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Commercial shell button making in the United States was first established in the late 19th century in Northeastern industrial cities, such as New York, using ocean shell imported from Australia and the South Pacific. A German immigrant brought the industry to the American Midwest after recognizing the potential of the freshwater mussel beds of the Mississippi River as a resource for shell button making. The industry flourished for several years but suffered from labor strikes and the depletion of the local mussel population. In the early 1930s, entrepreneurs established shell button factories in rural portions of eastern Maryland and Delaware (Delmarva Peninsula), again using imported ocean shell as the local species are unsuitable for shell button making. Shells of bivalves and gastropods from around the world became part of the Delmarva economy and, later, the ecosystem, as shell dust and other waste products were used to pave roads and improve the fertility of soils. Surviving shop sites and machinery, recovered shell waste, oral testimony, and census, legislative, land title, and other data document the rise and fall of Delmarva's shell button-making industry between the early 1930s and the 1990s.

Aux États-Unis, la fabrication commerciale de boutons de coquillage (nacre) a commencé dans des villes industrielles du nord-est comme New York à la fin du XIXe siècle, à l'aide de coquillages de mer importées d'Australie et du Pacifique Sud. Un immigrant allemand a amené cette industrie dans le Midwest américain après avoir reconnu le potentiel des bancs de moules d'eau douce du Mississippi en tant que ressource pour la fabrication de boutons de nacre. L'industrie a prospéré pendant plusieurs années, mais a souffert des grèves ouvrières et de l'épuisement de la population de moules locale. Au début des années 1930, des entrepreneurs ont créé des usines de fabrication de boutons dans des zones rurales de l'est du Maryland et du Delaware (Delmarva), utilisant à nouveau des coquillages de mer importées lorsque les espèces locales se sont révélées impropres à la fabrication de boutons. Les coquilles de bivalves et de gastéropodes du monde entier sont devenues partie intégrante de l'économie de Delmarva puis de l'écosystème, la poussière de coquillage et d'autres déchets étant utilisés pour paver des routes et augmenter la fertilité des sols agricoles. Les sites de magasins et leur machineries, les déchets de coquille récupérés, les témoignages oraux, les données de recensement, les lois, les titres fonciers et autres documentent l'essor et le déclin de l'industrie de la fabrication des boutons de coquillage de Delmarva entre le début des années 1930 et les années 1990.

Introduction

This project began with Bailey E. Berry's investigation of the Parizek button-cutting factory in Milford, Delaware, which operated in the 1940s (Berry 2014; *The Morning News* 1940: 26). Berry drew on primary sources, such as Parizek's letters, for insight into the operations of the factory. She also visited the factory, which had 17 cutting stations, and her field team sampled two waste piles. Berry's investigations documented the maker's mark: BARRY MFC, MUSCATINE, IOWA, on some of the machines in the factory, thereby connecting the Delmarva factory to the precursor industry in Muscatine. An important theme emerges from this research: the lack of control over raw materials that characterized the Delmarva Peninsula's shell button business. Parizek's factory used pearl oyster (*Pinctada maxima*) shells from the South Pacific and yellow sandshell mussels (*Lampsilis teres*) from the Upper Mississippi Valley. World War II disrupted shell shipments and post-war plastics usurped the button market (*Cumberland Times* 1941: 2). Berry's (2014) research provided a firm foundation for the current project investigating shell button making in Delmarva.

This is a study of a rural industry in which the community had no control over the single vital resource: mollusk shells. Shell button making on the Delmarva Peninsula provided an important source of income for Delmarva communities after the demise of shipbuilding

(the supply of white oaks on which the industry had been built had been exhausted) and during and immediately following the Great Depression of the 1930s (Berry 2014). Successful shell button operations in the region varied in size, product (degree of finishing), machinery employed, and mollusk species imported. The Delmarva Peninsula was home to button factories large and small; those that made blanks that were finished in Northeastern factories and those that made complete buttons. Some shops were open only a few years, while others endured into the latter half of the 20th century. They ranged in size from single operators working out of farm outbuildings (generally late in the industry as larger shops closed and sold their machines to individual cutters) to small shops with a dozen or so operatives, to modest-sized factories employing 100 or more men and women. The introduction of plastic buttons in the 1950s (Berry 2014) drove most shell button shops out of business, while others were able to adapt by occupying a niche in the industry (a shop near Vienna, Maryland, specialized in doll buttons and sequins until 1990) or switching to plastic button production (e.g., the Excelsior factory in Berlin, Maryland).

The present state of research into Delmarva's shell button-making industry leads to many questions with only preliminary answers. In light of the rapid depletion of river mussels that impacted the Midwest button industry, was the shell button industry in Delmarva more sustainable due to its reliance on ocean shells from overseas? Why did the industry take root in Delmarva, which lacked suitable shells? What factors contributed to the Delmarva factories' diversity in size, invested capital, and duration of operation? Was the federal Rural Electrification Act of 1935 a factor in promoting shell button making in Delmarva? How did the industry shape the lives of the communities that hosted it? What can be discerned about patterns of labor (including questions of gender, seasonality, and stability of work) from oral testimony and census data?

