The Slate Pencil: A Case for Behavioral Theory and the Life History Model in Historical Archaeology

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A SENIOR CAPSTONE PROJECT

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By

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Approved: _____

Date: _____

On my honor, I have neither given, nor received, any unauthorized aid on this project. Honor code upheld.

Samuel Stansel

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Introduction

In the archaeology of schoolhouses, slate pencils are a commonly found artifact. In archaeological reports they are, however, usually only mentioned in passing as evidence of educational activity or merely as another point of data (e.g., Gibb and Beisaw 2000; Peña 1992; Bigelow and Nagel 1987; Catts, Cunningham, and Custer 1983; Beisaw and Baxter 2017; Scura Trovato 2016). This lack of work constitutes a significant gap in the archaeological literature, and more work to address specific schoolhouse artifacts such as slate pencils has been advocated for by some archaeologists (Beisaw 2009, 65; Rotman 2009, 75). Slate pencils can provide us with basic temporal frames, economic indicators, and behavioral correlates which could be useful in understanding and interpreting the past. In this paper I will both compile and discuss the history, manufacturing, and use of slate pencils, and will propose how slate pencils may be used to help interpret the archaeological record. Any analytical or diagnostic information, be it temporal, geographical, economic, or otherwise, to be gained from these artifacts will benefit the greater archaeological community in future schoolhouse excavations.

Behavioral Framework

To demonstrate the value of slate pencils, I employ a behavioral framework of analysis. Behavioral archaeology focuses heavily on the relationship between objects and human behavior or activities (LaMotta 2012; Schiffer 1976). Not only can a behavioral approach be useful in understanding

cultural formation processes, but it also allows for the re-construction of past behaviors, as well as explaining those behaviors and their change over time. One aspect which differentiates behavioral archaeology from other paradigms is a lack of reliance on a single, pre-existing body of high-level theory (LaMotta 2012). Instead of using generalized or more universal theory to explain a specific context, behavioral theory builds localized theory for a given context based upon inferences about people-object interactions. Behavioral theory encourages us to view societies as networks of linked activities (people-object interactions). In analyzing any given artifact then, it is imperative to look at the ways in which human behavior has left traces upon it both physically and in relationship to its archaeological context (LaMotta 2012; Schiffer 1976). Rather than view artifacts as mere points of data or economic indicators, behavioral archaeology encourages us to explore and try to reconstruct past actions as they may be apparent within an artifact or element.

Life History Model

The primary tool of analysis in behavioral archaeology is called a life history model. What this model does is create a possible chain of events for the life of any given artifact. This type of model may contain as many as eight types of processes: procurement, manufacturing, use, maintenance, reuse, cultural deposition, reclamation, and recycling (LaMotta 2012; see Figure 1). Each one of these categories of processes may then be broken down further and viewed as containing “stages”. These stages in turn may be broken down into “activities” which signify the physical actions upon the artifact (Schiffer 1976, 46). For

example, a glass bottle may begin its life as sand, is then manufactured or molded into a shape, then sold and used by a consumer. From there it may be disposed of, entering the archaeological record, or it may be reused or reconFigured for another purpose before being culturally deposited. Each of these processes involve specific stages and activities which can leave traces of human behavior—from chemical traces which make it apparent that glass began as sand, to either a seam or pontil which indicates blowing or molding, to a localized scatter of shards which may suggest disposal or destruction.

A life history model attempts to work backwards from an artifact's physical attributes and provenience to better understand past human behaviors (LaMotta 2012). Applying a life history model to any given artifact class will help draw attention to the various potential ways in which trace-producing activities may represent distinct phases in the life cycle of the artifact.

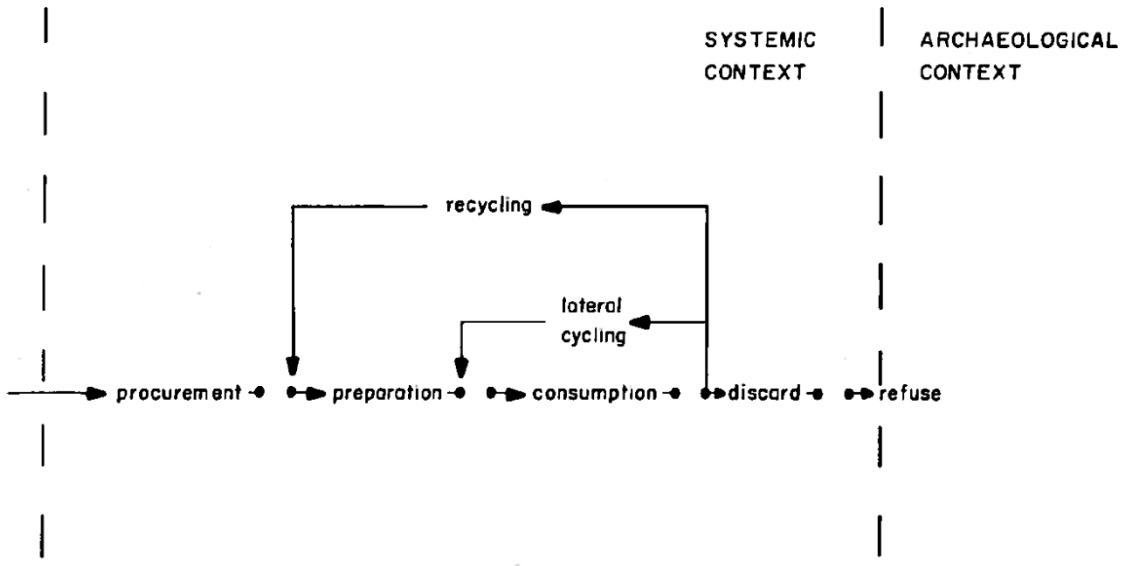

Figure 1 Schiffer's (1976) Life History Flow Chart

Life history models are rarely if ever used in the context of historical archaeology. Wheeler (2000) used a behavioral approach to argue for new considerations for the excavation of privies but did not use a life history model. It is unfortunate that behavioral theory and life history models have been underutilized in historical archaeology because they allow much room for the use of textual sources (LaMotta 2012) of which historical archaeology has in abundance. The use of these textual sources allows for the creation of a much more robust and precise model with more ease than can be done on sites which lack a textual record. The life history model can be thought of as a type of hypothesis. It is based upon assumptions about the given artifact (e.g., “the bottle is made of molded glass”) which allows it to be tested against the physical traces on the artifact as well as textual sources (LaMotta 2012).

I will apply a life history model to an assemblage of slate pencils from a 19th century Boston school house, the Dorchester Industrial School for Girls. Through this assemblage I will demonstrate the various behavioral correlates that are generally present on slate pencils, as well as provide a guideline for both future research into the archaeology of slate pencils. Doing so will also, I hope, encourage others to adopt a behavioral approach in historical archaeology for the analysis of other understudied artifact classes.

The structure of this paper begins with a brief historical overview of the city of Boston, the School, and the subsequent excavation and data collection. It then presents the construction of a chronological life history model for a slate pencil from this school. This construct will include the eight processes laid out by

Schiffer (1976) and LaMotta (2012) with appropriate contextual and historical information regarding the slate industry in the United States, the school itself, and the greater history of Boston during the 19th century. Due to the limitations of this study I am unable to pursue every possible avenue of analysis, but where there may be a fruitful path to follow I will include potential avenues and resources to guide the way.

Case Study: Dorchester Industrial School for Girls

Like all archaeological sites, the Industrial School for Girls is a historically situated place. It was established in November 1853 in Winchester, Massachusetts. On February 16, 1855 the school was incorporated and in 1859 moved to its permanent location at 232 Centre Street in Dorchester, Massachusetts just south of Boston proper[1] .

