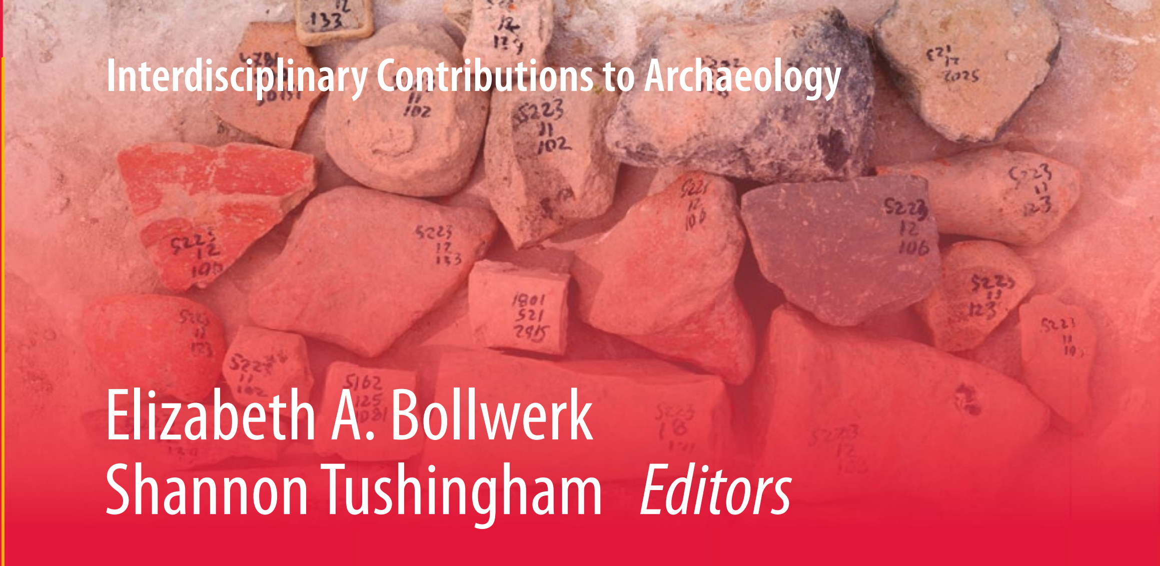

Interdisciplinary Contributions to Archaeology

Elizabeth A. Bollwerk
Shannon Tushingham *Editors*

Perspectives on the Archaeology of Pipes, Tobacco and other Smoke Plants in the Ancient Americas

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Chapter 1
Expanding Perspectives on the Archaeology of Pipes, Tobacco, and Other Smoke Plants in the Ancient Americas

Elizabeth A. Bollwerk and Shannon Tushingham

Popular culture has familiarized the general public with the roles tobacco and pipes played in American Indian ceremonial rituals concerned with diplomacy. Pipes in particular are often viewed as a pan-Indian symbol of sacred practices and beliefs. There is no doubt that tobacco and pipes played key roles in instigating interaction and cementing ties between Native communities, Europeans, and Americans. However, a focus on certain types of pipes, such as the iconic calumet, and particular smoke plants, such as tobacco, have encouraged the stereotype that pipes and tobacco were used solely to make peace, and that Native groups used the same pipes and smoke plants all over North America. For Native peoples, this simplified viewpoint is problematic and even offensive as it misrepresents the complexity of smoke plants and pipes in Native cultures. For anthropologists, historians, and other scholars this simplistic view not only hinders our understanding of what are likely very complex evolutionary processes and systems, but also can prevent engagement with interesting and fruitful avenues of research in collaboration with Native peoples that could have broader impacts for modern communities. As our knowledge expands, it is important to inform public audiences of these nuances so we can move away from cartoonish notions and stereotypic imagery related to pipes and smoking.

This volume presents recent archaeological, historical, and ethnographic research that challenges simplistic perceptions of Native smoking and explores a wide variety of questions regarding smoking plants and pipe forms from throughout the Americas.

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To uncover the diverse uses and meanings of smoke plants and pipes from the archaeological record, the contributors of this volume have used a variety of interdisciplinary analytical techniques including Laser Ablation Inductively Coupled Plasma Mass Spectrometry, portable X-ray Fluorescence (pXRF), residue analysis using mass spectrometry, petrographic analysis, analysis of seeds and microfossils (e.g., phytoliths and starch grains), experimental archaeology, and Geographic Information System (GIS) mapping. Some of these investigations meld their results with information from ethnographic research in collaboration with American Indian groups to better understand the spiritual and ritual roles of pipes and smoke plants. The marriage of these perspectives provides a more holistic sense of the variety of roles smoke plants and pipes played in Native societies. By broadening research questions, utilizing new analytical methods, and applying interdisciplinary interpretative frameworks, these papers offer new insights and a diverse array of perspectives on smoke plants and pipes.

The papers in this volume address two different but related themes. The first set of contributions discusses smoke plant research. Despite the important role smoke plants played in many Native societies, many of these botanicals did not leave obvious material signatures in the archaeological record. Consequently, archaeologists and paleobotanists are still working to piece together the timing of the adoption and domestication of tobacco by different Native groups in the Americas (Haberman 1984; Rafferty 2002, 2006; Rafferty et al. 2012; Tushingham et al. 2013; Wagner 2000; Winter 2000b). Advances in archaeometric techniques—in particular residue analysis of pipes (Rafferty 2002, 2006; Rafferty et al. 2012; Tushingham et al. 2013), residue in ceramic vessels (Zagorevski and Loughmiller-Newman 2012), and even human hair (Echeverría and Niemeyer 2013)—have revealed new information about the timing and types of smoke plants used by Native peoples. The papers in this volume contribute to this avenue of research by providing a consideration of potential future research questions (Tushingham and Eerkens, Chap. 12) that can be answered with data from chemical residue studies. Additionally, the application of interdisciplinary methods such as microfossil analysis and comparative collection development (Planella et al., Chap. 13) provide the tools that will help to push this important area of research forward.

Besides offering examples of methodological advancements, the contributors are also concerned with exploring the diversity of smoke plants used in an array of ritual, medicinal, and recreational contexts. The range of smoke plants identified in ethnohistorical sources is immense. This fact is becoming clear in archaeological studies such as Planella et al.'s (Chap. 13) archaeobotanical analyses, which demonstrate that we cannot assume we know what Natives were smoking in any given locale or period of time. A better understanding of the variety of smoke plants exploited, in turn, informs our views of the rituals that incorporated these plants, and how the meaning and importance of tobacco and smoke plants may have varied among different Native communities. A selection of chapters that focus on the use of tobacco by contemporary (Snyder, Chap. 10; Phillips, Chap. 11; Tushingham and Eerkens, Chap. 12) and historic groups (Keddie, Chap. 9; Phillips, Chap. 11) also highlight the complex relationships Native peoples had and continue to have with tobacco, especially in light of its role as a popular recreational substance.

In addition to using a variety of smoke plants throughout North and South America, Native peoples used an array of instruments to burn and inhale these substances. The second set of papers focuses on research questions regarding smoking pipes. Although the red stone calumet pipe (Blakeslee 1981; Paper 1988; Springer 1981) is by far the most iconic representation of this material class in North America, smoking pipes vary widely in form, size, and raw material. The papers in this volume explore the social processes that are behind this variation and how they impacted the use and meaning of pipes and the rituals of which they were a part. For example, contributors investigate pipe production (Creese, Chap. 3; Hadley, Chap. 7) and exchange (Bollwerk, Chap. 4; Ligman, Chap. 5), the social meanings of different smoking pipe forms used in ritual and domestic contexts (Hedden, Chap. 8, Bollwerk, Chap. 4), and the evolution of smoking rituals (Blanton, Chap. 6). In addition to pipes, Planella et al. (Chap. 13) describe other artifacts, such as snuff trays, small lithic and ceramic mortars (micromortars), and pestles related to the "smoking complex."

Apart from exploring diverse research questions and utilizing a variety of methods, the essays in the volume describe studies that cover a wide geographic breadth. Authors explore pipes and smoke plants from six different regions of North America as well as Chile and the surrounding Andean region of South America (Fig. 1.1). Despite this breadth we do acknowledge the paucity of papers south of the United States, and the general need for more ties with Mesoamerican, Central American, and South American researchers. By exploring the multiplicity of meanings that tobacco and pipes had in Native cultures, this volume expands on the interpretative window opened by George Winter's *Tobacco Use by Native North Americans* (2000; University of Oklahoma Press) and Rafferty and Mann's edited volume *Smoking and Culture* (2004; University of Tennessee Press).

However, it has been more than a decade since a volume was published on these subjects. Currently, there is a critical mass of people working throughout North and South America on these questions. Many of the authors included in this volume presented their research at the Society for American Archaeology meetings in April of 2013. Additional contributors were sought through word of mouth and professional connections. Given the growing level of interest in smoke plants and pipes, and the many innovative analytical techniques that are rapidly developing in our field, the time is right to synthesize the current state of knowledge, and this volume answers that call. Apart from bringing together smoke plants and pipes in the same volume for the first time this work also continues the effort to better understand how pipes and smoke plants can provide important insights into the past and challenge stereotypes that oversimplify the complexity of past Native cultures.

Even though the papers in the volume focus on smoke plants and pipes, the authors use these general ideas as points of departure for a variety of research questions and investigations. In the pages that follow, we provide a brief review of some of the themes present in this work.

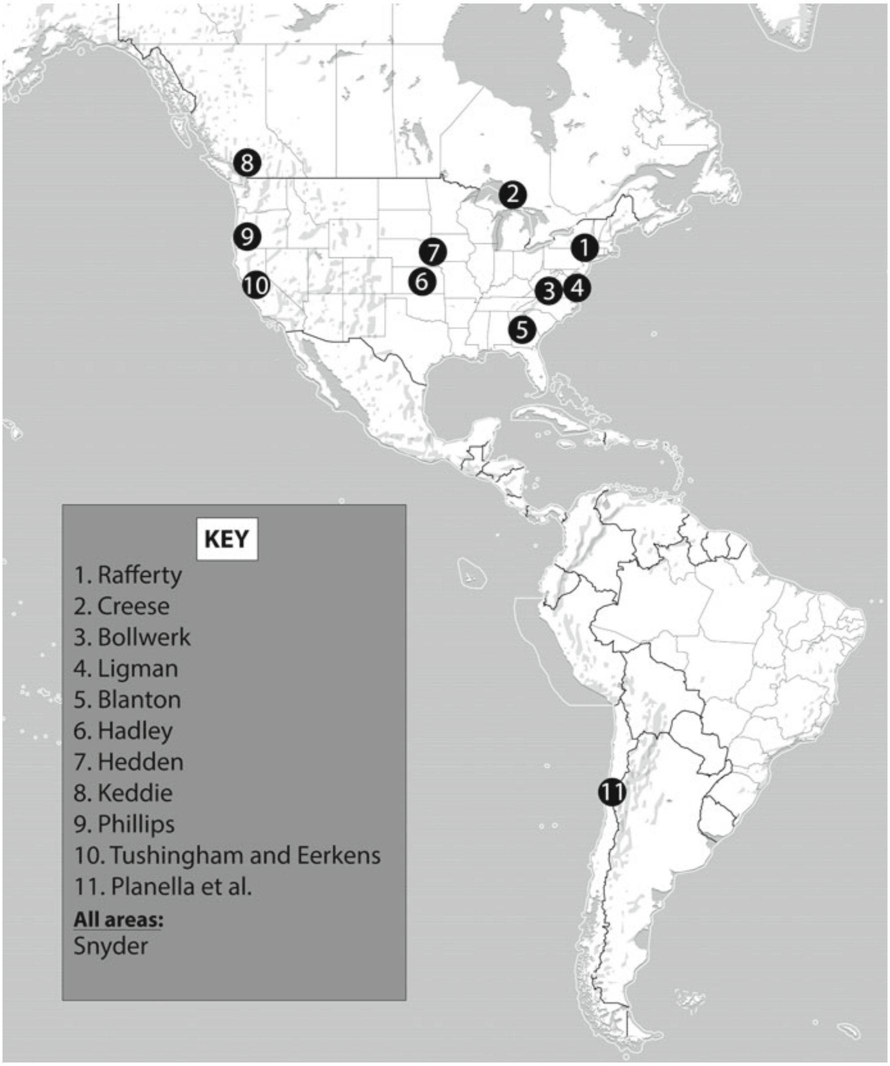

Fig. 1.1 Location map showing approximate geographic focus for papers in the volume

The importance of production and artifact life histories—One of the challenging questions for archaeologists is understanding how pipes were produced. Archaeological studies and investigations of historical records (Agbe-Davies 2014; Fox 2014; Luckenbach 2004; Luckenbach and Kiser 2006; Oswald 1975; Walker 1977) have provided insights on clay pipe production in England and America during the historic period. Pipe production among Native groups in prehistory, however, is a research area that could benefit from additional inquiry. Two contributions to this volume elucidate aspects of the production process of both clay and stone pipes and reveal that a better understanding of production provides important insights into past Native societies. Creese (Chap. 3) demonstrates that examining variation and increasing diversification of Wendat pipes' technocratic aspects over time can provide insights into their roles as personal items. Hadley's contribution (Chap. 7) outlines her process for identifying the material remnants of stone pipe production among Great Bend Aspect groups in Kansas through experimental archaeology. Hadley astutely notes that having a better grasp of what tools and materials are related to production will increase the variety of questions archaeologists can ask about stone pipes and their roles in Native societies of the Plains. Applying the insights from these studies can help researchers better understand how this artifact class is created, which in turn can help to fill current gaps in our knowledge base of pipes. Both of the authors advocate for additional research that takes into account the entire life history of pipes, from production, to use (and possible reuse), to disposal. Shifting the focus to include pipe production and discard enables researchers to decipher a more holistic understanding of the roles of smoking pipes in Native societies.

Smoking pipes as a window to ritual and social processes—The papers in this volume build on previous studies of pipes that provided the necessary framework for considering the variation of Native pipe forms over time and space (Drooker 2004; King 1977; McGuire 1899; Rafferty 2001, 2004; Rafferty and Mann 2004; West 1934). Using theoretical frameworks that consider ritual as a social process of cohesion and differentiation, these contributions illustrate how variation of pipe forms and decoration can provide insights into the evolution of ritual in Mississippian societies in Georgia (Blanton, Chap. 6), Central Plains communities in Iowa (Hedden, Chap. 8), prehistoric societies in the Eastern Woodlands (Rafferty, Chap. 2), and Middle Atlantic regions (Bollwerk, Chap. 4). Blanton traces how changes in pipe forms over time are linked to the rise and fall of Mississippian influence in the Etowah chiefdom in Georgia. Hedden considers what pipe styles reveal about potential smoking rituals performed by Native communities in the Glenwood locality of Iowa. Rafferty's (Chap. 2) contribution highlights how pipe forms and the contexts in which they are found are linked to both change and persistence of Native ritual practices throughout the Eastern Woodlands. Bollwerk (Chap. 4) considers whether the presence of reed stem pipes—which are typically associated with nonlocal groups—at Middle Atlantic sites is material evidence of behavioral change in pipe smoking rituals. One issue noted by multiple contributors is that the exchange of certain forms associated with particular ritual practices in one community or geographic region, such as the calumet pipe, does not necessarily mean that the ritual practices and behavior associated with that form were transmitted between groups of people. There is little doubt that pipes were used to create connections but individuals and communities also ascribed their own meanings and practices to pipe smoking. Thus, the degree to which the presence of certain materials and forms is related to the adoption or change of ritual behaviors is difficult to answer but is an interesting avenue for continued research, especially when linked to tobacco studies.

Pipes also provide a means to trace social processes of interaction and exchange. Multiple studies have demonstrated that pipes and tobacco played a notable role in exchange and economic networks during the historic period in America (Agbe-Davies 2014; Fox 2014; Mann 2004). A number of papers in this volume demonstrate that pipes were also part of extensive interaction and exchange networks in the centuries prior to European arrival up through contact. Ligman (Chap. 5) explores how Native pipes found in the seventeenth century settlement of James Fort in Virginia are material evidence of exchanges taking place between the Powhatan and English. Hedden (Chap. 8) considers how the presence of certain decorative motifs on pipes from the Glenwood locality in Iowa, such as the iconic Hand-in-Eye symbol, is related to the interactions taking place between Native groups on the Central Plains and distant locales. Blanton (Chap. 6), Rafferty (Chap. 2), and Bollwerk (Chap. 4) all note that the appearance of pipes generally associated with Mississippian cultures on sites outside the immediate sphere of Mississippian influence can be attributed to relationships and networks than span hundreds of miles. Finally, Planella et al. (Chap. 13) examine variation in pipe forms to better understand whether or not the Early Ceramic period study site of La Granja was a significant area of social aggregation. Clearly, there were a variety of pipes circulating through exchange networks throughout prehistory. Ligman (Chap. 5), Planella et al. (Chap. 13), and Creese's (Chap. 3) studies highlight the importance of using elemental concentration information from raw materials to directly trace the timing and scope of these movements. A host of other studies (Bollwerk 2012; Capone and Downs 2004; Kuhn and Sempowski 2001; Wisseman et al. 2002, 2012; Weets et al. 2005) further support that archaeometric methods can provide important insights into the movements of pipes and will provide an important avenue for future research.

Pipe use in prehistory—Before these studies can be accused of falling into the trap of solely focusing on exchange and diplomacy, it is important to note that the volume contributors examine a variety of other social processes that are linked to pipes. Like production, pipe use, by whom and for what, is a challenge to address. Studies of pipe use in this volume consider a variety of purposes including the emblematic signaling of status by users (Blanton, Chap. 6, Bollwerk, Chap. 4), and pipes as personal items akin to coffee mugs (Creese, Chap. 4). Although studying different territories and using different forms, Blanton and Bollwerk garner archaeological evidence from multiple sites to demonstrate that Native individuals in Georgia and the Middle Atlantic region used visually distinct pipes to signal their status to others in their communities. Alternatively, Creese (Chap. 3) shows how variation within one assemblage indicates the Wendat had a variety of uses for pipes ranging from expedient tools to items of extreme personal attachment.

While these papers open avenues for exploring different ways of how pipes were used, determining who used pipes is still difficult. Previous investigations (Dallal 2004; Fox 2014, p. 54–58; Neiman and King 1999; Nassaney 2004; Reckner 2004) provide insights into how different groups, including laborers, Native communities, and women, negotiated tobacco and pipe use in the historic period. Trubowitz's (1992, 2004) research demonstrates how certain Native groups either maintained or modified pipe smoking practices after European arrival. However, the question of who was using pipes in prehistory necessarily relies on associations of pipes with particular archaeological contexts, such as burials. While pipes are typically assumed to be associated with adult males. Blanton (Chap. 6: Table 6.3) provides evidence of pipes associated with female burials. Bollwerk (2012, p. 104–106) has also suggested that this pattern is present at certain Middle Atlantic sites. Although limited, such evidence indicates it is worth investigating whether a wider demographic may have been associated with pipes and smoking than previously considered.

The value of collections-based research—It is notable that a number of studies in this volume (Blanton, Chap. 6, Bollwerk, Chap. 4, Creese, Chap. 3, Hadley, Chap. 7, Keddie, Chap. 9, Ligman, Chap. 5, Planella et al., Chap. 13, and Tushingham and Eerkens, Chap. 12), highlight research (or potential research) on previously excavated collections housed in museums and archaeological repositories. While ongoing and new excavations are a critical part of archaeological research, legacy collections provide a wealth of data that has yet to be fully utilized. Researchers analyzing legacy collections must negotiate with a host of challenges to standardize data and make it usable but the research presented here proves that the combination of innovative interdisciplinary methods and theoretical frameworks makes it possible. Such accomplishments further prove that the efforts of past archaeologists to excavate and curate assemblages were worthwhile.

The benefits of integrating interdisciplinary methods—Papers by Planella et al. (Chap. 13), Creese, (Chap. 3), and Ligman (Chap. 5) demonstrate how archaeologists can gain new insights by combining a variety of archaeometric techniques, technological studies, and theoretical perspectives. For example, Planella et al. provide an overview of the exciting interdisciplinary research that is being conducted by their team of Chilean scholars. They combine an array of methods, including chemical residue analysis, petrographic analysis, and the analysis of paleoethnobotanicals and microfossils (e.g., phytoliths and starch grains). In terms of approach, Creese's paper is an especially evocative example of how scientific data can be combined with anthropological theory to ask new research questions.

Anthropogenic range extension, cultivation, and management of indigenous tobaccos and other plants—Keddie's important contribution (Chap. 9) provides the first modern synthesis of smoke plant use in the far northwest of North America—a region inhabited by some of the northernmost tobacco users in precontact North America—which provides an important starting point for future studies in this area. There is a growing appreciation for the varied and sophisticated ways indigenous hunting, gathering, and fishing communities in the northwest manipulate their "wild" environments (e.g., Deur 2002; Deur and Turner 2005; Lepofsky and Lertzman 2008; Lightfoot et al. 2013; Winter 2000b). Tobacco cultivation in the North American west provides irrefutable evidence of plant management. Cultivation practices include the preparation of plots, sowing of seeds, pruning, burning, and fertilizing soils, activities that were widely practiced by historic groups in California, parts of the Pacific Northwest, and the Great Basin (e.g., Deur and Turner 2005; Fowler 1996; Harrington 1932; Kroeber 1941; Moss 2005; Turner and Taylor 1972; Winter 2000b). In the northern Pacific Northwest Coast, tobacco cultivation and management is viewed as a remarkable example of anthropogenic range extension (c.f. Lepofsky and Lertzman 2008; Turner and Taylor 1972)—tobacco does not naturally grow in these places without the intervention of people, and we are just beginning to understand the complex dynamics between humans and tobacco. Tushingham and Eerkens (Chap. 12), for example, suggest that hunter-gatherer-fishers throughout western North America manipulated many different indigenous ("wild" and cultivated) tobacco species through cultural practices, and it seems likely that humans may have altered several tobacco species on a genetic and phenotypic level to a degree that has been underappreciated.

Tobacco use past and present: *Tobacco sovereignty and modern health initiatives*—In addition to a focus on pipes, three papers discuss the importance of tobacco both in the past and for present Native American communities. Today, tobacco is part of many Native communities' larger cultural renaissance. As detailed by Tushingham and Eerkens (Chap. 12) this includes "tobacco sovereignty," a term suggested by David Harrelson (Confederated Tribes of Grand Ronde), which refers to Native communities laying out designs for the use of tobacco on their own terms. This may include, for example, tribal programs that address healthy tobacco use, cessation, and/or small scale to commercial tobacco-growing operations. Reclaiming indigenous tobacco on tribal terms may involve its traditional propagation and sacred use. Phillips, a member of the Confederated Tribes Coos, Lower Umpqua, and Siuslaw Indians discusses how tobacco has been a critical component of ritual for both past and contemporary groups in central and southern Oregon (Chap. 11). Snyder (Chap. 10) demonstrates the importance of pipe studies in modern smoking cessation initiatives, and shows that tobacco revitalization can be a means for contemporary Native groups to take back tobacco and change it from a dangerous, unhealthy substance to a remedy that can provide spiritual and physical healing. In any case, it is abundantly clear that many Native peoples are defining traditional use practices (i.e., sacred, ceremonial, or other special use) within the terms of their own communities. This lies in great contrast with values placed on commercial tobacco smoking (unhealthy, addictive, nontraditional, colonial, large scale).

Although this volume focuses on prehistoric smoke plants and pipes in the Americas, it is our hope that researchers studying the material culture of smoking from any place or time period will find the papers a useful resource as they pursue their own questions. As Rafferty points out in the final chapter, this is not the last word in this area of study, by far, and we look forward to the exciting new avenues of research that scholars in the future will inevitably pursue.

We would like to thank all of the authors who contributed to this volume. We would also like to extend a special thank you to Jelmer Eerkens who approached us after the SAA session about turning this set of papers into a volume for the Springer Interdisciplinary series. Additionally, we greatly appreciate Sean Rafferty's willingness to contribute a few final musings on the future of smoke plant and pipe research (Chap. 14). Finally, we would like to thank Hana Nagdimov and Teresa Krauss from Springer, Inc. for guiding us through the publication process.

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Chapter 2
Smoking Pipes of Eastern North America

Sean M. Rafferty

2.1 Smoking Pipes and Tobacco

The earliest archaeobotanical evidence of the use of tobacco in eastern North America comes from the central Mississippi Valley between AD 100 and 200 (uncalibrated RCYBP) (Asch 1991, 1994; Haberman 1984; Wagner 2000; Winter 2000), with dates for the rest of eastern North America falling several centuries later (Haberman 1984; Wagner 2000). These dates indicate that tobacco was a major intoxicant from the Early Woodland onward. However, ethnohistoric accounts indicate that a variety of plants were smoked in addition to tobacco, including *Cornus* sp. (Dogwood), *Juniperus* species (Juniper), *Rhus glabra* (Sumac), and *Arctostaphylus uva-ursi* (Bearberry) (Brown 1989; Hall 1977; Springer 1981; Yarnell 1964). Although there remains much to be learned about the evolution of smoke plant use, what can be said is that smoking pipes were the primary means of intoxicant ingestion in prehistoric eastern North America.

In this chapter, I attempt to characterize changes in smoking pipes styles in eastern North America from the earliest known examples to recent ethnographically documented specimens. I also try to illustrate two recurring themes regarding the Native American use of smoking pipes over time: their context of use and their archaeological deposition.

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2.2 The Early Woodland Period and Adena (ca. 1000 BC–AD 200)

Tubular smoking pipes' are widely known as characteristic Early Woodland period artifacts (Rafferty2002, 2006, 2008; Rafferty et al. 2012; Salkin 1986). The typical morphology is that of a 1–2 cm wide cylinder with a wide hole at one end and a narrower opening at the other. The narrow opening could be blocked with a pebble to prevent inhalation of tobacco (Gehlbach 1982; Meuser 1952; Stephens 1957) (Fig. 2.1). Earlier shapes of pipes are more conical in form. Alongside "plain" tubes, we also see during this early period tubes with beveled ends, compound forms with right angle bore extensions, as well as the early forms of platform and elbow pipes, though these are minority types. Pipes at this period are made from several different materials, including clay or soft stone, but iconic specimens are made of a soft limestone from the central Ohio River Valley (Stewart 1989; Thomas 1971, p. 77). These earliest pipes tend to be interred in burials, and often show signs of intentional destruction.

Webb and Snow (1974, p. 86) suggested that not all "pipes" were used for smoking, and that some may have been sucking or pigment tubes for shamanic rituals (Frison and Van Norman 1993; Howes 1942). At least one researcher has even proposed that pipes may have served as primitive telescopes (Schoolcraft 1845), though this seems unlikely. I do not dispute the fact that some Early Woodland tubes may have had other uses besides smoking, but specimens in museum collections have sooting and sometimes carbonized residues, indicating a smoking function (Jordan 1959). As discussed in other published papers, there is chemical evidence that further supports a smoking function for early tube pipes (Rafferty 2002, 2006; Rafferty et al. 2012). Residues from five tubular pipes dating to between 500 and 300 BC have been analyzed by the author; three showed clear mass spectra for nicotine or related metabolites.

Fig. 2.1 Adena tubular pipes, Early Woodland period (ca. 1000 BC–AD 200). Photo by author

The earliest research that dealt with tubular smoking pipes viewed them as diagnostic of the Adena culture of the Ohio Valley (Webb and Baby 1957; Webb and Snow 1974) as well as within the Northeast (Ritchie and Dragoo 1960). Dragoo (1963) speculated on the social implications of smoking pipes in Adena mortuary sites, arguing that the pipes must have had social or ritual significance (Dragoo 1963, p. 211). Dragoo also noted that smoking pipes played roles in several Late Archaic and Early Woodland cultures in the eastern United States and hypothesized that smoking had taken on a primary role in a regional “Cult of the Dead” (Dragoo 1963, p. 245).

While early pipes have often been associated with Adena mound builder sites of the Ohio Valley and their local contemporaries (Bense 1994, p. 129), smoking pipes predate the Early Woodland (pre-ca. 1000 BC) and were more widely distributed geographically. Pipes have been recovered from Late Archaic Period (ca. 4000–1000 BC) burials as well, indicating that smoking’s connection with burial rituals had an earlier origin than has been hypothesized for the entirety of Early Woodland mortuary practices (Concannon 1993, p. 74; Custer 1987, p. 42; Dragoo 1963, p. 241, 1976; Walthall 1980, p. 77). One of the earliest pipes documented in eastern North America was recovered from the Eva Site in Tennessee and dates to ca. 2000 BC (Lewis and Kneberg Lewis 1961, p. 66). Webb and Baby (1957, p. 22) reference tubular pipes from Late Archaic shell mounds in Alabama and Kentucky, which were also, at least in part, functioning as burial contexts (Claassen 1991, 1996). These early examples suggest that the ritualistic function of pipes has a long history in eastern North America.

During the Early Woodland Period, the distribution of tubular pipes extends beyond the central Ohio Valley. Similar pipes have been recovered from northern New York, New England, and southeastern Canada (Fitting and Brose 1971, p. 33; Haviland and Power 1994; Heckenberger, Peterson, and Basa 1990; Loring 1985; Ritchie and Dragoo 1960; Spence and Fox 1986, p. 32). The Boucher site in Vermont contained a sizable assemblage of blocked-end tubular pipes (Concannon 1993; Heckenberger, Peterson and Basa 1990; Heckenberger et al. 1990; Loring 1985), while the Rosenkrans Site in New Jersey contained a mass of cremated pipes that had been burned separate from human remains and then interred in a burial (Carpenter 1950; Kraft 1976).

Smoking pipes that are similar to those from the Ohio Valley and the Northeast have been recovered from burial sites from the Chesapeake Bay area (Dent 1995, p. 231–235; Thomas 1971), most notably in sites classified as belonging to the “Delmarva Adena” complex, found primarily in Delaware, Maryland, southeastern Pennsylvania, and southern New Jersey. Regrettably, many of the Delmarva Adena sites were disturbed, looted, or nonprofessionally excavated (e.g., Cubbage 1941), so contextual information regarding these pipes is largely lacking.

Other examples of pipes in the Late Archaic/Early Woodland Northeast abound. Smoking pipes have been found at New York Point Peninsula sites (Ritchie 1980), in Pennsylvania (Smith 1978), Connecticut (Thomas 1971, p. 63), New Jersey (Kraft 1976), as well as the Chesapeake Bay Delmarva sites already mentioned. The presence of Ohio Valley artifacts in areas so geographically removed from central

Ohio can best be explained through interregional exchange of prestige artifacts (or raw materials) (Stewart 1989). The burial contexts in which early pipes typically are found—communal mounds and individual burials with a large number of associated grave goods—are strong evidence that smoking was associated with mortuary ritual across a wide swath of eastern North America from their earliest use.

While the majority of my research has focused on the northern half of the Eastern Woodlands, smoking pipes have been identified for this early period as far south as the Gulf Coast. Tubular pipes also occur in Tennessee Early Woodland period sites (Faulkner 1971, p. 102). Stone and clay smoking pipes have been found in small numbers on Poverty Point sites in the southern Mississippi Valley that date to 2000–850 BC, some quite early in the Poverty Point sequence (Neuman 1984, p. 99; Webb 1982, p. 44). Tchefuncte sites, which follow Poverty Point components in the southern Mississippi Valley, include clay tubular pipes (Ford and Quimby 1945, p. 29–32). Tchefuncte is roughly coeval with Adena, with most radiocarbon dates falling between 500 BC and AD 200 (Ford and Quimby 1945). While these pipes from the Deep South are formally distinct from the Adena tubular pipe, and are made of different materials (generally clay), they provide additional evidence of the vast distribution of smoking pipes during the Early Woodland period.

The point behind this general survey is that smoking pipes, far from being specific to Adena, or indicative of Adena-related complexes engaged in regional trade, can also be viewed as a form of material culture that was minimally variable in form and function and present over a wide area and long time period. While there are numerous differences between these archaeological complexes, they were all engaging in at least one common practice. The interesting question at this point is not what makes these complexes distinct, but what did they share? Viewed in this way, the importance of Adena "culture" is not so much in terms of its distinctive characteristics, but rather in its relation to the numerous other Early Woodland period mortuary complexes, and its role as the most elaborate of them (Dragoo 1976, p. 1).

2.3 The Middle Woodland Period (ca. AD 200–1000)

The Middle Woodland Period featured stylistic additions to the range of smoking pipes in the region. Just as tubular pipes are most closely associated with Early Woodland contexts, platform pipes exemplify Middle Woodland smoking technology (Gehlbach 1982). These most commonly consisted of pipes with a flat or curved base that included the stem, with a centrally- or distally- located bowl (Figs. 2.2 and 2.3). Scholarly and popular attention has been more focused on rarer effigy forms that typically featured an animal figure, birds being common.

Platform pipes are generally associated with Hopewellian cultures (King 1977, p. 11), and the largest quantities are associated with Ohio Valley Hopewell sites. The Tremper Mound site in the Scioto River Valley, and Mound City in Chilicothe (Brose 1985, p. 62–63; Otto 1992; Weets et al. 2005, p. 537–539) contain enormous caches of destroyed and cremated platform pipes, including many effigies, though

Fig. 2.2 Hopewell platform pipe (Broken), Middle Woodland period (ca. AD 200–1000). Photo by Author

Fig. 2.3 Hopewell platform pipe, Middle Woodland period (ca. AD 200–1000**).** Image courtesy of Metropolitan Museum of Art, Open Access collection (http://www.metmuseum.org/collection/the-collection-online/search/319178?rpp=90&pg=3&ft=pipe&pos=188)

most platform pipes have been recovered in small numbers from individual burials. Such sacrifices of large numbers of pipes have been attributed to the disposal of profaned sacred artifacts or some form of Potlatch-like ritual (Otto 1992, p. 11). Additionally, the fact that some of the pipes from the Tremper Mound cache were made from Minnesota catlinite despite the fact that the mound was located near a source of Ohio pipestone (Emerson et al. 2005), is evidence that pipes, or at least pipe-making materials, were part of the Hopewell long distance exchange network.

Opinions differ on the implications of effigy forms found on platform pipes. The range of fauna depicted mostly includes non-subsistence taxa. The most widely circulated interpretation is that the effigies were totemic animals or spirits prominent in Native cosmology (Otto 1992, p. 7). This interpretation would explain occasional human effigies. These interpretations assume widely shared symbolism throughout the geographically dispersed Hopewellian cultures. This is plausible since individual effigy forms are generally similar across the region, though these symbolic forms were likely already extant prior to the Hopewellian phenomenon's development (Brose 1985, p. 67).

While platform pipes are generally seen as typical Hopewell artifacts, they are not limited to the Ohio Valley. The Squawkie Hill complex of western New York and Ontario features platform pipes as well as other typical "Hopewell" artifacts

(Funk 1983, p. 340; Ritchie 1980). Crab Orchard sites in Illinois contain platform pipes, including effigies (Brose 1985, p. 62–67). Havana Phase sites in Illinois, Missouri, Kansas, and Oklahoma contain platform pipes as well (Griffin 1983, p. 268; O'Connor 1995, p. 17). Such pipes are occasionally made of Ohio Valley stone and thus represent exchange connections with the Ohio Hopewell, though the use of local materials and some local stylistic idiosyncrasies do occur as well (Penney 1985). Platform pipes are also found in burial contexts on Middle Atlantic sites in Maryland, Virginia, and North Carolina (Bollwerk 2012, p. 201–203; Dunham 1994, p. Table 15; Irwin et al. 1999). Their association with Hopewell is unclear as none of these pipes are effigy forms and to date no studies have demonstrated that they are made from Ohio Valley stone.

Middle Woodland communities in the southeast also used platform pipes. Such forms have been uncovered on Marksville sites in Arkansas and along the Gulf Coast (Toth 1979). Marksville pipes are not examples of direct trade as they are locally made, and likely indicate symbolic and intellectual rather than material exchange (Brose 1985, p. 62). The Copena site in Alabama also features pipes that differ from Hopewell examples. Copena burials include early elbow pipes, as well as large effigy tubes and platform effigies (O'Connor 1995, p. 17). These were exchanged throughout the Midwest (Walthall 1979, 1980). While Copena effigy pipes include a similar range of forms, Copena effigies differ from Hopewell examples. Copena effigies typically face away from the smoker, while Hopewell effigies face the smoker. As has been noted for Late Woodland and Historic period effigies, self-facing effigies are believed to be personally oriented symbols, while audience-facing pipes imply a less personal, more corporate function (Brasser 1980).

To summarize, the first millennium AD saw an elaboration in pipe forms, as well as an increased use of effigy pipes. The association of smoking pipes with mortuary sites and other ritual contexts continues during this time. The next periods in Native American history saw the development of complex societies and highly elaborate regional ideologies; smoking pipes were again central to these cultural developments.

2.4 The Late Woodland and Mississippian Periods (ca. AD 1000–1550)[1]

Late prehistory in the Eastern Woodlands saw the widespread adoption of maize agriculture, sedentism, and social complexity. While contemporaneous Northeastern populations were "tribal" cultures, the Mississippi Valley and Southeast included a series of ranked "chiefdoms." With regard to smoking pipes, these late cultures are

[1] The Mississippian period is only attributed to Native American groups in what are now the midwestern and southeastern areas of the United States. These groups are distinguished from Native groups farther north based on a confluence of traits including mound centers with centralized plazas, artifacts that exhibit imagery associated with the Southern Cult, and the adoption of Maize agriculture.

Fig. 2.4 Late Woodland elbow pipe (ca. AD 1000–1550). Photo by Author

most strongly associated with elbow pipes. The increasing importance of the elbow pipe form can be seen in potentially transitional styles such as the distal bowl platform pipes discussed above (e.g., Brose 1985, p. 84).

The Northeast during the Late Woodland period is dominated by relatively simple elbow-style pipes. Stone and clay elbow pipes with obliquely angled bowls characterize the beginning of the Late Woodland (Fig. 2.4). Prime examples include pipes created by Native peoples associated with the Owasco culture in western New York (Bradley 1987, p. 17–19). Pipes became increasingly angled in the Northeast through time, and by the beginning of the Iroquoian period, around AD 1300–1400, most smoking pipes had bowls that sat at a right angle to the stem (Bradley 1987, p. 30; Noble 1992, p. 42–43). This is not to say that elbow pipes in the Northeast lacked variability. Plain, decorated, and effigy forms existed.

A variety of effigy forms that incorporated zoomorphic and anthropomorphic imagery were used by Native groups of the Northeast (Kuhn and Robert 1986; Mathews 1980; Noble 1992; Wonderley 2005). Effigy pipes took the form of both inward- and outward-oriented faces on the bowl area of a pipe. As previously noted, Brasser (1980) argued that Iroquoian pipes exhibiting effigies that faced towards the smoker were possibly part of communications between the smoker and their guardian spirit. In contrast, outward, audience-facing pipes imply a less personal, more communal function.

Non-effigy-related designs found on pipes in the Northeast and Middle Atlantic included numerous abstract motifs, such as incised zig-zags, circles, bands of triangles, squares, rectangles, and horizontal and vertical lines (Bollwerk 2012, Fig. 8.1). Miniature forms also were manufactured, not as juvenile artifacts, but probably as exchange items to cement personal relations (Kapches 1992). Pipe bowl morphology varied over time, including barrel, square, flaring, and “trumpet” styles among others; these changes have been found to be chronologically more sensitive than decoration in the Northeast (Noble 1992, p. 41). In the Middle Atlantic, Late Woodland pipes also exhibit a variety of bowl forms, especially pipes associated with later Late Woodland period sites (Bollwerk 2012, Table 7.2).

Effigy pipes continued to play a prominent role among Mississippian communities. One is left with the impression that human effigies increase in frequency from the preceding eras (Fig. 2.5). Probably the most famous human effigy pipe of the late period is the “Big Boy” pipe from the Spiro Site in Oklahoma (Brown 1985, p. 102). This bauxite pipe consists of a kneeling male figure wearing elite raiment

Fig. 2.5 Mississippian figurine pipe (ca. AD 800–1550). Wikimedia Open Access collection (http://upload.wikimedia.org/wikipedia/commons/b/bf/%28Man_smoking_from_frog_pipe%29_effigy_pipe_HRoe-2010.jpg)

(Hall 1983, p. 240), likely representing a priest or chief. The pipe was originally a figurine and was later fashioned into a pipe (Emerson 1982).

Mississippian effigy pipes often include stylistic elements that relate to the constellation of motifs known as the Southeastern Ceremonial Complex, commonly referred to as the "Southern Cult." The Long-Nosed God earrings of the Big Boy Figurine are among these design motifs. Other Southern Cult motifs include effigy pipes in the form of horned serpents (Brown 1985, p. 127), or other snake symbols. Snakes—associated with the underworld, lightning, thunder, rain, water, and power over plants and animals—are powerful and prevalent symbols in Late Prehistoric and historic Indian cultures in the Southeast. Examples of these symbols in effigy pipe form include the Piasa Creek pipe from the American Bottom, which depicts a kneeling shaman with a snake/snake skin over his back, as well as the Schild Pipe from Green County Illinois, which shows a female kneeling on a coiled serpent (Emerson 1989, p. 56).

Other possible Southern Cult motifs include effigy pipes of kneeling figures, possibly prisoners, presumably related to Mississippian warfare-related ideology. An example from the Piasa Creek Mound portrays a kneeling figure incorporated into an outward-facing effigy bowl which would have had a detachable stem, probably of wood, inserted in the figure's rectal area (Penney 1985, p. 156–157; O'Connor 1995, p. 41). Other notable examples are found in Lamar sites as well as Natchez sites dating between AD 1400 and 1500. Significantly, these impressive effigy pipes tend to be found at mound sites, associated with burials, or other ceremonial contexts. As an example, effigy pipes from the early Stirling Phase (AD 1050–1100) BBB Motor Site (just 3.5 miles north of the site of Cahokia in Illinois), were associated with numerous burials, as well as some form of ceremonial structure containing fire pits, pottery, effigy vessels, mica, galena, and carbonized *Datura* seeds (Emerson 1989, p. 48–49). The associated material culture and ecofacts are presumably evidence of funerary rituals.

Other Mississippian effigy pipe motifs, while not specifically Southern Cult related, also provide some insight into the spiritual associations of smoking. These include numerous frog effigies, generally of bauxite, sandstone, or limestone that are found in the vicinity of Cahokia (O'Connor 1995, p. 40). At least one of these pipe effigies appears to be holding rattles in one hand, leading to the term "Rattler Frog." Similar Frog effigies have been found in areas well removed from the Cahokia sphere of influence, with examples from the Nodena Mound in Arkansas and other examples from Louisiana (O'Connor 1995, p. 40). The frog is a symbolically charged figure in the mythos of the Southeast, and like the snake is a symbol of the underworld, associated with water and fertility, rebirth, and life. The association of such a symbol with a smoking pipe further points to the clear spiritual associations that had come to pervade smoking by the Late Prehistoric Period. Mississippian effigy pipes are among the artifacts suggested to illustrate stylistic commonalities between the Mississippi Valley and Mesoamerica, though the direction of influence is unclear (Webb 1989, p. 283).

While Mississippian effigy pipes are impressive artifacts, most other late prehistoric pipes from southeastern and Midwestern sites were far less elaborate (Shriver 1983). There are numerous pipes with simpler decorations dating to this time. Regrettably, these have attracted less research attention. Cyrus Thomas's nineteenth-century mound survey illustrated several examples (Thomas 1985), most of which are simple elbow pipes (Thomas 1985, p. 233–234), including examples noted from the Hollywood Mound Group in Georgia (De Baillou 1965). One burial from these sites contained a clay pipe in the burial fill; one large fire bed feature contained six elbow pipes, four undecorated, and two with outward-facing face effigies on the bowl (Thomas 1985, p. 236).

At least five stone elbow pipes with simple geometric figures were recovered from the Nelson Triangle Site from Caldwell County, North Carolina, one of which was associated with a mass grave of at least ten individuals (Thomas 1985, p. 339–341). Other examples come from Tennessee; one very obliquely angled elbow was found at the Big Toco Mound "bearing evidence of long-usage" (Thomas 1985, p. 383), while the Lenoir Mound Group contained several elbow pipes in burials, generally near the head or hands of the deceased (Thomas 1985, p. 402–403). I personally noted dozens of pipes in the artifact catalogues of both of these sites at the Smithsonian Institution.

The widespread application of ceramic technology and the potential for mass production of smoking pipes during the Late Woodland could have allowed for a "democratization" of smoking, as the required material culture became more widely available. Alternatively, since tobacco is easily smoked without a pipe in cigar form, perhaps it was the symbolic associations of the pipe itself that became more generally distributed in society during this period.

2.5 The Contact Period (AD 1550–1700)

There is evidence of change in pipe use in the Northeast during the Contact Period, with some areas around the Great Lakes preferentially using Native pipes rather than the increasingly available Euroamerican clay or pewter trade pipes (Trubowitz

1992); other areas, such as the Onondaga territory, show a hiatus in Native pipes followed by a resurgence (especially in effigy forms) during the 1600s, possibly some form of nativistic response (Bradley 1987, p. 122). This trend in the maintenance or reinforcement of Native tobacco technology, even while most other Native technologies were lost, is a testament to the significant role smoking pipes played in Native culture. Smoking pipes and their use were tied up in Native religion, and religion tends to be among the more conservative aspects of any culture, and the most resistant to change.

It has been argued that the Contact period saw a decrease in the use of durable materials, with perishable wooden pipes replacing clay or stone pipes, as observed for the protohistoric Seneca (Bradley 1987, p. 61). It should be noted that the use of perishable materials for smoking is a possibility for all of prehistory, though the evidence for such practices would be unlikely to be preserved. It is thus possible that the presence of pipes of perishable materials during the Contact period may be more a matter of preservation bias than a real change in smoking practices.

2.6 Conclusions

I have attempted to briefly summarize the history of smoking pipes in the eastern half of North America from their earliest evidence to the eve of European contact. This is the merest scratch on a vast surface. Even so, several trends are clear. Smoking pipes were used quite early in the East, though not so early as in western regions of North America. As early as they were adopted, they became important artifacts for a range of significant social practices, including burial rituals and intersocietal trade and exchange. The earliest pipes were made of stone, and tended towards tubular or platform types, while late prehistory was dominated by numerous plain clay pipes with occasionally more elaborate, often effigy, specimens as well. Tobacco smoking likely began as a specialized practice associated with ritual practices, but over time became more ubiquitous and widespread. Smoking pipes remain socially significant artifacts to Native American traditional cultures to the present day. As always, more research is necessary into the earliest origins, chronological development, and cultural significance of smoking pipes from across the region.

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Chapter 3
Making Pipes and Social Persons at the Keffer Site: A Life History Approach

John L. Creese

3.1 Introduction

The Wendat Pipes Project (WPP) is a collaborative effort by researchers at the Universities of Cambridge and Toronto. Since 2012, the WPP has been undertaking a wide-ranging analysis of a remarkable collection of Iroquoian smoking pipes from the fifteenth-century Keffer site (AkGv-14) in south-central Ontario, Canada. The guiding theoretical orientation is an artifact "life history" or biographical approach (Hoskins 2006; Joy 2009; Marshall and Gosden 1999) inspired in particular by Igor Kopytoff's (1986) work on the social lives of things. The project seeks to understand all stages in the life history of fired clay smoking pipes at Keffer, from production through use, exchange, recycling, breakage, and discard. The investigation combines traditional macroscopic attribute analysis and morphometrics with thin-section petrography and trace-element analysis of clay pastes (using laser ablation inductively coupled plasma mass spectrometry, or LA-ICP-MS).

Beyond simply charting production methods and artifact use-lives, our goal is a holistic understanding of how pipe life histories were caught up in a variety of distinct fields of social practice within ancestral Wendat society. I argue here that, much like the Sumbanese memory objects discussed by Hoskins (2006), smoking pipes became crucial media for Wendat self-definition through the interweaving of personal experiences and pipe life histories. The resulting inalienability (cf. Weiner 1992) of smoking pipes was an important condition for their role in ritual and interregional gift economies.

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3.2 Beyond Shamanism and Diplomacy: An Archaeology of the 99 %

I think it is fair to say that two basic interpretive models have structured the study of indigenous smoking pipes in the Northeast Woodlands since the early 1970s. One is a "sociopolitical" model that emphasizes the role of pipes and smoking in intertribal diplomacy. This approach draws substantially on direct historic and ethnographic accounts of pipe use in aboriginal political contexts, ranging from the Jesuit Relations (Thwaites et al. 1896-1901) to Lewis and Clark (Paper 1988), and tends to focus on archaeological evidence for interregional exchange using stylistic and trace-element analyses (e.g., Drooker 2004; Kuhn and Sempowski 2001; Kuhn 1987). The other is an "Amerindian worldview" model that examines pipes and tobacco offerings in the context of ritual, shamanism, and aboriginal cosmology (e.g., Braun 2012; Hall 1983; Kearsley 1997; Mathews 1976; Robertson 2005; von Gernet 1992, 2000). These studies have often focused on the expressive corpus of Iroquoian effigy pipes (e.g., Mathews 1978, 1981; Noble 1979; Wonderley 2002), and exceptional finds such as the "sacred bundle" including a stone pipe and Carolina Parakeet remains found at the twelfth-century Calvert site in southwestern Ontario (von Gernet and Timmins 1987). The two models are not mutually exclusive, and several authors have developed interesting arguments by examining the symbolic and cosmological significance of pipe smoking in sociopolitical contexts (e.g., Hall 1983; Mann 2004; Wonderley 2005).

Arguably, however, the focus of both approaches has been on a significant but specialized subset of Late Woodland (ca. AD 900–1650) smoking pipes and practices. Attention has converged on pipe styles associated with calumet ceremonialism (Blakeslee 1981; Hall 1983; Paper 1988; von Gernet and Timmins 1987), exotic types and materials (Drooker 2004; Fox 2002), and representational themes (Mathews 1976; Kearsley 1997) to the relative neglect of more mundane-looking artifacts (but see Braun 2012; Kapches 1992).

Among the late-precontact Iroquoian peoples of southern Ontario and upstate New York, however, smoking pipes were one of the most common items of durable material culture (Smith 1992; Wright 1966). Given their ubiquity, it seems unlikely that the majority of the ceramic pipes found in village sites were restricted to specialized ritual and diplomatic contexts. More than 550 identifiable pipes and some 1000 additional undiagnostic fragments were recovered from all contexts of the Keffer site—at least one pipe per adult occupant based on village population estimates (Finlayson et al. 1987). These frequencies suggest that pipes played an important role not only in shamanic or diplomatic contexts but in people's everyday lives. Effigy pipes, while present at the site, comprise just 2.9 % of the sample. The remaining pipes take a remarkable diversity of forms, including lumps of poorly moulded clay, finely formed and highly burnished "trumpet" pipes, worked deer scapula, and a calumet-like stone pipe that was broken during manufacture. In light of this diversity, one of the goals of the WPP was to come to grips with the "99 %"—the broad array of pipes that were most likely a pervasive component of people's daily routines.

3.3 Northern Iroquoian Smoking Pipes

Our departure point must be to relinquish the notion that these pipes were exclusively associated with the ecstatic practices of ritual specialists. Pipes were certainly an important part of Wendat spirituality, but their importance extended to the mundane rhythms of personal routines and consumption habits. This does not obviate a religious or cosmological resonance, since a division of sacred and profane in the modern Western sense was probably quite alien to Wendat worldviews (Sioui 1999). Understanding why pipes gained special significance in certain contexts therefore requires that we take their ubiquitous place in people's everyday lives much more seriously.

At Keffer and contemporaneous Wendat sites, pipe smoking was a *multidimensional* practice that (much like food or alcohol consumption) could be improvised to suit a wide array of social contexts within a total universe of action. The evident symbolic potency and social impact of pipe smoking in Northern Iroquoian conjuring, healing, or trade can best be understood against a backdrop of ordinary practices that pipes were caught up in. A useful analogy is the way that feasts draw religious and political significance from the similarities and differences they set up vis-à-vis ordinary foods, utensils, and eating habits (cf. Dietler and Hayden 2001; Robb 1998).

Prior to AD 1200, smoking pipes were relatively rare objects within Iroquoian artifact assemblages. During the late thirteenth and early fourteenth centuries, the region experienced a major demographic transition involving population growth (Warrick 2008), intensification of maize consumption (Katzenberg et al. 1995), and rapid growth in the average floor area of longhouses and villages (Creese 2011, p. 136). Settlement research has shown that growth in total settlement floor area exceeds estimated rates of demographic growth for the period. This suggests a time of widespread village nucleation in addition to population growth (Creese 2011). By the fifteenth century, when Keffer was established, regional demographic growth had stabilized (Warrick 2008), but Wendat communities in the vicinity (along the north shore of Lake Ontario) were experiencing a second wave of village coalescence, leading to larger settlements located away from the lake and separated by buffer zones (e.g., Birch 2012).

The profound upheavals of village life during this period were associated with a veritable explosion in the popularity of smoking pipes. The graph in Fig. 3.1a shows the changing numbers of smoking pipes per 100 ceramic vessels for a diachronic sample of 49 village sites in southern Ontario. During the fourteenth century, the ratio of smoking pipes to ceramic vessels rose dramatically, as did the range of recognizable styles, though effigy pipes remained very rare during this period. In the following century, when Keffer was inhabited, the number of types, such as effigy styles, began to increase (Fig. 3.1b). Using an evolution metaphor, we see here an abrupt "adaptive radiation" of smoking pipes concomitant with demographic, subsistence, and settlement change. The continuing proliferation of pipe styles during Keffer's occupation (Smith 1991) suggests that pipe smoking had become firmly established as a significant practice across a wide range of social fields.

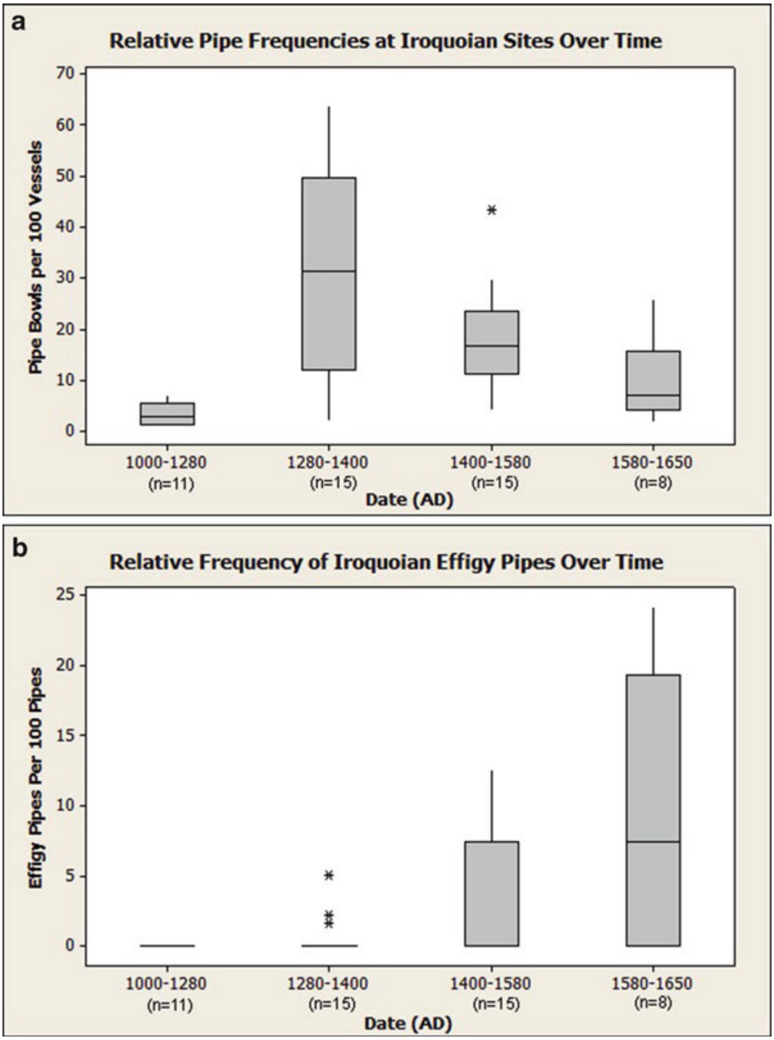

Fig. 3.1 (**a**) Bar graph showing the average number of smoking pipes per 100 ceramic vessels recovered from a sample of 49 Late Woodland village sites in southern Ontario by chronological period. The sample size (n = number of sites) for each period is indicated below the x-axis. Whiskers represent standard error of the mean. (**b**) Bar graph showing the average number of effigy smoking pipes per 100 smoking pipes recovered from a sample of 49 Late Woodland village sites in southern Ontario by chronological period. The sample size (n = number of sites) for each period is indicated below the x-axis. Whiskers represent standard error of the mean

The contemporary coffee mug provides an (admittedly crude) example of this phenomenon today. Coffee mugs come in a vast array of colors and shapes and can be customized with sayings, logos, or children's finger-paintings. The diversification of the common mug allows it to signal a variety of personal meanings according to widely shared genre conventions, albeit in a context of mass production and a market economy. Indeed, since the nineteenth century, ceramic mugs have been used to commemorate life cycle events (such as baptisms and marriages), and today these functions have been elaborated and compounded to memorialize all manner of personal identities and rites of passage.

The mug personalization phenomenon speaks to a potential for objects of personal consumption to become attached to self-identity in settings of routine, semipublic interaction with non-kin—such as the contemporary office environment. Like the mug, certain characteristics of smoking pipes arguably allowed them to become intimately associated with individual identities and bodies. These characteristics include:

- Small size and portability
- Personal customization in production
- Role in consumption and chemical dependency
- Heavy curation and repair
- Recycling into objects of personal adornment
- Use as gift exchange items at local and regional scales

3.4 Smoking Pipes and Personal Identity

Some of the diversification of smoking pipes that took place during the fourteenth and fifteenth centuries can be explained by the increasingly prominent role of pipes in self-identification and memory work (e.g., Kuchler 2002; Mills and Walker 2008; Stewart 1993). My hypothesis is that this happened through a process I shall refer to as *relational-affective* identification. Relational-affective identification can be contrasted with an *emblematic* or representation model of identification. The emblematic model draws on Saussurian semiotic theory, whereby "sign" and "signified" have a closed and more or less arbitrary relationship (cf. Robb 1998). We might think, for instance, of the use of pink and blue to signal gender identity in contemporary North American society.

Since the late nineteenth century, archaeologists have interpreted Iroquoian smoking pipe styles according to this emblematic model. Laidlaw (1903) and Boyle (1901, 1902), for instance, made early tests of the hypothesis that Iroquoian effigy pipes signalled clan affiliation. Others such as Noble (1979) have followed up on this thesis, but with limited success. Attempted correlations have not been highly convincing since frequencies of represented fauna do not fit particularly well with what is known of clan totems. Moreover, intra-site distributional studies of pipe styles show little evidence for spatial patterns that might indicate that pipes were lineage emblems or house totems (e.g., Smith 1991; von Gernet 1982).

Relational-affective identification, I believe, can better explain the proliferation and diversification of Iroquoian pipes. Relational-affective identification refers to the way that material things can come to embody their producers or users through processes of intimate bodily engagement. The identification of a person with an object in this case is not merely conventional. Rather, relational-affective objects become extensions of the self through persistent intimacies of skilled production, habitual use, and memory work. This is particularly true of tools, clothing, and adornments that together create a taken-for-granted matrix for sensory experience and action about the body's near periphery. The "blind man's cane" is a prototypical and frequently cited example (e.g., Knappett 2006). Such prostheses, as McLuhan (1964) has called them, serve to extend the subject's agency, and indeed mind, beyond the physical limits of the body's skin (Knappett and Malafouris 2008).

Relational-affective identification is at work, for example, when family members make keepsakes of the personal belongings of a deceased loved one. Because of their "prosthetic histories," such keepsakes and souvenirs take on a metonymic quality. They come to be seen as *parts* that indexically reference an absent *whole* (a deceased person), and consequently become a focus for longing, as Stewart (1993) has observed.

So relational-affective identification describes, first, the capacity of an artifact to become entangled with an individual's self identity through bodily intimacies in production and use, and second, the consequent, emotionally charged web of affective bonds such objects subsequently transact, even in an individual's absence or long after their death. As with the coffee mug, the nature of the attachment between artifact and person will vary depending on how it was routinely used and experienced. Whenever the life histories of an artifact and a person come to be mutually influencing over a long period of time, the artifact may become involved in relational-affective identification.

3.5 The Keffer Site

By tracing the artifact biographies of smoking pipes at the Keffer site, we can begin to piece together a picture of how relational-affective connections between pipes and personal identities were generated over time. The Keffer site was occupied between approximately 1450 and 1500 AD by a semisedentary community of maize horticulturalists, hunters, fishers, and traders (Finlayson et al. 1987; Smith 1991). Between 1985 and 1988, this 2.1 ha village was fully excavated by the Museum of Ontario Archaeology in advance of development (Finlayson et al. 1985; Smith 1985, 1987), exposing remains of nineteen longhouses, numerous middens, and a number of palisade walls (Fig. 3.2). The village stood on a rise above a tributary of the Don River, which today flows south through metropolitan Toronto into Lake Ontario. A series of parallel drainages, including the Humber, Don, Highland Creek, and Rouge River valleys comprise a zone of comparatively dense and well-studied aboriginal settlement during the Late Woodland period (ca. AD 900–1650). Ancestors of the Wendat people occupied this "North Shore" region from at least the thirteenth century (Birch 2012; Warrick 2008; Williamson and Pfeiffer 2003).

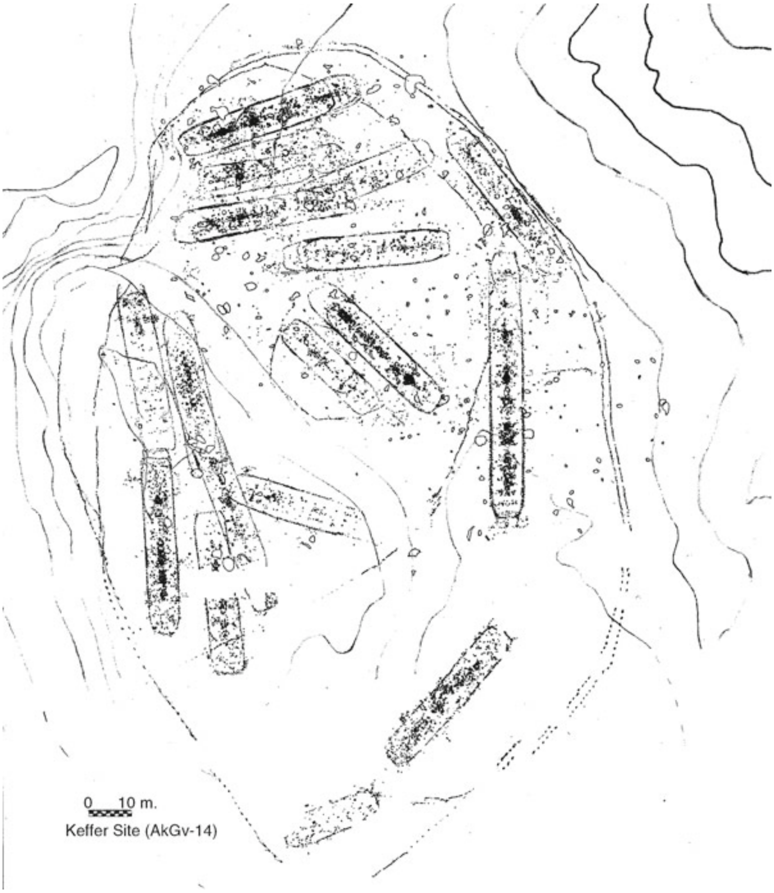

Fig. 3.2 Settlement plan of the Keffer site (courtesy D.G. Smith)

3.6 Methodology: Pipe Biographies

Since 2012, the WPP has been investigating the diverse life histories of Keffer smoking pipes. To do this, we have been using laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) to characterize raw material selection for a sample of 82 pipes, pipe-stem beads, and other ceramics recovered from the site. Additionally, we have analyzed attributes associated with forming methods, firing atmosphere, decoration techniques and motifs, use-wear, repair, recycling, fragmentation, and disposal.