Data Collection

This study approached the research issues in the Delmarva shell button industry through a combination of archival data, oral history, and information from limited investigations at former factories by the Smithsonian Environmental Research Center (SERC) archaeological team. Archived newspapers aided in the identification of the former Schwanda Button Factory in Denton, Maryland, and the Elliott Island shop near Vienna, Maryland. Newspaper articles were a source of information on the government's response to the depletion of mussels, the advances in biology spurred by industrial need, and the effect on economy and community of the shell button industry in Delmarva, which has received no scholarly attention. Federal census data from 1930 and 1940 for the towns of Federalsburg, Denton, Vienna (the closest town to Elliott Island), and Milton reveal a quadrupling (40 to 209) of the Excelsior staff in Federalsburg, with much more modest increases and smaller workforces in the other four towns (Data from the 1950 census will not be released until 2022). Men appear to have dominated the staff of the smaller operations (80% to 100%), while the large Federalsburg operation had a workforce roughly balanced between men and women. The different sex ratios may be attributable to cutting blanks in the smaller shops and production of finished buttons at Excelsior. These data should be interpreted in light of the prevailing economic decline of the 1930s.

On 31 August 2016, the SERC archaeology team interviewed Jim Reed, a former button worker from Milton, Delaware, whose participation in the industry was brief, intermittent, and during the industry's declining years. The town was home to many button cutters, but the dynamic and amorphous nature of the work, characterized by non-unionized, individual workers cutting shell in their backyards, means there is little documentary evidence of button-cutting in Milton apart from occasional items in local newspapers.

Origins of the Industry

A precursor to the shell button industry in Delmarva was the freshwater button industry,

which flourished in the U.S. Midwest from 1891 to the early 1920s. The center of this industry was Muscatine, Iowa, where a German immigrant named John Boepple opened the first freshwater shell button plant in the U.S. (Alexander 2009). Prior to the Muscatine factory (1855-1890) companies in northeastern states, such as New York and New Jersey, worked ocean shell imported from Australia and other parts of the South Pacific into the popular "mother-of-pearl" buttons. When the industry began to expand in the Midwest, button-cutting factories switched to locally sourced freshwater shells and were located as close as possible to the source of yellow sandshell mussels: the Mississippi River. Unlike buttons made from other materials, such as wood, bone, horn, and "vegetable ivory" (family Arecaceae), various grades of pearl buttons were obtained from a single shell. Sorting the button blanks by grade, therefore, was a significant step; "sorting girls" judged the quality of pearl-button blanks by thickness and color. Manufacturers of cheap garments purchased thin, discolored blanks, while higher-quality garment manufacturers paid a premium for the highest grade of pearl button. Wages for workers in the button-making business varied depending on the task. Shell sorting paid an hourly wage, while cutters earned pay by the gross of units completed, known as "piece-work" (Farrel-Beck and Meints 1983). Working conditions in Midwest button factories were hazardous and workers harbored a deep distrust of management, whom they suspected of shorting their pay. A combination of strikes, rising labor costs, depletion of freshwater mussels, and competition from the Japanese shell button industry contributed to the decline of the freshwater pearl-button industry in the Midwest (Farrel-Beck and Meints 1983; Rousmaniere 1982).

Depletion of Domestic Freshwater Shells

The rapid growth of the industry in Muscatine led to the depletion of the mussel population of the Mississippi River: "Only six years after Boepple started the industry, 53 button-cutting shops were operating in Muscatine, using more than 3,500 tons of shell taken from the Mississippi" (Alexander 2009). As early as 1898, only seven years after Boepple opened the first shell button factory in Muscatine, shells had to be imported from Missouri and Illinois (Farrel-Beck and Meints 1983: 15). Overharvesting depleted populations of yellow sandshell mussels (*Lampsilis teres*), and the practice of tossing dead mussels back into the water covered the live ones, interfering with their respiration and feeding and promoting microbial growth that reduced the supply of oxygen in the rivers (Farrel-Beck and Meints 1983: 15–16). Recognizing the seriousness of the situation, in 1908 the U.S. Congress founded the Fairport Biological Station to promote the propagation of mussels (Coker 1923). In a 1915 newspaper article from St. Louis, Missouri, F. C. Vetter of Muscatine highlights the plight of "the discouraged clam":

> The family life of the Mississippi clam has been so broken up by the hunters that the clam has become discouraged. The clams are beginning to hide in the river beds and are losing their former boldness. It is probable that within a dozen years buttons will be valuable trinkets. People will be wearing clothes without buttons and this will change the whole mode of dress of the country. (Vetter 1915: 2)

While his satirical prediction of a buttonless world never came to fruition, Vetter's (1915: 2) sentiment about the "boldness" of the clam reflected the thoughts of many industry workers of the time. This romanticized view of the clams' dispositions pointed to a very real biological fact, that the reproductive cycle had been disturbed. A 1908 article from the *Indianapolis Star* explains:

> It has been discovered that the mussel, in its incipient stages of development, is a parasite and that it must have a fish to cling to or it will perish. The spawn, after being laid by the female mussel, either sinks to the bottom of the stream and is lost or attaches itself to the fins and gills of fishes. In the latter case, after clinging to the fish between thirty and sixty days as a parasite, the germ falls off and becomes a mussel. The

> experiments showed that from 500 to 1,000 infant mussels will attach themselves to a single fish without any apparent injury or inconvenience to the fish. (*Indianapolis Star* 1908: 2)

