SOCIETY FOR
INDUSTRIAL
ARCHEOLOGY

Presentations

43rd Annual Conference
Holiday Inn By the Bay
Portland, Maine

Saturday, May 17, 2014

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Kitty Henderson
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Justin M. Spivey
Erin C. Timms

Society for Industrial Archeology
Michigan Technological University
1400 Townsend Drive
Houghton, Michigan 49931-1295
www.siahq.org

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Are Covered Bridges Worthy of National Historic Landmark Status? HAER's Case for Five Covered Bridges

[Revised abstract pending.]

Christopher H. Marston has been with the National Park Service's Historic American Engineering Record since 1989, after receiving architecture degrees from the University of Virginia and Carnegie Mellon University. He has led HAER documentation projects on a variety of historic engineering sites, and has been project leader of the HAER National Covered Bridge Recording Project since 2002. He served as co-editor of the award-winning *America's National Park Roads and Parkways: Drawings from the Historic American Engineering Record,* and associate curator of the Smithsonian traveling exhibit, *Covered Bridges: Spanning the American Landscape.* Christopher has presented at a variety of professional conferences, and chaired the Second National Covered Bridge Conference in Dayton last year. He is an active member of several preservation organizations, including the SIA, Preserving the Historic Road, the Transportation Research Board's Committee for Historic Preservation and Archaeology, and the Rustic Roads Advisory Committee in Montgomery County, Maryland.

From the Hudson Valley to Ohio: A Western Transfer of the Burr Truss

Developed in the early nineteenth century by the Connecticut-born Theodore Burr, the Burr truss has been widely recognized as a major American contribution to the history of bridge engineering. Less appreciated and documented is the spread of this technology by and through builders other than Burr and his associates.

The Roberts Covered Bridge was completed a few miles south of Eaton, Ohio, in 1830 by Joseph Lyman Campbell, after Orlistus Roberts began it in 1829. It antedates any other timber bridge still standing in the state and is the only double-barreled, or dual “wagon-way,” bridge remaining in Ohio. It is, in fact, the oldest of this type in the entire nation. Few other bridges in the state represent the remarkable early-nineteenth-century craftsmanship required to combine a wooden truss with a wooden arch that characterized the Burr truss. Originating in the Hudson Valley in the early nineteenth century, the design was completed in western Ohio a quarter century later, a journey of between seven and eight hundred miles (1,100 to 1,300 km), depending on the route.

This presentation will examine Theodore Burr’s development of the truss that bears his name as a prelude to exploring the construction of the Roberts Bridge in Ohio in the 1820s. Surprisingly, neither Orlistus Roberts nor his apprentice, James Campbell, were trained as bridge builders, so they undoubtedly had assistance in creating what is today Ohio’s oldest covered bridge. Because clear documentation remains elusive, identifying the series of events that led to the construction of the Roberts Bridge requires some speculation. Nonetheless, it is possible to construct a reasonable scenario illustrating a sequence of builders and bridges that brought the Burr truss to Preble County in 1829. In the process, it sheds light on a little-known aspect of the diffusion of this important American bridge technology.

David A. Simmons is recently retired after a thirty-seven-year career with the Ohio Historical Society in the historic preservation and publications departments. His last position was as editor of TIMELINE, the society’s award-winning popular history journal. The recipient of two prizes for the best article in the SIA’s journal *IA,* he currently serves as president of the Ohio Historic Bridge Association.

Taking a Truss Census: Documenting the Historic Steel Truss Population in Oregon

Often, when the replacement of a steel truss is planned, the first facts reported are its statistical rarity relative to others truss bridges of that type. Depending on how much the reviewer knows about the variability within steel truss designs, this can simply mean reporting how many steel trusses exist on the National Bridge Inventory (NBI) for that state or region. Even when more detailed sorting by truss type is used, this information only tells part of the story. To make a strong argument about the loss of these bridges, it is also important to know how many were constructed in the past.

Fortunately, the Oregon Department of Transportation (ODOT) retains a variety of different records that can be used to count the numbers of iron and steel trusses around the state. Many of these records are far more in depth than the NBI, and can be used to identify the truss type, and, occasionally, the designer, fabricator, or builder. By compiling these records into a database, Oregon's current and former truss populations are revealed. Patterns in this data may provide information on regional variations in truss usage, the frequency of truss reuse, and the best locations for preservation.

The records available for this survey begin, chronologically, with the contract files of the Coast Bridge Company (CBC). The available reproduction of these files consists of two parts: a ledger of all CBC transactions from 1910 through 1916 and a set of fabrication or design drawings for all of the trusses constructed in Oregon through 1914. Of the more than 250 Oregon bridges documented in this record, less than a dozen are known to survive. The second set of records is the Oregon Highway Commission Biennial Reports through 1930, which list all bridge projects designed by the state bridge engineers. Perhaps the most statistically useful of ODOT's records are the bridge inspection reports of the 1950s and 1960s. Unlike more recent inspections, these detailed reports often include sketches of the bridges, and they reported information on the source of the bridge if the inspector knew this data. If time permits, more modern information will also be added to the database, including the 1980s Engineering Antiquities Inventory (EAI) and the mostly current historic bridge inventory completed in 2012.

The hope of this project is not only to provide important statistical information for Oregon's bridges, but also to raise awareness of the plight of iron and steel trusses nationwide. It is widely known within the bridge preservation community that these important representatives of our past are threatened, but there has yet to be a major public outcry. Perhaps this study will serve to inspire other states to examine their disappearing truss bridges, and maybe one day they will be as well protected as the beloved covered bridges.

Rebecca Burrow is a structural designer with the ODOT Bridge Preservation Crew, where she was co-author of the recently published *Oregon's Historic Bridge Field Guide*. Her educational background includes a Master of Arts degree in Conservation Studies (Historic Buildings) from the University of York, England, and bachelor's degrees in Engineering and History from Swarthmore College. Her current projects include producing a narrative-form book on Oregon's bridges, researching logging roads, and a wide variety of bridge preservation projects.

The Uncommon Design of Louisiana's Small Movable Bridges on the Bayou

Louisiana has one of the largest and most diverse collections of movable bridges of any state in the U.S. Its extensive network of inland waterways ranges from rivers and canals to smaller bayous used by local shrimping boats and other recreational watercraft. As a result, Louisiana's movable bridges vary widely in terms of design, length, and scale. The three major movable bridge types found in Louisiana and nationally include bascule, swing, and vertical lift. This presentation will examine a subset of relatively small movable bridges within these major types. Louisiana's collection of small movable bridges is considered uncommon nationally and includes important design variations utilized especially for smaller crossings.

The type of movable bridge chosen for a crossing depends on site conditions, available funds, and necessary navigational clearance, among other considerations. Louisiana's small movable bridges are generally less than 200 feet (61 m) in length and include the subtypes of cable-stayed swing, pontoon swing, and tower drive vertical lift with connected tower structure. The state's cable-stayed swing bridges are located primarily in Terrebonne Parish, in the southern part of the state near the Gulf Coast. These structures are manually operated with motor assist and may be some of the few remaining examples of their type in the country. The seemingly ad-hoc design of these bridges indicates that they may have been designed and constructed by locals or Parish personnel. Despite their vernacular appearance and small scale, these bridges were engineered to address navigation needs and remain distinctive examples of a movable bridge subtype.

Pontoon swing bridges are another unusual subtype found in Louisiana and consist of a floating barge that is swung open via a system of cables and winches. Although other pontoon bridges exist throughout the country, the relatively simple structures in Louisiana are of a smaller scale and operate differently than their counterparts in other states. Similar to the cable-stayed swing examples, elements of several pontoon swing bridges reflect an almost improvised design that likely originated with locals or Parish personnel.

The tower drive vertical lift with connected tower structure is also found in the southern parts of Louisiana and is an uncommon variation of a vertical lift bridge. Its adapted design situates the drive machinery on a structure between the support towers, enabling greater synchronization between the four sheaves. This results in a more efficient and smooth operation of the movable span in comparison to other vertical lift types.

Representative examples of these three subtypes will be presented, along with examinations of how they function and their component parts. The content of this presentation is based on a statewide historic bridge inventory of Louisiana highway bridges conducted by Mead & Hunt, Inc., in 2013. The study evaluated the National Register eligibility of approximately 70 movable highway bridges constructed prior to 1971, including the smaller examples mentioned above.

Timothy Smith is a historic preservation specialist at Mead & Hunt, Inc., an employee-owned consulting firm with experts in multiple fields, including planning, design, engineering, and architecture. He has more than 10 years of experience in documenting and evaluating a variety of historic buildings and structures, including bridges, and has participated in statewide historic bridge surveys in Nebraska, West Virginia, Minnesota, Texas, California, and Louisiana. He has also prepared various Section 106 compliance documents for historic bridges, including determinations of National Register eligibility and effect assessments. Timothy has a Master's degree in history from Colorado State University.

Carlton Vertical Lift Bridge, Bath, Maine

The Carlton Bridge crosses the Kennebec River between Bath and Woolwich and replaced earlier ferry service carrying rail, vehicular, and passenger traffic at this location. Completed in 1927, this vertical lift bridge still carries railroad traffic along the southern coast of Maine and carried a two-lane roadway on its upper deck until 2000, when a wider roadway bridge was completed alongside it. Although rail service is currently light along this corridor, the bridge remains in service and the lift span still operates. The span is normally left in the open position to allow ships to navigate the river, and then lowered as needed for passenger and freight trains.

Designed by Dr. J. A. L. Waddell, the Carlton Bridge is one of a handful of double-deck, shared roadway and railroad vertical lift bridges ever built. Dr. Waddell was a leader in the field of both long-span trusses and movable bridges, with particular expertise in vertical lift bridges originating from his early partnership with John Lyle Harrington. Through an ongoing chain of partnerships, Dr. Waddell's firm survives today under the name of Hardesty & Hanover, LLC.

This presentation describes the engineering challenges overcome by the construction of this bridge and the conditions that led to the selection of this site. The span can lift 125 feet (38 m) vertically to allow tall vessels to pass. The 141-foot-long (43 m) through-truss lift span incorporates unique skewed sheaves, which are well suited to the double-deck arrangement. The roadway alignment took advantage of the topography to diverge from rail lines near each shore of the river. The deep water construction also posed challenges overcome by engineering and construction expertise driven by the political will and vision of Senator Frank W. Carlton, a Woolwich resident. This paper will discuss the evolving needs of the area, as well as the continuing role of the bridge today.

