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English Mineral Exploration in the New World

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ENGLISH MINERAL EXPLORATION IN THE NEW WORLD

A Thesis

Presented to

The Faculty of the American Studies Program

The College of William and Mary

In Partial Fulfillment

Of the Requirements for the Degree of

Master of Arts

by

Lisa Liberati Heuvel

2005


APPROVAL SHEET


This thesis is submitted in partial fulfillment of
the requirements for the degree of

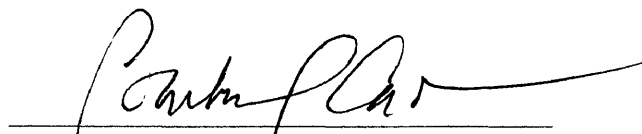
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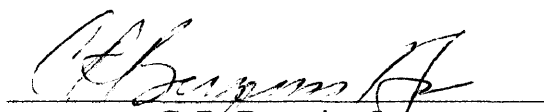

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DEDICATION

This project is dedicated with love to my husband Jan for his support and to my family (Sean and Katey Heuvel, Jean and Gene Liberati, Sandy and Dick Swift, and Lisa Swift Rose) for their encouragement. They often heard more than they ever expected to about mineral exploration, and believed.

TABLE OF CONTENTS

	Page
Acknowledgements	v
List of Figures	vi
Abstract	vii
Introduction	2
Chapter I. An Overview of Virginia, the Waiting Landscape	6
Chapter II. A Mineral Commodities Map of the Western Hemisphere	13
Chapter III. England Enters the Scene	19
Chapter IV. Precontact to Contact: The Virginians and the English	34
Chapter V. The Jamestown Story	44
Chapter VI. The Significance of Falling Creek	60
Chapter VII. Conclusions	65
Bibliography	70
Vita	83

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LIST OF FIGURES

Figure	Page
1. Generalized geologic map of Virginia (Commonwealth of Virginia Division of Mines, Minerals and Energy, Department of Mineral Resources)	7
2. Map of Popham colony, Fort St. George, Maine (By permission of Jeffrey P. Brain)	32
3. Map of sites of mounds and archeological sites producing native copper and steatite in Virginia Piedmont and mountain zones (Helen C. Rountree)	39
4. Map of Virginia [1612] attributed to John Smith	50
5. Map of selected colonial sites and geologic deposits (The College of William and Mary, Department of Geology)	57

ABSTRACT

This thesis explores the impact of English mineral exploration from the mid-sixteenth century through the London Company period of the Virginia colony. Through a survey of historical accounts, modern scholarship, archaeological and geologic documentation it examines why the English expected to find precious metals in Virginia by 1607, and demonstrates that the underlying knowledge base for English mineral exploration advanced through exploration and colonization before and during the Jamestown era. Potential mineral resources were realized over the next 400 years as mining for gold, silver, iron and other minerals in the Commonwealth ultimately fulfilled the original vision of the English colonists, investors and monarchs.

Both the Powhatan and English cultures were adept at manipulating their native environments and each modified its behavior and use of resources significantly throughout the Virginia Company period. The thesis conclusions show that frontier factors of disease, death and intercultural hostilities adversely affected the outcome of mineral exploration and delayed industrial development in the first quarter of the seventeenth century.

ENGLISH MINERAL EXPLORATION IN THE NEW WORLD

INTRODUCTION

Colonial mineral exploration by the English in the New World has long been considered a footnote to the larger story of Virginia. However, its influence on the contested landscape of British America and the evolution of cultural interaction should be re-evaluated from a new perspective, as this thesis will show.

Both the English and the indigenous peoples were irreversibly locked into an adaptation process that evolved over time through cultural contact. The scope of this intercultural relationship can be demonstrated and better understood through geo-archaeological evidence and a closer examination of primary source documents. English and European colonists did not necessarily recognize the complex skills of the native cultures they encountered, particularly in relation to the natural environment. By comparing historical events and geologic documentation, this thesis proposes that English colonists at Jamestown came much closer to precious metals than has been previously credited to them. They projected their knowledge of mining, mineral exploration, and metalworking onto the landscape, using it to express their expectations. Limitations born of territorial hostilities, technology, and unforeseen events were factors in their perceived failure. Like mineral exploration, attempts to create and support the Virginia iron industry would not bear fruit for the first colonists. Their descendants – and Virginians today – would be the ones to benefit from mineral-related industries, as statistics show. In fact, over 400 different minerals have been found and more than thirty different mineral resources are produced in Virginia at a combined annual value of nearly two

billion dollars.¹ Chapter I, “An Overview of Virginia and the Waiting Landscape,” examines geologic resources in modern-day Virginia and establishes the geologic realities underlying colonial mineral exploration. It documents that gold, silver, and other valuable minerals have been successfully prospected and mined in modern-day Virginia since the nineteenth century. Further, there were other mineral resources in Virginia that the early colonists and investors considered valuable commodities in the culture of the time. As a parallel, this chapter introduces the worldview of the Powhatan Indians relative to their use and mastery of the land prior to the English making landfall.

Chapter II, “Filling in the Mineral Commodities Map of the Western Hemisphere,” examines the explosion of knowledge about iron technology, metallurgy, and New World mineral resources contributed by the Spanish, French, and Germans. In the sixteenth and seventeenth centuries, the stage was being set for English mineral exploration from other nations’ voyages and technical advancement as well as international and national dynamics. At the same time in Algonkian America, the native peoples were building complex cultures from generations of land use and interactions with native allies, enemies, and foreign invaders.

Chapter III, “England Enters the Scene,” describes mining and mineral industries developed under Queen Elizabeth I along with the knowledge base underlying the explorations of Sir Martin Frobisher, Sir Humphrey Gilbert, and Sir Walter Raleigh. It compares mineral prospecting and patterns of exploration in the colonies of Roanoke and Popham as harbingers of the mineral exploration and mining planned and executed to some degree in the Jamestown colony.

¹ “Mineral Resource Development in Virginia,” Virginia Department of Mines, Minerals & Energy Web site. <http://mme.state.va.us/main.htm>, 5 December 2004.

Chapter IV, “Precontact to Contact: the Virginians and the English,” examines trade and cultural interactions of the Jamestown colonists and Powhatan Indians via the commodities desired by each and the dynamics of supply and demand related to Virginia’s natural resources. In recent years scholars have increasingly turned to scientific analysis of copper – both trade and native – to augment their understanding of trade patterns in the colony of Virginia. New works on ecological change, cartographic imperialism, and archaeological data from the Great Lakes and Virginia are part of the mounting evidence that changing cultural and economic relationships were tied to the physical environment and the values placed on specific natural resources.

Chapter V, “The Jamestown Story,” uses the historical, archaeological, and geologic background from preceding chapters as a foundation for better understanding the expectations and actions of the London Company organizers and officials. It focuses on the history of technical development and primary source documentation to review events in the colony in a new light, placing them in the context of Virginia geography and geology. A synopsis of archaeological findings related to scientific equipment and mineral-related artifacts follows. Economic priorities changed in the first decade of the colonization of Jamestown and the search for precious minerals was overshadowed in the emergence of tobacco as a major export. However, the search for alternative resources did not end, as the checkered history of the Falling Creek Ironworks will show.

Since gold deposits and successful mining activities are documented in eighteenth-and-nineteenth-century literature and physical evidence, why did the English fail in their seventeenth-century efforts? My hypothesis centers on the limitations of technology on the edge of the English frontier as well as a series of circumstances that

can best be described as near misses and plain bad luck, as well as disease and death that seemed to follow the “mineral men” [prospectors] in Virginia. In addition, conflicting perceptions of the landscape by the English and the Powhatans had a profound influence on events in the London Company era. This new perspective may increase awareness of metallurgical and cosmological concepts underlying the English colonial mindset by 1607, especially as compared to the spiritual and economic perspectives of the Powhatan Indian world. In turn, it may further delineate the scope of cultural interaction in early colonial Virginia. As James Axtell has written, “We cannot afford to privilege one kind of source over another: We need them all if we are to compensate for – when we cannot recover – the evanescent words and gestures that constituted much of the public past of these oral cultures and face-to-face societies.”² As the next chapter will show, geography and geology expand our understanding of the visual and physical landscape of four centuries ago, alerting us to the possibility – and reality – of different perceptions of a common ground.

² James Axtell, *The Indians' New South: Cultural Change in the Colonial Southeast* (Baton Rouge: Louisiana State University Press, 1997) 2-3.

CHAPTER I

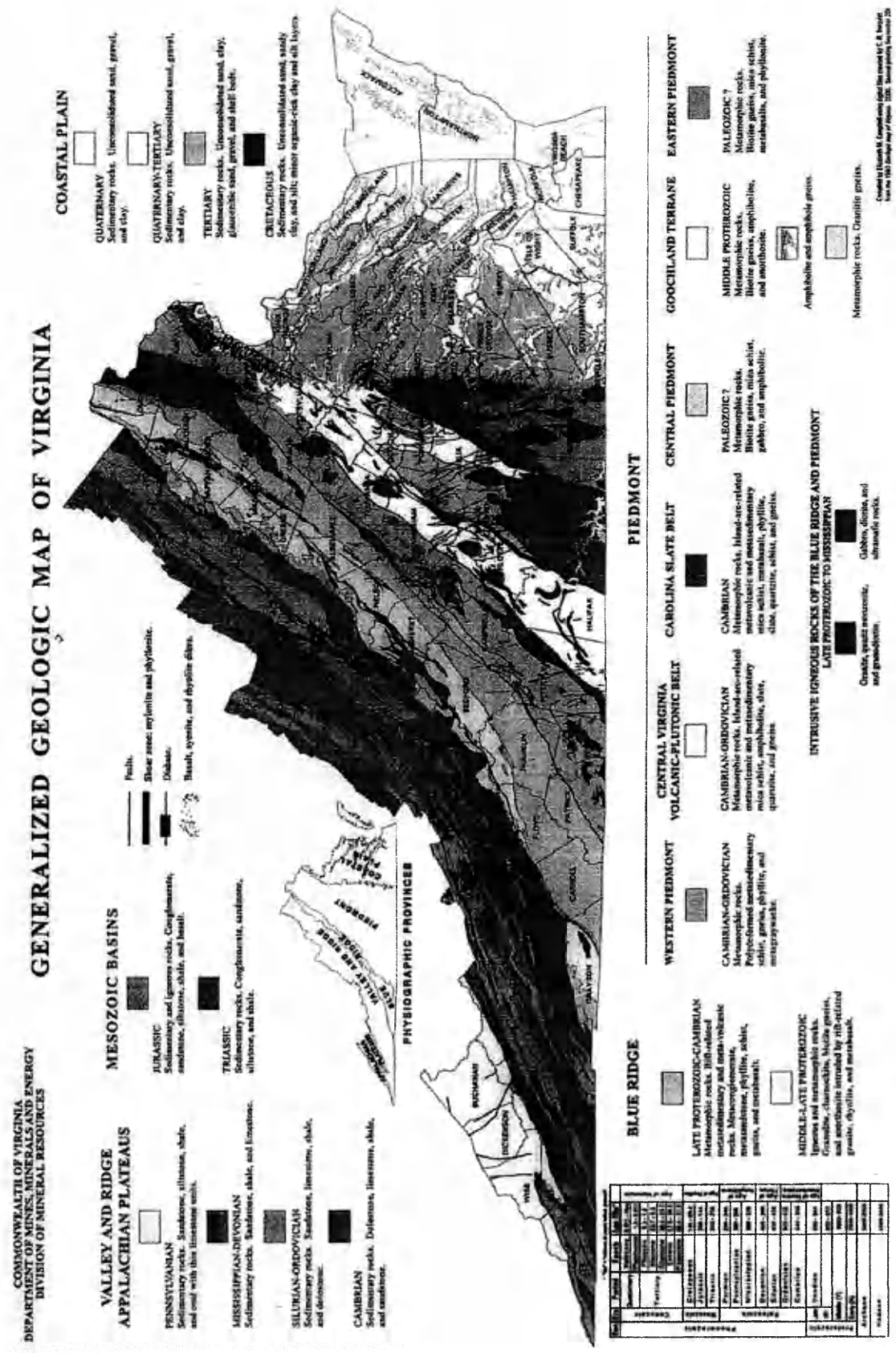
AN OVERVIEW OF VIRGINIA, THE WAITING LANDSCAPE

It was not their known world, this Virginia, and European exploration was akin to shining a light through a keyhole. If they could scan a modern nautical chart, mariners, mapmakers, and explorers of the late fifteenth and early sixteenth centuries would recognize its placement between the parallels 34 and 45 degrees north latitude.³ Despite the passage of centuries, Cape Henry, Point Comfort (modern-day Fort Monroe) and Jamestown Island would probably look familiar to experienced colonial mariners. However, Virginia's true size - and that of North America - would amaze them. Today's Commonwealth comprises some 42,450 square miles, of which 2,325 are covered by water; the Virginia that King James claimed stretched north to Halifax, Nova Scotia, south to Cape Fear, and west to the Pacific.⁴ According to modern geologic classifications, Virginia divides by surface features into provinces such as the Coastal Plain, Piedmont, Blue Ridge, Valley and Ridge, and Appalachian Plateau (see Figure. 1). Sediments to its fall line boundary characterize the Coastal Plain province, about one-fourth the area of Virginia. The Coastal Plain is composed of sand, gravel, clay and fossil shells; rarely they are cemented by iron oxide or carbonate of lime. West of the fall line are crystalline rocks such as granites, gneisses, phyllite, and basalts in the Piedmont

³ Edward Wright Haile, ed. *Jamestown Narratives: Eyewitness Accounts of the Virginia Company: The First Decade: 1607-1617* (Champlain: Roundhouse Press, 1998) 14.

⁴ Thomas L. Watson, *Mineral Resources of Virginia* (Lynchburg: J. P. Bell Company, Printers and Bookbinders for the Virginia Jamestown Exposition, 1907) 1. Watson, professor of economic geology at the University of Virginia, published his monumental work in 1907. It is still acknowledged as a major geologic resource on the Commonwealth and was re-issued in 2003 on compact disk by the Virginia Department of Mineral Resources. Also Michael V. Gannon, "Carry Me Back to Old La Florida," *The Virginia Magazine of History and Biography*, vol. 93, no. 1 (January 1985) 81.

Figure 1. Geologic Map of Virginia



province. The Blue Ridge province includes high-grade gneisses, greenstone, amphibolite, and schists. Rocks in the Valley and Ridge province include limestone, dolostone, sandstone, and shale. Coal, oil, and natural gas are present in the Appalachian Plateaus province and in Mesozoic basins where the rocks also include sandstone, siltstone, and shale.⁵ The wealth was just waiting for them: how would colonists exploit it? The quest for gold and silver was a catalyst for English exploratory and colonizing efforts. Such early hopes were not unfounded, but their realization would be premature. In 1782, Thomas Jefferson wrote in his *Notes on the State of Virginia* that a “four-pound lump of gold ore” was discovered on the north side of the Rappahannock River, the only such incident reported for the eighteenth century.⁶ Beginning in the early 1800s, gold was methodically extracted from visible sources (near-surface lode deposits and placer mining), and then the first reported lode deposit was discovered in 1806 in Spotsylvania County.⁷

By 1837, William Barton Rogers, first director of the Geological Survey of Virginia (1835 – 1841) and founder of the Massachusetts Institute of Technology, wrote, “the working of the auriferous veins of this wide region is destined to become an important branch of the systematic industry of the state.”⁸ Geologist Thomas L.

⁵ Palmer C. Sweet. *Mineral Industries and Resources of Virginia*, color map - Scale 1:500,000 (Virginia Department of Mines, Minerals & Energy, Division of Mineral Resources, 1983).

⁶ Watson, *Mineral Resources of Virginia*, 549.

⁷ Palmer C. Sweet, *Gold in Virginia*. (Virginia Department of Mines, Minerals and Energy, Division of Mineral Resources Publication 19, 1980) 1. The VDMR Web site also documents the “History of Gold Mining in Virginia.”

⁸ William B. Rogers, “Report of the Progress of the Geological Survey of the State of Virginia for the Year 1835,” *A Reprint of the Annual Reports and Other Papers, on the Geology of the Virginias* [Virginia and West Virginia] 132. In his “Report of the Geological Reconnaissance of the State of Virginia, Made Under the Appointment of the Board of Public Works, 1835,” Rogers wrote extensively of the “gold region.” It included mines in Spotsylvania, Orange, Louisa, Fluvanna and Buckingham counties, “from which many of which rich returns have been returned and under improved modes of operations a still larger profit may be expected” (74). Rogers observed that mining methods and the process for separating gold from ore were

Watson's 1907 *Mineral Resources of Virginia* recorded that the discovery of gold in Orange County by 1829 led to the 1831 incorporation of the Virginia Mining Company of New York. Before the Civil War stopped mining operations for its duration, annual gold production was valued at between \$50,000 and \$100,000.⁹ Between 1804 and 1947, Virginia mining operations produced more than 98,600 troy ounces of gold.¹⁰ In 1980, Virginia economic geologist Palmer Sweet reported location data documenting that out of primary literature references for 301 gold and silver mines, prospects and occurrences, more than eighty per cent of these were located in the "gold-pyrite belt" stretching approximately 140 miles between Fairfax County's Potomac River through Buckingham County.¹¹ This region varies from twelve to twenty-five miles wide. Colonial mineral exploration by the English in Virginia should be viewed not as a failure born of misinformation and greed, but rather a necessary step toward the revelation no early visionary or explorer would live to see.¹² By examining the events and intellectual developments culminating in the London Company phase of Virginia colonization, mineral exploration emerges from period accounts as a series of fits and starts. Although mineral exploration, mining, and iron working were well under way by the seventeenth century in England, these industries did not transfer substantially to the New World

wasteful because "a large proportion of the gold is lost and thrown out with the gravel from which only large masses of the gold have been separated" (74).

