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Uncovering Cooperation in Housepit 54, Bridge River, British Columbia, Canada

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UNCOVERING COOPERATION IN HOUSEPIT 54, BRIDGE RIVER, BRITISH COLUMBIA

By

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Abstract:

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Uncovering Cooperation in Housepit 54, Bridge River, British Columbia

Chairperson: Dr. Anna Marie Prentiss

There is a significant amount of literature regarding the theory of cooperation, as well as ethnographies and data from modern populations that clearly show cooperation, yet it is difficult to tease that information out of the archaeological record. My thesis will focus on floors IIi to IIc of Bridge River's Housepit 54 in British Columbia, Canada, which extends from the Bridge River 2 period to the Bridge River 3 period and includes two incidents of resource stress and one of resource plenty. These times of fluctuating resource availability should result in the population utilizing different approaches to social organization. By examining different measures of wealth and privatization, it may be possible to determine the level and mechanisms of cooperation the ancestors of the modern St'át'imc Nation engaged in at different times in the village's history. If successful, this method could be used in other areas of the world to similarly determine when cooperation was a beneficial strategy and which mechanism was the most useful.

Chapter 1: Introduction

The Bridge River archaeological project has been in operation since 2003 and continues to generate new research questions, including those of this thesis. The site presents a unique opportunity for archaeological research, and through collaboration with the Xwísten, the Bridge River Indian Band of British Columbia, has allowed for theoretical and methodological breakthroughs in the academic world while simultaneously uncovering more information about the Band's ancestors, supplementing its knowledge. This thesis hopes to accomplish both goals – to ultimately be able to quantify social behavior through the lens of the archaeological record and contribute to the Band's heritage tourism industry, a well-established and extensively researched program. This study aims to examine the role of cooperation in Bridge River's Housepit 54 through the spatial organization of artifacts across seven of the house's seventeen floors. Since cooperation – a purely social practice – is difficult to see from the archaeological record, this will be accomplished by examining different measures of private wealth using artifacts and features. I analyze the size and positioning of storage pits and the locations, types, and amounts of lithic raw material of tools and debitage – focusing mainly on those made of nonlocal raw material – to demonstrate the existence of private wealth.

It can be inferred that with an increase of privatization comes a reduction of cooperation – an interpretation that stems from an understanding of game theory and demography. These two schools of thought, along with the study of household archaeology, comprise the main theoretical underpinnings of this thesis. A strong foundation in cooperation is particularly important when seeking understandings of how human societies respond to demographic pressures or environmental changes produce variation in food sources. Household archaeology is similarly vital, as the spatial layout of the house will help determine how artifacts are deposited and what is preserved in the archaeological record. This thesis maps the spatial distributions of the artifacts in ArcGIS and determines the level of similarity between and across the floors. These data permit me to examine the roles that different types of wealth, privatization, and cooperation play in Housepit 54.

This thesis features six total chapters. Chapter 2 describes the region of British Columbia and provides an overview of the many relevant cultures of the region. I focus on the Mid-Fraser River and its people but will provide some information on the people of the wider region as a summary of the long history of the people in the area. Chapter 3 delves into the theories used in this thesis and why they are important to consider while examining cooperation. This chapter summarizes game theory with a focus on cooperation games, demographic theories with a focus on privately owned versus widely shared goods, and household archaeological methods and practices. Chapter 4 explains the methods I applied. I use the ArcGIS suite of programs to explore the spatial layout of the artifacts and statistical tools within these programs to quantifiably compare the selected floors. As an additional way to visually represent my findings, I also provide graphs created in Excel to compare the floors with each other. Chapter 5 explains and analyzes the results and discusses how my hypotheses apply to each floor. I include discussions about the features, lithic tools, and debitage, and how they contribute to the wealth of each section of the floor. Chapter 6 briefly summarizes my findings and suggests future areas of study, including a potential avenue to an expansion of this research project.

Chapter 2: The Mid Fraser and the St'át'imc

This thesis focuses on Housepit 54 in the Bridge River village in the Middle Fraser Canyon, in southwest British Columbia, Canada. The Fraser River starts in the Rocky Mountains in southeast British Columbia, meanders north to Prince George, then winds southwest until it meets the Pacific Ocean in Vancouver. The Mid-Fraser includes the area around Lillooet, a small mountain town in the Coast Mountain range and Bridge River, a tributary of the Fraser River (Figure 1).

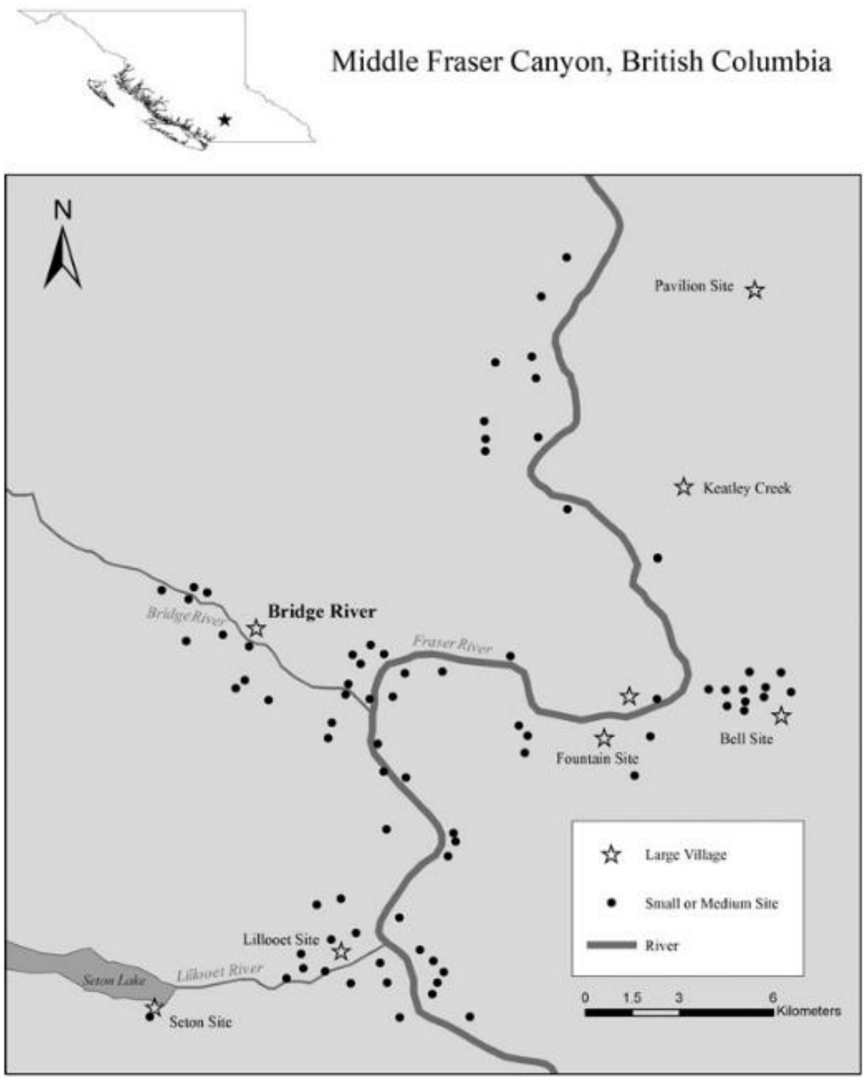

Figure: Map of the archaeological sites of the Mid-Fraser (Prentiss et al. 2018a).

Regional Background

There are several archaeological sites in the region, all of which act as a testament for how long the ancestors of the modern St'át'imc Nation have been in the area. Around 11,000 years ago, there is evidence of humans in the wider region, albeit only in the form of limited lithic scatters. The Nesikep tradition is the main culture that dominated the Mid-Fraser region, spanning from about 10,000 to 4,000 years ago, and includes the Early Nesikep, Lochnore, and Lehman phases (Fladmark 1982; Pokotylo and Mitchell 1998; Prentiss and Kuijt 2012; Rousseau 2004). These groups of people likely lived in small nomadic egalitarian family groups and seem to have relied on a wide range of mammals, focusing primarily on deer (Prentiss and Kuijt 2012). This subsistence strategy seemed to work for these groups until the Neoglacial cooling event occurred around in the area 4,200 to 4,100 years ago, when this cultural pattern disappeared (Prentiss and Kuijt 2012). This climatic cooling required a shift in subsistence strategies which resulted in the collector strategy (per Binford 1980) expanding onto the landscape (Prentiss and Kuijt 2012). The larger game populations seemed to stay stable, but access to them decreased during the cold months (Hallett et al. 2003). Likewise, the salmon population exploded with this change in the environment, but the length of salmon runs decreased which also reduced access (Hallett et al. 2003; Patterson et al. 2005; Prentiss and Kuijt 2012; Tunnicliffe et al. 2001). The colder climate caused the availability of berries and other floral resources to shrink both in length of time and quantity of bushes, especially with a decrease in forest fires that once helped to facilitate their spread (Hallett et al. 2003; Prentiss and Kuijt 2012). This limitation of edible resources lent itself to the development of a seasonal gathering round, utilizing the collector strategy – where groups would leave the camp in search of resources to return to the campsite with until the surrounding area's resources were depleted, then move the campsite to a new area

(Binford 1980). This strategy relies heavily on the stability and availability of resources year-round, but when the coldness of the winters decreased the available resources, the need for a food storage strategy developed (Angourakis et al. 2015; Prentiss and Kuijt 2012). The people of the Shuswap horizon adopted such a strategy around 3,500 to 2,500 years ago. The archaeological record shows that this group was semi-sedentary and lived in pithouses (Ritchie et al. 2016), developing storage pits around 3,000 years ago (Prentiss and Kuijt 2012). There is little evidence of the diet of these people, but salmon remains are the most frequently recovered faunal material, supporting the theorized impact of the Neoglacial cooling event on the both the fish and human populations (Prentiss and Kuijt 2012).

Around 2,400 to 1,300 years ago, a further shift in the climate occurred on a regional scale (Hay et al. 2007; Patterson et al. 2005; Tunnicliffe et al. 2001). The Fraser Valley Fire Period, so named for the rampant forest fires in the region, were likely a combination of longer and more severe droughts in the summer (Hallett et al. 2003), and an increase in human activity in the area (Lepofsky et al. 2005). A warmer trend would have meant another shift in resources – deer, elk, bears, and other smaller mammal populations increased, while salmon populations were smaller (Patterson et al. 2005; Tunnicliffe et al. 2001) and migrations were delayed until later in the season due to decreased rainfalls (Kew 1992; Lepofsky et al. 2005). This meant that the salmon were detained at the Lower Fraser River until the river raised sufficiently, which then lead to a smaller salmon population for the Mid-Fraser peoples due to overfishing at the Lower Fraser River in addition to the salmon runs occurring later in the year (Kew 1992; Lepofsky et al. 2005). Widespread forest fires also help spread plant seeds, which causes younger and more dense patches of plants. This was significant to the people of the Mid-Fraser because the availability of several edible plants – such as berry patches and tree stands – increased dramatically (Lepofsky et al. 2005). This increase in food availability led to a dramatic increase in the population size, leading to the development of villages in the Mid-Fraser, including the Bridge River village.

Site Background

The archaeological record of the Bridge River village consists of eighty pithouses that consist of larger multifamily and smaller single-family houses. In the single-family pithouses, there seems to be separate places for each different activity – cooking, knapping, or sleeping – but in the larger houses, there are multiple spaces used for the same activity around the perimeter of the house – indicating privatized space and specific areas for personal belongings for each of the families living in the house. In these houses, there is a significant amount of evidence for salmon harvesting and storage (Alexander 1992; Daly 2014), as the people of the Bridge River village and wider area developed better ways to collect and store salmon to meet the minimum caloric intake required to survive the winter (Kennedy and Bouchard 1992; Romanoff 1992a; Teit 1906, 1909, 1912). Some of these developments included dip nets – which could catch large quantities of salmon but let less highly ranked fish pass through – drying racks – a tool essential for drying salmon – as well as storage pits themselves (Kennedy and Bouchard 1992; Kew 1992; Prentiss and Kuijt 2012). According to ethnographic accounts, spring salmon was the preferred fish for storage, as it is a lean fish and is one of the first runs of the year (Kennedy and Bouchard 1992; Kew 1992)

The Bridge River village (Figure 2) was established about 1,800 years ago – referred to as the Bridge River 1 period – with seven houses (Prentiss and Kuijt 2012; Prentiss et al. 2018a). The Bridge River 2 period (1600 to 1300 cal BP) boasts eighteen houses (Prentiss et al. 2018b). The Bridge River 3 period began 1,300 years ago, when the village grew significantly in size and

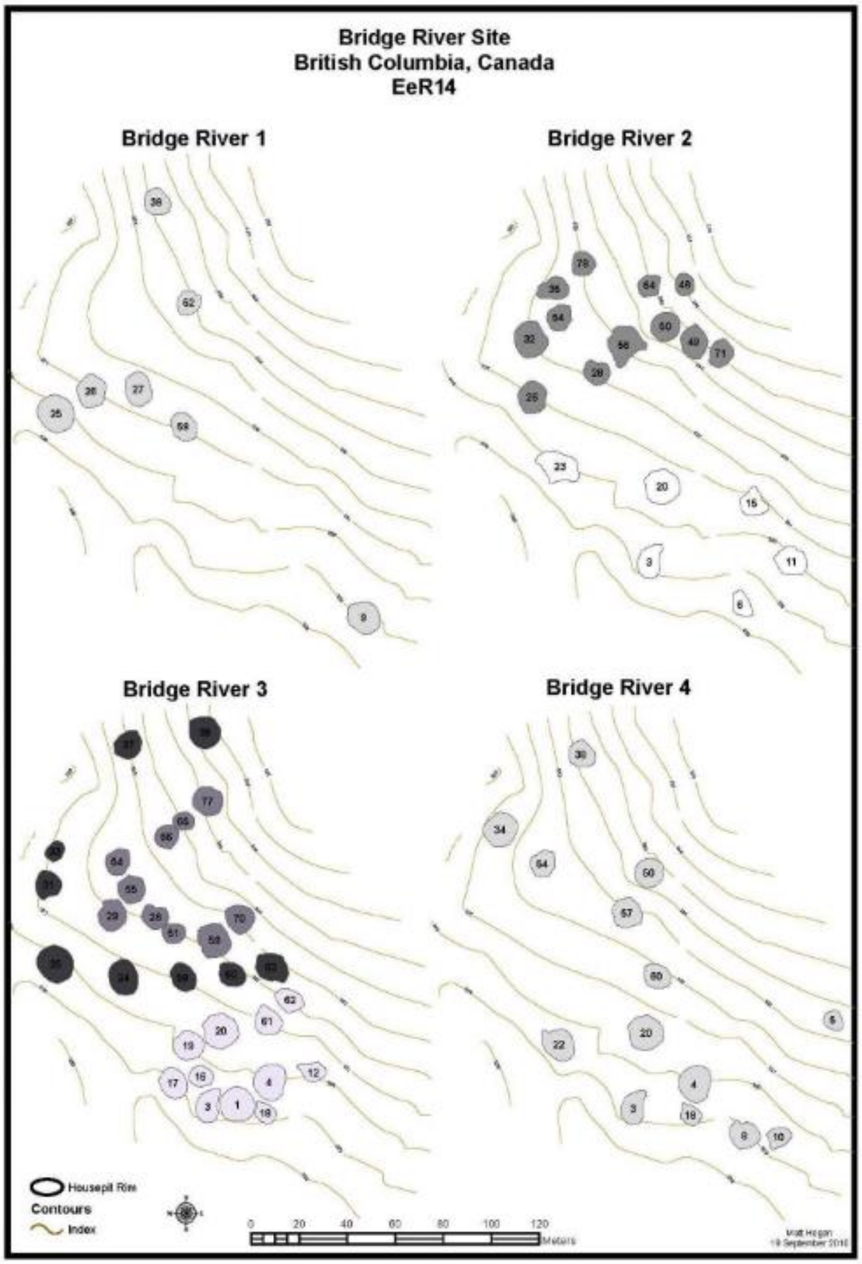

Figure 1: Map of the Bridge River village through different periods of occupation (Prentiss et al. 2018b).

population, to thirty occupied houses (Prentiss and Kuijt 2012; Prentiss et al. 2018b). Around this point, the archaeological record shows a decline in salmon remains and an incline in deer limb remnants (Prentiss et al. 2012, 2014), which indicates heavier field processing due to an increase in travel times and distance (Metcalfe and Barlow 1992). These trends reflect a shift in the climate, which in turn affected animal and human populations. Shortly after this major increase in village size, the village was abandoned around 1,000 years ago, marking the end of the Bridge River 3 period (Prentiss and Kuijt 2012). There are several competing theories as to why the village was abandoned. Some researchers claim it was due to a landslide that blocked the salmon from returning to their spawning grounds, decimating the salmon population, thereby similarly affecting the human population (Hayden and Ryder 1991). Others theorize that the increased global temperatures resulted in higher sea temperatures and lower amounts of rain, which reduced the vegetal resources that could be eaten by humans and the animals the humans hunted, resulting in a drastic reduction in food availability that decreased the human population (Hallett et al. 2003; Lepofsky et al. 2005). Another suggested cause is based on Malthusian population dynamics – as salmon populations fluctuated, the people hunted and gathered more intensively in the area, causing resource gathering excursions to travel farther for less food (Metcalfe and Barlow 1992), eventually resulting in a food desert that quickly and severely reduced the population (Prentiss et al. 2012, 2014, 2018a, 2020a). Whichever theory was the main factor in the abandonment of the Bridge River village, the inhabitants likely melted into smaller groups of 6 to 8 people and turned to a more cooperative, more mobile collector subsistence strategy (Prentiss and Kuijt 2012). The village's abandonment ended about 350 to 400 years ago, when a limited number of people moved back into Bridge River, occupying fourteen pithouses (Prentiss et al. 2018b). The influx of Europeans during the gold rush affected the Xwísten in profound and immeasurable ways through destroying habitats, stealing land and livelihoods, and spreading smallpox (Walsh 2017).

This thesis focuses on Housepit 54, one of the longer occupied houses of the Bridge River village. Throughout its life span, the house gained 17 floors and 7 roofs (Figure 3), spanning from the Bridge River 2 period into the Bridge River 3 period (Prentiss et al. 2020a). The deeper floors (IIm to IIo) were occupied during mid BR2 – from about 1460 to 1412 cal. B.P. – and were relatively small circular floors (Prentiss et al. 2020a). Floors IIl to IIf were larger and rectangular and were occupied during the transition from BR 2 to BR 3 – about 1388 to 1243 cal. B.P. – making Housepit 54 one of the three in the village to be continually occupied during this shift (Prentiss et al. 2018b, 2020a). The upper floors (IIe to IIa) saw the pithouse double in size again, becoming a large oval, and were occupied in the BR 3 period – from about 1219 to 1123 cal. B.P. (Prentiss et al. 2020a).

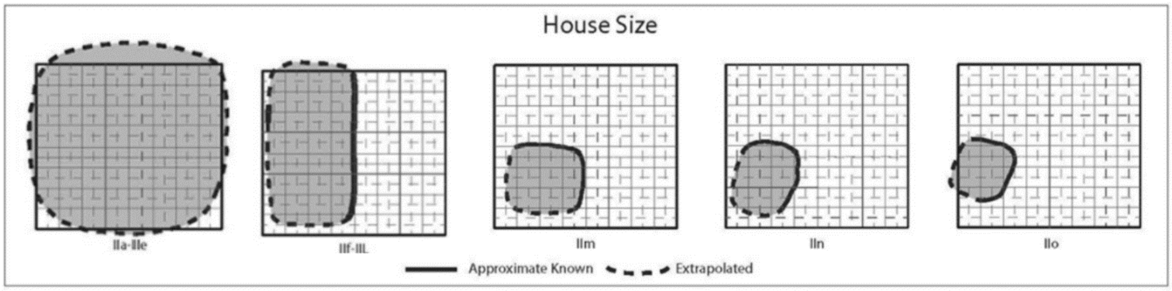

Figure 2: Floorplan of Housepit 54 over time (modified from Prentiss et al. 2018b).

There are a wide range of artifacts within the house: lithic debitage and tools, which use a wide range of raw materials, faunal remains that include salmon, deer, dog bones, fire cracked rocks, charcoal, and so far, a limited amount of macrobotanical materials. Prestige items – like anthropomorphic carvings or jade items – appear in the archaeological record in conjunction with ethnographic accounts of the establishment of an increased social hierarchy (Daly 2014; Teit 1906). According to these ethnographies, positions of power were both inherited and achieved – the title of chief was hereditary, but each head of household – while generally the eldest son of the previous head of the household – would have to earn their title through their own social status and achievements (Alexander 2000; Teit 1906). While some claim that ethnographies are not an appropriate or applicable analogy to precontact populations, ethnographies and oral histories can help interpret the archaeological record through the construction of ethnographic frames of reference (Binford 2001).

Demography

The size of the pithouse grew as a direct correlation to the population size of the house, but not necessarily the entire village. Based on ethnographic evidence, the average amount of space each person would inhabit was in the range of 1 square meter (Nastich 1954) to 3.9 square meters (Teit 1909). Hayden determined at the Keatley Creek site that in a small pithouse, each person would be alloted about 2 square meters, while in a larger pithouse, this average increased to about 2.5 square meters (Hayden 1997). This flat rate does not represent any potential fluctuations that may exist in a population at any time, and thus was not a sufficiently accurate estimate for Prentiss et al. (2018b) in the Bridge River village, who calculated a new measure using fire cracked rock – or FCR. This additional measure captures the distinctions of a changing population arguably more accurately, as the size of a pithouse often does not change between floors but the number of inhabitants likely does (Prentiss et al. 2018b). As seen in Table 1, the population estimate based on FCR changes at a different rate than the estimate based on floor size, but is relatively close for many of the floors (Prentiss et al. 2018b).

Table 1:Population estimates using two methods – the first method uses the average of 2 square meters per person based on the rough average of the pithouses of the Canadian Plateau, and the fire cracked rock was counted in cobble and pebble sizes (Prentiss et al. 2018b).

Floor	Square meters	Population estimate	FCR count	Excavated floor volume	FCR count/ floor vol.	NH	Population estimate
IIa	64	32	1736	1.3	1331	4	33
IIb	64	32	1415	1.24	1142	4	29
IIc	64	32	1199	0.93	1292	3	24
IId	64	32	1303	1.07	1220	3	23
IIe	64	32	1460	0.83	1756	4	44
IIf	32	16	1229	0.72	1704	3	32
IIg	32	16	623	0.6	1038	3	19
IIh	32	16	1153	0.92	1249	2	16
IIi	32	16	373	0.57	650	2	8
IIj	32	16	322	0.39	819	3	15
IIk	32	16	534	1.31	409	2	5
IIl	32	16	338	0.52	650	2	8
IIm	16	8	148	0.23	646	1	4
IIn	16	8	82	0.15	535	1	3
IIo	16	8	90	0.15	588	1	4

NH = number of hearth-centered activity areas.

The Bridge River village has also been thoroughly examined through the lens of Malthusian demographic theory. Based on the productivity of edible resources (Prentiss et al.

2014, 2020a) or the volume of cache pits (Prentiss et al. 2018b), it is clear when the village's population dynamics changed drastically enough to result in a Malthusian phase – a time in which a population has attained a relatively stable equilibrium (Puleston et al. 2014) – which seems to have occurred twice. By all measures, there appears to have been the end of the copial phase – the period where the population dramatically increases due to an abundance of food (Puleston et al. 2014) – at IIj and IIe (Prentiss et al. 2014, 2018b, 2020a). After the copial phase, the choices the population makes during the transition phase will determine the nature of the Malthusian phase (Malthus 1872; Puleston et al. 2014; Puleston and Winterhalder 2019). If the population recognizes the danger of population pressure and changes its behavior, it may achieve stability with a Malthusian ceiling (Malthus 1872; Prentiss 2019; Puleston et al. 2014). If a change in behavior does not occur, the population must be reduced in some manner to increase the chance of the society's survival (Malthus 1872; Prentiss 2019; Puleston et al. 2014). In the case of Bridge River, there is a sharp decrease in the population size at IIi and IId, which is likely due to a decrease in salmon populations (Kew 1992; Patterson et al. 2005; Tunnicliffe et al. 2001) which in turn caused the human population to move elsewhere in the search for food (Prentiss et al. 2014, 2018b, 2020a).

Chapter 3: Theoretical Framework, Hypotheses, and Test Expectations

This study uses spatial patterns and household archaeology to examine privatized wealth and cooperation within Housepit 54. As with many other studies on the social aspects of Housepit 54, this thesis relies heavily on the definition of "household" (Prentiss et al. 2012, 2014, 2018a, 2018b, 2020a, 2020b, 2020c; Ryan 2018; Tringham 1992, 1995; Wilk and Rathje 1982). The study of cooperation through game theory also provides a solid foundation for this thesis, as it is vital to understand how cooperative strategies theoretically arise and persist, and perhaps more importantly to the field of archaeology, to see if these scenarios can be extrapolated from the archaeological record. Additionally, risk reduction strategies from the world of demographic theory offers context for decisions regarding cooperation that are based on models based on an amalgamation of human logic and algorithms. In combination, these theories build a strong background for my hypotheses and thesis.

Household Archaeology

Examination of archaeological (Prentiss and Kuijt 2004; Chatters and Pokotylo 1998) and ethnographic accounts (Kennedy and Bouchard 1998) from the Canadian Plateau reveals that the culture groups of the Mid-Fraser can be classified as house societies (Coupland et al. 2009; Levi-Strauss 1982). Household archaeology is thus a highly appropriate approach for understanding the organization of those houses and communities. A major aspect of household archaeology is to define a "household" in and of itself, versus a "house," "hearth group" (Hampton and Prentiss 2020), or as an ethnography coined, "fire group" (Hill-Tout 1905). Early in the development of household archaeology, a "house" was not differentiated from a "household" – the term "household" was meant to simply be those who live in the "house" (Morgan 1881). According to Levi-Strauss, the house is a corporate body made up of material and immaterial wealth that gets transmitted through titles (1982). The house also links certain peer groups to specific physical objects, which allows for the study of the household artifacts and the social structures that provided for their deposition (Gillespie 2000). While the transfer of certain titles and forms of wealth did occur in the Bridge River village (Nastich 1954; Prentiss et al. 2020b; Teit 1906), the concept of "household" often extends farther than that. "Households" have been defined as comprising the basic unit of production (Braun and Plog 1982), the most common social component of subsistence (Wilk and Rathje 1982), as a domestic unit that is usually coresident (Netting 1982), or as the maximal overlap of different activity areas (Douglass and Gonlin 2012). There are some Northwest Coast household archaeology studies that differentiate between a corporate household – all of those living within a single structure – and independent households – or a nuclear family (Gahr et al. 2006). Alternatively, "hearth groups" is a term used to identify a group of individuals who routinely operate around a specific hearth within a house, and there may be multiple hearth groups within a household (Hampton and Prentiss 2020). A term that outwardly seems to be a similar concept, "fire groups" is narrowly defined as blood-kin and family and is primarily seen in ethnographic accounts (Hill-Tout 1905). The bulk of these definitions are vastly different from the concept of "family" and are more commonly used in anthropological writings, as it is often more important to determine the role a household plays rather than the social form it takes (Tringham 1991) as well as the behavior the household engages in (Douglass and Gonlin 2012). While there are aspects of the term that are contradictory, the household is vital to understanding Pacific Northwest house societies and in the Bridge River village, hearth groups are currently the smallest unit that is feasible for use in analysis.

It is a well-established theory that the size of a house and the wealth of the house are positively correlated, as it is easier to attract poor members from other houses to a house with a higher level of prosperity (Netting 1982). Moving to a wealthy house is an attractive prospect, as this would reduce the risk of starvation as well as increase that individual's social standing within the village (Ames 2006). However, a poorer group living within a wealthy house would not automatically be granted the same status as the head of the house – there would be distinct differences in each hearth groups' associated assemblages. Using household archaeology, each hearth group can be identified through the spatial layout of artifacts, features, and activity areas, and from there, it is possible to examine the social interactions within the house, as seen in multiple studies of the houses at Bridge River (Hampton and Prentiss 2020; Prentiss et al. 2014, 2018a, 2018b, 2020a, 2020b) and Keatley Creek (Lepofsky et al. 1996).

Household archaeological studies are informed by behavioral archaeology's conceptions of site formation processes and the life history of a house (Schiffer 1972, 1978, 2010; Tringham 1995). Behavioral archaeology is defined as "the study of material objects regardless of time and space in order to describe and explain human behavior" (Reid et al. 1975). This concept was eventually expanded to identify durable and consumable life histories, but regardless of its life cycle, material is eventually deposited into the archaeological record. An artifact could enter the archaeological record through the site's abandonment, loss of the artifact, with the burial of the dead, or intentionally discarded (Schiffer 1976). When an artifact is discarded, it can be at a primary or secondary refuse site. A primary refuse site is where material was utilized and discarded while a secondary refuse site is where the material was transported to after its use and then discarded (Schiffer 1976). It is generally difficult to determine which type of refuse site an archaeological site may be, and even more specifically, what a subterranean pit may have been used for. It is possible that cache pits were used for trash pits once the usable material was used, but this distinction may be difficult to determine from examining the abandoned pit as the kinds of materials that were cached were often the same as what was discarded (Kent 1999). Semi-sedentary populations, like those of the Bridge River village, were found to have specific locations for their trash and it may be possible to determine the difference between trash or cache pits (Kent 1999).

At the Bridge River village, when the pithouse inhabitants needed to refresh the floor due to the old floor's overuse or from the ritual burning of the house, they would lay fresh sediment rather than dig a new floor, as the inhabitants of the nearby Keatley Creek village would (Prentiss and Kuijt 2012; Hayden 1997). This practice preserves the spatial layout of each occupation layer of the pithouse, which can then be used to extrapolate variation in social relationships (Bailey 1990) over time (Prentiss et al. 2012, 2014, 2018a, 2018b, 2020a, 2020b, 2020c).