William E. Nyman, P.E., is a Principal Associate with Hardesty & Hanover Consulting Engineers in New York. He received both Bachelor and Master of Science degrees in Civil Engineering from Case Western Reserve University, and he is a registered Professional Engineer in eight states. Mr. Nyman's thirty years of experience has encompassed all phases of bridge design and construction for both fixed and movable bridges. His experience has included the design of every major type of movable bridge, including single- and double-leaf bascules, rolling lifts, swing spans, and vertical lift spans. He is also experienced in the fields of bridge rehabilitation and historic preservation. Mr. Nyman has been a member of SIA for many years and has specific interest in historic movable bridges and the role of Dr. J. A. L. Waddell in vertical lift bridge design. He has presented similar topics at the Heavy Movable Bridges Symposium and at historic bridge conferences.

Making a Construction System Universal: Frank B. Gilbreth and the Company Town of Woodland, Maine

The St. Croix River defines the eastern-most edge of the United States. For much of its course, this river travels through remote, heavily forested land before discharging in the Bay of Fundy. In 1906, at the tail end of late-nineteenth-century growth in wood-pulp paper production, the St. Croix Paper Company formed with the purpose of building a mill at Sprague's Falls, several miles upstream from the towns of Calais, Maine, and St. Stephens, New Brunswick. The general construction firm of Frank B. Gilbreth was awarded the contract to build both the mill and the neighboring company town of "Woodland" (the name was later changed to Baileyville) in Maine.

Compared to other northern Maine company towns, Woodland exhibited a unique comprehensiveness. In 1899, the formation of the Great Northern Paper Company stimulated the hasty construction of residences and businesses by local builders in the town of Millinocket. Many of these buildings, however, were razed shortly thereafter due to frequent plant expansions and unsafe living conditions. In 1900, the prominent Beaux-Arts architect Cass Gilbert was commissioned to plan the town of Rumford. While the results were aesthetically beautiful, it took many years to complete the town. Unlike these contemporaneous examples, Gilbreth and plant engineer George F. Hardy collaborated to design and build the entire town of Woodland as an industrial machine in full coordination with the pulp mill. In less than eight months, the forested banks of the St. Croix were transformed into a factory town, complete with hydroelectric power, steam heat, and running water throughout.

This presentation—which expands on a portion of the presenter's dissertation research—focuses on Frank Gilbreth's efforts to further his credibility as a builder outstandingly capable of executing large complex projects faster than his competitors. But more than just demonstrating the efficiency of his workforce, Woodland proved his company's capacity to implement systemic approaches to construction anywhere his clients desired, and under the most severe conditions. In short, Woodland helped Gilbreth frame his system of construction as universally valid and effective during an era when access to infrastructure was unevenly distributed across the North American continent.

This presentation relies on archival material from the Frank and Lillian Gilbreth collections at the Purdue University Library, as well as historic postcard images produced by the Eastern Illustrating and Publishing Company (formerly of Belfast, Maine), courtesy of the Penobscot Marine Museum.

Johnathan Puff is a doctoral candidate in Architectural History and the Science, Technology and Society program at the University of Michigan, where he also received a Master of Architecture degree. His research focuses on the expertise of American architects in the early twentieth century, particularly with respect to life safety and fireproofing. He worked for several years at architecture firms across the country before returning to pursue a Ph.D.

American Eagle: New Findings Involving the Industrial Production Methods of John Haley Bellamy, Shipcarver, Kittery, Maine

Hailing from the shipbuilding community of Kittery, Maine, today John Haley Bellamy (1836–1914) enjoys a reputation as one of America's most versatile and forward-thinking maritime shipcarvers. Creator of the celebrated USS *Lancaster* eagle figurehead (presently residing at the Mariner's Museum, Newport News, Virginia) and inventor of the iconic "Bellamy eagle," Bellamy is widely regarded by art historians, museum curators, and the general public to have been an itinerant folk carver, crafting his famous two-foot-long (60 cm) eagle plaques primarily for barter and personal amusement. Given the wide acceptance of this supposition, the popular impression is that Bellamy's eagle plaques are unique, one-of-a-kind, hand-carved creations that usually took him a day or more to complete. However, new findings discovered by the presenter challenge this time-held belief.

Findings culled from the personal correspondences and business records of John Haley Bellamy, the testimony of firsthand observers who witnessed him at work, nineteenth-century newspaper articles featuring Bellamy and his studio's output, historic photographs, and detailed examination of both his carved eagles and his still-extant studio, reveal Bellamy to have in fact employed assembly-line production methods within his studio. These production methods involved the use of apprentices, patterns, and mechanical scroll saws and appear to have been derived from experiences gained between the years of 1866 and 1872, when he served as the designer for Titcomb and Bellamy, manufacturers of emblematic frames and brackets.

By overseeing the design and production of Titcomb and Bellamy's Masonic-themed frames, clock cases, and what-not shelves within their Charlestown, Massachusetts, studio, Bellamy gained the practical knowledge necessary to establish a profitable manufacturing business dedicated to producing abstract, representational carvings of the American eagle. These carvings derived from the artistic forms he found in U.S. naval sternboard designs, as well as the expertise needed to successfully market them for consumption by the general public. Relocating to his hometown of Kittery, Maine, in 1872, Bellamy filled large orders for his eagle carvings numbering several hundred at a time and shipping them from his studio (which he repeatedly referred to as "a snug little factory") to markets in nearby Portsmouth and beyond, ranging possibly as far afield as Argentina.

Conclusions drawn from these findings are that John Haley Bellamy was an industrious maker of mass-produced nautical-themed eagle carvings, rather than the popular vision of him having been a stereotypical nineteenth-century folk carver. By employing an established network for distribution of his eagle carvings within the Portsmouth, New Hampshire, seacoast region and beyond, and through both the advantageous geographical disposition of his studio and the prevalence of a tourism-based industry in the Kittery-Portsmouth area, Bellamy was able to market his wares to a wide, diverse audience for roughly three decades. As a result, he derived a solid, predictable income while engaged in a thoroughly sedentary industrial pursuit.

James A. Craig is an author and independent curator specializing in American marine art. After receiving a Bachelor of Arts degree in Anthropology from the University of Massachusetts, Boston, in 1996, he was first employed at the House of the Seven Gables Museum in nearby Salem, Massachusetts, where he served as a curatorial assistant and museum educator. He went on to serve as Associate Curator for Collections at the Cape Ann Museum in Gloucester, Massachusetts, where he published an award-winning biography on the great American marine painter Fitz Henry Lane.

Besides *Fitz H. Lane: An Artist's Voyage through Nineteenth-Century America* (The History Press, 2006), he has published *100 Essex Road: an American Treasure* (2008) and *Frank Vining Smith: Maritime Painting in the 20th Century* (Hard Press Editions, 2010). In 2011 he contributed to the Portsmouth Historical Society's *Maritime Portsmouth: The Sawtelle Collection,* and he is poised to publish *American Eagle: The Bold Art and Brash Life of John Haley Bellamy* in April 2014.

Assessing How Environmental Concerns Impact an Industrial Heritage Landscape

Torch Lake, located in the Keweenaw Peninsula of Michigan, was a site for copper milling, smelting, and reclamation from the 1880s until 1968. Two main companies were present throughout the years, Calumet & Hecla and Quincy, which had building facilities for stamping, smelting, and reclamation. This industry contaminated the lake and surrounding land with copper, arsenic, polychlorinated biphenyls (PCBs), and other toxins that affect the ecosystem and are detrimental to human health. The U.S. Environmental Protection Agency (EPA) and Michigan Department of Environmental Quality (DEQ) have declared the Torch Lake area to be both a Superfund site and an Area of Concern, while the landscape and standing structures are also a part of the Keweenaw National Historic Park. These organizations have different goals, causing tension between the local community and governmental agencies. This presentation reports on research focusing on the interactions between the federal, state, and local groups involved with the land around Torch Lake and an assessment of different stakeholder views during presentations funded by a Michigan Sea Grant project on lake contamination and heritage issues. Using archival records and maps to try and locate possible sources of pollution, a fairly detailed map of the landscape during the industrial period was created. Interviews with former employees also give a sense of what the companies were doing with waste products and where possible dumping grounds may have been. Finally, conducting interviews with selected individual stakeholders can help construct a sense of place that incorporates mining heritage while addressing concerns about toxic contamination. There is a need not only to find the locations of pollutants and address their harmful effects, but also to keep local heritage intact for remaining and future populations. Understanding how local residents see their own landscape and taking into account their visions for change, can help put together a plan for remediation and begin to clean up the landscape in a more respectful way that balances environmental needs with cultural heritage issues.

Emma Schwaiger is a Master's degree candidate in the Industrial Archaeology program at Michigan Technological University. She graduated in the spring of 2012 with a Bachelor of Arts degree in History from MTU. Originally from Manistee, Michigan, she enjoys outdoor activities and has always been interested in the environment and how industry has changed the landscape. Her thesis focuses on how the Calumet & Hecla Mining Company used electricity to transform the Torch Lake waterfront and to excel in reclamation activities. Her prospective graduation date is in the spring of 2014 and she currently plans to continue her education by pursuing a Ph.D. from MTU.

Reconstructing Historical Chemical Releases Using Industrial Archaeology

Reconstructing past chemical releases—when they occurred and by whom they were caused—is a well-established, multifaceted central element in the field of environmental forensics. Narrowly defined, "environmental forensics" combines analytical and environmental chemistry to be used in the courtroom context; however, the broad definition of environmental forensics includes evaluation of all available information, including the historical record. Such reconstruction is important to understanding the timing of a release and whether one or multiple releases occurred, for apportionment and allocation of costs for remediation of environmental harm, and as an important element in insurance coverage disputes at contaminated sites. Historical reconstruction involves a thorough review of written records, operational histories, and chemical processes, as well as the application of advanced chemical forensics involving the identification of chemical sources, environmental quantities and compositions (i.e., chemical fingerprints), and degradation or weathering patterns.