Labor Costs and Competition

The 1913 tariff act reduced the duty paid on imported shell buttons, damaging the American industry by lowering the costs of imports. Frank M. Swacker, counsel for the National Button Manufacturers' Association, testified before a special subcommittee of the Committee of Ways and Means that convened 23–24 June 1919, urging Congress to enact legislation to protect the floundering American freshwater pearl-button industry:

> Prior to 1913 our manufacturers of shell buttons (ocean and freshwater) were protected by a duty of 1½ cents a line per gross and 15 per cent ad valorem. This imposed on a 16-line button (i.e., a button sixteen-fortieths of an inch in diameter) a duty of 24 cents per gross and 15 per cent ad valorem, while the tariff act of 1913 imposed on the same button an ad valorem duty of 45 per cent, which amounts to 2¼ cents on buttons at 5 cents per gross, making the cost, duty paid, 7¼ cents per gross (House of Representatives 1919: 8–9).

According to Swacker's figures, the change in tariff prompted a rise in Japanese imports from 287,437 gross in 1913 to 739,961 gross in 1914—an increase of 257%. He pointed out that "the raw material consists of the shells, and they cost nothing except the cost of the labor involved in gathering them," and, therefore, "what we [button manufacturers] are asking for is merely protection for labor" (House of Representatives 1919: 14). The hearing also revealed that the button industry differed from other industries, such as railroads, in that profit on investment was not a good indicator of its health because of the comparatively small investment required. A better indicator would be the compensation paid for labor at each stage, from shell-fishing to button production. Labor costs in the Japanese shell button industry were much lower than those in the United States. With the mechanization of their industry, Japan became a major competitor of Midwest factories. As a result, Muscatine factories—confronting lower demand for their product—operated at an average capacity of only 40% in 1921 and 1922 (Farrel-Beck and Meints 1983: 17).

Almost immediately following the decline of the freshwater industry in the Midwest, button shops began to appear on the East Coast. The link between the two industry centers is unclear at this point and merits further investigation. While the Midwestern industry used local freshwater shells, the Delmarva industry appears to have relied on imported ocean shell, much like the industry prior to 1890. But, why were these shops located in Delmarva rather than in New York, New Jersey, and other locations farther north to which the shells were originally imported? What factors can explain the diversity of shell button making operations in Delmarva, from the size of each factory to its longevity?

East Coast Button Making

The Delmarva Peninsula encompasses the eastern shores of Maryland and Virginia, and the whole of the state of Delaware. Shell button making and blank cutting businesses operated at numerous locations on the peninsula. The SERC team have located and documented three locations: the Schwanda factory in Denton, Maryland, which operated from 1936 to 1996 (Fritz 1997); Martinek's button shop in Elliott Island, Maryland, which operated from 1949 to 1992 (Sherwood 1994); and Parizek's shop near Milford, Delaware, which began operations in 1940 and closed by 1972, the year in which the property was sold (Berry 2014). Numerous shops were located in Milton, Delaware, while Federalsburg, Maryland, was home to one of the largest operations, Excelsior Pearl Works—known largely through the 1930 and 1940 population schedules of the federal census. The plant no longer exists.

Archaeological evidence recovered from the Parizek factory in Milford, Delaware (Berry 2014) and Vienna Historical Society collections from the Martinek shop in Elliott Island, Maryland, indicate that the Delmarva factories

did not use local freshwater or marine mollusk shells as their primary raw materials. Instead, the shell waste piles found at the Parizek and Schwanda factories, and the Vienna Historical Society collections of material from the Martinek shop, consist of imported ocean shells of various species and yellow sandshell from the Upper Midwest. The ocean shell and yellow sandshell were all shipped to the Delmarva factories from ports in the Northeast. Button companies were headquartered in New York, New Jersey, and Massachusetts, where officials made decisions, such as finding sources of shells abroad. Perforation of shells found in waster piles is an indicator of their suitability as raw materials; if the shells have holes, they were used to make button blanks. If they are not perforated in this manner, the shells can be interpreted as being unsuitable for shell button production. At the Schwanda factory, none of the yellow sandshell valves were perforated (all of the specimens were smaller and thinner than those recovered from the Parizek shop site), while the ocean shells were perforated. Availability of species may have changed between 1930 and 1990, accounting for the unused yellow sandshell valves and the many perforated whelk valves (the only indigenous species recovered from any of the Delmarva sites) at Schwanda.

Differences among the shops and associated archaeological deposits should include: period of operation (reflected in the mollusk species represented in the waste piles), capitalization, nature of ownership (local or not), and location (urban or rural), to name just a few of the variables. The following summary of shops and button-cutting locales provides some sense of the variability across the industry, changes in available raw materials, and the organization of labor.

Milton, Delaware

The Town of Milton in Sussex County, Delaware had many button shops at one point, including the large Lippincott factory, medium-sized shops, and small one-person operations where workers cut button blanks at home. Milton is a small agricultural town situated on the Broadkill River, where the shipbuilding industry flourished until the 1920s. Jim Reed (1930–2016), a button cutter in Milton, Delaware, worked for a smaller shop, and then, after a fire destroyed the factory building, worked on his own, cutting blanks in his backyard. The archaeological data are sparse for these sites in Milton. For example, the site of "Nut Reed's Button Shop" was paved over by the Reeds, who own an asphalt company. While there were other button shops in Milton, their locations are unknown at this time; however, Mr. Reed's memories of the industry provide a valuable glimpse into the daily life of a mid-century button worker (Reed 2016).