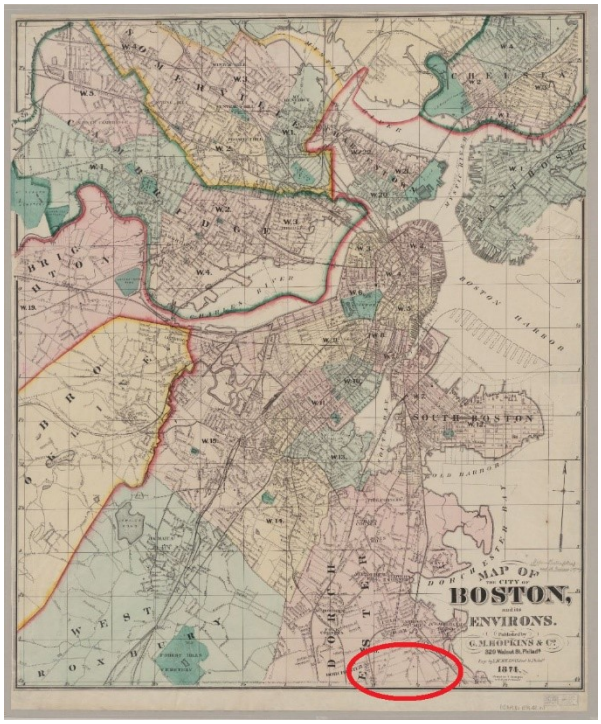

Figure 2 1874 map of Boston - approximate location of the Industrial School for Girls highlighted

The second half of the 19th century was a period of rapid change in urban centers around the world. East coast urban centers such as Boston were no exception to this change (Warner 1962, 3).

[1] Dorchester gained its present status as a neighborhood of Boston in 1870 after it was incorporated into the city.

As a seaport, Boston saw a massive influx of immigrants throughout the 19th century. According to census data, the population of Boston increased from around 130,000 in 1850 to nearly 600,000 in 1900, up from 450,000 in 1890 alone (U.S. Census Bureau, 1850; 1890; 1900). The constant flow of immigrants helped catalyze more rapid industrial growth, and for the first time in Boston and in other cities around the world there emerged a large and permanent working class. Leaving no source of labor untapped, even women and children began joining the labor force, working in textile mills and factories (Warner 1962). During the Civil War Boston was producing more inexpensive and ready-made garments than any other city in the United States; advancements in textile technologies meant that this work which once required skilled labor could now be performed by nearly anyone. This surplus of unskilled workers was largely responsible for unprecedented economic growth, as well as unprecedented urban growth (Warner 1962).

Rapid large-scale population growth and industrialization of course does not come without its own problems, including poverty and crime. As such, the nineteenth century also saw the emergence of many reform movements trying to alleviate these issues. This spirit of reformation manifested itself in many ways, seeking to alleviate poverty, provide free education, and uplift the economically disenfranchised (Hayden 1982). One such reform movement was that of domestic reform. An attempt was made to take housework (unpaid domestic labor) and professionalize and transform it into skilled wage labor, and many

institutions, so-called “Industrial Schools”, were established to provide domestic training for young girls (Hayden 1982, 3).

History of the Dorchester Industrial School

The Industrial School for Girls was one such institution (see Figure 2); the school was a charitable organization offering education and training in the domestic arts to the poor and underprivileged to help lift them from poverty and take them from troubled family backgrounds (Industrial School 1865). Many of the girls at the school were orphans, immigrants (from as far away as Canada, England, and Ireland), “lame [sic]”, “mulatto,” or from any number of other marginal classes. “The object of this school is to prevent evil. We desire to cut off some of the sources of supply to our jails and houses of correction; to apply prevention to evils of which the cure remains among problems unsolved” writes the Board of Managers in an 1873 report. These evils could include anything from alcohol or drugs, to crime or prostitution, all of which were growing concerns in the rapidly industrializing city. Indeed, another report clearly indicates that the school officials believed, “we are working…at one of the fountain-heads whence flow the streams of human sin and suffering.” (Industrial School 1865)

Fortunately, annual reports from the Board of Managers are mostly available for the entirety of the 19th century. Though not necessarily listed in any systematic way, nearly every annual report mentions the number of girls attending the school. I examined each report from when the school moved to Dorchester in 1859 through 1890 and compiled all population data on the girls, although reports from 1862 to 1864 as well as 1868, 1869, and 1871 were either unavailable or did not indicate the number of attendees. On numerous occasions the reports note that the school was never intended to house more than 30 girls during any given year, and this seems to have been the case (Table 1).

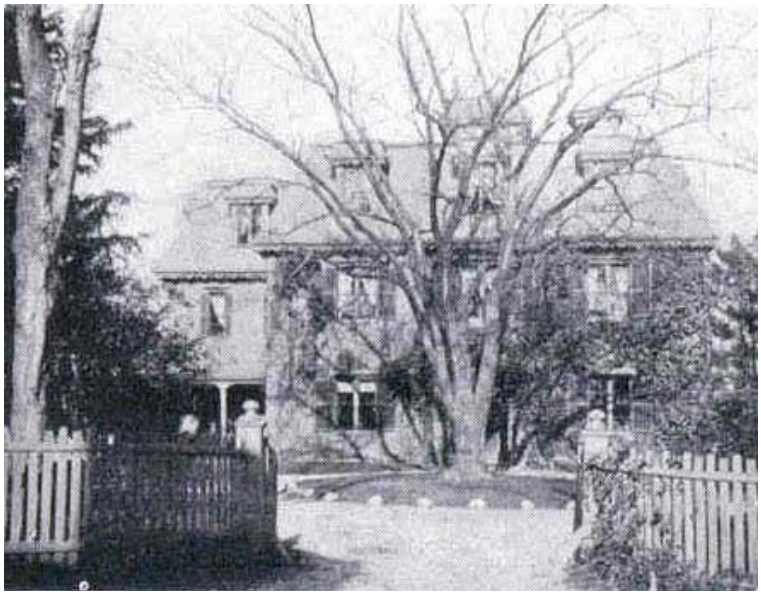

Figure 3 Dorchester Industrial School for Girls c. 1899

Year	Pop.	Year	Pop.	Year	Pop.
1859	30	1869		1879	24
1860	30	1870	17	1880	16
1861	28	1871		1881	17
1862		1872	21	1882	18
1863		1873	27	1883	25
1864		1874	27	1884	25
1865	31	1875	30	1885	27
1866	30	1876	21	1886	27
1867	23	1877	22	1887	26
1868		1878	24	1888	25

Table 1 Population (1859-1890)

Methods of Excavation and Data Collection

The site is located at 232 Centre Street in Dorchester in what is now the backyard of the original schoolhouse which still stands (see Figure 3). Excavation took place during the month of July 2015 and was conducted by Boston City Archaeologist Joseph Bagley and the City of Boston Public Archaeology Program, which is an almost entirely volunteer-based operation with volunteers involved in every step of the process from excavation to artifact processing. The field crew for excavation included on average six volunteers. A 1909 map indicates that there was an outbuilding, likely a carriage house, located in the back of the property. Initial plans were to try and locate and remove the foundation of the carriage house and attempt to locate the privy which was known to have existed at the school (Figure 5).

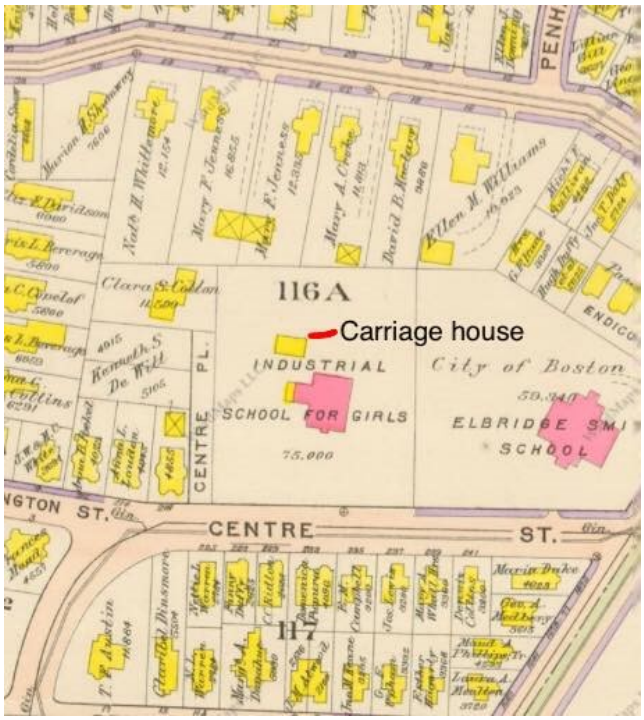

Figure 4 1909 Map of 232 Centre Street with Carriage House

Excavation Methods

Initial testing revealed two features of note. Three 2 x 0.5m test trenches were placed in Area 1, located in an area which was formerly underneath a patio. One of them (N99 E86/87, Figure 5) revealed an artifact-rich feature with ashy soil extending down 1 meter. This feature, Feature 1, was identified as a potentially a deliberately dug trash pit, with dense coal, ash, and slag deposits. There was also some ironstone ceramics indicating that the deposit is likely from the early years of the school (Bagley 2015).