Chemical releases are reconstructed using a variety of historical information, such as photos (oblique and aerial), maps, drawings and plans, patents, product labels, permits, facility records and documents, media reports, and the testimony of personnel formerly or currently employed at the facility in question and/or other eyewitnesses. The information obtained from these sources is then evaluated in the context of the chemicals present, the nature of past releases, and the historical processes at the site.

The focus of this presentation is on the combined use of industrial archaeological records and chemical evidence to reconstruct past chemical releases. The presenters will discuss a case study that illustrates how historical information regarding operations, processes, and waste streams can be linked with observed chemical fingerprints. The case study involved the allocation of remediation costs for sediments contaminated with polychlorinated biphenyls (PCBs) at a former shipbuilding site. One of the key questions was whether substantial amounts of PCBs were released from the site to sediments in an adjacent waterway during World War II-era shipbuilding activities. Patent records, early scientific literature, U.S. Navy communications, and historical facility records and plans provided evidence on the use of PCBs in shipbuilding for various applications, mainly for enhancing the fire resistance of cables, insulation, etc. Additionally, these documents provided information on pathways linking the potential PCB sources to contaminated sediments. The results of this investigation assisted the parties in reaching an equitable settlement of remediation cost contributions.

Dr. Jaana M. H. Pietari is a Managing Scientist in Exponent's Environmental Sciences practice. Dr. Pietari's expertise is in the fate, transport, and analytical chemistry of chlorinated compounds and other legacy contaminants. She focuses on environmental forensic evaluations of contaminant sources to soils, sediments, and groundwater, and on providing technical support for remediation of chlorinated solvents from soil and groundwater. In addition to environmental consulting experience, Dr. Pietari has more than 10 years of experience conducting environmental engineering and science research in academic and regulatory settings.

Taryn Sparacio is a Managing Scientist in Exponent's Environmental Sciences practice. She has 13 years of experience investigating and analyzing the historical, physical, regulatory, and financial aspects of contaminated sites. Her work at Exponent is focused primarily on environmental forensics, which involves determining the origin, transport, and fate of chemicals in soils, groundwater, surface water, sediments, and air, in support of the allocation of environmental harm in litigation and insurance matters. Ms. Sparacio is a Licensed Geologist in the State of Washington and a Registered Geologist in Oregon.

Dr. Walter Shields is the Director of Exponent's Environmental and Earth Sciences practice. A Certified Professional Soil Scientist, he specializes in the study of transport and geochemical fate of toxic pollutants and their environmental effects. He investigates the industrial archeology of sites to understand the history of contaminant sources in a given area. Dr. Shields serves as an expert witness in environmental forensics and has testified on the origin, transport, and fate of chemicals in air, soils, sediments, surface water, groundwater, and biota, and exposure of humans and ecological receptors to those chemicals.

The Westinghouse Atom Smasher: Atomic Heritage and the Legacy of the Westinghouse Research Laboratories, Forest Hills, Pennsylvania

The Westinghouse atom smasher, located in Forest Hills, Pennsylvania, was an important milestone in the progress of nuclear research. The rusting, giant, lightbulb-shaped structure is the remains of a five-million-volt van de Graaff generator constructed by Westinghouse Electric Company in 1937. It was the first and largest such generator constructed in the United States for industrial purposes, built as a centerpiece of Westinghouse's early industrial research program in nuclear physics. This type of generator allowed resulting nuclear reactions to be measured very precisely, an advantage over other types of particle accelerators during that period. It was here that scientists discovered photo-fission of uranium in 1940, and other research at this site led to the design and construction of the first pressurized water reactor, which powered the U.S. Navy fleet and advanced the use of nuclear energy for electrical power generation.

The atom smasher was just one part of the 11-acre (4.5-hectare) Westinghouse Research Laboratories, which, beginning in 1914, grew and developed over the next several decades. Ongoing research was conducted here in many related fields, including nuclear physics, magnetic and solid-state physics, metallurgy, chemistry, and others, resulting in a multitude of patents and inventions. Around 1950, the complex employed 192 scientists, with a total workforce of about 450. In addition, the company developed the "Westinghouse Plan" of homes in the adjacent neighborhood and contributed to the community in various other ways.

By the 1960s, the site began a long decline after Westinghouse Research & Development was relocated to nearby Churchill, Pennsylvania. Over time, most of the research buildings were removed from the complex, while the atom smasher has been left standing since the 1960s. The property is now under new ownership, and change is imminent. The atom smasher, one of the few such structures still standing in the U.S., might be dismantled for scrap metal or might find new life through reuse for educational or other purposes.

This presentation, based on archival research and preliminary reconnaissance, will discuss the history and development of the Westinghouse Research Laboratories in Forest Hills, highlighting the industrial history of the atom smasher itself and exploring its wider context, as part of the Westinghouse legacy, as an atomic heritage site, and as an important local heritage resource.

Marni Blake Walter is a native of the Westinghouse Plan in Forest Hills. She is a consulting archaeologist (RPA) based in the northeastern U.S. and has worked on a variety of cultural resources management (CRM) projects in New England. She holds a Master of Arts degree and Ph.D. from Boston University in archaeology, specializing in heritage management. Her dissertation focused on the United Nations Educational, Scientific, and Cultural Organization (UNESCO) World Heritage Convention and the conflicts between international and local demands placed on archaeological World Heritage sites. Marni earned a Bachelor of Arts degree in professional writing from Carnegie Mellon University, and has served as the editor of the *American Journal of Archaeology* and Journal Fellow of the *Journal of Field Archaeology*. Her research interests include historical archaeology and heritage management in New England and Pennsylvania, public archaeology and outreach, and the Westinghouse atom smasher—including its potential use for future generations.

Evolution of the Understanding of Caisson Disease

A caisson in its simplest form a heavy box that is open at the bottom, with a lid on top and increased air pressure within. It is used to work in areas where water would intrude more rapidly that it could be pumped out. By increasing the air pressure within the box, the entry of water into the open bottom of the box is halted, providing a working space within the box. The basic concept dates to Denis Papin in 1691. Thomas Cochrane applied for a patent on the idea in 1830. Jacques Triger, a civil engineer, utilized a caisson in a coal mining application in 1839. Caissons were used in Great Britain, Germany, Hungary, and Egypt in the 1850s and by 1854 in the United States. In the 1870s, caissons were used for construction of both the Eads Bridge and the Brooklyn Bridge. The Eads and Brooklyn Bridges required massive foundations that expanded the use of the caisson and presented new challenges to its utilization.

From its initial use, the increased air pressure of a caisson's working chamber was known to have effects on men working in the elevated pressure environment. Understanding of the mechanism for these effects developed over time. In 1841, Triger presented several observations related to working in a three-atmosphere pressure environment:

1. Everyone talks through his nose, which becomes increasingly noticeable with increased pressure.
2. One miner who was deaf heard more distinctly that other miners in compressed air.
3. Miners climbed steps better in compressed air.
4. Two miners developed joint pain.

B. Pol and T. J. J. Watelle were physicians who used notes from 1845 to write in 1854 about symptoms experienced by sixty-four miners employed by a mining company where Pol had served as company surgeon. Of the group, fourteen had slight symptoms, sixteen had more or less severe symptoms, and two people died.

As the use of caissons in bridge-building and other projects grew, so did morbidity and mortality among workers. Workers employed on both the Eads and Brooklyn Bridge projects sustained significant morbidity and mortality. Both projects employed a physician to address the health concerns of the workers. Alphonse Jaminet, the physician employed on the Eads Bridge project, and Andrew Smith, the physician employed on the Brooklyn Bridge project, used a variety of approaches to minimize the effects of the elevated pressure working environment on the workmen, to varying degrees of efficacy. Both physicians subsequently published reports of their experiences. The bridge builders, along with other workers, suffered from caisson disease, which results from nitrogen leaving solution as the individual moves from an area of higher atmospheric pressure to one of lower pressure. Over time, understanding of the disease improved and both prevention and treatment became more successful.

In subsequent years, there were several suggestions that returning workers who were suffering from caisson disease to an elevated pressure environment would be therapeutic. Leonard Corning, a physician involved in the care of men working on the Hudson River Tunnels, was able to confirm this in his report of 1890. This presentation will include an overview of caisson history and construction, as well as the resultant caisson disease that afflicted workers.

William McNiece, M.D., is a pediatric anesthesiologist with an interest in industrial development and history. His undergraduate degrees are in mathematics and electrical engineering. He is a member and former board member of the SIA, currently serves on a number of professional and not-for-profit boards, and is an avocational tuba player.

Maine Tide Mills: Surface Exploration of Early Coastal Industrial Sites

Though much has been written about European tide mills, those in America have been almost ignored until recently by industrial historians. Efforts over the last decade and a half have documented over 200 Maine tide mill sites from Kittery to Lubec. Field study of nearly a hundred of these has indicated no mill buildings remain, but remnants of construction details reveal a consistent response to varying topography, despite localized and interesting variations. Illustrations of variant details of dams, gates, sluiceways, and wheels are presented.

Well into the nineteenth century, Maine's salt-water mills powered extensive industrial activity. Early millwrights familiar with European tide mill technology applied it to the region's favorable topography and tides. What developed over 400 years was an unparalleled pre-steam milling landscape.

Early communities needed grist mills for the production of foodstuffs, but it was coastal timber and logs from inland forests floated down rivers to waiting tide mills that led to Maine's eastward population expansion after the 1750s. Clusters of these mills on convenient coves, such as the more than fifty that were grouped between Portland and Wiscasset, made mid-coast Maine a center of early tide-powered industrial activity. Finished lumber carried easily by sea beyond the region connected Maine to a growing nation's wider commercial environment. Well over 20,000 individuals had relationships with tide mills, as investors, millers, laborers, and customers. Communities that grew up around these mills exhibited similar patterns of production and commerce. Few business records remain of tide mill operations, but those that do give detailed, though limited, insight into business aspects of that activity.

Tide mills differ from fresh water mills only in the way that water is managed to drive the wheels and in their dependency on the rotating cycle of the tides, high tide each day being about fifty minutes later than the day before. Machinery inside the mills is the same for both. Most European mills, tidal and otherwise, were built of stone; Maine's were fabricated from wood. All that is left today for study by archaeologists are remnants of stone dam foundations or wooden posts still standing in the mud. A wooden tub wheel awaits archaeological study; a recent exciting archaeological effort uncovered an iron turbine. Further study along the coast may reveal other such devices.