3.6.1 A Personal Touch: Clay Sourcing and Selection

So what are the data telling us? Variability in raw material selection, quality of forming, temper size, finishing technique, and control over firing atmosphere indicates that pipe production at Keffer was socially “open,” i.e., not restricted to a limited number of skilled practitioners or semi-specialists, although such individuals may have been responsible for a minority of pipes deposited at the site. A strong case can be made that individuals with a wide range of knowledge and experience participated in pipe construction.

Preliminary results from the compositional study show that smoking pipes and pipe-stem beads were significantly more chemically diverse than pottery vessels at the site, displaying a broader range in the elemental composition of clay pastes. LA-ICP-MS is an extremely sensitive method of elemental characterization. A spot laser is used to ablate small amounts of solid material from an archaeological specimen. The vaporized sample, carried by helium gas, flows into an inductively coupled plasma for ionization and then to a mass spectrometer for separation and quantification of ions according to mass/charge ratio. The sensitivity of the method offers distinct advantages for sampling coarsely tempered low-fired ceramics such as those from Keffer. Unlike techniques requiring bulk sampling of ceramic fabrics, LA-ICP-MS permits laser parameters to be set so that aplastic inclusions can be avoided during ablation.

In the WPP study, the clay matrix was targeted in a series of ten spot ablations per sample using a 50 μm laser. A pre-ablation protocol was used to eliminate the possibility of sampling potentially contaminated outer surfaces. LA-ICP-MS was completed at the Field Museum’s Elemental Analysis Facility (EAF) using a New Wave UP213 laser set to 230 nm, 0.2 m_J, at a frequency of 15 Hz, with a Bruker quadrupole ICP-MS. To correct for potential drift in measurements over time (Glascock 1992; Speakman et al. 2007), National Institute of Standards of Technology (NIST) standard reference materials (NIST glass SRM 610 and NIST brick clay SRM 679, alongside Ohio Red Clay) were measured between every 5–10 archaeological samples. The EAF’s LA-ICP-MS protocol is further detailed in Dussubieux et al. (2007).

Forty-seven ceramic pipe mouthpiece fragments, 15 beads made from recycled pipestems, five effigy pipes, and 15 ceramic vessels were sampled from virtually all contexts of the site. A stratified random sampling approach was used to ensure inclusion of artifacts from all major contexts at the site (houses, middens, and palisade) and preliminary fabric groups (determined by examination of fresh breaks under low-powered microscopy). Pipe mouthpiece fragments with intact bits were sampled in order to eliminate the possibility of “double-dipping”—i.e., sampling multiple fragments from the same pipe. Rim fragments from identifiably unique pottery vessels were sampled for the same reason. Pottery sampling was likewise stratified to maximize contexts and variability in decorative attributes.

Statistical analyses demonstrate significantly greater variability in the elemental composition of the sample of pipes as compared to pottery vessels. Bivariate plots of major and trace elements and a Principal Components Analysis (PCA) of trace elements indicate the presence of several distinct but weakly differentiated chemical groups at the site, as well as a smattering of chemical outliers. Many of the latter, interestingly, are pipe-stem beads. There was also observable chemical differentiation between the samples of pipes, pipe-stem beads, and pots.

PCA was used as an exploratory method for assessing elemental variability within the sample and was combined with bivariate data splitting (Michelaki and Hancock 2011). For the PCA, principal components considered accounted for a cumulative variance of ≥90 %. Bivariate plots of principal components 2 and 3 (Fig. 3.3a), and 3 and 5 (Fig. 3.3b) illustrate the relatively restricted chemical variability within the sample of ceramic vessels relative to pipes, as well as a tendency for pottery vessels to fall on the positive side of the principal component 5 axis. The latter pattern strongly suggested a potential for chemical differentiation between pottery and pipes, which was explored via bivariate data splitting. Bivariate data splitting involves creating bivariate scatterplots of element concentrations (e.g., Lithium (Li) vs. Zinc (Zn)) and examining these for clustering patterns among tested artifacts (Fig. 3.4). Michelaki and Hancock (2011) recommend bivariate data splitting as a complement to statistical data reduction methods, as it permits direct assessment of the role of specific elemental ratios in sample variance.

The bivariate plot of Li and Zn proved particularly informative (Fig. 3.4a), showing strong organization within 3–4 partially overlapping groups. A group with low Li relative to Zn is composed primarily of pipe-stem beads. Bivariate data splitting of oxides of major elements revealed clustering in the relationship between Iron (Fe) and Aluminum (Al), with pipes and pipe-stem beads being high in Fe relative to Al. The existence of three chemical groups[1] largely but not exclusively corresponding to artifact type (pipes, pipe-stem beads, and pottery vessels) was confirmed by calculating and plotting inter-element ratios Li/Zn and Fe/Al (Fig. 3.4b). The correlation of these groups with artifact types was tested using Discriminant Function Analysis (DA) for 47 trace elements, with correct classification of 98 % of cases, or 74 % with cross-validation, and DA for Li/Zn and Fe/Al, with correct classification of 78 % of cases with cross-validation.

Several hypotheses can be given to account for these patterns. Relatively high chemical diversity in pipe and bead clays could indicate: (1) broader selection of locally available clays compared to ceramic vessels; (2) addition of various fine-grained additives such as powdered hematite into some pipe fabrics during production; (3) nonlocal production of a portion of pipes, implying exchange and/or mobility; and (4) preferential curation of pipes and pipe-stem beads, so that artifacts made from clay sources local to the community settlement(s) that predated Keffer's founding were deposited on site.

[1] These chemical groups were initially identified by visual inspection of bivariate data splitting plots. The ellipses shown in Fig. 3.4 represent these inferential groups. The association between artifact type (pottery vs. pipes) and chemistry was further examined statistically using Discriminant Function Analysis.

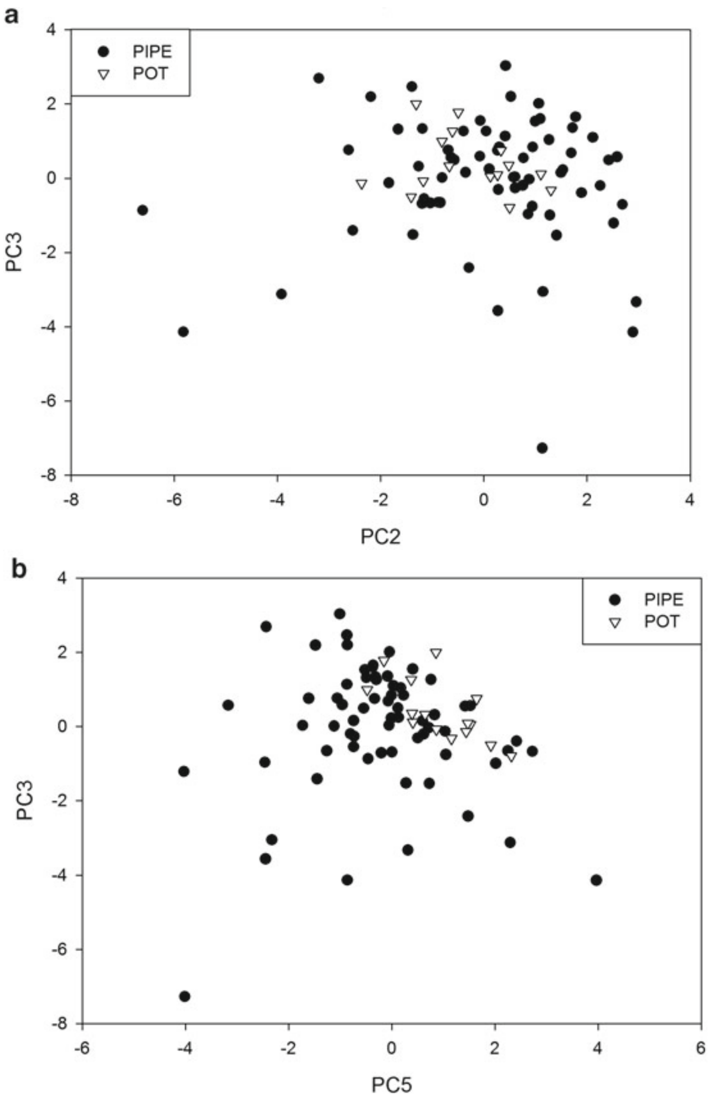

Fig. 3.3 (**a**, **b**) Bivariate principal component plots of ceramic objects at Keffer based on PCA of 47 trace elements

A combination of these factors may provide the best explanation for the patterning evident in Fig. 3.4. For instance, the pattern of widely scattered "outlier" pipe fragments (including pipe-stem beads) evident in Fig. 3.3 may indicate diverse origins and acquisition via heterogeneous exchange networks. Meanwhile, the presence of a chemically distinct bead-dominated chemical group in Fig. 3.4 may reflect the long-term curation of beads within a specific social group such as a family or

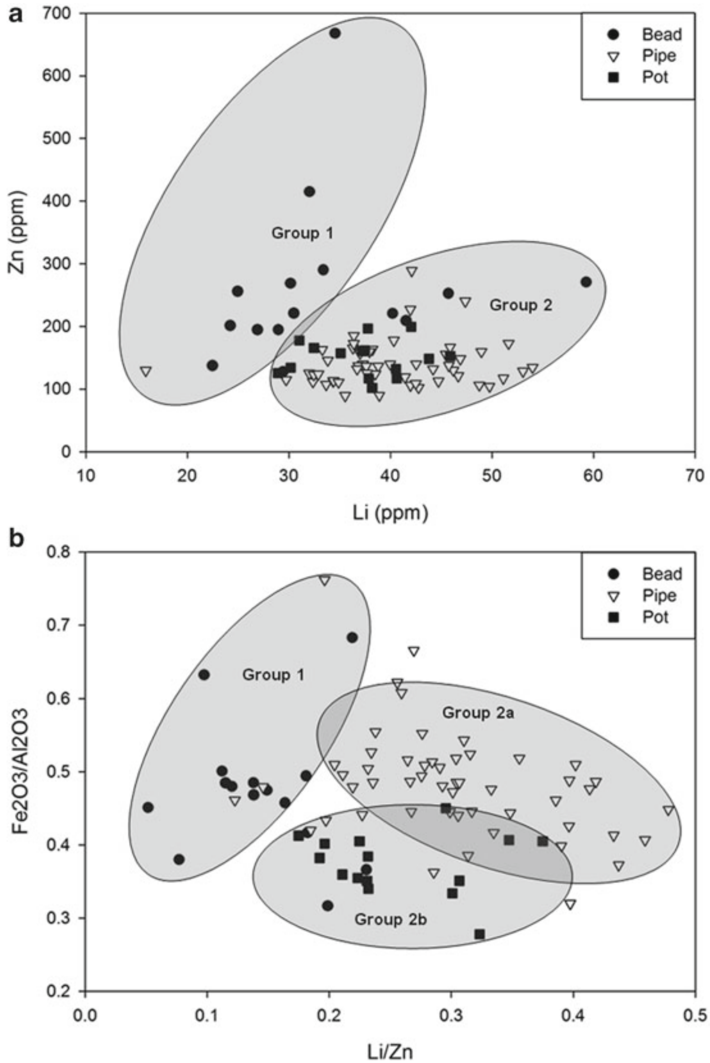

Fig. 3.4 Bivariate data splitting of ceramic objects at Keffer based on LA-ICP-MS results for (**a**) Lithium (Li) vs. Zinc (Zn) and (**b**) Li/Zn vs. Iron Oxide/Aluminum Oxide (Fe_2O_3/Al_2O_3). Ellipses illustrate inferred chemical groups

lineage, or exchange of many beads derived from the same non-local origin as part of a complex item such as a necklace. Although the diversity evident within the pipe mouthpiece sample might best be accounted for in terms of a diversity of clay sources, the presence of variable levels of added minerals (such as hematite or magnetite, which are mineral forms of iron oxide) within pipe fabrics could also account for the general distinction between pipes and pots along the y-axis in Fig. 3.4b that resulted from enriched levels of iron relative to aluminum. Definitive identification of local and regional compositional groups corresponding to distinct clay sources awaits more extensive regional study. Taken together, however, the chemical data for pipes as compared with pottery vessels signals a relatively high degree of diversity indicating fewer constraints on personal choices with respect to clays and perhaps additives, regional mobility or exchange, and perhaps intergenerational curation.

3.6.2 A Personal Touch: Skill and Simplicity

Pipe forming and finishing attributes show a correspondingly diverse range in skill levels, motor habits, and techniques. Attributes of forming, finishing, and firing were recorded for a sample of 304 intact mouthpieces from Keffer. An ordinal forming quality score was assigned to each mouthpiece on the basis of attributes listed in Table 3.1. Surface texture was assessed and documented using a Dino-lite™ AM4115TL digital microscope at 10–50× magnification.

A minority of pipes ranked "excellent" in forming quality (12 %). Pipes in this category exhibited an expert level of skill (e.g., Fig. 3.5a). Bits were finely tapered and symmetrical, with a well-formed flattened or slightly rounded lip of uniform thickness (Fig. 3.5e). Surfaces were very smooth (Fig. 3.5c) and hard (making an audible "clink" when struck), and temper was very fine. Nearly half (46 %) of pipes, however, were given either a "moderate" or "poor" score. These pipes represent the work of individuals with relatively little experience working with clay and/or an "expedient" approach to pipe fabrication. Pipes ranked "poor" (16 %, e.g., Fig. 3.5b)

Table 3.1 Pipe forming quality classes and associated attributes

Forming quality	Attributes
Excellent	• Bit finely tapered and symmetrical
	• Uniform to very uniform stem profile
	• Uniform to very uniform lip thickness
	• Smooth to very smooth surface
	• Hard, well-fired fabric, free of cracks, and welding faults
Good	• Fine to very fine temper
	• Bore alignment central
Moderate	• Unevenly shaped stem in plan and profile
	• Stem sagging/deformed during drying
	• Asymmetrical or unshaped bit
	• Clay splitting at bit during rolling
	• Coarse, randomly striated surface
Poor/expedient	• Loose and crumby fabric, drying cracks, and welding faults
	• Poorly tempered or untempered
	• Bore alignment errors and multiple attempts

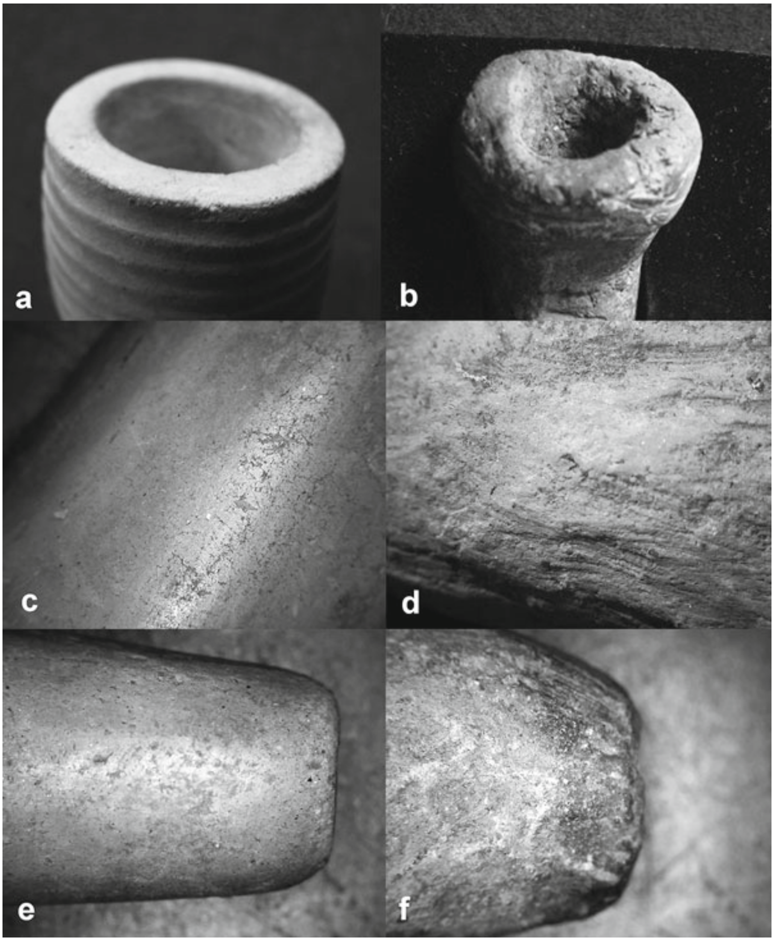

Fig. 3.5 Range of forming and finishing quality of pipes at Keffer: (**a**) well-formed bowl with even lip diameter; (**b**) poorly formed bowl with irregular shape and friable texture; (**c**) smooth, evenly burnished stem segment; (**d**) irregular, poorly smoothed stem segment; (**e**) well-formed bit in longitudinal profile; (**f**) moderately formed bit in longitudinal profile

show little interest in or ability to evenly shape the stem in plan and profile, to even out or smooth clay splitting around the bit, or to otherwise carefully shape and taper the bit (Fig. 3.5f). Texture is frequently coarse or striated (Fig. 3.5d), and sometimes loose and crumby (Fig. 3.5b), perhaps resulting from problems with firing temperature or duration. Surface texture was a statistically significant correlate of forming quality (Fisher's exact test $p<0.0001$), with well-formed pipes generally receiving some degree of burnishing (Fig. 3.5c), and 3 % of pipes exhibiting highly burnished surfaces.

Other recorded attributes showed unexpected correlations with forming quality and surface texture, including bore diameter and surface firing atmosphere and color. For instance, mean bore diameter was 2.7 mm for coarsely textured pipes but 3.4 mm for burnished pipes (ANOVA $F=3.48$, $p=0.002$). A bivariate plot of bore and bit diameter revealed that pipes ranked "good" and "excellent" for forming quality had large bore diameters relative to bit diameters, indicating relatively thin-walled stems and more delicate bits. An ANOVA of bore diameter and forming quality demonstrated a very strong relationship ($F=11.79$, $p<0.000$), with "excellent" pipes showing a higher mean bore diameter than "poor" and "moderately" formed pipes, but a slightly lower mean and standard deviation than "good" pipes. This pattern suggests the exercise of a high degree of precision and control over the targeted bore diameter for pipes in the highest quality forming class. Given a likely relationship between bore diameter and the quality of draw, this relationship indicates considerable knowledge and experience associated with a minority of expertly made pipes.

Control over firing atmosphere, perhaps with surface color as the primary aim, is also indicated for good and expertly formed pipes, while poor and moderately formed pipes show little evidence for such control. Pipes with oxidized buff to brown exterior surfaces were split evenly between poor/moderate (44 %) and good/excellent forming classes (56 %), while oxidized red-orange and reduced black pipe surfaces were strongly associated with good/excellent forming (80 %, Fisher's 2-tailed $p=0.0001$). In particular, a high proportion of "mixed" atmosphere pipes (resulting in a "mottled" oxidized and reduced surface) were associated with good and expert forming (82 %, Fisher's 2-tailed $p=0.001$). It should be noted that ceramicists often infer control over firing atmosphere from consistency of output (i.e., the production of either oxidized or reduced surfaces, rather than the presence of both [e.g., Rice 1987, p. 81]). In this case, however, the significant positive association of well-formed pipes with the conditions of a mixed firing atmosphere indicates that its esthetic effects (strongly mottled red and black surface colouration) were desirable and intentionally produced by experienced potters.

In summary, substantial diversity across a spectrum of technical attributes related to clay preparation, forming, surface treatment, bore specification, and firing methods is found within the pipe sample at Keffer. A suite of correlated characteristics can be identified that distinguish a small class of expertly made pipes. The majority of pipes at the site, however, show a rather fluid mosaic of attributes across a continuum of skill and experience, indicative of a large contingent of producers that had some familiarity with clay as a medium, and who made diverse choices about how pipes were to be made.

Taken together with the chemical variability discussed above, these characteristics reveal that pipe production at Keffer was an open field of practice in which individuals from a cross-section of society made pipes as and when desired. Arguably, the low technical demands for making a minimally functional pipe made it a "democratic" technology that included, but was not dominated by, a small number of experienced craftspersons. The many pipes at Keffer were most certainly made by the many, rather than by the few.

3.6.3 Substantial Attachments: Chemical Dependency

Following production, what do we know about pipe use? Archaeological evidence for use is more difficult to interpret, although tooth wear patterns on bits can be informative (see below). Exploratory efforts to extract and identify trace organic chemicals (such as nicotine) from pipe bowls at Keffer are underway (D.G. Smith pers. comm.). Meanwhile, ethnohistoric accounts emphasize how smoking promoted physical attachments between the pipe and the smoker. In early-seventeenth century New France, tobacco was widely smoked as an appetite suppressant. In this capacity, it was particularly prized for long days on the trail and periods of famine (Thwaites et al. 1896-1901). The consumption of tobacco also created real chemical dependencies among the seventeenth-century Wendat and their Algonquian neighbors. In his 1634 relation, Jesuit missionary Le Jeune reported of the Algonquins near Tadoussac that:

> The fondness they have for this herb is beyond all belief. They go to sleep with their reed pipes in their mouths, they sometimes get up in the night to smoke; they often stop in their journeys for the same purpose, and it is the first thing they do when they re-enter their cabins. I have lighted tinder, so as to allow them to smoke while paddling a canoe; I have often seen them gnaw the stems of their pipes when they had no more tobacco, I have seen them scrape and pulverize a wooden pipe to smoke it. (Thwaites et al. 1896-1901(7), p. 136–137)

The fact that the pipe was a medium for consumption of a substance that created tremendous physiological attachments is, I think, by no means incidental to its ubiquity and social significance. Chemical dependence arguably tied the pipe to the smoker in profound ways that would have involved the development of engrained physical habits and associated affective states. Under conditions of periodic hunger and widespread nicotine addiction, sharing the pipe, or helping a fellow to light the pipe, as Le Jeune recounts, becomes an important gesture of generosity, hospitality, and commensality.

In 1623, the French Recollet missionary Gabriel Sagard likened Wendat smoking culture to drinking customs in France:

> Then, just as over here we drink after another, presenting the glass to him whose health we have drunk, so the savages, who have only water for their sole drink, when they wish to entertain someone and demonstrate their friendship to him, present him with the lighted pipe after smoking themselves; and considering us as friends and relatives they would offer and hand it to us with very fine courtesy. But as I never wished to become habituated to tobacco I used to thank them but not take it, at which they were at first all astonished, because there is nobody in all those countries who does not take it and use it to warm the stomach in default of wine and spices… [Wrong 1939, p. 88]

It is evident from this passage that tobacco smoking was pervasive among the Wendat of the 1620s, involved potential "habituation," and had a very important role in day-to-day expressions of hospitality and fellowship, most likely couched in terms of kinship.

3.6.4 Substantial Attachments: Use-wear, Curation, and Embodiment

The hypothesis that smokers at the Keffer site experienced indelible attachments to their pipes is supported by evidence for use-wear, curation, and recycling. Noticeable tooth wear (as evidenced in Fig. 3.6a by erosion of the burnish to expose the granular texture of the fabric, discoloration, and chipping around the circumference of the lip) is a common feature of mouthpieces ($n=93$, 36 %), suggesting protracted use and/or the kind of "gnawing" described by Le Jeune. Nine percent of mouthpieces showed moderate-to-heavy tooth wear.

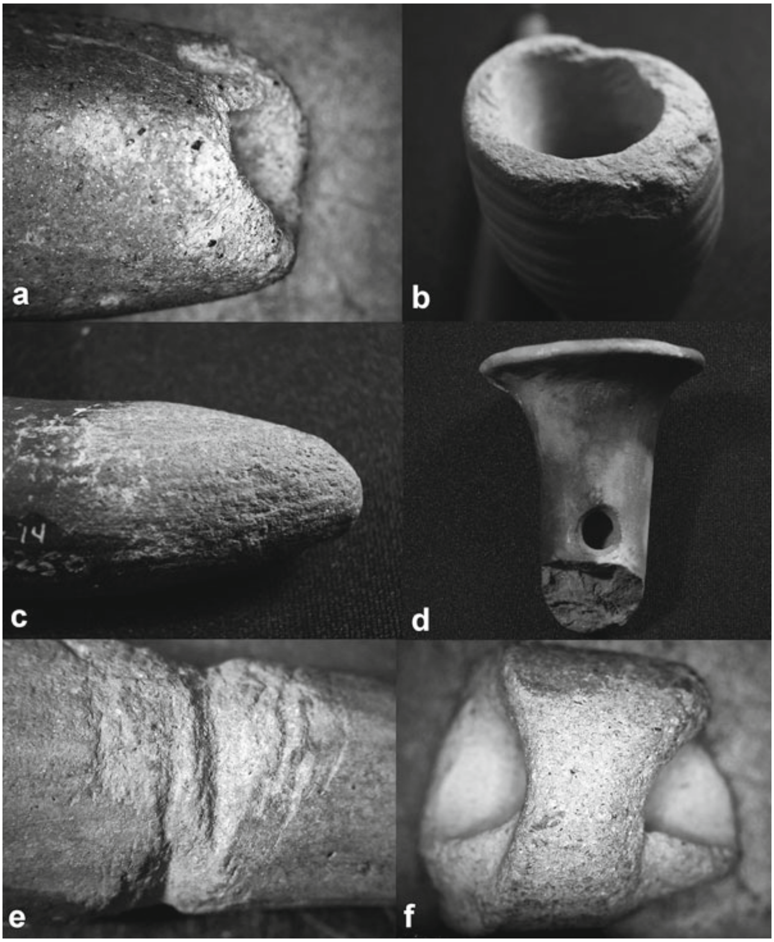

Fig. 3.6 Range of use-wear traces and modifications to pipes at Keffer: (**a**) tooth wear on bit; (**b**) pipe bowl ground to smooth broken upper rim; (**c**) stem ground to form new mouthpiece; (**d**) bowl drilled for stem replacement; (**e**) transverse scoring on a mouthpiece fragment typical of bead manufacture; (**f**) pipe-stem bead showing heavy asymmetric wear caused by stringing

There is also evidence that broken pipes were often not discarded immediately. Stems were ground down to form new mouthpieces following breakage ($n=54$, Fig. 3.6c). Bowls, too, were repaired by grinding smooth broken edges (Fig. 3.6b). Pipestems were even ground into new mouthpieces when the stem was nearly gone. In one case, when this wasn't possible, the pipe was drilled in the bowl so a replacement (probably wooden) stem could be inserted (Fig. 3.6d). Mouthpiece fragments also show modifications following breakage, likely related to bead production. Approximately 10 % of mouthpiece fragments showed modifications such as proximal and distal grinding, cutting, and transverse scoring (Fig. 3.6e). In the much larger dataset of undiagnostic pipe fragments ($n=986$), 104 or 10.6 % were intentionally modified in some way following firing, including various combinations of cutting, grinding, scoring, drilling, and in one highly unusual case, "knapping" (the exterior surfaces of the bowl had been flaked via direct percussion using the lip of the bowl as a striking platform).

A "curation index" was calculated for the Keffer pipe assemblage by taking the ratio of "new" mouthpieces—that is, stem fragments that had been ground down to form a replacement bit (Fig. 3.6c)—to original mouthpieces. This index assumes an equal probability of recovery of both types of fragments. Obviously, other factors such as intentional breakage and recycling (see below) may intervene, making inter-site comparison tricky. Notionally, however, the more intensively curated an assemblage, the higher the rate of mouthpiece refurbishment. Fifty-four stems modified to create new bits were identified at Keffer. This gives a curation index value of 0.18 (54/304). Unfortunately, since many site reports do not explicitly distinguish between original and "new" mouthpieces, or simply don't report on modified stem fragments, reliable comparative values are currently unavailable. However, this value suggests that as many as a fifth of Keffer pipes were retooled to maintain function following breakage.

Interestingly, repairs of this sort occurred irrespective of the suite of traits associated with skill identified above. New mouthpieces were fashioned for broken pipes with no regard for forming quality (Fisher's exact test two-tailed $p=1.0$) or surface texture (Fisher's exact test two-tailed $p=0.75$). Likewise, an ANOVA comparing mean bore diameters for repaired and unmodified stems shows no statistically significant difference ($F=0.65$, $p=0.42$), whereas we have seen that bore diameter correlated with skilled forming and firing traits ($F=46.7$, $p<0.000$ for the undiagnostic fragments sample). In other words, practices of curation and repair were not selective, and included pipes representing all skill levels, including seemingly "expedient" cases.

This is a telling pattern, as it signals the personal significance of pipes to their owners regardless of production quality. This weighs in favor of the hypothesis that, in the majority of cases, pipes were habitually used and repaired by the same individuals who had made them. Some sense of the depth of the attachments that developed between pipes and their owners is conveyed by Sagard's observation that the Wendat drew "blood from their arms for the purpose of joining and sticking together the broken pieces of their pipes or earthenware tobacco burning tubes" (Wrong 1939, p. 197).

Pipestems were also recycled into beads using the groove-and-snap method (Fig. 3.6e–f). Forty-seven stem and mouthpiece fragments (7.3 % of all undiagnostic stem and mouthpiece fragments) showed evidence of having been modified for use as beads or having had beads cut from them. Diagnostic traces include transverse scoring or cut marks, smooth, rounded, bevelled, or flat cut or ground ends, and asymmetric wear (Fig. 3.6f) symptomatic of stringing. In general, little effort was made to make beads symmetrical in plan or profile, and their origins as pipe parts would have been evident to observers. However, unlike stem refurbishment practices, recycling in this manner was significantly biased in favor of "good" and "excellent" forming quality (Fisher's exact test, two-tailed $p = 0.002$), and also "smooth" and "burnished" surface treatments (Fisher's exact test, two-tailed $p = 0.05$). Average bore diameter of beads was also higher than average bore diameter of other mouthpiece fragments (3.45 ± 0.12). The apparent selectiveness of bead production at Keffer is consistent with their chemical distinctiveness discussed above.

All of these features—the curation of pipes, frequent repair across the entire range of skill and experience, and selective recycling for personal adornment—speak to a significant level of attachment that routinely developed between smokers and their pipes at the site.

3.7 Relational-Affective Identification and the Gift

Exchange was another important dimension of pipe use. Iroquoian ceramic smoking pipes were exchanged over wide regions during the Late Woodland period (Drooker 2004; Kuhn 1987; Kuhn and Sempowski 2001). As discussed above, trace-element evidence from Keffer indicates that pipes and pipe parts were important objects of exchange at the site. The chemical and aesthetic uniqueness of the Keffer bead sample, for instance, is consistent with a model of local or regional exchange in recycled pipe parts. Because of the absence of suitable comparative samples, it is not possible at present to identify these sources or determine their geographical and chronological relationships with Keffer.

Nonetheless, the evidence for pipe and bead exchange further supports a relational-affective account of how pipes helped construct identities. For a gift to create or mediate a social attachment—for it to be a true sacrifice—it must first be meaningfully bound to the giver's identity. In this light, the intimate associations built up between smoking pipes and personal histories were critical to the subsequent operation of pipes as inalienable possessions (Mauss 1966)—objects that were exchanged in diplomatic contexts precisely because of their tendency to carry with them a sense of the unique body and persona of the giver. The same can be said for shamanic uses, where pipes became a vehicle for social attachments between the smoker and "other-than-human persons" such as *oki* (Engelbrecht 2003; Mathews 1976).

3.8 Conclusions: The Distributed Person

In order to understand why *some* pipes emerged as rather specialized "intersubjective mediators," we can't ignore the 99 %. Ceremonial pipes drew their rhetorical impact from the strong relational-affective attachments that emerged between pipes and their owners in significant personal histories of production and use. As an object of relational-affective identification for the self, the notion of parting with or fragmenting the pipe in order to end some relationships and to initiate others begins to make sense.

Intentional fragmentation of pipes has been observed in some Ontario Iroquoian graves (Kenyon 1982, p. 99; Kidd 1953, p. 366). At the seventeenth-century Attiwandaron Grimsby cemetery, for instance, ceramic pipes were frequently associated with individual burial bundles or flexed inhumations, and placed near the cranium. In Grave 20, the remains of an adult male were accompanied by an avian effigy pipe that had been snapped in half along the stem and placed in the grave with the pieces facing in opposite directions (Kenyon 1982, p. 99–100). Given what we have seen of the intimate connections between pipe and personal life histories at Keffer, it is hard not to draw a parallel between the death of the buried individual and the biographical closure achieved through the breaking of his pipe.

In such a milieu, the recycling of pipe stems into items of personal adornment is unlikely to have been a frivolous or inconsequential activity. Such acts distributed the social agency of the pipe beyond the object's primary use-life (and, conceivably, the owner's own biological life). The exchange of pipe-stem beads accordingly linked donor and recipient(s) through the common substance and shared history of the pipe. These objects, worn next to the skin or in the hair, sewn into clothing, or secreted away in sacred bundles, would have provided a potent connection to absent friends and relations, both human and other-than-human.

Among the historic Wendat, the relationships established and maintained through exchanges of this sort were understood to be the source of life-sustaining power. Steckley (2007) notes that the Wendat verb *atren*, meaning to "ritually invoke," also carried connotations of social alliance and collusion. Power flowed from such alliances, with health-giving benefits for both parties. The role of pipes in covenants of this sort is revealed in a tale attributed to a Micmac man as recounted by Sagard:

> Once upon a time there was a man who had plenty of tobacco, and God spoke to the man and asked him where his pipe was. The man took it and gave it to God, who smoked for some time, and after having had a good smoke broke the pipe into fragments. The man asked him, 'Why have you broken my pipe? Surely you see that I have no other.' So God took one that he had and gave it to him saying, 'Here is one which I give you; take it to your grand Sagamore, let him keep it, and if he keeps it safe he will not be in want of anything whatever, nor any of his companions (Wrong 1939, p. 169)

These principles lie behind the ritualized exchanges at the heart of calumet ceremonialism and shamanistic practices. In both of these specialized uses, the pipe pointedly mediated an exchange between parties in order to establish a suitable relationship from which power could flow. Among the fourteenth-seventeenth century Wendat, however, these practices were situated within a much broader field of action. A diverse array of clay smoking pipes were implicated in the development of personal routines, bodily habits, dress and adornment, as well as informal and formal modes of affirming friendship, hospitality, and life-giving interdependence. These relationships were probably central to successful village life, and, in turn, help to explain the temporal coincidence of the "adaptive radiation" of Ontario Iroquoian smoking pipes with a period of widespread village nucleation and longhouse growth.

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Chapter 4
An Examination of the Social Dynamics Behind Native Smoking Pipe Variation in the Late Woodland and Early Contact Period Middle Atlantic Region

Elizabeth A. Bollwerk

4.1 Introduction

This chapter examines stylistic variation in Native Middle Atlantic Late Woodland and Contact period tobacco smoking pipe forms and considers how such variation is linked to social processes. Previous explanations of pipe form variations in the Middle Atlantic region have often been couched in a cultural–historical framework and consider different forms as temporal markers or as markers of different cultural groups (McGuire 1899; King 1977; Rafferty and Mann 2004; von Gernet 2000:73; West 1934). Thus, such research has been largely focused on the chronological variation of pipe forms as a diagnostic tool. This view has created a sense that pipe variation over time followed an evolutionary progression beginning with tubular forms in the Early Woodland and ending with elbow forms in the Late Woodland and Contact periods.

Although I acknowledge that chronology and cultural differences certainly play important roles in the variation of forms, I suggest that such variation could also be a venue for stylistic expression or material evidence of interaction and ritual expression. This chapter draws from previous studies that have contended differentiations in other forms of material culture such as ceramics (Chilton 1998; Plog 1980), and projectile points (Andrefsky 2005; Binford 1979; Jelinek 1976) can provide insights into differences regarding functionality and the social processes related to stylistic variation. In particular, following Hodder (1982), Wiessner (1983, 1985), and Wobst (1977) I am concerned with understanding how stylistic variation in pipes could be

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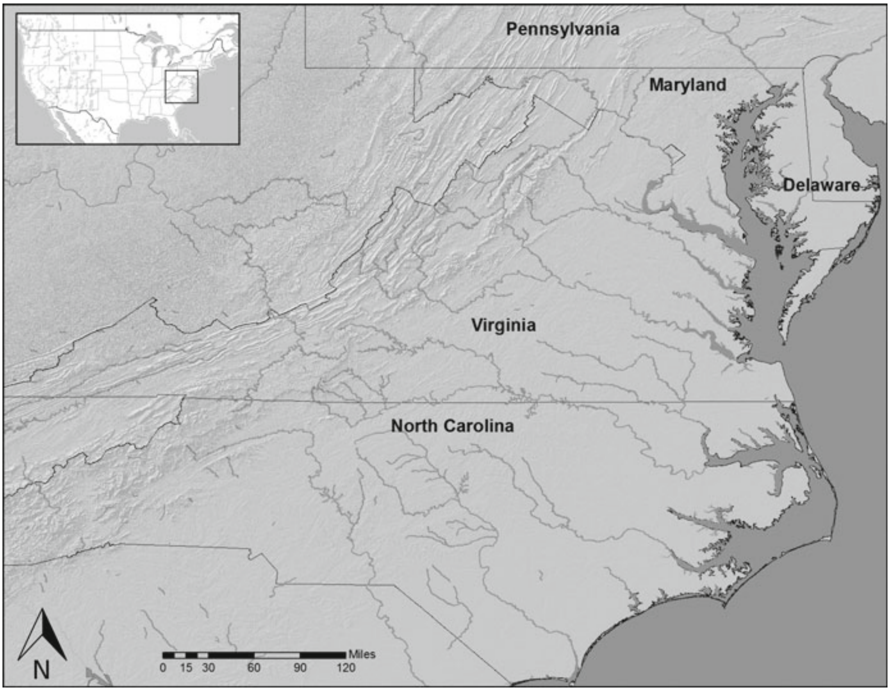

Fig. 4.1 The Middle Atlantic region—the study area; Source: ESRI USA Political Map and Topographic Map, Open Street Map

linked to active efforts by individuals or groups to express or communicate aspects of their identity. While establishing a chronological and typological framework is necessary, this discussion utilizes the interpretative window opened by recent research (Agbe-Davies 2004, 2010, 2014; Drooker 2004; Eastman 2001; Irwin 2004; Rafferty 2001; Rafferty and Mann 2004; Trubowitz 1992, 2004) and attempts to take the examination further to consider what variation of tobacco pipe forms reveals about the social dynamics of Native societies and cultures that used them.

The ethnohistoric record indicates that for Native groups living in what is now the Middle Atlantic region (Pennsylvania, Delaware, Maryland, Virginia, and North Carolina, Fig. 4.1), pipes served as an important accessory for elder males. They were also used as gifts that were exchanged during ceremonies to create alliances and connections with human and spiritual allies (Hamor 1971[1617], p. 39–40; Percy 1969[1606], p. 137; Smith 1986, p. 106; Strachey 1953, p. 123; White 1910[1634], p. 45). While these reports inform our understanding of Native pipe use during the historic period, it is necessary to acknowledge that the records of such associations and practices cannot be the sole sources used to interpret how Woodland period groups used smoking pipes. Given the focus on chronological differentiation, more information is needed to better understand the stylistic variation of pipes, and how it is related to their roles in prehistoric Middle Atlantic Native societies. Although all pipes presumably had a similar function—as implements for smoking—differentiation in form and choice of raw materials could have been a kind of stylistic expression that was tied to efforts of social differentiation, or the expression of particular communal cosmological worldviews (Helms 1993; Lechtman 1977; Stark 1998). With this in mind, this chapter investigates the temporal and geographic distributions of different pipe forms to: (1) identify what forms were present in the region during the Late Woodland and Contact periods and (2) consider how the presence of different and visually distinctive forms could be related to their use as prestige items that were meant to signal information about social status and connections with nonlocal human and spiritual allies.

4.2 The Dataset

The aforementioned research questions were a component of my dissertation (Bollwerk 2012), which examined the temporal and geographic distributions of stylistic variations in pipe forms and decorations. The dataset used for the study comprised 2543 pipes and pipe fragments associated with 70 Late Woodland and Contact period sites spread throughout the Middle Atlantic region (Bollwerk 2012, Fig. 4.2). The Middle Atlantic Culture Area[1] (Coe 1952; Schmitt 1952) served as the focal point for this analysis. This region includes (from north to south) Pennsylvania, Delaware, Maryland, Virginia, and North Carolina (Fig. 4.1) and is considered part of the larger Eastern Woodlands[2] cultural territory. Data collection consisted of traveling to fifteen different museums and archaeological repositories and recording data on over 30 stylistic attributes (see Bollwerk 2012, Appendix I for a complete listing of attributes). In order to establish a basis for examining changes over time, sites were assigned to three sub-periods: Late Woodland I—AD 900–1200, Late Woodland II—AD 1200–1607, and Contact and Colonialism—AD 1607–1665 (see Fig 4.2). These divisions are not arbitrary but align with the sub-periods used by previous researchers. The sub-period delineations are based on evidence of substantial social and material shifts that took place in various parts of the region (Dent 1995; Eastman 1999; Gallivan 2003; Gardner 1986; Gold 2004;

[1] The designation of the Middle Atlantic as a "Culture Area" is a result of cultural-historical studies that delineated culture areas based on similarities in artifact types and patterns. Although the term "Cultural Area" is problematic, it has been used here to define the area of interest. See Bollwerk 2012, Chapter 2 for a detailed history of the Middle Atlantic culture area and a critique of the Cultural Area approach.

[2] Eastern Woodlands is a term used to delineate all territory and Native groups living east of the Rocky Mountains. A number of archaeologists and anthropologists (Driver 1961; Holmes 1903; Kroeber 1939; and Wissler 1922) have suggested that the Native peoples of this area shared general cultural traits based on material evidence of broadly shared practices such as deer hunting, chiefdom level political systems, and the independent domestication of squash and sunflower along with the adoption of prevalence of maize agriculture after A.D. 800 (Cordell and Smith 1996; Smith 1989).

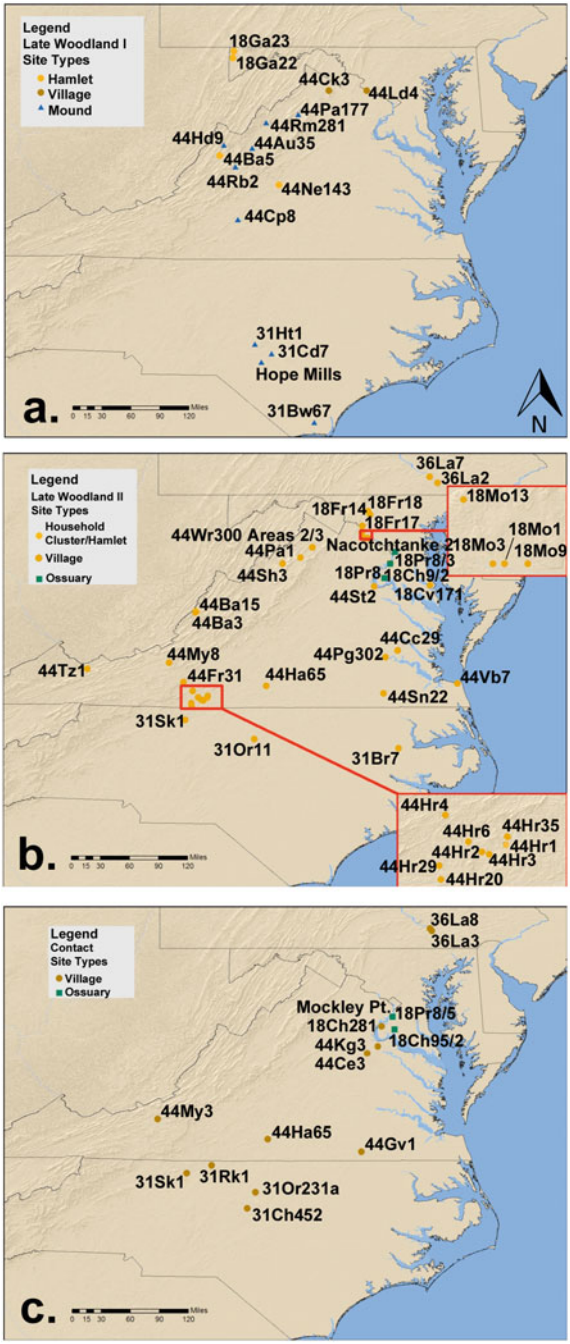

Fig. 4.2 Locations of Late Woodland and Contact period archaeological sites included in the study; Basemap Source: ESRI USA Political Map

Grumet 1995; Jirikowic 1995; Lapham 2005; Potter 1993; Ward and Davis 1999). The assemblages were divided into the sub-periods based on radiocarbon dates and relative dating techniques such as ceramic seriation (see Bollwerk 2012, Tables 5.1, 5.2, and 5.3 for detailed information on dating).

4.3 Middle Atlantic Tobacco Pipe Forms

My analysis revealed that seven different pipe forms were represented in varying quantities in the dataset. These seven forms are tubular, platform, bent tube, reed stem, effigy, multi-stemmed[3], and elbow (Figs. 4.3 and 4.4). Previous studies of pipe form variation in the Middle Atlantic region have primarily attributed differences to a progressive evolution of forms that became more sophisticated over time,

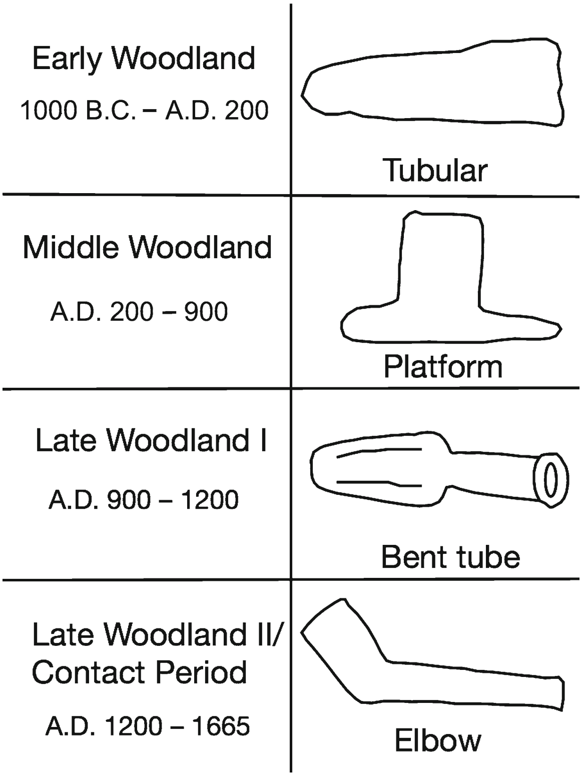

Fig. 4.3 General time periods associated with different forms in the dataset (tubular, platform, bent tube, and elbow)

[3] The multi-stemmed pipe was a unique form in the dataset. While interesting, the small sample size made it challenging to draw any conclusions on how it was related to social processes. Thus, it is not discussed in this chapter but more informaton can be found in Bollwerk (2012, p. 215–216).

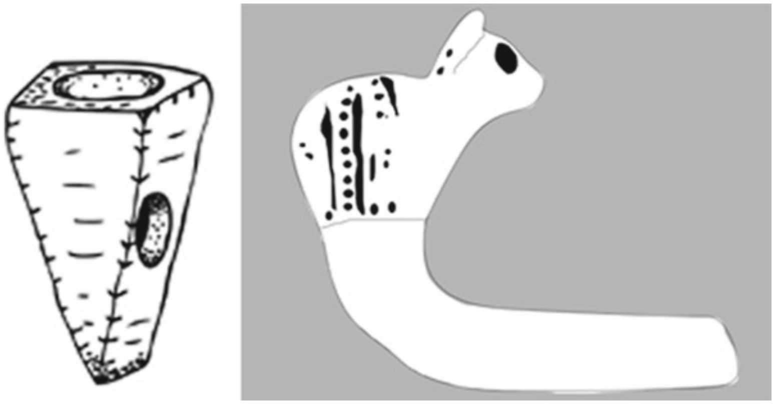

Fig. 4.4 (**a**) An ovoid reed stem from the Crab Orchard site in Virginia (44TZ1) and (**b**) A bear effigy pipe from the Stricker site in Pennsylvania (36LA3). The reed stem image is redrawn from MacCord Sr and Buchanan Jr (1980, Figure 11). Effigy image based on photo of effigy taken by the author courtesy of Pennsylvania State Museum. Original size of reed stem pipe is approximately 3 × 2 in. Original size of bear effigy pipe is approximately 5 in. long

starting with tubular pipes and ending with elbow pipes (Fig. 4.3). Joseph McGuire (1899), using collections from the US National Museum, created one of the first typologies that espoused this progressive development. His typology identified temporal and spatial distributions of different pipe forms over the whole of North America, including an area he identified as the Atlantic coast, which roughly approximates the borders of what is today known as the Middle Atlantic region. McGuire (1899, p. 626) identified the first nonperishable smoking implements in the area presently known as the Middle Atlantic as tubular in form and dating to the late Archaic (3000–1000 BC) and Early Woodland (1000 BC–AD 200) periods. The "classic" form is a parallel-sided tube with a wide distal opening and a narrow-bored proximal end (Fig. 4.3) although Rafferty's (2001, p. 97, 126–152) analysis of pipe stylistic variation in the northern Eastern Woodlands identified variation in tubular pipe styles that was more localized.

Multiple scholars have noted that the shift from the Early to Middle Woodland period (AD 200–900) in the Eastern Woodlands is associated with a dramatic change in form as pipe assemblages transformed from being dominated by tubular forms to being comprised of platform pipes (Hall 1997, p. 118; Rafferty and Mann 2004, p. xiii; Rafferty 2015 Chap. 2; von Gernet 2000:73; Fig. 4.3). These pipes take the form of a flat or curved base platform that contains the pipe bore, with a cylindrical bowl located in the center. As a result of their role in the Hopewell trading sphere, platform pipes are associated most closely with the Middle Woodland Ohio Valley Hopewell (Brose 1985, p. 62–63; King 1977, p. 11; Otto 1992; Weets et al. 2005, p. 537–539), but they are found in the north and southeast as well (Rafferty 2015 Chap. 2, this volume; West 1934).

The third form in the dataset, called the bent tube pipe (Fig. 4.3), has also been identified in limited quantities among Late Woodland Middle Atlantic sites. MacCord (1966) and Irwin (2004) have noted that bent tube pipes appear to be amalgams combining elements of platform and tubular pipes. Instead of being mounted on the base, the bowl is more of a continuation of the stem but is at an obtuse rather than right angle.

Tubular, platform, and bent tube pipes have generally been considered as precursors to forms where the base is bent away from the stem at an obtuse angle, a modification that is more prevalent among pipes dating to the Late Woodland period (900–1600 AD) (Rafferty and Mann 2004, p. xii). McGuire (1899, p. 628) identified pipes with this feature as elbow pipes. While they did exist in elementary forms during the Early and Middle Woodland periods, Rafferty and Mann (2004, p. xii) note that elbow pipes became the dominant form of smoking implement from the eleventh century onward in North America, although tubular pipes continue to be used by groups at this time.

Although the elbow form was predominant during the Late Woodland and Mississippian[4] periods in the Eastern Woodlands region, reed stem and effigy forms (Fig. 4.4) also played a prominent role among Mississippian, Fort Ancient, and northeastern Iroquoian groups who occupied territories adjacent to the study area (Blanton 2015 Chap. 6, this volume; Brain and Phillips 1996; Drooker 2004; Kuhn 1986; Mathews 1980; Noble 1992; Rafferty 2015 Chap. 2, this volume; Wonderley 2005). Reed stem pipes are especially distinctive because unlike the forms previously discussed they consisted of two separate pieces, a bowl and a stem, that each played an important symbolic role (Blakeslee 1981; Brown 1989; Springer 1981). The stem, which was generally a piece of reed, was inserted into the bowl so that it could be smoked. In many cases, however, only the stone or clay bowl has survived in the archaeological record. Effigy forms incorporated zoomorphic and anthropomorphic imagery into the bowl and/or stem shape.

Moving into the Contact period, the elbow form continued to predominate but the availability of different raw materials increased as Europeans introduced their own pipes into the repertoire of smoking options. European innovations included the large-scale production of white clay pipes as well as pewter pipeliners for pipes made of perishable materials, such as wood, which were also used by Native groups in parts of the region (Ward and Davis 1993). Base metal (e.g., lead and pewter) pipes have also been found on Native Contact period sites in the region (Veit and Bello 2004).

[4]The term Mississippian refers to a late prehistoric/protohistoric period and cultural pattern that lasted from approximately A.D. 900–1600. The term is used to distinguish Native communities in the Midwest and Southeast that shared a confluence of traits including mound centers with centralized plazas, artifacts that exhibit imagery associated with the Southern Cult, and the adoption of Maize agriculture. Although this cultural pattern did not extend into the Middle Atlantic, there is material evidence of interaction with Mississippian groups.

4.4 A Closer Examination of Pipe Form Diversity

While tubular, platform, bent tube, and elbow forms are generally considered to be more popular during particular periods, the researchers mentioned above have acknowledged that forms did not always adhere to strict temporal boundaries. My examination of pipe forms from Late Woodland and Contact period Middle Atlantic archaeological assemblages affirms that although elbow pipes were the predominant form used during these periods, a variety of other forms were also present in the collections surveyed in this study. As illustrated in Table 4.1, which provides a summary of forms in the dataset, elbow pipes were by far the most prevalent form. The next largest group comprised tubular pipes. The quantities of the rest of the minority forms are much smaller, ranging from 1 to 20 fragments or whole specimens. While the small sample size of many of these forms may seem to indicate they can be dismissed, I argue that despite modest presence they are deserving of attention.

I explored how these forms were distributed through time and space by using Geographic Information Systems software (ArcGIS ©) to create distribution maps that illustrate the relative frequencies of forms present in each site assemblage and compare these frequencies between the three different sub-periods (Fig. 4.5a–c). It should be noted that these charts and their proportions only reflect the fragments and whole pipes whose forms could be identified in the sample. Thus, the size of the pie chart is scaled to reflect the total number of samples that could be identified to form, not the size of the entire assemblage. Moreover, site assemblages that did not contain any fragments whose forms could be identified are not pictured on these maps.

A few noteworthy trends are revealed through a comparison of these three figures. Three forms—elbow, tubular, and platform pipes—are found in contexts that date to all three periods (see Fig. 4.5a–c). The other forms present in the dataset have more restricted time spans. Bent tube pipes only appear on sites dating to the Late Woodland I period (see Fig. 4.5a). Effigy pipes and reed stem forms do not

Table 4.1 Summary of pipe forms present in dataset

Form	Count
Elbow	754
Tubular	184
Platform	20
Bent Tube	17
Reed Stem	20
Effigy	28
Multi-Stemmed	1
Unidentifiable	1519
Total	*2543*

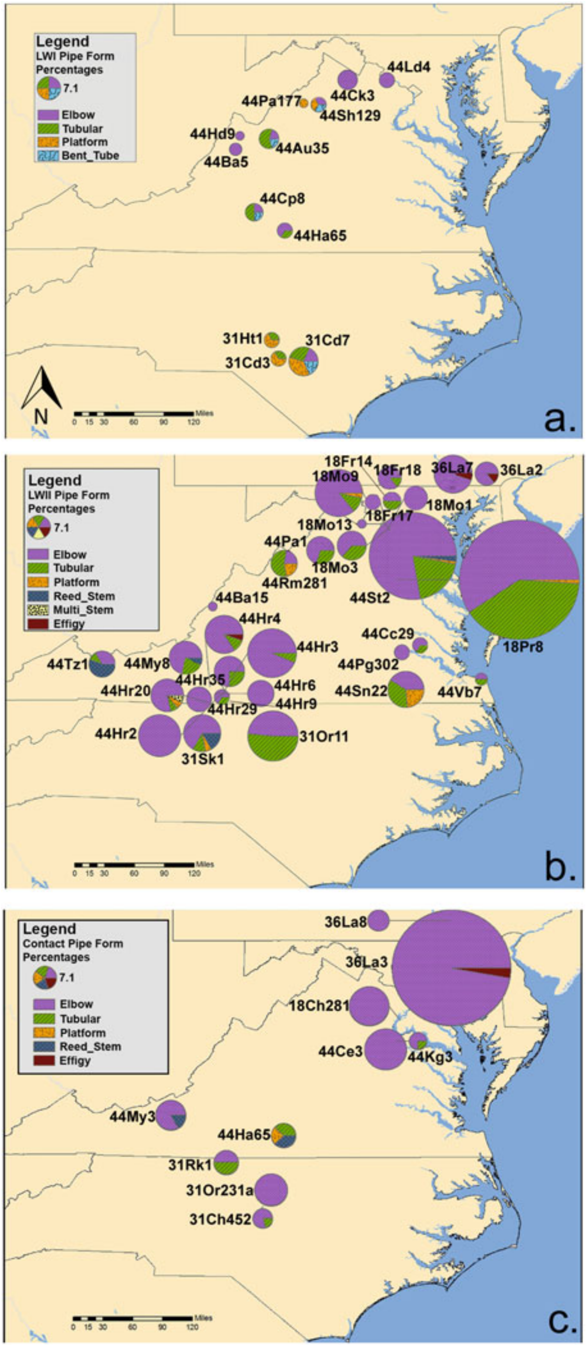

Fig. 4.5 (**a**) Percentages of different forms in Late Woodland I assemblages (Pie chart for reference in legend is scaled to assemblage size of 7.1 pipes), (**b**) Percentages of different forms present in Late Woodland II site assemblages (Pie chart for reference in legend is scaled to assemblage size of 7.1 pipes), (**c**) Percentages of different forms present in Contact period site assemblages (Pie chart for reference in legend is scaled to assemblage size of 7.1 pipes)

appear in the region prior to the thirteenth century, but their presence extends into the Contact period (see Fig. 4.5b, c). The variability of different forms' time spans demonstrates that Native groups were using multiple forms during the Late Woodland and Contact periods. A comparison of these three figures also indicates that the fewest forms were used during the Late Woodland I period, while the greatest number of forms seems to be occurring during the Late Woodland II period.

The increase in the number of forms present during the Late Woodland II period is noteworthy because this time period is associated with a great deal of social change in the region. The temporal division between Late Woodland I and Late Woodland II is based on research that suggests alterations took place in the social systems of Native societies in the thirteenth century as dispersed communities coalesced into larger villages similar to those generally described in historic accounts (Custer 1986; Dunham 1994; Gallivan 2003; Gold 2004; Phelps 1983; Potter 1993; Stewart 1989, 2004; Turner 1992; Ward and Davis 1999). These communities incorporated agriculture more intensively into their subsistence base. Additionally, the rise of social hierarchy and the increasingly sedentary lifestyle of groups in different parts of the region impacted burial rites (Curry 1999; Dunham 1994; Jirikowic 1995), and also led to an increase in warfare (Potter 1993; Rountree 1992), which impacted exchange and interaction networks during this period (Gallivan 2003; Stewart 1989, 2004). Thus, the increased diversity of pipe forms could be related to the efforts of individuals or groups to differentiate themselves as social hierarchy increased. The variation of forms could also be connected to changes in social relationships between different communities as sedentariness and warfare increased in the region.

Before examining additional information to consider what social processes could be linked to the diversity, it was also necessary to test the visual patterning suggested by the maps with more rigorous statistical methods to evaluate whether the patterns were in fact significant (Kvamme 1994, 1999; Lock and Harris 1992). The differences in the numbers of forms between periods suggested by mapping the proportions of pipes were evaluated by measuring the diversity of pipe forms in all of the assemblages for each of the three periods. Assemblage diversity can be measured in two ways: the number of different classes in an assemblage (richness) and the frequency of the distribution of cases between different types or classes (evenness) (Kintigh 1989, p. 26). For my analysis, I chose to focus on richness rather than evenness due to the nature of pipes and their role in Native communities. Evenness tends to minimize the importance of a particular class when it is present in smaller quantities in the sample. However, in the case of a pipe, the presence of only one or two examples of a particular form could be linked to their roles as important ritual objects that were only used by a limited portion of the population. Arguably, their rarity makes them more significant, but this type of social process is not accounted for in the evenness measure. Consequently, I chose to compare the richness of different classes—in this case the seven different forms—that were present in each assemblage. All analyses were done in R 3.1.2 (R Core Team 2014).

After determining the richness score for each site, I aggregated the richness scores for all sites whose time ranges fell into a particular period. Table 4.2 is a

Table 4.2 Richness values of pipe assemblages aggregated by temporal sub-period

Time period	No. of sites	Mean richness	Standard deviation
Late Woodland I	10	1.800	1.032
Late Woodland II	30	2.070	0.944
Contact	12	1.750	0.944

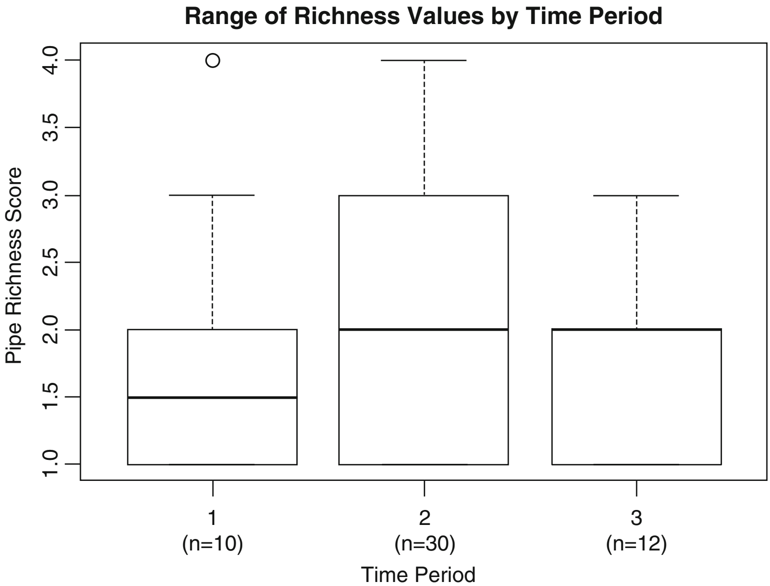

Fig. 4.6 Boxplot of richness values by time period, 1 = LWI, 2 = LWII, 3 = Contact

comparison of the richness scores for Late Woodland I, Late Woodland II, and Contact period sites. Additionally, the boxplot in Fig. 4.6 illustrates the range of forms in use during the different periods. The boxplot indicated that Native communities were using a wider range of forms during the Late Woodland II period in comparison to the other two sub-periods. Furthermore, the aggregation of the richness scores supported the pattern suggested by mapping the distributions, the Late Woodland II period did exhibit the highest richness of forms overall. If the diversity of Late Woodland II pipes was higher than the other time periods, that would support the possibility that the wider range of pipes could be tied to social changes taking place during that period. However, as the table also illustrates, high standard deviations suggested that the differences in the average richness between different periods may not be significant. A *t*-test was run to evaluate whether the differences were significant.