Jim Reed worked in his father's button shop from about the time he was 16 years old (Reed 2016). Mr. Reed could not remember the exact year his father opened the shop. Around 15–16 workers cut button blanks from shells that were then shipped to the owner of the shop, Mr. Platt. Mr. Reed's wife, Betty, was a sorting girl at the shop. After the shop burned down, individual workers cut blanks at home and continued to sell them to Mr. Platt. Mr. Reed could not recall facts, such as the year the shop closed, how many years he worked there, or the location of the former button shop, but he remembered clearly the people with whom he worked. During the interview, Mr. Reed's daughter-in-law, Cathy Reed, gave him a flat shell that they had saved from the factory. Holding the shell, Mr. Reed moved his hands over it and recalled grinding off knots when he worked in the shop, although this shell did not have any knots.

Some people came from outside Milton to work in Reed's button shop, and Milton's bustling industry suffered periodically from labor shortages. The work environment was very different from the Muscatine factories. Mr. Reed remembers coming and going as he pleased. Most of his coworkers worked a full eight hours, but there was no time clock and

no supervisor or manager overseeing the cutters; payment was based on piece work, not an hourly wage. When Mr. Reed felt he had made what he wanted to make that day he would leave before the eight hours were up (Reed 2016). In contrast, the factories of the Midwest were characterized by a rigid work schedule and there are reports from Muscatine of mandatory church services during lunch so the managers could count the cutters' work in secret, possibly shorting their pay (Rousmaniere 1982). While Mr. Reed's father managed the shop, he would also cut buttons during the day. He chose not to rebuild after the shop burned down. Instead, button workers took the cutting machines and continued cutting blanks for Mr. Platt at their homes (Reed 2016). Perhaps this is because, as the button manufacturers stated at the 1919 subcommittee hearing, the American button industry suffered from overhead costs, while the Japanese industry did not (House of Representatives 1919). When that capital, in the form of factory buildings, was lost, demand for the product provided no incentive to rebuild.

Elliott Island, Maryland

Home to the former Martinek factory, Elliott Island is a sparsely populated jut of marshy land in the extreme south of Dorchester County. Like Milton, it is situated on the water: to the west is Fishing Bay and to the east is the mouth of the Nanticoke River. Vienna, the nearest town, has a population of 271. According to newspaper columnist Dick Moore (1959), Daniel Martinek, who had previously owned a shell button factory in New York, purchased land in southern Dorchester County in 1949, planning to trap mink and muskrat. When he realized the meager population of these animals precluded success at this endeavor, he resurrected his button business on Elliott Island (Moore 1959). Tom Bradshaw, county councilman and local historian, thought that at one point while the Martinek factory was in operation, it employed almost every inhabitant of the small community on Elliott Island (Bradshaw 2016).

The Martinek factory is the smallest of the three Maryland operations and was likely comparable to the Parizek shop in Delaware. The factory contents, recently donated and moved to the Vienna Historical Society Museum, represent every stage of shell button making. Unlike the button cutters in Milton, who produced button blanks that were then shipped to the Northeast for finishing, the Martinek shop produced finished buttons. Daniel Martinek's wife sorted and packaged all the buttons by hand. The entire operation was carried out in a small building reminiscent of a one-room schoolhouse; the building has been adaptively reused as a hunting lodge. In a 1972 newspaper article in the *Daily Times*, Chester Martinek, son of Daniel, explained that one reason his family-run button business was still in operation, despite fierce competition from Japan, was that he was able to quickly fill rush orders that could not wait for Japanese imports (Moore 1972).

Martinek shut down operations in 1992 when it became too expensive to purchase the shells. The original factory building survives on the Martinek property on Elliott Island. The artifacts housed at the Vienna Historical Society Museum are critical tools for understanding the shell button industry. The machine lineup is particularly helpful, as it shows every stage of shell button making, from cutting the shells to facing and drilling the polished blanks. Berry (2014) provides a succinct description of the process. The first step in shell button making, after soaking the shells, was to drill button-shaped blanks from the shells using a lathe fitted with a tubular saw (FIG. 1). The saw operated in conjunction with a support that held the shell and allowed for gauging and spacing the cutting. Many operators in other earlier shops held the shell in their left hands and adjusted its position as the saw retracted and the blank was ejected. There was no identifiable maker's mark on this machine, the associated vacuum tube for dust removal, the variable-speed belt drive, or the

tray for collecting blanks. The unfinished blanks cut from the shell had uneven, chipped ends and varied in thickness. Different saw sizes cut different sizes of blanks, measured in "lines" of 1/40 in. The next step was for an operator to use a machine to sand the ends of the blanks so both sides were smooth and even. Next, the unfinished blanks were sorted by size using another machine, with rollers set at an angle so blanks of different lengths were shaken out into the bins below (FIG. 2). A worker operating another machine would then slice the blanks into a uniform thickness (FIG. 3). Pearl oysters (*Pinctada maxima*) yielded thick blanks that could be riven into several blanks, while other, thin-valved species produced blanks that could not be further reduced through splitting. Button shops producing only blanks then shipped them to another factory to be finished into buttons; however, at the Martinek shop the process continued with several more steps to produce a finished button.

