Paleoethnobotany of Kilgii Gwaay: a 10,700 year old Ancestral Haida Archaeological Wet Site

by

Jenny Micheal Cohen
B.A., University of Victoria, 2010

A Thesis Submitted in Partial Fulfillment
of the Requirements for the Degree of

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in the Department of Anthropology

Supervisory Committee

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Abstract

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This thesis is a case study using paleoethnobotanical analysis of Kilgii Gwaay, a 10,700-year-old wet site in southern Haida Gwaii to explore the use of plants by ancestral Haida. The research investigated questions of early Holocene wood artifact technologies and other plant use before the large-scale arrival of western redcedar (*Thuja plicata*), a cultural keystone species for Haida in more recent times. The project relied on small-scale excavations and sampling from two main areas of the site: a hearth complex and an activity area at the edge of a paleopond. The archaeobotanical assemblage from these two areas yielded 23 plant taxa representing 14 families in the form of wood, charcoal, seeds, and additional plant macrofossils. A salmonberry and elderberry processing area suggests a seasonal summer occupation. Hemlock wedges and split spruce wood and roots show evidence for wood-splitting technology. The assemblage demonstrates potential for site interpretation based on archaeobotanical remains for the Northwest Coast of North America and highlights the importance of these otherwise relatively unknown plant resources from this early time period.

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Acknowledgments

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Dedication

To the Haida Nation

Chapter 1 - Introduction

Paleoethnobotanical investigations offer lines of evidence into ancient lifeways that are often unvalued and underutilized within the archeological discipline on the Northwest Coast (NWC) (Lepofsky 2004; Lyons 2000). In particular, early Holocene sites are virtually unknown in regards to wood- and plant-based technologies and food procurement. Much literature on plant use in the NWC draws on ethnographic accounts. This is problematic when used strictly in lieu of archaeological evidence, and may be an especially tenuous parallel to draw for plant use from the early Holocene time period because neither vegetation nor cultural practices are static. Plants are relatively stable resources that show many similarities in use and management practices across geographic regions and through time (Deur and Turner 2005:331; Turner 2014:18). However, on global to local scales and over millennia, many human-plant relationships change, sometimes drastically. The transition between the Pleistocene and Holocene was a period of intensely shifting climatic regimes, as climate entered into a period of relative stability. Humans would have responded to this new stability and increasingly predictable seasonal cycles through their cultural practices. Attention given to the local paleoenvironmental context and the material evidence for plant use can bring forth new insights and potentially challenge assumptions about socio-economic practices by ancient people on the coast, much in the same way that research attention to other resource management practices, such as clam gardening, are highlighting complex and engaged management of the landscape and resources within it (Williams 2006; Deur and Turner 2005; Groesbeck et al. 2014).

Paleoethnobotany requires a specialized methodology which, on the NWC as a whole, is underdeveloped and unstandardized field within the discipline of archaeology. However the body of work accumulating is being increasingly incorporated into archaeological studies (Croes 2003; Lepofsky 2004; Lepofsky and Lyons 2013; Moss 2013). Stemming from these large gaps in knowledge, this research uses a paleoethnobotanical case study for interpreting site activity and plant use by ancestral Haida at Kilgii Gwaay, a 10,700 year-old coastal wet site on a south-facing beach on Ellen Island, southern Haida Gwaii (see Figure 1). The project relies on small-scale excavations and selective sampling from two key areas of the site: a hearth complex on the west side of the site and the edge of a paleopond next to an activity area on the east side. The analysis portion of the project focuses on wood artifacts recovered in the field and the archaeobotanical assemblage from the two sample areas. Discussion aims to contextualize plant use and seasonal site activity within a broader context of site formation processes and paleoenvironmental conditions.

Analyses focus on anatomical identification of wood artifacts, wood, and charcoal, and morphological identification of seeds, which have yielded a total of 23 plant taxa representing 14 families. The majority of the wood artifact identifications were made by Dr. Mary-Lou Florian. She also mentored me and, under her guidance, I identified a sample of seven artifacts and a random sample of woody debris and charcoal from cultural layers. Taxonomic identification of the material was subsequently used to investigate questions of wood artifact technology and other plant use represented through seeds, such as salmonberry (*Rubus spectabilis*) and elderberry (*Sambucus racemosa*) processing from this early time period, and is more broadly incorporated into site activity interpretations and paleoenvironmental assessments.

The first chapter of this thesis is an introduction to the research. Chapter 2 provides a background and literature review along three main lines: paleoenvironmental reconstruction of the NWC, Haida culture history, and a background of the Kilgii Gwaay archaeological site itself. From the literature, I situate ancestral Haida upon the landscape and contextualize the archaeological site within its unique set of taphonomic processes and research done to date. Chapter 3 describes methodology of the field component of the project as well as the laboratory methods used in anatomical wood and charcoal identification and morphological seed identification. Chapter 4, the results section, describes the wood artifacts and classifies them into types and technologies, including split and chopped wood. Seed taxa and artifacts are described in relation to their spatial distribution in two sample areas of the site – a seed concentration at the edge of a paleopond, and a generalized activity area with adjacent hearth features. The fifth chapter is a discussion of the archaeobotanical seed assemblage characteristics from the paleopond edge and hearth activity sample areas; technological implications of the wood artifact assemblage; and evidence for seasonal summer occupation of the site over the period of approximately 100 years. The final chapter is a paleoethnobotany of Kilgii Gwaay, providing taxon-specific environmental background and cultural implications for plant remains represented at the site.

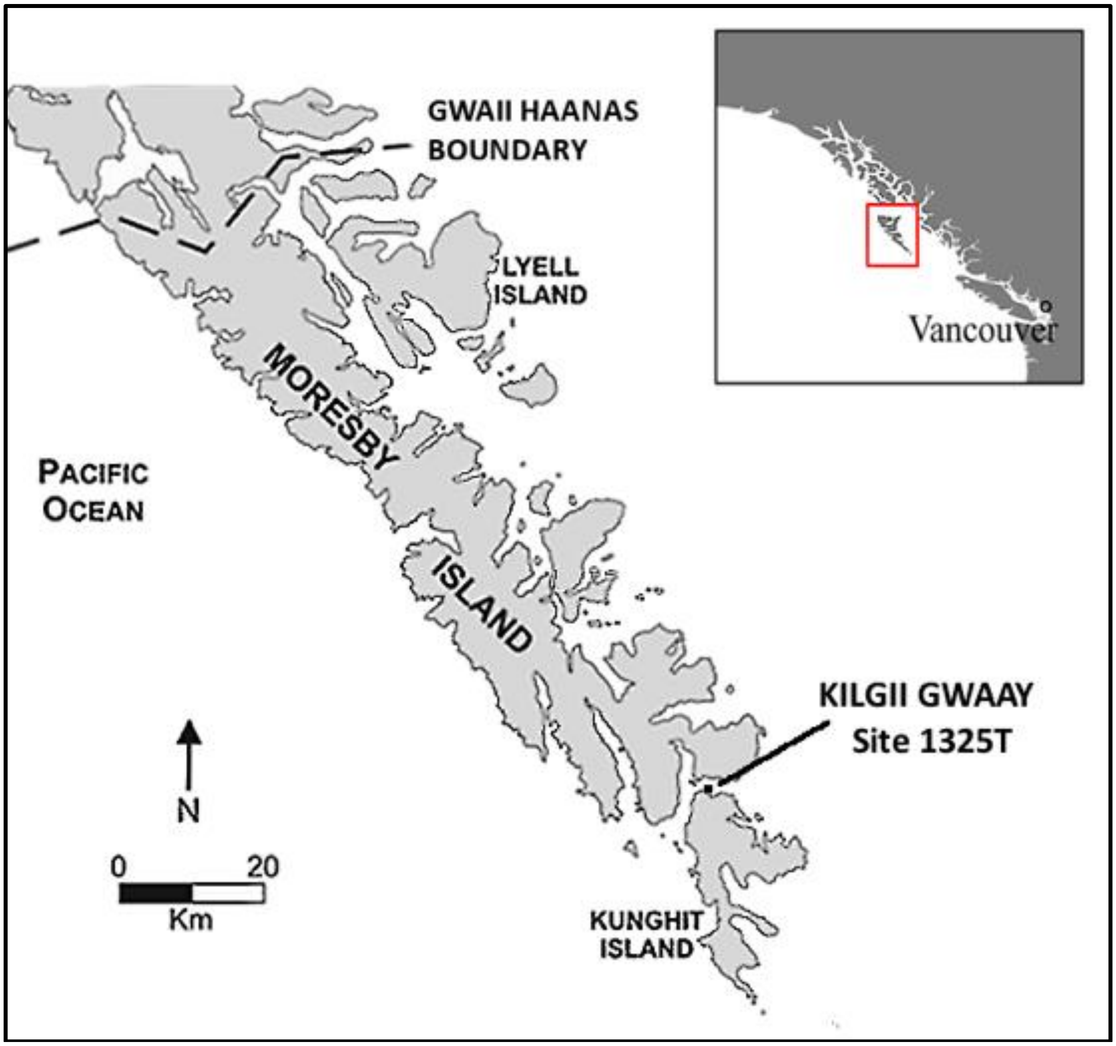

Figure 1. Map showing site location of Kilgii Gwaay (1325T).

Chapter 2 – Background and Literature Review

Palaeoenvironmental Reconstruction of the Northwest Coast

The Northwest Coast (NWC) of North America is a mosaic of diverse terrestrial and shoreline ecosystems adjacent to a highly productive marine environment. This landscape has been subject to much environmental change and seismic activity since the late Pleistocene (~12,000 years ago), particularly in the several millennia following deglaciation when relative sea levels in southern Haida Gwaii were shifting in a way that was perceptible even within the life of an individual person (Mackie et al. 2011).

Paleoenvironmental research on the NWC has been multidisciplinary, involving studies on climate and geography, animal populations, and plant ecosystems. Within the region, micro- and macrobotanical studies (e.g. Hebda and Mathewes 1984; Lacourse 2004; Lacourse et al. 2013; Lyons and Orchard 2007; McLaren 2008; Pellatt and Mathewes 1997; Pienitz et al. 2003), paleontology (Fedje 2008; Mackie et al. 2011; Ramsey et al. 2004), geomorphology, and measuring relative sea level change (Fedje 1993; Fedje 2000; Fedje et al. 2011c; Fedje et al. 2005c; Fedje and Christensen 1999; Josenhans et al. 1997; McLaren 2008) contribute to how paleoenvironments have been understood and reconstructed. Reconstructing ancient plant communities and vegetation patterns, in particular, provides context for understanding plant-based artifacts and palaeoethnobotany from early Holocene archaeological sites.

Modeling past environmental conditions provides a geographic context for how and where ancient people populated the ancient coastline. The existence of biological refugia is integral to the coastal migration hypothesis, which suggests that people moved from Beringia into the North American continent (Erlandson et al. 2008; Fladmark 1979). Researchers have hypothesized that refugia existed on Haida Gwaii or the adjacent drowned coastal plain during the late Wisconsin glaciation (Heusser 1989; Lacourse 2005; Lacourse et al. 2012; Warner et al. 1982), on Brooks Peninsula on northern Vancouver Island (Haggarty and Hebda 1997), and in the Alexander Archipelago of southeastern

Alaska (Carrara et al. 2007). These ice-free areas provide a foundation for defining a livable landscape for humans on the NWC even during glaciation. In addition to framing where people may have lived on the landscape, environmental reconstructions provide a basis for locating archaeological sites and assessing taphonomic processes and cultural change over time. In Haida Gwaii, early period archaeological evidence is contextualized within the broader models of substantial environmental change via rapidly rising relative sea levels and climatic warming (Fedje 1993; Fedje et al. 2004; Fedje et al. 2011c).

Archaeological visibility of this period of early human history on the NWC is a problem that archaeological surveys based on paleoenvironmental modeling have sought to address (Fedje et al. 2004). Archaeological projects that have focused on early to mid-Holocene site occupation have examined intertidal and raised beach terrace sites, where foreshore occupation would have likely existed where relative sea levels were above or rising above present levels (Christensen 1996; Fedje et al. 2011a; Fedje and Christensen 1999; McLaren 2008; McLaren and Christensen 2013). The site on which this thesis is based is one of these kinds of places, namely an intertidal site drowned by transgressive sea levels.

Pleistocene-Holocene Climate and Relative Sea Level History

During the Late Wisconsin Glaciation, glacier development on Haida Gwaii was less extensive that that on mainland BC (Lacourse 2004; Lacourse et al. 2005). Maximum ice level occurred after ~25,000 cal. BP (Barrie et al. 2005; Luternauer 1989), extending from the continent across Dixon Entrance to Haida Gwaii until 19,000 cal. BP (Barrie and Conway 1999). By 18,000 cal. BP portions of the Haida Gwaii coastal lowlands became ice-free (Barrie et al. 2005; Warner et al. 1982). At 14,400 cal. BP, relative sea levels were as much as 150 m lower than modern on the outer coast of Haida Gwaii (Fedje and Josenhans 2000). At this time Hecate Strait was a large coastal plain with only a narrow strip of water between Haida Gwaii and the continent, and the two landmasses possibly intermittently connected.

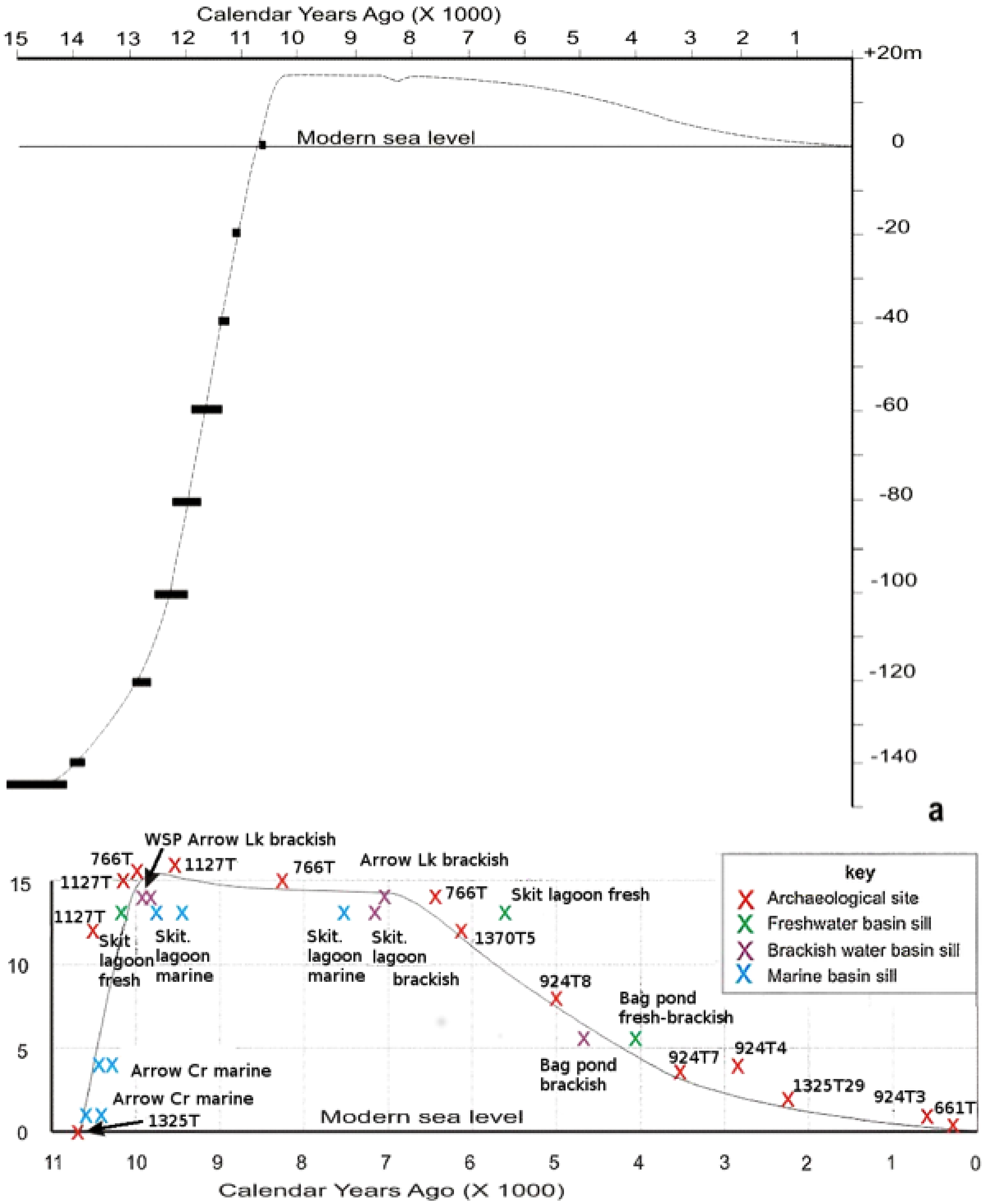

Figure 2. Top) Relative sea level curve history of Haida Gwaii; bottom) Early to late Holocene archaeological sites in relation to sea levels (Fedje et al. 2011).

From 14,000 – 12,700 cal. BP, sea level rise was gradual, then relative sea level rose rapidly at rates of approximately 5 cm a year, to 15 m higher than modern times at the maximum high stand at 9,800 cal. BP (Fedje and Josenhans 2000). This extreme change in relative sea levels was a result of a glaciostatic forebulge as the earth's mantle was pushed outward (westward) from the continental ice sheet during the glacial maximum (Hetherington et al. 2003). As ice melted, the forebulge collapsed, drastically rising local sea levels in Haida Gwaii, while causing them to lower in other coastal areas throughout British Columbia. Relative sea level change along the coast was diverse because of a complex interplay of eustatic, isostatic, and tectonic forces. Portions of the mainland rose, causing local sea levels to lower 200 m, while Central Coast hinge areas were relatively stable, shifting within a 10 m range (McLaren et al. 2014).

The area around Haida Gwaii has the earliest established refined model of sea level change for the BC coast. Rapid relative sea level rise was followed by stabilization during the early to mid-Holocene, and gradual regression to modern levels in the past couple thousand years (Fedje and Josenhans 2000). This model has greatly informed archaeological site identification along paleoshorelines at varying elevations at or above modern sea levels (Figure 2).

Paleontology of Haida Gwaii

Paleontology in relation to early period archaeology can provide context for available terrestrial habitats based on the presence of animals, mammals in particular. During glaciation, lower temperatures, stronger storms and increased precipitation would have influenced the composition of early succession plant communities (Bartlein et al. 1998; Lacourse 2004; Patterson et al. 1995). Vegetation on the NWC after the terminal Pleistocene went from open grass and shrub tundra to pine parklands to closed conifer forests that offered changing habitat for vertebrate fauna (Mackie et al. 2011). Now-extirpated species on Haida Gwaii at this time include brown bear (*Ursus arctos*), caribou (*Rangifer tarandus*), deer (*Odocoileus hemionus*) and possibly mastodon (*Mammut*) (Wigen 2005). Salmon were present on Haida Gwaii at end of Pleistocene, having the ability to colonize streams within a couple decades after localized deglaciation, with at least coho (*Oncorhynchus kisutch*) likely expanding from a refugium in Hecate Strait (Smith et al. 2001; Mackie et al. 2011). Indigenous mammals currently living on Haida

Gwaii include: Keen's mouse (*Peromyscus keeni keeni, P. keeni prevostensis*), dusky shrew (*Sorex monticolus elassodon, S. monticolus prevostensis*), ermine (*Mustela erminea haidarum*), marten (*Martes americana nesophila*), river otter (*Lontra canadensis periclyzomae*), black bear (*Ursus americana carlottae*), little brown bat (*Myotis lucifugus alascensis*), Keen's long-eared myotis (*Myotis keenii*), California myotis (*Myotis californicus caurinus*), and silver-haired bat (*Lasionycteris noctivagans*) (Golumbia 1999). Endemic land mammal populations suggest longstanding presence on the landscape via refugia.

Paleontological data on Haida Gwaii has been established through archaeological investigations, in particular, from karst cave investigations spanning the terminal Pleistocene to early Holocene. Cave archaeology focused on early human activity in higher elevations that would not have been drowned by changing relative sea levels: K1 cave and Gaadu Din caves 1 and 2 (Fedje 2008; Fedje and Smith 2009; Fedje and Sumpter 2006, 2007; Fedje et al. 2004; Ramsey et al. 2004). Karst caves provide excellent preservation conditions for bones from both paleontological and archaeological contexts. Evidence of black and brown bears from caves in Haida Gwaii has been used as a proxy for human ecology, since they occupy similar ecological niches as humans (Fedje et al. 2004; Fedje et al. 2011c). Bear remains dating in range from 17,000 – 11,000 cal. BP provide evidence for a climate suitable for human occupation during that time (Fedje et al. 2011c; McLaren 2005; Ramsey et al. 2004).

Vertebrate fauna data from the early Holocene during the time of the Kilgii Gwaay occupation have largely been derived from the site itself, and from the calcined bone remains from the Richardson Island archaeological site north of Darwin Sound (Steffen 2006). The faunal assemblages are diverse and strongly reflect marine based subsistence activities (Table 1; Table 2). Paleontological records from 7800 to 4960 cal. BP are derived from the Cohoe Creek archaeological site faunal assemblage**,** with dates ranging (Wigen and Christensen 2001). A partial paleomarine invertebrate faunal record is derived from a small non-cultural shellfish assemblage at Arrow Creek (Fedje et al. 1996) and from several sample locations in the region (Hetherington et al. 2003).

Table 1. Pleistocene-early Holocene vertebrate fauna from paleontological and archaeological sites on Haida Gwaii. KG = Kilgii Gwaay (Fedje et al. 2005a; Fedje et al. 2001; McLaren 2005); RI = Richardson Island (Steffen 2006); CC = Cohoe Creek (Wigen and Christensen 2001); GD1 = Gaadu Din 1 (Fedje and Sumpter 2006, 2007; Fedje 2008); GD2 = Gaadu Din 2 (Fedje and Smith 2009); K1 = K1 cave (Ramsey et al. 2004; Fedje et al. 2004).

Species present		**Sites**					
Common name	Latin name	KG	RI	CC	GD1	GD2	K1
Fish							
Cabezon	*Scorpaenichthys marmoratus*	X	X				
Dogfish shark	*Squalus acanthias*	X	X	X			
Dolly varden	*Salvelinus malma*				X		
Flatfish	Pleuronectiflormes	X	X	X	X		
Greenling sp.	*Hexagrammos* sp.	X	X		X	X	
Gunnel	Stichaeidae				X		
Gunnel/prickleback	Stichaeidae /Pholididae		X		X		
Prickleback	Stichaeidae				X		
Black prickelback	*Xiphister atropurpureus*				X		
Halibut	*Hippoglossus stenolepis*	X	X	X			
Pacific herring	*Clupea pallasii*		X	X	X		
Irish lord	*Hemilepidotus* sp.	X	X		X		
Robust lancetooth	*Haplotrema vancouverense*				X	X	
Lingcod	*Ophiodon elongatus*	X	X		X		
Jack mackerel	*Trachurus symmetricus*			X			
Pacific cod	*Gadus macrocephalus*		X	X			
Perch	Embiotocidae		X				
Striped seaperch	*Embiotoca lateralis*	X					
Shiner perch	*Cymatogaster aggregata*		X				
Pollock	*Theragra chalcogramma*			X			
Rockfish	*Sebastes* sp.	X	X		X	X	
Rock sole	*Lepidopsetta bilineata*			X			
Northern ronquil	*Ronquilus jordani*				X		
Sablefish	*Anoplopoma fimbria*		X		X		
Salmon	*Oncorhynchus* sp.	X	X	X	X		
Sculpin	Cottidae	X	X	X	X	X	
Great sculpin	*Myoxocephalus* sp.		X		X		
Antlered sculpin	*Enophrys diceraus*				X		
Buffalo sculpin	*Enophrys bison*				X		
Longfin sculpin	*Jordania zonope*				X		
Staghorn sculpin	*Leptocottus armatus*				X		
Tidepool sculpin	*Oligocottus maculosus*				X		
Skate	*Raja* sp.	X		X			
Smelt	Osmeridae				X		
Starry flounder	*Platichthys stellatus*		X				
Threespine stickleback	*Gasterosteus aculeatus*			X			
Rainbow trout	*Oncorhynchus mykiss*				X		
Mammal							
Carnivore	Carnivora		X		X	X	
Deer mouse	*Peromyscus* sp.		X	X	X		X
Rodent	Rodentia		X		X	X	X
Shrew	*Sorex* sp.			X	X		X
Black bear	*Ursus americanus carlottae*	X		X	X		X
Bear	*Ursus* sp.				X	X	X
Brown bear	*Ursus arctos*				X		X
Harbour seal	*Phoca vitulina*	X		X			
Sea otter	*Enhydra lutris*	X		X	X		

Species present Common name	Latin name	**Sites** KG	RI	CC	GD1	GD2	K1
River otter	*Lontra canadensis*	X		X	X		
Stellar sea lion	*Eumetopias jubatus*	X					
Fur seal/sea lion	Otariidae	X					
Dolphin/porpoise	Delphinidae			X			
Mule deer	*Odocoileus hemionus*				X		?
Ungulate	Ungulata						X
Caribou	*Rangifer* cf. *tarandus*			X			X
Canid	Canidae				X		
Red fox	*Vulpes vulpes*				X		
Dog	*Canis familiaris*			X	X		
Bat	Chiroptera				X		
Fisher	*Martes pennanti*				X		
Bird							
Cassin's auklet	*Ptychoramphus aleuticus*	X					
Short-tailed albatross	*Phoebastria albatrus*	X					
Alcid	Alcidae	X	X		X	X	
Rhinoceros auklet	*Cerorhinca monocerata*	X					
Common murre	*Uria aalge*	X					
Cormorant	*Phalacrocorax* sp.	X					
Double-crested cormorant	*Phalacrocorax auritus*	X					
Pelagic cormorant	*Phalacrocorax pelagicus*	X			X		
Grebe	Podicipedidae	X		X	X		
Red-necked grebe	*Podiceps grisegena*	X					
Duck	Anatidae	X		X	X		X
Gull	Laridae	X	X				
Loon	*Gayia* sp.			X			
Pacific loon	*Gavia pacifica*	X					
Medium goose	Anatidae	X					
Cackling Canada goose	*Branta canadensis*	X		X			
Snow goose	*Chen caerulescens*	X					
Surf scoter	*Melanitta perspicillata*	X					
Scoter	*Melanitta* sp.	X		X			
Pigeon guillemot	*Cepphus columba*	X					
Common raven	*Corvus corax*	X					
Shearwater	*Puffinus* sp.	X					
Merganser duck	*Mergus* sp.						X
Hooded merganser	*Lophodytes cucullatus*			X			
Sooty grouse	*Dendragapus fuliginosus*			X			
Songbird	Passeriformes			X			X
Small songbird (cf. bushtit)	Passeriformes				X		
Large songbird (cf. jay)	Passeriformes				X		
Ancient murrelet	*Synthliboramphus antiquus*				X	X	
Woodpecker	Picidae				X		
Sparrow	Passeridae				X		
Medium songbird (robin)	Passeriformes				X		
Small songbird (kinglet)	Passeriformes				X		
Small songbird (wren)	Passeriformes				X		
Amphibian	Amphibia						X

Table 2. Paleontological evidence for invertebrate fauna (not including insects). AC = Arrow Creek Sites 1 and 2 (Fedje et al. 1996); JPS = Juan Perez Sound (Fedje and Josenhans 2000); HS = Hecate Strait (Barrie and Conway 2002); RS = Rennell Sound (Hetherington et al. 2003); PS = Port Simpson (Archer 1998); other sites in the region (Barrie and Conway 1999; Josenhans et al. 1995; Josenhans et al. 1997; Lowden and Blake 1979; Southon, et al. 1990).

Species present		**Sites represented**							
Common name	**Latin name**	KG	AC	JPS	GD1	HS	RS	PS	Other
Invertebrate fauna (not including insects)									
Crab	Brachyura				X				
Slug	Gastropoda				X				
Land snail	Gastropoda				X				
Sitka periwinkle	*Littorina sitkana*				X				
Periwinkle	Littorinidae				X				
Checkered periwinkle	*Littorina scutulata*				X				
Marine snail	Trochidae				X				
Red turban	*Pomaulax gibberosa*				X				
California mussel	*Mytilus californianus*	X							
Mussel	*Mytilus* sp.		X			X			X
Jingle shell	*Pododesmus macrochisma*		X						X
Butter clam	*Saxidomus gigantea*		X	X		X		X	X
Littleneck clam	*Protothaca staminea*		X	X					
Thin-shell littleneck clam	*Protothaca tenerrima*			X					
Basket cockle	*Clinocardium nuttallii*					X	X		X
Cooperclam	*Cooperella* sp.						X		
Pacific gaper	*Tresus nuttalli*							X	
Bent-nosed clam	*Macoma nasuta*					X			
Truncate softshell clam	*Mya truncata*								X
Barnacle	Cirripedia, Arthropoda		X						X
Dunce cap limpet	*Acmaea mitra*								X
Marine snail	Gastropoda					X			
Baetic dwarf olive	*Olivella baetica*					X			
Horse mussel	*Modiolus rectus*					X			

Vegetation history

Vegetation variation within the Haida Gwaii archipelago can generally be represented in three broad geographic regions: the Queen Charlotte Mountain Range, Skidegate Plateau, and Queen Charlotte Lowlands (Holland 1976). Mountain elevations reach up to 1100 m and the plateau slopes northeast towards boggy lowlands on northern Graham Island (Lacourse 2004). The Pacific Ocean moderates the seasonal weather patterns which range from cool, moist summers and mild, wet winters.

Contemporary vascular flora on Haida Gwaii comprises 665 recorded taxa (Calder and Taylor 1968; Lomer and Douglas 1999). Haida Gwaii is host to endemic plant species and subspecies due to its relative isolation from the rest of the NWC. Vegetation composition is largely coniferous forests dominated by western hemlock (*Tsuga heterophylla),* Sitka spruce (*Picea sitchensis*), and western redcedar (*Thuja plicata*). Yellow cedar (*Chamaecyparis nootkatensis*) and mountain hemlock (*Tsuga mertensiana*) are present in varying degrees, with particular abundance in the mountains. Lodgepole pine (*Pinus contorta*) is common in lowland bogs. Mosses and ferns dominate the understory plants, with alder (*Alnus* sp.) present in open canopies (Calder and Taylor 1968). In the area of Kilgii Gwaay, the modern climate is hypermaritime cool and wet within a western hemlock-Sitka spruce-western redcedar vegetation zone (Banner et al. 1989). Common understory shrubs include Pacific reedgrass (*Calamagrostis nutkaensis*), salal (*Gaultheria shallon),* black twinberry (*Lonicera involucrata)* and salmonberry (*Rubus spectabilis)* (Golumbia 2007).

Non-arboreal species from bogs and bog woodlands of neighbouring Kunghit Island, southern Haida Gwaii, are characterized by crowberry (*Empetrum nigrum*), edible ericaceous berry shrubs (*Vaccinium* spp., *Gaultheria shallon*), and other ericaceous shrubs and heathers (*Ledum groenlandicum, Kalmia microphylla*). Herbs include swamp gentian (*Gentiana douglasiana*), bunchberry (*Cornus unalaschkensis),* northern starflower (*Trientalis europaea*), partridgefoot (*Luetkea pactinata*), avens (*Geum calthifolium*), goldenthread (*Coptis aspleniifolia),* sticky tolfieldia (*Triantha glutinosa*), marsh marigold (*Caltha biflora),* apargidium (*Microseris borealis*), sundew *(Drosera rotundifolia*), great burnet (*Sanguisorba officinalis*), and false hellebore (*Veratrum viride*). Dominant water species include: skunk cabbage *(Lysichiton americanus*), yellow pond lily (*Nuphar lutea*), bur-reed (*Sparganium minimum*), deer cabbage (*Fauria crista-galli*), butterwort (*Pinguicula vulgaris*), sedges (*Carex, Eleocharis, Eriophoum*), and rushes (*Juncus* sp.). Non-flowering vascular plants include deer fern (*Blechnum spicant),* club moss (*Lycopodium annotinum*), western polypody (*Polypodium hesperium*), and a variety of mosses and sphagnum (Lacourse et al. 2012; Quickfall 1987).

Vegetation patterns have been significantly altered by the introduction of deer and other invasive fauna to the archipelago since colonial settlement, resulting in a decrease in shrubs and other leafy edible seedlings and herbaceous plants. Over 143 species of plants have been recently introduced, further altering the composition of local plant communities (Golumbia 1999; Lomer and Douglas 1999).

Vegetation communities have been patchy and variable along the coast at different latitudes and microenvironments (Table 3). From approximately 17,400 to 14,600 cal. BP, pollen from Dogfish Bank in Hecate Strait represented herb tundra consisting of sedges, grasses, horsetail (*Equisetum* sp.) willow (*Salix* sp.) and crowberry. Pine parklands dominated parts of Haida Gwaii by 15,600 cal. BP, transitioning to spruce and hemlock as temperatures increased (Lacourse et al. 2005). In drier regions of northern Haida Gwaii, kinnikinnick (*Arctostaphylos uva-ursi),* sagebrush (*Artemisia* sp.), and Jacob's ladder (*Polemonium* sp.) were present from 14,600 to 11,300 cal. BP, while a diverse array of herb, shrub, and fern species inhabited wet areas (Fedje et al. 2011c). In Juan Perez Sound on the east side of Haida Gwaii, sea floor sediment sampling from a submerged fluvial terrace recovered a pine (*Pinus* sp.*)* stump dating to 14,100 cal. BP (Fedje and Josenhans 2000). Pollen analysis of a sample of the surrounding peaty soil showed that ferns and fern allies comprised up to 50% of the pollen and spore total. Pine represented 99% of all tree, shrub and herb pollen. Low amounts of mountain hemlock (*Tsuga mertensiana*), willow, crowberry (*Empetrum nigrum*), cow parsnip (*Heracleum maximum*), red alder (*Alnus rubra*), willow (*Salix* sp.), sedges (Cyperaceae), and mare's tail (*Hippuris vulgaris*) were identified (Lacourse 2004). A single needle tip was tentatively identified as subalpine fir (*Abies lasiocarpa*), a species not known on present-day Haida Gwaii, but often associated with recently deglaciated areas and known refugia in BC (Heinrichs et al. 2002; Lacourse 2004).

Table 3. Reconstructed paleoenvironmental vegetation assemblages in Haida Gwaii indicated by major species. Approximate radiocarbon years and calibrated years Before Present (Adapted from Lacourse 2004). Light shading indicates dominance of cedar; darker shading indicates herb (and willow) tundra environments

^{14}C BP	Cal. BP	West Side Pond (Fedje 1993)	Cape Ball (Warner 1984)	Langara Island (Heusser 1995)	Kilgii Gwaay (Fedje et al. 2005)
1000	930	Yellow- and western redcedar, western hemlock, spruce (*Chamaecyparis nootkatensis*, *Thuja plicata*, *Tsuga heterophylla*, *Picea*)	Yellow cedar, western redcedar, spruce, western hemlock	Western hemlock, spruce, crowberry (*Empetrum*)	–
2000	1940				–
3000	3180				–
4000	4490			Western hemlock, spruce, crowberry, pine (*Pinus*)	–
5000	5730				–
6000	6820	Western hemlock, alder (*Alnus*)	Western hemlock, spruce	Western hemlock, skunk cabbage, (*Lychsichiton Americanus*)	–
7000	7810				–
8000	8870			Alder, skunk cabbage, ferns	–
9000	10,190	Alder, ferns, spruce	Spruce, western hemlock		–
10,000	11,400	Western hemlock, alder, spruce	Pine, mountain hemlock	Spruce, sedges, ferns	Spruce, pine, hemlock, alder
11,000	13,000	Alder, spruce, pine, mountain hemlock (*T. mertensiana*)		Spruce, alder, mountain hemlock	Spruce, pine
12,000	14,060	Pine, crowberry	Pine, herbs crowberry	Pine, ferns	Pine
13,000	15,630	Willow, grasses, sedges	Herbs, willow (*Salix*)	Sedges, grasses, herbs	Herb tundra
14,000	16,790		Sedges, grasses	Grasses, crowberry	
15,000	17,940				

Paleoenvironmental reconstructions around Haida Gwaii tend to represent generalized plant communities from the Pleistocene-Holocene transition through to recent Holocene successions. Late Pleistocene plant communities varied considerably from those of the early Holocene, demonstrating the heterogeneity of habitat, and reflective of a temporal range in regional species diversity. This range of diversity may not be analogous to the

Kilgii Gwaay site ecosystem or to those accessible to people from the site, but it provides a framework for the range of taxa that could have provided ancient resources.

One archaeobotanical study that may offer the closest comparative sample to Kilgii Gwaay material is from a series of hearth features from the Richardson Island site in Haida Gwaii. One hundred and twenty-one seeds were recovered from approximately 10 liters of sediment from the site, with 89 seeds identified to six taxa (Endo n.d.). Berry seeds included crowberry (*Empetrum nigrum*), *Rubus* spp., and *Vaccinium* spp. Other taxa included water lobelia (*Lobelia dortmanna)*, wild rose (*Rosa* sp.), and mint (*Mentha* sp.). The majority of seeds were likely from the mustard family (Brassicaceae). Western hemlock, Sitka spruce, lodgepole pine, and red alder were represented through charcoal and needles (Table 4).

Table 4. Plant remains from the early Holocene Richardson Island site in Haida Gwaii. Material analyzed from hearth features in Excavation Unit 13, dating to ca. 10,300-10,450 cal. BP. Adapted from Endo (n.d.).

Richardson Island Site 1127T EU 13			Seeds (N)								Needles (N)			
Provenience (Quad-layer)	Feature	Sediment volume (liters)	cf. Brassicaceae	*Empetrum*	cf. Lamiaceae	*Rubus* sp.	*Vaccinium* sp.	Unknown	Unidentifiable	TOTAL	*Picea*	*Tsuga*	Unidentifiable	TOTAL
D-6	n/a	0.40				1				1	1			1
E-14	F1	0.30								0				0
G-22	F1a/b	1.5	1							1	2		1	3
H-22	F1b	0.50			1			1	8	10	1			1
J-21	F1a/b	>0.80	2						1	3				0
K-26	F1a/b	0.30								0			1	1
K-26	F2a/b	0.35							1	1		1		1
Q-12	F2	1.0	29						4	33	7		1	8
Q-12	F1	1.0								0				0
Q-12	F2b	1.50	48	1	1		1	2	14	67	3		1	4
R-24	F2b	0.15								0				0
R-24	F1a/b	0.40								0				0
R-24	F2a	0.15								0		2		2
R-24	F3b	0.10							1	1				0
S-22	F1a	1.0								0	1			1
T-24	F1b	0.20								0	9			9
TOTAL			80	1	2	1	1	3	29	117	24	3	4	31

At the time of occupation at Kilgii Gwaay the tree line was higher as temperatures were somewhat warmer and drier than present day (Fedje et al. 2005). Notwithstanding, the early Holocene forest composition was similar to modern, but with the rare presence of Cupressaceae (Hebda and Matthewes 1984; Lacourse et al. 2012). Pollen samples have not provided conclusive evidence that Western redcedar (*Thuja plicata*) - often considered a cultural keystone species on the NWC (e.g., Donald 2003) - was established in southern Haida Gwaii during the early Holocene (Hebda and Mathewes 1984). The fossil record for the arrival of western redcedar is not as clear as for other tree species such as western hemlock, currently considered a co-dominant species with western redcedar, which is well represented in Haida Gwaii during the early Holocene. Cupressaceae species have structurally similar pollen, with yellow cedar (*Chamaecyparis nootkatensis)* and juniper (*Juniperus* spp.) considered almost indistinguishable from western redcedar. From ~10,000 to 5000 years ago, Cupressaceae was recorded at low frequencies at Boulton Lake, northern Haida Gwaii (Hebda and Matthewes 1984). The earliest macrofossil evidence for western redcedar comes from Hippa Island off the west coast of northern Haida Gwaii at 8700 cal. BP, pre-dating regional pollen expansion between 6600 and 3500 years ago (Hebda and Matthewes 1984). Within the discipline of archaeology, the increase of western redcedar in the environment is often associated with, and attributed to, the increase of complex woodworking technologies throughout the NWC as will be discussed in chapter 5.

Plant taxa described in paleoenvironmental reconstructions are often only to genus level, and are discussed as representative plant communities. The Kilgii Gwaay site, which appears as a richly biodiverse ecological edge, has the potential for a wide array of plant species, either growing at or brought to the site. Because there is a large range of plany taxa present on Haida Gwaii, I built a set of parameters to begin looking for species that may be present at the site by combining ethnobotanical literature on salient plant taxa from Haida Gwaii and comparing them with paleoenvironmental and archaeobotanical evidence on the NWC. Table 5 compares common ethnographically recorded species present on Haida Gwaii (Turner 2010) with plants represented in pollen cores from sites on Haida Gwaii and the drowned sediments of the nearby coast (Fedje 2011c; Lacourse 2004;

Lacourse et al. 2005) and archaeobotanical remains recorded from archaeological sites in BC throughout the Holocene (Lepofsky 2004; Lepofsky and Lyons 2013). The list of plants is by no means comprehensive, rather it provided a general context for possible plant elements present a the site. Much of the macrofossil evidence is in the form of seeds and wood and, therefore, herbaceaous plants and soft tissue such as leaves are not likely to be preserved.

Table 5. Comparison of ethnobotanical use of plants by Haida (Turner 2010), Paleoenvironmental presence of plants in Haida Gwaii during the Early Holocene (Lacourse 2004), plants recorded from archaeological sites on the NWC (Lepofsky 2004; Lepofsky and Lyons 2013), and early Holocene archaeobotanical presence on Haida Gwaii (Endo n.d.) including Kilgii Gwaay site.
* Indicates taxa considered to be late Holocene or historic introductions to Haida Gwaii.
**Table is not representative of all recorded species. Many plants, especially herbaceous plants are not included.

Family	**Latin name**	**Common name**	**Ethnobotanically recorded**	**Paleoenvironmental evidence**	**Archaeobotanical remains (NWC)**	**Early-Holocene archaeobotanical remains (HG)**
Aceraceae	*Acer* sp.	Maples			X	
Apiaceae	Apiaceae	Carrot/parsleys	X	X		
Apiaceae	*Conioselium gmelinii*	Pacific hemlock parsley	X	X		X
Apiaceae	*Glehnia littoralis*	Beach silvertop		X		
Apiaceae	*Heracleum maximum*	Cow parsnip	X	X		
Apiaceae	*Ligusticum calderi*	Calder's lovage		X		
Apiaceae	*Lomatium* spp.	Lomatiums			X	
Araceae	*Lysichiton americanus*	Skunk cabbage	X	X	X	
Araliaceae	*Oplopanax horridum*	Devil's club	X			
Asteraceae	Asteraceae	Aster family			X	X
Asteraceae	*Achillea millefolium*	Yarrow	X			
Asteraceae	*Artemisia* sp.	Sage, wormwood		X		
Betulaceae	*Alnus* sp.	Alder			X	X
Betulaceae	*Alnus crispa*	Sitka alder	X	X		
Betulaceae	*Alnus rubra*	Red alder	X	X		
Caprifoliaceae	*Lonicera involucrata*	Black twinberry	X		X	?
Caprifoliaceae	*Sambucus racemosa*	Red elderberry	X		X	X
Caprifoliaceae	*Sambucus caerulea*	Blue elderberry			X	
Caprifoliaceae	*Symphoricarpos albus*	Snowberry	X		X	
Caprifoliaceae	*Viburnum edule*	Highbush cranberry	X			
Caryophyllaceae	*Sagina maxima*	Sticky stem pearlwort		X		
Characeae	*Chara* sp.					X
Amaranthaceae	Amaranthaceae	Goosefoot family			X	X
Amaranthaceae	*Atriplex* sp.	Goosefoot			X	X
Cornaceae	*Cornus sericea*	Red-osier dogwood	X	X	X	
Cornaceae	*Cornus canadensis*	Bunchberry	X	X	X	X

Family	**Latin name**	**Common name**	**Ethnobotanically recorded**	**Paleoenvironmental evidence**	**Archaeobotanical remains (NWC)**	**Early-Holocene archaeobotanical remains (HG)**
Cupressaceae	*Chamaecypraris nootkatensis*	Yellow cedar	X	X	X	
Cupressaceae	*Juniperus communis*	Common juniper	X		X	
Cupressaceae	*Thuja plicata*	Western redcedar	X		X	X
Cyperaceae	Cyperaceae	Sedges	X	X	X	X
Cyperaceae	*Carex* sp.	Sedges	X		X	X
Cyperaceae	*Scirpus* sp.	Bulrushes	X		X	
Cyperaceae	*Eleocharis* sp.	Spikeweed	X		X	
Elaeagnaceae	*Shepherdia canadensis*	Soapberry*	X	?		
Empetraceae	*Empetrum nigrum*	Crowberry	X	X	X	cf.
Equisetaceae	*Equisitum telmateia*	Giant horsetail	X	X		
Ericaceae	*Arctostaphylos* sp.	Manzanitas			X	
Ericaceae	*Arctostaphylos uva-ursi***	Kinnikinnick	X	X	X	
Ericaceae	*Ericaceae* sp.	Heath/ heathers		X		
Ericaceae	*Gaultheria shallon*	Salal	X		X	X
Ericaceae	*Menziesia ferruginea*	False azalea				X
Ericaceae	*Rhododendron groenlandicum*	Labrador tea	X			
Ericaceae	*Vaccinium* sp.	Huckle-/blueberry			X	X
Ericaceae	*Vaccinium ovalifolium*	Oval-leaved blueberry	X			
Ericaceae	*Vaccinium oxycoccus*	Bog cranberry	X		X	
Ericaceae	*Vaccinium parvifolium*	Red huckleberry	X			
Ericaceae	*Vaccinium uliginosum*	Bog blueberry	X			
Ericaceae	*Vaccinium vitis-idaea*	Low bush cranberry	X			
Ericaceae	*Vaccinium alaskaense*	Alaska blueberry	X			
Fabaceae	*Lupinus* sp.	Lupines			X	
Fabaceae	*Lupinus littoralis*	Beach lupine	X	X		
Fabaceae	*Lupinus nootkatensis*	Nootka lupine	X	X		
Fabaceae	*Trifolium* sp.	Clover			X	
Fabaceae	*Trifolium wormskioldii*	Springbank clover	X			
Fabaceae	*Vicia* sp.	Vetches			X	
Fabaceae	*Vicia gigantea*	Giant vetch	X			
Fabaceae	*Trifolium* sp.	Clovers			X	
Gentianaceae	*Gentiana douglasiana*	Swamp gentian		X		
Grossulariaceae	*Ribes* sp.	Currants			X	
Grossulariaceae	*Ribes bracteosum*	Stink currant	X			
Grossulariaceae	*Ribes laxiflorium*	Trailing currant	X			
Hippuridaceae	*Hippuris vulgaris*	Common Mare's tail		X	X	
Huperziaceae	*Huperzia selago*	Club moss		X		
Isoetopsida	Isoetaceae; Selaginellaceae	Quillwort; spikemoss		X		?
Juncaceae	*Juncus* sp.	Rush	X	X	X	X
Laminaceae	Laminaceae	Mint family			X	cf.

Family	**Latin name**	**Common name**	**Ethnobotanically recorded**	**Paleoenvironmental evidence**	**Archaeobotanical remains (NWC)**	**Early-Holocene archaeobotanical remains (HG)**
Laminaceae	*Prunella vulgaris*	Self-heal	?		X	
Laminaceae	*Stachys cooleyae*	Hedge nettle	X			
Leucodontaceae	*Antitrichia curtipendula*	Pendulous Wing-moss		X		
Liliaceae	*Fritillaria camschatcensis*	Northern riceroot	X	X		
Liliaceae	*Maianthemum dilatatum*	Wild lily-of-the-valley	X		X	
Liliaceae	*Allium* sp.	Onion			X	
Liliaceae	*Streptopus amplexifolius*	Twisted stalk	X			
Menyanthaceae	*Menyanthes trifoliata*	Bogbean	X	X		
Nymphaeaceae	*Nuphar luteum*	Yellow pond lily	X	X		
Onagraceae	*Epilobium angustifolium*	Fireweed	X	X		
Pinaceae	*Abies* sp.	True firs*			X	
Pinaceae	*Abies lasiocarpa*	Subalpine fir*		?		
Pinaceae	*Picea sitchensis*	Sitka spruce	X	X	X	X
Pinaceae	*Pinus contorta*	Lodgepole pine	X	X	X	
Pinaceae	*Pseudotsuga menziesii*	Douglas fir*			X	
Pinaceae	*Tsuga* sp.	Hemlocks			X	X
Pinaceae	*Tsuga heterophylla*	Western hemlock	X	X		X
Pinaceae	*Tsuga mertensiana*	Mountain hemlock	X	X		
Plantaginaceae	*Plantago maritima/macrocarpa*	Seaside plantain	X	X		
Plantaginaceae	*Plantago* sp.	Plantain			X	
Poaceae	Poaceae	Grasses		X	X	
Polemoniaceae	*Polemonium* sp.	Jacob's ladder		X		
Polygonaceae	*Koenigia islandica*	Iceland purslane		X		
Polygonaceae	*Polygonum* sp.	Knotweed			X	
Polygonaceae	*Polygonum viviparum*	Alpine bistort	X	X		
Polygonaceae	*Rumex* sp.	Docks	X	X	X	
Polypodiaceae	*Adiantum aleuticum*	Maiden hair fern	X	X		
Polypodiaceae	*Athyrium filix-femina*	Lady fern	X	X		
Polypodiaceae	*Dryopteris expansa*	Spiny wood fern	X	X		
Polypodiaceae	*Polypodium glycyrrhiza*	Licorice fern	X	X		
Polypodiaceae	*Polystichum munitum*	Sword fern	X			
Polypodiaceae	*Pteridum aquilinum*	Bracken fern	X	X		
Portulaceae	*Montia* sp., *Claytonia* sp.	Miner's lettuce	X		X	
Potamogetonaceae	*Potamogeton* sp.	Pondweed		X	X	
Pryolaceae	*Moneses uniflora*	Single delight	X			
Ranunculaceae	*Aquilegia* sp.	Columbine			X	
Ranunculaceae	*Caltha* sp.	Marsh marigolds		X		
Ranunculaceae	*Coptis* sp.	Coptis		X		
Ranunculaceae	*Thalictrum* sp.	Meadow-rues		X	X	
Rosaceae	*Amelanchier* sp.	Saskatoon berries	X		X	
Rosaceae	*Crataegus* sp.	Hawthorns			X	
Rosaceae	*Crataegus douglasii*	Black hawthorn	X		X	

Family	**Latin name**	**Common name**	**Ethnobotanically recorded**	**Paleoenvironmental evidence**	**Archaeobotanical remains (NWC)**	**Early-Holocene archaeobotanical remains (HG)**
Rosaceae	*Fragaria* sp.	Strawberries			X	
Rosaceae	*Fragaria chiloensis*	Seaside strawberry	X			
Rosaceae	*Potentilla* sp.	Cinquefoil			X	
Rosaceae	*Potentilla anserina*	Pacific silverweed	X	X		
Rosaceae	*Prunus* sp.	Wild cherry*			X	X
Rosaceae	*Malus fusca*	Pacific crab apple	X		X	
Rosaceae	*Holodiscus discolor*	Oceanspray			X	
Rosaceae	*Rosa nutkana*	Nootka rose	X		X	
Rosaceae	*Rubus* sp.	Raspberries, etc.			X	X
Rosaceae	*Rubus chamaemorous*	Cloudberry	X			
Rosaceae	*Rubus parviflorus*	Thimbleberry	X			X
Rosaceae	*Rubus pedatus*	Trailing raspberry	X			
Rosaceae	*Rubus spectabilis*	Salmonberry	X	X		X
Rosaceae	*Sanguisorba canadensis*	Canadian burnet	X	X	X	
Rosaceae	*Sorbus sitchensis*	Mountain ash	X		X	
Rosaceae	*Spiraea douglasii*	Hardhack			X	
Rubiaceae	*Galium* sp.	Bedstraws	X		X	
Saliaceae	*Populus* sp.	Poplars*	X		X	
Salicaeae	*Salix* sp.	Willow	X	X	X	
Saxifragaceae	*Saxifraga oppositifolia*	Purple saxifrage	X	X		
Saxifragaceae	*Tellima grandiflora*	Fringecup			X	
Saxifragaceae	*Tiarella trifoliata*	Foamflower			X	
Sphagnceae	*Sphagnum* sp.	Sphagnum mosses	X	X	X	
Taxaceae	*Taxus brevifolia*	Pacific yew	X		X	
Typhacea	*Typha latifolia*	Cattail/ bulrush		X	X	
Urticaceae	*Urtica dioica*	Stinging nettle*	X		X	
Valerianaceae	*Valeriana* sp.	Valerian		X		
Violaceae	*Viola* sp.	Violet			X	?
Zosteraceae	*Zostera marina*	Eel grass/ seawrack	X		X	

Limitations and Gaps in Research

Interpretation of early occupation sites presents some challenges to archaeologists, requiring a systematic understanding of local environmental changes over time. Because the NWC coastline has been subject to millennia of dynamic change and much of the Pleistocene coastal plain terrain is now submerged, identification and access to a comprehensive suite of long-term paleoenvironmental data is limited. Information gathered to date shows a variable set of environmental conditions, implying regional microclimatic differences over the NWC (Fedje et al. 2011c).