Inspection of plots revealed that richness values were normally distributed for all three time periods. However, *F*-tests comparing variances between LWI and LWII, LWII and Contact values, and LWI and Contact means showed that variances were not equal. To compensate for the lack of equal variance two-sided *t*-tests with Welch's adjustments were run to evaluate whether the mean richness was significantly different for all three comparisons. *T*-tests showed that means from the three sub-periods were not significantly different (LWI and LWII $t(14.37)=0.722$, $p=.2409$; LWII and Contact $t(30)=1.2725$, $p=0.1064$; LWI and Contact $t(14.195)=13.42$, $p=.4476$)). Thus, despite the fact that there was variation between time periods, the results of the statistical analyses do not indicate the average number of forms present differed significantly through time.

While the amount of diversity may not have differed significantly between periods, the high diversity of Late Woodland II period was still interesting. One more issue had to be addressed, however, before considering the social processes behind this diversity. A number of Late Woodland II sites tended to exhibit the largest pipe assemblage sizes of all the sites included in the study (see Bollwerk 2012, p. 148–179 for more information on assemblage size variation). Researchers have cautioned the use of richness measures due to the strong relationship between richness and sample size (Kintigh 1989; Neiman 1995). Larger assemblages often demonstrate a tendency to have more classes of artifacts than smaller assemblages. Additionally, my research had suggested that larger pipe assemblage sizes from Late Woodland II sites could be a reflection of archaeological excavation methods (Bollwerk 2012, p. 158–162), such as the amount of excavation conducted on a site. If assemblage size was a factor, that would impact my ability to tie the variation to Native practices.

To see if the pattern of higher richness values among Late Woodland II assemblages could be a factor of assemblage size, I chose to compare each assemblage richness score with the assemblage size of ceramics that were also excavated from the site. Ceramics are an artifact class that is ubiquitous across Late Woodland and Contact period sites and provide a useful baseline for assemblage size. If ceramic assemblage size increased as richness scores increased that would suggest assemblage size might be a major factor influencing the Late Woodland II period diversity measure. Following Thomas (1986, p. 427), I transformed pipe and ceramic counts to log10 values. This transformation converts a nonlinear relationship into one that is easier to evaluate using linear trends in the data.

Figure 4.7 is a scatterplot of pipe richness scores of Late Woodland II sites compared with log values of ceramic assemblage size. A Pearson's correlation coefficient demonstrated that there is a positive correlation between ceramic assemblage size and pipe richness value ($r=.28$). Yet, the relationship was not statistically significant ($t=1.3678$, $p=0.18$, $\mathrm{df}=21$). A regression analysis also indicated that there was a positive but weak relationship between richness and ceramic assemblage size. The statistical tests revealed that the percentage of variation explained by assemblage size was low enough that it shouldn't impact the results. Although some sites with larger ceramic assemblages had high richness scores, there were also many sites with large ceramic assemblages that had low pipe richness scores. Additionally, there were a few sites that had high pipe richness scores but smaller ceramic assemblages. The lack of correlation between assemblage size and the number of pipe forms on a site suggested it was worth searching for evidence of other factors that could have caused the presence of these different forms.

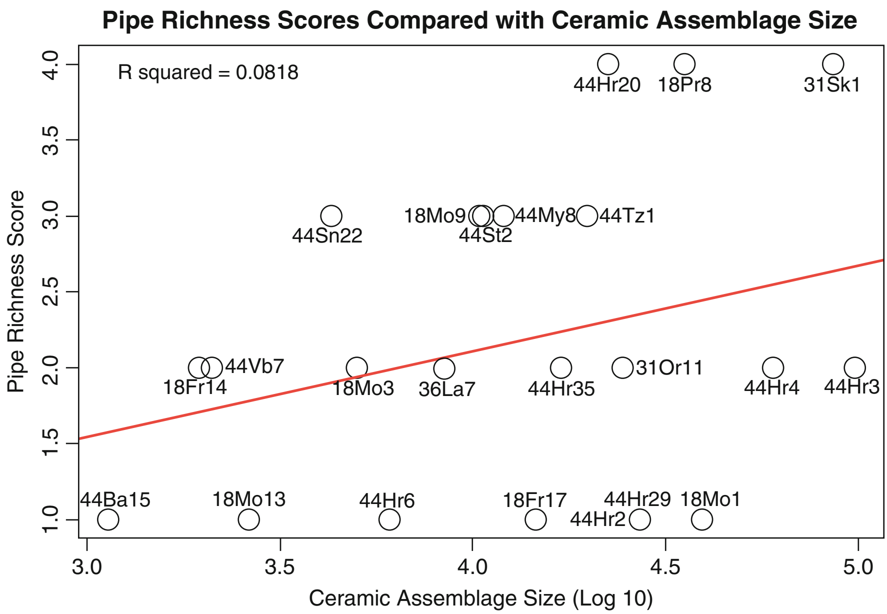

Fig. 4.7 Scatterplot comparing richness values of pipes versus ceramic assemblage size (Scatterplot created using R (2013))

Other factors that could have been influencing the stylistic variation were differences in social and ritual practices between different groups in the region. Consequently, ArcGIS was used again to further examine the geographic distributions of particular forms to see if they were associated with any particular area or areas within the region. I concentrated on tubular and reed stem pipes because they were visually distinct from the elbow pipes that were typical of the Late Woodland/Contact periods. Furthermore, as previously noted, reed stem pipes are not generally considered to have been produced in the region but are associated with Native communities outside of the study area. Consequently, their presence in the dataset was particularly intriguing.

4.5 Spatial Distributions of Tubular and Reed Stem Pipes and Their Relationships to Social Processes

4.5.1 Tubular Pipes

A number of different tubular pipes were present in the dataset analyzed for this study. One type, known as the conical tubular pipe, is named for its cone-shaped appearance. The defining character of a conical pipe is that the diameter of both the exterior of the pipe and the interior bore expand from proximal (bore or mouthpiece) end to distal (bowl) end, typically with the distal end being at least 150 % the diameter of the proximal end (Rafferty 2001, p. 140). Conical tubular pipes are typically associated with earlier Woodland periods (see Fig. 4.3), but the examples in this dataset were associated with Late Woodland contexts.

Three other kinds of tubular pipes observed in the dataset differ markedly from conical tubular pipes. These three types were differentiated based on bowl shape. The first, known as a trumpet pipe (Wells 2002) expands from the proximal to distal end but not as dramatically as conical pipes. A variant of the trumpet shape is the restricted rim. These forms exhibit elongated bowls that flare outwards from the stem bowl juncture to the rim and inverted lips. Finally, tubular pipes with more bulbous shaped bowls, also known as onion bowls (Coe 1995), were present.

In general, mapping the distribution of tubular forms revealed that they were were widely spread throughout the study region and not associated with any particular area (Fig. 4.8). To test the visual patterning suggested by the maps, I compared the distribution of tubular pipes with physiographic boundaries. A physiographic province is a landform region or area delineated according to similar terrain that has been shaped by a common geologic history. The five major physiographic provinces in the Middle Atlantic are (from east to west): the Coastal Plain,

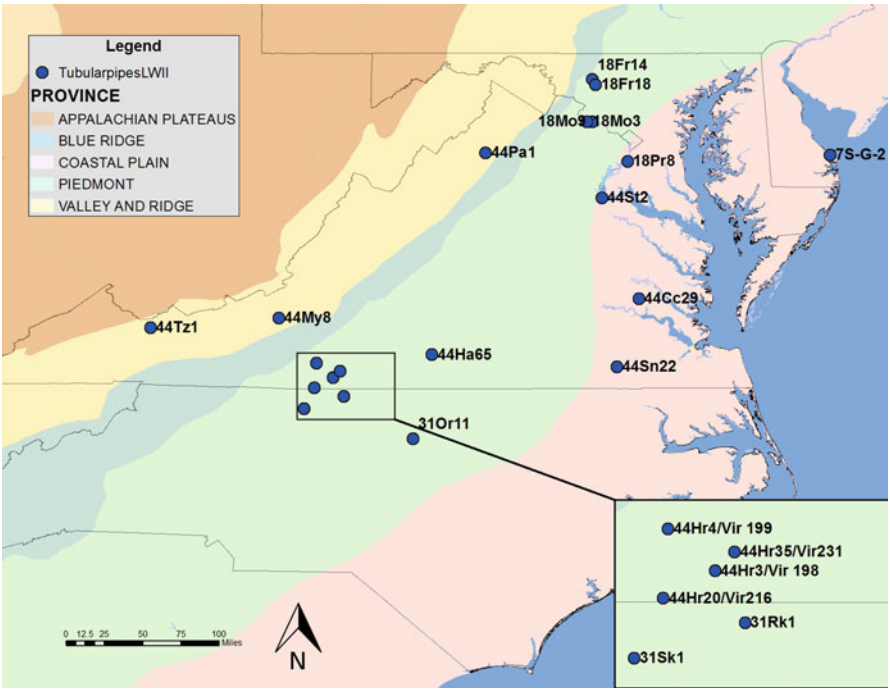

Fig. 4.8 Geographic distribution of all tubular pipes among Late Woodland II sites

the Piedmont, the Blue Ridge Mountains, the Ridge and Valley, and the Appalachian Plateau. For this study, I chose to focus on the Coastal Plain, Piedmont, and Ridge and Valley provinces because (1) no sites in this study were located in either the Blue Ridge Mountains or Appalachian Plateau and (2) the territories of different cultural and linguistic groups in the region have often been loosely aligned to the physiographic boundaries of these three provinces (Goddard 1978; Holmes 1903; Mooney 1894; Sturtevant 1958, cf. Gallivan 2003).

A Fisher's test was used to compare the presence and absence of tubular pipes on sites in the three physiographic provinces in the region. It should be noted that this test included assemblages containing fragments of tubular pipes that could not be identified to any of the three forms discussed above. The test supported the patterning suggested by the distribution maps and indicated that the presence/absence of tubular pipes between different physiographic provinces was not significantly different (Tables 4.3, 4.4, and 4.5). Thus, it would seem that the use of tubular pipes was widespread and not limited to any one area or group in the region. In contrast, a visual comparison of trumpet and onion bowl pipe distributions with physiographic boundaries seemed to indicate the distributions of these tubular pipes were more restricted. They were primarily found on sites in the central and eastern parts

Table 4.3 Contingency table comparing the presence/absence of tubular pipes between Coastal Plain and Piedmont sites

Tubular	Coastal Plain	Piedmont	Total
Yes	7	7	14
No	3	12	15
Total	10	19	29

$p = .1281$

Table 4.4 Contingency table comparing the presence/absence of tubular pipes between Coastal Plain and Ridge and Valley sites

Tubular	Piedmont	Ridge and Valley	Total
Yes	7	4	11
No	3	3	6
Total	10	7	17

$p = .6437$

Table 4.5 Contingency table comparing the presence/absence of tubular pipes between Piedmont and Ridge and Valley sites

Tubular	Piedmont	Ridge and Valley	Total
Yes	7	4	11
No	12	3	15
Total	19	7	26

$p = .4065$

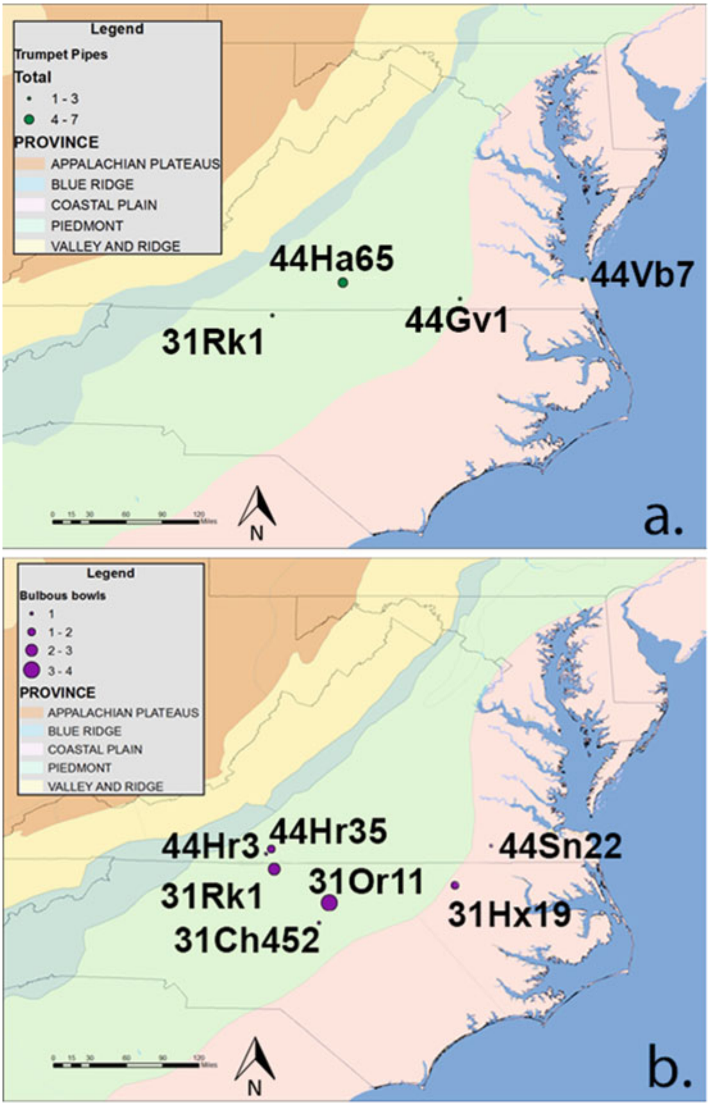

Fig. 4.9 (**a**) Geographic distribution of trumpet pipes (raw counts) among Late Woodland II sites, (**b**) Geographic distribution of onion-bowl pipes (raw counts) among Late Woodland II sites

of the study area (Fig. 4.9a, b). Unfortunately, the small sample sizes of these forms made it difficult to further test these patterns.

Although drawing conclusions based solely on the large-scale distributions of pipes is difficult, the contexts in which tubular pipes were found provide additional insight. While the vast majority of tubular pipes came from plowzone contexts, nine fragments or whole pipes were recovered from feature contexts that were not burials (see Table 4.6). Additionally, there were a handful of sites where multiple pipe

Table 4.6 Examples of feature contexts where tubular pipes were identified

Site no.	Site name	Feature no.	Feature interpretation	Reference
44PA1	Keyser	P-2	Pit, rounded sides and bottom	Manson, MacCord, and Griffin (1944): Table 1
44PA1	Keyser	P-35	Bell-shaped rounded pit, storage pit	
44TZ1	Crab Orchard	Feature 30	Refuse pit	MacCord and Buchanan (1980)
44HA65	Abbyville	Feature 47	Refuse pit	Wells (2002):261
44HR20	Dallas Hylton	Feature 7 (TP-7)	Bell-shaped pit	Davis et al. (1997):11
44HR35[a]	Stockton	Feature 9 (TP-9)	Refuse-filled storage pit	Davis et al. (1998):Table 1
44HR35	Stockton	Feature 41 (TP-41)	Straight-sided, circular pit	Davis et al. (1997):15
18FR18	Rosenstock	Feature 6	Trash-filled pit	Curry and Kavanagh (2004)
18FR14[a]	Biggs Ford	Feature 11	Refuse-filled storage pit	Bastian (1974), Field notes

[a]Both elbow and tubular pipe found in feature

forms were found in datable contexts that could be considered contemporaneous. The most concrete examples of the contemporaneous use of different forms are found at the Stockton (44HR35) and Biggs Ford (18FR14) sites (see Table 4.6 and Fig. 4.8). At each of these sites, elbow and tubular pipes were found in the same levels of a feature context. These examples suggest that individuals living on these sites had choices in terms of what form of pipe they could use when smoking. Moreover, the disposal patterns of these pipes are noteworthy. Instead of being interred in burials, they were found in what were interpreted as refuse pits with other materials. This suggests that although pipes served important roles in rituals they could also be disposed using methods similar to those used for other, more mundane, items.

In contrast, other tubular forms in the dataset were found in different contexts. A trumpet pipe found at the Great Neck site (44VB7), located in coastal Virginia, was associated with an elder male burial, which investigators interpreted as a high status burial based on the presence of other burial items, such as copper beads, and its location near the interior of a palisade (Hodges 1998, p. 44, 77). Another trumpet pipe was recovered from an elder male burial at the Abbyville (44HA65) site. Although it is impossible to say whether these pipes were personal possessions of these individuals, their interment with adult males supports the idea that these distinctive forms were at least associated with this demographic in certain communities and social groups in the eastern and central parts of the Middle Atlantic.

Given that the Late Woodland II period was a time of increasing social hierarchy, tubular pipes in general, and more visually distinctive types such as trumpet pipes, could be related to individual efforts to differentiate themselves from others in their communities. The persistent use of tubular pipes into the Late Woodland II and

Contact periods, the presence of visually distinctive forms that differ from elbow pipes, and possible associations with high status individuals suggest the tubular pipe cannot be dismissed as a more simplistic form that was completely abandoned in favor of the more sophisticated elbow pipe.

4.5.2 *Reed Stem Pipes*

ArcGIS was also used to investigate the geographic distribution of reed stem pipes on Late Woodland II period sites. The geographic patterning indicated there might be significant differences in the distributions of this form in different areas of the region (Fig. 4.10) as reed stem pipes tended to be associated with sites in the Coastal Plain and Ridge and Valley provinces. Additionally, the maps indicated that there was a cluster of pipes present among a number of sites in southwestern Virginia. Tables 4.7, 4.8, and 4.9. are contingency tables that compare the presence and absence of reed stem pipes on Late Woodland II sites between different physiographic provinces. Fisher's tests showed a significant difference between the presence and absence of reed stem pipes in the Coastal Plain and Piedmont ($p=0.0005$), and the Piedmont and

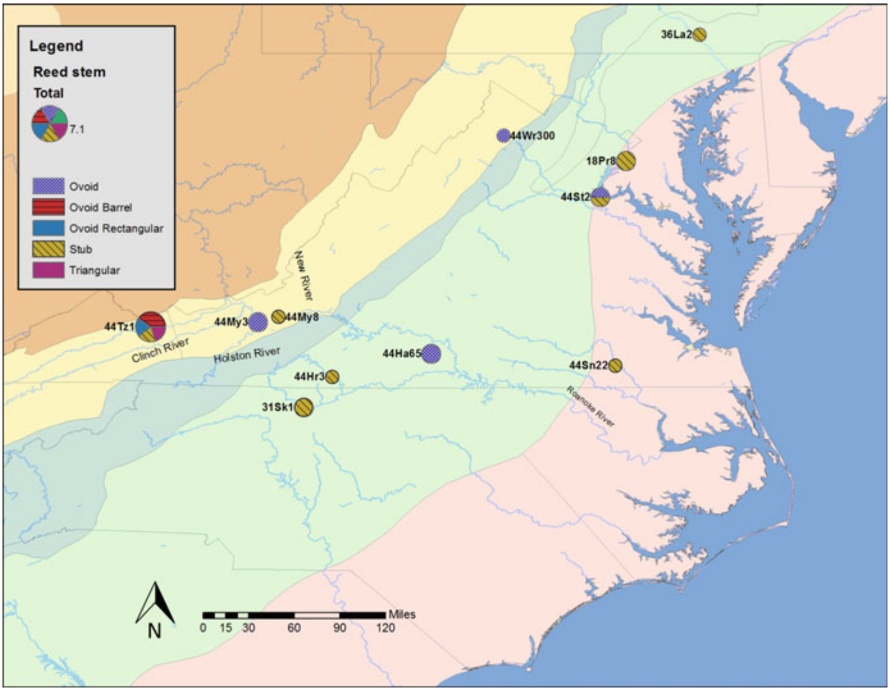

Fig. 4.10 Geographic distribution of reed stem pipes in the study area (a triangular pipe is another form of ovoid pipe). Pie charts illustrate percentage of different reed stem shapes present in assemblages

Table 4.7 Contingency table comparing the presence/absence of reed stem pipes between Coastal Plain and Piedmont sites

Reed stem	Coastal Plain	Piedmont	Total
Yes	7	1	8
No	3	18	21
Total	10	19	29

$p = 0.0005$

Table 4.8 Contingency table comparing the presence/absence of reed stem pipes between Coastal Plain and Ridge and Valley sites

Reed stem	Coastal Plain	Ridge and Valley	Total
Yes	7	4	11
No	3	3	6
Total	10	7	17

$p = 0.6437$

Table 4.9 Contingency table comparing the presence/absence of reed stem pipes between Piedmont and Ridge and Valley sites

Reed stem	Piedmont	Ridge and Valley	Total
Yes	1	4	5
No	18	3	21
Total	19	7	26

$p = 0.01043$

the Ridge and Valley ($p = 0.01043$). However, there was not a significant difference in the presence or absence of reed stem pipes in the Coastal Plain and Ridge and Valley ($p = 0.6437$). The comparison of reed stem pipes between physiographic provinces confirmed that there are stronger connections between this form and particular areas of the study region.

The presence of seven stub reed stem pipes (pipes with a short "stub" stem) on Ridge and Valley sites (Fig. 4.10) is likely material evidence of relationships between Ridge and Valley Native groups with communities of Mississippian peoples in Tennessee and other parts of the Southeast. The sites with stub-stem pipes in the Middle Atlantic region were occupied in the sixteenth and seventeenth centuries (Eastman 1999; Egloff and Reed 1980; Smith 1984; Stewart 1992) and were widely distributed throughout the region (Fig. 4.10). This period coincides with the proto-Cherokee/Qualla phase in North Carolina (AD 1350–1700, Ward and Davis 1999, p. 181) and Dallas phase, which are associated with Muskogean-speaking Mississippian peoples (AD 1300–1600, Sullivan (ed.) 1995, p. xx) in Tennessee. Researchers have noted the presence of other Mississippian-style artifacts, including ceramics with shell temper and complicated stamped surfaces, and other non-utilitarian objects such as citico-style gorgets, on sites in the southwestern Ridge and Valley of Virginia and northwestern North Carolina. These items have been considered material evidence of interactions that would have made Mississippian groups part of the social landscape of Ridge and Valley Native peoples (Egloff 1992; Brain and Phillips 1996; Meyers 2011). In a similar vein, the stub reed stem forms found on Coastal Plain sites could also be tied to connections with Mississippian groups. Ceremonial shell masks with the weeping eye motif (Brain and Phillips 1996; Potter 1993), another Mississippian iconographic tradition, have been found in that territory suggesting that exchange networks between Coastal Native groups in this area and groups in the southeast were active.

The presence of ten ovoid reed stem pipes in the dataset (see Figs. 4.4 and 4.10) is also notable. Ovoid pipes, or pipes that completely lack a stem and instead have a large hole drilled into the bowl for insertion of a reed stem (Drooker 2004), are typically associated with Northeastern Iroquoian groups of New York and Canada, as well as Fort Ancient peoples who inhabited areas of Ohio, Kentucky, and West Virginia during the fifteenth and sixteenth centuries (Drooker 2004). The distribution of ovoid pipes on sites on the western portion of the study area suggests linkages between these communities and other Native groups occupying areas to the north and west.

While the distributions are informative, the contextual associations of these pipes provide additional important evidence. Eighty percent of ovoid reed stem pipes (8/10) were found in burial contexts. Seven of these burial contexts were adult male internments. The direct association of ovoid pipes with adult males suggests that these objects may have been of particular importance to these individuals. Moreover, the restricted association and limited quantities of these forms on sites in the Middle Atlantic indicates that ovoid pipes may have served as material markers of some component of social status. Following Helms (1993), Earle (1990), and Hodder (1982), certain individuals could have used an association with these objects, thought to have traveled in long distance exchange networks, to demonstrate their connections with distant people and places. The association with far-off areas could have helped these individuals create or legitimize a higher status role in their community.

Besides serving as important individual accessories, the presence of reed stem pipes introduces the question of whether some Middle Atlantic communities may have been changing their ritual behavior. A number of researchers have suggested that reed stem or separate stemmed pipes had special significance due to the fact that the joining of the bowl and stem was a significant part of the ceremony (Blakeslee 1981; Coe 1995; Paper 1988; Springer 1981). Thus, rituals involving reed stem pipes may have involved different customs or practices than those that entailed smoking an elbow, bent tube, or platform pipe in which the bowl was already attached to the stem. Accordingly, the presence of reed stem pipes on sites in the Middle Atlantic not only symbolizes the social connections of these groups with more distant communities but also potential innovations within ritual practices and behaviors. It is important to note, however, that Middle Atlantic groups may not have used the forms in the same ways as the Native communities in other areas. The exchange of materials, while likely creating an understanding between communities, did not necessarily mean that there were changes in behavior.

4.6 Conclusion: Smoking Pipes and Native Social Landscapes

I have argued that variations in pipe forms were not just linked to the evolutionary progression of forms through time but also to social processes such as status signaling, social relationships, and ritual practice. I base this conclusion of three forms of evidence. First, five out of the seven forms in the dataset were found in two or more temporal sub-periods within the Woodland Period. Thus, while pipes can serve as markers of temporal shifts diachronic change is not the only process causing variation in forms. Second, the persistent use of visually distinctive tubular pipes well into the Late Woodland period, when elbow pipes were more prevalent, introduces the possibility that individuals had multiple forms to choose from when producing or using pipes. Moreover, the widespread distribution of tubular pipes indicates that their use was not limited to any one particular community. However, given ethnographic and archaeological evidence that links this material culture class with males, the presence of different forms may be related to efforts by adult males to distinguish themselves within their communities. In a similar vein, the variation may be related to individuals exercising personal preferences about the types of pipes they wanted to smoke (see Creese 2015, Chap. 5, this volume, for a detailed discussion of the role of personal preference in pipe production and use).

Third, the presence of reed stem pipes—a form associated with Native groups from outside the region—and differences in their geographic distributions serve as further evidence that factors other than chronological change were behind variations in form. The presence of this form is physical evidence of exchange networks and social relationships that traversed cultural and geographic boundaries. Moreover, the strong association of ovoid pipes with adult males indicates that they may have been important personal accessories for this social group. However, the presence of these pipes cannot be said with certainty to indicate that Middle Atlantic groups also adopted the practices and behaviors associated with the reed stem form in other regions. More research is necessary to determine whether the reed stem examples in the dataset were produced by individuals at sites outside of the study area and traveled to the Middle Atlantic via exchange networks, or whether ideas about their production were incorporated into local production networks. Such information may provide more insight into the extent to which the incorporation of these forms impacted ritual behaviors and practices. The degree to which the presence of certain materials and forms is related to the adoption or change of ritual behaviors is difficult to answer but an area that should be further explored.

In conclusion, a closer look at pipe form variation demonstrates that pipes serve as tangible proof of the complex dynamics that were part of the Late Woodland and Early Contact period Native social landscape of the Middle Atlantic region. Additionally, this study illustrates how the examination of stylistic variation at the inter- and intrasite level opens new avenues for research and introduces opportunities to explore different aspects of past Native societies. Consequently, identifying diversity and evaluating it with a different interpretative framework shifts the focus from static boundaries to social networks; thereby providing a more holistic picture of past

Native pipe use that is not captured by previous analytical models of Native pipes in the region. In turn, this complex picture enables researchers and the public to better understand the intricate social topography of Native peoples both in the past and the present.

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Chapter 5
The Potential of Portable X-Ray Fluorescence for Understanding Trade and Exchange Dynamics in the Seventeenth Century Chesapeake: A Case Study Using Native American Tobacco Pipes from the James Fort Site, Virginia

Michael Ligman

5.1 Introduction

For Native American groups in the Eastern Woodlands, the smoking of tobacco and exchange of tobacco pipes occupied a significant position within the social and political rituals of these groups, acting as integral instruments of diplomacy, hospitality, and choreographed social ritual. One of the most prevalent expressions of the social use of smoking is found in the context of Native American political interaction and diplomacy. During political council sessions, council members and visiting dignitaries would often smoke before deliberations, speeches, or welcoming visitors, as the smoking of tobacco pipes symbolized peaceful, friendly discourse (Jacobs 1966, p. 24; Jennings et al. 1985, p. 121) and the binding of agreements or obligations made in the presence of tobacco (Goodman 1993, p. 33).

Similar to its role in contexts of formal political interaction between Native groups, the social ritual of smoking also played a significant role in contexts of interaction between Native American groups and early European colonists, particularly between Native groups of the Chesapeake Bay region and James Fort colonists in Virginia. Following the establishment of the James Fort settlement on the James River in Virginia on May 14, 1607 (Dent 1995, p. 261), one of the most significant aspects of life and survival for the colonists were voyages of exploration and trade with local Powhatan groups within the Chesapeake Bay region. Throughout these voyages, nearly all of these interactions included elaborate welcoming and entertainment practices involving the exchange and smoking of tobacco (Rountree et al. 2007, p. 81–131). During a visit

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to the village of Kecoughtan, the colonists recorded that "they gave us their Tabacco, which they tooke in a pipe made artificially of earthe as ours are, but far bigger" (Horn 2007, p. 925), while a description of the entertainment of the English by the Queen of the Apumatecs describes the English receiving their "accustomed Cates, Tobacco, and wellcome" (Horn 2007, p. 944). As shown by these accounts, the act of smoking tobacco with pipes as part of Native American entertainment procedures was quickly recognized and understood by English colonists.

The prominence of trade during such encounters is also highlighted by these accounts. Through trade and exchange, the colonists received a variety of Native American materials and goods, including native tobacco pipes (Horn 2007, p. 288, 344, 350). Although many of the goods received by the English were likely perishable in nature and therefore not represented in the archaeological record, the presence of Native ceramic tobacco pipes at the James Fort site provides clear evidence of trade and exchange, as well as evidence of potential diplomatic visits that occurred between the colonists and Native groups in the Chesapeake Bay region (Kelso and Straube 2008; Kelso et al. 2012). A more thorough understanding of the source of these pipes would enable archaeologists to develop more detailed, nuanced interpretations of the nature of the frequent, and often vital, relations between the James Fort colonists and the surrounding Native groups in the Chesapeake region.

Despite the social, political, and economic roles associated with the smoking and exchange of tobacco pipes in Native American societies of the Chesapeake Bay, the fragments of Native American ceramic tobacco pipes found at many sites across the region represent an artifact class that is often underutilized in archaeological studies. Archaeologists have tended to focus on developing typologies or classification schemes, largely based on visual characteristics of pipes, such as decorative techniques and motifs, form, or temper, aimed at placing these pipes within broader regional cultural complexes (Stephenson et al. 1963; Dent and Jirikowic 2001). By focusing on these visual characteristics of pipes, however, these typologies effectively discriminate against the majority of pipe fragments recovered, which often lack these characteristics. Because of such limitations, archaeologists have been unable to integrate the large number of undecorated, fragmentary Native American ceramic pipe specimens recovered at regional Late Woodland and early-Colonial period sites into their analyses. In an attempt to expand the analytical potential of these pipe fragments and improve our understanding of pipe manufacture and exchange, this project was undertaken to evaluate the potential benefits and successes of portable X-ray fluorescence analysis (pXRF) through the chemical characterization and identification of the cultural or material provenience of Native American ceramic tobacco pipes recovered from the James Fort site in Virginia.

5.2 Native American Pipe Assemblages Selected For Study

During the course of archaeological excavations at the James Fort site from 1994 to the present, Jamestown Rediscovery researchers have recovered a moderate number of locally produced Native American pipe fragments from a diverse collection of

James Fort period (1607–1624) and post-Fort period (1624 onwards) features. Due to the broad, regionally-focused nature of current pipe typologies, the recovery of fragmentary, undecorated pipe specimens, and the lack of "culturally definitive" decorative elements on recovered pipe specimens, researchers have been unable to identify the sources of these pipes beyond broad, regional cultural affiliations. In an attempt to develop a more detailed understanding of the source of these pipes and expand archaeological reconstructions of early trade relations in the region, a small assemblage of pipe specimens ($n=25$) from the James Fort site in James City County, Virginia and a comparative pipe assemblage ($n=109$) from 11 Late Woodland Algonquian sites within the Chesapeake Bay region were selected for pXRF analysis (Fig. 5.1).

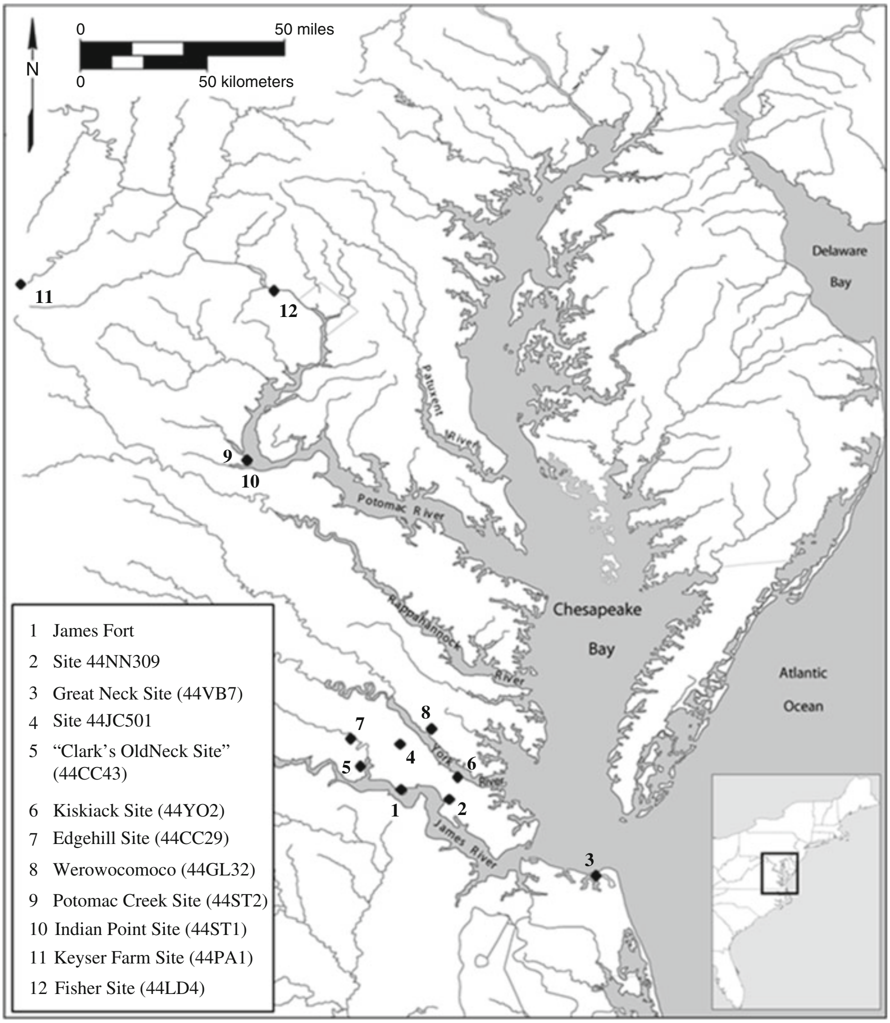

Fig. 5.1 Location of sites containing pipe samples selected for this study

It must be noted that while other XRF studies of Native American ceramic pipes have selected Native ceramic pottery vessels as a comparative ceramic baseline for pipes in a particular region (Kuhn and Sempowski 2001; Rieth et al. 2007), the broad geographical region selected for this study would have required the inclusion of a wide variety of ceramic pottery ware types with varying temper selections that differ from the pipes selected for this study. Because of this diversity in pottery ware types and temper selections, it was decided to utilize a comparative assemblage of Native ceramic pipes from Late Woodland sites in the Chesapeake Bay region as these would be more comparable to the unknown pipe specimens from the James Fort site.

5.3 Methods

X-ray fluorescence spectrometry (XRF), a chemical compositional analysis technique based upon the analysis of the interactions between X-rays and analytical samples, was selected as the primary analytical technique for this study (for more detailed discussions of XRF, see Beckhoff et al. 2006; Jenkins 1999; Shackley 2011). All XRF analyses were conducted using a Bruker Tracer III-SD handheld XRF spectrometer, on loan from Dr. Bruce Kaiser of Bruker Elemental, from March 16 to March 24, 2011. The Bruker Tracer III-SD unit functions on the basis of energy dispersive spectrometry (EDXRF) and utilizes a 10 mm^2 X-Flash silicon drift detector (SD) capable of producing resolution of 145 eV at 200,000 counts per second (cps). The unit also includes a rhodium (Rh) target X-ray tube capable of producing a maximum amperage of 30 μA (microampere, a unit of electrical current) at 40 kV (kilovolt) and 55 μA at 15 kV (Bruker Corporation 2013).

Two analytical setups (Green Filter and No Filter) were used in this study to optimize for particular elemental groups. The Green Filter analytical mode (hereafter referred to as GF) utilizes a Bruker "Green" filter (three layers consisting of 12 mil Al (Aluminum), 1 mil Ti (Titanium), and 6 mil Cu (Copper)), no vacuum pump, a voltage setting of 40 kV, and the highest current setting available (16 μA). These settings allow all X-rays from 17 to 40 keV to reach the sample and are particularly useful for the measurement of the elements Rb (Rubidium), Sr (Strontium), Y (Yttrium), and Zr (Zirconium), which are commonly used in the study of silicate or ceramic materials. The No Filter analytical mode (hereafter referred to as NF) utilizes no filter, uses the vacuum pump, a voltage setting of 15 kV, and the highest current setting available (55 μA). These settings allow all the X-rays from the tube up to 15 keV to reach the sample; thus, efficiently exciting elements with their absorption edge below 2.3 keV, particularly the elements Mg (Magnesium), Al (Aluminum), Si (Silicon), and P (Phosphorus) through Cu.

Using these two analytical modes, three measurements, at 180-s live-time counts, were collected at different locations on each sample in order to provide an average compositional profile. When selecting these three measurement locations for each sample, every effort was taken to avoid obvious surface interference (inclusions, temper, in-laid decoration, etc.) in order to ensure that XRF data for each location is reflective of the composition of the clay body. For the GF data, the elements Fe (Iron), Zn (Zinc), Ga (Gallium), Th (Thorium), Rb, Sr, Y, Zr, and Nb (Niobium) were selected for analysis; for the NF data Al, Si, P, K (Potassium), Ca (Calcium), Mn (Manganese), and Fe were selected for analysis.

In order to evaluate the analytical accuracy and precision of the Bruker Tracer III-SD pXRF unit, a certified National Institute of Standards and Technology (NIST) reference standard [Standard Reference Material (SRM) 679, or Brick Clay] was analyzed before, during, and after all pXRF analyses. As a measure of analytical accuracy, the level of correlation between the NIST published values of constituent elements (Rasberry 1987) and the compositional data collected by the Tracer III-SD unit for the NIST SRM 679 was evaluated in the form of concentration ratios, or the ratio of the mean Tracer III-SD compositional values to the published mean NIST compositional values. As a measure of the instrumental precision of the Bruker Tracer III-SD pXRF unit, the statistical error of each selected element was calculated using standard deviation (SD) and relative standard deviation (%RSD) in order to evaluate the degree of agreement between replicate measurements of the NIST SRM 679. The results of these analyses of the NIST SRM 679 sample are provided in Tables 5.1 and 5.2.

Table 5.1 Tracer III-SD analytical accuracy results for NIST SRM 679

Green filter results				No filter results			
Element	Mean	std	%RSD	Element	Mean	std	%RSD
Fe[a]	0.97	0.02	1.83	Al[a]	0.62	0.01	1.86
Sr[a]	0.86	0.05	5.34	Ca[a]	0.99	0.05	4.89
Rb[b]	0.88	0.04	4.19	K[a]	0.92	0.00	0.20
Th[a]	1.07	0.10	9.43	Si[a]	0.72	0.01	0.85
Zn[b]	1.21	0.02	1.88	P[b]	0.78	0.02	2.77

std standard deviation, *%RSD* relative standard deviation
[a]Based on NIST certified values of constituent elements
[b]Based on NIST noncertified values of constituent elements

Table 5.2 Tracer III-SD instrumental precision results for NIST SRM 679

Green filter results				No filter results			
Element	Mean	std	%RSD	Element	Mean	std	%RSD
Fe	87967.8	2210.0	2.5	Al	68543.9	1230.6	1.8
Zn	182.5	10.0	5.5	Si	175906.7	1551.7	0.9
Ga	33.7	2.5	7.5	P	585.4	26.8	4.6
Th	15.4	2.3	14.9	K	22407.5	112.0	0.5
Rb	167.7	8.7	5.2	Ca	1610.4	55.1	3.4
Sr	62.5	4.2	6.7	Fe	76714.0	456.3	0.6
Y	35.5	2.8	7.8				
Zr	140.7	7.3	5.2				
Nb	17.1	1.3	7.6				

std standard deviation, *%RSD* relative standard deviation

After the identification of elements of interest through qualitative analysis, semi-quantitative data for each element was calculated using net area analysis. These semiquantitative values were then converted to quantitative parts-per-million (ppm) measurements, using linear regressions derived from two calibration files [Bruker Mud-Rock Calibration file (Rowe et al. 2012) and Bruker Obsidian Calibration file (Glascock and Ferguson 2012)] provided by Bruker. For each analytical setup, the depths of attenuation (depth to which X-rays are able to penetrate the study material) for the selected elements were also calculated to assess how "representative" the Tracer III-SD elemental values are relative to the pipe clay bodies.

In order to reduce the complexity and size of the datasets and simplify subsequent analysis, the elemental values from the three sample measurements were combined to produce both average and accumulated values for each sample. While both accumulated and average data create elemental values that do not physically exist in each sample, they provide a useful singular compositional value with minimal alteration of the original raw elemental data. One final modification to the datasets involved the transformation of the data into logarithms in response to potential problems associated with the statistical analysis of compositional datasets which combine major, minor, and trace elements. Such analyses tend to be dominated by those elements having the highest concentration (Glascock 1992; Kuhn and Sempowski 2001).

5.3.1 Statistical Evaluation

After final modification of the GF and NF datasets, a variety of statistical applications were employed to evaluate these datasets using the SPSS Statistics (Version 20) computer package. Univariate statistics were evaluated for each element to develop an understanding of the variation inherent in the compositional data for each dataset. Bivariate correlations of elemental pairs were also evaluated to identify potentially meaningful correlations of elements at both the 0.05 and 0.01 significance levels. In addition to these sets of bivariate correlations, another dataset of potentially significant elemental correlations [Fe/Sr, Zr/Sr, Rb/Sr, Fe/Rb, Fe/Zr, Rb/Zr, Y/Sr, and Y/Rb], selected in previous studies as best reflecting trace element variability between samples (Kuhn and Sempowski 2001; Rieth et al. 2007), was produced. These correlations were added as an additional dataset for the GF group only as the elements used in these correlations were not analyzed within the analytical parameters of the NF group.

Multivariate statistics constituted the principal tools for evaluating potential structure and grouping within the compositional datasets. Based upon previous XRF studies of ceramics (Kuhn and Sempowski 2001; Rieth et al. 2007), cluster analysis and discriminant function analysis (DFA) were selected as the primary multivariate techniques for this study. For this study, cluster analysis was conducted on the comparative pipe assemblage in order to identify potential geological or cultural groupings that could be used to source the James Fort pipe specimens with unknown provenience. The resulting dendrograms were analyzed for potential patterning in the groupings of pipe samples using four potential grouping factors: watershed location, location of site in Chesapeake Bay region, decorative technique (when present on pipe samples), and temper type. Following cluster analysis, a DFA using the grouping (dependent) variable of Group Number (derived from cluster analyses of the comparative pipe assemblage, the predictor (independent) variables of the selected elements' ppm values, and a Mahalanobis distance classification method, was conducted to predict the group assignments of the unknown James Fort pipe fragments.

5.4 Results of pXRF Analysis

Trace element data was collected for the 25 pipe fragments of unknown provenience from James Fort and the comparative assemblage of 109 pipe fragments assembled from 11 surrounding Algonquian sites. In this section, the results of the pXRF analysis of the pipe assemblages are presented and the results of the subsequent statistical analyses are discussed (for complete presentation and discussion of pXRF analyses, see Ligman 2013).

5.4.1 Green Filter (GF) Results

Univariate statistics for each element were evaluated for the GF Accumulated, Average, Log10 Accumulated, and Log10 Average datasets in order to assess the variation inherent in the compositional data for each dataset. A relatively high level of compositional variance (10–60 %) was exhibited by all of the selected elements for the GF Accumulated and Average datasets, with the highest levels of variance observed for Fe, Zn, and Sr (>30 %). Within the GF Log10 Accumulated and Log10 Average datasets, the level of variance observed for each element was greatly reduced (3–9 %), with Zn, Th, Rb, Sr, Y, and Nb consistently exhibiting the highest observed levels of variance (>4 %) within both datasets, suggesting that these elements could potentially be useful discriminating elements in efforts to source pipe specimens to particular geological or cultural sources within the study area.

In addition to identifying potentially significant elements, bivariate correlations were evaluated for the GF datasets to identify potentially significant correlations of elements (Fig. 5.2). For the GF Accumulated and Average datasets, 10 bivariate correlations significant at the 0.05 level and 22 bivariate correlations significant at the 0.01 level were identified. For the GF Log10 Accumulated and Log10 Average datasets, 12 bivariate correlations significant at the 0.05 level and 26 bivariate correlations significant at the 0.01 level were identified. The ratio values of each identified bivariate correlation for both the 0.05 and 0.01 significance level were evaluated and entered into eight separate datasets. Additionally, the ratio values for the eight

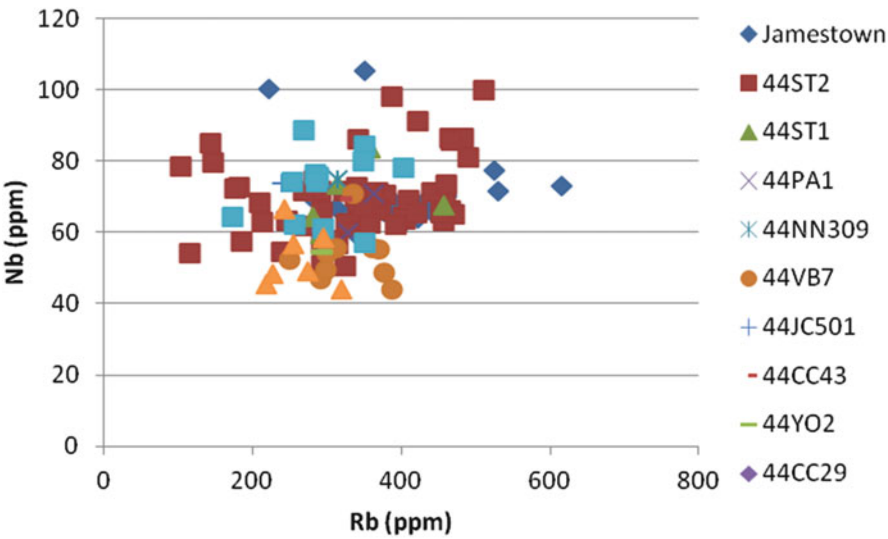

Fig. 5.2 Sample bivariate plot of Rubidium vs. Niobium discriminating the James Fort and comparative assemblage pipe specimens for GF Accumulated pXRF dataset

bivariate correlations identified as significant by Rieth et al. (2007) were evaluated for the GF datasets and entered into four separate datasets.

Cluster analyses of the GF datasets were conducted to identify possible patterns in the groupings of the comparative assemblage pipe specimens; however, analysis of the resulting dendrograms did not result in the identification of any meaningful or discernible patterning of the comparative assemblage pipe specimens as none of the dendrograms corresponded to any of the four expected grouping factors (watershed, location in Chesapeake Bay, temper type, or decorative technique). This lack of consistent correlation between the produced dendrograms and any discernible grouping factor within any of the GF datasets makes it difficult to define distinct, meaningful groups within the comparative pipe assemblage and to identify which, if any, of the analytical dataset formats is able to provide the most consistent and significant groupings needed to source the unknown pipe specimens from the James Fort site.

Although none of the dendrograms consistently correlated to any of the expected grouping factors, it is worth noting that two consistent patterns were observed across several small groups of datasets. GF Pattern 1, observed within the GF Accumulated/Average and Accumulated/Average [Rieth et al. 2007 Correlations] datasets, involves the consistent grouping of pipe specimens GF45 (44ST2) and GF118 (44LD4) as the least associated group within the dendrograms. GF Pattern 2, observed within the GF Accumulated/Average [0.05 Significance Level Correlations] and the GF Log10 Accumulated/Average [0.05 Significance Level Correlations] datasets, involves the consistent grouping of pipe specimens GF45 (44ST2), GF118 (44LD4), and GF119 (44LD4) as the least associated group within the dendrograms. While it is not clear what grouping factor(s) are responsible for these patterns, their presence suggests that some patterning, whether geological or cultural, does exist within the comparative pipe assemblage compositional dataset.

Without clearly defined and statistically significant discriminating groupings within the comparative pipe assemblage, the proposed use of DFA to identify the provenience of the unknown James Fort pipe specimens was not possible as the analysis would not be able to produce valid or meaningful provenience predictions. As a test of the proposed methodology, however, the GF Accumulated dataset, which exhibited the GF Pattern 1, was selected for an investigative DFA. Using the GF Pattern 1 groupings, the classification functions generated by the DFA were able to classify pipe specimens from the comparative assemblage correctly 96.9 % of the time (96.9 % after cross-validation), suggesting that compositional data within the comparative assemblage can be used to create pipe groupings that are sufficiently distinct to justify their classificatory use. The unknown James Fort pipe specimens were then entered into the DFA classification functions and classified based upon the smallest computed distance to the centroids of the GF Pattern 1 groupings. Posterior probabilities, calculated to assess the strength of association between unknown specimens and the group they were assigned to, show that with the exception of two specimens, all of the group memberships for the unknown pipe specimens were assigned with posterior probabilities greater than 90 %.

As shown by these results, the proposed DFA methodology is able to produce statistically significant group membership (provenience) predictions for the unknown pipe specimens based upon the groupings identified in the comparative pipe assemblage for the GF Accumulated dataset. Although the significance of the groupings identified in GF Patterns 1 and 2 is unknown, the results of the DFA investigations suggest that patterning does exist in the compositional matrix of the pipe specimens and that the proposed methodology in this study is capable of producing statistically significant and valid classification (provenience) predictions.

5.4.2 No Filter (NF) Results

Univariate statistics for each element were evaluated for the NF Accumulated, Average, Log10 Accumulated, and Log10 Average datasets in order to assess the variation inherent in the compositional data for each dataset. Within the NF Accumulated and Average datasets, a moderate level of compositional variance (10–30 %) was exhibited by the elements Al, Si, K, and Fe, while a significantly higher level of compositional variance (>70 %) was exhibited by the elements P, Ca, and Mn. Within the NF Log10 Accumulated and Log10 Average datasets, the level of variance observed for each element was greatly reduced (1–11 %). The consistently highest observed levels of variance (>5 %) within both datasets were exhibited by P, Ca, and Mn, suggesting that these elements could potentially be useful discriminating elements in efforts to source pipe specimens to particular geological or cultural sources within the study area. It is important to note, however, that each of these elements do occur naturally in varying levels within soils, and it is possible for low-fired ceramic artifacts to absorb varying amounts of these elements, thereby altering the compositional profile of these elements within the artifacts (Lynott et al. 2000, p. 112; Fowles et al. 2007, p. 133). Because of this, a level of caution must be exercised when considering these elements as discriminating variables in compositional analyses.

Following the identification of potentially significant elements, bivariate correlations were evaluated in order to identify potentially significant correlations of elements. For the NF Accumulated and Average datasets, only 10 bivariate correlations significant at the 0.01 level were identified. For the NF Log10 Accumulated and Log10 Average datasets, six bivariate correlations significant at the 0.05 level and eight bivariate correlations significant at the 0.01 level were identified. The ratio values of each identified bivariate correlation for both the 0.05 and 0.01 significance level were evaluated and entered into six separate datasets.

Similar to the GF results, none of the dendrograms produced by the cluster analyses of the NF datasets corresponded to any of the four potential grouping factors and a fairly consistent occurrence of groupings containing pipes from separate site proveniences that share no geographic, stylistic, or compositional connections was observed. Although none of the dendrograms consistently correlated to any of the expected grouping factors, one relatively consistent pattern (NF Pattern 1), involving the grouping of pipe specimen NF55 (44ST2) as the least associated group, was observed within the NF Accumulated/Average, NF Log10 Accumulated/Average [0.05 Significance Level Correlations], and NF Log10 [0.01 Significance Level Correlations] datasets. While it is not clear what grouping factor(s) are responsible for this pattern, its presence could suggest that some meaningful patterning does exist within the comparative pipe assemblage.

As with the GF results, an investigative DFA was conducted for the NF Log10 Accumulated [0.01 Significance Level Correlations] dataset using the groupings identified in the previously mentioned NF Pattern 1 as a test of the proposed methodology. Using the DFA classification functions, pipe specimens from the comparative assemblage were classified correctly 96.6 % of the time (89.9 % after cross-validation). These results suggest that compositional data within the comparative assemblage can be used to create statistically distinct groupings of pipe specimens for classifying unknown specimens. The unknown James Fort pipe specimens were then entered into the DFA functions and classified based upon the smallest computed distance to the centroids of the NF Pattern 1 groupings. Posterior probabilities for each unknown pipe specimen were calculated and show that, with the exception of six specimens, all of the group memberships for the unknown pipe specimens were assigned with posterior probabilities greater than 98 %, indicating a strong association between the specimen and the group to which it was assigned. As with the exploratory GF DFA results, these results suggest that the proposed methodology in this study can be used to generate statistically significant and valid classification (provenience) predictions for pipe specimens of unknown provenience. Determining the overall significance/meaning of these provenience predictions, however, is not possible from the current results in this study and deserves further study.

5.5 Interpretations and Conclusions

Although the current study was unable to successfully identify the cultural or material proveniences for the unknown James Fort pipe specimens, the results do provide important information and data relevant to 1) issues of methodology for future compositional studies in the region, 2) potential limitations for pXRF compositional studies, and 3) potential improvements to existing typological systems for Native American pipes in the Chesapeake region. One of the most important issues highlighted by the study results is the need for a comprehensive geological database of primary clay sources within the Chesapeake region. At the beginning of this study, it was expected that the Native American pipe assemblages for each selected site would exhibit sufficient homogeneity in elemental composition to enable identification of potential provenience groupings within the comparative Native American pipe assemblage based upon the site proveniences of the pipe specimens. Contrary to this initial expectation, however, the study results suggest that it is not possible to identify statistically significant and meaningful groupings– using factors such as geographic location, drainage association, temper selection, or decoration– within the compositional profiles of Native American ceramic pipes based solely on the site provenience of the pipe specimen.

As with the application of XRF analyses in lithic sourcing studies (Silliman 2005; Craig et al. 2007; Lundblad et al. 2011), the production of a geologic database of the various primary clay resources likely to be exploited within the Chesapeake region would provide a more suitable "provenience label" for Native American ceramic pipe specimens as it would identify the material source of the clay used to produce each pipe specimen (zone of production) as opposed to merely the site location where the pipe was discarded at the end of its use-life (zone of distribution) (Arnold 1980, p. 148). Using such a geologic provenience label, the resulting dendrograms from the cluster analysis of the GF and NF datasets in this study would then be representative of the groupings of pipe specimens based on geological proveniences as opposed to mere site location, thereby allowing for more nuanced interpretations of the potential significance of the observed grouping patterns. Although it is unknown if the use of geologic provenience labels would clarify the compositional groupings of pipe specimens observed during the statistical analysis of the GF and NF datasets in this study, it is clear that without the inclusion of geological clay source information, it is not possible to further refine and establish the methodology of this and future pXRF studies in the Chesapeake region.

Another important issue highlighted in this study is the potential limitations of pXRF for archaeological ceramic samples. As illustrated by the results of other compositional analysis techniques, such as instrumental neutron activation analysis (INAA) or inductively coupled plasma-mass spectrometry (ICP-MS), many researchers question the ability of pXRF analysis to identify and accurately measure certain elements in clays that have been shown to be effective in the characterization and sourcing of ceramic artifacts (Johnson 2012; Liritzis and Zacharias 2011; Speakman et al. 2011). While pXRF has been shown to be effective in the identification and measurement of major elements, ceramic studies using INAA have shown that typically it is the trace, rare earth, and lower Z elements that are most effective in discriminating between geographic regions (Johnson 2012). Because of the reduced sensitivity of many pXRF analyzers for these types of elements (Speakman et al. 2011, p. 2), relative to other techniques such as INAA and ICP-MS, many researchers consider pXRF to be less effective in ceramic sourcing studies.

In addition to the potential reduced sensitivity of pXRF analyzers for discriminating elements, the effectiveness of pXRF in ceramic studies has also been debated due to the surficial nature of pXRF analysis results. While compositional analysis techniques such as INAA and ICP-MS require the removal of a small portion of ceramic samples, which is ground and formed into pellets or disks for analysis of major and trace elements, pXRF only involves the shallow penetration of X-rays into samples. Because of this, the compositional analysis results obtained from pXRF are predominantly representative of the surface and shallow subsurface of ceramic samples and may be significantly different from the bulk elemental composition of the sample (Speakman et al. 2011, p. 2). Considering the potential surficial factors (e.g., the presence of temper, surface patination, the presence of slip or paint) that may influence pXRF results, researchers have questioned the validity and representativeness of pXRF results for ceramic artifacts.

In light of these potential analytical limitations, it is possible that the inability to identify potential geological or cultural sources of ceramic tobacco pipes within the Chesapeake Bay region is more closely related to analytical and instrumental limitations than a lack of significant and meaningful structuring within the compositional profiles of the pipes and the geographic clay sources. The potential problems of surficial sampling of the pipes (e.g. non-representative compositional results and potential surface interference) and reduced sensitivity to what could be more significant discriminating elements raise important questions regarding the study results and suggest the need for additional work using a complementary compositional analysis technique, such as INAA or ICP-MS.

One final issue highlighted by the study results is the need for critical reassessment of existing typological and classification systems for Native American ceramic pipes in the Chesapeake region. Archaeologists have constructed a number of taxonomies and classificatory schemes to categorize Native American ceramic pipes based on a single or combination of visual or physical attributes, such as decorative technique, decorative motif, form, or clay body and temper (Blanton et al. 1999). While these typologies provide useful and efficient classifications for ceramic pipes, the failure to incorporate compositional data in such systems limits the ability of archaeologists to fully understand the distribution, both intra- and interregional, of these visual and physical attributes and allows only for broad, generalizing regional classifications.

A clear example of these complex associative factors is seen in the attempted classification of the unknown James Fort pipe specimen GF1 (Fig. 5.3). Using existing typologies for the Chesapeake region, pipe GF1 most closely resembles Native American pipes recovered from the Potomac Creek site (44ST2) and the Patawomeke site (44ST1). This association is based upon the presence of a triangular-shaped

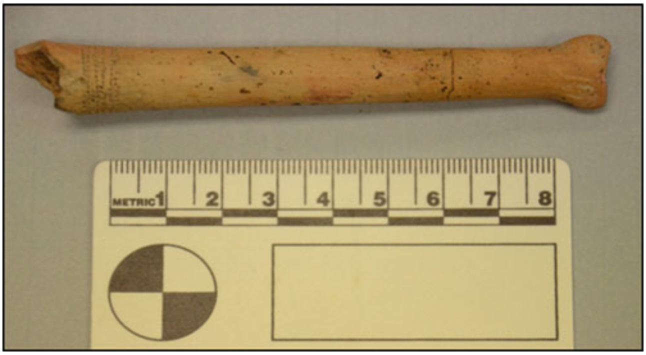

Fig. 5.3 Pipe GF1 (NF1) with spatulate bit and banded dentate decoration recovered from James Fort Site. Photo by author

spatulate bit and "rouletted-like" dentate linear band decoration, and the use of sand for clay temper, which are attributes associated with the Potomac Creek Complex of pottery (Blanton et al. 1999, p. 70). Similar attributes are also observed in several pipe specimens within the 44ST2 pipe assemblage. Based upon the visual/physical attributes shared by GF1 and the specimens from 44ST2, these pipe specimens can be tentatively classified as one of the variants of the broad, regionally-based Potomac Creek complex taxonomic group. However, any attempt to further understand the potential intra-regional variation within this group would be difficult based solely upon visual/physical attributes.

The results of the DFA for the GF Accumulated Results dataset of pipe GF1 also point to the potential for greater complexity and intra-regional variation within these taxonomic groupings. In the GF Accumulated Results DFA results, pipe GF1 was assigned to Group 1, but only one of the pipes exhibiting similar dentate decoration (GF44) and five of the pipes exhibiting a similar triangular-shaped bit form (GF52, GF64, GF70, GF71, and GF73) were assigned to Group 1. Rather than correlate with the attribute-based taxonomic results, the DFA grouping results of the GF Accumulated Results dataset show that pipes from site 44ST2 that exhibited similar visual/physical traits to those of pipe GF1 were grouped together based on compositional data 50 % or less of the time. Bollwerk (2012, p. 460–486) observed a similar lack of correlation between compositional and visual/physical attributes in her LA-ICP-MS study of pipe specimens at site 44ST2. Her study found that despite the presence of similar visual/physical attributes, pipes from 44ST2 broke into two distinct compositional clusters. While a direct correlation between visual/physical attribute-based classifications and compositional-based classifications should not be assumed to exist, the study results clearly demonstrate the limitations of existing classification systems for Native American pipes in the Chesapeake region in identifying and understanding intra-regional variation within taxonomic groupings.

While it was not possible to identify and interpret the significance of the groupings observed in the cluster analyses and DFA examples undertaken in this study, it is clear that the lack of correlation between the visual/physical typological classifications and the compositional groupings of the pipe specimens selected for this study raises important questions concerning the usefulness of such physical attribute-based typological classification systems. Archaeologists need to employ broader, more inclusive classification techniques rather than continuing to rely on taxonomic systems based upon a limited set of pipes' physical attributes assumed to be "fundamental" by previous researchers that produce broad, regional-level classifications for pipe specimens.

One alternative approach is "modal" analysis, in which archaeologists use multiple attributes or "modes" to sort pipe assemblages and create not a single, rigid typology model, but rather a series of cross-cutting groupings (Agbe-Davies 2006, p. 123). By employing such an approach, archaeologists could avoid the inherent problems of "traditional" taxonomies and paradigms, such as the use of prior knowledge/assumptions regarding the inclusion of particular pipe attributes and the resulting hierarchical ordering of selected attributes, and instead consider multiple attributes (technical, physical, decorative, compositional, etc.) in order to understand the complex associative factors and grouping present within a pipe assemblage (see Creese 2015, Chapter 3, this volume, and Planella et al. 2015, Chapter 13, this volume, for examples of this method). Additionally, by incorporating multiple "modes," particularly compositional data, in the analysis of a pipe assemblage, it will be possible to greatly expand the size of pipe assemblages one is able to study by including fragmented and undecorated pipe specimens, which are often excluded by hierarchical taxonomies because they lack the attributes assumed to be fundamental and primary.

Although the current study was not able to sufficiently evaluate the interpretive potential of pXRF to source Native American ceramic pipes in the Chesapeake region, the results clearly highlight the potential methodological and interpretive contributions of future pXRF studies in the region. The use of pXRF, a nondestructive, portable compositional analysis technique, offers archaeologists the ability to move beyond analyses based solely on subjectively defined and recorded physical attributes or the context in which it was discarded or recovered, and instead incorporate compositional signature and visual attribute data into our understanding of artifact production and distribution over time and space. Given the addition of the previously discussed geologic provenience data, the results of this and subsequent studies of Native American ceramic pipes will provide sufficient evidence of the methodological and analytical potential for pXRF studies in the Chesapeake Bay region.