⁹ Watson, *Mineral Resources of Virginia*, 549. According to the Virginia Division of Mineral Resources, placer mining usually involves extraction of gold or other minerals at beaches or alluvial deposits by running water, as nuggets or grains. Lode deposits are found as vein formations in solid rock, associated with quartz. ("Glossary of Gold Terms," VDMR Web site).

¹⁰ Sweet provides annual statistics of gold production in *Gold in Virginia*, 1-4.

¹¹ Palmer C. Sweet, "Update on Unreported Occurrences of Gold-Silver in Virginia," *Virginia Minerals*, vol. 41, no. 2 (1995) 9.

¹² In addition to gold, silver, copper, iron, and coal, a host of other mineral resources have been mined in Virginia. Iron production began in 1609 with the mining and smelting of limonite, or bog iron. Commercial coal mining dates from 1709 near Richmond.

compared to Spanish achievements there.¹³ Spanish mineral exploration in the American Southeast had the same halting results, but was clearly overshadowed by the flood of gold and silver reaching Spain from other parts of its New World dominion.

The key to understanding English mineral exploration in Virginia lies in the collective data accumulated by the English and assimilated into a working body of knowledge. This framework of reference based on available exploratory information and expectations was an evolving “imaginary map” that supported early English efforts to locate mineral resources. England’s documented quest for gold and silver, the Powhatans’ desire for finished copper and copper products in trade, and the potential value of Virginia iron are known factors in the development of the colony. However, clays and other less-noted geologic resources have not been sufficiently studied in relation to specialized European demand, nor has the primary literature been reviewed as a “shopping list” of desired mineral commodities other than gold and silver. Potential export value was a driving force in exploring unknown territories, and the imaginary map of English North America was the guide. If, as Paul Groth has written, landscape denotes the interaction of people and place as a source of shared meanings and cultural identity, then the geological features of the land called variously “Tsenacomoco,” “La Florida,” and “Virginia” are integral to understanding its significance as a historical and cultural landscape.¹⁴ Powhatans, Spanish, and English perceived the landscape and its resources through their own cultural lenses. Within the James River basin, a complex chiefdom

¹³ In *An Historical Atlas of Wales from Early to Modern Times* (London: Farber and Farber, 1967), William Rees discusses the technological development of mining of coal and metals in Britain, specifically mining enterprises in Wales, and how heavily dependent Britain was on both German and Dutch technological expertise in mining, smelting copper and lead ore as well as the smelting and working of iron by the process of battery (66).

¹⁴ Paul Groth, “Frameworks for Cultural Landscape Study” in Paul Groth and Todd W. Bressi, eds., *Understanding Ordinary Landscapes* (New Haven: Yale University Press, 1997) 1.

under Powhatan's father arose in the second half of the sixteenth century. His son would expand that chiefdom to an estimated 13,000 to 14,000 warriors, women, and children, cutting a wide swath across all Tsenacomoco, the modern-day coastal plain of Virginia despite periods of conflict with the Monicans to the west and other tribes to the north and south. It is unknown how many other Algonkians lived to the south in today's North Carolina: Ralph Lane, first governor of the Roanoke colony, described the region as "very well peopled and towned."¹⁵

As descendants of the indigenous peoples (i.e. pre-Algonkians) who had occupied the land now called Virginia for between 10,000 and 12,000 years, Powhatans in the Pre-Contact Period had the greatest level of familiarity with the woods and waterways. They were the guides for Europeans moving between Chesapeake Bay and the fall line, particularly before the English laid visual claim to the territory with maps of their own. For land and water travel and identification, the Powhatan culture relied on hieroglyphics, physical markers, and oral tradition, all of an ephemeral nature. In "Seeing Beyond the Dominant Landscape," Wilbur Zelinsky discusses the ultimately "super potent Anglo-American landscape," noting that:

The invading Europeans encountered in North America a varied set of genuine preexisting ethnic landscapes that were the result of many generations of cultural revolution. We have only a hazy perception of what most of these places were like in visible, physical terms, and for too many virtually no information at all.¹⁶

The motivation for Europeans, specifically the English who would re-shape the Powhatan landscape via their own physical actions and intellectual concepts, was

¹⁵ Theda Perdue, *Native Carolinians: The Indians of North Carolina* (Raleigh: Division of Archives and History, North Carolina Division of Cultural Resources, 1985) 25.

¹⁶ Wilbur Zelinsky, "Seeing Beyond the Dominant Landscape," in Groth and Bressi, *Understanding Ordinary Landscapes*, 158.

possession. The motivation for indigenous peoples to offer themselves as guides and informants is more complex. Believing their cooperation to be of short-term consequence (before the balance of power shifted), the Powhatan Indians stood to gain much more than they would lose, with trade for highly-valued copper and high-technology goods (metal tools, weapons, cloth among others) a prime incentive. For the English, trade supplied short-term value in food and furs, but long-term value in information and eventual land ownership. Gregory Nobles pointed out that trade established European dominance while New World Indians exhausted goods and resources through trade to the point that land itself - or the use of it - was exchanged. However, as William Cronon observed, Indians “thought they were selling one thing and the English thought they were buying another.”¹⁷ Strategically placed along major waterways in the Chesapeake region, the Powhatans were self-sufficient and linked by trade and communications to other native populations. However, they could not accurately gauge land resources and populations beyond their shores. This was the world and ethnic landscape irrevocably changed by the English, whose moral certainty and national needs propelled them forward. The consequences of exploration and occupation by the English and other Europeans throughout the late fifteenth to early seventeenth centuries would be irreversible.

¹⁷ Gregory Nobles, “Breaking into the Backcountry: New Approaches to the Early American Frontier,” in *William and Mary Quarterly*, 3rd ser., vol. XLVI, no. 4, 646. In many cases in the early colony, trade was

CHAPTER II

A MINERAL COMMODITIES MAP OF THE WESTERN HEMISPHERE

European explorers of the fifteenth through early seventeenth centuries were essentially “pilgrims-for-a-price,” seeking New World knowledge and possession by divine right. As Michel Foucault stated in “Questions on Geography,” “Those seventeenth-century travelers and nineteenth-century geographers were actually intelligence-gatherers, collecting and mapping information which was directly exploitable by colonial powers, strategists, traders and industrialists.”¹⁸ Much earlier European metallurgical technology in the New World has been documented through archaeological excavations at La Isabela, site of the 1493-1498 colony established by Christopher Columbus.¹⁹ In the Caribbean, placer mining was required to obtain gold and the Spanish used the indigenous natives as laborers.²⁰ Gold and cedar were factors in Spanish involvement in the Canary Islands beginning in the 1340s, along with slaving. Spain spread European technology in ironworking, metalworking and metallurgy throughout its empire, and gold and silver from mines in Mexico and Peru fueled Spain's

coerced rather than voluntary.

¹⁸ Michel Foucault, “Questions on Geography,” in *Power/Knowledge: Selected Interviews and Other Writings 1972-1977*. Colin Gordon, ed., Colin Gordon, et al., trans. (New York: Pantheon Books, 1980) 75.

¹⁹ Kathleen Deagan and Jose M. Cruxent, “The First European Artefacts in the Americas: La Isabela, Dominican Republic (1493-8), 3-5,” in Duncan R. Hook and David R. M. Gaimster, eds., *Trade and Discovery: The Scientific Study of Artefacts [sic] from Post-Medieval Europe and Beyond, British Museum Occasional Paper 109* (London: British Museum Press, 1995). The authors state that artifacts from the site document ironworking, the extraction and smelting of lead and precious metals, with crucibles and mercury indicating the assaying of gold. Blacksmithing has been documented for production and repair of tools; however, the absence of slag or bloom fragments is indicative of as yet undiscovered forges away from the primary settlement area or the use of wrought iron carried as cargo (5).

²⁰ John E. Kicza, “Patterns in Early Spanish Overseas Expansion.” *William and Mary Quarterly*, 3rd ser., vol. 49, no. 2. (April 1992) 233, 240.

royal military operations and empire building.²¹ After 1513, Spanish exploration in the colonial Southeast did not yield the same results. As James Axtell noted, “native rumors, wishful thinking, and obliging geotropical theories that planted gold and silver in tropical and semitropical zones – wherever the Spanish happened to land – kept the search alive, even in the face of daunting native opposition and unremitting emptyhandedness.”²² One of the important sources of scientific information on the New World was Gonzalo Fernandez de Oviedo Valdes, Royal Overseer to the mines in Hispaniola beginning in 1514. Oviedo was also royally commissioned to write a history of the New World. Some of his actions may indicate already established patterns of colonial mineral exploration in the New World: trading with natives for mineral specimens (in his case, precious stones such as pearls and emeralds) and writing extensively about natural resources.

In the fifteenth century, Portugal - a major maritime power - secured gold and slave profits from the Senegal region of Africa as Portuguese mariners worked southward to the Cape of Good Hope in 1488.²³ Spanish explorers mapped Florida and moved west questioning the natives about precious metals. To the north, Jacques Cartier had been sent by King Francis I in 1534 and continued to explore New France, which he may have named Canada in 1536. In 1542, it was reported that Cartier had accumulated eleven barrels of what he believed to be gold ore (actually iron pyrites) and precious stones. Rock crystal quartz specimens were erroneously identified as diamonds, generating the

²¹ W. Iain MacKay, “Gold Extraction Equipment at Maukallqta: The Merging of Indigenous and Spanish Colonial Technologies” in Duncan R. Hook and Gaimster David R. M., eds., *Trade and Discovery: The Scientific Study of Artefacts from Post-Medieval Europe and Beyond*, British Museum Occasional Paper 109, 159.

²² Axtell, *Indians' New South*, 5.

²³ John Thornton, *Africa and Africans in the Making of the Atlantic World, 1400-1800*, 2nd ed. (Cambridge: Cambridge University Press, 1998) 30-31.

expression “faux comme diamants du Canada” for anything false. In 1604 Samuel de Champlain acted on an account of copper mines in New France from another Frenchman, Captain Prévert of St. Malo, whom he met the previous year. Champlain carried a miner, Maître Simon, in his three-week expedition with the instructions to keep hammer and chisel ready. During his trip around part of the Nova Scotia peninsula, Champlain kept notes on natural resources and promising areas for settlement. Simon detected what appeared to be a silver mine at modern-day Mink Cove and an iron mine at Waterford. Both occurrences went into Champlain’s reports. The modern-day Advocate Harbor was named Port aux Mines by Champlain, who found both copper and amethysts there (both are geologically verified). Champlain cut one large amethyst out of the rocks, broke it in two, and presented the two pieces to two of his noblemen investors. They accordingly set the stones in gold and presented them to the king and queen of France.²⁴ In 1604, the French settled Quebec, and in effect abandoned La Florida to the Spanish.

As a by-product of their Atlantic exploration, Spain and France contributed substantial information on mineral resources that can be examined in the context of perception and reality, and be compared for similar patterns of observation and inquiry. In turn, English exploration efforts show related consistencies that will be discussed in this chapter. Elizabethan scholar A. L. Rowse wrote, “The awakening interest in America, from the middle of the century, had at first to feed upon translations, from Spanish, French, Latin. When the English began to go to Virginia themselves in the

²⁴ Elizabeth Jones, *Gentlemen and Jesuits: Quests for Glory and Adventure in the Early Days of New France* (Toronto: University of Toronto Press, 1986) 24-31.

1580's [sic], they were able in turn to contribute new information from other peoples, whom we find beginning now to translate from them."²⁵

From the Middle Ages on, stone quarrying technology in Europe laid the groundwork for iron technology and metallurgy. German miners were already recognized and in demand across Europe in the twelfth and thirteenth centuries for mining gold, silver, iron, copper, lead, zinc and tin. The predominant vocabulary for mining became German, underscoring how widely their technical expertise spread.²⁶ Paralleling these earlier developments were advances in navigation, cartography, physical science, and technology. At the same time, superstition and science blended to create an atmosphere that has often been taken out of context but should be examined as a product of the times. While alchemy and mystical theory were interconnected, active observation and experience led to two major advances in mining and metallurgical literature in the sixteenth century, born of the practical applications of metalworkers and other workers unknowingly on the frontier of chemistry and geology. However, there were hurdles to sharing such technical information in this period: communications were difficult at best and competitors feared giving one another any advantage. Advanced knowledge was destined for communication through the written word.

Georg Bauer, better known by his Latin name Georgius Agricola, was a practicing doctor and professor who devoted himself to first-hand observation of mining and geology in some of Europe's great mining centers. Before the publication of this treatise *De Re Metallica* (On the Nature of Metals) and others, the knowledge needed for

²⁵ A. L. Rowse, *The Elizabethans and America* (New York: Harper and Row, 1959) 189.

²⁶ Jean Gimpel, *Medieval Machine: The Industrial Revolution of the Middle Ages* (New York: Penguin Books USA Inc., 1977) 72.

smelting metal was largely handed down from father to son. Written in 1530 and published after Agricola's death in 1556, this would become the standard text on mining for the next two centuries. *De Re Metallica*'s illustrations show methods of surveying and digging, assaying ores, smelting, and mining that were still credible when Jamestown was founded. It demonstrates that the Virginia colonists and officials had access to or at least acquaintance with a well-developed body of knowledge connected with mining and metallurgy. Agricola's published work brought mining and metallurgy from an arcane science passed from father to son to a more universally understood and technically based discipline. The spread of these related ideas and information had already made an impact on England's economy, defensibility and thirst for exploration.

Agricola's first work on mining (1530) influenced the master Italian smelter, ironworker and mining engineer, Vannoccio Biringuccio. He wrote *The Pirotechnia*, (1540) a treatise that became the first printed book on the metal arts and metallurgy and a significant influence on both until the end of the eighteenth century. Eschewing necromancy as a dependable tool in mineral prospecting and metallurgy, Biringuccio advised his readers to walk around, "always keeping eyes and ears turned to wherever there is hope of finding some information, especially towards shepherds or other ancient inhabitants of the countryside."²⁷

Biringuccio's instructions foreshadow the extensive efforts of English explorers, colonizers and mineral men (prospectors) to engage native people in information

²⁷ Vannoccio Biringuccio, *The Pirotechnia of Vannoccio Biringuccio: The Classic Sixteenth-Century Treatise on Metals and Metallurgy* intro. Cyril Stanley Smith and trans. Martha Teach Gnudi (New York: Dover Publications, Inc, 1990) 14.

exchanges as the “ancient inhabitants” of Virginia. (Similar practices are still incorporated into modern geologic fieldwork.) In the same way, the call for direct observation suggests a separation from the supernatural aspects of alchemy, an expression of natural history in development. The next chapter will outline England’s developing role in mining, metallurgy, and mineral exploration.

CHAPTER III

ENGLAND ENTERS THE SCENE

The sixteenth century began with England lagging behind other nations in mining and mineral development. Henry VIII recognized the need to develop lead and iron mining in Wales. Because of the demand for brass and iron for English artillery production, metal prospecting and the skill to smelt copper to make bronze for cannons were seen as vital by the crown. German technical skills were essential if England was to cease relying on the importation of copper and gun-makers for manufacturing ordnance, or worse, importing the cannons themselves.²⁸ Queen Elizabeth I succeeded in importing German miners and metallurgists to recoin currency that had become debased, to train English workers on a higher level in mining and metallurgy, and to support organized monopolies to search for metals in her realm.²⁹ Under the Germans, industrial operations were greatly expanded in England. New metal sources were found within the nation and mining operations went deeper into the earth than ever before with more sophisticated technology - such as water pumps - available to English and Welsh miners. At the same time, English promoters, privateers, and explorers opened the path to the New World. Among them were Sir Martin Frobisher and Sir Walter Raleigh, whose efforts foreshadowed English colonial ventures after 1600. By 1568, two mineral development monopolies had been formally incorporated. The primary function of the Society of Mines Royal was to mine and smelt copper and lead ores. Joachim Gans, a German

²⁸ Ronald Rees, *King Copper: South Wales and the Copper Trade 1584-1895* (Cardiff: University of Wales Press, 2000) 3.