Palynological variables that present challenges to paleobotanical interpretation include samples with low densities of insect pollinated taxa, low local pollen production, and long distance transport of certain types of pollen (e.g., *Pinus* spp.). Moreover, sedge and grass pollen can only be identified to family; therefore the ability to interpret specific environments is limited (Lacourse et al. 2005). Multiple lines of evidence are required to refine the general paleoenvironmental reconstructions that are currently produced.

Establishing appropriate analogues for specific paleoenvironmental phenomena may provide clarity for interpretation of past conditions. For example, in order to conceptualize the effects of the Younger Dryas on NWC marine ecosystems between 16,000 and 11,500 cal. BP, Davis (2011) used data from a La Niña event in 1983 to highlight the extent of potential trophic cascade patterns. The modern cool period had measurable effects causing lower nutrients and cooler ocean temperatures which led to a reduction in zooplankton by ~50% and subsequent reductions in fish and sea bird populations (Davis 2011).

Early period coastal archaeological sites may be underrepresented in general on the NWC due to the discipline's historical pessimism of site visibility coupled with logistical complexities and difficult working conditions (Easton 1992; Mackie et al. 2011:51). More recent archaeological work has addressed some of these concerns by using remote sensing technologies to identify the inherent potential and archaeological visibility of sites. These interdisciplinary methods involve the use of photogrammetric high-resolution contour maps, LiDAR and multi-beam swath bathymetry (remote sensing imagery technologies) in conjunction with paleoenvironmental datasets (e.g., Fedje and Josenhans 2000; Fedje and Christensen 1999; McLaren 2008; McLaren and Christensen 2013). This work has been useful for understanding sites on a cultural landscape; however, site-specific datasets are required not only to "ground truth" these models, but also to identify local variations within the models. Conversely, these mapping technologies provide valuable landscape data that may give clues to past microenvironments, and an interconnectivity of possible resources within the paleoenvironment. Even with remote sensing data, environmental contexts often remain reliant on observations in the field and existing regional paleoenvironmental data.

Regional sequences of paleoenvironmental data are patchy within all areas of expertise. However, combined knowledge sets offer an integrated approach to paleoenvironmental reconstruction. Correlations are drawn between Haida oral traditions that relate to past environments and archaeological work in relation to relative sea level change and past landscape events and characteristics and can lead to valuable insights from shared embodied understandings and relationships with the land (Kii7ilijuus and Harris 2005; McLaren 2008). It is against the background of partial yet continually refined environmental records of the NWC and Haida Gwaii that clear cultural patterns are manifested and recognized on the landscape.

Haida Culture History

At the time of occupation at the Kilgii Gwaay site, people had been on the NWC for at least a few thousand years. Archaeological evidence suggestive of bear hunting activity on Haida Gwaii dates to 12,800 cal. BP (Fedje 2008; Fedje et al. 2011b). People living on the Pacific Northwest coastline from terminal Pleistocene – Holocene transition to present times were and are locally adapted to their maritime environments (Erlandson et al. 2008; Fedje et al. 2004). Although ancient shorelines of Haida Gwaii may be drowned from just after deglaciation, early, broad movement and trade are evident from other parts of the NWC. Mount Edziza obsidian at On-Your-Knees Cave in southeast Alaska and *Olivella* sp. shell beads at both coastal and interior sites in California indicate human mobility of hundreds of kilometers (Erlandson et al. 2008).

Paleoenvironmental changes and relative sea level play a key role in understanding Haida culture history (Figure 2; Table 6). The archaeological record itself is patchy, with an emphasis in early time periods in Gwaii Haanas National Park, southern Haida Gwaii, and mid to late Holocene on Graham Island, where faunal and botanical remains at sites tend to be sparse, therefore much archaeological interpretation is based on stone tool technology and extrapolation from early contact material culture. Culture history in later periods on Haida Gwaii still tend to emphasize stone and bone technologies due to poor preservation of plant remains and biases in research. However, where archaeobotanical remains are present on the NWC, they tend to represent a large proportion of material culture.

(Pre-) Kinggi cultural material (>12,800 – ~10,700 cal. BP)

Very little is known about settlement practices from this time period, since material evidence pre-dating 10,700 cal. BP is sparse. The earliest archaeological evidence leading to the Kinggi Complex, a constructed cultural sequence from the early Holocene in Haida Gwaii characterized by biface and lack of microblade tool technologies (Fedje and Christensen 1999), is contextualized within a dynamic environment in which rising relative sea levels caused dramatic shifts in shorelines and resource locations. Presumably, people lived along this now drowned ancient coastline, though inland sites show evidence for temporary camps (Fedje et al. 2011b). Cultural material on Haida Gwaii as old as 12,800 cal. BP has been found at inland cave sites when relative sea levels were ca. 100 m lower than present. These cave sites (K1 Cave, Gaadu Din 1, and Gaadu Din 2) suggest ancient bear hunting practices (Fedje 2008; Fedje et al. 2011b; McLaren et al. 2005). Bifacial points similar to Kinggi Complex technology, chipped stone tools, and a bone point represent the technological assemblage from these sites. A single retouched flake tool was dredged from the sea floor 53 m below modern sea level in Werner Bay off the east coast of Moresby Island (Fedje and Christensen 1999; Fedje and Josenhans 2000). The inferred date of at least 11,400 cal. BP and the radiocarbon dates from the accompanying drowned ancient forest are consistent with sea level models for the area (Fedje and Christensen 1999; Fedje and Josenhans 2000). Visibility of early period is low, and until further evidence for material culture is collected, interpretative potential remains limited.

Kinggi Complex (>10,700 – 9700 cal. BP)

The known emergence of the Kinggi Complex is constrained by limited earlier site types and poor accessibility of material evidence below modern shoreline prior to 10,700 cal. BP. To date, approximately 170 intertidal lithic scatter sites have been identified on the beaches of Haida Gwaii, ranging from isolated diagnostic artifacts to assemblages of thousands. Of these, Kilgii Gwaay (1325T) has been confidently dated to the early period when relative sea levels were close to modern (Fedje et al. 2005). The lithic assemblage contains thousands of large flakes, scrapers, scraperplanes, cobble choppers, gravers, large unifaces, spokeshaves, discoidal cores, and unidirectional blade-like flake patterning that bear similarity to other large intertidal lithic sites by way of raw material type and distinct tool typology. This suggests that these represent contemporaneous shoreline activity areas (Fedje and Smith 2010; Fedje et al. 2011b; Mackie et al. 2011). Additionally, Kilgii Gwaay contains intact waterlogged organic artifact preservation (Fedje et al. 2005; Fedje et al. 2001). Perishable technologies include bone and wood tools and points, wooden wedges, split root technology, and cordage (Fedje et al. 2005). By 10,700, Kinggi Complex faunal and botanical assemblages demonstrate highly maritime subsistence patterns, terrestrial resource use and substantial seasonal camp and village sites.

The Richardson Island site (1127T) is a more recent Kinggi Complex raised beach site that was occupied from 10,400 to 3200 cal. BP. Its elevation is in relation to the marine transgression and relative sea level maximum of ca. 15 m above modern sea level. This site has lead to well-documented studies of the shift in lithic technologies from the Kinggi Complex (pre-9700 ca. BP) to the Early Moresby Tradition (Fedje and Christensen 1999; Fedje and Matthewes 2005; Mackie et al. 2011; Magne and Fedje 2007; McLaren et al. 2005; Smith 2004; Storey 2008; Waber 2011). Of note is that while Richardson Island contains over 165 bifacial tools from the Kinggi period, Kilgii Gwaay shows a near absence, save three bifacial tool fragments and a few bifacial reduction flakes. Apparent differences in technologies and faunal remains are suggestive of differences in site function and seasonality. Kilgii Gwaay shows evidence for summer bear hunting or trapping. The faunal assemblage at Kilgii Gwaay further suggests summer activity at the site (Fedje et al. 2005; McLaren et al. 2005) while Richardson Island has a faunal assemblage from hearth features dominated by a diverse range of fish, including salmon, which is suggestive of autumn and year-round occupation (Steffen 2006). Both sites contained bone tools including bone points dating to the Kinggi Complex (Steffen 2006; Fedje 2008). Other sites from this time period include Arrow Creek 1 (766T), a lithic site dating to 9100 cal. BP (Fedje and Christensen 1999), and Collison Bay (1370T), an intertidal lithic site bearing stylistic similarity to Kilgii Gwaay, and other smaller intertidal lithic scatters (Fedje et al. 2011b).

Later Period Traditions

Later traditions in Haida Gwaii are characterized by shifts from bifacial to microblade lithic technologies, followed by a long term trend of declining flaked stone use and an emphasis on bipolar percussion, ground stone and organic material-based technologies. Increased attention by archaeologists has been placed on ceremonialism, art, longhouses, perishable fibre technologies, food procurement, and warfare leading up to the post-contact era. The emphasis on recent complexity may be in part due to preservation and increased visibility of recent material culture. Significant sites, technologies, and time lines for these later periods are described in Table 6.

Early Moresby Tradition (9700-8900 cal. BP)

The Moresby Tradition is subdivided into early and late periods on the basis of presence/ absence of specific technologies. The early component shows a trend in which microblade technology emerges and slowly replaces bifacial technology. Significant sites from this period include Echo Harbour, Lyell Bay (Christensen 1996; Christensen 1997; Fedje and Sumpter 1999) and Richardson Island (Fedje 2008; Storey 2008; Waber 2011). Lithic analysis of the Richardson Island assemblage suggests microblade technology evolved from already established techniques in scraperplane manufacture by ca. 9,700 cal. BP (Smith 2004; Magne and Fedje 2007; Fedje et al. 2008; Waber 2011), and possibly as an adaptation from earlier western Beringian technologies (Fedje et al. 2008). During this shift, unifacial technology essentially remained constant (Storey 2008). The mixed bifacial and microblade technology on Haida Gwaii resembles those of the Nenana Complex of On-Your-Knees Cave Site (10,150 cal. BP) in central Alaska (Dixon 1999) and evidence at the Namu Site (10,200-9,500 cal. BP) on the central coast of BC (Carlson 1996). The gradual shifts towards microblade technology have been suggested to be a result of varying and gradual coastal wide technological adaptations in the Pacific Northwest (Magne and Fedje 2007).

Late Moresby Tradition (8900-5700 cal. BP)

The Late Moresby Tradition is characterized by well-established microblade and pebble tool technologies from raised beach sites, with an absence of bifacial technology. Bone and antler tools include slotted antler points (Fedje and Mackie 2005; Fladmark 1989). Seventeen sites have been identified on sea level maximum paleoshores and a few intensively investigated. Significant sites from Graham Island include Kasta, Lawn Point, Skoglund's Landing, Skidegate Landing and Cohoe Creek (Fladmark 1971, 1986; Ham 1988, 1990 in Fedje and Mathewes 2005; Christensen and Stafford 2005). In southern Haida Gwaii sites include Arrow Creek, Lyell Bay, Richardson Island, and Burnaby Narrows (Fedje et al. 1996; Christensen 1997; Fedje and Christensen 1999; Fedje et al. 2011a). Lyell Bay shows evidence for camp activities, and Richardson Island provides abundant lithics showing a record of use over a 7,000-year period.

Early (Transitional) Graham Tradition (5700-2000 cal. BP)

During this period, microblade technology ceased, transitioning into ground and pecked stone tool technology and an increased use of organic (bone, shell, and plant-based) tool technologies, and some bipolar percussion technique. An apparent increase in ceremonialism has also been described (Acheson 1998; Mackie and Acheson 2005). Evidence for this transitional period comes from the upper components of Cohoe Creek, Blue Jackets Creek, Lawn Point, and Skoglund's Landing (Fladmark 1990; Breffitt 1993; Ham 1990, Christensen and Stafford 2000 in Fedje and Mathewes 2005; Fedje and Mackie 2005). Recent investigations at Burnaby Narrows provide evidence for well-established ground stone woodworking technology, bipolar microlith technology, and ornamental worked bone. Faunal material from this site points to a heavy reliance on salmon and herring consumption (Orchard et al. 2013).

Table 6. Culture history of Haida Gwaii.

Cultural Period	**Environment**	**Technological Characteristics**	**Key Sites**	**References**
(Pre)-Kinggi 12,900-11,400 cal. BP	Glaciation ends 15,000 BP. Herb tundra; warming to first pine trees at 13,800 BP; Younger Dryas cooling.	Bifacial technology; bifacial projectile point in association with faunal remains; bear hunting; worked bone point.	K1 cave Gaadu Din 1 and 2	Fedje and Mackie 2005; Fedje et al. 2008; Fedje 2008; Fedje et al. 2011b; Fedje et al. 2004.
		Flake tool 53 m below modern sea level	Werner Bay	Fedje and Josenhans 2000
Kinggi Complex 10,700-9700 cal. BP	Relative sea level rapidly rising 13,800-10,000 BP. Dynamic landscape and resource changes. Hemlock-spruce forests.	Diverse marine focused economy; whale use; black bear hunting. Bifacial technology; large unifacial stone tools, spokeshaves, scrapers. Bone tools, wood-splitting technology, and cordage.	Arrow Creek 2; Collison Bay; Richardson Island; Kilgii Gwaay.	Fedje and Christensen 1999; Fedje et al. 2004; Fedje et al. 2001; Mackie et al. 2011; Magne and Fedje 2007; McLaren et al. 2005.
Early Moresby Tradition 9700-8900 cal. BP	Sea level maximum stabilized at ca. 15 m above modern. Slightly warmer and drier than modern.	Mixed Kinggi large stone tool/biface technology and introduction of microblade technology. Hearth features, marine species including sea otter and fish.	Richardson Island; Echo Harbour; Lyell Bay	Fedje and Christensen 1999; Fedje et al. 1996; Mackie et al. 2011; Magne 1996; Smith 2004; Steffen 2006; Storey 2008; Waber 2011.
Late Moresby Tradition 8900-5700 cal. BP	Relative sea level lowering to 10 m above modern; relatively stable; spruce-hemlock forest. No red cedar.	Microblade technology, large scrapers. Marine focus, use of whale. Bone and antler technology including slotted antler points.	Richardson Island; Lawn Point; Kasta; Skidegate Landing; Skoglund's Landing; Arrow Creek 1; Cohoe Creek; Lyell Bay.	Fladmark 1971, 1986; Ham 1988, 1990; Christensen and Stafford 2005; Fedje et al. 1996; Christensen 1997; Fedje and Christensen 1999; Fedje et al. 2011; Magne 1996.
Early Graham Tradition 5700-2000 cal. BP	Relative sea level lowering to 5 m above modern. Red cedar becomes common around 6000-3000 BP. Climate similar to modern.	Bipolar and microlith technology; ground, pecked and bifacially worked stone; shell midden, bone, plant, wood and shell use. Faunal preservation.	Cohoe Creek; Blue Jackets Creek; Skoglund's Landing; Lawn Point; Burnaby Narrows.	Breffitt 1993; Fedje et al. 2011a; Severs 1974; Orchard et al. 2013.
Late Graham Tradition 2000-200 cal. BP	Relative sea levels falling slowly to present. Climate and vegetation similar as modern.	Villages and large habitation structures; monumental and portable art; maritime focused economy. Large and small shell middens; organic artifacts; bone and antler tools; simple flaked stone; ground stone. Xyuu daw Phase (ca. 2000-800 BP) overlaps with the Qayjuu Phase (1200-200 BP) in southern HG.	Blue Jackets Creek; Skoglund’s Landing; Honna River; S'Gaang Gwaay; T'aanu; Qai-dju; Cumshewa; Skedans; Chaatl; Kaisun.	Fladmark et al. 1990; Severs 1974; Fedje 2008; Orchard 2006; Acheson 1998.

Late Graham Tradition (2000-200 cal. BP)

Further decreases in flaked stone occur in the Late Graham period, while social complexity and ground stone and bone (in particular bird), shell and antler technologies are emphasized with an increased visibility through preservation in middens (Acheson 1998; Orchard 2009). The Late Graham tradition is subdivided into the Xyuu daw Phase (2000 to 1000 cal. BP) and the Qayjuu Phase (after 1200 cal. BP) by Trevor Orchard (2006). Rockfish dominate faunal assemblages from the earlier while salmon dominate the latter. These distinctions are possibly due to enhanced bone preservation within shell middens not seen in most older time periods. However, preservation of organic artifacts and faunal remains at the Kilgii Gwaay site demonstrate complex organic technology from a much earlier period, and that the lack of emphasis on these technologies in the literature of older sites may reflect research strategies and variable preservation of organic material (Storey 2008; Fedje et al. 2004).

The Late Graham Tradition emphasizes extensive trade, monumental and portable art, longhouses, fibre technologies, food procurement strategies and warfare leading to ethnographically recorded Haida culture (Swanton 1905a; Newcombe 1901). During this period large amounts of artifacts were taken abroad to be preserved in collections. For the most part, cultural material dating post-1846, is not under Provincial archaeological jurisdiction (Province of BC 1996), leaving much of the information from this time provided through historical and ethnographic records (e.g., Swanton 1905a, 1905b, 1908; Newcombe 1901) and conserved material collections, such as those collected at the Royal BC Museum in Victoria and other museums throughout North America and Europe.

Kilgii Gwaay Site

Kilgii Gwaay is a 10,700-year-old (9450 ^{14}C BP) wet site in southern Haida Gwaii and provides the study sample for this thesis. The site contains a thin layer of cultural deposits with shell-rich matrices, hearth features, a large assemblage of flaked tools and debitage, and preservation of bone and wood artifacts. The site (1325T) is currently located in the modern intertidal zone on the east and west banks of a small buried peat-rich paleopond (Figure 3). The site is in a sheltered beach along a narrow marine channel. At the time of occupation the channel was likely similar to modern-day Burnaby Narrows, a highly productive and biodiverse marine channel also in Gwaii Haanas National Park[1], Haida Gwaii. People would have occupied the site for only a few generations before being flooded out by rapidly rising local sea levels (Fedje 1993; Fedje and Mathewes 2005). The site was submerged and then capped by marine shell hash deposits as relative sea levels rose to the marine maximum ca. 15 m higher than present by 9,700 cal. BP (Fedje and Christensen 1999; Fedje and Josenhans 2000). The paleopond basin has subsequently served to retain water and maintain waterlogged preservation of the site as relative sea levels regress and expose the site above low tide (Fedje et al. 2005).

Archaeological work to date

The site was identified by Haida cultural specialist, Captain Gold, in the 1990s and formally investigated by Parks Canada archaeologists and the University of Victoria from 2000 to 2002 (Fedje et al. 2001; 2005). During these years, approximately 4,000 stone, 90 bone, and 100 wooden artifacts were recovered through intertidal surface collection, test excavation, and 16 m^2 of block excavation (Fedje et al. 2005). Further testing in 2010 and 2011 focused on assessing intertidal site disturbance and testing for intact areas containing plant-based organic artifacts, which lead to a full-scale excavation in 2012. Testing on the three-metre terrestrial terrace in 2010 revealed a site component dating from 2200 to 1600 years ago. Culturally modified trees in the adjacent forest and a surface shell midden exposure provide evidence of other late Holocene cultural activity (Fedje 2011a). In 2011, approximately 400 intertidal surface lithics were mapped. These had eroded out onto the beach surface subsequent to the 2002 surface collection (Fedje and Sumpter 2003). The continual erosion has highlighted the sensitivity of organic preservation at the site. Radiocarbon dating of the early Holocene cultural material at the site has aided in

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[1] Gwaii Haanas National Park, National Marine Conservation Area, and Haida Heritage Site.

understanding other intertidal lithic scatter sites with characteristic Kinggi Complex lithic technology, but that have no associated dateable organic material.

In 2012, formal excavations were carried out with the objective of collecting plant-based artifacts and archaeobotanical samples for the paleoethnobotanical research described in this thesis. A detailed outline of the fieldwork is described in the Methodology section (chapter 3).

Preliminary paleoenvironmental reconstruction of the site from 15,000 years ago to the time of site occupation has been established from paleopond sediment core pollen samples (Fedje et al. 2005). Palynological studies of the vegetation at the Kilgii Gwaay site have primarily analyzed post-glacial sequences, however a small sample from the archaeological deposits provided preliminary data at the time of site occupation (Fedje and Mathewes 2005). The local vegetation is described as a Sitka spruce (*Picea sitchensis*), western hemlock (*Tsuga heterophylla*), and shore pine (*Pinus contorta*) forest surrounding an open alder (*Alnus rubra* and *A. viridis*) and herbaceous community around the paleopond (Fedje 2003; Fedje et al. 2005). Other taxa from ~10,500-10,850 cal. BP include abundant Polypody ferns (*Polypodium* sp.) and other ferns, and sedges (Cyperaceae), grasses (Poaceae), and members of the rose family (Rosaceae) (Emily Helmer pers. comm. 2014).

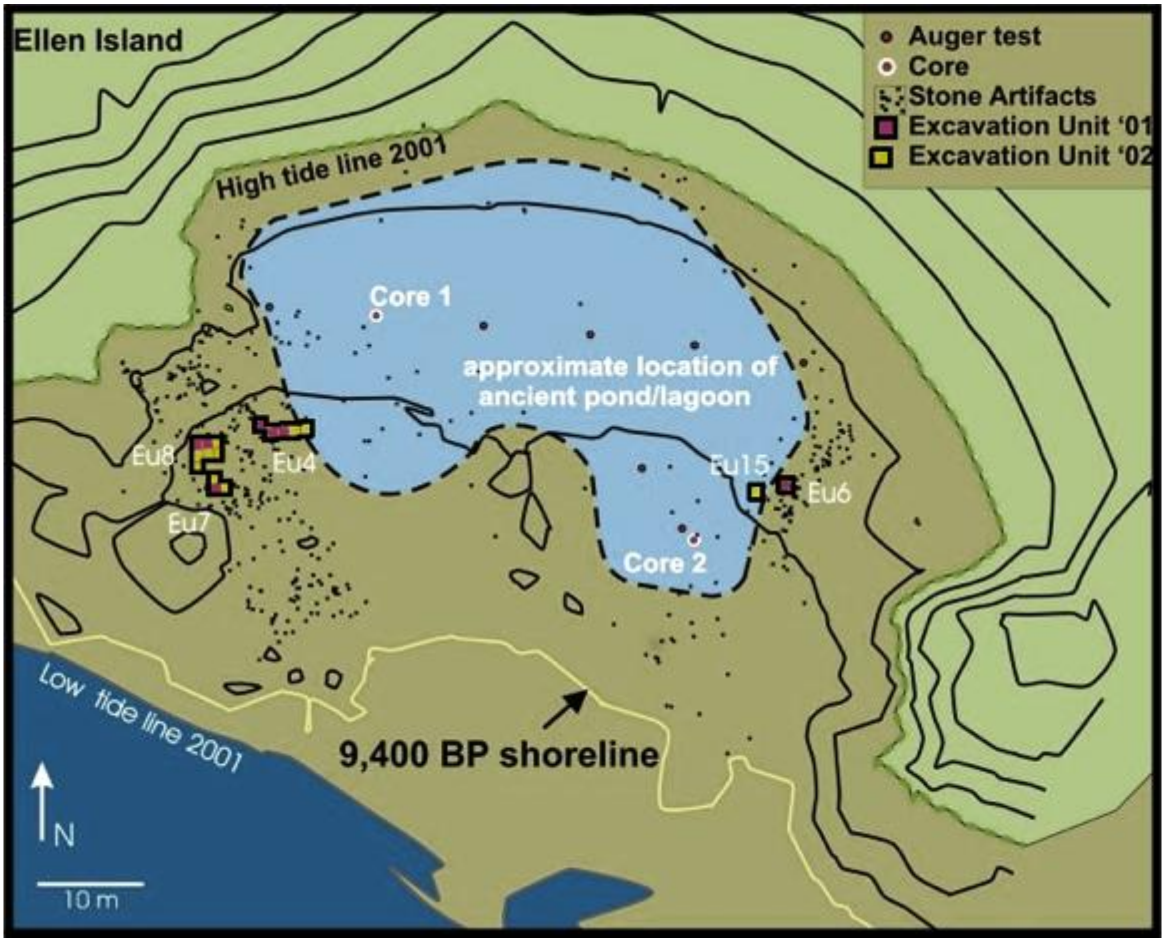

Figure 3. Map of Kilgii Gwaay site, showing location of 2001 and 2002 excavations, core locations, and surface lithics Fedje and Sumpter 2003).

Site structural context

The site has undergone complex depositional and erosional processes over the past ten millennia. Originally a campsite when relative sea levels were slightly lower than modern, the time of early period occupation occurred from when the paleopond was fresh water to when it became flooded by the ocean. Evidence for cultural activity was obscured where flooding processes brought in layers of silt, gravel, and cobbles, possibly shearing off and mixing the top portion of the paleosol and cultural layers and effectively capping them under a dense mixed mineral deposit (Figure 4; Figure 7). The paleopond edge holds intact stratified pond deposits overlain by peat and dark brown cultural sediment. The adjacent paleo-terrestrial matrices are comprised of glacial diamicton overlain by organic-rich paleosol and dark brown cultural sediment. These intact layers contain no shell or beach cobbles, suggesting this area was effectively protected beneath a dense cobble layer from most subsequent marine processes (Cohen In Prep; Fedje et al. 2011a; Smith et al. 2013). Conditions at this lower level may not have been suitable for shell preservation, however, the peat layer shows remnants of clam burrows. These appear to be from a temporary colonization by bivalves during a low energy period as sea levels rose over the site before being suffocated by energetic deposition of marine sediments, including a dense cobble layer, associated with continued relative sea level transgression. The visibility of the stratigraphy of these layers ranges from not well defined near the beach surface to well defined at the deeper (closer to the pond edge) cultural strata.

Above the cobble layer is a dense gravel and sand layer overlain by a sandy shell hash (shell fragment and sand mix) over the basin area of the beach. The base of the shell hash from the center of the paleopond basin dates to 9,400 cal. BP. The date is congruent with the local marine transgression maximum (Fedje et al. 2005). Abundant water-rolled boulders are mixed with the upper gravel and marine sand on the beach surface. The boulders were likely carried over a ridge on the east side of the island by storm waves or tsunami on one or more occasions at or near the maximum sea level transgression (Smith et al. 2013). A study of the beach surface showed that boulders on the east side of the site were ~50% more abundant and averaged 7 cm larger in diameter than those on the west side (Fedje et al. 2011a). Though portions of the modern beach surface show clear late Holocene modification by people (e.g. canoe runs), the sample areas showed no apparent modification. The density reflects an overall trend of higher degree of post-marine transgression deposition of large clast deposits on eastern portions of the site.

The extent of recent shell activity appears to be limited to the shell hash and upper gravel layers at the edge of the paleopond. By contrast, the west side of the site, shows evidence of some bioturbation and the presence of a few live bivalves even within the cultural layers and hearth features. On the west side of the site, the cultural layers were as close as 10-20 cm below the beach surface. The dense cobble layer did not extend over this portion of the beach, however the preservation of the features, despite modern bioturbation, suggests that it was once capped by protective sediments. A thin, but distinct periwinkle shell wash overlays the intact early Holocene cultural deposits only on the west side of the site. Two periwinkle shells from this wash dated to ~500 years ago, indicating a deposition of intertidal biota during a relatively recent regression event.

The limited extent of bioturbation in the upper strata suggests relatively recent bivalve colonization. Experiments in surficial intertidal sediment density and bivalve activity have shown acute sensitivities and behavioral shifts by bivalves in response to changes in geoenvironmental conditions (Sassa et al. 2011). Burrowing rates of several bivalves have been measured, and though they vary by species, provide a model based on the Ogeechee estuary in Georgia USA that suggests that ten filter-feeding individuals would take up to 115 years to churn a 1 x 1 m plot of sediment (Gingras et al. 2008). The bivalve burrows at Kilgii Gwaay each appear as a single disturbance through otherwise intact deposits. Based on these considerations, the early Holocene, colonization by bivalves at the Kilgii site may have been quite brief, supporting rapid transgression estimate of 50 to 100 years to go from supra- to subtidal. The modern bivalve population appears relatively recent and/or small.

The continual erosion and disturbance to the site by burrowing shellfish and winnowing of fine sediment by wave and current action is a current threat to the shell, bone and organics within the cultural sediments as they increasingly become subject to bacterial decay resulting from oxidization via mechanical processes. Samples for my thesis were collected from two artifact–rich areas threatened by erosion.

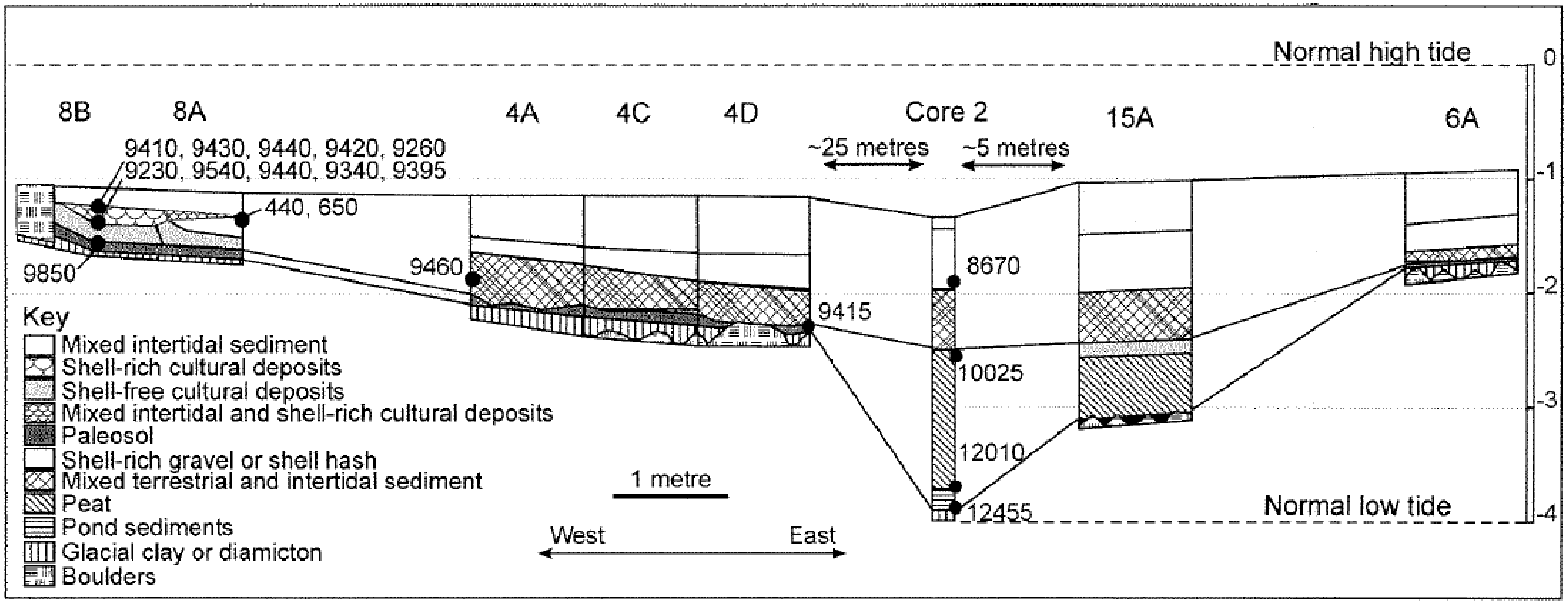

Figure 4. Schematic cross-section from representative tests at Kilgii Gwaay (Fedje and Sumpter 2003). Black circles indicate radiocarbon sample location and associated uncalibrated ^{14}C dates.

Artifact Assemblage

Many wet sites tend to be saturated by water too acidic for bone preservation, however Kilgii Gwaay, being inundated with alkaline marine water, has preservation of both bone and plant remains. This has allowed researchers to examine a range of bone, stone, and plant-based technological and food resources. The preservation of wood and bone organic artifacts at the site is of high significance for the NWC early period. Up to 95% of historic NWC material culture is estimated to be of organic material (Croes 2003), which preserves archaeologically only occasionally under specific circumstances, including at waterlogged wet sites. Therefore, the site offers insight into some of the oldest known plant-based technologies on the Northwest Coast of North America to date (Croes 2003; Erlandson and Moss 1999; Fedje et al. 2005; Moss 2011).

Early Holocene archaeological sites are not well understood on the NWC. In particular, early plant use is virtually unknown outside of the Kilgii Gwaay wood artifact assemblage. Other plant-based artifacts date to ca. 8,500 cal. BP from a mat needle-type tool on Triquet Island, British Columbia (McLaren and Christensen 2013), and 6200 cal. BP from a basket at Thorne River estuary, Prince of Whales Island, Alaska (Croes 1997: 601), but the majority of sites with preserved plant remains date to within the last 5,000 years. Because early period plant use patterns are not understood on the NWC, an interdisciplinary and holistic approach to paleoethnobotany is critical for evaluating the Kilgii Gwaay archaeobotanical assemblage. Recursively, the assemblage itself provides insight into the local availability of plant resources at the time of occupation.

Plant-based artifacts described from 2001 and 2002 excavations (Table 7) include in situ hemlock stakes from paleosol deposits and wedges for splitting wood. A finely crafted piece of braided three-strand spruce root and monocot fiber cordage and spruce root-wrapped sticks, possibly from a basket handle, provided evidence for split root technology. The majority of wood and plant fibre artifacts are wood chips, split root or withes, and unidentifiable worked wood (Fedje et al. 2005). The wooden artifacts demonstrate a well-developed woodworking technology with components remarkably consistent with wood-splitting, cordage and basketry traditions from recent time periods.

Table 7. Wood and fibre artifact types by excavation Unit (EU) from previous excavations in 2000 – 2002 (see Figures 6 and 19 for EU locations).

Artifact type	Excavation unit				**Total**
	4	**6**	**7**	**8**	
Cordage	1				**1**
Wrapped stick	1			1	**2**
Wedge				1	**1**
Stake or wedge	1			2	**3**
Stake			2	1	**3**
Stake?	1				**1**
Haft?				7	**7**
Wood chip	2		1	29	**32**
Worked wood (woodchip?)			1	3	**4**
Split withe/root	7			1	**8**
Split stick	2			5	**7**
Point?		1		6	**7**
Spatulate worked wood				1	**1**
Worked wood	2	1		12	**15**
Worked? wood		1		5	**6**
Total	**17**	**3**	**4**	**74**	**98**

Because much of the wood from the early assemblage had been subject to various levels of degradation, many of the manufacturing features, such as abrading and whittling marks were obscured. Therefore confidence in some artifact type designations has been tentative (Mackie et al. 2003; Mackie and Mackie 2009). Of the 98 wood artifacts, Mary-Lou Florian identified 24 to taxon (Table 8) (Mackie et al. 2003; Mackie and Mackie 2009). The artifacts were primarily western hemlock and Sitka spruce, strongly reflecting the use of the widely available local tree species.

Table 8. Descriptions and species identifications of sampled wood artifacts from 2000-2002 excavations (Mackie et al. 2003).

Artifact number	**Artifact type**	**Manufacture technique**	**Species**
1325T4E4W-1	Cordage	Splitting, other	*Three components of two materials* - Monocot stem/leaf and conifer root (possible Sitka spruce)
1325T4D4W-9	Wrapped sticks and withes	Splitting, wrapping	Sitka spruce: *wrapping* - root; *stick fragments* - branch
1325T8F3W-6	Wrapped stick	Splitting, whittling?	Sitka spruce
1325T6A5W-1	Wedge	Splitting	Western hemlock
1325T8F5W-1	Wedge	Whittling, chopping, abrading, other	Western hemlock
1325T8E5W-14	Wedge or stake	Splitting, crushed end	Sitka spruce, compression
1325T8E5F1W-2	Stake	Splitting, crushed poll	Western hemlock
1325T8A100W-1/2	Haft?	Splitting, whittling	Western hemlock, compression
1325T8A5W-1	Haft?	Whittling, chopping	Western hemlock
1325T8A5W-2	Worked wood (haft?)	Whittling, crushed	Pine/hemlock indeterminate
1325T8F3W-1	Wood chip	Chopping	Western hemlock
1325T8F8PW-1	Wood chip	Whittling	Sitka spruce
1325T8E5F1W-1	Wood chip	Splitting	Western hemlock
1325T7E2W-1	Worked wood (wood chip?)	Splitting, whittling	Western hemlock
1325T8A5W-3	Point?	Whittling, abrading	Western hemlock
1325T8E5F1W-4	Point? uni-point?	Splitting? abrading?	Sitka spruce
1325T8E5F1W-5	Point? uni-point?	Splitting, whittling?	Western hemlock
1325T8E5F1W-6	Point? uni-point?	Splitting	True fir/hemlock indeterminate
1325T8E5F1W-7	Point? uni-point?	Splitting, whittling	Western hemlock
1325T8FPW-2	Worked wood (point?)	Splitting, whittling	Sitka spruce
1325T8E5W-6	Worked wood (spatulate)	Splitting, abrading	Western hemlock
1325T8D4W-2	Worked wood	Splitting, whittling, abrading	Sitka spruce
1325T8A4W-1	Worked wood	Whittling	Western hemlock
1325T4D3W-1	Worked wood	Splitting, whittling	Sitka spruce

The lithic assemblage contains ~7,600 artifacts characterized by Kinggi Complex flaked stone technology of expediently manufactured large stone tools including scraperplanes, cobble choppers, spokeshaves (concave scrapers), gravers, and unimarginally retouched flake tools and one small unifacial point (Fedje et al. 2005; Cohen in prep). Three biface fragments, and a few bifacial reduction flakes are the only evidence of bifacial technology at the site (Fedje et al. 2005; Cohen in prep). Lithic material is primarily metasedimentary siltstone with small quantities of dacite, chalcedony, rhyolite, and other unidentified raw material.

Bone artifacts including a barbed point, two awls, and a billet flaker, which were fashioned from large land mammal bone, likely bear (McLaren et al. 2005). Additional artifacts recovered from 2012 excavations include a cut and split land mammal bone and a small ground point (Cohen in prep; Mackie et al. 2013).

Faunal remains

Much of the regional paleontological data on fauna for this time period has been derived from the faunal assemblage from Kilgii Gwaay itself, described on page 7. However, there are several culturally significant considerations to mention. The faunal assemblage at Kilgii is diverse and strongly reflects marine-based subsistence activities. The site also includes a high proportion of bear remains, the only large terrestrial mammal identified from the site (McLaren et al. 2005). Many of the bear bones were cut or otherwise modified and disproportionally more burnt than other species, suggesting specialized processing and treatment of bear (McLaren et al. 2005). Presence of halibut and lingcod indicate sophisticated hook and line fishing technology during this time, while albatross and sea otter are indicative of offshore hunting in boats (Wigen 2003). Presence of large whale bone at the site, while it cannot be directly linked to hunting, suggests the value of whale resources for raw material and/or food. Juvenile seal remains and a general lack of salmon and herring suggests a summer occupation (Fedje 2003).

Macro- and microbotanical remains

Archaeobotanical remains, including seeds and plant macrofossils, can be useful in a similar manner to how faunal data is interpreted at archaeological sites. These data provide information for seasonality, procurement strategies, and availability species, both local or brought to the site. Previously only general observations about the macrobotanical remains at the site have been described (Fedje et al. 2005). Microbotanical pollen remains from the site have been used to reconstruct long term patterns in vegetation communities (Fedje et al. 2005). I have analyzed the plant-based artifacts and seeds, wood, charcoal macrobotanical remains from the site, which I describe in detail in the following chapters.

Chapter 3 - Methodology

The research leading to this thesis involved all stages of archaeological investigations from fieldwork design and excavation to laboratory processing and analysis. Field design took into consideration past excavations and areas of the site likely to yield preserved plant remains. Wood artifacts and seeds were the subjects of laboratory analysis. I describe the methodology of the field and lab components below.

Field sampling

In 2012, sediment samples and column samples were collected from selected proveniences within the cultural strata and features from excavated Units (EU) at the Kilgii Gwaay site (Figure 5). The two focal areas for investigation were waterlogged deposits at the edge of the paleopond on the east side of the site and an activity area around a hearth and neighbouring ash lens feature on the west side (Figure 6). The samples primarily came from EU 31, the edge of the paleopond, and from EU 34, the hearth activity area. The primary purpose was to collect select samples containing archaeobotanical remains for taxonomic identification. I identified the taxa of seeds and a small sample of wood, charcoal, and wood artifacts from the collected material. The field project followed wet site excavation, recovery and conservation techniques appropriate to organic materials (Bernick 1998; Lepofsky and Lertzman 2008; Pearsall 2000).

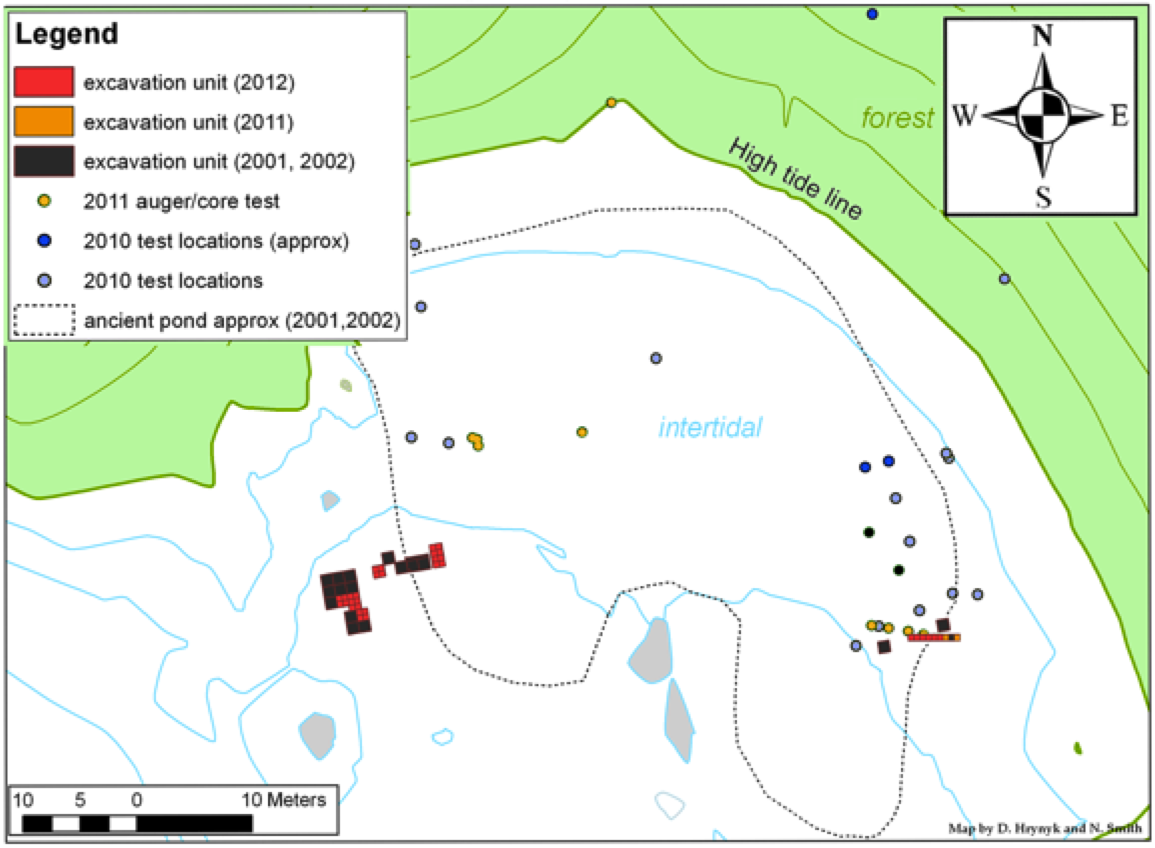

Figure 5. Map of Kilgii Gwaay site, showing location of excavations and estimation of paleopond. EU 31 is the linear trench excavation in the lower right of the map. The hearth activity area (EU 34) is represented by red block at left connecting EU 7 and EU 8 in black. EU 35 is towards the edge of the pond on the west side (adapted from D. Hrynyk and N. Smith 2013).

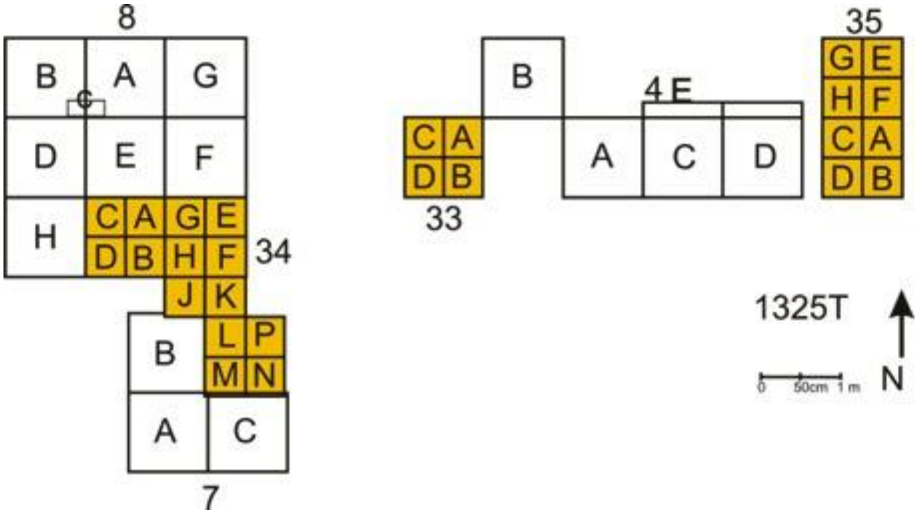

Figure 6. Excavation Units on west side of site. 2012 excavations are in yellow. EU 34J/K/M is the area sampled from the hearth activity area. Previous excavations in 2001 and 2002 include EU 4, EU 7, and EU 8.

Paleopond edge deposits

Waterlogged material was sampled from the eastern edge of the paleopond. Operation 1325T31B-G (EU 31) was a 50 cm by 3 m trench running along an east-west axis (Figure 7). The general stratigraphy of the trench is described in the site background in Chapter 1, page 31. The intact cultural deposits dipped down toward the edge of the pond to approximately 110 cm below the beach surface. Cultural layers over the terrestrial paleosol in the most eastward part of the trench were increasingly disturbed as they became shallow within the beach.

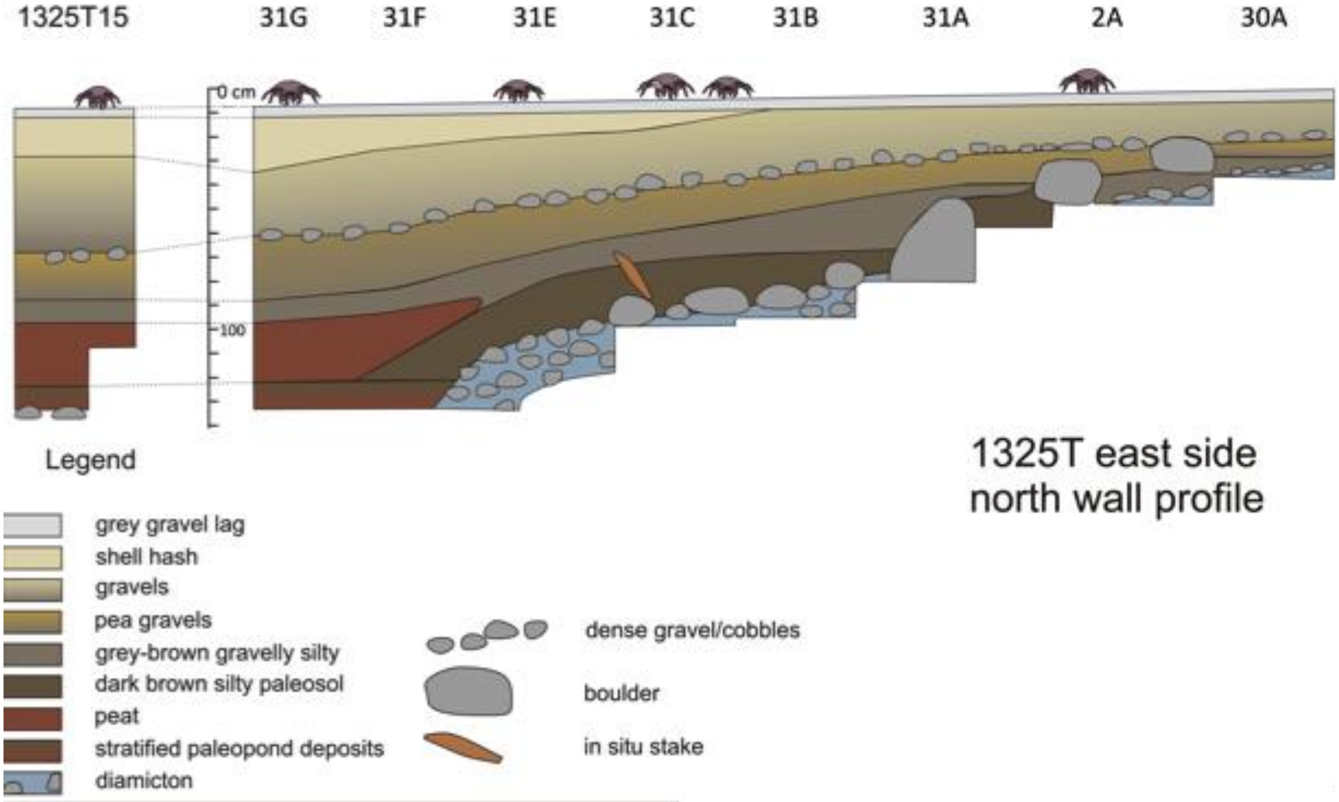

Figure 7. North wall profile of 1325T30, 2, 31 and 15 on east side of site.