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Chapter 6
Evolution of a Ritual: Pipes and Smoking in Etowah's Realm

Dennis B. Blanton

6.1 Introduction

The long persistence of smoking ritual in the late prehistoric Southeast was a function of its efficacy and its mutability. Based on the results of an analysis of the contexts and physical attributes of hundreds of archaeologically recovered smoking pipes, I will demonstrate how the format of a seemingly indispensable rite was adjusted to accommodate shifting societal conditions between about AD 900 and 1600. Essentially, this is a case study of the material record of ritual change. Ritual paraphernalia, like Mississippian-era smoking pipes, are designed to transmit fundamental ideological concepts and by tracking patterns of their purposeful alteration we can indirectly chart equally fundamental changes in a cultural system.

I will be making frequent reference to the Etowah site (9BR1) in Georgia, which emerged as the largest and most influential Middle Mississippian center in the South Appalachian Mississippian culture area (Ferguson 1971; Ferguson and Green 1984) (Fig. 6.1). The story of this prominent Native American regional chiefdom, as it is for others like it, is one of ascendancy, climax, and decline and, by extension, the concomitant recalibrations of social, political, economic, and religious patterns that occurred along the way.

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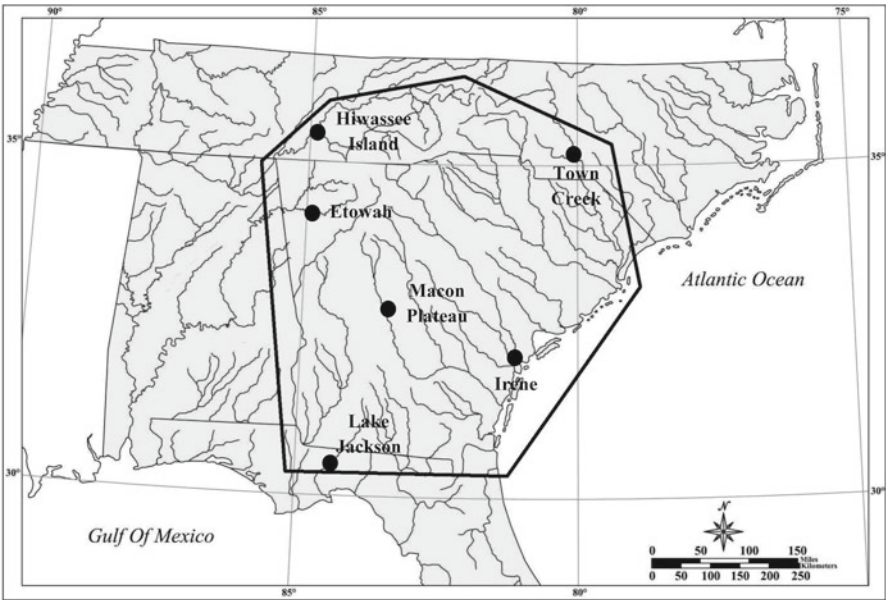

Fig. 6.1 Location of South Appalachian Mississippian culture area and key archaeological sites

6.2 Theoretical Perspective on Religious Ritual

One helpful perspective for my accounting of ritual change is the pattern of religious modality recognized by Atkinson and Whitehouse (2011) and by Winkelman (1990) via comparative ethnographic analyses. Correlations are observed to exist between particular socioeconomic structures and religious formats along a continuum, suggesting to Atkinson and Whitehouse that "new rituals, rather than other technological factors, may… account for the changes in the scale and structure of human societies" (Atkinson and Whitehouse 2011, p. 60). In simplified terms, cultures at one end of the spectrum are organized into relatively small communities and have little to no reliance on agriculture. Their religions tend to be less formal and, in this so-called *imagistic* mode, associated rituals are low-frequency, stressful, and collective events whose principal practitioners likely fall into shaman or healer categories. In contrast, the *doctrinal* mode occurs in conjunction with intensification of agriculture, hierarchical sociopolitical structures, and the homogenization of regional traditions. Religions that prevail under these conditions are highly centralized and include influential priesthoods, with rituals that tend to be high-frequency, low-arousal (less stressful/less emotional) events steeped in codified language.

Those correlations are compelling and useful but concepts derived from evolutionary theory may lead to deeper understanding of the relationship between socioeconomic structures and religions. Such a framework better allows for evaluation of exactly *how* and *why* religious rituals were so central to Mississippian societies in the southeastern United States and, in fact, why they would be so basic in any society.

Specifically, many anthropologists, sociologists, and psychologists with an interest in cultural evolutionary process are in agreement that religious ritual is an evolved mechanism for enhanced social cooperation (Alcorta and Sosis 2005, 2007; Sosis 2004; Wade 2009; Wilson 2002). Over the long span of human experience, religion became a context in which the interests of individuals could be subordinated to those of a collective, and one payoff was facilitation of coordinated action. Another appeal of ritualized religion was the satisfaction of innate emotional needs of individuals. In short, self-restraint in favor of social cohesion improved abilities to compete with rival groups.

To elaborate, this line of argument holds that religious ritual improves social and genetic fitness by establishing costly and reliable signals of membership, principally in the form of institutionalized concepts derived from a prevailing belief system. Those kinds of concepts, unique and often counterintuitive, become unbreakable codes to nonmembers (Alcorta and Sosis 2005, p. 324–325, 344, 348; Dow 2004, p. 2; Sanderson 2008, p. 143–144; Wilson 2002, p. 228). In this way, ritual becomes a highly flexible tool for motivating individual behavior, discriminating between friends and enemies, and forging intergroup alliances. As individuals give up a measure of self-interest on behalf of the social unit, cooperative activities strengthen the group and resulting successes attract new members. Some advocates of this theory further reduce the operation of ritual to the neurophysiological level, arguing that ritual is a vital mechanism because it elicits positive emotional responses and learning behaviors (Alcorta and Sosis 2005, p. 332–340).

Anthropologists and archaeologists have also sought to evaluate religious behavior under complementary models of costly signaling (Bird and Smith 2005; Shennan 2008; Wade 2009, p. 59). Although the costs of religious behavior can be high, they may be tolerated if group cohesion is improved. Ultimately, the costliness of religion, including explicit signaling behavior, is related to the kind of collective challenges a society confronts (Alcorta and Sosis 2005, p. 329). For example, according to Sosis (2003), the costs associated with rituals increase when group membership translates into obvious benefits, the makeup of a group is diverse, and many groups are operating in close proximity, much as the portrayal of the so-called doctrinal mode implies. He argues that by and large the benefits of group membership increase as groups grow in size, since larger groups tend to realize greater political influence while simultaneously lowering their costs for acquiring specialized goods. Ultimately, however, levels of participation in costly religious activity are strongly determined by general economic conditions. By extension, it stands to reason that the general level of investment in ritual practice will vary for the same reasons, including investments in symbolically endowed material goods—like smoking pipes. In the case presented here, I demonstrate that the adaptation and deployment of smoking ritual follows a trajectory that begins with low intensity, builds to a highly centralized and elaborated mode, and then reorients to a more secular but still relatively elaborated pose.

6.3 The Archaeological Context of Mississippian Smoking Ritual

There is evidence to suggest that ritualized smoking has a history extending back to at least 1000 BC in the Eastern Woodlands of the United States (Wagner 2000). The first dramatic elaboration of it occurred between 200 BC and AD 600 in association with Hopewell cultures (Brown 1997, p. 472; Jefferies 2004; Knight 2004; Rafferty 2002, 2004). After their decline, smoking was maintained at a low ebb throughout the Late Woodland period. Its continuation in the subsequent Mississippian Stage is my focus.

Mississippian refers to the late prehistoric–protohistoric (AD 900–1600) cultural pattern of the midwestern and southeastern United States that was based on a relatively rigid social hierarchy, a significant commitment to maize agriculture, a highly structured system of exchange, and a formalized belief system (Cobb 2003; Pauketat 2007; Smith 1985, 1996). Traditionally, these societies have been characterized as classic cases of chiefdoms.

What we know about the genesis and spread of the Mississippian pattern has improved over the last two decades owing to the work of Timothy Pauketat whose work has focused on the preeminent site of Cahokia in western Illinois (2007, 2010; Pauketat and Emerson 2000), as well as from the complementary work of others (Anderson 1997; Brown 2004, 2007; Milner 1999). It is now apparent that the environs of Cahokia was the Mississippian hearth, the original locus of what was to become a repetitive pattern of Mississippian emergence, florescence, and decline that played out in numerous locales. In the Cahokian case, this trajectory spanned the period between AD 950 and 1300 and, importantly, the new cultural pattern radiated outward following the site's dramatic growth during the eleventh century AD. Under that influence, the Mississippian mode came to dominate elsewhere in the Mississippi Valley and throughout much of the southeastern United States, extending east to the Atlantic Ocean.

However, Mississippian influence did not take hold uniformly across the region following the so-called *big bang* at Cahokia. Instead, we see the emergence of nodes of relatively intensive development, almost always marked by the creation of another major mound center. Part and parcel with the geographical unevenness of the radiation was the emergence of unique expressions of "Mississippianess." A number of operational common denominators pervaded the many disparate sociopolitical formations, to be sure, but it is equally obvious that they were functioning under unique identities expressed by iconographic and other stylistic distinctions (Brown 1989; Knight et al. 2001; Lankford et al. 2011; Muller 1989, 2007; Phillips and Brown 1978, 1984; Power 2004; Reilly and Garber 2007).

Etowah in Georgia is one such case of relatively localized but intensive Mississippian development. An improved perspective on the site based on the ongoing work of Adam King (2003, 2004, 2007) allows us to understand its story with some precision (Table 6.1). Following establishment of relatively modest, autonomous "chiefdoms" in the vicinity, Etowah experienced dramatic and rapid growth

Table 6.1 Summary chronological chart for Etowah (after Cobb and King 2005)

	Early Mississippian period	Middle Mississippian period	Late Mississippian period
Date range:	AD 900–1200	AD 1200–1375	AD 1375–1600
Archaeological phase name:	*Etowah*	*Wilbanks*	*Brewster*
Sociopolitical pattern:	• Communal	• Hierarchical and exclusionary	• More Communal
	• Autonomous local chiefdoms	• Paramount chiefdom	• More secular
			• Varied chiefdom formats
Ideological themes:	• Universalizing	• Anthropocentric	• Universalizing
	• Mythical time referent	• Individualizing	• Mythical time referent
	• Fertility	• Genealogical time referent	• Fertility
	• World renewal	• Legitimation by appeal to foreign power	• Natural world
		• Supernatural communication	

between about AD 1250 and 1375. During this heyday, it exerted wide influence across the area now occupied by Georgia and the Carolinas, if not beyond (see Fig. 6.1). By the end of the fourteenth century, Etowah had fallen into decline and in its wake a number of Late Mississippian mound sites emerged elsewhere to fill the vacuum (King 2003, 2004; Hally 1994; Hally and Langford 1988; Hally and Rudolph 1995; Smith 2000).

Especially relevant here, in addition to Etowah's unique cultural history, is evidence that, as a paramount cultural center, the site and its leadership formulated and promoted a unique identity. On one hand, intriguing arguments have been made for tangible stylistic ties with the ancestral site of Cahokia in the form of "antique" copper plates (Brown 2004). But beyond the vital importance of the charter myth that legitimized much of what emerged and was sustained at Etowah, seemingly with some acknowledgement of Cahokian history, there is equally strong evidence for the conscious formation of a specific Etowahan pattern. In short, local artisans were crafting objects for exclusive use and circulation that bear stylistic features peculiar to the area and the time, such as shell gorgets in the locally specific Hightower style (Cobb and King 2005; King 2007, 2011). I believe smoking pipes were also among those unique objects but, as the next section describes, stylistic and other attributes of pipes were altered to accommodate changeable cultural environments and, archaeologically, we discover in them a reflection of Etowah's rise and fall.

The basis for my analysis is a sample of 945 smoking pipes and fragments of pipes from 97 sites in the study region (Blanton 2012). Physical attributes were typically recorded by direct inspection of pipes but additional information was gleaned from published sources ranging from the shell gorget study of Brain and Phillips

(1996) to cultural resource management reports. Major pipe collections examined include those of the American Museum of Natural History, the Smithsonian Institution, the Waring Laboratory at West Georgia University, and the McClung Museum at the University of Tennessee.

6.4 Archaeological Observations of Smoking Practices in Etowah's Realm

6.4.1 The Early Mississippian (AD 1000–1100) Pattern

Smoking ritual had at this time more in common with Late Woodland antecedents than with those to follow. From the perspective of form, simple, one-piece, elbow pipes made with an integrated bowl and stem are predominant in both periods (Fig. 6.2a) (Table 6.2). Pipes are still not found in great numbers but they do begin to occur more frequently. Also, different kinds of embellishment occasionally appear, such as red filming and elaborated stems, that seem to betray emerging, new views. Another distinction is contextual; at Etowah, for example, Early Mississippian pipes occur in obvious association with feasting-related features.

In sum, Early Mississippian ritual investments were still modest and commensurate with an emergent chiefly system. The subtle alterations to smoking practices were gradual and probably catalyzed by forces such as a shift to an increasingly hierarchical social order. The religious pattern fits an intermediate position between the archetypal imagistic and doctrinal modes, and practitioners likely corresponded to healer or shaman-healer categories.

6.4.2 The Transitional (AD 1100–1200) Pattern

A wholly new tradition of smoking began to develop toward the end of the early period, probably due in part to foreign stimulus. More than one scholar has proposed that classical Mississippian influence was introduced to the area of Etowah

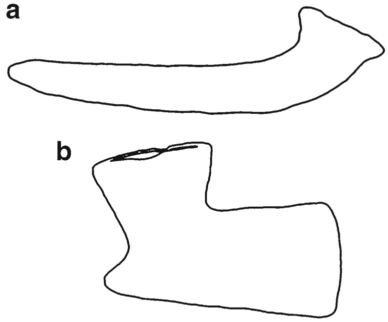

Fig. 6.2 Representative Early Mississippian and Transitional Mississippian pipe types, AD 900–1200 (**a**) Simple Long; (**b**) Footed

Table 6.2 Summary description of common pipe types

Pipe type	Mississippian period	Basic form	Unique formal attributes	Unique symbolic attributes
Simple Long	Early	Elbow with integrated bowl and stem	Long stem and small bowl	Typically undecorated
Footed	Transitional-Middle	Large elbow	Large size; forward-projecting "foot"	Typically undecorated
Jointed	Middle	Elbow; for compound "calumet" pipe	Joint-like treatment at bowl–stem junction	None
Noded	Middle	Elbow; for compound "calumet" pipe	Raised nodes on bowl	Nodes and sun-fire motifs
Seated Effigy	Middle	Effigy; for compound "calumet" pipe	Human effigy	Seated figure with ceramic vessel
Obtuse	Middle	Elbow; for compound "calumet" pipe	Obtuse angle at bowl–stem junction	None
Square	Middle	Elbow; for compound "calumet" pipe	Sharply squared bowl and stem	None
Tube	Middle	Tube-like; for compound pipe	Tube-like arrangement of bowl and stem	None
Wrapped	Middle	Elbow; for compound "calumet" pipe	Raised, simulated lashing	Handles and zoned punctation
Monolithic Axe	Late	Elbow; for compound "calumet" pipe	Stem modeled as hafted monolithic axe	One variety has handles on bowl
Trumpet	Late-Protohistoric	Large elbow for use with compound pipe	Large trumpet-shaped bowl	Gridding, loops, nodes, adornos, etc.

from points westward and some tie it to the effect of the Cahokian "big bang" (Anderson 1997; Brown 2004, 2007; King 2007). Under this scenario, sometime after AD 1100, emissaries from the Mississippian hearth began to assert influence in other locales (Pauketat 2007).

The vivid results of a literal Mississippian intrusion are imprinted in this area's western sector (i.e., the Chattahoochee River valley) by the abrupt appearance of new forms of architecture and ceramics (Blitz and Lorenz 2006). Other tangible evidence is the appearance of a kind of pipe traditionally associated with areas lying farther west. I refer to it as the Footed type (Fig. 6.2b) because of the prow-like projection extending from the lower part of the front of the pipe bowl (see Table 6.2). It is precisely in the western zone of the study area that it is most common, and others show up around sites like Macon Plateau where different groups of migrating Mississippians relocated before AD 1200 (Hally and Rudolph 1995, p. 32–33; Schroedl 1994; Williams 1994).

The fact that Footed pipes, a type most common on western Mississippian sites, do not occur with traditional, Woodland-style elbow pipes before AD 1100 or with Middle Mississippian material postdating AD 1250 squares well with proposals for the Mississippian radiation. It also lends credence to Southeastern Indian origin myths that describe a west to east movement of both people and "medicines" like tobacco (Grantham 2002, p. 8–9, 56–57; Swanton 1929; Waring 1977, p. 65). I believe, too, that Footed pipes ushered in the calumet pipe design composed of a separate bowl and long, detachable stem, thereafter adopted universally in the region. However, at least a century seems to have elapsed before the Footed pipe legacy was fully formed.

6.4.3 The Middle Mississippian (AD 1200–1375) Pattern

In the wake of those transitional influences, smoking ceremonialism of the Middle Mississippian period attained a fully unique, regional character, distinct from traditions elsewhere in the Mississippian world. And this was the time Etowah operated as the new South Appalachian center of gravity, rivaling contemporary sites like Moundville and Spiro, and its leadership exerted heavy influence from about AD 1250 to 1375 (King 2003, 2007).

In the new atmosphere of exclusivity and elaboration, the diversity of particular pipe types, their sheer numbers, and their level of elaboration became exceptional. At least nine categories were produced as opposed to only one or two during preceding periods (see Table 6.2). They were fashioned to conform to a strict set of formal and stylistic criteria, emphasizing ancestor, fertility, and celestial themes, and they are strongly associated with adult male burials in special contexts. Still, all those pipe types were not made and used at exactly the same times and places, and that variation informs on the nature of Etowah's dominion.

Two of the new styles became the standard within Etowah's core domain, corresponding archaeologically to the Savannah Phase area (Hally and Rudolph 1995; King 2003, 2007). I call them the Noded and Jointed types (Fig. 6.3a–b).

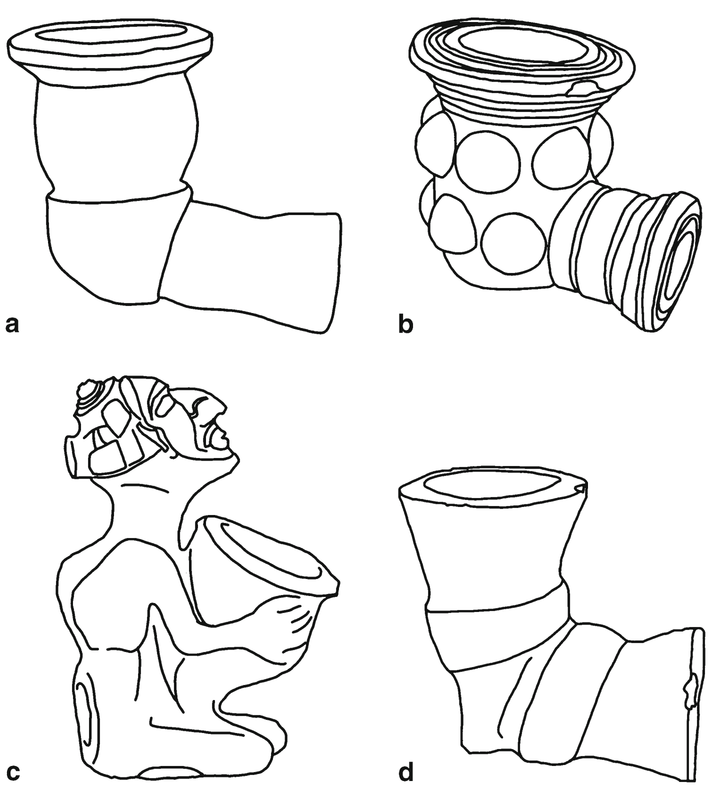

Fig. 6.3 Representative Middle Mississippian pipe types, AD 1200–1375 (**a**) Jointed; (**b**) Noded; (**c**) Human Effigy, Seated; (**d**) Wrapped)

A host of clues indicates the Jointed category appeared earliest, during the thirteenth century, and while both may have been in use for a time, the Noded form eventually replaced it. Both are ordinarily recovered in privileged contexts like elite mound burials and I would argue they formed part of the material identity of the polity, as did distinctive shell gorgets and other types of esoterica.

The Noded type also became the most widely distributed kind. For example, they occur at Lake Jackson (Florida), Hiwassee Island (Tennessee), and Moundville (Alabama) located 200 to more than 400 km away from Etowah. I propose such outliers, possessed by non-Etowah elite, mark the maximal extent of Etowah's sphere. Possession of them by prominent individuals in other, potentially rival polities would have at least signaled tacit acknowledgement of Etowah and, perhaps, a willingness to entertain if not maintain some form of alliance. Similar intent might be represented by comparable distributions of shell gorgets and other prestige items conforming to Etowah's Hightower iconographic style (Hally 2007; King 2011).

Emulation of the Noded type was also occurring at the periphery of Etowah's influence. Exposure by some means to that iconic form inspired production of a stylistic variant in the hinterland, the clearest example being production of Weak Noded pipes in the Pisgah culture area of North Carolina. Nodes are not raised on these pipes but are instead represented by incised circles, and their longer stems are in keeping with pipe forms of the Siouan-Algonquian traditions that overlap the northern border of the South Appalachian region.

A few other pipe types are closely associated with Etowah but in smaller numbers. The seated Human Effigy was confined to the Etowah core and points northwest into the Tennessee and Cumberland River valleys (Smith and Miller 2009) (Fig. 6.3c). They may be among the earliest middle-period pipes, or possibly heirlooms linked with the Mississippian expansion, and the anthropomorphic styles potentially depict ancestral figures with which elite claimed legitimizing connections. The Square and Tube types are restricted to Etowah's core territory and their low numbers indicate they carried different and more particular meanings.

Although the region became more homogenized under Etowah's influence, competing forms of smoking ritual also expose a contested landscape, especially toward the northern and eastern fringes of its domain. In the Carolinas, for example, a northerly, one-piece elbow pipe tradition persisted while calumet-style, Etowah-derived pipes were being adopted in parts of the same area. Conversely, types representative of the peripheral Carolina territories, such as Obtuse pipes, also occur at Etowah and some affiliated sites. The degree to which these overlapping ranges reflect aggressive tactics of Etowah elite, resistance of less powerful polities, or both, remains to be determined.

At the same time, Etowah was not the only polity to make strategic use of smoking ritual. Wrapped-type pipes, emblematic of the relatively independent, western-sector polities, are a case in point (Fig. 6.3d). Although prevalent at a point of Mississippian intrusion, they were without the kind of specific foreign analog the earlier Footed type had. Their features express transfer of classical Mississippian traits, such as handled vessel forms and related decoration, but they are otherwise the product of a distinct, local history. Their range of occurrence conforms to a narrow corridor extending from the panhandle of Florida north to the Tennessee River valley. That corridor linked the major Mississippian polities centered around Lake Jackson, Cemochechobee, Etowah, and Hiwassee Island and served as the conduit for distribution of highly valued Gulf Coast marine shell (Blitz and Lorenz 2006; King 2003, p. 124; Scarry 1996, 2007).

In summary, the religiosity of Middle Mississippian societies was extreme, consistent with the doctrinal mode of Atkinson and Whitehouse (2011). Smoking ritual changed in response to both external and internal influences but it was maintained as a vital element of the institutionalized belief system promoted and administered by a privileged descent group at the pinnacle of the paramount chiefdom. Still, I believe smoking embodied a set of meanings largely distinct from, but probably complementary to, those associated with better-known mortuary and mound ceremonialism (Knight 1986). Ultimately, however, after about a century and a half, the entire Etowah-oriented system eroded under circumstances that are not altogether clear and the rupture rewarded a modified set of attendant smoking rituals.

6.4.4 The Late Mississippian (AD 1375–1600) Pattern

Looking at the stylistic attributes of Late Mississippian pipes and the way they are distributed, it can be difficult to find continuity with the Middle Mississippian period (see Table 6.2). For all practical purposes, smoking again conveyed a different set of messages. Indeed, the ritual reorientation supports long-standing views about emergence of a different status quo at this time, reached by other lines of evidence. One major cause was Etowah's demise, after which the scope of regional integration was weakened, areas of intensive settlement shifted (Anderson 1996; Cobb and King 2005; King 2003), and new pipe types came to dominate as alternatives to the old orthodoxy and its presiding authorities arose.

At least eight major pipe styles appear. Initially, a few of them demonstrate stylistic links with the preceding period, especially in the area close to Etowah, but eventually they were largely replaced by different forms. In contrast to the wide distribution of several earlier, Etowah-centric pipes, nearly all of the Late Mississippian styles were restricted to the territories of much smaller chiefly provinces. The new styles were also emphasizing quite different symbolic themes, warfare, and supernatural concerns being prominent among them (Fig. 6.4a–b). In addition, the symbolically extravagant

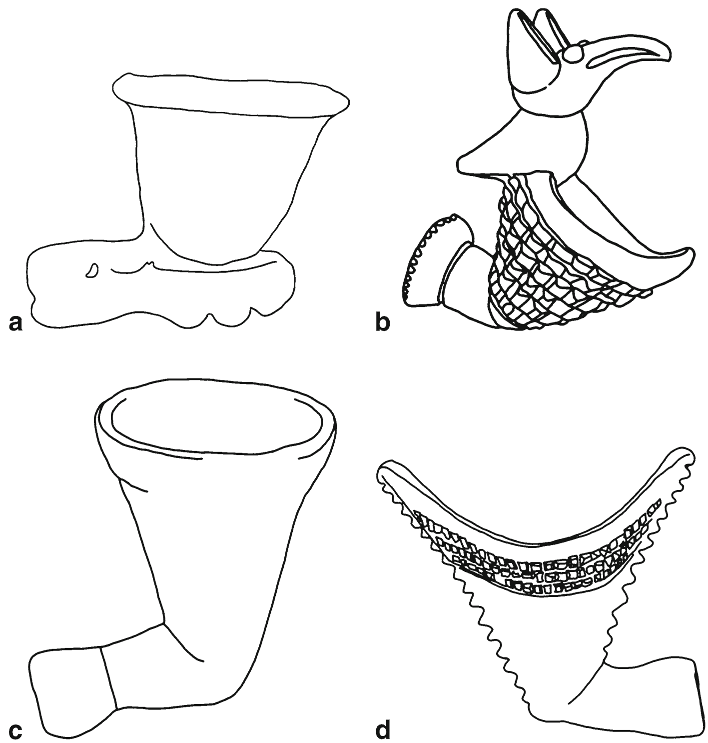

Fig. 6.4 Representative Late Mississippian-Protohistoric pipe types, AD 1375–1600 (**a**) Monolithic Axe; (**b**) Avian Effigy; (**c**) Trumpet, Simple; (**d**) Trumpet, Gridded Band

Table 6.3 Summary of age and sex associations of pipes in burial contexts (M = Male; F = Female; Undet = Undetermined)

	Adult			Subadult			Infant			Undet. age		
Period	M	F	Undet	M	F	Undet	M	F	Undet	M	F	Undet
Early	0	0	0	0	0	0	0	0	0	0	0	2
Middle	16	0	5	1	0	4	0	0	0	0	0	21
Late	26	3	16	1	0	1	0	0	2	0	0	23
Historic	0	0	4	0	0	0	0	0	0	0	0	4

pipe bowls, some of which were quite large, attained a new level of visibility. Finally, pipes begin to appear in non-male and non-adult graves, and as often in non-privileged contexts as in exclusive ones (Table 6.3).

The closest exemplar of anything approaching a pan-regional pipe style during this period is the Trumpet category, dated just prior to and immediately following the time of Spanish contact (Fig. 6.4c–d). Because they crosscut the estimated extent of several provinces often portrayed as competitive rivals, it would seem different mechanisms were at work, such as the aggressive spread of a late-dating cult.

The deep changes detectable in the nature of Late Mississippian society appear to have occurred rapidly as the result of internal rather than external forces. Under circumstances of weaker centralized authority, the belief system and its ritual programs were adapted to support disparate, competing polities rather than a paramount power. These tendencies reveal persistence of a doctrinal religious mode but in a variant form. Specifically, I surmise the Late Mississippian adjustment was reactive, unfolding, perhaps, in a spirit of revitalization. For successor authorities operating at a provincial level, alternative ritual programs could demonstrate access to divine powers on new terms, and new forms of smoking rituals were introduced to satisfy their needs. The identity of the ritualists in these instances is unclear, but powerful shamans or cult leaders could have been among the main functionaries.

6.5 Explanation of Observations

The pipe-based ritual history I have outlined independently aligns with other portrayals of Etowah's rise and fall. Cobb and King (2005, p. 167), for example, posit that a series of abandonment episodes created opportunities for "interest groups," including immigrant populations, to distance themselves from past structures and "reformulate new forms of sociopolitical organization" within an independent polity. Under this or even alternative explanations for Etowah's history, it is not difficult to imagine the important role of ritual in the emergence of new regimes.

Certainly, in this case, we discover the basic correlations that Atkinson and Whitehouse (2011) and Winkelman (1990) independently observed in the ethnographic record. Human societies are wont to adjust religious ritual formats in order to accommodate conditions linked to different modes of production and social organization. That the strategic advantage of elaborating, formalizing, and closely controlling a ritual pattern was appreciated by the Etowah elite is amply clear. The synopsis of the Etowah pattern as observed in smoking pipe evidence is that those maneuvers entailed, at first, low-level maintenance of an ancient rite, then, with Etowah's ascendance, wholesale adoption of a doctrinal strategy expressed as a pan-regional ritual mode, and, finally, in the wake of Etowah's decline, appearance of a plethora of competing ritual patterns within a balkanized cultural landscape (Blanton 2012).

Through the perspective of evolutionary theory, we better appreciate how and why religious ritual was central to each mode in this series of patterns. Fundamentally, rituals are contrived to economically convey key messages, to concentrate attention upon them, and to build cohesive communities around them. The messages change in accordance with cultural circumstances and, more specifically, with strategic motives; otherwise the elemental dimensions of religious rituals are universal. Smoking-oriented ritual, for example, was deployed to take advantage of each of the three elements of ritualized behavior, but the materialized messages were altered in order to achieve different kinds of structural–organizational goals.

As a closing thought, I am inclined to describe the essence of these changeable formulations of smoking ritual as one of ideological innovation. The relevance and efficacy of rituals were maintained only by a process of adaptation to evolving circumstances, and perhaps vice versa. Consequently, other secular and sacred activities would come and go but the act of smoking was never abandoned. If one accepts, as I do, that rituals represent a means of economically and persuasively communicating core beliefs, the process required devising new strategies of signaling, or projecting, those doctrines as they evolved. Nothing less than the cohesion of groups, and their ability to undertake collective action, was in the balance. We also see in this series of events the production of a unique regional history, one that explains why this area's smoking tradition differed from others in the Mississippian universe.

It is difficult to escape the conclusion that smokable plants like tobacco played as central a role in Mississippian societies as maize. Related rituals surely entailed a complex series of integrated actions ranging from propagating and preparing smokable ingredients, to fashioning pipes and other paraphernalia, to conducting rituals, and to disposal of the remains. Pipes and the residues within them are our most direct archaeological links to those practices.

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Chapter 7
Pipestone's True Grit: Observations from Experimental Pipe-Making

Alison M. Hadley

7.1 Introduction

Historically, pipes played many roles in Plains Indian societies. Pipes could simultaneously be artistic representations of people and animals (Ewers 1986), ritualistic paraphernalia as part of a sacred bundle (Brown 1953; Catlin 1866; Hall 1997; Hennepin 1903; Lowie 2004; Sidoff 1977; Thomas 1941; Wissler 1912), media for political and social commentary (Ewers 1986, p. 91), erotically themed carvings (Ewers 1979), objects to facilitate trade and outside interaction (Blakeslee 1975), and recreational smoking devices (Catlin 1866, 1996). With historic pipes functioning in so many roles, it is challenging to study archaeological pipes without considering these detailed ethnographic insights. At the same time, analogies limit our perspective on pipes to the observations and interests of people in the past. For example, in ethnographic and ethnohistoric accounts, the manufacture of pipes is rarely addressed with a few exceptions (cf. Ewers 1963; Weltfish 1965). In this research, experimental archaeology is employed to foster the understanding of pipes as part of a technological system. Recent experiments in pipe technology highlight the utility of bridging actions with evidence from the archaeological record (Hadley 2014; Odell et al. 2011; Tushingham et al. 2013). The technological study of pipes can reveal the contexts of raw material procurement and manufacture; thereby allowing archaeologists to link these important contexts to pipe use and better address the social and political roles of pipes from the archaeological record.

The theoretical framework for this research is based on previous archaeological studies of the organization of technology. Organization of technology is a research agenda that examines "the selection and integration of strategies for making, using,

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transporting, and discarding tools and the materials needed for their manufacture and maintenance….[taking into consideration] economic and social variables that influence those strategies" (Nelson 1991, p. 57). The theoretical basis and origin of this research strategy comes from processual and behavioral archaeology. A major influence is Schiffer's (1972) seminal paper defining archaeological and systemic contexts (Bleed 2001, p. 108). Schiffer's (1972) definition of systemic context addresses the stages of a tool's life cycle (procurement, manufacture, use, maintenance, and discard) and encourages researchers to link the interpretations of these stages to "behavioral and organizational hypotheses" (Schiffer 1972, p. 163). An essential strategy for organization of technology research is the use of experimental archaeology (Bleed 2001, p. 108). A weakness of technological organization research, however, is that sometimes the technology becomes the primary concern and the broader social, economic, and political realms within which the technology is embedded are neglected.

Many organization of technology studies focus on technologies that are primarily functional in nature. Archaeologists often humorously observe that if a feature or artifact lacks an obvious economic function then it must be associated with ritual (Wesler 2012, p. 9). In such cases, ritual and religion are approached as realms that are problematic to access through empirical evidence (Howey and O'Shea 2006). This has been a common assumption in the study of North American smoking pipe rituals, with previous research focusing on pipe typologies (e.g. Ewers 1986; Dunhill 1969; West 1934) and relying on ethnographic and ethnohistoric observations for interpretations of ritualistic smoking practices (e.g. Hall 1977, 1983, 1997). It is also often assumed that prehistoric pipes are primarily items of ritual based on archaeological contexts and ethnographic analogies. The result is an imprecise understanding of ritual and the technologies associated with pipes in past societies, including aspects of intended purpose and the social relations surrounding pipe production and use. By applying experimental archaeology to the manufacturing processes of a ritual technology, archaeologists can begin to understand the social and economic contexts influencing the technology. From this broader interpretation of the social and economic contexts, archaeologists are then in a better position to theorize about the impact of technology and production on ritual activities.

The purpose of this research was to build a use-wear and residue comparative collection to aid in archaeological analyses. The experiment and analysis here specifically target the pipe manufacturing techniques and pipestone materials that were used during the late prehistoric and early historic periods on the central and southern Plains. In the process of making the comparative collection, information was collected about the characteristics of the raw materials, the effectiveness of tools in particular actions, and various signatures of pipestone manufacture. The experimentally produced comparative collection was then used in an analysis of archaeological materials to situate pipestone manufacturing activities into the larger technological organization of a past society.

7.2 Previous Research on Pipe Manufacture

There are multiple archaeological, historical, and ethnographic studies that are concerned with pipe manufacture and replication experiments (e.g. Blakeslee 2012; Bleed 2010; Catlin 1975, p. 247; Del Bene and Shelley 1979; Ewers 1963, 1979; Hadley 2014; Murray 1993; Odell et al. 2011; Waggoner 2005; West 1934, p. 341–342). West (1934) conducted one of the first documented pipe replication experiments using George Catlin's (1975, p. 247) observations of Sioux pipestone pipe drilling. West (1934, p. 341–342) employed ash wood drills with sand and water and found that the time it took to make a 25-mm deep hole in different materials varied: 60 min in pipestone from Pipestone National Monument, Minnesota; 66 min in Barron County, Minnesota pipestone; and 110 min in limestone.

Recent research by Bleed (2010) and Blakeslee (2012) demonstrated the utility of the in-depth analysis of pipe manufacture. Bleed (2010, p. 112) analyzed pipe refuse from a historic Oto or Ioway site (Bozell and Carlson 2010, p. 1) in northeastern Nebraska and documented four stages of pipe manufacture. This research was the first effort in the Great Plains to identify the stages in pipe manufacture using an archaeological assemblage. Blakeslee (2012) used the *chaîne opératoire* as an organizing concept and explored the production trajectory of stone pipes. He defined the six stages of manufacture for a particular type of red pipestone elbow pipe: blank, preform, decoration, shaping of interior passages, use, and dismantling for another use. Importantly, he addressed issues of who made the pipe, the tools used to make the pipe, and the spatial distribution of associated materials. Bleed and Blakeslee's research demonstrated the interpretive utility of studying more than just complete and finished pipes. Since production trajectories deal with technology as a system as opposed to a typology (Bar-Yosef and Van Peer 2009; Bleed 2001), it is plausible to use them to identify social and economic influences on the technology.

Odell et al. (2011) recreated pipe working tools and identified pipestone use-wear (see also Del Bene and Shelley 1979 for soapstone pipe replication). Their experiments helped define the diagnostic characteristics of pipestone use-wear. The researchers then examined an assemblage of stone tools from a Great Bend Aspect (GBA) site in southern Kansas. The GBA was associated with late prehistoric and early historic groups (1425–1700 AD) that were likely ancestral to the historic Wichita (Vehik 1992; Wedel 1959). To compare the experimental use-wear to the archaeological collection, Odell et al. used a binocular microscope with up to 100× magnification. Odell et al. identified pipestone wear on five different types of bifacial[1] and unifacial[2] artifacts: end scrapers, tabular tools, drills, gouges, and reamers (defined in Table 7.1). Pipestone residue was not systematically recorded in their study.

[1] A tool that was flaked on both faces (Andrefsky 2005, p. 253).

[2] A tool that was flaked on only one face (Andrefsky 2005, p. 262) and that often retained flake features because of the lack of modification.

Table 7.1 Artifacts that were used at Great Bend Aspect sites to carve pipestone (identified and defined by Odell et al. 2011, Table 1)

Tools	Shape and manufacture	Action	Retouch
End scrapers	Rectangular or ovoid-shaped uniface	Primarily scraping; some cutting	Unifacial
Tabular tools	Rectangular or ovoid-shaped biface	Cutting	None
Gouge	Club-shaped biface	Carving a depression	Bifacial
Reamer	Small rectangular or ovoid-shaped uniface	Enlarging a depression by widening it and deepening it	Unifacial
Drill	Parallel-sided or slightly tapered biface	Deepening a depression	Bifacial

These previous studies on pipe manufacture were instrumental in the development of the present experimental study design. The research conducted by Odell et al. (2011) was particularly important in guiding the design and replication of pipe carving tools used in this experiment. Additionally, Odell et al.'s initial identification of diagnostic pipestone use-wear demonstrated the potential for further research into microscopic analysis of pipe carving tools.

7.3 Building a Comparative Collection

A central part of developing the comparative collection was to replicate the relevant types of artifacts from archaeological pipe assemblages. The Great Bend Aspect, located in south-central Kansas, (Fig. 7.1) was the archaeological complex that provided the models for the tools. Blakeslee and Hawley (2006, p. 174) identified the major lithic types used in the GBA chipped stone economy. The GBA was the focus of this analysis because of the prevalence of pipestone artifacts, in various stages of manufacture, at these sites. However, the role of pipestone manufacturing at GBA sites has not been thoroughly explored. Future research on pipe manufacture should consider the tools and materials that are specific to other geographic areas or cultures.

In order to create a use-wear and residue comparative collection, the following steps were used (further detailed in Table 7.2). First, the appropriate lithic materials were procured. Next, flintknapping was conducted to replicate multiple sets of tools from each material. Then, the finished tools were used in various activities on three different materials, Minnesota pipestone, Kansas pipestone, and hematite. Next, the used tools were washed in order to recreate standard curation procedures of archaeological assemblages for comparison to archaeological specimens. Finally, the tools were microscopically analyzed, and the use-wear and residue patterns were documented. Ultimately, the comparative collection was used during the analysis of GBA archaeological artifacts to help identify pipestone residue and use-wear.

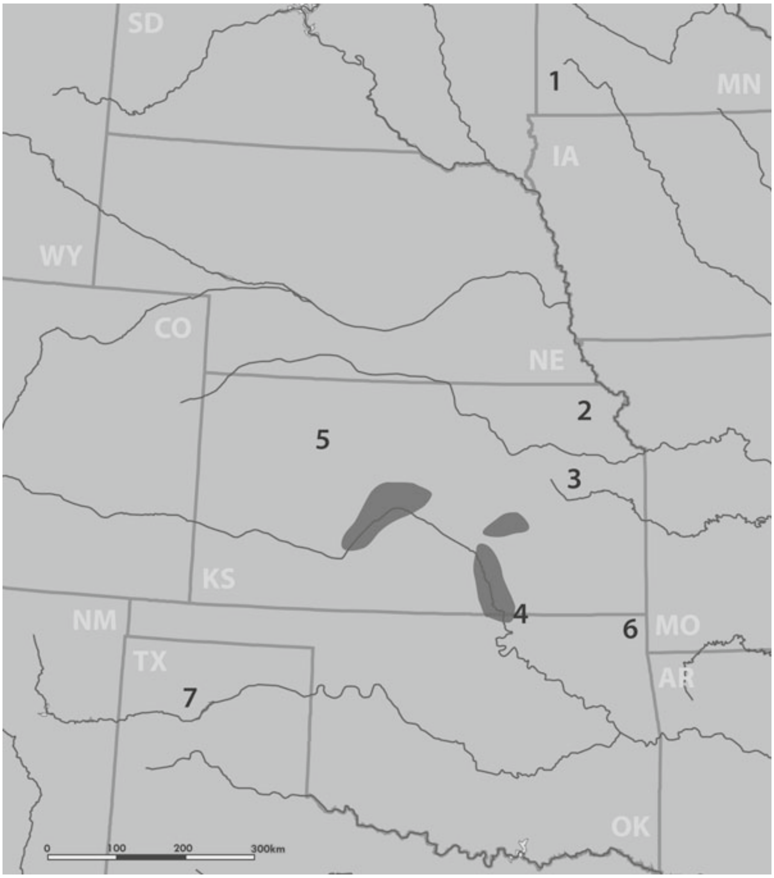

Fig. 7.1 Shaded areas are locations of Great Bend Aspect villages and the numbers represent approximate procurement locations for the lithic materials used in the study: (*1*) Minnesota pipestone; (*2*) Kansas pipestone; (*3*) Hematite; (*4*) Florence chert; (*5*) Smoky Hill jasper; (*6*) Peoria chert; (*7*) Alibates agatized dolomite; Map by A. Hilburn

7.3.1 Lithic Materials

The first step was to collect samples of lithic materials represented in GBA archaeological assemblages (Fig. 7.1). Based on previous research (Blakeslee and Hawley 2006; Stein 2006), there were four main types of lithic materials used at GBA sites: Florence chert, Smoky Hill jasper (also known as Smoky Hill silicified chalk), Alibates agatized dolomite, and Undifferentiated Osagean cherts (following Ray 2013, Table 7.3). The worked material for the experiment was Kansas pipestone, Minnesota pipestone, and hematite (Table 7.4). There were multiple sources of pipestone throughout the United States that were prehistorically utilized (e.g., Emerson and Hughes 2000, 2001; Emerson et al. 2003; Penman and Gundersen 1999;

Table 7.2 Experimental design for the study

Objectives:	Steps:
Replicate GBA chipped stone tools	1. Procure lithic materials from four local sources
	2. Heat-treat the chert that is most commonly heat-treated prehistorically
	3. Knap raw chert into five types of tools (as defined by Odell et al. 2011): end scraper, tabular tool, gouge, reamer, drill
	4. Knap at least two tools for each chert type (refer to Table 7.5 for total number of tools per chert type)
Replicate pipestone and hematite use-wear and residue on tools	1. Use an end scraper from each chert type and scrape the Minnesota Pipestone, Kansas Pipestone, and hematite
	2. Use a tabular tool from each chert type and cut a line into the Minnesota Pipestone, Kansas Pipestone, and hematite in the same area that was scraped
	3. Use a gouge from each chert type and gouge a depression into both pipestones
	4. Use a reamer from each chert type and enlarge the gouged holes in both pipestones
	5. Use a drill from each chert type and drill the gouged and reamed holes deeper in both pipestones
Replicate archaeological curation activities that may affect the appearance of residue and wear on tools	1. Wash all of the used tools with water and a soft toothbrush
	2. Air dry the tools
	3. Bag the tools into individual polyurethane bags
Describe the use-wear and residue	1. Analyze each tool with a microscope ranging from 50× to 100× magnification
	2. Describe the residue and use-wear exhibited on each tool
Use tools as a comparative collection	1. Refer to notes and tools during analysis of archaeological artifacts to aid in the identification of pipestone and hematite residue and wear. (The comparison with archaeological tools is not discussed in this paper)

Table 7.3 Properties and characteristics of chert materials used in the experiment

Chert type	Geological age	Colors	Texture	Source location	References
Florence Chert	Permian	Gray and dark-gray to tan and brown, sometimes banded	Fine-grained, highly fossiliferous with quartz inclusions	Flint Hills of Eastern Kansas	Haury (1981, 1984)
Smoky Hill Jasper (Silicified Chalk)	Cretaceous	Highly variable: green, red, black, white, yellow, and brown	Fine-grained, varies from lustrous to chalky	Northwestern Kansas	McLean (1998)
Peoria (Undifferentiated Osagean) Chert	Mississippian	White, very light gray, and tan, with darker linear mottles lined by white	Fine-grained and brittle	Northeastern corner of Oklahoma	Ray (2007, 2013)
Alibates Agatized Dolomite	Permian	Banded and mottled with red, pink, purple, brown, orange, blue, and white	Fine-grained lacking fossils, sometimes with veins of quartz	Texas Panhandle	Banks (1990); Haury (1981)

Table 7.4 Properties of worked materials

Worked material	Source locations	Size (cm) (length × width × thickness)	Weight (kg)
Minnesota Pipestone	Southwestern Minnesota	12 × 10 × 7	2.2
Kansas Pipestone	Northeastern Kansas	17 × 11.5 × 10	2.2
Hematite	Throughout Kansas	4.5 × 3.5 × 1.8	0.028

Scott et al. 2006, Table 3; Sigstad 1973; Wisseman et al. 2002; Wisseman et al. 2012). However, the two primary types used at GBA sites were from Minnesota and Kansas (Hadley 2015, p. 70). Additionally, red pigments have been collected from multiple GBA sites in Kansas that may either be hematite or pipestone powder. Hematite was used in this experiment to help define its distinctiveness from pipestone wear, residue, and powders. Basic descriptions of each material and the location of procurement were recorded for each sample.[3]

Minnesota pipestone is a red argillite[4] that interbeds with Sioux Quartzite in southwestern Minnesota (Gundersen 1988, 2002; Scott et al. 2006). Minnesota pipestone is most often associated with the outcrop in Pipestone National Monument. This particular pipestone, sometimes referred to as Catlinite, was historically quarried and carved into pipes that were traded throughout the Plains (Blakeslee 1975; Catlin 1975; Ewers 1979, 1986). The metamorphosed stone is mineralogically distinctive from other pipestones (Gundersen 1987, p. 2, 2002, p. 37; Gundersen et al. 2002, p. 110). The red color that is associated with pipestone is created by the presence of oxides, most commonly the mineral hematite (Gundersen 1988, p. 82).

Kansas pipestone is also a red argillite that is found in glacial till deposits in northeastern Kansas. Previous mineralogical sourcing found that Kansas pipestone is distinctive from other pipestone because it contains quartz (Gundersen and O'Shea 1981; Gundersen 1981, 1987, p. 6). Both pipestone samples used in this study were between 5 and 6 on the Moh's Hardness scale (which means they can be scratched with a knife or steel file). The majority of pipestone artifacts that have been mineralogically tested at GBA sites were made from Kansas pipestone (Gundersen 1993, p. 561; Hadley 2015, p. 70).

Hematite is abundant throughout the state of Kansas within beds of shale and clay and as a cementing agent in sandstones (Tolsted and Swineford 1984, p. 72). The red hematite sample used in this experiment was collected in the uplands of Osage County, Kansas. It is the soft, earthy variety of hematite as opposed to the hard, specular variety that is metallic-colored. The sample of hematite was so soft that it could be scratched with a fingernail (which equates to 2 on the Moh's

[3] Minnesota pipestone and Alibates agatized dolomite are protected lithic sources within National Monuments. The particular samples used in this experiment were not procured on the protected properties, but from outcrops elsewhere in the general area.

[4] An argillite is "a relatively soft compacted rock derived from shale or mudstone. Essentially they are a transitional rock in terms of hardness and permeability between slate and shale" (Scott et al. 2006, p. 19).

Hardness scale). Specular hematite is much harder at 5–6 on the Moh's Hardness Scale, which can only be scraped with a knife or steel file (Rapp and Hill 1998, p. 120). At archaeological sites in Kansas, both types of hematite were used (Stein 2006, p. 264). The material was included in this study as a control to test whether or not pipestone and red hematite are distinctive in terms of their use-wear evidence, residue, and powder.

Florence chert is found throughout the Permian Limestone Formations in the Flint Hills of eastern Kansas. Florence varies in color from gray and dark-gray to tan and brown and is often banded (Haury 1981, p. 46; see also Haury 1984 for a detailed list of characteristics). This material has a smooth texture despite being highly fossiliferous with complete and fragmented silicified fossils and quartz crystal inclusions (Haury 1984, p. 72–73). The material used in this experiment was specifically procured from a source near Maple City in Cowley County, Kansas. The extra tools made from this material were also used on hematite.

At GBA sites, Florence cherts were often heat-treated (Stein and Reynolds 1994, p. 7), so it was necessary to replicate the change of the material's texture for the experiment. The target temperature was 260 °C (500 °F), which had been previously identified as the "optimal high temperature" in a heat-treating experiment with Florence chert (Stein and Reynolds 1994, p. 10). Blades and flakes that varied in length from 5 to 15 cm with thicknesses of less than 2 cm were buried in 4 cm of clean sand. This amount of sand covered all sides of the tools. The sand helped "to spread the heat slowly and evenly" (Whittaker 1994, p. 73). The sand-covered tools were then heated in a conventional oven set to its lowest temperature, 79 °C (175 °F). The temperature was slowly increased by 37.8 °C (100 °F) every hour. Rapidly increasing or decreasing the temperature was avoided due to the potential of causing thermal shock and fractures in the chert (Whittaker 1994, p. 73). Once the oven temperature reached 260 °C (500 °F) the tools were left at this temperature for three hours. Afterwards, the oven was turned off to let the chert cool overnight (approximately nine hours). The heat-treatment made the gray and tan flakes pink with slightly more luster.

Smoky Hill jasper was another common lithic material used at GBA sites. This material occurs in tabular and nodular forms in northwestern Kansas (McLean 1998, p. 187; Stein 2006). The Smoky Hill jasper used in this experiment is a sample of unmodified nodules collected from a talus slope in Graham County, Kansas. Smoky Hill has highly variable colors (from green to red and all neutral colors in between [McLean 1998]). Only white, yellow, and brown varieties were used in this experiment. Smoky Hill has a fine-grained texture with a soft, chalky cortex. The brown variety is lustrous, and the white and yellow varieties are chalky.

Undifferentiated Osagean chert is an analytical term for cherts that are fine-grained and light-colored (white or light-gray) from Mississippian-age outcrops (Burlington, Keokuk, Elsey, Reeds Spring, Pierson) in southeastern Kansas, northeastern Oklahoma, much of southern Missouri, and northern Arkansas (Ray 2007, 2013; McLean 1998, p. 185). Lithic artifacts made from chert from these formations are commonly indistinguishable and thus are placed in this broad category. For this experiment, chert that was highly localized to the extreme northeastern corner of Oklahoma was quarried and used. This Mississippian-aged material is Peoria chert, which is likely a part of either the Keokuk or Warsaw Formations (although the parent limestone is no longer present; Ray 2007, p. 225). Peoria chert lacks fossil inclusions and is distinctive due to darker linear mottles and streaks that are lined with white (Ray 2007, p. 226). The thin cortex, fine grain, and brittleness make this material excellent for flintknapping. The chert was obtained from a modern quarry near Quapaw, Oklahoma.

Alibates agatized dolomite is from the Canadian River Valley in the Texas Panhandle, approximately 35 miles north of Amarillo. The Alibates Flint Quarries National Monument contains a large portion of the outcrop. The material for this experiment was purchased from a rock collector who collects on private property adjacent to the monument. The material is fine-grained, lacks fossils, and is highly variable in color with bands and mottles of red, pink, purple, brown, orange, blue, and white (Haury 1981, p. 47). Occasionally, veins of quartz crystals are observed in the Alibates material (Banks 1990). This material can be exceptionally brittle, which makes it difficult to flintknap, but excellent for working on pipestone.

7.3.2 Tool Production and Use

The flintknapping was conducted by a novice flintknapper. Thus, the resulting experimental tools were not as finely made as the original Great Bend Aspect artifacts after which they were modeled. Modern, copper-tipped tools were employed for soft hammer and retouching, and a quartzite gravel was used as a hard hammer. The flintknapping portion of this research included four steps. First, a hammerstone was used to remove large flakes from the blocks of raw material (Fig. 7.2). Next, further reduction was conducted on flakes that still had cortex[5] or prominent flake features such as platforms[6] or bulbs of percussion,[7] which would hinder its use as a tool. Then, flakes were further modified into one of five morphological categories that were previously identified as used in pipe manufacture at a GBA site (i.e., Odell et al. 2011). Finally, some edges of the flakes were retouched by directly removing small flakes from the tool edge, making the edge more durable (Whittaker 1994, p. 20).

A total of 75 tools were replicated into five morphological categories: end scraper, tabular tool, gouge, reamer, and drill (Table 7.5). Sixty-three tools (84 %) were used in the experiment on the Kansas and Minnesota pipestones and hematite (Table 7.6). Each tool was used for an extended amount of time, with a goal of at least 2000 strokes. One thousand strokes have been shown to be sufficient in use-wear experiments (i.e., Tringham et al. 1974), however, that number was doubled because 1000 strokes created very shallow marks on the pipestone and it was

[5] A weathered surface on rocks (Andrefsky 2005, p. 245).

[6] Also known as the striking platform, this is the area of a stone that is struck during flintknapping and this surface is often removed when a flake is detached (Andrefsky 2005, p. 262).

[7] A bulge in a flake that is the result of the striking energy turning outward, as in a Hertzian cone (Andrefsky 2005, p. 253). The bulb of percussion is located below the platform on a flake.

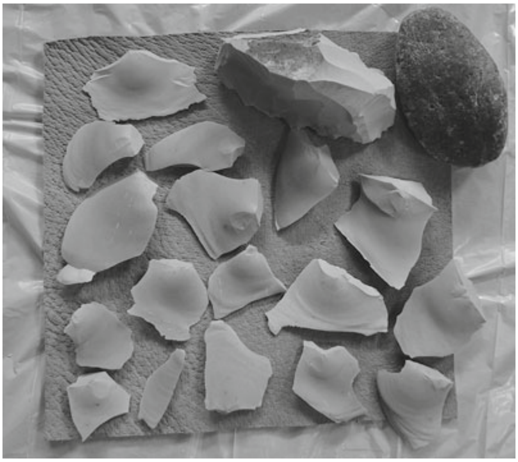

Fig. 7.2 Flakes removed from a block of Peoria chert with a hammerstone; Photo by A. Hadley

Table 7.5 Experimental tool types by chert materials

Tool types	Flintknapped chert materials					
	Florence	Florence heat-treated	Smoky Hill Jasper	Peoria	Alibated Agatized Dolomite	Total
End Scraper	4	2	6	4	1	**17**
Tabular Tool	3	2	4	3	3	**15**
Pipe Gouge	3	3	3	4	3	**16**
Reamer	2	2	3	3	2	**12**
Pipe Drill	2	2	5	3	3	**15**
Total	**14**	**11**	**21**	**17**	**12**	**75**

Table 7.6 Tool types by the material in which they were used

Tool types	Worked Material			
	Minnesota pipestone	Kansas pipestone	Hematite	Total
End Scraper	6	6	1	**13**
Tabular Tool	8	5	1	**14**
Pipe Gouge	9	6	0	**15**
Reamer	6	4	0	**10**
Pipe Drill	5	6	0	**11**
Total	**34**	**27**	**2**	**63**

determined that realistically to carve a pipe, more strokes would be needed. Eventually, the tool edges would have been so damaged that they would have needed resharpening, but that particular threshold has not been determined for stone tools used on pipestone. The average number of strokes for all of the tools was 2346 (Table 7.7). A small number of tools were ineffective due to either the poor quality of lithic material or the unsuccessful design/replication of tools.

Table 7.7 Number of strokes for each action, tools organized by raw material type

Number of tools	Tool raw material	Action	Total number of strokes	Number of tools	Tool raw material	Action	Total number of strokes
2	Alibates	Scraping	4132	2	Smoky Hill Jasper	Reaming	4452
3	Alibates	Cutting	6005	1	Smoky Hill Jasper	Gouging and Reaming	1465
2	Alibates	Gouging	3927	2	Smoky Hill Jasper	Drilling	4455
2	Alibates	Reaming	3745	3	Florence, non-heat treated	Scraping	7276
1	Alibates	Gouging and Reaming	2438	4	Florence, non-heat treated	Cutting	6498
2	Alibates	Drilling	17,132	2	Florence, non-heat treated	Gouging	5730
3	Peoria	Scraping	6942	2	Florence, non-heat treated	Reaming	3804
2	Peoria	Cutting	2469	1	Florence, non-heat treated	Gouging and Reaming	2312
2	Peoria	Gouging	4484	2	Florence, non-heat treated	Drilling	5430
2	Peoria	Reaming	3062	2	Florence, heat-treated	Scraping	4720
1	Peoria	Gouging and Reaming	1390	2	Florence, heat-treated	Cutting	6280
2	Peoria	Drilling	4280	2	Florence, heat-treated	Gouging	5140
3	Smoky Hill Jasper	Scraping	6636	2	Florence, heat-treated	Reaming	4320
4	Smoky Hill Jasper	Cutting	8092	1	Florence, heat-treated	Gouging and Reaming	88
2	Smoky Hill Jasper	Gouging	5916	2	Florence, heat-treated	Drilling	4360

Fig. 7.3 (**a**) Alibates agatized dolomite end scraper; (**b**) Florence chert gouge; (**c**) Smoky Hill jasper reamer with chalky cortex on the side of the tool; (**d**) Pipe drill made from heat-treated Florence chert; Photo by A. Hadley

End scrapers, characterized by steep unifacial retouch on one end of the tool (Fig. 7.3a), were handheld (unhafted). Twelve end scrapers were used for scraping and one was used as a cutting tool. The end scrapers were efficient and easy tools to use because the size was large enough to fit into the hand. Scraping involved pulling the tool edge across the pipestone or hematite to create a flat surface, which was ideal for alteration during the subsequent stages of production.

Tabular tools are flake tools that have straight or slightly convex edges with acute edge angles (between 30° and 60°) that are ideal for cutting. Thirteen tabular tools were used for cutting and one was used for scraping. The majority of these tools were not retouched. Cutting was conducted on previously scraped surfaces of pipestone and involved a sawing motion with the tool held at a 90° angle to the pipestone.

Gouges are small bifacial tools that are handheld and exhibit a prominent end (Fig. 7.3b), which is ideal for creating a dimple or depression by pressing the tool into the pipestone and gouging or "scooping-out" lithic material. The small gouged dimple was the start of what would become, first with reaming, and then by drilling, a larger hole.

Reamers are small, unifacial tools that are also handheld during use (Fig. 7.3c). Reamers were pressed into the gouged indentation in the pipestone. Then, the tool was used in a semicircular motion to enlarge and deepen the indentation.

Gouging and reaming were the most difficult stages of pipestone manufacture because of the small size of these tools. Initially, the gouging and reaming were a combined motion because it was easier on the experimenter's hand. However, later in the experiment, the two actions were separated to see if there was a different outcome in the wear and residue patterns. There was no discernable difference. During the experiment the small tools were handheld, which contributed to the difficulty in their use. The gouge and reamer artifacts reported by Odell et al. (2011) were small (between 3 and 4 cm) and some were hafted. It was found that without a haft, it was easier to use gouges and reamers that were longer than 5 cm.

Drills are long and narrow bifaces or trifaces[8] (Fig. 7.3d). It was important for the drills to be symmetrical because asymmetry made them difficult to control during use. Knapping the drills was so challenging that even the help of two experienced flintknappers resulted in rudimentary tools that only slightly resembled the GBA artifacts from which they were modeled. Often the drill blank would snap in half before it was appropriately narrow. All of the drills were placed into a hafted piece of dry cane and fixed with modern binder and mastic. The drilling was then conducted in the gouged and reamed hole. Drilling was done either with a twisting motion with the cane between the palms or with the cane twisted by a bow drill.

7.3.3 *Microscopic Analysis*

Once the 63 tools were used and washed with water and a soft toothbrush (to replicate post-excavation cleaning and curation), each was analyzed using a Nikon Eclipse LV150NL microscope at 50× and 100× magnification. All of the edges of the tools were initially analyzed at 50× to define the extent and patterns of residue. Analysis of the used edges was then conducted at 100× in order to describe the use-wear and residue patterns in detail. An eight-plane grid system was employed with a drawing of the tool to systematically document the location of wear and residue (e.g., Odell 1979, p. 331). The resulting data were archived with the comparative collection at the University of Kansas' Archaeological Research Center.

7.4 Results

This section summarizes the results of the experimental analysis. Observations of use-wear and residue patterns on chipped stone tools are primarily descriptive. Observations were also made during the experiment about the effectiveness of particular tools and chipped stone materials.

[8] A tool that has been flaked on three distinct sides or faces.

7.4.1 Use-Wear

Observed use-wear on chipped stone tools included edges that were noticeably rounded, crushed, and occasionally scarred. Rounding was defined as the smoothing out of the surface or edge of the tool. Rounding was the most common wear type on tools used to work Kansas and Minnesota pipestones. The tools used on hematite were very slightly rounded, compared to the extremely rounded edges of the tools used on pipestone. Rounding was observed on every experimental tool to some extent and often overlapped with dark red pipestone residue and striations.

Crushed and rounded edges occasionally overlapped on a tool. A crushed edge exhibited multiple overlapping step fractures, which appeared under the microscope as tiny flake scars that were stepped and often filled with pipestone residue (Fig. 7.4). Odell et al. (2011, p. 5) defined such a surface as a comminution, where there are multiple overlapping step fractures that make the surface look pockmarked. Del Bene and Shelley (1979, p. 245) also observed crushing, which they similarly defined, after replicating a soapstone pipe. Crushed edges were most often observed on the tools that were used to gouge and ream the pipestone because the intense use was concentrated on a small area of the tool edge (Table 7.8).