Demographic Theory

Theories of demographic ecology are useful in understanding the histories of human settlements (Puleston and Winterhalder 2019). They are especially effective when combined with other models from human behavioral ecology concerning subsistence and social relationships, all of which are studied in the greater umbrella of human ecology. This research examines human behavior and assesses the ways in which humans optimize efficiency, thereby reducing risk. The subsistence patterns and cultural traditions of a group of people also tend to dictate what risks a society may face at any given time based on several factors, aspects of which are translated into parameters to build a model to attempt to replicate human behavior as accurately as possible

(Winterhalder 1986). Through these models, some commonalities in basic human reactions arise, which in turn help identify behaviors.

In a foraging society, humans should select food resources that have low short-term risk of capture failure rather than a riskier food source (Winterhalder 1981), but this diet depends on the ever-changing densities of the surrounding resources (Winterhalder et al. 1988). The more dependent a population is on any resource (Winterhalder 1983), the greater of a risk the population is exposed to in the event of resource failure (Winterhalder and Goland 1997). Similarly, in times of food scarcity, a population may be willing to engage in increasingly more risky behavior to ensure its survival (Kohler and Van West 1996; Winterhalder et al. 1999). In seasonally sedentary populations like the Bridge River village inhabitants, the population is limited by the amount of energy – rather than time – it will be able to spend gathering a highly ranked resource (Winterhalder 1983).

In a population's never-ending quest to increase its fitness, there is a greater chance for catastrophe when the region's carrying capacity is reached. Malthusian and Boserupian demographic theory examine different reasons behind the processes a population may experience to reach this limit (Prentiss 2019; Puleston and Winterhalder 2019). Malthus considers the balance between consumers and edible resources as the main force in changes in population size (Malthus 1976; Prentiss 2019; Puleston and Winterhalder 2019). Boserup views the independent variable as population growth and the caloric production was increased to meet the needs of the population (Boserup 1965; Prentiss 2019; Puleston and Winterhalder 2019). However, high fertility and a high efficiency in food gathering leads to collapse at a much faster rate, as these trends tend to diminish the resource availability exponentially, especially in comparison to populations with lower efficiencies, where the resources can stabilize at a level that is healthy for the ecosystem (Szulga 2012). Fertility is generally linked to efficiency in caloric gathering and food availability (Lee et al. 2009; Lee and Tuljapurkar 2008; Puleston and Tuljapurkar 2008). Additionally, the more growth a population experiences before a Malthusian event, the more difficult the transitional period and Malthusian event will be (Puleston et al. 2014), which may have been the case in Housepit 54's IIe and IId floors. The Malthusian cycle has been well studied in the Bridge River village (Prentiss et al. 2014, 2018b, 2020a), and has been theorized that as the village approached the limit of its carrying capacity, the people were forced to either find a more efficient way to gather food, change food sources, or reduce the population size through moving to a new location (Hegmon 1989; Winterhalder et al. 2015) or perishing.

Food based risk management develops another set of common human responses. A poor year for resource accumulation may cause the population to decrease at a faster rate than a good year may increase it, causing the most prudent reaction to be attempting to develop mechanisms to offset the potential risk of a bad year as much as possible (Lee et al. 2009). Diversification in diets, crops, spatially, and temporally, along with overproduction (Marston 2011), or through maximizing the collecting efficiency (Winterhalder 1986) are avenues to minimize this risk. Diet, crop, spatial, and temporal diversification depends on patch availability of different resources or the knowledge to maintain different crops, the ability to expand territories, and the climate. Overproduction, or the creation of surplus – especially in sedentary societies – was generally only considered useful and a risk-minimization strategy if this surplus is combined with the development of storage strategies (Brenton 1988; Kuijt 2009) or through collaboration (Angourakis et al. 2015; Winterhalder 1986, 1996). Sharing food within a small, stable group comprised of more than a singular individual or household is a more efficient way to reduce risk than to fully change a diet (Winterhalder 1986, 1996). Thus, it is helpful to consider the usefulness of cooperative strategies.

Cooperative Game Theory

There is an extensive literature concerning the evolution of cooperation and altruism. This is approached through the study of game theory (Axelrod and Hamilton 1981; Boyd and Richerson 1992; Carballo et al. 2014; Henrich et al. 2010; Mathew and Boyd 2011) and ethnographic case studies (Bowles 2006; Wiessner 2002). Despite this fascination, there have been very few studies on cooperation in archaeological contexts (Eerkens 2004; Munro and Grosman 2010), and even fewer methodological approaches developed to examine cooperation from the archaeological record (Prentiss et al. 2018a).

Altruism and cooperation are believed to have begun in closely related kin groups, where cooperative behaviors formed to assist family members and increase inclusive fitness – even when combined with a personal cost (Axelrod and Hamilton 1981). Further studies found that the tit for tat strategy is also evolutionarily stable, which means that one act of altruism could start a cascade of cooperation, thereby allowing group selection to occur and the strategy to invade the population and create a cooperative society (Axelrod and Hamilton 1981; Kristinsson and Júlíusson 2016). Another study of cooperation determined that there is a relationship with purchased calories and fairness, as well as community size and punishment (Henrich et al. 2010). According to modern ethnographic populations, the larger a community is, the more prevalent punishment is (Henrich et al. 2010). The term “punishment” also implies the presence of a strong central authority that has the authorization or power to dole out punishment and still maintain popular support (Stanish 2017). While they may lack a clear central authority that we associate with statehood, Northwest Coast societies are highly hierarchal, where kin structures act a as a proxy for organizational authority – allowing for the creation of a formalized punishment system (Bettinger 2015).

Boyd and Richerson (1992) posit that retribution, a different form of punishment, can lead to a cooperative society, and that this pathway to cooperation is more likely than through reciprocation. Retribution can lead to cooperation by invading the community and proliferating or through moralistic strategies (Boyd and Richerson 1992). Moralistic strategies are ways for an authority to call upon the consciences of a population to extend their control (Hardin 1968), a concept that ties in well with another mechanism of cooperation – reputation (Carballo et al. 2014). If an individual did not adhere to the social norms, the individual might be punished by those who witnessed the deviation, as well as those who were told about the deviation, resulting in a wider range of people refusing to interact in a normal manner with the individual – also called second-hand punishment (Carballo et al. 2014). This would most likely take the form of refusing to trade, which would result in a clear shift in material goods as time went on. Either through the physical act of punishment, or the more social and economic forms of retribution, there should be some remaining archaeological evidence regarding a shift in the social organizations as the village gets larger.

In addition to punishment or retribution, reciprocity, reputation, and reward are mechanisms that help encourage cooperation in societies (Carballo et al. 2014; Stanish 2017). Reciprocity, or fairness, is highly important in societies where coercion is not utilized. In a hierarchal society like those of the Northwest Coast, elites could use their social status to coerce people to hoard wealth and gain more power (Bettinger 2015; Hardin 1968; Stanish 2017). Using their accumulated power, elites could then set norms of fairness which would reflect upon an individual's reputation, and reward people operating in an appropriate manner according to these norms or punish those who were not (Stanish 2017). Reward is where an individual forgoes material gain in favor of giving it to someone else who had treated the individual favorably in the past (Carballo et al. 2014; Stanish 2017). The final mechanism, reputation, is defined as the degree to which an individual's actions determine how a community may feel about the individual (Carballo et al. 2014; Stanish 2017) and is tied very closely to the mechanism of reciprocity (Carballo 2013). The four mechanisms are interlinked and create a feedback loop that ultimately results in a cooperative society (Stanish 2017).

Even in societies like on the Northwest Coast where coercion may have been an important management tactic, Hayden's (2014) aggrandizer hypothesis is unlikely, as social standing was primarily pursued through feasting events and engaging in other costly behaviors that would materially benefit the population, as well as the evidence that high levels of cooperation and group cohesion were primarily sustained by ritual and taboo (Stanish 2017). As effective storage strategies were developed and allowed for longer term storage (Kuijt 2015), food sharing became a more effective way of displaying wealth (Barrier 2011; Bogaard et al. 2009; Romanoff 1992a, 1992b). Potlatches, while used in the Pacific Northwest to show and gain status (Hayden 2014; Teit 1900), were also used a way to redistribute wealth and share more widely among the village (Teit 1900). Furthermore, in collector societies such as those of the Mid-Fraser Valley, a significant amount of food was likely consumed as it was gathered, and any surplus was kept for storage – thereby eliminating the scrounging strategy from the population (Winterhalder 1996).

Based on the study of food storage from Angourakis et al. (2015), in most settings with high resource availability in a short length of time, a cooperative society is the most likely outcome. However, Winterhalder et al. (2015) find that competitiveness is highly likely in situations where food sources are unpredictable, and food storage would only sometimes be available to the population. In Housepit 54, based on the consistent presence of storage pits, it seems more likely that the theory posited by Angourakis et al. (2015) is applicable and we can reasonably expect evidence of cooperation. There is also strong evidence suggesting that many societies operated in modular system (Carballo et al. 2014). The members of a house may cooperate with themselves for the purposes of gathering food, but the entire village may join to repel invaders (Carballo et al. 2014). This system provides for each household and hearth group to maintain its own form of economic autonomy but reap the benefits of living in a village – a classic example of a collective society (Coupland et al. 2009). The Coast Salish are such a collective society, where each hearth group would have its own private food collection (Coupland et al. 2009) and would not "'lose the self' for the welfare of their community" (Moemeka 1998:119). Cooperation is also likely to be a more valuable strategy when there is temporally or spatially variable, high producing resources – such as the salmon runs at the Bridge River village (Kohler and Van West 1996; Kew 1992; Prentiss and Kuijt 2012).

As previously stated, cooperation was vital during salmon runs and for collecting other seasonally limited resources (Kohler and Van West 1996). Due to the high resource level restricted to a short time, the food had to processed quickly and correctly to ensure it would still be edible during the winter when it would be needed most (Kuijt 2009, 2015; Winterhalder et al. 2015). Food production, food storage, and social inequality are interrelated, thus presenting another facet to the study of cooperation (Kuijt 2009; Testart 1982). Each hearth group had to decide whether to keep the food in a private storage or to provide the entire group access (Angourakis et al. 2015), as a little extra food would barely add any benefit a household with enough food but would immensely improve the fitness of a household that barely had anything

(Winterhalder 1996; Winterhalder et al. 1999). It is also likely that each house shared amongst itself, as there is a better proportion of risk reduction when sharing occurs in smaller groups (Kelly 1995; Winterhalder 1986, 1996). As is the case at Bridge River, cooperation is a favored strategy in medium to high household dependency on storable foods – which was vital in the winter months (Hayden 1997; Prentiss and Kuijt 2012); intermediate control over reciprocity – which was likely a very balanced system (Bettinger 2015); a medium amount of efficiency of food storage – when there was spoiled food, it was likely given to the dogs of the household (Kuijt 2015; Prentiss et al. 2012); and higher cooperative efficiency than household efficiency – which was certainly the case, as leaders were able to organize and mobilize groups of people to do different tasks to complete complex tasks quickly (Ames and Maschner 1999; Angourakis et al. 2015). Once these cooperative strategies emerge, it is unlikely they fell out of use – except in cases where there is extremely low cooperative storage efficiency or extremely high household storage efficiency (Angourakis et al. 2015).

From the previous studies at the Bridge River village, it seems that Housepit 54 was overarchingly a collective house, where members regularly cooperated but each hearth group was able to maintain its own economic autonomy (Coupland et al. 2009; Prentiss et al. 2012, 2018a). One study identified a large disparity of edible wealth between Housepit 54 and other houses – during a time of resource depression due to a lack of salmon and ungulates, Housepits 24 and 25 were feasting while Housepit 54 had very little faunal remnants (Prentiss et al. 2012). At the time, Housepits 24 and 25 were newer houses and much larger in comparison to Housepit 54 (Prentiss et al. 2012). One theory was that Housepits 24 and 25 were more effective at cooperating which allowed the house to stockpile food and goods, allowing the members to throw feasts to attract more people from other failing houses to their house (Ames 2006; Prentiss et al. 2012). In times of abandonment where production needs to be diverse to offset the risk of the variably available resources, the remaining people should group together to ensure the group's subsistence and protection (Wilk and Rathje 1982). Larger houses that pool production and distribution are more stable and have more generational continuity, which would be helpful in times of resource stress to reduce the risk of starvation and raiding parties (Wilk and Rathje 1982). While this makes logical sense, it is likely that the remaining members of the village cooperated only reluctantly as a last resort before complete abandonment (i.e., Boyd and Richerson 1992). Studies of cooperation within Housepit 54 are similarly interesting. Through the use multivariate statistics, wealth-based inequality was compared to cooperation within Housepit 54 (Prentiss et al. 2018a). Cooperation was determined by examining the spatial layout of the house – redundant activity areas with the same artifacts likely indicate low rates of cooperation due to each household having its own processing and lithic workshop areas (Prentiss et al. 2018a). In this context, cooperation would be seen either through less redundancy in activity areas or through highly specialized activity areas.

In theory, there are many ways to search for the presence of cooperation in the archaeological record. Stanish (2017) presents a few theoretical scenarios that show evidence for cooperation, but the most applicable for this site is the enhancement of domestic structures as a correlate for more social complexity – by the time of Bridge River 3, the newer and wealthier houses are the largest houses with the highest evidence of inequality (Prentiss et al. 2012, 2014, 2018a). This increase in social complexity meant that certain people had some amount of control over others – in Bridge River, these are known to be the heads of the houses (Alexander 2000; Ames 1981; Nastich 1954). Those of greater and larger houses had more people to organize, and through one method or another, could get members of the house to cooperate and engage in complex simultaneous tasks, with many people doing different tasks at the same time (Ames and Maschner 1999). This was vital during salmon runs, where most of the food for the winter would come from. It is possible this was the cause of cooperation at Bridge River, as it is likely to be a valuable strategy in situations where there is a high amount of food calories available for only a limited time (Angourakis et al. 2015; Kohler and Van West 1996). Similarly, to obtain the most calories per unit of work, the salmon had to be efficiently processed and stored to prevent spoilage (Dejene et al. 2006) – likely requiring more cooperation (Kuijt 2015). The heads of larger houses that already had the most people would create a positive feedback loop, where the houses would work together more effectively to collect more salmon, thereby adding to the house's wealth, which would then attract more people to it, creating more wealth the next year (Ames and Maschner 1999; Prentiss et al. 2020c). This generally meant that the larger houses were wealthier and more powerful (Ames and Maschner 1999).

Members of houses generally followed the head of the house's lead for many reasons. Many of the members of the house were likely related to the head in some way and so by increasing the head's status, members would be helping their own family (Hill-Tout 1905; Teit 1906). In the case the member was not related to the head, however, it is still likely they would cooperate, as being a member of a prestigious house was still very honorable, and by increasing the house's status, the status of the members would likewise rise (Teit 1906). A cascade of cooperation could have easily occurred – an individual sacrifices some of their own energy to assist a neighbor who happens to be kin, creating a standard and predisposition to assist others, expanding the strategy of cooperation. In addition to that trend, the heads of the houses were instructed by their predecessors to treat the other members fairly, which seems to be evidence for a well-established custom of fairness and thereby, cooperation (Teit 1906). Furthermore, as the

Coast Salish houses had permissive membership, if a member felt they were being treated unfairly, they could leave for another house where they felt there were better prospects (Coupland et al. 2009). After combining these lines of evidence, cooperation was incredibly likely to have been a useful and utilized strategy at Bridge River, even before considering the potential to examine punishment.

As Carballo et al. (2014) state, punishment is an important mechanism to ensure cooperation. From the ethnographic record (Teit 1906), it seems that there was a strong custom of reciprocity among the St'át'imc, which is another vital mechanism to promote cooperation (Carballo et al. 2014). With the established existence of fairness, it is equally likely that there is evidence for punishment, especially in conjunction with other studies of cooperation. Henrich et al. (2010) posits that there should be evidence of punishment as a population grows – which, during the life span of the village, Bridge River had doubled in size. Since it is not possible to view the ancestors and their methods of punishment to coerce cooperation, we should use the archaeological record to look for changes in the material goods – if there is secondhand punishment, this could be reflected in the record due to people refusing to trade with the offending party, thereby impacting the material goods this household has access to (Boyd and Richerson 1992). In addition to the material remains, we can also use the ethnographic record and oral histories to examine the social and economic results of punishment, but as we do not wish to disturb the ancestors, the physical aspect of punishment cannot be pursued.

The main goals are to quantifiably assess cooperation from the material record. However. since cooperation is so difficult to see in the record, I look at cooperation through the study of its opposites. Through the lack of evidence for the reverse, it would be possible to demonstrate the existence of cooperation. There can be multiple opposites of cooperation, which depends on the facet of cooperation under study. Conflict or warfare is one example, where people either fight (showing conflict) or make peace (showing cooperation) but is not a viable option for research at Bridge River (Eerkens 2004; Dye 2009). These research topics rely heavily on the physical presence of the ancestors, which are to remain undisturbed (Dye 2009). It could also be possible to examine oral histories and ethnographies, but it would be difficult to take what the modern or ethnographic populations' experiences are and extrapolate them to a thousand years ago – even if a population has been continually warring with the same group for that long, periods of relative peace and prosperity are just as likely during that time span.

A more applicable and widespread way to examine cooperation is through the study of privatization. Eerkens (2004) justified privatization in the Western Great Basin through the increase in seeds and pottery – both of which were privately collected or constructed and stored exclusively within houses. Goods stored in locations that are hidden from the members of other households are more likely to be privately owned (Eerkens 2004; Hawkes 1993; Kuijt 2015). Seeds and plants gathered by women are likely to be kept privately to feed their families, while big game meat collected by men is more likely to be shared among a wider population to increase social standing (Eerkens 2004; Hawkes 1993; Wiessner 2002). From a purely biological standpoint, it makes more sense to secure sufficient calories for the individual's hearth group before providing any assistance to the rest of the house, although reducing risk through sharing provides a strong argument for cooperation and sharing (Winterhalder 1986, 1996; Winterhalder et al. 1999).

Hypotheses

As Housepit 54 is a larger house in a more collectivist society, privatization is expected throughout the lifespan of the house. Based on the availability and productivity of resources, the population size, and the location of the features and artifacts within the house, it is possible to examine the degree of privatization and therefore cooperation, for each floor of the pithouse, providing a better picture of how the St'át'imc have operated throughout the habitation of the Bridge River village. While collecting food for storage may be a communal activity, as the quantity of surplus increases, a stronger and more formalized hierarchy develops, and the surplus advances the interests of the elites, resulting in more wealth (Angourakis et al. 2015; Wesson 1999; Winterhalder et al. 2015). As the relative wealth of these elites increased, more extravagant displays of food sharing increased, further increasing the household's wealth (Bogaard et al. 2009). Concurrently, the locations of storage pits likely shifted to reflect control over subsistence good distributions (Frink 2007). In addition to effectively preventing food from spoiling, the use of subterranean pits may reflect a desire to keep goods hidden (Barrier 2011) and therefore privatized, and in some places like the nearby Thompson villages, actively hiding cache pits under where people sit (Alexander 2000; Teit 1898). Therefore, based on the size, location, and contents of the cache pits in addition to the spatial layout of the floors themselves, there should be evidence of differential wealth and privatization. This evidence will, in turn, provide support for the existence of cooperation as an integral strategy.

Hypothesis 1**:** The level of cooperation is driven primarily by the level of wealth rather than the population size. This is due to the importance of material wealth within the society, expressed through the economically driven cooperative mechanisms of reward and punishment. The more wealth there is on the floor, the more cooperation there should be. The use of reward and punishment to reenforce cooperation indicates the heads of the households' abilities to organize household members to generate more wealth, which in turn, attracts more members to the house. The heads of the households coerce the other members of the household to leverage the best goods for themselves, controlling distribution and using the surplus to display their wealth to the wider village, increasing the status of the house.

Test Expectations**:** In this scenario, on the floors with higher material wealth, there should be a higher population on the subsequent floor. On the floors with higher relative material wealth, the cache pits should be large to accommodate more hearth groups but positioned in the block with the highest proportion of the floor's wealth. In these sections on these floors, there should be the highest amount of rare lithic raw material, such as nephrite, and more labor-intensive tools, both of which indicate material wealth. The other hearth groups in the house should possess a fair amount of similar raw material, but likely smaller in quantity. This should result in uneven elements across blocks – the block with the head of the household should distribute the wealth amongst the rest of the blocks depending on how each block may have curried favor with the head of the household, indicating cooperation between each hearth group and the head of the house, but not necessarily among the hearth groups. On the floors with lower relative material wealth, there should be multiple small cache pits that are positioned in different hearth groups' areas. These floors should have vastly different goods across the hearth groups that are privately owned, as each hearth group pursues individual interests and strategies and contributes to the wealth of the elite hearth group. This should result in a relatively even amount of total nonlocal material, as the head of the household will not be able to coerce different groups into working together to achieve a goal. There should be more local material, but less types of material on these floors as well. Reward and punishment should result in two distinct patterns of differential wealth.

The use of reward should be visible through a higher amount of material wealth across the entire floor on average. On floors where there is a higher level of this form of wealth in one section of the house compared to other floors, the rest of the hearth groups in the floor should similarly reflect a higher relative level of material wealth. On floors where there is lower material wealth in the traditionally wealthy area of the floor, the rest of the floor should be similarly less wealthy and more evenly distributed. Direct evidence of punishment may be more difficult to see in the archaeological record, as the span of time is likely not sufficiently fine-grained to determine if a hearth group was being punished. Additionally, in Bridge River's society with fluid house membership, it is unlikely that a hearth group would submit to being punished without fixing the situation – instead likely choosing to leave for another house or village. If the group does not leave and accepts its punishment, the evidence of such should take the form of a shift from relative wealth on the previous floor to significantly less wealth on the next floor. Alternatively, if the group left, there should be a drastic shift in the raw materials and spatial organization of the block as another group moved into the house.

***Hypothesis 2*:** The level of cooperation is driven primarily by the size of the population rather than the level of wealth. This is due to the importance of relational wealth in the society, expressed through the socially driven cooperative mechanisms of reputation and reciprocity. The larger the population there is on the floor, the more cooperation there should be. The use of reputation and reciprocity to reinforce cooperation indicates the concept of fairness that was vital to the structure of the households, eventually creating more wealth for the house. The heads of the households would have used their social standing and influence to inspire cooperation within the house.

***Test Expectations*:** In this scenario, on the floors with a higher population, there should be more material wealth on the subsequent floor. On the floors with a larger population, the cache pits should be large to accommodate more hearth groups and centrally positioned. It is likely that not all the most prestigious artifacts will be found in the same section of the house, as different groups develop different relationships with other groups, resulting in different densities of tools made of nonlocal raw materials, thereby indicating relational wealth. The total amount of nonlocal lithic materials should be more even between the blocks as the inhabitants trade some material for others. On the floors with a smaller population, there should be smaller independently controlled cache pits in individual hearth areas. The total amounts of artifacts should be relatively uneven as each hearth group leverages their relationships with other groups to gain status and social capital. It is likely that one group will have a significantly large amount of a specific material and will either share a small amount with the members of another block or keep it all to themselves. Reputation and reciprocity are closely related social mechanisms but should still appear in the archaeological record.

In the case of both reputation and reciprocity, the actions of household members in the larger society would dictate how others reacted to them. This should lead to more popular – or more generous – members of a society to acquire social capital, collecting others to expand their household and thereby generating material wealth. In the scenario where relational wealth is more important, material wealth would be uneven at first as individuals competed for status until the population and social hierarchy solidified. In this larger population, the head of the household might be more generous with material goods to gain social favors and inspire individuals to efficiently work together, so the artifacts spread across floors would be more even. It is possible that there would be relatively large activity areas where members of multiple households may have worked together to accomplish a task.

Table 2: A summary of test expectations for each hypothesis to examine the potential amount of cooperation between blocks.

	Hypothesis 1	Hypothesis 2
Storage Pits	Larger, in wealthiest block	Larger, centrally placed
Debitage	Larger pieces in wealthiest block with smaller pieces in the other blocks	Varying sizes and materials between all blocks
Tools	Prestigious tools in wealthiest block with some less prestigious items in other blocks	Prestigious tools should be found in relatively equal amounts in all blocks
Nonlocal Raw Materials	Most types in wealthiest block, other blocks have less of some of the same types	Raw material in all blocks spread more evenly

Table 3: A summary of test expectations for each hypothesis to examine the potential amount of cooperation between floors.

	Material Wealth (Hypothesis 1)	Relational Wealth (Hypothesis 2)
Relatively Low	Even	Uneven
Relatively High	Uneven	Even

Chapter 4: Methods

The study of cooperation through the lens of privately owned goods requires a study of different types of wealth. There are three different types of wealth: embodied, relational, and material (Borgerhoff Mulder et al. 2009). Embodied wealth is difficult to examine without the physical remains but could be possible to tease out through diet studies. Relational and material wealth are comparatively much easier to examine. We know from ethnographies that individuals could claim membership in either of their parents' clans, but not both (Teit 1906). House membership was determined in a similar way – an individual could live in an appropriate house in the village but could not belong to multiple households simultaneously (Coupland et al. 2009). Since clans, villages and households were organized by kin networks, it is possible to trace trade networks and patterns of sharing, thereby providing evidence of social wealth. In Housepit 54, specific sections of floor were inheritable as seen through the measure of social continuity index (Hampton and Prentiss 2020). Through the archaeological record, it is possible to view both the material wealth and the relational wealth by examining nonlocal lithic raw material in the form of tools and debitage.

The use of GIS tools and spatial analysis within the framework of household archaeology has proven to be useful from the plentiful studies of Housepit 54 (Barnett 2015; Hampton and Prentiss 2020; Prentiss et al. 2018b, 2020b; Ryan 2018; Williams-Larson 2017). None of these studies could have been possible without the careful excavation techniques that have been used at Bridge River since 2003. The house is partitioned into four blocks – Block A in the southwest, Block B in the southeast, Block C in the northwest, and Block D in the northeast – which are then divided into sixteen one square meter units numbered 1 through 16, which are further divided into quadrants of 50 by 50 centimeters identified by the cardinal direction – northeast, northwest, southeast, and southwest. Whenever possible, artifacts are left in situ and the location is precisely measured, otherwise, artifacts are recovered from screens and are associated with the entire quad and tied to the centroid of the quadrant in the databases. However, there appear to be some blanks in the datasets due to previously excavated trenches from the 2008 field season. These test pits were completed before these methods were fully developed, thereby creating these empty spaces. While analyzing the spatial organization of the house, these trenches are important to consider. Overall, these field methods have allowed researchers to extensively analyze the spatial patterns of the house to gather information on the social constructs used within the house.

Using ESRI's ArcMap 10.7, I constructed a basic map of the house identifying the centroids of each quadrant and the features on each floor. The locations of the cache pit features were visually assessed to determine if the pit represents cooperative or private storage. I then attached the lithic data from each of these floors to the appropriate centroids. I tabulated the total amounts of different nonlocal lithic raw materials for each centroid on each floor and each type of material that have been recovered in each quad. The types of nonlocal material are defined as chalcedony, yellow chalcedony, green chert, jasper, Hat Creek jasper, and obsidian (Goodale et al. 2010; Hampton and Prentiss 2020; Rousseau 2000; Figure 4). The local material I defined as any other type of material found in Housepit 54, which includes basalt, chert, conglomerate, dacite, granite, mica, ochre, quartzite, sandstone, shale, slate, soapstone. I also considered nephrite as a material wealth indicator and did not include it with the local material even though it is likely from the Bridge River valley, as this material is often used for artifacts that are associated with a high amount of prestige (Morin 2015; Prentiss 2017). The yellow chalcedony and the green chert are separated from their wider categories as there are known yellow chalcedony sources that are found in a quarry farther away than many other colors of chalcedony (Rousseau 2000). The known Glen Fraser chalcedony source provides translucent, white, purple, or pink chalcedony and is 15 kilometers from the Bridge River village while the Blue Ridge Ranch, Moran, and Maiden Creek sources are significantly farther away – respectively 24, 30, and 51 kilometers, and are either relatively far upriver or inland away from any major waterways (Table 4 and Figure 4). The green chert was separated from other colors of chert in the database and has a known primary source, located farther away from the village than other chert sources – the green chert is 29 kilometers west of the village along the Bridge River, but other colors of chert can be found at the Glen Fraser source around 15 kilometers north along the Fraser River, only a little further north than the Keatley Creek village. From these definitions of the type of material and these data, I made several maps for each floor to show change over time in the locations, types, and amounts of both tools and debitage. A table identifying the methods used for each aspect of the test expectations can be found below (Table 5) and the maps can be found in Appendix A (Figures A.1 through A.18).

Table 4: Linear distances from the Bridge River village to the lithic raw material sources.