At the lower edge of the pond, cultural deposits were 80-110 cm below the beach surface. These deposits included a dense concentration of wood artifacts, seeds, and woody debris. Significantly, a dense concentration of berry seeds was found adhering to a split wood plank in this area. A single seed from this concentration directly dated to 10,680 cal. BP, confidently representing the time of early Holocene occupation. Samples were collected from the cultural strata and the underlying peaty layer (Table 9).

Table 9. Samples from berry concentrations in artifact-rich cultural deposits at the paleopond edge at east side of site.

Sub-operation/ level	**Depth below datum**	**Sample volume**	**Sediment sample description**
1325T31F8	90-100 cm	2800 ml	From around split plank; dense wood in paleosol, fauna present
1325T31F9	100-110 cm	200 ml	
1325T31F10	110-120 cm	950 ml	
1325T31G8	90-100 cm	150 ml	
1325T31G9	100-110 cm	400 ml	
1325T31G10	110-120 cm	350 ml	
1325T31G12	138-148 cm	50 ml	Control from column sample

Hearth feature samples on west side of site

The hearth activity area encompasses a hearth feature (Hearth B) and an ash lens feature (Feature A) located within a meter of each other approximately 20 cm below the modern beach surface on the west side of the site (Figure 8; Figure 9). Hearth B is ~10 cm thick and ~75 cm in diameter and comprises abundant fire-altered rock and reddened earth. Feature A is a light brown silt/ash and is ~50 cm in diameter and ~10 cm thick (Figure 10). The features appeared stratigraphically intact, although some vertical mixing has occurred through shellfish bioturbation.

The hearth activity area is an area of a mineralized, medium to light brown paleosol, differing from the dark brown paleosol elsewhere at the site. The area may represent a higher level of human disturbance through burning or activity associated with a possible structure or living area. The sediment at the edge of the hearth features therefore was hypothesized to have charred plant remains, a wide range of seed types, and post-occupational weedy seed deposits in any remaining upper levels. Sediment samples selected from this area spanned the entire thickness of the cultural layer (Table 10).

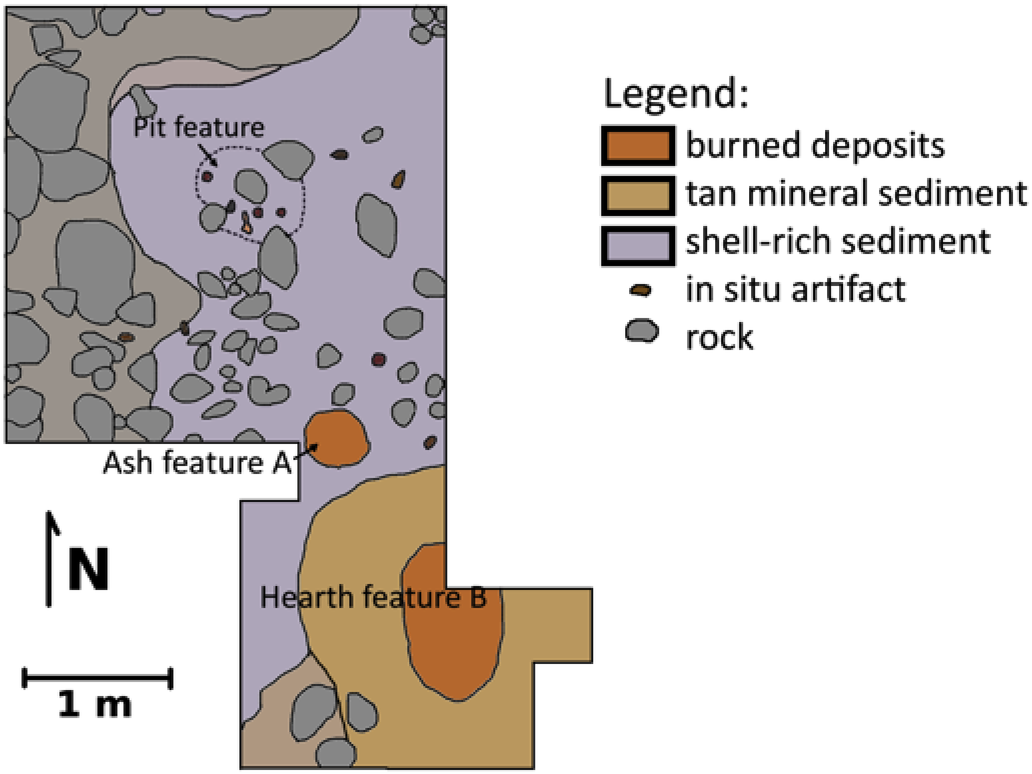

Figure 8. Planview of main cultural layer features of hearth activity area (EU 7/ EU 8/ EU 34). Only representative in situ wood and bone artifacts included.

Figure 9. West side excavations in area of hearth activity (EU 7/ EU 8/ EU 34), view facing south, showing marine channel and where bedrock constrains the site at right.

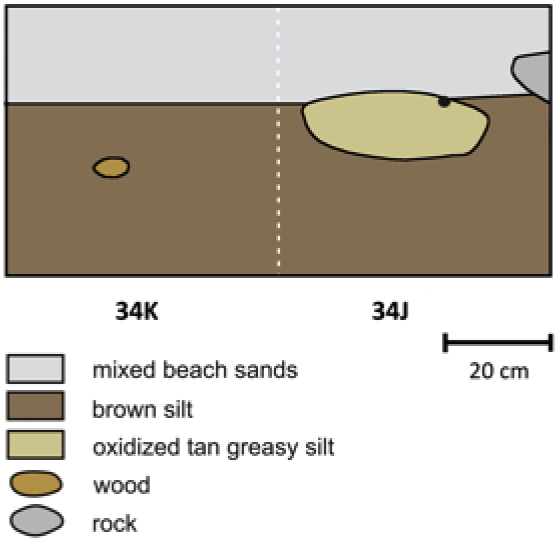

Figure 10. North wall profile of ashy silt lens Feature A in hearth activity area (1325T34J/K).

Charred botanical remains are used as a standard indicator of cultural remains by showing the general context for cultural deposits, including uncharred remains (Lepofsky 2004). However, charred seeds and needles were quite rare compared with wood charcoal around the cultural features. Based on well-defined cultural layers with the presence of wood charcoal and waterlogged wood artifacts dating to the time of early occupation, waterlogged seeds were included in all samples selected for analysis.

Table 10. Samples from hearth feature A – samples are approx. 25 x 25 x 5 cm horizontally contiguous across the feature and extend 50 cm beyond the feature's edge.

Sub operation	**Depth below datum**	**Sample volume**	**Sediment sample description**
1325T34J4 #1	20-25 cm	1000 ml	Paleosol, yellowy-brown oxidized silt feature (25-50 cm W)
1325T34J4 #2	20-25 cm	800 ml	Paleosol, yellowy-brown oxidized silt feature (0-25 cm W)
1325T34K4 #3/4	20-25 cm	400 ml	Dark brown, grey paleosol (25-50 cm W)
1325T34K4 #6	20-25 cm	1300 ml	
1325T34J5 #7	25-30 cm	200 ml	Paleosol, yellowy-brown oxidized silt feature (25-50 cm W)
1325T34J5 #8	25-30 cm	400 ml	Brown paleosol (0-25 cm W)
1325T34K5 #9	25-30 cm	1100 ml	Brown paleosol (25-50 cm W)
1325T34K5 #10	25-30 cm	850 ml	
1325T34J6 #11	30-35 cm	200 ml	
1325T34K6 #13	30-35 cm	200 ml	
1325T34M4 #2/3	21-25 cm	600 ml	Transition to red sediment hearth feature
1325T34M5 #4	25-30 cm	200 ml	Brown sediment with charcoal
1325T34M6 #5	30-37 cm	800 ml	

Control samples

I targeted the pond edge peat deposits underlying the berry concentrations for a control sample (1325T31F/G10) to assess natural patterns of local plant deposition and to evaluate cultural activities. The peat and paleopond, though likely representing plants in the immediate vicinity of a wetland context, were considered to reflect the early Holocene plant community more than would a modern sample. However, upon analysis in the lab, it was evident that cultural material including artifacts extended into all samples collected from the lower ‘natural’ layers. Cultural material was likely impressed into the underlying layers by human activity, such as trampling. Therefore distinction between the cultural and natural signatures could only be broadly assessed in both the field and lab.

Because cultural material extended into the lower paleopond samples, a random sampling from upper active beach sediments (~1200 ml) was used as a control sample. Sparse to rare charcoal, wood fragments, salmonberry and elderberry seeds, and small bone fragments (including calcined bone) were present in the marine sediments. The lack of other types of organics suggests that minor quantities of the lower cultural material have been mixed upwards towards the beach surface. Abundant lithic artifacts on the beach surface further substantiate the trend.

Exploratory sample from EU 35

A 200 ml exploratory sample was examined from intact organic paleosol around an in situ stake from 1325T35G13 at 110-115 cm below datum, the bottom layer of excavations. The degree of confidence is very high that this sample is from the primary context.

Laboratory Methodology

The main foci of analysis were taxonomic identification through morphological analysis of seeds and anatomical analysis of wood artifacts, charcoal, and wood debitage. Wood, charcoal, and seed types were described and photo-documented with attention to attribute features. Descriptions and rationale for taxonomic identification for each wood or seed type is included in Appendix B. This section provides an overview of the methodologies used.

In order to facilitate identifications, I established comparative collections for wood, charcoal, and seeds of species known to currently to grow on Haida Gwaii, which served to supplement identification keys and anatomical literature (e.g., Dale 1968; Florian 1990; Friedman 1978; Harvey 2010; Hoadley 1990; Klinkenberg 2013; Kukachka 1960; Martin and Barkley 1961; Montgomery 1977; Panshin and de Zeeuw 1970; Ransom Seed Laboratory 2011). Further use of comparative material was through seed collections housed at the Royal BC Museum, Simon Fraser University, and the University of Victoria herbarium.

Seeds

Macrobotanical remains were sorted for seeds. Charcoal, needles, and other macrofossils were collected and tallied, but not analyzed in detail. A total of 13.3 liters of sediment was sorted. Since the plant remains from the site were waterlogged, sediment samples were water-sieved through nested geological screens of 2 mm-, 1 mm-, 710 µm-, and 500 µm- sized mesh. The smallest mesh size used, 250 µm, was periodically picked to monitor small seed size representation within the overall samples. Overall quantity from this size was very low and any seeds from this size fraction are included in qualitative results only. Plant macrofossils were hand sorted by size fraction and separated from inorganic sediment and fauna following standard procedures outlined by Pearsall (2000*).*

Following Pearsall (2000), redundancy calculations were used to determine an adequate, yet manageable representative sample size. Samples were sorted into several subsamples to determine the percentage required to represent the number of individual taxa (NIT) representing the full range of seeds at the two areas of the site. Since the sample areas contained different seed volumes and signatures, the following calculation was used to determine volume:

$$p \pm Z\text{œ}\sqrt{\frac{(1-n/N)\ p(1-P)}{(n-1)}}$$

Because of the large quantity of seeds from the edge of the pond, a smaller sample was taken from this area in comparison to the hearth activity area. Standard measures applied in seed data include: frequency, ubiquity, richness (number of identified taxa), and density (number of seeds per litre) for each taxon (Lyons 2000). Samples were divided into 200 ml subsamples for manageable working sample size. Several people assisted in sorting seeds from the samples. In order to maintain consistency between samples sorted by different individuals, I spot-checked the picked samples for missed seeds and seed types and repicked the samples in the case of any noticeable differences.

In order to evaluate the richness in taxa represented by the sample sizes, I plotted the accumulation rates of taxa per 200 ml subsample from each of the two main sample areas at the site (e.g., Lepofsky et al. 1996; McKechnie 2005). In both sample areas, the accumulation rates begin to level out, showing a level of redundancy (Figure 11). They do not completely level out and hit absolute redundancy. This is not expected considering the quantity of unidentified seeds and the possible range of seed taxa that could be present in the local environment. The sample sizes are adequate to address the broad exploratory questions of this research.

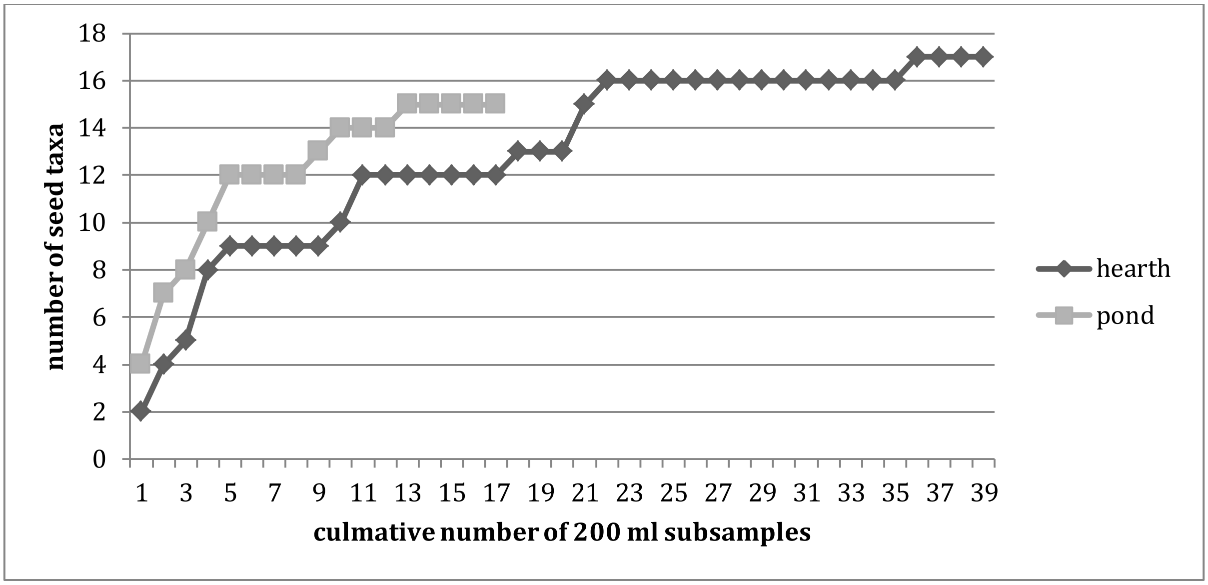

Figure 11. Accumulation rates of seed taxa from sediment subsamples at the paleopond edge and hearth activity sample areas.

Wood and charcoal

Anatomical analysis was done on a large representative sample of wood artifacts as well as on a sample of woody debris and charcoal from cultural components of the site. Prior to analysis, wood artifacts were described and documented. Artifact classes and manufacturing techniques were determined in consultation with Alexander Mackie, who has extensive experience with waterlogged artifacts. Photo and written descriptions were recorded for each artifact, and location of the thin section removal was also recorded (Friedman 1978).

Microscopic sample preparation followed techniques outlined in Pearsall (2000), Florian et al. (1990), and Butterfield (2006) and through working directly with Mary-Lou Florian. Conventional cellular analysis of wood and charcoal relies on identifying attributes along three aspects of the wood: cross-sectional, tangential and radial. In order to achieve these view planes, wood was cut in thin sections with a sharp razor and charcoal pieces were broken along the appropriate orientation. Wood thin sections were mounted on slides with distilled water or a 50-50 solution of glycerol and distilled water to maintain hydration and increase clarity of cellular features. The use of stronger chemicals was avoided in order to prevent further degradation of plant tissue (Florian pers. comm. 2013). Charcoal was mounted on a microscope slide with putty. The sections were viewed at 4-40 X with an Omano OMM200T metallurgical microscope, under obliquely angled top lighting to limit light reflection (Pearsall 2000).

Cell types (e.g., longitudinal tracheids, ray parenchyma, vessels) and features (e.g., pitting, end walls, resin canals, vessel arrangement) could often be distinguished along one or two planes (Pearsall 2000). Several samples from each specimen were analyzed, as not all features were present in each thin section sample (Friedman 1978). Attention was paid to distinctions between trunk, branch and root sections in order to further aid in archaeological interpretation, since raw material portions presumably would have been preferentially selected based on physical attributes. Considerations specific to the NWC followed Butterfield (2006), Dale (1968), Friedman (1978), Hawes (2008), and Hawes and Rowley (2012).

In handling the degraded waterlogged wood, I followed methodological approaches by Pearsall (2000) and Florian (1990, pers. comm. 2013), and recommendations from condition inspections of previously collected artifacts from Kilgii Gwaay (Mackie and Mackie 2009). The waterlogged wood possessed varying degrees of degradation, often the result of loss of spiraled cellulose strands within the wood structure (Florian pers. comm. 2013). In wood that was quite degraded and swollen, microcapillaries between the weakened cellulose strands (secondary space) tended to expand and became enlarged from absorption and retention of water (Grattan 1988). Where wood samples were too soft or deteriorated to cut cross sections, the sampling surface was daubed with isopropyl alcohol to stiffen the wood tissue for cutting (Pearsall 2000:152).

Methodological Issues

All seeds, possible seeds and fragments were collected during sediment sample sorting. However biases in the sorting may have occurred due to easier detection of some distinctive seed types (e.g., salmonberry, elderberry, and spruce) while smaller seeds such as *Vaccinium* sp. (huckleberry/blueberry) and salal may be less distinguishable as they have less distinctive surface textures and are similar in size to sand grains. Unidentified seeds and seed fragments were recorded as such – some of these too fragmented or degraded to identify, while others exhibited features that were unidentifiable by me or experts that I consulted.

The state of preservation provided some difficulties in identification. This may vary depending on the post-depositional context, feature or landform structure and function, and cultural discard practices of combustible waste material (Gelabert, et al. 2011). Charring and waterlogged conditions (e.g., microbial enzymatic digestion, oxidation, acid hydrolysis) can cause distortion, shrinkage, and loss of detail (Florian et al. 1990; Pearsall 2000; Grattan 1988). Because of these factors, absolute measurements of features were not incorporated into the anatomical study.

Macroscopic mineral crystals have grown on wood and charcoal that was collected in 2000-2002. These crystals did not appear visible in most of the 2012 waterlogged material, however the crystals affected some charcoal samples by obscuring some features. Multiple samples were taken in such cases in order to obtain a clear view of features.

Analyses of the material sought to incorporate the depositional context that may have affected the state and nature of preservation. Hearth structure and function, cultural discard practices, and post-depositional conditions were considered in relation to recovered macrobotanical remains (Florian et al. 1990; Gelabert et al. 2011; Pearsall 2000).

Much of the literature on cellular wood structure comes from the forestry sector and tends to focus on fresh tissue from trunk wood of economically important tree species, but not other traditionally important resources such as roots (Hoadley 1990; Panshin and de Zeeuw 1970). This limits application within the NWC archaeological context.

Paleoethnobotany is an underdeveloped field in the NWC, with incomplete comparison collections and no standardized regional reporting criteria, which makes a critical review of identified specimens difficult (Lepofsky 2004). However, work has been done regionally to address the associated issues unique to identification of local archaeological plant remains (Friedman 1978; Hawes 2008; Hawes and Rowley 2012). Cellular distinctions can be made between compression wood, heartwood, sapwood, and branch and root material. This highlights the importance of establishing a reference collection. Therefore, I have taken a prudent approach to make explicit the criteria used for identification, especially for describing less common taxa or uncertain identifications (see Appendix B).

Chapter 4 - Results

Wood Artifacts

From the 2012 material, I analyzed the collected wood remains for evidence of cultural modification. I identified a total of 53 wood artifacts (Table 11). Tentative artifact designations were made on material that appeared to have been modified by people, but had no distinctly visible manufacturing attributes (i.e., orientable whittling/chopping scars, abrading, splitting or other obvious tool marks). Many split wood pieces fell into the possible artifact categories, since the common technique of splitting wood can also occur through natural processes. I included approximately 110 pieces in the category of possible artifact. For anatomical analysis, I selected only artifacts for which I confidently found evidence of human modification.

Table 11. Summary of artifacts collected in 2012, by excavation Unit.

Artifact type	**Excavation Unit**			**Total**
	31	**34**	**35**	
Wedge tip	1	1		**2**
Stake	1	1	1	**3**
Haft tool handle	(2pc) 1			**1**
Wood plank	1			**1**
Split root	4	1		**5**
Split root/withe	3	1	1	**5**
Split wood	3	2	1	**6**
Point/ pointed artifact	4		1	**5**
Wood chip	10	2	2	**14**
Worked wood (woodchip?)	2	2	1	**5**
Worked wood	3	1	2	**6**
Total	**33**	**11**	**9**	**53**

Of the wood artifacts that were identified as cultural, 42 were further identified to taxon through anatomical analysis undertaken by Mary-Lou Florian and myself. To maintain consistency with earlier identifications tabulated in Table 1, page 37 (Mackie and Mackie 2009; Mackie et al. 2003). Dr. Florian identified 35 of the artifacts recovered in 2012

(Table 12). Under her mentorship, I identified an additional seven artifacts (Table 13) and a small sample of wood and charcoal from the cultural component of the site (Table 14).

Table 12. Typology and manufacturing analysis of artifacts sampled for anatomical species identification by Mary-Lou Florian (2014).

Artifact number	**Artifact type**	**Manufacturing technique**	**Taxa** (Florian 2014)
1325T31B4-2	Point	split? whittled	Hemlock
1325T31B4-4	Worked wood	chopped, split	Spruce
1325T31D6-1	Split, wood chip?	split	Spruce
1325T31D6-2	Pointed stick	whittled, abraded?	Hemlock (cf)
1325T31D6-3	Stake	whittled, poll end crushed	Hemlock
1325T31E7-1	Pointed object	split, whittled	Hemlock
1325T31E7-4	Worked wood	split, whittled	Hemlock
1325T31E8-2	Wood chip	shaved, chopped?	Spruce
1325T31E8-3	Wood chip	shaved, chopped	Hemlock
1325T31F8-1	Wood chip	split, chopped	Spruce
1325T31F8-2	Wood chip	shaved, chopped	Spruce
1325T31F8-4	Split wood	split, notched	Spruce
1325T31F8-5	Wood chip	shaved, chopped	Spruce
1325T31F9-1	Split wood	split	Spruce
1325T31G8-1	Wood chip	split/ chopped	Alder
1325T31G8-2	Split root/branch	split	Hemlock (cf)
1325T31G9-1	Split root/branch	split	Conifer
1325T31G9-2	Split wood	split	Hemlock
1325T31G9-7	Split root	split	Spruce
1325T31G9-8	Split root	split	Spruce (cf)
1325T31G9-9	Wood chip	chopped, shaved	Spruce
1325T31G9-10	Haft	whittled, abraded	Hemlock
1325T31G9-10	Haft	whittled, abraded	Hemlock
1325T31G9-13	Worked (point?)	whittled	Hemlock
1325T31G9-14	Worked wood	abraded, cut	Prunus emarginata
1325T31G10-2	Wood chip	chopped	Spruce
1325T31G10-3	Wood chip	chopped	Spruce
1325T34B 3-1	Split root	split	Spruce
1325T34C5-1	Worked wood	split whittled, abraded?	Hemlock
1325T34C6-1	Split wood	split, whittled?	Spruce
1325T34F5-1	Wood chip	chopped? crushed, whittled?	Spruce
1325T34G4-1	Wood chip	split, chopped	Hemlock
1325T35F11-1	Wood chip	split, chopped?	Spruce
1325T35G13-2	Wood point?	whittled, abraded?	Spruce
1325T35H8-1	Wood chip	chopped?	Spruce

Table 13. Anatomical taxonomic identifications from a sub-sample of artifacts. *ID made by both M. Florian and myself.

Artifact number	**Artifact type**	**Manufacturing technique**	**Taxa**	**Confidence**
1325T31F	Wood plank	split, wedge mark	Spruce	high: resin canals
1325T31F8-3	Spatulate worked wood	split, whittled, abraded	Spruce	high: resin canals
1325T31F8-6	Wood chip	shaved, chopped	Conifer	likely Hemlock
1325T31G9-5	Split root/branch	split	Spruce	high: resin canals
1325T31G9-11	Wedge? tip	whittled, abraded?	Hemlock*	high
1325T34C6-_	Wedge/digging stick tip	whittled, abraded, split	Conifer	likely Hemlock
1325T35C4-1	Notched, worked, charred	whittled, abraded	Conifer	likely Hemlock

The artifacts were dominated by 22 of Sitka spruce (*Picea sitchensis*) and 17 western hemlock (*Tsuga heterophylla*) wood, and one of alder (*Alnus* sp.) and one of bitter cherry (*Prunus emarginata*) wood. One artifact was of an indeterminate conifer wood classified as hemlock/spruce. Spruce and hemlock share many of the same or similar anatomical features, and distinguishing characteristics – namely resin canals – may not always be present in a sample. True firs also share many similar anatomical characteristics, however, their presence at the site is unlikely due to inferences based on the cone and seed macrofossils present at the site, current regional forest populations and paleoenvironmental records (Calder and Taylor 1968; Lacourse et al. 2005).

The following section is a descriptive summary of the analyzed wood artifacts from the 2012 field season. Brief descriptions of artifacts from previous excavations are included by general artifact typology.

Wedge tips

Wedge tips at the site may have served a variety of purposes. Unlike the complete wedges that were recovered in earlier excavations, only the distal ends of two wedge-shaped tools were recovered in 2012. One was relatively small, unlikely to be a wood splitting wedge, while the other was finely worked and may have been the end of a digging stick or a wood-splitting wedge.

1325T34C6-4 is a finely finished hemlock wedge or wedge-tipped digging stick fragment, measuring 10.7 x 3.3 x 1.5 cm (Figure 12). The surface has been abraded to a symmetrically tapered end with an acute tip. The margins transition from rounded to sharp towards the tip. The artifact is split on one side with crushing or use wear on the tip.

1325T31G9-11 is a distal end of a hemlock wedge or wedge tool measuring l9.7 x 2.5 x 17 cm in size (Figure 13). The fragment is lenticular in cross section with surfaces that are somewhat rounded from degradation. The tip is slightly uneven with at least one small splinter off the tip on the ventral side. The broad end is broken with lateral splinter fractures and is split lengthwise along the grain, suggestive of lateral torque from prying. The piece appears to be whittled from a branch or small trunk based on curvature of the wood rings. Whittling scars are evident on the ventral side, while the exterior roughly follows the natural curvature of the wood, though appears to be shaped by abrading or fine whittling towards the tapered tip.

Figure 12. 1325T34C6-4 wedge or digging stick tip in four views.

Figure 13. Artifact 1325T31G9-11 viewed from four sides. Worked tip is wedge-shaped.

Stakes

1325T31D6-2 is a stake that was recovered in situ from near the edge of the paleopond. It was positioned within the dark silty cultural strata and into the lower organic-rich paleosol. The outer surface generally follows natural wood rings and the pointed end was worked into a wedge-shape, the tip blunted from possible crushing. It measures 22.1 cm in length and ranges in width from 3.6 to 2.4 cm. The pointed tip is 0.8 cm thick. Although the tip is somewhat wedge-shaped, it is coarsely shaped, unlike the wedges from the site. The length of the stake is not uniform or straight, further suggesting its use as a stake rather than a different tool type such as a wedge or digging stick. The broken end has been mostly degraded away, however it still shows some evidence of splintering at the top, which may indicate remnants from crushing or breakage. *1325T35F12* is a stake from in situ within a couple meters east of where the three-strand cordage was recovered in earlier excavations. It was situated in low-lying peaty deposits, but not from the pond proper. It was broken lengthwise and fractured with several small splinters. The base is bluntly tapered and shows some facets, though there is also some trowel damage. It measures 26.5 cm in length, and averages 4.8 cm in diameter. Small branch knots around the circumference indicate this stake was made from a sapling. It has not yet been identified to species. *1325T34E9* was recovered in situ from within one meter of the hearth activity area features. It measures 36.2 cm long and 4.8 cm wide. The top was sheared off on an angle and degraded, suggestive of exposure and decomposition at the uppermost end, similar to more recent in situ fish weir stake nubs which are more or less eroded flush with the surface of the stratum they have been driven into. The distal tip is bluntly tapered and battered from being driven into the sediment. This stake is made from a sapling, as evidenced by the small branch knots around the circumference, but it has not yet been identified to taxon.

Tool handle haft

1325T31G9-10 is a two-part hemlock hafted tool handle, which bears technological similarity to two larger two-part wood hafts from earlier excavations at the site. This is the only composite artifact recovered from 2012 excavations. It is 9.9 x 1.2 x 0.9 cm in size and the outer surface of the larger piece follows the general contours of the growth rings. The larger piece is C-shaped in cross section, with a concave groove carved out center along the length. The smaller piece fits snugly in the groove cavity along its smooth convex surface that follows the natural growth ring. Both pieces exhibit a shallow notch or groove on the outer surface where they may have been bound together. The margins are rounded and smooth, suggestive of being worked into an overall ovoid shape in cross-section. The exposed outer side of the small piece is split and appears to have been shaped convexly. The cellular structure of the wood has a high amount of cellulosic fibril spirals, indicative of branch compression wood.

Wood chips

Wood chips are the largest wood artifact class from the site, showing a range of coarse to finer wood working at the site. A total of 46 wood chips were from all years of excavation. Thirty-two of these were from the west side of the site in the shallow deposits of EU 7, 8, and 34, four from the deeper west side deposits of EU 4 and 35, and seven were from the paleopond test trench EU 31. The 15 wood chips from 2012 excavations ranged from 2-5.5 cm in length, 1-3.2 cm in width, and 0.2-0.7 cm in thickness. Annual ring width of wood ranged from less than 1 mm to approximately 5 mm, representing a variety of branch wood or slow-growing trunk wood and fast growing trunk wood. Three taxa are represented: spruce, hemlock and alder.

Of the wood chips identified to taxa, all but three were conclusively identified as spruce. This may reflect the use of spruce for larger woodworking (small chips may not be preserved well or be easily recognized as cultural). Many of the other formed wood artifacts are made from hemlock, which tend to be small (compared to the spruce plank) or otherwise buried in the sediment, (e.g., stakes) where perhaps they were less likely to be burnt upon disposal. The hemlock also appeared more as twig, branch or small trunk wood based on curvature and thickness of annual rings (though no in-depth study has been done to substantiate these observations). The three taxa were all from the pond edge, and spruce wood chips were present throughout the site.

1325T31E8-2 is a spruce wood chip that is split on both faces. The squared end is somewhat feathered, while the blunt end tapers to one margin on a curved angle which may reflect having been chopped on an angle or is the broken distal end 2.7 x 1.5 x 0.3 cm. *1325T31E8-3* is a hemlock chip similar in overall shape and size (2.6 x 1.6 x 0.4 cm) to *1325T31E8-2*, but is chopped on the straight, somewhat square end. Four facets show fine striations and grooves from serrated (chipped stone) cutting blade on the dorsal side. The ventral side is a single split. *1325T31F8-2* is 2.6 x 1.4 x 0.2 cm in size with growth rings between 1-2 mm in size, possibly from spruce trunk wood or a large branch. Both ends are thin with feather termination and exhibit some crushing or breakage. The straight, less broad end appears to be the chopped end, though no clear chop marks are present. A narrow fragment is broken off on margin.

Figure 14. Two wood chips: 1325T31G9-9 spruce chip viewed from three sides (left), and 1325T31G8-1 alder chip viewed from two sides (right).

1325T31F8-5 is a large, thin spruce wood chip with growth rings approximately 3 mm in width. Measuring 5.5 x 2.6 x 0.5 cm, the chip is slightly tapered and curved from end to end along the split faces. The broad end is chopped, and half of the chip is broken or chopped off midway along the length. *1325T31F8-6* is classified as hemlock with moderate confidence, based on no observed resin canals, however the morphological characteristics (annual ring size and degradation pattern, shape, and size) bear great similarity to *1325T31F8-5* and they were both recovered from very close proximity. The chip measures 5.2 x 2.7 x 0.4 cm with growth rings approximately 3 mm in width. The chip is slightly recurved with an angled chop perpendicular to wood grain on one end, and slight feathering at the other end.

1325T31G8-1 is a small radially split alder chip (Figure 14). The surface is quite degraded and therefore orientation is difficult to determine. Both faces are split; however there appear to be subtle whittling scars on the dorsal surface. The chip measures 2 x 1.1 x 0.3 cm and growth rings measure less than 1 mm in width.

1325T31G9-9 is the thickest of all the spruce wood chips recovered, with dimensions of 4.1 x 3.2 x 0.7 cm. The annual rings are as wide as ~5 mm, suggestive of fast growing trunk wood. Chop marks are clearly evident on the dorsal surface and ends of the chip. The proximal end chop mark is rough and uneven, reflective of a flaked stone chopper with a denticulate edge as opposed to a chopping tool with a smooth ground blade. The distal end is feathered with visible scrape grooves left from at least two uneven chop mark scars on the dorsal surface. *1325T31G10-4* is a large wood chip similar in wood structure to *31G9-9* having wide growth rings of fast growing trunk wood (Figure 14). It measures 2.0 x 2.6 x 0.5 mm, being wider than long. It was not identified to species.

1325T31G10-2 is spruce with fine annual rings (<1 mm in width) and measures 2.4 x 1.3 x 0.5 cm. Both faces are split longitudinally with two planes on the dorsal side. The thinner end appears to be the chopped end, while the thicker end exhibits a smooth clear surface. *1325T31G10-3* is a long, slender spruce chip with fine annual rings (<1 mm in width) measuring 3.1 x 1 x 0.3 cm. It is split obliquely on both faces and shows a distinct chop mark at the proximal end. The distal end is broken, which could be the result of recent damage during excavation.

1325T34F5-1 is a relatively thick spruce wood chip (2.1 x 1 x 0.4 cm) with an annual ring width of approximately 1 mm. The ventral surface is convex, contributing to the thickness. The proximal end is crushed while the chip itself is a spongy texture. Despite the condition of the wood, a whittling scar from a stone tool remains visible on the dorsal surface near the thin tapered distal end. *1325T34G4-1* is spruce and measures 4.4 x 1.6 x 0.4 cm. The proximal chop angle is very acute and both faces are split, suggesting shallow chopping coupled with a prying action to remove the flake. The distal end is feathered and there are no whittling scars on the dorsal surface.

1325T35F11-1 is an obliquely split spruce chip measuring 2.3 x 1.3 x 0.3 cm. Annual rings of the wood are approximately 1 mm wide. The chip is long and thin with parallel sides and two longitudinal facets on the dorsal, resembling a microblade in shape. *1325T35H8-1* is a spruce chip with wide annual rings (~4 mm) measuring 3.1 x 1.3 x 0.5 cm. The surface is spongy and smooth from deterioration. The proximal end is rounded and battered, while the distal end is somewhat feathered but remains thicker than 1 mm thick. No fine detail or striations are apparent on any surface.

Split root/withes

Split root/withe is a general category used for the wood artifacts that morphologically appeared as roots or thin, flexible branches (withes). Four were identified as roots based on a non-pithy central core, while two were more generically categorized as root/withe, in keeping consistent with previous artifact descriptions from 2001 and 2002 excavations. Florian's study (forthcoming) did not go into detail differentiating root and branch wood on an anatomical scale, and I was unable to resolve this issue anatomically based on the sample I examined. All the artifacts in this category range from 4 to 6.5 mm in width and 2.5 to 3.5 mm in thickness, showing a level of consistency in selected size of raw material.

Figure 15. Two views of *1325T31G9-8* split spruce root fragment from edge of the paleopond at Kilgii Gwaay.

1325T31G8-2 is a withe measuring 55 x 4 x 3 mm with a probable species designation of hemlock. The piece is split longitudinally down the center on a slight angle from just over half the circumference remaining on one end to a tapered end on the other. The central core is visible for the middle half of the length. The outer surface is the natural growth ring, with the bark absent. *1325T31G9-1* is from an indeterminate conifer split longitudinally through center measuring 73 x 5 x 3 mm. Both ends are broken and the outer bark absent. *1325T31G9-5* is a piece of spruce split longitudinally through center. The central core is visible and the piece is broken at both ends, measuring 28 x 5 x 2.5 mm. *1325T31G9-7* is a longitudinally split spruce fragment with a visible core. Bark is absent. The piece measures 34 x 4 x 2.5 mm, with one end broken, the other in a feather termination. *1325T31G9-8* is a spruce fragment split longitudinally across the center, measuring 62 x 5 x 3.5 mm (Figure 15). The central core is partially visible, as the split is somewhat diagonal. The central core appeared red when first removed in the field, and was immediately identifiable as spruce to Laura Beaton, a practicing Haida weaver with much experience making spruce root baskets. Approximately two thirds of the root mass remains at one end, tapers to one third at thin end. Some cambium area is present on the outer surface, however outer bark is absent. *1325T34B3-1* is a spruce fragment split longitudinally, measuring 31 x 6.5 x 3 mm. The central core was absent and approximately 1/3 of the circumference was remaining. The outer surface was along a natural xylem ring with a possible degraded bark remnant or dirt adhered. The artifact was moderately degraded with fungal growth and therefore features were somewhat obscured

Wood plank

The split wood plank, *1325T31F*, was made from spruce. One broad split surface had a linear imprint extending across the grain, indicating where a wedge may have been positioned for splitting. Some recent shovel damage was distinguishable from the original split surfaces, including damage to one end. The plank measured 43 cm in length from the edge of the recent damage, and was originally several centimeters longer when first excavated. It is 8.9 cm wide and 4.7 cm thick, slightly smaller than a 2 x 4” piece of lumber.

Split wood

The split wood category is a broad category exclusive of split roots/withes, representing a range of pieces that likely were involved in the manufacture of different technologies or firewood. In some instances they have other manufacturing evidence such as chop marks.

1325T31B4-4 is a triangular fragment of split and chopped spruce measuring 7.2 x 2.4 x 1.9 cm. The chop is on an angle across the grain and two longitudinal faces are split while the third face follows the natural contour of the annual ring. Annual rings are approximately 2 mm thick. *1325T31D6-1* is a split piece of spruce, resembling a short piece of kindling at 7 x 2 x 1.2 cm. The larger end is rounded, terminated by a small knot. The smaller end is broken on a blunt angle across the grain. Annual rings are ~4 mm wide, suggestive of trunk wood. *1325T31F8-3* is the largest of the split spruce wood artifacts after the plank, measuring 15 x 4.8 x 1.8 cm (Figure 16). The annual rings on the wood are from less than 1 mm to approximately 2 mm thick, likely from a large branch or small trunk. The outside surface follows the natural growth ring with bark absent. A shallow notch approximately 2.2 cm wide is evident on one margin. Both ends are broken. *1325T31F9-1* is a fragment of spruce measuring 3 x 1.6 x 0.5 cm. Both faces are longitudinally split on a radial axis on either side of a small knot. Annual rings are approximately 2.5 mm wide.

1325T31G9-2 and *1325T31G9-4* are two hemlock fragments that refit lengthwise. They are both split longitudinally and broken at each end, the broad end terminating in a step fracture. The smaller piece (*31G9-4*) measures 4.1 x 0.9 x 0.4 cm and is shaped by five longitudinal faces, the largest of which is the refitting surface. *31G9-2* has five faces on its narrower end, decreasing to four on the wider and is 5.8 x 0.9 x 0.6 cm in size.

Figure 16. Split spruce wood *1325T31F8-3*, from the paleopond edge.

1325T34A3- 2 was not identified to species. It was quite deteriorated with rounded edges and therefore splitting was the only visible manufacturing evidence. One face was longitudinally split. One margin tapers across the grain to a pointed end. The artifact measures 7.7 x 2 x 1.1 cm with growth rings generally less than 1 mm thick. *1325T34C6-1* is a spruce splinter that is split longitudinally on the tangential surface with a small notch present near one end. Due to the degree of deterioration it is difficult to tell if one side had been worked (i.e., whittled), perhaps representing a fragment split off the outer surface of a larger artifact. The fragment measures 3.7 x 1 x 0.4 cm with annual rings generally less than 1 mm thick.

Points/ pointed artifacts

The pointed wood artifacts are primarily made from hemlock branches, with the exception of a small pointed spruce tip. These tend to be facetted pieces, suggestive of whittling manufacture. Most of them are broken on one end and range from expediently made to detailed manufacture.

1325T31B4-2 is a hemlock tip measuring 3.3 x 1 x 0.9 cm. The point is shaped by seven facets and has a slightly rounded tip. The other end is split likely from a break, though it is not clear if the wood was also worked to a taper on this end. *1325T31D6-2* is a pointed hemlock branch 15.7 x 1.4 x 1 cm in size. The surface is the outer branch xylem. A small amount of remnant bark is present in places along the surface. Five facets shape the pointed end, while the blunt is cut on an angle and slightly rounded. *1325T31E7-1* is a longitudinally split piece of hemlock with at least four facets at the tip. Parallel grooves run perpendicular to the grain near the split broken end on one margin. The artifact measures 7.3 x 1.2 x 0.5 cm. *1325T31G9-13* is a pointed hemlock fragment measuring 7.6 x 2 x 1.7 cm. It features four main facets at the pointed end and has been whittled all the way around the circumference. A ~1.6 cm wide rounded notch is midway along the length. The broad end tapers to a blunt point with a gouge running lengthwise from the end. The gouge may be from a breakage splinter. *1325T35G13-2* is a small pointed spruce tip measuring 2.5 x 0.6 x 0.6 cm. It is circular in cross section and the outer surface appears worked all around as indicated by small facets. The very tip itself is almost wedge-like in shape. The other end is broken.

Worked wood

The rest of the wood artifacts fall under the category of worked wood. These pieces may show evidence of several manufacturing techniques, but are not necessarily dominated by one type in particular, or they may be part of a tool too fragmented for me to identify with confidence.

1325T31B4-4 is a longitudinally split and worked piece of hemlock that tapers to a blunt end. It is rounded at the thicker end and along one margin. Possible whittling scars are at the tapered tip. It measures 11.5 x 1.9 x 1.3 cm.

1325T31F8-3 is a spatulate or spoon-like spruce artifact measuring 19.4 x 2 x 0.9 cm (Figure 17). A dish-like hollow runs the length of piece, becoming increasingly V-shaped at the narrower end. The margins grade from rounded at the broad end, becoming more angular at the other. The broad rounded end is concave and shows evidence of some crushing or wear, and was recovered with a berry clump adhered. The berries may have been incidentally attached after the artifact was disposed, since the location from which the artifact was recovered appeared to be a general waste disposal area with dense berry seed concentrations. The narrow end was broken in a split down the center with a fragment missing off approximately one third of the length. The margins are split with striation/scrape marks on one side and a shallow groove on the other.

Figure 17. 1325T31F8-3 spatulate worked spruce wood artifact from the paleopond edge.

1325T31G9-14 is a beveled fragment of bitter cherry wood with parallel faces and a V-shaped notch cut perpendicular into the center of the beveled margin (Figure 18). The piece was recovered with thin plant fibre adhered to surface. The face without the angled bevel is smooth and slightly rounded. The artifact measures 5.3 x 2.7 x 1.1 cm.

Figure 18. Three views of bitter cherry worked wood artifact *1325T31G9-14* from paleopond edge.

1325T35C4-1 is a charred hemlock fragment measuring 3.9 x 3.0 x 2.4 cm. The piece is roughly cylindrical with smooth breaks at either end, tapering somewhat at one end. The surface appears worked all the way around with some additional shaping. Two distinguishable V-shaped grooves run lengthwise along the grain on opposite sides of the piece. The large groove runs the whole length, while the smaller groove extends ~2.2 cm from the tapered end. The large groove is as deep as 4.4 mm, the small groove as deep as 1.5 mm. The annual rings are around 1 mm thick and the wood itself is hardened and dense.

1325T34C5-1 is a piece of split and worked hemlock bearing several facets and measures 7.4 x 1.5 x 1 cm. One end is sharply pointed. Annual rings are generally around 2 mm thick. *1325T35G13-1* measures 4.5 x 2.1 x 1.6 cm and was not analyzed for taxonomic identification. It is chopped or broken at both ends and split longitudinally on two perpendicular radial planes. The outer surface is smooth and looks worked by way of a shallow gouge. Fine annual rings and the degree of ring curvature are suggestive of branch or small trunk wood.

Wood and charcoal debitage

Wood debitage and charcoal samples were selected from cultural deposits. Dense concentrations of fragmented shrub stalks underlying and among the wood artifacts from the edge of the paleopond were targeted for waterlogged wood investigation and therefore may represent a larger proportion than the otherwise random wood selection. Thirteen pieces of waterlogged wood debitage were sampled from the pond edge, whereas only two were from the hearth activity area. The sample was exploratory in nature and does not reflect a statistically significant sample size. However, it presented a wider degree of taxonomic variation than the wood artifacts, including the presence of a range of angiosperm taxa.

Table 14. Wood and charcoal ID samples from cultural contexts by provenience.

Provenience	**Sample number**	**Sample type**	**Species**	**Confidence**
1325T31C5	31C-A	twig wood	Conifer	
1325T31D6	31D-A	wood-branch	Angiosperm	no large aggregate rays
1325T31D6	31D-B	wood-root	Conifer	
1325T31E/F/G8	31-A	wood-branch	*Rubus* sp.	high
1325T31E8	31E-A	wood	*Taxus brevifolia*	moderate
1325T31F8	31F-A	wood-branch	*Rubus* sp.	high
1325T31G9	31G-A	wood-branch	*Rubus* sp.	high
1325T31G9	31G-B	wood-branch	*Sambucus racemosa*	high
1325T31G9	31G-C	wood	*Picea/Tsuga*	likely *Tsuga*
1325T31G10	31G9-A	wood	*Picea/Tsuga*	high
1325T31G10	31G9-B	wood	*Picea/Tsuga*	likely *Tsuga*
1325T31G10	31G9-C	wood	*Picea/Tsuga*	high
1325T31G10	31G9-D	wood-branch	*Rubus* sp.	high
1325T34D9	34D9-2	wood	Conifer	
1325T34E7	34E7-A	wood-branch/root	*Sambucus racemosa*	high
1325T34D9	34D9-1	charred branch	Conifer	
1325T34D6	34D6-ch1	charcoal	*Alnus* sp.	high
1325T34D6	34D6-ch2	charcoal	*Picea/Tsuga*	high
1325T34D6	34D6-ch3	charcoal	Rosaceae	moderate
1325T34G5	#2	charcoal	*Picea sitchensis*	high
1325T31C5	#4	charcoal	*Picea sitchensis*	high
1325T31E7	#1	charcoal	*Picea sitchensis*	high
1325T31F8	#5	charcoal	Conifer	
1325T31F9	#3	charcoal	*Picea/Tsuga*	likely *Picea*

The wood debitage sample contained eight conifer and seven angiosperm pieces of wood (Table 14). Four of the conifers were identified within the spruce/hemlock (*Picea/Tsuga*) category. One splintered piece, likely from excavation damage, was identified as Pacific yew (*Taxus brevifolia* cf.), and four were undetermined conifers. Of the angiosperms, four were identified as the raspberry genus (*Rubus* spp.) – likely salmonberry (*R. spectabilis*) or thimbleberry (*R. parviflorus*). These were the notable branches or stalks that were matted below several of the wood artifacts and berry clusters. Two wood samples were identified as red elderberry (*Sambucus racemosa*), and one unidentified angiosperm that did not show characteristics of *Rubus* or elderberry.

Of the eight pieces of charcoal that were identified, five were from the hearth area and three from the pond edge. Two pieces of charcoal were angiosperms - one alder (*Alnus* sp.) and one rose family member (Rosaceae). Four were identified as spruce and three as conifer. Two of the conifer samples were in the category of spruce/hemlock (Table 14).

Spatial distribution of artifacts

In order to contextualize the wood artifacts within the site, their general locations were mapped and compared with the distribution pattern of the lithic artifacts (Figures 19 and 20). Two areas showed a high level of wood artifact preservation and reflect activity area as well as topographic features within the site.

The densest concentrations of wood artifacts are in the lower levels of the pond edge and around a pit feature in EU 8 (Figure 19). The excavated area of EU 7, EU 8, and EU 34 adds to a contiguous 13.5 m^2 excavated block, from where 89 of the 151 wood artifacts from all years of excavation were recovered. Within this area there is a clear pattern of artifact distribution. A single stake was found in the mineral sediments around the hearth feature in the hearth activity area. All other wood artifacts appear to be within or at the roughly delineated shell-rich cultural deposit boundary[2] to the north. The high density of lithic artifacts from previously excavated EU 8 on the west side of the site further points to an active manufacturing/waste disposal area adjacent to a living/cleared area around the hearths.

While EU 8 averages ~10 wood artifacts per square meter overall, a pit feature and surrounding edge (8E) contained 31 wood artifacts within one square meter. This quantity is comparable to the 31 wood artifacts recovered from the lower pond edge, though the density sharply increased at the lowest edge, where 24 wood artifacts were from a 50 cm x 1 m area (EU 31F/G).

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[2] The field notes from earlier excavations were unclear as to where the shell-rich gravel boundary extended. This is due, in part to the many challenges of excavating in the intertidal zone. The shell-rich cultural deposits were partially recorded in some of the planviews, but these are approximate at best.

EU 8 and 31D-G are directly adjacent to and have some overlap with the two densest excavated lithic concentrations, representing two general manufacturing areas of stone, wood and composite tools (Figure 20). Both areas feature stakes, formed wood tools and wood debitage, such as wood chips, and split roots and sticks. Similarly to the lower paleopond edge, the pit feature in EU 8 itself may have been a debris trap. The pit, at a depth of 59 cm below the beach surface, may have provided a relatively protected area for perishable material, and being constrained by bedrock to the north and west and a compact buildup of mineral soil in the area of the hearth, it may have acted as a drainage sump for runoff water and provided perennially waterlogged conditions.

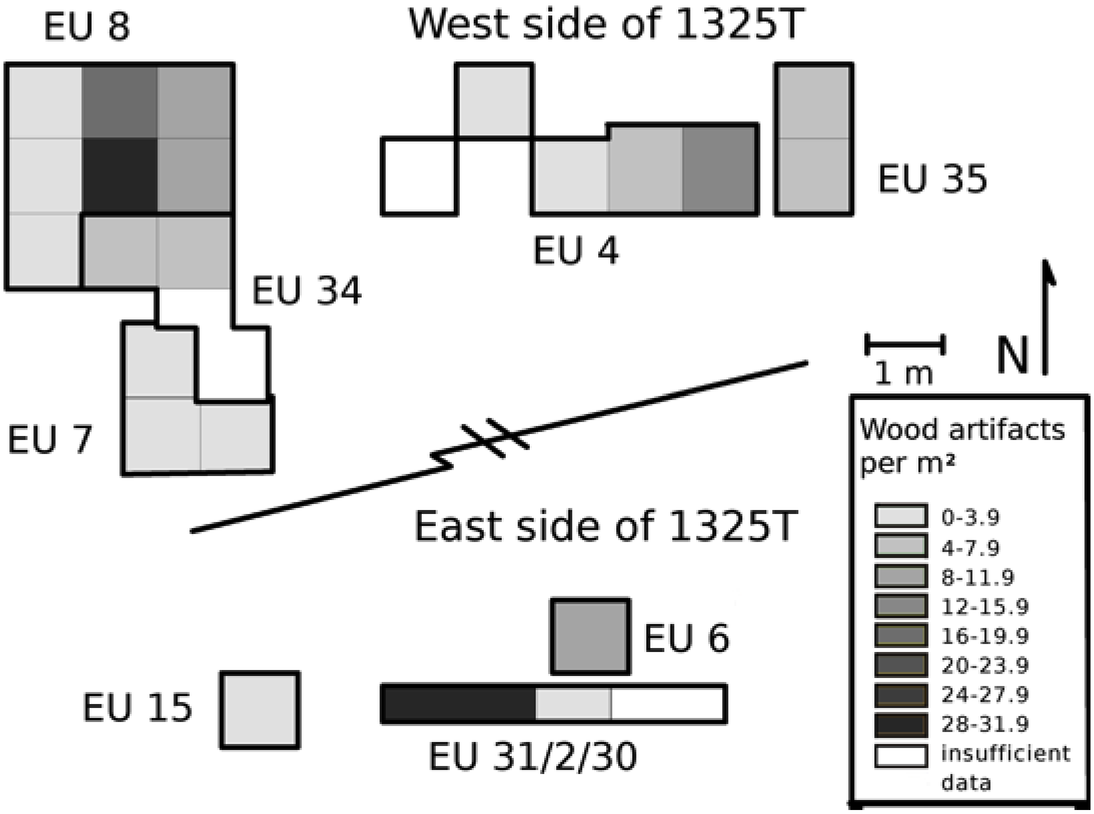

Figure 19. Kilgii Gwaay wood artifact density map by square meter. White indicates areas where sediment sample processing is ongoing.