Bud Warren is a retired teacher, free-lance maritime historian and popular lecturer who has been studying Maine's tide mills for over 15 years, documenting over 200 of them. After graduating from Yale University in 1956, he participated in archaeological digs at the 1640s Phipps site in Woolwich and for 10 years at Popham, the first English settlement in New England (1607-1608). He has guided coastal tours for Smithsonian Associates and the National Trust for Historic Preservation, and is a regular Elderhostel/Road Scholar leader for on a Maine windjammer. A co-founder of the Tide Mill Institute, he now edits its newsletter, *Tide Mill Times*.

Ten Mills – Like a Penny: Tidal Workings at Winnegance

The history and what is known about the development and early evolution of Winnegance, Maine, makes it one of the most unique geographies and industrial sites in New England. Here, a tidal creek adjacent to the Kennebec River, a major Maine waterway, evolved over a span of three centuries, from circa 1607 to circa 1907. What started out as a heavily forested Native American and French canoeing waterway evolved into a mostly deforested colonial and Early American English landscape that supported Maine's largest tide mill complex. After the late eighteenth century, between ten and twelve adjacent tidal water-powered saw and planning mills were built on two wooden and island-anchored dams in Winnegance, in what is now part of the city of Bath and town of Phippsburg.

This presentation will provide an overview of the unique tide-milling community of Winnegance that built and operated water-powered tide mills. Leading industrialists and entrepreneurs cut forests of virgin Maine pine timber upstream, and rafted and floated timbers down the Kennebec from inland Maine to await processing in the Bath area's "Slabtown." Here great logs were sliced into boards, planks, and timbers to feed nearby Bath as a shipbuilding city, and to produce merchantable timber for maritime trade export. Surpluses of high quality (and relatively low cost) tide-milled timber in Winnegance also permitted the area to attract leading housewrights and builders who built fine houses, churches, blacksmith shops, cemeteries, and schools near the mills – adding to the infrastructure of a new urban community.

This study looks at history, geography, industry, and family relations to paint a vivid picture of tide-milling as it was practiced on the Maine coast centuries ago. The unique characteristics associated with Winnegance and its water-powered tide mills produced an abundance of local resources, local pride and a can-do attitude in its citizens, as well as wealth achievement and advancement – and a lifestyle tied to the tides.

John Goff is an architectural historian, historian, restoration architect, and preservation planner. He grew up near the old Winnegance tide mill sites, in a former tide mill owner's residence in Bath, and near Phippsburg, Maine. He graduated from Brown University in 1979, co-founded the Tide Mill Institute, and has also researched and helped to restore historic tide mills and tide-mill-related structures in Quincy and Dorchester, Massachusetts, and in Bath, Maine. First publisher of the *Tide Mill Times,* Goff has presented on tide mills and tide mill history to the SIA and in London, England, at the first international tide mill symposium. Goff also writes columns and articles for the *Salem Gazette* and *Old Mill News,* published by the Society for the Preservation of Old Mills (SPOOM).

Archaeology at the Perkins Tide Mill, Kennebunkport, Maine

From the seventeenth century into the twentieth, over 200 tide-powered grist and saw mills operated on the coast of Maine. The Perkins Grist Mill was located on a small tributary to the Kennebunk River in Kennebunkport, Maine. A saw mill was first built on the stream in the early 1680s, but was destroyed within a few years. A grist mill was then built in the mid-eighteenth century and continued to operate until the late 1930s. In its early years, the mill ground locally grown grain; later, corn was brought to the mill by rail. The mill was converted to a restaurant in 1940, and the restaurant remained in operation for over 50 years. In 1994, the structure was destroyed by fire, the victim of arson. Today, the Kennebunkport Conservation Trust, the site's current owner, hopes to reconstruct a working tide mill, using the original dam. To that end, the Conservation Trust sponsored an archaeological study to uncover remnants of the Perkins Grist Mill's structural underpinnings and machinery.

Excavations in 2011 focused on remnants lying in the stream bottom. Among the finds were numerous *in situ* structural timbers from the mill's foundations and the wooden sluice floor. No written or graphic documents have been found to indicate what kind of water wheel originally powered the mill. Archaeological evidence hints that it originally was powered by a vertical undershot wheel.

The original water wheel was replaced by an iron turbine in the second half of the nineteenth century. Many broken remnants of the turbine were uncovered during excavations, providing a more detailed portrait of the mill's power train during the final decades of its operating life. These included the base ring, lower bearing, supports for the casing, fins from the runner, and the wooden water-control gate. The turbine's size and complexity show that it was manufactured in a well-equipped foundry, probably one that specialized in the manufacture of such large machinery. Analysis of the parts have made it possible to reverse-engineer this Jonval-type turbine in some detail. Through the combination of historical records, photographs, Historic American Building Survey (HABS) records, and surviving features and artifacts, it is possible to understand much of the mechanical function of the mill, as well as its economic role evolved over time.

Peter Morrison is a partner in Crane & Morrison Archaeology, an independent archaeological and historic preservation consulting firm in Freeport, Maine. He earned a Master's of Arts degree in History through the University of Maine's Historical Archaeology program in 2002. From 1997 to 2005, Peter served as an instructor at the Maine State Museum's archaeological field school at the site of the 1607-1608 Popham Colony in Phippsburg, Maine. Study of the architectural evidence from that site became the basis for his master's thesis. His professional interests include historical fortification, early Acadian settlement, vernacular architecture, agricultural history, and historical landscapes. His recent projects concerning the history and archaeology of industry include study of the Cumberland and Oxford Canal, in Westbrook, Maine, and study of the early infrastructure of the Bar Harbor Water Company, in Acadia National Park, Bar Harbor, Maine.

See the City by Streetcar: Digital Mapping and Survey of Atlanta's Historic Street Railway Systems

Popularly known as the trolley, or more formally referred to as the street railroad or railway, the streetcar transformed Atlanta's geography over the course of the late nineteenth and early twentieth centuries. The transportation system opened up new economic opportunities for the city's residents, bringing in-town workers home to the suburbs and then back the next morning to work. Businesses, neighborhoods, and schools were tied to the streetcar, which provided transit to places people needed or wanted to go. The streetcars also changed social relations as they brought white and black riders into close contact within the Jim Crow South. While the trackless trolley and automobile would bring an end to their use after World War II, funeral parties were held on final runs honoring "the last trolley ride," which testified to their hold on the public.

In many cases, the historic resources associated with Atlanta's streetcar system, such as track, barns, bridges, culverts, street configurations, and landscape features have been preserved in place, sometimes in plain view or (more often) covered by paving. However, they are typically not identified as historic or even streetcar-related resources, thus making them one of the least recognized and studied types of linear resources in terms of their historic significance. These streetcar features can exist individually, or more likely, as groups of resources. Although the geography of the streetcar can be obscured by the progress of time, clues remain in the buildings, landscape, and streetscape.

In 2012, the Georgia Department of Transportation (GDOT) and the Federal Highways Administration (FHWA) contracted with New South Associates to develop a context study of Metro Atlanta's historic streetcar systems. This context study would help identify above- and below-ground resources associated with the streetcar era and provide a strong basis for evaluation of their eligibility to the National Register of Historic Places. This presentation will provide an overview of New South's work, of which key elements included the research and mapping of all streetcar routes that operated in Atlanta between 1871 and 1949 using Geographic Information Systems (GIS), as well as the field survey of identified historic resources associated with those systems.

Patrick Sullivan is a historian and architectural historian with New South Associates in Stone Mountain, Georgia. He received his Master of Arts degree in Heritage Preservation from Georgia State University in 2007. Over the course of his almost eight-year career at New South Associates, Mr. Sullivan has worked on a number of architectural and historic resource surveys throughout the eastern United States for clients that include the Centers for Disease Control and Prevention, the General Services Administration, the Georgia Department of Transportation, and the National Park Service, among others.

From Points to Prints: Expanding the Role of Digital Documentation in the Preservation of Industrial Heritage

For the first time in history, anyone with a smart phone or digital camera has the capability to capture images of an object, upload those images to a three-dimensional (3D) printing service provider, and receive a full-color, three-dimensional model of the object the following day. The instrumentation and computing power making this possible is exciting, but for industrial heritage professionals the results can also be profound. Data collected by digital photography and 3D capture now makes it possible to document an industrial site and allow visitors the freedom to experience the site in immersive contexts and through augmented (AR) and virtual (VR) applications running on mobile technologies. Industrial archaeologists with a strong interest in the preservation, interpretation, and documentation of the industrial past are in a position to assist in the development of new collaborative efforts. These efforts will guide heritage professionals and other stakeholders, amateurs, and enthusiasts, to develop skills in photogrammetry, table-top laser scanning, and ethnography and to produce and publish archival information compatible with traditional means of archaeological research and publication. As heritage organizations make decisions on how they will attract new visitors and revenue to their sites, there is a timely need to understand and consider the benefits that digital technologies can provide when allocating funds for conservation and promotion.

This presentation offers a holistic approach to the conservation of industrial heritage, which considers all structures, machinery, photographs, texts, and the like as "assets" that can contribute to a comprehensive preservation plan of documentation, interpretation, and publication. This strategy argues that by considering all assets in the context of data, and by making that data available to heritage professionals, stakeholders, and associated interest groups to use and determine meaning, the collection of data can be used to generate interest and revenue that contributes toward the data-collection mission. The presentation will demystify the differences in photogrammetry and laser scanning as they apply to the documentation of industrial sites and artifacts, identify the skills necessary to operate the instruments and software, and introduce the concept of creating a "brand" or common theme or philosophy in which every input is optimized to support the brand, making the heritage site relevant to the current generation of consumers. The presentation will conclude by providing resources for acquiring proficiency and skills necessary to apply appropriate digital documentation techniques that are currently available to heritage managers.

The holistic approach to the preservation of industrial heritage given in this presentation will offer heritage professionals, stakeholders, and hobbyists a pathway to develop data collection skills. These skills can contribute to the archival record and the preservation and profitability of small, medium, or large industrial heritage sites at a local, regional, or national level.