Source Name	Distance from BR (in km)	Types of Material
Fountain	12	Chalcedony
Pisolite	15	Pisolite
Glen Fraser	15	Silicate
Rusty Creek	23	Chert
Blue River Ranch	24	Chalcedony
Green Chert	29	Chert
Moran	30	Chalcedony
Upper Hat Creek	41	Basalt
Upper Hat Creek	42	Silicate
Maiden Creek	51	Basalt/Silicate

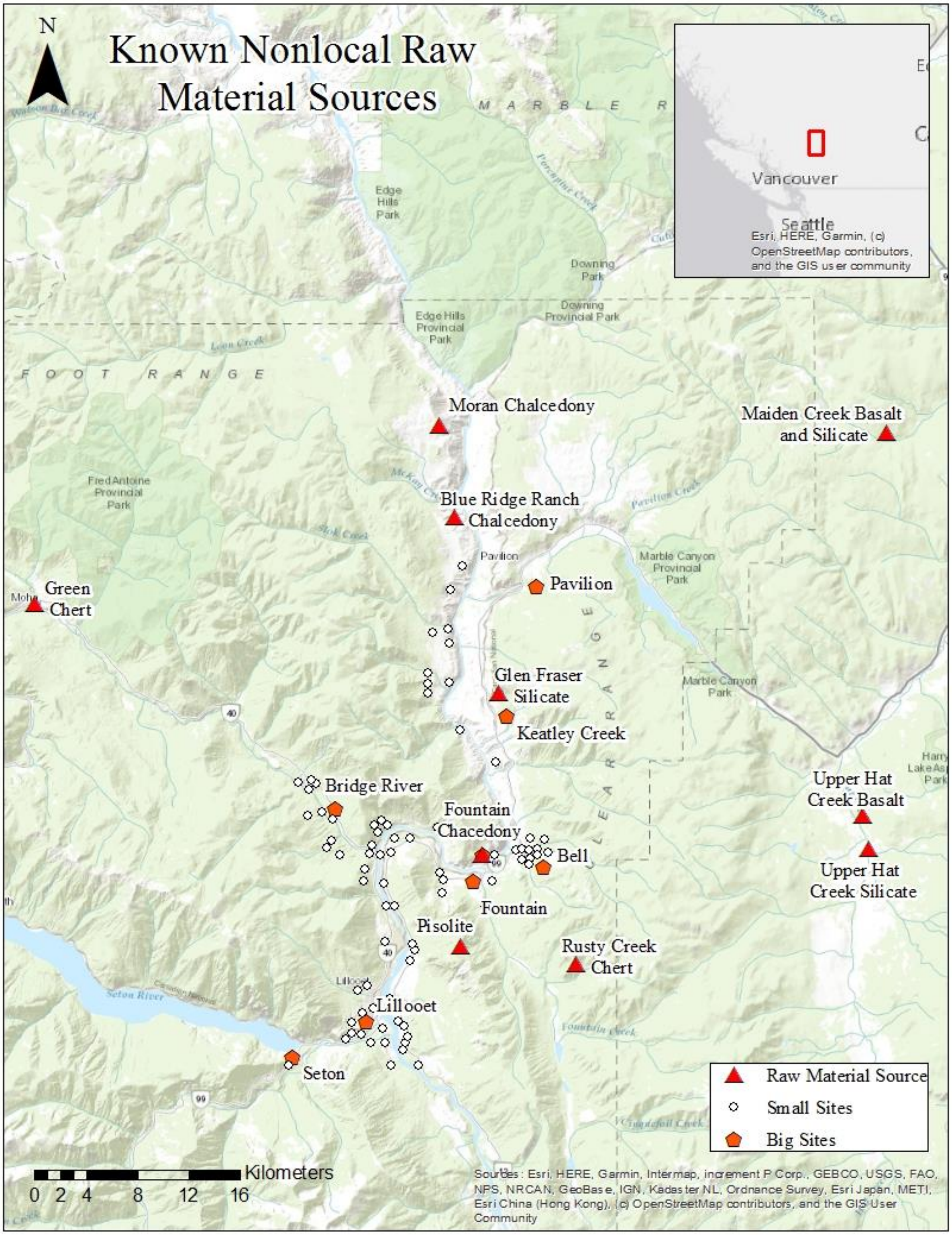

Figure 3: Map of nearby raw material sources (modified from Prentiss et al. 2018a and Rousseau 2000).

Table 5: Methods associated with each test expectation. Each map shows the features of each floor, so it is not mentioned in this table.

Method	Test Expectation Assessed
Pie Chart Maps (Local v. Nonlocal)	Raw Material Concentrations
Raw Count Debitage Maps (Local v. Nonlocal)	Raw Material Counts in Debitage
Type of Raw Material in Debitage and Tools Maps	Raw Material Types in Tools and Debitage
Minus Spline Maps	Raw Material Concentrations between Floors
Proportion of Raw Material by Block and Floor Graphs (in Tools and Debitage)	Raw Material Proportions in Tools and Debitage
Percentage of Raw Materials by Block and Floor (in Tools and Debitage)	Raw Material Proportions in Tools and Debitage
Change in each Nonlocal Raw Material over Time by Block and Floor Graphs	Raw Material Prevalence in Tools and Debitage

In the first set of maps, I took the total amounts of local and nonlocal raw material and created a pie chart to show the proportion of each material type on each floor for both debitage and tools (Figures A.1 through A.4). The locally sourced materials in both sets of maps are symbolized with green while the nonlocal materials are shown in yellow. These pie chart maps are helpful in identifying potential concentrations of nonlocal material on each floor and if these concentrations are in the same area. The rough proportions the pie charts provide also can indicate how the prevalence of nonlocal material changes over time. The decision to differentiate between tools and debitage are for the purposes of seeing if the trends of raw material choices between these categories are different, and therefore to help determine if relational or material wealth was the main vehicle for private ownership. If there are more tools made of nonlocal raw material in a house section without associated debitage, this would indicate that trading, relational wealth, and reciprocity was more important, as it was likely these tools were traded in from another group. Tools without debitage may be indicative of hostile giving, where the giver may choose to flaunt their extra resources and force the receiver to work even harder to match their generosity (Romanoff 1992b). Alternatively, tools without debitage may be indicative of the lithic source being farther away, necessitating the reduction of the material to facilitate more efficient travel (Metcalfe and Barlow 1992). As Bridge River was likely a center for trade in the region, it is equally likely that travelers would bring heavily reduced nonlocal raw material to trade, thereby minimizing the amount of material there was to create debitage (French 2013, 2017; Romanoff 1992a). If there is more nonlocal raw material debitage without associated tools in an area, material wealth was likely more important, and reward was the most useful cooperative mechanism. This likely indicates that the completed tools were too necessary or prestigious to misplace and were carried from one place to another until they were deposited in another setting. While some tools were cached in storage pits in the spring (Teit 1898), the inhabitants of the floor were not likely to forget the cached prestigious items unless they could afford to, either because they could obtain more of the material or because they had that much material wealth. Tools associated with the same variety of debitage indicate that the block inhabitants were obtaining the material themselves and could easily get more whenever they needed, and the material was readily available. This is unlikely to be the case for many nonlocal materials, as these materials were not as readily available.

In the next set of maps, I utilized graduated symbols to examine the total amount of nonlocal and local material of the debitage (Figures A.5 and A.6). As the debitage of Housepit 54 has been very well studied, I chose to count the total number of local and nonlocal raw material pieces for this map (Austin 2007; French 2013; Hampton and Prentiss 2020; Ryan 2018). The nonlocal debitage is represented by differently sized red diamonds and the local debitage is portrayed by differently sized blue circles. Both layers are shown on the map of each floor and the sizes are the same across all maps for direct comparison. The purpose of this set of maps is to examine the raw counts of each category of raw material over time. Theoretically, over the lifespan of each floor, as the population of the house increases, so should the amount of debitage as more people are creating more tools.

The third set of maps portray the different types of nonlocal raw materials found in each section of the floor for both the tools and debitage (Figures A.7 and A.8). Each raw material had a specific color attached to it; yellow chalcedony is yellow, chalcedony is purple, green chert is green, Hat Creek jasper is orange, jasper is blue, nephrite is teal, and obsidian is red. The tools were symbolized with square markers and the debitage with circles. In this map, I simply recorded the material as being present and did not focus on the amount. In the cases where there were multiple counts of the same kind of material in the debitage, I only placed a single marker to identify the material's presence in the quadrant. In cases where there were multiple raw materials found in the same quadrant, I placed the additional markers to show all raw materials while still preserving the location. These maps are helpful to visually examine the similarities in raw materials between the floors and between the tools and the debitage, as well as to compare the possibility of a skilled knapper in one block based on the types of debitage compared to the types of tools in the same block.

The next set of maps portray the local and nonlocal raw materials in tools as point and the local and nonlocal material in debitage as a spline layer (Figures A.9 and A.10). The nonlocal raw material for the tools is specified in the same manner as the previous set of maps and the local raw material tools are white dots. I used the total debitage counts across the floors to create spline layers to identify distinct activity areas in both local and nonlocal raw material. I symbolized the local material debitage as red and the nonlocal as blue. The more intense these discrete colors are, the higher amount of the associated material is in the area, whereas if the area is purple, that area would indicate a high amount of both categories of material. The tools were included in these maps as a comparison of the debitage layer, and to show potential higher concentrations of nonlocal raw material tools versus the local material tools.

The last set of maps I created were the minus maps (Figures A.11 through A.18). I took the previously discussed spline layers and used the minus tool to mathematically distinguish differences between each floor. This created four sets of maps: the nonlocal raw material tools, the nonlocal raw material debitage, the local raw material tools, and the local raw material debitage. For each map, I subtracted the newer floor from the older floor to show what changes there have been in each subsequent floor. This created a raster layer with a color spectrum of blue as the low value – indicating a higher amount of the selected material on the newer floor – yellow as the middle value – indicating no change – and red as the high value – indicating that there was a higher amount of the material on the older floor. I chose to show the features of each map's floors to help explain the potential differences between the floors, and symbolized the upper floor's features with blue and the lower floor's features with red. These maps allow for direct comparisons between two floors and help show how the raw material distribution is associated with the features of each floor. For this set of maps within my thesis, I decided to focus on the broad categories of raw material and not the patterns of the specific types of raw materials to gain a general sense of the trends of the floors.

I also made several graphs in Microsoft Excel to mathematically compare the totals of raw material type on each floor. The first set are bar charts to compare the proportion of raw materials in debitage and tools in the blocks and floors (Figures A.19 and A.20). The first line chart examines the population, debitage, and tools as a percentage per floor for all the floors covered in this thesis (Figure 5). The rest of the graphs examine each material as a percentage of the total on each floor to make the floors comparable, both between blocks and between floors.

The first set of these line graphs take the floors as a whole and examine the nonlocal raw material in both debitage and tools (Figures A.21 and A.22), debitage (Figures A.23 through A.26), and tools (Figures A.27 through A.30). I then broke each floor down into blocks to directly compare the changes in each raw material by floor (Figures A.31 through A.51). The next set of line graphs examined the amounts of the raw materials with the tools and the debitage at the same time, then separated out by block. For the line graphs with raw material types symbolized, I used the same color scheme as in ArcMap.

Each floor was then individually assessed for evenness between floors and blocks in five categories: storage pits, local debitage, local tools, nonlocal debitage, and nonlocal tools. It is difficult to quantifiably assess evenness in storage pits, so I qualitatively determined if access to the storage pits could be considered as privately owned or controlled as a test of evenness. If there were larger storage pits towards the center of the house, I considered this even. If the smaller pits were in corners, along the margins of the house, or next to hearth pits, I considered these to be privately owned and uneven. Larger pits in these areas I deemed to indicate privately controlled by the wealthiest hearth group in the house, thereby making access to these uneven. For the other four categories, I examined the graphs I had made to visually determine if there were any vastly different patterns among the raw materials in blocks and the floors (Figures A.19 through A. 51). I separated the data into progressively smaller fields of study to more easily visualize these data to illustrate areas of drastic change. Finally, to make the measures of evenness mathematically grounded, I considered these relative amounts as even if the percentages from each block were all within 10% of each other. A table summarizing these findings can be found in Table 20.

Chapter 5: Results and Discussion

This chapter delves into the results from each floor. I will describe the features, the types of lithic raw materials present on each floor, and how many pieces of debitage or tools there are of each of the nonlocal raw materials. The counts and frequencies for the local raw material, nonlocal debitage, and nonlocal tools are tabulated and can be found in Appendix B. I also include information about the estimated population size on each floor based on the FCR and floor area (Hayden 1997; Prentiss et al. 2018b). Using this information, I will then discuss how each floor relates to the mechanisms of cooperation thereby testing my hypotheses.

Floor IIi Results

Floor IIi is the oldest floor studied in this thesis. It is also one of the several rectangular floors that were occupied during the Bridge River 2 period. Based on the FCR, there were likely eight people living in the house on this floor (Prentiss et al. 2018b), while based on the area of the floor, there may have been sixteen people (Hayden 1997). In Block A, there is a large pit in the northeast corner, which is considered a more central position in the house. This block's hearth is also relatively large and similarly located in the northeast portion of the block. In Block C, there are small hearths in the center of the block. Of the 250 total pieces of local raw material debitage, Block A has 139 pieces while Block C has 111, and of the 26 local raw material tools, Block A has fourteen to Block C's twelve (Table B.1). Of the nonlocal material, there are ten pieces of debitage which are split evenly between the blocks (Table 6), and Block A has the singular tool made of nonlocal material (Table 7). Block A has two pieces of chalcedony, two pieces of green chert, and a piece of Hat Creek jasper debitage. Block C has three pieces of chalcedony, one piece of yellow chalcedony, and one piece of Hat Creek jasper debitage (Table

6). While the debitage is split evenly between the blocks, with the inclusion of the Hat Creek jasper tool found in Block A, Block A has the most nonlocal lithic raw material on floor IIi.

Table 6: Floor IIi debitage frequencies. Refer to Table B.2 in the appendices for complete totals.

Block	Chalcedony	Chalcedony (Yellow)	Chert (Green)	Hat Creek Jasper	Total
A	20%	0%	20%	10%	50%
C	30%	10%	0%	10%	50%
Total	50%	10%	20%	20%	100%

Table 7: Floor IIi tool frequencies. Refer to Table B.3 in the appendices for complete totals.

Block	Hat Creek Jasper	Total
A	100%	100%
C	0%	0%
Total	100%	100%

Floor IIh Results

Floor IIh is the next oldest rectangular floor and marks the beginning of the Bridge River 3 period. Based on the FCR totals and the area of the floor, there were likely sixteen people living in the house at this time (Hayden 1997; Prentiss et al. 2018b). The features in Block A consist of several medium to large hearths on the east, with a medium one on the southern edge, the smallest one on the northern edge, and two larger ones in the northern part. There is also a large pit on the northern border of Block A in a more central location in the house. Block C has several smaller hearths in the west on the southern border of the Block, possibly lining up with the smallest hearth on the northern edge of Block A. There are more medium sized hearths in a centralized location in the eastern part of Block C, and a single medium sized pit in the center of the northern part of Block C, likely indicating this pit was for privately owned stores. Of the 970 total local raw material debitage, Block A has 468 and Block C has 502 pieces. The local raw material tools total is 237, of which 81 were found in Block A and 156 local raw material tools in Block C (Table B.1). There are 43 pieces of nonlocal debitage across the floor and two nonlocal raw material tools. Block A has seventeen pieces of debitage and the two tools, while Block C has 26 pieces of debitage and no tools. Block A has six pieces of chalcedony debitage to Block C's seventeen; Block A has three pieces of green chert while Block C has one; Block A has two pieces of jasper to Block C's one piece; Block A has four pieces of Hat Creek jasper and Block C has five pieces; and both blocks have one piece of yellow chalcedony and one piece of obsidian debitage each (Table 8). Block A has the two tools, one made of nephrite and the other made of jasper (Table 9).

Table 8: Floor IIh debitage frequencies. Refer to Table B.2 in the appendices for complete totals.

Block	Chalcedony	Chalcedony (Yellow)	Chert (Green)	Jasper	Hat Creek Jasper	Obsidian	Total
A	13.95%	2.33%	6.98%	4.65%	9.30%	2.33%	39.53%
C	39.53%	2.33%	2.33%	2.33%	11.63%	2.33%	60.47%
Total	53.49%	4.65%	9.30%	6.98%	20.93%	4.65%	100.00%

Table 9: Floor IIh tool frequencies. Refer to Table B.3 in the appendices for complete totals.

Block	Jasper	Nephrite	Total
A	50.00%	50.00%	100.00%
C	0%	0%	0%
Total	50.00%	50.00%	100.00%

Floor IIg Results

Floor IIg is another rectangular floor occupied in the Bridge River 3 period. According to the FCR counts, there were nineteen people living in the house (Prentiss et al. 2018b) while the floor area maintains the estimate of sixteen (Hayden 1997). Block A has a large pit at the southern border and two smaller pits on the eastern border and no hearths. Block C has a large hearth in the northern portion of the Block and a smaller hearth in the southern part. There are 540 pieces of debitage made of local raw material, where there are 341 pieces in Block A and 199 pieces in Block C. There are 148 tools made of local raw materials with 58 tools in Block A and 90 tools in Block C (Table B.1). The nonlocal raw material debitage total is 23 pieces, with fourteen pieces in Block A and nine pieces in Block C. In Block A, there are four pieces of chalcedony debitage, one piece of yellow chalcedony, two green chert, two jasper, and five pieces of Hat Creek Jasper debitage. In Block C, there are six pieces of chalcedony, one piece each of jasper, Hat Creek jasper, and obsidian debitage (Table 10). There are five tools made of nonlocal raw materials found on this floor, with four tools in Block A and one tool in Block C. In Block A, there are two chalcedony tools, one green chert tool, and one nephrite tool, while there is only one obsidian tool in Block C (Table 11).

Table 10: Floor IIg debitage frequencies. Refer to Table B.2 in the appendices for complete totals.

Block	Chalcedony	Chalcedony (Yellow)	Chert (Green)	Jasper	Hat Creek Jasper	Obsidian	Total
A	17.39%	4.35%	8.70%	8.70%	21.74%	0%	60.87%
C	26.09%	0%	0%	4.35%	4.35%	4.35%	39.13%
Total	43.48%	4.35%	8.70%	13.04%	26.09%	4.35%	100.00%

Table 11: Floor IIg tool frequencies. Refer to Table B.3 in the appendices for complete totals.

Block	Chalcedony	Chert (Green)	Nephrite	Obsidian	Total
A	40.00%	20.00%	20.00%	0%	80.00%
C	0%	0%	0%	20.00%	20.00%
Total	40.00%	20.00%	20.00%	20.00%	100.00%

Floor IIf Results

Floor IIf is the last rectangular floor of the house and continued to be inhabited in the Bridge River 3 period. 32 people likely lived in the house at this time from the FCR count (Prentiss et al. 2018b), but as the area of the floor did not change in this period, the estimate for this floor is still sixteen (Hayden 1997). The features in Block A consist of a large pit in the southwest edge, a small pit in the center of the west, and a large hearth in the center of the north. The features in Block C consist of a large hearth in the northwest corner of the Block, a small hearth in the southwest, a small pit on the east of the southern edge, and there are several postholes in the north part of the house. There are 838 local raw material pieces of debitage, with 379 pieces in Block A and 459 in Block C. There are 127 local raw material tools across the floor, with 68 in Block A and 58 in Block C (Table B.1). Of the nonlocal raw material debitage, there are 31 pieces total, with 14 pieces in Block A and 17 in Block C. The pieces in Block A consist of ten pieces of chalcedony, one piece of green chert, and three pieces of Hat Creek jasper. The nonlocal raw material debitage in Block C consists of seven pieces of chalcedony, two pieces of green chert, three pieces of jasper, two pieces of Hat Creek jasper, and three pieces of obsidian (Table 12). There are seven total nonlocal raw material tools on IIf, with two in Block A and five in Block C. Block A has a chalcedony tool and an obsidian tool. Block C has a yellow chalcedony tool, one green chert tool, two nephrite tools, and one obsidian tools (Table 13).

Table 12: Floor IIf debitage frequencies. Refer to Table B.2 in the appendices for complete totals.

Block	Chalcedony	Chert (Green)	Jasper	Hat Creek Jasper	Obsidian	Total
A	32.26%	3.23%	0%	9.68%	0%	45.16%
C	22.58%	6.45%	9.68%	6.45%	9.68%	54.84%
Total	54.84%	9.68%	9.68%	16.13%	9.68%	100.00%

Table 13: Floor IIf tool frequencies. Refer to Table B.3 in the appendices for complete totals.

Block	Chalcedony	Chalcedony (Yellow)	Chert (Green)	Nephrite	Obsidian	Total%
A	14.29%	0%	0%	0%	14.29%	28.57%
C	0%	14.29%	14.29%	28.57%	14.29%	71.43%
Total	14.29%	14.29%	14.29%	28.57%	28.57%	100.00%

Floor IIe Results

Floor IIe is the first large oval shaped floor and was occupied during the Bridge River 3 period. The population estimate for the floor based on the FCR is 44 people (Prentiss et al. 2018b), while based on the area of the floor is 32 (Hayden 1997). Block A has small pits and hearths in the south, Block B has three pits in the south portion, one pit is on the northern edge, and two hearths in the northeast portion. Block C has a large hearth in the north and a smaller one on the northeastern edge of the block. Block D has a large hearth in the south and center parts of the block and medium to large pits on the eastern part of the Block. There 2,229 total pieces of local debitage across IIe – 155 pieces are in Block A, 659 in Block B, 564 in Block C, and 851 in Block D. There are 204 local tools on IIe, with nineteen tools in Block A, 49 in Block

B, 62 in Block C, and 74 in Block D (Table B.1). There are 77 pieces of nonlocal raw material debitage and 12 nonlocal raw material tools. Block A has no nonlocal debitage, Block B has 23 pieces of debitage, Block C has 18 pieces, and Block D has 36 pieces. Block B has twelve pieces of chalcedony, two pieces of green chert, six pieces of jasper, two pieces of Hat Creek jasper, and one piece of obsidian. Block C has nine pieces of chalcedony, four pieces of green chert, three pieces of Hat Creek jasper, and two pieces of obsidian. Block D has nineteen pieces of chalcedony, four pieces of green chert, three pieces of jasper, five pieces of Hat Creek jasper, and five pieces of obsidian (Table 14). IIe also has twelve tools made of nonlocal material, with one in Block A, three in Block B, two in Block C, and six in Block D. The tool in Block A is made from chalcedony, Block B has a tool made of jasper, Hat Creek jasper, and nephrite, Block C has a tool made of chalcedony and obsidian, and Block D has five tools made of chalcedony and one made of green chert (Table 15).

Table 14: Floor IIe debitage frequencies. Refer to Table B.2 in the appendices for complete totals.

Block	Chalcedony	Chert (Green)	Jasper	Hat Creek Jasper	Obsidian	Total
A	0%	0%	0%	0%	0%	0%
B	15.58%	2.60%	7.79%	2.60%	1.30%	29.87%
C	11.69%	5.19%	0%	3.90%	2.60%	23.38%
D	24.68%	5.19%	3.90%	6.49%	6.49%	46.75%
Total	51.95%	12.99%	11.69%	12.99%	10.39%	100.00%

Table 15: Floor IIe tool frequencies. Refer to Table B.3 in the appendices for complete totals.

Block	Chalcedony	Chert (Green)	Jasper	Hat Creek Jasper	Nephrite	Obsidian	Total
A	8.33%	0%	0%	0%	0%	0%	8.33%
B	0%	0%	8.33%	8.33%	8.33%	0%	25.00%
C	8.33%	0%	0%	0%	0%	8.33%	16.67%
D	41.67%	8.33%	0%	0%	0%	0%	50.00%
Total	58.33%	8.33%	8.33%	8.33%	8.33%	8.33%	100.00%

Floor IId Results

Floor IId is the second large oval floor in the lifespan of Housepit 54 that was also occupied during the Bridge River 3 period. During this time, the population was either 23 people according to the FCR (Prentiss et al. 2018b), or 32 people according to the floor's area (Hayden 1997). In Block A, there is a small hearth in the northeast portion of the house and a small pit in the southwest. There are no features in Block B. In Block C, there is a medium hearth in the southwest of the block and a larger hearth in the center of the north portion. Block D has a medium hearth in the center of the east side of the block and two larger pits directly to the north and south of this hearth. Floor IId has 2,283 local pieces of debitage, where there are 231 pieces in Block A, 241 in Block B, 584 in Block C, and 1,227 pieces in Block D. Of the 182 tools made of local raw material, there were 12 in Block A, 22 in Block B, 50 in Block C, and 98 in Block D (Table B.1). There are 75 pieces of nonlocal debitage on IId, with four pieces in Block A, three in Block B, sixteen in Block C, and 52 in Block D. Of the four pieces in Block A, two each are chalcedony and jasper, while Block B has one piece of chalcedony and two obsidian pieces. In Block C, there are eight pieces of chalcedony, three pieces of yellow chalcedony, one piece of green chert, two pieces of jasper, one piece of Hat Creek jasper, and one piece of obsidian debitage. In Block D, there are 22 pieces of chalcedony, four pieces of yellow chalcedony, two pieces of green chert, one piece of jasper, nineteen pieces of Hat Creek jasper, and four pieces of obsidian (Table 16). There are thirteen tools made of nonlocal raw material, with one tool each in Block A and B, five in Block C, and six in Block D. The tool in Block A is chalcedony and the tool in Block B is green chert. Block C has two tools made of chalcedony, two of jasper, and one tool made of Hat Creek jasper. Block D has one tool made of green chert, one of Hat Creek jasper, two nephrite tools, and two obsidian tools (Table 17).

Table 16: Floor IId debitage frequencies. Refer to Table B.2 in the appendices for complete totals.

Block	Chalcedony	Chalcedony (Yellow)	Chert (Green)	Jasper	Hat Creek Jasper	Obsidian	Total
A	2.67%	0%	0%	2.67%	0%	0%	5.33%
B	1.33%	0%	0%	0%	0%	0%	4.00%
C	10.67%	4.00%	1.33%	2.67%	1.33%	1.33%	21.33%
D	29.33%	5.33%	2.67%	1.33%	25.33%	25.33%	69.33%
Total	44.00%	9.33%	4.00%	6.67%	26.67%	9.33%	100.00%

Table 17: Floor IId tool frequencies. Refer to Table B.3 in the appendices for complete totals.

Block	Chalcedony	Chert (Green)	Jasper	Hat Creek Jasper	Nephrite	Obsidian	Total
A	7.69%	0%	0%	0%	0%	0%	7.69%
B	0%	7.69%	0%	0%	0%	0%	7.69%
C	15.38%	0%	15.38%	7.69%	0%	0%	38.46%
D	0%	7.69%	0%	7.69%	15.38%	15.38%	46.15%
Total	23.08%	15.38%	15.38%	15.38%	15.38%	15.38%	100.00%

Floor IIc Results

Floor IIc is the final floor covered in my thesis. It is another large oval shaped floor that was occupied during Bridge River 3. The population on this floor is estimated to be 24 people from the FCR (Prentiss et al. 2018b) or 32 people based on the area (Hayden 1997). The features on the floor consist of a small hearth on the western edge of Block B, a small hearth in the north of Block C, a small pit in the southern part of Block C, two large hearths in the center portion of Block D, and a medium pit on the northeast corner of Block D. There are 1,641 pieces of local raw material debitage across the entire floor, with 310 pieces in Block A, 234 in Block B, 249 in Block C, and 848 in Block D. There are 149 tools made of local raw material, twenty of which are from Block A, 26 in Block B, 24 in Block C, and 79 in Block D (Table B.1). There are 67 pieces of nonlocal raw material across the floor, with eighteen in Block A, five in Block B, ten in Block C, and 34 in Block D. Of the debitage found in Block A, eight are made of chalcedony, two are made of green chert, three of jasper, three of Hat Creek jasper, and two of obsidian. The pieces of debitage in Block B, two are made of chalcedony and three are made of obsidian. The pieces in Block C consist of five made of chalcedony, three of yellow chalcedony, and two of Hat Creek jasper. In Block D, there are thirteen pieces of chalcedony debitage, one piece of yellow chalcedony, six of green chert, two of jasper, six of Hat Creek jasper, two of nephrite, and four of obsidian (Table 18). Nine tools made of nonlocal raw material are from floor IIc, four from Block A, one from Block B, once from Block C, and three from Block D. The tools from Block A consist of one made of yellow chalcedony, one of green chert, and two of obsidian. The tool from Block B is made of Hat Creek jasper. The one from Block C is made from chalcedony. The tools from Block D consist of one each of chalcedony, green chert, and Hat Creek jasper (Table 19).

Table 18: Floor IIc debitage frequencies. Refer to Table B.2 in the appendices for complete totals.

Block	Chalcedony	Chalcedony (Yellow)	Chert (Green)	Jasper	Hat Creek Jasper	Nephrite	Obsidian	Total
A	11.94%	0%	2.99%	4.48%	4.48%	0%	2.99%	26.87%
B	2.99%	0%	0%	0%	0%	0%	4.48%	7.46%
C	7.46%	4.48%	0%	0%	2.99%	0%	0%	14.93%
D	19.40%	1.49%	8.96%	2.99%	8.96%	2.99%	5.97%	50.75%
Total	41.79%	5.97%	11.94%	7.46%	16.42%	2.99%	13.43%	100.00%

Table 19: Floor IIc tool frequencies. Refer to Table B.3 in the appendices for complete totals.

Block	Chalcedony	Chalcedony (Yellow)	Chert (Green)	Hat Creek Jasper	Obsidian	Total
A	0%	11.11%	11.11%	0%	22.22%	44.44%
B	0%	0%	0%	11.11%	0%	11.11%
C	11.11%	0%	0%	0%	0%	11.11%
D	11.11%	0%	11.11%	11.11%	0%	33.33%
Total	22.22%	11.11%	22.22%	22.22%	22.22%	100.00%

Table 20: Summary of evenness or unevenness across the floors based on qualitative measures.

Floor	Features	Local Debitage	Local Tools	Nonlocal Debitage	Nonlocal Tools
IIi	Even	Even	Even	Even	Uneven
IIh	Even	Even	Uneven	Uneven	Uneven
IIg	Uneven	Uneven	Uneven	Uneven	Uneven
IIf	Uneven	Even	Even	Even	Uneven
IIe	Uneven	Uneven	Uneven	Uneven	Uneven
IId	Uneven	Uneven	Uneven	Uneven	Uneven
IIc	Uneven	Uneven	Uneven	Uneven	Uneven

Discussion

Admittedly, these results are all dependent on how artifacts are deposited in the archaeological record. While the location of the debitage has been shown to represent in situ deposition (Ryan 2018), some pieces of debitage might get trampled into the floor. Similarly, bioturbation is another valid concern for the movement of artifacts, but in Housepit 54, there was minimal evidence of disturbance in the upper floors, which were not covered in this thesis. While doing any form of archaeology, the impacts from these processes tend to be unavoidable and are accepted as a potential impact the spatial organization but must be considered while engaging in any form of household archaeology.