²⁹ Gary C. Grassl, "German Mineral Specialists in Elizabethan England and Raleigh's Virginia" (1993), (paper on file at Jamestown Settlement Library, Williamsburg, Virginia) 10-14.

mineral specialist, did assay work for the Society in 1581 before sailing to Roanoke in 1585.

In examining the cultural underpinnings of mineral exploration and metallurgy, the role of alchemy should not be underestimated. Although it was simultaneously a philosophy of the universe and an experimental science, the transmutation of metals has become a historical “sound bite” for a much larger and complex body of knowledge. Alchemists sought to satisfy “their material needs, their intellectual capacities, and their spiritual yearnings.”³⁰ The essence of early alchemy was a belief that different metals represented stages of evolution as the metals “ripened” in the earth into the purest metal, gold. Physicians between the fifteenth and nineteenth centuries used both common metals (zinc, tin, iron, lead, manganese, and nickel) and precious or noble metals (gold and silver) as medicinal ingredients and astrology connected metals to parts of the body: silver, associated with the head, was used as an ingredient in treating mental and cerebral diseases.³¹ Dr. John Dee (1527-1608), like the times he lived in, blurred the line between science and the supernatural. A learned geographer, mathematician, alchemist, and occultist, Dee was philosopher to Queen Elizabeth and taught Martin Frobisher and other naval captains the mathematical art of navigation. In a 1577 proposal written for the queen’s Privy Council, Dee envisioned England’s expansion as an empire with Elizabeth as ruling monarch over all its territories. Dee also predicted that rich mines would be found as the English explored the northern reaches of North America and found a route to Asia, and probably shared this belief with Martin Frobisher.

³⁰ J. Gordon Parr, *Man, Metals and Modern Magic*, as quoted in Geoffrey Marks and William K. Beatty, *The Precious Metals of Medicine* (New York: Charles Scribner’s Sons, 1975) 29.

³¹ Gold, for example, was a blood purifier, poison antidote, preventative for miscarriages, and treatment for heart disease (Marks and Beatty, *Precious Metals of Medicine*) 59, 63.

"Meta Incognita," or the Unknown Shore, was Elizabeth's name for the Canadian Arctic. Martin Frobisher explored this area during three voyages from 1576 to 1578. At first searching for the Northwest Passage, his second and third voyages were part of a "gold rush" based on the misidentification of glittering particles in an ore sample. However, of the first four assayers who tested pieces of the original stone sample, three correctly said that there was too little gold to warrant mining it.³² Major scientific and archaeological studies of England's Arctic Colony have shown that the black hornblende ore found there contained biotite mica, which gleams like gold when oxidized or heated. Kamaiyuk, an Inuit village site near the Countess of Warwick Sound, was an early contact site described in 1577 by Frobisher's lieutenant George Best. Among the artifacts found have been slag-encrusted crucible fragments. Kodlunarn Island, explored in 1577, was a base camp in 1578 and has yielded artifacts representative of both blacksmithing and assaying activities.³³ Questions have arisen regarding the field assay operation of 1578 as to why testing conducted before shipping twelve tons of ore did not prevent shipping it or at least raise doubts as to its worth. Possibly inadequate test results were generated when samples were contaminated by the lead used to separate gold and silver from the matrix. The queen supported Frobisher's second and third expeditions after one of several assayers found promising amounts of gold in the ore samples. The second voyage in 1577 returned 160 tons of ore from one mine (the Countess of Warwick Mine, on modern-day Kodlunarn Island) and precipitated the construction of the largest blast furnace in England. The third, a huge undertaking of fifteen ships and 400 men in

³² Robert Ruby. *Unknown Shore: The Lost History of England's Arctic Colony* (New York: Henry Holt and Company, 2001) 257.

³³ Réginald Auger et al., "Material Evidence from the Frobisher Voyages: Anglo-Inuit Contact in the North American Arctic in the Late Sixteenth Century" in Duncan R. Hook and David R. M. Gaimster, eds., *Trade*

1578, conveyed almost 2,000 tons of ore to England. One hundred forty-seven men were recruited as miners and would work seven mines of which only two, the Countess of Warwick and the Countess of Sussex (Frobisher Bay, on a small peninsula) are firmly established).³⁴ Modern archeological evidence for assaying activity discovered on Kodlurnan Island includes scorched brick, broken crucibles, and partly fused rock. Other documentation, including bills of lading, for the second and third voyages, include detailed lists of mining equipment.³⁵

Frobisher's effort has often been marginalized, much as colonial mineral exploration in Jamestown has generally been dismissed. However, Smithsonian-sponsored geologic research by Donald Hogarth and others between 1981 and 1991 identified and documented over half of the mine sites and provided interesting new data on the true nature of the ore Frobisher saw. Rather than iron pyrites, small flecks of biotite mica oxidized among black hornblende crystals when the ore was heated. Further, the ore does contain gold, but not in a proportion worth mining. Extensive information, including lists of mining equipment taken on the second and third expeditions, show that mining methods relied primarily on crowbars, sledges, wedges, pickaxes, and manpower to excavate the hard rock in open pits. The mines were simply abandoned whenever the rock proved too hard to excavate.³⁶ Technical support was provided by English and Welsh miners and "goldfiners" (assayers), with two German metallurgists and a London goldsmith in the second voyage and with similar expertise on a larger scale in the third.

and Discovery: The Scientific Study of Artefacts from Post-Medieval Europe and Beyond, British Museum Occasional Paper 109 (London: British Museum Press, 1995) 12-15.

³⁴ Donald D. Hogarth, "Mining and Metallurgy of the Frobisher Ores" in William W. Fitzhugh and Jacquelin S. Olin, eds., *Archaeology of the Frobisher Voyages* (Washington: Smithsonian Institution Press, 1983) 137-139.

³⁵ *Ibid.*, 142-144.

³⁶ *Ibid.*, 142.

It took more than two years to determine that the ore was worthless, its gold content possibly linked to assayers either deliberately or inadvertently introducing additives in the assay process.³⁷ Despite the resulting financial disaster for investors, Frobisher was exonerated. He was knighted at sea as a naval commander during defeat of the Spanish Armada in 1588.

English mineral exploration in the New World continued under the auspices of Sir Walter Raleigh, sponsor of several voyages and colonizing attempts between 1584 and 1590 in what is now North Carolina. Raleigh followed in the path of his half-brother Sir Humphrey Gilbert, who was the first Englishman to promote active colonization with discovery of gold and silver as a primary goal. Master Daniel the Saxon, a mineral specialist and refiner from Saxony, was listed in the expedition, and English exploration chronicler Richard Hakluyt wrote that Daniel had found iron and silver-bearing ore before perishing in a storm at sea with his shipmates.³⁸ Gilbert followed John Cabot's 1496 and 1497 voyages to North America with Bristol ships and crews: Cabot, a Genoese, claimed the land he discovered (northern New England) for the crown of England.³⁹ Sir Humphrey Gilbert claimed Newfoundland for England in 1583 before his frigate sank on the return voyage. Edward Hayes captained *The Golden Hind* for Gilbert

³⁷ Thomas H. B. Symons, "The Significance of the Frobisher Expeditions of 1576-1578" in Thomas H.B. Symons, ed., *Meta Incognita: A Discourse of Discovery. Martin Frobisher's Arctic Expeditions, 1576-1578* (Quebec: Canadian Museum of Civilization, 1999) xxvii.

³⁸ Grassl, "German Mineral Specialists," 58. Also Richard Hayluyt, "The Voyage of Sir Humphey Gilbert," in Henry S. Burrage, ed., *Early English and French Voyages Chiefly from Hakluyt 1534-1608* (New York: Charles Scribner's Sons, 1930) 205.

³⁹ Carl Ortwin Sauer, *Sixteenth Century North America: The Land and the People as Seen by the Europeans* (Berkeley: University of California Press, 1971) 6.

and made a report printed in 1589: “We were in number in all about 260 men...also mineral men and refiners....”⁴⁰

In the field of exploration literature, Richard Hakluyt contributed a significant work, *The Principal Navigations, Voiages and Discoveries of the English nation*.

Expanded later in three volumes published in 1598, 1599, and 1600, it includes an insight into Master Daniel the Saxon’s job security:

Who after search brought at first some sort of Ore, seeming rather to be yron then other mettall. The next time he [Master Daniel] found Ore, which with no small shew of contentment he delivered unto the General, using protestation, that if silver were the thing that might satisfy the Generall and his followers, there it was, advising him to seeke no further: the perill whereof he undertooke upon his life (as deare unto him as the Crowne of England unto her Majestie, that I may use his owne words) if it fell not out accordingly.⁴¹

In 1584, Raleigh obtained a patent from the Queen transferring his deceased relative Humphrey Gilbert’s land rights in North America to him. Raleigh had aggressively sought out information and expert opinion for founding an English colony in America.⁴² One of the most important intellectual assets and friends he had was Thomas Hariot, the scientist and mathematician who taught Raleigh’s pilots the navigation and mathematics skills needed to reach the New World. Bohemian mineral expert Joachim Gans was also instrumental in the quest for precious metals. Following Hariot’s role as expedition scientist, his seminal English contribution to the literature of New World

⁴⁰ Louis B. Wright, ed. *The Elizabethans’ America. A Collection of Early Reporting by Englishmen in the New World* (Cambridge: Harvard University Press, 1965) 82-83. Edward Hayes also accompanied Bartholomew Gosnold on his 1602 voyage to New England, through which it was hoped new discoveries of gold and copper would be made. Unfortunately, the exploring party had prepared using information from Ralph Lane of Roanoke: native information about gold and silver may have referred to deposits in the Allegheny foothills. (Warren F. Gookin, *Bartholomew Gosnold: Discoverer and Planter, New England – 1602, Virginia 1607*) 160.

⁴¹ Hakluyt in Burrage, *Early English and French Voyages*, 8, 205.

⁴² Giles Milton, *Big Chief Elizabeth: The Adventures and Fate of the First English Colonists in America* (New York: Farrar, Straus and Giroux, 2000) 45.

exploration, *A Briefe and True Report of the New Found Land of Virginia* was first published in 1588 and printed again in 1590 by Theodor de Bry with illustrations by John White. De Bry commissioned botanist Charles de l'Écluse to translate it into Latin and French and more than seventeen printings were made in the next quarter-century.⁴³

Hariot gave valuable and detailed information on the flora, fauna and native inhabitants of the Carolina Outer Banks, yet his perspective was keyed to the area's economic possibilities. Some descriptive terms he uses are unfamiliar in modern times: "Roche Allum," [double sulphate of aluminum and potassium] "White Copresse," [protosulphate of zinc] "Nitrum," [potassium nitrate] "Alumen Plumenum," [plume or feather alum] and "Wapeih" ["very like to terra sigillata," a clay], in addition to iron, copper, and silver.⁴⁴ Hariot lists locations for all of the above and mentions that the "aforesaide copper wee also founde by trialle to holde silver." Also, ore tested "by the triall of a minerall man, was found to holde yron richly."⁴⁵ Hariot also interviewed the "naturall inhabitants" for information, noting that "wapeih" had been refined and found by some of our Phisitos and Chirurgeons to be of the same kinde of vertue and more effectuall" than Terra Sigillata, similarly discovered and earmarked as a commodity by Jamestown explorers.⁴⁶

In *The Roanoke Voyages*, David Beers Quinn analyzed Hariot's mineral commodities observations according to the known geology of North Carolina, noting there is no alum in the coastal clays of North Carolina, although iron and bog iron can be found in swamp forests, and marshes and along the Roanoke and Chowan riverbanks.

⁴³ Rowse, *The Elizabethans and America*, 189; also Paul Hulton, introduction to Thomas Hariot, *A Briefe and True Report of the New Found land of Virginia: The Complete 1590 Theodor de Bry Edition* (New York: Dover Publications, Inc., 1972) xiii.

⁴⁴ Thomas Hariot, 'A briefe and true report of the new found land of Virginia,' in David B. Quinn, ed., *The Roanoke Voyages*, 2 vols. (New York: Dover Publications, Inc., 1991), I:327-28

⁴⁵ Hariot, 'A briefe and true report,' in Quinn, *The Roanoke Voyages*, I:333, I:331.

⁴⁶ *Ibid.*, I:328.

According to Quinn, natural silver is also rare in eastern North America and he doubted that white copperas (protosulphate of zinc) had been located, although copperas (iron sulphate) was possibly identified.⁴⁷

Proficient in understanding and speaking Algonquin dialects with the native inhabitants of the Outer Banks, Hariot wrote of their interest in English objects:

Most things they saw with us, as Mathematicall instruments, sea Compasses, the vertue of the lodestone in drawing yron, a perspective glasse whereby was shewed many strange sights, burning glasses, wildefire workes, gunnes, bookes, writing and reading, spring clockes that seems to go of themselves, and many other things that we had, were so strange unto them, and so farre exceeded their capacities to comprehend the reason and meanes how they should be made and done, that they thought they were rather the workes of gods then of men.⁴⁸

The supernatural element underlying each of these cultures in the Contact period is significant to understanding the acclimatization taking place then. Although the learning curve is not an adaptation of technology in the modern sense, first impressions of English “workes of gods” indeed changed as native people became more familiar with their use. At what points of cultural interaction did these native observers realize that they could share in the power of such objects, given the opportunity? At what point did they separate supernatural authority from objects of daily or specialized use?

The exchange of information across cultures and subsequent intellectual and material modifications is easier to trace from the English perspective. It is the dominant

⁴⁷ Ibid., I:327-332. In the same footnotes (I:328) Quinn said that “German mineral men were notoriously unreliable and could ‘find’ any mineral for which they were asked.” However, he does not specify Joachim Gans by name in this general category. J. W. Miller, professor of environmental science at the University of North Carolina-Asheville, noted in personal communications that in eastern North America, he only knows of mines that produce silver as a byproduct. Neither white copperas nor copperas have been mined in any quantity or exist in the Roanoke area to his knowledge, although large sulphide deposits that could have these minerals occur in central Virginia, Southwestern Virginia, western North Carolina and eastern Tennessee (Letter to author, Williamsburg, Va., 2 September 2004).

⁴⁸ Hariot, *A Briefe and True Report*, 27.

voice of colonization and does not reflect the indigenous peoples' response as they comprehended the true nature of "the workes of men," as Hariot put it. Although much of the data on natural and human resources by Hariot has not survived, his published report indicates a deep interest in native culture and knowledge about the material world, as well as native beliefs.

Expedition artist John White, scientist Thomas Hariot, and mineral expert Joachim Gans accumulated written notes and drawings between July, 1585, and June, 1586. They mapped the region between the Neuse and James rivers as far inland as the head of the Albemarle Sound, traveled and wintered in modern-day Norfolk, Lynnhaven Bay, and Cape Henry, and added immeasurably to the English understanding of the New World both then and for future colonization.⁴⁹ Unlike many other expedition members who came for adventure and wealth, Hariot and Gans methodically inventoried the region's natural resources for England's benefit (and probably Sir Walter Raleigh as owner under the crown of these North America property rights). Similarly, Gilbert's assayer, Master Daniel the Saxon, had a portable assay furnace onboard the *Delight* before it sank off Sable Island [300 km southeast of Halifax, Nova Scotia, Canada], and an assaying building has been identified as part of the Frobisher expedition archaeological project. Frobisher's assayer Jonas Schultz may have also brought a portable assay furnace.⁵⁰ These actions point to systematic procedures in use by the English in mineral exploration on the frontier.

⁴⁹ David B. Quinn and Alison M. Quinn, eds., *The First Colonists: Documents on the Planting of The First English Settlements in North America 1564-1590* (Raleigh: North Carolina Department of Cultural Resources, Division of Archives and History, 1995) vi-vii.

⁵⁰ Grassl, "German Mineral Specialists," 87.

At Roanoke, Governor Ralph Lane's military emphasis did not preclude him from detailing available native information about the hoped-for minerals and mines of Chaunis Temoatan, where copper and gold might be found. Its inhabitants, capable of smelting metal, lived in a province beyond the "Magoaks," who may have been an Iroquian tribe living between the Roanoke and Chowan Rivers.⁵¹ David Beers Quinn has theorized that Chaunis Temoatan, the fabulous copper mine, may have been the stuff of native legend, based on large exposed copper nodes found in the Appalachian mountain range near the Roanoke River basin.⁵² As would be the case at Jamestown, initial testing was important to knowing the potential of promising ore deposits. In 1849, a visitor reported finding "glass globes containing quicksilver and hermetically sealed."⁵³ On Roanoke Island, twentieth-century archaeological work uncovered earthworks and artifacts through the archaeological projects headed by Jean C. "Pinky" Harrington and Ivor Noël Hume. Assay work was conducted on Carolina ore on Roanoke Island as documented by over one hundred artifacts found (including crucibles, delftware drug pots, chemical glassware, worked and unworked copper, and antimony – used to separate silver from copper) during the 1990s excavations led by Ivor Noël Hume. These artifacts and similar materials recovered in earlier excavations all point to distilling and assaying by Hariot

⁵¹ Ralph Lane, "Narrative of the Settlement of Roanoke Island 1585-1586," in Quinn, *Roanoke Voyages*, I: 268-69.

