluding that even in the case of very large villages (e.g., Ipiutak [Mason 1998]), actual human group sizes were never exceptionally large when compared to the overall numbers implied by total house frequencies. While it is certainly possible that these assumptions and corresponding population estimates could be accurate for many contexts, such as Ipiutak, our findings suggest that, at least in some cases, large villages could, at times, have been occupied by equally large numbers of people. Bridge River apparently grew rapidly, peaking with up to 50 percent of all houses simultaneously occupied by perhaps 600–1000 people for a significant period of time. This conclusion implies that more complex social dynamics may have existed than would have been predicted otherwise. If processes like this happened in other regions where household dating has been minimal, we may be seriously misrepresenting the scale of some past societies. Consequently, we hope this study helps to stimulate new research of this nature elsewhere.

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Notes

1. This figure is calculated for heuristic purposes and may be too high since it is entirely likely that occupations during the BR 1 period may never have reached seven simultaneously occupied housepits.

2. Current data suggest an opening on the east side of each arrangement of housepits during BR 3 times. However, our project was unable to test or date most houses on the extreme east side of the village. Consequently it is possible that the supposed arc-like shapes could have originally resembled closed rings.

3. Housepit diameters were measured in the field from rim crest to rim crest using a metric tape. At least two measurements were taken from each house. The largest of these was used in these calculations as the maximum diameter. Measurements were not taken in locations of potential side entrances for some housepits (e.g., housepits 10, 11, 23, and 56).

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