Another of the test trenches (N103 E90, Figure 5) revealed a stone building foundation. This feature, Feature 2, was positively identified as the foundation of an outbuilding, likely the carriage house, which was indicated to exist on the 1909 map (Bagley 2015). A fuller excavation of the site took place in July 2015 and further uncovered features 1 and 2, two more features, 4 and 5 were also identified during excavation. Lab work focused entirely on artifacts recovered from features 1, 4, and 5. Though features 4 and 5 were initially considered separate, they were eventually decided to both be part of the same feature, the privy (Figure 5).

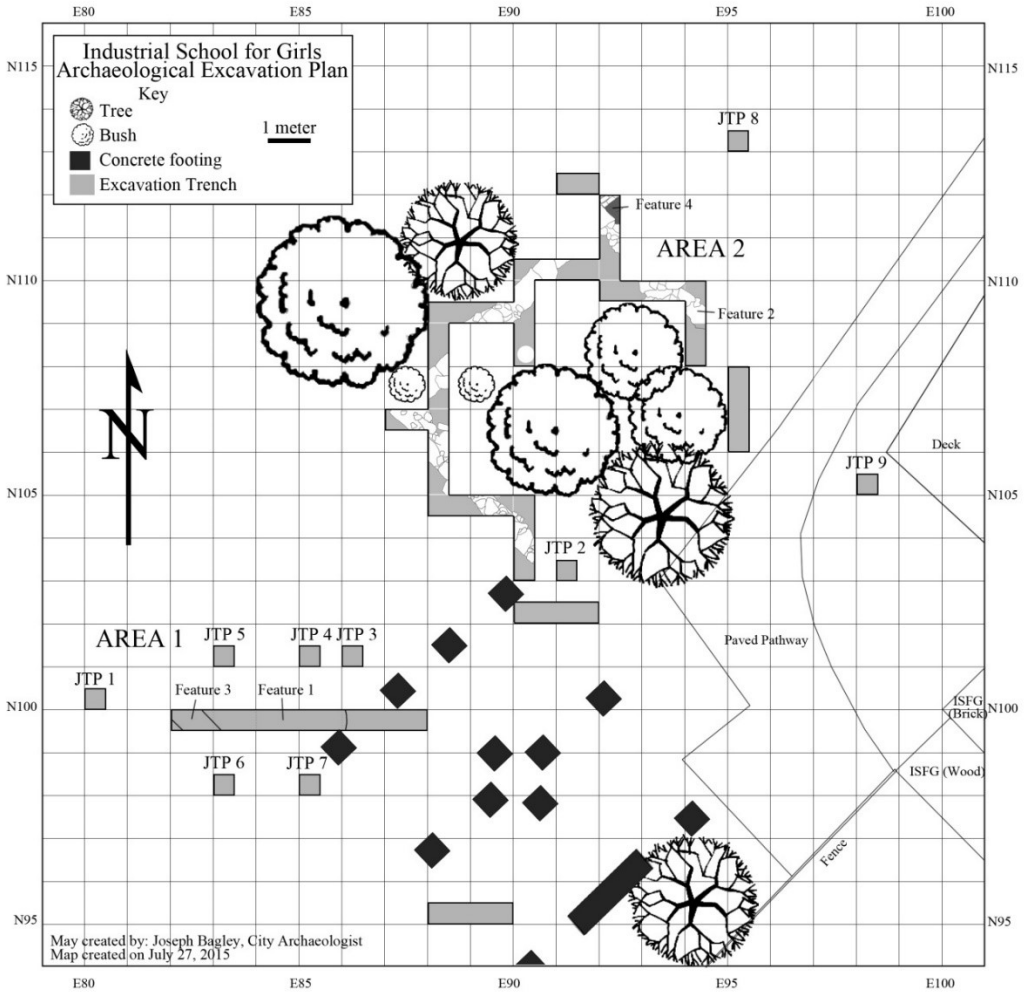

Figure 5 Industrial School for Girls excavation site map

Data Collection

Of the slate pencils recovered (n=399) 95 percent (n=378) came from features 4 and 5 and only 5 percent (n=21) from feature 1. Of the 399 slate pencils found across all three features, 60 percent (n=240) were identified as being made of gray slate, and 39 percent (n=157) being identified as made of black slate. Only two pencils were recovered which were not identified as either black or gray, making up less than 1 percent of the total pencil assemblage. One

of these slates was made of a red stone and was recovered from feature 1; the other was made of a white stone and was recovered from feature 5.

For the purposes of this paper I limit the artifacts examined to those found in the privy; that is, features 4 and 5. The reason for this is that the privy can be reliably dated through the historical record and better situates the artifacts in time. The annual reports from the school indicate that indoor plumbing came to the school some time during the late 1870s, and that by 1880 the privy was completely out of use. Knowing this we can reliably say that the artifacts from feature 4 and 5 date from between 1859 (when the school was relocated to Dorchester) and 1880 when the privy was capped.

In the spring of 2016, data were collected by myself on the slate pencil assemblage at the Boston Public Archaeology Lab. With no direct research question in mind at the time, I collected on several variables: mass, length, width, diameter, color, portion (base, mid-section, tip, complete, or fragment), and any evident modifications were recorded for each artifact.

Data Analysis

To estimate the number of complete pencils represented in the assemblage rather than simply the total number of artifacts (pencil pieces), a modified form of the number of identified specimens (NISP) and minimum number of individuals (MNI) statistics commonly applied to assemblages of faunal remains was used. NISP provides the highest possible number of unique specimens that could be represented by the data (Beisaw 2013). Typically, this

statistic is broken down by taxonomic group but in this situation, it will be broken down by color. The reason for this is that it must be assumed that two pencil portions of different colors could not have come from the same artifact. Of the slate pencils recovered from features 4 and 5 (n=378) 151 were black, 226 were gray, and a single pencil was identified as white. If it is presumed that each slate pencil section recovered represents an entire slate pencil, then the maximum number of possible pencils represented in the assemblage is easily calculated.

This modified NISP is a very simple calculation, but the MNI is slightly more involved. First it is important to more thoroughly describe the assemblage. Artifacts were categorized in respect to their portion of a complete pencil. There were some pencils which were complete; that is, they had a pointed tip which extended either to a clearly manufactured flat end or to another tip on the other end. Other artifacts were simply the tips of a pencil, extending but then showing a clear break without an undisturbed termination point. Some artifacts just represented the mid-section of a pencil; they had a full circumference but were broken on both ends with neither any tips nor clearly manufactured end points. Yet more were solely the flattened and manufactured end, extending but broken off with no tip. Finally, there were very small fragments, and these were classified by their lack of a complete circumference. Examples of these have been provided in Figures 6-10.

Figure 6 Slate Pencil Tip from Industrial School excavation

Figure 7 Slate Pencil Mid-Section from Industrial School excavation

Figure 8 Slate Pencil End from Industrial School excavation

Figure 9 Complete Slate Pencil (sharpened at both ends) from Industrial School excavation

Figure 10 Slate Pencil Fragment from Industrial School excavation

Slate Pencil Assemblage Description

The assemblage of black pencils contained 19 complete pencils, 61 pencil tips, 33 mid-sections, 21 end pieces, and 17 fragmented pieces (Table 2). A complete pencil is defined as containing one tip, one mid-section, and one end. By creating complete sets, many artifacts can be eliminated from the NISP count. Twenty-one complete pencils can be constructed in addition to the 19 already present, and an additional 40 can be assumed from the presence of the remaining tip pieces. This makes the MNI of the assemblage of black pencils 80.

A simplified way of making this calculation is to take the number of complete pencils and add it to the artifact count of the most common of the other pieces; in this case 61 tip pieces.

By applying these same methods to the assemblage of gray pencils (n=226) the NISP and MNI may again be calculated. The gray pencil assemblage contains 11 complete pencils, 57 tips, 23 mid-sections, 7 end pieces, and 128 fragments. The NISP of this assemblage is 226 and the MNI is 68.