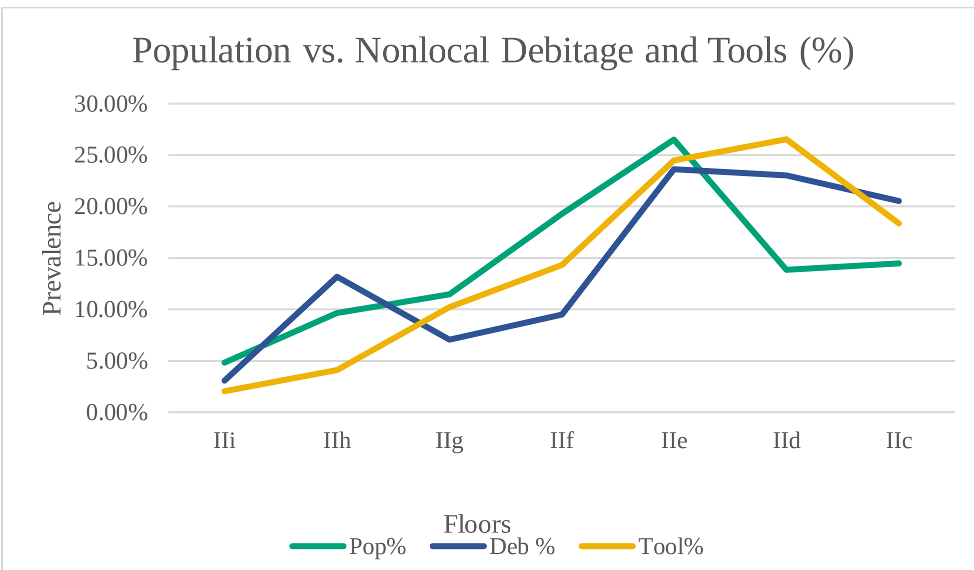

Figure 4: The percentage of population (green), debitage (blue), and tools (yellow) on each floor relative to the totals covered in this thesis. In my discussion of evenness, I determined the arbitrary marker at 15% for high versus low amounts of wealth and population.

Overall, floor IIi seems to be the most cooperative population represented in this thesis. With only eight people living in the house, the population is the optimal size for the most effective risk reduction strategy to be sharing (Kelly 1995; Winterhalder 1986). The storage pits in Block A seem to be positioned to allow for house wide access, and the hearths are in more centralized positions, possibly indicating communalism (Prentiss et al. 2020c). As the oldest block, Block A has the most local raw material tools and debitage, as well as the most nonlocal raw material tools. Both blocks have the same amount of nonlocal debitage, although in different quantities of raw materials. None of these nonlocal raw materials are cached or discarded in the storage pits, which indicates a lack of interest in hoarding material wealth, however, there are some local material debitage and complete tools in the pit – which were likely communally accessed or owned based on the position of the pit. In a similar vein, most of the nonlocal raw materials come from relatively close sources, with the farthest one being the Hat Creek jasper at 42 kilometers (Rousseau 2000; Figure 4 and Table 4). Based on the location of the storage pit, the single nonlocal raw material is a Hat Creek jasper core with a small amount of associated debitage, and a relatively even amount of nonlocal debitage and tools, this floor will be considered relatively even (Table 20). Combined with the relatively low amount of material wealth (Prentiss et al. 2018a) and a similarly low population density (Prentiss et al. 2018b), the occupants of this floor place importance on reward and punishment as cooperative mechanisms (Figure 5). The head of the household would have controlled the wealth and rewarded other household members as they saw fit.

From this basis, I would expect the next floor to have more people on it as more people were drawn to the rewards the head of Housepit 54 would provide. Indeed, based on the FCR counts, floor IIh has twice the people than floor IIi (Prentiss et al. 2018b). The inhabitants of floor IIh seems to maintain their cooperative strategy, but with a higher degree of private ownership. The occupants of Block A display a high level of cooperation with the storage pit in a location easily accessed by the entire house. The members of Block C, on the other hand, create their own storage pit in an area close to their hearth and removed from the rest of the house. The position of the pit next to the hearth may have been advantageously chosen to hide its contents by having people sit over it, as Teit noted with the Thompson (Alexander 2000; Teit 1898). Both blocks show an interest in developing stores of private wealth, as there are several pieces of nonlocal raw material debitage in the Block A pit and one in the Block C pit. There is also a significant concentration of local debitage and tools in Block A's pit. Block C has the most local tools and nonlocal debitage, A has more nonlocal tools, and both blocks have about the same amount of local debitage. Of the two tools in Block A, the nephrite piece is a relatively large hammerstone, with no nephrite debitage in either block. Since sporadic, secondarily deposited nephrite sources are common in the Bridge River valley (Morin 2015), it is most likely that Block A had the access rights to this area, thereby showing the importance of material wealth. Other options are that Block A traded for these items, showing the importance of relational wealth and reciprocity, or that Block C found the material and gave it to Block A, either as a reward or as an act of reciprocity. There is a larger piece of obsidian debitage in Block C than in Block A, which implies that Block C had initial access to the obsidian – a highly sought after distantly source tool stone – since the members could afford to be more wasteful with bigger pieces of shatter. Block C also had larger pieces of yellow chalcedony and green chert but more pieces of chalcedony and Hat Creek jasper, while Block A had larger pieces of jasper and Hat Creek jasper but more pieces of green chert and jasper. The sources for many of Block A's most prevalent lithic raw materials stretch across the north, while Block C's most prevalent lithic raw material sources lie in the south – although the obsidian at Bridge River has not been sourced yet. During this period of occupation, it appears that the hearth groups expanded their exchange networks, as both blocks have more and very different nonlocal lithic raw materials than the inhabitants did on floor IIi. The amount of nonlocal debitage increased drastically on IIh, while the total nonlocal tools and estimated population only increased a little relative to the other floors covered in this thesis (Figure 5). Based on these trends, the artifacts on these floors are considered even (Table 20), and with the relatively low material wealth (Prentiss et al. 2018a) and low population (Prentiss et al. 2018b), the inhabitants of this floor found material wealth important and cooperated in the hopes of reward or in fear of punishment.

As a function on this reliance on material wealth, I would expect the next floor to increase in population size as well as the overall wealth of the house. Supporting this theory, both the population and tool count increase on IIg, although the amount of nonlocal raw material debitage comparatively decreases (Figure 5). The artifacts and features in the house indicate a higher amount of privatization, but still clearly maintain some degree of cooperation. The only storage pits in the house are along the exterior margins of Block A, away from Block C. There is a hearth between the two sets of relatively large pits in Block A, so these pits may have been hidden underneath sleeping areas (Teit 1898). There is more local raw material debitage, nonlocal tools and nonlocal debitage in Block A, but Block C has more local raw material tools. Block A has a polished nephrite fragment, which shows differential material wealth and status, as one or multiple individuals could have afforded to devote time and energy into the polishing of this item rather than searching for food. In a similar vein, Block C has an obsidian Kamloops projectile point and all the obsidian debitage on the floor, indicating a continuation of the importance of relational wealth. The southernmost pit in Block A – the one farthest away from the rest of the house – contains a significant amount of local debitage and complete local and nonlocal tools – including the polished nephrite fragment. The raw material amounts follow similar trends as on previous floors, indicating a continuation of the same relationships in the same blocks. On this floor, Block A has more types of nonlocal raw material in larger pieces and for the most part, higher quantities, indicating that it is likely Block A used the material first and then gave it to Block C. The higher quantities of the nonlocal raw material in Block A have sources in the north, while Block C once again gains more from southern sources. This indicates that groups may have maintained affiliations with the same groups. The distribution artifacts on these floors are considered even (Table 20), there is a relatively low amount of material wealth (Prentiss et al. 2018a) and population size (Prentiss et al. 2018b; Figure 5), the groups on this floor cooperated through rewards and punishment, showing the importance placed on material wealth.

To this point, I would expect the next floor to have more people and more wealth as the reputation of the house rises, which once again seems to be the case – in fact, other studies have found that material wealth began noticeably increasing on floor IIf (Prentiss et al. 2018a). On this floor, there are storage pits along the back wall – a private area – of Block A, but the smaller pit in the southwest section of Block C – the center of the house – indicates continued cooperation. These features are also in about the same location as they were in on the previous floor, which strengthens the argument for intergenerational inheritance (Prentiss et al. 2020b). Block A's southernmost pit – a private area of the house – contains local and nonlocal debitage, local tools, and the chalcedony used flake. This amalgamation of artifacts may indicate a trash pit or a hidden collection of goods. On this floor, the amounts of local tools and debitage are relatively even, but Block C has the most and the most types of nonlocal tools and debitage. Block A's nonlocal raw material sources are primarily to the east – such as Hat Creek – while Block C's inhabitants newly provide the green chert, as there are more and larger pieces in Block C than there are in Block A. Block C also has two polished nephrite fragments, an obsidian end scraper, and obsidian debitage – compared to no nephrite in Block A, and an obsidian bipolar core – which was likely gifted from Block C after the end scraper was made. This apparent shift in relationships likely caused Block C's increase in status and material wealth. Once again, the artifact distribution on IIf is considered even (Table 20) and the low material wealth (Prentiss et al. 2018a) and high population size (Prentiss et al. 2018b; Figure 5) indicates the continued importance of material wealth and a new emphasis on relational wealth, emphasizing a shift in social complexity.

On the next floor, I would expect this slow rising trend of increased wealth and population to continue – which is the case, as the house doubled in size and there is the highest amount of nonlocal lithic raw material on this floor. Floor IIe displays a dramatic shift not only in population, but also in storage strategies, which has been theorized was due to social events (Prentiss 2017). There are four large pits in Block B, two of which are in private space, and two that share borders with either Block A or D, indicating cooperation. Block D has its own cache pits that are decidedly in private space, as they are positioned in a defensible position near hearths and away from more public spaces. It appears that tools were cached in both new blocks, B and D, and Block D has the most total local debitage, local tools, nonlocal debitage, and nonlocal tools. It is possible that the inhabitants of Block D were skilled knappers and were invited to live in the house to elevate its status. Both Block B and D have the most types of raw material and the most pieces of this raw material. Block B has a polished nephrite fragment, Block C has an obsidian tool, and Block D has the most nonlocal material tools, as well as the most local lithic material. Blocks B, C, and D are relatively close in the amounts of local tools and debitage, but it appears that Block A has significantly lost status. Block D, with the most debitage and tools across the floor in the widest array of raw material type, was likely the group with the best connections to raw material sources, leading to an increase of status. Block C and D likely both had a connection to an obsidian source based on the size of the debitage, and someone shared with Block B. The raw material of Block D's tools – chalcedony – indicate that Block D is not the highest status group at this point, as Blocks B and C have significantly higher prestigious tools and material. In addition to these trends, the artifacts on IIe are relatively even (Table 20), but the high level of material wealth (Prentiss et al. 2018a) and population size (Prentiss et al. 2018b; Figure 5) show the continued shift in social complexity as the inhabitants of the floor found relational wealth more important and cooperated through reciprocation and reputation.

With this shift, I expect Blocks C and D to increase their status over time and this trend of material and population growth continue. However, the population size and measures of wealth on IId decrease in numbers (Figure 5). Block D has pits that were either used as a trash pit or for caching prestigious tools – which consist of a nephrite polished scraper and an obsidian unifacial denticulate – and are at the far end of the block, well into privately owned space. As most of the tools found in these pits are complete, it seems these artifacts may have been cached for later, but further studies into the contents of these pits could uncover more data. The pits are directly in line with the single hearth in this block and were likely hidden from view (Teit 1898). Block A also has two privately located small pits, but based on the size, it is unlikely they were used in a significant manner (Prentiss 2017). Block D again has the most local debitage, local tools, nonlocal debitage, and nonlocal tools, but Block C possesses the next highest amount of each of these categories. In all nonlocal lithic material types except for jasper, Block D has a higher amount of debitage than the other blocks. Blocks A and B have very little nonlocal lithic material, with a slightly higher amount of local material used for tools and in debitage. Block D has the most different types of nonlocal tools, including all nephrite and obsidian tools from the entire floor. The lack of nephrite debitage indicates that this tool was likely obtained through a trade network with a high-status group, which would indicate an emphasis on relational wealth. This high-status group likely gifted complete tools to show that it can afford the time and energy spent to make tools just to give away, cementing its higher status, rather than relying on the rarity of the raw material itself. Similarly, the obsidian pieces of debitage are larger in Block C, which might indicate that this block still maintained its relationship with the exchange network to get its own obsidian but could not afford to forget about an obsidian bipolar core like Block D was able to. IId is the first floor where the distribution of artifacts is considered uneven (Table 20), and with the relatively high material wealth (Prentiss et al. 2018a) and relatively low population for the oval floors (Prentiss et al. 2018b), the inhabitants of this floor again find material and relational wealth important, using all four mechanisms of cooperation.

With the lower population on this floor, I would expect an increase in the population size and wealth on the next floor and a highly uneven distribution of nonlocal materials across the floor. On IIc, Block D has one storage pit in the northeast of the block, the furthest away a pit could be from public spaces, especially with the two hearth features placed between the pit and the rest of the house. This cache pit is in a similar position as the one on the floor before, again showing intergenerational inheritance (Prentiss et al. 2020b). Block C has small pit and hearth features peppered throughout the block, with the pit features closer to the rest of the house than the hearths, potentially showing some cooperative storage with Blocks A and D. Block D has the most local debitage, local tools, and nonlocal debitage, but on this floor, Block A has the most nonlocal tools. Block D has the most types of nonlocal debitage and ties with Block A for the most types of nonlocal tools. Block A has the next most local and nonlocal debitage, and the second-most types of nonlocal raw material on this floor. Based on the vastly different lithic material trends from previous floors (see Figures A.21 and A.22), it is likely that the inhabitants of Block A are new to the house, possibly indicating that the household were punishing the previous inhabitants who then left the house, allowing a new group with different relationships to move in. The use of punishment would indicate an emphasis on material wealth, and per my hypotheses, I would expect the next floor, IIb, to have a larger population, which is theorized to be the case based on FCR counts (Prentiss et al. 2018b). As the artifact distribution on IIc is considered uneven (Table 20), the material wealth is relatively high (Prentiss et al. 2018a), and the population size is relatively low (Prentiss et al. 2018b; Figure 5), the members of the house utilized reward, punishment, reciprocity, and retribution as material and relational wealth seem to have been regarded as important.

The overall trend of Housepit 54 from IIi to IIc goes from an emphasis on material wealth to a hierarchal society with differential relational wealth. There is evidence of cooperation throughout the history of the house, but how cooperation manifests changes over time. The first floor covered in this thesis suggests reward is the most heavily relied upon cooperative mechanism, which stays the case until IIf, where reciprocity joins reward as a vital mechanism to the continuation of cooperation. Floor IIe, which has been identified as the most differentially wealthy floor with the lowest amount of cooperation from other studies, is the only floor covered in this thesis that seems to focus solely on reciprocity and relational wealth (Prentiss et al. 2018a). The next couple of floors, IId and IIc, once again use reward and reciprocity, with IIc even potentially having evidence of punishment. With these findings, it appears that both hypotheses are true, to a certain extent. The first hypothesis appears to be applicable throughout every floor except IIe, while the second hypothesis is applicable when the house grows larger and more densely populated, on IIe. These results lead to several other questions, as is the case in many studies of Housepit 54 with its wealth of data that allow for continually more complex questions to be asked.

Chapter 6: Conclusions

The goal of this thesis was to use nonlocal lithic materials to tease out the different cooperative mechanisms that were utilized in Housepit 54 across seven floors. To do so, I made maps to visually assess how artifacts were spread out over the floors and assessed the evenness of various lithic materials and storage pits. This process has revealed that the two kinds of wealth covered in this thesis – material and relational – were more vital to generate and maintain status in Bridge River society at different times. Material wealth, along with reward and punishment, seemed to have been more important mechanisms to cooperation at an earlier stage in the life history of the house and remained important throughout most of the floors studied in this thesis. The only floor of the seven I studied that did not seem to value reward as a mechanism of cooperation is floor IIe. As for the second hypothesis, relational wealth, reciprocation, and reputation grew in importance as time went on, starting on floor IIf and continuing onto floor IIc, which was the last floor covered in this thesis. As such, both hypotheses can be partially accepted, as the social complexity of the village increased over time, thereby changing the effectiveness of different strategies. This thesis also displays patterns of wealth, population, and status, and how each generally increases over time.

As this thesis only examined seven of the seventeen floors and focused on feature and primarily nonlocal lithic data, there is much more to this line of questioning that could be accomplished with additional datasets and an analysis of the rest of the floors. I chose to focus on these floors as they were occupied in times of changing food resource availability, which should provide some interesting trends. Additionally, studying the changing trends of the local lithic material could imply different findings or strengthen the conclusions of this thesis. Another idea to pursue would be to compare the different amounts of wealth and population based on the house size and include calculations of Shannon's index for evenness and richness of lithic material, which I did not do in this thesis to simplify the process.

This thesis, though narrower in scope than I originally planned, generated some thoughts about future research concepts. This thesis could be expanded to examine the remaining floors and include the faunal and botanical datasets to validate and delve deeper into these results. Additionally, an exhaustive study of the diet using the faunal and botanical data would be an excellent study to examine the effects and changes in embodied wealth – one of the types of wealth identified by Borgerhoff Mulder et al. (2009), which was not possible to examine in this thesis. If possible, a breakdown of the house's population by block would further lead to interesting results regarding the demographic trends and differential wealth of the house over time. Finally, a thorough examination of the contents of the storage pits through geomorphology would also be a good addition to this research to further determine if these features were shared equally, controlled by the head of the house, or privately owned. This thesis generated more questions than I started with, but overall, this exploration of cooperation, privatization, and different types of wealth may be a conceptualization of a method to examine social structures from the archaeological record.

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Appendix A: Figures

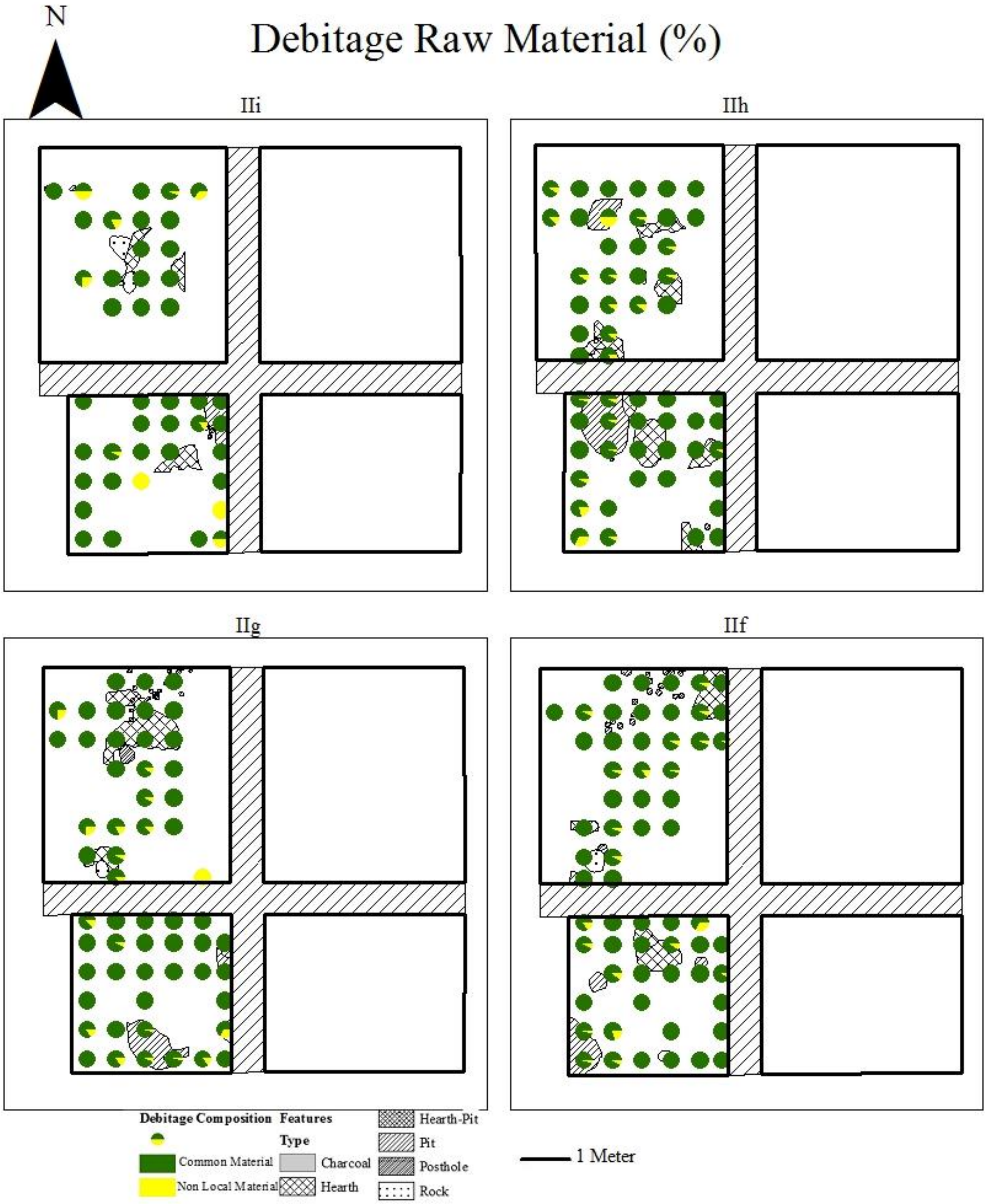

Figure A.1: These maps show the proportion of raw material in debitage using pie charts for floors IIi to IIf.

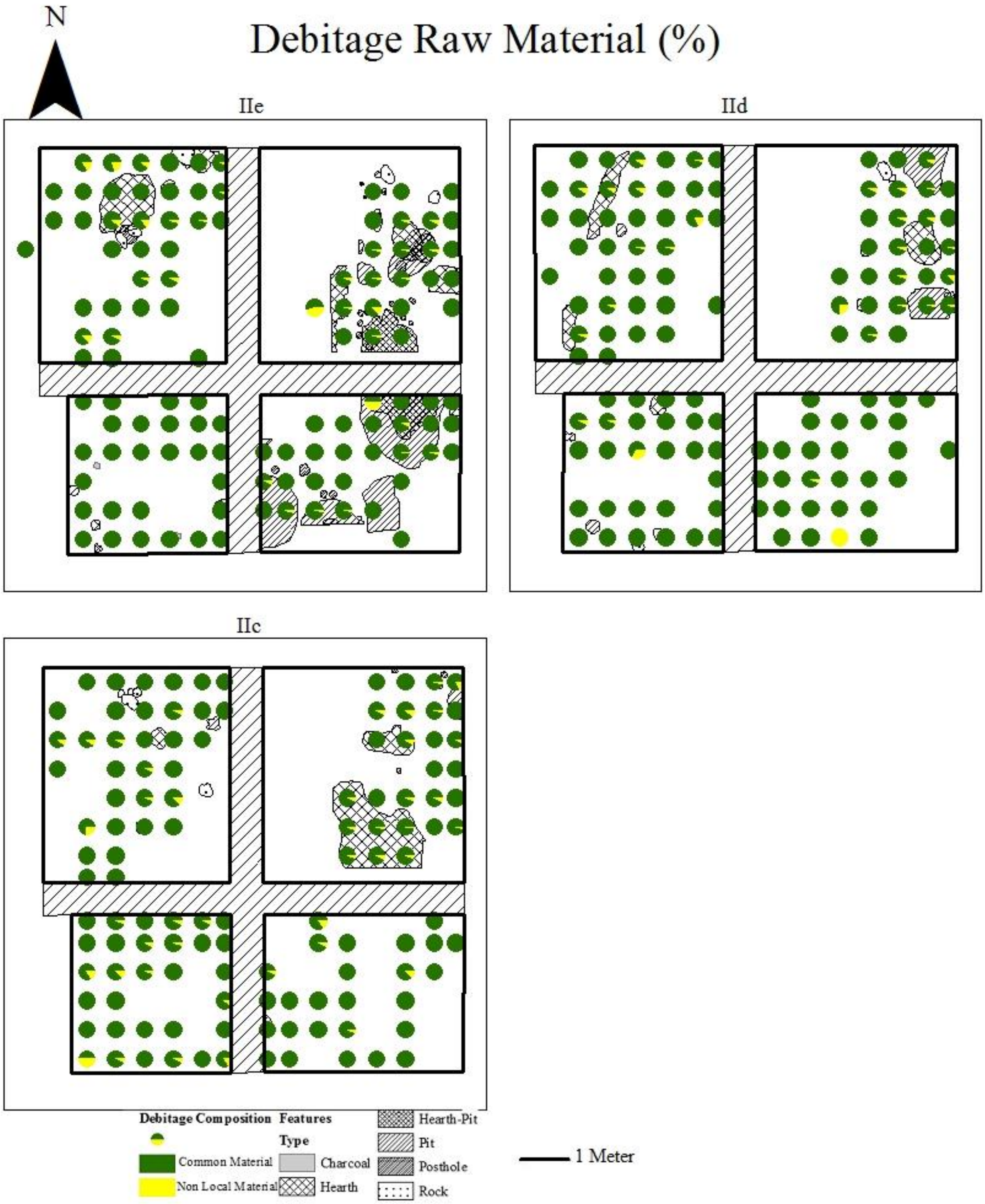

Figure A.2: These maps show the proportion of raw material in debitage using pie charts for floors IIe to IIc.

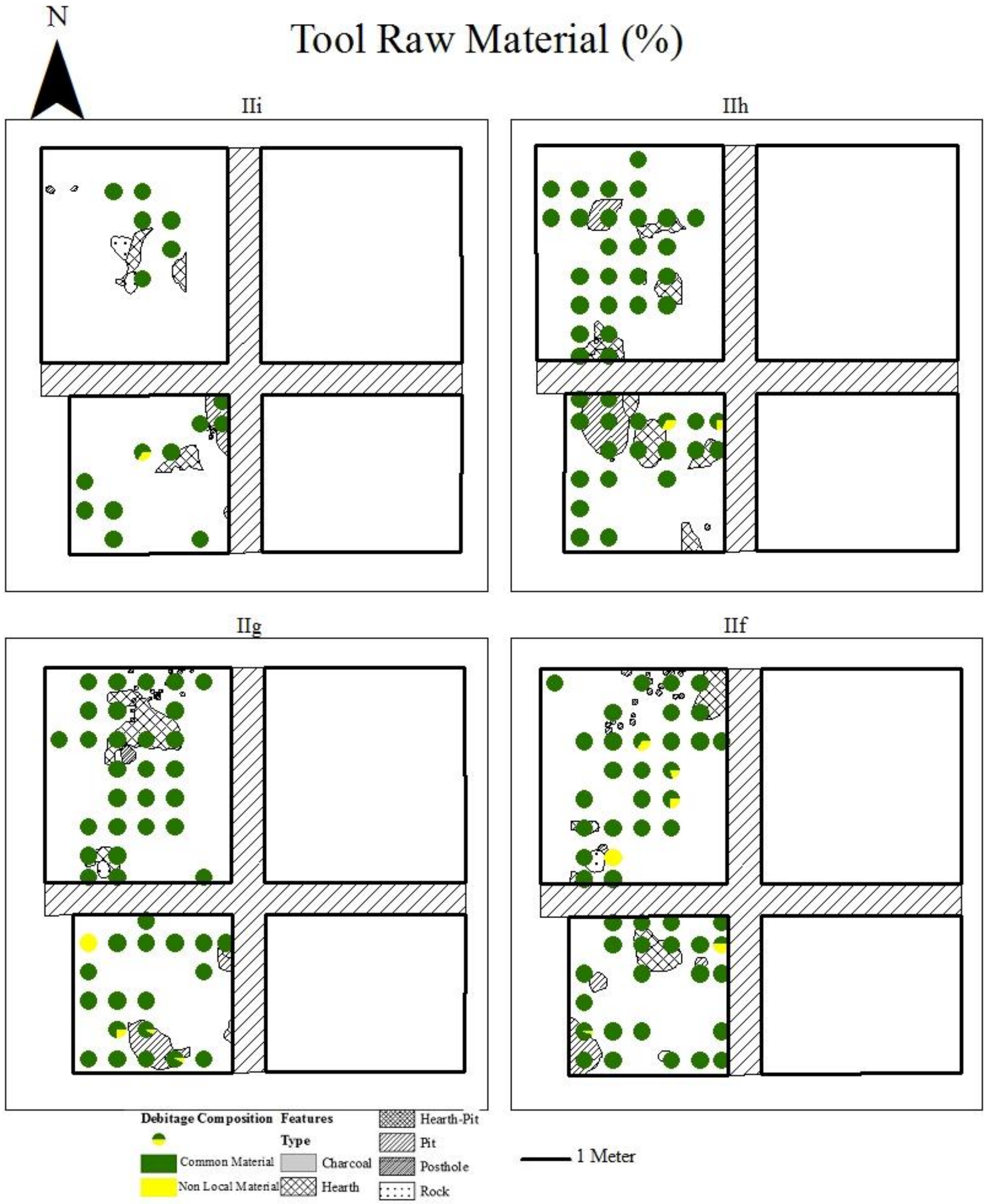

Figure A.3: These maps show the proportion of raw material in tools using pie charts for floors IIi to IIf.