The used tool edges were also scarred with step, hinge, and feather terminations although these types of scars were not as common as crushed edges (Table 7.8). Hinge scars resulted in a flake termination that had a rounded or blunt distal end. Feather scars resulted in a very thin tapered termination on the distal end of the scar. The most common type of scarring occurred on the extreme margins of the used edge with step terminations. There were also multiple tools that had large isolated or discontinuous step fractures in the center of the used edge. Step scarring was not isolated to one particular type of action. Feather and hinge scarring, however, were only observed on tools used to scrape and cut the pipestones. In general, there was no

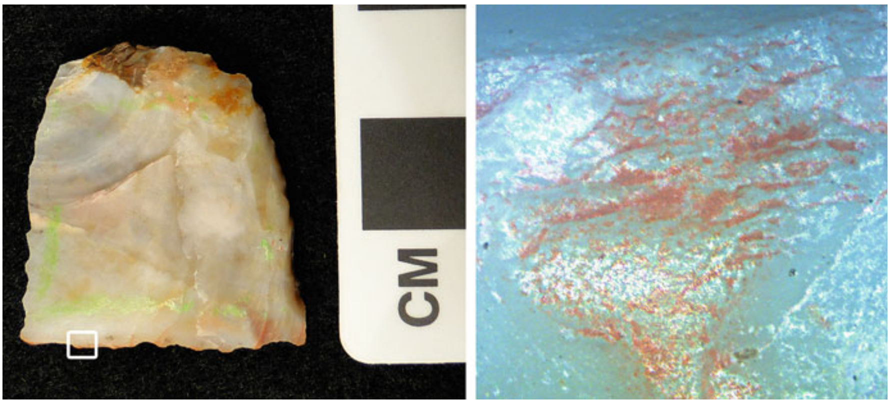

Fig. 7.4 Alibates tabular tool used to cut Minnesota pipestone (*left*); A microscopic photo (at 100-magnification) of the used distal edge of the Alibates tabular tool, demonstrating step fracture scars filled with pipestone residue (*right*); Photos by A. Hadley

Table 7.8 Actions and associated scarring and crushing of the tool edges

Action	Crushing and scarring of used edges						Total
	Crushed	Crushed and step termi-nations	Step termi-nations only	Step and feather termi-nations	Crushed and hinge termi nations	Hinge and step termi-nations	
Scraping	1	2	0	1	1	1	**6**
Cutting	3	2	2	2	0	0	**9**
Gouging and Reaming	3	2	0	0	0	0	**5**
Gouging	2	1	1	0	0	0	**4**
Reaming	1	2	3	0	0	0	**6**
Drilling	3	0	2	0	0	0	**5**
Total	**13**	**9**	**8**	**3**	**1**	**1**	**35**

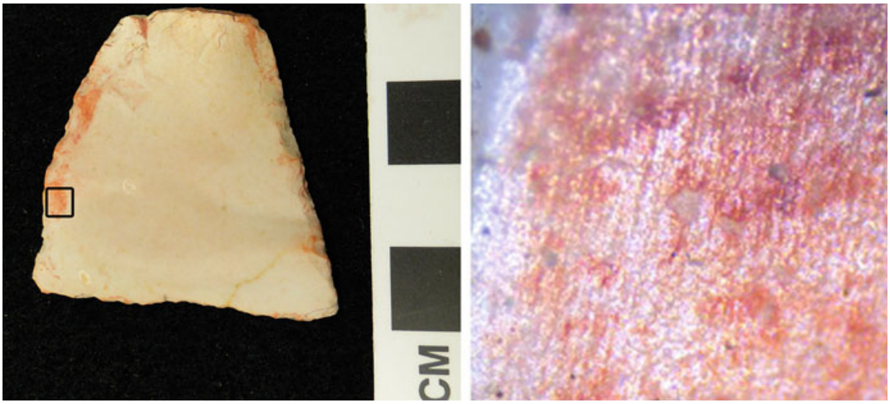

Fig. 7.5 Peoria chert tabular tool that was used to cut Minnesota pipestone with macroscopic pipestone residue evident on the tool margins (*left*); A microscopic photo (at 50 magnification) of the tabular tool with striations that are parallel to the tool's edge and pipestone residue (*right*); Photos by A. Hadley

Table 7.9 Tool actions and striations

Action	Striations present	Striations absent	Total
Scraping	5	8	**13**
Cutting	7	9	**16**
Gouging and Reaming	0	5	**5**
Gouging	1	8	**9**
Reaming	0	10	**10**
Drilling	1	9	**10**
Total	**14**	**49**	**63**

consistent or patterned difference in the rounding, crushing, and scarring of the tool edges used on Kansas versus Minnesota pipestones.

Striations[9] were observed at both 50× and 100× magnification on 22 % of the tools (Fig. 7.5). Of the 14 tools with striations, 12 were tools used for scraping or cutting (Table 7.9). The striations were so pronounced that in all cases under microscopic analysis it was possible to determine the direction of use from the alignment of the striations to the tools' edges. Scraping resulted in striations perpendicular to the used edge. Cutting created striations that were parallel with the used edge. Striations also consistently overlapped with dark red residue on the tools. Striations were identified on eight tools or 30 % of tools used on Kansas pipestone and six tools or 18 % of tools used on Minnesota pipestone. The two tools used on hematite lacked striations when viewed at 100×.

[9] Microscopic scratches on the surface of rock.

7.4.2 Pipestone Residue

Two types of residue patterns were observed in this experimental assemblage and were identified by color and texture: a dark red residue that gave surfaces what looked to be a polished finish and a pink powdery residue (Hadley 2014). Both types of pipestone residue were easily observed at 50× magnification after the experimental tools had been cleaned. The dark red residue and the rounding together gave the edge a polished appearance under magnification. The pink residue contained a powdery appearance and was most often observed in flake scars and in natural crevices. Residue was also macroscopically visible on the light-colored tools.

All 61 tools that were used to work Kansas and Minnesota pipestones contained the dark red polish type of pipestone residue, and 53 of those tools also had the diagnostic pink powdery residue. Tools made from Alibates and the white variety of the Smoky Hill jasper had the least amount of pipestone residue, which may be attributed to the hardness and softness, respectively, of these materials. The dark red residue always occurred on rounded edges where a tool experienced the most intensive wear, but was also present on some of the non-worked edges. It was much more common, however, for the pink powdery residue to occur on non-worked edges. A total of 40 tools had pipestone residue on the non-worked edges (Fig. 7.6). Pink residue was observed on a total of 38 tools (95 % of the tools with pipestone residue on the non-worked edge). Only 25 tools had red residue on the non-worked edges (62 % of the tools with pipestone residue on the non-worked edges). Essentially, tools used to carve pipestone were covered in microscopic pipestone residue.

Distinguishing between red residue and red inclusions in the chert was difficult and initially proved problematic. The dark red pipestone residue was easy to confuse with red inclusions in the heat-treated Florence and red spots of the Alibates. Heat-treatment of Florence chert creates a highly oxidized cortex that without microscopic examination was easily confused with the dark red pipestone residue. The used edges of the brown Smoky Hill tools appeared to be reddened possibly due to friction. Separating pipestone residue from the red used edge of the brown variety of Smoky Hill tools was very difficult even with a microscope. Previous observations of this pattern have been made with Smoky Hill jasper tools (Hadley 2014), and further experimentation is needed with other soft stones (such as limestone and preferably a type of stone that is not red) to confirm whether or not friction causes reddening of the brown Smoky Hill tools.

A combination of analysis and experimentation is suggested to overcome the difficulties in distinguishing between natural red areas in a lithic material and pipestone residue. First, analysis needs to be conducted at multiple magnification levels. The analyst should become familiar with color variations in the raw material at a macroscopic level and at high and low magnifications. Flintknapping and heat-treatment experimentation will further familiarize the analyst with color variations inherent in chipped stone materials.

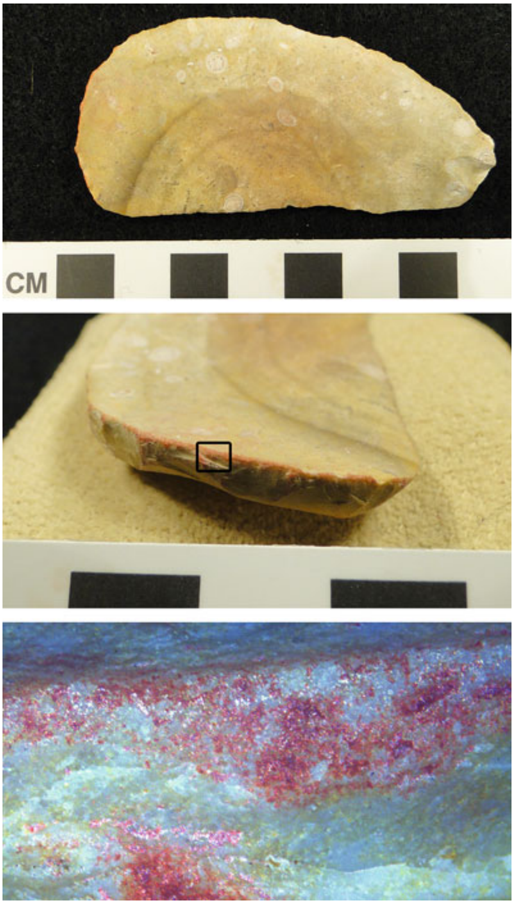

Fig. 7.6 An end scraper made from Florence chert that was used to scrape Minnesota pipestone (*top*); The distal used edge of the end scraper (*middle*); Microscopic photo (at 50 magnification) of the rounded used edge and pipestone residue (*bottom*); Photos by A. Hadley

7.4.3 Material Differences

The Alibates and the brown variety of Smoky Hill jasper were very effective in pipestone-working activities. Neither of these materials exhibited obvious macroscopic use-wear and residue from the pipestone. In contrast, the tools made from the white variety of Smoky Hill jasper were inefficient because they were extremely soft and the edges wore down quickly against the pipestone. The Smoky Hill tools also had the least amount of dark red pipestone residue on the worked edges. One of the white Smoky Hill tools was so ineffective on the gritty Kansas pipestone that the tool actually created white chalky residue on the pipestone rather than pipestone residue on the tool. The inefficiency of these white Smoky Hill tools suggests they will rarely appear in a past pipe-maker's tool-kit.

Table 7.10 Pipestone residue that was observed on non-worked parts of the tools

	Types of pipestone residue			
Worked material	Red residue	Pink residue	Both	Total
Kansas Pipestone	1	3	6	**10**
Minnesota Pipestone	1	12	17	**30**
Total	**2**	**15**	**23**	**40**

A notable observation made in this experiment was the difference in Kansas and Minnesota pipestones. The sample of Kansas pipestone had a very different texture, with visible quartz and feldspar grains within the fine-grained argillite matrix. The grains were as large as one millimeter in diameter and are subrounded (grains that are mostly rounded with some angular edges). In contrast, there were no visible grains in the Minnesota pipestone. The textures of both pipestones were apparent in the powder samples that resulted from the experiment. The Kansas pipestone powder was gritty compared to the fine powder from the Minnesota pipestone. The resulting pipestone powders differentially coated the non-worked edges of the tools (Table 7.10). Although there was very little difference in the rounding, crushing, and scarring of tools used on the pipestones, striations were observed more often on the tools used on Kansas pipestone, which can be attributed to its grittier texture. These results may not be representative of all Kansas and Minnesota pipestone samples and additional experimentation will further clarify these observations.

There was concern at the beginning of the experiment that the use-wear and residue from pipestone might be indistinguishable from hematite. To test this, a scraper and tabular tool were used to scrape and cut a piece of earthy hematite. Because this piece of hematite was so soft, the only resulting use-wear was a slightly rounded tool edge. The residue from the hematite was located on the rounded edge and was abundant during the scraping and cutting. Two significant differences were observed between the hematite and pipestone powder. First, the hematite residue was more of a brownish color than the pipestone powder under both 50× and 100× magnification (Fig. 7.7). Second, the hematite residue was a single brown color, whereas there were two colors of pipestone residue (red and pink). The experiment demonstrated that it was possible to distinguish the difference between hematite and pipestone residues, based on the color and overlap with wear patterns. One problem with this experiment was that soft hematite was used instead of the harder specular hematite, which is closer in hardness to pipestone. While the residue colors would be similar, it is likely that the harder hematite would create more significant use-wear patterns that would be similar to the use-wear from the pipestones. However, the differences in the residues should be enough to distinguish tools used on pipestone and hematite.

7.5 Discussion and Conclusion

This experiment involved the creation of a stone tool collection that was used to work Minnesota and Kansas pipestones and hematite using tool motions that were likely involved in the manufacture of pipes found at GBA archaeological sites.

Fig. 7.7 A Florence tabular tool that was used to cut hematite demonstrating macroscopic residue (*top*); Used distal edge of the tabular tool (*middle*); Microscopic photo (at 50 magnification) of the slightly rounded used edge and hematite residue (*bottom*); Photos by A. Hadley

The comparative collection was then used in the analysis of archaeological materials in order to aid accurate and reliable identification of tools that were used in the manufacture of pipestone pipes. This research was different from previous pipe replication experiments because Kansas pipestone and hematite were used in addition to other raw materials. This experiment provided three unique contributions to the organization of pipestone pipe technology: (1) There was an observable difference in use-wear and residue between Kansas pipestone, Minnesota pipestone, and hematite; (2) Pipestone powder was important in identifying pipe manufacture; (3) Pipestone wear and residue were diagnostic and identifiable through microscopic analysis.

7.5.1 Differences in Use-Wear and Residue

A key observation from this experiment involved the differences between the Kansas pipestone, Minnesota pipestone, and hematite. While archaeologists have previously defined the mineralogy of Kansas and Minnesota pipestones, the ways the three materials affected tools have not been defined. One notable observation was that Kansas pipestone had a grittier texture, with visible quartz and feldspar grains whereas Minnesota pipestone was a homogenous argillite. The two stone powders also had very different textures. The result was that tools used on Kansas pipestone had less pink powdery residue on non-worked edges than the tools used on Minnesota pipestone. Despite the different textures in the pipestones, there was no observable difference in their use-wear patterns, except that more striations resulted from the Kansas pipestone. This experiment also demonstrated that hematite residue can be distinguished from pipestone residue. Hematite created a homogeneous reddish-brown residue that was very different from the red and pink residues from pipestone.

7.5.2 Pipestone Powder

Another important observation made in this experiment was the ubiquity of pipestone powder as a major by-product of pipestone manufacture. Pipestone manufacture was a reductive process like chipped stone technology. Pipestone powder is equivalent to debitage from lithic manufacturing. Ethnographic accounts of Plains tribes document the use of pipestone powder for pigments (Weltfish 1965, p. 395) and as a substance that was mixed with other materials to repair accidental holes made in stone pipes (Ewers 1963, p. 46–47). Modern pipe carvers also collect the powder and make paint out of it during ceremonies such as the Sun Dance (Hadley 2015, p. 86). If pipestone manufacture is taking place in one particular part of a site or if the powder is collected and used for other purposes, then one should be able to find evidence for this in the archaeological record.

Hundreds of red powder samples have been collected in the field from GBA sites in the southern Plains (according to the online Smithsonian artifact catalog, 2014). Such samples can be tested with a nondestructive infrared spectrometer to determine if they are pipestone or hematite. This experiment has also shown that in archaeological contexts it may be possible to differentiate between Kansas and Minnesota pipestone powders. Consequently, archaeologists may be able to identify areas of pipestone manufacture and uses of pipestone powder that have not previously been considered.

7.5.3 *The Diagnostic Nature of Pipestone Wear and Residue Types*

Finally, this experiment has demonstrated that pipestone creates diagnostic wear and residue on chipped stone tools and these are diagnostic at low-level magnification even after the artifacts have been thoroughly washed with water and a toothbrush. Therefore, it is possible to identify both pipestone residue and wear in an archaeological context (see also Blakeslee 2012; Hadley 2014; Odell et al. 2011; Waggoner 2005). Additionally, pipestone and hematite create very different residue on chipped stone tools, so it is possible to distinguish the two in the archaeological record.

In conclusion, this replication study systematically documented the wear and residue characteristics on tools that were made from various materials, used in different actions, and employed on different stones. The comparative collection and study observations aided in the identification of archaeological stone tools that were used in the manufacture of pipes and other pipestone objects. Pipestone wear and residue were found to be rare in GBA archaeological assemblages (Hadley 2015). This evidence coupled with the restricted pattern of pipestone manufacturing activities (Hadley 2015; Vehik 2002) suggests that there may have been a ritual and/or specialized aspect to the production of GBA pipes. If pipe manufacture was ritualized or specialized, then this evidence also suggests that the pipes may have had a role in society beyond secular smoking activities. This small step in framing the archaeological understanding of pipes within the larger technological organization provides a strong foundation on which archaeologists can begin interpreting the role of pipes within past societies.

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Chapter 8
Central Plains Tradition Smoking Pipes in the Glenwood Locality of Iowa: Within a Landscape of the Rising and Falling Sky

John Hedden

8.1 Introduction

Late prehistoric smoking pipes have long been recognized and described in archaeological site reports from the Plains. The presence and use of tobacco and other smoking materials is well known in the region. Interpretation of these artifacts is usually restricted to a casual mention of their use as possibly ceremonial. Much more emphasis in archaeological research is placed on investigations of subsistence and areas that are more suitable for artifact identification, tabulation, and scientific analysis. In this chapter, I attempt to elaborate on the types of specific smoking pipe styles and forms of decoration on these objects from Central Plains tradition earth lodge sites in the Glenwood locality of western Iowa. Through this analysis, I hope to provide possible explanations to better understand these objects' meanings and use, and to provide new interpretations concerning the occupation of the groups of people identified as the Central Plains tradition in this localized region of the Plains.

The direct historic approach of archaeological research has a long history in the Plains region. However, with a few notable exceptions, little effort has been used to apply this concept to objects that are recognized as ceremonial. Documentation of ceremony, myths, ritual, and religion of historic groups in the Plains is present in early ethnographic accounts of these groups. While direct association of late prehistoric groups with the historic occupants of the Plains is still tenuous, there may be validity in attempting to tie belief systems of historic groups with earlier occupations as a way to better understand the prehistoric occupation of this region.

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As lifeways changed in the late prehistoric periods from nomadic hunter-gatherers to early horticulturalists, belief systems likely evolved as well. Hultkrantz (1992, p. 116) has pointed out that the emphasis in hunting religions focuses on belief while the emphasis in horticulture religions is on ritual. Although specific rituals may remain the same over long periods of time, their meaning for society is constantly recontextualized. People transform and change underlying religious beliefs through the creation and practice of rituals (Fogelin 2007). Attempting to recognize ritual behavior, as evidenced through specific artifacts, may provide additional methods of understanding and interpreting the data that generations of archaeological research have provided.

Native American tobacco research is an area where science and mysticism must necessarily overlap. It is well-documented that the role of tobacco use intertwined the concepts of ritual, mysticism, and existence (Paper 1988). Ethnographic data concerning the use of tobacco smoking pipes in ceremonial and religious settings is abundant (Winter 2000). As stated by Frank Fools Crow, an Oglala Lakota civic and religious leader:

> “No ceremonial item is more important and vital to my people than the sacred pipe. No holy man or medicine person could do his ceremonies without his pipe. Every Sioux pipe was said to have its origin in the first pipe brought to the people by the White Buffalo Calf Maiden.” (Mails 1979)

Fools Crow was taught this great event took place as many as 800 years ago, sometime between AD 1200 and 1500 (Mails 1979, p. 54–55). Within the Central Plains region of the United States, this time period coincides with the occupation of archaeological sites that have been assigned to the Central Plains tradition.

8.2 Central Plains Tradition

Due to its sudden appearance over a wide geographical area near the beginning of the last millennium, the Central Plains tradition, with its distinctive earth lodge habitation, was once described as a possible migration from an unidentified source to the south and east (Wedel 1959, p. 628). The origin of the Central Plains tradition is now more widely viewed as the cultural response of resident populations to the intensification of maize agriculture, albeit with direct influences from groups to the south and east (Bell 1983, p. 11). While the discreet phases of the Central Plains tradition originally defined in the early-to-mid-twentieth century continue to erode in meaning, it is generally recognized that a distinct new settlement and subsistence pattern emerged and flourished throughout the Central Plains region from ca. 1150 to 1400 AD (Roper 2007; Roper and Adair 2011). Covering thousands of square miles west of the Missouri River, a small cluster of Central Plains tradition sites is present in Iowa directly east of the confluence of the Platte and Missouri Rivers, in what is known as the Glenwood locality (Fig. 8.1).

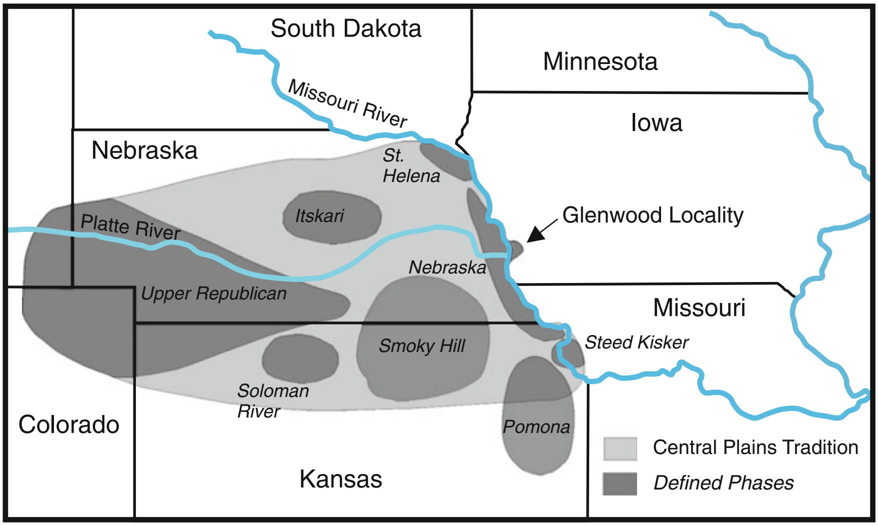

Fig. 8.1 Location of the Glenwood locality

The Glenwood locality encompasses a 30 square mile territory within the Loess Hills region in the far southwest corner of the state of Iowa. The irregular Loess Hills are recognized as one of the mid-continental region's most distinctive landscapes (Prior 1991, p. 48). With an abrupt western boundary in the Missouri River floodplain, the sharp-featured topography rises with alternating peaks and saddles that climb along narrow, crooked ridge crests and extends to the east into the state of Iowa for approximately 10 miles (16 km). Formed through its unique eastern position along the wide, north–south Missouri River Valley during the last glacial period, silt-laden winds were deflected by the eastern valley margin, which caused a major portion of the silt load to settle and effectively bury and obscure the pre-existing land surfaces. Subsequent erosional activities have created a terrain of drainages forming closed-in hollows, narrow ravines, and steep-sided gullies that contribute to the complex terrain (Prior 1991). The high-relief terrain harbors a rich mosaic of specialized ecological niches because of strong local contrasts in soil moisture, temperature, slope angle, evaporation, and exposure that create unique microenvironments not seen elsewhere in the Central Plains. The dry ridge tops and south-facing slopes sustain distinctive shortgrass prairie communities interspersed with unusual plants and animals such as yucca and the Plains spade foot toad, two species typically found in desert environments. In contrast, the protected back slopes offer cooler, moister habitats favorable to the growth of trees and shrubs (Prior 1991, p. 52).

Within the Glenwood locality, over 240 Central Plains tradition sites have been identified. These sites contain single or multiple earth lodge habitations. Except for the Glenwood locality, no Central Plains tradition earth lodge sites have been identified within the state of Iowa. Originally defined in the late-nineteenth century, the

Glenwood locality has a long history of investigation, primarily by local enthusiasts and avocational archaeologists (Orr n.d.; Proudfit 1881a, b, 1886a, b; Rowe and Davis 1960). Due to the abundance of sites in the restricted locality, the area has a tradition of private collection and a rich local history associated with the presence of these earth lodge sites. While well known to local enthusiasts, due to the lack of early professional investigation or reporting, these sites, while generally acknowledged, were often neglected in the development of taxonomic classifications of the Central Plains region during the twentieth century. Because of this, they were primarily designated simply as the Glenwood Culture (Keyes 1951). The sites have subsequently been associated with the Nebraska phase of the Central Plains tradition (Zimmerman 1977).

More recent analyses of artifact assemblages from the Glenwood locality have documented the complex nature of these sites, as they actually contain many of the traits that were often used in the early delineation of the various phases and variants of the Central Plains tradition (Hedden 1993). Ceramic traditions associated with both the Nebraska and the Upper Republican Phases are present at individual lodges within this area. Outside influences have also been identified at a number of sites indicating some types of relationships with groups well beyond the Central Plains (McNerney 1987; Billeck 1993). These include contact with groups such as the Cahokia-influenced Steed-Kisker complex in the Kansas City area, connections with Caddoan influences via exchange routes through the Southern and Central Plains, and contact with Oneota groups from the north and east. The fragmentary nature of archaeological research, lack of tight radiocarbon dating of individual sites, and the complexity of the material from outside influences have hampered interpretation of the occupation of this small locality. Adding to this complexity is the fact that materials once believed to be trade objects are now known to be locally produced copies of forms from other regions. Recent studies have also highlighted the fact that unlike any other region that contains Central Plains tradition sites, the Glenwood locality lacks any pure mortuary facilities. The present evidence suggests that there were no formal, below-ground cemeteries in the Loess Hills of Iowa during the Central Plains tradition occupation (Peterson et al. 2010).

The presence of such a dense cluster of earth lodge sites east of the Missouri River, directly across from the confluence with the Platte River, has long been a mystery. It has been suggested that perhaps this locality was chosen to regulate trade networks to the Plains (Hedden 1997). The complexity of the material culture, particularly the ceramic tradition, as well as the fact that no antecedent transitions in ceramic forms have been identified, suggests a more intrusive nature for sites in the Glenwood locality rather than the more developmental one as suggested for other regions of the Central Plains (Krause 1969, p. 90; Tiffany and Lensink 2013). While the origin of Central Plains tradition groups within the Glenwood locality continues to be a mystery, it has been pointed out by Alex (2000, p. 174) that if the region was selected for aesthetic, spiritual, or historic reasons we will probably never know what these were.

Sites associated with the Central Plains tradition were some of the earliest recognized and are perhaps one of the most widely studied prehistoric groups within the

Plains region. Early professional work in eastern Nebraska described these manifestations and provided the baseline of data that has made them well known (Gilder 1909, 1926; Strong 1935). Characteristics of this tradition include the earliest known use of the earth lodge with a central hearth, four central support posts, interior storage pits, and extended entryways. Sites are generally small, varying from one or two house units on a small creek terrace to a dozen or more widely scattered units strung along a creek or one of the larger streams (Wedel 1959, p. 563). Recovered artifacts include cord-roughened and smoothed-over cord-roughened globular-shaped ceramics with both unthickened and collared rims. Notched and unnotched arrow points, beveled bifacial knives, unifacial side and end scrapers, and a variety of ground stone and bone tools make up the usual material culture assemblage. Detailed descriptions of sites within the Glenwood locality are provided in numerous publications and technical reports (Alex 2000; Anderson 1961; Anderson and Anderson 1960; Billeck 1993; Blakeslee 1978, 1990; Brown 1967; Dean 1881; Ives 1955; Perry 2004; Peterson et al. 2010; Rowe 1922; Rowe and Davis 1960; Schermer 1984; Zimmerman 1971, 1977). While there has been a plethora of analyses conducted on sites within the Glenwood locality, most notably on the ceramics from individual lodges, very little detailed analysis exists on the smoking pipes that are routinely encountered in excavations at these sites.

8.3 Smoking Pipe Assemblage

Smoking pipes from the Glenwood locality are fairly ubiquitous from most lodges that have been investigated through large-scale excavations. While few formal studies of these artifacts have been conducted, numerous examples are illustrated in the literature (Anderson 1961; Billeck 1993; Brown 1967; McNerney 1971, 1987). Amateur excavations under the direction of Ellison Orr and Charles Keyes in the early twentieth century provided numerous specimens, many of which are now housed at the University of Iowa, Office of the State Archaeologist, and the Museum of Natural History. Salvage archaeology projects in the late-twentieth century also generated additional examples. Many local collectors have donated pipes to the Mills County Historical Museum in Glenwood, Iowa. A large collection of prehistoric smoking pipes, as well as a reconstructed earth lodge, are on display at this facility. Yet little formal investigation of this specific artifact type from Iowa sites has been conducted. The following analysis focuses on 58 complete specimens and fragments from 19 sites (13ML64, 13ML79, 13ML119, 13ML120, 13ML126, 13ML128, 13ML129, 13ML130, 13ML136, 13ML145, 13ML176, 13ML229, 13ML230, 13ML233, 13ML235, 13ML236, 13ML237, 13ML238, and 13ML239) in the Glenwood locality. These collections are housed at the University of Iowa.

More information has been published concerning smoking pipes recovered from Central Plains tradition sites located immediately west of the Missouri River in the state of Nebraska. F. H. Sterns dissertation “Archaeology of Eastern Nebraska with Special Reference to the Culture of the Rectangular Earth Lodge” contains one of the earliest analyses of these artifacts (Sterns 1915). Sterns noted the pipes vary greatly in form and material. The most common form is a ceramic bent tubular form. The angle of the bend between the bowl and stem varies considerably. The small opening at the stem suggested that no auxiliary stem was used with this type. Several unusual forms were also noted. These included the form of a human foot, a bison skull, unknown animal shapes, human head features, and pipes with incised designs such as turkey tracks (Sterns 1915, p. 239). Sterns also noted that within one of the collections there are forms of birds, beasts, and reptiles.

Duncan Strong's 1935 *An Introduction to Nebraska Archaeology* identified the predominant pipe form of the Nebraska culture as an angular horn-shaped form manufactured from clay. They are tempered with sand, grit, or shell and exhibit an expanded bowl and a tapered stem (Strong 1935, p. 259). Gradwohl (1969) described a sample of pipes recovered from Cass County, Nebraska, which is located directly across the Missouri River, west of the Glenwood locality. He noted that several variations of the bent tubular form occur. These variations are primarily based on the extent of the angular profile (Gradwohl 1969, p. 90). Circular incisions were noted on a number of these types and one pipe had a foot-like lug applied to its basal surface. McNerney (1987) noted that the bent tubular form shared all the attributes with the horn-shaped variety except that the bowl–stem juncture forms an obtuse angle. He combined the two forms into a single category described as the plain Nebraska phase pipe. True elbow type pipes were also noted with a bowl set at a right angle to the tapering stem and a projecting prow, but these were not common. Contrary to Stern's analysis, McNerney indicates that stone pipes rarely are reported in the Nebraska phase (McNerney 1987, p. 27).

Similar to the Central Plains tradition sites to the west of the Missouri River, the most predominant pipe form in the Glenwood locality is the ceramic angular tube, or obtuse angle form. Complete specimens or fragments of this type are ubiquitous at most earth lodge sites in the Glenwood locality. These types range from the obtuse angle to a bent tubular form and fit McNerney's description of the plain Nebraska phase type (Fig. 8.2a–g). Temper is primarily sand or grit although small numbers of shell-tempered specimens are present. Decoration, when present, is usually limited to an incised ring around the exterior of the bowl or occasionally around the exterior of the stem. One specimen exhibits small vertical incisions near the top of the bowl similar to decoration applied to certain McVey ceramic vessels (Fig. 8.2c). The small diameter of the stem on a majority of the pipes again suggests that no auxiliary stems were used with these types. A number of these specimens show a stem that was apparently chewed down to nearly the bowl (Fig. 8.2e). True elbow types with the projecting prow are also present in the assemblages (Fig. 8.2h) but are much rarer than the plain Nebraska phase type.

While the majority of recovered pipes are ceramic, a number of specimens manufactured from stone have also been recovered from Glenwood locality sites. Stone pipe forms recovered include stone pipe preforms, broken fragments, and a single pipe manufactured from Catlinite (Fig. 8.3a–f). Three specimens of pipes manufactured from stone are in actuality preforms that were shaped and partially finished. Two of these preforms are manufactured from heated limestone (Fig. 8.3a, b).

Fig. 8.2 Plain Nebraska phase pipes from the Glenwood locality. Images used with permission of the University of Iowa Office of the State Archaeologist

Fig. 8.3 Stone pipes from the Glenwood locality. Images used with permission of the University of Iowa Office of the State Archaeologist

These preforms were recovered from separate lodges and contain a pronounced prow but show no evidence of drilling of the bowl or the stem. A similar example of a pipe blank of this style and material was reported from a lodge at the Whiteford site in Kansas. Whiteford is also known as the Salina Indian Burial Pit, the former tourist attraction, where over 140 individuals associated with the Central Plains tradition were interred (Whiteford 1941, p. 15). As no finished pipes of this material have ever been reported from sites associated with the Central Plains tradition, it is possible these were manufactured to this stage intentionally for some specific purpose.

A third stone elbow pipe blank from Glenwood shows evidence of partial drilling on the bowl and stem (Fig. 8.3c). A small number of broken stone pipe fragments have also been recovered from the Glenwood locality (Fig. 8.3d, e). The gray stone pipe bowl and stem are from a single specimen (Fig. 8.3d). This pipe is an elbow form and there is an incised ring around the top of the bowl. The large bore on the stem indicates that some type of auxiliary stem would have been used with this specimen. The other fragment is from a pipe that had a somewhat longer bowl than most specimens from the locality (Fig. 8.3e).

While the sample of stone pipes in the University of Iowa collections consists mainly of unfinished blanks and broken fragments, one complete specimen has been recovered from site 13ML130 (Fig. 8.3f). The pipe consists of a small elbow form with a projecting prow. An incised ring is present on the top exterior of the bowl. The pipestone used to manufacture this artifact has been identified as Catlinite B from the Pipestone National Monument quarries in southwestern Minnesota (Alex 2010, p. 12.6). This pipe is similar in form to the gray stone fragments, and an auxiliary stem would be needed. This single specimen is identical to those types from Central Plains tradition sites in eastern Nebraska that were described by Blakeslee (1981). Blakeslee argued that the recovery of this style of pipe suggests the development of an early calumet ceremony may have occurred during the late prehistoric period in the Central Plains region (Blakeslee 1981, p. 766).

The Central Plains tradition in eastern Nebraska is also associated with a wide variety of zoomorphic and anthropomorphic effigy pipe forms (Blakeslee 1981; McNerney 1987; Sterns 1915). Effigies have been reported in many amateur collections in the Glenwood locality and others have been recovered in controlled excavations (Rowe 1922; Anderson 1961, p. 98, 101). A small number of effigy forms are also present in collections housed at the University of Iowa. Many of these pipes take on the form of reptiles and birds. Effigy pipes include zoomorphic and anthropomorphic forms as well as representations of other objects (Fig. 8.4). Zoomorphic pipe forms have been suggested as possibly being used in specific vision quest ceremonies, ceremonies associated with seasonality and renewal, perhaps for use as totemic emblems of clans named for animals, or for the perceived transformation of a human into an alternate form (Blakeslee 1981; Kinsey 1989; Mathews 1981; Noble 1979). Effigy pipe forms from the Glenwood locality are usually found in lodges that also contain uncommon artifact types, primarily ceramic vessels that exhibit uncommon forms or unique decorations (Hedden and Horgen 2012).

Fig. 8.4 Effigy pipes from the Glenwood locality. Images used with permission of the University of Iowa Office of the State Archaeologist

Two zoomorphic pipes in the collections represent birds. The first pipe, from 13ML64, is a realistic representation (Fig. 8.4a). The pipe is tempered with grit and incised lines delineate the wings. The bowl is on the back of the bird near its head, which has been broken. The tail of the bird served as the stem. A red slip has been applied to the effigy. This specimen is nearly identical to a pipe recovered from a Central Plains tradition site (25HN44) in south-central Nebraska (McNerney 1987, p. 31). The specimen from the Glenwood locality is extremely similar in style—and even in breakage patterns—to the specimen from Nebraska. The second bird effigy pipe represents a different style (Fig. 8.4b). This pipe, from the lodge at 13ML119, is a shell-tempered elbow form whose prow has been decorated with two lateral incised lines suggesting a beak. An incised ring is also present below the top of the bowl. Other artifacts recovered from this lodge include a nearly complete, locally manufactured, grit-tempered, red-slipped bottle with a vertical rim and rounded lip and a nearly complete Steed-Kisker-like vessel. The red-slipped water bottle is unique in the Glenwood locality, and Steed-Kisker type ceramics have been recovered from only a few lodges. The distinct style of this effigy pipe is comparable to the modified-T pipes recovered from the Spiro Ceremonial Site in southeastern Oklahoma (McNerney 1987, p. 32; Hamilton 1952, p. 145). It has been noted that the presence of pipes from distant places may indicate a state of peaceful relations with those locales (Wonderley 2009, p. 126).

Two anthropomorphic effigy pipes are present in the Glenwood assemblages contained at the Iowa Office of the State Archaeologist and both are from a single lodge at 13ML129 (Fig. 8.4c, d). The first is tempered primarily with sand although some small flecks of shell are present. The face shows the brow, nose, ears, eyes, and mouth. The second, also shell tempered, is smaller with the face showing a nose, eyes, and ears. The eyes, nostrils, and ears are punctated, and the ears are pierced through to the back of the pipe. An incised ring encircles the top of bowl. A locally made copy of a Steed-Kisker type decorated vessel was also recovered from this lodge.

One additional human effigy pipe is reported from the Glenwood locality. This pipe is illustrated in McNerney (1987, p. 29) and is reported to have been found along Pony Creek prior to Lionel Brown's work in the area in the 1960s. The pipe was reported as shell tempered, with a prow projecting beyond the bowl and a full human figure with a forked eye motif sitting on the stem. This pipe has since been lost and its current location is unknown. Human effigy pipes are well known from the Central Plains tradition and have been recovered within the states of Nebraska and Kansas (McNerney 1971; Schmits et al. 1988; Wedel 1986).

A final effigy form in the University of Iowa collections is a mace-shaped pipe unlike any other reported from the Central Plains tradition (Fig. 8.4e). This pipe is a grit-tempered ceramic form and was recovered from the same lodge at 13ML64 as the red-slipped effigy bird pipe (Fig. 8.4a). The mace was a powerful symbol shown repeatedly in Mississippian art throughout the southeastern portion of the United States (Diaz-Granados 2004, p. 145; Dye 2004, p. 190, 196). These well-known artifacts are also found at the Spiro Ceremonial Center (Brown 1996, p. 475; Hamilton 1952, p. 158–168). The presence of this pipe has intrigued archaeologists since its discovery in the early twentieth century (Anderson 1961; Hall 1997). Hall (1997) has argued convincingly that the progression of symbolism associated with the atlatl, the atlatl flute, and the late prehistoric mace may have also played a vital role in the development of the calumet ceremony. This effigy reinforces Blakeslee's (1981) earlier speculation about the potential for the calumet ceremony developing during the Central Plains tradition in this region.

One last specimen that deserves attention is a pipe that was recovered in a field school excavation in 1984 at 13ML176, a site with a direct view of the Missouri River floodplain. This pipe is similar in shape to the plain Nebraska phase style, is shell tempered, and has incised decorations on the distal and proximal sides of the bowl and along the base of the stem (Fig. 8.5a, b). There is an incised circle around both the outside of the bowl and around the top of the bowl. No other pipe recovered from the Glenwood locality shows a similar double-incised-ring pattern on the bowl. On the proximal surface of the pipe bowl is an incised symbol of an extended left hand with fingernails and an incised circle within the hand. The pipe is broken just above the wrist area but a possible fragment of an incised line is present near the wrist. On the distal surface of the bowl is an amorphous shape with an incised circle near its base (Fig. 8.5b). A large fracture removed a portion of this incised design. Along the base of the stem is a serpent representation that apparently joined the amorphous shape on the distal surface of the bowl. The amorphous shape is just beyond the extent of the middle finger of the incised hand. The incised designs appear to represent an eye-in-hand symbol, which would have faced the person smoking the pipe and a "serpent-like" creature with an amorphous shaped head facing away.

These well-known symbols are generally associated with the Mississippian Ideological Interaction Sphere (Lankford 2007, p. 173; Reilly et al. 2007, p. 3; Waring and Holder 1945, p. 4). This pipe is not the only example of the use of these symbols in the Glenwood locality. A review of collectors' notebooks from the Glenwood locality reveals a second pipe recovered from the area in the 1930s that was also decorated with an eye-in-hand symbol (Fig. 8.5c). The 1940s field notes indicate that the pipe was recovered at the "Hog Farm" excavations in 1938 on the State Institution grounds in Glenwood. Field notes indicate that "the figure of a hand was incised on both sides of the pipe" (Orr n.d., p. 23). Perhaps the most famous eye-in-hand representation is the rattlesnake disc from the Moundville site in Alabama (Steponaitis and Knight 2004, p. 166). This sandstone disc shows a left hand with fingernails and an apparent eye on the back of the hand. Surrounding the hand are two intertwined serpents with cat-shaped heads, horns, and extended tongues. The eye-in-hand motif is also found on artifacts from Spiro (Brown 1996, p. 600, 605, 607; Hamilton 1952, p. 208).

The eye-in-hand symbol appears in at least one other context on sites associated with the Central Plains tradition (Strong 1935, p. 111). An antler bow guard-type bracelet was recovered in the early-twentieth century from the Graham Ossuary at 25HN25 in south-central Nebraska and is decorated with two hands. A circle was incised within each hand. First identified by Strong (1935) the decoration of this artifact is described as an outspread hand at either end reaching along the bracelet.

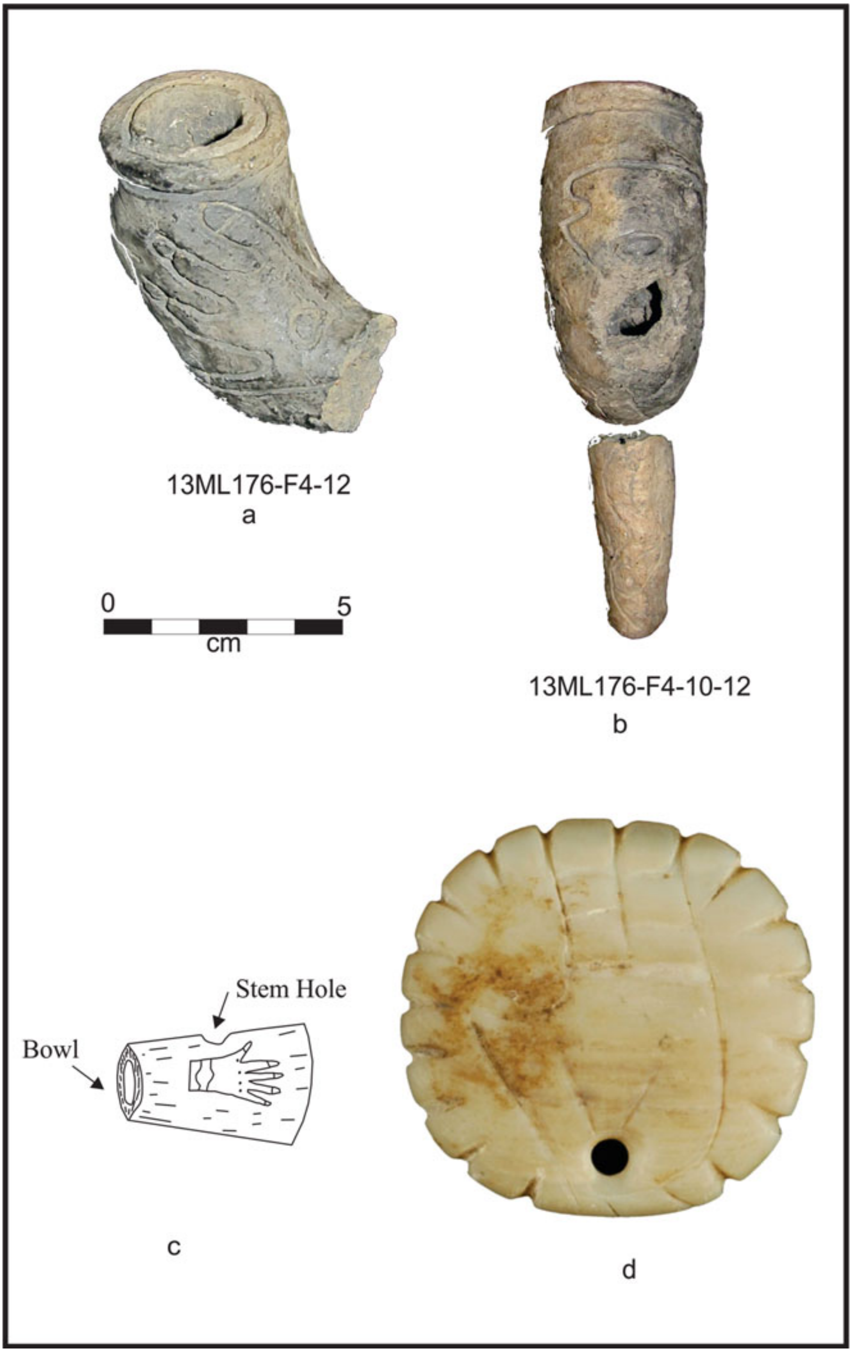

Fig. 8.5 Eye-in-hand representations from the Glenwood locality. Figure 5c adapted from Orr (n.d.). Images used with permission of the University of Iowa Office of the State Archaeologist

The wrist of each hand is decorated with four angular lines probably representing bracelets. There is a circle on the center of each hand, and the nails of each finger are clearly indicated. Around the greater curve of the object are six double lines, each cross-hatched at 8 mm intervals. Each of these double lines culminated in a point and reaches just within the fingers at both ends. The artifact is illustrated by both Strong and later by Wedel (Strong 1935, p. 111; Wedel 1986, p. 112–113). Wedel recognized the southeastern orientation of the iconography of this object but declined to speculate on whether "cult" activities were taking place on the Republican River (Wedel 1986, p. 113). The recovery of this artifact from an ossuary lends credence to the interpretation that these symbols may in fact be related to a mortuary belief complex perhaps also practiced by groups associated with the Central Plains tradition.

Finally, a shell pendant with petaloid edges recovered from salvage excavations at site 13ML139 in the early 1970s has historically been described as a turkey cock with a forked-eye motif (Hotopp 1978). This artifact is a very different style than most turkey cock or other bird pendants recovered from sites in the southeastern United States. Flipping the artifact over reveals that the motif resembles another possible hand symbol with a hole in the center of the palm (Fig. 8.5d). Petaloid edges surrounding shell pendants have been interpreted as denoting a celestial origin or meaning of the motif it encloses (Reilly 2007, p. 53). A celestial designation would reinforce the potential identification of this artifact representing a possible eye-in-hand symbol.

8.4 Discussion

Analysis of this smoking pipe assemblage from the Glenwood locality provides numerous potential insights into the Central Plains tradition occupation in Iowa that should be investigated further. While smoking pipe remains are frequently encountered at lodge sites in this locality, the presence of special symbolic shapes, styles, and symbols suggests specific rituals may have been performed in this locality that may have had impacts on the widespread phases archaeologists have classified as belonging to this tradition. Blakeslee (1981) has pointed out that it is extremely difficult to demonstrate the presence or absence of a specific ritual using archaeological data. However, analysis of physical traits and interpretations of decorative motifs associated with specific artifacts provide compelling clues as to the possible practices and potential origins of historically documented rituals in this prehistoric setting. There is widespread archaeological understanding that ritual is a form of human action that leaves material traces, where religion is a more abstract symbolic system consisting of beliefs, myths, and doctrines (Renfrew 1994).

For example, the presence of the eye-in-hand motif indicates that pipe rituals may have included some type of path of souls mortuary–renewal ritual. Utilizing ethnographic notes and myth texts from a large geographical area Lankford (2007) has suggested the iconographic complex associated with the eye-in-hand—winged serpent, skull and bones, and raptor—illustrates a mortuary belief complex in which the Milky Way is seen as the path that deceased souls must walk. This "path of souls" model describes a belief that after a certain period following death the free soul leaves the body and begins a journey to the west, the place of the setting sun, the point of transition from day to night. The free soul must continue the journey to the realm of the dead, which is so far to the south that it can only be reached by walking the path of souls, the Milky Way, across the night sky. Ethnographic literature associated with historic groups in the area, such as the Pawnee, the Omaha, and the Osage, indicates these groups had beliefs that the Milky Way was associated with a journey after death (Fletcher and Flesche 1911, p. 587; Fletcher 1903, p. 13).

According to this model, it was believed that to get to the path the free soul must leave the earth-disc and enter the celestial realm through a portal in the sky. The portal in which the free soul must enter the celestial realm is a constellation in the shape of a hand and the portal is in its palm. The hand constellation is the lower portion of the constellation that is known as Orion (Lankford 2004, p. 213). According to the model, the portal must be entered by a leap at the optimal time when the constellation vanishes into the water to the west. This occurs just before dawn on November 29 to just after dusk on April 25 after which the constellation is not visible again for 6 months. During the winter period, this portal is available on the horizon for a few brief moments and the free soul must make the leap at that time or be lost. Free souls who are not successful in this transition may enter the underworld or remain in the middle world and become threats to the realm of the living (Lankford 2007, p. 177).

The recovery of multiple artifacts from the Glenwood locality associated with a possible path of souls mortuary renewal model is intriguing on a variety of levels. The locality is the only area east of the Missouri River where Central Plains tradition earth lodge sites have been identified. There has been a good deal of speculation as to why this specific area was chosen for occupation. We know that no formal Central Plains tradition burials, ossuaries, or cemeteries have been identified in this locality. The Missouri River forms the western boundary for this small area of occupation, and the Loess Hills rise and fall like an unnatural series of mounds in this area that is a unique landscape in the Central Plains. The Central Plains tradition ushered in a new lifestyle on the Plains concentrating on maize agriculture. The coming together of widely dispersed groups and sharing of new technologies, such as the adoption of the earth lodge and maize agriculture, likely involved some religious ceremonies and the adoption of a certain belief system for the factors of the Central Plains tradition to have spread as far and as fast as it did with few identifiable local antecedents. A major change in lifestyle and subsistence may have necessitated new forms of belief.

Hall (1983) has pointed out that the line separating agriculture and religion in prehistoric times may have been very weak. Perhaps a ritual related to the path of souls model focusing on death and renewal was one of these types of ceremonies. As mortuary rituals concentrate on the west—where the sun sets—these symbols perhaps provide clues as to the unique occupation of this locality. The Omaha believed that spirits could not cross a stream (Fletcher and Flesche 1911. p. 591). Perhaps if during this specific ritual the free spirit did not succeed in making the leap into the portal and was left to wander, the Missouri River would keep the spirit from reentering the traditional Central Plains tradition homeland. The topography of this locality, with sharp-featured alternating peaks and saddles that dip and climb along narrow crooked ridge crests, could conceivably be associated with the concept of "the rising and falling sky" as expressed in the many myths and legends associated with trips into the sky (Lankford 2007, p. 204). The position of this locality on the east side of the river could also be associated with renewal as this area would receive the sun's rays before the remainder of the Central Plains. The fact that the date of April 25th is the last night of spring that the Hand constellation would be visible in the sky until the next fall also suggests the ritual could have been associated with the planting of corn. The Iowa State University agricultural extension office indicates that for the optimum yield of corn, planting in this region must be done between April 17 and May 8.

Historically, the Plains earth lodge itself was described as representing a part of the cosmology of beliefs in which the directions played major importance. As reported by Chamberlain (1982), the four-pole ceremony conducted in the construction of the earth lodge by the Skidi Pawnee contained references to mounds of dirt in the east and their relationship with the gods in heaven.

> …Next in importance is the fireplace representing the earth's horizon…in preparing the fireplace the grass is cleared away for some distance around it. This space represents the horizon where the sky touches the earth. Next a circular excavation is made…This excavation represents the sun. The earth from the excavation is carefully removed and carried outside the lodge a few paces to the east where it is carefully heaped upon a little mound. This mound is compared to a fund of knowledge. It reminds the priests of the first commands of Tirawa to the gods…In this pile of earth is the voice to man of the gods. This mound represents the words of Tirawa (Chamberlain 1982, p. 157).
>
> You see our fireplace. It is the morning star. It is also a picture of a turtle where really it is the morning star. You see the head of the turtle is towards the east. That is where the gods do their thinking in the east. While in the west all things are created and you see the hind end of the turtle in the west (Chamberlain 1982, p. 160).

In addition to a possible death and renewal ritual, the potential origin and development of a calumet ceremony in this region would help explain the variety of artifact types encountered in single lodge within this locality. The Pawnee calumet or the Hako ceremony served to form ceremonial friendships and to create fictions of kinship between different villages (Fletcher 1904, p. 280). As suggested by Blakeslee (1981), the calumet ceremony and its ritual adoption component may have been developed in this region to cement intergroup relations among different cultural groups. This type of ritual, developed in an area where artifacts suggest interaction of geographically widespread groups, could possibly offer an explanation as to the adoption of the Central Plains tradition lifeways over such a large geographical area in such a short span of time.

8.5 Conclusion

The recovery of smoking pipes from the Glenwood locality includes numerous effigy types and individual pipes decorated with iconography typically associated with cultural groups of the lower Mississippi Valley. The recovery of these pipes in a small locality on the east side of the Missouri River, separated from the main areas of occupation of the Central Plains tradition, only adds to the many questions concerning the presence of these types of sites in this area. An explanation for the origins, rapid development, and eventual disappearance of the Central Plains tradition has long eluded archaeological research in the Central Plains. The recovered assemblages from sites in this locality include individual artifacts with attributes that span a large geographical area of the central and southeastern portions of the continent, indicating some type of contact between different cultural groups was occurring in this area.

The identification of some of the earliest recovered Catlinite pipes in this region, of the forms associated with the historically documented calumet ceremony, suggests a possible origin of this ceremony in this area in the early portions of the last millennium (Blakeslee 1981). This ritual ceremony may have aided in the introduction and adoption of a new practice that quickly spread throughout the Central Plains region. Other potential rituals may have been performed in this region based on the types of specialized smoking pipes that have been recovered.

Through speculation and correlation with historic Native American belief systems, ideas concerning specific rituals have been suggested in this chapter. However, it is noted that these pipes may have been used in their own ways for completely different ritual practices. The practices may or may not have been enacted in the same manners as they were in the places of their origin. As different groups adopt new beliefs, they certainly adapt them to their own needs and practices. Future research should concentrate on identifying ritual spaces in this locality. Such investigations can better identify the types of activities that were occurring. We are still far from an understanding why Central Plains tradition sites were occupied in this small locality in western Iowa.

Although we still have much to learn, the material culture and environment of the Glenwood locality provide a tantalizing possibility for examining a prehistoric ritual landscape. This chapter concludes by comparing the Glenwood locality with Renfrew and Baum's (1991, p. 359–360) four criteria for the archaeological determination of religious ritual space. The first criterion is the focusing of attention; the ritual may take place in a spot with special natural associations or an area that is rich in repeated symbols. The Loess Hills' physical characteristics in the Glenwood locality provide a unique landscape within the Central Plains region. Second, there may be a boundary zone between this world and the next. The Missouri River forms a natural boundary between earth lodge sites within the Glenwood locality and the remainder of the territory occupied by the Central Plains tradition. Third, there may be evidence of the presence of a deity. Evidence may include ritualistic symbols that often relate iconographically to the deities worshipped and to their associated myth.

The presence of multiple images of the eye-in-hand motif within this locality suggests the recognition of some type of belief system that associated an unearthly being or domain with these symbols. And finally, the role of participation and offering in the ritual may employ various visual devices to initiate the religious experience and these may be reflected in art, iconography, decorations, or images. The presence of these motifs on smoking pipes may indicate the method of inducting the religious experience. The Glenwood locality appears to meet all these defined criteria. This suggests that the area could have been occupied for the practice of specific rituals necessary for the development and continuance of a new form of society.

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Chapter 9
Aboriginal Use and Context of Pipes, Tobacco, and Smoking in Northwestern North America

Grant Keddie

9.1 Introduction

Aboriginal groups in the far northwest of North America were some of most northerly Native peoples throughout the Americas to use tobacco (Turner and Taylor 1972). This chapter provides an overview of tobacco consumption and smoking practices of Native peoples living in British Columbia, Canada, and the Northwest Coast of the United States. The discussion breaks the larger region into three subregions—the Interior Plateau of southern British Columbia, the Northern Coast of Alaska and British Columbia, and the Southern Coast of British Columbia—to compare and contrast the uses of tobacco and pipes between different groups (Fig. 9.1). The main focus of the chapter is on British Columbia, a province that has a diverse range of environments in its 360,000 square miles. Environmental variability can be substantial; the Southern Interior is marked by dry summers and cold winters while the Pacific coastal rainforest has mild winters and is more temperate overall. It was home to Native peoples speaking 32 mutually unintelligible languages belonging to seven different language families. Native peoples throughout the region were hunter-gatherer-fishers, each with their own distinct histories and way of life.

In the Interior Plateau of southern British Columbia, First Nations peoples cultivated or collected the wild *Nicotiana attenuata* species. The practice of smoking likely goes back to the thirteenth century when stone pipes appeared in the region. Smoking of tobacco does not seem to have been practiced on the coast of British Columbia, southeastern Alaska or among the Dene (Athapaskan) speakers of Northern British Columbia until Europeans introduced it. The Haida and Tlingit

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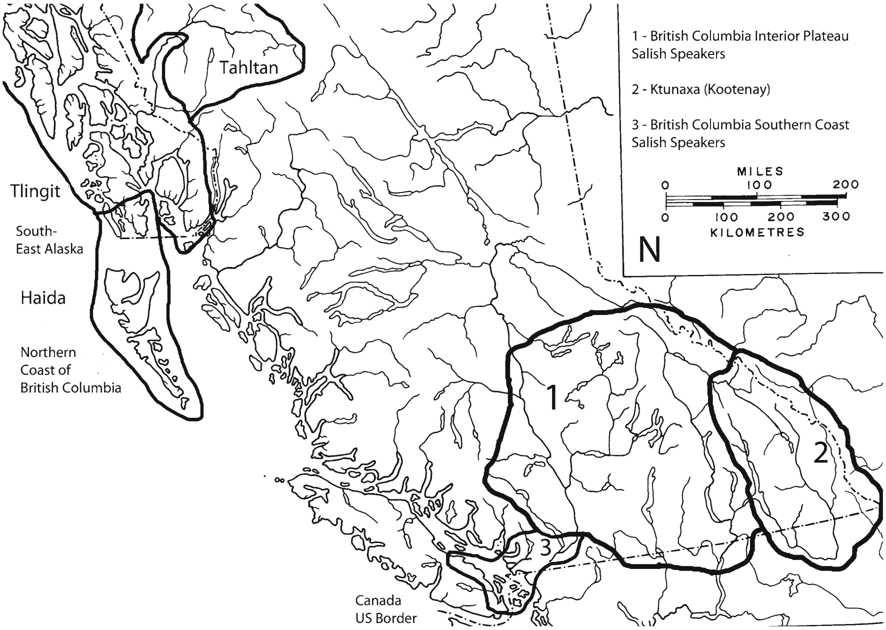

Fig. 9.1 Map showing locations mentioned in text

peoples on the northern coast cultivated the *Nicotiana quadrivalvis* (bigelovii variety) but did not smoke it. Instead, they mixed it with a lime solution and sucked it, a practice similar to that of other cultures far to the south (Barrett and Gifford 1933, p. 195; Heizer and Whipple 1960, p. 24; Kroeber 1941). On the southern coast of British Columbia, the presence of some limited pre-contact smoking practices related to ritual activities is of a speculative nature. The archaeological evidence of mostly fragmentary stone pipes suggests their use as exotic trade items rather than necessarily reflecting evidence of smoking activities.

9.2 The Canadian Interior Plateau

9.2.1 Tobacco

Nicotiana attenuata, a species of tobacco that grows wild in dry areas of the Great Basin, southern Plains, northern Idaho, Montana and Washington State, extended from the south into the dry southern Interior Plateau of British Columbia, where it was both gathered wild and cultivated in small gardens. Its historic use is well documented for the southern Interior. However, European tobacco had mostly replaced it by 1900 (Teit 1900, p. 300). It is now extremely rare in southern British Columbia and has disappeared from many areas of Washington State. This plant was both cultivated and collected in the wild by the Ktunaxa of the Kootenay Region and the Nlaka'pamux (Thompson) of the lower Thompson/Fraser River Region. The area near the Canada–United States boundary became known as Tobacco Plains. Other groups speaking Interior Salish languages: the Okanagan, Stl'atl'imx, and the Secwepemc, smoked tobacco, either gathered wild or obtained by trade.

Interior peoples used tobacco for many ritual purposes. The Ktunaxa of south-eastern BC were famous for sowing and harvesting tobacco for ceremonial smoking. The origins of some of their ceremonies known in historic times were shared with their neighbours to the south and east. The Ktunaxa have many legends that make reference to the use of tobacco (Turney-High 1974). Large tobacco gardens were divided off for different families or groups of people. There was the recognition of a head grower who was often called the tobacco shaman and whose medicine was believed to keep the crop healthy. The Ktunaxa also had large gatherings with sports events that involved prizes of tobacco (Johnson 1969).

Among the Nlaka'pamux, when a death had taken place in the winter house, it was purified with water infused with tobacco and juniper, and widowers abstained from smoking for half a year. One year after the death a ceremony was held in which the male relatives smoked a large pipe. The pipe was constantly passed around in the direction of the sun. An old man had to fill the pipe as soon as it was empty. Warriors smoked facing towards the sun and souls were believed to be brought back on tobacco smoke (Teit 1900, p. 331–334; 357–359). In the Southern Interior, tobacco grew in the warmer valleys. The leaves were dried, greased, and mixed with bearberry-leaves, and then roasted. In historic times, women smoked equally as much as the men, but traditionally only women who claimed to be strong in medicine smoked (Teit 1900, p. 300).

A variety of additives were used with tobacco, but it is difficult to determine whether these are older traditions or ones adopted in the historic period as a result of the introduction of European trade tobacco. In the late 1890s, Chief Salicte of Nicola Lake said that the Native tobacco was used without any mixtures and the bearberry plant was used with European-introduced tobacco (Smith 1900, p. 429).

The dried leaves of Kinnikinnick or bearberry (*Arctostaphylos uva-ursi*) were widely known to have been mixed with introduced tobacco for smoking (Anderson 1925, p. 102) and may have been smoked alone. Interior peoples also used Canby's Lovage (*Ligusticum canbyi*) with tobacco to give a pleasant taste and provide a relaxant. It was also held in the mouth as a chewing tobacco. Indian Celery (*Lobatium nudicaule*) was used as flavouring (Turner 1997, p. 80). Turner noted that the Nlaka'pamux mixed roots and leaves of Mountain Valerian (Valeriana dioica) in a dried and powdered form and the powdered leaves and bark of the Dwarf Wild Rose (*Rosa acicularia*) with tobacco as flavouring. She also noted that some people smoked the leaves or bark of Red Osier Dogwood (*Cornus* sp.), or mixed them with tobacco (Turner 1997, p. 169; 150; 107).

There is historic evidence that some groups prepared tobacco using stone mortars. Flat boulders were provided with a shallow depression on one side, and used to pound tobacco (Teit 1909, p. 474). Stone mortars for grinding tobacco were seldom used for other purposes and were confined mostly to the Kamloops and Bonaparte divisions of the Secwepemc. The anthropologist James Teit found only one old man who was positive that stone mortars, not the flat grinding slabs, were made by contemporary peoples, while all the other band members declared that they were made by Coyote in mythological times (Teit 1909, p. 500).