Object	Portion	Color	Provenience		Total
			Feature 1	Features 4 and 5	
Slate Pencils	Tip	Black	2	61	63
		Gray	9	57	68
		Red	1		1
	Mid-Section	Black	1	33	34
		Gray	2	23	25
	Base	Black	1	21	22
		Gray		7	7
	Whole	Black	2	19	21
		Gray	2	11	13
		White		1	1
	Fragment	Black		17	17
		Gray	1	128	129
Slate Pencil Total			21	379	399

Table 2 Artifact Totals

Life History Model Process 1 - Procurement

The first process in a life history model is procurement. What this refers to is not the procurement of the artifact itself but rather the procurement of the raw materials of which the artifact is composed. In the case of slate pencils there exists only one material, slate. To begin this section, I will briefly cover the geology of slate to better understand what exactly it is, then I will discuss the various places where it would have been available for quarrying in the United

States as well as the likely origin of the slate pencils from the Industrial School for Girls, and finally I will elaborate on the general extraction process of slate.

Geological Characteristics of Slate

Slate is a metamorphic rock created typically from either shale or sandstone and occasionally volcanic ash deposits. Metamorphic rocks are created from previously existing rocks which have undergone changes in minerology, texture, or chemical composition because of heat, pressure, and other geological forces (Grotzinger 2007: 131). One of the common features of all metamorphic rocks, and a defining feature of slate, is known as foliation. Foliation refers to a set of flat or wavy parallel planes produced by deformation. The degree of metamorphism corresponds to the degree of foliation, and slate is considered the lowest-grade of foliated rocks. This produces relatively flat planes of cleavage and gives slate its unique characteristic of being able to be easily fashioned into flat slabs (Grotzinger 2007).

Because of its geological nature, slate is only found in specific areas and varies greatly in quality. A 1914 report by the United States Geological Survey provides a map showing every slate-producing area active during that period (Figure 11). The two largest clusters of slate-producing areas are found around the border between Vermont and New York as well as in the Mid-Atlantic states of Pennsylvania, Maryland, and Virginia (Dale 1914). These areas constitute the only areas where slate is quarried in the United States (Carpenter 2002; Slate Valley Museum).

An important factor in understanding the origin of the slate pencils from the Industrial School for Girls is simple geography. For companies producing slate in the 19th century to distribute their products, they needed to get them to a port or other point of distribution. Most of the companies or firms producing slate products in the Mid-Atlantic region would have had many available markets such as Philadelphia, Washington, or even New York City. For the firms in the so-called "Slate Valley" of the Vermont-New York border area, however, the most viable market was that of Boston. Indeed, documentary evidence suggests that many slate manufacturers from this region sent their products directly to Boston (Thompson 2010: 45). Because the slate pencils in my analysis come from the northeastern

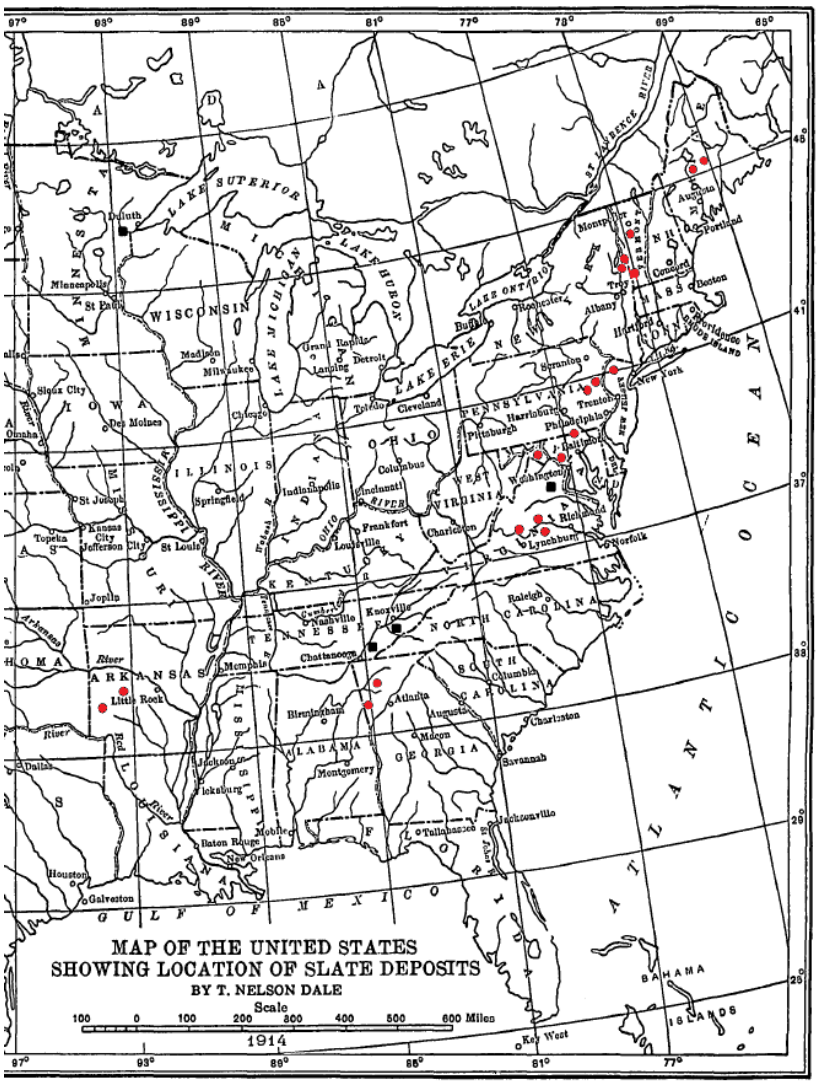

Figure 11 Map from report "Slate in The United States," 1914 cropped

United States, I will limit discussion to the Slate Valley. It is the most likely source of the slate pencils based on the historical record.

The Slate Valley of Vermont and New York

The Slate Valley extends across two states from its northernmost town of West Castleton, Vermont down to its southernmost in Granville, New York (Carpenter 2002; Slate Valley Museum). Though only approximately 300 square miles, the Slate Valley was the most productive region of slate quarrying in Vermont, and was renowned for the strength, durability, and variety of colors found in its slate (Carpenter 2002). An 1861 report on the geology of Vermont published by the state legislature describes Slate Valley slate as “the most fissile [easily split into slabs] of any in the State, and being remarkably free from any silex or other foreign matters, it is exceedingly valuable in cases where it is necessary to have it sawed and planed.” (Hitchcock 1861, 795) It was also considered the most like Welsh slate which, at the time, was considered the gold standard for slate (Carpenter 2002; Hitchcock 1861).

Slate quarrying in the United States began in 1839, in of all places the Slate Valley. Various sources state that the first slate quarry was opened on Scotch Hill in Fair Haven, Vermont in 1839 by Colonel Alanson (or Alonzo) Allen to manufacture grave headstones, hearths, paving stones, and eventually around 1848 for roofing (Thompson 2010, 43-44; Hower 1888, 7). The ensuing decades would bring explosive growth in the slate industry in this area, with much of its products shipped out to Boston (Thompson 2010, 45).