The third densest wood artifact conservation occurs on the east end of EU 4. This is where the three-strand cordage and wrapped spruce root bundle from earlier excavations were recovered. This area also contained eight other pieces of split root/withes, which may indicate the disposal of exhausted fibre technologies and/or a manufacturing/ mending area. Seven split pieces of root were recovered from the edge of the pond, but it is difficult to determine with what part of manufacture these are associated without larger scale excavations.

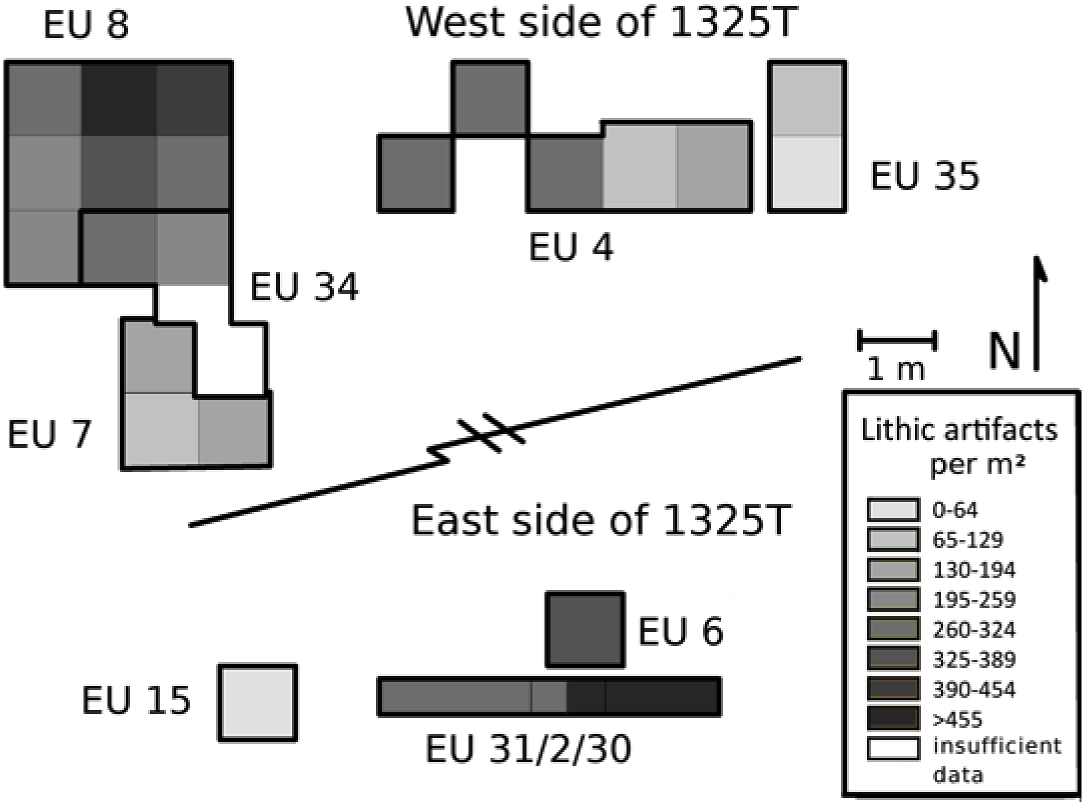

Figure 20. Kilgii Gwaay lithic artifact density map by square meter based on preliminary data.

Seed Morphological Analysis

A total of 11,967 seeds and seed fragments were recovered from the sediment samples. All but 429 of these were identified as salmonberry (*Rubus spectabilis*) or red elderberry (*Sambucus racemosa*) (Tables 15 and 16). Seed diversity at the edge of the pond and in the hearth activity area is represented by at least 22 taxa. Seventy-three seeds were unidentified (34 from the pond edge and 39 from the hearth activity area), representing approximately 20 types (Table 17). Many of these had very decomposed seed coats, while others contained features that may be identifiable with a more complete comparative collection. Seeds described with a "cf." before the plant name indicates the closest morphological resemblance I could determine. Seeds with a "?" indicate a lower level of confidence in the identification. Rationale and confidence level is detailed in Appendix B.

Table 15. Seed totals and percentages for 1325T. R = *R. spectabilis*; S = *S. racemosa*.

Latin name	**Common name**	**Total**	**% of total**	**% non-R+S**
Rubus spectabilis	Salmonberry	6536	54.60	n/a
Sambucus racemosa	Red elderberry	5005	41.81	n/a
Picea sitchensis	Sitka spruce	201	1.68	46.85
Alnus sp.	Alder	38	0.32	8.86
Gaultheria shallon	Salal	28	0.23	6.53
Conioselinum gmelinii	Pacific hemlock parsley	18	0.15	4.20
Juncus sp.	Rush	18	0.15	4.20
Asteraceae I	Aster family	9	0.08	2.10
Rubus parviflorus	Thimbleberry	5	0.04	1.17
Thuja plicata	Western redcedar	5	0.04	1.17
Tsuga heterophylla	Western hemlock	4	0.03	0.93
Carex spp.	Sedges	4	0.03	0.93
Rubus sp.	Raspberry-type	4	0.03	0.93
Vaccinium sp.	Huckle-/blueberry-type	4	0.03	0.93
Amaranthaceae	Goosefoot family	3	0.03	0.70
Asteraceae II	Aster family	3	0.03	0.70
Isoetopsida	Quillwort/spikemoss	3	0.03	0.70
Cornus canadensis	Bunchberry	2	0.02	0.47
Chara sp.	Stonewort	1	<0.01	0.23
Menziesia ferruginea	False azalea	1	<0.01	0.23
Lonicera involucrata?	Black twinberry?	1	<0.01	0.23
Viola sp.?	Violet?	1	<0.01	0.23
Unidentified seeds (at least 20 types)		73	0.61	17.02
Total seeds and seed fragments		**11967**		**429**

Seed distribution

Seed frequency contrasted sharply between the two sample areas, with 10,365 seeds from the edge of the paleopond while 1,588 were from the hearth activity area[3]. Three taxa are ubiquitous from all sampled depths across both the pond edge and the hearth activity areas – salmonberry, red elderberry, and Sitka spruce. Taxa present from both areas, but not at all depths include alder (*Alnus* sp.), quillwort or spikemoss

Table 16. Seeds represented at the site and presence in the two activity areas.

Latin Name	**Common name**	**Paleopond**	**Hearth area**	**Exploratory sample**
Rubus spectabilis	Salmonberry	X	X	–
Sambucus racemosa	Red elderberry	X	X	–
Picea sitchensis	Spruce	X	X	–
Alnus sp.	Alder	X	X	–
Rubus parviflorus	Thimbleberry	X	X	–
Rubus sp.		–	X	–
Tsuga heterophylla	Western hemlock	X	X	–
Isoetopsida	Quillwort/spikemoss	X	X	–
Cornus sp.	Dwarf dogwood	X	X	–
Gaultheria shallon	Salal	–	X	–
Thuja plicata	Western redcedar	–	X	–
Carex spp.	Reed	–	X	–
Vaccinium sp.	Huckle-/blueberry type	–	X	–
Amaranthaceae	Saltbush, etc.	–	X	–
Asteraceae II	Aster family	–	X	–
Viola sp.?	Violet	–	X	–
Conioselinum gmelinii	Pacific hemlock parsley	X	–	–
Asteraceae I	Aster family	X	–	–
Juncus sp.	Rush	X	–	X
Chara sp.	Stonewort	X	(?)	–
Lonicera involucrata?	Black twinberry	X	–	–
Menziesia ferruginea	False azalea	X	–	–
Unidentified	At least 20 types	X	X	–

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[3] An additional 14 seeds, all identified as *Juncus* sp., were from a small 200 ml exploratory sample from EU 35, but are not used in the comparative studies.

(Isoetopsida), bunchberry (*Cornus* sp.[4]), western hemlock (*Tsuga heterophylla*), and thimbleberry (*Rubus parviflorus*). Taxa that were observed from the pond edge only include: Pacific hemlock parsley (*Conioselinum gmelinii*), aster family (Asteraceae type I[5]), false azalea (*Menziesia ferruginea*), and possible black twinberry (*Lonicera involucrata*). Seed species observed from the hearth area only include: salal (*Gaultheria shallon*), huckleberry/blueberry (*Vaccinium* sp.), sedges (*Carex* spp.), western redcedar (*Thuja plicata*), aster family (Asteraceae type II), chenopods (Amaranthaceae), and possible violet (*Viola* sp.) (Table 16; Figure 21).

Table 17. Relative amounts and densities of seeds common to both the pond and hearth areas, including ambient levels of charcoal. See seed fragmentation section below for how fragments are defined.

	Pond seed total		**Hearth seed total**	
Sample size	**4850 ml**	**Per 1L**	**8250 ml**	**Per 1L**
Whole *R. spectabilis* seed	1414	291.6	46	5.6
R. spectabilis 1/2 fragment	1646	339.4	48	5.8
R. spectabilis <1/2 fragment	3226	665.2	156	18.9
Whole *S. racemosa* seed	988	203.7	39	4.7
S. racemosa 1/2 fragment	691	142.5	228	27.6
S. racemosa <1/2 fragment	2232	460.2	827	100.2
Rubus parviflorus	3	0.6	2	0.2
Picea sitchensis	86	17.7	115	13.9
Alnus sp.	5	1.0	33	4.0
Tsuga heterophylla	2	0.4	2	0.2
Cornus sp.	1	0.2	1	0.1
Unidentified seeds	35	7.2	38	4.7
Charcoal[6] (1 and 2 mm)	1515	312.4	7350	890.9

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[4] Three species of bunchberry grow in BC (*C. suecica, C. canadensis, C. unalaschkensis*) with at least the latter two on Haida Gwaii. They are very similar, and often require microscopic work to identify (Griffiths and Ganders 1983). For the purposes of this study, I use the genus *Cornus* when referring to the multiple species of bunchberry.

[5] Asteraceae types I and II were both identifiable to family only. They are differentiated because each type was found only in one sample area of the site – type I at the pond edge and type II at the hearth activity area. See Appendix for more detail.

[6] Charcoal is tabulated as approximate quantity of pieces from 2 mm and 1 mm screen. Larger pieces from sediment samples were rarely as large as 2 cm^3.

Seed Density

Salmonberry and elderberry seeds at the edge of the pond show marked vertical differences in density, with level 8 (90-100 cm below datum) having the highest density. Level 9 (100-110 cm below datum) showed somewhat less, but relative high density of seeds, while level 10 (110-120 cm below datum) showed the lowest density seed levels from the edge of the pond (Table 18; Table 19).

Table 18. Seeds present in each 1325T site sample area by level with volume of sorted sediment.
*Indicates seeds from a depth of 90-110 cm DBD, quantity not certain.
**Unknown quantity, several observed but not recorded.

	Pond edge			**Hearth area**			**Stake**
Seed type	31F/G8 2950 ml	31F/G9 600 ml	31F/G10 1300 ml	34J/K/M4 4300 ml	34J/K/M5 2750 ml	34J/K/M6 1200 ml	35G13 200 ml
Rubus spectabilis	4907	806	573	122	84	44	–
Sambucus racemosa	3074	566	271	619	360	115	–
Picea sitchensis	65	17	4	31	65	19	–
Alnus sp.	5	–	–	12	17	4	–
Rubus parviflorus	3	–	–	2	–	–	–
Tsuga heterophylla	2	–	–	2	–	–	–
Isoetopsida	2	–	–	1	–	–	–
Cornus canadensis	1	–	–	–	1	–	–
Gaultheria shallon	–	–	–	13	14	1	–
Thuja plicata	–	–	–	2	2	1	–
Carex spp.	–	–	–	1	2	1	–
Rubus sp.	–	–	–	3	1	–	–
Vaccinium sp.	–	–	–	2	2	–	–
Amaranthaceae	–	–	–	3	–	–	–
Asteraceae II	–	–	–	–	3	–	–
Viola sp.?	–	–	–	1	–	–	–
Conioselinum gmelinii	16	1	1	–	–	–	–
Asteraceae I	9	–	–	–	–	–	–
Juncus sp.	≥4	*	–	–	–	–	13
Chara sp.	≥1	**	–	–	–	–	–
Menziesia ferruginea	1	–	–	–	–	–	–
Lonicera involucrata?	1	–	–	–	–	–	–
Non R+S IDed total	110	18	5	62	108	23	13
Unidentified seeds	30	2	3	22	13	3	1
Total	**8121**	**1392**	**852**	**836**	**564**	**188**	**14**
Cupressaceae macrofossils	–	–	–	142	173	44	–
Needles	–	–	–	19	18	5	–
Needle fragments	281	29	49	413	672	136	–
Charcoal	1174	158	183	3842	2548	960	–
Bone	127	–	–	73	34	2	–
Lithics	1	–	–	9	7	5	–

However even the lowest pond deposits examined contained much higher densities of salmonberry and elderberry seeds than all of the levels from the hearth area. At the pond edge, the total range of density was 220-832 seeds per 500 ml for salmonberry and 104-521 seeds per 500 ml for elderberry. Not including fragments smaller than a half seed, the range was 88-415 for salmonberry and 71-202 for elderberry per 500 ml.

Table 19. Rate of seeds and other archaeological material per 500 ml from each 1325T sample area by level.
[*] Indicates seeds from a depth of 90-110 cm DBD, quantity not certain.

	Pond edge			**Hearth area**		
Per 500ml	31F/G8	31F/G9	31F/G10	34J/K/M4	34J/K/M5	34J/K/M6
Rubus spectabilis	831.7	671.7	220.4	14.2	15.3	18.3
R. spectabilis excluding <1/2 frags	(414.6)	(320.8)	(88.1)	(5.6)	(6.2)	(5.0)
Sambucus racemosa	521.0	471.7	104.2	72.0	65.4	47.9
S. racemosa excluding <1/2 frags	(202.2)	(251.7)	(70.8)	(15.8)	(20.4)	(7.9)
Picea sitchensis	11.0	14.2	1.5	3.6	11.8	7.9
Alnus sp.	0.9	–	–	1.4	3.1	1.7
Rubus parviflorus	0.5	–	–	0.2	–	–
Tsuga heterophylla	0.3	–	–	0.2	–	–
Isoetopsida	0.3	–	–	0.1	–	–
Cornus sp.	0.2	–	–	–	0.2	–
Gaultheria shallon	–	–	–	1.5	2.6	0.4
Thuja plicata	–	–	–	0.2	0.4	0.4
Carex spp.	–	–	–	0.1	0.4	0.4
Rubus sp.	–	–	–	0.7	0.2	–
Vaccinium sp.	–	–	–	0.2	0.4	–
Amaranthaceae	–	–	–	0.4	–	–
Asteraceae II	–	–	–	–	0.6	–
Viola sp.?	–	–	–	0.1	–	–
Conioselinum gmelinii	2.7	0.8	0.4	–	–	–
Asteraceae I	1.5	–	–	–	–	–
Juncus sp.	≥0.3	–*	–*	–	–	–
Chara sp.	≥0.2	unknown	unknown	unknown	unknown	unknown
Menziesia ferruginea	0.2	–	–	–	–	–
Lonicera involucrata?	0.2	–	–	–	–	–
Non R+S IDed total	18.1	16.7	1.9	8.4	19.8	10.8
Unidentified seeds	5.1	1.7	1.2	2.6	2.4	1.3
Total	**1376.1**	**1160**	**327.7**	**97.6**	**102.5**	**78.4**
Cupressaceae macrofossils	–	–	–	16.5	31.7	18.0
Needle	–	–	–	2.2	3.3	2.1
Needle fragment	47.6	249.2	180.0	48.0	122.2	56.7
Charcoal	199.0	132.0	70.0	447.0	463.0	400.0
Bone	21.5	–	–	8.5	6.2	0.8
Lithic	0.2	–	–	1.0	1.3	2.1

Seed density for all seed types at the pond edge was highest in level 8, with the exception of spruce from level 9. Spruce seeds had the overall site lowest density from level 10. Pacific hemlock parsley was the only other taxon present in all levels of the pond edge, though in lower densities (0.4-2.7 seeds per 500 ml) comparable to several of the densities of seed taxa from the hearth area.

The hearth area itself contained overall lower seed densities of salmonberry (14-18 seeds per 500 ml) and elderberry (8-20 seeds per 500 ml). Overall densities of spruce seeds were comparable with those from the pond edge. Alder seed was present at all hearth levels at approximately twice the density (1-3 seeds per 500 ml) as represented from level 8 of the pond (1 seed per 500 ml). All other identified taxa have a density range of 0-3 seeds per 500 ml. Since the densities are very low for many taxa, often represented by one to four individual seeds, any inferences drawn between these taxa is limited.

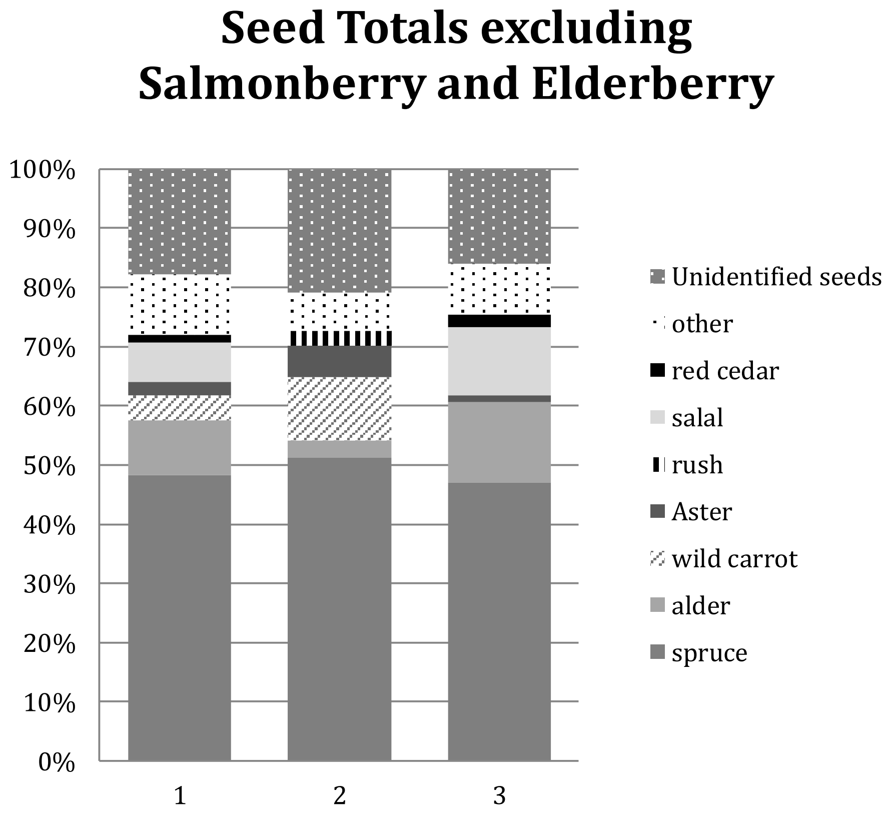

Figure 21. Seed composition from total sample, excluding salmonberry and elderberry. Column 1 = total seeds; column 2 = paleopond; column 3 = hearth area.

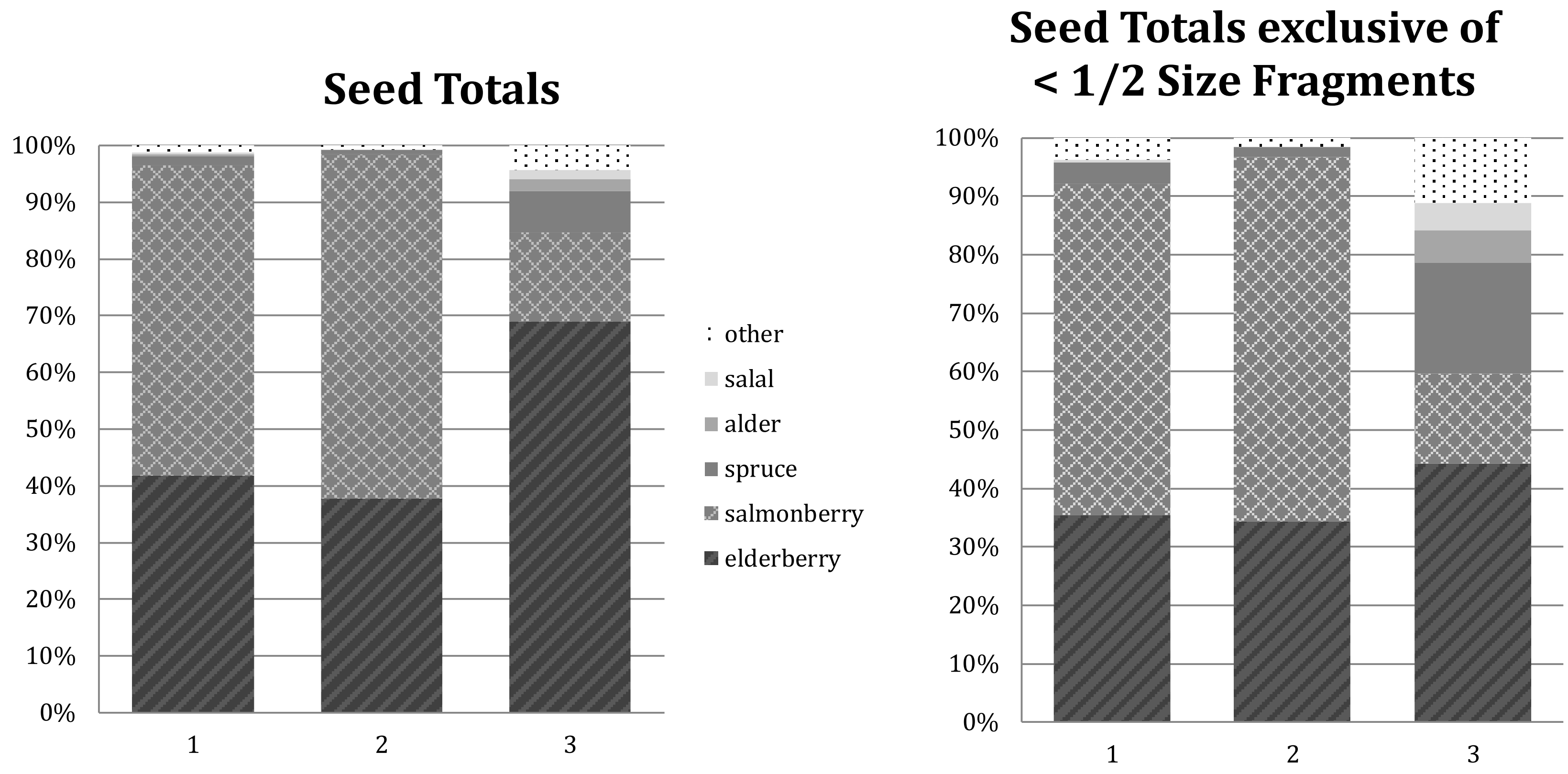

Figure 22. Seed taxa composition of total sample including all seeds and seed fragments (left); total seed proportions not including salmonberry and elderberry seed fragments <50% (right). Column 1 = total seeds; column 2 = paleopond; column 3 = hearth area.

Seed fragmentation

Salmonberry and elderberry have distinct and durable seed shell characteristics, and therefore even small fragments were easy to identify. Incomplete seeds of other taxa, though identifiable when diagnostic features were present, were usually unidentifiable when less than half complete. For this reason, I did a secondary calculation to exclude the salmonberry and elderberry seeds fragments that were smaller than half a seed (the category of ½ seed was judgmental observation of 40-70% subject to presence or absence of diagnostic features). Given these values, salmonberry and elderberry represent a significantly smaller proportion of the overall hearth area assemblage (Figure 22). Salmonberry becomes ranked third after spruce in density in the hearth activity area. Fragmentation of elderberry at the hearth was at a ratio of 27:1 compared to the pond edge approximately 3:1. Fragmentation of salmonberry was 7:2 and 9:2 at the pond and hearth areas respectively, comparable, but slightly more fragmented than the elderberry seeds at the pond edge.

Fruit weight

Red elderberries are small round berries that grow in clusters with each fruit containing between 3-5 seeds (Pojar and MacKinnon 1994). An estimated weight given for an elderberry is approximately 1 g (Martindale and Jurakic 2004), though perhaps a more accurate weight estimate is ~0.2 g per berry[7] (based on Whorley and Nixon 1974). I have not obtained a sample of fresh berries to evaluate these different weight calculations. Salmonberry fruits are a larger aggregate fruit consisting of several drupelets, each containing a seed. An estimated weight given for a salmonberry is ~3.5 g (Martindale and Jurakic 2004) and each berry contains between 17-128 seeds per fruit, with an average range of 40-62 from some sites throughout the NWC (Tappeiner and Zasada 1993; Zasada and Tappeiner 2008). To calculate berry weight for Kilgii Gwaay, I considered

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[7] Individual berry average weight was calculated on the basis of an average of 286,000 seeds per pound of elderberry seeds with 4 lbs. of seeds produced for every 100 lbs. of berries (presumably fresh).

each sample area as a whole as a unit of aggregation and omitted all seed fragments smaller than ½ a seed. With these imperfect measures, the samples represent approximately 420-715 berries, weighing less than 350 g (Table 20). These two small sample areas and likely only represent a small percentage of the berry remains at the site.

Table 20. Fruit weight estimates for salmonberry and elderberry at the paleopond and hearth activity area at Kilgii Gwaay.

Sample area	Pond edge		Hearth activity area	
Berry type	Berries (fruit)	Weight (g)	Berries (fruit)	Weight (g)
Salmonberry	31-62	108-217	1-2	3.5-7
Elderberry (M and J)	335-560	335-560	54-89	54-89
Elderberry (W and N)		67-112		10.8-17.8

Salmonberry seeds dominate the seed assemblage from the samples at the edge of the pond and have a modest presence at the hearth activity area. However, based on the fruit weight calculation, the dominant fruit at the site was elderberry in both the hearth activity area and the pond edge. See discussion of the sample areas in chapter 5 and specific discussion of taxa in chapter 6 for further detail.

The results from this chapter will be discussed within the context of each sample area and the overall site structure. Ancient human activity is discussed through the technological implications of the wood artifact assemblage and seasonal indicators of the plant remains.

Chapter 5 - Discussion

The botanical remains and artifacts from Kilgii Gwaay offer several main points of discussion. The pond edge and hearth activity sample areas are both independently discussed within the context of the site as a whole, with attention drawn to probable differences in activity in the two areas and site formation processes. The range of technologies represented through the wood artifact assemblage is described within the context of Haida culture history and NWC archaeology more generally. Finally, seasonality and evidence for summer occupation is used to further frame human activity at the site. In chapter 6, I provide a broader paleoethnobotanical interpretation of the taxa represented at the site.

Areas of Investigation and Site Interpretation

Many plant species at the site are suggestive of cultural use, in particular of berries and wood, although the examined samples presumably do not reflect the full range of taxa that would have been used. The distribution and density of taxa vary between the two sample areas with the highest densities of both wood artifacts and seeds at the edge of the paleopond. Here, the cultural layers were mixed with the lower pond deposits, and therefore I was unable to obtain an adequate early Holocene control sample. Rather, the two activity areas act as controls for each other. Several other lines of evidence including taphonomic factors are drawn upon in order to further assess the sample area seed profiles. These factors will be discussed in relation to each sample area and within the overall site context.

Hearth activity area

Sediment samples examined for seeds were from largely stratigraphically intact cultural deposits, however, there is a small, yet undetermined, degree of modern contamination via bioturbation into the archaeological strata, which thereby creates some interpretive problems (see Overall site context for further detail).

The majority of the 16 identified taxa represented by seeds from the hearth area have known ethnobotanical uses described in chapter 6. Despite the potential for usage, indicators that would suggest specific cultural practices are limited, especially for seeds that are present in low quantities. Plant use specialization patterns typical of “hunter-gatherer” activity are characterized by broad usage of many species and intensive use of only a few (Lepofsky and Lyons 2003). The lower density of seeds in the hearth activity area are consistent with a living floor that may have been regularly swept clear, and debris (including charred needles) burnt in a hearth, forming low levels of organic material accumulation (Lyons 2000). This general human activity may have prevented accumulation of large amounts of botanical remains as seen at the edge of the paleopond, but have introduced a larger range of taxa. The shallowness of the cultural deposits could have also affected the overall preservation from this sample area. However, seed and needle forest litter is comparable in both areas. These natural and cultural influences are not mutually exclusive, and could have both contributed to the seed profile.

A larger range of edible berry seeds was present at the hearth activity area compared to the paleopond edge. Taxa included salal, huckle-/blueberry, bunchberry, thimbleberry, salmonberry, and red elderberry. Elderberry was the most abundant seed, albeit at much lower quantities than at the paleopond edge. The elderberry seeds possessed a high degree of fragmentation, possibly from being trampled over on the compacted mineral surface by the people inhabiting the site.

If the hearth activity area is a living floor, higher levels of elderberry and salmonberry and the low quantity of other seeds berry seeds fits a similar pattern to the Ozette site, where very few salal/huckle-/blueberry seeds were recovered from house floor middens and where salmonberry and elderberry were abundant and closely associated in both indoor and outdoor contexts (Gill 2005:91).

The presence of Isoetopsida in the cultural deposits at this area of the site may be due to seasonal fluctuations in pond levels or transport through human activity around the pond.

Spruce, alder, and hemlock seeds may have been part of the general seed litter from the forest.

A small amount of western redcedar seeds and twigs were identified from the hearth area. One seed was radiocarbon dated to the modern era (post-1945), representing recent contamination. It is likely that the presence of the western redcedar is entirely modern, however until this is confirmed by rigorous dating, it cannot be completely ruled out that western redcedar was available at the time of early Holocene occupation, since it may have had a presence (if only very sparse) on the regional landscape growing or as driftwood (see chapter 6 for more detail).

The remaining 38 of the 39 radiocarbon dates from the site dated to the expected range of the given sample – late Pleistocene paleopond deposits, cultural material dating to the narrow window of ca. 10,700-10,600 cal. BP, and more recent dates relating to regressive shoreline and a terrestrial late Holocene cultural component (see Appendix A). Three other seeds from the hearth activity area returned early Holocene radiocarbon dates that were a couple hundred years younger than the time of occupation – when relative sea levels would have been at the transgressive high stand. Because the dates were all from the early Holocene, but dated to slightly younger than expected in relation to relative sea level curves and the other radiocarbon dates, this batch of dates suggests modern carbon lab contamination. Based on the remaining 21 samples dating to the early Holocene time of occupation around the hearth activity area, and clear stratigraphic layers below the beach surface, there is a high level of confidence for intact deposits with minor disturbance.

Paleopond edge

Stratigraphy from the paleopond edge deposits exhibited clear distinctions between marine, mixed marine and terrestrial, paleosol, and paleopond deposits as detailed in chapters 2 and 4, with an elderberry seed dating to the cultural paleosol at

10,680 cal. BP. There is no indication that the buried and capped intact paleosol in this part of the site has been impacted by recent natural disturbance.

The overall density of seeds, wood artifacts, and other macroflora from the pond edge is high relative to the hearth area. The pond edge itself offers several factors that may have lead to higher levels of deposition and or preservation than other parts of the site. The edge is a relatively protected catchment for waste positioned abruptly adjacent to a high activity area. Continual water saturation and deeper deposition of the cultural layer below compact strata may have protected the deposits through the millennia. A similar pattern is described from the Q^{w}u?g^{w}es site in Washington, where preserved macrofossils were found in strong association with cultural deposits, and following the shoreline structure and where low-oxygen groundwater flowed from a spring (Diedrich and Fullmer 2013:271).

Properties of plant material itself may have lead to over- or underrepresentation of taxa. Elderberry seed coats may have a higher level of durability due to their toxicity (Losey 2003; Martindale and Jurakic 2004) and can survive hundreds of years in non-waterlogged midden matrices (Losey et al. 2003). Salmonberry seed coats also tend to be thicker and larger than many of the other taxa represented, leading to better representation. Despite these qualities leading to differential preservation among taxa, other factors, such as seed and needle rain litter densities from the forest, suggest a similar preservation level in the two sample areas. The forest mat underlying (and mixing with) the cultural layers at the paleopond edge is largely organic woody debris, including highly fragmented large salmonberry stalks, beetle and other insect fragments, termite pellets, and soil mites (see Appendix B). This is suggestive of people clearing and or trampling the area in pursuit of their activities, but not so heavily right at the pond edge as to completely disrupt the humic paleosol beneath. Deposition of material, and relative levels of human activity (compared to a possible living floor of the hearth activity area), and preservation all appear to have lead to high levels of botanical material at the paleopond.

Salmonberry and elderberry dominated the seed assemblage at the pond edge. They were observed as discrete concentrations during field excavations. Salmonberry and red elderberry seeds are common in other sites on the NWC and have been the subject of analyses and interpretation based on spatial distributions (e.g., Croes 2005; Cybulski et al. 1992; Losey et al. 2003; Martindale and Jurakic 2004; Welchel 2005). Their high quantities and low levels of fragmentation are consistent with a berry processing area where human trampling activity may be limited, and where the soft, wet organic-rich sediment may have buffered the seeds and other botanical remains from mechanical damage. Seed quantities were fewer in the lower levels of analyzed sediment, however all levels contained berry seeds. The soft, highly saturated soil matrix and human activity may have been a factor in vertical distribution, as even a single footstep on the pond edge at the time of occupation could impress seeds into lower deposits.

Elderberries contain toxic constituents that usually require cooking prior to consumption. The seeds in particular are somewhat toxic and therefore not generally eaten by people (Turner 1995). Ethnographically, Haida cook the berries into a sauce and then remove the seeds, either by hand or by spitting them out as the cooked berries are eaten whole. Salmonberries, when eaten fresh, were presumably eaten whole with the fruit. However, their association with elderberries is suggestive of mixed processing during the narrow period when both species were ripe. Although salmonberries begin to ripen earlier in the year, they have an approximate two-month fruiting period that overlaps somewhat with elderberries around June, but varies along the NWC. Berry cakes, as a means of processing and preserving berries for winter use is practiced ethnographically all over the coast, however, salmonberries were usually not dried, but were eaten fresh due to their watery composition.

The location of the deposits at the edge of the pond amongst refuse does not seem to indicate a storage area (see chapter 6 for more detailed description of each taxa). Further, the concentrations do not appear to represent excrement, based on the elderberry content and their location in a freshwater body abutting a high activity area. The concentrations could possibly represent contents of entrails from bears that were being brought back to the site and processed (McLaren et al. 2005). Bears do eat elderberries, but the full entrails are unlikely to have been disposed of at the site after butchery was carried out off-site, as suggested by McLaren and colleagues (2005). The seeds most likely represent seeds spat out from immediate consumption of mixed berries or that of processing waste of strained fruit leather type product.

Future excavation at this side of the Kilgii Gwaay site may clarify some of the taphonomic processes and clarify the spatial distribution and extent of the berry processing area as well as artifact and macrofossil deposition.

Overall site context

Seeds present in the two activity areas in relative abundance were salmonberry and elderberry, spruce, and alder. Present in small and equal quantities in both sample areas were hemlock, thimbleberry, bunchberry, and Isoetopsida. Hemlock cones were abundant throughout the site, suggesting a stronger presence at the site than the seed preservation alone represents.

Gaston et al. (2006) identified relationships between decreased vegetation richness and diversity on small islands in Haida Gwaii with heavy deer disturbance. Presently, flowering plants are scarce in the immediate vicinity of the site due to heavy browsing by introduced deer. Berry plants such as salal (*Gaultheria shallon*) and huckle-/blueberry (*Vaccinium* spp.) observed on Ellen Island were rare, only growing in isolated locales such as high tree stumps or rocky outcrops inaccessible to deer. The majority of the salal present on the island was too heavily browsed to produce fruit. A full modern botanical inventory was not carried out while in the field during the years of excavation. However, plant species observed in the immediate vicinity of the shoreline of the site included mature red alder and Pacific crabapple, western redcedar, Sitka spruce, and western hemlock. Mosses dominated the forest floor with some single delight (*Moneses uniflora)* and salal.

Modern disturbance in the archaeobotanical non-tree seed assemblage may be quite minor considering the dearth of seeding berry plants and sedges currently in the local environment. Alder and conifer trees are more likely to represent the modern inclusion of seeds. Since these species are present in both early Holocene and modern forest composition, degree of mixing remains unknowable unless a significant sample is radiocarbon dated. Seeds do not appear to remain preserved in the active beach matrix for long, as there were nearly none present from sampled upper marine beach deposits.

The presence of western redcedar macrofossils and higher prevalence of alder in the hearth activity area may be suggestive of modern seed rain, however hemlock and spruce levels are comparable from both sample areas. The absence of conifer and alder seeds from the control samples suggests relatively rapid deterioration within active beach strata. Based on the overall small amount of western redcedar remains, the poor survival of seeds and other plant material in active beach deposits, and the rare presence of seeding plants due to deer browsing, the extent of modern contamination in the early Holocene deposits seems to be small. Being in the beach subject to regular tidal flushing, and not directly under a seed canopy, or a suitable location for caching by small mammals, the site may contain less modern seed contamination than terrestrial sites that are under an active forest canopy (e.g., Lopinot and Brussel 1982; Orchard and Lyons 2007).

Comparing only charred seeds as evidence for cultural deposition is not appropriate for the Kilgii Gwaay site, as the vast majority of seeds are waterlogged and are not charred. Resolving the degree of modern contamination question would require a thorough radiocarbon dating strategy beyond the scope of this research. Additional studies such as investigations into local shellfish behaviour patterns may shed more insight into taphonomic processes at the site and may help predict future disturbance levels from bioturbation.

Technological implications at the site

The wood artifact assemblage from the Kilgii Gwaay site shows general classes of technology directly dating to this early time. Wood properties between taxa were recognized as reflected in a general species preference for certain classes of technology. Evidence of composite tool use, large-scale splitting and chopping of wood, and fine decorative fiber technology from the site demonstrates diverse human engagement with the plant world. Through the use of these technologies people could have made baskets, nets, cordage, dishes, watercraft, drying racks, textiles, regalia, plank structures, and many other plant based-items seen in more recent times. These data provide implications for NWC culture history, showing that woodworking, an important part of the ancestral Haida toolkit, has carried on, embracing new material and tools to develop the material culture that continues to be recognized in much more recent times.

Wood splitting technology

Split wood technology, in which a maul is typically used to pound wedges into a piece of wood in order to split it apart lengthwise, is a very common practice in Haida Gwaii and along the NWC. Split wood technology is often manifested in western redcedar bentwood boxes, house planks and other structures, and initial stages of canoe-building, et cetera. Western redcedar wood is straight-grained which lends itself very well to splitting, and is considered a cultural keystone species of the NWC (Donald 2003; Garibaldi and Turner 2004). Although there is no dated evidence for western redcedar at the early Holocene component of the site, its presence at the time of occupation cannot yet be ruled out. Macrofossil evidence shows the presence of western redcedar on Haida Gwaii at 9,800 years ago (Lacourse et al. 2012), but pollen suggests it did not become widespread until 4,000-5,000 years ago (Hebda and Mathewes 1984; Mathewes 1991). Nevertheless, split wood technology, Sitka spruce wood in particular, makes up a considerable portion of the wood artifact assemblage at Kilgii Gwaay, signifying the importance of this technology in relation to Sitka spruce in the millennia pre-dating the widespread advent of western redcedar. The early age, diversity, and range from small to large-scale within the split wood assemblage at Kilgii Gwaay means that relationships between technological practices and environmental resources need to be carefully considered. Hebda and Mathewes (1984) suggest a correlation of large-scale wood working in relation to an increased local presence of mature western redcedar on Haida Gwaii. This correlation is often cited as causal in grey literature and broad recounts of NWC culture history (e.g., Davis 2013). However, wood splitting was clearly not a mid-Holocene technological adaptation to western redcedar. If anything, split wood technology appears to be a stable cultural practice over many millennia with Sitka spruce as an earlier cultural keystone species. This suggests a level of continuity of cultural practices that were later subject to ongoing refinement and increased sophistication with the addition of new raw material and tool manufacturing techniques (e.g., ground stone adzes, and then metal woodworking tools).

Wooden wedges and wedge fragments from earlier excavations showed distinct notching where a grommet would have been attached around the poll end. The wood plank showed a wedge mark as further evidence for wood splitting technology. Wedges were mostly made of dense, hard hemlock wood, whereas the plank was of spruce. Most of the wood chips, particularly the large ones, were of spruce, showing that this wood was used in major woodworking. Further north along the coast where cedar does not currently grow, spruce is used to manufacture items such as canoes and building structures (de Laguna 1972). Linguistically, the Haida words for spruce (*k̲aayd* and *k̲iid*) in the Masset and Skidegate dialects are also the general terms for tree (Turner 2010), apparently signifying its early importance.

Composite tools

Two interlocking pieces of a haft provide evidence for the wood handle of a small tool, perhaps for fine woodworking. Two other hafts from earlier excavations show this type of technology in a range of sizes and possible applications. Although no detailed analysis has been done on the lithic artifacts from the site to date, there are a large number of utilized and expediently retouched flakes, some being small and pointed with use wear along one or both margins. Such flake tools, and other unimarginally retouched tools may have been hafted, with the stone bits being replaced when their working edges became exhausted. Further investigations are required to determine the relationships between lithic and wood tool components.

No doubt other types of composite tools were used at the site – a small bone point at Kilgii Gwaay is reminiscent of a late period composite fishhook barb, and other indeterminate artifacts may have been parts of composite tools. The charred wood artifact with two parallel grooves down the side (1325T35C4-1) may have been part of a tool, possibly a harpoon. Further inferences can be made from the faunal assemblage at the site, which would require composite tools to acquire various species of deep-water fish and large mammals.

Stakes

Stakes at Kilgii Gwaay were recovered in situ, indicating small structural remains, perhaps drying or cooking racks or shelters. The six artifacts identified as stakes from all years of excavation ranged between 3 and 4.8 cm in diameter, four of which were from around the hearth activity area. Other early Holocene stakes from Haida Gwaii are known by several moulds within 2 m of a hearth feature at the Richardson Island site (1127T) (Steffen 2006). One stake was from adjacent the paleopond edge. This high activity area with a dense concentration of lithic and wood artifacts and bone is largely unexcavated, and it is likely that there are more stakes in the unexcavated deposits.

Split root technology

Although no basketry was recovered, evidence for split root fiber technology was recovered from the site. A total of 14 peeled and split root fragments are from all years of excavation which likely represent the cut waste ends of basketry or binding material. Earlier artifact analysis categorized the split fragments as split root or withe. I use the general category as it relates to probable technological function. Anatomical analysis did not differentiate between root and branch wood. However, I describe most of the pieces from the 2012 material as root based on the morphological characteristic that, unlike branch wood, root does not have a pithy central core. A spruce root-wrapped bundle of sticks from earlier excavations shows a similar split root technology used for binding wood elements together.

The wood species present within the artifact assemblage are consistent with pollen analyses from the site. Preliminary pollen data at the time of occupation is described generally as a western hemlock, spruce, and pine forest surrounding an open alder, Rosaceae, and herb community in the vicinity of the archaeological site (Fedje et al. 2005). Of note is the identification of bitter cherry, which currently is uncommon on Haida Gwaii, thought in some instances to be a recent introduction (Turner 2010). Some of the Rosaceae pollen from the site may belong to bitter cherry, but is very difficult to distinguish the pollen grains to the genus level (Emily Helmer pers. comm. 2014). For a more detailed discussion see Chapter 6 on Paleoethnobotany.

Site Seasonality

Determining seasonality is an important measure to contextualize and develop a clearer idea of cultural activity at the site. Botanical and faunal remains that show signs of cultural manipulation can be used as seasonal indicators at the site through their annual stages of development. Plant remains are particularly good at determining seasonality since their fruits and cones ripen during predictable seasons, with the mature seeds often preserving archaeologically. Food plants preserved for later use may exhibit patterns that could provide an indication of storage, but these may be more difficult to determine than use of fresh plants.

The faunal assemblage from the site is suggestive of a summer occupation, an interpretation supported by the presence of juvenile sea mammals, at or just after the May to July birthing season (McLaren et al. 2005; Wigen and Sumpter 2003). The seed assemblage further indicates early summer activity. Salmonberry and elderberry overlap in ripening at this time, and salmonberries are often eaten fresh, rather than dried for winter storage due to their watery composition (Turner 1995, 2010).

The range of berry seeds suggests human activity throughout the summer. Availability of ripe salmonberry and elderberry fruit overlaps somewhat with red huckleberry (*Vaccinium parvifolium*) and thimbleberry (*R. parviflorus*), however, peak availabilities are different: salmonberries in May to July, elderberries in mid-July, red huckleberry and thimbleberry in late July to early August. Salal (*Gaultheria shallon*) and bog blueberry (*V. uliginosum*) ripen later, from mid-August to early September. Florence Edenshaw Davidson recalled gathering huckleberries, crabapples (*Malus fusca*), and salal during late summer to early fall (September-October) and cranberries in late fall. " 'My mother, Emma Matthews' mother, and Adam Alfred's mother used to paddle out to Tow Hill to pick crabapples in October…They'd spend days there and get real lots of crabapples'," (Davidson in Blackman 1982: 82). Her mother would then preserve salal, huckleberries, cranberries, blueberries, and crabapples, and cloudberries (*R. chamaemorous*) for winter storage (Blackman 1982: 57; 76).

Many people on the NWC dry salal and other berries for future use. The salal and huckle-/blueberry seeds at the hearth activity area may indicate some degree of collecting activities during mid- to late summer. They could also represent waste from processing berries for winter storage, berries that would have been consumed and then excreted off-site or transported and eaten elsewhere.

Seed rain from conifers and alder occurs mainly through the fall and may be present in similar densities at the two sample areas of the site. They could represent a natural deposition without human activity intervention over the winter, thereby allowing the seeds to seasonally become embedded in the soil matrices.

Gathering of tree, shrub and herbaceous plant roots are featured prominently in Swanton's (1905a, 1905b, 1908) ethnographic records, and some of these have a brief mention of seasonality.

> When spring came, the people abandoned their towns and scattered to camp, where the men fished for halibut, salmon, and on the West Coast for black cod, and hunted black bear, marten, seals sea-lions, etc.; while their wives picked berries, dug roots… (1905a: 71).

Seasonal Haida group dispersal generally took place from March to November (Blackman 1982: 85). Spruce roots offer a less clear picture of seasonality, since roots can be harvested at different times of the year, however the primary time to harvest is in the spring or early summer (e.g., June-July in Alaska) when the bark is easily removed during processing (Dick and Dick 1998). After bark removal and splitting, the roots can be dried and stored for future use at anytime when they are softened and made flexible by soaking them in water (Turner 2010). Therefore they can be harvested at one time and place and deposited at another.

Seasonality may only be one factor in seed taxa representation of Kilgii Gwaay, with other factors such as harvesting, processing, or disposal areas and strategies, variable preservation and sampling structure. In the case of Ozette, not all edible fruit producing species growing in the modern site area were among those represented among the taxa of the archaeobotanical seed assemblage. Notably absent were currants and gooseberries (*Ribes* sp.), coastal strawberry (*Fragaria chiloensis*), Indian plum (*Oemleria cerasiformis*), bunchberries (*Cornus* sp.), and crab apple (*Malus fusca*) (Welchel 2005). Ethnographically consumed, the fruit of these taxa ripen seasonally from spring through autumn (Klinkenberg 2013). At Kilgii Gwaay the strongest evidence for seasonal use is early summer. The botanical and faunal evidence both support this. The site may have been occupied for a longer portion of the year with other plant foods potentially being processed and stored, leaving little in the way of material evidence.

Conclusions to the discussion

Where the material evidence for plant use is presented, we begin to see the level of richness plants played in ancestral Haida lifeways. Composite tool use, woodworking-from large scale to fine detail work, ornamental cordage, and specialized processing of edible berries make tangible the types of daily activities at the site. Unsurprisingly, ancestral Haida used local plant materials according to their inherent qualities. *Prunus emarginata* requires a more open environment as opposed to a closed conifer forest and is a species, along with berry plants, that would have likely grown in particular locales and would have been sought out and brought to the site for use.

Perhaps only general assertions may be made about early Holocene technological woodworking evidence on Haida Gwaii, as not to gloss over 10,000 years of dynamic and nuanced living patterns in the region. Split wood technologies and chopping are widespread practices throughout the globe. These wood and the split spruce root technologies also bear resemblance to recent practices. We still do not know the particular techniques used and how shifts in lithic technologies may have affected overall practices. Croes uses stylistic patterns over space and time as evidence for cultural continuity, despite technological changes (Croes 2003). The types of things being made and their style of manufacture are, in part, what reflect cultural continuity.

The berry seed concentrations are dominated by salmonberry and red elderberry, consistent with other sites over the NWC (e.g. Ozette, Hoko River), and may not necessarily demonstrate continuity of specific Haida cultural practices. It does however speak to the specialized knowledge and practices with regards to the properties of the plants themselves. Further work on the material, such as phosphate and lipid analysis, may help determine how the concentration may have been produced, whether it is processing waste, remains of a preserved berry cake, stored fruits, or from coprolite material.

There is currently not much evidence at Kilgii Gwaay on which to evaluate stylistic continuity or change. However, the site as a whole bears notable similarity in use of flora and fauna to more recent assemblages and is consistent with material in the ethnographic and ethnobotanical literature. The following section will describe each taxon identified from Kilgii Gwaay and discuss it within a physical environmental context and in relation to archaeological and ethnobotanical literature.

Chapter 6 - Paleoethnobotany of Kilgii Gwaay

This chapter provides an overview of the plants present at Kilgii Gwaay. I begin with a few theoretical considerations for paleoethnobotany and a brief overview of aspects of Haida ethnobotany and paleoethnobotany. In the sub-section of *Plants present at Kilgii Gwaay*, I discuss the ecological context and physical properties of each taxon regarding the portions (i.e., seeds or wood) present in the site assemblage. I outline other archaeological examples of each taxon and describe some recent ethnobotanical uses by Haida and other First Nations. Lastly, I draw from this background material to discuss the material at Kilgii Gwaay in relation their environmental and cultural context. I have not provided an extensive archaeological review, but a more complete review can be found in Lepofsky and Lyons (2013).