⁵² J.W. Miller notes the presence of large copper deposits in the Appalachians to the west of the Roanoke River; however, he knows of no such copper deposits near the Roanoke River basin. All the copper production in Virginia and North Carolina currently known is from copper compounds, with the most famous native copper (metallic copper Cu, found in its elemental state) coming from the Keewenaw Peninsula of Michigan (Letter to author, Williamsburg, Va., 2 September 2004).

⁵³ Ivor Noël Hume, "Roanoke Island: America's First Science Center," in a reprint of *Colonial Williamsburg: The Journal of the Colonial Williamsburg Foundation* (Spring 1994) reviewed by Hume in personal correspondence, 3 November 2004. In *The Creature in the Map: Sir Walter Raleigh's Quest for El Dorado* (London: Vintage Press, 1995), Charles Nicholl includes Sir Walter Raleigh's account of surprising some Spaniards in Guiana. Raleigh described an Indian basket containing a gold refiner's kit abandoned in the bushes: "I found in it his quicksilver, salt-petre and divers things for the trial of metals," as well as the dust of "such ore as he had refined." (157).

and Gans during the 1585-1586 colonization effort.⁵⁴ It is likely that miners and soldiers assisted the experiments and explorations of metallurgist and mining engineer Joachim Gans. However, the colonists' search for gold in modern-day North Carolina was ill fated. Hariot criticized "the many that after gold and silver was not so soone found, as it was by them looked for, had little or no care of any other thing but to pamper their bellies."⁵⁵ Although gold was not found in the seventeenth century, in 1799 a seventeen-pound gold nugget was discovered in Carbarus County near Charlotte, North Carolina and the property where it was found yielded an estimated \$100,000 in gold by 1824. From the early-to- mid-nineteenth century when the California Gold Rush overshadowed it, the Charlotte area was a leading producer of gold in the nation with an average of one million dollars annually.⁵⁶

Roanoke was not Raleigh's only quest for mineral resources. In 1595, he implemented a plan to exploit iron ore found on his Irish estates by mining it, licensing the building of a smelting-works and the felling of timber for fuel.⁵⁷ That year he also led an expedition up the Orinoco River in Guiana to look for El Dorado, the city of gold, writing extensively of his findings and technical preparations. They sound remarkably

⁵⁴ Nicholas M. Lucchetti, interview with author, Williamsburg, Va., 23 September 2004; also lecture text used by permission, "Roanoke Island, James Towne, Powhatan, and Copper or How Thomas Hariot May Have Saved James Towne," September 1998. According to William Kelso, who worked on the excavation in the early 1990s with Hume and Lucchetti, no actual workshop site was found, only the crucible fragments and distilling evidence. (Letter to author, Williamsburg, Va., 23 July 2004).

⁵⁵ Hariot, *A Briefe and True Report of the New Found Land of Virginia*, 6.

⁵⁶ Dana Alexander, "Charlotte's Golden Past," *Trip: Greater Charlotte Visitor Resource*, November 2004, 2-3. Gold occurs from Newfoundland to Alabama along the Atlantic Slope: Auriferous regions in modern-day North Carolina are near Asheville (the Georgian belt), the South Mountains and Charlotte: Virginia's gold deposits lie mainly within this third or Carolinian belt. Other gold deposits were found in Cherokee County and along the Valley River (George F. Becker, "Gold Fields of the Southern Appalachians" in *Report of the Director of the Mint upon the Production of the Precious Metals in the United States during the Calendar Year 1895* (Washington: Government Printing Office, 1896) 110-111. No gold is mined in North Carolina at present because the deposits are neither large nor contiguous enough to be mined economically (J.W. Miller, personal communications, Williamsburg, Virginia, 2 September 2004).

⁵⁷ Nicholl, *The Creature in the Map*, 47.

similar to the types of physical descriptions that John Smith would make in Virginia, noting land topography and locations of soils, rocks, and minerals, or Hariot's observations on the Outer Banks. According to the calculations of Raleigh's map, El Dorado lay on the banks of a lake "eleven days" march from the Orinoco River. In Spanish expeditions of the period, a day's march covered five leagues, equivalent to fifteen miles.⁵⁸ In his 1596 work *The Discoverie of the Large, Rich and Beautiful Empyre of Guiana, with a Relation of the Great and Golden Citie of Manoa* (which the Spaniards call El Dorado), Raleigh identified mineral deposits. He also described the limited industrial resources available in Guiana: "whosoever hath seen with what strength of stone the best gold is environed, he will not think it is easy to be had in heaps."⁵⁹ Raleigh detailed contradictory assaying of his mineral samples by refiners and assay-masters in London to refute what he called "malicious slander." More valuable details are found in his 1612 proposal for another voyage. The supply list included a smith's forge, bricks for a furnace, refining equipment, pickaxes, spades, crowbars, and baskets lined with leather in which to carry ore from the mine to the river for transport.⁶⁰ In an interesting economic comparison to native labor costs in Virginia, William Strachey reported in *The Historie of Travell into Virginia Britannia* [1612] that in Guiana one hatchet would buy the services of thirty natives with a canoe for one month, and a three-penny knife would buy "a hundred weight of good biscuitt."⁶¹

⁵⁸ Ibid., 17-18.

⁵⁹ Ibid., 197.

⁶⁰ Ernest A. Strathman, "Raleigh Plans His Last Voyage," in *The Mariner's Mirror*, published by the Society for Nautical Research, London, England, vol. 50 (1964) 265.

⁶¹ William Strachey, "The Historie of Travell into Virginia Britania, Louis B. Wright and Virginia Freud, eds. 2nd. series, no. CIII (London: The Hakluyt Society, 1953) 93.

Raleigh's quest ended with his 1618 execution following long imprisonment in the Tower of London as punishment for allegedly planning James I's overthrow. Ironically, although they were not exploited successfully by Raleigh, gold deposits are found in Guiana just as they are in Virginia, both in deposits with quartz (Raleigh's white spar) and in gravels and river beds. In his account of replicating the Raleigh expedition in Guiana in 1992, Charles Nicholl dates isolated gold prospecting to late 1595. In a false start, Mexican miners located what turned out to be iron pyrites in the foothills of the Guiana Highlands before gold was ultimately discovered north of the Yuari River in 1857. Raleigh was not alone in influencing future exploration: in 1602, when Raleigh sent Samuel Mace to explore and search for surviving members of the 1587 settlement, Hariot had sent Mace advice for the voyage in a memorandum. Hariot detailed instructions on the procurement and preparation of copper circles and squares of specific numbers and sizes for trade with the natives, although it is not known if Mace followed through.⁶²

Jeffrey P. Brain, chief archaeologist for the Popham Project, heads the ongoing excavation of Jamestown's "lost twin" in modern-day Maine (see Figure 2). Paralleling the founding of Jamestown, English backers looked north to Maine for exploitable furs and minerals. Established by the April 10, 1606, charter forming the Virginia Company (West-Country branch), two ships left Plymouth, England in May 1607 with more than one hundred colonists led by George Popham, landing in August 1607. The principal settlement was Fort St. George on the Sagadahoc (today's Kennebec) River. Gome

⁶² David B. Quinn, *Explorers and Colonies: America, 1500-1625* (London: The Hambleton Press, 1990) 253; "Thomas Hariot and the Virginia Voyages of 1602," *William and Mary Quarterly*, XXVII, no. 2 (April 1970) 273-74.

Carew, identified as one of the “Gentlemen of Quality” and “the “Chief Searcher (for mines),” may have been an alchemist.

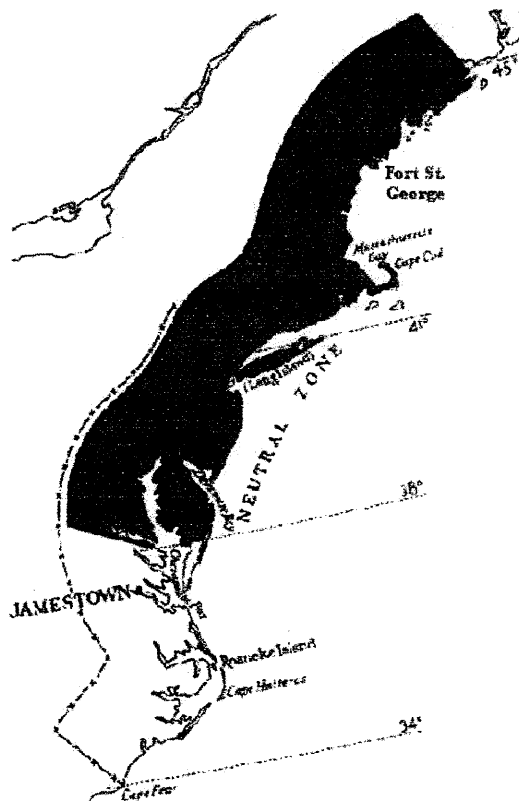


Figure 2. The Popham Colony (or the Northern or Second Colony) was planted at the mouth of the Sagadahoc River, today's Kennebec River in the State of Maine. (“Popham Colony: The First English Colony in New England,” <http://www.pophamcolony.org/>, used by permission of Jeffrey P. Brain)

A map drawn onsite by one of the colonists before the colony was abandoned in the fall of 1608 shows the presence, or plan for, a blacksmith's house and possibly, an attached workshop or forge. The Hunt map shows eighteen buildings, and if the Popham site is further excavated, archaeologists may learn how many were actually constructed.⁶³

⁶³ Jeffrey P. Brain, “The Popham Colony: A Historical and Archaeological Brief,” Peabody Essex Museum, Salem, Massachusetts, 2001 (3rd. rev.) 1.

As a parallel settlement to Jamestown, Fort St. George offers further understanding of the English colonial mindset including similar processes in mineral exploration. As of the 2004 archaeological season, no artifacts have been identified as relating to metalworking or refining. Popham colonial leaders did not mention the same kinds of activities and explorations documented for Roanoke and Jamestown, but a December 1607 letter written to the Earl of Salisbury by Sir Ferdinando Gorges is part of extant correspondence relaying news of the colony. In this letter, Gorges assesses the “Kennebec colony” commodities, noting: As for mettals, they can say nothings, but they ar confidente there is in the Contry, if they had meanes to seeke for it, neither could they go so high, as the Allom mines ar, which the Sauages doth ashure them there is great plenty of.”⁶⁴ It appears that in both the Maine and Virginia colonies, natives and colonists interacted concerning identification and location of mineral resources.

⁶⁴ David B. Quinn and Alison M. Quinn, eds. *New England Voyages 1602-1608* (London: The Hayluyt Society, 1983) 448.

CHAPTER IV

PRECONTACT TO CONTACT: THE VIRGINIANS AND THE ENGLISH

When English investors and adventurers combined forces to prepare for the first voyage to Jamestown, the travelers' agendas must have ranged from selfish to nationalistic with many shades between. Expectations and experience levels varied, but one constant may have been the "shopping list" of commodities authorities expected to find. Such a specific list does not appear in Virginia Company documents, but shows up indirectly between the lines of detailed descriptions made by Archer, Smith, Strachey, and others. References appear over and over to Terra Sigillata, Mastick, Alum, Salsa Perilla, and Bolus, unfamiliar terms until one consults the *Oxford English Dictionary* for their seventeenth-century meanings. Contemporary sources provide a roadmap to the use and value of these substances. In his 1612 *Historie*, Strachey referred to Dr. Lawrence Bohun, who came to Virginia in 1610 as the first physician appointed by the Virginia Company. In addition to his expertise in medical botany, Bohun may have directed or suggested how the colonists proceeded to look for medicinal clays in the natural *pharmacopeia* in which they found themselves.⁶⁵ Such clays, ingested like modern kaopectate, could relieve debilitating diarrhea and were prescribed in England for such intestinal afflictions. Dr. Bohun discovered and named "*Terra Alba Virginensis*," a Virginia white clay that promised poison expelling and absorbent properties that would help pestilent and malignant fevers.⁶⁶

⁶⁵ Raymond Phineas Stearns, *Science in the British Colonies of America* (Urbana: University of Illinois Press, 1970) 75-76.

⁶⁶ Wyndham B. Blanton, M.D. *Medicine in Virginia in the Seventeenth Century* (Richmond: William Byrd Press, 1930) 13.

Bohun was not the only forward-thinking physician connected in some way with Jamestown and the London Company. Among the medical men who were subscribers in the Company were Peter Turner, physician to Sir Walter Raleigh in the Tower, John Woodall, author of *The Surgion's Mate*, and Thomas Hood, who traveled with Sir Walter Drake in his explorations.⁶⁷ In *The Admirable Secrets of Physicke and Chyrurgery* by Thomas Palmer (1696), a young Massachusetts practitioner, other earth-based materials are listed for their healing properties. In the prevailing system of the time, an illness under treatment fit into one of several categories of humours: a perceived hot, moist condition such as dysentery, heart disease, or gangrene would be treated with cool and drying cures, clay being a valuable curative. Bole Armoniac was red clay, with "bole" meaning a bolus or mass, mixed with other ingredients to treat "moist distempers of the heart," infections of the lungs, and even eye inflammations.⁶⁸ Masticks were tree gums or resins used in the treatment of dyspepsia, dysentery, and gout. Terra Lemnia or Sigillata was "the sovereign minerall against infections," according to a 1632 reference in the *Oxford English Dictionary*. An OED 1802 reference continues, "This earth {of Lemnos}...is called Terra Sigillata, being formed into small loaves sealed with the grand seigneur's seal, and thus dispersed over various parts of Europe." Turkey, Armenia and Italy were known for exporting Terra Sigillata, Bole Armoniac, and Roach (Romish) Alum respectively. The 1621 export value of similar resources in Virginia included Mastick at three shillings the pound; Red Allum, called Carthegena Allum, and also Roach Allum [alum or allum is potassium aluminum sulphate, an astringent], both ten

⁶⁷ Blanton, *Medicine in Virginia*, 4-5.

⁶⁸ Thomas Palmer in Thomas Roger Forbes, ed., *The Admirable Secrets of Physick and Churgery* [1636] (New Haven: Yale University, 1984) 109, 121, 126.

shillings the hundred.⁶⁹ Smith's *Map of Virginia* demonstrates the link between geological observation and such commodities: "The Colour of the earth we found in diverse places, resembleth *bole Armoniac, terra sigillata and lemnia*, Fuller's earth [a variety of earth used in cleaning and scouring woven cloth to remove oil and grease] marle, and divers others such appearances."⁷⁰ In such statements, Smith and other colonial reporters not only helped readers to connect through familiar cultural references, but apprised them of Virginia's potential in mineral resources.

The first permanent English colony in North America took hold through such commodification and possession of the landscape, but what of the culture it displaced? In 1607 when the English landed, they were in the midst of the powerful Powhatan chiefdom of an estimated 13,000 to 15,000 people, spread over some 6,000 square miles of Virginia's coastal plain. It has been designated through the centuries by the birthplace name of its ruler Wahunsunacock, father of Pocahontas, and *mamanatowick* (paramount chief), of over thirty tribes. A portrait of the Southern Algonkians partially emerges from several sources: 1) the documentation of English artist John White; 2) the accounts of early explorers such as Thomas Hariot (both White and Hariot traveled to the Chesapeake Bay area as part of the 1585 expedition to found the ill-fated Roanoke Colony, and 3) modern archaeological evidence in Southeastern Virginia. In *A Briefe and True Report of the New Found Land of Virginia* (1590), Hariot wrote that although the native people lacked the tools, crafts, sciences, and arts of the English, "yet in those things they do,

⁶⁹ "A Note of the Shipping, Men, and Provisions sent to Virginia, by the Treasurer and Company in the yeere, 1619," in Peter Force, ed., *Tracts And Other Papers*, etc. [1844] (Bowie, Maryland: Heritage Books, 1999) III: 51 and 52.

⁷⁰ John Smith, "A Map of Virginia" in Philip L. Barbour, ed., *The Complete Works of Captain John Smith (1580-1631)* I: 145.

they show excellency of wit.”⁷¹ However, another source is invaluable: later English observers who, despite cultural biases, provide important clues as to how Powhatan technical processes and preferences (particularly related to tools) would change after 1607, when the first English settlers landed on Jamestown Island. Before any contact with Europeans or their trade goods, Powhatans extracted the materials they needed from their immediate environment, and traded or traveled to obtain other natural resources they desired. From the woods and water, they gathered stone, bone, shells, plant fibers, and wood, as well as food to supplement the crops they grew. Skillful use of fire enabled them to char, scrape, and thus modify hard woods for woodworking.