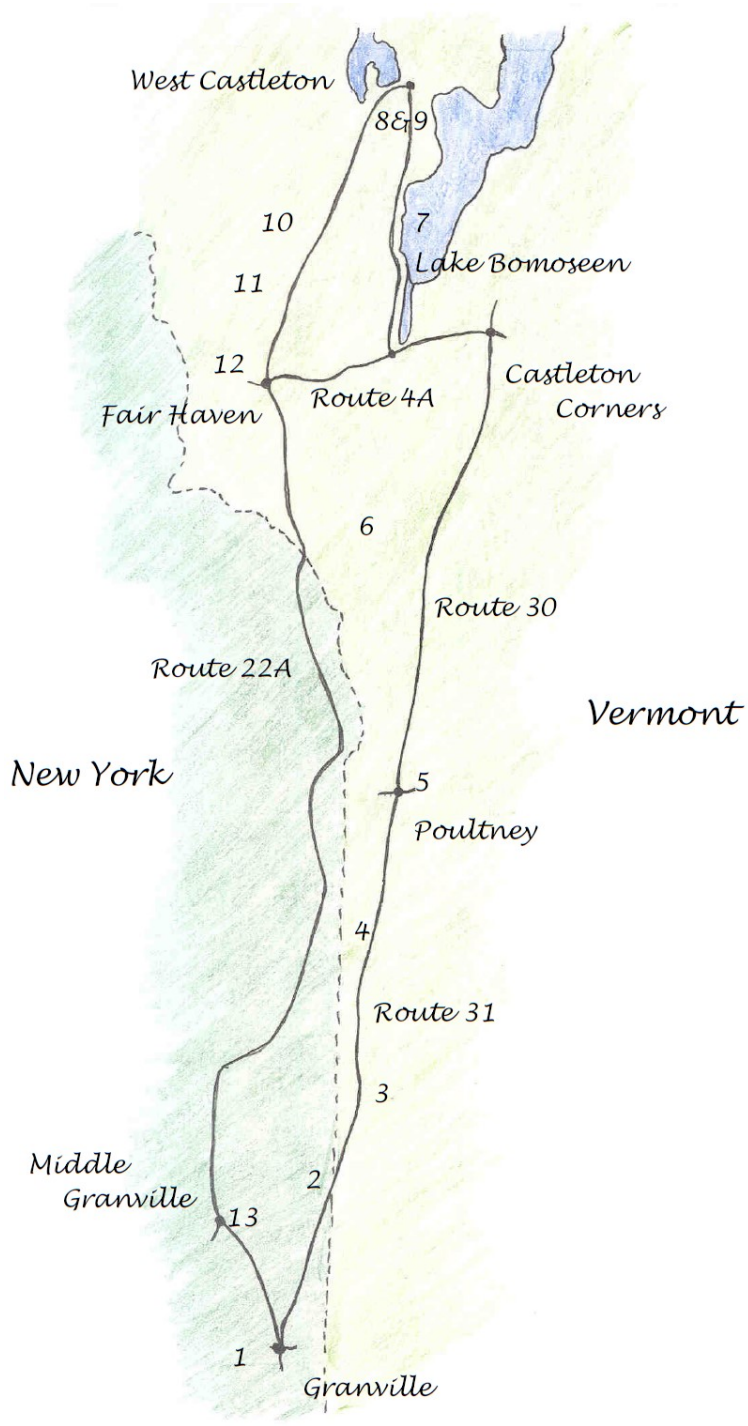

Figure 12 Map of the Slate Valley (Slate Valley Museum)

The Slate Pencil Industry

The slate pencil industry is also thought to have begun in this area. A potentially apocryphal story tells that a man named John Cain, then eighteen years old, was fishing near Lake Bomoseen in Castleton, Vermont one day in 1843 and needed a weight for his line. He broke a piece from a large rock to use as his weight and noticed that as he did this it left a scratch mark on another stone. Taking several pieces home at the end of the day he carved them down into pencil shaped rods and began selling them to local schools. The slate from Sucker Brook, the stream where John Cain made his discovery, had physical properties which made it more apt to be used as slate pencils; slate from this area contained magnesia which made it softer than most other slates giving it the property to better leave a mark on a slate Tablet as well as the ability to be more easily cut into pencil rods (Thompson 2010, 54).

Eventually John Cain acquired some property near the lake and opened his local one-man operation. After ten years he was bought out by Benjamin Adams along with his son James Adams (Thompson 2010). They began what was known as the Adams Manufacturing Co. and eventually began mass-producing slate pencils. By the 1860s the business expanded, built a factory, and at its peak was manufacturing over 100,000 pencils per day (Thompson 2010). Though the company shut its doors in 1878 it had long reigned as the top manufacturer of slate pencils the region.

Slate Quarrying

The physical quarrying of the slate was a dangerous process. The following description of the quarrying comes from the Cedar Mountain quarry north of West Castleton in the Slate Valley but would have been typical of all quarries at the time (Bowles 1939, 254). Typically, in the 19th century slate was extracted by blast mining. Workers would drill a long hole into the side of the quarry and stuff an explosive charge deep into the hole. Using a fuse, they would blast large sections of the cliff down. This process was inefficient, with about 75 percent of blasted slate being wasted (Thompson 2010). From this point the slate was gathered into narrow-gauge railway cars and moved down to the nearby lake to be sent off to be worked into a useable product.

Procurement of Slate

In attempting to address the analytical significance of the procurement process within a behavioral framework, attention must be drawn to the artifacts analyzed. The purpose of the behavioral framework and the life history model is to create a connection between the artifact and the processes which led to its current state. The processes of a life history model may be further broken down into distinct “stages” which are themselves further broken down into distinct “activities.” In the case of slate pencils, the process of procurement may be broken down into two subsequent stages: discovery and extraction.

Discovery and Extraction

Discovery here is the most fruitful stage in the procurement process. Though discovery is not itself a physical interaction with the artifact, it has greater implications which are reflected in the artifact. As covered in the section on the geological characteristics of slate, slate is a rock which is found in geographically specific regions. Before the raw materials can be physically extracted from the earth, they must be metaphorically extracted from the landscape.

Though the anecdote of John Cain's fateful fishing trip in 1843 is one specific example of an interaction with the slate, it is representative of the greater discovery process. The physical characteristics of the slate he discovered, and which would eventually be used in the mass production of slate pencils, gave it distinct properties which made it perfect for use as pencils. Because these properties are intrinsic to the stone, they should be visible in a microscopic analysis of a slate pencil. Though this does not necessarily correspond to the exact act of discovery, the emergent property of the slate is indicative of the potential of the material to be used for its eventual purpose.

Linking discovery with geography also leads to another route of analysis. Inherent characteristics of the slate from which the pencils are made can also geographically narrow the source of the stone. Though grey and black slate were relatively common colors, red slate is somewhat unique to the Slate Valley. It is somewhat unique because though red slate is not specific to this region, the Slate Valley had the only red slate which was *of high enough quality* to be used in products (Bowles 1939, 242; Thompson 2010, 43). This red slate, found only

in Granville, New York at the southern end of the Slate Valley contains hematite and iron oxide which gives it its color (Thompson 2010, 43; The Manufacturer and Builder 1885, 181; The Manufacturer and Builder 1893, 253). Where attributing one of the gray or black pencils to the Slate Valley would likely require microscopic analysis and local samples from the quarries, the sole red pencil of the assemblage can with confidence be attributed to being from Granville.

The second stage of the procurement of the slate is the physical extraction. As discussed in the quarrying section of this paper, most mass-produced slate from quarries was procured in two “activities”, blast mining and transportation to a place for manufacturing. Unfortunately, these stages do not leave any traces on the artifact and therefore the activities can be demonstrated through the archaeological record. The historical record is used as a supplement though and can all but confirm this given its prevalence as a technique of extraction.

Conclusion

To recap: The procurement process in the life history of a slate pencil generally involved two stages: discovery and extraction. Discovery, though not a physical interaction between a person and the object, can be thought of as present in the emergent chemical and physical properties of the slate because they indicate its aptitude for use and its geographical situation. From both historical sources and surface-level examination of the artifact assemblage, one can be assumed that they came from the Slate Valley of the Vermont-New York

border area, and perhaps with even more specificity to Granville (the red slate) and Castleton where John Cain's pencil factory was located.

The next section will cover the manufacturing process in the life history of the slate pencil.

Life History Model Process 2 - Manufacturing

The second process laid out in Schiffer's (1976) life history model is manufacturing. In the context of this paper, manufacturing will refer to the stages and activities which take the raw, extracted material and turns it into a markeTable product. This section will follow a similar format as the previous, but with less necessary historical background. The manufacturing process for slate pencils is quite straightforward and requires less geological and historical background. First, I will cover the general way in which slate is processed for manufacturing, and then I will go into the specific details of how slate pencils themselves are manufactured, followed by a discussion of the significance of these activities.

Slabbing

There is little detail to be found about the precise manufacturing methods for slate pencils in the 19th century, and what follows is my synthesis of available descriptions. Blocks of slate, after having been blasted from the quarry were transported to a place of manufacturing. Various sources indicate that a common practice dating back to the earliest days of the industry was known as the "shanty method" and was regarded as a widespread practice (Bowles 1939, 269). This

method involved the transport of quarried blocks to structures called “shanties” which served as the base of operations in the splitting of the slate. There is scarce documentary evidence to be found of what exactly these shanties looked like, but we know that each one was usually designed to have enough space for two workers. Noted Canadian-American mineralogist Oliver Bowles’ 1939 book *The Stone Industries* contains a photograph (Figure 12) with the caption “Typical roofing-slate piling yard with splitting shanties in the background.” (Bowles 1939, 271)

Figure 13 Splitting Shanties (Bowles 1939)

The photograph indicates that shanties were simple covered structures where the splitting of the slate was done. It also suggests that there would have been many of them per splitting yard placed in a line.