At this stage the blanks were smooth on both sides and uniformly thick, but still dull and chalky in color (Bradshaw 2016). Next, the workers used a plastic drum to bathe the blanks in a mixture of acids, including muriatic acid. Then the blanks were tumbled in a wooden drum with "finishing oil" (a formula that varied from factory to factory) and corncob dust. "Knurling," also called "facing," was the next step in turning a blank into a button. The knurling machine in the Vienna Historical Society Museum is stamped with the name of the manufacturer, Holub-Dusha, and a patent date of 31 July 1906 (Patent 827,309). Holub-Dusha operated out of New York and patented many different machines for the specific purposes of the pearl-button industry (e.g., Patent 1,343,042). A chuck held the blank, while the worker brought any of a number of tools into contact with the blank to create the inset "face," while a vacuum tube removed the dust. Finally, a machine (Patent 1,083,202; 30 December 1913, Holub-Dusha) was used to drill the button holes, or "eyes" (FIG. 4). The Martinek operation produced different types of pearl buttons in a variety of finishes. Differences in color, from a dark smoky gray to a more traditional pinkish white, resulted from a combination of variations in the natural colors of the shells and modifications to the finishing process (Bradshaw 2016).The Martinek shop remained in operation for many decades by occupying a niche in the industry; they made the tiniest of pearl buttons for doll clothing and even crafted sequins (Sherwood 1994).

Denton, Maryland

The SERC team also investigated the site of a former button factory at 317 Carter Avenue in Denton, Maryland (FIG. 5). The small town of Denton, with a 2010 population of 4,418, is the county seat of Caroline County and is located on the Choptank River. Called simply "the button factory" by residents of the town, the plant employed a modest number of workers, never reaching the scale of the Lippincott or Excelsior factories. Nevertheless, the button plant, built and operated by the B. Schwanda & Sons Company of New York City, was a source of community pride. It often hosted community events and sponsored projects, including the construction of a hospital. The surviving factory building is significantly larger (12,000 ft^2) than the one-room buildings of the Parizek and Martinek factories (about 600 ft^2).

According to items in the *Denton Journal* (1935, 1950: 1), the community had long wanted to attract an industry to their town. A committee of businessmen went to New York City to meet with B. Schwanda & Sons and secured a contract to build a button plant in Denton. John T. Carter offered the firm any one of three building sites without charge, and other members of the community donated land for streets (*Denton Journal* 1935). The button factory operated from 1936 to at least 1954, when the local plant of B. Schwanda & Sons was featured on a television program called *Industry on Parade* (*Denton Journal* 1954: 1). During the 1960s the industry declined and

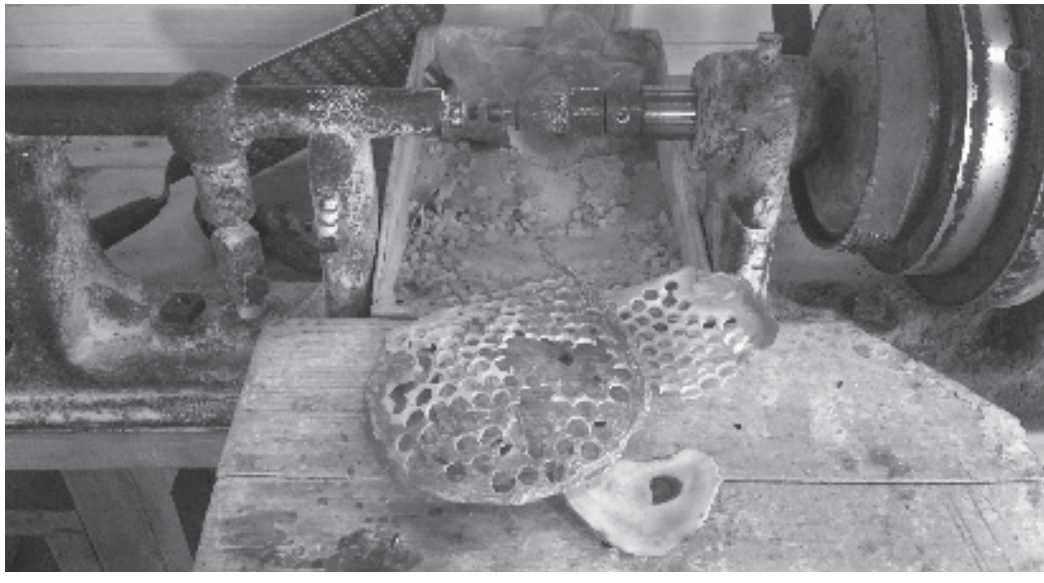

Figure 1. Machine used for cutting blanks. (Photo by Siara L. Biuk, 2016.)

Figure 3. Machine used to slice blanks to even thickness. (Photo by Siara L. Biuk, 2016.)

Figure 2. Shaker sieve used to sort blanks by size. (Photo by Siara L. Biuk, 2016.)