Mark Dice has over 35 years of experience in video media production and is completing a Master of Science degree in Industrial History and Archaeology at Michigan Technical University in Houghton, Michigan. He earned a Bachelor of Music Education from Kansas State Teachers College in Emporia, Kansas, and launched a video production company in 1976. In 1982, Mark designed and built the first portable multi-camera production system for projecting live concerts and has participated in over 400 live events. Mark presented a paper titled "Designing the LIDAR Mission for Industrial Heritage: Cooperation Across the Fields" at the SIA conference in 2012 and again at the Digital Documentation Summit hosted by the National Center for Preservation Technology and Training in San Francisco, also in 2012. Upon completing his thesis, Mark will continue researching ways to engage engineering and heritage professionals in designing comprehensive documentation and preservation experiences to positively influence visitor appreciation of heritage sites.

Working Model: Building Information Modeling the U.S. Customs House in Eagle, Alaska

The rapid adoption of Building Information Modeling (BIM) software by the architecture, engineering, and construction professions in recent years attests to its utility as a tool for the design of new buildings, but its potential applicability extends beyond this intended purpose. BIM can also be used in exploring and recording existing buildings, and was successfully used in recent work for the National Park Service (NPS) involving the documentation of the historic Customs House in Eagle, Alaska. Furthermore, BIM holds great promise for the investigation, documentation, and interpretation of industrial heritage, as many elements of industrial buildings and structures are directly visible and accessible for digital emulation.

At the turn of the last century, Eagle, Alaska, was the transportation, trade, and communication center of the Yukon, serving the thousands of gold seekers prospecting the region. The Customs House, built in 1900 as non-commissioned officer (NCO) housing at nearby Fort Egbert, was moved to the waterfront of Eagle in 1915 and served as the port of entry for miners coming into Alaska's interior on the Yukon River. Today, the Customs House is owned by the City of Eagle and managed as an historical museum, and it is the only remaining Klondike Gold Rush-era building on Eagle's historic waterfront. It was lifted from its foundations and seriously damaged by the ice jams and severe flooding on the upper Yukon River in late spring 2009. Following emergency stabilization, the first step in its relocation and repair was thorough documentation of existing conditions, a task completed with two site visits and five weeks at the NPS Alaska Regional Office in Anchorage, creating a digital model and printed two-dimensional (2D) output with BIM.

Unlike 2D computer-aided design (CAD), in which a user describes a three-dimensional (3D) object with multiple independent 2D drawings, with BIM the user directly constructs a single coherent 3D model. The model is then used to produce any number of scaled 2D projections, such as the familiar plans, sections, and elevations of traditional architectural documentation, as well as isometric or perspective views. Furthermore, the model is readily employed in the creation of interpretive information, including simple fly-by animations, time-based formal accretion studies, and virtual dissections to demonstrate material class or function. Unlike other digital recording technologies, BIM requires the continuously engaged participation of knowledgeable recorders, and promotes the active exploration of heritage resources.

John D. Arnold holds a Bachelor of Science degree in Biology and a Master of Architecture degree from the University of Oregon, and he is a licensed architect who has worked in several small firms in California, Washington, and Oregon for nearly a decade. He recently completed his Master of Science degree in Historic Preservation, also at the University of Oregon, with his Terminal Project, *Exploring the Utility of BIM in Buildings Archaeology: A Case Study at the Historic Briggs House, Springfield, Oregon*. John is currently a Ph.D. student in Industrial Heritage and Archaeology at Michigan Technological University in Houghton, Michigan.

The Robinson Oil Works: Preservation in Documentation

The William A. Robinson Oil Works of New Bedford, Massachusetts, opened as a sperm oil refinery under Captain Edward Merrill during the peak years of whaling in 1838. It closed as a much larger refinery of sperm, whale, and fish oils in 1927. Partially demolished for a later fish processing plant, the entire site was slated for a hotel development in 2010. Refineries like Robinson were an essential part of American whaling because most whale oils had to be refined before they could be used in the market. Today, however, the industry is little known and of the 60 to 80 refineries once in operation, only seven refinery structures have been identified. Among these, Robinson had the greatest potential for evidence of the industry.

With development imminent, the author received an SIA Industrial Heritage Preservation Grant to support Historic American Engineering Record (HAER) documentation of the site. This documentation led to a request from the New Bedford National Whaling Historical Park for a Historic Structure Report. The result was a 350-page report, including forty-eight drawings. The report is the first in-depth study of an American whale oil refinery, and it preserves the Robinson site through photographs and drawings and provides material that will help interpret and preserve other refinery sites. This paper will present the results of the documentation and the Historic Structure Report.

While attention focused on the prominent "candle house," ten additional structures, comprising the whole refinery and subsequent fish plant, were finally documented. Four were partially intact (later demolished), others represented only by foundations or photographs. These include:

- 1838 Oil Shed (partially intact)
- 1838-1850 Bleach House
- 1850 Icehouse
- 1850-1854 Try House and Sheds
- 1869 Oil Shed (partially intact); additions to ice, bleach, and candle houses (partially intact)
- 1869-1873 Boiler House
- 1944 Fish Processing Plant (intact)

Though considered "a ruin," the 1838 candle house (later gutted) offered a wealth of information. Evidence included the floor opening and press post section for the hydraulic "slack" press, floor opening, piston, piston collar, and foundation for the "taught" press, and the foundation, hearth, hearth platform, and stairs for the kettles.

In addition, interior photos of Robinson were identified in a U.S. Fish Commission pamphlet from 1901, at the New Bedford Whaling Museum from 1927, and in the 1922 film *Down to the Sea in Ships*. Combined, the first two sets document the sperm oil refining process. The third shows an area used for refining whale oil. With one exception, these are the only known interior photographs of a nineteenth-century whale oil refinery.

Taken together, the above documentation allowed for a general reconstruction of this typical whale oil refinery and its evolution as it was adapted to changing technology and products from 1838 to 1927. In particular, site documentation and period photographs provided a basis for reconstructing most of the candle house – an essential part of a nineteenth-century refinery and in which sperm oil and spermaceti were refined – including its three main features, the slack press, taught press, and kettles.

Mark Foster is a museum exhibit designer, researcher, author, and illustrator with a background in history, architecture, and the arts. He became interested in the whale oil refining industry twenty years ago while conducting research on a brush and bellows factory at Nantucket. In 2010 he received a Sarah R. Delano Preservation Award from New Bedford's Waterfront Historic Area League (WHALe) for his documentation of the Robinson site. Material from the HAER study has contributed to his lectures on refining, to the interpretation of the Hadwen & Barney Candle Factory (Whaling Museum) at Nantucket and will likely be included in an upcoming exhibit on New Bedford's industrial history at the city's Whaling Museum.

A Material Culture Study of the Upper Peninsula Firefighters Museum

The Upper Peninsula Firefighters Memorial Museum in Calumet, Michigan, serves as both a reminder of the progression of firefighting technology since the mid-nineteenth century, and as a stark reminder of a company town abruptly let go in the 1960s. Currently operated by the Upper Peninsula Firefighters Association, the museum collects artifacts and ephemera from the early days of firefighting in the Western Upper Peninsula, up through the 1990s, when the museum first opened. The museum helps tell the story of the region's copper mining past, and also of how the community came together to provide with basic services when the mines, and the money that fueled the towns, left. The village of Calumet is the primary focus – once home to Calumet & Hecla, the most successful company of the region. Calumet & Hecla was sold to Universal Oil Products in 1967, which shut down the Calumet Mines in 1969 following a nine-month strike.

This presentation will proceed from the beginnings of the firefighting industry on Michigan's Keweenaw Peninsula, through the 1960s, when the mines pulled out, and the municipalities were forced for the first time to not only supply their own firefighters and equipment, but also transfer entire water supplies and sewage lines from the once powerful companies to the hands of the shrinking villages. These changes dramatically changed the way that the communities functioned, as the small communities were forced to supply their residents with services for the first time in their century-long existence, while also dealing with a decreasing tax base. Fire, medical, and other emergency services were not the only changes facing the communities; they also had to (for the first time) supply their own water, waste disposal, and even heat – a necessity in the far north of Michigan. Where people were once employed as full-time firefighters for the mining companies, the community began to rely on volunteers; when the mines closed, everything was affected, and everyone had to adapt.

Brendan Pelto is a student of Industrial Archaeology at Michigan Technological University. He has a Bachelor of Arts in History and a Bachelor of Science in Anthropology from MTU. Prior to studying archaeology and history, he owned and operated the historic Harbor Theater in Muskegon, Michigan. He lives in Houghton with his wife Jen, his 4-year-old son, Cable, and his 2-year-old daughter, Moxie.

Operational and Cultural Change among Blacksmiths of the Industrial Era: A Case Study of the Quincy Machine and Blacksmith Shop, Hancock, Michigan

Research in archaeology and other social science fields have been focused on the artisanal craft of blacksmithing, including an extensive ethnography undertaken by Charles M. Keller and Janet Dixon Keller on the development of principled and procedural knowledge among the modern artist-blacksmith community engaged in traditional practice. This research entails foundational knowledge gained through the transmission of practice from an experienced blacksmith, as well as engaging in the creative process of producing and shaping materials. In contrast, this presentation sets out to explore the community of blacksmiths, and the creative process associated with it, in an industrial context during the late nineteenth and early twentieth centuries. It was during this time that capitalist principles, company organization, mechanization, and interchangeability had a considerable effect on the practices of the former and the manifestation of the latter.

The Quincy Mining Company blacksmith shop in Hancock, Michigan, documented by the Historic American Engineering Record (HAER), is used as a case study to demonstrate that the operational and cultural changes among the community of blacksmiths in the industrial era can be seen in the physical space in which the blacksmith is working. The primary activity areas of the Quincy Mining Company blacksmith shop are marked in the HAER documentation and are contrasted with other plan view drawings of more traditional blacksmith shops to emphasize the major differences. Sources such as technical school textbooks, *Mine and Quarry* articles, advertisements, and diary entries concerned with industrial and machine blacksmithing technology and practice were also utilized to further elucidate the evolving nature of blacksmithing and the increasingly mechanized landscape in which they were situated. The physical space and documentary record all serve to demonstrate that this community of practitioners was altered by outside concerns, that the opportunity for creativity was shifted to those higher in the company hierarchy, and that the traditional practice of blacksmithing was transformed by more efficient and interchangeable technologies.