Paleoethnobotanical and ethnobotanical overview

Haida ethnography and ethnobotany are rich navigational tools for helping to draw comparisons with the archaeobotanical remains at Kilgii Gwaay. General plant usage throughout the NWC tends to share many common practices between different groups of people. These similarities may stem from the inherent edibility, medicinal properties, or physical/structural properties of particular taxa, and are likely to have broad similarities in usage through time as well (Deur and Turner 2005). Because longstanding practices continue to be held by living Haida, I cannot assume that ethnobotanical or ethnographic accounts have ceased. Therefore I use the present tense when describing recent plant use.

More than 80 terrestrial plant species have been documented as used by Haida for food, medicine, technologies, and spiritual and other cultural purposes (Turner 2010) (Table 5). Over 30 plant species have been used as material for technological manufacturing alone (Turner 2010). Prior to recent use of plastic and metal, plants were used in virtually all tools used to procure fish and animal foods. Fishing lines, nets, weirs, hooks, canoes, paddles, shelters, tools and composite tool handles, houses, clothing, matting, and containers are just some of these plant-based technologies. The wide range in technologies highlights the importance of plants in all food procurement and storage, and the embedded knowledge that comes with each specific process. Some of these species do not grow on Haida Gwaii, but are considered valuable trade items. Others were brought to the islands during relatively recent times. Some economically important berry shrubs not present on Haida Gwaii today, but available elsewhere on the coast include: soapberries (*Shepherdia canadensis*), wild raspberries (*Rubus idaeus*) and blackcap raspberries (*Rubus leucodermis*); hazelnuts (*Corylus cornuta*); and blue elderberries (*Sambucus cerulaea*); trees include: black cottonwood (*Populus balsamifera*), paper birch (*Betula papyrifera*), cascara (*Rhamnus purshiana*), true firs (*Abies* spp.), flowering dogwood (*Cornus nuttallii*), and Douglas maple (*Acer glabrum*) (Turner 2010). Based on the taxa represented at Kilgii Gwaay, locally available plants played an important role in human activity.

Ethnobotany can provide insights into resource management and harvesting strategies within seasonal rounds. Preparation and preservation of food, ceremonial items, and raw materials for winter may also provide insight into taxa or portions of material that are present or absent at a particular site or area within a site. Throughout the coast, drying is the most common way to preserve foods such as seaweeds, inner bark, berries and edible roots, basketry materials, and some medicines for winter use.

Cooking (pit-cooking being a common method) and smoking aids preservation by drying and adds flavour to foods. Acidic foods are preserved in water, in wooden boxes or perhaps earlier in leaf-lined pits, and often topped with grease (Turner 2010). These types of food preparation practices should leave deposits of charred plant/fuel remains in the archaeological record. Ceremonial activities may also preserve in the archaeological record, though interpretation of such may be speculative. For example, Swanton (1905a) recorded the preparation activities of Masset hunting-expeditions, where men and women both had specific preparation protocols. Hunters drank salt water and medicine of elderberry root and devil's-club root. The root of an unspecified water lily, likely *Nuphar polysepala,* was also buried in the ashes to cook for (medicinal?) consumption (Turner 1995). A deeper understanding of these types of practices, particularly by local cultural experts, may make them more recognizable in the archaeological record and further inform paleoethnobotanical work.

Although some cultural practices may have reoccurred with a certain level of consistency, others may have changed significantly. The ancient vegetative landscape, though somewhat similar to modern (Fedje and Mathewes 2005; McLaren et al. 2005), may not be analogous, and ancestral Haida may have had different ways of interacting with that environment. Therefore applying ethnobotanical analogies to the archaeological record, particularly to the early period, is best approached within a holistic framework. Haida basket weaver Laura Beaton invaluably shared her expertise of split spruce roots, while co-interpreting the material during fieldwork. She immediately recognized features of a split spruce root based on her experience working with the material – insight about material that transcends time. I offer this thesis for cultural experts to continue to evaluate and interpret. As the site's depth of time is large, the interpretative framework necessitates informed analogy, and all types of expertise will enrich our collective understanding of ancestral Haida plant use.

Ecological frameworks can provide useful considerations to situate interpretations of paleoethnobotanical spatial patterning upon the ancient landscape. For example, an ecological edge is considered an area that is easily accessible from two or more unique ecosystems, has properties of both, and is more biologically diverse than either (Ries et al. 2004; Turner et al. 2003). Ecological edges may be transient or stable edges, examples of the latter being lakesides, beaches, and edges of meadows or wetlands. Temporary ecological edges are areas of disturbance, such as fires, wind thrown vegetation, and flood areas. Most of the plants present in the assemblage at Kilgii Gwaay grow at ecological edges. Humans tend to seek out these fairly predictable types of resource areas (Ries et al. 2004), and strive to maintain these edges through agricultural and land tenure practices in order to increase ecological diversity and resource abundance, and thereby increasing cultural resilience (Turner et al. 2003). Resilience can be defined as: 1) the amount of change a system can undergo and still maintain function and structure; 2) the degree to which a system is capable of self-organization; and 3) the ability to build and increase the capacity for learning and adaptation (Resilience Alliance, 2002 2001). In this way, people not only tend to congregate around stable ecological edges, but also tend to manage the land to reflect temporary ecological edges or disturbance areas. Ecological edges within a social landscape can parallel cultural edge zones of social interaction. Cultural edges are maintained continually and habitually, even if a physical nature of the place is fleeting, and they are where exchanges of social capital – material, ideas, kinship, and language – occur, which lead to increasing an individual family's resilience (Turner et al. 2003).

Ecological edges and cultural edges during the early Holocene in Southern Haida Gwaii would have been expressed as thousands of years of continually moving uphill with the relative sea level rise. As new shoreline ecological edges were created, they provided new resources (fishing locations, lithic raw material and driftwood), while shifting or drowning old ones. The rise in relative sea levels would have had a large and noticeable effect on the landscape, and these changes would have been used to advantage by people living through them (Mackie et al. 2013). The concept of edges thereby draws our attention to types of social, cultural and ecological processes that may provide a human-scale spatiotemporal context to cultural landscapes.

Plants Present at Kilgii Gwaay

In this section, I outline the environmental context and physical characteristics of each taxon identified at the site. I provide an archaeological and ethnobotanical context where possible. Examples I provide are intended to illustrate types of cultural and archaeological engagement with plants, and are by no means exhaustive. See Lepofsky and Lyons (2013) for a more detailed list of taxa recovered at other archaeological sites in coast and interior British Columbia. Where I have been unable to find explicit reference to Haida ethnobotanical use of a certain taxon, I have included regional usage and uses from other places in North America and Eurasia. I use these examples from elsewhere to highlight types of human and taxon-specific relationships that, although not recorded in the ethnobotanical literature, may have played a similar type of role in ancestral Haida lifeways.

***Alnus* sp. (*Alnus rubra* Bong.; *Alnus viridis* [Chaix] DC.) – red alder; green/Sitka alder (Betulaceae)**

One alder wood chip from the pond edge and 38 alder seeds from both sample areas were recovered from the site in 2012.

Environmental context: Red alder (*A. rubra*) and green (or Sitka) alder (*A. viridis*) both occur on Haida Gwaii. Red alder is currently one of the most common deciduous trees in Haida Gwaii (Turner 2010). Red alder is a fast-growing, shade intolerant early successional species that grows in moist woodlands, forests, floodplains and disturbed areas in lowland and montane zones (Douglas et al. 1998a; Klinka et al. 1989). It forms dense stands and is found along streams and other wet areas, often associated with skunk cabbage (*Lysichiton americanus*) (Klinka et al. 1989). Green alder is a deciduous shrub or tree that grows on moist slopes, stream banks, disturbed areas, and wetland areas in all zones (Douglas 1998a). Lichen often covers the bark or branches (Young and Young 1990).

Physical characteristics: Of the deciduous trees on the NWC, only red alder has received much silvicultural study (Brown and Antos 2012). The modern lumber industry values alder as the most important hardwood species of the Pacific Northwest (Plank 1971 in Friedman 2005 [1975]: 173). The wood is moderately light, of intermediate strength and low shock resistance (Bergman 2010). Because it is very soft and easy to carve, but susceptible to decay, it is not favored as material for items requiring high strength or durability. It is tasteless and odorless (Panshin and de Zeeuw 1970: 556), a desirable factor in the use of food vessels and as fuel wood in cooking.

Red alder can grow up to 25 m tall and begin to bear seeds at around 10 years of age. Green alder is a shrub or tree that grows to 5 m tall. Seeds ripen around August to

October and seed dispersal occurs throughout the fall and winter (Young and Young 1992).

Archaeological background: Alder and maple (*Acer* sp.) were the two most abundant hardwoods at the Ozette site in Washington, being used nearly interchangeably for dishes, paddles, and canoe bailers (Friedman 2005:173). Alder charcoal occurred on over half the deposits at the Scowlitz site, likely used for fuel, possibly for smoking fish to impart a pleasant flavor (Lyons 2000).

Ethnobotanical uses: Ethnographically, alder wood is a material used for bowls, spoons, small dishes, masks, rattles, and fuel among the Haida (Turner 1998). Wood charcoal is made into as tattoo ink and the bark is used medicinally, as a disinfectant and as a red to orange dye (Turner 2010). Green alder is considered less coarse than red alder and is used in carving small items such as spoons, small dishes, masks, and rattles (Turner 2010). Along the coast, the genus is highly valued as a flavoring agent for roasting food (HTG 2011:38), and many groups eat the inner bark and cambium fresh or dried for winter use (Turner 1995).

Discussion: Both green and red alder were present at the site at the time of occupation based on pollen analysis from the site. Though the seed morphology tends to vary between species, there is also an overlap in features and therefore I have classified them to genus level only. Wood artifacts from the site were small – from branches or sapling/shrub trunks and could have been from either species. Further anatomical and morphological studies would help in determining the species.

Amaranthaceae: *Atriplex* spp. (cf.) – orache; saltbush

Three Amaranthaceae seeds were recovered from the hearth activity area of the site, and likely represent *Atriplex* spp.

Environmental context: The genus *Atriplex* comprises nearly 200 species with a cosmopolitan distribution. Most of the species are halophytes and grow along the coast or inland saline habitats (USDA 2014). On Haida Gwaii, Gmelin's orache (*A. gmelinii* C.A. Mey.) grows infrequently along the coast on moist to mesic shorelines (Bassett et al. 1983) and common orache (*A. patula)* grows on disturbed mesic areas (Douglas et al. 1998b). Other members of the Chenopodiaceae family include sea blight (*Suaeda calceoliformis* [Hook.] Moq.) and sea asparagus (*Salicornia pacifica* [Standley] A. J. Scott), which occur on beaches and in coastal wet salt marshes (Douglas et al. 1998b).

Physical characteristics: Amaranthaceae are generally weedy herbaceous annuals, sometimes perennials. Their seed is a utricle that is dispersed by wind and animal activities. Seeds often persist on the plant until the following spring.

Archaeological background and ethnobotanical uses: The surface levels of the food processing area at the Q^{w}u?g^{w}es site in Washington contained non-native lambsquarters (*Chenopodium* spp.), reflecting contamination from the present-day nearby plant assemblage. Chenopod seeds dominated the weedy seed assemblage within house pits at the Keatley Creek site on the British Columbia Plateau, but their presence remained undetermined, since they had no ethnographic records of being locally consumed as food (Lepofsky et al. 1996). Sea asparagus (*Salicornia pacifica*) is an intertidal Amaranthaceae that is eaten as a green vegetable, though apparently not consumed by the Haida in the “old days” (Turner 2010:144). The abundant presence Amaranthaceae pollen, likely of sea asparagus, on the robe of Kwäday Dan Ts’ínchi indicates his activity at the marine shore (Hebda et al. 2011).

Discussion: The presence of uncharred chenopod seeds in the hearth activity area may have been cultural or deposited naturally when the site was not in active occupation. Low quantities may reflect incidental deposition. Since many species are salt tolerant, their presence may represent the transition period of the site as it became a lagoon, particularly in the western portion of the site, or possibly from recent contamination.

Asteraceae – Aster family

Twelve seeds were recovered from the site, representing two types of Asteraceae. Nine of type I were from the edge of the pond, while three of type II were from the hearth activity area.

Environmental context and physical characteristics: The family of Asteraceae contains ca. 23,000 species worldwide. This cosmopolitan family is well adapted to temperate climates, and is the third largest vascular plant family on Haida Gwaii represented by 42 species (Calder and Taylor 1968). Several are weedy, growing in disturbed soils, while others are of economic importance on the coast (Pojar and McKinnon 1994). Asteraceae are diverse in plant structure, often herbaceous and are with an inflorescence characterized by a composite head. Fruit are achenes, usually dry and thick, and accompanied by a pappus to aid in wind dispersal.

Archaeological background and ethnobotanical uses: Asteraceae seeds have been recovered on Vancouver Island and the lower Mainland in southwest BC (Golder 2007; Schaepe et al. 2005), including a single Asteraceae seed was recovered from a hearth feature at the Scowlitz Site (Bank 1953: 427). Some species of Asteraceae have Haida uses. Yarrow (*Achillea milefolium* L.), Sand-bur ragweed (*Ambrosia chamissonis* [Less.] Greene), and tallow beach-tansy (*Tanacetum buronense* Nutt.) are used for medicine (Turner 2010).

Discussion: The presence of Asteraceae at the site, particularly by the pond edge, could indicate plants growing in the area. Though some Asteraceae could have been used at the site, discussion is limited at a family level identification.

Carex spp. – sedge (Cyperaceae)

Four sedge seeds were identified from the hearth activity area of the site.

Environmental context and physical characteristics: Sedges are common in moist or wet areas such as meadows, along lake margins, and brackish coastal marshes. Grass-like in appearance, sedges often have elongate leaves and triangular (or rounded) stems that produce small spikes. Seeds are present from spring to summer months (Calder and Taylor 1968).

Archaeological background and ethnobotanical uses: *Carex* spp. seeds have been found at archaeological sites in BC, often in minor quantities, represented by a few seeds (e.g. Rousseau et al. 2003; Lepofsky 2000; Lepofsky et al. 1996). The fibers of the plants are used in basketry and the archaeological presence of these fibers is not well represented archaeologically on the NWC. Carex is often used with some interchangeability in basketry by First Nations, especially if growing in the same area. Slough sedge (*C. obnupta*), Lyngby's sedge (*C. lyngbyei*), and small-flowered bulrush (*Scirpus microcarpus*) are commonly used on the NWC by Nuu-chah-nulth, Makah, and Coast Salish groups for twined baskets (Turner 1998; 2010).

Discussion: Low quantities of many of the seed types represented at the hearth area leave much room for interpretation. Sedges could have been present at the site and incidentally brought to the hearth activity area by people or natural processes. The overall low level of seed representation in this area likely obscures many of the cultural processes. Sedge leaves might have been useful in textile or basketry production and repair.

Chara sp. – Charophyte, stonewort (Characeae)

One oospore was collected from the sediment samples at the edge of the pond.

Environmental context: Charophytes commonly grow in water with low nutrient levels to moderately eutrophic, giving way to angiosperms in turbid water bodies (Hellson 1974; Moerman 2003). Four species of *Chara* are recorded in British Columbia: *C. braunii*, *C. canescens*, *C. globularis*, and *C. vulgaris* (Blindow 1992; Kufel and Kufel 2002). They are found in shallow to deeper water in ponds, lakes, and rivers, and slightly brackish to saline water. They can grow in isolated clumps or in thick mats in shallow water

(Klinkenberg 2013). For massive occurrence in lakes, most stoneworts require hard waters of relatively high alkalinity (Wood 1967).

Physical characteristics: *Chara* spp. are mat-forming filamentous green algae. Their main body is generally stiff and composed of internodes and nodes from where whorls of branchlets and side branches grow. The female reproductive oogonia form at these axis. The oogonia mature into darkened oospores and form a spirally-ridged wall (Blindow 1992; Kufel and Kufel 2002).

Archaeological background: Unknown.

Ethnobotanical uses: Stoneworts have few recorded uses. In parts of North America, the genus is used for medicinal purposes. The Mamaceqtaw in Wisconsin use *C. fragilis* or *C. vulgaris* for kidney troubles (Cartajena and Carmona 2009). The Navajo use the genus in the treatment of spider bites (Smith 2014 [ca. 1924]).

Discussion: Stoneworts could have been present at the site prior to occupation leading to the time of marine transgression, as this genus can occur in fresh or brackish waters. The genus possesses a few potentially useful properties. However, due to its proximity at the pond, it was likely growing at the site and may have become incorporated in to the cultural deposits through human activity.

Conioselinum gmelinii (Cham. & Schltdl.) Steud. – Pacific hemlock-parsley (Apiaceae)

Eighteen seeds were recovered from the edge of the pond.

Environmental context and physical characteristics: Wild carrot, or Pacific hemlock-parsley, is common along the coast in BC. It grows on moist to mesic coastal bluffs, sandy beaches, tidal marshes, and lowland bog woodlands (Klinka 1989; Douglas et al.

1998a). An herbaceous perennial, it has a long taproot, and feathery leaves. A plant produces flowers and seeds on at least one compound umbel in 8-30 small, compact heads (Douglas et al. 1998a).

Archaeological background: Unknown.

Ethnobotanical uses: The roots of Pacific hemlock-parsley are eaten throughout the coast (Turner 1995). Haida boil or roast the roots, sometimes eating them with grease. They are also mashed and dried into cakes (Turner 2010). Harvesters reportedly marked plants in the summer and then dug up the roots the following spring before the leaves sprouted, often with the larger roots harvested while the smaller ones were left to grow (Turner 1998). The vegetative parts of the plant have uses along the NWC as external medicine in sweatbaths for arthritis, rheumatism, and general weakness (Compton 1993:83; Turner 1995), and leaf tea for sore throats (Turner and Bell 1973:266).

Discussion: The seeds at the site apparently represent plants that were not harvested for their roots and were left to grow. They may have been growing at the edge of the pond or harvested when the plants were seeding. There are no written accounts of seed use by Haida, however, their usage at the site cannot be ruled out.

***Cornus* sp. (*Cornus canadensis* L.; *Cornus unalaschkensis* Ledeb.) – bunchberry; Alaskan bunchberry (Cornaceae)**

Two seeds were identified, one from the hearth area and one from the pond edge.

Environmental context: Bunchberry commonly grows in moist to mesic coniferous forests and openings throughout BC. It often grows on decaying wood, peaty wetland prominences, and the mossy forest understory (Douglas et al. 1998b; Klinka et al. 1989; Lesher and Henderson 1998). Three species of bunchberry occur in British Columbia: *C. canadensis*, *C. suecica*, and *C. unalaschkensis*. C. *unalaschkensis* is derived from a hybrid of the other two. All three species are very similar in appearance, often requiring microscopic analysis of the plant structure to identify (Griffiths and Ganders 1983).

Physical characteristics: Bunchberry is an evergreen herbaceous perennial that produces clusters of edible red berries, each with a hard central seed. Fruit ripens around August and seeds dispersal occurs up to October (Young and Young 1992).

Archaeological background*:* A single bunchberry seed was recovered from the Scowlitz site in southwest BC and its low presence was attributed to secondary economic importance and taphonomic processes (Lyons 2000).

Ethnobotanical uses: Bunchberries are eaten fresh, dried and mixed with grease throughout the coast (Compton 1993; Gunther 1973; Turner and Bell 1973; Turner and Efrat 1982). The Haida also sometimes steam and preserve them in water and grease for winter use (Turner 1995). The Kaigani Haida in Alaska eat the seeds along with the berries (Turner 2010). The leaves of the plant have medicinal applications for pain relief (Smith 1929).

Discussion: The presence of the bunchberry seeds does not show a clear indication of their cultural use at the site. The plants have been growing in the vicinity especially at the edge of the pond where they could have been protected from human activity. However, their presence in the activity areas may suggest human involvement in deposition. As the seeds are relatively large, they could have been spat out during casual consumption or represent other wayward berry waste. If the deposition is cultural, the presence of the seed may indicate human activity at the site in later summer or early fall.

Gaultheria shallon Pursh – salal (Ericaceae)

Salal seeds were the third most common berry seed from the hearth activity area of the site, represented by 28 seeds. The hearth area was the only portion of site containing salal seeds.

Environmental context: Salal is a very common coastal shrub that often grows in dense thickets in open canopy coniferous forests with nitrogen-poor soils. In nutrient–rich and or wet forests and bogs it tends to be restricted to decaying coniferous wood or topographic prominences (Douglas et al. 1999b; Klinka et al. 1989). Its growth is sporadic in shaded immature, closed-canopy stands (Vance 2001).

Physical characteristics: Salal is a spreading evergreen shrub that can reach up to 3 m in height. Fruit generally ripens from August to October (Tirmenstein 1990a). The degree that seeds persist as a seed bank in the soil is seemingly very low under natural conditions. A seed banking study from a Douglas-fir (*Pseudotsuga menziesii*) forest in Maple Ridge BC, recovered one salal seed from 24.8 L of surface soil (0-10 cm dbs) (Kellman 1970).

Archaeological background: Seven charred salal seeds were recovered from two of three late Holocene midden sites in Haida Gwaii, which were interpreted as possibly being introduced through harvesting of salal for food. Two uncharred seeds were possibly deposited through more recent seed rain (Lepofsky 2004; Lyons 2000; Lyons and Orchard 2007). The seed category of salal/*Vaccinium* was the most abundant seed type at the Ozette site in Washington, likely representing berry cakes preserved for storage (Welchel 2005). At the Hoko River Rockshelter site, their seed presence was determined to not be a strong indicator of seasonality, based the widespread preservation practices throughout the NWC prominently represented in the ethnographic literature.

Ethnobotanical uses: Salal berries are widely eaten along the coast, usually gathered in late summer when berries are ripe (Blackman 1982: 76). They are often mashed, cooked and dried into cakes for storage to eat throughout winter, often with grease. The berries are sometimes used in cooking with salmon eggs. The leaves are useful as a household item to separate layers of preserved fish [and seaweed] and to surround food in cooking pits. The leaves and shoots also have medicinal applications (Turner 2010).

Discussion: The low quantity of salal seed in the hearth activity area is consistent with an earlier summer occupation, during which the berries were not generally ripe yet, or suggestive of a processing area away from this portion of the camp. However, if people were processing salal at the site, one might expect to see berries at the edge of the paleopond, where the other berry processing was occurring, as observed at Ozette and Hoko River sites (Welchel 2005; Croes 2005). If salal berry processing did occur at Kilgii Gwaay, it was done in a specialized manner, different from salmonberry and elderberry, as no salal seeds were found from the pond edge. The presence at the hearth activity area may represent a few isolated early-ripening berries brought to the area, or possibly recent contamination into the early cultural component. The low quantity of seeds is consistent with eating the entire berry, either fresh or processed and disposing the seeds as waste elsewhere. Preservation practices of the berries as described ethnographically would tend to not leave a strong archaeological presence, thus being a poor indicator for seasonality.

Isoetopsida: *Isoëtes* sp.*;* *Selaginella* sp. (L.) P. Beauv. ex Mart. & Schrank (cf.) – quillwort; spikemoss *(*Isoetaceae; Selaginellaceae)

Two Isoetopsida megaspores were recovered from the Kilgii Gwaay site, one from each sample area.

Environmental context: Quillworts (*Isoëtes* spp.) are aquatic or seasonal terrestrial plants that grow in permanent or temporary bodies of water or water-saturated soil; some species are submerged or emergent in lakes, ponds, streams, estuaries, bogs, or perennially wet soil, while others are temporary aquatics that go into dormancy when conditions become dry (Douglas et al. 2001). There are eight species of quillwort in

British Columbia, of which four currently are recorded on Haida Gwaii: *I. flettii* (A. A. Eaton) N. Pfeiff., *I. maritima* Underw. *I. occidentalis* L.F. Hend., *I. tenella* Lohman (Klinkenberg 2013). Spikemoss (*Selaginella* spp.) grows in wet meadows, peat bogs or boggy lakeshores. It is present on Haida Gwaii, though generally infrequent throughout BC (Klinkenberg 2013).

Physical characteristics: The class of Isoetopsida creates two types of reproductive spores: female megaspores and male microspores. The megaspores are approximately 0.5mm in diameter and distinctly round with three ridges coming to a point on one side. These tend to ripen from August into the fall for most New England species of quillwort. When they are immature, the megaspores often lack the surface detail needed for species identification. (Eaton [1900], Kott and Britton [1983] in Taylor et al. 1993)

Archaeological background and ethnobotanical uses: Wallace's spikemoss (*Selaginella wallacei*) pollen was recorded in small quantities from late Holocene deposits at a pond at SGang Gwaay, southern Haida Gwaii (Lacourse et al. 2007). Species within the *Selaginella* genus have uses in North America for medicine and famine food (e.g., Godwin 1984).

Discussion: The megaspores present at the site suggest natural occurrence in the wet soils or pond area of the site. Presence in the cultural areas could be a result of human activity in the vicinity or seasonal fluctuations in water body levels.

Juncus spp. – rush (Juncaceae)

At least four *Juncus* sp. seeds were recovered from the edge of the pond, while the majority (n = 13) was from a small exploratory sample from EU 35, in the low-lying area towards the pond from the hearth activity area.

Environmental context: Fourteen species of *Juncus* are recorded from Haida Gwaii: *J. drummondii* E. May*; J. filiformis* L.*; J. effusus* L.*; J. lesueurii* Bol.*; J. balticus* Willd., *J.*

bufonius L.*; J. triglumis* L.*; J. mertensianus* Bong.*; J. falcatus* E. May*; J. ensifolius* Wikstr.*; J. tenuis* Willd.*; J. supiniformis* Engelm.*; J. alpinoarticulatus* Chaix*;* and *J. articulatus* L. (Calder and Taylor 1968). Of these, based on their presence in disturbed camp areas, *J. tenuis and J. bufonius* are likely to be recent introductions to the islands (Griffiths and Ganders 1983).

The species most likely to represent the seeds from the site are described in more detail. Common rush (*J. effusus*) occurs in moist to wet disturbed open clearings, forest margins, marshes and peat bogs. Commonly associated with Carex sp., it grows on wet sites with exposed mineral soil and a fluctuating groundwater table (Klinka et al. 1989). Baltic rush (*J. balticus*) occurs at lakeshores, sandy river bars, streambanks, and mixed forests and shrub- grasslands (Douglas et al. 2001). It tolerates the salinity in salt marshes and salt-freshwater transition zones and is a dominant species along with Pacific silverweed (*Potentilla anserina* ssp. *pacifica*) on the west coast of Vancouver Island (Hauser 2005). Spreading rush (*J. supiniformis*) favors wet mud, shallow water, lakeshores, and open peat bogs (Douglas et al. 2001).

Physical characteristics: Baltic rush grows in small clusters up to 1.1 m tall, reaching its maximum height by early summer. It seeds by mid- to late summer, fruiting abundantly each year though seed quantity varies among populations. Its seedbank is persistent with dispersal occurring largely through wind (Hauser 2005). Spreading rush is often submerged with erect or spreading stalks 15-75 cm long (Douglas et al. 2001).

Archaeological background: Although *Juncus* sp. Seeds have been recorded from archaeological contexts in other parts of the globe, archaeological evidence on the NWC is unknown to my knowledge.

Ethnobotanical uses: Different types of rushes are distinguished among the Haida, although not necessarily distinguished by name. Only one*, J. effusus,* is recorded as being used in basket weaving among the Haida but is considered quite brittle (Turner 2010). Elsewhere on the coast and in North America, rushes are used for binding and for temporary or practice basketry (Baker 1981; Turner 1998; Turner et al. 1983), and the young shoots were eaten fresh (Gunther 1973; Steward 1933).

Discussion: Given the two locations of the seeds in relation to the site, the plants could have been growing locally. The non-seed-bearing parts of the plant could have been used as young shoots or raw material throughout its growing period.

Lonicera involucrata (?)– black twinberry (Caprifoliaceae)

One possible black twinberry seed was recovered from the edge of the paleopond at Kilgii Gwaay.

Environmental context: Black twinberry grows in moist forests and thickets in the coastal lowland, steppe and montane zones (Douglas et al. 1998b). It grows in nitrogen-rich moist to wet water collecting areas, such as floodplains, stream edges or fens (Klinka et al. 1989).

Physical characteristics: Black twinberry is a deciduous shrub with four-angled twigs, growing to approximately 5 m in height. The double yellow flowers and subsequent paired black fruit are a distinguishing feature of the plant.

Archaeological background and ethnobotanical uses: The berries are not considered edible for humans, but for crows and ravens (Turner 2010). Pollen records show a presence of the species as old as 1800 years on SGang Gwaay (Anthony Island) from the Nan Sdins village site and from a meadow at the south end of the village (Hebda et al. 2005). Interestingly, Swanton (1905b:52-57) describes the use of black twinberry for gambling sticks at the Nan Sdins village on SGang Gwaay, drawing a local parallel to the archaeological presence at the site.

Discussion: The possible presence of this species at the site is likely indicates human activity at the site, whether by creating a disturbed area that would facilitate the growth of the plant, or through direct usage of the plant itself.

Menziesia ferruginea Sm. – false azalea (Ericaceae)

Trace presence comprising of one capsule was identified from the edge of the pond at Kilgii Gwaay.

Environmental context: False azalea is a common deciduous shrub that grows in dry to wet forests of BC in nitrogen-poor soils or decaying coniferous stumps where soils are rich in nutrients (Douglas et al. 1999b; Klinka et al. 1989).

Physical characteristics: False azalea is a woody ericaceous shrub that grows up to 2 m in height, and not unlike woodier *Vaccinium* spp., such as huckleberry, in general appearance. False azalea does not produce edible berries, but fibrous dehiscent capsules that are lance to egg-shaped (Douglas et al. 1999b). Plants generally begin to flower from late May and capsules mature in July and August (Viereck 2007).

Archaeological background: False azalea was represented in the artifact assemblage from Ozette, though not a widely used material. It was used in several types of items that were more commonly made with other wood types, the one exception being lance heads, which were dominated by false azalea in raw material type (Welchel 2005).

Ethnobotanical uses: False azalea is a highly respected plant by Haida. It is used in female puberty rights, the charcoal used for tattooing, and the wood placed with corpses for protection by Haida (Turner 2010). Leaves and bark serve as physical and spiritual medicine elsewhere along the coast (Gunther 1973; Turner and Bell 1973; Turner and Efrat 1982; Turner et al. 1983). The Quileute and Makah of Washington weave the twigs together with cedar as mats for canoe covers and grills on the bottom of canoes (Gunther 1973). The plant is also used for children’s toys (Turner et al. 1983).

Discussion: The capsule from the edge of the pond was immature and therefore could have been broken off the plant sometime around early summer or could have aborted before reaching maturity. It is likely the plant would have been growing at the site with potential implications for use or trampling by human activity. Because only one immature capsule was identified, its potential for interpretation is limited.

Picea sitchensis **(Bong.) Carrière – Sitka spruce (Pinaceae)**

Spruce seeds were the third most common type at the site after salmonberry and elderberry seeds. Spruce cones, needles, and wood fragments were also abundant at the site. 30 wood artifacts in the assemblage were made from spruce.

Environmental context: Sitka spruce is a coastal species seldom found far inland from the ocean. It requires the humid growing conditions provided by moist maritime air and summer fog. Cones are produced occasionally prior to 20 years of tree age, but stands are usually considered to begin cone bearing between 20 to 40 years of age (Harris 1990).

Physical characteristics: Sitka spruce has a high strength-to-weight ratio and is valued in the modern lumber industry for being a strong, yet lightweight wood which does not splinter easily on impact (Peattie 1953). These qualities were especially valued in the manufacture of aeroplanes during WWI. The wood texture is relatively fine and uniform, generally with a straight grain and no distinctive taste or odor (Welchel 2005: 155). The seeds ripen from August to September and disperse throughout the winter from October onwards (Young and Young 1992).

Archaeological background: Spruce root technologies are evident from the middle Holocene from sites in Alaska, including netting at the Lanaak site on Baranof Island (Bernick 1999), and a 6,100-year-old spruce root basketry fragment preserved in a bank of the Thorne River, Prince of Whales Island. The basketry piece shows the same manufacturing techniques that are used among modern Tlingit basket makers (Croes 2001). At the Hoko River site in Washington, thin cordage made from split spruce was abundant, likely reflecting its use in sewing of tule mats (Croes 1980; Bernick 1983, 1989). Certain artifact categories, such as wedges, require wood with strong compression strength. People at Ozette primarily used spruce wood for the manufacture of wedge, but carefully selected the compression wood portions for better compression strength and durability (Welchel 2005: 210).

Ethnobotanical uses: “This is the commonest Haida tree, the word for spruce and that for tree being, indeed, identical (*k̲aayd* and *k̲iid* [Turner 2010]),” (Swanton 1905b: 234). Haida have a history of broad usages for spruce. These include cod and halibut hooks from knots and branches, split house boards from trunks, salmon roasting splints, and fuel wood that produces smoke that does not adversely affect the flavour of food. Spruce wood is occasionally used to make spoons and boxes (Turner 2010). Like hemlock, the inner bark is scraped in late May to June, and eaten fresh or dried for winter use, and the pitch is chewed as a gum or medicine (Turner 2010; 1995). According to Chief Ernie Wilson (Niis Wes), long ago Haida used spruce planks for their houses because spruce was light, strong, and easy to split straight (Barbara Wilson [Kii’iljuus], pers. comm., 2014; Turner 2014).

The roots are used in basketry, hats, nets, sewing wood, rope, and fishing lines. In order to obtain basketry material, the roots are harvested in early summer from areas with a sandy soil matrix (Turner 1998). In the story A-Slender-One-who-was-Given-Away, the chief’s slave had spruce root in his tackle box from repairing halibut hooks (Swanton1905b:153). The story of Those-Who-were-Abandoned-at-Stasqa’os mentions spruce roots being collected after winter “when the snow was gone” (Swanton 1905b: 290). Florence Edenshaw Davidson and her mother would collect and process spruce roots in May then tie them and store them in boxes. Her mother would then weave baskets and hats “all winter long” (Blackman 1982: 86).

Discussion: Widespread use of spruce is evident at the Kilgii Gwaay site, represented by 30 wood artifacts, constituting half of the identified pieces. Most of these were wood chips, split root, and split wood. Although many of the spruce remains are debitage, the large wood chips and split plank are suggestive of large-scale woodworking, and the cordage and split roots demonstrate differential use of different parts of the tree. Spruce needles and cones were present at the site, likely representing natural deposition and in some cases where the needles were burnt, fuel wood or burning as a means of disposal of branches.

Spruce wood, which is light and durable is often used similarly to red cedar, particularly in areas where cedar does not grow. Tlingit spruce dugout canoes were typically used for hunting, fishing, and travelling - usually accommodating approximately six people (de Laguna 1972). This type of usage may point to a longstanding practice of pre-cedar dugout canoe carving throughout the NWC.

Prunus emarginata (Douglas ex Hook.) D. Dietr. – Bitter cherry (Rosaceae)

One bitter cherry wood artifact was recovered from the lower edge of the paleopond.

Environmental context: Bitter cherry is an early-successional tree ranging from California to British Columbia east across the Rocky Mountain Range (Little 1976; Taylor and Taylor 1981). Three recorded specimens have been collected from Haida Gwaii. One of which is a UBC herbarium specimen of the coastal subspecies *P. emarginata* ssp. *mollis* from a rocky bluff at the historic Haida village of T'aanu Llnagaay (Tanu) (Douglas 1999a). Other specimens collected near roadsides may represent recent introductions to Haida Gwaii (Turner 2010) or reflect a sparse local population. Young bitter cherry can become locally abundant in open areas (Rose et al. 2006). During succession, Bitter cherry is typically overtopped first by red alder and later by slower-growing conifers, and eventually dies out of the stand (Oliver and Larson 1990). Bitter cherry is usually a short-lived species, growing for ca. 30 years (Lutz and Halpern 2006 in Brown and Antos 2012), but can reach 100 years in age (Oakley and Franklin 1998). The species is generally shade intolerant, growing in sparse woods, riparian sites, and open areas where there is often evidence of past disturbance. Over-browsing by deer decreases its prevalence (Esser 1995).

Physical characteristics: The wood of bitter cherry is close-grained, soft, and brittle. The surface takes a high polish and is therefore sometimes used in modern furnishings (Elias 2000). The bitter cherry fruit ripen from July to August with seed dispersal occurring until September (Esser 1995).

Archaeological background: Bitter cherry was the third most abundant charcoal type that was identified at the Qʷu?gʷes site in Washington. Despite the abundance of the species as a fuel wood, only one seed was recovered from a column sample at the site (Diedrich 2013).

Ethnobotanical uses: Bitter cherry is used widely on the NWC for its bark to make bags, nets and lines, to decorate baskets, wrap joints of composite fishing gear, tie splints for broken bones, and to bind bows for strength and decoration (Steedman 1930; Turner 1998; Turner and Efrat 1982). The wood is used for fuel and as a friction fire starter drill (Turner and Bell 1971). Within its habitat range, people have carved small items, such as throwing game darts, handles, salmon stretchers, and tongs (Compton 1993; Turner 1998). Coastal Peoples generally do not eat the berries due to their bitter taste and difficulty to harvest (Turner 1995).

Discussion: The wood artifact from the site was finely shaped with smooth, straight beveled edges, suggesting an artifact of a finished quality. No bitter cherry bark was identified at the site. Further, detailed macrobotanical analysis would be valuable in determining the taxa of material such as small bark fragments. One piece of charcoal from near the hearth activity area was identified to Rosaceae, but no seeds or other evidence of *Prunus* sp. were identified. It is possible the species was selectively sought out as a raw material and brought to the site rather than growing locally.

Rubus parviflorus Nutt. – thimbleberry (Rosaceae)

Four thimbleberry seeds were recovered from the site: two from pond edge deposits and two from the hearth activity area.

Environmental context: Thimbleberries often grow in thickets in moist to mesic open forests, stream edges, disturbed areas such as roadsides form subalpine to coastal areas (Douglas et al. 1999a; Klinka et al. 1989). Thimbleberry occurs on nitrogen-rich soils often associated with red alder, salmonberry, elderberry, fireweed (*Epilobium angustifolium*), lady fern (*Athyrium filix-femina*), devil's club (*Oplopanax horridus*), twisted stalk (*Streptopus lanceolatus*), and foam flower (*Tiarella trifoliata*) (Klinka et al. 1989).

Physical characteristics: The berries ripen slightly later in the summer than salmonberry (July- September), though they do overlap somewhat (Gucker 2012). The fruits readily fall off the plant when ripe (Turner 2010).

Archaeological background: At the Hoko River rock shelter site, thimbleberry seeds represent the second largest seed quantity after elderberry, suggestive of a mid-summer occupation at the rockshelter (Croes 2005). At Ozette, a small fraction (<1%) of the *Rubus* spp. seeds were thought to possibly be thimbleberry based on their size (Welchel 2005; see also, Koppert 1930: 83). *Rubus* spp. seeds from archaeological deposits are not always determined to species (e.g. Orchard and Lyons 2007, Richie 2010), since several morphological features overlap between species (Wada 2009). See appendix B for diagnostic attributes between *R. parviflorus* and *R. spectabilis*.

Ethnobotanical uses: Haida eat the shoots in spring and the berries are often dried or stored in grease for later consumption. The leaves are used as basket liners and covers for steam-cooked food and for wiping fish (Turner 2010). The berries are eaten and leaves used medicinally throughout the coast (Welchel 2005). The Kwakwaka'wakw pick the berries with their stems when unripe, then let them specially ripen in a container (Turner 1998).

Discussion: The small, but even distribution and presence of thimbleberry at the site may reflect differences in consumption practices among the ancestral Haida, and/or a nuanced reflection of summer seasonality at the site. As an often much drier fruit than salmonberry, it may have been subject to differential processing and consumption practices. The fruit of thimbleberry, though somewhat smaller and drier than salmonberry would be more difficult to separate from the seeds if processed, and likely would have been consumed fresh or preserved with the seeds. Given this possibility, the low presence at the site would be expected of berries consumed by people and excreted off-site. Thimbleberries ripen over a longer season, but with only a few ripening at a time and quickly falling off the plant, and the low presence of seeds at the site could reflect lower harvested quanties.

Rubus spectabilis **Pursh – salmonberry (Rosaceae)**

Salmonberry seeds were the most abundant taxon at the site, with 6,536 seeds and seed fragments represented. The vast majority of the seeds came from the concentrations at the edge of the paleopond. Abundant salmonberry stalk fragments were also observed at the pond edge, with three anatomically identified to species.

Environmental context: The *Rubus* genus is cosmopolitan, represented by ~750 species and on every continent except Antarctica (Hummer 1996; Wada 2009). On Haida Gwaii, the species include: salmonberry (*R. spectabilis*), thimbleberry (*R. parviflorus*), cloudberry (*R. chamaemorous* L.*)*, and five-leaved bramble (*R. pedatus* Sm.). A single specimen of trailing blackberry (*R. ursinus* Cham. & Schltdl.) was recorded in Haida Gwaii in 1878 by George Dawson (Calder and Taylor 1968; Douglas 1999a; Klinkenberg 2013). Salmonberry commonly grows along the coast in moist to wet forests, swamps and stream banks in nitrogen-rich soils, and is an early successional species in a variety of disturbed areas (Douglas 1999a; et al.; Klinka et al. 1989; Tirmenstein 1989).

Physical characteristics: Salmonberries are deciduous shrubs that can grow up to 4 m in height. They often form large, dense thickets (Pojar and MacKinnon 1994). The shrubs can regenerate quickly through rhizome shoots and fallen woody cane stalks. Flowers bloom reddish purple in early spring. The yellowish, red, or purple fruit is made up of many small glabrous drupelets forming a "berry" that is 1-2 cm in length (Hitchcock and Cronquist 1964; Tirmenstein 1989). Salmonberry fruits ripen during May-July, and are among the earliest of the berries to produce (Turner 1998).

Archaeological background: *Rubus* species are widely distributed through the archaeological record in North America, reflecting the overall prominence of the genus (Schaefe 2012). Salmonberry seeds are present in large quantities at a few sites on the NWC, for example, at the Hoko River wet site suggestive of an earlier spring/summer occupation with halibut fishing and dominance of salmonberry. At Ozette, salmonberry and elderberry were both well-represented through their seeds, though varied greatly in percentage in different houses throughout the site (Welchel 2005). At the Scowlitz site in southwestern BC, *Rubus* seeds were recovered from nearly half of all seed deposit samples, in low numbers for each case (Lyons 2000). At the Hoko River rock shelter, salmonberries were present, but in low quantities, compared with presence of other berry seeds suggestive of later summer occupation (Croes 2005; Ecklund-Johnson 1984). Usually only a few *Rubus* spp. seeds are found at time at archaeological sites in places such as the Midwest. A concentration of over 600 seeds was found in two coprolites in Salts Cave in Kentucky (Yarnell 1969: 42). The rarity of seeds at many sites could indicate that the fruits were being consumed in late spring to early summer and deposited as waste elsewhere (Schaefe 2012: 47; Yarnell 1969).

Ethnobotanical uses: Along the NWC, salmonberries are usually eaten fresh in early summer, since they tend to be watery. They are, however, also sometimes dried or stored in grease and may have been mixed with elderberries in this type of preparation (Turner 1995; Compton 1993). The young shoots are harvested in the spring and eaten raw or stored in grease (Turner 2010). The leaves are used as basket liners and covers for steam-cooked food and for wiping fish. The stalks are used as straightening reinforcements for cedar roofing and for throwing spears in games (Swanton 1905a: 60). *Rubus* spp. stalks are used elsewhere on the coast as roasting tongs (Koppert 1930: 83). Various parts of the plant have properties used in cosmetics and medicine (Smith 1929; Turner 1973; Turner and Bell 1971, 1973; Gunther 1973).

Discussion: The berry concentrations at the edge of the paleopond are primarily salmonberry and red elderberry and they are described together in the discussion chapter, (page 83). The salmonberry stalks at the pond edge were fragmented and could have been waste material like the spruce root ends. They also could have been from plants growing in the vicinity that were razed by people and resulting in highly fragmented stalks being trampled into the organic-rich paleosol. Abundance of stalks may be suggestive of having been managed by people through harvesting of the green shoots if site was occupied that early in the season, and/or through clearing at the pond edge, as stands can be diminished by cutting in June-July with plants recovering the next spring (Oleskevichi et al. 1996).

***Sambucus racemosa* L. – red elderberry (Caprifoliaceae)**

Red elderberry seeds were the second most abundant seed type at the site and the most abundant seed type in the hearth activity. A total of 5005 seeds and seed fragments were identified, the vast majority were from the edge of the pond.

Environmental context: Red elderberry is the only species of the *Sambucus* genus that is native to Haida Gwaii (Gill 1983; Gunther 1973; Welchel 2005). It is found in meadows, stream-banks, grasslands, shrubby areas, disturbed areas in lowland, steppe and mountain forests (Calder and Taylor 1968). It grows in moist nitrogen-rich soils and is indicative of rapid decomposition of forest floor debris (Klinka et al. 1989).

Physical characteristics: Red elderberry is a deciduous shrub growing up to 6 m tall (Douglas et al. 1998b). Most parts of the plant contain cyanide-producing glycosides

(Pojar and MacKinnon 1994). Fruits ripen from June to August in coastal BC (Fryer 2008). The seed coats are durable and contain toxins, which may account for their persistence in some forest soils. Studies on *Sambucus* spp. preservation in soil seed banks in North America have shown no correlation to abundance of seeds and presence of the genus in the living forest. A study from Maple Ridge, BC that measured the viability of seeds within the top 10 cm of forest soil, resulting in fewer than one viable seed of all taxa per liter of sediment. Elderberry, the second most common viable seed after red alder, represented less than 10% of this total (Kellman 1970).

Archaeological background: Elderberry has been identified in several other archaeological sites on the NWC (Douglas et al. 2000). In Ts'msyen [Tsimshian] territory, Martin and Jurakic (2004) spatially analyzed distributions of elderberry and other berry seeds at several sites. In this context, they hypothesized the economic organization of elderberry in relation to social organization within contact era. Elderberry was well represented at the Ozette site in close association with salmonberries, which ripen at approximately the same time. Two explanations were provided for the association of the seed types: they were the result of inadvertent deposition at similar times, or were mixed during processing of berries. The second explanation, would serve the functional purpose of both extending the salmonberries and increasing the palatability of the elderberries. Mixing of seeds would also account for the high degree of both seeds present within the samples (Welchel 2005). At the Greenville burial site at Prince Rupert, elderberries were found in high concentrations within square structures, interpreted as grave offerings packed within boxes (Cybulski 1992: 55). High levels of elderberry were recovered from the Scowlitz site in southwest BC (Lyons 2000), consistent with several other sites on the NWC (see Losey 2003).

Ethnobotanical uses: The berries require cooking prior to consumption and Haida often eat them mixed with eulachon grease, removing or spitting out the seeds and stems as they are consumed (Turner 2010). Depending on the local ripeness along the NWC, berries are harvested in early summer to August (Turner 1995). Coastal People generally pick the berry clusters whole by pulling the boughs down with a hooked stick (Turner

1995). The clusters are then cooked with their seeds and stems, to be separated once boiled soft, or separated as they are eaten. Elderberries are not highly regarded by many coastal peoples, and therefore are also often mixed with other berries to make them more palatable (Turner 1998, 2010; Welchel 2005). The stems and pith of the plant are sometimes used for arrows. The plant's purgative and emetic properties serve as medicinal qualities (Gottesfeld 1992; Smith 1929; Turner 2010; Turner and Bell 1973), and Haida hunters use the roots as a ritual medicine (Swanton 1905: 57).

Discussion: The high representation of elderberry seeds over other fruit seeds may be due to a number of factors including the high seed volumes per fruit, higher rates of seed removal prior to consumption due to their toxicity, and high degree of durability. Comparatively, other fruit seeds may be underrepresented in archaeological contexts, since they may be consumed or transported and deposited as waste elsewhere, and may be less durable in the soil. (Martindale and Jurakic 2004; Turner and Davis 1993:186).

The seed concentrations may represent processing waste and are unlikely to be human coprolites, based on their toxicity and location – the pond edge and hearth adjacent to intensive human activity. It may be possible that these concentrations are from entrails of bears that were being processed at the site, since bears do eat the seeds. Seeds have been found in low quantities from brown bear scat in Alaska, although the apparent low preference may not be a suitable analogy for early Holocene black bears on Haida Gwaii (Travaset and Wilson 1997). Other berry seeds such as salal and huckle-/blueberry were presumably eaten with the fruit, thereby being deposited beyond the immediate vicinity of the site as human waste. Because salmonberries are quite palatable and their seeds are easily consumed with the fruit, their presence with the elderberry seeds seems likely to be due to processing as well. If the elderberries were to represent a storage area, on would expect to see evidence for a container of some sort, such as a leaf lined pit or folded bark, and not in a general discard area.

Thuja plicata Donn ex D. Don – western redcedar (Cupressaceae)

Four seeds and highly fragmented twig macrofossil remains were recovered from the hearth activity area of the site.

Environmental context: Earliest evidence for western redcedar on Haida Gwaii is 9800 cal. BP (Lacourse et al. 2012). Its presence as a dominant forest climax species is not considered to occur until the middle Holocene (Hebda and Mathewes 1984). Red cedar commonly grows on the coast in moist, nutrient-rich floodplains, river terraces and slopes (Douglas 1998a).

Physical characteristics: Trees start producing seeds at 15-25 years of age (Young and Young 1992). Pollination occurs throughout the spring, as early as March in southern coastal stands (Minore 1990; Schopmeyer 1974). Cone ripening and seed dispersal begins in late summer with major seed fall occurring during October and November (Minore 1990). Compared with seed dispersal of western hemlock, Sitka spruce, and Douglas fir, western redcedar seeds fall more quickly and disperse less far, with adequate dissemination within 100 m of a source (Clark 1970; Minore 1979).

Archaeological background: Many important tools and materials were made from red cedar wood (see ethnobotanical uses). I limit archaeological evidence to branches as they pertain to the Kilgii Gwaay site. At Ozette, two categories of red cedar branchlets were uncovered in some of the houses. The first were unmodified fragments, possibly involved with a wide variety of activities, including basketry, cordage manufacture, or medicine. The second category contained branchlet fragments with their leaves removed from one end, possibly representing debris from cordage or basketry manufacture (Welchel 2005: 80).

Ethnobotanical uses: Western redcedar is a highly useful and important plant in Haida culture, and other cultures on the coast. The wood is used in the manufacture of canoes, house boards, posts, totem and mortuary poles, posts, masks, boxes, furnishing, snares, fish traps, and more. The branches and leaves have medicinal uses throughout the coast (Compton 1993; Gunther 1973; Smith 1929; Turner and Bell 1973). The inner bark has wide application in textiles and cordage, and is shredded for sanitary napkins, diapers, and towels (Fleisher 1980; Gottesfeld 1992; Turner and Efrat 1982). Bark is gathered from young trees with few lower branches in May and June and can be stored for use later in the year. Bark sheets were also harvested from older trees, for use in roofing and siding of houses (Turner 2010:85).

Discussion: Tree species present across the site in both the pond and hearth activity are represented by seeds included spruce, hemlock and alder, suggesting ubiquity in the vicinity. Western redcedar, however, was present only at the hearth activity area. One seed was radiocarbon dated to the modern era, indicating a certain level of vertical mixing of the sediment. Until further dates are obtained, it is difficult to determine the level of contamination (see discussion section for more site taphonomy).

We do not know that cedar was unknown to the ancestral Haida at the time of their original occupation. As a possibility for a modern analogy, Douglas fir was ethnographically known to the Haida in the form of driftwood (and likely from travels and trade along the coast) prior to its recent introduction on Haida Gwaii (Turner 2010). Similarly, early uses of cedar could have been from driftwood or potentially selectively sought out on the regional landscape.