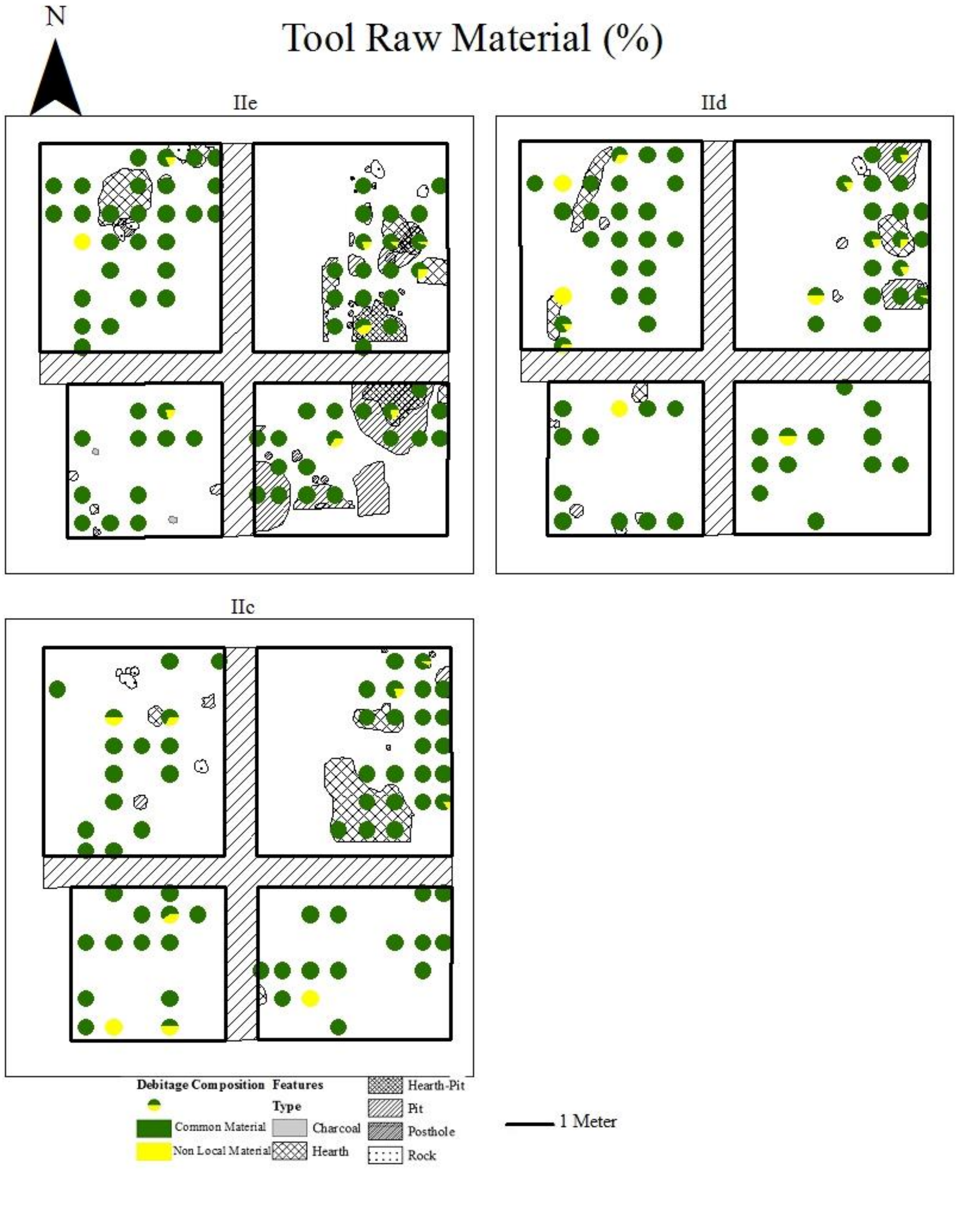

Figure A.4: These maps show the proportion of raw material in tools using pie charts for floors IIe to IIc.

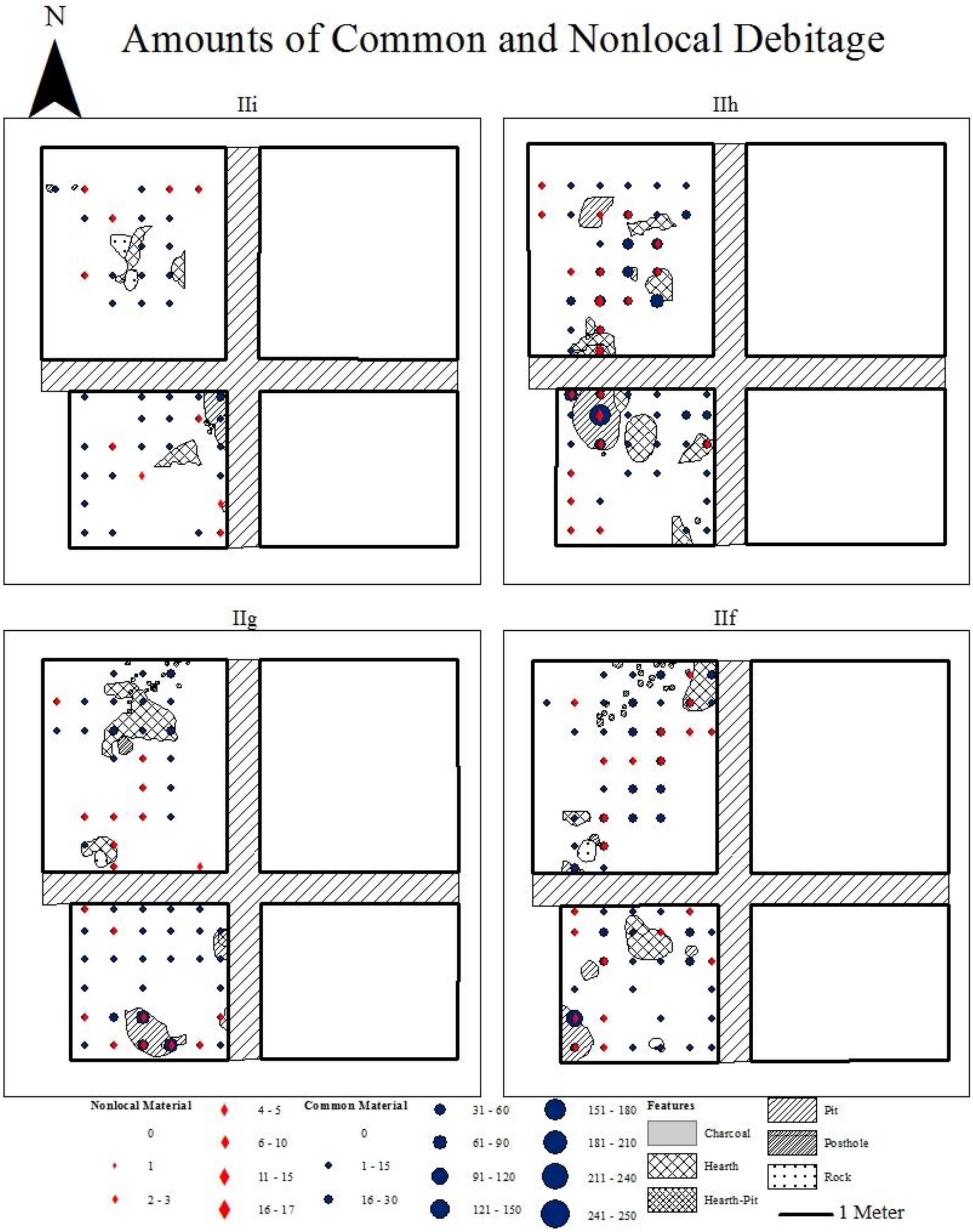

Figure A.5: These maps show the raw counts of local and nonlocal debitage for floors IIi to IIf.

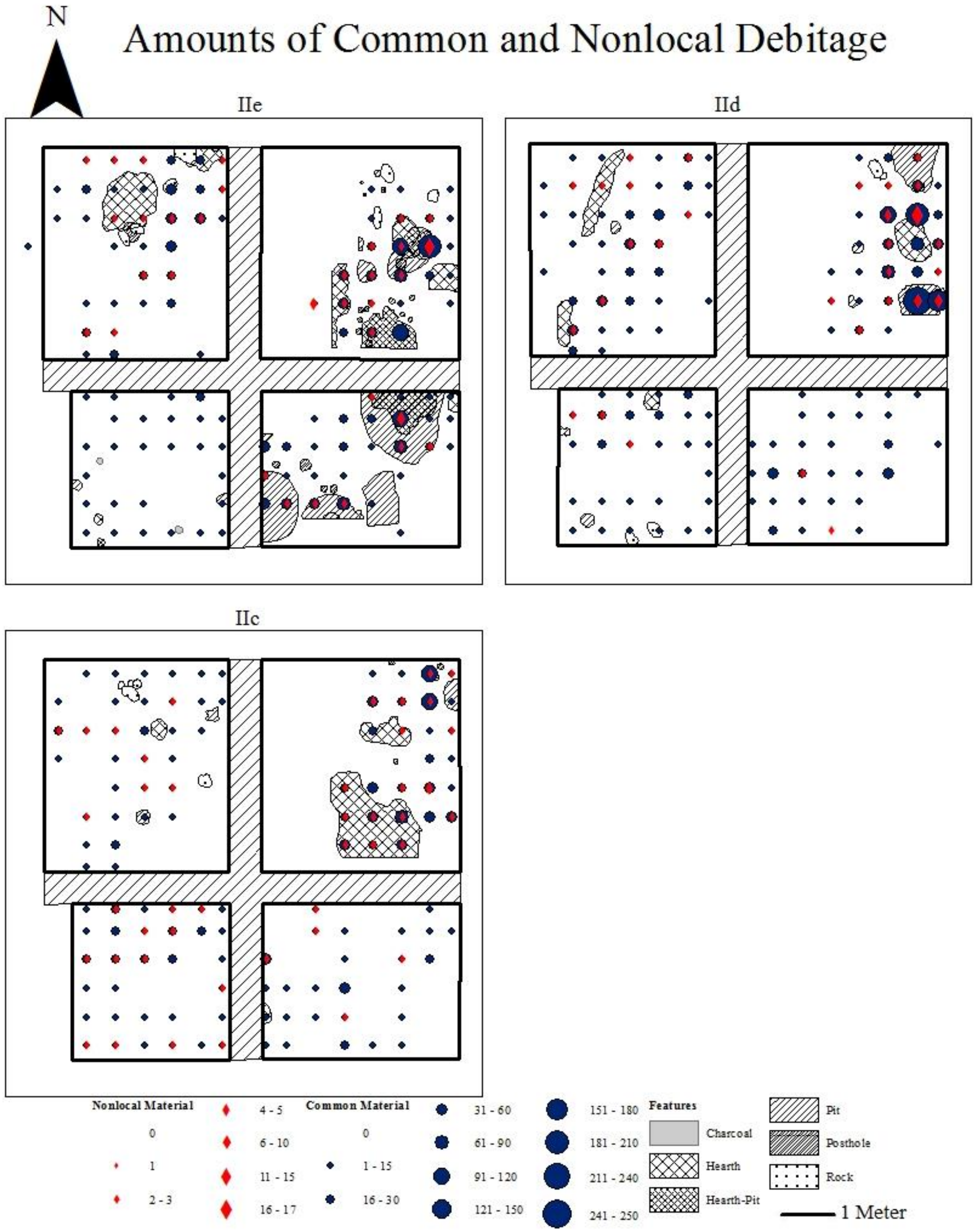

Figure A.6: These maps show the raw counts of local and nonlocal debitage for floors IIe to IIc.

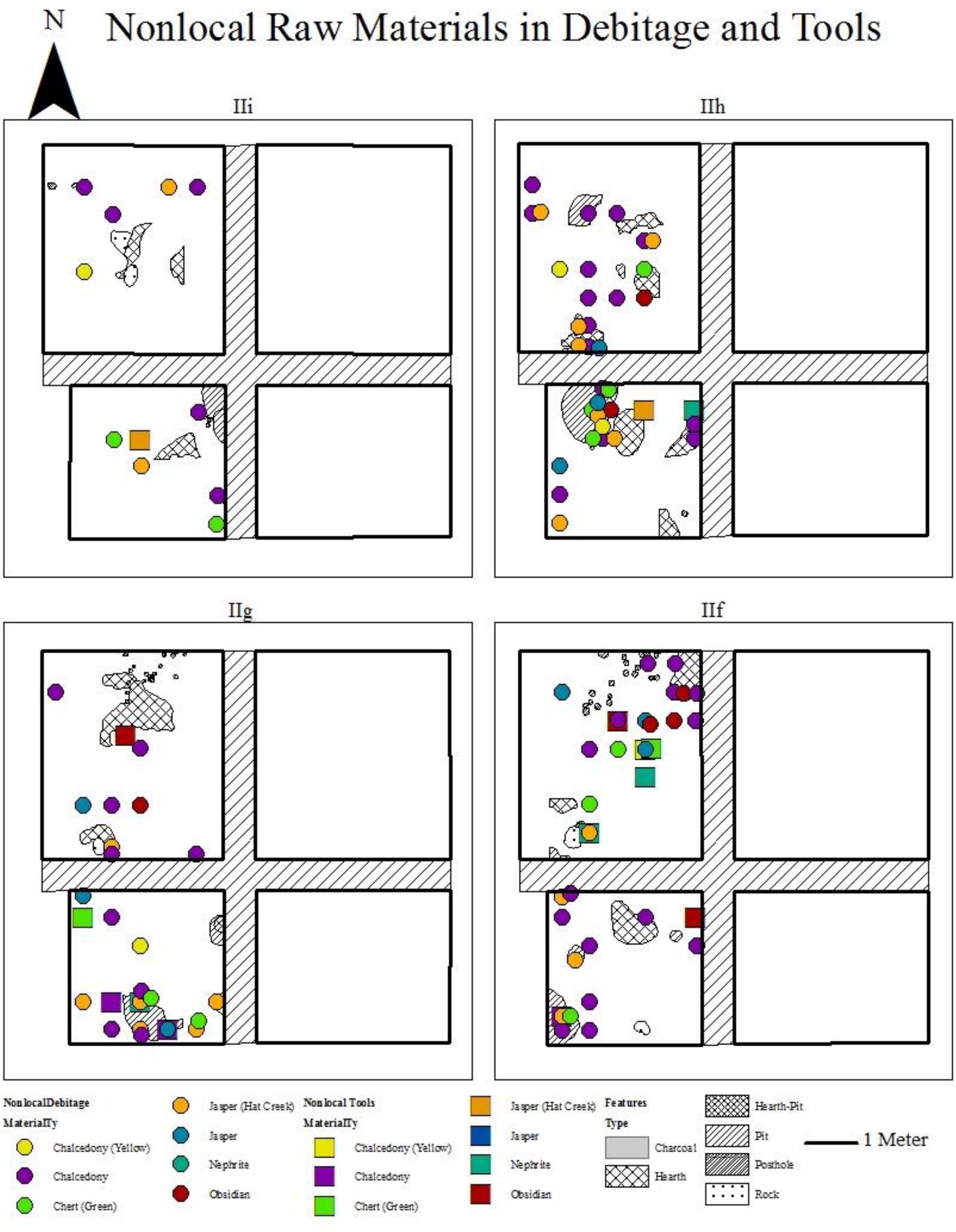

Figure A.7: These maps show the types of nonlocal materials in debitage and tools for floors IIi to IIf.

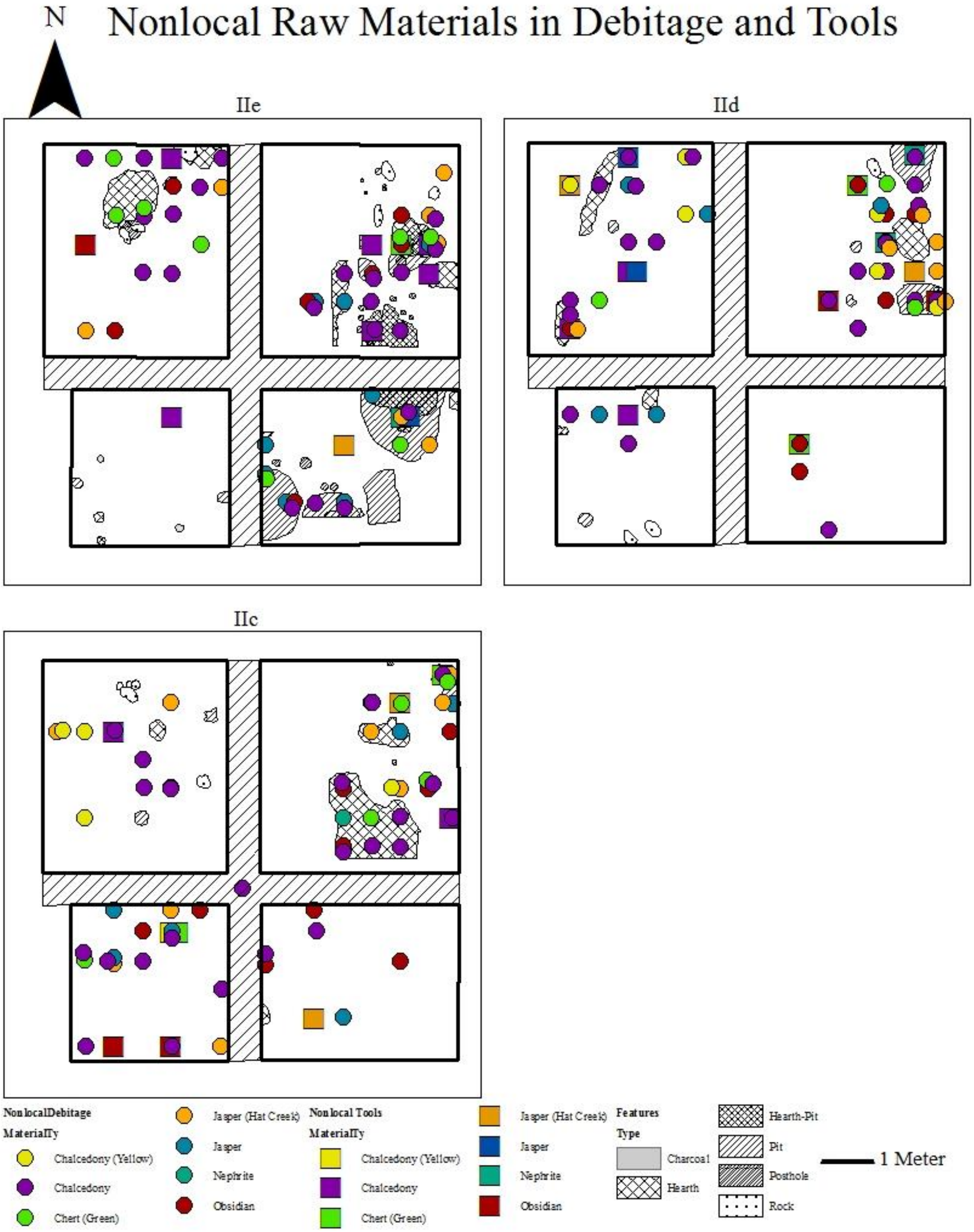

Figure A.8: These maps show the types of nonlocal materials in debitage and tools for floors IIe to IIc.

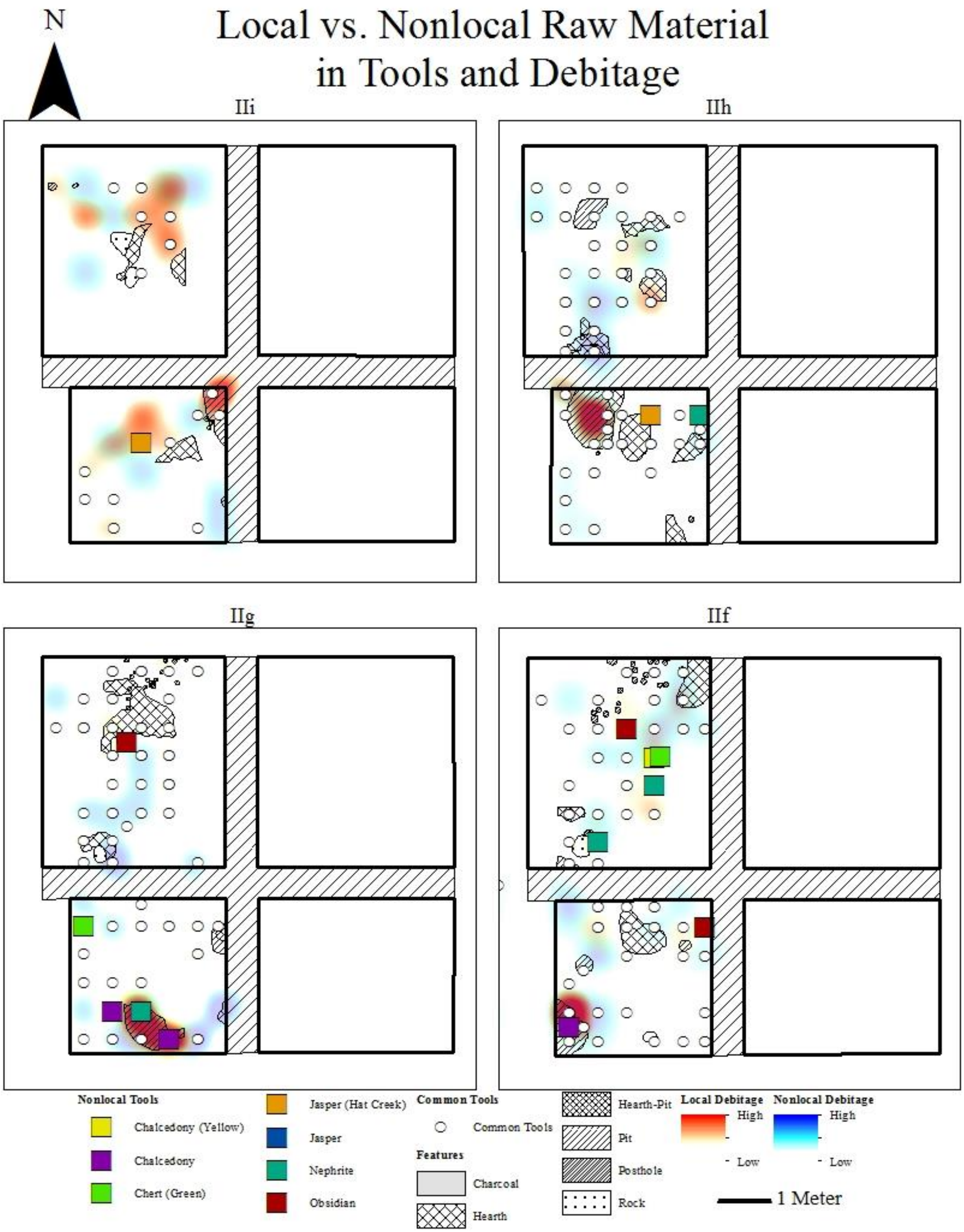

Figure A.9: These maps show the amounts of local and nonlocal debitage as spline layers, local tools, and nonlocal material type in tools for floors IIi to IIf.

Figure A.10: These maps show the amounts of local and nonlocal debitage as spline layers, local tools, and nonlocal material type in tools for floors IIe to IIc.

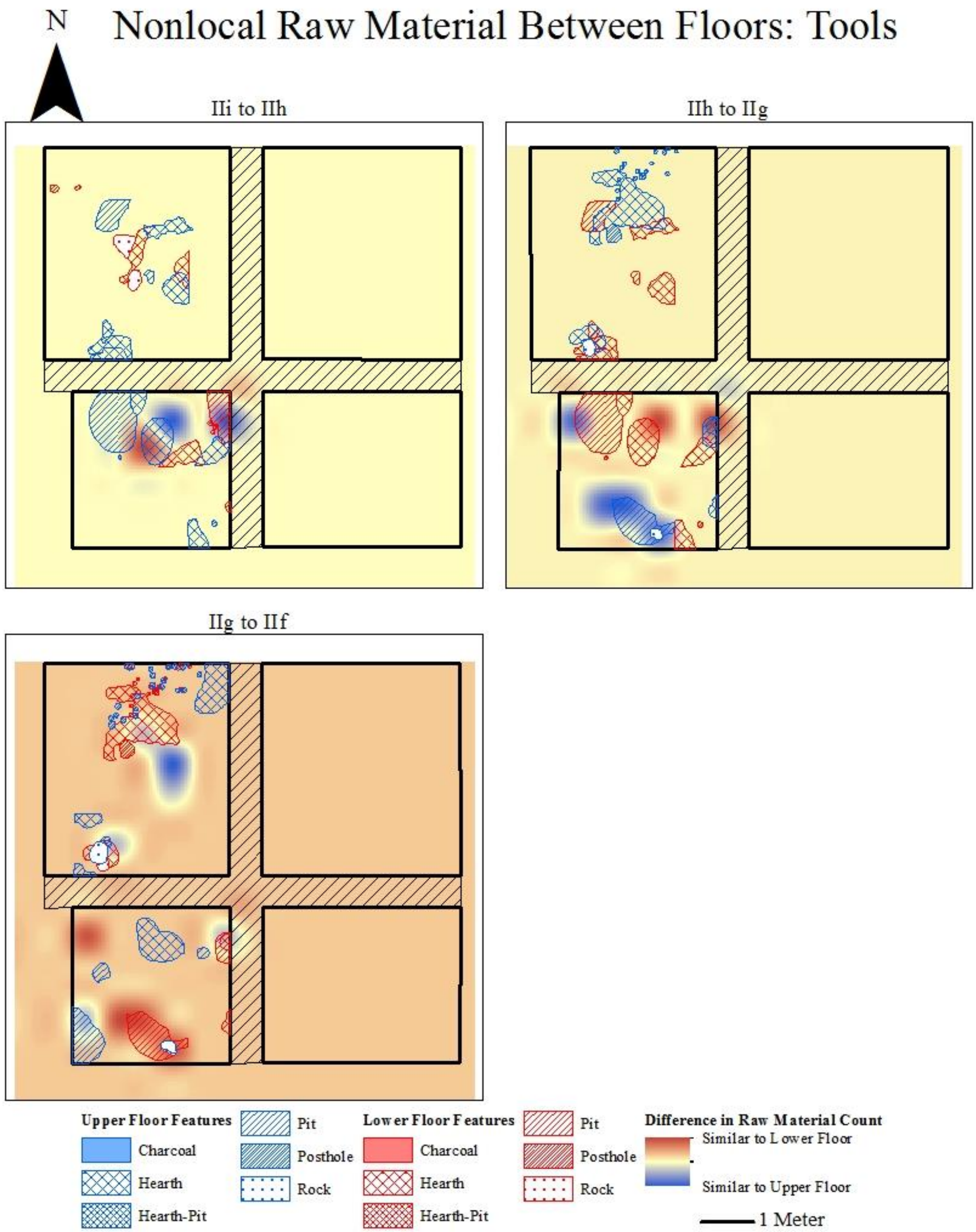

Figure A.11: These maps show the difference between two floors in nonlocal raw material amounts in tools for floors IIi through IIf.

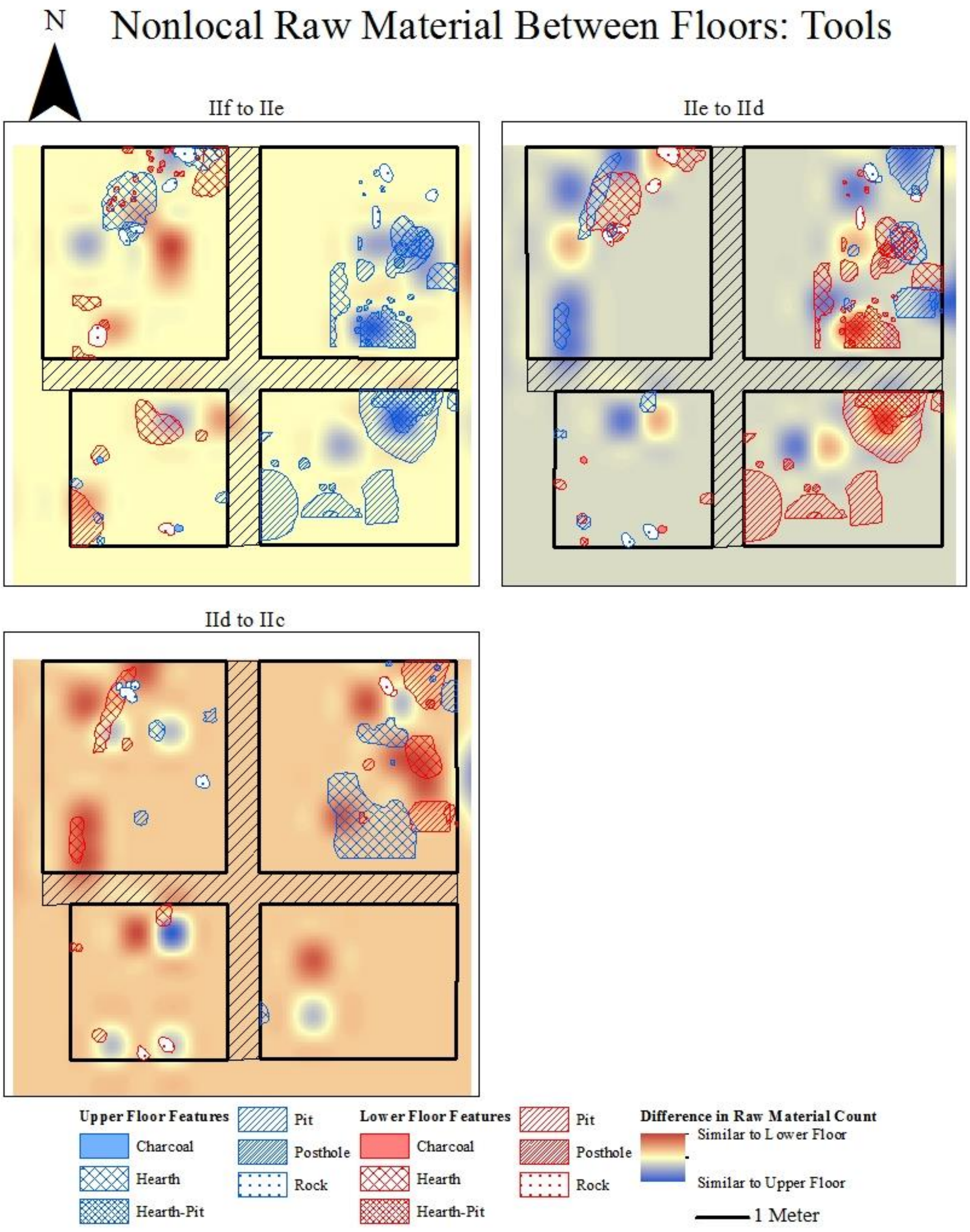

Figure 5.12: These maps show the difference between two floors in nonlocal raw material amounts in tools for floors IIf through IIc.