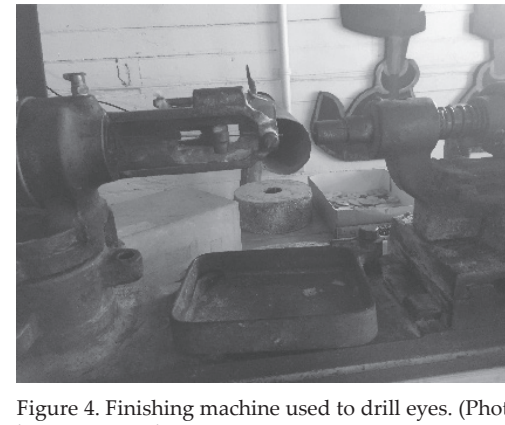

Figure 4. Finishing machine used to drill eyes. (Photo by Siara L. Biuk, 2016.)

Figure 5. Repurposed building that formerly housed the Schwanda button factory. (Photo by Siara L. Biuk, 2016.)

in 1969 B. Schwanda & Sons, which had been manufacturing buttons from ocean shells in New York City since 1894, went bankrupt.

The Caroline Economic Development Corporation repurposed the factory building, and it is now occupied by county social services (FIG. 6). The machine in front of the building is stamped: BARRY MFC, MUSCATINE, IOWA (FIG. 7), as were the machines discovered in the Parizek factory by Berry (2014). The Barry family invented button-making machines for the Muscatine industry that came to be known as "Barry automatics." This machine appears to be a shell-grinding machine patented 13 August 1907 for the purpose of removing the hinge and ridge of the mussel shell and reducing the thickness of the exterior portion of the shell. It is unclear when this machine arrived in Denton.

The yard behind the factory building remains intact. The surviving tower structure housed the apparatus for collecting shell dust from the factory's days of operation. Shell waste discarded in the yard is concentrated on the perimeter near the buildings. The yard is

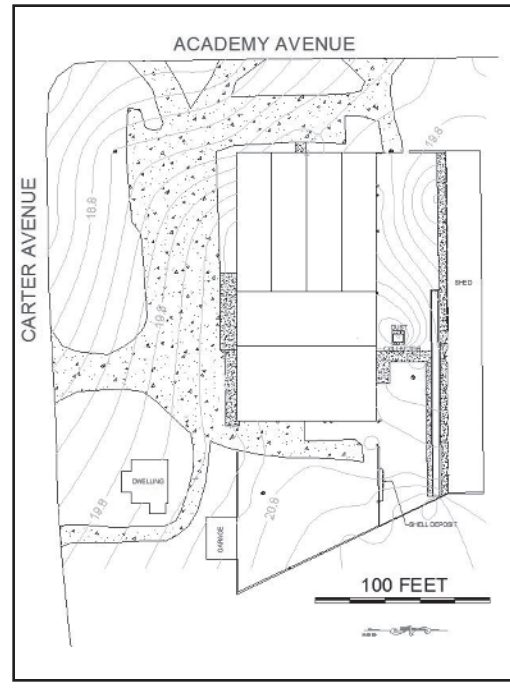

Figure 6. Map showing the former Schwanda button factory in Denton, MD. (Map by James G. Gibb, 2016.)

enclosed by a rusticated concrete-block wall. Perforated whelk (*Busycon* sp.) shells are mortared to the top of the wall like a line of spikes. Dust collected from drilling shells may have been used as fertilizer or for other chemical applications, and the crushed shell remains may have been used for pothole filling or road paving. The dust collector and the Barry machine are the only machines remaining at the site. The SERC team was able to access most of the sheds and discovered they are currently used for storage by the county offices and do not contain materials from when the button factory was in operation.

The SERC team found both perforated and non-perforated shell waste in the yard, which prompted many questions. A pile of non-perforated yellow sandshell and pearl oyster shells may have been rejected for their small size, thin shells, or thick, rough layer of periostracum (an organic layer that forms on the outer shell that interferes with the button-cutting process). Next to this deposit was a pile of perforated abalone and columella, the latter of which is the central anatomical feature of a coiled gastropod shell. The perforations indicate that these shells were used for cutting button blanks; therefore, this finding may indicate the relative value of different types of shells to the industry.

The species of several types of shells sampled from the Denton site were identifiable. Black abalone (*Haliotis cracherodii*) is a relatively small species of critically endangered abalone from the eastern Pacific (FIG. 8). Black abalone can be found on the Pacific coast of the United States from Mendocino County, California, to Baja California, Mexico.

Yellow sandshell (*Lampsilis teres*) was the only freshwater species found at Denton, and all the samples are unperforated (FIG. 9). This mussel is one of the many species of freshwater mussel used in the Muscatine industry. Yellow sandshell is found in the Mississippi and Gulf of Mexico drainage systems of North America and comes from the Unionidae family of freshwater mussels, a family with a worldwide distribution that is also found in great diversity off the coasts of China and Southeast Asia. The Japanese freshwater shell button industry, a direct competitor of button manufacturers in the Midwest, also used species of Unionidae, commonly called the Chinese pond mussel.

The pearl oyster (*Pinctada* sp.) found at Denton is much smaller than the other pearl-oyster species recovered from the Parizek site and examined at the Vienna Historical Society Museum (FIG. 10). The specimen fits the description of *Pinctada albina*, which grows to about 4 in. in diameter and has a grayish- or greenish-yellow outer shell with indistinct brownish-green radial bands. It is distributed from Shark Bay in Western Australia north to Indonesia, the Philippines, and Micronesia, and can be found in waters off China, Korea, and Vietnam.