Copper has been recognized by modern scholars and archaeologists as one of the ornamental or exotic Indian commodities that Daniel Richter has described as conferring rarity and great significance to those who acquired them, esteemed in long-distance reciprocal exchanges and found often as grave goods.⁷² Both Powhatans and the Indians of the Outer Banks of North Carolina wore and valued copper, according to English explorers. These native cultures lacked pyro-technology and the ability to smelt or cast metal. Thus, they did not develop copper alloys for efficient metal weapons and tools. For the Powhatan Indians, copper sources included native trade from the Great Lakes area, European visitors, and later the Jamestown colonists. In Virginia, most native copper is located in the Greenstone units in the Blue Ridge province west of the Monacan Indians in the western Piedmont province. Purest native copper has been found in the Blue Ridge Mountains in the Dark Hollow mine (Madison County), Hightop mine

⁷¹ Hariot, *A Briefe and True Report*, 25.

⁷² Daniel K. Richter, *Facing East from Indian Country: A Native History of North America* (Cambridge: Harvard University Press, 2001) 6.

(Greene County), and Allen mine (Nelson County).⁷³ Jeffrey Hantman proposed in “Powhatan’s Relations with the Monacan Indians” that Powhatan also utilized Monacan copper sources. In 1607, colonist Gabriel Archer described a Powhatan-English interaction in which a petty chief made that claim (see Figure 3 for Helen C. Rountree’s map of archaeological sites producing native copper in Monacan territory). He also noted that whether the Monacans were miners, middlemen in a copper trade chain, or both, copper was spiritually and economically charged and important to Indian regional prestige.⁷⁴ It is likely that the Powhatans shaped vein copper into tube beads and other desired forms by annealing it, a simpler method which does not require smelting.⁷⁵

Vein copper, such as is found in the Great Lakes region, is of purer quality and more malleable for such processes. Studies of native copper use and metallurgy in prehistoric northeastern North America by Amelia M. Trevelyan point to a sophisticated and complex use of native copper for ritual use and a “copper elite.” Data gathered in ancient mining works in the Lake Superior region show that Precontact mining practices were primarily governed by spiritual rather than economic considerations. Accumulated archaeological evidence from hundreds of mines in the Great Lakes region indicates that the miners were capable of working and moving large masses of copper but generally worked only in small veins ¼ to ½” deep, possibly for ritual reasons.⁷⁶

⁷³ Palmer C. Sweet, *Copper, Lead, and Zinc Resources in Virginia* (Virginia Division of Mines, Minerals and Energy, Department of Mineral Resources Publication 93, 1989) 185p.

⁷⁴ Jeffrey L. Hantman, “Powhatan’s Relations with the Piedmont Monacans,” in Helen C. Rountree, ed., *Indian Foreign Relations, 1500-1722* (Charlottesville: University Press of Virginia, 1993) 109

⁷⁵ Lisa L. Heuvel and Jerry Veneziano, “Copper: Some Ways to Work It with Powhatan Indian Technology” (unpublished), February 1999, The Jamestown-Yorktown Foundation. The author and blacksmith Jerry Veneziano tested the probability of annealing copper through experimental archaeology, replicating a simple annealing process using a fire, wooden sticks, and stones to flatten and shape copper nuggets into beads and pendants similar to sixteenth-century artifacts found in Virginia and copper ornaments shown in the John White drawings.

⁷⁶ Amelia M. Trevelyan, *Miskwabik, Metal of Ritual: Metallurgy in Precontact Eastern North America* (Lexington: The University Press of Kentucky, 2003) 126-127.

Figure 3. Map of sites of burial grounds and archeological sites producing native copper and steatite in Virginia Piedmont and mountain zones

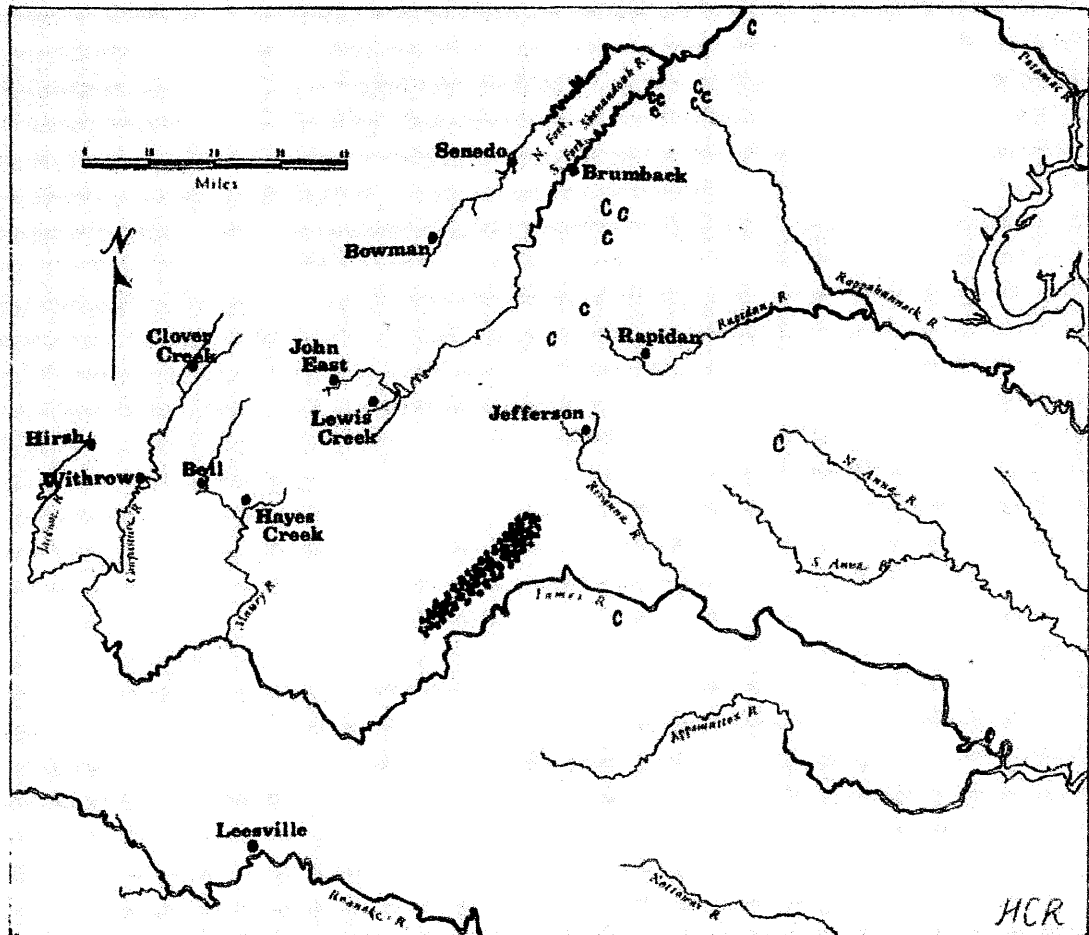


Figure 3. Sites of burial grounds and archaeological sites producing native copper (C) and steatite [soapstone used to carve bowls in prehistoric times and later beads and ornaments](S) in the Virginia piedmont and mountain zones in Monacan territory, as seen in this map by Helen C. Rountree (found in "Powhatan and the Piedmont Monacans," *Powhatan Foreign Relations*)

Copper's importance in the lower Chesapeake is also substantiated by archaeological evidence. The summer 2004 announcement of archaeological findings at Kiskiack, the Powhatan Indian village site now surrounded by the Naval Weapons Station at Yorktown, Virginia, has significant implications for the study of copper usage in the Chesapeake region. Archaeological evidence from the Kiskiack context established the presence of trade copper in Indian middens rather than native burial sites.

This is possibly indicative of a major devaluation in copper's spiritual and economic value among Powhatans once an uncontrolled English copper trade glutted the native market, a trend previously presented by Seth Mallios and Stephen Potter.⁷⁷ Advanced chemical analysis by Carter Christian Hudgins of copper artifacts from Jamestown and Kiskiack definitely ties the Kiskiack copper artifacts to the English and is helping to define copper trade and distribution in the Contact period.

Although the colonists did not identify the Powhatan Indians as miners, mining activity was observed elsewhere. To the north near the Potomac River, antimony was mined and washed free of impurities by Patowomeck natives, then traded as a commodity to other Virginia tribes as decoration.⁷⁸ From the Blue Ridge Mountains of Virginia, the Powhatan Indians gathered or traded for Catoctin green stone (a metabasaltic stone) from the Blue Ridge Mountains to polish into celts for stone axes. They were limited by a geologic shortage of stone and ore in the Virginia coastal plain they inhabited.⁷⁹ Cutting tools ranged from those fabricated of easily obtainable quartz, quartzite, or deer bone to sharpened reeds and shells. However, the material objects they made were not static in use or design over time. As with other Indian cultures, they changed as the Powhatan people's needs and desires changed within their own culture, and after prolonged contact with English culture.⁸⁰ Keith Egloff, assistant curator with the Virginia Department of

⁷⁷ Dennis B. Blanton and Carter C. Hudgins [son of Carter Lee Hudgins], "Archaeological Evidence for Native Prestige Commodity Devaluation: An Example from the Chesapeake Associated with the Jamestown Colony. Working paper (6/04) cited by permission of Dennis Blanton and the Naval Weapons Station, Yorktown, Virginia, <http://www.nwsy.navy.mil/press/blanton.html>, 1-2.

⁷⁸ Philip Alexander Bruce, *Economic History of Virginia* (New York: Peter Smith, 1935) I: 83. Also one colonial description by George Percy of the werowance or chief of Rapahanna describes his face painted blue, besprinkled with silver ore (actually antimony-based decoration).

⁷⁹ Helen C. Rountree, *Pocahontas' People: The Powhatan Indians of Virginia through Four Centuries*. (Norman: University of Oklahoma's Press, 1990) 7.

⁸⁰ Keith Egloff and Deborah Woodward, *First People: The Early Indians of Virginia*, (Charlottesville: University Press of Virginia, prepared by The Virginia Department of Historic Resources, 1992) 3.

Historic Resources and co-author of *First People: The Early Indians of Virginia*, has noted that changes in culture do not occur evenly. In comparison to religion, which normally changes slowly, or government, technology tends to change at a faster rate.⁸¹

It is clear from primary English sources such as John Smith and William Strachey that the Powhatans observed and absorbed the colonists' uses of metal. The Powhatans' desire for metal tools, firearms, and other trade items, together with the English desire for food and information, fueled their early interaction with each other. Timothy Silver's conclusions in *A New Face on the Countryside: Indians, colonists, and slaves in South Atlantic forests, 1500-1800*, point to ecological change not simply as an irrevocable result of European arrival, but as a series of changing cultural and economic relationships between three successive cultures - Indian, European, and African – and the land. Silver's "new face on the countryside," created by early colonization, was prefaced by native use of the land and changed by the use of slave labor in South Atlantic agriculture.⁸² The English desire for precious metals, among other commodities, was matched by the Powhatans' equal desire for processed copper among other trade goods. Amelia Trevelyan's analysis of English descriptions of Wahunsonacaugh (or Powhatan), his people, and the ways they used copper suggests that copper was spiritually vital to their well being as a society. An elite kin group led by Wahunsonacaugh in his role as priest and leader may have ceremonially governed the use of copper.⁸³ In his article

⁸¹ Keith Egloff interview with author, Richmond, Va., 1 June 1999.

⁸² Timothy Silver, *A New Face on the Countryside: Indians, Colonists, and Slaves in South Atlantic Forests, 1500-1800* (Cambridge: Cambridge University Press, 1990) 197. William Cronon similarly argued that one danger of contrasting New England before and after the Europeans is that "it obscures the actual processes of ecological and economic change. It makes that change seem too sudden and uncausal." *Changes in the Land: Indians, Colonists, and the Ecology of New England* (New York: Hill and Wang, 1989) 161.

⁸³ Trevelyan, *Miskwabik, Metal of Ritual*, 138-139.

“Breaking into the Backcountry: New Approaches to the Early American Frontier,”

Gregory Nobles maintains that the English elite sought to shape the frontier “to fit their social vision and economic interests.”⁸⁴ The dynamics of supply and demand existed on both sides: the metals valued by the English could enrich individuals as well as investors; similarly, Powhatan men and women of lower standing than the chiefly class traded goods and services with sailors and other colonists without sanction of their leaders.⁸⁵ It can be inferred that in addition to the guide services offered officially by the mamanatowick Powhatan and his chiefs, other knowledge and technical transfers took place through interpreters (both English and native) and other cultural contact points, many involving metals and minerals as well as native flora and fauna. In “A True Relation,” John Smith described a 1608 interaction in which “a Paspahayan came to show us a glistening mineral stone and with signs demonstrating it to be in great abundance like some rocks.” Smith and a dozen men accompanied the Indian, whose behavior convinced Smith that it was either a potential ambush or a trick to get valuable copper. As a punishment, the suspicious English leader displayed copper the guide would have received had he been trustworthy, then Smith “gave him twentie lashes with a Rope, and

⁸⁴ Nobles, “Breaking into the Backcountry: New Approaches to the Early American Frontier” in *William and Mary Quarterly*, 643.

⁸⁵ Stephen R. Potter has theorized that during the early Contact Period, the Algonquian chiefs of werowances attempted to control the flow of trade goods from the English as they did the flow of tribute from their own people. “Early English Effects on Virginia Algonquian Exchange and Tribute in the Tidewater Potomac in Peter H. Wood, Gregory A. Waselkov, and M. Thomas Hailey, eds., *Powhatan’s Mantle: Indians in the Colonial Southeast*, 151. Copper was perceived as a high prestige trade good and as private trade and official trade inflated the amount of copper within the Powhatan economy, its value diminished, affecting the chiefly hierarchy’s prestige. As trade and interaction continued, copper receded in importance. In his essay “North American Natives Responses to Europeans: Romantic Versus Rationalistic interpretations,” Bruce Trigger proposed that in reacting to Europeans, native groups eventually overcame an initial belief that Europeans possessed supernatural powers and came to re-evaluate them as human beings with whom they would trade and interact within recognized cultural perimeters (Karen Ordahl Kupperman, ed., *Major Problems in American Colonial History*, 2nd ed., (Boston: Houghton Mifflin Company, 2000) 44–45. Editor Karen Ordahl Kupperman noted in *Major Problems in American History* (45) that desired trade goods evolved from those immediately recognizable and useable within the native

his bowes and arrowes, bidding him shoote if he durst, and so let him goe.”⁸⁶ This account and another involving the native guide Namontack (to be described in Chapter V) suggest other mineral-related cultural interactions took place.

During the transition from the initial Virginia gold rush to realization of economic viability through tobacco, expectations for commodities and industry kept resources flowing to the colony from overseas. In his New England exploration, John Smith continued to make geologic references pertaining to the land and its promise. Despite his oft-quoted comments about gold-related activities in the early Jamestown colony, Smith continued to inform readers of potential mineral resources in his New England descriptions and noted that he was no alchemist, nor did he have a “mineral man” with him to verify his identifications of clays, stone and other mineral resources.⁸⁷

communities, i.e., copper and beads, to those showing increasing degrees of cultural adaptation, such as metal tools and cloth.

⁸⁶ John Smith, “A True Relation, etc.” [1608] in Philip L. Barbour, ed., *The Complete Works of Captain John Smith (1580-1631)*. (Chapel Hill and London: The University of North Carolina Press, 1986) I:93.

⁸⁷ Stearns, *Science in the British Colonies of America*, 74.

CHAPTER V

THE JAMESTOWN STORY

“But the worst was our guilded refiners with their golden promises made all men their slaves in hope of recompences; there was no talke, no hope, no worke, but dig gold, wash gold, refine gold, load gold....”⁸⁸ It is tempting to target this passage by John Smith as a condemnation of mineral exploration in the colony and the ineptness of its organizers. However taking words out of context may alter their meaning and significance. The colonial Virginia context unfortunately has gaping holes due to loss of written English records and the lack of written documentation for the native population. Analyzing context involves studying as much credible information as possible and also comparing circumstances and actions that appear to have similarities. The historical accounts previously outlined show that an exceptional body of practical knowledge on geography, previous exploration, and technology accompanied the English to Jamestown. Both Raleigh and Hariot still lived, and substantial exploration literature, most of it lost to modern scholars, was still probably read and discussed by investors and officials connected to the Virginia Company’s plans. In addition, natives from Roanoke and later South America played a key role in providing a linguistic and information bridge when Raleigh brought them back to England between 1584 and 1618. Alden T. Vaughan provided in-depth information on as many as twenty natives (beyond the well-known pair Manteo and Wanchese) who were “gently” indoctrinated into English speech and customs by Raleigh and Hariot during Raleigh’s prime expeditionary phase and acted as

⁸⁸ Smith, “The General Historie” Bk. 3, Ch. 3, in Barbour, *Complete Works of Captain John Smith*, II:247-48.

expedition translators.⁸⁹ Based on exploration literature circulating in Europe, the English could easily have believed that finding precious metals or stones would require little effort. Carole Shammas developed this thesis in her essay on English commercial development and American colonization between 1560 and 1620. She noted that anyone who had read a translated account of Spanish colonization in America might have assumed that a relatively small number of Englishmen could accomplish the same type of conquest and access to vast riches via a subdued native population.⁹⁰

A thorough reading of John Smith's writings (for both Virginia and New England) shows his ability, like Raleigh's, to observe and analyze his physical surroundings for their mineral potential. In addition to problems of provisioning and productivity, he was concerned that local metallurgical testing - which he was not allowed to observe, possibly for political reasons or artisanal secrecy - was inadequate and that gold fever might be overriding a more rational approach to governance and exploration, both legitimate concerns. "Were it that Smith would not applaud all those golden inventions because they admitted him not to the sight of their trials nor golden consultations, I know not. But I have heard him oft question with Captain Martin, and tell him, except he could show him a more substantial trial, he was not enamoured with their 'dirty' skill...."⁹¹

⁸⁹ Alden T. Vaughan, "Sir Walter Raleigh's Indian Interpreters, 1584-1618," in *William and Mary Quarterly*, 3rd ser., vol. LIX, no. 2 (April 2002) 341-42. Although eight other natives were taken to England between 1501 and 1570 as a result of exploration, none were apparently trained to interpret - although Martin Frobisher realized the need for two-way communications; the four Inuits he brought back died and he was unable to capture more in 1578. Vaughan notes that no Indian is listed in the final 1617 Guiana voyage of 40 ships and 1,000 men. However, the two natives who returned from that voyage were intended to witness that although Raleigh did not find gold, it did in fact exist. Christopher, servant to the Governor of Guiana, attested after Raleigh was imprisoned in the Tower of London that he would "take it upon his lfe that he is able to shewe and say heere they are 7 or 8 severall mynes of Gold." (Vaughan, 370).