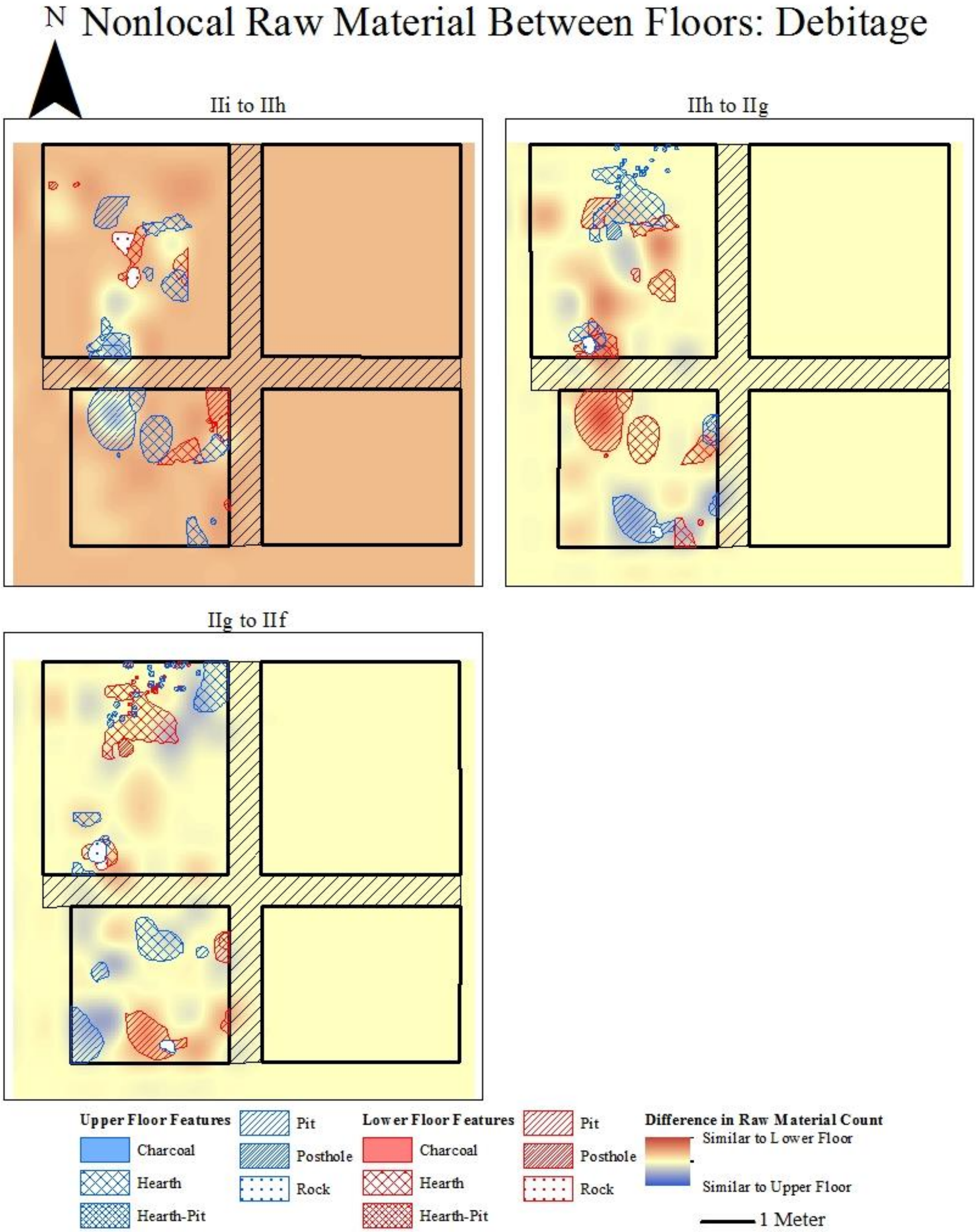

Figure A.13: These maps show the difference between two floors in nonlocal raw material amounts in debitage for floors IIi through IIf.

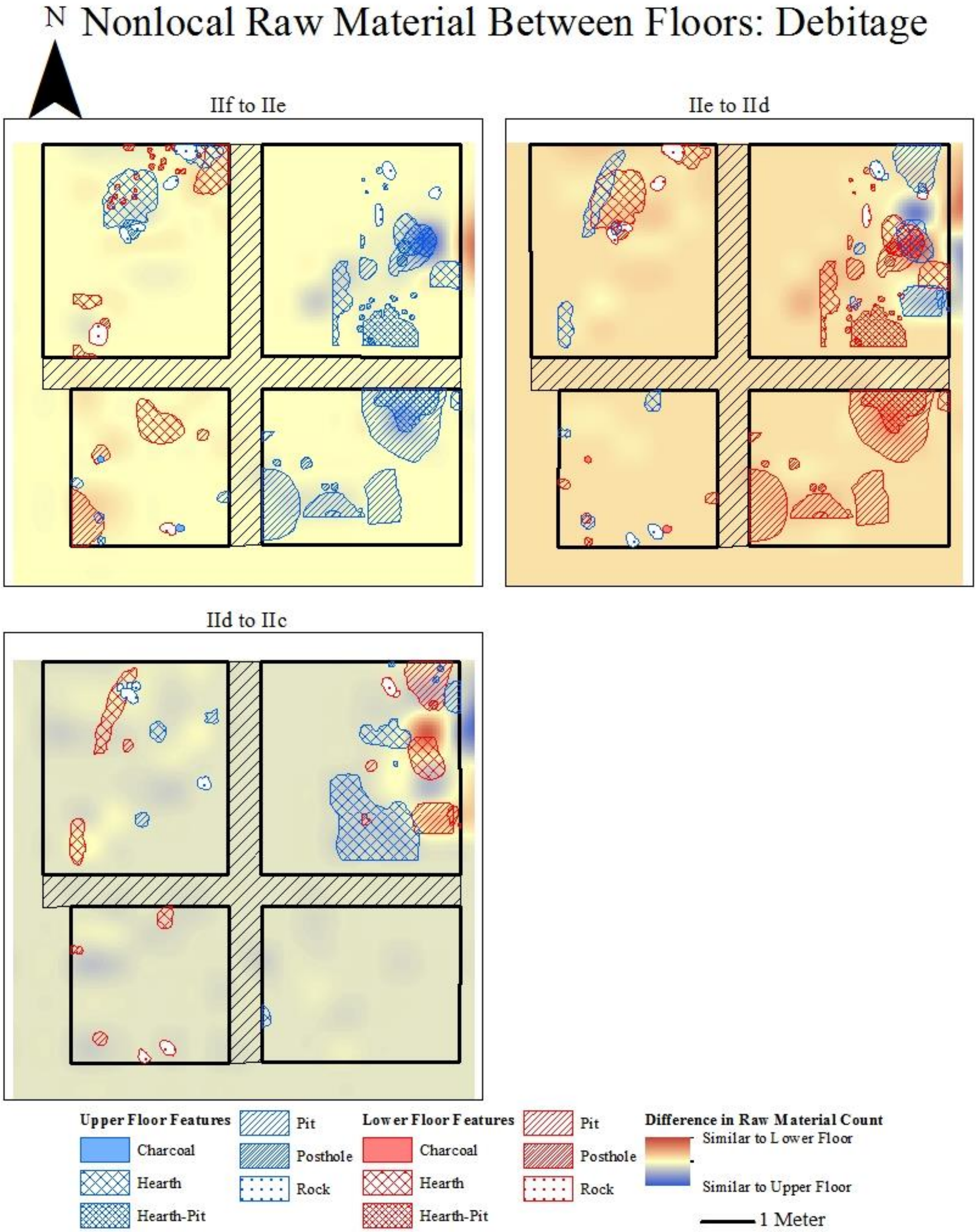

Figure A.14: These maps show the difference between two floors in nonlocal raw material amounts in debitage for floors IIf through IIc.

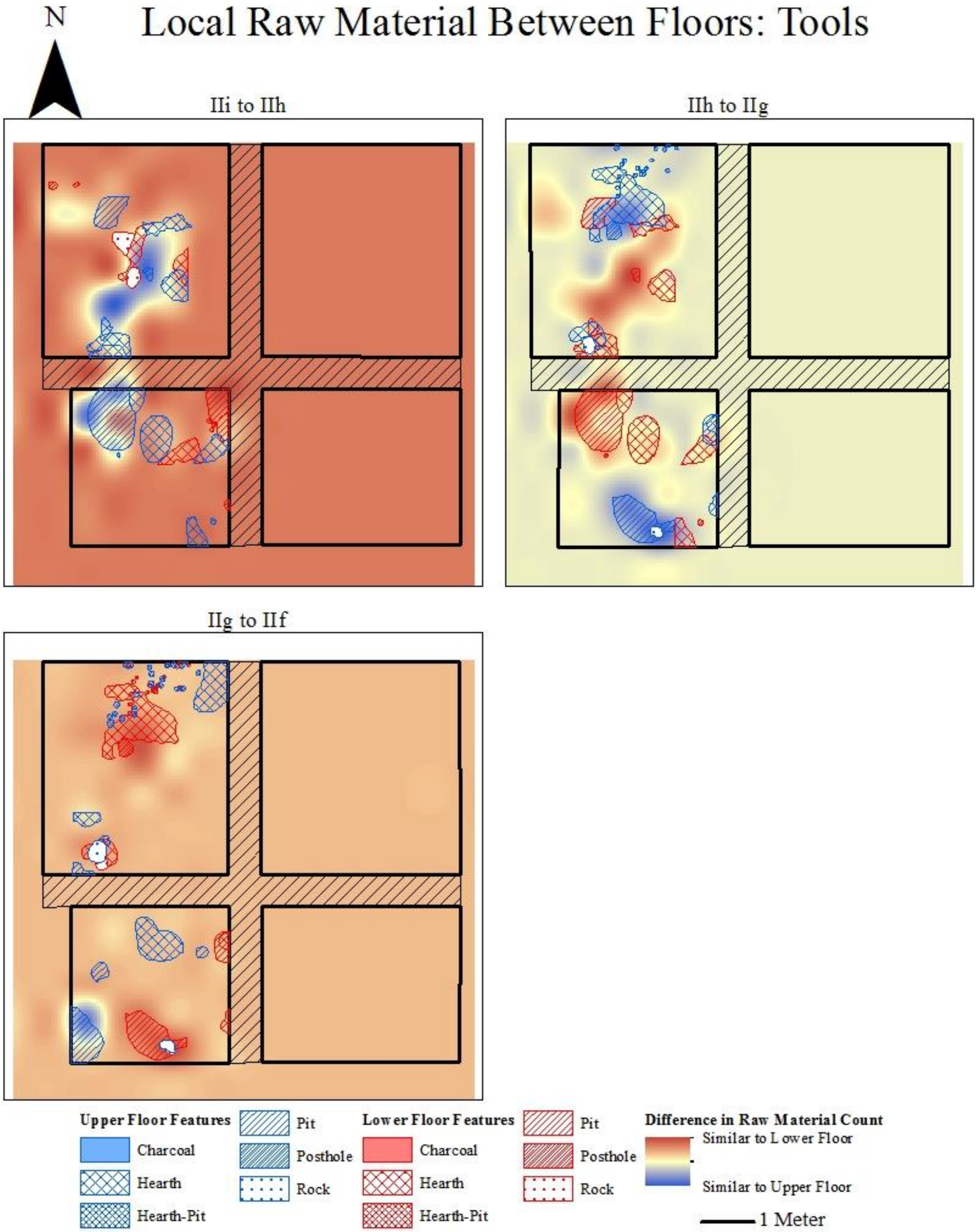

Figure A.15: These maps show the difference between two floors in local raw material amounts in tools for floors IIi through IIf.

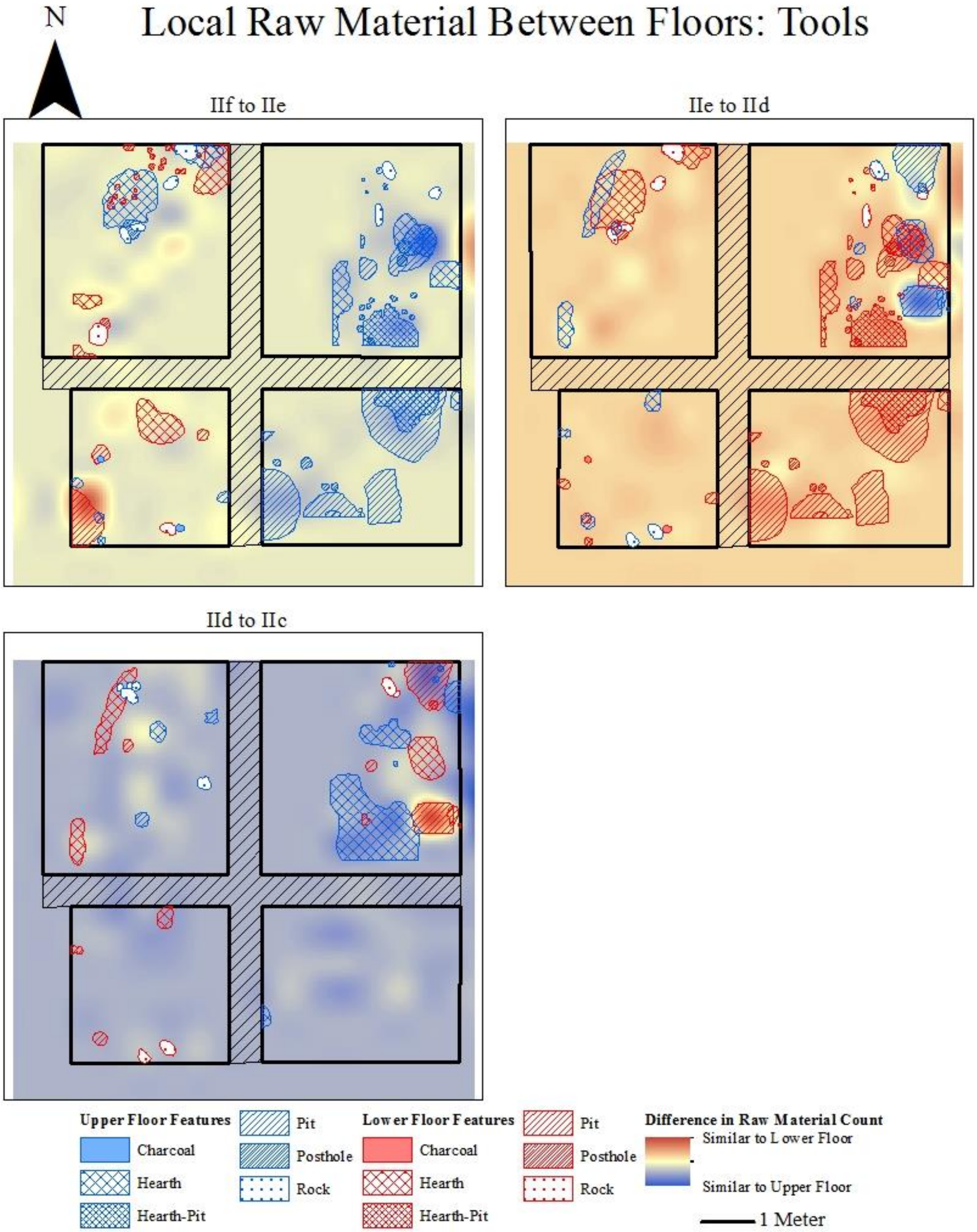

Figure A.16: These maps show the difference between two floors in local raw material amounts in tools for floors IIf through IIc.

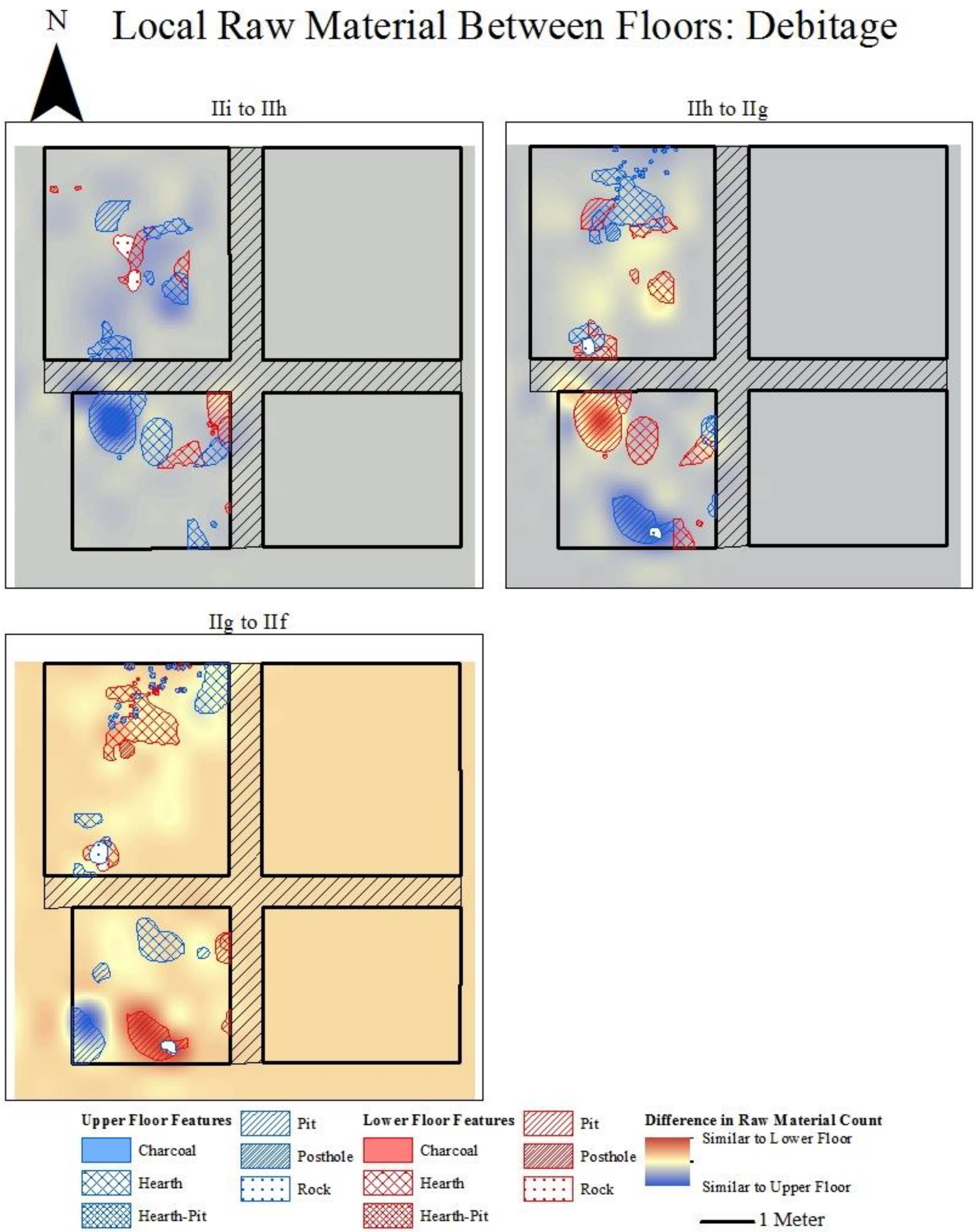

Figure A.17: These maps show the difference between two floors in local raw material amounts in debitage for floors IIi through IIf.

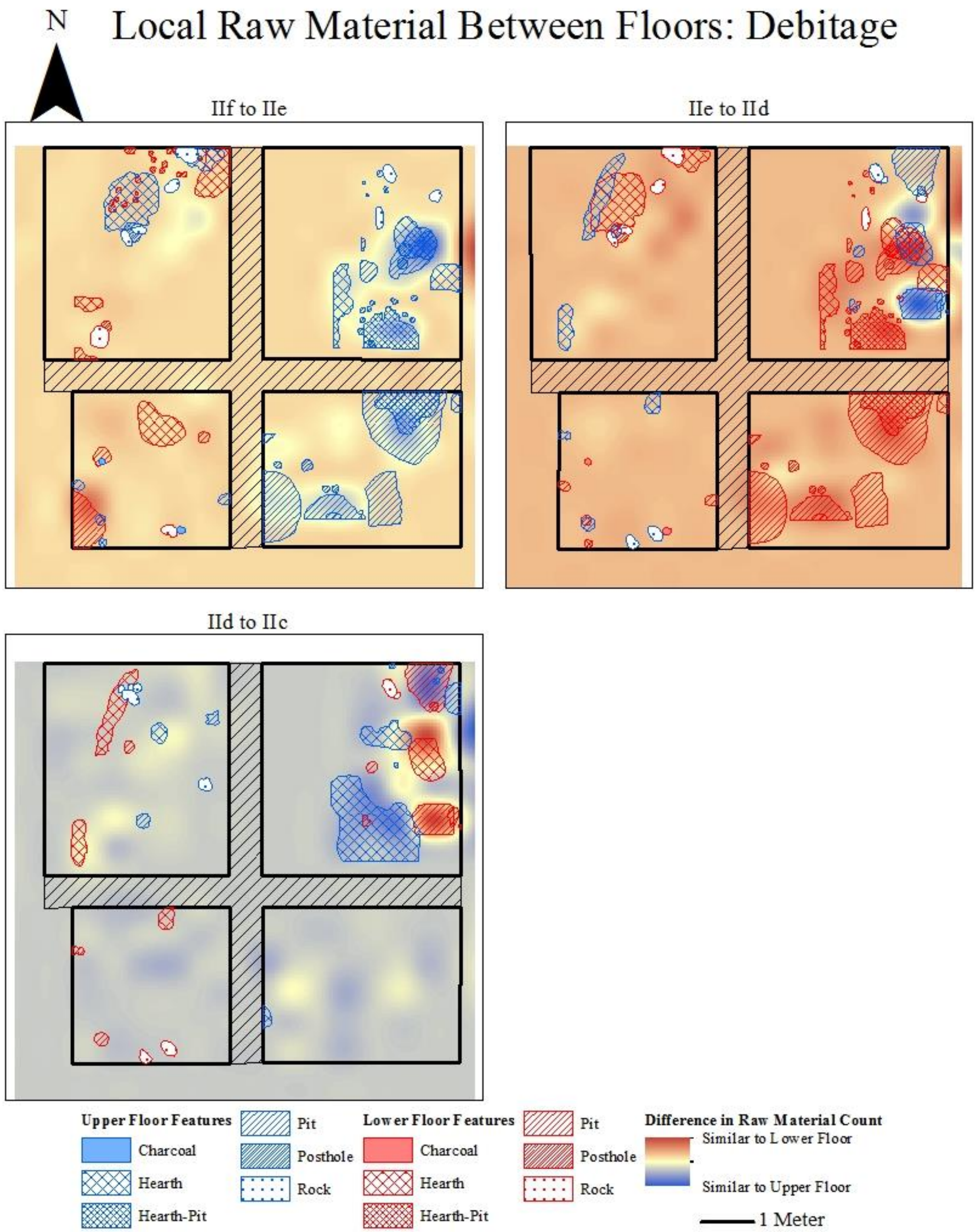

Figure A.18: These maps show the difference between two floors in local raw material amounts in debitage for floors IIf through IIc.

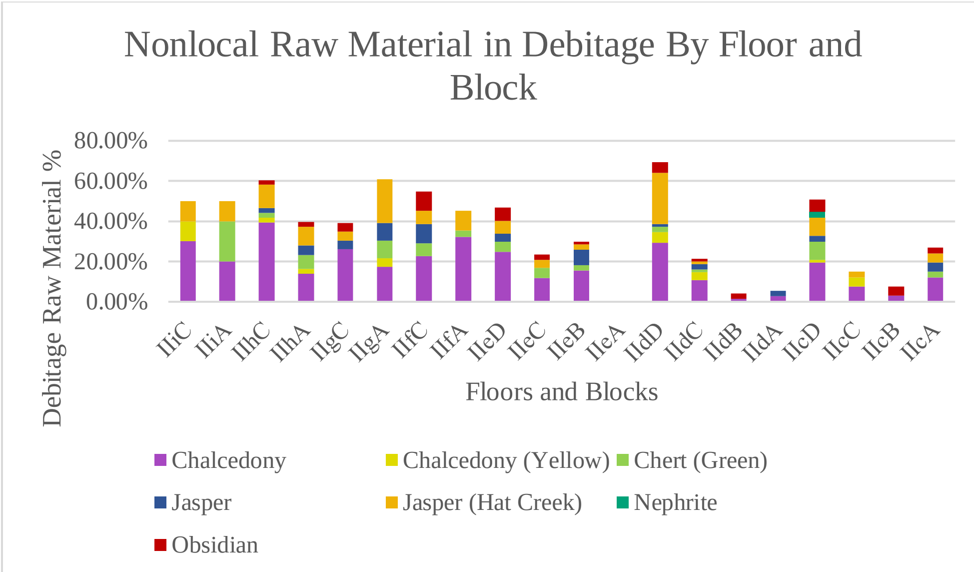

Figure A.19: This graph shows the proportion of different types of nonlocal lithic material in debitage by floor totals.

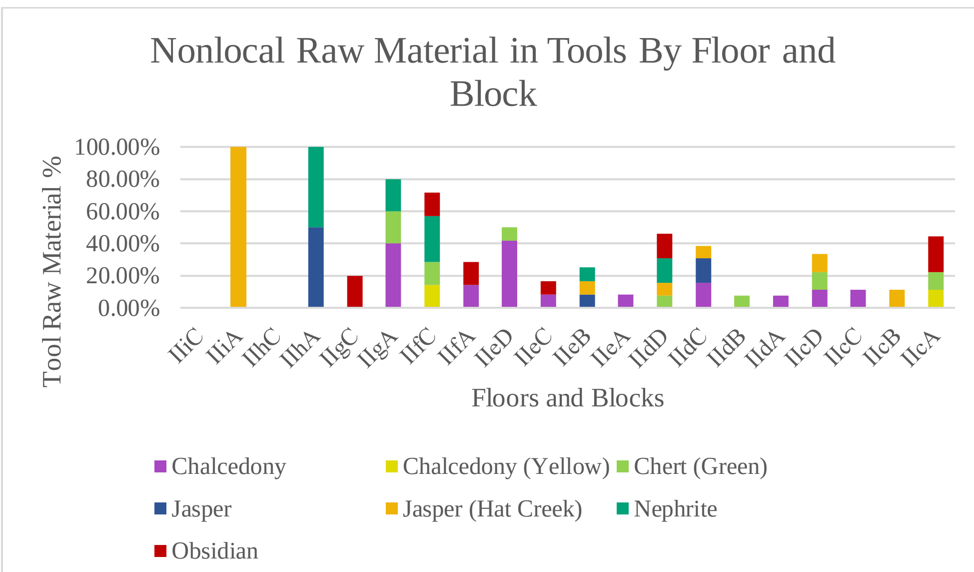

Figure A.20: This graph shows the proportion of different types of nonlocal lithic material in tools by floor totals.

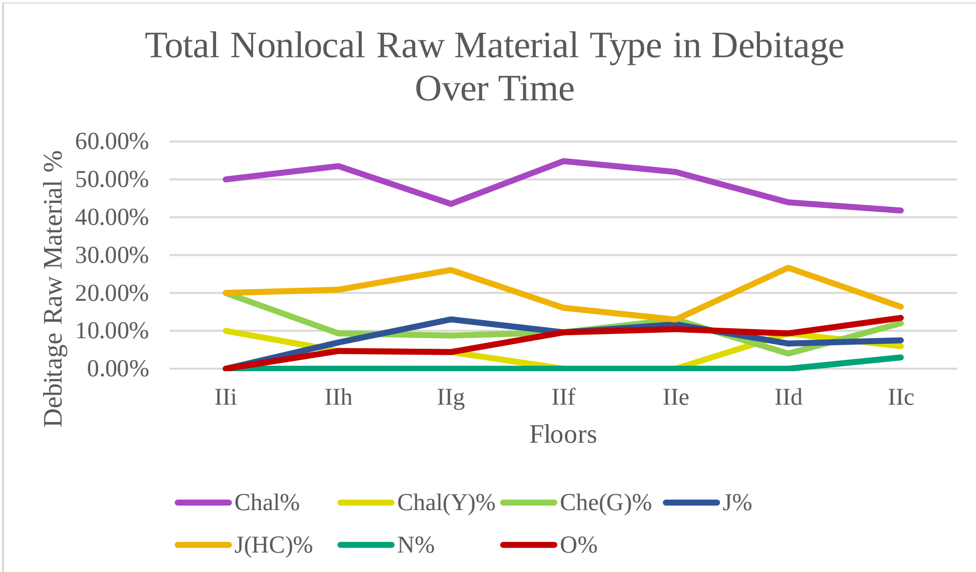

Figure A.21: The prevalence of each debitage raw material relative to the totals on each floor.

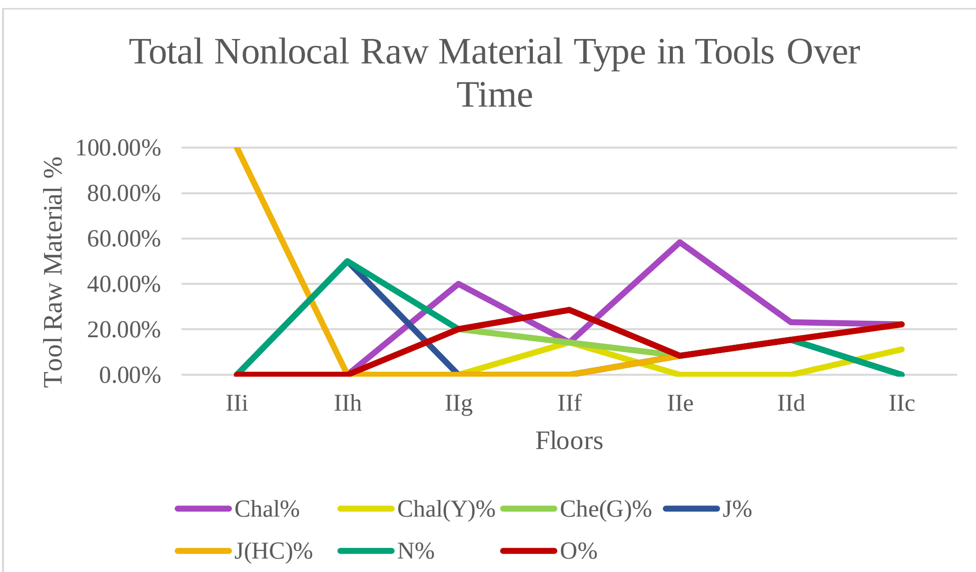

Figure A.22: The prevalence of each tool stone raw material relative to the totals on each floor.