The slate blocks must be split into thinner slabs for both the manufacturing of slate pencils as well as roofing slates. In the case of roofing slates, the reason is obvious—the thinner slab of slate is already nearly a finished product. When splitting a slab of slate, it is necessary to always work in halves. A chisel and wooden mallet are used to strike the slab along its cleavage so that it will easily and naturally separate. Typically, a one-inch thick slab of slate is halved until there are eight 1/8th inch slabs suiTable for finishing. For the curious, there are numerous British Pathé videos on the internet[2] which contain primary footage of slate miners working.

Figure 14 Grooved slate slab for pencil manufacturing

Slate pencils on the other hand are manufactured from slabs not quite so thin. In the manufacturing of slate pencils, the slab must be no thinner than ¼ inch. Though either the shanty method of splitting as is outlined by Bowles (1939) or by using a special saw as is indicated by Thompson (2010), the slate pencil manufacturing process first depends on the creation of ¼ inch slabs of slate.

[2] https://www.youtube.com/watch?v=y_yfS7JuV_w
https://www.youtube.com/watch?v=L94l10NUI9s
https://www.youtube.com/watch?v=hZk_YO2o-gg

Grooving and Finishing

After having been split into ¼ inch thick slabs, a specialized machine known as a grooving machine is used to incise deep lines into the slab of slate. Figure 13 is a photograph of a fragment of grooved, but not yet fully manufactured, slab of slate pencils. After cutting the slate pencil slab into pencil rods, the rods are broken apart and then smoothed and sharpened before being packaged for shipment and sale (Thompson 2010, 55). It is unclear exactly how this was done, and also therefore difficult to know exactly what effects this would have on the physical characteristics of the pencils.

Manufacturing of Slate Pencils

The manufacturing process for slate pencils is a rather simple one, but nonetheless represents a significant stage in the life history model. Manufacturing, the second process of the life history model, has two stages which contain potential trace-producing activities. The first of these is the splitting of the slate blocks, the second is the polishing and sharpening of the cut pencils.

An important factor in the splitting of slate blocks into thinner slabs is the thickness of the final slabs. Knowing from the historical research that slabs were typically split at approximately ¼ inch thickness, we would then expect the diameter of the slate pencils to roughly correspond to this Figure. It is likely that the ¼ inch measurement was not precise, as the slabs would have been split by workers using chisels and mallets and the measurement done by eye. The

grooving process also likely shaves some material off, so generally we should expect slate pencils to be less than ¼ inch in thickness.

Examining the slate pencil assemblage from the Industrial School for Girls, I calculated the average diameter of the pencils to be approximately 5mm, or 0.2 inches. This calculation was done using only the whole pencils, pencil mid-sections, and pencil bases because they are the only artifacts from which a reliable diameter could be measured. Though slate pencil tips have a complete circumference, there is a strong chance that it is tapering and therefore not representative of the true diameter of the pencil it came from. Fragments, by definition, do not have complete circumferences and therefore could not be included in the calculation either.

The significance of this is simply that the artifact assemblage generally lines up with the expected value. This gives credence to the historical research, but also suggests a relationship between the diameter of a slate pencil and the thickness of the slab it came from. Though some variation is to be expected, one could potentially argue that thicker slate pencils came from thicker slabs and that thinner pencils came from thinner slabs. The keen eye of stonemasons and their minute-to-minute decisions, absentmindedness, or best work may shine through in discarded pencils hundreds of miles away.

The second stage of the manufacturing process is the sharpening and polishing of the cut pencils. This stage is much harder to find in the archaeological record because normal patterns of wear on a slate pencil could all but erase it. Just like a normal wood and graphite pencil, slate pencils will wear

with use and need to be re-sharpened. Because of this, the pencil assemblage from the Industrial School for Girls cannot reliably assumed to have any traces of the manufacturing process in the artifacts.

Summary

The manufacturing process for slate pencils is significant in the life history of the object, but also is somewhat lacking in concrete sources of trace-producing activities which make themselves apparent in the physical structure of the pencils. Unfortunately, the process of use inevitably wears these away over time, making it nearly impossible to distinguish between a used and unused pencil. There are, however, some useful sources of information, most notably the diameter of the pencils, which can be seen as corresponding to the thickness of the slab from which the pencils were carved. Showing characteristics of uniformity and the expected traits of a mass-produced pencils helps confirm their source; they came from somewhere and were manufactured by someone.

The next section will cover the process of use, which occurs after manufacturing and after the pencils arrived at the Industrial School in Dorchester.

Life History Model Process 3 - Use

Following the process of manufacturing, Schiffer's (1976) model dictates that the next process in an artifact's life history is its use. This process is defined by LaMotta (2012) as "[the] principle functions of an object—the activity or activities for which it was specifically designed or obtained, and in which it was actually used." Slate pencils, as the name would suggest, were used as writing utensils. Used in conjunction with a slate writing Tablet, they were an economical and reusable resource which was well suited to use in schools. The difference in relative hardness of the specific slate between the pencil and Tablet allowed for the pencils to leave superficial marks upon the Tablet. If you've ever scraped two rocks together and seen one make a line, you understand what this sort of process looks like.

Due to the superficial nature of the marks made by the pencil, the Tablets were also reusable. Marks could simply be wiped from the Tablet with a cloth or even the hand to make a literal "clean slate". This was of course not practical for most uses—it makes little sense to write a letter on a slate pencil and send it off to someone. The slate pencil and Tablet were most utilized in schoolhouses where students could practice their handwriting and arithmetic. This chapter will cover briefly what trace-producing activities might occur during the use process through examination of the Industrial School assemblage.

LeeDecker (1994) created a flow chart for the formation processes of a privy (the eventual resting place of our pencils, fig. 15). This is quite like that of

Schiffer (1976) but is modified only to include those process which took place within the household. From here on it is a very good visual aid for the next parts of the life history model.

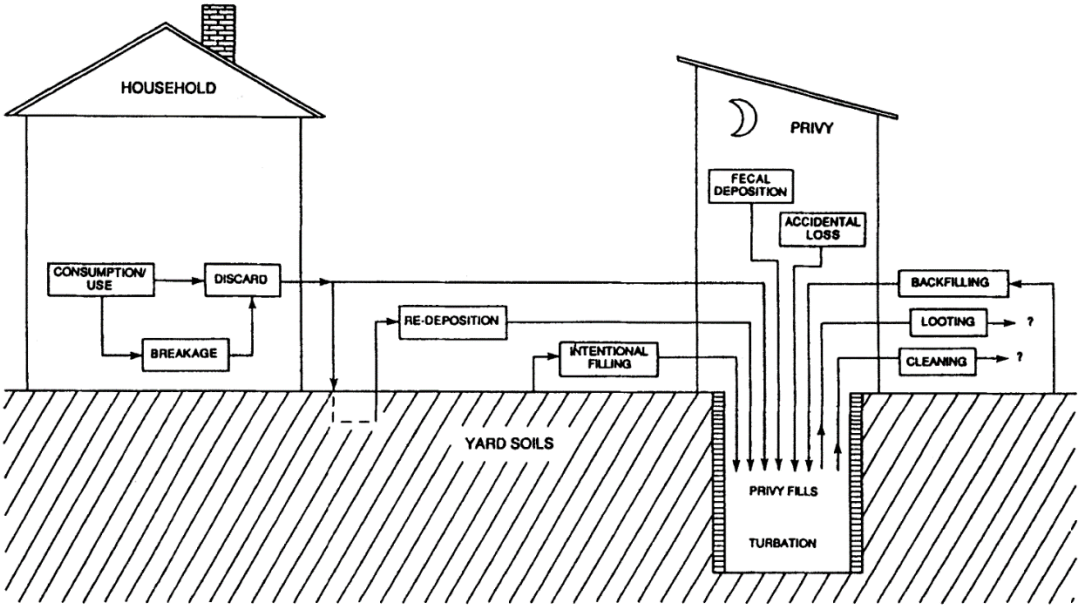

Figure 15 Privy formation flow chart from LeeDecker (1994)

Writing

In considering what potential trace-producing activities might be present on a slate pencil, we can look to the Industrial School assemblage. Because the pencils come from within the confines of a schoolhouse, most of the expected use-wear will be on the tips of the pencils. Variation in the tips of the pencils is somewhat minimal—some have nicely defined cylindrical tips which seem to suggest either minimal use or deposition shortly after having been sharpened.