The team also recovered specimens of two gastropod species: cone top shell (*Tectus conus*),

Figure 7. Barry machine located in front of the former Denton factory. (Photo by Siara L. Biuk, 2016.)

Figure 8. Non-perforated abalone shell sampled from the Denton site. (Photo by Siara L. Biuk, 2016.)

a marine snail found in the Red Sea and off the coast of Southeast Asia and Australia; and toothed top shell (*Tectus dentatus*), found in the northwest Indian Ocean, the Persian Gulf, and the Red Sea (FIGS. 11 and 12).

The Denton site was extremely valuable to the SERC investigation of Delmarva's shell button industry. The findings complicate the question of shell sourcing, as various species of shells from different parts of the world were discovered in the shell waste piles of the site. The factory size appears to be in the middle ground between the large factories (Lippincott and Excelsior) and the smaller operations (Martinek and Parizek). Finally, the documentary evidence from newspaper articles reveals that, for several decades, the button factory in Denton was a vital component of the small, rural town, providing a source of employment,

Figure 9. Non-perforated yellow sandshell sampled from the Denton site. (Photo by Siara L. Biuk, 2016.)

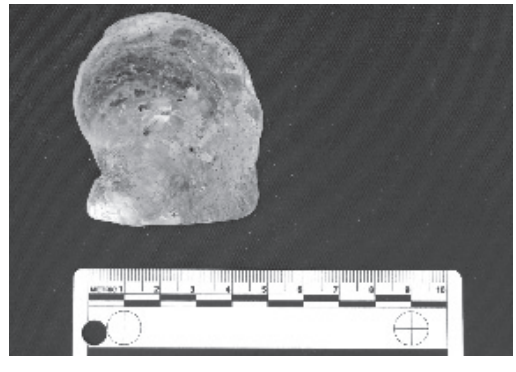

Figure 10. Non-perforated pearl oyster sampled from the Denton site. (Photo by Siara L. Biuk, 2016.)

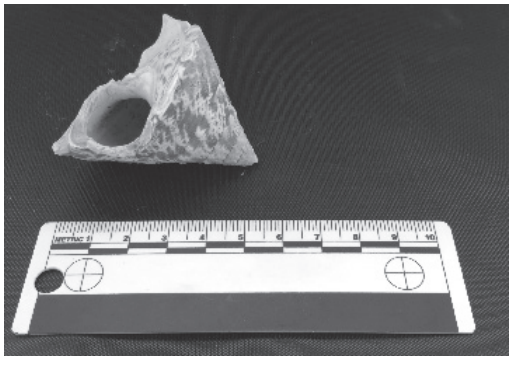

Figure 11. Perforated top shell sampled from the Denton site. (Photo by Siara L. Biuk, 2016.)

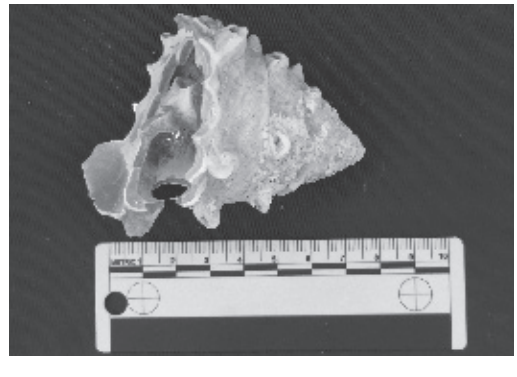

Figure 12. Perforated toothed top shell sampled from the Denton site. (Photo by Siara L. Biuk, 2016.)

charitable donations, and pride in the thriving industry.

Census Data

In addition to the information gathered through site visits, interviews, and archival research, a review of census data can provide valuable insight into aspects of the shell button industry in Delmarva. The shell button industry there is first reflected in the national census in 1930. Table 1 shows the number and sex of button workers in four Delmarva towns for 1930 and 1940.

Population census data (TAB. 1) show that, between 1930 and 1940, employment in Federalsburg button factories, presumably the Excelsior Pearl Works button factory, increased by 423%. In 1930 the Federalsburg shell button workforce was 48% male and 52% female; in 1940, 50% of workers were male and 50% were female (US Bureau of the Census 1930a, 1940a). It, therefore, appears that the shell button industry was unusual for its time in providing a significant source of employment outside the home for women. According to the manuscript schedules of the census, in 1930 (US Bureau of the Census 1930b) there were no button workers in Denton. In 1940 only 15 people in Denton worked in the industry: 12 males and 3 females (US Bureau of the Census 1940b). These data are surprising, given the size of the Denton button-factory building, and may indicate that button workers hailed from other parts of the state. Similarly, in Vienna there were no button workers in the 1930 census (US Bureau of the Census 1930c). In 1940 (US Bureau of the Census 1940c) one male identified himself as a button worker. It is unclear from the census how many people in the area worked at the Martinek plant and when that plant was opened. These data are complicated further by the likelihood that shell button cutting may not have been the principal occupation of many of the industry's participants, with farmers, for example, cutting during lulls in the agricultural season. Unfortunately, census data from 1950 and 1960 remain unavailable for comparison, limiting the conclusions that can be drawn from these data about the relative success of the industry in these decades. In 1930 the button industry in Milton employed 71 workers, 100% of whom were male (US Bureau of the Census 1930d). Between 1930 and 1940 the number of button workers increased by 44%, of which 85% were male and 15% female. This may indicate that button-cutting operations were consolidating into shops that hired women in the position of "sorting girls." Women rarely, if ever, held the position of button cutter.