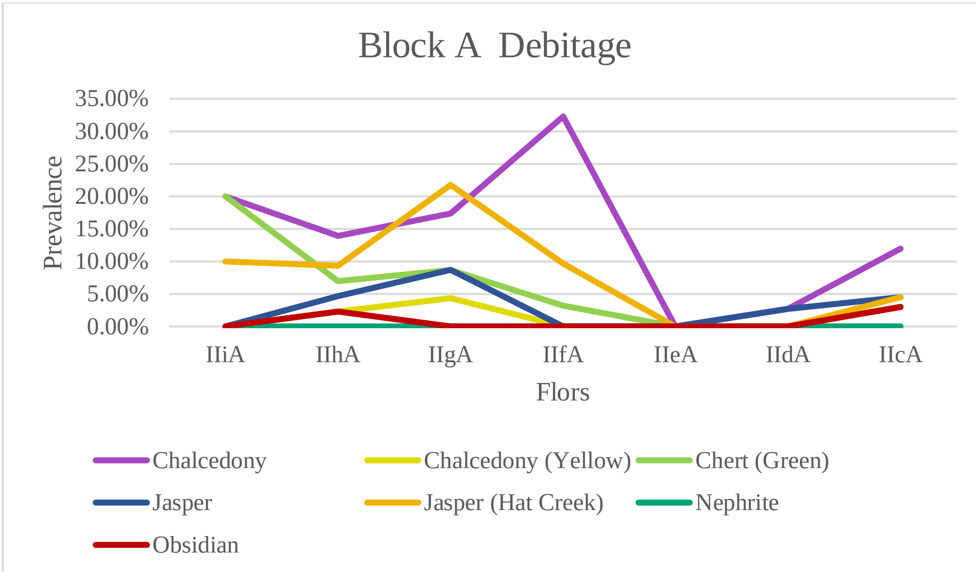

Figure A.23: This graph shows the proportion of nonlocal lithic material in debitage in Block A by floor totals.

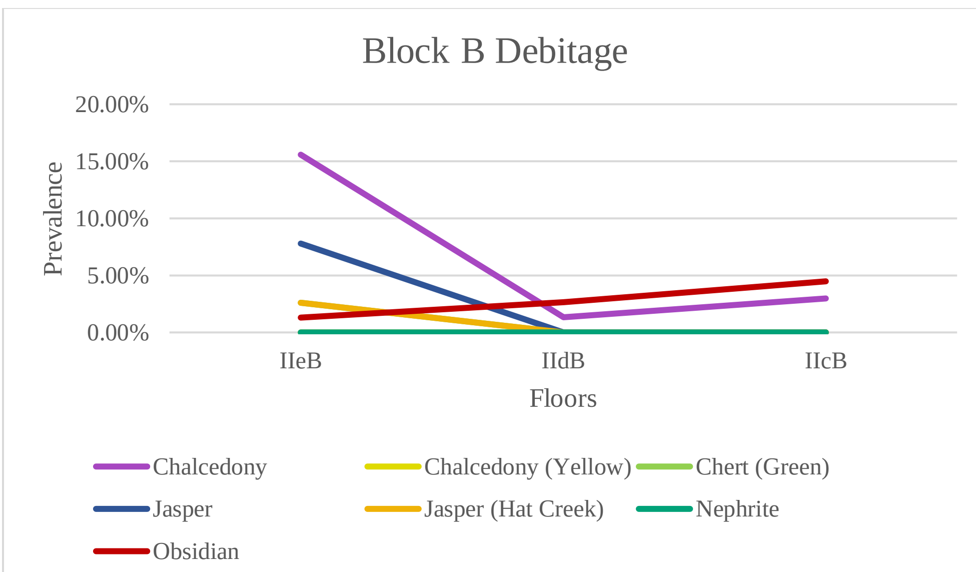

Figure A.24: This graph shows the proportion of nonlocal lithic material in debitage in Block B by floor totals.

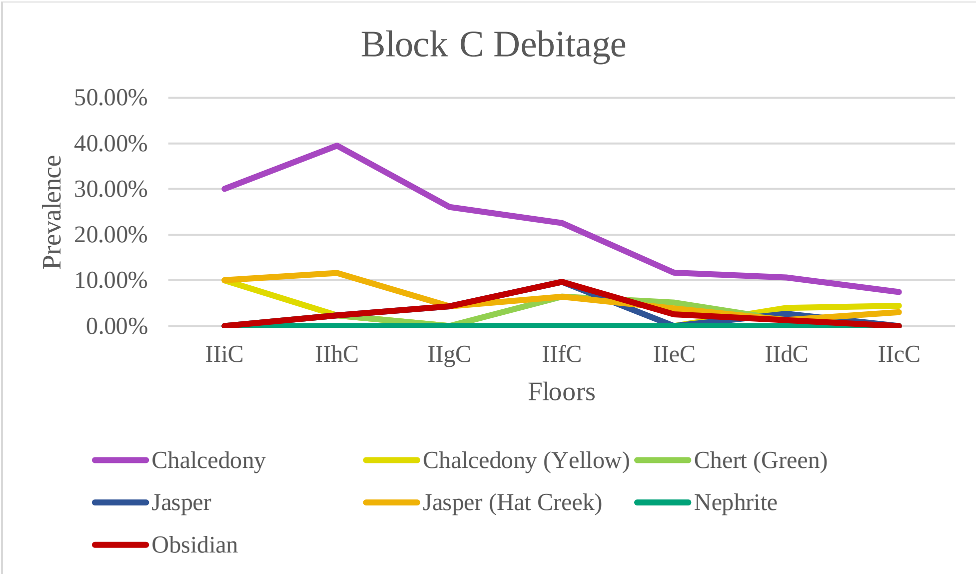

Figure A.25: This graph shows the proportion of nonlocal lithic material in debitage in Block C by floor totals.

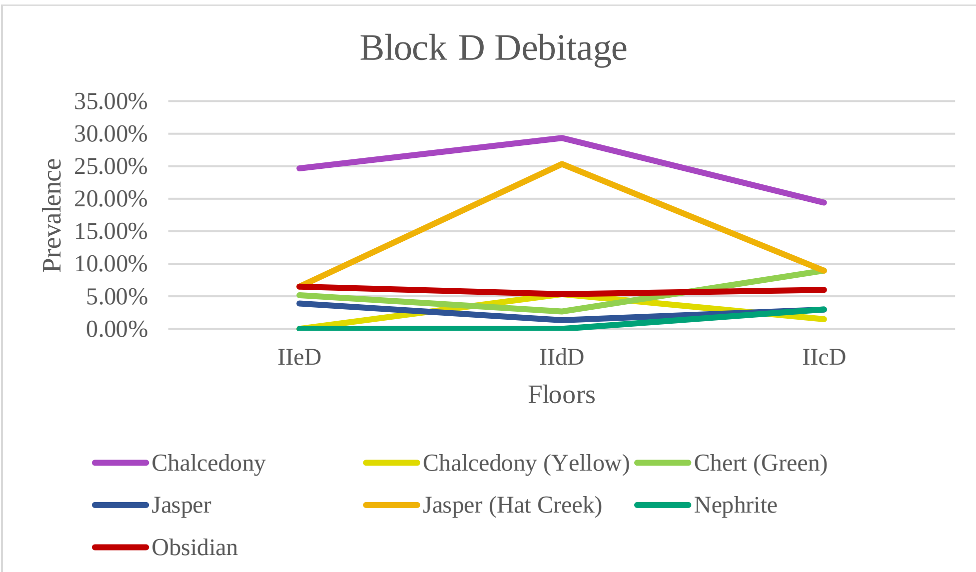

Figure A.26: This graph shows the proportion of nonlocal lithic material in debitage in Block D by floor totals.

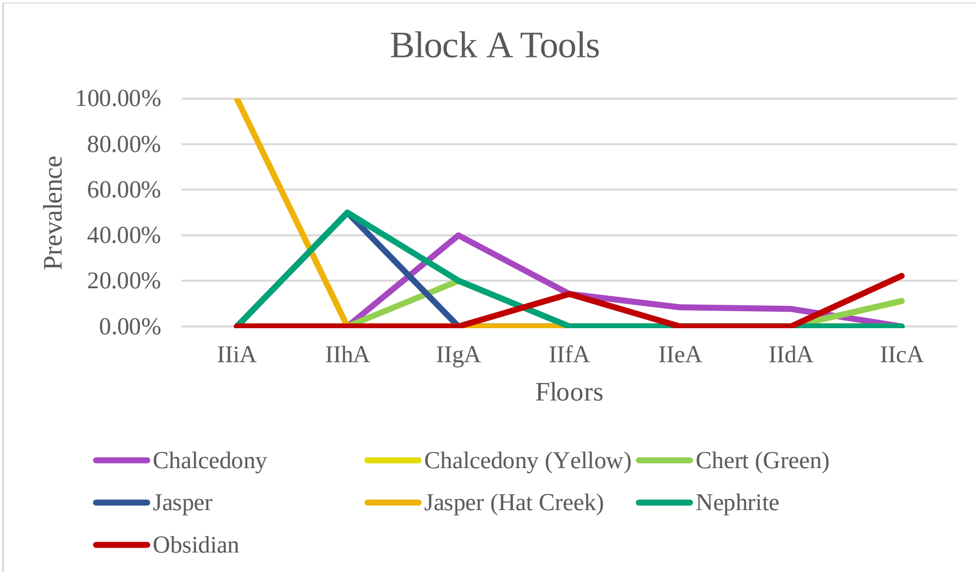

Figure A.27: This graph shows the proportion of nonlocal lithic material in tools in Block A by floor totals.

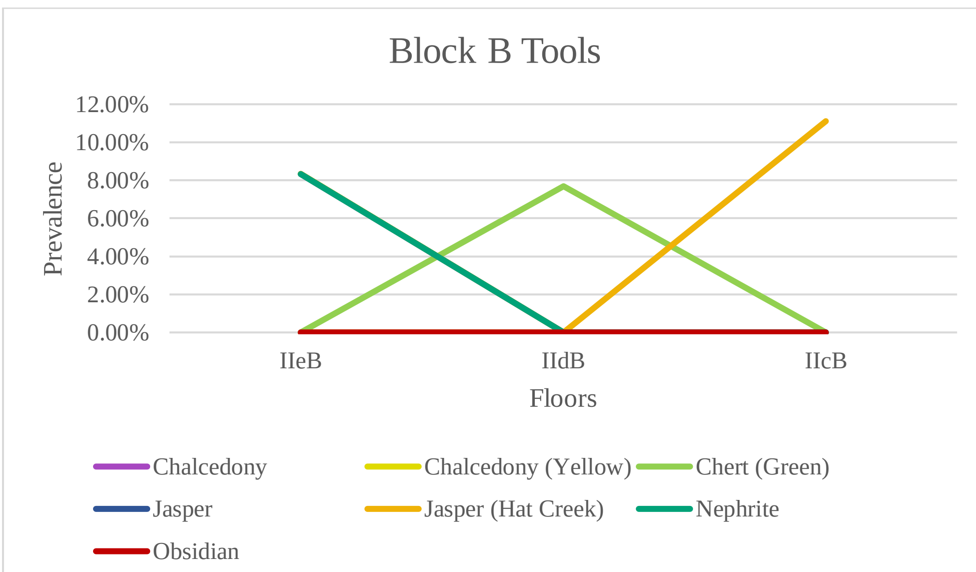

Figure A.28: This graph shows the proportion of nonlocal lithic material in tools in Block B by floor totals.

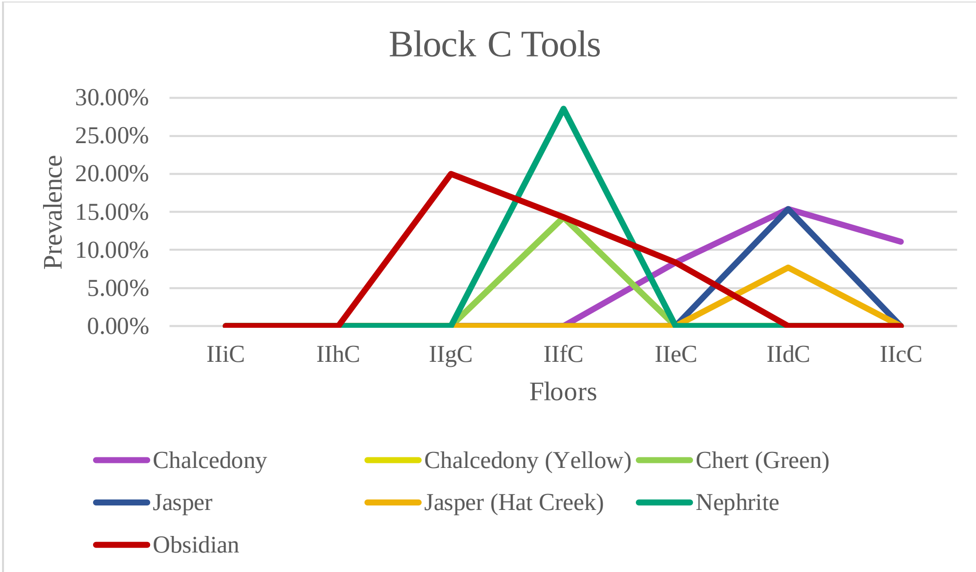

Figure A.29: This graph shows the proportion of nonlocal lithic material in tools in Block C by floor totals.

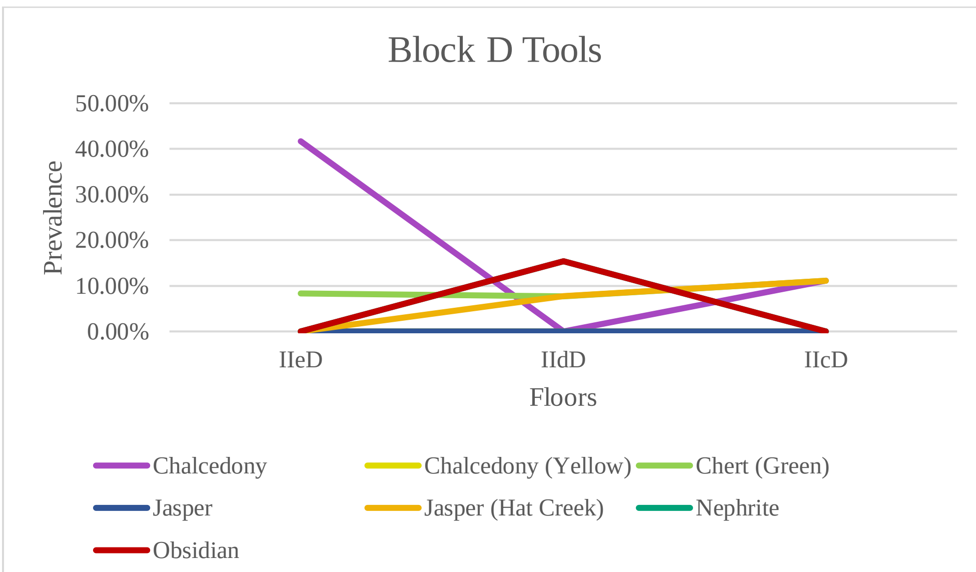

Figure A.30: This graph shows the proportion of nonlocal lithic material in tools in Block D by floor totals.

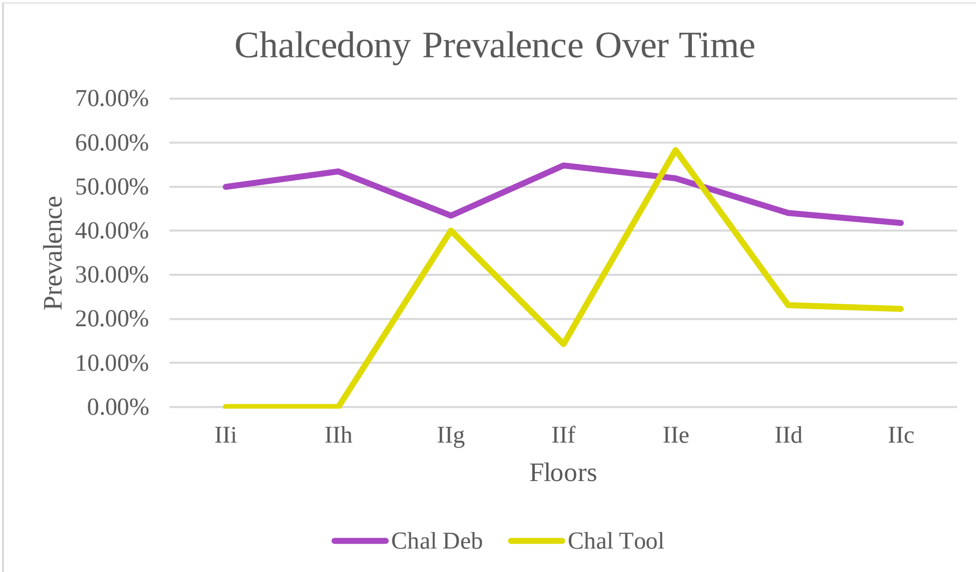

Figure A.31: The proportion of chalcedony in tools and debitage by floor totals.

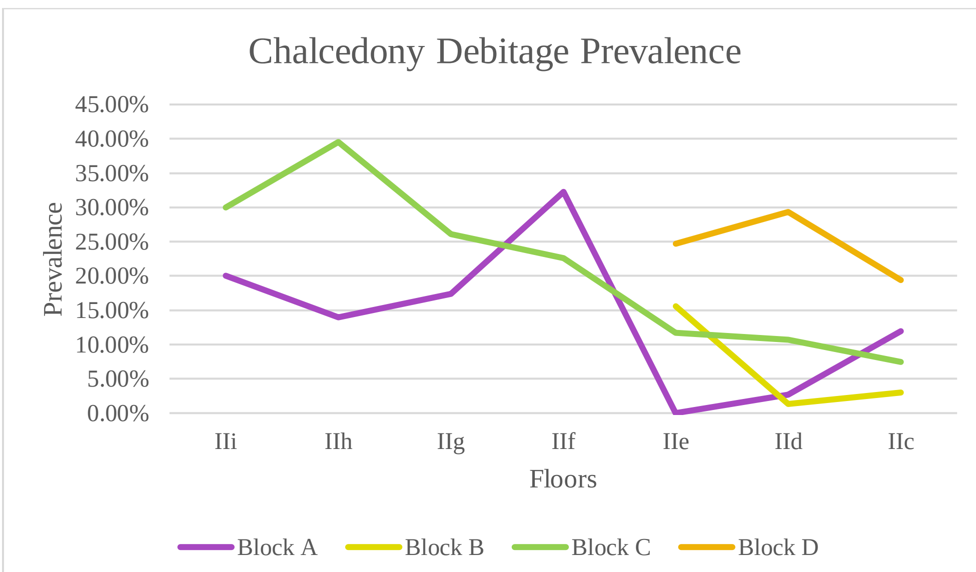

Figure A.32: The proportion of chalcedony debitage in each block by floor totals.

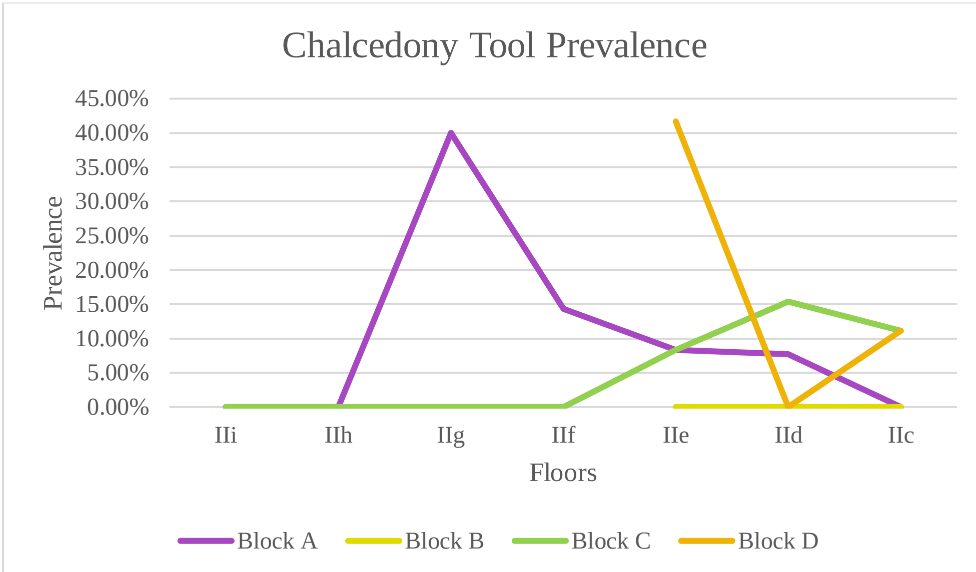

Figure A.33: The proportion of chalcedony tools in each block by floor totals.

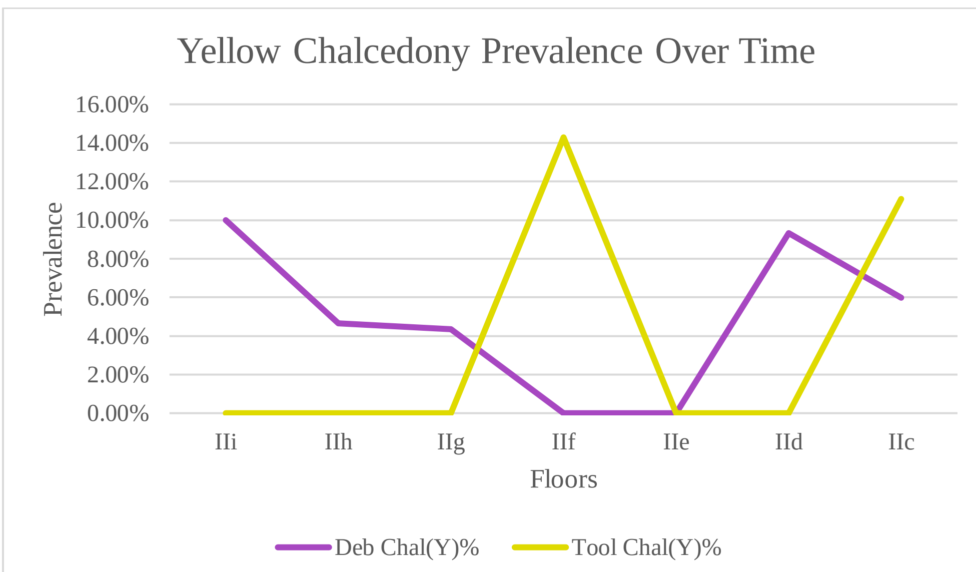

Figure A.34: The proportion of yellow chalcedony in tools and debitage by floor totals.

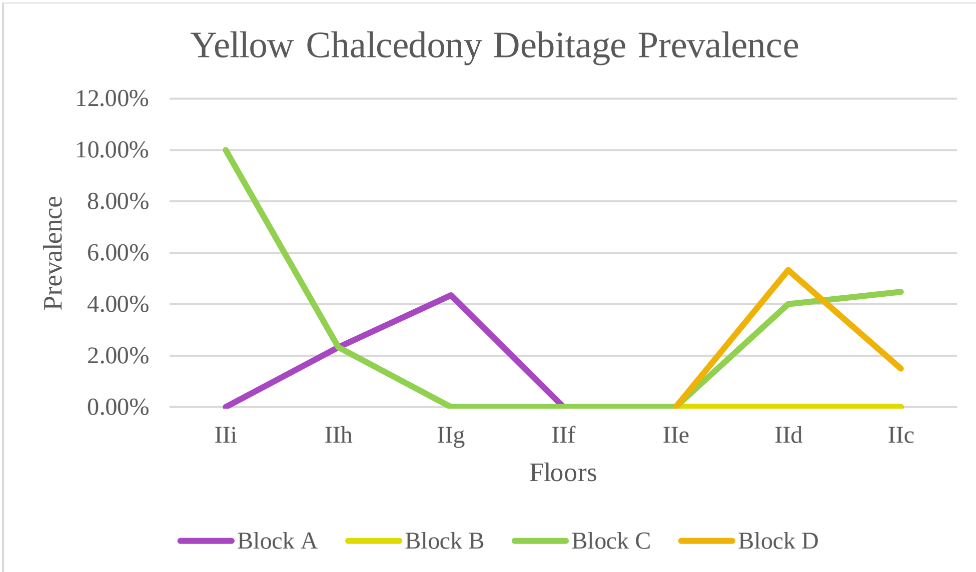

Figure A.35: The proportion of yellow chalcedony debitage in each block by floor totals.

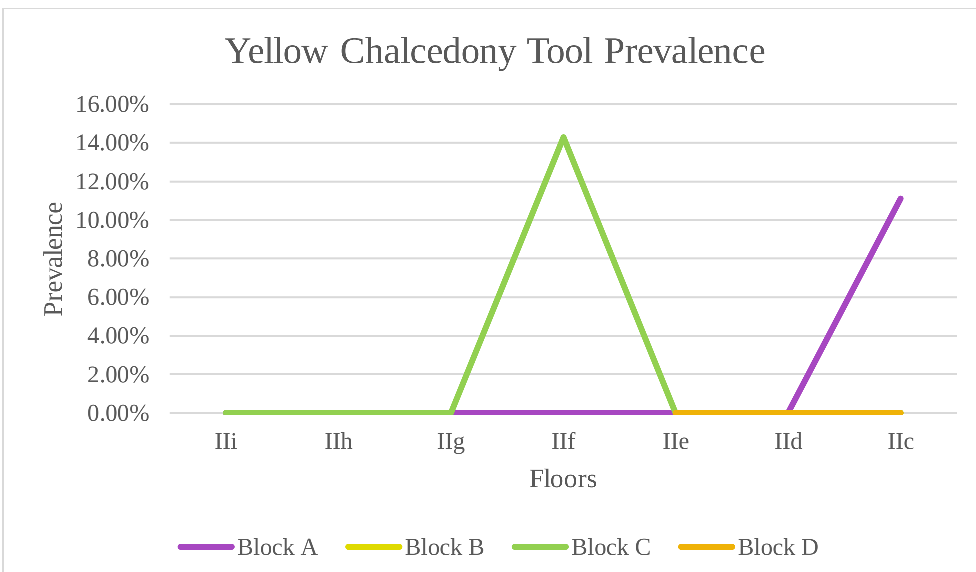

Figure A.36: The proportion of yellow chalcedony tools in each block by floor totals.

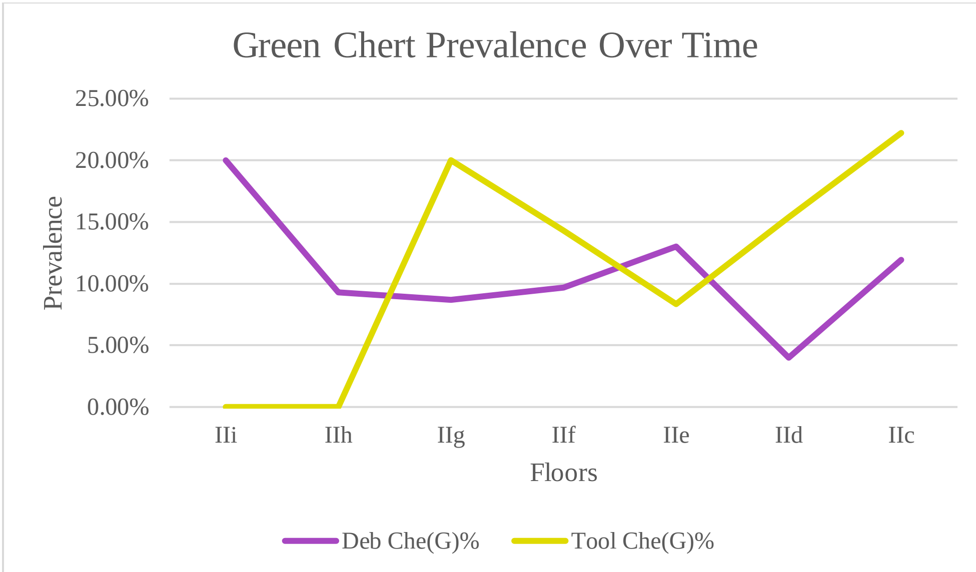

Figure A.37: The proportion of green chert in tools and debitage by floor totals.

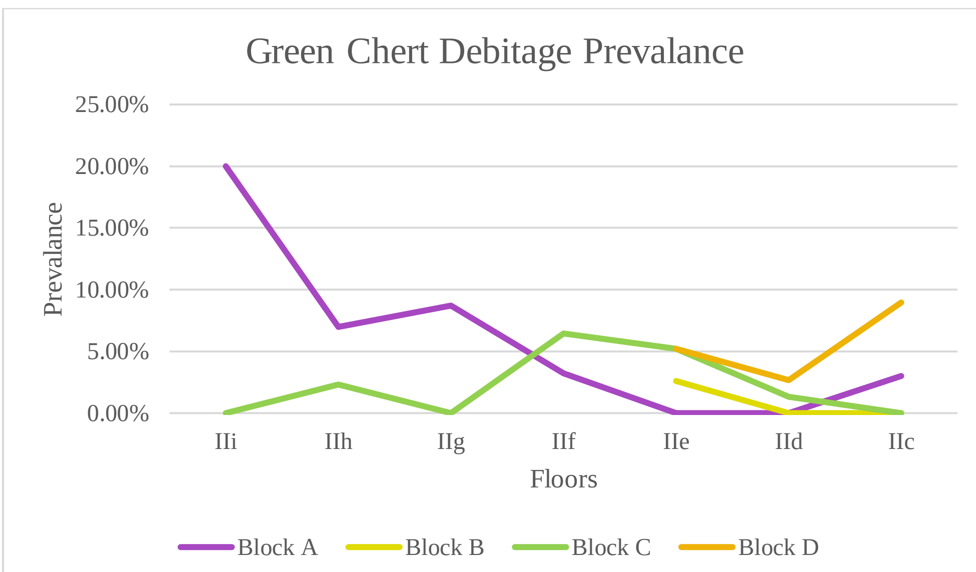

Figure A.38: The proportion of green chert debitage in each block by floor totals.