Steven Sarich has a background in anthropology and archaeology from the University of Nebraska-Lincoln, both of which he utilizes to craft narratives of past human behavior. He is currently a Master's student in the Industrial Archaeology program at Michigan Technological University. His interests include operational sequence modeling, work processes, and ethno-archaeological techniques for studying the archaeological record.

Job Printing in the Twilight of Hot Type: A Work Process Analysis of the *Ontonagon Herald* Print Shop

The *Ontonagon Herald,* a weekly newspaper with a job printing shop located in a remote copper mining district in Michigan's Upper Peninsula, used letterpress printing equipment into the 1980s, long after the wider printing industry had made the transition to photo-offset technology. The major equipment in the *Herald*'s job shop has remained undisturbed since the 1980s, preserving the machines' spatial relationships. This presentation analyzes the spatial arrangement of the *Herald*'s extant letterpress printing equipment as a physical manifestation of the work process of printing as it was performed in the shop.

Letterpress technology was the dominant printing technology for five centuries, from the time of Gutenberg to the middle of the twentieth century. The linotype machine, patented July 30, 1895, by Ottmar Merganthaler, revolutionized the typesetting portion of the printing process, but press operation remained unchanged until photo-offset printing began to emerge during the 1950s. By the end of the 1960s, photo-offset technology had effectively displaced "hot type" in the commercial printing industry.

Extant letterpress equipment at the *Herald* includes two Merganthaler linotype machines, a large collection of lead type and its accessories, a "windmill"-style Heidelberg self-feeding platen press, and a 12-by-18-inch (30 by 46 cm) Chandler and Price job press, in addition to paper cutting and bindery equipment. Employing measured drawings of job printing shop floor at the *Herald,* as well as data from a short ethnographic study and from the author's own experience setting up a letterpress printing studio at a community arts center, this presentation examines how letterpress printing equipment's physical characteristics, and its arrangement within a print shop, delimited and defined printers' work.

Daniel Schneider is a graduate student in the Industrial Archaeology program at Michigan Technological University and a practicing letterpress printer.

The Earliest Iron Roof Structures and Cast Iron Staircases in the U.S.

This presentation will describe the earliest iron roof structures and cast iron stairs in the U.S., dating from the second quarter of the nineteenth century. It arises from the discovery of wrought iron roof trusses spanning the two terminal gatehouses of Boston's 1848 Cochituate aqueduct, Boston's first public water supply system. These appear to be the oldest extant "iron roofs" in the U.S. One of these gatehouses also has a continuous wrought iron roof deck and the oldest extant cast iron staircases in the U.S. intended for public use.

Until now, the oldest known extant U.S. wrought iron roof trusses were thought to be in William Strickland's Tennessee State Capitol, which were installed in 1852. The little-known, long-lost, roof structures of Strickland's Philadelphia Gas Works retort houses (1835-1837) were the only earlier recognized U.S. examples. Two other cast iron roof structures of the period have also recently been identified, although they too remain little-known.

In the course of this research six additional, no longer extant, U.S. "iron roofs," earlier than or contemporaneous with those of the aqueduct gatehouses, have been identified (or recognized as significant for the first time). Also newly recognized is the extant, and structurally remarkable, iron roof of the 1848-1852 U.S. Custom House in Savannah, Georgia. It, too, predates Strickland's Tennessee State Capitol trusses.

At least six of these pre-1852 roof structures were wrought iron. Two of these were combined cast and wrought iron, four spanned gas works retort houses, and three spanned railroad buildings. The two earliest non-industrial examples were in or near Boston: on Harvard University's 1837-1840 Gore Hall Library and on the 1841-1842 Boston Merchants Exchange, designed by Isaiah Rogers.

In this presentation, attention will be paid to the unusual accordion-pleated, self-spanning roofs of the Boston Merchants Exchange and Savannah Custom House. Both of these also incorporate trusses of unusual but differing designs. Both of these fireproof buildings had iron stairs, and both probably had brick jack-arch vaulted ground floor ceilings supported on iron beams – early non-industrial examples in the U.S.

A handful of earlier, wholly or partially iron, U.S. staircases, identified mostly for the first time, will be touched upon. This presentation will show a link will be shown between the Cochituate gatehouse staircases and those at the Boston Athenaeum, and a circumstantial link suggested between those buildings and the first Ammi B. Young building to significantly use iron. As Architect of the Treasury beginning in 1852, Young is often credited with fostering the wider adoption of iron building components in the U.S.

Dennis J. De Witt holds a Masters of Architecture from the University of Pennsylvania and an M.Arch./A.S. from Harvard. He is currently Vice-Chairman of the Metropolitan Waterworks Museum in Boston and a Commissioner of the Massachusetts Historical Commission. Previously he has had faculty appointments at Harvard and the Boston Architectural College, was President of the New England Chapter, Society of Architectural Historians, and cartographer for the Field Museum Archaeological Expedition to the Southwest (Broken K site). He also has 40 years of experience in the design and manufacture of industrial machinery. His publications include *Modern Architecture in Europe: A Guide to Buildings Since the Industrial Revolution.* This presentation is drawn from an article entitled "Conspicuous Iron and the Cochituate Aqueduct Gatehouses: The Earliest Extant American Wrought Iron Roofs and Roof Trusses, and Cast Iron Staircases for Public Use," which is scheduled for publication in 2014, in *IA, The Journal of the Society for Industrial Archaeology.*

Development of the Steel and Glass Production Shed

Large, single-story buildings with open interior plans were a type commonly found at some manufacturing plants in the nineteenth century, notably plants in heavy metal-working industries. These buildings were known as "mill buildings" or by the name of their function within a plant, for example, machine shop, fabricating shop, rolling mill, and so on. Since the term "mill building" at the time also was used for multi-story factories, the single-story buildings have been called worksheds or production sheds, to distinguish them. This presentation will illustrate the history of this distinctive industrial building type, starting with early nineteenth-century production sheds at iron works and the like, and ending with the steel and glass mill buildings of the early twentieth century.

The production shed was a high-walled, rectangular structure and largely column-free inside, in order to accommodate big machines, bulky raw materials and products, and overhead cranes. Early examples of the building type were single rooms, enclosed in wood or masonry load-bearing walls, and covered by vast roofs framed with timber trusses. Over time, a characteristic basilica-like form evolved in which a wide, central hall was flanked along one or both sides with shorter aisles. In the second half of the nineteenth century, iron and steel roof trusses were introduced and began to be used in place of wooden ones. Later, iron, and then steel, posts were placed in the walls to support the trusses. At the end of the century, an entirely framed structure emerged, made of iron or steel posts, beams, and roof trusses, enclosed with light-weight, non-load-bearing walls. Because the buildings were wide as well as long, it was a challenge to get adequate light in the buildings' centers. Walls often were filled with windows, and a ridge monitor with windows was a characteristic feature of the building type. The development of metal-framed structures allowed the buildings to be enclosed in window walls. In the 1890s, the steel and glass production shed came into being.

This history has been studied by Betsy Bradley in her book *The Works: the Industrial Architecture of the United States* (1999). Rick Greenwood presented a paper at the 2010 SIA conference on examples of these buildings located in Providence, Rhode Island, which had been erected by the Berlin Iron Bridge Company, one of the first firms to design and construct steel mill buildings. This presentation, however, will present a fuller chronology of the development of this building type. It covers the introduction of steel sash factory windows, which became a key ingredient in the steel and glass production shed.

Sara E. Wermiel is an independent scholar, historic preservation consultant, and teacher. Her specialties are the history of nineteenth-century American technology, industrialization, and urbanization. She has written several books and many articles on the main subjects of her research: structural fire protection, and the development of new materials and assemblies for constructing buildings in the nineteenth and early twentieth centuries. She currently teaches a course on nineteenth-century building materials at Boston Architectural College. Wermiel received a doctorate in urban history and history of technology in 1996 from the Massachusetts Institute of Technology (MIT). She has served as Treasurer of the Southern New England Chapter (SNEC) of the SIA since the end of 2009, has organized many tours for the SNEC, and presented many papers at New England annual conferences on industrial archeology, among other IA activities.

From Horse to Electric Power at the Metropolitan Railroad Company Site: The Labor, Space, and Materials of Technological Change

This presentation will describe the findings of a new re-examination of the Metropolitan Railroad Company (MRC) Complex Site in Roxbury, Massachusetts. The MRC operated a horse-powered railroad system in Boston, Massachusetts, between 1855 and 1886. The company was conglomerated into the West End Street Railway (WESR) in 1887, which took over the Roxbury Crossing complex and soon thereafter converted the facility and their lines to operate on the new technology of electric traction. Excavation of the companies' Roxbury Crossing car house, workshops, stables, and blacksmithing facilities was first completed in the late 1970s. Backhoe trenching and hand excavation recovered objects related to harnessing, grooming, and veterinary care of the MRC and WESR horses, as well as evidence of blacksmithing, carriage painting, leatherworking, electric rail establishment, and later demolition. These findings were summarized in a descriptive report published in 1986.

Continuing the more detailed investigation presented at last year's SIA conference, the re-analysis of the site is enhanced by new technology and methods to more completely describe human and animal labor conditions at the MRC complex, its functional layout and reorganization over time, and its technological transition from animal to electric power. The original report hypothesized that the site's compartmentalized use areas were largely indistinguishable from one another as evidenced in the archaeological record. Further, little consideration was given to the site's comprehensive retooling around 1890 as its managing body changed and the facilities transitioned from horse to electric locomotion. For the first time, the site's excavation maps have been integrated into a Geographic Information System (GIS), which allows a complete map of the original Phase II and Phase III excavations. The GIS also displays the situation of the excavations and artifact concentrations in relation to the complex's different buildings as observed in geo-referenced Sanborn fire insurance maps. These digital maps illustrated the way that the complex changed with the introduction of electric traction. Also for the first time, the site's contexts and artifacts were organized by their function and use area, for example blacksmith shop, carhouse, etc. Grouping the data in this way demonstrated that the complex's different production and maintenance facilities produced distinct artifact sets. Additionally, artifacts deposited before the complex's electrification were characteristically different than those deposited afterwards. Finally, it became apparent that horse locomotion was not completely abandoned when electric traction was first adopted.