⁹⁰ Carole Shammas, "English commercial development and American colonization 1560 - 1620" in K. R. Andrews, N. P. Canny, P. E. H. Hair, eds., *The Westward Enterprise: English Activities in Ireland, The Atlantic, and America 1480 - 1650* (Liverpool: Liverpool University Press, 1978) 157.

⁹¹ Smith, "The General Historie," in Barbour, *Complete Works of Captain John Smith*, II:247-48.

Gold forms as a product of volcanic or hydrothermal activity. Geologically, it may be found as free gold” in quartz veins, in iron pyrite, or alloyed with other base metals. “Free gold” is gold that eroded and re-deposited in sediments. Iron pyrite (“fool’s gold”) may have been present as small bits in the sand on river shores, discovered by the colonists as they searched for mineral resources along the coastal plain of Virginia and toward the Falls (Richmond) and Piedmont.⁹² Mica, in the form of biotite, also may have been confused for gold. Despite the efforts of German mineral men and gold refiners from England, gold was not found for the Virginia Company or the crown, which lay claim to one-fifth of the gold and one-fifteenth of the value of copper discovered in Virginia (in the first charter dated 10 April 1606).

In the “instructions by way of advice” given by the Council for Virginia, Captain Newport and Captain Gosnold were charged with taking forty men upriver and into the surrounding territory. Where high hills or lands were seen, Gosnold would then split with half the men and six pickaxes to look for minerals. Should any exploration parties take native guides, they were advised not to let them slip away, but take a compass and keep track of directional changes to avoid being abandoned and lost.⁹³ It should be apparent that Captain Newport's two early transports of "gilded dirt" to England, like Frobisher's or Raleigh's, returned large testing samples for trials by different assayers. Was anyone at Jamestown familiar with precious metals or mineral exploration? Newport, married to the daughter of a goldsmith, had previously invested in a ship with London goldsmiths. In 1596, he was part owner of the privateer *Neptune* with prominent

⁹² Palmer C. Sweet, letter to author, Williamsburg, Va., 14 August 2004.

⁹³ “Instructions given by way of advice, by us whom it hath pleased the King’s Majesty to appoint of the Council for the intended voyage to Virginia, to be observed by those captains and company which are sent

goldsmiths Francis and Richard Glenville, who were well established in their trade and primarily interested in gold, silver, and precious stones. Captain John Martin, who supervised metallurgical work at Jamestown, was the son of England's Master of the Mint. Bartholomew Gosnold, captain of the *Godspeed* in 1606, had explored "the North part of Virginia" [the New England coast] in 1602, taking Captain Bartholomew Gilbert - a London goldsmith and no relation to Sir Humphrey Gilbert - with him on the *Concord*. Having returned to England on the *Susan Constant* with a sample of "gold" on 29 July 1607, Newport brought back two goldsmiths (William Johnson and Richard Belfield), a jeweler (Daniel Stallings), and two metallurgical refiners (William Dawson and Abram Ransack) with the First Supply ship in January 1608.⁹⁴ Richard Dole joined James Read as the colony's second known blacksmith. If the Frobisher expeditions can be taken as models for mining logistics, then blacksmiths would have been important for the repair of pickaxes and other tools used in Virginia.

The subject of mines and miners appears again and again. A passage that appears in John Smith's *A True Relation* but none of his subsequent writings describes mineral exploration with Captain Christopher Newport following Newport's return and resupply in January 1608: "Captain Nuport in the pinnace leaving me in the barge to dig a rock where we supposed a mine at Cinquaoteck, [...] which done, ere midnight I arrived at Weroacomoco, where our pinnace anchored, being 20 miles from Cinquaotecke."⁹⁵ The following directive was included in the instructions of May 1609: "You must be very solitouse that our fleetes come not home empty not laden with useles mechandize," with

at this present to plant there," in Alexander Brown, ed., *The Genesis of the United States [1605-1616]* (Bowie: Heritage Books, Inc. (1993) I:82-83.

⁹⁴ Smith, "The General Historie," in Barbour, *Complete Works of Captain John Smith*, II:253.

⁹⁵ Smith, "A True Relation" in Barbour, *Complete Works of Captain John Smith*, I:77-78.

profits to be gained from discovery of the “southe seas or royall mines,” commodities from other countries, tribute, and exports from the Virginia colony, including steel and iron.⁹⁶ In 1610, George Percy reported there was a conspiracy plotting among “some of our men which wrought in iron mines to run away with a bark [a ship].” The plot was unsuccessful. While it seems to confirm the presence of iron mines, this account does not mention what type of mining was taking place, and no sources have yet confirmed or denied that colonial miners worked in underground shafts in Virginia, although the process of mining was well-known in England. William Strachey refers to “divers sorts of minerals, especially of iron ore lying upon the ground for ten miles circuit,” which would make surface mining a distinct possibility.⁹⁷ The eighteenth-century *Diderot Encyclopedie* illustrates techniques of superficial and deep mining in Europe, as well as quarrying and transport of minerals “found in earth and in water” that may have been similar to those colonial authorities hoped to implement.⁹⁸ The colonists discovered bog iron (limonite or other iron-cement-sand deposits) as they searched for mineral resources along the coastal plain of Virginia and toward the Piedmont.⁹⁹ Because bog iron was readily accessible along rivers and in bogs, and exposed in eroding cliffs, the quarrying process could have taken place several ways in the colony: by boat, using long-handled scoops, or mined with picks and shovels in swamps and low-lying areas. Bog iron was

⁹⁶ Virginia Council, “Instruccions Orders and Constituciones...to Sr Thomas Gates Knight Governor of Virginia [May 1609], *The Three Charters Of the Virginia Company of London, With Seven Related Documents* (The Virginia 350th Anniversary Corporation) 204 p.

⁹⁷ William Strachey, “ True Reportory” in *A Voyage to Virginia in 1609*, Louis B. Wright, ed., 3rd printing (Charlottesville: The University Press of Virginia, 1967) 101.

⁹⁸ *Diderot Encyclopedie: The Complete Illustrations 1762-1777, Vol. 2*, Plates 788 and 789.

⁹⁹ In *James City County, Keystone of the Commonwealth*, author Martha McCartney relates an account by agronomist Edmund Ruffin in the mid-19th century concerning his visit to the Stonehouse, a stone structure then in ruins. Its walls (two feet wide in the basement, eighteen inches above) were constructed of ferruginous sandstone (limonite or bog iron with carbonate inclusions) found in abundance nearby *Commonwealth* (Virginia Beach: The Donning Company Publishers, 1997) 278-79.

processed to make iron chisels that Smith describes, and may have been in two barrels of iron ore samples he sent back to the Treasurer and Council of Virginia as a result of his explorations. An expedition led by Captain Christopher Newport after his return with the Second Supply in autumn 1608 went from the Falls (near modern-day Richmond) to the boundaries of Powhatan/Monacan territory (near modern-day Columbia and Fork Union) where the James and Rivanna Rivers come together, then back to Jamestown. Smith, then President, was not a member of the expedition but described it in *The Generall Historie*: “in our returns we searched many places we supposed mines, about which we spent some time in refining.” Smith’s “Virginia” map shows both areas he explored and those known to him only “by relation,” identified by Maltese crosses (see Figure 4).¹⁰⁰

In 1609, an ocean away in Ireland, iron ore had been found in abundance and London agents were already assessing where and how it was deposited (in mines, bogs, basalt quarries and other sites), and taking samples of ore, iron, and steel back to English authorities. In comparison, by 1612 an estimated one hundred tons of Virginia iron had been shipped to England with Captain Christopher Newport and been smelted into sixteen to seventeen tons of useable iron. In 1612, William Strachey made note of an iron mine that Sir Thomas Dale described in his letters to the lords of the Council. However, a “mine” could also represent shallow pits in the ground or swampy areas where bog iron was dug up.¹⁰¹ The initial gold rush at Jamestown seemed to subside as other challenges confronted the colonists. The second wave of exploration began after

¹⁰⁰The author thanks Barbara Carson and James Axtell for insights on Smith’s role, also Edward Wright Haile for clarifying Newport’s expedition beyond the Falls in *Jamestown Narratives* (283-84) and for the detailed index of mineral references in that work that made beginning research in this area possible; Smith’s “The General Historie” in Barbour, *Complete Works of Captain John Smith*, II:184-85.

¹⁰¹ Strachey in Wright and Freund, *Historie of Travell*, 132. “To dig for the purpose of obtaining minerals; etc” [1568 in Pettus, *Fodiae Reg.* (1670)], She grants unto them to search, dig and mine for the Callamine

Thomas West, Baron de la Warr, arrived to renew the colony in 1611. Lord de la Warr's push toward the fall line to search for gold, silver, and the South Sea is well documented.

Through his perseverance, a fort was constructed near the Falls, marking English intentions to explore beyond the Blue Ridge.

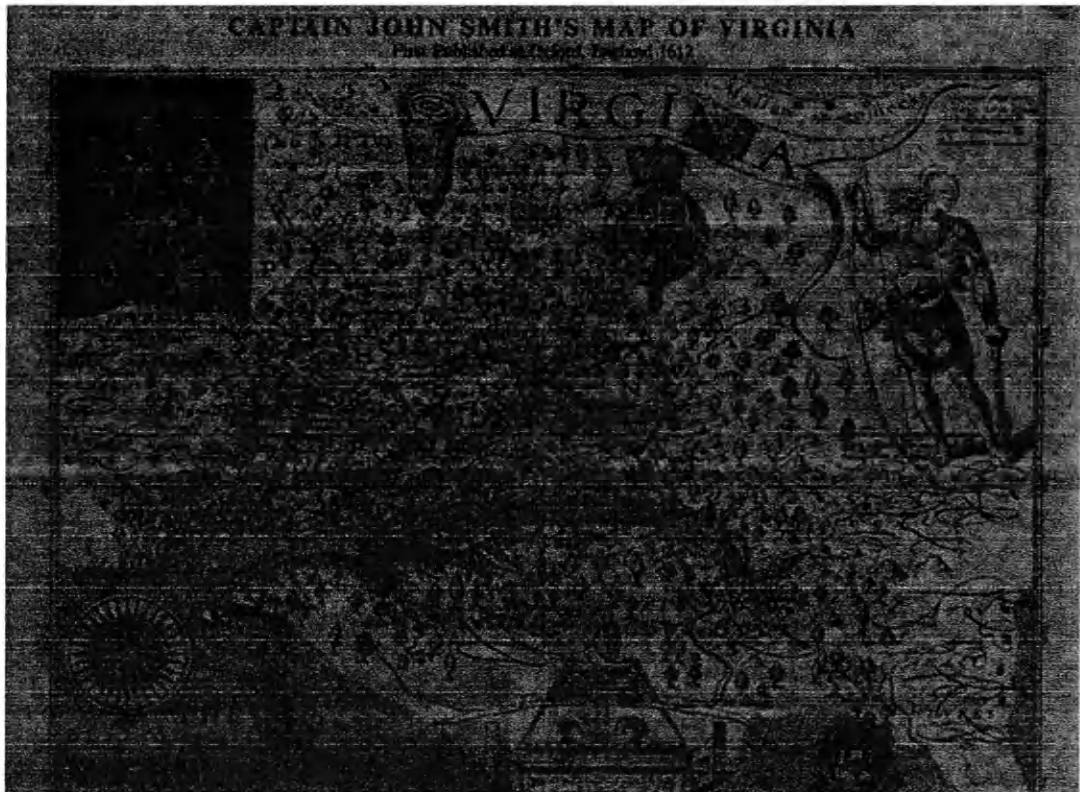


Figure 4. John Smith's "Virginia" was separately published in London in 1612 and was also included in the Oxford publication of John Smith's *A Map of Virginia: With a Description of the Countrey, the Commodities, People, Government and Religion* [1612].

In *The Historie of Travell in Virginia Britannia*, William Strachey noted, "These waters wash from the rocks such glistening tinctures that the ground in some places seemeth as gilded where both the rocks and the earth are so splendant they contained more than probabilities. Sure it is that some minerals there have been found."¹⁰² The

stone in all places of England." *The Compact Edition of the Oxford English Dictionary* (Oxford: Oxford University Press, 1971) 1801.

¹⁰² Strachey in Wright and Freund, *Historie of Travell*, 34.

region Strachey described forty to fifty miles beyond the Falls is in the heart of the gold-pyrite belt between modern-day Columbia and Fork Union, Virginia, where a sizeable number of gold deposits and occurrences were mined in the nineteenth and twentieth centuries. Previously, Christopher Newport had explored in the same area as far as Rassawek, an Indian village located near Fork Union.

In 1729, in what is now Woodbridge, Prince William County, “King” Carter built a landing to ship copper ore at Occoquan.¹⁰³ In 1733, the Slith Mine located in Meckenburg County was worked for copper, gold, and silver by one miner and two helpers. In 1836, William Barton Rogers reported that virgin copper had been reported in many parts of the Blue Ridge in thin veins and small masses, and small samples picked up.¹⁰⁴ Watson also reported in 1906 that “the ores of copper have wide distribution over the State, although there are at present but few producing mines,” with deposits in the Piedmont, the Blue Ridge, Southwest Virginia, and in Loudoun and Culpepper counties. In North Carolina, copper was mined as early as 1856 in Person County and in the 1800s and 1890s in Granville County.¹⁰⁵ Watson reported deposits from Front Royal south in Warren, Fauquier, Rappahannock, Madison, Page, and Greene Counties. Amherst County was noted for old openings as “the endeavor of earlier explorers to find workable deposits” and in the Blue Ridge, “copper deposits have been known to exist...since the earliest settlements.” Watson also wrote, “the native copper of the region probably furnished the Indians with the metal from which their ornaments and axes were made.”¹⁰⁶

¹⁰³ Palmer C. Sweet, “Additional Gold Mines, Prospects, and Occurrences in Virginia 1985.” *Virginia Minerals* (Virginia Division of Mines, Minerals, and Energy, Department of Mineral Resources) vol. 31, no. 4, 49-50.

¹⁰⁴ Rogers, “Report of the Progress of the Geological Survey of Virginia of the State of Virginia, for the Year 1836” in *A Reprint of Annual Reports and Other Papers, on the Geology of the Virginias*, 134.

¹⁰⁵ Watson, *Mineral Resources*, 492.

¹⁰⁶ *Ibid.*, 503.

In his *Historie of Travell*, William Strachey noted “We do already heare the Indians talk both of Allum-Mynes and copper to the South-ward, where hath bene sufficient tyme for digestion, all which we must submitt to more cliere Discoveries.”¹⁰⁷ Strachey also wrote of the “Bocootawwonaukes,” or a people so called by Powhatan, living north of the Falls and northeast beyond the Monacans. According to Strachey, Powhatan said that they “doe likewise melt Copper and other mettells; how true we must leave to further discovery.”¹⁰⁸ Beyond the Bocootawwonaukes at 44 degrees latitude, Strachey wrote, was the country called Pamaquid, in which “our westernne Colony (vpon the River of Sachedehock) [Fort St. George, or the Popham Colony, on the Sagadahoc River in modern-day Maine] was sometyme planted.”¹⁰⁹ While it is tempting to link the Boccotawwonaukes and Monacans to Virginia Indians mining and smelting copper, the Powhatans, like their English counterparts, were stymied in comprehending the true geographic distances involved in their descriptions to the English. Strachey’s descriptions show that in the second decade of English occupation, the colonists continued to observe their environment and question the Virginia natives about it. In *Marvelous Possession: The Wonder of the New World*, Stephen emphasizes that the critical cultural difference between European and American peoples was the presence or absence of writing, and that this difference virtually determined the outcome of their

¹⁰⁷ Strachey in Wright and Freund, *Historie of Travell*, 40.