9.2.2 Stone Pipes

9.2.2.1 Historic and Archaeological Evidence

The practice of smoking is well documented in the archaeological record based on the presence of stone pipes. Straight tubular pipes, sometimes with a trumpet-like end, are an older style found on sites in the Southern Interior of British Columbia dating to around the last 1200–1000 years (Fig. 9.2). Most are found in the mid-Fraser and Thompson River region and southern river valleys such as the Okanagan. Similar pipes are found along the Columbia River of Washington State. Sharp-angled elbow pipes replaced the more traditional varieties of tubular pipes (Fig. 9.3) in historic times.

Of the many objects made of steatite, pipes are one of the most common items. Most of these have been found associated with burials. Sanger gives a suggested date of AD 1400–1750 for the Chase burial mound site. The site is located on a ridge-like formation extending into a floodplain of the South Thompson River in south central BC, three miles west of Chase. Much of this site was looted, but a few of the burials were systematically excavated. He shows 11 tubular pipes from the site in a photograph provided by Wilson Duff. All of these are of the tubular/trumpet type—the bowl flares out like a trumpet bell. Five are complete and the others fragmentary. A number of the pipes had an encircling ring at the junction of the bowl

Fig. 9.2 Tubular steatite pipes from the Lytton area of southern British Columbia. Royal B.C. Museum (RBCM) collection

Fig. 9.3 Steatite elbow pipes exhibit a variety of shapes and sizes, and have bottom spurs in imitation of European clay pipes. Lytton area, Interior Plateau. RBCM collection

and stem. Several were decorated with incised lines. One has a human head carved in bas-relief (Sanger 1966, p. 25; 1968a, p. 105; 165 Plate IV Fig. B).

The Texas Creek site, EdRk-1, located on the Fraser River 12 miles from the town of Lillooet, is composed of inhumations in pits dug into sandy terraces, promontories, and loose talus slopes. The site is thought to date between AD 1400 and 1600. The site assemblage contained four pieces of tubular pipes (three stems and one bowl fragment). These pipes are very similar to those described in ethnographies as the earlier tubular varieties. The pipe with the longest stem has a raised ring at the bowl junction. The bowl fragments indicate a gently expanding trumpet variety (Sanger 1968b). An example from a non-burial context is illustrated in Fig. 9.10.

Three partial tubular pipes were found with a burial in the Merritt or lower Nicola River area at site EaRf-6. The artifacts include two trumpet-shaped bowls that expand outward from a raised ring that defines the boundary of the bowl and stem. West (1934, p. 506) shows six pipe examples collected by Emmons from around Lytton, BC. Fifteen pipe fragments also were found at four house pits at the Keatley Creek site, which dates to approximately 1000 years ago (Hayden 2000a, p. 35–40; Hayden 2000b, p. 195–196).

In addition to tubular and elbow pipes, zoomorphic motifs are fairly common, such as the deer head carving and bird bowl illustrated in Fig. 9.4, or the bird head with a hole for a stem at the back and a broken extension above the head in Fig. 9.5. Borden attributes a small, seated human forming a pipe bowl as belonging to the Emery Phase (before 1250 AD), but admits that this Fraser River Canyon Phase is still poorly defined (Borden 1983, p. 156–7; Fig. 8:29a). Some of the pipes and other artifacts may have been imported as trade items, such as that in Fig. 9.6 (top), which was carved from a distinct type of raw material found in the Eastern USA. Other, rarer, examples include the thick wedge-shaped bowl in Fig. 9.6 (bottom right).

Fig. 9.4 Deer carving on pipe bowl and bird forming a pipe bowl. From private collections

Fig. 9.5 Bird head bowl. Hole for pipe stem at back of head. Top extension is broken. Lytton area. RBCM EbRj-Y:481

Fig. 9.6 Rare pipe styles. (**a**) *Upper*: Trade pipe. RBCM EbRj-22:5. (**b**) *Left*: Short thick tubular bowl. EbRj-Y:1175. (**c**) *Right*: Thick wedge-shaped pipe bowl. EbRj-Y:1199. Lytton area, Interior Plateau

9.2.2.2 Historic Observations

Harlan I. Smith described tubular pipes that he observed Native peoples using in Lytton (Smith 1899, p. 154–158) and in Kamloops, BC (Smith 1900, p. 428–29). Teit noted that elders remembered seeing tubular pipes in use but they were not as common as elbow-shaped pipes. One tubular pipe was seen in use in eastern Washington as late as 1896 (Teit 1900, p. 300; see Smith 1913, Plates XIII and XIV).

Teit observed that in the decades leading up to the late 1890s, pipes were made mostly of stone with high, narrow bowls and long stems. He illustrated a variety of types, which included elbow pipes with lead inlay designs (Teit 1900 Fig. 271, Fig. 9.7). The material used was a dark greenish, slightly transparent soapstone and a soft slate, which, when rubbed with grease and smoked, turns a glossy black colour. Teit also noted that some pipes were made of sandstone, white clay, sagebrush-root, and antler. Carved designs in the pipes were once filled with red ochre, but in historic times they were infilled with melted lead or German silver (Teit 1900:300). Verne Ray, who collected information two generations later than Teit, notes that the Secwepemc still used straight tubular-shaped pipes and the Nlaka'pamux also used them along with elbow pipes. The latter group and the Stl'atl'imx used a mortised steatite to carve out pipe bowls (Ray 1942, p. 188).

Some pipes had a square piece at the bottom of the bowl with an attachment hole for a string connecting it with the stem, on which beads were often strung, or in the case of a shaman's pipe, decorated with eagle feathers (Teit 1900, p. 300). This description may refer to the style of pipe shown in Fig. 9.8. Smith observed people in the Thompson River region winding string around the mouthpieces of their pipes to make them easier to hold in their mouths (Smith 1900, p. 428).

Teit notes that among the Okanagan the older tubular pipes had figures of animals carved along the top and others were carved like an animal's mouth. There is one case in which a First Nation man named George Lezard from the Penticton Band provided the name *Kalkalues* for a steatite pipe with a lizard-like creature mounted on top. This appears in the notebook of Atkinson (1937) and is seen here as Fig. 9.9.

Fig. 9.7 Elbow pipe with lead inlay design. Styled after European pipes

Fig. 9.8 Rare large sandstone pipe with holes for attaching a string to the stem or hanging ornaments. Shuswap Lake. Interior Plateau. RBCM EfQw-9:12

Fig. 9.9 Soapstone pipe with Lizard carving

Teit's reference to a "simple pipe bowl" in use may refer to pipes with an extension on the bowl (see Fig. 9.10) that fits into a wooden stem and had a raised ring defining the proximal end of the bowl (Teit 1930, p. 278). He mentions that a few men had small male images that they kept in their medicine bags and these had some connection with guardian spirits. Some of these were tubular pipes with anthropomorphic figures. They were rare and apparently had gone out of use long ago, as Teit could not find any old men who had ever seen them (Teit 1909, p. 603). The author observed one of these in a private collection in the 1970s. It was a full figure of a man with the pipe tube forming the centre of his body, arms and legs angled out to the side, and his head forming the bowl. Others have a human head only as in Fig. 9.11.

9.2.2.3 Manufacturing Techniques

During his ethnographic research in the early-twentieth century, Teit noted the use of scouring rush, and the practice of including "a mixture of grease and pitch of the black pine" to manufacture pipes (Teit 1900, p. 182). Scouring rush (*Equisatum*

Fig. 9.10 *Left*: Tubular pipes with trumpet-shaped bowls. *Right*: Variation of proximal ends of pipes

Fig. 9.11 Double faced steatite pipe bowl. Lytton area, interior plateau; RBCM EbRj-22:3

hyemale) or "horsetail" is rough because of silica imbedded in the outer cell walls. This property makes an ideal abrasive for the finishing, smoothing, and polishing of pipe surfaces. Teit also noted that steatite used in pipe manufacture was cut using beaver tooth knives and bored with flaked stone drills (Teit 1909:474).

Decades later, some of these practices were still being used. The late Joseph Harris of the Penticton Museum (personal communication 1974) told the author that

Fig. 9.12 Straight parallel cut marks showing the use of iron files in the making of older style tubular pipes

Fig. 9.13 An example of a late historic soapstone pipe carved in 1908 from the Thompson River area; RBCM EdRh-Y:6

his friend and predecessor Reginald Atkinson obtained information from George Lezard of the Penticton First Nation who was the last of the traditional carvers in British Columbia. Lezard carved soapstone pipes as well as animals and other items for the tourist trade with hacksaw blades, a variety of steel files, and a steel point as late as the 1960s (Sismey 1966).

Atkinson (1937) recorded that black soapstone was carved as it hardened and that pipes varied in size from 2-8 inches. He also noted that tubular pipes with wooden stems were smoked in an upright position. Lezard told him that a plant called mare's tail (likely *E. hyemale*) was used as a file to wear off the rough surfaces. It was also used to smooth the bore after it was roughed out with a stone drill bit. The raw material that Lezard used came from a source on the Similkameen River. The author obtained some of this light-green coloured material and experimented with it, grinding with scouring rush and cutting with beaver teeth. These techniques worked well, especially with softer material that was recently dug out. Evidence in the form of distinct parallel lines seen in the primary shaping of the pipe indicates that even some of the old styles of pipes were being made with iron files (see Fig. 9.12). Finally, an example of a later and more angular-shaped soapstone pipe carved by a Stl'atl'imx man in 1908 is seen in Fig. 9.13.

Fig. 9.14 Catlinite pipes traded into British Columbia

9.2.3 Trade

Exchanges in pipes and raw material, occurring at the Tulameen River forks trade centre, involved people from the Similkameen, Okanagan, and Thompson River regions. Teit notes that pipes and pipestone of red, brown, green, mottled-yellowish, bluish, and grey colors were interchanged. Teit also suggests that the bright-red catlinite came from the east, mostly via the Kalispell people of Idaho, and the green soapstone from the Thompson River (Teit 1930, p. 254). Black soapstone was obtained in the Similkameen Valley, below the village of Keremeous.

A large variety of catlinite pipes were also traded into British Columbia in the historic period. The tomahawk pipe, second from right in Fig. 9.14, could be purchased at Hudson Bay Company stores (Teit 1900, p. 300; 1909). When speaking about the Lake and Okanagan First Nations from information obtained in the 1920s, Teit indicated that trade goods had gradually filtered through the larger region, but in some places a few people occasionally made special long distance trading trips across mountain ranges and through uninhabited country to distant trading partners. After the introduction of horses (c. mid–1700s), large parties undertook these trips more regularly.

When routes opened in July and August, the Similkameen and Okanagan sometimes crossed the Cascade Mountains and visited the people of Hope on the lower Fraser River. These visits occurred annually with the regular use of horses. Regular trade also occurred from The Dalles area on the Columbia River to the Okanagan (Teit 1930, p. 250; 254). Simon Fraser observed a pack horse along the lower Fraser in 1808 (Lamb 1960), but an early Spanish account suggests the people from the interior were coming on horseback to the Fraser River Delta area as early as 1791 (Wagner 1933).

9.2.4 Interior Plateau: Ritual Use and Status of Pipes

Pipes described in a traditional story involving the characters Hare and Fox suggest a status difference in the types of pipes. Fox was smoking a fine stone pipe carved and incised with numerous designs, while Hare's pipe was made of wood (Teit

1909, p. 625). The stems of most stone pipes were made of the preferred Maplewood and were up to a foot and a half in length.

As Teit observed in 1900, the custom of passing the pipe around a circle of men was still being practiced to some extent. This was done before making speeches or discussing business transactions. The pipe was passed around while a person spoke at gatherings. It was customary, when a man or woman wanted to converse with a friend, to prepare a pipe and sit down for a smoke, and everyone would take turns puffing. The pipe was passed around in the direction of the movement of the sun. (Teit 1900, p. 302).

Teit notes that among the Okanagan ceremonial smoking was practiced at the beginning of serious undertakings, such as councils. What is described as a large pipe seems to play a special role in a number of ceremonies. During a Spring Dance at fishing sites, all the middle-aged and elderly men gathered after sunset in the house of the head chief for dances. Here they had a ceremonial smoke that included passing around a large pipe. Pipes smoked at gatherings or councils typically were much larger in size than ordinary ones (Teit 1900, p. 300 and 335; 1930, p. 278). It is possible that the pipe in Fig. 9.8 may be one of these large pipes.

9.2.5 The Social and Regional Context of the Interior Plateau Pipes

Stone pipes from the Interior Plateau of BC were clearly introduced from the Columbia River area to the south. The work of Harlan I. Smith (Smith 1899, 1900, 1910), James Teit (1900, 1906, 1909, 1928, 1930), and others showed the similarities between these areas but explanations for these similarities were not articulated until recent times. Hayden and Schulting (1997) show stone pipes as part of a larger assemblage of what they define as mainly prestige artifacts that provide evidence of an Interior interaction sphere. As this northwestern Plateau interaction sphere transcends language and cultural boundaries, they argue that factors other than common historical origins explain the similarities of artifacts among these Plateau groups. Pipes are seen as part of the prestige items (and I would add ritual activities) acquired by a class of elites who seek to maximize their power and wealth at the tribal level. These individuals gain their status "in part, by establishing trading, marriage, ideological, military, and other ties to elites in other communities and regions. They use these ties to monopolize access in desirable regional prestige goods and to enhance their own socioeconomic positions" (Hayden and Schulting 1997).

Furthermore, Hayden and Schulting (1997) view these traded prestige items as being concentrated in communities that have the greatest potential to produce surplus and to develop socioeconomic inequalities. The extensive examination of pipes discussed here does not change this general conclusion. My study, however, shows a more diffuse distribution of pipes than is shown by Hayden and Schulting.

Fig. 9.15 Five ornamental objects cut from broken pipe bowls

Distribution centres where most pipes are found may be a product of the intensity of where archaeologists have been undertaking their work or where construction activities have uncovered burials. For example, burials are often located in sand-banks and talus slopes in narrow canyons, where they are frequently uncovered by roads and railway lines.

Although Hayden and Schulting refer to the interaction period as pertaining to what are termed the Plateau and Kamloops horizons in British Columbia (400 BC–1750 AD) pipes only occur in the later part of this time period (between 750 and 950 AD). Prentiss and Kuijt (2012) argue on the basis of dating sequences that people in this region did not have the capacity to accumulate excess material wealth before 750 AD when populations reached their maximum. In the large excavated village sites such as Keatley Creek, Bridge River, and the Bell site, many of the early pipes are fragmentary. For example, a child burial from house pit 19 at the Bell site contained five pipe fragments—all made into pendants. The value of the raw material from which pipes were made is likely the reason that broken pipes were reworked as functional pipes or cut into sections to create other kinds of artifacts. Figure 9.15 shows five steatite bowl fragments from site EeRk-4, near Lillooet, made into pendants. These pendants were associated with obvious trade goods in the form of 246 dentalia shells from the coast. This leads one to be cautious about interpretations of the presence of pipe fragments as evidence of smoking activities.

I argue, as an extension to Hayden and Schulting's ideas of elite connections, that these connections were enhanced in the late pre-contact period by the long distance effect of European fur trade activities on the eastern portions of the continent. Changes in pipe styles from straight tubular pipes to European angled pipe bowls may be an extended product of European pipe styles found further east and their entry into these more western trade networks before the presence of Europeans in the local region.

9.3 Northern Coast of British Columbia and S.E. Alaska

9.3.1 Tobacco: Its Origin, Use, and Preparation

The *Nicotiana quadrivalvis* (bigelovii variety) is the type of tobacco cultivated on the Island of Haida Gwai (Queen Charlotte Islands) and some islands in southern Alaska in Tlingit territory. The Tlingit and Haida were cultivating *N. quadrivalvis* before the European trade period of the 1770s and traded it to the Nisga'a, Coast Tsimshian, and Tahltan groups on the mainland. Although popular among the people of the Northern Coast, *N. quadrivalvis* (bigelovii variety) is Native to California and southern Oregon where it was sometimes cultivated (Linton 1924; Harrington 1932; Heizer 1940; Kroeber 1941). *Quadrivalvis* was introduced from the West through Idaho and into the northern Plains of Montana and North Dakota as a cultivated plant. It was also cultivated in the Columbia River rapids area of Washington State. This eastern variety is known as the sub-variety quadrivalvis (Haberman 1984). The same aboriginal term for this plant "op" or "ope," is used throughout much of its geographic range despite the fact that a number of different language groups are represented (Dixon 1921, 1933; Driver 1969). There is no known historic connection with this plant on the northern coast and the area of its origin much further to the south.

In the 1880s, Niblack's (1890, p. 333) First Nation consultants indicated that the origin of the pre-European tobacco plant in this region was Haida Gwai (Queen Charlotte Islands). Captain Vancouver observed the cultivation of tobacco at Kootznahoo or Admiralty Island [near Point Caution] in 1783. He noted that small square garden patches of a species of tobacco, which he understood to be commonly cultivated on the Queen Charlotte's Islands (Vancouver 1798), could be found in the vicinity of houses. Over 100 years later, Charles Harrison recorded a Haida story he called The Tobacco Legend. The story indicates that the Haida obtained tobacco from a tree that was safeguarded by a powerful deity who lived far inland on a mountain in the Stickeen country. They went to this location on top of a mountain and shot seeds down from the tree, took them home, and planted them (Harrison 1925, p. 141). The importance of tobacco is also revealed in the Story of Those Born at Skedans. When many killer whales lay in Canoe Cove in a threatening manner, they caused the whales to leave by laying out tobacco and lime for them, which was taken up by a mythical creature resembling a porpoise who "took it into its mouth." (Swanton 1905, p. 88).

Native inhabitants of the Northern Coast did not smoke *N. quadrivalvis*. Rather, they mixed it with a lime solution and sucked the substance, as was common in several regions from Central America to California (Dawson 1880; Chittenden 1884; Deans 1890; Kroeber 1941; Newcombe 1897; Turner and Taylor 1972). The leaves were cured by drying and crushed in a stone mortar. A separate mixture of lime was made by heating up abalone or clam shells, putting them in cold water, and then crushing them into a fine white powder. The tobacco was put in the mouth and the finger dipped in the pasty lime and put into the centre of the tobacco. The Tlingit also made it into pellets with spruce or cedar gum to be sucked.

Similar to the Interior Plateau, some groups in northern British Columbia also used stone tobacco mortars to process tobacco. In the 1880s, Niblack described an Alaskan raven-shaped stone pestle for preparing tobacco and observed stone tobacco mortars in old houses (Niblack 1890, Plate 63). Large stone tobacco mortars have been collected from historic house ruins and disturbed surface areas of archaeological sites on the northern and central coast of British Columbia. As none have been found in a systematic excavation project, we can only speculate from current evidence that these mortars are confined to the later pre-contact or early historic time period. The example seen in Fig. 9.16 is engraved with a scene of men in a canoe hunting sea otters.

9.3.2 Smoking Pipes

In the sixteenth century, European colonists acquired domesticated species of tobacco in the West Indies. Through Russian trade, it diffused across Siberia to Alaska by, at least, the late 1700s (Khlebnikov 1976). When Russian leaf tobacco and pipes were introduced to the area in the late-eighteenth century, northern groups turned readily to smoking and the making of elaborate carved pipes for smoking at feasts and funerals. Many of the Tlingit pipes resemble those used in Siberia and China, with bowls often composed of a straight piece of metal or stone stuck into a hole at the end of a long curved stem made out of wood, bone, or other materials. The Tlingit held a smoking feast in which tobacco was offered via the fire to all the dead of the clan hosting the feast. At these events clan mourning songs were sung and the clan history recalled.

Fig. 9.16 Large stone tobacco bowl from the Bella area on the central coast of British Columbia. RBCM FaTa-Y:2

Fig. 9.17 A wooden frog with copper-lined bowl and a wooden pipe with northern style carving and copper bowl cover

Khlebnikov, who was at Sitka Alaska from 1817 to 1832, noted that "Virginia tobacco" was being traded to the Tlingit for eight mink skins in 1825. He also described the Tlingit making slate pipes with carved representations of bird eyes and beaks (Khlebnikov 1976, p. 39, 69). After the historic introduction of smoking numerous carved pipes appear with elaborate animal shapes being the most common among the Tlingit and Tahltan peoples (Fig. 9.17). A copper or iron pipe was often inserted inside the bowl or a metal cap placed on top (Fig. 9.17, right). It is known that chlorite, serpentine, and talc are found in the Sitka region and were used in pre-contact times to make labrets. It is likely that this already known indigenous technology was later used for pipe making.

9.3.2.1 Haida Argillite Pipes

Among the Haida, there were two varieties of pipes, one for ordinary use copied from commercial styles and another, which involved more elaborate animal designs, used for ceremonial occasions. Tobacco and pipes were provided for all guests at funerals after the wailing period (Harrison 1925, p. 79). Argillite pipes were made in the "ceremonial pipe form" beginning about 1829, and represented combinations of humans and animals. More elaborately carved "Haida-motif panel" (Fig. 9.18) and "ship panel" pipes (Fig. 9.19) developed later (Macnair and Hoover 2002). European clay pipes became common and were being copied by the Haida in argillite by at least 1847. Trade pipes from the mid-nineteenth century had both Haida and European figures and sometimes the addition of ivory pieces. Late period pipes (post-1880s) change in style with more traditional Haida figures (Macnair and Hoover 2002, p. 119). Many of these were purely decorative for the European market. In contrast, the Tlingit pipes from the early 1800s "in almost every instance represent the family crest" (Emmons 1911, p. 64) of their owners and were often made of exotic woods from the stocks of trade guns. The bowls of wooden pipes were lined with metal, such as a section of musket barrel and, in later times, stems were extended using a section of brass shell cartridge.

Fig. 9.18 Haida Argillite Pipes. *Upper*: Late period Trade pipes made after 1880; RBCM15682. *Lower*: Haida panel pipe—mid 1800s; RBCM collection. Haida Gwai (Queen Charlotte Islands)

Fig. 9.19 Historic Haida ship panel pipe. Made of wood, inlayed ivory, with metal-lined and capped bowl; RBCM17019

Smoking tobacco was traded inland to the Tahltan after it was introduced by Europeans in the early-nineteenth century. The Tahltan made elaborate versions of European style elbow pipes and used them as ceremonial pipes during feast occasions. Prior to the time of smoking, the coastal practice of mixing burnt shell, charred tree bark, and tobacco involved the reduction of these ingredients to the form of a paste that was rolled into pea-sized pellets. A pellet "was placed between the lower lip and the gum and sucked, necessitating constant expectoration." Emmons recorded that this "nicotine plant" cultivated by the Tlingit, was "said to have been brought up the Stikine River and planted in small garden patches at the old village of Tutchararone, near the mouth of the Tahltan river" (Emmons 1911, p. 63).

9.4 Pipes on the Southern Coast of British Columbia

Archaeological and ethnographic investigations of indigenous groups of the Southern Coast of BC and Northern Coast of Washington indicate that these communities did not smoke at the time of the coming of the first Europeans (Drucker 1965, p. 45). However, small numbers of stone pipes, mostly fragmentary, have been found on the Southern Coast of BC. Unfortunately, most are not from dated contexts and no residue analysis has been undertaken on any of these pipes. We cannot rule out that some smoking activities were practiced for short periods of time in some areas, but the limited number of pipes and the absence of sufficiently dated pipes suggests that trade in valued raw materials may be the explanation for the occurrence of pipes in this region.

In very early historic times, some Coast Salish speaking peoples in the southern part of Puget Sound smoked tobacco, which they obtained in trade, along with stone elbow pipes, from east of the Cascades. In the early 1800s, Alexander Ross noted an Okanagan chief had formally been in the habit of going on trading excursions to the coast (Ross 1956, p. 37). No pipes are mentioned in regard to this early trade, but we may speculate that European pipe styles were introduced at this time. Smoking in the Puget Sound area in early historic times seemed to be associated mostly with Shamanistic ritual activities (Spier and Sapir 1930, p. 269).

Local plants were used in the historic period to bulk up or give flavour to the tobacco introduced by Europeans. In western Washington State, yew (*Taxus brevifolia*) needles were pulverized and used in place of tobacco for smoking. The Snohomish mixed them with kinnikinnick and later with tobacco. Gunther's First Nations consultants suggested that before the introduction of European tobacco, the leaves of kinnikinnick were pulverized and smoked alone. Later, they were used to stretch the small supplies of tobacco available. The Chehalis say that if one swallows the smoke of kinnikinnick, it produces a drunken feeling. A Klallam consultant said that either kinnikinnick or yew leaves were mixed with tobacco, but kinnikinnick was never mixed with yew because it was too strong (Gunther 1945, p. 16, 44).

9.4.1 The Lower Fraser River Area

Stone elbow style pipes are found in historic period sites on the lower Fraser River. Only fragmentary portions of older style tubular pipes have been found in this region, such as those at Port Hammond (Smith 1903, p. 180–181). The undated rattle-snake-man pipe seen in Fig. 9.20 was found in a site near the junction of the Fraser and Harrison Rivers. This could be a product of some ritual activity involving smoking but could just as likely be a trade item from the neighbouring Interior. Two pipe bowl pieces shown in Fig. 9.21, from the same general area, are in the process of being sectioned—probably for use as ornaments.

9.4.2 Vancouver Island

Only one complete pipe bowl of a unique type (Fig. 9.22) has been found at the False Narrows site, DgRw-4, on Gabriola Island off the east coast of the Vancouver Island (Burley 1988). Although portions of this site date to over 2000 years ago, the context of this artifact is not known. The fact that it has two small holes drilled on both sides just below the rim suggest that it was used for ornamental purposes, and it is different from other Southern Coastal styles.

Fig. 9.20 Rattle-snake-man face on steatite pipe bowl; RBCM DhRl-5:2

Fig. 9.21 Pieces of two pipe bowls in the process of being cut; DhRlm-Y:1839

Fig. 9.22 Carved pipe bowl with two small holes drilled on both sides, stem attachment hole on the bottom and animal head on the bowl edge. RBCM DgRw-4:3397

Small numbers of fragmentary pipes have been found from the Saanich peninsula (Smith 1903, p. 181) and at the Pedder Bay site, west of Victoria, where five tubular pipe bowl fragments and one stem fragment were found (Fig. 9.23). It is significant that four of the five bowls have cut marks that indicate they were to be sectioned. These sites date after about 800 years ago. It is uncertain as to whether these were used for smoking or are raw material trade items from the Interior Plateau.

9.5 Discussion

The type of tobacco used in the far northern areas of northwestern North America has been the subject of much discussion. It is often thought that one of the southern species of tobacco (e.g., West 1934, p. 102). However, it is more likely that the

Fig. 9.23 Four of five pipe bowl fragments with scored lines; RBCM collection

tobacco used in this region is a species with a natural range from central Oregon to the Mexican border that spread as a result of human cultivation from an area extending eastward to the Missouri River and northward to the Columbia River (Turner and Taylor 1972, p. 255). I suggest that such varieties of cultivated tobacco had a much wider distribution in the past, and that distribution patterns changed through time along the Pacific Coast of North America. Tobacco was possibly grown for ritual uses in the warmer regions of the Southern Coast of BC. The historic tobacco industry was successful in the warmer parts of the Southern Coast (Lewis 1980). At present, there is only minimal archaeological evidence of the use of stone pipes for smoking.

If pipes were used on the Southern Coast, we cannot yet rule out that both pipes and tobacco could have been traded from outside and used in a limited way by ritual specialists. The existence of *N. quadrivalvis* (bigelovii variety) on the Queen Charlotte Islands further north may simply be the northern extent of what was once a longer coastal continuum of the species from California to the islands of southwest Alaska. Botanist David Douglas found specimens of *N. quadrivalis* near the mouth of the Columbia River in 1829, suggesting that the distribution of the species may have been more extensive in the late pre-contact period (Douglas 1914). However, the species subsequently disappeared from the area. Botanist B.A. Meilleur suggests the Haida acquired the tobacco seeds in trade from the Columbia River (Meilleur 1979).

9.6 Conclusions

The archaeological evidence clearly places the introduction of smoking pipes on the Southern Plateau of British Columbia by the start of the Kamloops Horizon around 1250 AD and possibly 200 years earlier. This practice continued into historic times with a change to more European-style pipes. Traditional tubular pipes with more elaborate carved depictions of humans and animals were more common before the early nineteenth century.

Although it is known that sharp-angled elbow pipes replace the more traditional varieties of tubular pipes in the historic times, there is some suggestion that the type transition may have begun more gradually in proto-historic times as a result of First Nations peoples copying old European styles from eastern North America. Elbow pipes began replacing the older tubular forms by the 1830s and the placing of lead inlays in designs was well established by the 1890s. Increasingly during the fur trade period more exotic varieties of pipes from eastern North America began to filter into British Columbia. Catlinite pipes were being purchased for use by the 1840s.

Speakers of Salishshan languages with similar cultural practices, such as the Guardian Spirit and Dance Complex, extended from southern British Columbia into the Middle Columbia River region (Ray 1939). These cultural relations likely extended back in time and account for the similarity of pipe styles throughout the region. Tobacco cultivation and pipe smoking appear to have occurred slightly earlier in the middle Columbia River region, which suggests the practices spread to the north.

The Haida and Tlingit practice of sticking burnt abalone shell paste (lime) into rolled tobacco balls that were sucked was also practiced by the Central and Southern Miwok and Yokuts, Tubatulabal, Kitanemuk, and Costanoans of California (Barrett and Gifford 1933, p. 195; Heizer and Whipple 1960, p. 24; Kroeber 1941). The shared practice strongly indicates the likelihood of previous contacts and connections between peoples of these areas or the previous existence of intermediate groups with the same practice. It should be noted that Heizer and Whipple (1960) mistakenly use the terms chewing and eating, rather than the more correct term of sucking, when referring to tobacco use in these areas.

Current archaeological and historical information suggests that Europeans introduced pipe smoking in the late-eighteenth to early-nineteenth centuries in Alaska and Northern British Columbia. First Nations adapted this new practice with the production of a wide range of elaborately carved wood, bone, ivory, and slate pipes representing both European and traditional subject matters. Sproat observed in the 1860s that many First Nations communities on the southern coast of British Columbia were using what he called the blue-stone or Tsimshian pipes traded from the northern coast (Sproat 1868).

Stone elbow pipes as well as clay pipes were used on the southern coast in early historic times, as a result of the adoption of the European smoking habit. Pipe fragments are found scattered throughout the region, but in very small numbers. It is common to see pipe fragments being used as raw material for making other artifacts—such as pendants. Some may have been part of a ritual-related smoking complex that is not well defined or dated. Unlike the Interior Plateau, we cannot make a connection with ancient and historic pipe smoking. People on the southern coast apparently did not smoke according to early European accounts. Thus, further work needs to be done on the southern coast to determine if pipe smoking did occur in pre-contact times.

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Chapter 10
Restoring Traditional Tobacco Knowledge: Health Implications and Risk Factors of Tobacco Use and Nicotine Addiction

Charles M. Snyder

> *When we conduct a Sacred Pipe ceremony we fill the pipe with sacred tobacco and offer it to Grandfather, the Great Spirit, then to the spirits of the East, South, West and North and finally to Earth Mother. Taking part in this ceremony allows a individual to become centered in this life.*
>
> —Adam Fortunate Eagle, Ojibway Pipe holder, Bear Clan (Schinke 1995)

10.1 Introduction

The use of tobacco (*Nicotiana* sp.) and other smoking plants has been a feature of Native American traditions for thousands of years, or since "time immemorial" according to some oral histories (Linton 1924; Tushingham et al. 2013; Winter 2000a). Traditional uses of tobacco include medicinal, social, religious and ceremonial, and economic purposes. As such, tobacco served as a catalyst for forming and maintaining important relationships at the individual and group level (Winter et al. 2000). Tobacco has also served an integral role in traditional healing practices as a blessing and a pathway for connecting the supernatural and physical worlds. The spiritual power of tobacco is also often considered to be great. For instance, in some tribes, crushed tobacco leaves are sprinkled on the ground to create a barrier to ward off evil spirits, bad luck, or those that have ill intent (Daley et al. 2006; Winter 2000b). Tobacco leaves can also be used as a protective barrier for handling sacred or spiritually important items, or burned to cleanse sacred items that have been soiled or mishandled. The process of consuming tobacco includes chewing (often with lime), snuffing, and smoking in pipes, cigarettes, and cigars in

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order to relieve stress, facilitate meditation, and to balance oneself spiritually. This rich history of traditional tobacco and non-tobacco smoking plants include the ingestion of many species. Some common non-tobacco smoking plants include bear berry (*Arctostaphylos uva-ursa*), juniper (*Juniperus* sp.), dogwood (*Cornus* sp.), and many others (Moerman 1998; Rafferty 2002). These plants have served to assist in the maintenance of Native cultural identity while also setting the stage for a public health crisis among Native people (Pego et al. 1995).

Addressing the challenging issue of tobacco-related illness while also respecting traditional practices, identity, and sovereignty will require a creative and interdisciplinary approach. One such interdisciplinary approach is the use of archaeological pipe and tobacco studies to inform public and community health program development and to provide tools for the restoration of traditional knowledge. While there have been efforts to reintroduce traditional tobacco as a means of increasing sense of connection to Native identity and cultural revival (Phillips 2015, Chap. 11 in this volume), as well as substantial work utilizing ethnography to reduce commercial tobacco consumption (Kohrman and Benson 2011), no other project bringing together archaeology and public health to directly reduce the health burden of commercial tobacco is known to the author. This highlights the opportunity and untapped potential present in linking archaeology and public health.

The purpose of this chapter is to discuss the implications of tobacco use on contemporary physical, mental, and community health and the impact of traditional knowledge loss with specific emphasis on traditional smoking practices. Furthermore, this chapter will discuss current efforts to mitigate the harmful effects of tobacco abuse. It argues that addressing the challenging issue of tobacco-related illness while also respecting traditional practices, identity, and sovereignty, will require a creative and interdisciplinary approach. This paper advocates for the use of archaeological pipe and tobacco, and smoking research studies to inform public and community health program development and to provide tools for the restoration of traditional knowledge. As such it argues that the aforementioned studies are an important element to addressing the epidemic of tobacco-related illness being experienced by Native Americans today.

10.2 Traditional Origins of Tobacco

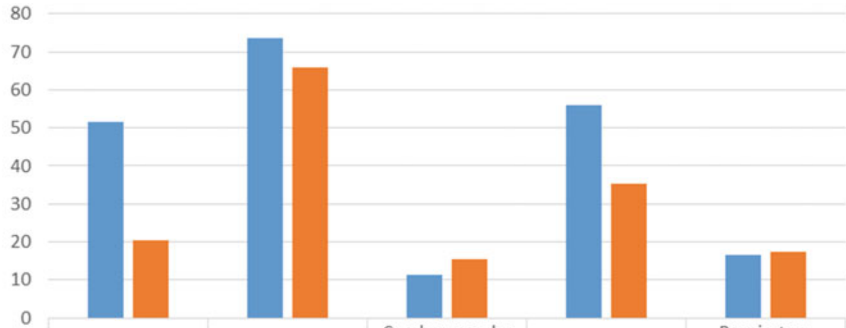
Native American tobacco origin stories are as diverse as the tribes themselves. However, several common themes emerge and speak to the importance of smoking plants in maintaining cultural continuity. In some tobacco origin stories, tobacco is stolen from a supernatural being to improve the lives of one's community. For example, the Menomini tell a story in which Manabush smells the sweet fragrant aroma of tobacco being guarded by a Giant, the keeper of tobacco (Hoffman 1890). After the Giant refuses to share tobacco, Manabush steals the tobacco and turns the Giant into Jumper (Grasshopper) for his stinginess with the sacred plant. Similar to the story of Manabush and Jumper, the Abenaki tell of Gluskabe, who bravely walked among the bones of Grasshopper's victims in order to steal tobacco that had been stolen by Grasshopper and return it to the people (Winter 2000b). Continuing the theme of stealing tobacco, one Cherokee story tells of Hummingbird, who used his speed and grace to steal tobacco back from Dagulku Geese, ultimately returning it, and with it, restoring health and strength to the people (Mooney 1900).

In other legends, tobacco is given as a gift from a supernatural entity through visions or direct interaction with people. For example, a Blackfoot story tells of tobacco coming in four visions to four brothers (Erdoes and Ortiz 2013). These visions instructed the brothers in the ways to find tobacco, how to prepare it for smoking, how to construct pipes, and how to use the pipe for smoking the plant. These visions bring the practice of smoking tobacco to the Blackfoot and with it, peace. The Hidatsa tell how the First Creator ordered Male Buffalo to make tobacco for Lone Man so that he could learn to use the pipe that he carried (Winter 2000b). Among the Sauk, a beautiful woman who had descended from the sky gave tobacco as a gift to hunters (Hawk et al. 1916). She was hungry and was offered venison by the hunters. In exchange for their generosity, the beautiful woman gave tobacco to the hunters before returning to the clouds. In Crow legends, tobacco is a gift to Star-boy from his father, the star (Daley et al. 2006). Whereas, Star-boy's brother, Earth-boy, inherits the way of the Medicine Pipe from his father. Together, the tobacco and the pipe help to maintain peace between the Crow and the Hidatsa people.

In many other tribal legends, tobacco comes directly from a deity. Among the Kickapoo, for instance, tobacco came from Kitzihiat via a Kickapoo spirit messenger that carried a piece of Kitzihiat's heart which contained the seeds of tobacco (Winter 2000b). While the stories vary in when, how, and why tobacco was granted to the people, they almost universally focus on tobacco and smoking plants as a gift from the spiritual world that instills or transmits strength, peace, and power. These deep spiritual and cultural connections between Native people and smoking practices have served an important and beneficial role for centuries. However, they have also resulted in Native people's greater vulnerability to commercial tobacco marketing initiatives, as well as a dramatic and disproportionate increase in smoking-related illness.

10.3 Health Effects of Tobacco

Each Native tribe has a unique culture, historical background, and health profile. However, national trends in Native health that have been attributed to several risk factors that are experienced by a majority of Native American populations. The leading causes of mortality and morbidity in Native people include cardiovascular diseases, diabetes, accidental injury, chronic liver diseases, respiratory disease, stroke, cancer, and suicide (Centers for Disease Control and Prevention (CDC) 2015; Indian Health Service 2015) (Fig. 10.1). Furthermore, significant and disproportionate impacts from high rates of teen pregnancy, obesity, and substance abuse, and an infant mortality rate approximately 40 % higher than the national average (CDC Wonder Database 2015) have a profound impact on the health of Native American populations.



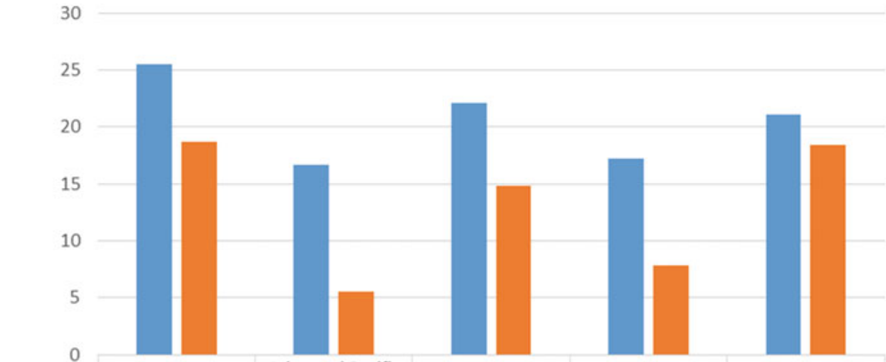
	Accidental Death	Cancer	Cerebrovascular Diseases	Heart Disease	Respiratory Diseases
Male	51.6	73.6	11.3	56	16.5
Female	20.3	65.8	15.4	35.2	17.5

Fig. 10.1 Age-adjusted mortality rates in American Indian or Alaska Natives 1999–2013, per 100,000. Data from CDC Wonder Database 2015

Historically, the leading causes of death in Native American people are cardiovascular diseases such as heart disease and stroke, though cancer has risen to the top in recent years (Centers for Disease Control and Prevention (CDC) 2015). Risk factors for heart disease include high blood pressure, cigarette smoking, high cholesterol, obesity, and diabetes. It is important to note that these risk factors are highly prevalent across Native tribes in the United States (US), with 63.7 % of Native Americans reporting having at least one risk factor for cardiovascular disease (Indian Health Service 2015). One key risk factor that cross cuts five of the top six causes of death in Native communities is smoking. As such, a key intervention step is to reduce smoking rates in Native populations.

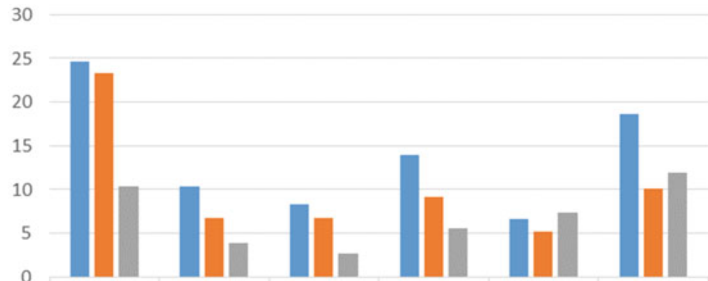
Tobacco smoke is a well-known cause of illness and injury throughout the world that not only impacts the heart, lungs, and other body systems, but also produces almost $300 billion dollars of economic harm annually in the United States alone (CDC Wonder 2015; US Surgeon General 2006). Placing a disproportionate burden on Native people, cigarette-smoking rates among Native Americans are significantly higher than smoking rates among all other ethnic groups in the United States (Fig. 10.2). According to the Centers for Disease Control and Prevention (CDC), the smoking prevalence rate was 19 % for the total US population across ethnic groups in 2012. The smoking prevalence rate among all Native American tribes was 21.8 % with males smoking at much higher rates than females in all racial categories (Fig. 10.2) and some tribe-specific rates reaching as high as 79 % (Carson et al. 2012; CDC Wonder 2015).

Regional variations in smoking prevalence rates are distinct with the highest regional smoking rate (44.1 %) found among groups in the Northern Plains region, and the lowest (21.2 %) associated with groups in the Southwestern United States. Among persons under the age of 18, Native Americans experience the highest smoking rates with almost 25 % of youth reporting as regular smokers, and 23.3 %



	Native American	Asian and Pacific Islander	African American	Hispanic	White
Males	25.5	16.7	22.1	17.2	21.1
Females	18.7	5.5	14.8	7.8	18.4

Fig. 10.2 Smoking rates in persons over the age of 18 in 2012. Data from CDC Wonder Database 2015



	American Indian and Alaska Native	Asian	African American	Hispanic	Native Hawaiian or Pacific Islander	White
Current Smoker	24.6	10.3	8.3	14	6.6	18.6
Smoked Before Age 13	23.3	6.8	6.7	9.2	5.2	10.1
Uses Smokeless Tobacco	10.3	3.9	2.7	5.6	7.3	11.9

Fig. 10.3 Percentage of youth who use tobacco, by race. Data from CDC youth risk behavior surveillance system

having started smoking before the age of 13 (Fig. 10.3). These trends in youth smoking are immensely important as they set the stage for smoking behaviors and smoking-related illness later in life. The dramatically increased smoking prevalence rates stemming from deeply ingrained historical and contemporary vulnerabilities result in profound and disproportionate health impacts on Native people. Furthermore, smoking is the leading cause of preventable death among Native Americans with a smoking-related mortality rate double that of all other groups in North America (CDC Wonder 2015).

10.3.1 Secondhand Smoke

Environmental tobacco smoke, also called secondhand smoke, is one of the most damaging elements of smoking behavior. Just as Native people experience disproportionality high rates of commercial tobacco consumption, they also experience disproportionately high levels of exposure to secondhand smoke. Particularly high rates of exposure are found in Native children, and employees of Indian Casinos, restaurants, and smoke shops (Best 2009). Secondhand smoke is formed and disseminated primarily from "sidestream smoke," which is generated from the burning end of cigarettes and pipes (Law and Hackshaw 1996). Exhaled tobacco smoke, known as "mainstream smoke," further contributes to secondhand smoke, though at a smaller rate than the burning tobacco device itself (Law and Hackshaw 1996). The health risk of secondhand smoke is well established in the scientific literature and has been associated with a variety of pathologies such as heart disease, lung cancer, and asthma (American Cancer Society 2014; Law and Hackshaw 1996).

Sidestream smoke is different from mainstream smoke in several ways. For example, mainstream smoke contains nicotine in a larger particulate form when inhaled whereas sidestream smoke contains nicotine in a gaseous form (Law and Hackshaw 1996). More importantly, sidestream smoke is not filtered whereas mainstream smoke is filtered by the tobacco column and by the smoking device filter. Consequently, sidestream smoke presents elevated health risk due to lack of filtration and smaller particle size (Best 2009; Law and Hackshaw 1996; Repace et al. 2011).

According to the US Surgeon General, secondhand smoke is an EPA Group A carcinogen with over 7000 compounds, over 250 of which are hazardous. Additionally, approximately 70 of those compounds are known carcinogens (US Surgeon General 2006). Some especially noteworthy compounds found in secondhand smoke include formaldehyde, benzene, radioactive polonium 210, vinyl chloride; gasses such as hydrogen cyanide, butane, ammonia, and carbon monoxide; and metals such as chromium, arsenic, lead, and cadmium (US Surgeon General 2006). Together, these compounds present significant health risks to people and have been associated with several respiratory and cardiovascular conditions.

Research into the health impacts of secondhand smoke continue to demonstrate new and alarming trends in diseases associated with exposure to even low dosages. Known risks include lung cancer, acute and chronic respiratory illnesses in children, middle ear diseases in children, sudden infant death syndrome, and an array of respiratory and cardiovascular illnesses across age ranges (CDC Wonder 2015; US Surgeon General 2006). According to the American Cancer Society, the annual impact of secondhand smoke in the United States is 46,000 nonsmoker deaths per year, 3400 lung cancer deaths in nonsmokers, asthma complications in one million children, and 150,000–300,000 lower respiratory tract infections in children under 18 months of age (American Cancer Society 2014). Furthermore, injury and loss of productivity in workers from secondhand smoke presents considerable financial impact each year (US Surgeon General 2006).

10.4 Colonialism, Tribal Culture, and Health

Compounding the damage of high smoking rates in Native people, the shift from the traditional smoking of plant products toward commercial tobacco has had significant impacts on tribal culture and health (Margalit et al. 2013; Pego et al. 1995). Traditionally, whole-leaf tobacco would be grown, dried, and traded within a complex set of customs and economic relationships. This traditional (indigenous) tobacco was free of the additives found in commercial tobacco. It also had lower abuse potential due to many species having lower levels of nicotine, a relative scarcity of the plant, and cultural beliefs that held tobacco as sacred and only for limited use in certain contexts (Godlaski 2013; Linton 1924; Pego et al. 1995).

Trade tobacco was primarily the domesticated species *N. tabacum* and to a limited extent, *N. rustica*. Both are significantly more potent than indigenous wild tobaccos (Winter 2000c, p. 316–317) and in pre-contact times were in use among farming communities in the eastern US, parts of the southwest, the Caribbean, and Mesoamerica (Goodspeed 1954; Haberman 1984; Wagner 2000). Their development as colonially produced trade commodities occurred after Contact. Trade tobacco's introduction to Native Americans followed a pattern of east to west, starting with the Northeastern tribes in 1608 (Pego et al. 1995), eventually making its way throughout almost all of North America by 1731. The introduction of trade tobacco proceeded over land to the west, as well as by French fur trading ships, reaching the Coastal Salish by 1656 (Robert 1967; Winter et al. 2000, p. 359–360). Because of the abundance of trade tobacco, and possibly facilitated by increasing prevalence rates of nicotine addiction, the introduction of commercial tobacco by European traders presented an easy, convenient, and attractive alternative to native wild tobaccos. This ultimately resulted in the replacement of small-scale tobacco collection and cultivation for the more easily accessible trade tobacco (Phillips 2015, Chap. 11 in this volume).

As the supply and availability of trade tobacco increased, the composition and form of tobacco products shifted first toward non-native, and substantially more addictive, whole-leaf tobacco, followed by a shift toward processed tobacco, cigarettes, and chew tobacco (Margalit et al. 2013). Subsequently, forced assimilation and displacement policies resulted in many Native people becoming reliant on trade tobacco for the continuance of tribal customs and the practice of Native identity, which increased vulnerability to structural factors that drive tobacco addiction. For example, tobacco companies have long engaged in the extensive promotion of commercial tobacco products to Native people that capitalizes on Native American imagery (BlueEye 2004; Shorty 2007) and ancient tobacco traditions that tie into Native identity. Furthermore, high rates of poverty, depression, and social violence found on reservations also serve as important risk factors for nicotine addiction (Daley et al. 2006; Evans-Campbell et al. 2006). This not only has deleterious impact on tribal health, but also has resulted in the loss of many elements of tribal tobacco traditions (Myhra 2011; National Native Network 2014).

For example, Lakota Elders have described a loss of traditional tobacco knowledge that is blurring lines between what constitutes traditional tobacco—which may include tobacco plants or other (non-tobacco) smoking plants—and what constitutes commercial tobacco (Margalit et al. 2013). Furthermore, marijuana is increasingly being integrated into notions of "traditional" smoking plants despite its absence in oral histories on the subject. A study on smoking knowledge among Native American youth in California found there was little distinction made between smoking cigarettes and smoking "blunts" (slang term for marijuana-filled cigarette or cigar), either as a recreational activity and as an expression of Native cultural identity (Soto and Baezconde-Garbanati 2009). Furthermore, marijuana is frequently presented as a "traditional" smoking plant for Native American people in popular sources such as magazines and websites which form an important information pathway to both Native and non-native youth (Bennett 1995; Greene 2015).

10.4.1 Culture Loss and Historical Trauma

As defined by Brave Heart et al. (2011, p. 283), historical trauma is the "…cumulative emotional and psychological wounding across generations, including the lifespan, which emanated from massive group trauma." Historical trauma has its origins rooted in traumas such as genocide, ethnocide, and forced migrations (Brave Heart and DeBruyn 1998). With the adoption of cigarettes, traditional cultural knowledge and practices around smoking plants have been lost; including social and economic connections with tribes that provided traditional tobacco in pre-contact times, and social activities around harvesting and processing traditional tobacco. These changes exacerbate the ongoing historical trauma experienced by Native people as a result of colonialism and government abuses that contribute to a great number of health problems such as depression, anxiety, self-destructive behavior, and low self-esteem (Brave Heart 2003; Brave Heart et al. 2011). Furthermore, the increased availability of commercial tobacco coupled with the cultural imagery of smoking as "being Indian" has contributed to high rates of smoking among tribal youth (Choi et al. 2006). However, traditional tobacco can have a healing effect on the victims of historical trauma and related illnesses. One noteworthy example of this effect is the impact that a return to traditional smoking practices can have on substance abuse treatment programs. Myhra (2011) cites an example of restoration of traditional cultural practices increasing the effectiveness of an alcohol abuse recovery program.

> I'm trying to be more traditional than before, now that I'm sober, because I know that traditional ways can't be practiced while you're using; you know it's very disrespectful. Mom also never practiced the traditional ways. We were born and raised in [the metro]. She was born and raised on the reservation but the whole time we were growing up, we didn't practice our ways at all. Just recently I talked with a couple pipe carriers to learn more about our ways. I just recently gave tobacco [as an offering] and got an Indian name. (Myhra 2011, p. 29)

This case is an example of the restoration of cultural knowledge, in this case tobacco, working as an integral pathway to healing from substance abuse— a major element in long-term, collective, trans-generational trauma experienced by Native people. For these programs, it is imperative that tobacco knowledge lost to acculturation, assimilation, and colonization be restored. Furthermore, evidence is mounting that the restoration of cultural traditions serves to reinforce positive imagery of Native identity use and serve as a buffer against substance abuse and addictive use patterns (Daley et al. 2006; Margalit et al. 2013; Myhra 2011).

10.5 Efforts to Combat Tobacco-Related Illness

While seemingly contradictory to supporting traditional tobacco use and sovereignty, commercial tobacco cessation programs are an important part of restoring traditional smoking practices. However, Native Americans have benefited very little from recent significant developments in the science of tobacco cessation and addiction treatment. Reasons for this include a lack of cultural relevance in outreach programs, lack of cultural competency in treatment providers, high costs of therapeutic interventions, and a shortage of research into cessation program outcomes for Native people (Fu et al. 2013). Further exacerbating the health impact of smoking, exposure to secondhand smoke in nonsmokers becomes more frequent as smoking rates climb among their family, friends, neighbors, and coworkers.

Programs developed to reduce smoking and secondhand smoke exposure in tribal people have had limited success because of their failure to engage underlying elements of culture in their design (Choi et al. 2006, 2011; Daley et al. 2006). Not only is smoking viewed as “being Indian” by many tribal members, but attempts from non-natives to reduce tobacco abuse are viewed as suspect and an infringement on tribal sovereignty (Shorty 2007). Furthermore, the history of exploitation of Native people, compounded by a pattern of broken treaties by all levels of government, has led to a pervasive sense of distrust and skepticism of governmental interventions in Native health. Under such circumstances, challenges in successfully implementing tobacco abuse prevention and cessation programs that are created for the US population as a whole are intensified.

However, some programs do integrate tribal culture and tradition in an attempt to reduce tobacco use and consequently have positive impacts on reducing tobacco abuse and improving indoor air quality in tribal buildings and housing. For example, the National Native Network “Keep Tobacco Sacred” program does not villanize tobacco but rather calls upon symbolic images of traditional usage and ritual to reinforce the idea that tobacco is not evil, but must be respected and not abused (National Native Network 2014). Moreover these programs advocate for the use of traditional tobacco over commercial tobacco products that are known to contain many hazardous compounds not found in traditional tobacco.

10.5.1 Addressing Smoke Exposure Through Tribal Policy

In order to address the problem of indoor air pollution due to secondhand smoke, many tribes have adopted smoke-free ordinances that range from mandates for smoke-free sections within a casino to absolute tobacco-free policies for all enclosed public spaces, tribal housing, and private property open to the public or with employees (Glasgow et al. 1993, 1995). For example, the Cheyenne River Sioux Tribe passed a smoke-free ordinance using strong language to position clean air as a basic right: "The Cheyenne River Sioux Tribe recognizes that everyone has the right to breathe clean air and be free from the pollution of commercial tobacco products" (National Native Network 2014). This language is followed by an ordinance banning smoking in all enclosed public spaces, places of employment, and within 50 ft of such places. Moving further along the spectrum closer to an all-out ban, the Cherokee Nation passed a tobacco-free ordinance in 1998 making all public spaces and places of employment free of secondhand smoke as well as smokeless tobacco (National Native Network 2014). Some tribes, such as the Sault St. Marie Tribe of Chippewa Indians, have passed smoke-free ordinances in tribal housing to protect indoor air quality in semi-private spaces.

Advocates for these smoke-free policies on tribal lands cite that in addition to the direct health benefits related to reducing smoking, smoke-free policies can reduce tribal medical costs such as the $200 million spent per year by Indian Health Services on smoking-related illness. Consequently, smoke-free policies can create a potential financial boon for tribes (US Health and Human Services 1998). Furthermore, smoke-free ordinances originating from within tribal councils help to reinforce notions of tribal sovereignty. For example, in 2005, the Crow Nation levied a tax on commercial tobacco resulting in additional tribal revenue and a shift toward traditional noncommercial tobacco (National Native Network 2014). This was viewed as a victory by many stakeholders as it not only sent a message about the tribal position on commercial tobacco use, but it also legitimated the sovereign right of the tribe to set and control taxes on tribal land. Nevertheless, many Native people view these policies as an assault on tribal customs by "agents" of the white-government (Daley et al. 2006).

In an effort to respond to these concerns about potential restrictions on traditional tobacco use, many tribes place language into their smoke-free policies that exempt tobacco used for traditional or spiritual use from such policies. Nevertheless, one of the largest current barriers to smoke-free policy is refusal by individuals to adhere to such policies (Glasgow et al. 1995, 1996). Within Native communities, a common reason for resistance to policies and community programs that seek to reduce or eliminate tobacco abuse is the perception that these policies are a thinly veiled means for attacking and marginalizing Native identity. To address this, some policy approaches place traditional uses of tobacco first and foremost as protected rights whenever smoke-free policies are developed. For example, in the Blackfeet Tobacco Free Act, protections for traditional tobacco usage appear in the third section of the ordinance language (National Native Network 2014). In Resolution 1–2011 of the

Bois Forte Band of the Minnesota Chippewa Tribe, language protecting the traditional use of tobacco does not appear until the last clause of the resolution. One noteworthy example of placing protective language in the top of a proposed ordinance is that of the Fort Peck Tribe of Assiniboine and Sioux People's Ohinni Candi Wakandapi Act. In separate statements placed before any restrictive language, this act explicitly protects the traditional use and cultivation of tobacco in addition to the use of tobacco in tribal education. By placing language honoring tribal traditions as the leading element to all smoke-free ordinances, community buy-in and compliance may be dramatically improved.

While this exemption makes such policies much more difficult to enforce, it is a necessary component to tribal smoke-free advocacy. Such exemptions cultivate acceptability in communities that view smoking as an element of indigenous identity and tobacco as a gift from the earth. It also highlights the importance of identifying and documenting traditional practices that may be used to fill the void created by such laws.

10.5.2 Developing Culturally Relevant Cessation Programs

Options for more effective management and mitigation of tobacco-related illness and injury on tribal lands involve modifications and improvements to current practices in policy development, education, and the provision of health services to Native people. However, it is important to note that each of these must be driven by Native people from within sovereign tribal nations in order to gain the community buy-in required to be successful. More importantly, one highly effective solution to the hazard of secondhand smoke is to eliminate smoking. However, because the complete elimination of smoking is not practical, would cause cultural harm, and exacerbate issues related to historical trauma, advocating for responsible, traditional tobacco use to replace commercial tobacco abuse presents the best opportunity.

Research into culturally focused tobacco cessation programs, while growing, continues to leave unanswered questions about efficacious program strategies. More importantly, most tobacco programs have, until recent years, focused on a pan-tribal population (Carson et al. 2012; Daley et al. 2006; Fu et al. 2013). However, as noted by Choi et al. (2011), the great cultural diversity and similarly complex traditional, ritual, and spiritual uses of tobacco require tobacco cessation programs to be tailored to the needs of specific tribes in order to be successful. Furthermore, messages that portray tobacco in an entirely negative light or fail to acknowledge and respect tribal tobacco traditions can cause more harm than good (Daley et al. 2009; Fu et al. 2013). As such, it is imperative that tobacco education and cessation programs integrate a comprehensive understanding of tobacco tradition and culture at the tribal level.

While significant efforts to curb smoking and create smoke-free public spaces are being initiated among many tribes, these programs and policies are difficult to enforce and frequently come under attack by members of the tribal community as being anti-Native. However, there is promise in newer approaches to tobacco education and smoke-free policy development that place an emphasis on protecting and promoting traditional tobacco culture. By positioning cultural identity and practices as an immutable right to be protected and exempted from regulation, these programs have the potential to be more effective than more restrictive policies modeled on non-native tobacco policy. By engaging traditional users of tobacco as allies in the protection of health against the damage from commercial tobacco use, significant improvements can be made in health and indoor air quality on tribal lands.

10.6 Pipe, Tobacco, and Smoking Studies and Tribal Health Initiatives

Tobacco is a powerful, medicinal, and potentially dangerous drug. Research into the traditional practices around this plant form an essential step toward advancing Native health. However, the importance of tobacco to many Native cultures creates a challenge for the public health research and outreach communities who are striving to develop programs that will reduce disparities in tobacco-related illnesses without perpetuating patterns of trauma and cultural harm. To meet that end, it is imperative that culturally appropriate interventions to commercial tobacco use honor the sacred tobacco traditions held by the tribes. However, because of the history of assimilation and culture loss experienced by Native people, many traditional smoking practices are no longer known or not widely recognized at the tribe-level. It is for this reason that collaborative research into tobacco and other smoking plant use patterns plays an important role in the future of public health and service delivery to Native people.

10.7 Conclusion

Commercial tobacco has played a significant role in the health disparities experienced by Native people for hundreds of years, leading to illnesses such as heart disease, stroke, and cancer. These disparities have been exacerbated by the replacement of traditional smoking products with commercial tobacco, which has contributed to culture loss and historical trauma. The interplay of culture loss, declining community health, and disenfranchisement of Native people has fed into the constellation of factors associated with historical trauma such as substance abuse, suicide, and other mental health conditions. All of these concerns call for an interdisciplinary approach to addressing the deleterious role of commercial tobacco while also respecting the essential role of indigenous tobacco and smoking plant uses. More importantly, efforts to restore or reinforce traditional tobacco knowledge and sovereignty can serve as an important tool for improving community health. To that end, pipe, tobacco, and smoking studies present an opportunity for collaborative research into the ancient tobacco and smoking plant use practices that predate the introduction of commercial tobacco. This knowledge provides essential background needed for the development of culturally appropriate responses to commercial tobacco addiction and abuse. By working with tribes to identify the suite of smoking plants traditionally used by the tribe, researchers not only work to reaffirm the knowledge held by elders while also helping to return knowledge to tribes, but also provide important information for health education professionals tasked with creating culturally relevant tobacco education and cessation programs.

The application of archaeological pipe studies to important public health questions around tobacco consumption, smoking, and addiction offer a novel and innovative approach to reducing health burdens experienced by Native people today. Furthermore, broader interdisciplinary connections between public health and archaeology holds promise for mitigating many other behavioral risk factors by creating a vehicle for understanding the origins of disease and applying it to approaches for improving contemporary community health. In this vein, significant opportunities for a broader application of archaeology to matters of contemporary health emerge when viewed from an interdisciplinary framework that pulls together ancient practices to help explain patterns of behavior and repatriate traditions that will help to secure health and cultural continuity for generations to come.

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Chapter 11
History and Modern Use of Sacred Tobacco on the Central and Southern Oregon Coast

Patricia Whereat Phillips

11.1 Introduction

In the mid-nineteenth century, tribal life in southwestern Oregon was radically disrupted by epidemics and the Rogue River War, which resulted in the physical and cultural dislocation of the indigenous people. Knowledge of many cultural practices was lost. Many scholars and some contemporary tribal members generally have not appreciated that tobacco smoking was part of the traditional culture of the region. I hope to demonstrate that pipes and tobacco were used for untold generations, as evidenced by the archaeological record, the observations of early fur trappers, explorers, and pioneers, and the oral traditions recalled by tribal elders of the southern Oregon coast.

11.2 Cultural Informants and Interviews

This chapter grew out of one I wrote for the Coquille Indian Tribe's cultural preservation conference in the year 2000 and was published in "Changing Landscapes: Proceedings of the Fourth Annual Coquille Cultural Preservation Conference" (Whereat 2001). Since the chapter was first written, I have been able to deepen my research on cultural practices of the Coos, Lower Umpqua, and Siuslaw and neighboring tribes as well as gain a better understanding of the Coosan and Siuslawan languages. Only after I first wrote this chapter did I read the volume, *Tobacco Use by*

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Native North Americans: *Sacred Smoke and Silent Killer*, edited by Joseph Winter (Winter 2000), and this book helped me understand the wider context of tobacco use in North America.