Conclusion

The Delmarva industry depended significantly on high-quality ocean shell, leaving the industry vulnerable to the vicissitudes of a global market; however, the Muscatine industry relied on local freshwater shells, rapidly depleting and nearly exterminating the resource. Each regional variation of the shell button industry had its own dependent resources and vulnerabilities. Availability of local mussels and the cost of labor limited Midwestern production. Delmarva factories

Table 1. Number and sex of shell button industry workers in four Delmarva towns.†

Town	Male (1930)	Female (1930)	Male (1940)	Female (1940)
Federalsburg	19	21	104	105
Denton	0	0	12	3
Vienna	0	0	1	0
Milton	71	0	87	15
Total	90	21	204	123

†Data from US Bureau of the Census (1930a, 1930b, 1930c, 1930d, 1940a, 1940b, 1940c, 1940d).

bought imported ocean shell from companies in the Northeast; workers saw only the country of origin stamped on the crates, if they noticed even that. They may have assumed that the shells were local or at least from the United States. Current residents of Milton who find shell waste assume just that, especially when encountering abalone shells.

Was the shell button industry in Delmarva sustainable? First, what is sustainability? Is it the ability to continue indefinitely without significant change? In a sense, no "natural" material button industry was sustainable because eventually plastics would replace them all. Leaving aside questions of technological obsolescence for now, the more common use of "sustainability" refers to environmental pressures as they tangle with industrial practices.

Was the Delmarva industry sustainable? I suggest that it was more sustainable than its predecessor in the Midwest. This may have been due, partially, to the distance and diversification of shell sourcing, which begs the question: was this an intentional move or a fortuitous accident of circumstance? In Delmarva upper-management decisions were made offsite, which also differs from the Midwest industry. Choices in sourcing shells, transportation of shells and blanks, finishing into buttons, and selling to wholesale buyers, such as garment manufacturers, were made in the Northeast by absentee managers, including Mr. Platt in New Jersey (Reed 2016) and the Schwandas, whose corporate office was located in New York (*Denton Journal* 1950). In Milton the configuration of labor could not be more different from the perilous conditions, heavy-handed management, and resulting formation of unions that occurred in the Midwest. The feverish industry in the Midwest pushed the limits of safety and ecological sustainability through maximization of mechanical and labor efficiency, and it imposed a paternalistic order on factory workers (Rousmaniere 1982). In contrast, Delmarva appears to have offered a different system of production in which work hours were more fluid and workers readily moved back and forth from shell button making to agricultural and other industrial activities (Reed 2016). Atomization of labor meant that workers largely determined their own working conditions. The pressures that gave birth to unions in the Midwest never materialized in Delmarva, which ultimately made the industry more economically sustainable than the short-lived Muscatine industry.

What environmental pressures impacted Delmarva shell button making? The local availability of abundant oyster beds appears irrelevant to the industry. The few samples of freshwater shells found at Denton were a species native to the upper Mississippi, not Delmarva. But, they were a minority of the shell resources used in the industry, if indeed those shells were used at all; recall that in Denton no instances of perforated yellow sandshell were found, indicating that these shells were rejected before any button blanks were cut from them. The majority of raw material was clearly ocean shell imported from the South Pacific to Northeastern port cities and then transported by truck or rail to Delmarva. Swacker testified before the House of Representatives (1919) that transportation was cheap. Was there ever concern over depleting ocean shells? Tom Bradshaw (2016) indicated that at Vienna/Elliott Island they eventually had trouble obtaining high-quality shell. If issues arose in procuring high-quality ocean shell, then the Delmarva industry could have dried up instantly.

Were Delmarva's oyster beds largely a coincidence and irrelevant to the location of the shell button industry in that area? One would assume that the presence of oysters, similar to the proximity of Mississippi River mussels in Iowa, had something to do with the initial decision to open shell button factories in Delmarva, but does the evidence bear this out? In contrast to the industry in Muscatine, there appears to be no evidence of a subsequent clamming industry in Delmarva and no mention of "Delmarva shell", but always ocean shell from abroad. What drew

the industry to Delmarva? It is possible the pool of labor available on the peninsula was an attractive factor for the industry.

The present research indicates that there was no single pattern for a successful shell button business in Delmarva; rather, each operation varied in size, machinery, and raw materials used. Future research on this topic could explore the influence of protectionist trade policies on the American shell button industry. There is evidence that the precursor industry in the Midwest would not have developed without protection from Japanese competition. Another topic worth exploration is the relationship between the availability of high-quality ocean shell, the growth of the industry, and the post-World War II decline of the Delmarva factories. Finally, the question remains as to why the industry took root in Delmarva in the first place. One hypothesis is that abundant land and labor made Delmarva attractive to established shell button companies in New York. Further research into the forces that drove management decisions could illuminate questions about this unique and important industry.

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