Tsuga heterophylla **(Raf.) Sarg. – western hemlock (Pinaceae)**

Hemlock was locally abundant as evidenced by cones, needles, and other macrofossils. Four seeds identified suggest poor preservation of the seeds themselves. A minimum of 30 wood artifacts represent hemlock usage at the site.

Environmental context: The presence of western hemlock as a dominant climax forest species is well documented in regional paleoenvironmental reconstructions. Hemlock is common along the coast from low to moderate elevations. Due to its high tolerance to shade (Turner 1995), hemlock seedlings often rapidly recolonize forest disturbances and the resulting sapling stands offer a set of resources distinct from mature trees. The distinction is reflected in Haida terms *k'aang* and *tlaaji* for older trees and *hlk̲'ang'waal* (Skidegate dialect) for young trees (Turner 2010).

Physical characteristics: The wood is moderately heavy and durable, lending itself to be fairly easily worked. The anatomical structure and physical strength properties of the wood as a raw material are very comparable with true firs (*Abies*), with hemlock being slightly stronger in tests (Friedman 2005 [1975]). Hemlock bark contains a high tannin content. Trees regularly produce cones by 25-30 years of age (Packee 1990). Hemlock male and female cones ripen around May and June in coastal Alaska, earlier further south. The woody female cones (19-32 mm long) mature approximately 120 to 160 days after pollination. Cone scales usually open in late October, with the empty cones often persisting on the tree for up to several years. Western hemlock seeds remain viable only into the first growing season after seed fall (Packee 1990).

Archaeological background: Because of their anatomical similarity, identification between hemlock and true firs (*Abies* spp.) posed an issue for artifact analyses from the Ozette site (Friedman 2005 [1975]). However, the two taxa were seemingly used interchangeably by the people at Ozette, presumably due to their physical similarities, and thus were treated as a single wood category (Welchel 2005:166). Hemlock needles recovered from Ozette were usually associated with berry seeds. The needles were thought to represent accidental contamination during berry harvesting, and thereby indicated that at least some of the harvest occurred from inland locations (Welchel 2005:94). Alternatively, hemlock boughs could have been used to line berry pits, as they were acorn pits in the Sunken Village site (Croes 2009). A carved hemlock plank came from the Wolf's Lair Site in southeast Alaska (Moss and Erlandson 2000). A bent wood fishhook, wood chips, and a wedge/stake, all of hemlock, were recovered from Q^{w}u?g^{w}es in Washington (Croes et al. 2013).

Ethnobotanical uses: Haida apply different terms and have different uses for hemlock saplings and mature trees. Cambium and inner bark from younger trees is a food that is harvested from mid-May to June (Turner 2010). This food is consumed fresh or processed and dried for winter by several coastal Peoples. Haida often combine the cambium with highbush cranberries (Turner 2006). Hemlock serves broad application for wood technologies throughout the NWC. Some uses for the wood include: fish hooks, spoons, roasting spits, dipnet poles, eelgrass twisting poles, spear shafts, digging sticks, and elderberry-picking hooks. Additionally, the Haida use hemlock wood for wedges, snares, feast dishes, small boxes, fish weirs, octopus spears, children's bows, and ridgepoles for portable houses (Swanton 1905b; Turner 1998). Other parts of hemlock are also valued. Bark is a tanning agent, pigment, and cleaning solution. Branches are used to collect herring spawn and used for bedding, as well as for ceremonial scrubbers. The roots are used for slipknot snares for hunting waterfowl and are spliced onto fishing lines to strengthen them (Swanton 1908: 481).

The Supernatural-Being-Who-went-Naked story (Swanton 1905b) describes the origin of hemlock fishhooks:

> Then the hemlock was moving there. And he went to get it. He struck it. It was as when something is split up fine. Then he laid aside two branches and took two short ones. Then he threw one [of the latter] so that it went into a tree. And he threw another one. It stuck endwise into a hemlock. He spit after it. And he said: "Future people will use these as fishhooks in getting food (214).

The monster was transformed into a halibut hook, which was usually made out of the limb stumps that had rotted out of hemlock trees. The story also described hemlock limbs being whittled into pointed weapons and placed over the fire, presumably to heat-harden the sharpened ends. Ditidaht also make halibut hooks from hemlock knots, but not spruce, since it purportedly does not hold its shape like hemlock (Turner et al. 1983).

Discussion: Hemlock's utility for technologies and food are not limited to mature trees or trunk and branch wood. Saplings trunks, with their uniform straightness have been used for fish weirs and presumably stakes and thin structural components recorded by Swanton (1905b). Haida terms for mature hemlock and saplings reflect different types of use at these growth stages. Hemlock wood chips from Q^{w}u?g^{w}es suggest trunk or branch diameters between 8.5 and 10.5 cm were being used, consistent in size with weir/ stake/ post use (Graham 2013). Many of the hemlock artifacts from Kilgii Gwaay were pointed tools, wedges, stakes, and hafts, reflecting selected use for tools requiring a degree of weight and tensile strength. The preferential selection of hemlock appears pronounced in the assemblage.

The even distribution, though scarce presence, of hemlock seeds in comparison with spruce seeds suggests a preservation bias between species. In many instances the spruce seed coats preserved while the internal structure was lacking. Hemlock seeds have thinner wings and seed coats than spruce and it is not surprising that the overall preservation of the seeds is poor, despite cone preservation.

Vaccinium **spp. – blueberry; huckleberry; bilberry; cranberry (Ericaceae)**

Four seeds including one charred seed were recovered from the hearth activity area of Kilgii Gwaay.

Environmental context: Seventeen *Vaccinium* species occur in BC, mainly west of the Coast-Cascade Mountains. Coastal species are generally shade-tolerant shrubs that prefer nitrogen-poor soils (Douglas et al. 2000). Several species occur on Haida Gwaii. Red huckleberry (*V. parvifolium*) grows in dry to moist forests and on decaying wood in coastal to subalpine zones, Alaskan blueberry (*V. alaskaense*) occurs in forests and forest openings on fresh to very moist, nitrogen-poor soils (Klinka et al. 1989), oval-leaf blueberry (*V. ovalifolium*) is a transcontinental species occurring in moderately moist to wet forests and openings, and bogs (Douglas et al. 2000; Klinka et al. 1989). Bo*g* cranberry (*V. oxycoccos*) is circumboreal, growing in muskegs and peat bogs (Douglas et al. 2000; Klinka et al. 1989). Lowbush cranberry (*V. vitis-idaea*) occurs in bogs especially on sphagnum hummocks and bog blueberry (*V. uliginosum*), a sphagnum bog species (Calder and Taylor 1968). Dwarf bilberry (*V. caespitosum*) is a subalpine species found in dry forests, bogs, meadows, rocky ridges, and alpine tundra (Calder and Taylor 1968; Douglas et al. 2000; Klinka et al. 1989).

Physical characteristics: Species vary somewhat in their fruiting seasons. *V. ovalifolium* generally ripens from Mid-June to September, while *V. parvifolium* and *V. alaskaense* ripen from July to August (Hitchcock and Cronquist 1964; Tirmenstein 1990b; Tirmenstein 1990c). *V. oxycoccus* berries ripen in August to October and persist into the winter (Turner 1995; Viereck 2007). *Vaccinium* spp. seeds are not dormant and seedlings can start to develop within a month after seeds are planted (Crossley 1974) and therefore less likely to persist in the soil than more robust, dormant seed types.

Archaeological background: A single *Vaccinium* sp. seed was identified from a hearth feature of the early Holocene component of the Richardson Island site in Haida Gwaii (Endo n.d.). Several uncharred Vaccinium sp. seeds were recovered from late Holocene deposits at Site 699T on the southeast end of Moresby Island (Orchard and Lyons 2007). *Vaccinium* is an economically important genus and seeds and macroremains have been identified at several NWC sites. *Vaccinium* and *Gaultheria* were treated as the same seed class at Ozette, as the most abundant berry type present at the site (Welchel 2005). The concentrated presence of seeds was interpreted as berry cake remains.

Ethnobotanical uses: The different species of blueberries are recognized by Haida, but are commonly called by the same name. Bog cranberry is considered the summer form of cranberry while lowbush cranberry the winter form, though they are both harvested around the same time of year (Turner 2010). The berries are eaten fresh or dried in cakes. Throughout the coast people preserve the berries by drying or being stored with salmon spawn and sealed by skunk cabbage leaf and grease (Turner 1995). Huckleberries are often eaten fresh, and now commonly cooked into baked goods or preserves. Bog cranberries are often cooked or stored fresh in damp moss. The stems are considered medicinal and the hard wood of older blueberry shrubs is used for house pegs. (Turner 2010). Florence Edenshaw Davidson and her mother would gather huckleberries, crabapples, and salal berries in late summer (Blackman 1982: 57).

Discussion: A range of morphological overlap occurs among *Vaccinium* species and therefore only identification to genus was given. However, some general bog cranberry seed features do not appear to match the remains from Kilgii Gwaay and therefore are likely not represented. The low numbers of huckle-/blueberry seeds in relation to those of salmonberry and elderberry can be due to several possible scenarios. Overall preservation may be underrepresented due to the smaller, less robust seed structure. Their presence at the hearth may be more incidental in the hearth activity area rather than representing a processing area. The seeds were likely consumed with the berries and therefore deposed of as waste material in a different location, particularly if the berries were preserved for winter use and transported from the site.

Viola sp. (cf.) – violet (Violaceae)

One charred possible violet seed was recovered from the hearth activity area of the site.

Environmental context: Several species of violet occur in Haida Gwaii, ranging in habitat from dry to moist soils in meadows, forest floors, and rock outcrops. Hookedspur violet (*V. adunca*) grows in dry to moist mid-elevation to alpine open woods and meadows (Lyons 2000). Queen Charlotte twinflower violet (*V. biflora* L.) is a Haida Gwaii and Brooks Peninsula specialist related to possible refugia on the NWC. It grows in the montane to alpine zones on moist rock outcrops and meadows. Canadian white violet (*V. canadensis* L.) grows in moist to dry forests and meadows in lowland to montane zones (Klinka et al. 1989; Klinkenberg 2013). Stream violet **(***V. glabella* Nutt.) is a common submontane to subalpine species in western North America. It is often found on very moist to wet, nitrogen-rich soils along stream-edges or flood plains (Klinka et al. 1989; Douglas et al. 2000). Alpine marsh violet (*V. palustris* L.) is a commonly recorded species that occurs on moist to wet streambanks, meadows, swamps, fens and woodlands from the lowland to subalpine zones. Occurs on wetland soils in semi-terrestrial, non-forested communities and wet open-canopy forests (Klinka et al. 1989; Douglas et al. 2000).

Physical characteristics: Violets are small perennial herbs with distinctly shaped purple, blue, white, or yellow flowers and seeds that form in capsules.

Archaeological background: Violet has been recorded sparsely in coastal sites in British Columbia. Low quantities at sites, such as single seed from a pit house feature at Hiqelem (DhRI-74) on the Harrison River (Ritchie 2010), may reflect minor usage of the genus.

Ethnobotanical uses: Violets are in the Haida 'rain flower' plant group, of which there are taboos around picking, particularly at the time when the edible seaweed is drying, lest it cause rain (Turner 2010). Hookedspur violet is medicinally by many groups including the Makah, S'Klallam, Blackfoot, and Southern Carrier (Gunther 1973; Appell 2000). Dwarf marsh violet (*V. epipsila*) roots are burnt as incense by the Dena'ina of Alaska (Appell 2000; Gunther 1973; Hellson 1974; Smith 1929) and twinflower violet (*V. biflora*) is used by Inuit as an incense and fragrance (Kari 1995).

Discussion: The identification of *Viola* sp. is tentative. Though recorded information regarding Haida use of this genus is lacking, violet has several different applications along the NWC and throughout the world. The charred nature of the seed indicates cultural deposition. The plant could have been growing at the site in an area protected from human activity until brought to the hearth area, though it may be more likely to have been brought to the site from a less impacted area.

Chapter 7 - Conclusion

The botanical material recovered from Kilgii Gwaay offers a rare opportunity for multi-faceted insights into ancestral Haida plant use during large-scale environmental change in the early Holocene. The methodological focus of this research was on botanical analysis of water-saturated wood artifacts, seeds and other botanical material and has relied on a literature review to contextualize data from the samples within a cultural paleolandscape.

Literature on regional wood and seed identification is a starting point for comparative analyses, but ultimately, comparative collections can provide detail for a range of morphological variations and conditions (e.g., charring, fragmentation) for each taxon, which is essential for taxonomic determination. In addition to expanding the knowledge base about ancestral Haida plant use, I have provided supplemental data in contribution to the knowledge base for NWC taxonomic identification. To date, the cumulative data from literature resources is neither comprehensive nor consolidated for the NWC. I have made explicit my rationale for identification, in part to contribute a larger recorded dataset for similar research regionally, and also to highlight observable differences between waterlogged or charred material and fresh or dried comparative collection samples.

Understanding the taphonomic processes at a site is integral to locating botanical-yielding deposits and for providing a physical context for interpretation. Intertidal sites in particular can be very complex. Prior paleoenvironmental reconstruction at the Kilgii Gwaay site (Fedje et al. 2005) has provided a framework for paleoethnobotanical interpretation, and ongoing interpretation of site formation processes and sediment samples from the edge of the paleopond, the hearth activity area, and exploratory tests from within the site throughout this research has aimed to address the particularities of the site, and to expose inherent biases resulting from deposition, preservation, and contamination.

The wood artifact assemblage primarily consists of items manufactured from Sitka spruce and western hemlock - the local dominant conifer trees. Minor evidence for alder may reflect lower levels of preservation or usage. The presence of bitter cherry may relate to a larger presence of the species in the early Holocene environment and/or selective harvest of material and transport to the site. Charcoal and wood debitage from the site show a larger range of wood taxa - particularly angiosperms - present and being used at the site than are represented by the artifact assemblage. Burnt wood and charcoal do not necessarily represent primary usage as fuel wood. Fire is a very efficient a disposal method, for plant remains used in medicine, ritual, food, or material processing in addition to technological implements. Further detailed study of the charcoal at Kilgii Gwaay would provide a fuller understanding of plant use at the site.

Twenty-two taxa were identified in the seed assemblage from the edge of the paleopond and the hearth activity sample areas of the site. Identified seeds were largely taxa that are used by Haida. Salmonberry and elderberry seed concentrations at the edge of the paleopond suggest refuse from berry-processing in late spring to early summer, at around the same time of year that people would have been hunting juvenile sea mammals that they brought back to the site (Wigen and Sumpter 2003; Fedje et al. 2005), while other berry seeds suggest summer occupation to at least August. The hearth activity area has a lower quantity of seeds, but a more diverse range, particularly those associated with ethnographically and ethnobotanically recorded food, medicine, and raw material uses. The seed profile from this sample area of the site is consistent with a generalized activity area on or around a living floor, which may have been regularly swept clean. The low quantity of seeds may also reflect other preservational differences. Although a red cedar seed from this area shows minor modern contamination in the beach matrices, the intact features and radiocarbon dates on artifacts, suggest largely intact early Holocene deposits.

The archaeobotanical and plant-based artifact assemblages from Kilgii Gwaay show an intensive use of a few locally available species for food and technology within a broader diversity of plant use. This pattern fits with typical hunter-gatherer groups (Lepofsky and Lyons 2003), however the evidence for taxa used as food appears to be seasonal and therefore may be incomplete data, as only some types of activities may have occurred at the site. Seasonal or specialized activities at Kilgii Gwaay are also reflected in the lithic assemblage in which only three biface fragments have been recovered. In comparison, the Richardson Island site has many bifaces from a similar age, showing heterogeneity of inter-site usage (Fedje et al. 2005; Fedje et al. 2008; McLaren et al. 2005).

Technologies represented by the wood artifacts provide insight into preferences in raw material selection as well as technological continuity leading into much more recent archaeological periods. Splitting wood with the use of wedges is a particularly successful large-scale woodworking technology that is still broadly practiced today. Although the modern emphasis for split wood technology is on western redcedar, in areas further north in coastal Alaska where western redcedar does not grow, people use split spruce wood in manufacturing. Haida also have longstanding oral histories of the use of split spruce for house planks (Barbara Wilson [Kii'iljuus], pers. comm., 2014; Turner 2014), and it is likely that spruce played a keystone role prior to western redcedar.

Split spruce root (and monocot) cordage and spruce root binding technologies are necessary for the manufacture of nets, fishing lines, basketry, composite tools, and textiles – items that would have been used for fishing, transporting and storing material, and for comfort and ritual during the early Holocene habitation of Kilgii Gwaay. Two-piece hafts, used in composite tool technology, would have provided the user with a durable handle with the flexibility to switch out stone working edge pieces as they became exhausted through use. The stone tool assemblage at the site has many utilized flakes, several of which are small with bimarginal use wear and would likely have been hafted to the end of a handle similar to the two piece haft recovered in 2012. A detailed analysis of the lithic assemblage is needed to better understand the relationships between the lithic and perishable artifacts. Stakes, pointed tools, and different-sized woodchips show species and plant portion selection also seen in more recent contexts.

The salmonberry and red elderberry concentrations shows similarities to berry assemblages at other sites on the NWC where the two taxa are in close association (e.g., Martindale and Jurakic 2004; Welchel 2005; and see Losey 2003:702) and may help towards the development of a meta-interpretive framework for seeds at archaeological sites. An area for further work within the discipline is to take information from specific sites and to compare it regionally in a systematic effort. The patterns may point to distinctions between natural seed deposition and culturally influenced remains, seasonal patterns, trade and past plant management practices. Additionally, plant species identification provides evidence for local plant ecology during the time of occupation, offering complementary data to previously established pollen records for the area.

The archaeobotanical assemblage not only demonstrates evidence for a range of plant use at Kilgii Gwaay, but also demonstrates the potential for site interpretation with archaeobotanical remains as a primary line of investigation. Perishable technologies signify a large proportion of many aspects of cultural activity. The role of plant foods or technologies are often underutilized in archaeological interpretations, especially where their preservation is realtively poor. The importance of plant preservation at Kilgii Gwaay and other wet sites on the NWC offer key lines of data that are rare from non-watersaturated sites. Broader implications for wet site methodologies and the Kilgii Gwaay site highlight the importance of relatively unknown use of plant resources at this early time period, as well as situating early woodworking technologies on the landscape before the large-scale arrival of western redcedar, a cultural keystone species for Haida. While the archaeobotanical assemblage yields important information about the Kilgii Gwaay site itself, it also expands our understanding not only for early Holocene paleoethnobotany, but also for archaeology on the NWC.

In relation to this work, other types of knowledge and reflections may enhance, expand, and refine these findings and their significance. Haida cultural experts may be able to refine interpretations of this data and its significance by relating it to oral histories and living practices. Collaborations in the future will benefit from incorporation of diverse sets of expertise from the onset of the project. Lastly, it is important to acknowledge that the descriptions I provide are only one “truth” that hopefully complements other truths that are embraced in Haida traditions.

Bibliography

Acheson, Steven R.
1998 *In the Wake of the Ya'áats'xaatgáay 'Iron People': a Study of Changing Settlement Strategies among the Kunghit Haida*. Oxford, J. and E. Hedges.

Appell, Scott D.
2000 The Ethnobotanical Uses of the Genus *Viola* by Native Americans. American Violet Society. Electronic resource, http://americanvioletsociety.org/Violets_In_America/Ethnobotanical.htm, accessed March 13, 2012.

Archer, David
1998 Early Holocene Landscapes on the North Coast of BC. Paper presented at the 31st Annual Meeting of the Canadian Archaeological Association. Victoria, BC.

Baker, Marc A.
1981 The Ethnobotany of the Yurok, Tolowa and Karok Indians of Northwest California, M.A. thesis. Humboldt State University, Arcata, CA.

Banerjee, Mishtu, Kim Creasy, and Diane D. Gertzen
2001 *Native Woody Plant Seed Collection Guide for British Columbia.* BC Ministry of Forests, Tree Imporvement Branch. Victoria, Province of British Columbia. Pp. 147. Electronic document, http://www.for.gov.bc.ca/hti/nativeseedguide/nativeseedguide.htm, accessed May 11, 2014.

Bank, II, Theodore P.
1953 Botanical and Ethnobotanical Studies in the Aleutian Islands. In *Health and Medical Lore of the Aleuts*. Botanical and Ethnobotanical Studies Papers. Vol. 2. Michigan Academy of Science, Arts and Letters.

Banner, Allen, Jim Pojar, Jim W. Schwab, and Rick Trowbridge
1989 Vegetation Soils of the Queen Charlotte Islands; Recent Impacts of Development. In *The Outer Shores*. Edited by G. G. E. Scudder and N. Gessler, pp. 261–279. Skidegate, Islands Museum Press.

Barrie, J. Vaughn, and Kim W. Conway
1999 Late Quaternary and Postglacial Stratigraphy of the Northern Pacific Margin of Canada. *Quaternary Research* 51:113-123.

—

2002 Rapid Sea Level Change and Coastal Evolution on the Pacific Margin of Canada. *Journal of Sedimentary Geology* 150:171-183.

Barrie, J. Vaughn, Kim W. Conway, Heiner Josenhans, John J. Clague, Rolf W. Mathewes, and Daryl W. Fedje

2005 Late Quaternary Geology of Haida Gwaii and Surrounding Marine Areas. In *Haida Gwaii: Human History and Environment from the Time of Loon to the Time of the Iron People*. Edited by D. Fedje and R. Mathewes. Vancouver, UBC Press.

Bartlein, Patrick J., K. H. Anderson, Patricia M. Anderson, Mary E. Edwards, C. J. Mock, R. S. Thompson, R. S. Webb, T. Webb Ill, and Cathy Whitlock

1998 Paleoclimate Simulations for North America over the past 21,000 Years: Features of the Simulated Climate and Comparisons with Paleoenvironmental Data. *Quaternary Science Reviews* 17(6-7):549-585.

Bassett, I. John, Clifford W. Crompton,, J. McNeill, and P. M. Taschereau

1983 The Genus Atriplex (*Chenopodiaceae*) in Canada. In *E-Flora BC: Electronic Atlas of the Plants of British Columbia [eflora.bc.ca]*. Edited by B. Klinkenberg. Vancouver, Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia. Electronic resource, http://ibis.geog.ubc.ca/biodiversity/eflora/index.shtml, accessed June 6, 2014.

Bekris, Yianna, Joe Bettis, Marianna Bissonnette, Sara Coutts, Melissa Crowe, Emily Driskill, Greg Eide, Eli Evans, Zach Fleig, Lily Hynson, Krista Koller, Irene Matsuoka, Kale McConathy, Kate McSorley, Saff Smith, Michael Stacey, Nikolai Starzak, Mollie Steele, Sofia Vasconi, and Isabel Watts

2012 *Puget Prairie Plants*. Edited by M. Crowe, M. Stacey, and N. Starzak. The Evergreen State College, Olympia, WA. Electronic resource, http://wikis.evergreen.edu/pugetprairieplants/index.php/Main_Page, accessed July 4, 2014.

Benedict, James B.

2011 Sclerotia as Indicators of mid-Holocene Tree-limit Altitude, Colorado Front Range, USA. *The Holocene* 21(6):1021-1023.

Bergman, Richard, Zhiyong Cai, Charlie G. Carll, Carol A. Clausen, Mark A. Dietenberger, Robert H. Falk, Charles R. Frihart, Samuel V. Glass, Christopher G. Hunt, Rebecca E. Ibach, David E. Kretschmann, Douglas R. Rammer, Robert J. Ross, and Nicole M. Stark

2010 Wood Handbook: Wood as an Engineering Material. General Technical Report FPL-GTR-190. Madison, WI, U.S. Department of Agriculture, Forest Service. Forest Products Laboratory. Electronic resource, http://www.fpl.fs.fed.us/products/publications/several_pubs.php?grouping_id=100&header_id=p, accessed July 12, 2014).

Bernick, Kathryn

1983 A Site Catchment Analysis of the Little Qualicum River Site, DiSc-1: A Wet Site on the East Coast of Vancouver Island. Volume 118. Ottawa, National Museum of Man.

—

1989 Water Hazard (DgRs 30) Artifact Recovery Project Report. Permit 1988-55. University of BC. Ministry of Municipal Affairs, Archaeology and Outdoor Recreation Branch, Recreation and Culture.

—

1998 *Hidden Dimensions: the Cultural Significance of Wetland Archaeology*. Vancouver, UBC Press.

—

1999 Lanaak (49XPA78), a Wet Site on Baranof Island, Southeastern Alaska. Archaeological Investigations, State of Alaska Field Archaeology Permit 99-10. Report on file, Alaska Office of History and Archaeology, Division of Parks and Outdoor Recreation, Anchorage.

Blackman, Margaret B.

1982 *During My Time: Florence Edenshaw Davidson - a Haida Woman*. Seattle, University of Washington Press.

Blindow, Irmgard

1992 Long- and Short-term Dynamics of Submerged Macrophytes in two Shallow Eutrophic Lakes. *Freshwater Biology* 28(1992):15-27.

Breffitt, John

1993 The Skoglund's Landing Complex: a Re-examination of the Transitional Complex of Artifacts from Skoglund's Landing, Queen Charlotte Islands, British Columbia. M.A. Thesis, Depratment of Archaeology, Simon Fraser University.

Brown, Kevin R., and Joseph A. Antos

2012 Seedbanks, Germination and Early Survival of Bitter Cherry (*Prunus emarginata*) in Coastal British Columbia. *Forest Ecology and Management* 282(2012):92-104.

Butterfield, Brian

2006 The Structure of Wood: Form and Function. In *Primary Wood Processing: Principles and Practice*. 2nd edition. Edited by J. Walker, pp. 1-22. Netherlands, Springer.

Calder, James A. and Roy L. Taylor

1968 *Flora of the Queen Charlotte Islands, Part 1: Systemics of Vascular Plants*. Monograph No. 4. Department of Agriculture. Ottawa, Queen’s Printer.

Carlson, Roy L.

1996 Early Namu. In *Early Human Occupation in British Columbia*. Edited by R.L. Carlson and L. Dalla Bona. Pp. 83-102. Vancouver, University of British Columbia Press.

Carrara, P. E., T. A. Ager, and J. F. Baichtal

2007 Possible Refugia in the Alexander Archipelago of southeastern Alaska during the Late Wisconsin Glaciation. *Canadian Journal of Earth Sciences* 44:229-244.

Cartajena, Mariana Guadalupe, and Javier Carmona

2009 Morphological and Ecological Characterization of Charales (Chlorophyta) from Calcareous Tropical Streams in Mexico. *Cryptogamie* 30(3):193-208.

Christensen, Tina

1996 The Gwai Haanas Archaeological Project: Raised Beach Survey 1995 Field Report. Report on file, Parks Canada Agency Western and Northern Service Center.

—

1997 Threatened Raised Beach Sites in Gwaii Haanas: Further Investigations. The Archipelago Management Board, the Council of the Haida Nation, and Gwaii Haanas Park Reserve. Report on file, Parks Canada Agency, Western and Northern Service Center.

Christensen, Tina, and Jim Stafford

2005 Raised Beach Archaeology in Northern Haida Gwaii: the Cohoe Creek Site. In *Haida Gwaii: From the Time of Loon to the Time of the Iron People*. Edited by D. Fedje and R. Mathewes. Vancouver, UBC Press.

Clark, Murray B.

1970 Seed Production of Hemlock and Cedar in the Interior Wet Belt region of British Columbia related to Dispersal and Regeneration. Research Notes 51. Victoria, British Columbia Forest Service. Electronic document, http://www.for.gov.bc.ca/hfd/pubs/Rn.htm, accessed July 12, 2014.

Cohen, Jenny M.

In Prep 2012/2013 Gwaii Haanas and Gwaii Haanas Marine Archaeology Programme. Unpublished report to be on file with Parks Canada Agency.

Compton, Brian Douglas

1993 Upper North Wakashan and Southern Tsimshian Ethnobotany: The Knowledge and Usage of Plants and Fungi Among the Oweekeno, Hanaksiala (Kitlope and Kemano), Haisla and Kitasoo Peoples of the Central and North Coasts of British Columbia. Ph.D. dissertation, Department of Botany, University of British Columbia.

Croes, Dale R.

1980 Hoko River: A 2,500 Year Old Fishing Camp on the Northwest Coast of North America. Reports of Investigaions No. 58, Laboratory of Anthropology, Washington State University.

—

1997 The North Central Cultural Dichotomy on the Northwest Coast of North America: Its Evolution as Suggested by Wet-site Basketry and Wooden Fish-hooks. *Antiquity* 71(273):594-615.

—

2001 North Coast Prehistory – Reflections from Northwest Coast Wet Site Research. In *Perspectives on Northern Northwest Coast Prehistory*. Edited by J. Cybulski, pp 145-172. Mercury Series Archaeological Survey of Canada Paper 160. Hull, Canadian Museum of Civilization.

—

2003 Northwest Coast Wet Site Artifacts: A Key to Understanding Ancient Resource Procurement, Storage, Management, and Exchange. In *Emerging from the Mist: Studies in Northwest Coast Culture History.* Edited by G. Matson, G. Coupland, and Q. Mackie. Vancouver, UNBC Press.

—

2005 *The Hoko River Archaeological Site Complex: the Rockshelter (45CA21), 1,000-100 B.P., Olympic Peninsula, Washington*. Pullman, Washington State University Press.

Croes, Dale R., John L. Fagan, and Maureen Newman Zehendner

2009 Sunken Village, Sauvie Island, Oregon, USA: A Report on the 2006-2007 Investigations of National Historic Landmark Wet Site 35MU4. *Journal of Wetland Archaeology* 9:1-216.

Croes, Dale R., Rhonda Foster, and Larry Ross (editors)

2013 Qwu?gwes: the Qwu?gwes Archaeological Site and Fish Trap (45TN240), and Tested Homestead (45TN396): Eleven-Year South Puget Sound Community College Summer Field School Investigations with the Squaxin Island Tribe. Report submitted to South Puget Sound Community College; Squaxin Island Tribe, Cultural Resources Department.

Crossley, John

1974 *Vaccinium* L. Blueberry. In *Seeds of Woody Plants in the United States*. Edited by C.S. Schopmeyer, pp. 840-843. Agriculture Handbook 450. Washington DC, U.S. Department of Agriculture, Forest Service.

Cybulski, Jerome S., Darlene Balkwill, Gregory S. Young, and Patricia D. Sutherland

1992 *A Greenville Burial Ground: Human Remains and Mortuary Elements in British Columbia Coast Prehistory*. Hull, Quebec, Canadian Museum of Civilization.

Dale, Arlene

1968 Comparative Wood Anatomy of some Shrubs Native to the Northern Rocky Mountains, Vol. 45. Ogden, Utah, US Department of Agriculture Forest Service, Intermountain Forest and Range Experiment Station. Research Paper International.

Davis, Loren

2011 The North American Paleaocoastal Concept Reconsidered. In *Trekking the Shore*. Edited by N. Bicho, J. Haws, and L. Davis, pp. 3-26. New York, Springer.

de Laguna, Frederica

1972 *Under Mount Saint Elias: the History and Culture of the Yakutat Tlingit*. Part One. Smithsonian Contributions to Anthropology. Volume 7. Washington DC, Smithsonian Institution Press.

Deur, Douglas E., and Nancy J. Turner (editors)

2005 *Keeping It Living: Traditions of Plant Use and Cultivation on the Northwest Coast of North America*. Seattle, University of Washington Press.

Dick, Alan, and Helen Dick

1998 Digging and Preparing Spruce Roots. In *Alaska Native Knowledge Network*. Fairbanks, University of Alaska Fairbanks. Electronic document, http://www.ankn.uaf.edu/Curriculum/Units/spruceroots.html, accessed Jul 14, 2014.

Diedrich, Melanie

2013 Analysis of Site Micro-Geomorphology using 100% Column Samples. *In* Qwu?gwes: the Qwu?gwes Archaeological Site and Fish Trap (45TN240), and Tested Homestead (45TN396): Eleven-Year South Puget Sound Community College Summer Field School Investigations with the Squaxin Island Tribe. Edited by D. Croes, R. Foster, and L. Ross. Report submitted to South Puget Sound Community College; Squaxin Island Tribe, Cultural Resources Department.

Diedrich, Melanie and Josh Fullmer

2013 Macroflora Overview. *In* Qwu?gwes: the Qwu?gwes Archaeological Site and Fish Trap (45TN240), and Tested Homestead (45TN396): Eleven-Year South Puget Sound Community College Summer Field School Investigations with the Squaxin Island Tribe. Edited by D. Croes, R. Foster, and L. Ross. Report submitted to South Puget Sound Community College; Squaxin Island Tribe, Cultural Resources Department.

Dixon, James E.

1999 *Bones, Boats and Bison: Archeological Evidence for the First Colonization of Western North America*. Albuquerque, University of New Mexico Press.

Donald, Leland

2003 The Northwest Coast as a Study Area: Natural, Prehistoric, and Ethnographic Issues. In *Emerging from the Mist: Studies in Northwest Coast Culture History*. Edited by R.G. Matson, G. Coupland, and Q. Mackie, pp. 289-327. Vancouver, UBC Press.

Douglas, George W., Del Meidinger, and Jim Pojar

1999a *Illustrated Flora of British Columbia: Volume 4. Dicotyledons (Orobanchaceae through Rubiaceae)*. Victoria, B.C. Ministry of Environment, Lands and Parks and B.C. Ministry of Forests.

Douglas, George W., Gerald B. Straley, Del Meidinger, Jim Pojar

1998a *Illustrated Flora of British Columbia. Volume 1: Gymnosperms and Dicotyledons (Aceraceae Through Asteraceae)*. Victoria, B.C. Ministry of Environment, Lands and Parks and B.C. Ministry of Forests.

—

1998b *Illustrated Flora of British Columbia. Volume 2: Dicotyledons (Balsaminaceae Through Cucurbitaceae)*. Victoria, B.C. Ministry of Environment, Lands and Parks and B.C. Ministry of Forests.

—

1999 *Illustrated Flora of British Columbia. Volume 3: Dicotyledons (Diapensiaceae Through Onagraceae)*. Victoria, B.C. Ministry of Environment, Lands and Parks and B.C. Ministry of Forests.

—

2000 *Illustrated Flora of British Columbia. Volume 5: Dicotyledons (Salicaceae through Zygophyllaceae) and Pteridophytes*. Victoria, B.C. Ministry of Environment, Lands and Parks and B.C. Ministry of Forests.

—

2001 *Illustrated Flora of British Columbia. Volume 6: Monocotyledons (Acoraceae Through Najadaceae)*. Victoria, B.C. Ministry of Environment, Lands and Parks and B.C. Ministry of Forests.

Dowidar, A. E., M. A. Loutfy, E. A. Kamel, A. H. M. Ahmad, and H. H. L. Hafez

2003 Studies on the Rosaceae 1 - Seed and/or Achene Macro and Micromorphology. *Pakistan Journal of Biological Sciences* 6(20):1778-1791.

Easton, Norman Alexander

1992 Mal de Mer above Terra Incognita, or, "What Ails the Coastal Migration Theory?". *Arctic Anthropology* 29(2):28-41.

Ecklund-Johnson, Debra J.

1984 Analysis of Macroflora from the Hoko River Rockshelter, Olympic Peninsula, Washington. M.A. thesis, Department of Anthropology, Washington State University.

Elias, Thomas S.

2000 *Complete Trees of North America: Field Guide and Natural History*. London, Chapman & Hall.

Endo, Naoko

n.d. Richardson Island (1127T): Archaeobotanical Analysis. Unpublished report on file at the University of Victoria.

Erlandson, Jon M., and Madonna L. Moss

1999 The Systematic Use of Radiocarbon Dating in Archaeological Surveys in Coastal and Other Erosional Environments. *American Antiquity* 64(3):431-443.

Erlandson, Jon M., Madonna L. Moss, and Matthew Des Lauriers

2008 Life on the Edge: Early Maritime Cultures of the Pacific Coast of North America. *Quaternary Science Reviews* 27(23-24):2232-2245.

Esser, Lora L.

1995 *Prunus emarginata*. *In* Fire Effects Information System. U.S. Department of Agriculture, Forest Service. Rocky Mountain Research Station, Fire Sciences Laboratory. Electronic resource, http://www.fs.fed.us/database/feis/, accessed June 8, 2014.

Fedje, Daryl W.

1993 Sea-levels and Prehistory in Gwaii Haanas. Unpublished M.A. thesis, Department of Archaeology, University of Calgary.

—

2008 2007/08 Gwaii Haanas Archaeology and Paleoecology. Victoria, BC. Report on file, Cultural Resource Services, Parks Canada Agency, Western and Northern Canada Service Centre.

Fedje, Daryl W., and Heiner Josenhans

2000 Drowned Forests and Archaeology on the Continental Shelf of British Columbia, Canada. *Geology* 28(2):99-102.

Fedje, Daryl W., and Ian D. Sumpter

1999a 1998/99 Archaeological Resource Management Programme: Gwaii Haanas National Park Reserve and Haida Heritage Site. Victoria, BC. Report on file, Cultural Resource Services, Parks Canada Agency, Western and Northern Service Center.

—

2003 2001-2002 Archaeological Resource Management Programme, Gwaii Haanas National Park Reserve and Haida Heritage Site. Victoria, BC, Report on file, Cultural Resource Services, Parks Canada Agency, Western Canadian Service Centre.

—

2006 2004 - 2005 Gwaii Haanas Archaeology and Paleoecology. Victoria, BC. Report on file, Parks Canada Agency, Western and Northern Service Centre.

—

2007 2006/07 Gwaii Haanas Archaeology and Paleoecology. Victoria, BC. Report on file, Cultural Resource Services, Parks Canada Agency, Western and Northern Service Centre.

Fedje, Daryl W., and Nicole Smith
2009 2008/09 Gwaii Haanas Archaeology and Paleoecology. Victoria, BC. Report on file, Parks Canada Agency, Western and Northern Canada Service Centre

—

2010 2009/10 Gwaii Haanas Archaeology and Paleoecology Programme. Victoria, BC. Report on file, Parks Canada Agency, Western and Northern Canada Service Centre.

Fedje, Daryl W., and Quentin Mackie
2005b Overview of Culture History. In *Haida Gwaii: Human History and Environment from the Time of Loon to the Time of the Iron People*. Edited by D. Fedje and R. Mathewes, pp. 154-162. Vancouver, UBC Press.

Fedje, Daryl W., and Rolf W. Mathewes
2005c *Haida Gwaii: Human History and Environment from the Time of Loon to the Time of the Iron People*. Vancouver, UBC Press.

Fedje, Daryl W., and Tina Christensen
1999b Modelling Paleoshorelines and Locating Early Holocene Coastal Sites in Haida Gwaii. *American Antiquity* 64(4):635-652.

Fedje, Daryl W., Alexander P. Mackie, and Joanne B. McSporran
1995 Gwaii Haanas Archaeology: Assessment of Two Early Period Sites. Paper presented at the Annual Meeting of the Canadian Archaeological Association, Kelowna, BC.

Fedje, Daryl W., Alexander P. Mackie, Rebecca J. Wigen, Quentin Mackie, and Cynthia R. Lake

2005a Kilgii Gwaay: an Early Maritime Site in the South of Haida Gwaii. In *Haida Gwaii: Human History and Environment from the Time of Loon to the Time of the Iron People*. Edited by D. Fedje, R. Mathewes, pp. 187-203. Vancouver, UBC Press.

Fedje, Daryl W., Andrew Mason, and Joanne McSporran

1996 Early Holocene Archaeology and Paleoecology at the Arrow Creek Sites in Gwaii Haanas. *Arctic Anthropology* 33(1):116-142.

Fedje, Daryl W. Duncan McLaren, and Rebecca J. Wigen

2004 Preliminary Archaeological and Paleoecological Investigations of Late Glacial to Early Holocene Landscapes of Haida Gwaii, Hecate Strait and Environs. Report on file, B.C. Archaeology Branch Permit 2001-172. Haida Nation Permit 2002 (renewed 2003) for Haida Gwaii Karst Research.

Fedje, Daryl W., Jenny M. Cohen, Rob Commisso, and Nicole Smith

2011a 2010/2011 Gwaii Haanas Archaeology Programme. Victoria, BC. Parks Canada annual report. Report on file, Parks Canada Agency, Western and Northern Service Centre.

Fedje, Daryl W., Quentin Mackie, Duncan McLaren, and Tina Christensen

2008 A Projectile Point Sequence for Haida Gwaii. In *Projectile Points of Northwestern North America*. Edited by R. Carlson and M. Magne, pp. 21-38. Burnaby, Simon Fraser University Press.

Fedje, Daryl W., Quentin Mackie, Nicole Smith, and Duncan McLaren

2011b Function, Visibility, and Interpretation of Archaeological Assemblages at the Pleistocene/Holocene Transition in Haida Gwaii. In *From the Yenisei to the Yukon*. Edited by T. Goebel and I. Buvit, pp. 323-342. Texas A&M University Press.

Fedje, Daryl W., Quentin Mackie, Terri Lacourse, and Duncan McLaren

2011c Younger Dryas Environments and Archaeology on the Northwest Coast of North America. *Quaternary International* 242(2011):452-462.

Fedje, Daryl W., Rebecca J. Wigen, Quentin Mackie, Ian Sumpter, and Cynthia R. Lake

2001 Preliminary Results from Investigations at Kilgii Gwaay: An Early Holocene Archaeological Site on Ellen Island, Haida Gwaii, British Columbia. *Canadian Journal of Archaeology / Journal Canadien d'Archéologie* 25(1/2):98-120.

Fladmark, Knut R.

1971 Archaeological Sites on the Queen Charlotte Islands. On file with the Resource Information Center, BC Heritage Conservation Branch.

—

1979 Routes: Alternate Migration Corridors for Early Man in North America. *American Antiquity* 44(1):55-69.

—

1986 Lawn Point and Kasta: Microblade Sites on the Queen Charlotte Islands, British Columbia. *Canadian Journal of Archaeology* 10:39-58.

—

1989 The Native Culture of the Queen Charlotte Islands. In *The Outer Shores*. Edited by G.G.E. Scudder and N. Gessler. Based on the Proceedings of the Queen Charlotte Islands First International Symposium, University of British Columbia, Vancouver.

—

1990 Possible Early Human Occupation of the Queen Charlotte Islands, British Columbia. *Canadian Journal of Archaeology* 14:183-198.

Fleisher, Mark S.
1980 The Ethnobotany of the Clallam Indians of Western Washington. *Northwest Anthropological Research Notes* 14(2):192-210.

Florian, Mary-Lou
1990 Plant Anatomy: An Illustrated Aid to Identification. In *The Conservation of Artifacts Made from Plant Materials*. Edited by M.-L.E. Florian, D.P. Kronkright, and R.E. Norton, pp. 1-27. Princeton, Princeton University Press.

Florian, Mary-Lou
2014 Wood Taxa Identification of Kilgii Gwaay Wood Artifacts. Unpublished data, on file Parks Canada. Gwaii Haanas National Park Reserve, Haida Heritage Site and National Marine Conservation Area, Skidegate.

Friedman, Janet
1978 *Wood Identification by Microscopic Examination: a Guide for the Archaeologist on the Northwest Coast of North America*. Victoria, British Columbia Provincial Museum.

—

2005 [1975] The Prehistoric Uses of Wood at Ozette Archaeological Site. In *2005 Ozette Archaeological Project Research Reports, Ethnobotany and Wood Technology*. Edited by D. Welchel. Reports of Investigations 68. National Park Service, Pacific Northwest Regional Office. Pullman, Washington State University.

Fryer, Janet

2008 *Sambucus racemosa*. *In* Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Electronic resource, http://www.fs.fed.us/database/feis/, accessed Jun 20, 2014.

Garibaldi, Ann, and Nancy J. Turner
2004 Cultural Keystone Species: Implications for Ecological Conservation and Restoration. *Ecology and Society* 9(3):1.

Gaston, Anthony J., Stephen A. Stockton, and Joanna L. Smith
2006 Species-Area Relationships and the Impact of Deer-browse in the complex Phytogeography of the Haida Gwaii Archipelago (Queen Charlotte Islands), British Columbia. *Écoscience* 13(4):511-522.

Gelabert, Llorenç Picornell, Eleni Asouti, and Allué Marti
2011 The Ethnoarchaeology of Firewood Management in the Fang Villages of Equatorial Guinea, Central Africa: Implications for the Interpretation of Wood Fuel Remains from Archaeological Sites. *Journal of Anthropological Archaeology* 30(3):375-384.

Gill, Steven J.
1983 Ethnobotany of the Makah and Ozette People, Olympic Peninsula, Washington. Ph.D. dissertation, Department of Botany, Washington State University.

Gingras, Murray K., S. George Pemberton, Shahin Dashtgard, and Lynn Dafoe
2008 How Fast do Marine Invertebrates Burrow? *Palaeogeography, Palaeoclimatology, Palaeoecology* 270(3-4):280-286.

Godwin, Harry
1984 *The History of British Flora*. Cambridge, Press Syndicate of the University of Cambridge.

Golumbia, Todd E.
1999 Introduced Species Management in Haida Gwaii (Queen Charlotte Islands). Proceeding from the Conference on the Biology and Management of Species and Habitats at Risk, Kamloops, BC, Vol. 1. Pp. 490. Victoria, BC Ministry of Environment, Lands and Parks.

—

2007 Terrestrial Plant Communities and Ecosystems of Gwaii Haanas National Park Reserve and Haida Heritage Site. Parks Canada Technical Reports in Ecosystem Science, Vol. 47. Pp. 70. Queen Charlotte City, Parks Canada Agency.

Gottesfeld, Leslie M. Johnson

1992 The Importance of Bark Products in the Aboriginal Economies of Northwestern British Columbia, Canada. *Economic Botany* 46(2):148-157.

Graham, Tyler

2013 Woodworking Debitage, Experimental Archaeology, and Qwu?gwes Woodworking Tools: Ground Stone Adzes and Antler Hafts and Wedges. *In* Qwu?gwes: the Qwu?gwes Archaeological Site and Fish Trap (45TN240), and Tested Homestead (45TN396): Eleven-Year South Puget Sound Community College Summer Field School Investigations with the Squaxin Island Tribe. Edited by D. Croes, R. Foster, and L. Ross. Report submitted to South Puget Sound Community College; Squaxin Island Tribe, Cultural Resources Department.

Grattan, David W.

1988 Treatment of Waterlogged Wood. In *Wet Site Archaeology*. Edited by B.A. Purdy, pp. 237-254. Caldwell, New Jersey, Telford Press.

Griffiths, Anthony J., and Fred R. Ganders

1983 *Wildflower Genetics: a Field Guide for British Columbia and the Pacific Northwest*. Vancouver, Flight Press.

Groesbeck, Amy S., Kirsten Rowell, Dana Lepofsky, and Anne K. Salomon

2014 Ancient Clam Gardens Increased Shellfish Production: Adaptive Strategies from the Past Can Inform Food Security Today. *PloS one* 9(3):91235.

Groningen Archaeobotany Platform

2013 *Selaginella selaginoides* Megaspore. Electronic image resource, https://www.flickr.com/photos/93552528@N02/, accessed June 11, 2014.

Gucker, Corey

2012 *Rubus parviflorus*. *In* Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Electronic resource, http://www.fs.fed.us/database/feis/, accessed June 19, 2014.

Gunther, Erna

1973 [1945] *Ethnobotany of Western Washington*. Revised edition. Seattle, University of Washington Press.

Haggarty, James C., and Richard J. Hebda

1997 Brooks Peninsula: an Ice Age Refugium on Vancouver Island. Occasional Paper, no. 5. Victoria, Ministry of Environment Lands and Parks, BC Parks.

Harris, A. S.

1990 *Picea sitchensis* (Bong.) Carr. – Sitka Spruce. In *Silvics of North America: Conifers*. Edited by R.M. Burns and B.H. Honkala, p. 877. Agriculture handbook 654, Vol. 1. Washington D.C.: U.S. Department of Agriculture, Forest Service.

Harvey, Tanya

2010 Seeds. *In* Mountain Plants of the Western Cascades. Electronic resource, http://westerncascades.com/photos/seeds/, accessed June 5, 2014.

Hauser, A. Scott

2005 *Juncus balticus*. *In* Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Electronic resource http://www.fs.fed.us/database/feis/, accessed June 20, 2014.

Hawes, Kathleen L.

2008 Microscopic Identification by Cellular Analysis: a Comparison of Artifact Plant Material from Wet-Sites on the Northwest Coast of North America. Paper presented at the 62nd Annual Northwest Anthropological Conference. Victoria, BC.

Hawes, Kathleen L. and Daniel Rowley

2012 Cellular Identification of Wood/Fiber Artifacts and Fuelwoods. *In* Qwu?gwes: The Qwu?gwes Archaeological Site (45TN240), Fish Trap, and Homestead. Comprehensive Eleven-Year Scientific Descriptive and Cultural Explanatory Report. Edited by D.R. Croes, L. Ross, and R. Foster. Olympia. Report submitted to South Puget Sound Community College; Squaxin Island Tribe, Cultural Resources Department.

Hebda, Richard J., and Rolf W. Matthewes

1984 Holocene History of Cedar and Native Indian Cultures of the North American Pacific Coast. *Science* 225:711-713.

Hebda, Richard J., Sheila Greer, and Alexander Mackie

2012 Teachings from Long Ago Person Found: Highlights from the Kwäday Dän Ts'ínchi Project. Victoria, Royal BC Museum; Champagne and Ashihik First Nations; BC Archaeology Branch. Electronic document, http://issuu.com/royalbcmuseum/docs/kdt_highlights, accessed August 24, 2014.

Hebda, Richard J., Marlow G Pellatt, Rolf W. Mathewes, Daryl W. Fedje, and Steven Acheson

2005 Vegetation History of Anthony Island, Haida Gwaii, and Its Relationship to Climate Change and Human Settlement. In *Haida Gwaii: Human History and Environment from the Time of Loon to the Time of Iron People*. Edited by D.W. Fedje, R. W. Mathewes, pp. 59-76. Vancouver, UBC Press.

Heinrichs, Markus L., Joseph A. Antos, Richard J. Hebda, and Greg B. Allen

2002 *Abies lasiocarpa* (Hook.) Nutt. in the late-Glacial and early-Holocene Vegetation of British Columbia, Canada, and adjacent regions in Washington, USA. *Review of Palaeobotany and Palynology* 120(1-2):107-122.

Hellson, John C.
1974 *Ethnobotany of the Blackfoot Indians*. Mercury Series. Ottawa, National Museums of Canada.

Hetherington, Reneacute, J. Vaughn Barrie, Robert G. B. Reid, Roger MacLeod, Dan J. Smith, Thomas S. James, and Robert Kung
2003 Late Pleistocene Coastal Paleogeography of the Queen Charlotte Islands, British Columbia, Canada, and Its Implications for Terrestrial Biogeography and Early Postglacial Human Occupation. *Canadian Journal of Earth Sciences* 40:1755- 1766.

Heusser, Calvin J.
1989 North Pacific Coastal Refugia: the Queen Charlotte Islands in Perspective. In *The Outer Shores*. Edited by G.G.E. Scudder and N. Gessler, pp. 91-106. Queen Charlotte City, Queen Charlotte Island Museum.

—
1995 Late-Quaternary Vegetaion Response to Climatic-Glacial Forcing in North Pacific America. *Physical Geography* 16(2):118-149.

Hitchcock, C. Leo, and Arthur Cronquist
1964 *Vascular Plants of the Pacific Northwest*. Seattle, University of Washington Press.