In this chapter, I principally focus on the late precontact and the post-contact period tobacco practices of the Coos, Lower Umpqua, Siuslaw, and Upper Coquille tribes, although I have included some information on the neighboring Alsea and southwest Oregon Athabaskan tribes, which include the Upper Coquille, Upper Umpqua, Tututni, Galice, and Applegate groups (Fig. 11.1). Data is derived from field notes and interviews conducted between about 1909 and the 1950s by various anthropologists and linguists (Barnett 1934; Drucker 1933; Frachtenberg 1909; Jacobs 1932–1934, 1935; Harrington 1942). Primary cultural informants include Lottie Evanoff (Hanis Coos), Annie Miner Peterson (Hanis Coos), Frank Drew (Hanis Coos), Spencer Scott (Lower Umpqua/Siuslaw), and Coquelle Thompson (Upper Coquille). Other informants include Susan Ned and Ida Mecum (Lower Coquille), John Albert (Alsea), Leona Ludson (Alsea), Wolverton Orton (Chasta Costa), Bill Metcalf (Joshua/Chetco), and Hoxie Simmons (Upper Rogue/Yamhill). Supplementary background data on tribal groups in this area is available in a number of additional sources (e.g., Dorsey 1884; Frachtenberg 1913, 1914; Youst and Seaburg 2002).

11.3 Historic and Ethnographic Data

The first white visitors observed smoking as part of the daily lives of the Indians of the southern Oregon coast. In June of 1828, the American fur trapper Jedediah Smith and his party—the first Euro-Americans to directly contact Native Americans in southwestern Oregon—arrived at a Chetco village on the coast near the California border, and made this observation:

> June 24 … Near my camp was a village of 10 or 12 Lodges but the Indians had all ran off. Among the Indians of this country I have seen a small kind of tobacco which is pretty generally cultivated (Peterson and Powers 1952, p. 12).

One of the earliest archaeological expeditions to the south coast was conducted in 1873 by A. W. Chase on the Chetco River, and he found tobacco plants growing there:

> A plant of this weed was found growing (Aug. 1873) in Miller's garden on the shell mound. It resembles the ordinary Virginia weed but the leaf is smaller…I obtained the botanical name, upon the authority of Prof. Asa Gray. It is the *Nicotiana quadrivalvis*, a native of Oregon and Washington Territory and confined to that region. It is highly narcotic in its properties. Miller says that on his arrival in 1850, he found the Indians using it, and that it was the only plant or herb that they cultivated. It was found growing only on shell mounds. When used the leaves were parched, then crushed in the hands and stuffed in the largest end of the pipe. The leaves of the mansinita [sic, kinnikinnick, *Arctostaphylos uva-ursi*)] were also used to mix with the tobacco, and were prepared in the same manner. (Chase 1873, p. 34–5)

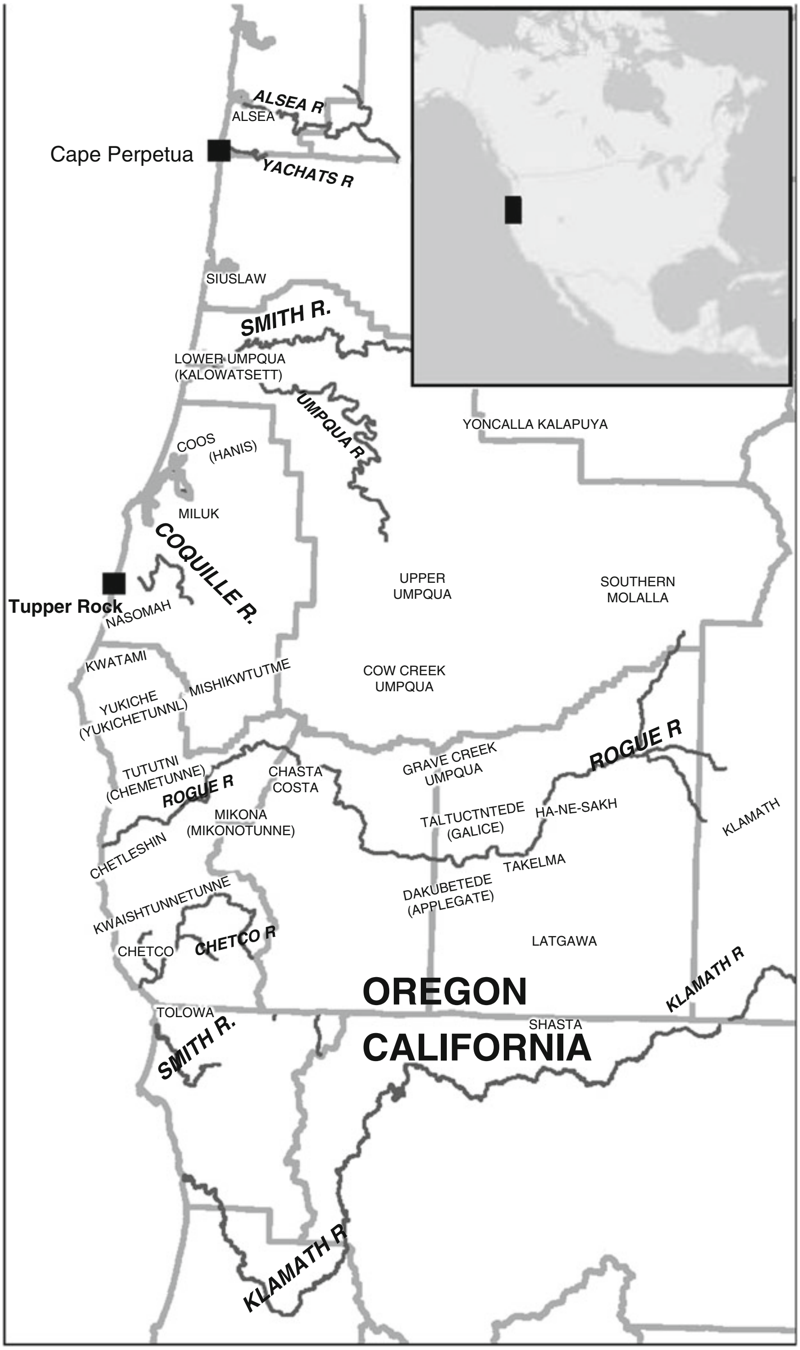

Fig. 11.1 Central and southern Oregon coast ethnographic groups. Map by Confederated Tribes of Grand Ronde (CTGR)

These early accounts demonstrate early cultivation and use of an indigenous or non-domesticated variety of tobacco, *Nicotiana quadrivalvis*, which was mixed with kinnikinnick, a widespread practice in other parts of northwestern North America (Kroeber 1941; Winter 2000). This information, summarized below, is corroborated and expanded upon by oral testimony from ethnographic studies in the early twentieth century.

11.3.1 Tobacco Management, Cultivation, and Harvesting

Tobacco appears to be unique among plants used by Native Americans of southwestern Oregon. Although there are records of Native Americans setting fire to landscapes to manage numerous plant resources, only tobacco appears to have been cultivated in managed plots from seed (Boyd 1999). Annie Miner Peterson gave the best description of Coos tobacco harvest and replanting:

> The Indians used to raise tobacco (tall, with long flat leaves, tiny white blossom, grew 2 ft. high, there used to be lots of Scottsburg on the Umpqua where they'd grow wild). They say they used to plant them above Rocky Pt. On [the east] side of Coos Bay … . They took the leaves, dried them, crushed and put them in buckskin bags. … They left [tobacco] stems stand in order to let the seeds dry, then they saved and planted them, or got those that grew wild sometimes. (Jacobs 1932–1934 [101], p. 18)

Coquelle Thompson's Upper Coquille people had similar cultivation practices:

> They planted tobacco. Maybe one lot. Fence around it. Before make fence, have to build big fire. Burn over whole place. Now when fire all gone, clean off. Dig at it with digging stick, now they plant Indian tobacco seeds. They look like turnip seeds. They planted tobacco long before whites. Some old men knew how when first white leaves come. They take them off. Throw away. New growth. Fine tobacco. Brush fence… Just brush fence keep dog out… Have to burn ground to make tobacco grow. They let plants stand, make seeds, don't bother. Only take leaves to smoke. Then picked seeds and put in little sack. Keep until next spring. (Jacobs 1935 [120], p. 44–45)

All of the Native informants agreed that tobacco was actively cultivated, and the methods seem to differ only slightly among different Tribes. Among the Lower Umpqua, Coos Bay and Coquille, seeds were scattered in a burned over area and brush fences erected around the plot to keep out the wind. Lottie Evanoff and Spencer Scott said the people put fences around it because they thought the flavor of tobacco was much improved if its leaves were protected from the wind. Some tribes used fertilizer to help their tobacco crop thrive. Bill Metcalf said he saw tribes on the Klamath and Rogue Rivers that used salmon bones and sand to fertilize the tobacco. Once harvested, the leaves were trade items (Harrington 1942, [22], p. 794; Jacobs 1935; Barnett 1934).

The practice of fertilizing tobacco plots was well known in other parts of Oregon as well. Scottish botanist David Douglas collected samples from a tobacco plot in the upper Willamette Valley. After Douglas gave some gifts to the owner of the tobacco plot, he was told that seeds were planted in wood ashes, as that made the plants grow larger. (Douglas 1914, p. 141).

11.3.2 Kinnikinnick and Tobacco

All elders agreed that kinnikinnick (*Arctostaphylos uva-ursi*) leaves were mixed with tobacco for smoking. There is little information on how the leaves of both plants were processed. Annie Miner Peterson said that tobacco leaves were merely dried, but other sources stated or implied that tobacco and kinnikinnick leaves were parched or toasted over a fire (Chase 1873, p. 34–5; Jacobs 1932–1934[101], p. 18–20; Drucker 1939; Harrington 1942 [21], p. 126b). Kinnikinnick leaves were toasted according to Lottie Evanoff: “Had to toast the kinnikinnick-have to hold it near the fire and when one side is toasted then turn it” (Harrington 1942 [22], p. 794). Leona Ludson said that kinnikinnick leaves were dried by the fire, or boiled and then sun-dried before being mixed with tobacco (Drucker 1933).

Why was kinnikinnick mixed with tobacco? According to an Alsea legend, the world-transformer S’uku accidentally dropped some tobacco among kinnikinnick plants and declared that when human beings came into the world, they would mix these plants together for smoking (Frachtenberg 1920, p. 84). Lottie Evanoff said Indians thought it had a good smell and improved the taste. Just as with tobacco, the Coos Bay people preferred to gather kinnikinnick leaves in areas where it was relatively protected from the wind. Lottie recalled that her father, Chief Doloos Jackson, liked to gather kinnikinnick by Clear Lake, just south of Reedsport, Oregon (Harrington 1942 [22], p. 794). Spencer Scott agreed that mixing tobacco with kinnikinnick made the tobacco “milder & cooler” (Harrington 1942 [22], p. 584a). Beverly Ward helped her husband’s Lower Coquille grandmother Susan Ned gather kinnikinnick leaves. “Sometimes we helped Grandmother gather kinnikinnick on the sandhills and she supervised the operations and every leaf had to be just so. She said some Indians smoked plantain (probably *Plantago* sp.) and broad-leaf dock (probably *Rumex* sp.), but she liked kinnikinnick the best. She mixed a little tobacco with the dried leaves to smoke in her pipe” (Ward 1986, p. 87).

Tobacco and kinnikinnick leaves were stored in bags and pouches made of buckskin, as were clay smoking pipes. Coquille Thompson said that among his people, the pipe and tobacco were stored in the same bag. He observed that among the Alsea and Tillamook, they kept the tobacco and kinnikinnick in separate pouches and mixed the two as they put them into the pipes (Harrington 1942 [25], p. 836, [25], p. 152).

11.3.3 Pipes

Annie Miner Peterson confirmed that traditional pipes were straight pipes, made of “a material she called soapstone and decorated by butting in the material when still ‘soft’” (Fig. 11.2). (Soapstone is a metamorphic schist rock that is often referred to as steatite). Deposits of this substance were found just south of Bandon and some 160 km to the north at a stream between the Yachats and Alsea Rivers. Nancy Nelson analyzed dozens of pipes and pipe fragments from Oregon coastal sites

Fig. 11.2 Complete clay pipe (**a**) and pipe fragments (**b**–**g**) from *Tcetxo* (35CU42), a Chetco site in Brookings Harbor, southwestern Oregon (Minor 2012, Figure 30). Catalog numbers (**a**) MT1-1/MT1-13, (**b**) MT2-40, (**c**) 4A-5/2-1, (**d**) MT1-8, (**e**) MT2-41, (**f**) MT1-37, (**g**) MT4-21. Photo courtesy of Rick Minor

(discussed below), some of which were found to be made of schist. The site Mrs. Peterson mentioned just south of Bandon may refer to Tupper Rock, which was schist (Nelson 2000, p. 64). Mrs. Peterson had a somewhat modernized pipe she showed to Melville Jacobs in 1934. He observed that it was made of some kind of stone, had lead inlay, and a pipe stem made of "arrow wood" (probably *Holodiscus discolor*) that was one and a half feet long, decorated with hawk feathers and dentalium (Jacobs 1932–1934, 101, p. 34).

Leona Ludson noted that Alsea pipes were made of stone or wood, with red elderberry pipe stems (Drucker 1933). Coquelle Thompson said the older people made pipes carved entirely (bowl and stem) from red elderberry (*Sambucus racemosa*). Thompson described how one smoked these straight pipes:

> The older people picked up a burning stick and lit pipe with it, and thereupon tipped up the pipe and took a smoke, first blowing out the flaming stick he had picked to light the fire with and laying near the fire, to use again for lighting pipe later that night or at some subsequent time (Harrington 1942 [25], p. 834, normalized).

Thompson also noted that some pipes were made of red alder, with the hole in the bowl about two inches deep (Seaburg 2007, p. 293). Bill Metcalf said that southwestern Oregon Athabaskan pipes were made of a "hard wood," might have stone inlay, or were made wholly of stone (Barnett 1934). Jim Buchanan stated that Coos pipes were about one foot long and made of hard "arrow wood" (Frachtenberg 1909). Leona Ludson recalled that Alsea people had two pipes; one that was straight and made wholly of wood, the other had an elbow-shaped stone bowl and a pipe stem made of elderberry (Drucker 1933).

The little ethnographic information on the traditional construction of pipes can be augmented by those found in museums or those recovered from archaeological sites. From what I have observed in the late 1990s in museum and private collections containing pipes or of pipe fragments from archaeological sites in Douglas, Coos and Curry counties, precontact pipes appeared to made of clay or stone. It is interesting to note that some informants stated that many pipes were said to be made wholly of organic materials (such as red elderberry or red alder wood) versus nonorganic materials. Probably, few to none of the wooden pipes would likely be preserved in archaeological sites. To date, only pipe bowls constructed from nonorganic materials have been recovered.

There are numerous pipe fragments that have been recovered from archaeological sites on the Oregon coast. Nancy Nelson analyzed 32 such pipes and pipe fragments from sites in Lincoln, Douglas, and Curry Counties (Nelson 2000). Twenty two of these pipes were made of clay, four of sandstone, three of schist, and three were carved from steatite. The oldest pipes were made of biconically drilled sandstone, and the oldest of these was dated at approximately 3000 years old. Most of the pipes were straight tubular pipes, although three were "shouldered" pipes. These pipes were not uniformly straight and smooth, but were somewhat wider at the end where tobacco was packed. Nelson found in her analysis of the clay pipes that they were baked in a low temperature reduction atmosphere. Many clay pipes were decorated. Most of the decorations consisted of lines, zigzags, or dots carved into the pipe, but one pipe from Cape Perpetua was entirely covered in red ochre (Endzweig 1989; Nelson 2000).

11.3.4 Tobacco Culture, Ritual, and Religion

It should be first noted here that Indian tobacco had a strong narcotic effect. Coquelle Thompson said "Enough kinnikinnick make you dizzy" (Jacobs 1935 [119], p. 56). Both Thompson and Annie Miner Peterson noted the powerful effects of smoking on Alsea Indians. Thompson likened it to being "drunk," and gave the following description:

> When an Alsea Indian prepared to smoke, he sat down in a nice place with a cup of water nearby, and kept swallowing the smoke again and again and again, then would drink a half a bucket of water, and for an hour, dead drunk, coughing, farting, his wife was seated by him, this as at the John Morris place … [somewhere on the Siletz reservation]. (Harrington 1942[25], p. 155, normalized)

Frank Drew said there was a Hanis Coos term for this state, *ts*'*si*, meaning "paralyzed, stupefied":

> They'd go lie on their backs and smoke, directly then they'd commence trembling, turn over and lie on their stomach … the smoker lost his senses when he got like that. The others would look on and laugh, and say he drew too hard. (Jacobs 1932–1934 [91], p. 138)

Annie Peterson also noticed that smoking could make men dizzy:

> Every night when some-at least-Alseas went to sleep they'd smoke till they got dizzy; they'd be in bed and on their backs, one would take the pipe from the other, then fall asleep. But they'd smoke only then. Of the Coos, Mrs. P is in doubt; she never saw Coos get dizzy, half unconscious, like Alseas, when smoking. She seems to know only of passing the pipe around at a meeting of men. (Jacobs 1932–1934[101], p. 19–20)

Lottie Evanoff's father, Chief Doloos Jackson, told her that the Alseas "swallowed" the tobacco smoke, and thus may have been more strongly affected:

> My father said that the Alseas used to swallow the smoke of tobacco. At Yachats the Alsea men sat in a row and passed a single straight tube stone pipe from one to another around the circle each taking a draw in or two, and would grunt like pigs, some falling over backwards, swallowing the smoke and no smoke coming out of their mouths. (Harrington 1942[24], p. 682, normalized)

Due to its powerful effects, smoking was restricted to the evening time, and informants from several tribes agreed that no one smoked in the morning. In general, only men and women doctors were allowed to smoke. A possible exception are the Coos, Lower Umpqua and Siuslaw, as Coos informants all insisted that they had never seen any Coos, Lower Umpqua, or Siuslaw women smoke, not even female doctors, although they observed that they did among the Alsea and Coquilles (Harrington 1942; Jacobs 1932–1934; Jacobs 1935).

Coquelle Thompson said that Upper Coquille doctors always smoked before curing someone. The doctor smoked first, then passed the pipe around to other men present. Women doctors were the only women who did smoke, and Thompson said of them:

> Woman Doctor smoke. She smoke her own pipe. Some woman light it for her. Only woman Doctor smoke pipe. Woman Doctor mustn't Doctor when menstruating. They wouldn't try at that time. It would be dangerous for patient. (Jacobs 1935[119], p. 57)

Coquille and Coos informants both recalled that when groups of men met, they would pass around the pipe and smoke. This was probably common at meetings of men throughout the region (Jacobs 1935[119], p. 57; Jacobs 1932–34[101], p. 19–21). Annie Miner Peterson described such meetings:

> When the people (men) assembled, to talk over things, so that they would be friends… Then they would finish whatever they had been discussing. Now the head man (the wealthy leader of one side) would light his pipe, then he would smoke it (a few puffs). Then all of them would (similarly) smoke it. (Jacobs 1939, p. 66)

Indeed, if a man refused to smoke with others in the group, it was a bad sign. This person was showing himself to be unfriendly, and perhaps downright dangerous. Annie went on to say:

> If you did not smoke it, it would not be a good thing (you indicated enmity and disagreement). They would not feel well disposed towards him. They would watch him. Should they see him alone, they might kill him, because he was not their friend… (Jacobs 1939, p. 66)

Among the Upper Coquilles, groups of men smoked in the sweathouse. The sweathouse was the usual gathering place and also the dormitory for southwestern Oregon Athabaskan men.

> You fill pipe once. Smoke three, four time one pipe full. You fill pipe, take few puffs. Put away when lots of people in Sweathouse. They had to light two pipes. Light Chief's pipe. He furnish tobacco. Chief starts, puts up fire. Passes it to man on his right. It goes round. Chief other corner lights pipe. He passes his to man on left. About half take smoke on each Chiefs {sic} pipe. Now they go to sleep. Chief don't say anything, just lights and pass. Each one when he smokes says, "I wish I be alive a long time. I wish I get something easy…(I wish money come to me), then blow out smoke. All old men always do that… Maybe smoke again about midnight when company, talk and tell stories night … (Jacobs 1935 [120], p. 45–46)

Among the Coos Bay tribes, tobacco had another function. It could be used to assuage the anger of the Thunderbird during thunder storms. In Coos mythology, Thunder is the chief of the ocean and all of its creatures, and he loves salmon most of all. If salmon were treated disrespectfully in some way, Thunderbird became angry and caused a thunderstorm. During these storms, Coos people threw tobacco, paint, paddles, and nets into the fire, telling the Thunders to "go away, go on north, they are abusing your children there" (Jacobs 1939:97). Nets and paddles were thrown in because, like salmon, they belonged to the realm of the fish, and tobacco was supposed to quiet Thunder down (Jacobs 1939:97; Jacobs 1932–34 [100], p. 172, [101], p. 34). Lottie said it was an old custom to blow smoke in the face of male babies (Harrington 1942 [22], p. 761).

The Upper Coquille people prayed with tobacco for protection in the mountains. Coquelle Thompson said that when people camped out in the mountains they "smoked and offered smoke in each direction, and asked the mountain to help them" (Jacobs 1935[120], p. 43–44). Hoxie Simmons said people prayed with it at other times too. "Before taking a bit of food they'd toss a little food around and say 'this is all I have, I give it to you-now give me.' Did same with tobacco and remainder in hand after filling pipe…" (Barnett 1934).

The traditional myths that were recorded along the Oregon coast are probably only a fraction of the rich corpus that once existed. In the stories that were recorded, tobacco and pipes are mentioned only incidentally and are rarely central in a myth. However there are two stories, one from the Alsea people of the central Oregon coast and one from the Chemetunne (Joshua) people from the mouth of the Rogue River, where tobacco plays a significant role in the myth. In the Joshua creation story, The Giver and his companion contemplate creating land. As part of the process of creating the land, and later creating plant and animal life, The Giver smokes tobacco several times and scatters tobacco over the land (Ramsey 1977, p. 217–219).

In an Alsea legend, the world-transformer S'uku created the custom of mixing kinnikinnick and tobacco. As S'uku stood by the south bank of the Umpqua River preparing to catch salmon, he called up a pipe and tobacco. He dropped some tobacco into the kinnikinnick growing in the sand. For this reason, the human beings who were yet to come would always smoke kinnikinnick and tobacco together (Frachtenberg 1920, p. 84).

11.4 Reclaiming Indigenous Tobacco: Modern Use and Propagation of a Sacred Plant

In the 1850s, many western Oregon Indians were removed from their home lands to reservations, such as Grand Ronde, Siletz, the Alsea Subagency, and Table Rocks. Some of these reservations were subsequently closed and Native people dispersed to other reservations or their old homelands, joining relatives who had stayed behind to marry settlers or those who had run away from the reservations. In the post-reservation economy, Indian people no longer grew their own tobacco, but bought it through the cash economy. This introduced commercial tobacco was a nonlocal trade tobacco, likely the domesticated species *N. tabacum*, a species that was widely traded throughout the Americas and entered parts of Oregon and Washington by the mid-1600s (Winter et al. 2000, p. 359).

Increased awareness of the cultural heritage of tobacco in our region has led to tribal acquisition of *N. quadrivalvis* seeds. In the late 1990s, Amanda Siestreem, a Coos tribal member, obtained seeds of *N. quadrivalvis* from Joseph Winter's Native Tobacco seed bank (the seed bank, sadly, is now defunct after the recent passing of Joseph Winter). From those seeds, I was able to grow a few plants over the course of the next two years, but had trouble maintaining healthy plants. A few years later John Schaeffer, Biologist and tribal member for the Confederated Tribes Coos, Lower Umpqua, and Siuslaw Indians (CLUSI), obtained some more seeds from Monticello, Virginia, from plants descended from samples collected by the Lewis and Clark expedition. These plants are being propagated by CLUSI tribal members as well as the Confederated Tribes of Grand Ronde and are being integrated into cultural practices and ceremony. Traditional uses associated with Tobacco have been preserved over time through the substitution of commercially available sources. Besides smoking the plants, the most frequent use of tobacco observed in tribal communities today is the use of the plant as an offering to the spirits. As it is said in tribal communities throughout western Oregon and the western United States, "Tobacco is the only thing that even the spirits are addicted too."

The bringing back of tobacco has coincided with a renaissance or larger cultural revival that is taking place in the region—many people have, for example, learned to weave baskets and carve bows, are reviving ancient camas patches, and are also learning western Oregon languages including Athabaskan languages and Chinook jargon. Reclaiming indigenous tobacco has been part of this broader cultural revival.

11.5 Conclusion

We do not know precisely when tobacco was introduced into western Oregon but the archaeological record suggests that pipes and smoking is a cultural practice that goes back at least 3000 years in the region. The oral histories recalled by tribal elders and recorded by ethnographers indicate that tobacco played an important role in the indigenous cultures of the region, and was used in doctoring ceremonies, prayers, social occasions, and as a trade item.

In spite of its ancient roots, tobacco was, until recently, largely a forgotten part of the cultural heritage of the Oregon coast. Some scholars, the general public, and even many tribal members were unaware that our ancestors grew and used tobacco prior to the movement of trappers and pioneers into our region. After more than a century since the abandonment of tobacco cultivation, *N. quadrivalvis* is rare in western Oregon. The only confirmed specimens found within the last four decades are on an island in the Umpqua River northwest of Roseburg that were found during botanical surveys conducted in the 1970s and 1990s (Thompson 2001). This strongly suggests that human manipulation and cultivation of tobacco was necessary to the species' persistence on the landscape. This is a similar situation to that documented for the Haida and Tlingit in British Columbia. These groups also cultivated *N. quadrivalvis*, a plant that does not grow naturally in this part of the Pacific Northwest Coast and in fact disappeared after the introduction of domesticated tobacco by early trading partners in this area (Turner and Taylor 1972).

Further work is needed to assess whether or not naturalized populations of these plants exist in western Oregon, specifically in the Umpqua watershed where populations were observed in the late-nineteenth and early-twentieth century and locations identified in the 1970s and 1990s. Another area of work that needs attention is determining if different populations of plants reported to be *N. quadrivalvis* are the same or if they are different from one another.

In the decade since I first began this research, more awareness of the cultural history of tobacco has grown among the CLUSI and some tribal members have obtained seeds of *N. quadrivalvis* and have been successfully cultivating it. Native people are again cultivating and tending tobacco in Western Oregon as they have done since time immemorial. Providing tribal member access to this plant is a part of maintaining cultural continuity into the past and perpetuating our culture into the future. Maintaining our tobacco is an exercise in smoke sovereignty; meaning cultivating local, indigenous varieties of tobacco and using it in traditional ceremonies and prayers, rather than relying on commercially grown tobacco. This is the action of working to reclaim, maintain, and perpetuate acceptable and responsible use of this plant as medicine and tool of cultural practice in our communities.

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Chapter 12
Hunter-Gatherer Tobacco Smoking in Ancient North America: Current Chemical Evidence and a Framework for Future Studies

Shannon Tushingham and Jelmer W. Eerkens

12.1 Introduction

At the time of European contact, tobacco (*Nicotiana* sp.) was the most widely exploited intoxicant in the Americas (Moerman 1998). Tobacco's popularity among humans both past and present lies in the psychotropic alkaloids it contains, including, but not exclusively, nicotine. These alkaloids cause a range of physiological effects including euphoria, increased heart rate and alertness, and suppression of hunger and thirst. In very high doses, the alkaloids of tobacco can induce hallucinations, out-of-body experiences, and color blindness, effects that were sought after by shamans, traditional doctors, and others as they relate to vision quests, medicine, and other religious practices (Siegel 1989; Wilbert 1987, p. 96). Indeed, tobacco was—and still is—widely regarded as a sacred plant or medicine by many indigenous peoples in the Americas, figuring prominently in Native traditions, religions, and rituals (Shorty 2007; Winter 2000c; Winter et al. 2000).

The chemical properties of tobacco form the basis of its long history of use among humans. A growing number of archaeologists use these very chemical properties to identify use of the plant in the past. Residue extraction methods and identification of alkaloid compounds using gas or liquid chromatography, often coupled to mass spectrometry (LC-MS or GC-MS), of pipes from archaeological contexts was recently demonstrated by Sean Rafferty. His work documents use of tobacco in the northeastern United States by at least 3000 BP through the identification of the

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biomarker nicotine in the ash content of prehistoric pipes (Rafferty 2006, 2002; Rafferty et al. 2012). Similarly, our own work in western North America demonstrates a continuous record of smoking tobacco in pipes by non-farming peoples from at least AD 860 through the historic period (Tushingham et al. 2013).

While methodological development is clearly important, so too is the development of a robust theoretical framework for future chemical studies focused on tobacco. Indeed, there are a wide range of anthropological questions that may be addressed through chemical residue analysis of tobacco and other smoke plants. Below, we outline several key research questions, with an emphasis on tobacco use, among hunting, gathering, and fishing societies in western North America. Research questions revolve around the antiquity of use, reconstruction of artifact function, manipulation and cultivation of tobacco, anthropogenic range extension, the origins of addiction and ritual activity, and applications relating to modern Native American tobacco use.

12.2 Antiquity of Use

Development of residue extraction and identification methods will give researchers the tools to better understand when and why people began using psychoactive plants, including tobacco. Such research will qualify what, if any, relationship there is between tobacco and the domestication and spread of other cultivars (e.g., Eastern Agricultural Complex plants, "three sisters" Mesoamerican domesticates: maize, beans, squash) and/or indigenous tobaccos or ritual plant complexes. More than 30 years ago, it was suggested that domesticated tobacco was cultivated around AD 1000 outside North America and was absent in the American Southwest until the historic period (Ford 1981, 1985). However, more recent work suggests a much earlier sequence, with tobacco, most likely *N. rustica*, reaching the eastern North America between 3000 and 2000 years ago (Rafferty 2006, 2002; Rafferty et al. 2012), by way of South America, and possibly *N. tabacum* spreading to parts of the southwestern United States and the Caribbean shortly thereafter (Winter 2000a, b). In these places, domesticated tobacco is thought to have been added to the suite of plants people were already farming, or spread in tandem with the rise of maize agriculture (Driver 1970, p. 106; Yarnell 1964, p. 85), though the development of different crops likely had different trajectories (Fritz 1990).

There is a growing appreciation that the development of tobacco use may have been more complex than previously imagined. For example, photogrammetric studies of tobacco seeds found at some sites in eastern North America are intriguing and suggest they more closely resemble indigenous tobacco species found in the west than domesticated *N. rustica*. Based on archaeobotanical evidence, Haberman (1984) suggests by about AD 1000 an eastern variety of *N. quadrivalvis* (var. *bigelovii*) was being cultivated in the Middle Missouri region. Likewise, Pauketaut et al. (2002) present evidence that a tobacco variety such as *N. quadrivalvis* or *N. multivalvis* was used at Cahokia, a Mississippian mound center in southwestern

Illinois, around AD 1050–1100. Thus, there remains the possibility that indigenous tobaccos spread from the west, presumably through anthropogenic processes. In this scenario, these tobacco species were later abandoned in favor of the domesticated *N. rustica* from South America, or, as suggested by Haberman (1984, p. 283), the *replacement* of *N. rustica* by "a western tobacco, which became the historic *N. bigelovii var. quadrivalvis* (Pursh) East, sometime during the early expression (ca. AD 900–1100) of the Initial Variant of the Middle Missouri tradition, at which time wide-ranging trade contacts were being established by sedentary village populations with a strong emphasis on horticulture." While there is much to understand about the timing and spread of domesticated tobaccos, even less is known about indigenous tobacco use in western North America.

While some have argued that tobacco smoking in western North America was a very recent practice brought by Euro-American traders in the contact period (e.g., Dixon 1933; Kroeber 1941, p. 14), other scholars argue that the practice has very ancient origins (e.g., de Rios 1984, p. 6; Furst 1976, p. 5–6; Heiser 1969, p. 16; La Barre 1970; Siegel 1989, p. 3; von Gernet 1989; von Gernet and Timmons 1987, p. 41; Winter 2000a; Winter and Hogan 1986, p. 120). In a model presented by Goodspeed (1954, p. 45–46), wild tobacco spread naturally into the deserts and arid zones of the southwest, Great Basin, and California by the early Pleistocene. If true, humans may have been using these tobaccos as early as Paleo-Indian times, though direct evidence for such early use is lacking.

In this scenario, the first peoples of North America, as early immigrants from Asia, may have "brought a 'cultural predisposition' for the use of psychoactive plants from Asia as part of their shamanistic religion" (Winter 2000a, p. 308–309). If so, tobacco could have simply been an additive to an ideological system where plants were already being used for "visions, hallucinations, and other shamanistic journeys" (Winter 2000a, p. 309). Here it is assumed that hallucinogenic plants were used to communicate with the spirit world and to produce the visions and out-of-body journeys that are commonly a part of shamanism. Though the literature emphasizes shamanism, supernatural visions, and out-of-body experiences, it is important to note these botanicals were also substances that were part of on-going medicinal practices, often due to other active ingredients within the plants.

Related to this issue is the evolution of smoking practices in North America. Tobacco use is often inferred based on the presence of archaeological pipes. This can be misleading for two reasons. First, the historic record demonstrates that Native peoples ingested tobacco in a variety of ways that are not always associated with durable artifacts or pipes (e.g., chewing with lime, smoking in organic materials such as wooden pipes, in reedgrass "cigarettes", or in leaf wrapped "cigars") (Adams 1990; Kroeber 1941). Second, it is not clear that the earliest smoking was necessarily of tobacco: while archaeological pipes are often assumed to have been used to smoke tobacco, we know that a staggering pharmacopeia of plants was smoked by historic groups for medicinal, ceremonial, and recreational purposes. For example, Moerman's Native American Ethnobotany (1998) documents over 100 plant species representing 55 *genera* of smoke plants used throughout North America.

Among hunter-gatherer communities in western North America, the variety of smoke plants was especially high. Popular smoke plants included bearberry or kinnikinnick, which was the main alternative smoke plant to tobacco in many parts of the Pacific Northwest Coast, either smoked with tobacco or on its own. While kinnikinnick usually refers to *Arctostaphylos uva-ursi*, Kroeber (1941) points out that this is a general term that can also refer to other plants smoked in this region, including Yew (*Taxus brevifolia* Nutt.) needles, Dogwood (*Cornus* sp.) leaves, Salal (*Gaultheria shallon* Pursh) leaves, and Madrone (*Arbutus menziesii* Pursh) leaves. In California, Native smoke plants include the leaves of various species of Manzanita (*Arctostaphylos* sp.), Sagewort (*Artemisia douglasiana*), Common Mistletoe (*Phoradendron villosum* Nutt.), California Black Oak (*Quercus kelloggii* Newb.), Creeping Sage (*Salvia sonomensis*), and Sacred Thornapple (*Datura wrightii*). Thus, it is possible that smoking in pipes began with any of these other species, and was only later adapted to include tobacco.

By focusing on tobacco and/or the biomarkers of tobacco, we run the risk of overlooking other smoke plants that may have been important in the past. As a result, we could be limiting our understanding of the complexity that plants play in ritual and medicinal activities, the evolution of such activities over time, plant cultivation practices, and related human-plant dynamics (see below). The potential for the presence of other plants demonstrates that chemical studies must not only target tobacco compounds (e.g., nicotine, nornicotine) but also compounds associated with other smoke plants. Thus, it is recommended that researchers develop a list of potential smoke plants specific to their study area that draws on regional ethnography, oral histories, and research into plant ecology and past environmental conditions. Ideally this work is done in collaboration with local tribal communities, since smoke plants in the past may have been obtained via trade or people in the past may have been growing and tending plants outside their natural geographic range. Researchers should also be sensitive to the fact that they may be asking people to share proprietary information associated with such plants. Once a list is constructed, these plants should be analyzed for associated biomarkers prior to undertaking chemical analyses on archaeological materials. LC- or GC-MS analysis should then seek specifically to identify these potential biomarkers in residues associated with archaeological materials. Furthermore, discovery of compounds not previously identified may lead to interesting avenues of research where new plants not previously considered could be added to a list of smoke plants, although it can be difficult to identify specific plants without pre-identified biomarkers.

12.2.1 Ethno-Historic Distribution of Indigenous ("Wild" and "Cultivated") Tobacco

Whether farmed, cultivated, gathered, or obtained by trade, tobacco was used by Native groups practically everywhere on the North American continent, from very mobile hunter-gatherers in the western deserts to sedentary agricultural groups in

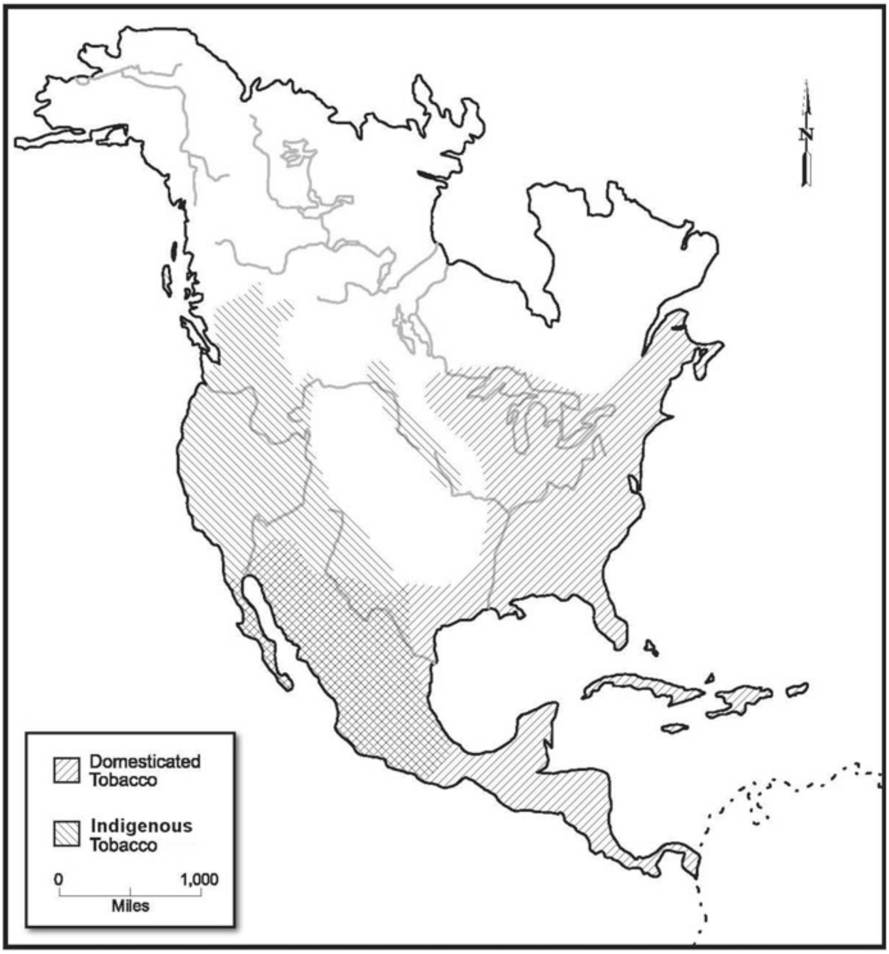

Fig. 12.1 Generalized distribution of indigenous and domesticated tobaccos in North America (Redrawn from Winter 2000a, p. 311, Map 28). Note domesticated tobaccos were likely traded further into northeastern Canada than depicted here

the Eastern Woodlands (Fig. 12.1). Of the range of species available, tobacco plants are often grouped into two broad categories: wild (also known as desert or "coyote") and domesticated tobaccos. This is, however, a misleading dichotomy, as many of the "wild" tobaccos were in fact manipulated through selection by native groups to a degree that has been largely unappreciated, and these cultural practices likely altered several species on a genetic level, perhaps even leading to the generation of new species (cf. Goodspeed 1954, p. 9–10; Winter 2000a). We are confident that future genetic and chemotaxonomic studies on ancient, historic, and modern remains will lead to important insights into the degree of manipulation or domestication on the part of humans. In the meantime, following Goodspeed (1954), we hereafter refer to the cultivated and "wild" tobaccos used by Native peoples in the west as *indigenous tobaccos*.

People are generally more familiar with domesticated tobaccos, which include the species *N. rustica* and *N. tabacum*, grown by indigenous farming groups throughout the eastern United States, the Caribbean, parts of the southwestern United States, and South and Central America. After European contact, these domesticated varieties of tobacco spread quickly to parts of the globe where they had never been before. For example, tobacco was brought to Europe by Spanish explorers in the early 1500s, and rapidly distributed throughout the Old World. More relevant to this chapter, tobacco was transported by Hudson Bay Company agents and other traders to northwestern North America as a trade item that was highly valued by many Native groups. Domesticated tobaccos are distinct in that, through genetic selection and modification by humans, a process that began perhaps 6000–8000 years ago in South America, the plants have much larger leaves and a higher nicotine content than the "weedier" indigenous tobaccos.

In contrast, there are many more species of indigenous tobaccos used by hunting, gathering, and fishing communities throughout the western United States and Canada. Some of these species can grow without human intervention, although there is a growing appreciation that plant management and cultivation was widely practiced by many pre-contact resident groups, a point that will be expanded upon below. Despite the absence of farmed crops (i.e., maize, beans, and squash) and agriculture, it is clear that the western North American landscape was highly managed through fire maintenance (or pyroculture) for thousands of years (e.g., articles in Blackburn and Anderson 1993). Though not in maintained plots of maize, beans, or squash, the patchwork of interconnected landcover was tended through encouragement of particular species regimes (e.g., Fowler 1996), with plant encouragement and selection for key characteristics (size, flavor, hardiness strength, etc.). Within these regimes, there is evidence for management and/or cultivation of indigenous tobaccos (Fig. 12.2). Ethno-historic sources (e.g., Kroeber 1941, papers in Winter 2000b; Moerman 1998) describe specific manners of planting, tending, and even ownership practices. This suggests that some genetic modification did occur at the hands of indigenous residents in the west, and the process of tobacco domestication should be regarded as a continuum (i.e., not simply domesticated vs. "wild").

Furthermore, as supported historically, Native Californians commonly traded for tobacco (Davis 1961), even in places where the plant grows wild without the aid of humans (i.e., central California). That people sought to acquire exotic varieties of a plant, whose wild variety could be gathered locally, suggests the tobacco that they were trading for, and consuming, had different properties. It remains a hypothesis, but we suggest such "outside" tobacco may have been a more genetically modified variety, perhaps with a stronger nicotine content, or having other preferred chemical properties sought after by people. Thus, while not all people may have sought to invest in cultivated plots, some individuals may have specialized in maintaining small gardens of preferred varieties of tobacco and traded these plants to neighboring people. Specialized production of particular items for trade, such as obsidian

Fig. 12.2 Hunter-gatherer tobacco cultivation. Mrs. Estefana Salazar (Tubatulabal) with tobacco leaves gathered from patch, Kern County, California (1932 photo). *Courtesy of the Phoebe A. Hearst Museum of Anthropology and the Regents of the University of California—photographed by* Erminie W. Voegelin, Image 3145-22

blades or shell beads, is well documented archaeologically and ethnographically in California (e.g., Arnold 1992; Gilreath and Hildebrandt 1997), and tobacco may constitute such a product as well.

Social factors may also be involved in the distribution of tobacco. For instance, there were social sanctions against smoking tobacco that was not cultivated in northwestern California. For example, plants that grew on graves or other sacred places were deemed unfit for human use. Instead, people had to cultivate tobacco in specific patches (Kroeber 1941), including perhaps, soils that were otherwise not favorable to tobacco. These restrictions encouraged husbanding of tobacco by certain individuals. If so, selection of particular seeds for future cultivation by such gardeners could have caused pheno- and chemo-typic changes in the plant. Although difficult to demonstrate archaeologically, other social factors affecting the use, growing, and geographic distribution of tobacco might include family/group connections, and linguistic or social barriers.

12.2.2 Anthropogenic Range Extension

There is a growing appreciation for the varied and sophisticated ways indigenous hunting, gathering, and fishing communities manipulate their "wild" environments (e.g., Deur 2002; Deur and Turner 2005; Lepofsky and Lertzman 2008; Lightfoot et al. 2013; Winter 2000c). Tobacco cultivation in the North American west provides unquestionable evidence of plant management: cultivation practices include the preparation of plots, burning, sowing of seeds, pruning, and fertilizing soils, and demonstrates these activities were widely practiced by historic groups in California, parts of the Pacific Northwest, and the Great Basin (e.g., Deur and Turner 2005; Fowler 1996; Harrington 1932; Kroeber 1941; Moss 2005; Turner and Taylor 1972; Winter 2000c).

In certain cases, plants were cultivated, managed, or domesticated outside of their natural range. Management of indigenous tobaccos is hypothesized to have expanded their range in the western United States and possibly led to the creation of new species (Winter 2000a). In the northern Pacific Northwest Coast, where tobacco is a non-native plant, human management of these species is seen as "a special and dramatic case of geographic range extension" (Lepofsky and Lertzman 2008, p. 136). The Haida and Tlingit groups cultivated *N. quadrivalvis*, for example, a plant that does not grow naturally in their homelands and in fact was no longer found on the landscape after the introduction of domesticated tobacco by early trading partners in this area (Turner and Taylor 1972).

Human action, specifically plant management and cultivation, may have extended the range of indigenous tobaccos over time (Winter 2000a). As mentioned above, active manipulation by humans may also have led to selective breeding and genetic changes in these plants, and ultimately, the development of new species in some areas. In other words, hunter-gatherers may have domesticated tobacco, changing the plant's ability to grow under different environmental conditions as well as altering the density and range of chemical compounds produced.

Western indigenous tobaccos are taxonomically grouped into petunioides, one of three subgenera of tobacco (the other two are rustica and tabacum) (Goodspeed 1954). At contact, petunioides were widely dispersed in North and South America, Australia, and the South Pacific Islands (Goodspeed 1954). Human cultivation and manipulation of several species used by hunter-gatherers in the west, however, likely extended their distribution. For example, *N. bigelovii*, in particular var. *multivalvis* and var. *quadrivalvus* were widely dispersed species used in California and the Pacific Northwest at the time of contact, and it is "probable that selection was actually toward their more compact habit and greater amount of leaf tissue in proportion to stem length" (Goodspeed 1954, p. 10).

Goodspeed (1954) outlines the basic mechanisms that may have led to the spread of indigenous tobaccos: "Three major factors have been responsible for such deliberate or fortuitous extension by man as has occurred in *Nicotiana*: (1) ancient and/or modern use of certain species as sources of ritualistic or pleasurable narcotics; (2) unintentional transport of seeds, sometimes over long distances; (3) propensity of a number of species to occupy disturbed soil" (Goodspeed 1954, p. 9). The ultimate reason for the spread of certain tobaccos may be hard to determine, and may in fact reflect a combination of the suggested mechanisms. Research investigating connections between indigenous tobaccos (wild and cultivated) remains largely unexplored. However, this may change through the application of chemical identification techniques and DNA analysis, on both archaeological artifacts and/or ancient or herbarium plant specimens.

Several authors have proposed tobacco is connected to plant domestication and cultivation in different parts of the continent. For example, according to Winter (2000a, p. 313) "tobacco use is a very ancient and far reaching cultural complex that formed or at least became part of the foundation for other kinds of plant manipulation, perhaps even agriculture." Along the Pacific Northwest Coast, it has been hypothesized pre-contact experience with tobacco cultivation may have "set the stage" for the rapid adoption of potatoes and other historically introduced vegetable crops. Tlingit and Haida peoples were successful in these horticultural practices by simply drawing on their previous knowledge of tobacco cultivation (Moss 2005; Turner and Taylor 1972). While intriguing, this "Pacific Northwest Tobacco Mystery" (Turner and Taylor 1972) unfortunately remains unsolved.

12.2.3 The Origins of Tobacco Addiction and Ritual

Today, tobacco is used by hundreds of millions of people around the world (World Health Organization 2011), and despite being the leading cause of preventable death, nicotine dependence is a worldwide epidemic. In the United States, an estimated 29 % of Americans continue to smoke tobacco in cigarettes, pipes and cigars, and even more chew smokeless or "spit" tobacco (World Health Organization 2011). Tobacco use has had clear worldwide consequences, yet as discussed above, we know surprisingly little about the evolution of human–tobacco relationships.

When did human use develop into human need of some of these intoxicant plants (as an essential component of ritual life and/or because regular use led to physiological addiction), and how do these dynamics relate to the domestication of certain plant species? Does this have any relevance in the modern world? The attractiveness of psychoactive plants to humans is clearly related to the physiological effects they cause when ingested, and their addictive nature (Winter 2000a, p. 326). The same properties that resulted in widespread prehistoric use are the same that cause continued widespread use today.

Winter (2000a, p. 327), posits that these qualities may have led "shamans and other heavy users to domesticate a number of the wild species and expand the ranges of others." In this scenario, after Native peoples had incorporated psychotropic plants such as tobacco, datura, and coca into their pharmacopeia, they then changed their geographic distributions, first by disturbing soils in sites where they could grow, later by burning old plants to improve the next season's growth, third by pruning and irrigating them, and finally by planting seeds. Over millennia people became increasingly dependent on tobacco and may have developed tobacco shamanism and other religious rites organized around large-scale ingestion of nicotine. This may have fostered intentional selection for increased nicotine content in tobacco (Winter 2000a, p. 315).

While this is not a testable proposition given current knowledge about ancient tobacco, techniques may be developed in the future that can ultimately produce data to address these issues. Indeed, understanding the origins and development of tobacco addiction and ritual can help us to better understand tobacco's current pull on global users: "domestication of tobacco and its widespread use by Native Americans has had profound effects upon the rest of the world. Previously used by Indians primarily as an offering and a way to communicate with the spirit world, tobacco is now ingested as a recreational, addictive drug all around the planet, with enormous economic and medical consequences" (Winter 2000a, p. 326).

12.2.4 "Tobacco Sovereignty", Colonialism, and Modern-Day Applications

Tobacco continues to be traditionally smoked and/or used as an offering by many Native peoples throughout the Americas. For example, the plant figures prominently in the annual World Renewal Ceremony of the Hupa, Karuk, and Yurok of northwestern California. Without tobacco, the ceremony is incomplete, which in traditional terms literally jeopardizes the future regeneration and well-being of the earth. Studies of past tobacco use can help document and gain perspective on the ancient nature of this ceremonial and ritual complex that continues to be an integral part of indigenous culture today (e.g., chapters in this volume by Phillips 2015; Snyder 2015; Winter et al. 2000).

At the same time, tobacco addiction is a critical health issue for Native Americans. More Native Americans than any other group habitually smoke tobacco (see discussion in Snyder 2015, this volume). Typical tobacco abatement programs approach tobacco use in black and white terms, with all tobacco use being bad, and abstinence from smoking as good. This is not the reality for many American Indians, who recognize the sacred and traditional aspects of tobacco.

Many Native communities practice "tobacco sovereignty" today (David Harrelson, personal communication, 2014), which refers to American Indians proscribing appropriate and healthy use of tobacco on their own terms. This may include, for example, development of tribal programs addressing healthy tobacco use, cessation, and/or small scale to commercial tobacco growing operations. Furthermore, many are defining traditional use practices (i.e., sacred, ceremonial, or other special use) within the terms of their own communities. This lies in great contrast with values placed on commercial tobacco smoking (unhealthy, addictive, nontraditional, colonial, large scale).

Shorty (2007) outlines several critiques of the tobacco industry, which has both a history of targeting Native Americans in their advertising and of using Native American imagery in the selling of tobacco. In an effort to better understand Native use patterns and develop successful abatement patterns, he calls for a recognition of the historical context of tobacco use and acknowledgement of its colonial past. Tribes may embark on smoking cessation programs as an act of self-determination, and he encourages a "threefold basis for engaging in indigenous tobacco control work: sovereignty, health, and spirituality. Slogans that guide work with American Indians and Alaska Natives include 'Keep Tobacco Sacred,' 'Tobacco: Use It in a Sacred Way,' 'Many Voices One Message: Keep Tobacco Sacred.' The rhetorical strategy implicit in the slogans is to create a distinction between 'commercial tobacco' and 'traditional/ ceremonial tobacco' and to work against the former. Respect for tribal sovereignty compliments an emphasis on spirituality" (Shorty 2007, p. 130).

A growing number of studies have focused on the development of a culturally specific smoking cessation program for Native Americans (e.g., Choi et al. 2006; Daley et al. 2006; Gohdes et al. 2002; Shorty 2007; Struthers and Hodge 2004; Unger et al. 2008; see also Snyder 2015, this volume). Common themes or priorities include acknowledging the importance of sacred tobacco use (versus recreational use of commercial tobacco), increasing education on the history of tobacco, and defining traditional use. For example, in a study by Choi et al. (2006), American Indian participants "who reported that traditional tobacco use is important were less inclined to use tobacco recreationally." Yet few programs to date have investigated the roots of traditional tobacco use, which has, in many cases, become obscured by historic events (see Snyder 2015, this volume). As discussed above and below, analysis of ethnographic and archaeological collections is one avenue indigenous communities could use to explore the nature of traditional tobacco practices.

Certainly, commercially grown species of tobacco have replaced traditional tobacco and use of other smoke plants among many Native peoples, a process that began several hundred years ago during earliest days of European colonialism of the Americas. According to Shorty (2007), increased awareness of the history of tobacco and its process of colonialization is critical to future smoking abatement programs as is distinguishing between commercial/manufactured tobacco and traditional/ceremonial tobacco. For example, few realize the extent to which domesticated strains of commercial tobacco have replaced indigenous species of tobacco and other smoke plants. In many cases, "commercial tobacco" has become the tobacco used for ceremonial purposes, "replacing the many Nicotiana species or other botanicals originally used by Indians who had a religious smoking tradition" (Shorty 2007, p. 133; see also Winter et al. 2000, p. 359–340). Briece Edwards (personal communication 2014) suggests a reason for this phenomenon: "In our office [Confederated Tribes of Grand Ronde], it may simply be a case of expedited ease. It is easier to buy a pack of cigarettes or even loose leaf at the shop and use it in ceremony than to grow and cultivate the indigenous species today. This is not to say this is true for all tribes and all uses. If anything, it further illustrates the complexity of the subject and the intricacies of use."

Ever since tobacco began to be grown by Euro-Americans, the commercial tobacco industry has evolved

> "….into a colossal, world-wide empire….Today there are thousands of commercial *N. tabacum* varieties. The 1993–1994 U.S. Tobacco Germplasm Collection alone has 2,358 varieties, and very few of them resemble the original Native American strains, which are much shorter and have smaller leaves. Contemporary commercial tobacco is therefore the result of 500 years of controlled selection for larger leaves and standardized levels of nicotine, experimental breeding, recent genetic engineering, and the use of immense quantities of chemical fertilizers, insecticides, and additives. As a consequence, the commercial varieties of *N. tabacum* are very different from the smaller, traditional varieties still grown by Native Americans. The uses to which they are put are also quite different, though many Indians do ingest commercial tobacco for secular purposes and even for ceremonies when they have no other choice" (Winter et al. 2000, p. 358–359).

Future research may shed light on the history of tobacco use and help tribes today establish baseline information critical to the development of culturally specific tobacco cessation programs (Snyder 2015, this volume). More specifically, chemical analysis of archaeological pipes, human hair, or dental calculus may supplement other lines of evidence (ethnographic and archaeological research, oral history documentation, examination of rock art, recovery of leaves in special contexts like dry caves, and flotation analysis to look for seeds) to identify the suite of plants used in traditional smoking in pre- and post-contact era through ethnographic research, oral history documentation, and archaeological analysis.

12.3 Chemical (GC-MS) Residue Studies in Western North America

While there are a wide range of interesting questions that may be addressed through the archaeology of tobacco, resolution of these issues is impeded by the challenges of recognizing tobacco in the archaeological record. The presence of charred tobacco seeds in archaeological sites is currently the main means of determining ancient use. However, this approach is limited due to the exceedingly small size of tobacco seeds, their rarity in the archaeological record due to preservation, taphonomic challenges (combustion of tobacco leaves typically does not include seeds), and the high cost of archaeobotanical analysis.

Residue analysis of archaeological pipes and other materials (e.g., tobacco pestles, human hair) using LC or GC-MS analysis provides an alternative means to trace the origins and spread of tobacco and other smoke plants. In this section, we summarize our recent studies (Eerkens et al. 2012; Tushingham et al. 2013) on the extraction of residues directly from the matrix of stone and clay pipes. As complete pipes and ash content are very rare archaeologically, we sought to develop methods that could be applied to even very small fragments of pipes. Method validation included experimentally smoking tobacco and a suite of other smoke plants used by ethnographic hunter-gatherers in replica clay pipes. We then compared the chemical signature of residue extracted from these experimental pipes to that of the unsmoked plant material, which allowed us to both identify plant-specific biomarkers and better understand their decomposition following combustion in a pipe.

We developed a chemical and sonication process to directly extract residues from complete and fragmentary pipes. The extracts were then analyzed using GC-MS techniques sensitive enough to identify nicotine and other plant compounds. Three groups of analyzed plants contained detectible biomarkers in both plant tissues and experimental pipes. All of the *Nicotiana* plants contained nicotine, a tropane alkaloid biomarker for tobacco. Nicotine was not detected in non-tobacco plants, but was detected in all modern experimental pipes smoked with tobacco. Together, this suggests that nicotine can be detected in a similar manner in archaeological pipes and that its presence is indicative of ancient tobacco smoking.

Our results suggest that pipes smoked with *N. glauca* or "tree tobacco", a historically introduced California smoke plant, might be identified via the combined presence of nicotine and anabasine, a pyridine alkaloid, which was found in both the plant and in an experimental pipe smoked with *N. glauca*. Finally, *Arctostaphylos* sp. plants, including *A. uva-ursi* or kinnikinnick, widely smoked in the Northwest Coast, Arctic, Plateau and parts of the Great Basin as a tobacco "substitute" or additive (Moerman 1998, p. 87–88) can be detected via the presence of the ether glycoside arbutin.

12.3.1 Archaeological Applications

Archaeological application of the methods developed above includes the analysis of a suite of pipes from the southern Pacific Northwest Coast and central California (Figs. 12.3 and 12.4).

12.3.1.1 Northwestern California/Southern Pacific Northwest Coast

We tested a total of 16 clay and steatite (soapstone) artifacts (15 fragments and a complete steatite pipe) from the Red Elderberry site (CA-DNO-26) and an adjacent unnamed village (CA-DNO-333), located in Tolowa ancestral territory in the extreme northwestern corner of California (Fig. 12.3) (Tushingham et al. 2013). The Tolowa, along with other groups in northwestern California and southwestern Oregon lived in a coastal rainforest ecozone and shared many cultural traits in common with other Pacific Northwest Coast groups (e.g., permanent plank house dwellings, developed woodworking technology, emphasis on salmon in the diet), but other key cultural elements including the focus on acorns, small size of houses and household units, and extreme autonomy of sociopolitical units made them distinctive among Pacific Northwest Coast groups as well. Recent excavations documented over 9000 years of site use, including the emergence of plank house village life by

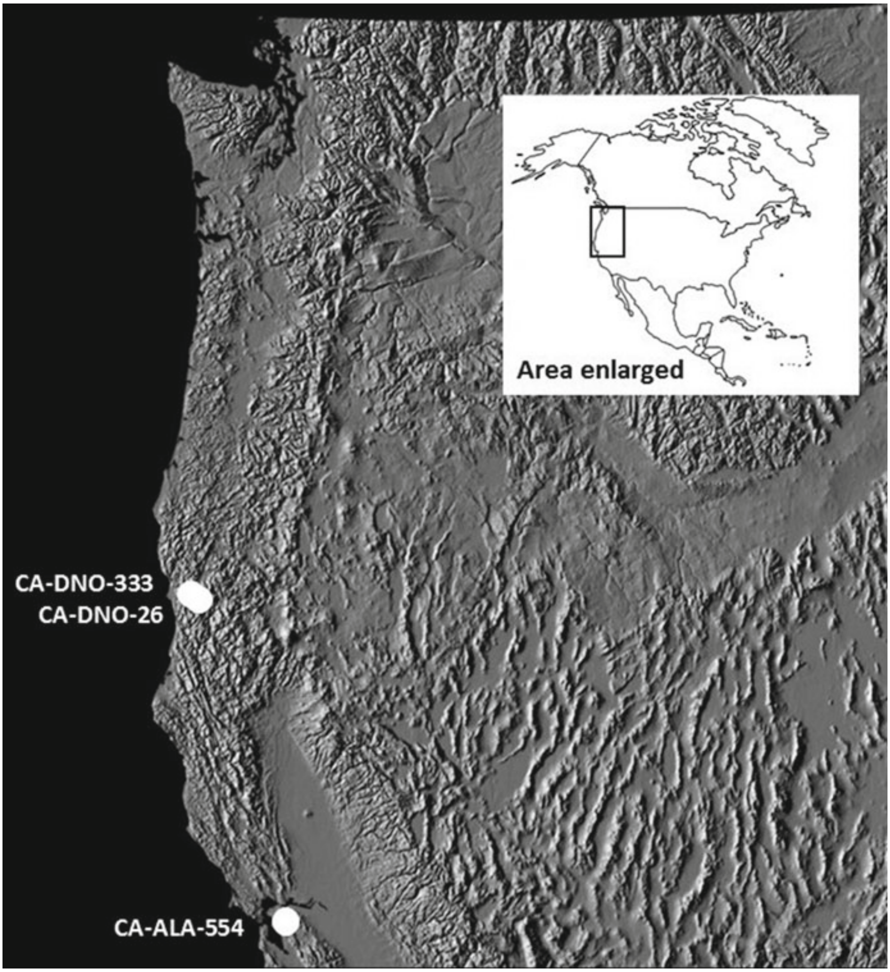

Fig. 12.3 Nicotine-positive artifact site locations

AD 700, a development that seems to be associated with an influx of Athabascan and Algonquian speaking peoples into the region (Tushingham 2009, 2013).

Nicotine was identified in residues extracted from five of the pipe fragments (Fig. 12.4b) and the complete pipe (Fig. 12.4a). Biomarkers for other smoke plants were absent in the ancient pipes. Several pipe fragments were associated with a house dating to AD 1850–1890, confirming historic use of tobacco, confirmed by a number of ethno-historic studies (Balls 1962; Harrington 1932; Kroeber 1941; Winter 2000c; Setchell 1921) and members of the modern Tolowa community. Another fragment was found at site CA-DNO-333 beneath a living surface and slab-lined hearth AMS radiocarbon dated to AD 1230. The oldest nicotine-positive artifact was a complete pipe found in a semi-subterranean plank house radiocarbon dated by AMS to AD 860.