Re-examination of the MRC Roxbury Crossing complex concludes that its operations, while huddled in a small lot, were linked, but spatially and functionally separate. Before electrification, carriage manufacturing and horse maintenance produced a distinct and spatially focused artifact set generated by specialized craft and maintenance activities. After the WESR reorganized and electrified Boston's transit, the complex was converted into a comparatively inactive station, with leather craft persisting to accommodate sleighing and line maintenance. Grooming was related to but functionally and materially separate from carriage maintenance, which in turn was linked to but distinct from blacksmithing. Their common coordination under the industrial auspices of the MRC bound them, especially spatially. The complex's reorganization and electrification under the WESR makes it a valuable microcosm of grand technological change. More broadly, this research offers the opportunity to recognize human and animal contributions to increasing the efficiency of transportation infrastructure between the economic core of Boston and its growing suburbs during the latter half of the nineteenth century.

Miles C. Shugar attended Millersville University of Pennsylvania after obtaining early volunteer experience in archaeology. There, after conducting fieldwork on colonial sites in Lancaster County, Pennsylvania, and Bermuda, he obtained his Bachelor's degree in both history and anthropology, with a concentration in archaeology. After spending a few years in the professional realm, Shugar re-entered academia at the University of Massachusetts, Boston, to work towards his Master's degree in Historical Archaeology. He is finishing his thesis, which explores the collections of the Metropolitan Horse Railroad Complex Site in Roxbury, Massachusetts. In addition, Shugar is the head of the GIS department at the Massachusetts Historical Commission, where he maintains digital geographic data on the Massachusetts' above-ground and archaeological historic resources.

Gold Mining in the Carolinas: The View from Haile Gold Mine

Gold mining was an important early industry in North and South Carolina, with significant impacts on the regional economy, settlement, and labor relations and organization. Gold was discovered in the North Carolina Piedmont in 1799, setting of a process of steady growth and improvement. Although southeastern production of gold never reached the levels of the western U.S. in later years, the region contributed significantly to the national supply. In addition, the experience and ore-handling skills learned in the Carolinas were later put to use in developing the California goldfields. After the Civil War, the Carolinas were the scene of important ore-handling innovations. The development of gold mining in the region, from initial discovery and small-scale extraction through large industrial plants, has left a material legacy that has not been systematically studied and evaluated. Production of an archaeological context study was an initial step in the process of addressing this limitation. Additionally, a recent study of archaeological remains at Haile Gold Mine in Lancaster County, South Carolina, illustrates some of the major themes in the development and progress of gold mining in the region.

This presentation provides an overview of the historical development of the gold mining industry in the Carolinas and presents the results of archaeological investigations at the Haile Gold Mine stamp mill. The Haile Mine was one of the earliest gold mining operations in South Carolina. Gold was discovered there around 1827 and mining continued intermittently into the twentieth century. Development and operation of the mine followed many trends noted throughout the region. Early mining involved individuals and small partnerships working placer deposits. Improvements included the use of a small stamp mill, installed during the 1830s. The most significant period of operation occurred between 1880 and 1908, when professional mining engineers took over the management of the mine and experimented with a variety of technologies and ore-handling processes. This period of innovation saw mining engineer Carl Adolph Thies successfully apply a modified chlorination process. The heyday of profitable mining ended suddenly and dramatically in 1908 when the stamp mill's boiler exploded and led the mine's ownership to shut down operations.

Archaeological study of the 1880s stamp mill, the only surviving portion of the mining complex, revealed aspects of its construction and organization within the landscape. The study also revealed rather insubstantial and haphazard construction materials and techniques. A similar pattern was noted at a nearby worker's house. Although comparative data is lacking, these findings raised questions about how the mine's managers handled construction and maintenance of facilities, and whether these patterns were typical for the region.

Brad Botwick is an archaeologist in the Stone Mountain, Georgia, office of New South Associates, Inc. He has completed archaeological studies of industrial and urban sites throughout the Southeast and Mid-Atlantic and has produced studies that address the development of industry and associated economic activities in Georgia and the Carolinas.

Former Industrial Sites and Craft Beer: Reviving Neighborhoods

According to the Brewers Association, an organization representing seventy percent of the beer industry, an average of one craft brewery opens per day in the U.S. Given the devotion of the craft beer movement to locality and projections for continued growth, there exists a real opportunity to channel some of this momentum toward saving historic structures. This presentation will provide a fuller understanding of what it takes to start a brewery and examine ways in which some brewers have been successful in reusing former industrial sites while also reviving neighborhoods. The presentation will also encourage attendees to identify historic resources in their communities and determine whether these properties are ripe for craft-beer-driven revitalization.

The craft beer revolution in the U.S. started as a grassroots movement growing out of the kitchens, basements, and garages of ordinary Americans. Because their creations offer more substance than mass-produced beer, many have outgrown their home operations and sought larger facilities in order to meet demand. Historic structures have often been chosen to house these small businesses because such buildings are more affordable, have adaptable interiors, can meet a brewer's needs for utilities, and are aesthetically appealing. Factories, warehouses, and railroad depots are among some of the buildings converted to craft breweries and brewpubs since the movement has taken off. Some examples include: Harpoon Brewery, housed in a former U.S. Navy shipbuilding operation on the revived Boston waterfront; Philadelphia Brewing Company, where a former brewery built in the 1880s was restored and turned into a neighborhood gathering place and hub; Wynkoop Brewery, housed in the National Register-listed J. S. Brown Mercantile Building, which helped spark the revitalization of Lower Downtown in Denver, Colorado; and the Brooklyn Brewery, housed in a former matzo factory and one of the major catalysts in making the borough of Brooklyn into a cultural center.

Governments and business organizations have taken notice of craft beer's popularity and have pushed to bring these businesses to their downtowns. These entities understand that craft breweries create jobs, revitalize downtowns, and bring in outside dollars to the community. Cities like Asheville, North Carolina, and Grand Rapids, Michigan, use their status as "Beer Cities" and provide incentives for smaller brewers to open operations in their town. Many metropolitan areas have an entire week dedicated to beer as one way of enticing tourists.

The affinity of craft brewers for historic buildings is real; however, there does not exist any formal connection between craft brewers and preservationists. This presentation seeks to strengthen that link and encourage attendees to return to their communities and work with local organizations and craft brewers to save former industrial sites.

Brian J. Horne's life-long passion for history has taken him down many roads. After receiving a degree in History from the University of Virginia, he worked at a museum in suburban Philadelphia where he fell in love with old tools. This led him to train as a Preservation Carpenter at the prestigious North Bennet Street School in Boston. Following stints at the National Park Service in Gettysburg, the Fairmount Park Historic Preservation Trust in Philadelphia, and with local restoration and preservation firms, he undertook graduate study to pursue his Master's degree in Historic Preservation at Goucher College. His thesis explored the connections between the craft beer and historic preservation movements. Following graduation in August 2013, he was selected to present on this topic at the 2013 conference of the National Trust for Historic Preservation in Indianapolis. He currently resides in New York City, where he works as a restoration carpenter and preservation consultant.

The Environmental Benefits of Saving Historic Mills: Why Preservation of Mill Structures Should Be a High Priority for Brownfield Cleanup

Large numbers of New England's iconic textile mills and factories are empty and many are lost to decay while their owners struggle to clean up pollution. Such properties often contain soil and groundwater contaminants, and state and federal regulations typically require remediation before an owner can proceed with redevelopment. Owners, anxious to breathe new life into their magnificent mills, are instead compelled to focus financial resources on lengthy and expensive cleanups. Unable to afford repairs to roofs and other important structural elements, owners also cannot obtain loans due to the unresolved environmental issues. The consequences can be severe. Historic mills that might otherwise be saved fall victim to weather or arson. Once a mill is beyond repair, an owner may simply abandon it, leaving the community to shoulder the costly burden of cleaning it up. Derelict mill sites may lie vacant and blighted for years. Importantly, the loss of a mill building can also cause real environmental harm. A mill that collapses or burns can release airborne pollutants such as asbestos and lead that endanger the health of nearby people. Loss of a mill building can also expose contaminated soils to wind and water, increasing risks to human health and the environment. For these reasons, cleanup regulations and brownfield assistance programs should recognize that sometimes, the wisest environmental investment at a historic industrial property is the preservation of the mill building itself.

This presentation will examine two groups of mill redevelopment case studies from Connecticut. In the first group, initial redevelopment efforts focused on environmental cleanup; investments to keep the buildings weather-tight and safe from trespassers were insufficient. Before regulatory cleanup was completed, the owners ran out of money, the roofs caved in, and one building was destroyed by arson. The presentation will discuss environmental and economic impacts that were direct outcomes of the loss of these buildings.

The second case study group highlights projects in which the mill owners' priorities were to maintain building occupancy and rental income. Although contaminant levels exceeded regulatory limits, the owners demonstrated that these contaminants posed no imminent risk to humans or environmental resources. The owners postponed environmental cleanup and instead invested in structural repairs. As a result, the mill buildings remained occupied, providing tax revenue and rental income that was eventually leveraged to remediate the properties.

These examples point to an important synergy between historic preservation and environmental cleanup. Sometimes, the preservation of a historic mill is imperative strictly from an environmental perspective. State and federal environmental authorities should revise cleanup regulations to encourage historic mill preservation as an important tool to protect the environment. Brownfield funding programs should include loans and grants to be used specifically for repairs to roofs, windows, doors, and sprinkler systems needed to protect historic mills from deterioration and fire. By increasing cooperation between environmental professionals and historic preservationists, more resources can be made available to simultaneously preserve historic mills and improve the environment.

Wayne Bugden is the Director of Environmental Sciences at CME Associates, a professional architecture, engineering, and environmental consulting firm. He is a Licensed Environmental Professional and has more than 20 years of experience cleaning up contaminated sites. He has a long-held interest in New England manufacturing history and the interplay of cultural and natural environments. In 2011, he was appointed by the Governor to the State of Connecticut Brownfield Working Group, where he contributes to drafting proposed legislation and developing programs to promote brownfield reuse and community revitalization. He holds degrees in Ecology from Johnson State College and in Geology from the University of Connecticut.