For the sake of this section the only verifiable use for the pencils was writing, and this therefore is the only stage for the use process in the life history

model. The behavioral trace left on the pencils from this activity is wear on the tips, or dullness. Shown below in Figure 14 are two slate pencils from the Industrial School which have dulled tips. (Note how the lower of the two is dulled on both sides, indicating both ends may have been used for writing.)

Figure 16 Slate pencils from Industrial School with dulled tips

Length and Use

Examined alone these artifacts lead to a simple enough conclusion, that clearly there was a good deal of writing going on at this location. This is expected from the simple fact that we know the site is a school, as well as the fact that the annual reports mention the several hours a day the girls spent in the classroom. One metric which could be more useful in determining patterns of use in the pencils is length. If the length of an unused slate pencil could be determined, then comparing it with the lengths of those complete pencils within the assemblage may be able to provide some insight into long the pencils were used for. An 1895 Montgomery Ward & Co. catalogue lists several different slate

pencils, varying from 5.5 inches to 7 inches in length (Montgomery Ward & Co. 1969, 115-116).

The smallest complete pencil of the assemblage was recorded as being 27mm in length, or just over 1-inch long; the largest is 74mm, or just under 3 inches long. The mean of the entire data set is 44.48mm, or approximately 1.75 inches. Though the data set of complete slate pencils from the site (only 31 in total) is lacking because many of them inevitably were fragmented over the years, this still indicates an interesting pattern of use. I cannot state with any certainty the amount of time it takes for a slate pencil to wear down to such a length, but an experimental approach would be to acquire some slate Tablets and pencils and record just how long, or after how many words written, it takes for them to wear down to comparable lengths. There is the distinct possibility that the reason the complete slate pencils present in the assemblage are so short is because anything much longer would have broken into pieces, but regardless the existing data sets indicates a significant amount of use before disposal.

The relative length of the pencils compared to the assumed unused length may speak to many things—perhaps there was some sort of attachment to an individual pencil. An unrelated artifact discovered in the same context as the pencils discussed was a slate Tablet used for writing on; this Tablet had an individual's name ("Lilly") incised into its back, which possibly suggests a similar sense of ownership for this type of object at the school. This is among many possibilities but still perhaps worth considering. Other reasons for using such a simple object for so long could be economic. Slate pencils, though relatively

cheap, may not have been the easiest to acquire. At any given time, there would only be a finite amount at the school and it is possible that they were either prohibitively expensive or in short supply.

Summary

The use process is key in the life history model, as it covers the period in which the object was used for its intended purpose. The two variables examined in this section provided some potential insight into how the slate pencils demonstrate behaviors or patterns of behaviors by their users. The qualitative metric of dulling is relatively uninformative as it simply confirms the already-assumed function of the pencils as writing implements. The more quantitative metric of length is, however, a potentially much more fruitful metric. Future studies could create a model to describe wear over time on slate pencils and better identify what the length of a pencil indicates about how much it was used. The brief comparison done in this chapter is just skimming the surface—all I can say for certain is that they were used, and common sense indicates likely for a while. The next section is about the maintenance process which, though related, does differ from use.

Life History Model Process 4 - Maintenance

The maintenance process takes place sometimes after the use process, and sometimes interspersed between periods of use. It is described by LaMotta (2012) as the “periodic modification or repair of an object to allow its continued

use.” Slate pencils, like all pencils, require a certain amount of upkeep in the process of sharpening. Once a pencil becomes too worn down to make sharp lines, it needs to be sharpened. Though made of stone, slate pencils were still subject to normal wear-and-tear. The tips inevitably would dull and require sharpening. This chapter will briefly cover the ways in which slate pencils could be sharpened and how these different methods are reflected in the archaeological record.

Sharpening

During the late 19th century there were many patents made for different varieties of “slate pencil sharpeners.” (See Hicks 1862, Putnam 1885, Humphries 1892) These all functioned similarly to modern wooden pencil sharpeners. Either a blade would rotate around the pencil or the pencil would be rotated into a blade; regardless, a cylindrical tip would be formed from the process. Though the exact price of these devices is unknown, it is important to note that there was always a much more cost-effective alternative to them. Instead of having a machine dedicated solely to the sharpening of slate pencils, it was in fact possible to simply sharpen a slate pencil using a knife or other blade, just as one would a stick.

Multiple flat planes converging at the tip suggesting sharpening, not with a typical sharpener but rather a knife or other sharp object. A stark example of this from the Industrial School assemblage can be seen below in Figure 15.

Figure 17 Slate pencil tip from Industrial School for Girls, carved

Though it is relatively easy to determine whether a pencil was hand sharpened like that in Figure 14, it is more difficult to determine whether the pencil was sharpened with a mechanical sharpener. The reason for this is simply that the product created by a mechanical sharpener should be very similar to an unused pencil. Furthermore, a pencil which has signs of use may also be difficult to attribute to either method of sharpening. This question is significant because it addresses the availability of certain technologies at the Industrial School.

Within the artifact assemblage from features 4 and 5 there were 118 pencil tips present. Of those 47 could be identified as having a clearly hand-sharpened tip, 12 could be identified as seemingly being sharpened mechanically or been unused, and the remaining 59 were indeterminate. Although the sample size is small, there are clearly more pencils which have been hand-sharpened than not. This suggests that while the possibility of there being a mechanical sharpener present exists, there was still a clear reliance on other methods, though it intuitively seems unlikely that the girls would have been using knives to sharpen their pencils. Through the many years of available reports on the school where the girls' daily activities are loosely described, there is not a single mention

of slate pencils or their sharpening as a chore or activity done by the girls. This suggests one of two things: that this was such a quotidian activity that it merited no comment, or that the task was done by one of the adults at the school.

Conclusion

The maintenance of slate pencils, though most commonly only visible on their tips, presents us with interesting information. The way in which the pencil is maintained is potentially representative of economic access in regard to the sharpening implements, though further historical research on exact prices is surely needed for this to be at all meaningful.

Life History Model Process 5 - Reuse

Following maintenance comes the process of re-use. This phase is described by LaMotta (2012) as the “repurposing of an object, especially after it has become broken or worn.” Unfortunately, this process of the life history model is largely irrelevant to slate pencils; or rather, it is irrelevant to the assemblage in discussion. There is no material evidence for the repurposing of slate pencils for other uses. Not only is there no material evidence, but the written record provides no evidence either. This is not to suggest that this process ought to be disregarded in future assemblages, as there is a very distinct possibility that slate pencils could be repurposed, but rather that in the context of the assemblage at hand there is no evidence.

Life History Model Process 6 - Cultural Deposition

The final process of the life history model is that of cultural deposition. LaMotta (2012) defines this as the "processes through which objects leave systemic context and enter the archaeological record, including loss, discard, and abandonment." Schiffer (1976) describes this as an "S-A process" (signifying an objects movement from a *systemic context* to an *archaeological context*). An artifact's spatial and depositional context can provide a great deal of information regarding human behavior. Its context and association with its surroundings almost always reflects the final activity in its life history. Though this may not always be the case, especially regarding larger non-porTable artifacts it certainly is in the case of the slate pencil assemblage being investigated. In beginning the discussion of the deposition of the slate pencils, we must first start with where they were recovered: a privy.

Privies

Broadly speaking, a privy is a toilet—that is, a place designed specifically for the disposal of feces and other bodily wastes. Because a privy is defined in terms of its function rather than its structure, there can be a great deal of variability in what exactly constitutes a privy. LeeDecker (1994), Carnes-McNaughton (2000), and Wheeler (2000) go more in-depth about the variety, significance and excavation of privies. What is important for this paper is just the privy from which these slate pencils were excavated.