Hoadley, R. Bruce
1990 *Identifying Wood: Accurate Results with Simple Tools*. Newtown, CT, Tauton Press.

Holland, Stuart S.
1976 Landforms of British Columbia: a Physiographic Outline. Bulletin 48. Victoria, British Columbia Department of Mines and Petroleum Resources.

Hul'q'umi'num Treaty Group
2011 *Ecosystem Guide: A Hul'q'umi'num Language Guide to Plants and Animals of Southern Vancouver Island, the Gulf Islands and the Salish Sea*. Hul'qumi'num Treaty Group.

Hummer, Kim E.
1996 *Rubus* Diversity. *HortScience* 31:182-183.

Josenhans, Heiner W., Daryl W. Fedje, Kim W. Conway, and J. Vaughn Barrie

1995 Post Glacial Sea Levels on the Western Continental Shelf: Evidence for Rapid Change, Extensive Subaerial Exposure, and Early Human Habitation. *International Journal of Marine Geology, Geochemistry and Geophysics* 125:73-94.

Josenhans, Heiner W., Daryl W. Fedje, Reinhard Pienitz, and John Southon
1997 Early Humans and Rapidly Changing Holocene Sea Levels in the Queen Charlotte Islands Hecate Strait, British Columbia, Canada. *Science* 277(5322):71-74.

Kari, P. R.
1995 Tanaina Plantlore, Dena'ina K'et'una, Ana Ethnobotany of the Den'ina Indians of Southcentral Alaska. National Park Service, U.S.D.I.

Kellman, M. C.
1970 The Viable Seed Content of some Forest Soil in Coastal British Columbia. *Canadian Journal of Botany* 48:1383-1385.

Kemp, Brian M., Ripan S. Malhi, John McDonough, Deborah A. Bolnick, Jason A. Eshleman, Olga Rickards, Cristina Martinez-Labarga, John R. Johnson, Joseph G. Lorenz, E. James Dixon, Terence E. Fifield, Timothy H. Heaton, Rosita Worl, and David Glenn Smith
2007 Genetic Analysis of Early Holocene Skeletal Remains from Alaska and its Implications for the Settlement of the Americas. *American Journal of Physical Anthropology* 132(4):605-21.

Kii7ilijuus and Heather Harris
2005 Tllsda Xaayda K'aaygang.nga: Long, Long Ago Haida Ancient Stories. In *Haida Gwaii: Human History and Environments from the Time of the Loon to the time of the Iron People*. Edited by D. Fedje and R. Mathewes, pp. 121-139. Vancouver, UBC Press.

Klinka, Karel, Vladimir J. Krajina, Adolf Ceska, and Anna M. Scagel
1989 *Indicator Plants of Coastal British Columbia*. Vancouver, UBC Press.

Klinkenberg, Brian (editor)
2013 E-Flora BC: Electronic Atlas of Plants of British Columbia [eflora.bc.ca]. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia. Electronic resource, http://ibis.geog.ubc.ca/biodiversity/eflora/, accessed September 14, 2013.

Klinkenberg, Brian (editor)
2014 E-Fauna BC: Electronic Atlas of the Fauna of British Columbia [efauna.bc.ca]. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia. Electronic resource, http://ibis.geog.ubc.ca/biodiversity/efauna/, accessed September 14, 2013.

Koppert, Vincent A.
1930 Contributions to Clayoquot Ethnology. Pp. 1-130. Washington, D.C., Catholic University of America, Anthropological Series.

Kufel, Lech, and Irena Kufel
2002 Chara Beds Acting as Nutrient Sinks in Shallow Lakes: a Review. *Aquatic Botany* 72(3-4):249-260.

Kukachka, Francis
1960 Identification of Coniferous Woods. *Technical Association of the Pulp and Paper Industry* 43(11):887-896.

Lacourse, Terri
2004 Late Quaternary Vagetation Dynamics of the Queen Charlotte Islands, Northern Vancouver Island, and the Continental Chelf of British Columbia, Canada. Ph.D. Dissertation, Biological Sciences, Simon Fraser University.

Lacourse, Terri, J. Michelle Delepine, Elizabeth H. Hoffman, and Rolf W. Mathewes
2012 A 14,000 Year Vegetation History of a Hypermaritime Island on the Outer Pacific Coast of Canada based on Fossil Pollen, Spores, and Conifer Stomata. *Quaternary Research* 78(2012):572-582.

Lacourse, Terri, Rolf W. Mathewes, and Daryl W. Fedje
2005 Late-glacial Vegetation Dynamics of the Queen Charlotte Islands and Adjacent Continental Shelf, British Columbia, Canada. *Palaeogeography Palaeoclimatology Palaeoecology* 226(1-2):36-57.

Lacourse, Terri, Rolf W. Mathewes, and Richard J. Hebda
2007 Paleoecological Analyses of Lake Sediments reveal Prehistoric Human Impact on Forests at Anthony Island UNESCO World Heritage Site, Queen Charlotte Islands (Haida Gwaii), Canada. *Quaternary Research* 68(2):177-183.

Lepofsky, Dana
2000 Site Formation Processes at Keatley Creek: The Paleoethnobotanical Evidence. In *The Ancient Past of Keatley Creek Volume 1: Taphonomy*. Edited by B. Hayden, pp. 105-134. Burnaby, Simon Fraser University Archaeology Press.

—

2004 Paleoethnobotany in the Northwest. In *People and Plants in Ancient Western North America*. Edited by P.E. Minnis, pp. 367-464. Washington D.C., Smithsonian Books.

Lepofsky, Dana, and Kenneth Lertzman
2008 Documenting Ancient Plant Management in the Northwest of North America. *Botany-Botanique* 86(2):129-145.

Lepofsky, Dana, and Natasha Lyons

2003 Modeling Ancient Plant Use on the Northwest Coast: Towards an Understanding of Mobility and Sedentism. *Journal of Archaeological Science* 30(11):1357-1371.

—

2013 The Secret Past Life of Plants: Paleoethnobotany in British Columbia. *BC Studies* (179):39-83.

Lepofsky, Dana, Karla D. Kusmer, Brian Hayden, and Kenneth P. Lertzman

1996 Reconstructing the Prehistoric Socioeconomies from Paleoethnobotanical and Zooarchaeologial Data: an Example from the British Columbia Plateau. *Journal of Ethnobiology* 16(1):31-62.

Lévesque, P.E.M, H. Dinel, and A. Larouche

1988 Guide to the Identification of Plant Macrofossils in Canadian Peatlands. Publication No. 1817. R.B. Ottawa, Agriculture Canada, Land Resource Research Centre.

Little, Elbert L.

1976 Atlas of United States Trees. Minor Western Hardwoods, Vol. 3. U.S. Department of Agriculture, Miscellaneous Publication 1314.

Lomer, Frank and George W. Douglas

1999 Additions to the Flora of the Queen Charlotte Islands, British Columbia. *Canadian Field Naturalist* 113(2):235-240.

Losey, Robert J., Nancy Stenholm, Patty Whereat-Phillips, and Helen Vallianatos

2003 Exploring the Use of Red Elderberry (*Sambucus racemosa*) Fruit on the Southern Northwest Coast of North America. *Journal of Archaeological Science* 30:695-707.

Lowden, J. A. and W. Jr. Blake

2005 [1979] Geological Survey of Canada Radiocarbon Dates XIX. In *Haida Gwaii: Human History and Environment from the Time of Loon to the Time of the Iron People*. Edited by D. Fedje, R. Mathewes. Vancouver, UBC Press.

Luternauer, J. L., John J. Clague, Kim W. Conway, J. Vaughn Barrie, B. Blaise, and Rolf W. Mathewes

1989 Late Pleistocene Terrestrial Deposits on the Continental Shelf of Western Canada: Evidence for Rapid Sea Level Change at the End of the Last Glaciation. *Geology* 17:357-360.

Lyons, Natasha

2000 Investigating Ancient Socioeconomy in Sto:lo Territory: a Palaeoethnobotanical Analysis of the Scowlitz Site, Southwestern BC. M.A. thesis, Department of Archaeology, Simon Fraser University.

Lyons, Natasha, and Trevor J. Orchard
2007 Sourcing Archaeobotanical Remains: Taphonomic Insights from a Midden Analysis on Haida Gwaii, British Columbia. *Canadian Journal of Archaeology / Journal Canadien d'Archéologie* 31(1):28-54.

Mackie, Alexander P., Daryl W. Fedje, and Mary-Lou Florian
2003 Early Holocene Wood Artifacts from the Kilgii Gwaay Site, southern Haida Gwaii. Paper presented at the 10th International Wetland Archaeological Research Project Conference. Olympia, WA.

Mackie, Kjerstin E. and Alexander P. Mackie
2009 Kilgii Gwaay (1325T) Wood Artifacts Conservation Condition Assessment. Report on file, Cultural Resource Services, Parks Canada Agency.

Mackie, Quentin and Steven R. Acheson
2005 The Graham Tradition. In *Haida Gwaii: from the Time of Loon to the Time of the Iron People*. Edited by D. Fedje and R. Mathewes, pp. 274-302. Vancouver, UBC Press.

Mackie, Quentin, Daryl W. Fedje, Duncan McLaren, Nicole Smith, and Iain McKechnie
2011 Early Environments and Archaeology of Coastal British Columbia. In *Trekking the Shore: Changing Coastlines and the Antiquity of Coastal Settlement, Interdisciplinary Contributions to Archaeology*. Edited by N.F. Bicho, J.A. Haws, and L.G. Davis, pp. 51-104. New York, Springer Science and Business Media.

Mackie, Quentin, Jenny Cohen, and Daryl Fedje
2013 Kilgii Gwaay: New Data from a 10,700-Year-Old Water Saturated Site on the Northwest Coast of North America. Paper presented at the Society for American Archaeology 78th Annual Meeting. Honolulu, HI.

Mackie, Quentin, Loren G. Davis, Daryl W. Fedje, Duncan McLaren, and Amy E. Gusick
2014 Searching for Pleistocene-Aged Submerged Archaeological Sites along Western North America's Pacific Coast. In *Paleoamerican Odyssey Conference*. Santa Fe, Texas A&M University Press.

Magne, Martin P. R., and Daryl W. Fedje
2007 The Spread of Microblade Technology in Northwestern North America. In *Origin and Spread of Microblade Technology in Northern Asia and North America*. Edited by Y.V. Kuzmin, S.G. Keates, and C. Shen, pp. 171-188. Vancouver, Archaeology Press, Simon Fraser University.

Martin, Alexander C., and William D. Barkley

1961 *Seed Identification Manual.* Berkley, University of California Press.

Martindale, Andrew, and Irena Jurakic
2004 Northern Tsimshian Elderberry Use in the Late pre-Contact to post-Contact Era. *Canadian Journal of Archaeology / Journal Canadien d'Archéologie* 28(2):254-280.

Mathewes, Rolf W.
1991 Connections between Palaeoenvironments and Palaeoethnobotany in Coastal British Columbia. In *New Light on Early Farming, Recent Developments in Palaeoethnobotany.* Edited by J. Renfrew, pp. 378-387. Edinburgh University Press.

McKechnie, Iain
2005 Five Thousand Years of Fishing at a Shell Midden in the Broken Group Islands, Barkley Sound, British Columbia. M.A. thesis, Department of Archaeology, Simon Fraser University.

McLaren, Duncan
2008 Sea Level Change and Archaeological Site Locations on the Dundas Island Archipelago of North Coastal British Columbia. Ph.D. dissertation, Interdisciplinary Studies, University of Victoria.

McLaren, Duncan and Tina Christensen
2013 Report for the Hakai Ancient Landscapes Archaeology Project 2011 and 2012 Field Seasons (Permit 2011-171). Report submitted to BC Archaeology Branch, Heiltsuk First Nation, Wuikinuxv First Nation, Nuxalk First Nation, Hakai Beach Institute.

McLaren, Duncan, Daryl W. Fedje, Murray Hay, Quentin Mackie, Ian Walker, Dan Shugar, Jordan Eamer, and Christina Neudorf
2014 A post-Glacial Sea Level Hinge on the Central Pacific Coast of Canada. *Quaternary Science Reviews* 97 (2014):148-169.

McLaren, Duncan, Rebecca J. Wigen, Quentin Mackie, and Daryl W. Fedje
2005 Bear Hunting at the Pleistocene/HoloceneTransition on the Northern Northwest Coast of North America. *Canadian Zooarchaeology/Zooarchéologie canadienne* (22):1-29.

McWeeney, Lucinda
1989 What Lies Lurking Below the Soil: Beyond the Archaeobotanical View of Flotation Samples. *North American Archaeologist* 10(3):227-230.

Minore, Don

1979 Comparative Autoecological Attributes of Northwestern Tree Species: a Literature Review. Pp. 72. Portland, USDA Forest Service, General Technical Report PNW-87. Pacific Northwest Forest and Range Experiment Station.

—

1990 *Thuja Plicata* Donn ex D. Don – Western Red Cedar. *In* Silvics of North America: Conifers. R.M. Burns and B.H. Honkala, eds. Washington D.C.: U.S. Department of Agriculture, Forest Service.

Moerman, Dan (editor)

2003 *Native American Ethnobotany: a Database of Plants Used as Drugs, Foods, Dyes, Fibers, and More, by Native Peoples of North America*. Dearborn, University of Michigan.

Montgomery, Frederick H.

1977 *Seeds and Fruits of Plants of Eastern Canada and Northeastern United States*. Toronto, University of Toronto Press.

Moss, Madonna L.

2011 *Northwest Coast: Archaeology as Deep History*. Washington, D.C., Society for American Archaeology Press.

—

2013 Fishing Traps and Weirs on the Northwest Coast of North America New Approaches and New Insights. In *The Oxford Handbook of Wetland Archaeology*. Edited by F. Menotti, and A. O'Sullivan. Oxford Handbooks Online. www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199573493.001.0001/oxfordhb-9780199573493-e-20, accessed September 7, 2014.

Moss, Madonna L., and Jon M. Erlandson

2000 Wolf's Lair: Middle and Late Holecene Artifacts From a Sea Cave on Baker Island, Southeast Alaska. *Canadian Journal of Archaeology* 24(1,2):107-128.

Newcombe, Charles F.

1901 Notes on a Journey around the Southern Island of the Queen Charlotte Group, British Columbia in the Year 1901. Victoria, Royal Museum of British Columbia.

New England Wild Flower Society

2011 Genus: *Isoetes* - Quillwort. *In* Go Botany. Framingham, MA. Electronic resource, https://gobotany.newenglandwild.org/genus/isoetes/, accessed June 22, 2014.

Oakley, Brian B., and Jerry F. Franklin

1998 Bitter cherry (*Prunus emarginata*) Distribution, Successional Dynamics, and Implications for the Role of the Seed Bank. *Canadian Journal of Botany* 76:1725-1732.

Oleskevich, Carmen, Simon F. Shamoun, and Zamir K. Punja
1996 The Biology of Canadian Weeds. 105. *Rubus strigosus* Michx., *Rubus parviflorus* Nutt., and *Rubus spectabilis* Pursh. Canadian *Journal of Plant Science* 76:187-201.

Oliver, Chadwick D., and Bruce C. Larson
1990 *Forest Stand Dynamics*. New York: McGraw-Hill.

Orchard, Trevor J.
2006 Gwaii Haanas Case Study: the Era Surrounding Contact. In *Living Marine Legacy of Gwaii Haanas*. Volume V: Coastal Zone Values and Management around Haida Gwaii. Edited by N. A. Sloan. Skidegate, BC. Parks Canada, Technical Reports in Ecosystem Science Report 42.

—
2009 *Otters and Urchins: Continuity and Change in Haida Economy during the Late Holocene and Maritime Fur Trade Periods*. Oxford, Archaeopress.

Orchard, Trevor J., Jenny M. Cohen, Daryl W. Fedje, and Quentin Mackie
2013 Sea Levels and Mid- to Late Holocene Subsistene and Settlement in Gwaii Haanas: Final Report on Small-Scale Archaeological Research at Site 924T in June 2012. Report on file, Gwaii Haanas National Park Reserve and Haida Heritage Site, Gwaii Haanas National Marine Conservation Area Reserve.

Packee, E. C.
1990 Tsuga heterophylla (Raf.) Sarg. Western Hemlock. *In* Silvics of North America: 1. Conifers. Agriculture Handbook 654. R.M. Burns and B.H. Honkala, eds, Vol. 2. Washington D.C., U.S. Department of Agriculture, Forest Service.

Panshin, Alexis J., and Carl de Zeeuw
1970 *Textbook of Wood Technology*. New York, McGraw-Hill.

Patterson, R. Timothy, Jean-Pierre Guilbault, Richard E. Thomson, and John L. Luternauer
1995 Foraminiferal Evidence of Younger Dryas Age Cooling on the British Columbia Shelf. *Geographie Physique et Quaternaire* 49(3):44-67.

Pearsall, Deborah M.
2000 *Paleoethnobotany: a Handbook of Procedures.* San Diego, Academic Press.

Peattie, Donald, C.
1953 *A Natural History of Western Trees*. Boston, Houghton Mifflin.

Pellatt, Marlow and Rolf Mathewes

1997 Holocene Tree Line and Climate Change on the Queen Charlotte Islands, Canada. *Quaternary Research* 48(1997):88-99.

Pienitz, Reinhard, Daryl W. Fedje, and Michel Poulin

2003 *Marine and Non-marine Diatoms from the Haida Gwaii Archipelago and Surrounding Coasts, Northeastern Pacific, Canada*. Berlin, Stuttgard and Cramer.

Plank, Marlin E.

1971 Red Alder (*Alnus rubra* Bong.): US Department of Agriculture, Forest Service.

Pojar, Jim, and Andy MacKinnon

1994 *Plants of Coastal British Columbia Including Washington, Oregon and Alaska.* Vancouver, BC Ministry of Forests and Lone Pine Publishing.

Province of British Columbia

1996 Heritage Conservation Act. Victoria, Queen's Printer. Electronic resource, http://www.bclaws.ca/civix/document/id/complete/statreg/96187_01, accessed August 24, 2014.

Quickfall, Geoffrey S.

1987 Paludification and Climate on the Queen Charlotte Islands during the Past 8,000 Years. M.Sc. thesis, Department of Biological Sciences, Simon Fraser University.

Ramsey, Caroline L., Paul A. Griffiths, Daryl W. Fedje, Rebecca J. Wigen, and Quentin Mackie

2004 Preliminary Investigation of a Late Wisconsinan Fauna from K1 Cave, Queen Charlotte Islands (Haida Gwaii), Canada. *Quaternary Research* 62(1):105-109.

Ransom Seed Laboratory, Inc.

2011 Knowledgebase of Native Seeds. Electronic resource, http://www.ransomseedlab.com/knowledgebase.htm, accessed December 23, 2013.

Resilience Alliance

2002 Resilience. Electronic resource, http://www.resalliance.org/index.php/resilience, accessed September 7, 2014.

Ritchie, Patrick Morgan

2010 From Watershed to House: the Cultural Landscapes of the Sts'ailes People. M.A. thesis, Department of Archaeology, Simon Fraser University.

Ries, Leslie, Robert J. Fletcher Jr., James Battin, and Thomas D. Sisk

2004 Ecological Responses to Habitat Edges: Mechanisms, Models, and Variability Explained. *Annual Review of Ecology, Evolution, and Systematics* 35:491-522.

Rose, Robin, Lee S. Rosner, and J. Scott Kethcum

2006 Twelfth-year Response of Douglas-fir to Area of Weed Control and Herbaceous versus Woody Weed Control Treatments. *Canadian Journal of Forest Research* 36:2464-2473.

Rousseau, Michael K., Lisa Seip, Paul Ewonus, and Simon Kaltenrieder

2003 Port Hammond Revisited. In *Archaeology of Coastal British Columbia: Essays in Honour of Professor Philip M. Hobler*. Edited by R.L. Carlson, pp. 87-108. Burnaby, Archaeology Press, Simon Fraser University.

Sassa, Shinji, Yoichi Watabe, Soonbo Yang, and Tomohiro Kuwae

2011 Burrowing Criteria and Burrowing Mode Adjustment in Bivalves to Varying Geoenvironmental Conditions in Intertidal Flats and Beaches. *PloS one* 6(9):e25041.

Schaefe, Kimberly

2012 Rubus spp. - Blackberry, Raspberry, Dewberry, Bramble. *In* Paleoethnobotany Laboratory Guide. St. Louis: Department of Anthropology, Washington University in St. Louis. Electronic resource. http://pages.wustl.edu/peblabguide/articles/1139, accessed March 4, 2014.

Schopmeyer, Clifford S.

1974 Thuja L. Arborvitae. *In* Seeds of Woody Plants in the United States. Edited by C.S. Schopmeyer, pp. 805-809. Washington D.C.: U.S. Department of Agriculture, Agriculture Handbook 450.

Severs, Patricia D. S.

1974 Archaeological Investigations at Blue Jackets Creek, FlUa-4, Queen Charlotte Islands, B.C., 1973. Canadian Archaeology Association Bulletin, Volume 6, pp.163-205.

Smith, Christian T., R. John Nelson, Chris C. Wood, and Ben F. Koop

2001. Glacial Biogeography of North American Coho Salmon (*Oncorhynchus kisutch*). *Molecular Ecology* 10:2775–2785

Smith, Harlan I.

1929 Materia Medica of the Bella Coola and Neighbouring Tribes of British Columbia. Bulletin No. 56. Annual report for 1927. Ottawa: Canada Department of Mines, National Museum of Canada.

Smith, Huron H.

ca. 1924 Menomini Medicine Details - Part III. *In* Ethnobotany of Menomini. Wisconsin: Manataka American Indian Council. Electronic resource, http://www.manataka.org/page73.html, accessed May 15, 2014.

Smith, Nicole
2004 A Geochemical Approach to Understanding Raw Material Use and Stone Tool Production at the Richardson Island Archaeological Site, Haida Gwaii, British Columbia. M.A. thesis, Department of Anthropology, University of Victoria.

Smith, Nicole, Jenny M. Cohen, Daryl W. Fedje, Denee Renouf
2013 2011/12 Gwaii Haanas and Gwaii Haanas Marine Archaeology Programme. Report on file, Parks Canada Agency, Western and Northern Service Center.

Southon, John R., D. E. Nelson, and J. S. Vogel
1990 A Record of Past Ocean-Atmosphere Radiocarbon Differences From the Northeast Pacific. *Paleoceanography* 5(2):197-206.

Steedman, Elsie V.
1930 *Ethnobotany of the Thompson Indians of British Columbia*. Washington, D.C., Bureau of American Ethnology.

Steffen, Martina L.
2006 Early Holocene Hearth Features and Burnt Faunal Assemblages at the Richardson Island Archaeological Site, Haida Gwaii, British Columbia. M.A. thesis, Department of Anthropology, University of Victoria.

Steward, Julian H.
1933 Ethnography of the Owens Valley Paiute. *University of California Publications in American Archaeology and Ethnology* 33(3):233-250.

Storey, Jennifer
2008 An Analysis of the Unifacial Tool Assemblage from the Richardson Island Site, Haida Gwaii, British Columbia. M.A. thesis, Department of Anthropology, University of Victoria.

Stuiver, Minze, Paula J. Reimer, and Ron Reimer
2014 CALIB Radiocarbon Calibration. Version 7.0. Revision 5.0, modified 10/03/2014: Minze Stuiver and Paula Reimer. Electronic resource, http://calib.qub.ac.uk/calib/, accessed October 3, 2014.

Swanton, John R.
1905a Contributions to the Ethnology of the Haida. In *Jesup North Pacific Expedition Publications*. Pp. 1-300. New York, American Museum of Natural History.

—

1905b Haida Texts and Myths: Skidegate Dialect: Bureau of American Ethnology, W. H. Holmes, Chief. Bulletin 29. Smithsonian Institution. Washington Government Printing Office.

—

1908 Haida Texts: Masset Dialect. In *The Jesup North Expedition. Memoir of the American Museum of Natural History*. New York, E. D. Brill Ltd. Printers and Publishers; G. E. Stechert and Co.

Tappeiner, John C., and John C. Zasada
1993 Establishment of Salmonberry, Salal, Vine Maple, and Bigleaf Maple Seedlings in the Coastal Forests of Oregon. *Canadian Journal of Forest Research* 23(9):1775-1780.

Taylor, R. L., and S. Taylor
1981 *Prunus emarginata* in British Columbia: Bitter Cherry, Member of the Family Rosaceae. Description, Cultivation, Ornamental and Landscape Plant. *Davidsonia* 12:78-83.

Taylor, W. Carl, Neil T. Luebke, Donald M. Britton, R. James Hickey, and Daniel F. Brunton
1993 Isoëtaceae Reichenbach: Quillwort Family. *In* Flora of North America North of Mexico. Edited by North America Editorial Committee, [http://www.efloras.org]. New York, Oxford University Press.

Tirmenstein, Debra A.
1989 Rubus spectabilis. *In* Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Electronic resource, http://www.fs.fed.us/database/feis/, accessed June 19, 2014.

—

1990a Gaultheria shallon. *In* Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Electronic resource, http://www.fs.fed.us/database/feis/, accessed June 21, 2014.

—

1990b Vaccinium ovalifolium. *In* Fire Effects Information System. U.S. Department of Agriculture, Forest Service. Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Electronic resource, http://www.fs.fed.us/database/feis/, accessed Jun 21, 2014.

—

1990c Vaccinium parvifolium. *In* Fire Effects Information System. U.S. Department of Agriculture, Forest Service. Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Electronic resource, http://www.fs.fed.us/database/feis/, accessed June 27, 2014.

Traveset, Anna and Mary F. Wilson

1997 Effect of Birds and Bears on Seed Germination of Fleshy-fruited Plants in Temperate Rainforests of southeast Alaska. *Oikos,* 80:89-95.

Turner, Nancy J.

1973 The Ethnobotany of the Bella Coola Indians of British Columbia. *Syesis* 6:193-220.

—

1995 *Food Plants of Coastal First Peoples*. Vancouver, Royal British Columbia Museum; UBC Press.

—

1998 *Plant Technology of British Columbia First Peoples.* Vancouver, University of British Columbia Press.

—

2010 *Plants of Haida Gwaii = Xaadaa Gwaay gud gina k'aws (Skidegate) = Xaadaa Gwaayee guu giin k'aws (Massett).* Winlaw, BC, Sono Nis Press.

—

2014 Ancient Pathways, Ancestral Knowledge: Ethnobotany and Ecological Wisdom of Indigenous Peoples of Northwestern North America. Volume One: The History and Practice of Indigenous Plant Knowledge. Pp. 1056. Montreal, McGill–Queen's University Press.

Turner, Nancy J. and Alison Davis

1993 “When Everything was Scarce”: the Role of Plants as Famine Foods in Northwestern North America. *Journal of Ethnobiology* 13(2):1-28.

Turner, Nancy J. and Barbara S. Efrat

1982 Ethnobotany of the Hesquiat Indians of Vancouver Island. Victoria, British Columbia Provincial Museum, Cultural Recovery Paper No. 2.

Turner, Nancy J. Chapman, and Marcus A. M. Bell

1971 The Ethnobotany of the Coast Salish Indians of Vancouver Island. *Economic Botany* 25:63-104.

—

1973 The Ethnobotany of the Southern Kwakiutl Indians of British Columbia. *Economic Botany* 27:257-310.

Turner, Nancy J., Iain J. Davidson-Hunt, and Michael O'Flaherty
2003 Living on the Edge: Ecological and Cultural Edges as Sources of Diversity for Social-Ecological Resilience. *Human Ecology* 31(3):439-461.

Turner, Nancy J., John Thomas, Barry F. Carlson, and Robert T. Ogilvie
1983 Ethnobotany of the Nitinaht Indians of Vancouver Island. Victoria, B.C. Provincial Museum.

USDA, NRCS
2014 The PLANTS Database. National Plant Data Team, Greensboro, NC 27401-4901. Online resource, http://plants.usda.gov, accessed May 27, 2014.

Vance, Nan C., Melissa Borsting, David Pilz, and Jim Freed
2001 Special Forest Products: Species Information Guide for the Pacific Northwest. General Technical Report PNW-GTR-513: United States Department of Agriculture, Forest Service.

van der Waaij, Michiel
2009 *Cristatella mucedo* (Cuvier, 1798). Online resource, http://www.bryozoans.nl/soorten/en/cristatella_mucedo.html, accessed June 14, 2014.

Viereck, Les
2007 *Alaska Trees and Shrubs*. Fairbanks, University of Alaska Press.

Waber, Nicholas
2011 The Development of the Microblade Industry at the Richardson Island Site, Haida Gwaii, British Columbia. M.A. thesis, Department of Anthropology, University of Victoria.

Wada, Sugae
2009 Evaluation of Rubus Seed Characteristics: Seed Coat Morphology, Anatomy, Germination Requirements and Dormancy Breaking. Ph.D. dissertation, Department of Horticulture, Oregon State University.

Wada, Sugae, James A. Kennedy, and Barbara M. Reed
2011 Seed-Coat Anatomy and Proanthocyanidins Contribute to the Dormancy of Rubus Seed. *Scientia Horticulturae* 130(4):762-768.

Warner, Barry G.
1984 Late Quaternary Palaeoecology of Eastern Graham Island, Queen Charlotte Islands, British Columbia, Canada. Ph.D. dissertation, Department of Biological Sciences, Simon Fraser University.

Warner, Barry G., Rolf W. Mathewes, and John J. Clague

1982 Ice-Free Conditions on the Queen Charlotte Islands, British Columbia, at the Height of Late Wisconsin Glaciation. *Science, New Series* 218(4573):675-677.

Welchel, David (editor)

2005 *Ozette Archaeological Project Research Reports: Ethnobotany and Wood Technology*. Volume 3. Seattle: Department of Anthropology, Washington State University, Pullman, and National Park Service, Pacific Northwest Regional Office.

Wigen, Rebecca J.

2005 History of the Vertebrate Fauna in Haida Gwaii. In *Haida Gwaii: Human History and Environment from the Time of Loon to the Time of the Iron People*. Edited by D.W. Fedje and R.W. Mathewes, pp. 96-116. Vancouver, UBC Press.

Wigen, Rebecca J., and Tina Christensen

2001 The Fauna from Cohoe Creek: an Early Shell Midden in Haida Gwaii. *Canadian Zooarchaeology* 19:1-8.

Wigen, Rebecca J., and Ian D. Sumpter

2003 Preliminary Faunal Analysis of an Early Holocene Site, Kilgii Gwaay (1325T), South Haida Gwaii. Paper presented at the 10th International WARP Conference. Olympia, Washington, USA.

Wild Plant Seed Bank of Korea

2014 *Suaeda maritima* (L.) Dumort. Electronic resource, http://www.seedbank.re.kr/detail.php?seed=1271, accessed June 20, 2014.

Williams, Judith

2006 *Clam Gardens: Aboriginal Mariculture on Canada's West Coast*. Volume 15. Vancouver, New Star Books.

Wood, Richard D.

1967 Charophytes of North America: a Guide to the Species of Charophytes of North America, Central America and the West Indies. *In* E-Flora BC: Electronic Atlas of the Plants of British Columbia [eflora.bc.ca]. Edited by B. Klinkenberg. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia. Electronic resource, http://ibis.geog.ubc.ca/biodiversity/eflora/, accessed June 6, 2014.

Worley, D. M. and C. M. Nixon

1974 Elders. *In* Shrubs and Vines for Northeastern Wildlife. General Technical Report NE-9. Edited by J. D. Gill, W. M. Healy, pp. 48-51. Upper Darby, PA, U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station [6707].

Yarnell, Richard A.
1969 Contents of Human Paleofeces. In *The Prehistory of Salts Cave, Kentucky*. Edited by P. J. Watson. Reports of Investigation No. 16. Springfield, IL, Illinois State Museum.

Young, James A., and Cheryl G. Young
1992 *Seeds of Woody Plants in North America*. Portland, Dioscorides Press.

Zasada, John C. and John C. Tappeiner III
2008 Rubus L. – Blackberry, Raspberry. In *Woody Plant Seed Manual. Part II - Specific Handling Methods and Data for 236 Genera*. Edited by F. T. Bonner, R. P. Karrfalt, pp. 984-996. Agriculture Handbook 727. USDA Forest Service, Southern Regional Extension Forestry. Government Printing Office.

Appendix A – Radiocarbon dates from Kilgii Gwaay

Table A1. Radiocarbon dates from the Kilgii Gwaay site, all years of investigations. Dates calibrated using Calib 7.0 (Stuiver et al. 2014).

Lab #	**Sample #**	**Material**	**Del ^{13}C**	**^{14}C Age**	**(+/-)**	**Delta R**	**(+/-)**	**Marine %**	**Calendar Age BP (1 sigma)**	**Calendar Age BP (2 sigma)**
CAMS 70704	1325T3-L5-45cm	Mammal bone	-22.1	9440	50			0	10729 - 10588	11062 - 10520
CAMS 70704	1325T3A45	Bear bone		9460	50	210	50		10759 - 10590	11068 – 10590
CAMS 76666	1325T8B24-1	Charcoal	-25	9430	50			0	10712 - 10587	11056 - 10515
CAMS 76667	1325T8B24-3	Mussel shell*	0	10040	50	200	50	100	10879 - 10589	11028 - 10560
CAMS 76668	1325T8B40-1	Charcoal	-25	9230	50			0	10491 - 10295	10546 - 10250
CAMS 76669	1325T8B40-2	Mussel shell*	0	10140	40	200	50	100	11040 - 10769	11107 - 10664
CAMS 76670	1325T8B52-1	Charcoal	-25	9850	40			0	11266 - 11215	11325 - 11199
CAMS 77248	1325T8B24-2	Charcoal	-25	9410	50			0	10697 - 10580	10756 - 10511
CAMS 77719	1325T8C	Periwinkle shell*	0	1040	40	210	50	100	517 - 407	547 - 307
CAMS 77720	1325T8A6	Periwinkle shell*	0	1250	40	210	50	100	655 - 553	709 - 510
CAMS 79681	1325T8B3-31	Mussel shell*	0	10020	50	200	50	100	10799 - 10571	11009 - 10542
CAMS 79682	1325T8B3-31	Charcoal	-25	9260	40			0	10515 - 10301	10562 - 10289
CAMS 79683	1325T8B4-40	Mussel shell*	0	10040	40	200	50	100	10875 - 10590	11014 - 10565
CAMS 79684	1325TB4-40	Charcoal	-25	9340	40			0	10647 - 10502	10679 - 10426
CAMS 79685	1325TC2-20	Sea urchin*	0	9270	40	220	50	100	9879 - 9645	10003 - 9539
CAMS 79686	1325TC2-207	Potamogeton seed	-25	12420	60			0	14771 - 14177	14981 - 14122
CAMS 82214	1325TC2-216	Seed	-25	12190	60			0	14131 - 13943	14474 - 13812
CAMS 87243	1325TC2-216	Wood	-25	12335	40			0	14514 - 14094	14888 - 14029
CAMS 87641	1325T4D4	Split root wrap	-25	9415	35			0	10691 - 10588	10737 - 10567
CAMS 87642	1325T8F5	Wood wedge	-25	9395	40			0	10676 - 10576	10717 - 10516
CAMS 95557	1325TC2-79	Wood	-25	10025	40			0	11617 - 11396	11747 - 11322
CAMS 95558	1325TC2-199	Pine needle	-25	12010	60			0	13936 - 13786	14023 - 13729

Lab #	**Sample #**	**Material**	**Del ^{13}C**	**^{14}C Age**	**(+/-)**	**Delta R**	**(+/-)**	**Marine %**	**Calendar Age BP (1 sigma)**	**Calendar Age BP (2 sigma)**
CAMS 95559	1325TC2-219	Seed	-25	12455	40			0	14736 - 14229	14997 - 14168
CAMS 95560	1325TC2-223	Seed	-25	11695	45			0	13620 - 13447	13712 - 13396
UCIAMS 102667	1325TC2-74			9640	20				10882 - 11141	10809 - 11172
UCIAMS 102668	1325TC1-59			9375	20				10570 - 10652	10521 - 10676
UCIAMS 102669	1325TC1-43a			9485	20				10699 - 10750	10663 - 11055
UCIAMS 102670	1325TC1-43b			9375	20				10570 - 10652	10521 - 10676
UCIAMS 102671	1325TC1-3			9250	25				10307 - 10500	10296 - 10512
UCIAMS 88438	1325T29A-53	Charcoal	-26.5	1715	20			0	1691 - 1568	1694 - 1559
UCIAMS 88439	1325T29A-90	Charcoal	-25.1	2210	20			0	2307 - 2156	2313 - 2152
UCIAMS 89068	1325T20? -2m	Shell*	0.1	8375	25	245	50	100	8691 - 8523	8831 - 8434
UCIAMS 89133	1325T20?	Wood	-26.6	7470	20			0	8345 - 8215	8362 - 8202
UCIAMS 139567	1325T34M6 .029mgC	Western redcedar seed		-415	40			0		
UCIAMS 116598	1325T34	Stake		9380	30			0	10569 - 10658	10520 - 10691
UCIAMS 116599	1325T31G8	Elderberry seed		9455	30			0	10608 - 10734	10587 - 10761
UCIAMS 143281	1325T34K4 SSD-6	Charred seed .015mgC		8510	320				9034 - 10111	8632 - 10256
UCIAMS 143282	13 1325T34K4 SSD-6	Rubus seed .14mgC		9075	35				10215 - 10246	10190 - 10264
UCIAMS 143283	1325T34K6 SSA-13	Elderberry seed	-22.0	9240	25				10301 - 10494	10293 - 10504

Appendix B - Identification Criteria for Archaeobotanical Remains from Kilgii Gwaay

This section is divided into to three sections, dealing with taxonomic identification of cellular wood structure, seed morphology, and other macrofossil identifications. Taxa are discussed according to their presence in the archaeological record at Kilgii Gwaay as they fall under the three sections, with some taxa represented in multiple sections.

I only include the detailed the criteria for identification of specimens I have analyzed personally. Wood identified by Mary-Lou Florian is not included in this section. Anatomical attributes of conifer wood are tabulated by taxon (Table B1), and provide supplemental attribute detail to the wood or charcoal samples discussed under each identified conifer category.

For the purposes of this study, I use the term ‘seed’ in the popular sense, referring to true seeds, endocarps, and other fruiting structures such as achenes. Following Montgomery (1977) and Bekris and colleagues (2012), seed dimensions are recorded as length by width by thickness. The location of the hilum is considered the base of the seed, and the length is measured from base to apex. Where a style is present, the length is measured from the hilum to the bottom of the style. Width is measured at a right angle to the length at the widest part. All measurements are in millimeters unless otherwise noted.

Contents

Wood and charcoal anatomical structure

Table B1. Anatomical attribute characteristics of conifer wood growing in the Kilgii Gwaay study area or which may have been available as driftwood at the site.

species	rays		ray parenchyma		ray tracheid		fusiform ray seriation	longitudinal resin canal		epithelial cells		spiral thickenings present	cross-field pits		longitudinal parenchyma present	abrupt transition of growth ring	early wood portion of annual ring	decay resistance (tracheid)
	ray height (N)	Average height (N)	nodular end wall	Longitudinal wall	present	dentate walls		present	grouping	thick	quantity		type	quantity				
Pinus contorta	15+	6	+	thin	+	+	2-3	+	scattered, rarely 2-3	x	7 - 12	(+)	w/pn	(1)2-4(6)	-	+	most	low+
Abies lasiocarpa	30+		+		-	-	–	-	–	–	–	-	t	(1)2-4	- /s	-	1/2+	low
Picea sitchensis	20+	7	+		+		3-5	+	Single - 2+ contiguous	+	7 - 12	-	pc	(1)3-6	Root +; trunk -		1/2-2/3	low+
Tsuga heterophylla	16+	8	+		+		–	-	–	–	_	-	pc/c	(1)2-3(4)	- /s	-	2/3+	low+
Tsuga mertensiana	16+		+		+		–	-	–	–	–	-	pc/c	(1)2-3(4)	- /s	-	2/3+	low+
Larix occidentalis	20+	10	+		+	-	2-3	+	latewood; solitary-2+ contiguous	+	7 - 12	+	pc	(1)4-6(10)	- /s	+	2/3+	
Pseudotsuga menziesii	25+	7	+		+	-	3-5	+	outer 1/2 of ring; scattered to rowed	+	7 - 12	+	pc	(1)4(6)	- /s	+/-	most	moderate
Taxus brevifolia	25		-		-	-	–	-	–	–	–	+	c	1-2(4)	-	-	1/2	
Chamaecyparis nootkatensis	12+	5	+/-	smooth	+	short	–	-	–	–	–	-	c	1-3	+/-	+	most	
Juniperus	6		+		-	-		-	–	–	–	-	c		+			
Thuja plicata	12+	7	-	smooth	(+)	–	–_	-_	–	–	–	-_	t	1-4	+	+	most	high

Cross-field pit types: c = cupressoid; pc = piceoid; pn = pinoid; t = taxodioid; window-like. Adapted from (Hoadley 1990; Panshin and de Zeeuw 1970).

Wood Identification

Alnus spp. – Alder (Betulaceae)

Based on pollen samples, both red alder (*Alnus rubra) and* Sitka alder (*Alnus viridis*) were present at the site (Emily Helmer pers. comm. 2014). *Alnus rubra* wood has many small vessels with small orbicular to oval, widely spaced pitting. The two kinds of rays are uni- to biseriate and a distinct broad aggregate type (Figure B1) (Friedman 1978). Perforation plates are scalariform with 15+ thin bars (Panshin and de Zeeuw 1970).

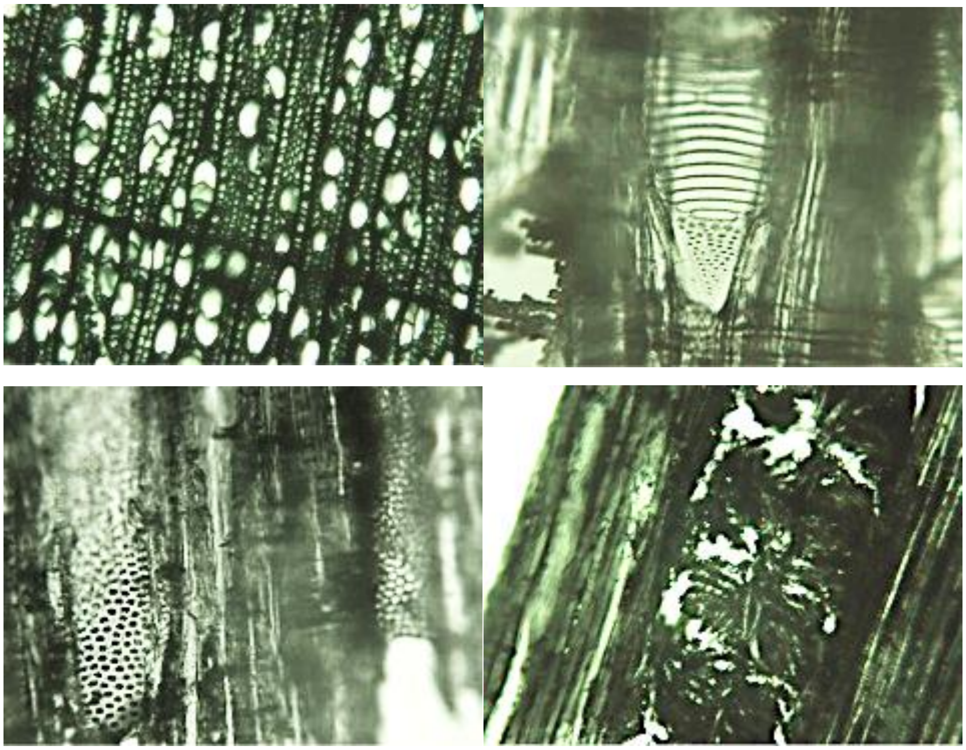

Figure B1. *A. rubra* comparison sample cross-section vessels in radial groupings and singular (top left); radial view of scalariform perforation plate (top right). Tangential view with vessel pitting (bottom left) and ancillary ray cells (bottom right).

The charcoal sample identified as *Alnus* sp. (34D6-ch1) was primarily based on the distinct aggregate rays (e.g. Figure B2) and scalariform perforation plate (Friedman 1978). The vessels were diffuse-porous and abundant in singles and multiples. Although *A. rubra* was likely a more useful wood, since it grows larger than *A. viridis*, I did not have a sample of *A. viridis* in my wood comparative collection and could not find information regarding presence of aggregate rays. Therefore I could not rule out this shrub species.

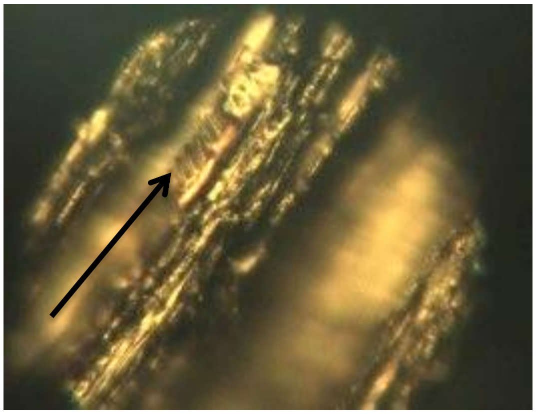

Figure B2. Radial section of charcoal sample 34D6-ch1 showing remnant of scalariform perforation plate.

Picea sitchensis – Sitka spruce (Pinaceae)

Picea sitchensis wood was identified based on a suite of characteristics and fits within the group of *Picea/Tsuga/Abies,* which are often difficult to distinguish from each other. This group contains many cellular attributes (see Table B1). Cross-field pitting of *Picea* sp. is small and uniform, usually in a single horizontal row. The anatomical features were considered as a collective suite, since structural variation can occur within an individual tree and within a sample. The wood from the artifacts and debris was degraded to varying degrees, and therefore not all attributes were clear or observable (Figure B4).

Species was determined largely by the presence of resin canals observable in the tangential and transverse views of the wood (Figure B3). Resin canals were not necessarily present in each sample, and therefore multiple sections of a sample were analyzed where resin canals were not immediately observable in conifer wood. *Picea* sp. is distinguishable from *Pinus* spp., which similarly has resin canals, by the surrounding thick-walled epithelial cells and by the cross-field pit shape (Panshin and De Zeeuw 1970). Other conifer species in the NWC that contain regular resin canals are other species of *Picea*, *Larix* spp. and *Pseudotsuga menziesii*. These taxa, if currently present on Haida Gwaii, are recent introductions by human activity and are not known from the paleoenvironmental records (e.g. Hebda and Mathewes 1984; Lacourse et al. 2005). The possibility of the use of driftwood of species not growing on Haida Gwaii was not ruled out, however, none of the samples analyzed contained the diagnostic spiral thickenings that are characteristic of Douglas fir. *Larix* resin canals tend to be smaller, and other features such as growth ring patterns are distinguishable from *Picea* sp. (Panshin and De Zeeuw 1970). Regular resin canals may be distinguishable from traumatic resin canals, which can occur in species that normally do not possess regular resin canals. Traumatic resin canals are commonly grouped in tangential chains, whereas regular resin canals may occur singularly or irregularly grouped (Panshin and De Zeeuw 1970). I considered all these variables for each sample I analyzed.

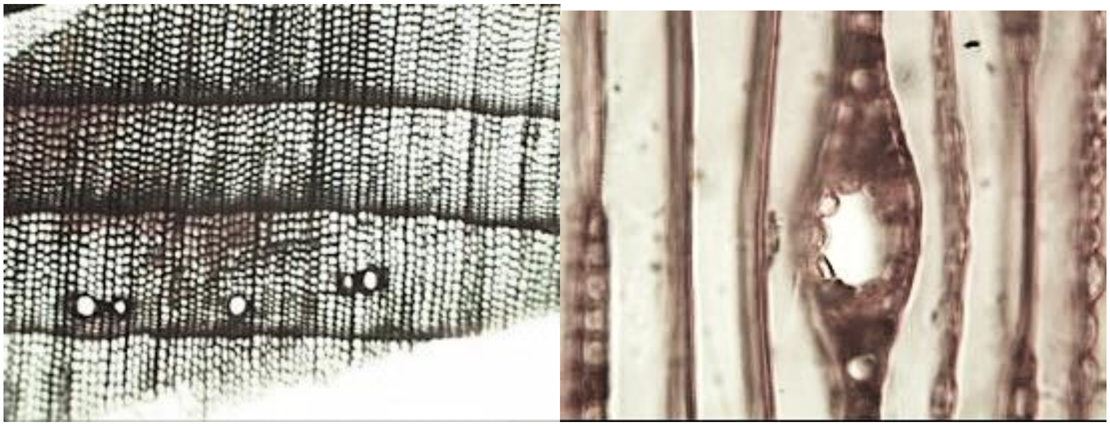

Figure B3. Cross section of comparative *Picea sitchensis* with longitudinal resin canals (left); Tangential view of fusiform ray 40X (right).

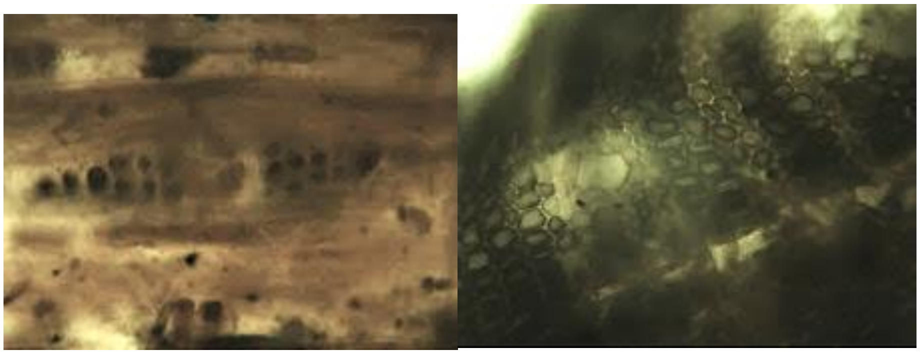

Figure B4. Artifacts identified as *P. sitchensis*: tangential view of artifact 1325T31F8-3 showing fusiform ray (left); cross sectional view of artifact 1325T31G9-5 showing longitudinal resin canal (right).

Rubus **sp. – Salmonberry- thimbleberry-type (Rosaceae)**

The wood of *Rubus* spp. is readily distinguishable by its thick aggregate and abundant rays viewed in cross-section. *Rubus* spp. anatomical features are often indistinguishable from each other (Figure B5) (Dale 1968).