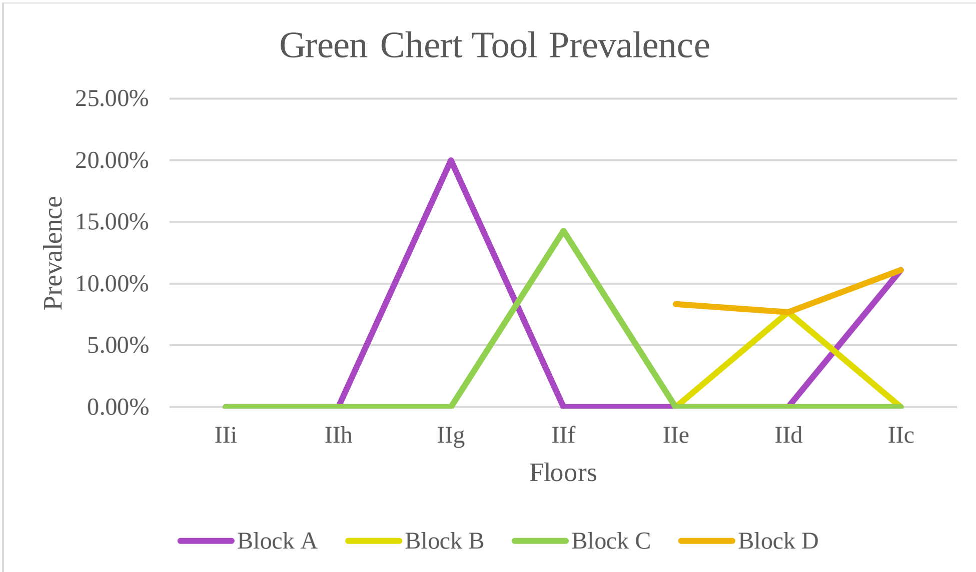

Figure A.39: The proportion of green chert tool in each block by floor totals.

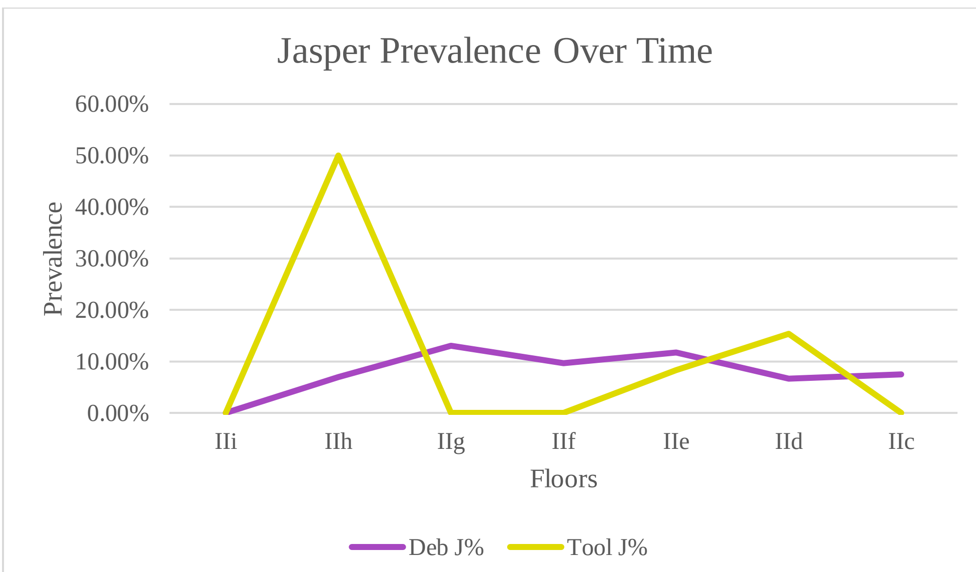

Figure A.40: The proportion of jasper in tools and debitage by floor totals.

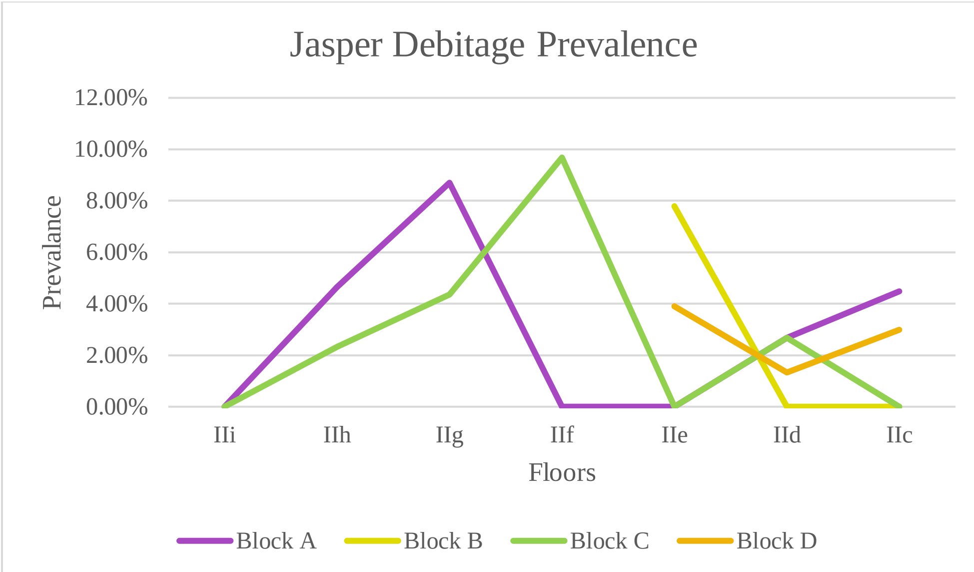

Figure A.41: The proportion of jasper debitage in each block by floor totals.

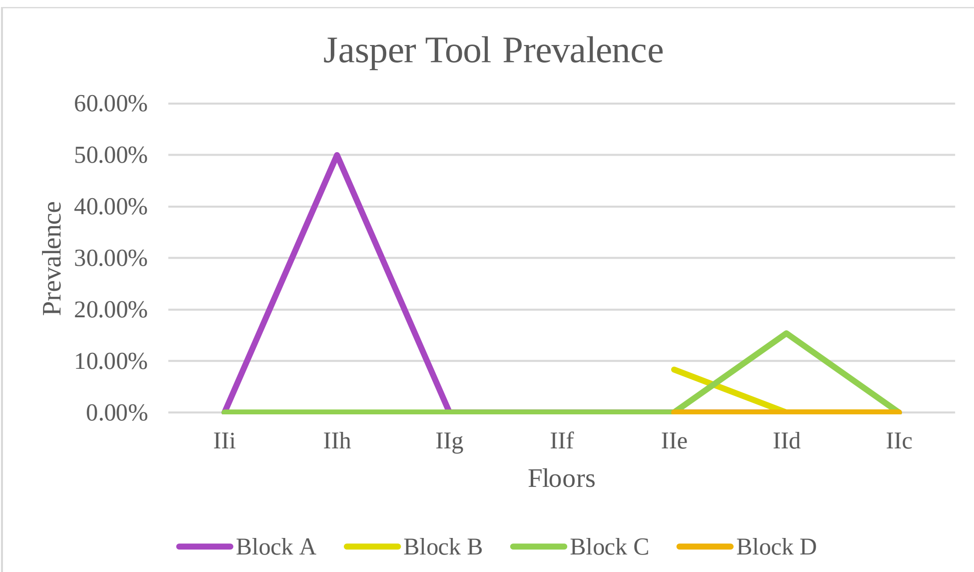

Figure A.42: The proportion of jasper tools in each block by floor totals.

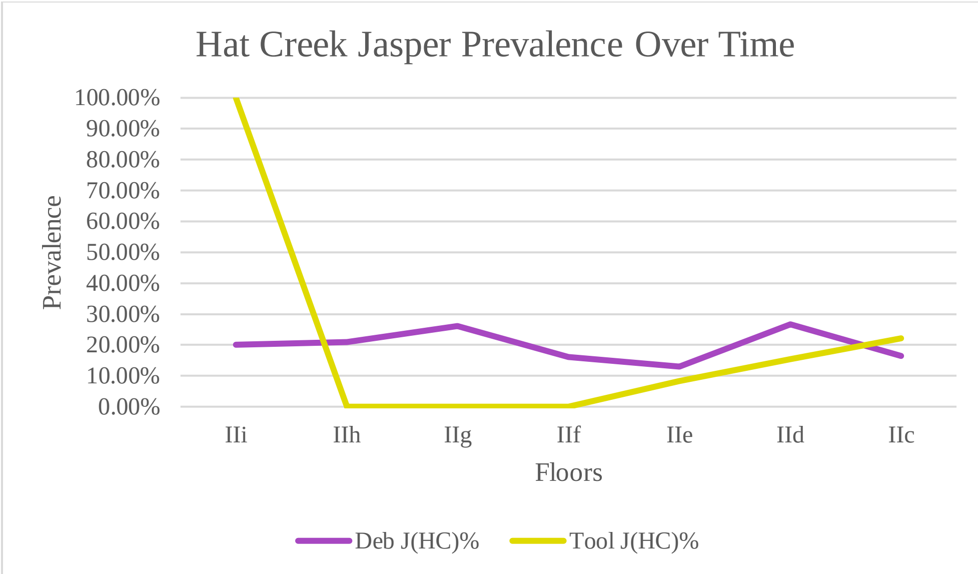

Figure A.43: The proportion of Hat Creek jasper in tools and debitage by floor totals.

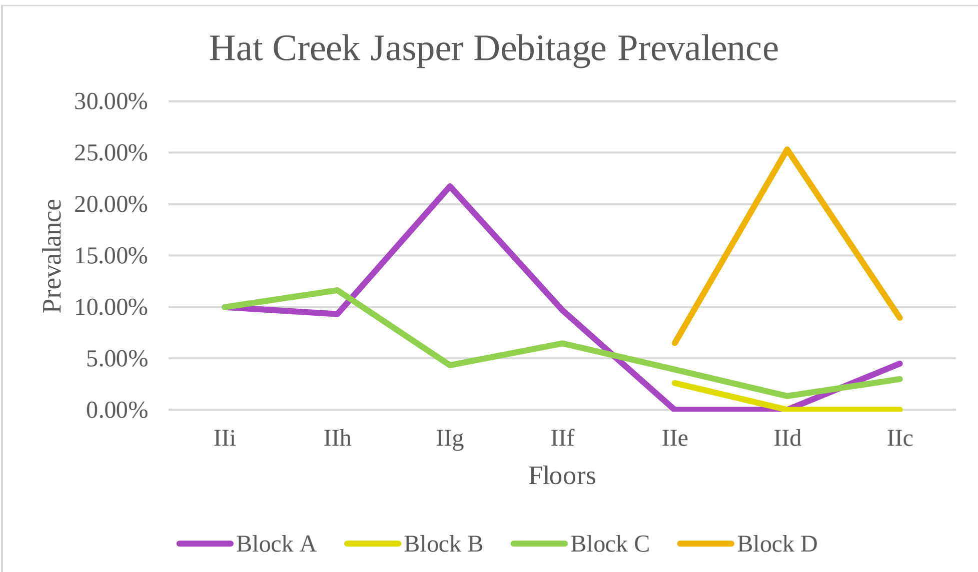

Figure A.44: The proportion of Hat Creek jasper debitage in each block by floor totals.

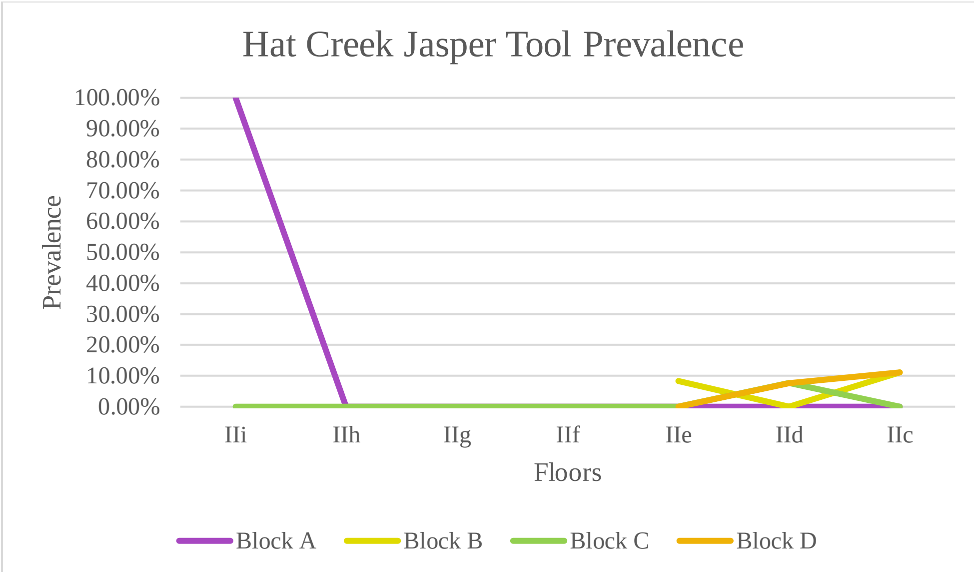

Figure A.45: The proportion of Hat Creek jasper tools in each block by floor totals.

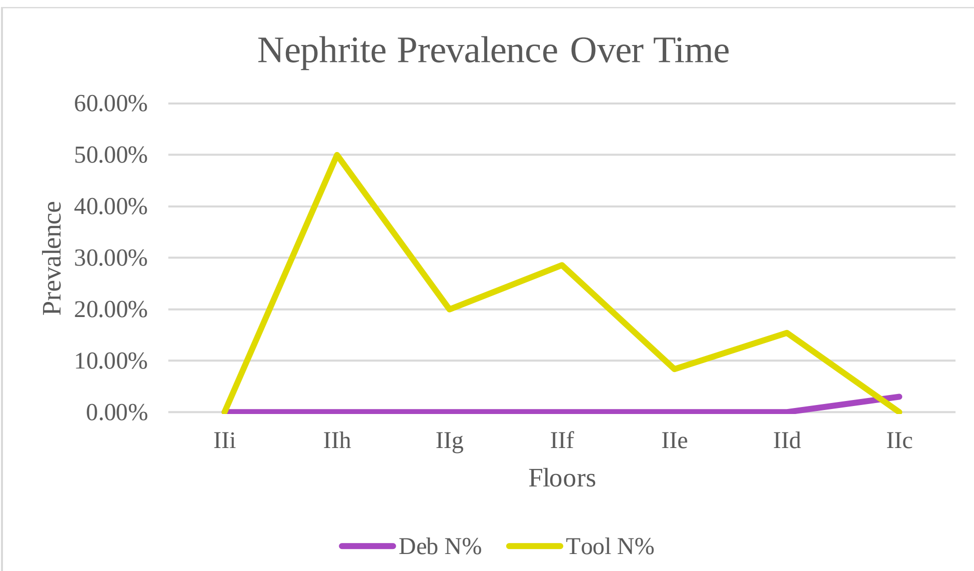

Figure A.46: The proportion of nephrite in tools and debitage by floor totals.

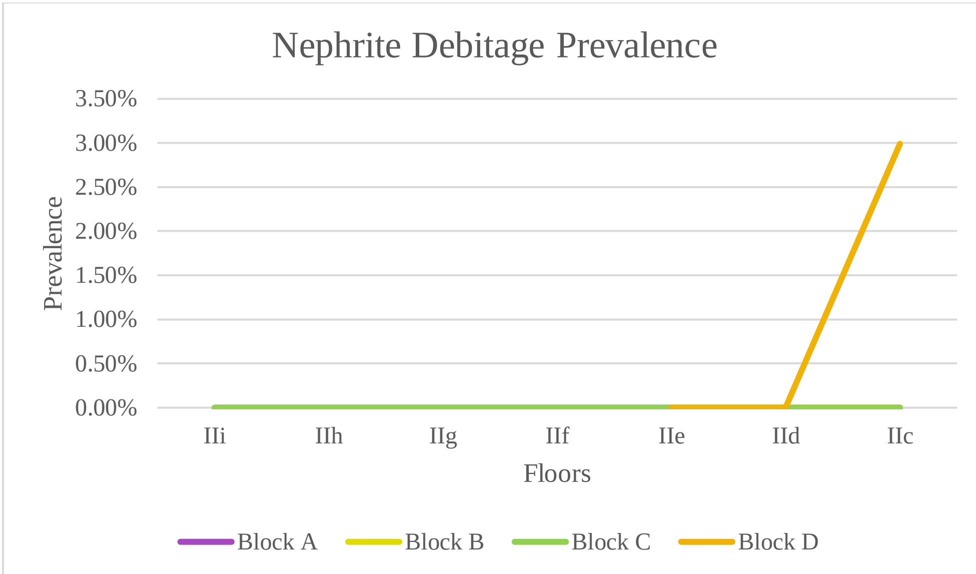

Figure A.47: The proportion of nephrite debitage in each block by floor totals.

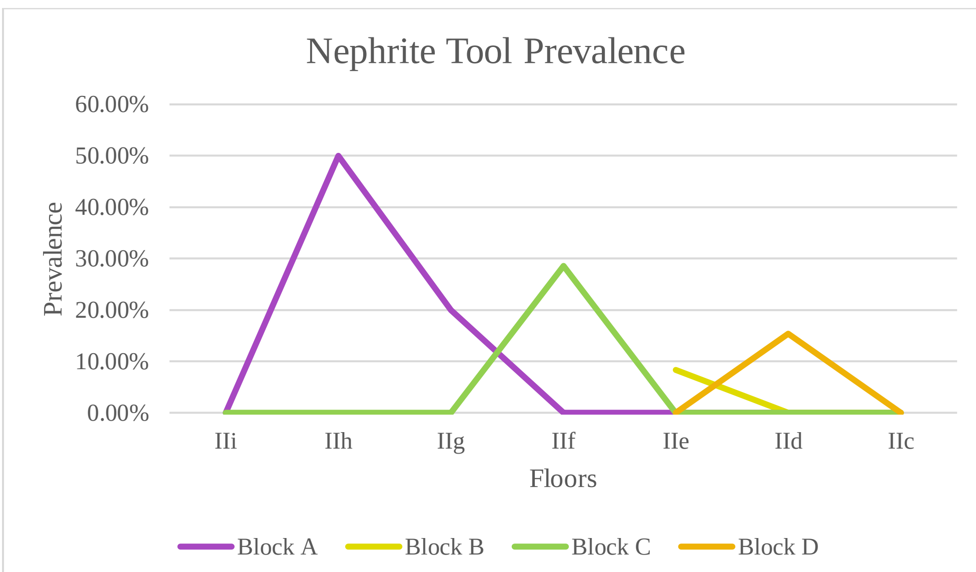

Figure A.48: The proportion of nephrite tools in each block by floor totals.

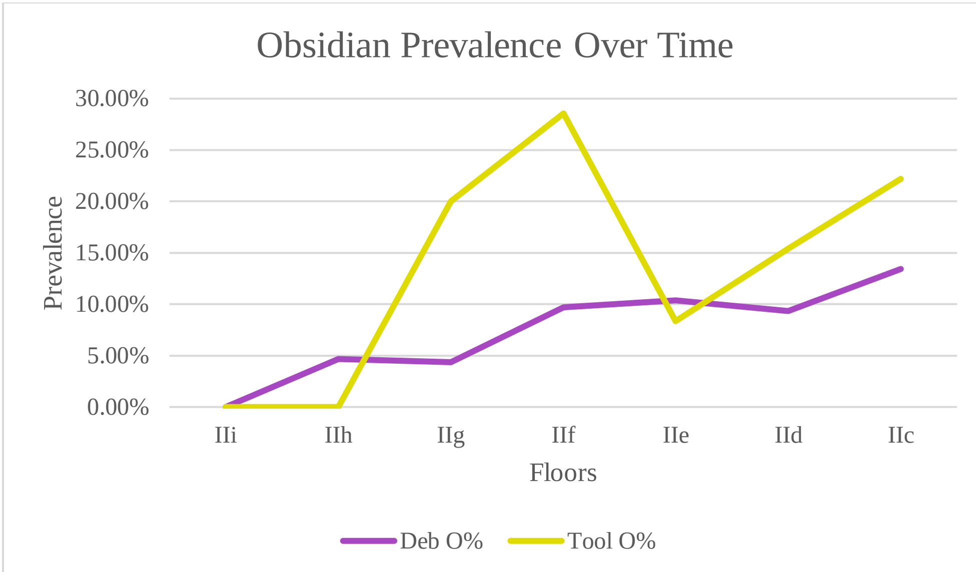

Figure A.49: The proportion of obsidian in tools and debitage by floor totals.

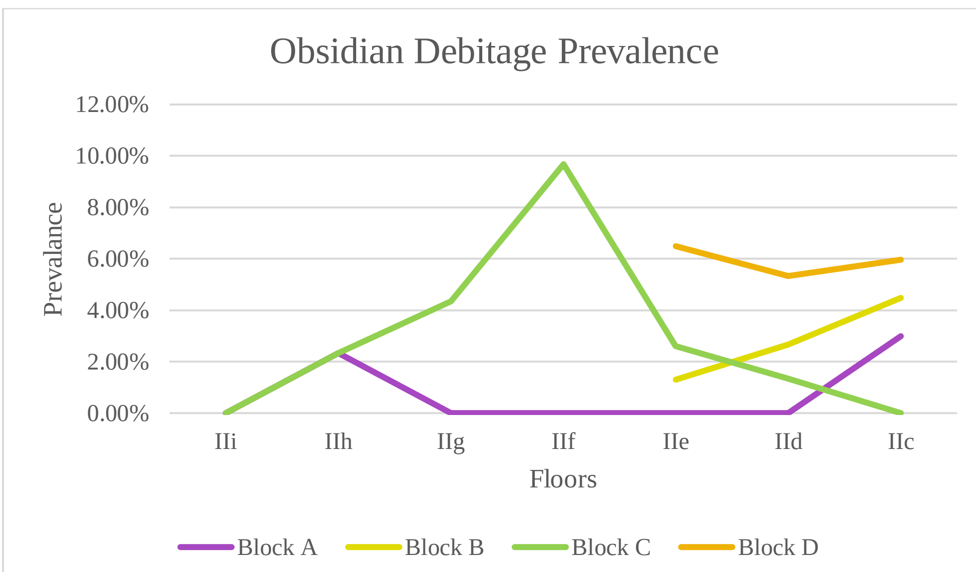

Figure A.50: The proportion of obsidian debitage in each block by floor totals.

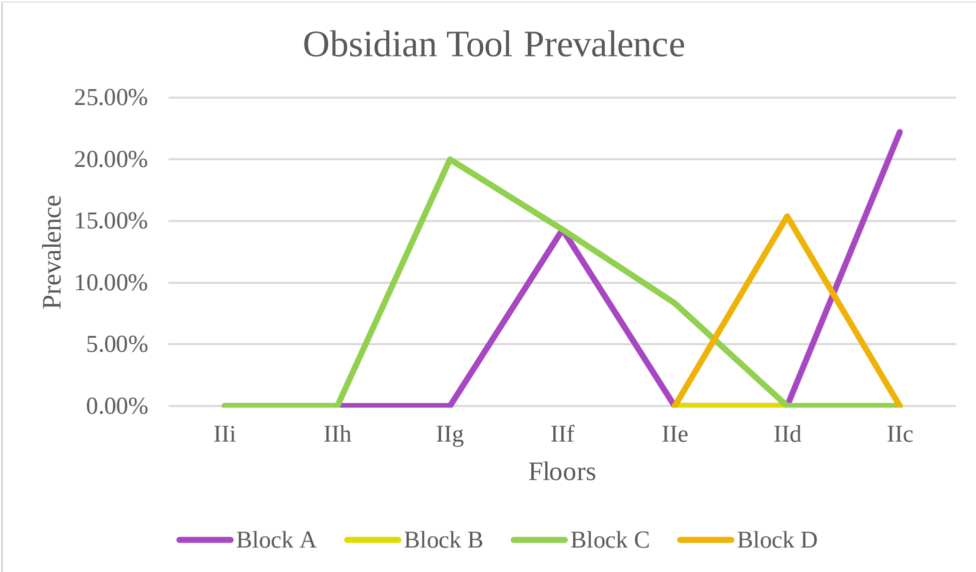

Figure A.51: The proportion of obsidian tools in each block by floor totals.

Appendix B: Tables

Table B.1: Raw counts and frequencies of local raw material across all floors.

Floors	Blocks	Debitage	Tools	Debitage %	Tool%
IIc	A	310	20	18.89%	13.42%
	B	234	26	14.26%	17.45%
	C	249	24	15.17%	16.11%
	D	848	79	51.68%	53.02%
	Total	1641	149	100.00%	100.00%
IId	A	231	12	10.12%	6.59%
	B	241	22	10.56%	12.09%
	C	584	50	25.58%	27.47%
	D	1227	98	53.75%	53.85%
	Total	2283	182	100.00%	100.00%
IIe	A	155	19	6.94%	9.31%
	B	659	49	29.49%	24.02%
	C	564	62	25.23%	30.39%
	D	857	74	38.34%	36.27%
	Total	2235	204	100.00%	100.00%
IIf	A	379	68	45.23%	53.97%
	C	459	58	54.77%	46.03%
	Total	838	126	100.00%	100.00%
IIg	A	341	58	63.15%	39.19%
	C	199	90	36.85%	60.81%
	Total	540	148	100.00%	100.00%
IIh	A	468	81	48.25%	34.18%
	C	502	156	51.75%	65.82%
	Total	970	237	100.00%	100.00%
IIi	A	139	14	55.60%	53.85%
	C	111	12	44.40%	46.15%
	Total	250	26	100.00%	100.00%

Table B.2: Raw counts and frequencies of nonlocal raw material debitage across all floors.

Floor	Block	Chalcedony	Chalcedony (Yellow)	Chert (Green)	Jasper	Jasper (Hat Creek)	Nephrite	Obsidian	Total	Chal%	Chal(Y) %	Che(G)%	J%	J(HC)%	N%	O%	Total%
IIc	A	8		2	3	3		2	18	11.94%		2.99%	4.48%	4.48%		2.99%	26.87%
	B	2						3	5	2.99%						4.48%	7.46%
	C	5	3			2			10	7.46%	4.48%			2.99%			14.93%
	D	13	1	6	2	6	2	4	34	19.40%	1.49%	8.96%	2.99%	8.96%	2.99%	5.97%	50.75%
	Total	28	4	8	5	11	2	9	67	41.79%	5.97%	11.94%	7.46%	16.42%	2.99%	13.43%	100.00%
IId	A	2			2				4	2.67%			2.67%				5.33%
	B	1						2	3	1.33%						2.67%	4.00%
	C	8	3	1	2	1		1	16	10.67%	4.00%	1.33%	2.67%	1.33%		1.33%	21.33%
	D	22	4	2	1	19		4	52	29.33%	5.33%	2.67%	1.33%	25.33%		5.33%	69.33%
	Total	33	7	3	5	20		7	75	44.00%	9.33%	4.00%	6.67%	26.67%		9.33%	100.00%
IIe	A																
	B	12		2	6	2		1	23	15.58%		2.60%	7.79%	2.60%		1.30%	29.87%
	C	9		4		3		2	18	11.69%		5.19%		3.90%		2.60%	23.38%
	D	19		4	3	5		5	36	24.68%		5.19%	3.90%	6.49%		6.49%	46.75%
	Total	40		10	9	10		8	77	51.95%		12.99%	11.69%	12.99%		10.39%	100.00%
IIf	A	10		1		3			14	32.26%		3.23%		9.68%			45.16%
	C	7		2	3	2		3	17	22.58%		6.45%	9.68%	6.45%		9.68%	54.84%
	Total	17		3	3	5		3	31	54.84%		9.68%	9.68%	16.13%		9.68%	100.00%
IIg	A	4	1	2	2	5			14	17.39%	4.35%	8.70%	8.70%	21.74%			60.87%
	C	6			1	1		1	9	26.09%			4.35%	4.35%		4.35%	39.13%
	Total	10	1	2	3	6		1	23	43.48%	4.35%	8.70%	13.04%	26.09%		4.35%	100.00%
IIh	A	6	1	3	2	4		1	17	13.95%	2.33%	6.98%	4.65%	9.30%		2.33%	39.53%
	C	17	1	1	1	5		1	26	39.53%	2.33%	2.33%	2.33%	11.63%		2.33%	60.47%
	Total	23	2	4	3	9		2	43	53.49%	4.65%	9.30%	6.98%	20.93%		4.65%	100.00%
IIi	A	2		2		1			5	20.00%		20.00%		10.00%			50.00%
	C	3	1			1			5	30.00%	10.00%			10.00%			50.00%
	Total	5	1	2		2			10	50.00%	10.00%	20.00%		20.00%			100.00%
									316								

Table B.3: Raw counts and frequencies of nonlocal raw material tools across all floors.

Floor	Block	Chalcedony	Chalcedony (Yellow)	Chert (Green)	Jasper	Jasper (Hat Creek)	Nephrite	Obsidian	Total	Chal%	Chal(Y)%	Che(G)%	J%	J(HC)%	N%	O%	Total%
IIc	A		1	1				2	4		11.11%	11.11%				22.22%	44.44%
	B					1			1					11.11%			11.11%
	C	1							1	11.11%							11.11%
	D	1		1		1			3	11.11%		11.11%		11.11%			33.33%
	Total	2	1	2		2		2	9	22.22%	11.11%	22.22%		22.22%		22.22%	100.00%
IId	A	1							1	7.69%							7.69%
	B			1					1			7.69%					7.69%
	C	2			2	1			5	15.38%			15.38%	7.69%			38.46%
	D			1		1	2	2	6			7.69%		7.69%	15.38%	15.38%	46.15%
	Total	3		2	2	2	2	2	13	23.08%		15.38%	15.38%	15.38%	15.38%	15.38%	100.00%
IIe	A	1							1	8.33%							8.33%
	B				1	1	1		3				8.33%	8.33%	8.33%		25.00%
	C	1						1	2	8.33%						8.33%	16.67%
	D	5		1					6	41.67%		8.33%					50.00%
	Total	7		1	1	1	1	1	12	58.33%		8.33%	8.33%	8.33%	8.33%	8.33%	100.00%
IIf	A	1						1	2	14.29%						14.29%	28.57%
	C		1	1			2	1	5		14.29%	14.29%			28.57%	14.29%	71.43%
	Total	1	1	1			2	2	7	14.29%	14.29%	14.29%			28.57%	28.57%	100.00%
IIg	A	2		1			1		4	40.00%		20.00%			20.00%		80.00%
	C							1	1							20.00%	20.00%
	Total	2		1			1	1	5	40.00%		20.00%			20.00%	20.00%	100.00%
IIh	A				1		1		2				50.00%		50.00%		100.00%
	C								0								
	Total				1		1		2				50.00%		50.00%		100.00%
IIi	A					1			1					100.00%			100.00%
	C								0								
	Total					1			1					100.00%			100.00%
									49								