Figure 18 Nineteenth century privy from New York (New York Public Library Digital Collections)

The privy feature at the Industrial School for Girls was constructed from stone and brick, and the interior was likely white-wash plastered. The privy was located along the outside wall of the outbuilding in the back yard of the school, and due to its length likely contained multiple stalls or holes for use. Historical pictures from the same period of other privies like Figure 17 may give an idea of what it looked like. Privies like that in Figure 17 were very common in the 19th century, and it is no surprise that they are analytically significant features in any site in which they are present.

Schiffer (1976) discusses S-A processes and mentions the significance of certain loci as “artifact traps”. An artifact trap, according to Schiffer, is a place where an artifact has a very low probability of being recovered from after entering. If an object is dropped on the ground, what is the probability it will be picked up? He uses the example of dropped coins. “Coins dropped on a linoleum floor, sidewalk, lawn, sand, sewer grating, and privy will be retrieved differentially with decreasing frequency.” (Schiffer 1976, 32) Because privies are loci from which a person would be highly unlikely to recover any artifact, they constitute artifact traps; they provide rich data on accidental loss and undisturbed disposal. Unlike perhaps other areas of waste disposal, a privy is less likely to be searched

due to its inherently underground nature as well as due to significant health concerns.

Spatial Distribution of Slate Pencils

Within the privy, the slate pencils were heavily concentrated in the lower levels of excavated soil. Below is a simple chart (fig. 19) displaying the artifact count across their respective levels of excavation. The “levels” on the x-axis refer to the depth of the artifact; level 12 signifies a depth of between 110 and 120cmbd (centimeters below the datum), and so on. As is quite clear, the great majority of the pencils are located between levels 16 and 17, that is, between 150 and 170cmbd. A reasonable assumption from this information might simply be that these slate pencils were used in diminishing quantity over time. Excavation, however, revealed a likely drainage feature located in the northwest corner of the privy. Drainage of the organic soils in the privy would have left heavier soils and materials to compact and gather towards the bottom of the feature; in fact, the privy very much lacked significant quantities of organic soil, and the lower levels *were* more compacted. This unfortunately means that it is unlikely we can correlate the concentration of artifacts on any given level as evidence of an increased period of use or as a potential correlate for population.

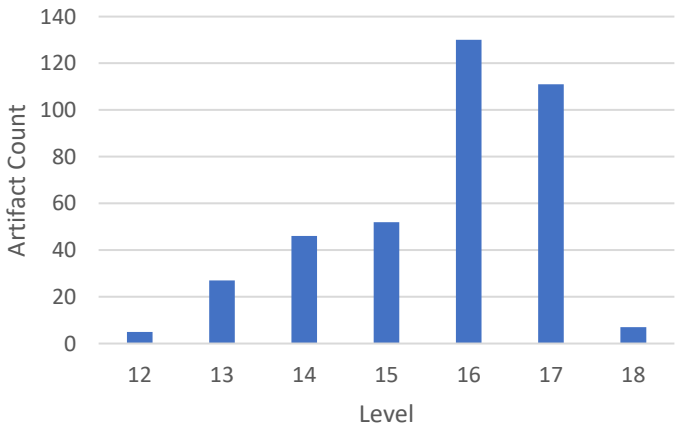

Figure 19 Slate pencil distribution by depth

While the spatial information about the slate pencils is significant, it is important to examine the surrounding artifacts as well. The artifacts excavated from the privy were quite numerous Type of artifacts recovered included faunal remains (food scraps), plentiful ceramics of varying functions, fragments of a tooth brush, various artifacts related to personal adornment including buttons and beads. There were numerous shell fragments, artifacts relating to sewing, sherds from flowerpots, and even alcohol bottles and smoking pipe fragments. In sum these artifacts help generate at least one simple conclusion—the privy at the Industrial School was clearly used in part as a place to purposefully dispose of trash. Of course, it is possible, very likely in fact, that some artifacts were dropped accidentally into the privy; however, many of the artifacts recovered are too large to be accidentally dropped into the privy, especially in such large quantities. The slate pencils are an interesting exception though, as it seems like an odd thing to willfully dispose of unless it was truly broken or too small and worn to use.

Lost or Discarded?

In examining the cultural deposition of the slate pencils in terms of human behavior, we are necessarily presented with the question of whether the pencils were deposited intentionally, as trash, or were deposited accidentally, as a lost object. It should be important to note that there is no way of determining whether the slate pencils were deposited intentionally or not, but there are characteristics of artifacts and general rules that help us make an educated guess. Schiffer

(1976) defines the two processes of cultural deposition as “loss” and “discard.” First, I will look at the notion of intentional discard regarding the slate pencils.

Schiffer (1976) presents two hypotheses or general theories relating to the probability of an artifact having been lost. The first hypothesis is that, all other variables being constant, loss probability varies inversely with an artifact’s mass; that is, the smaller an artifacts mass, the more likely it is to be lost. The second hypothesis is in the same vein as the first. It follows that all other variables being constant, loss probability varies directly with the portability of an artifact. Both hypotheses follow common sense. Smaller and more porTable objects are easier to drop, harder to find if dropped, and more likely to go unnoticed if dropped. In relation to our slate pencils these theories clearly suggest that it is likely many of the pencils were lost in the privy rather than intentionally disposed of.

In examining the process of discarding, Schiffer (1976) delineates two different types of refuse, *primary refuse* and *secondary refuse*. Primary refuse is defined by Schiffer as refuse which is discarded or disposed of at the site of its use. His example to clarify this is a scatter of flakes used for skinning animals simply dropped on the ground after use. Secondary refuse is defined as refuse which is discarded away from its area of use. Secondary refuse is something which would be found in a trash pit or other area designated specifically for the disposal of waste. In the context of the slate pencil assemblage, those pencils which may not have been accidentally lost in the privy are then to be considered secondary refuse, deposited in the privy intentionally away from the actual site of use inside the school. In order for the slate pencils being examined to be

considered primary refuse they would have to have been used within the privy, which seems to be unlikely, though not impossible.

Ultimately, there is no clear method to determine whether or not the slate pencils were accidentally dropped into the privy or intentionally deposited there; it's perhaps most likely some combination of the two. Likewise, it is also difficult to differentiate between a slate pencil which was accidentally dropped and one which was intentionally disposed of. One possible metric for this is the integrity of the artifact. An intact slate pencil was most likely not intentionally disposed of, and one which is broken or fragmented is more likely to have been disposed of. This metric is however problematic because it disregards any formation processes which could have fragmented the pencils in-situ making it difficult to quantify the proportion of pencils disposed versus lost. It does however prove to be somewhat useful if used as a simple behavioral indicator. The fact that there are intact pencils at all suggests that there was likely some unintentional loss of slate pencils in the privy.

Conclusion

Each of the six processes represented in the life history model created for this assemblage of slate pencils represent a distinct event in biography of the artifacts—from the discovery and extraction of the raw materials until the moment it last left the hands of a human before being deposited into the archaeological record. Such a model can be a powerful tool when applied correctly, even (perhaps especially) in the context of an understudied artifact class such as the

slate pencil. Historical archaeology has much to gain from the application of this model, if only because it helps broaden the horizon for what classes of artifacts are considered analytically significant.

In the specific case of the slate pencil assemblage discussed in this paper, I hope to have given both an example of what such a developed model might look like as well as raise some potential avenues for future research. An experimental study on how much slate pencils wear down over time from use could provide insight into the rate of consumption of the artifacts and therefore correlate with economic access. Likewise, a more thorough survey of slate manufacturers could provide even more narrow geographic specificity for other assemblages; the same goes for closer mineralogical and chemical analyses outside of the scope of this paper. Cross-site comparisons could also be fruitful endeavors (the entire slate pencil data set has been attached in the appendix here). Variation in both color, length, or even simply artifact count across multiple sites could inform us to varied patterns of consumption across schools of different economic, social, or geographical background.

There is a tendency in historical archaeological literature to focus in on artifacts which are classically considered diagnostic such as ceramics and glass, but unless other artifact classes are examined in close detail a great deal of potential avenues for analysis can be lost. I do not mean to suggest that all artifacts provide an equal amount of information, or even necessarily that slate pencils ought to be the center of archaeological analysis (though I hope I've made a compelling argument to give them more consideration). What I do,

however, hope is that further applications of the life history model and a behavioral approach in general may be made to new classes of artifacts which are similarly underutilized.

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