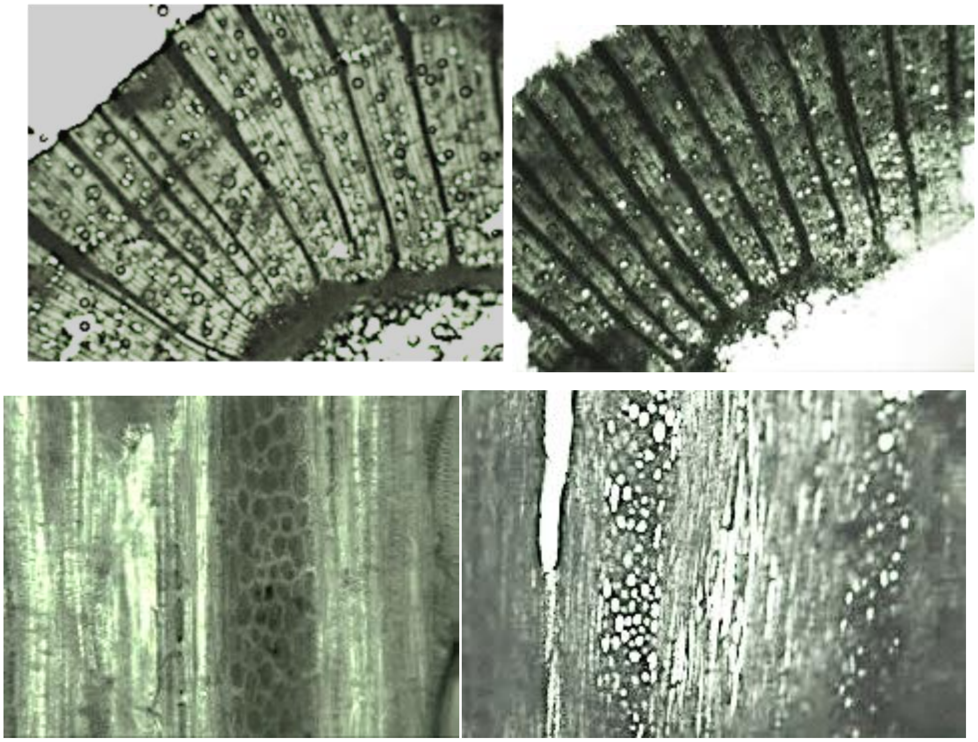

Figure B5. Comparative samples showing wide multi-seriate rays: *R. parviflorus* cross-section (top left), tangential view (lower left); *R. spectabilis* cross-section (top right), tangential view (lower right).

The wood debitage samples from Kilgii Gwaay exhibited distinct attributes of *Rubus* spp. that were well preserved (Figure B6). Wood samples were diffuse-porous viewed in cross-section, with vessels sometimes occurring in semi-radial chains. Vessel pitting was alternate and fairly abundant. Perforation plates were simple. The primary distinguishing feature was the structure of the ray cells. Ray cells were uniseriate and multi-seriate aggregate rays (3)9-10 cells wide.

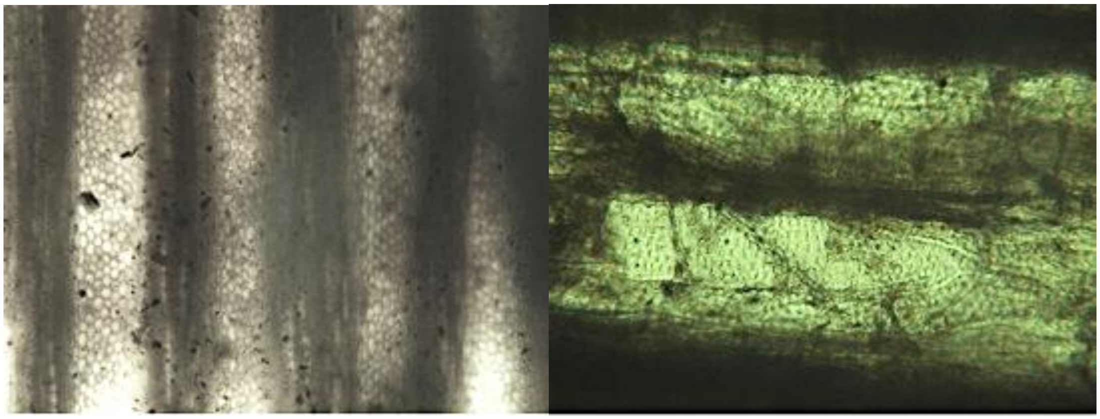

Figure B6. Tangential section of wood samples 31G-A showing abundant wide multi-seriate rays (left); radial view of vessels with pitting (right).

Sambucus racemosa – Red elderberry (Caprifoliaceae)

Kilgii Gwaay samples of *Sambucus racemosa* wood debitage were semi-ring to diffuse porous with abundant pores in singles and multiples. Ray cells were uniseriate and heterogeneous multi-seriate (~3-5 cells wide). Vessels were relatively short with abundant alternate pitting. Perforation plates were simple (Figure B7) (Friedman 1978).

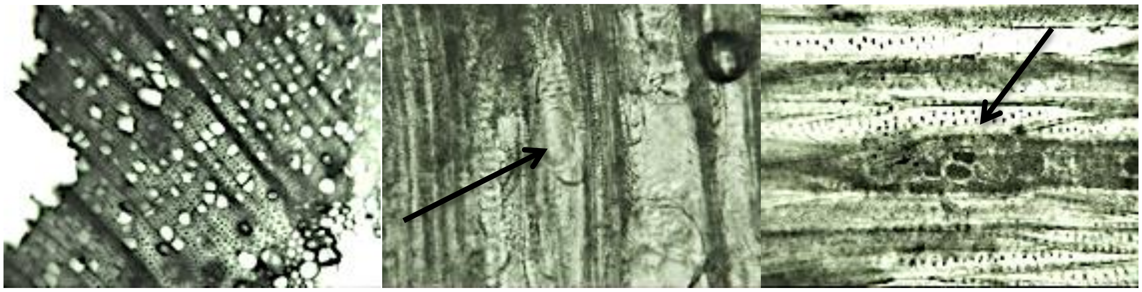

Figure B7. Comparative sample cross section of *Sambucus racemosa* showing vessel arrangement (left); radial view with simple perforation plate (middle); tangential view of multiseriate ray (right).

Tsuga heterophylla – Western hemlock (Pinaceae)

Tsuga spp. wood is in the conifer category of *Picea/Abies/Tsuga*, which are anatomically similar (see table B1). *Tsuga* spp. lacks regular resin canals and spiral thickenings in the longitudinal tracheids. Cross-field pitting is piceoid to cupressoid and with 1-4 per cross-field. (Panshin and De Zeeuw 1970). Based on the lack of evidence for the paleoenvironmental and contemporary presence of *Abies* sp. in Haida Gwaii, wood in this category that was not assignable to *Picea* sp. was considered to be *T. heterophylla*. *T. mertensiana* also occurs in Haida Gwaii in alpine to sub-alpine regions. Its presence at the site was deemed unlikely, since only *T. heterophylla* cones were in the cultural deposits. *Tsuga* spp. generally have annual rings that are more even and narrow, and marginal ray tracheids (Figure B8) that are not usually present in True firs (Panshin and De Zeeuw 1970). This is a particularly difficult category to distinguish at the species level, and therefore inferences were made based on other botanical evidence. Many of my identifications of wood debitage were not at a high level of confidence, based on the degree of degradation that obscured key anatomical features necessary for identification, such as cross-field pitting. The features were much clearer in charcoal samples from the site (Figure B9).

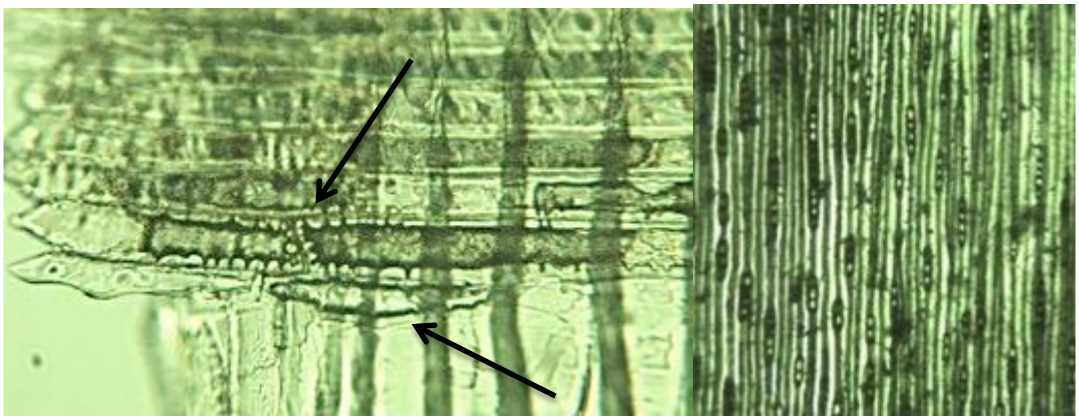

Figure B8. *T. heterophylla* comparative samples. Radial view with ray parenchyma nodular end walls and marginal ray tracheids with bordered pits 40X (left); Tangential view of uniseriate rays typical of many conifer species 10X (right).

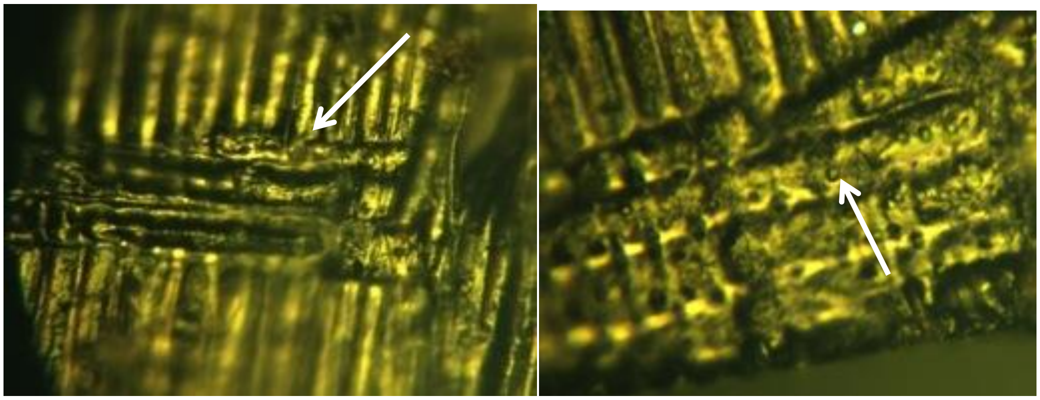

Figure B9. Radial views of *T. heterophylla* charred artifact 1325T35C4-1 showing ray tracheids with bordered pits (left) and cupressoid cross-field pitting (right).

Seed Morphology

Alnus sp. – Alder (Betulaceae)

Alnus spp. seeds are flat and more or less cordiform in shape, and golden brown at maturity. In contrast to birch (*Betula* spp.), *Alnus* stigmas often break off, leaving two stubby style bases in the apical notch (Martin and Barkley 1961). *A. rubra* and *A. viridis* are winged while *A. incana* and *A. serrulata* have flat faces that are woody and thick (Martin and Barkley 1961). *A. viridis* seeds are 2–3 mm in length and average 2.5 mm wide and 0.5 mm thick, having very thin, broad translucent wings, while *A. rubra* seeds have narrow, membranous wings (Banerjee et al. 2001; Montgomery 1977: 56).

Identification is informed by the modern presence of *A. rubra* and *A. viridis* on Haida Gwaii and the lack of other alder and birch species, and based on physical attributes of the thin wing remnants of the seeds (Figure B10). I have not determined the range of morphological overlap between *A. rubra* and *A. viridis* seeds, however pollen studies show that both species were present at the site (Fedje et al. 2005; Emily Helmer pers. comm. 2014).

Figure B10. Three *Alnus* sp. seeds show variation in size and morphology from Kilgii Gwaay.

Amaranthaceae: *Atriplex* sp. (cf.) – orache; saltbush

The Kilgii samples ranged in height from 0.95 mm to 1.67 mm (Figure B11). The variation may represent seed development stages within one taxon or may represent at least two species. One of the larger seeds was identified to *Atriplex* cf., whereas the other two were identified only to family.

The Chenopodioideae subfamily has seeds that are usually 1-2 mm in size and shiny dark brown to black. *Atriplex* sp. seeds are circular-lenticular with a black and faintly areolate surface, and approximately 1.5-2.5 x 1.5-2.5 x 1.2 mm in size (Montgomery 177: 69). They usually have a rounded margin, distinguishing them from *Amaranthus* sp., which has a narrow rim (Martin and Barkley 1961). *Suaeda calceoliformis* seeds are dark purple-brown to black, smooth or fine wrinkled, 1.0-1.7 mm wide. They are almost globular in shape, depressed at one end, and with a shallowly pitted surface (WPSBK 2006). These seeds are very shiny compared to those from Kilgii Gwaay, but the extent of surface degradation in the archaeobotanical samples is unknown.

Montia spp. (miner’s lettuce), within the family of Montiaceae, have similarly shaped seeds. *M. fontana* has black, round seeds that are 0.7-1.2 mm long. The surface is covered with numerous small projections - too textured in comparison to the smooth surfaced archaeobotanical specimens. *M. parvifolia* has black, smooth, shiny seeds 1-1.5 mm long (Douglas et al. 1998b; USDA 2014). *Chenopodium* (lambsquarters), a recent introduction along roadsides in Haida Gwaii, has seeds that are similar in shape and appearance but smaller than *Montia* sp. (Diedrich 2013). *Claytonia sibirica* (Siberian miner's lettuce) seeds are round to elliptic, black, shiny or dull, 1.5-2 mm long (Douglas et al. 1998b), and based on the comparative collections, more elongate than the Kilgii Gwaay samples.

Figure B11. Two Amaranthaceae seeds from the hearth activity area of the site.

Asteraceae – Aster family

Asteraceae types I and II were both identifiable to family only (Figure B12). Each type was found only in one sample area of the site – type I at the pond edge and type II at the hearth activity area. Asteraceae have one-seeded fruit (achenes) that often crowned with a pappus. None of the specimens from the site has a preserved pappus, although the slightly ridged flattened apex where the pappus would have attached is evident in the type II sample. The seeds have a tapered hilum expanding to a broad and slightly rounded apex. Type I seeds range in size from 1.4 to 2 mm long. They have a stiff leathery coat and are relatively wider than type II. Type II is more thin and elongate with longitudinal ridges, which may be a result of post-depositional wrinkling rather than a ribbed surface.

Figure B12. Four Asteraceae type I seeds from the edge of the paleopond (left); one Asteraceae type II from hearth activity area (right).

Carex spp. – sedge (Cyperaceae)

The three *Carex* spp. seeds from the hearth area appear to have a range of characteristics that may represent different species. They are all lenticular in cross-section and lack persistent styles. One has small dimpling at the base (Figure B13). Two seeds were light brown, while one was a darker chestnut brown. Depositional factors may have influenced the colour of the seeds. All specimens had a relatively smooth surface without bristles or check-rowed markings, which can be present in other Cyperaceae genera (Martin and Barkley 1961). *Scirpus microcarpus* seeds are also lenticular in shape, are very pale and somewhat smaller than the Kilgii Gwaay samples at 1-1.2 mm long (Douglas et al. 2001). Comparative samples also did not taper to the base as abruptly as Carex samples I observed. *Carex* spp. seeds are can be identified to species by measuring small technical differences, particularly in the mature perigynia structure (Hitchcock and Cronquist 1964). No perigynia were preserved with the samples, thereby not providing sufficient information to identify the seeds beyond genus level. However, seeds from my comparative collection that most closely resembled those from the archaeobotanical sample were: *C. lyngbyei*, which is lenticular and minutely pimpled, and measures 1.9-2.4 mm in length, somewhat larger than the dimpled archaeobotanical sample of 1.8 mm long; *C. obnupta*, which was a medium chestnut brown, smooth, lenticular and 1.6-2.2 mm in length, and; *C. aquatilis* which is lenticular with a pale, granular surface, measuring 1.1-1.5 mm in length (Lévesque et al. 1988; Martin and Barkley 1961). I was unable to find literature on seed morphology or a comparative sample for some of the species present on Haida Gwaii, and therefore this study is non-exhaustive.

Figure B13. Two Carex seeds from the hearth activity area at Kilgii Gwaay. Seed at bottom has dimpling at base.

Chara sp. – Charophyte, stonewort (Characeae)

Identification of *Chara* to species level is dependent on features of the stem and reproductive structures, and usually requires microscopic analysis (Wood 1967). Oogonia, reproductive parts of the plant, are a distinct characteristic of this genus. They are 0.49-0.63 by 0.35-0.43 mm, ellipsoidal, with a surface textured with eight or more helicoidal ridges (Cartajena and Carmona 2009; Lévesque et al. 1988). The single collected oogonium from the site was identified to genus level only based on the morphological descriptions mentioned above.

Figure B14. Schematic of a *Chara* oogonium with helicoidal ridges on surface.

Conioselinum gmelinii – Pacific hemlock-parsley (Apiaceae)

Conioselinum gmelinii seeds are elliptic or elliptic-oblong 5.0-8.5 mm in length, dorsally compressed, and glabrous. The lateral ribs are with thin wings, and dorsal ribs are low and corky. One to 12 oil tubes are present in the intervals between ribs, and 2-4 on the commissure, often not reaching base of the seed (Hitchcock and Cronquist 1973; Douglas et al. 1999). The archaeobotanical seeds were identified on the basis of these attributes, in particular the oil ducts and ribbing structure (Figure B15). Some of the seeds were smaller that the averages provide in the literature, however, they were consistent with the size range of the comparative samples.

Other similar Apiaceae seeds are briefly discussed here. *Ligusticum calderi* is an endemic species on Haida Gwaii. Comparative seeds from the RBCM herbarium were more rounded, less oblong, nearing globose, and without well-defined ribs. *Lomatium* spp. have fruits with distinct dorsal ribs and oil tubes however, the genus is not recorded on Haida Gwaii. *Liliaeopsis occidentalis* is a coastal species that has fruit with corky-thickened ribs, however average only 2 mm in length and globose with inconspicuous dorsal ribs (Douglas et al. 1998b). *Heracleum lanatum* seeds are much larger (7-12 x 5-9 mm) and obovate to heart-shaped, narrowing toward the base, flat, winged. *Angelica lucida* fruit are oblong-elliptic, 4-9 mm long, glabrous, with corky-thickened, thin-edged ribs, but lack distinct oil ducts. *Oenanthe sarmentosa* is oblong, 2.5-3.5 x 2 mm, however the ribs are broader than the narrow intervals (Douglas et al. 1998b).

Figure B15. Three *Conioselinum gmelinii* seeds from the edge of the paleopond, showing variation in size.

Cornus sp. – bunchberry (Cornaceae)

Seeds for this genus are usually globose to ellipsoid and contain a single chamber or two chambers indicated by a lengthwise line or groove all the way around the seed. The seeds generally lack ridges (Martin and Barkley 1961: 188). *C. canadensis* is elliptic or ovate, smooth surface and light brown and measures approximately 3 x 2 x 2 mm in size. This is contrasted with *C. stolonifera* (red osier), which is elliptic, dull grey with longitudinal white nerves, and measures 4 x 4 x 3.3 mm (Montgomery 1977: 90). I identified the seeds from the site as the bunchberry category of *Cornus* sp. (*C. canadensis, C. unalaschkensis, and C. suecica) (*Figure B16*). These* are similar in appearance, often requiring microscopic work on the leaf and flower structures to separate by species (Griffiths and Ganders 1983).

Figure B16. Two views of *Cornus* sp. (bunchberry) seed from Kilgii Gwaay, showing the non-symmetrical double chamber indicated by a lengthwise groove.

Gaultheria shallon – salal (Ericaceae)

Seeds from this genus are characterized by their somewhat flat irregular shape - often curved, ovate or wedge-shaped with a rounded apex. The surface is glossy brown with distinct cellular reticulations (Martin and Barkley 1961:189). *G. shallon* seeds tend to be approximately 1 mm in length (Montgomery 1977:104). Seeds from the site were identified primarily on the basis of the comparative samples. They differed from *Vaccinium* spp. by their glossy surface and more rounded shape (Figure B17).

Figure B17. Three *Gaultheria shallon* seeds from the hearth activity area archaeobotanical sample.

Isoetopsida: *Isoëtes* sp.; Selaginella selaginoides (cf.) – quillwort; spikemoss (Isoetaceae; Selaginellaceae)

Because the samples from Kilgii Gwaay all had very smooth surfaces, I have tentatively identified them as immature *Isoëtes* sp. or *S. selaginoides* (Figure B18). Immature megaspores of *Isoëtes* sp. are small and fragile, with a smooth or mealy yellowish white surface, and are difficult to identify to species (Taylor et al. 1993). I included *Selaginella selaginoides* as a likely candidate for the megaspores based solely on photos from Groningen Archaeobotany Platform (2013), as it was the only visual reference I found for the species. *Isoëtes* sp. that currently grow on Haida Gwaii are *I. tenella*, which measures ~ 500 µm and has some spiny surface texture on the mature megaspore, and *I. maritima* which has abundant large surface spines and is smaller than 500 µm in diameter when mature (Douglas et al. 2001). Neither of these fit the smooth surface character of the Kilgii Gwaay samples. I was unable to obtain comparative *Isoëtes* spp. collection samples, and therefore only identified the three megaspores to the Class level. Further studies may aid in finer resolution.

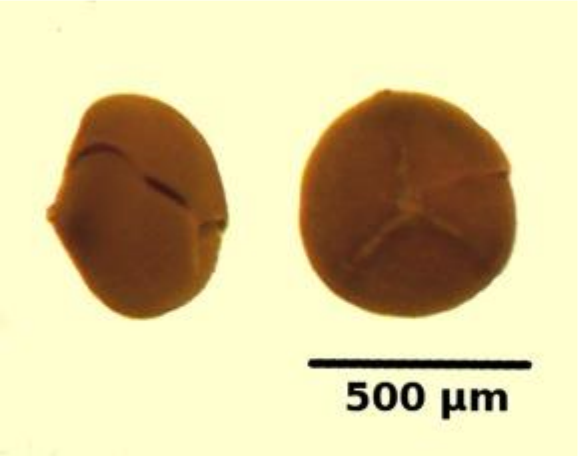

Figure B18. Two views of one Isoetopsida megaspore from the archaeobotanical sample at Kilgii Gwaay.

Juncus spp. – rush (Juncaceae)

Fourteen species of *Juncus* spp. are recorded in Haida Gwaii, two of which, *J. tenuis* Willd. and *J. bufonius* L., are thought to be recent introductions based on their presence in disturbed camp areas. The rest include: *J. drummondii* E. May; *J. filiformis* L.; *J. effusus* L.; *J. lesueurii* Bol.; *J. balticus* Willd.; *J. triglumis* L.; *J. mertensianus* Bong.; *J. falcatus* E. May; *J. ensifolius* Wikstr.; *J. supiniformis* Engelm.; *J. alpinoarticulatus* Chaix; and *J. articulatus* L. (Calder and Taylor 1968).

Juncus spp. seeds are usually less than 500 µm in length, ellipsoid to globular in shape. Cellular reticulations are often evident as well as terminal appendages (Martin and Barkley 1961:140). Seeds are more or less fusiform, caudate or apiculate at one or both ends. An aril-like coating may be present on some species (Montgomery 1977: 129).

Several *Juncus* species are unlikely to be represented in the sample. *J. falcatus* has a wedge-shaped seed and both *J. mertensianus J. articulates* have seeds that are barrel-shaped and lack the distinct nodule on the end. *J. drummondii* and *J. triglumis* have spindle-shaped seeds, but have tail-like appendages at each end. *J. ensifolius* and *J. filiformis* have egg-shaped seeds approximately 0.4-0.5 mm long (Douglas et al. 2001; Hitchcock and Cronquist 1964).

A likely contender for the larger specimen is the *J. balticus/J. arcticus* complex of species (Figure B19), which has 0.8-1.1 mm long spindle-shaped seeds that lack tail-like appendages. The seed surface is longitudinally striate and faintly areolate (Douglas et al. 2001; Montgomery 1977; 129). Three somewhat smaller species may also be potentially represented at the site. These are *J. supiniformis,* which has spindle-shaped seeds, about 0.6-0.7 mm long, and *J. effusus* which has 0.5 mm elipsoid seeds, caudate at each end, with a finely striate and areolate surface (Douglas et al. 2001; Montgomery 1977), and *J. alpinoarticulatus* which has spindle-shaped seeds, about 0.4 mm long that lack appendages (Douglas et al. 2001).

Figure B19. Two *Juncus* spp. seeds from the archaeobotanical assemblage. The one on the right may likely be *J. balticus* based on its singular protuberance. The one on the left may be a separate species.

Lonicera involucrata **(?) – black twinberry (Caprifoliaceae)**

The genus has seeds that are oval to elliptic in shape, compressed or flattened with a notch or point at one end. They are often irregularly ridged and warped, ranging from 2-5 mm in length (Montgomery 1977: 63). Seeds are yellow to black, with coarse or woody to finely cellular surface texture (Martin and Barkley 1961: 200). *L. involucrata* seeds are approximately 2.7 x 1.8 x 0.7 mm, elliptic, obliquely oblong, with an areolate surface, and slightly shiny and black when mature (Montgomery 1977:63). Identification of the single specimen from the Kilgii Gwaay sample was based on comparative collections (Figure B20). Comparative seeds were egg-shaped, surface minutely pimpled. The mature seeds were dark brown while immature were lighter brown and flattened disks with a thickened rim. The seeds were relatively round and smooth and lacked many other defining attributes. Therefore I only assigned a tentative identification of *L. involucrata*. The colour of the archaeological specimen was a medium brown with darker patches, indicating uneven degradation of the seed surface.

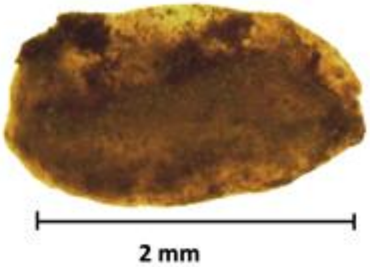

Figure B20. Possible *Lonicera involucrata* seed from Kilgii Gwaay.

Menziesia ferruginea Sm. – False azalea (Ericaceae)

One immature seed capsule was identified from the edge of the paleopond (Figure B21). Identification was based off of the UVic herbarium samples, from which I was able to observe multiple samples of ericaceous capsules at different stages of development. The acute conical shape of the capsule matched the shape of immature *M. ferruginea*. Other Ericaceae capsules had distal ends that were too blunt. *Rhododendron groenlandicum* has similar capsules, but they are egg-shaped to spherical (Douglas et al. 1999).

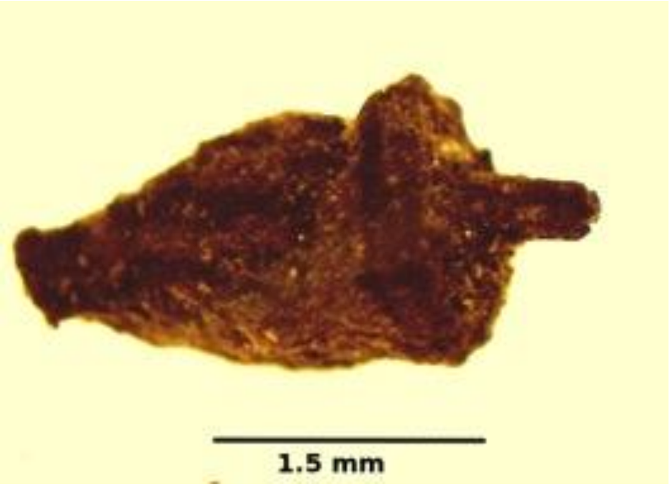

Figure B21. Immature capsule of *Menziesia ferruginea* from the edge of the paleopond.

Picea sitchensis – Sitka spruce (Pinaceae)

Seeds of *P. sitchensis* were identified by their seed wings and seed coats. Seeds are brown to black, oblong to acute at the base with a single well-defined wing 2-4 times the length of the seeds (Young and Young 1992). The wings are apical, attaching to the seeds on one face which is easily separated, leaving a distinct concave seed impression. Other conifer seeds do not share this characteristic: *Pinus* spp. seeds separate and leave a partial impression on the seed wing and *Tsuga* spp. and *Abies* spp. seeds are completely attached to the thin wing. Cupressaceae have two side wings as opposed to an apical wing. The size range of *P. sitchensis* seeds (~2.5-4 mm in length) overlaps somewhat with *Pinus* spp. seeds (~3-24 mm in length) (Martin and Barkley 1961). However, based on the lack on *Pinus* spp. needles, cones, wood, and seed wings observed at the site, the seeds in this conifer category were assumed to represent *P. sitchensis*. The inner wall surface of the conifer seeds from Kilgii Gwaay more closely resembles Picea sp. with shot and wavy fine longitudinal lines, unlike *Pinus* spp., which tend to have “finger-print like” markings (Martin and Barkley 1961).

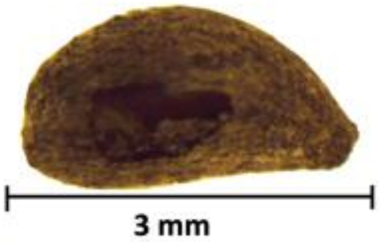

Figure B22. *Picea sitchensis* seed from Kilgii Gwaay.

Rubus sp. – Raspberry-type (Rosaceae)

Differences between *Rubus* species tend to be described in Floras of BC through their plant and leaf structures and morphological traits of whole berries rather than by seed characteristics (Douglas et al. 1999; Hitchcock and Cronquist 1964; Klinkenberg 2013). *Rubus* spp. seeds tend to share many broad morphological characteristics – generally compressed, ovate or oval-oblong, and often 2-3 mm in length. They tend to have a straight edge with a narrow groove running lengthwise and a low ridge is often present on the broad back (Martin and Barkley 1961: 166). The surface is coarsely reticulate, a distinct pattern making identification of seed fragments possible. Some literature on variation in seed morphology between species is available, including studies on seed variation within *Rubus*, though indicating size and shape differences between species outside the study area (Schaefe 2012; Wada et al. 2011). However, I mainly relied on comparative collections at SFU, the RBCM, and my own comparative collection which contained seeds at various stages of maturity from several locations throughout southern Vancouver Island.

The characteristic surface texture was used to identify all *Rubus* spp. including *R. spectabilis* and *R. parviflorus,* from the Kilgii Gwaay site (see below). Because of the similarity in seed *Rubus* spp. morphology, it is difficult or even impossible to distinguish a seed to the species level based on macromorphology (Schaefe 2012). However, a few species do not share the same surface pattern or other traits.

On Haida Gwaii, these species include *R. acaulis* and *R. chamaemorous*, which have smooth to faintly reticulate surfaces. *R. chamaemorous* also tends to be 3-4 mm in length and round, not flattened in cross section. *R. pedatus* seeds tend to be 4-5 x 2 mm in size and ovate in shape (Montgomery 1977:182). *R. ursinus* (measuring 1.5-2.5 x 0.5-1.5 mm in size) and *R. arcticus* (2-2.5 x 1.5 mm) are crescent/paisley-shaped (Wada et al. 2011), and generally fit the size and shape range for the smaller specimens present at the site. However, although *R. arcticus* has been recorded on Haida Gwaii, its presence is not confirmed with a collection sample, and *R. ursinus* is represented by a single example of a non-fruiting male plant collected from southern Haida Gwaii in 1878 (Calder and Taylor 1968). The presence of these two taxa may have been more established during the early Holocene, but the likelihood for them being an abundant resource in the region is low, and not likely represented in the archaeobotanical assemblage. Ultrastructural pattern analysis through scanning electron microscopy has been done on the micromorphological seed coat surface structure to distinguish between *Rubus* species and also between cultivated varietals. This may be a useful tool in identification of *Rubus* seeds in archaeobotanical samples (Dowidar et al. 2003; Wada 2009; Wada et al. 2011).

Rubus parviflorus – thimbleberry (Rosaceae)

A distinguishing feature of *R. parviflorus* seeds is the unique location of the hilum, which is located at the proximal end of the seed, not at the concave or straight margin as in other species in the genus. They are (obliquely) elliptic, with ridged margins, and a coarsely reticulate or alveolate surface (Montgomery 1977:183). *R. parviflorus* seeds are approximately 1.5-2.5 x 0.8-1.5 x 1 mm in size, and are generally slightly smaller and with finer surface texture than mature *R. spectabilis* seeds *(Wada et al. 2011)*.

Five seeds, which I identified as *R. parviflorus*, exhibited slightly different features than the vast majority of *Rubus* seeds from the samples. The overall shape of these five seeds was more ovoid and the surface pattern less coarse. The hilum was located on the end, not the flat or concave margin of the seed. The seeds also tended to have a thinner seed coat and darker pigmentation (likely from absorption of particles from the encompassing sediments) than the seeds identified as *R. spectabilis* (Figure B23).

Figure B23. *R. parviflorus* (left) and *R. spectabilis* (right) seeds. Hilum location on top end for *R. parviflorus* and on the upper left margin for *R. spectabilis*.

Rubus spectabilis **– Salmonberry (Rosaceae)**

R. spectabilis seeds are crescent to paisley shaped with a hilum attachment point at the lower concave margin *(Wada et al. 2011)*. Seeds from the *Rubus* genus tend to share similarities in shape and seed surface characteristics, with morphological overlap between species, thereby often making species determination by these features alone difficult. Fewer *Rubus* species occur on Haida Gwaii than continental BC, and those present tend to have distinguishing characteristics from each other. These species include *R. chamaemorous, R. pedatus, R. ursinus, R. arcticus, and R. parviflorus,* and are described in more detail in the *Rubus spp.* and *R. parviflorus* sections above. I incorporated this information to deduce which species were more likely to be represented at the site.

The seeds from the Kilgii Gwaay site exhibited a size range of ~1 to 3 mm in length, the majority within the 2-3 mm length range that is described in literature on *R. spectabilis* (Martin and Barkley 1961; Montgomery 1977; Wada et al. 2011). Seed fragments were identified based on the seed surface texture of deep pitting and grooves. Other morphological variations of seed attributes included the shape, from more rounded to more angled margins, and thickness of outer shell (Figure B24). The seeds tended to range from light brown to very light (dark cream) in colour when they were removed from the sediment, with the small seeds tending to be lighter in colour than the larger.

The smaller seeds matched the surface texture of *Rubus*, but not the size or necessarily the shape of mature *R. spectabilis*. The main questions I sought to address in *Rubus* seed variation were whether the morphological feature variation represented different stages of maturity and whether they represented variation within or among species. Based on comparative samples, I have determined, for the most part, that seeds from the smaller end of the size spectrum were *R. spectabilis* at different stages of (aborted) development. Other variation in overall seed shape appeared to represent a natural variation of the species, exclusive of five seeds identified as *R. parviflorus*. This was not an exhaustive technical study, but one based on general observations.

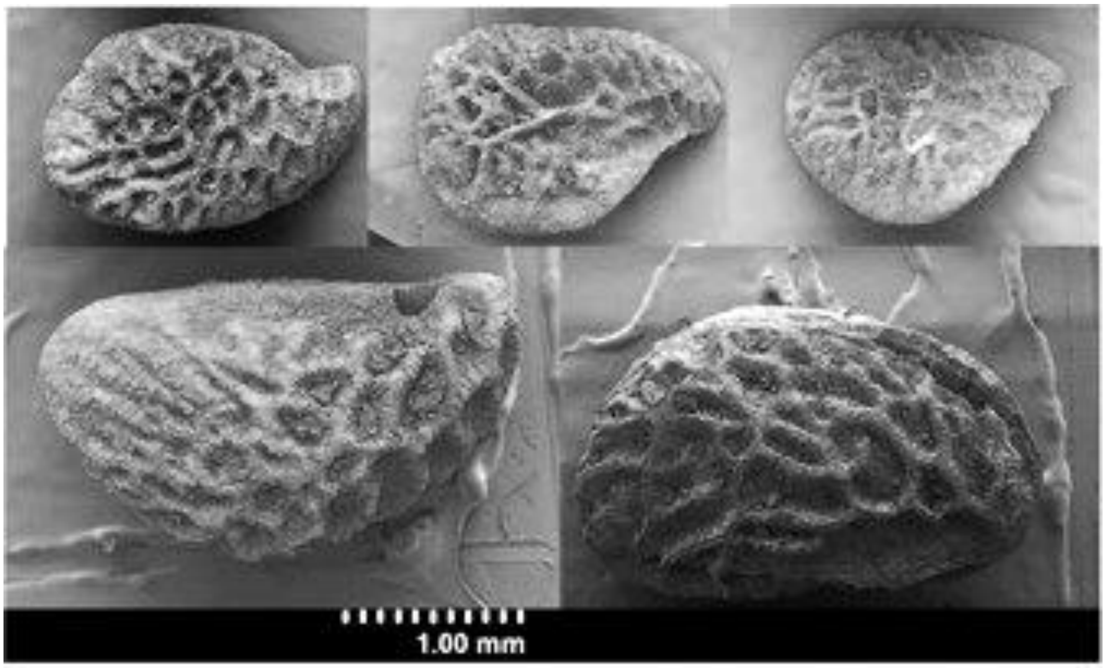

Figure B24. Scanning electron microscopic (SEM) images of *Rubus* seeds, showing degree of preservation, size variation, and surface patterning.

Sambucus racemosa – Red elderberry (Caprifoliaceae)

Sambucus racemosa seeds are elliptic-ovate, compressed rounded to triangular in shape and are generally slightly plano-convex. They usually measure 2-3 mm in length and have a dull brown woody coat with subtle lateral wrinkles (Martin and Barkley 1961: 200; Montgomery 1977: 64). The hilum is often evident on the ventral side of the pointed base. Seeds from the site were readily recognizable, in large part due to their well-preserved robust and durable seed coat (Figure B25). The seeds maintained their surface texture and appeared as a distinct orange-brown colour illuminated under a microscope. Fragments of seeds were identified based on the distinct surface texture and colour.

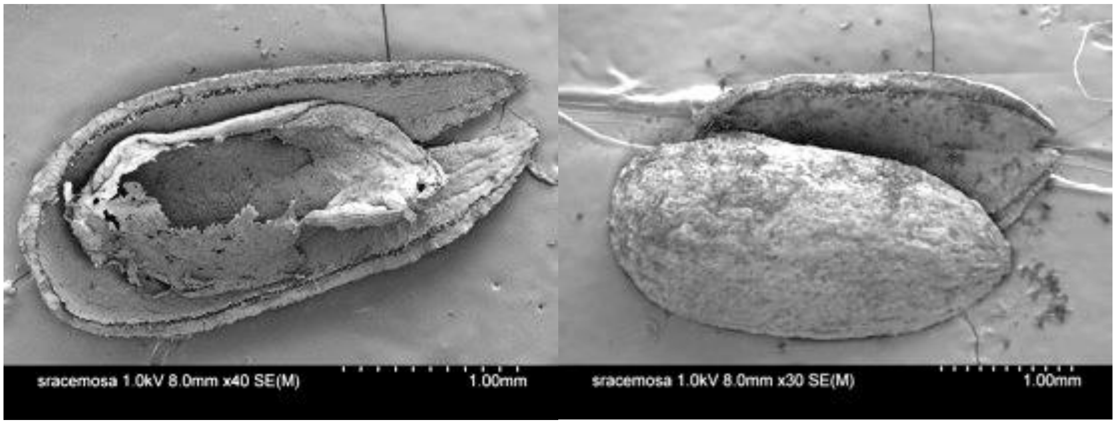

Figure B25. SEM images of *Sambucus* seeds. Image on the left shows intact endosperm and cross-sectional cellular structure of seed coat.

Thuja plicata – Western redcedar (Cupressaceae)

Thuja plicata seeds are approximately 6 mm long, light chestnut brown in colour, and have lateral wings which are about as wide as the body (Young and Young 1992). They contain few to several elongated resin vesicles running lengthwise along the seed body (Levesque et. al 1988:27). The seeds were identified by the resin vesicles and by the surface texture of the body and wing. The texture was more fibrous than *Alnus* spp., which has similarly shaped seeds, particularly when degraded. *T. plicata* also lacked the double style base that is characteristic of *Alnus* (Figure B26).

Figure B26. Comparison between incomplete *Thuja plicata* (left) and *Alnus* (right) seeds from Kilgii Gwaay. Resin nodules in seed body of *T. plicata* and recurved wing edge at base of *Alnus* seed.

Tsuga heterophylla – Western hemlock (Pinaceae)

Only four *T. heterophylla* seeds were identified despite the many cones that were observed and collected in the field. The seeds were dark brown to black, and angular. Two of the seeds were enveloped within wing remnants. These were light-coloured, thin papery skins, and were completely lacking on the other two seeds. Protruding globular resin chambers or resin nodule impressions were present in all specimens (Figure B27), a characteristic feature of *Tsuga* sp. (Martin and Barkley 1961). The seeds ranged in size from ~2.63-2.48 long by 1.55-1.17 mm wide, which is somewhat smaller than the length average of 3.5-4 mm described in Martin and Barkley (1961). Identification to species was largely based on inferences from the cones, which do not closely resemble *T. mertensiana* (mountain hemlock), which is also present on Haida Gwaii, though usually only in alpine to sub-alpine areas.

Figure B27. *Tsuga heterophylla* seed from Kilgii Gwaay, with round resin nodule and thin seed wing remnant.

Vaccinium spp. – Huckle-/blueberry-type (Ericaceae)

Vaccinium seeds are dark brown to black with a reticulate cellular pattern of the seed surface. They usually range from 1-2 mm in length and are non-uniform in shape, which can be angled, ellipsoid, or compressed-elliptic to compressed-oval (Martin and Barkley 1961: 189).

The four seeds from the samples were distinguished from *Gaultheria shallon* (Figure B17) based on their non-glossy surface texture and a more angular and elongate shape (Figure B28). One charred seed was identified based on the overall shape and location of the hilum, which resembled the seed at right in Figure B28. I could only identify the specimens to genus, as there is much morphological overlap between species. Notwithstanding, I concluded that none of the seeds from Kilgii Gwaay are *V. oxycoccos* based on comparative samples and descriptions (Montgomery 1977: 108; Levesque et al. 1988). A more comprehensive understanding of the full range of morphological variation would be required to completely rule out this species.

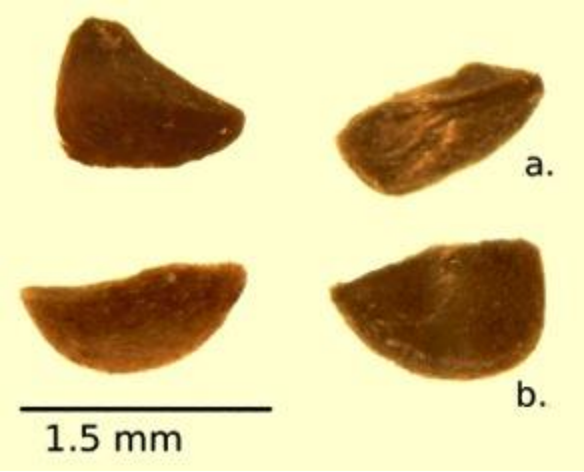

Figure B28. Three uncharred seeds classified as *Vaccinium* spp. Seed at right (a.) and (b.) are two views of the same seed.

Viola **sp. (?) – Violet (Violaceae)**

Viola spp. seeds are generally ovoid with a lengthwise hilum scar on one side and a flattened spot at the apex. They range in colour from cream to mottled, olive green, dark brown, to black. The usually are in the range of 1.5-3 mm in length (Martin and Barkley 1961:183). *Viola* seeds can vary in size and shape considerably between species. *V. pedata* is generally 1.8 x 1 x 1 mm in size and dark brown, while *V. arvensis* is 1.5 x 0.8 x 0.8 mm in size and light brown. Both are elliptic with an obvious caruncle and raphe ridge, surface glossy and scalariform. These two species are the most elongate of the ones discussed in Montgomery (1977: 202), and bear the strongest resemblance to the sample recovered from the hearth activity area of the site. Due to lack of available comparative samples for the range of species known on Haida Gwaii, only a tentative ID has been assigned. The sample in question has a scalariform surface, however, it was charred and thereby diminished the surface condition for analytical purposes (Figure B29).

Figure B29. Possible *Viola* sp. recovered from the hearth activity area at 1325T.

Other identifications

Conifer cones

Conifer cones of *Tsuga heterophylla* and *Picea sitchensis* were observed in the field and collected from cultural components. Both cone types are quite distinct: *T. heterophylla* are small and oblong-egg-shaped, ranging in length 1.5-2.5 cm; and, *P. sitchensis* cones range from 5-9 cm long with papery rounded scales that are finely and irregularly toothed at the tip (Douglas et al. 1998a). No formal analysis was done on them as they are beyond the scope of the project.

Conifer needles

Many needles and needle fragments were recorded from Kilgii Gwaay. *Tsuga heterophylla* and *Picea sitchensis* were observed, but no formal analysis was done on them as they are beyond the scope of the project. Other taxa may be present as well. *P.*

sitchensis have stiff, four-sided needles that are slightly flattened and sharp at the tip. *T. heterophylla* needles are flattened and rounded at the tip, and have an uneven size range from less than 8-20 (25) mm long (Douglas et al. 1998a).

Cupressaceae leaf bract macrofossils – Western redcedar; yellow cedar

Red cedar branchlets are strongly flattened in a fan-like spray. The leaves are 1.5-3 mm long and scale-like, flattened closely to the stem in somewhat overlapping opposite pairs (Douglas et al. 1998a; Minore 1990). This contrasts with yellow cedar which has four-angled branchlets and leaves with a sharp, rigid tip (Douglas et al. 1998a; Viereck 2007). The Cupressaceae leaf and branchlet macrofossils were recorded on the grounds of presence/absence, and elements were not quantified or formally identified to species, though both yellow cedar and western redcedar were observed. The presence of western redcedar at the site was also confirmed by seeds.

Conifer strobili

Conifer strobili were identified from the site, but not analyzed in detail (Figure B30). The presence of these vegetal reproductive features in cultural deposits may perhaps indicate seasonality, potentially when boughs were harvested. This may be an area for further research.

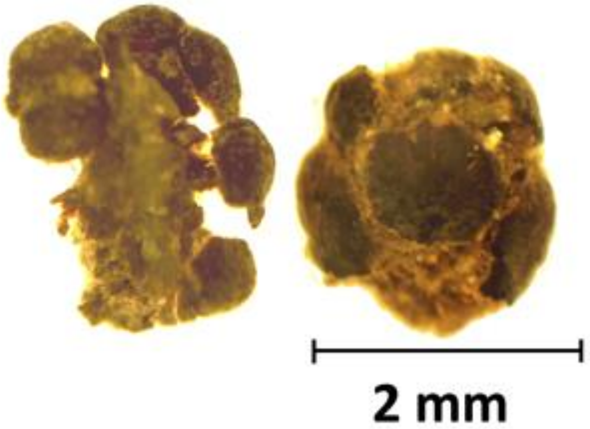

Figure B30. Conifer strobili from Kilgii Gwaay site.

Sclerotia – Fungi

Sclerotia are mycorrhizae associations of fungi that form in sediments, often appearing as small black spherules with a dense, smooth surface and a spongy interior. They were observed in the sediment samples at the Kilgii Gwaay site ranging in size from a fraction of a millimeter to a few millimeters in diameter. I did not quantify or analyze these remains as they were beyond the scope of the project. Sclerotia often appear in archaeobotanical samples, but are not widely discussed in archaeological literature (McWeeney 1989, but see Benedict 2011; McLaren and Christensen 2013). Sclerotia analysis may provide valuable line of information for environmental reconstruction of archaeological sites.

Cristatella mucedo – Bryozoa (Cristatellidae)

Although a bryozoan is an aquatic invertebrate animal, not a plant, I include the identification of a bryozoan stadoblast. A stadoblast is readily identifiable discoid capsule with radiating glochidiate hairs and is covered by chitonous membrane (Figure B31). The structure is used for asexual reproduction (Lévesque et al. 1988). *Cristatella mucedo* occurs in standing or lightly streaming water up to 2 m in depth, forming clear, soft, gelatinous colonies on most substrates (van der Waaij 2009).

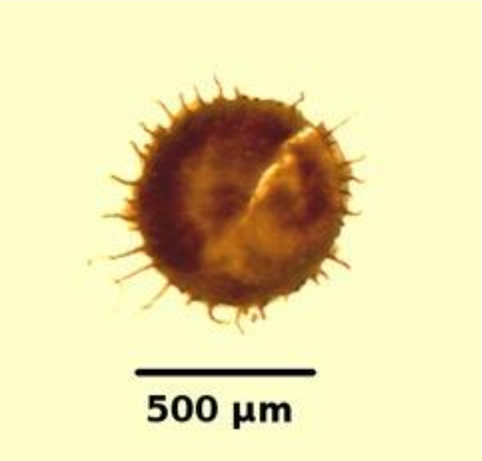

Figure B31. *Cristatella mucedo* stadoblast recovered from Kilgii Gwaay.

Termite fecal pellets

Several clumps and individual pellets were observed in the sediment samples at Kilgii Gwaay (Figure B32). These were not quantified or analyzed in detail as it was outside the scope of this project. Three species of wood-eating termite live in BC (Klinkenberg 2014). Their fecal pellets are small, dense, and elongate with rounded ends. They are easily recognized by their hexagonal cross section. The six facets along the length of the pellet were flat or rounded in the sediment samples from the site. They were a light-medium brown and crumbled when pressed with tweezers.

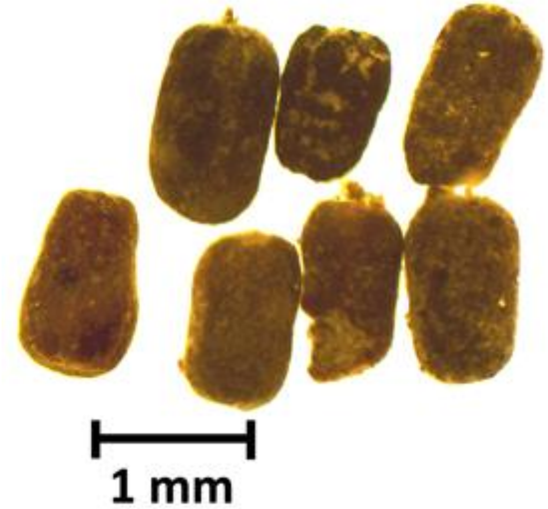

Figure B32. Termite fecal pellets from Kilgii Gwaay sediment samples.

Soil mites

At least two types of soil mites were observed from the sediment samples at Kilgii Gwaay (Figure B33). In addition to the soil mites, other insect fragments were observed. They were not analyzed in detail as it is beyond the scope of the project. Determining the insect species at the site may provide more insight into paleoenvironmental reconstruction.

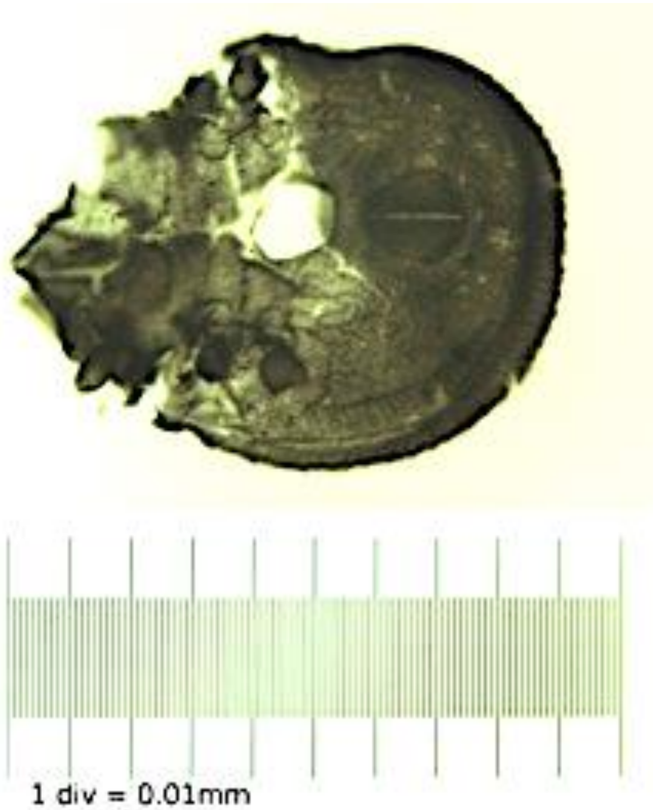

Figure B33. Soil mite viewed from underside, specimen from sediment samples at Kilgii Gwaay.