¹⁰⁸ Ibid., 35-36. Strachey wrote that the “Boocootawwinnauke are said to part the sollide Metelle from the stone without fier, bellowes or additament, and beat yt into plates, the like whereof is hardly found in any other parte of the world.” (Ibid., 132.) In defining the borders of Powhatan’s domain, Strachey wrote “- and west-ward he Commaundes to Manahassanugh, which standes at the foot of the mountaynes, from Chesapeak [perhaps modern-day Charlottesville] or the mouth of our Bay 200 myles: Nor-west, to the borders of Massawomeck, and Bocootawwonaugh: Nor-east and by east to Accohanock, Accomack, and some other petty Nations, lying on the East syde of our Bay” (Ibid., 57) .

¹⁰⁹ Ibid., 35.

encounter.” Greenblatt goes further to discuss the technology of symbolism.¹¹⁰ As part of the process of possessing Virginia, English colonial implementation of representational technology as manifested in their maps and writings was an inevitable factor in the conquest of Virginia. Andrew Sturtevant has demonstrated that maps “belong to the lexicon by which European powers psychologically and legally acquired New World territory from its native inhabitants,” and through their deconstruction are evidence of English attitudes and intentions in colonization.¹¹¹

A map’s accuracy and measurement of geographic space were dependent on agreed-upon units of measurement and territorial limitations. Members of different cultures with different conceptions of time and space could probably agree on the amount of ground or water that could be covered in a day by foot; however, hostile forces could prevent them from verifying accounts of the peoples and places beyond their safe zones. Smith, Strachey, and colonial authorities would have liked to range freely beyond the mountains of “Britannia,” but depended on native information in that era. However, the Powhatans were limited by the perimeters of their territory or safe zone. Even under ideal communications conditions, Powhatan leaders may have restricted or redirected revealing disclosures for the protection of their people.

While the factors outlined above are essential to understanding the limitations of colonial mineral exploration, there may be a third: interactions between the English and Powhatans, as noted in the previous chapter, that have been overlooked. A case in point is the Powhatan warrior Namontack, who was cited by Strachey as the discoverer of a

¹¹⁰ Stephen Greenblatt, *Marvelous Possession: The Wonder of the New World* (Chicago: University of Chicago Press, 1991) 11.

¹¹¹ Andrew Sturtevant, “Flag Planting and Mapmaking: Claiming North America with English Maps,” Master of Arts thesis (unpublished work in progress) for the College of William and Mary (2004) 38.

mine within six miles of the head of the Falls. Significantly, the colonists named the mine for Namontack, an action out of keeping with the English desire to honor their own with place names. John Smith mentioned that Namontack was a guide on several occasions for him and for Christopher Newport. Although Irishman Francis Maguel's 1610 account may exaggerate in speaking of "many mines of iron and of copper and others," his description of sailing to England with the "son of the emperor" fits with Namontack's sailing to England with Christopher Newport on 10 April 1608 and arriving there on 21 May 1608. The Indian warrior returned to Virginia with Newport in September 1608.

When Newport met with Powhatan after his return, he requested additional men and guides for the expedition to Monacan territory. Powhatan refused to supply anyone other than Namontack. Refiner William Callicut had arrived, possibly on Newport's Second Supply in September 1608 with Namontack. Callicut accompanied Newport, the colonial council members, five appointed leaders, and 120 chosen men in the search for mines. According to Smith, he conducted mineral trials on location, claiming to extract a small amount of silver ore.¹¹² Strachey also described two other silver mines midway between two Monacan villages 14 miles apart: one with ore located only two to three feet into the ground and the other attested to by the Swiss William Hendrick Faldoe. When Faldoe returned to England with Captain Newport, the mineral man's assurances persuaded London Company authorities to put him under contract. However, in 1610

¹¹² Smith, "The General Historie," in Barbour, *Complete Works of Captain John Smith*, II:184.

Faldae died with the silver mine's location still secret.¹¹³ Strachey reported that Lord de la Warr had shown him a Portuguese map in which "our seat is laid out and in the same two silver mines pricked down."¹¹⁴

Was there actually silver? There are several possibilities. Weathered muscovite looks similar.¹¹⁵ According to Virginia Department of Mineral resources geologist John Marr, it is possible there may have been a very small amount of silver in the alluvium near Richmond. Records of mining operations in Virginia date from 1829 and show that silver was produced from both quartz and copper ores. In 1904, eleven counties in Virginia contributed to the production of gold and silver. Silver was located in quartz veins associated with gold in both Montgomery and Floyd Counties on the west side of the Blue Ridge and at the southeast base of Pilot Mountain.¹¹⁶ As of 1976, the Division of Mineral Resources had noted forty mines in Virginia that reported the presence of silver in varying amounts.¹¹⁷ Additional silver mines, prospects, and occurrences have been found since 1976.¹¹⁸

Comparison of historical events and geologic documentation reveals that limitations born of territorial hostilities, technology and unforeseen events were factors in their perceived failure to locate precious metals. One such factor was de la Warr's ill health and his withdrawal from Virginia in 1611, removing one of the major proponents

¹¹³ John Smith related the story of Valdo or Volda[y] or Faldae, concluding his account that with Faldae's return with Lord de la Warr, having been "found a meere Imposter he dyed most miserably." ("The General Historie," Bk. 3, Ch. 12, in Barbour, *Complete Works of Captain John Smith*, II:226.

¹¹⁴ Strachey in Wright and Freund, *Historie of Travell*, 131.

¹¹⁵ John Marr, letter to author, Williamsburg, Virginia, 22 October 1999.

¹¹⁶ Watson, *Mineral Resources*, 564-65.

¹¹⁷ Palmer C. Sweet, "Silver in Virginia," *Virginia Minerals* (Virginia Department of Mines, Minerals & Energy, Division of Mineral Resources), vol. 22, no. 1 (1967) 9-11.

¹¹⁸ Noted in *Virginia Minerals* in the following: vol. 28, no. 4; vol. 31, no. 4; vol. 31, no. 1.

of mineral exploration.¹¹⁹ From that time on, the priority moved gradually to exploitation and manufacturing of iron, continuing activity near the Falls (see Figure 6). Yet in Don Diego de Molina's letter to Don Alonso de Velasco dated 28 May 1613, Molina wrote:

...They have discovered some mines which are considered productive, altho' they have not yet been able to benefit much by them, until they shall be well established here. There are great expectations of what they will find in the mountains in great abundance; so say the Indians and offer to show the places which they know. They say at the headwaters of the rivers, after they have come forth from the mountains, there is a great quantity of grains of silver and gold; but as they do not attach any value to them, but only to copper which they esteem very highly, they do not collect them. Until now these men have not been able to go out to discover them, however eagerly they may desire it....¹²⁰

Of over 700,000 prehistoric and historic period artifacts uncovered to date at the original location of James Fort by the APVA Jamestown Rediscovery staff, over 60,000 are geologic materials. Apart from native stone tools and flakes, there are other lithics found in the colonial contexts that represent local cherts and sandstones, English flint and chalk, Bermuda coral and limestone, and samples of volcanic rock.¹²¹ One explanation for the presence of these specimens is that the mineral men or prospectors were collecting examples wherever they landed or explored. A collection of semi-precious stones was found in the fort's pre-1610 fill of Structure 165. In 1611, Thomas Dale wrote: "And at the Falls, I cannot onely testifie of corne, but of all probabilities of mines, when our tyme shall serve (which may not be yet) and where I gathered many scattered pieces of Crystall."¹²²

¹¹⁹ Although the ailing Governor for life attempted a return to Virginia in June 1618, he died during the voyage.

¹²⁰ Don Diego de Molina to Don Alonso de Velasco, letter dated 28 May 1613 in Alexander Brown, *The Genesis of the United State* [1898] (Bowie: Heritage Books, Inc., 1994) II: 646.

¹²¹ Confirmed by Beverly A. Straube, curator of APVA Jamestown Rediscovery, letter to author, Williamsburg, Va., 1 March 2005.

¹²² Thomas Dale, "Letter from Dale to Salisbury," [17 August 1611] State Papers, Colo., James I, vol. 1, no. 26, in *Brown's Genesis*, 505.

Figure 5. Locations of Selected Early Colonial Sites Related to Geologic Deposits in Virginia

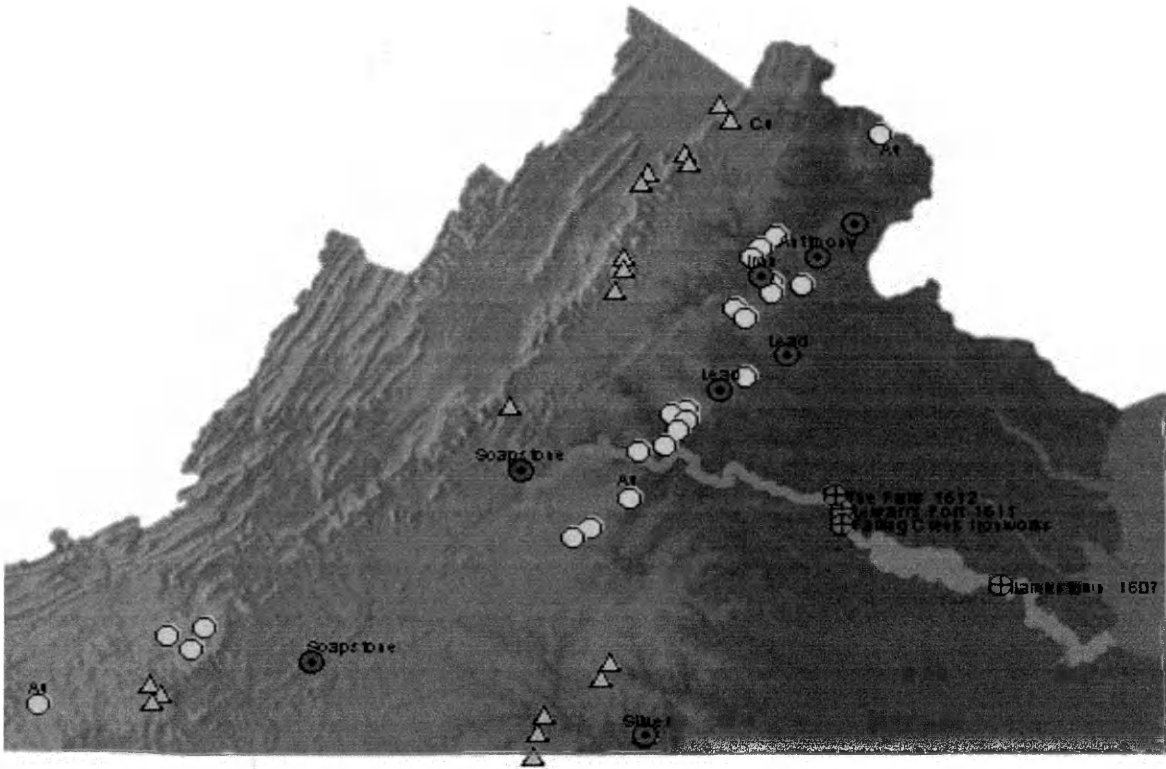


Figure 5. Shows locations of early colonial settlement and mineral related activity relative to geologic deposits of gold (Au), copper (Cu), silver, soapstone and lead. Relief map of Virginia (shown in part) courtesy of the Department of Geology, College of William and Mary)

The ongoing archaeological discoveries centered in the fort site on Jamestown Island indicate the presence of industrial activity almost 400 years ago. As at Roanoke, the crucibles and distilling equipment in the National Park Service's Colonial National Park collection are indicative of metallurgical testing. Related finds include: evidence of iron smelting (Structure 111); brass measuring scales (Refuse Pit 1); bog iron samples and quartz crystal (Kiln area); beaker fragments and a small vial (Refuse Pit 1); and coral and fossil pieces along with a small crucible (Structure 128). A seventeenth-century alembic

was found at Martin's Hundred during excavations from 1976 to 1980.¹²³ William Kelso and his staff of archaeologists have excavated other pieces of distilling equipment of the type used by refiners in the fort context at APVA Jamestown Rediscovery. These artifacts, among them crucibles, distilling vessels, alembics, and cucurbits, have been described at length in published APVA Jamestown Rediscovery reports over the last ten years.¹²⁴ As this project uncovers more and more evidence of concerted efforts in industrial activity and trade, old concepts of colonial ineptness and lack of planning are losing credibility. An interesting parallel is the discovery of drug jars and butter pots at a number of seventeenth-century sites including The Maine, Jamestown, and Jordan's Journey. A period brass image of a Forest of Dean miner in the Newland Parish Church in the Grayndour Chantry Chapel shows him wearing a leather bag on his belt to hold such medicinal ointments or tools.¹²⁵ At Jordan's Journey, the outlying settlement in modern-day Henrico County, archaeological evidence included bog iron chunks, crucible fragments, and rocks listed as "non-local" by the archaeologists.¹²⁶ In the 1992 preliminary report on archaeology prepared by L. Daniel Mouer and his colleagues, they noted that among the "more humble, but highly intriguing" artifacts were several pounds of rocks (micaceous schists and gneisses from the Western Piedmont) filled with glittery materials like biotite and pyrite. They concluded that these artifacts represented ore samples abandoned in site trash pits.

¹²³ Ivor Noël Hume, *Martin's Hundred: The Discovery of a Lost Virginia Settlement* (New York: Dell Publishing Co., Inc., 1982) 101-103.

¹²⁴ William M. Kelso with Beverly Straube, *Jamestown Rediscovery 1994-2004* (USA: The Association for the Preservation of Virginia Antiquities, 2004) 157-161.

¹²⁵ A brass rubbing of this design was included in Robert Baldwin's "Speculative Ambitions and the Reputations of Frobisher's Metallurgists," as Fig. 7) in *Meta Incognita*, 418.

¹²⁶ An examination of the artifacts stored in the collections at the Virginia Department of Historic Resources in Richmond, Va., with geologist Palmer Sweet did not include the so-called exotic or non-local rocks, which were not available.

Further, the team wrote:

And yet they reveal either the presence of an extensive Indian trade in potential ore sources, or else the presence of English prospectors in the Piedmont fully 30 years or more before any are historically known to have traveled there (excepting, of course, Newport's 1608 expedition to the Monacans). At the very least, we need careful and expert geological identification of these materials so that we can determine the extent of this trading network, or exploration.¹²⁷

It is highly possible that related activities – refining and mineral exploration – were taking place in the satellite settlement areas, as authorities continued to press the search for mineral resources in Virginia. That hope, a driving force in colonization, was destined not to disappear but to be realized over the next four centuries. In a letter dated 16 April 1630, Sir John Harvey wrote to Secretary Dorchester, “I intend about September, when the heate is over, to travaille about 8 or 9 dayes journey above the falls to inform myself truly whether there be anie such silver mine as is or hath been commonly reported or not.” Winter cut short Harvey's planned expedition with 170 men. A later attempt with fifty men to look for gold and silver was made by Colonel Edward Hill without official approval twenty years later, proving that expectations still ran deep.¹²⁸

¹²⁷ L. Daniel Mouer et al., Virginia Commonwealth University Archaeological Research Center. “Jordan's Journey: A Preliminary Report on Archaeology at Site 44,” 302. Prince George County, Virginia, 1990-1991.” Prepared for the Virginia Department of Historic Resources and The National Geographic Society, June 1992, 163.

¹²⁸ Philip Alexander Bruce. *Economic History of Virginia in the Seventeenth Century: An Inquiry into the Material Conditions of the People, Based Upon Original and Contemporaneous Records* (New York: Peter Smith, 1935) I:82.

CHAPTER VI

THE SIGNIFICANCE OF FALLING CREEK

The evolution of mineral exploration and mining technology in colonial Virginia should be compared to overall patterns of cultural transmission and adaptation. Martin Quitt's 1988 study of cultural evolution over space and time showed how immigrant leaders in Virginia fused their English background and response to new surroundings to create a legacy to succeeding generations of their families.¹²⁹ Joanne Bowen, Cary Carson, Willie Graham, Martha McCartney, and Lorena Walsh addressed the mutability of culture at "The Atlantic World and Virginia, 1550-1624" conference in March 2004. They proposed that seventeenth-century Jamestown and Virginia reflected an adaptive process going on throughout the Western Hemisphere: "Atlantic world scholarship has broken through to the important realization that cultures are made and continually remade on location, not born at home and cloned abroad."¹³⁰ The colonists learned by trial and error how to exploit the ecological environment of Virginia. A Spanish witness, Francis Miguel, testified that in the first three years of Jamestown, English settlers had erected machinery to work the iron mines.¹³¹

The second major wave of English colonial mineral exploration occurred after the Starving Time of 1610, when Lord de la Warr arrived as governor to restore and renew the debilitated colony. In a letter from Virginia Council members to the Corporation of

¹²⁹ Martin H. Quitt, "Immigrant Origins of the Virginia Gentry: A Study of Cultural Transmission and Innovation," in *William and Mary Quarterly*, 3rd ser., vol. XLV, no. 4 (October 1988) 629.