Industrial Ports: Protection by Development and Heritage as a Driver of Development

The health and resilience of water systems is fundamentally interconnected with those same concerns in surrounding communities, while separate bureaucracies manage America's cultural and natural heritages. This poster examines the socio-environmental contexts and intersections of industrial land- and waterscapes.

As part of his studies, the presenter developed a plan for the industrial port of Marghera in Venice, which would adaptively reuse the cooling tower. He asserts that the neglected structures of industrial ports must be preserved through environmental remediation and economic redevelopment, guided by public involvement, carefully transformed, and then given new functions in regional planning. Most importantly, repurposing industrial ports allows for environmental mitigation and public involvement that connects people with places and engages them with their environments.

The presenter's dissertation examines the concepts of "protection by development" and "heritage as a driver of development," and will include an adaptive reuse proposal for an abandoned ore dock, designed around landscape and historical ecology, as a water resources interpretation and scientific center. The ore dock is located in the Lower Harbor of Marquette, Michigan. The ore dock adaptive reuse is a first case study in the presenter's research, because it is conceived as a part of a network of historic strategic places "landmarks" that have connected land and water. Then, the research has to focus on ultra-local linked projects and substantive strategic interventions that would result in the protection, conservation, and diffusion of larger areas, thus avoiding management decisions to make on the basis of a fragmentary, and therefore biased, viewpoint. These landmarks would therefore be an ideal medium of topological and symbolic value for gaining a cognitive immersion-emersion cycle in the waterscape and the different thematic landscapes related to it.

The ore dock adaptive reuse proposal will strongly consider the preservation and enhancement of the values still embodied in the colossal structure: ore docks have been hallmarks of the socio-environmental landscapes and waterscapes impacted by industry in the Great Lakes, especially in Michigan. These structures represent historically significant technological and engineering achievements, as they were centers for economic activity. Connecting the mines and mills with the water, these monuments have functioned ingeniously, transferring ore to ships for subsequent transportation. Despite their great heritage value in the historical water system, many of these docks have been abandoned and/or demolished. The local community has begun structural studies of the Marquette Lower Harbor ore dock because residents value the structure as a heritage monument; however, they have not yet developed a plan. This highly symbolic structure at the center of the community could become a vibrant central location, key to economic revitalization, dedicated to increasing environmental literacy and sustainable development in waterfront communities.

Leopoldo Ernesto Cuspinera Madrigal is a Mexican architect, planner, and artist interested in address environmental and social contexts of historical industry. The constant interests of his professional career have been the relationship between humans and landscape, as well as the museumization, conservation, and enhancement of natural and cultural legacy. This experience was gained in the United States, Italy, France, Portugal, Spain, Switzerland, and Mexico. He continues to work to understand and respect the natural and cultural legacy and goes beyond its utilitarian qualities. He also produces and promotes new works that demonstrate both evolution and continuity based on pre-existing tangible and intangible heritage. He is currently a Ph.D. student in Industrial Heritage and Archaeology in the Department of Social Sciences at Michigan Technological University.

Water, Manganese, et une Société Minière: Copper Harbor's Clark Mine Location

The Clark Mine, located just south of Copper Harbor, Michigan, was one of several failed nineteenth-century attempts at profitable copper mining on the Keweenaw Peninsula. Begun on some of the earliest exploited copper deposits in the Lake Superior region, the Clark Mine experienced one of the longer sustained efforts at profitable mining in the area. Its proximity to a good harbor on Lake Superior, along with access to a readily available source of waterpower, meant that the Clark Mine was free of the transportation and energy constraints that quickly undermined other struggling mining enterprises of the time.

From the start, the Clark Mine set itself apart by not only mining mass copper found in fissure veins on their property, but also by exploring the potential for profitable mining of manganese ore deposits found within those same fissures. Unfortunately, several separate attempts at mining and smelting the manganese ore proved unsuccessful, but the uniqueness of the Clark Mine's mineral character make the Clark Mine more that an interesting footnote to the narrative of Michigan's Copper Country.

Failure in mining can often be a very long process, with many interruptions and ownership changes taking place as markets, costs, and technologies change. In this way, the Clark Mine was no different. Its relatively long history (roughly 50 years) meant that six different ownership groups each put their own stamp on the property. However, three of these groups were based in France, with one of them actively working the property for nearly twenty years and passively owning it for another twenty. For most Copper Country operations, capital and investment was held in Boston, Pittsburgh, and New York, while management had a decidedly Yankee (or perhaps Cornish) bent. At the Clark, under French ownership, a typical Copper Country mining community took shape with French-speaking management, and worked with Parisian-backed capital investment.

These three elements (foreign ownership, waterpower as energy source, and copper and manganese mining) come together at the Clark Mine to create a unique opportunity to expand the economic, technological, and geological narratives ascribed to Michigan's Copper Country.

In the summer of 2013, a Phase I historical and archaeological survey was conducted of historic Clark Mine lands now owned by Fort Wilkins Historical State Park, a partner site of the Keweenaw National Historical Park. The survey not only identified archaeological sites related to the mine, but also provided historic context for possible future interpretation of those sites for the state park. The poster briefly outlines the historical and archaeological survey of the state park lands, and provides archival imagery, maps, and current photographic evidence of the physical remains of this unique chapter in the history of Michigan's Copper Country.

Sean M. Gohman is currently a Ph.D. student of Industrial Heritage and Archaeology at Michigan Technological University. Portland marks Sean's fourth SIA conference, and he finds the annual conference to be a great way to stay professionally industrious. Sean's work is focused heavily on the nineteenth-century copper mining activity of Michigan. Over the last five years, Sean assisted in the design and operation of MTU's archaeological field school, as well as conducted various survey and documentation work for the National Park Service and Michigan's Department of Natural Resources.

Sean is interested in exploring new narrative possibilities for the area's historic interpretation and preservation. Sean believes narratives inclusive of ecological truths, energy transformation, and technological practice can have the power to present the Copper Country not as a post-mining, deindustrialized landscape, but as inhabited space exploring new economic possibilities respectful of its intimately linked cultural and natural heritage.

Memory, Material, and Place-Making: Ethnographic Interpretation of the Industrial Heritage of the Calumet Region

In Chicagoland, steel shapes more than the iconic manmade canyons of The Loop. Twenty miles (30 km) south of the Magnificent Mile, in a landscape popularly defined by monolithic steel mills lining the Lake Michigan shore, the Calumet region of southeastern Chicago and northwestern Indiana has hosted the dynamic rise and decline of American "Big Steel" over 130 years. Industrial communities outside the mills' gates are similarly identified as extensions of the factories, as historically paternalistic environments in which workers and their families exist "off the clock." While this trope holds true as the origin story of the industrialization of the Calumet region, its narrative arc is characterized by continuous adaptation of cultural landscape.

This poster investigates how the Calumet region defines, identifies, and memorializes itself through memory and materiality. Ethnographic research conducted via semi-structured interviews and participant observation illustrate the roles that elements such as ethnicity, religion, local commerce, community place-making, demographic shifts, and workers' self-identification have played in the establishment of the Calumet region's intangible heritage. Examples are drawn from a range of locations: from Chicago's "The Bush" neighborhood adjacent to the sprawling former U.S. Steel South Works (itself soon to be converted into the US$4 billion "Lakeside" development) to Gary, Indiana, where the bustle of U.S. Steel's largest integrated mill stands in stark contrast to the city's boom-bust landscape. This research, conducted for The Field Museum's Contemporary Urban Collections – Calumet Region project, focuses on the identification of social assets that foster community cohesion upon which residents can build a solid future.

Carol Griskavich came into the Industrial Archaeology Master's program at Michigan Technological University after three years working for a Class I railroad in Chicago. This practical experience served to kindle her interest in the hidden and public infrastructure of Midwestern heavy industry. Her research interests lie in the social and landscape elements of "Big Steel," which she investigated while interning with the Field Museum Contemporary Urban Collections – Calumet Region project during the summer of 2013. She is an active member of the Calumet Heritage Partnership, American Anthropological Association, Southeast Chicago Historical Society, and the SIA.

The *Foz de Alge* Foundry

In the margins of the *Ribeira de Alge,* in *Figueiró dos Vinhos,* Portugal, are the remains of one of the most important documents of the country's industrial history. Having crossed three centuries of history, non-continuously from 1692 to 1834, the *Foz de Alge* foundry represented the highest hopes for the industrialization of the country at the time. It failed to answer such expectations, and its decline led it to its current state of abandonment, now no more than a ruin under the waters of the *Castelo de Bode* dam.

Fruit of the initiatives for industrial development of King Pedro II, the *Foz de Alge* foundry was built by French experts, who at the time were behind the establishment of other ironworks in the region. Not only was the crown importing workers and experts from abroad, but it was also importing the most advanced technology in blast furnaces. Still, this collaboration never achieved successful production, regardless of the amount of investment and legislative support it received, and the foundry was therefore closed in 1759. But, at the turn of the nineteenth century, it received a new reinvestment from the crown, eager to follow the steps of industrialization throughout Europe, and this time did so under German technical expertise. The French invasion of 1807 brought new constraints to the work at the foundry, as the royal court left for Brazil. The manager of the foundry was considered relevant enough to join that exodus, and it led to the establishment of important foundries in Brazil.

Throughout its history, taking center stage in the events of the French invasions or the Portugese Civil War, the foundry always failed to produce quality iron, despite the expertise brought from France and Germany. But the fact is that its presence is strong in the history of industrial development of Portugal and also of Brazil, even though it is now difficult to access under water. The research done at this site, where the waters now prevent any relevant archaeological work on the site but present an occasion to be resourceful in practices, revealed interesting aspects of the organization of this foundry. The historic documents, many lost in archival transitions, helped shed light on its bad performance and on what remains under water.

Leonor A. P. de Medeiros has a degree in Archaeology from the Universidade Nova de Lisboa and a Master of Arts degree in Heritage Management from the Ironbridge International Institute for Cultural Heritage. Currently a Ph.D. student in the Industrial Heritage and Archaeology program at Michigan Technological University, Medeiros is working on a project create a national Inventory of Industrial Heritage Resources and researching industrial landscapes and communities.