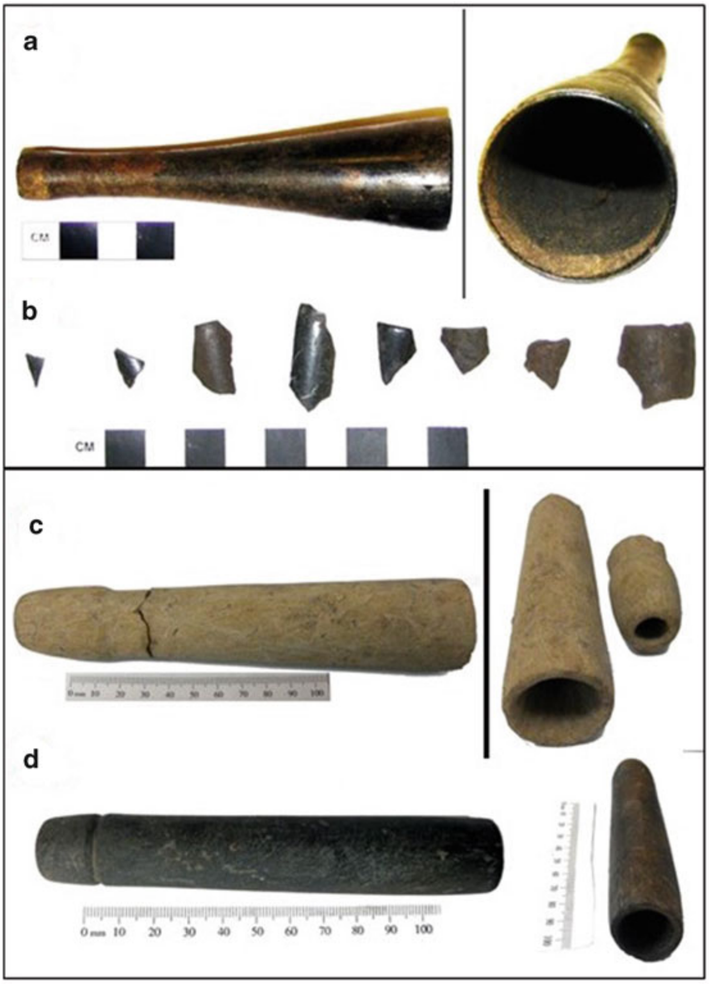

Fig. 12.4 Nicotine-positive artifacts: (**a**) Complete steatite pipe from site CA-DNO-26 dating to AD 860; (**b**) clay and steatite pipe fragments from sites CA-DNO-26 and CA-DNO-333 dating to AD 1200 to contact; (**c**) complete (broken) sandstone pipe from CA-ALA-554 dating to AD 1400-1430; (**d**) complete steatite pipe from CA-ALA-554 dating to AD 1319–1406. From studies on artifacts from sites CA-DNO-26 and CA-DNO-333 (Tushingham et al. 2013) and site CA-ALA-554 (Eerkens et al. 2012)

The tobacco smoked in these pipes may have been obtained through trade or grown by resident groups. As these sites are located in the coastal rainforest away from the natural habitat of tobacco, it seems likely that, if grown locally, it represents anthropogenic range extension, human management, and/or cultivation of tobacco. In any case, our study shows that tobacco smoking was part of the plank house dwelling cultures in the southern Pacific Northwest Coast very early in time.

12.3.1.2 Central California

We also identified nicotine in a similar study of two complete pipes associated with human interments from CA-ALA-554 (Fig. 12.4c, d), a site located in the city of Pleasanton in central California (Fig. 12.3) (Eerkens et al. 2012). With full support from the descendent community (Ohlone), analysis of these pipes provided important information linking tobacco to these particular items and gave contextual information on the lives of individuals buried with pipes, and perhaps, their role in shamanistic and/or ceremonial rituals. Again, no other alkaloid biomarkers were identified, suggesting tobacco was the main smoke plant associated with these items. Radiocarbon dates on bone collagen from the burials place the presence of tobacco at this site no later than AD 1415, and perhaps as early as AD 1305.

Pipes or pipe fragments are not ubiquitous constituents of prehistoric sites in central California, but they are regularly found in a wide range of environments, especially when funerary contexts are the focus of investigations. For example, three of 185 burials at CA-ALA-554 contain pipes, and one additional pipe was found in a non-burial context (Estes et al. 2012).

While rare, pipes have been found in prehistoric contexts in western North America dating to as old as 2500–4000 BP (e.g., Mack 1994; Touhy 2002), and perhaps even older. Because these chemical analyses of pipes are among the first with confirmed context dates, additional dating of materials associated with other pipes containing nicotine residues will likely push the date of tobacco use back even earlier.

12.4 Summary

Residue analysis has the potential to broaden our understanding of human use of psychoactive plants in ancient societies. Analyses on ancient materials that contain nicotine and other alkaloids will provide insight into the role these substances played in Native American ceremonial and ritual life, and may help us to better understand their historical development into products habitually used by people throughout the world today. Such work will also underscore the importance and evolution of these plants in ritual, economic, and other activities.

We are only beginning to understand the complicated history of the use and spread of tobacco and the many other different smoke plants used by the indigenous peoples of Western North America. Alkaloid-bearing plants were undoubtedly chosen for the psychoactive effects they caused, but tobacco became the most widely used. In our view the wild-domesticated tobacco dichotomy is a false one. Tobacco domestication was likely a continuum and manipulation by Native peoples in the west likely extended the plants' range, and led to genetic and phytochemical changes in these plants. Put another way, plant cultivation, husbanding, and similar processes may have led to genetic selection and perhaps even the creation of new species. Indeed, we have only begun to understand the history of this remarkable plant and its long co-evolution with people.

Our studies in western North America included analyzing modern plants, analyzing samples from experimental pipes, and analyzing archaeological specimens. This sequence allowed us to examine alkaloid biomarkers, including their uptake into artifacts, their breakdown following combustion, and their degradation and preservation over archaeological time. This approach, where residues are extracted directly from the pipe matrix of complete or fragmentary pipes, without any damage to the pipe itself, may expand our future data set of testable artifacts. Evidence of the prehistoric use of tobacco by hunter-gatherers has remained elusive. Our results definitively place *Nicotiana* use at AD 860, continuing into the historic period in the southern Pacific Northwest Coast, and in central California by AD 1305. This was an area where the antiquity of tobacco smoking was, until now, completely unknown.

We are confident that future studies will push the antiquity of tobacco use even earlier, and may help us track the spread of different varieties of tobacco, and the use of other ritual and medicinal smoke plants in the ancient Americas and elsewhere. Tobacco is hypothesized to have been present during the Pleistocene in arid parts of the west (Goodspeed 1954). Thus, it is possible that the first tobacco users in North America were actually hunter-gatherers in western North America. Additional studies will help us better understand the history of human manipulation and cultivation of tobacco, and provide insights into anthropogenic range extension, the origins of addiction and ritual activity, and modern-day issues relating to Native American tobacco use.

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Chapter 13
Towards the Reconstruction of the Ritual Expressions of Societies of the Early Ceramic Period in Central Chile: Social and Cultural Contexts Associated with the Use of Smoking Pipes

María Teresa Planella, Carolina A. Belmar, Luciana D. Quiroz, Fernanda Falabella, Silvia K. Alfaro, Javier Echeverría, and Hermann M. Niemeyer

13.1 Introduction

Smoking and sniffing activities and the general consumption of psychoactive substances are a widespread practice among North, Meso, and South American Native peoples (Dougherty 1972; Haberman 1984; Schultes and Hofmann 1979; Wilbert 1987). Characteristics of the substances and their uses have been described in northern Chile by several authors (Berenguer 2001; Chacama 2001; Echeverría and Niemeyer 2013; Hermosilla 2001; Llagostera 2001; Torres 1998, 2001), in the central region of Chile by Planella et al. (2005–2006), and the southern part of the country by Aldunate (2002–2003) and Olivos (2004).

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In Chile, artifacts associated with the consumption of psychoactive substances have been found to vary both spatially and temporally (Fig. 13.1). Although smoking pipes were gradually substituted by snuffing trays in the Atacama Desert of northern Chile during the late Formative period (ca. 200 AD; Torres 1996), pipes were the main artifacts used in other areas including: semi-arid northern Chile (El Molle culture: 0–800 AD; Niemeyer et al. 1989, 1998), central Chile (Early Ceramic communities: 200 BC–200 AD; Bato culture: 200–1200 AD and Llolleo culture: 300–1300 AD; Falabella et al. 2001; Falabella et al. 2014; Planella et al. 2000), and southern Chile (Pitrén Complex: 500–1400 AD; Quiroz et al. 2012; Planella et al. 2012a). Both types of artifacts (pipes and trays) have been found in the trans-Andean territories and in northwestern Argentina (Capparelli et al. 2006; Fernández Distel 1980; Fernández Distel et al. 1999; Pochettino et al. 1999). Pipes have been found in more southerly locations in Argentina as well (Lagiglia 1991, 1992).

In central Chile, archaeological findings have suggested that pipe smoking was an important part of the cultural traditions of prehispanic peoples during the Early Ceramic Period (300 BC–1300 AD). Smoking pipes are ubiquitous during this time at most residential sites, yet they tend to be found in small quantities at any one site. They are, however, abundant at our main study site, La Granja. After this period, pipes disappeared or notably decreased in the archaeological record (Cornely 1966; Falabella et al. 2001; Niemeyer et al. 1989, 1998; Planella et al. 2000; Quiroz and Sánchez 2005; Reyes et al. 2003–2004; Westfall 1993–1994). In this region, smoking pipes were frequently used within the Bato and Llolleo cultures. Important socioeconomic changes occurred during these times among these communities, particularly among the Llolleo groups. These changes led to permanent settlements, horticultural practices, and the development of ceramics with complex decorations such as phytomorphic, anthropomorphic, and zoomorphic motifs, as well as a vast set of regional interactions and ritual activities (Falabella and Stehberg 1989; Falabella et al. 2008; Planella and Tagle 1998; Planella et al. 2005–2006; Sanhueza et al. 2003; Sanhueza and Falabella 2009).

The fragmented state of information on smoking pipes and the disaggregated spatial evidence of smoking activities during the Early Ceramic Period of central Chile have produced a rather incomplete picture of the Smoking Complex as it has been approached by Springer (1981), Planella et al. (2000), and Falabella et al. (2001). It is difficult to empirically approach the social processes sustaining non-tangible subjects such as beliefs, in spite of their important role in the cohesion of human populations. However, the study of the Smoking Complex is beginning to show its importance in the understanding of this abstract dimension of social relations during this period.

Our research is focused on redefining the Smoking Complex in central Chile and neighboring regions during the Early Ceramic Period. Here, we explain the material elements that compose this Smoking Complex, and consider stylistic and technological features of pipes. We also seek to identify the psychoactive and aromatic plants that were consumed. We discuss the hypothesis that one site, La Granja,

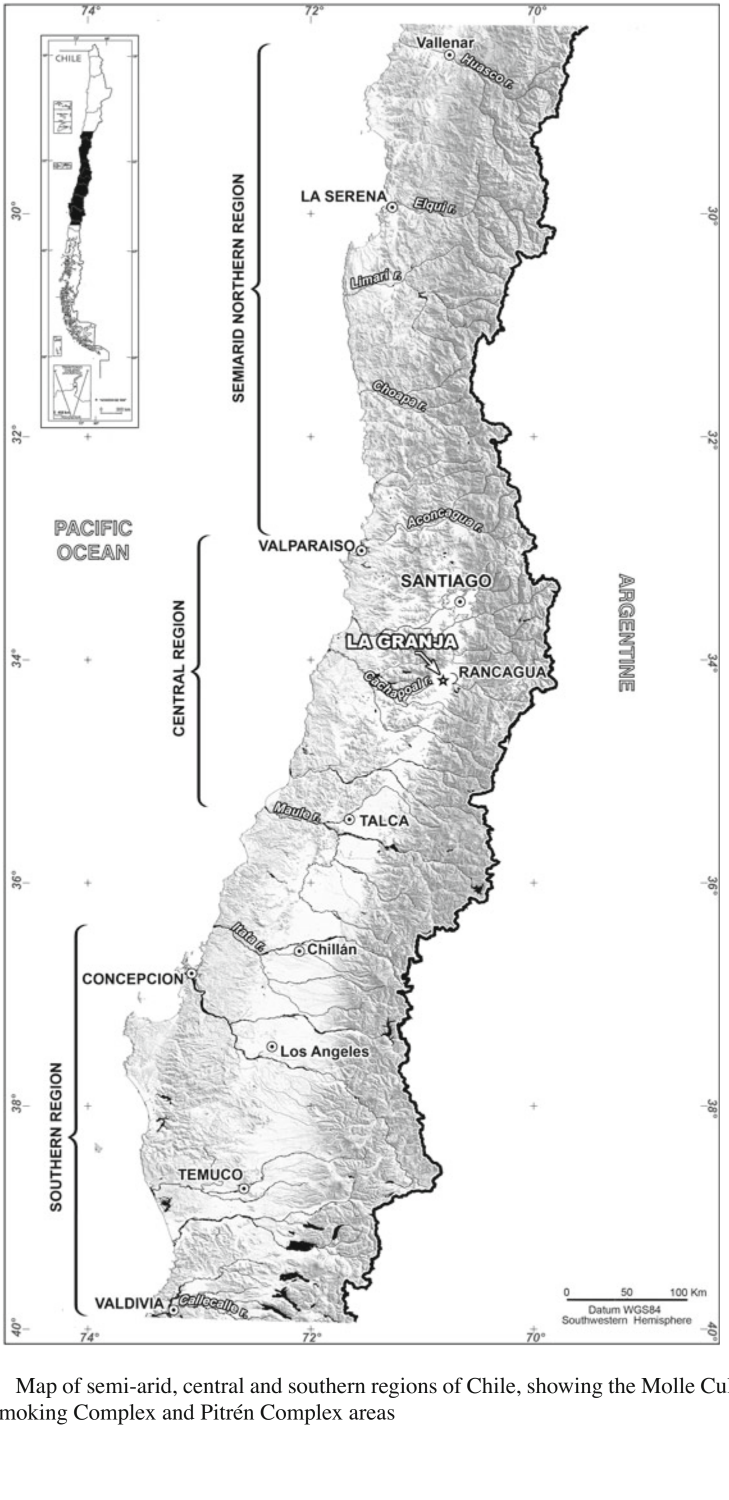

Fig. 13.1 Map of semi-arid, central and southern regions of Chile, showing the Molle Culture, La Granja Smoking Complex and Pitrén Complex areas

which has a particularly large pipe assemblage, was a social aggregation site. Our approach has been multidisciplinary and integrates archaeological, archaeobotanical, chemical, physical, and morphotechnological studies.

13.2 Pipes and Tobacco at La Granja

Archaeological studies have shown that most Early Ceramic Period sites in central Chile yield fragments of smoking pipes in very low numbers (five or fewer). This has led to the idea that sites with large numbers of smoking pipes correspond to special places, where social gatherings for people from distant areas took place (Castro and Adán 2001; Falabella et al. 2014). The La Granja site (ca. 500–1000 AD) in the Cachapoal Valley of central Chile is one of them. The site has an exceptionally high number of pipe fragments ($n = 787$) and variety of pipe styles that were found associated with decorated drinking vessels. Additionally, other artifacts related to the process of smoking were documented, such as small grinding stones and pestles, which were used to process tobacco leaves (Fig. 13.2). The large assemblage of pipes and processing implements suggests the existence of a Smoking Complex. Furthermore, such a Complex would have been an integral part of ceremonial and ritual activities of horticultural groups (Falabella et al. 2001; Planella et al. 2000).

Fig. 13.2 Paraphernalia associated with the Smoking Complex: (**a**) lithic pestle; (**b–c**) ceramic pestles; (**d**) small handstones; (**e–i**) small grinding stones or micromortars; (**j**) wooden stick found inside a smoking pipe tube. Bar scale: 1 cm

Fig. 13.3 Semi-buried oval, circular, and lineal shaped stone structures at La Granja site

The La Granja site covers approximately 2.5 km^2 and contains distinct areas used for domestic activities and ceremonial practices; two human burials were also found (Planella et al. 2000). The presence of semi-buried stone structures of oval, circular, and lineal shapes is noteworthy (Fig. 13.3). Early historical documents (Planella 1988) point to the area where La Granja is located as a possible place of native Indian gatherings (*junta de indios*) thus suggesting it also might have been a prominent site in the context of smoking activities in the more recent past.

Regional gatherings of Native peoples have been mentioned during the Hispanic conquest of Chile. They are described as places where indigenous people performed rites and ceremonies (Valdivia, Pedro de 1545/1960; Vivar, Gerónimo de 1558/1979). Spanish conquerors looked upon these rituals as mere drinking activities. The use of smoke and tobacco in smoking pipes in different types of rituals began to be mentioned in the seventeenth century by Núñez de Pineda and Bascuñán (1663/1984) and thereafter by several authors (Medina 1898; Molina 1788/2000; de Rosales 1877–1878). Reports emphasizing social organization and contexts linked to tobacco use during various ceremonies performed by Mapuche groups from southern Chile are known since the beginning of the twentieth century (Cooper 1949; Faron 1964; Guevara 1911; Guevara and Oyarzún 1912; Gusinde 1917; Hilger 1957; Housse 1940; Latcham 1924, 1936).

The probable use of La Granja as a regional gathering site opened the interesting possibility of studying, at a single site, objects related to the Smoking Complex produced by these groups. Moreover, the archaeological collection is well defined, described, catalogued, and preserved; the objects are associated with well-documented contexts from excavations that have been carefully and thoroughly described (Ciprés Consultores 2002; Planella et al. 1994–1996). Hence, a reappraisal of cultural materials from this site following the concept of collection-based archaeology (Lemp et al. 2008; Seguel and Ladrón de Guevara 1997) was undertaken. Collection-based archaeology studies rely on curated collections that are deposited in museums instead of excavating new sites. In the following sections, we summarize the results of our multidisciplinary research, including investigations of morphotechnological traits, raw material variability, and archaeobotanical and chemical studies. We then discuss what they reveal about the Smoking Complex.

13.2.1 Morphotechnological Studies

A total of 787 ceramic pipe fragments[1] were analyzed from the La Granja site. The most frequent type of smoking pipe found in La Granja is the "inverted T" pipe (Fig. 13.4a), which has a central bowl and two mouthpieces in opposing directions (Table 13.1). Different parts of the pipes were recovered: stems, mouthpieces, and bowls. Open stems with a longitudinal perforation and mouthpieces predominate the pipe assemblage (87.3 %, $n = 687$). Only seven non-perforated stems (0.9 %) and only two partially perforated stems were documented. One hundred and twenty seven open stems and mouthpieces have the complete bowls or parts thereof still attached, and 15 specimens have the whole bowl and the two open stems. Their overall size is difficult to determine because the assemblages are highly fragmented. Nevertheless, stem length (the length between the bowl and the end of the mouthpiece) is highly variable, with lengths ranging in excess of 90 mm to only 15 mm.

The form of stems and their mouthpieces can be cylindrical (42.3 %), conic (28 %), subconic (23.6 %), curved (5.7 %), irregular (0.2 %), or spiraled (0.2 %). The cross section is predominantly circular (95.5 %); very few fragments have ellipsoidal (2.6 %), subrectangular (1.2 %), subtriangular (0.4 %), and oval sections (0.4 %). Most pipes have cylindrical stems and circular cross sections, whereas only six have flattened conical stems (0.8 %) and three subrectangular or ellipsoidal sections (0.4 %). These latter fragments could belong to another type of pipe, different from the "inverted T" pipes, but this has yet to be determined with certainty (Fig. 13.4b).

Another type of pipe identified at La Granja is the "fish tail" pipe, so called because the stem opposite to the mouthpiece looks like a caudal fin (Fig. 13.4c). This pipe type is represented at this site by only two fragments, a closed stem and a stem with one closed end; both are conical with an elliptical section. These pipes display a short handle whose length fluctuates between 20 and 40 mm. There are few records of "fish tail" pipes within the Early Ceramic contexts in central Chile,

[1] The La Granja fragments cannot be pieced together; therefore, each fragment most likely represents one whole pipe.

Table 13.1 Types and techniques of decoration of pipes analyzed in La Granja site

	Un-decorated pipes	Decorated pipes									
Pipe type	Plain	Modeled	Modeled and incised	Incised	Slip	Slip and modeled	Slip and incised	Specular hematite	Black paint	Total decorated pipes	Total %
Undetermined	642	29	5	37	38	1		6	1	117	85.4
Inverted T	1	15								15	10.9
Flattened tube A	3				2					2	1.5
Flattened tube B	1										
Ellipsoidal tube				2			1			3	2.2
Fish tail	2										
Vertical	1										
Total	650	44	5	39	40	1	1	6	1	137	
Total %	82.6	32.1	3.6	28.5	29.2	0.7	0.7	4.4	0.7	17.4	100[1]

[1]Total % of decorated pipes

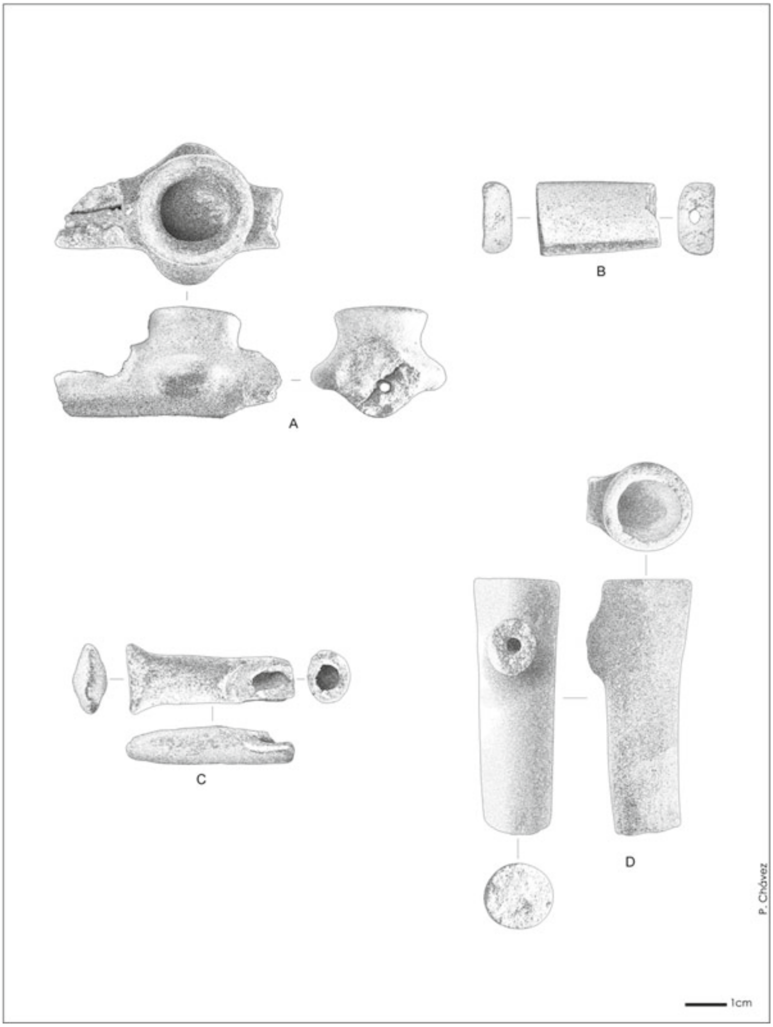

Fig. 13.4 Types of smoking pipes from La Granja site in central Chile: (**a**) inverted "T" type, (**b**) flattened tube, (**c**) fish tail type, (**d**) vertical pipe

and they are usually associated with Bato groups (Rivas and González 2008; Sanhueza et al. 2003). Finally, a third type of pipe is the "vertical pipe" (Fig. 13.4d), represented at La Granja by only one specimen. This type has been described mainly in central-western Argentina (Lagiglia 2005).

Most pipes have polished surfaces (79 %, $n=622$), and 15.1 % ($n=119$) have smoothed surfaces. One hundred and thirty seven display some type of decoration: modeled, red slip, incising, modeled and incised, specular hematite, slip and modeling, red slip and incising, and black paint (Table 13.1). Some of the most frequent decorative motifs are: (a) two modeled bulges located in the base of the bowl ($n=37$), or one bulge on the stem ($n=12$), some of them with a linear incision

($n=4$); (b) red slip applied over the whole piece ($n=40$), or specular hematite over red slip, or on the surface of the pipe; (c) incised motifs which include a spiraled continuous line (26.3 %), chevrons (23.7 %), angles (13.2 %), short oblique parallel lines (10.5 %), a stepped motif (5.3 %), and random lines (5.3 %) (Fig. 13.5). It is notable that while the decorative techniques used for smoking pipes are similar to those applied to ceramic vessels by Llolleo groups, the motifs are totally different.

13.2.2 Analysis of Raw Materials

Even if the extraordinary number of smoking pipes and associated elements suggest that special social and ceremonial activities were being performed at La Granja, the notion that people from different settlements within the region aggregated at the site still needed archaeological confirmation. Thus, raw material analyses were designed to test the hypothesis that La Granja was a social aggregation site. We assumed that pipes were manufactured at the residential sites where the people who owned them lived, and that raw materials were collected near these places. If this were true and people from different settlements carried pipes to La Granja, cultural and geographical provenience should be reflected in distinctive paste and chemical groups. If pipes were found to be made of raw materials from different areas, this would support the hypothesis that La Granja was a socially significant site and enhance our understanding of smoking behavior. Such findings would also provide valuable information about social networks, cohesion, and organization.

Thus, one line of research has been ceramic paste analysis of the smoking pipes. Previous work in the region has shown that pottery manufacture is a community based, non-specialized industry, and that cultural groups can be distinguished according to paste preparation traditions (Sanhueza 2004). Paste inclusions also provide information about distinct geomorphological deposits in this region, mainly distinguishing between volcanic and intrusive formations, and locations of sand collection derived from them (Falabella et al. 2013).

In our study, sections of 569 (73.2 %) of the La Granja specimens were analyzed with a binocular microscope under 10–40× magnification, and classified into six paste groups according to physical attributes (color, form, size, and density) of inclusions. All groups are sand tempered, with igneous rocks as the main component. To help determine source provenience, classifications were made according to the two broad geomorphological features in the area: volcanic and intrusive rocks. Volcanic paste groups (V, VB, and VGr) are characterized by mafic-intermediate rock fragments (andesite, basalt). They differ in the amount of mafic vs. leucocratic inclusions; paste groups are medium-to-fine grained. Volcanic paste groups have a composition similar to sands in the rivers that flow from the Andes Mountains that could have been added as temper. An intrusive paste group (Gr) is characterized by the presence of granite rock fragments associated mainly with quartz and feldspars. Temper sizes range from fine to very fine or heterogeneous. Granites are mainly available in the Coastal Range, west of our study area. Paste group B has mainly white inclusions with heterogeneous grain size, probably derived from intrusive rocks.

Fig. 13.5 Motifs and techniques of decoration in pipes from La Granja site in central Chile. (**a**) two modeled bulges; (**b**) one modeled bulge with incision; (**c**) one modeled bulge; (**d**) incised, spiraled, and continuous lines; (**e**) incised chevrons; (**f**) incised angles within a band; (**g**) short oblique incised lines; (**h**) random incised lines; (**i**) two superimposed incised stepped motifs

Three hundred and twenty pipes (56.2 %) seem to be part of the Llolleo tradition due to their volcanic inclusions and a modal size distribution. Additionally, 227 (39.9 %) show similarities with Bato manufacturing traditions. The final 22 pipes exhibit unique characteristics (3.9 %). Preliminary results show that pipes were manufactured with similar raw materials as associated pottery, suggesting that both kinds of artifacts could have been produced by the same artisans and in the same places, the main difference being a measurable decrease in temper density in the paste preparation for ceramic pipes. These results are inconclusive regarding the hypothesis of La Granja being a social aggregation site, a point that we elaborate further in the discussion.

13.2.3 Archaeobotanical Studies

Ethnographic and historic data indicate that tobacco played an important role in Native ceremonies in Chile. Studies by Foerster (1995) and Foerster and Gundermann (1996) contain detailed descriptions of the social and ritual structures of healing ceremonies (*machitún*) and prayer ceremonies (*nguillatún*), where the use of smoke is also mentioned. Ethnohistorical and ethnographical accounts also describe the use of mixtures of tobacco with various adjuvant plants such as maqui (*Aristotelia chilensis* Mol.), boldo (*Peumus boldus* Mol.), pitra (*Myrceugenia exsucca* DC.) Berg, molle (*Schinus latifolius* Gill. ex Lindl.), calafate (*Berberis buxifolia* Lam.), and wild potato (*Solanum* spp.) (Capparelli et al. 2006; Cooper 1949; Erize 1987; Guevara 1911; Guevara and Oyarzún 1912; Housse 1940; Latcham 1936; Martinic 1991; Serrano 1934). The accounts also describe the use of psychoactive plants such as tupa (*Lobelia tupa* L.) (Schultes and Hofmann 1979) and latué (*Latua pubiflora* (Griseb.) Phil.) (Plowman et al. 1971), independently of tobacco. Based on the variation of smoke plant use revealed in these studies, it was deemed important to investigate what kinds of substances were consumed in the smoking pipes at La Granja. The study of the substances consumed in the smoking pipes was conducted using archaeobotanical analysis, focusing on microscopic remains recovered from use residues, and chemical studies employing mass spectrometry identification methods.

13.2.4 Microscopic Remains Reference Collection

A reference collection of relevant plant materials was constructed, which focused on assembling diagnostic microscopic remains. This was a necessary step in our effort to identify the variety of *Nicotiana* species available in Chile as well as those mentioned in ethnohistorical and ethnographical literature as adjuvant and psychoactive plants used independently of tobacco.

The microscopic remains reference collection of *Nicotiana* species native to Chile includes 11 different species: *N. acuminata* (Graham) Hook., *N. cordifolia* Phil., *N. corymbosa* Remy, *N. linearis* Phil., *N. longibracteata* Phil., *N. miersii* Remy, *N. noctiflora* Hook., *N. pauciflora* Remy, *N. petunioides* (Griseb.) Millán, *N. solanifolia* Walp., and *N. undulata*. Five of the specimens, from the northern semi-arid region, were collected as entire plants, which allowed for the study of remains of all anatomical plant parts. Five other samples consisted of leaf fragments and came from the Universidad de Concepción's herbarium. The two remaining incomplete specimens have been gathered in the Metropolitan and Atacama regions of Chile. Also included in the analysis were trichomes in epidermal slices of the leaves, stems, fruits, and flowers from *N. acuminata*, *N. miersii*, *N. glauca*, *N. linearis*, and *N. solanifolia*. Tobacco was deemed one of the most probable plants in the context of smoking not only because of the historical accounts but also because charred and desiccated seeds of the native species, *N. corymbosa* (Planella et al. 2012b), have been recovered from cultural deposits of the Early Ceramic period component of Las Morrenas 1 rock shelter site in central Chile (Planella et al. 2005). Although no pipes or pipe fragments were recovered from that site, this finding demonstrates the availability of this species to the social groups inhabiting central Chile during this period. The reference collection of aromatic plants was built upon Planella et al.'s (2009) previous work. Species of the families Anacardiaceae, Campanulaceae, Desfontainaceae, Elaeocarpaceae, Fabaceae, Gomortegaceae, Lauraceae, Monimiaceae, Poaceae, and Solanaceae were included due to ethnographic references of their use.

The first plant microscopically characterized was *N. miersii*. Our studies include component characterization of the leaves, stems, fruits, and flowers of the plant. An assessment of the range of variation and potential diagnostic properties of the microscopic remains associated with the different anatomical parts provided the foundation for our approach with other species that have only been partially studied. For example, we found that the distribution and presence of redundant starch grains is associated with stems rather than leaves, because of their abundance, and the conspicuous starch grains of the genus are more frequent and bigger in leaf tissue.

Using the multiple microfossil analysis method (Coil et al. 2003),[2] we examined the microfossil assemblage of each anatomical part of each species, and then combined the results to create a more comprehensive picture of the species' overall microfossil assemblage. At the genus level, we observed that the leaves exhibited trichomes, diagnostic storage starch grains, along with double, triple, and multiple compound starch grains. We also noted the presence of small single redundant starch grains, conductive tissue cells, crystals (prismatic, sand), tracheids, epidermal tissue cells, and spongy and palisade parenchymal cells. The stems displayed trichomes, reticulated, stepped or spiraled pattern conductive tissue cells, tracheids, crystals (sand), cellulose rings, single, pseudo-compound or double, triple, and multiple compound starch grains and frequent small single redundant starch grains. Fruits and flowers are characterized by the presence of epidermic cells, cellulose rings, crystals, and trichomes. In these samples, pollen grains are restricted to the flowers of the plant. Finally, conductive tissues, crystals, and absence of trichomes can be considered characteristic of the roots.

Interspecies differences were identified based on differences in the size of single storage starch grains, the frequency and modality of double and multiple compound starch grains, the particular association with different types of crystals, and the absence/presence and morphology of trichomes. For example, the leaves of *N. glauca*

[2] Multiple microfossil analysis considers the totality of a microfossil assemblage instead of only studying one category of these materials, e.g., only phytoliths. This approach strengthens archaeological interpretations.

exhibit a specific microfossil assemblage represented by the association of storage starch grains and two well-defined types of crystals (Fig. 13.6).

A complete description of the entire reference collection of microscopic remains is currently in progress, and we continue our work observing and classifying the studied species by anatomical part, notably to include the accurate determination of their dimension range and morphological features. In the case of starch grains, size and general shape, features and dimensions of the cross, hilum, lamellae, and eventual crack or fissures will be evaluated. In the case of the other micro remains, measurements will cover minimal and maximum length, width, and height and any notable special features.

13.2.5 Microfossil Residue Analysis

The identification of the substances consumed in pipes through microfossil analysis of the residue allows elements of plant and animal origin to be detected. Thus, the presence of microscopic elements such as faunal spherulites, diatoms, algae of the order Chrysophyta, and sponge spicules may be determined (Coil et al. 2003). In addition, the multiple analysis perspective that we have applied enables the recovery of the assemblage of microfossil evidence associated with an artifact (Coil et al. 2003). This methodological approach implies the use of less aggressive extraction methods (Babot 2003, 2004; Coil et al. 2003; Korstanje 2006); hence, direct scraping (Loy 1994) was used since it benefits the conservation of organic microfossils.

Considering that distance from the combustion process may differentially affect the integrity of the organic microfossils (e.g., starch grains), artifact sampling was conducted to obtain extracts from different parts of the pipes (i.e., stem, bowl, and mouthpiece). We used inert materials and distilled water to minimize the risk of contamination during the extraction process (Belmar et al. 2014). Additionally, a control sample of sediments was analyzed to identify microfossils that form as part of the site's deposit due to natural processes.

The morphological description of the microfossils was based on the International Code for Phytolith Nomenclature (Madella et al. 2005) and International Code for Starch Nomenclature (ICSN 2011). Published reference collections (Korstanje and Babot 2007; Reichert 1913) and our own reference collection of alkaloid containing species (Albornoz 2014; Quiroz et al. 2014, described above) were also used for taxonomic identification. These samples were observed with a petrographic microscope at 200× and 400× magnifications.

Of the 787 pipes and pipe fragments recovered from the La Granja site, 50 pipe fragments were analyzed, plus nine micromortars and four pestles (Fig. 13.2). Elements identified in the residues reflected the great variety of components used in smoking practices. A vast diversity of microfossil morphotypes were recovered, including silicophytoliths, as well as starch grains. Silicified trichomes, stomata, and long and short cells formed part of the smoking pipe residues, as well as fragments of plant tissues and microcarbons that reflect the use of plants and the combustion process that takes place in the pipes.

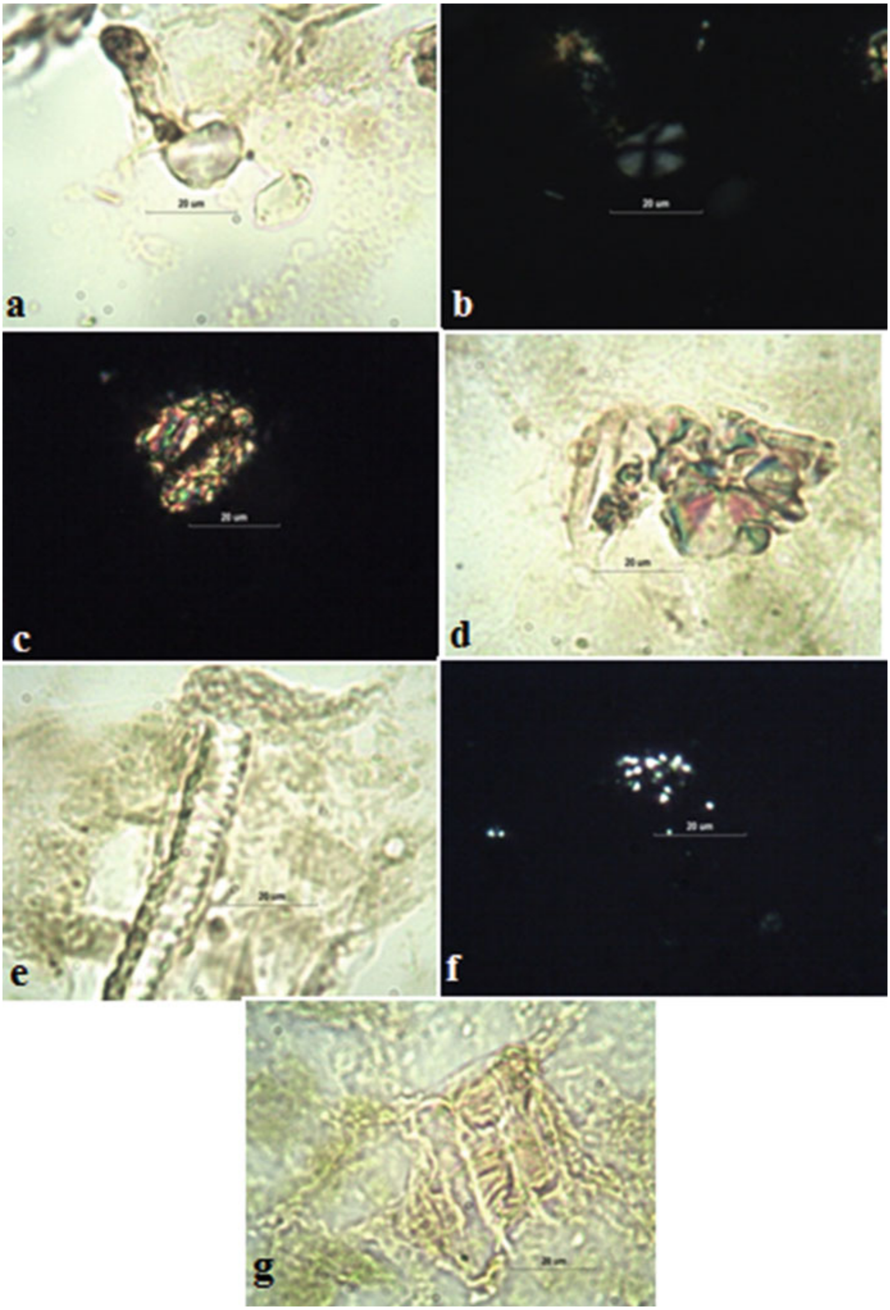

Fig. 13.6 Micro remains reference collection. (**a**) single storage starch grain, found in *Nicotiana glauca* leaf, normal transmitted light; (**b**) single storage starch grain, found in *Nicotiana glauca* leaf, polarized light; (**c**) kidney-shaped druse crystal, found in *Nicotiana glauca* leaf, polarized light; (**d**) druse crystal, found in *Nicotiana glauca* leaf, normal transmitted light; (**e**) reticulated pattern conductive tissue, found in *Nicotiana glauca* leaf, normal transmitted light; (**f**) amorphous sand crystal, found in *Nicotiana glauca* leaf, polarized light; (**g**) stepped pattern conductive tissue, found in *Nicotiana glauca* leaf, normal transmitted light. Bar scale: 20 μm

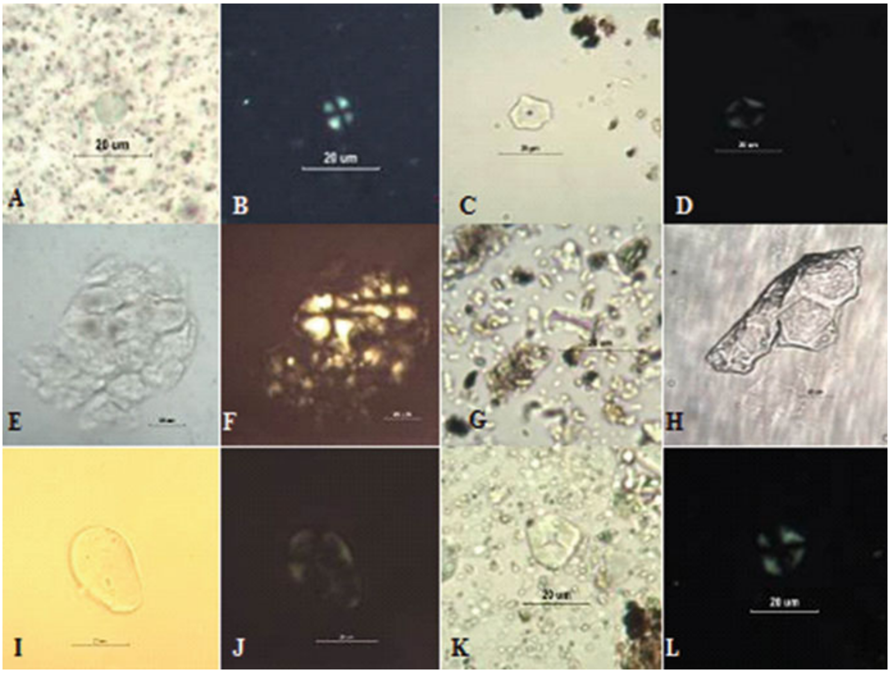

Fig. 13.7 Microfossils recovered from pipe residues. (**a**–**b**) *Nicotiana* spp. starch grain; (**c**–**d**) cf. *Zea mays* starch grain; (**e**–**f**) low *Nicotiana* spp. aggregates of starch grains; (**g**) *Nicotiana* spp. trichoma; (**h**) silicified tissue; (**i**–**j**) unidentified starch grain with clear taphonomical damages, such as flat relief and low visibility; (**k**–**l**) unidentified starch grain with clear taphonomical damages such as fissures. Bar scale = 20 μ

From this assemblage, the consumption of *Nicotiana* spp. was determined through the presence of trichome and starch grains (Fig. 13.7a, b, e, f, g). Other identified taxa include wild potato, *Solanum maglia* Schlecht (starch grain of cimarrona potato), *Zea mays* L. or maize (a possible starch grain) (Fig. 13.7c, d), and a species of subfamily Mimosoideae (Fabaceae) (starch grains). These findings are consistent with ethnohistorical documents that mention the use of native tobaccos (Guevara 1911; Guevara and Oyarzún 1912; Serrano 1934) by groups of the southern regions of Chile, the incorporation of leaves of wild potato in the smoking pipes (Hilger 1957; Housse 1940; Serrano 1934) and the use of maize leaves as a "wrapper" to make cigars (Joseph 1930).[3] In some of the smoking pipes, we recorded the presence of animal spherulites, which, based on ethnohistorical data, suggest the use of animal dung as a means to enhance combustion inside the pipe bowl (Guevara 1911; Serrano 1934).

Although identification of the complete microfossil assemblage associated with the smoking pipes is still in progress, it is important to point out that taphonomical markers are noticeable on the microfossils, specifically the damage on starch grains

[3] Even though the ethnohistorial reference states the use of the maize leaf as a wrapper, the association of maize/tobacco and the presence of maize in a smoking pipe is interesting.

caused by grinding and combustion of plants. Babot's observations of the alterations experienced by starch grains exposed to different plant processing techniques applied in archaeological experiments (2007, p. 108) were particularly relevant to this study. For example, observations of the presence of fissures, loss of birefringence, depressions in the grains, gelatinization, and alteration in the cross and hilum suggest the plants were ground and burnt, since such damage was recorded on starch grains (Fig. 13.7i, l). It should be noted that other noncultural processes may cause similar damage (Haslam 2004).

13.2.6 Chemical Studies

Preliminary chemical analysis of residues deposited in pipe stems and bowls found at the La Granja site detected the presence of alkaloids although their nature could not be elucidated (Hairfield and Hairfield 2002). Similar Gas Chromatography–Mass Spectrometry (GC/MS) analyses were performed on a larger number of Smoking Complex elements (fragments of pipe bowls, stems and mouthpieces, along with mortars and pestles; $n=116$), this time using single ion monitoring, a method which monitors only specific mass fragments of any given compound and thus is more sensitive (Echeverría and Niemeyer 2012). The analyses showed the total absence of dimethyltryptamines and the presence of nicotine in 39 % ($n=45$) of the objects analyzed, suggesting consumption of tobacco, in accordance with the demonstrated availability of species of this genus in the general geographic area (Planella et al. 2012b) and the microfossil results of the residue analysis described above. The prevalence of nicotine in the bowls of smoking pipes was higher than in the mouthpieces, a finding that is in agreement with earlier work on pipes from sites in western North America (Eerkens et al. 2012).

Analysis of several plant species from the study area used as adjuvants has found that they produce aromatic essential oils (Niemeyer and Teillier 2007). Psychoactive plants used independently of tobacco also contain alkaloids (Echeverría et al. 2014a, b). The chemical analysis of combustion residues of these species should lead to a reference collection of compounds to be used as potential markers in residues of objects belonging to the Smoking Complex (Table 13.2).

13.3 Discussion and Conclusions

Due to the diverse dispersion routes of species of the genus *Nicotiana* (Goodspeed 1954), Native groups from the Americas adopted these plants and crafted particular applications for their use. One widespread application is their ritual use, which crosses the different cultures as an infallible component of social activities. In Chile, there is no robust evidence that these activities began during the Archaic Period; however, clear evidence exists for these practices in Early Ceramic societies with the adoption of agriculture or the initial phases of this process. Interestingly, the use of pipes during the following periods in the central zone of Chile decreased or was

Table 13.2 Main constituents of aromatic plants' essential oils that may have been used in mixtures with tobacco

Species	Family	Main compounds found in essential oil (% of total identified compounds)
Amomyrtus luma	Myrtaceae	β-Caryophyllene (23.1), γ-elemene (11.6), α-humulene (9.1), viridiflorol (6.9)
Amomyrtus meli	Myrtaceae	(*E*,*E*)-α-Farnesene (20.2), germacrene D (16.5), α-Copaene (15.3), β-caryophyllene (12.1),
Baccharis linearis	Asteraceae	Limonene (22.0), germacrene B (13.2), germacrene D (11.7)
Beilschmiedia miersii	Lauraceae	*cis*-Isosafrol (39.2), myristicine (18.6)
Cryptocarya alba	Lauraceae	1,8-Cineol (21.4), 4-terpineol (18.2), β-pinene (17.5),
Laurelia philippiana	Atherospermataceae	Linalool (43.4), *cis*-isosafrol (21.4), methyleugenol (10.0), 1,8-cineol (8.2)
Laurelia sempervirens	Atherospermataceae	*cis*-Isosafrol (89.8)
Luma apiculata	Myrtaceae	Linalool (21.2), α-terpineol (20.3), methyleugenol (18.7), *cis*-isosafrol (13.7)
Luma gayana	Myrtaceae	Linalool (21.2), 4-terpineol (17.8), α-terpineol (8.9)
Myrcianthes coquimbensis	Myrtaceae	Carvone (14.3), (*E*)-carveol (10.2), limonene (7.2), *trans*-pinocarveol (6.2)
Peumus boldus	Monimiaceae	Ascaridol (60.3), *p*-cymene (19.2), 1,8-cineol (15.7)
Satureja gilliesii	Lamiaceae	Isoperitenone (40.3), pulegone (34.9), carvacrol (7.0)
Schinus latifolius	Anacardiaceae	β-Pinene (24.2), bornyl acetate (19.7), α-pinene (16.6), camphene (14.3)
Senecio adenotrichius	Asteraceae	Dehydrofukinone (72.7)

even lost. Therefore, it is viable to ask about the cultural changes and causes that led to the disappearance of smoking pipes in the archaeological record, possibly because the need for the existence of a Smoking Complex was lost or because such a need was satisfied through other practices.

The potential role and significance of the identified substances as part of ritual smoking practices has not been fully explored. The main contribution is to determine the presence of certain substances in pipe contents or other elements of the Smoking Complex, therefore, making it possible to answer the following questions: what kinds of substances or combinations of substances were consumed, in what situations were they consumed, and by which groups of people? What is the significance or importance of the plant, additive substance, or combination of them, in the development of ritual practice? At this time, the microfossil residue and chemical studies have both shown the presence of plants of the genus *Nicotiana*. But through our analysis of plant micro remains, we have also been able to identify the presence of *Solanum maglia* (a wild potato), possible *Zea mays* and species of the subfamily Mimosoideae (Fabaceae or legume family).

It is worth noting that the chemical analysis detected nicotine in micromortars and pestles, where the plant micro remains analysis could not. This difference suggests such techniques are complementary and should be used together to create a more holistic picture of past tobacco use. Furthermore, each method of analysis can demonstrate different things. While chemical analysis has shown the higher deposition of nicotine in pipe bowls than in mouthpieces, micro remain studies have shown that starch grains recovered from smoking materials were damaged (e.g., grinding or burn marks), as well as demonstrating the probable association of maize with tobacco.

Certainly, the future analysis of the micro remains and chemical components reference collections is a key issue to pass through the actual limits of the identification of the plants consumed in this Smoking Complex. The accurate identification of the smoked species could provide a means to investigate intercultural and interregional relationships as well as some specific details in the modality of the rituals and the tradition of these species' consumption in Early Ceramic populations of central Chile.

The material dimension of the Early Ceramic Smoking Complex observed in the La Granja site could be partially characterized through the results of morphotechnological and the archaeological analyses. The morphotechnological study identified the most frequent type of pipe as the "inverted T" pipe, predominantly equipped with open stems and mouthpieces. Conic, subconic, and cylindrical-shaped stems, cylindrical stems with circular sections, as well as polishing and smoothing surface treatment of the ceramic were represented in the highest frequencies. Less than one fifth of La Granja pipes were decorated, principally by modeling, red slip painting, and application of incisions. Other artifacts were also incorporated in the Smoking Complex paraphernalia, such as small lithic and ceramic mortars (micromortars) and pestles. These objects are thought to have been used in the processing of substances involved in ritual activities, as indicated by the finding of nicotine residues associated with them (Echeverría et al. 2014a, b). Additionally, a wooden stick, probably of the genus *Schinus* (Riquelme 2013), was found inside the stem of a ceramic smoking pipe (Fig. 13.2j); ethnographic studies demonstrate similar tools were used to clear pipes (Guevara 1911; Guevara and Oyarzún 1912); therefore, they may be considered another component of the Smoking Complex.

The ritual dimension of this Smoking Complex is more difficult to assess. The high fragmentation of pipes suggests they may have been ritually broken at the La Granja site in a manner similar to the tradition of "*matar*" or killing ceramic containers by making a hole in them. This ritual has been documented at Early Ceramic Period sites of central and southern Chile (Dillehay and Gordon 1979; Falabella and Planella 1980; Gordon 1985). Nevertheless, the different modalities and circumstances involving smoking have not been totally revealed. At La Granja, pipes are found in different contexts; they are associated with domestic features as well as with areas of stone alignments considered to be of a ritual nature. Three fragments were found under those intentionally buried alignments, two of which might belong to the same pipe. Nevertheless, the notorious density of fragments of smoking pipes accumulated in this one site, compared to their scarcity elsewhere, leads us to think that people preferred that these practices take place in only some special places where various communities gathered.

Our results, however, did not provide clues for differentiating among the Llolleo communities thought to have gathered at the site. The homogeneity of the geological environment prevents us from distinguishing raw material sources with binocular analyses alone. Neutron activation analyses will hopefully provide further clarity either by reinforcing the paste analysis information, confirming the hypothesis of several local/regional communities participating in these ceremonies, or indicating the presence of foreign materials. Until now, the sole evidence supporting the hypothetical presence of foreign groups in La Granja would be the presence of two types of rare pipes, the "fish tail" pipe, usually associated with Bato groups, in spite of the Llolleo cultural assignment of La Granja; and the "vertical pipe," found mainly in central Argentina. The raw material study has identified that a majority of pipes were manufactured with materials that follow a Llolleo pattern and a minority follow a manufacturing tradition similar to that associated with Bato groups.

Based on the evidence presented here we accept the hypothesis of La Granja as an aggregation site. In this case, aggregation is understood as the concentration of individuals and groups that were spatially dispersed, which may be triggered by ecological, subsistence, and/or ritual/social motives (Conkey 1980; Lee 1976). It is composed of various dimensions; here, the social/ceremonial component of this phenomenon is essential for cohesion and identity reinforcement (Conkey 1980; Lee 1976). Although these are cultural aspects that are hard to detect in the archaeological record, the study of a vast and diversified array of artifacts and ecofacts associated with the Smoking Complex, such as smoking pipes, tobacco, and ceremonial structures associated with the ritual burial of pipes constitute a material image of this intangible cultural sphere. As such, they help unravel the cultural processes that cause this aggregation and the development of social dynamics related to interaction and cooperation. This will eventually help us to better understand the reasons why individuals and groups coming from other areas congregated at La Granja.

Increased cultural complexity during the Early Ceramic Period is ubiquitous throughout Chile. The presence of smoking pipes is widespread, encompassing cultures from different regions and ecosystems, such as the northern, central, and southern regions of Chile. We are addressing the issues outlined above through further complementary studies of the Smoking Complexes in two of these regions, specifically the archaeological materials from Molle (northern) and Pitrén (southern) complexes. As artifacts, pipes are part of different types of rites and ceremonies, which have social implications, including healing rituals, and ceremonies begging for rain and good harvests. Pipes also played key roles in events of group congregation with the aim of reinforcing cultural identities. Comparing those contexts, the smoking paraphernalia, and the information contained in residues, we will be able to define particularities, similarities, and differences and be able to shed light on the relationships between regional groups. The results of the initial phase we have described herein constitute a solid base for our studies of the Smoking Complex in the Early Ceramic Period of central Chile.

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Chapter 14
Final Thoughts and Future Directions

Sean M. Rafferty

When the editors of this volume approached me with the offer to write an afterword, my initial reaction was that I was the wrong archaeologist for the job. My research interest in smoking pipes came about purely by accident. Some years ago during my postgraduate work, I was casting about for a suitable dissertation project. My experience in debitage analysis during my M.A. work had shown me one topic I had no further interest in, but otherwise I was lacking direction. Fortunately for me, chance intervened. During a phone conversation with my undergraduate advisor, he happened to ask "Say, do you need a dissertation topic?" As it happened he had come into possession of a sample of smoking pipe residue, and proposed I investigate whether it was possible to determine its original substance.

After somehow convincing the chemistry department of a nearby community college to allow access to an analytical chemistry lab, as well as free training in gas chromatography, I was sold on the project. I would collect hundreds of residue samples of early smoking pipes and establish for good the antiquity of tobacco in North America. Then reality intervened. Out of several hundred pipes I catalogued, only one had residue, thanks to the thorough cleaning of countless intrepid curators and lab technicians. Undaunted (maybe a little daunted) I analyzed two pipes, both of which showed chemical evidence of nicotine. The results, while limited in sample and preliminary in scope, were published (Rafferty 2002); the research overall was deemed sufficiently interesting to land me a job interview for the position I now hold, and I resigned myself to being known as "That Pipe Guy."

I was fortunate to stumble into a developing field. Residue analysis was a rapidly expanding area of research with vast potential, but much of the inquiry was (and still is) focused on questions of subsistence, with scant attention to possible drug residues.

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This is despite abundant evidence in the archaeological record in the form of various drug delivery devices, smoking pipes being a notable example. This gap in substantial research on pipes was not limited to residue analysis; with the exception of a few typological studies, at that time there was not a lot of current research on pipes. This under-occupied niche was what led Rob Mann and me to organize an SAA symposium on smoking pipe studies, with the only stipulation being that the research presented relate to the social and ideological roles pipes play in the cultures that use them. The collected papers were later published under the title *Smoking and Culture* (Rafferty and Mann 2004), and I am pleased beyond measure to see this current volume following in a similar direction.

What have we learned about pipes as artifacts so far? One point which is often glossed over is that first and foremost smoking pipes are *drug delivery devices*. Inhalation of intoxicating vapors or smoke is among the most effective means of ingesting a mind-altering substance, and smoking pipes have been independently invented numerous times to fulfill this purpose. There have been hypotheses that pipes may have “evolved” out of artifacts with other functions, such as tubes used to suck illness out of a shamanic healer’s patients. I strongly suspect that this is erroneous (and, in any event, likely unverifiable) and that pipes were invented for the specific purpose of smoking. Everything else about their social and ideological significance stems from this basic fact. Why this fundamental point has often been, if not ignored, then underemphasized, I cannot say, though I suspect it has much to do with cultural stigmas regarding drug use in our own society. Researchers often shy away from ascribing perceived antisocial or otherwise negative behaviors to their subjects, hence the focus on typology and symbolism as opposed to their role in fostering altered states of consciousness.

It should also be stated clearly that the drug of choice for smoking pipes in North America, the nicotine contained in tobacco, is unique among intoxicating substances. Its effects can range from mild stimulation and relaxation, up to the experience of significant hallucinations with sufficient dosage. It is difficult to fatally overdose, and its physiological and psychological effects are predictable. It is a relatively “safe” drug in that its negative side effects are not acute and become apparent only with chronic use. It is also one of the most addictive compounds humans have isolated, far more so than alcohol, hallucinogens, or most other intoxicants, the exceptions being opiate compounds. These factors make tobacco an ideal intoxicant and explain how tobacco came to dominate North America early and rapidly to the exclusion of all other mind-altering substances.

Given smoking pipes’ basic function, what then is the role that intoxicating drugs play in traditional societies? As the chapters in this volume all explicitly or implicitly agree, smoking among Native Americans was a symbolically charged, often sacred practice. Pipes were vital personal possessions that were central to individual spirituality, collective ritual, and (as discussed by Bollwerk, Chap. 4 and Hedden, Chap. 8, in this volume) intersocietal interactions. Pipes are what one might call “total social artifacts” in that they have significant technological, sociological, and ideological functions. Their analysis provides a window into a suite of past practices, as is illuminated in the various chapters in this volume.

Their manufacturing techniques give insight on technological prowess, as demonstrated in Hadley's paper (Chap. 7). Also, Creese's paper (Chap. 3) shows how a lack of standardization in pipe manufacture points to an individualization of smoking in late prehistory in contrast to the more standardized and presumably thus more corporate nature of earlier smoking technologies.

Pipe forms and decorations relate to culturally significant iconography, and Bollwerk (Chap. 4) examines this visual information contained on pipes through an interpretative framework that focuses on the communication of information through stylistic variation. Pipes were also commonly traded between neighboring groups; Ligman's paper (Chap. 5) demonstrates that archaeometric sourcing analysis of pipe materials has the potential to elucidate how the movement of pipes is related to their roles in social interactions. Keddie (Chap. 9) highlights the roles of pipes in ritual practices, dominated in many cases by males, by showing pipes' connection to gender relations. Fortunately for archaeologists and anthropologists, pipe smoking was a behavior commonly remarked upon by ethnographers and the authors of ethnohistoric sources as shown by Phillips (Chap. 11). They are among the few "ritual objects" that are so termed because we know they are such, and are not arriving at that designation by default, having eliminated any other explanations, and as I seek to show in my paper (Chap. 2), their common inclusion in burial points to a role in Native religion.

Snyder's paper (Chap. 10) shows that smoking tobacco is still an important practice in many Native American cultures, but the desanctification of the practice in the modern world has led to significant mortality and morbidity among Native populations. This has been exacerbated by the economic marginalization that many Native populations have experienced. As the title of the late Joseph Winter's edited volume demonstrates (Winter 2000), tobacco is the source of sacred smoke while also a silent killer. Snyder argues that archaeological knowledge of smoking pipes can play a role in the resanctification of tobacco and therefore possibly have a positive impact on modern Native health. This is truly a welcome message, as any archaeologist can argue passionately about the relevance of their craft; it is rare that our research can be said to have such a direct and positive impact on society today.

And lest we throw the methodological baby out with the positivist bathwater, smoking pipes are often invaluable chronological markers with a huge role in forming artifact seriations and typologies. Blanton's contribution to this volume (Chap. 6), for example, shows the potential of tracking variations in the decorative and morphological style of smoking pipes in the delineation of regional chronologies. Tushingham and Eerken's paper (Chap. 12) illustrates the continued potential of residue analysis for the identification of nicotine. Finally, Planella et al.'s paper (Chap. 13) takes a commendably multidisciplinary approach to the study of Chilean pipes, incorporating ethnohistoric, archaeological, and archaeometric data.

These chapters show how smoking plant and pipe studies continue to be a fruitful angle of archaeological research. There are several areas where the study of smoking pipes could provide useful archaeological data. For example, we need more sourcing studies. We know smoking pipes were popular trade items at contact. I have seen Catlinite smoking pipes from Minnesota in artifact collections from

New York sites. I have personally seen excavated stone pipe fragments I strongly suspect indicate trade from the Ohio Valley. In most cases, the stone used for smoking pipes is not as visually distinctive as was the case in these anecdotes, and ceramic pipes, in the absence of clear, regionally specific decorations, are even less distinctive. Archaeometric sourcing techniques should be used more extensively to trace the patterns of prehistoric smoking pipe trade and exchange. Sourcing research is challenging, to be sure, especially as one must collect a comprehensive sample of potential source samples for any artifact analysis to be meaningful. Technological developments are making such work easier though, and provide opportunities to gain insights from artifacts excavated yesterday and artifacts curated from excavations decades ago.

The issue of trade and exchange also brings up the question of regional distribution patterns in the styles, raw materials, and iconography of smoking pipes. This is an ideal area for the application of mature geographic information systems (GIS) software, which is capable of identifying geographic patterns in data that are not readily apparent from purely visual analysis of distribution maps.

Additionally, there is still so much to be learned through residue analysis. Can we refine our techniques to the point that we can identify specific tobacco species from residue alone? Perhaps a combination of spectrographic chemistry techniques in combination with DNA, pollen, or phytolith analysis have potential in this regard. We know essentially nothing about the earliest use of tobacco, or what was smoked in the earliest smoking pipes. Did tobacco become insinuated into an existing smoking practice, or was its introduction the birth of the practice in North America? I would also be interested in seeing if we can refine our methods to the point that viable data can be taken from the numerous pipe specimens that were long ago cleaned of visible residue and stored in museums or other collections.

Besides residue analysis, other potential future research avenues could focus on how the existing tobacco smoking/smoking pipe complex changed and adapted during and after the contact period. Much of our focus is one-sided and directed towards understanding how tobacco affected Euro-American and European cultures and economies. We have impressions of changes on the part of Native Americans as well, with possible expansions of the secular use of tobacco by Natives after contact. But we have yet to see a systematic analysis of archaeological, ethnohistoric, and ethnographic data to address this issue.

Finally (though not comprehensively), I would like to see additional technological studies to better understand production and manufacturing techniques. We have abundant information of this sort for historic smoking pipes, and we have been able to infer much of the production of late prehistoric clay pipes from the analysis of other pottery artifacts. We know very little at all about the lapidary methods used to create the earliest stone pipes, whose iconographic and morphologic uniformity and complexity would be challenging to reproduce using modern tools. How many person-hours of effort went into the manufacture of a Hopewell effigy platform pipe? What tools and methods were used? How long did it take to become specialized in their manufacture? Were there numerous artists, or was it a specialized skill found only among a few craftspersons? This is just one example of one type of pipe from one time period. Much analytical and experimental work in this area awaits.

Smoking plants and pipes are unusual among artifacts in that they play roles in so many cultural and social domains. Thus, their analysis can provide insights into a vast range of anthropological topics. Technology, social interaction, iconography, religious ideology, chronology, and surely other issues are explicable through smoking pipes. To study pipes is to study the people who smoked them. Tobacco and other smoke plants also provide diverse opportunities to study how Native peoples defined and enacted a variety of ritual practices in the past and present. The ubiquity of smoking plants and pipes among Native American cultures, and the still limited number of analyses centered on these topics, leaves much work for the future. This volume is a valuable, but far from final, contribution to this work.

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