¹³⁰ Joanne Bowen et al., "New World, Real World: Improvising English Culture in Seventeenth Century Virginia," paper for the Omohundro Institute of Early American History and Culture Jamestown Conference, "The Atlantic World and Virginia, 1550-1624," 4-7 March 2004. Paper cited by permission.

¹³¹ Report of Francis Miguel, 1610, Spanish Archives, *Brown's Genesis of the United States* in Bruce, II:445 and 398.

Plymouth in February 1608, Thomas Smith, Edwin Sadness and others requested a ship and supplies to support “a lardge supplye” of 800 men under Lord de la Warr. The Council members had already entreated William Herbert, Earl of Pembroke, to impress one hundred mineral and laboring men from the Cornish tin mines for the voyage in his capacity as lord warden of the stannaries.¹³² The Governor would indeed send an expedition to search for mines above the Falls, “but the Indians were very troublesome and no mines were found.”¹³³ Lord de la Warr also “nominated Captaine John Martine, Master of the Battery workes for Steele and Iron.”¹³⁴ In his *A trewe relyacon*, Percy described aspects of the governor’s dual search to find minerals and to further prove the existence of iron mines in the colony. Among the setbacks was an attempt by some of the men, including blacksmith James Read, who “wrought in iron mines to run away with a bark.” When de la Warr sent another expedition toward the Falls, they were lured on shore by natives who then attacked them, leaving only one survivor. In another attempt, the governor sent a group of men ahead to the Falls to build a fort, winter over and continue mineral exploration the following spring, but sickness, scarcity, and severe Indian attacks were discouraging. The final blow was de la Warr’s return to England in March 1611 due to ill health with Dr. Lawrence Bohun. Sir Thomas Dale took up the cause and “hath mentioned in his letters to the lords of the council of a goodly iron mine.”¹³⁵ William Strachey reported that in 1610, Captain Samuel Argall found “a Myne

¹³² David B. Quinn and Alison M. Quinn, eds., *The New England Voyages 1602-1608*, 466-467. According to the OED, “stannaries” are “the districts comprising the ten mines and smelting works of Cornwall and Devon formerly under the jurisdictions of the Stannary courts; also the customes and privileges attached to the mines” (OED, vol. 2, 823).

¹³³ Lyon Gardiner Tyler, ed., *Encyclopedia of Virginia Biography* (Baltimore: Genealogical Pub., 1998) 39.

¹³⁴ Alexander Brown, ed., *The Genesis of the United States* (Boston: Houghland, Mifflin and Company, 1891) I:469.

¹³⁵ Bruce, *Economic History of Virginia*, II:445-446.

of Antimony, which (as aforesaid) never dwells single, but holdes assured legue with Quicksiluer, as likewise a myne of Lead” among the Patawomecks.¹³⁶ When tobacco began to emerge as Virginia’s “green” gold after 1613, the structured search for precious metals declined. Both human and economic resources were increasingly redirected. The period from 1606 to 1622 shows a learning curve related to mines, minerals and metallurgy. Colonial authorities gradually shifted from one priority - finding a quick profit in gold and silver - to launching native iron manufacturing as an important colonial industry.¹³⁷

Between 1618 and 1619, records of the Virginia Company reflected this goal. Falling Creek provided a waterpower supply and available timber suitable for an iron works and blast furnace, and ships could be used to transport both ore and processed iron along the James River. Between 1619 and 1621, Virginia Company officials made ambitious plans. By 1619, 150 workers had been sent under a Captain Blewett to set up three iron works, coming from Warwickshire and Staffordshire (about 110) and Sussex (about forty), “all framed to *Iron-workes*.”¹³⁸ Despite the death of Blewett and other specialists from disease and the death at sea of more chief ironworkers en route, another twenty were planned for the operation in 1621 under Blewett’s replacement, John Berkley. Those included founders to cast the metal, filers to smooth it, refiners,

¹³⁶ Strachey, in Wright and Freund, *Historie of Travell*, 132.

¹³⁷ Diego de Molina was reputed to have shown the King of Spain a piece of silver he obtained through some means while in Virginia and repeated news of a silver mine discovered there and reported in London in June 1618, according to Alexander Brown, *The first republic in America; an account of the origin of this Nation, written from the records then (1624) concealed by the Council, rather than from the histories then licensed by the Crown* (New York: Russell & Russell, 1969) 289, in Ivor Noël Hume, *The Virginia Adventure: Roanoke to James Towne: An Archaeological and Historical Odyssey* (New York: Knopf, c 1994) 360.

¹³⁸ “A Note of the Shipping, Men, and Provisions sent to Virginia, by the Treasurer and Company in the yeere, 1619,” in Peter Force, ed., *Tracts And Other Papers, etc.*, III:13.

blacksmiths, and auxiliary workers like carpenters, traders, and servants.¹³⁹ Expectations rose for a nearby shipbuilding operation, with the blast furnace was scheduled to begin operations on Good Friday, 22 March 1622. On that day, only two children escaped out of twenty-nine residents (including twenty-five men, two women), and the iron production facility was reportedly destroyed as part of the uprising against the English.¹⁴⁰ According to the 1994 archaeological findings, some auxiliary buildings might not have been completed or even under construction at the time of the attack.

Throughout the colonial period, the Powhatans had loomed in the exchange of food and information for copper and metal tools and absorbed metal and steel into their culture immediately, through trade and interaction. Fear that English trade in iron would strengthen Monacan power may have accelerated the calculated Powhatan attack on the blast furnace and the colony as a whole. The year after the 1622 uprising, the Virginia Company made more modest plans for a bloomery. In 1623, Jamestown had at least one blacksmith, James Blisse, and the King's Privy Council had created a commission to investigate the Virginia Company and colonial conditions. "Statements of Seamen as to Conditions in Virginia" between April and June of 1623, demonstrate significant changes:

Armours, swords, musquets, truncks and such like goods, lye a fortnight together uncared for, everie tide beeing overflowed with water and the trunks readie to be swallowed. Lilkewise Iron bars and sowes of Ledd, and milstones and Grinstones and Iron furnaces, lye right against the same places sunk and covered with sans, the water dayly overflowing them.¹⁴¹

¹³⁹ Nancy Egloff, "Iron Manufacture and Ironworking in Early Virginia," unpublished research paper for the Jamestown-Yorktown Foundation, Jamestown Settlement Library, Williamsburg, Va. (1989) 2.

¹⁴⁰ Thomas Higgins III et al. "Archaeological Investigations of Falling Creek Ironworks and Vicinity, Chesterfield County, Virginia," 6.

¹⁴¹ "Statement of Seamen as to Conditions in Virginia" [1623], Susan Myra Kingsbury, comp., *The Records of the Virginia Company of London* (Washington: Government Printing Office, 1935) 4:93.

In the fifteen years between the English arrival in Powhatan territory and the destruction of the long-awaited blast furnace before it could begin operations, there was an ebb and flow to expectations of mineral wealth from precious metals and stones, as has been shown. Concurrently, an iron-making industry in Virginia was moving forward, haltingly at times, with exaggerated claims often overshadowing less dramatic realities. A succession of iron furnaces followed in the early 18th century and by 1836, the Tredegar Ironworks was established in Richmond, operating during the Civil War and producing fifty per cent of the Confederate cannons. Despite a decline after the war, it remained in service until destroyed by fire in 1892. Falling Creek was the forerunner of these ironworks, and deserves further study for its impact both positive and negative on the colonial ironworking industry in Virginia.

CHAPTER VII

CONCLUSIONS

Ralph Hamor entreated his countrymen in his *A True Discourse of the Present State of Virginia* to hearken unto Caleb and Joshua of the Bible, saying, “Let us go up at once and possess it, for undoubtedly we shall overcome it.” In *A New Face on the Countryside: Indians, colonists, and slaves in South Atlantic forests, 1500-1800*, Timothy Silver concluded that Indian subsistence patterns - as opposed to their own “God-given” and proper use of the land - convinced colonists that they were justified in organizing and transforming the colonial landscape.¹⁴² In contrast to the Spanish empire in America, the English colonists were prepared to mine for gold and precious stones themselves (instead of using native labor) as Martin Frobisher’s second and third expeditions proved before Jamestown’s founding.¹⁴³ Although there is some evidence that Powhatan Indian knowledge and skills extended the boundaries and viability of colonial mineral exploration, documentation of such interactions is limited to a few written statements by the English. Differences in languages and communication as well as cultural perceptions of time and space led to misunderstandings of and by each culture. James Merrell has pointed out that during the English conquest of Indian territory in early America, the vast majority of natives “remained illiterate, inhabitants of a symbolic universe they were unable to decipher,” communicating mainly for trade purposes.¹⁴⁴ The Powhatan

¹⁴² Timothy Silver, *A New Face on the Countryside: Indians, colonists and slaves in South Atlantic forests, 1500-1800*, 190-91.

¹⁴³ K.R. Andrews, N .P. Canny, P. E. Hair, eds. *The Westward Enterprise: English Activities in Ireland, the Atlantic and America 1480-1650* (Liverpool: Liverpool University Press, 1978) 3.

¹⁴⁴ James H. Merrell, “‘The Customes of Our Countrey’: Indians and Colonists in Early America,” in *Strangers Within the Realm: Cultural Margins of the First British Empire* (Chapel Hill: Published for the Institute of Early American History and Culture, Williamsburg, Virginia, by the University of North Carolina Press, c 1991) 131.

Indians' knowledge of natural resources was valued and recorded by the English in the early colonization period because it enabled them to use the environment for their own benefit and adapt to it at a faster rate. However, David Beers Quinn concluded that from the European perspective, the earliest accounts of the New World were "if often naïve, the least biased." As he wrote in *Explorers and Colonies: America, 1500-1625*, "Clearly, almost every source ought to be looked at again and with a many-faceted approach. Already we appreciate better than we did the significance of data on natural history contained in the early exploration documents."¹⁴⁵

In the 1620 Virginia Company records, a valuation of the commodities "growing and to be had" included the following Virginia mineral resources: Iron, ten pounds the ton; Red earth Allenagra, three shillings the hundred; Red Allum, called Carthegena Allum, ten shillings the hundred, and Roach Allum, called Romish Allum, ten shillings the hundred. (Alum springs were later identified in Rockbridge, Bath, and Rockingham counties.).¹⁴⁶ Instructions for shipping specified "Cristall rocke: send as much as you can, and any sort of Minerall stones, or earth that weighs very heavy."¹⁴⁷ What this list tells us four hundred years later is that despite the Virginia Company's inability to successfully mine gold, silver, and precious stones, iron and medicinal clays continued to be valued as commodities. Prospecting did not disappear, nor did the hope that unusual specimens might prove profitable (earth that weighed heavy might contain silver, for example).

¹⁴⁵ David B. Quinn, *Explorers and Colonies: America, 1500-1625* (London: The Hambleton Press, 1990) 14.

¹⁴⁶ William Rogers, "Report of the Progress of the Geological Survey of the State of Virginia for the Year 1840," *A Reprint of Annual Reports and Other Papers, on the Geology of the Virginias*, 550-51.

¹⁴⁷ "A valuation of the Commodities growing and to be had in Virginia; rated as they are there worth," [1620] C. O. 1, vol. I, no. 24 {MSS.} in Kingsbury, *Records of the Virginia Company of London* (Washington D.C.: Government Printing Office, 1935) 3:238.

Despite the destruction of the Falling Creek blast furnace, there would be more exploration along with the evolution of the Virginia iron and coal industry in the centuries to follow. If English explorers of the late sixteenth and early seventeenth centuries could compare their maps to those of modern Virginia and North Carolina, it would show that mineral resources were actually near areas of exploration. However, it is clear that the technical developments of the time and cartographic knowledge simply could not keep up with early colonial hopes and expectations in a wilderness environment. As archaeological work is unveiled from James Fort, Werowocomo, Kiskiack, and other colonial settlement sites, it may show a greater degree of contact and conflict between the Virginia English and the Powhatan Indians, conflict involving their own perceptions and use of natural resources as well as conflict with each other. Both cultures continually re-shaped the land to suit their traditional and changing needs.

When twenty-first-century archaeologists, ethnohistorians and anthropologists incorporate chemical analysis of copper artifacts into their studies, science is demonstrating its value to all three disciplines regarding early colonial material culture, especially analysis of copper from the Appalachian belt. Native copper and European copper have different “fingerprints” or chemical profiles: native copper has lower levels of arsenic, lead, and antimony than its European counterpart, as shown in proton-induced X-ray emission spectrometry and neutron activation techniques.¹⁴⁸ Geoarchaeological research in determining sourcing of copper artifacts shows promise as a tool in expanding historical narratives.¹⁴⁹ Trace-element sourcing is becoming a significant archaeological

¹⁴⁸ Helen C. Rountree and E. Randolph Turner III, *Before and After Jamestown: Virginia's Powhatans and Their Predecessors* (Gainesville: University Press of Florida, 2002) 137-139.

¹⁴⁹ George Rapp et al., *Determining Geologic Sources of Artifact Copper: Source Characterization Using Trace Element Patterns* (Landham: University Press of America, 2000) 2.

tool in tracing trade and distribution patterns in the Contact period. Analysis of two early Jamestown-era copper artifacts excavated after 1998 at the historically important Powhatan Indian village, Kiskiack, revealed that one copper piece was English (possibly official trade, because it matches copper artifacts excavated at Jamestown) and the other Swedish (possibly a remnant of trade by sailors).¹⁵⁰ Similar analyses at James Fort by the Association for the Preservation of Virginia Antiquities (APVA) Jamestown Rediscovery and at the Powhatan village, Paspahegh, have shown that copper goods from imported sheet copper were produced and/or traded by early colonists. That trade was highly valued in early interactions between the two cultures, at least until the supply began to exceed native demand for copper. Analysis of copper artifacts from Werowocomoco, a Powhatan political center circa 1607 archaeological site, is currently being conducted to further investigate early Anglo-Powhatan trade. In addition to providing evidence of trade, chemical analysis and research by Carter C. Hudgins indicates that copper-related metallurgical trials were also being conducted in the James Fort period.¹⁵¹

Scholars and scientists should acknowledge each other's abilities to read the past, whether in words or geologic formations. The land has a story to tell. As the English colonial era unfolded, those who had come before and mastered the landscape encountered newcomers with a vastly different technology and mindset. Their common denominator was survival using available resources: what the land could provide for immediate and long-term use.

¹⁵⁰ Andrew Petkofsky, "Archaeologists Discover Traces of Colonial History," *Richmond Times Dispatch*, Richmond, Va., 29 June 2004.

¹⁵¹ Carter C. Hudgins, "Articles of Exchange and Ingredients of Metallurgy: The Duality of English Scrap Copper at Early Jamestown," Jamestown Conference, Williamsburg, Va., 18 November 2004.

Due to the difference in their belief systems and technology, sharing the land was impossible and the changes born of economic encroachment were immediate. The English intended to make the environment their own in their own words, as our national historical narrative has demonstrated. With the limited documented history the Powhatans and other native tribes have left behind, the richness of their culture and technology can only be hinted at presently, and geology helps to illuminate the story. What if the threat of native attack had not impaired more exploration and mining parties in the auriferous or gold-bearing region between Jamestown and modern-day Richmond? What if mineral men on the scene like William Hendrick Faldoe and Newport's exploring party had lived longer to find, prove, or disprove their claims, rather than die from disease or Indian attack? As archaeological excavations continue at James Fort and other seventeenth-century English and Powhatan sites in tidewater Virginia, more signs of mineral-related trade and industrial activities may provide answers to the scope of colonial activity in these areas. Neither the colonists nor the natives were operating without expertise or a rapidly developing body of knowledge about the New World landscape and each other. This adaptive process, despite its trials, errors and conflicts, was essential to the development of the colony and the future Commonwealth of Virginia. The reality underlying England's colonial quest for mineral resources with its conflicting dreams and perspectives, its yet unspoken "might have beens," has a rightful place in America's historical narrative.

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VITA

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Lisa Liberati Heuvel was born in Charleston, West Virginia on January 30, 1952. She graduated from Herndon High School in June 1970 and received her B.A. in Theatre and Speech from the College of William and Mary in 1974, working in the University Communications Office as a staff writer until 1979. In 1998, after writing national, regional and local articles about Virginia history for over 30 years, the author joined the Jamestown-Yorktown Foundation and has since worked there as an education instructor, a historical interpreter, and administrative assistant to the Senior Director of Museum Operations and Education. An instructor for the Foundation's Training Academy, outreach and on-site education programs, she has developed and taught programs for the Virginia Historical Society Teachers Institute, the Colonial Williamsburg Teachers Institute, the National Park Service, Chippokes Plantation State Park, The College of William and Mary Elderhostel program and area schools.

In September 2002, Lisa Heuvel entered the College of William and Mary as a graduate student in the American Studies Program. She is currently Assistant Capital Projects Administrator in Curatorial Services for the Jamestown-Yorktown Foundation.