The Conservation of Copper Alloy Public Artworks in Houghton Mi

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Written for the degree Bachelor of Science in Anthropology

Table of Contents

Introduction

When a city defines itself, it often does so in terms of its art. Every city has at least one statue which not only serves as a landmark, but also as an expression of identity. Often these statues serve as a very real, physical connection to a national, civic, or ethnic history. Cities are not the only communities which have pieces of public art which are very important to their identities. Universities also are well known for having large public art installations. These installations tend to become central to the city's identity. Rituals form around them, they are used as landmarks for navigation, and they are important parts of the culture of their respective locations. Public artwork is a meaningful thing to the people who have a stake in it. Unfortunately, art, like all other physical things, does not last forever. If they are to remain in their communities, work must be done to preserve and conserve them for the future.

Here in Houghton, there are two pieces of copper alloy public artwork. Both represent something important to their communities. The miner statue, located at the beginning of downtown Houghton, represents the region's strong mining heritage. The Veterans memorial park Civil War soldier shows respect to the region's veterans of the United States armed forces. These are each important pieces of artwork in their own right, and should be maintained in order for these pieces to be enjoyed by the public far into the future. This is the objective of this project. The goal of this thesis is to design effective, practical, and cost effective conservation plans for both artworks. There will be several short term options designed to address immediate problems or concerns with the artwork .Long term needs of the statues will

be identified so that the process of treating them can begin. The goal of this is to ensure the stability of the artwork in the future for the longest amount of time possible.

Persuading people of the importance of conservation work, both corrective and preventive, might be more difficult than it would seem. Research of this nature is important, and pursuing it is a meaningful task. Bronze is a material which can, under the right conditions, last for a very long time. Ancient bronze artifacts can easily be 2000 to 3000 years old (Fox 1995). So, it would seem that statues that are less than a hundred years old likely will not need too much work in their current states. However, does not take into account modern atmospheric contaminates, which greatly decrease the lifespan of bronze. Additionally, preventing a problem is always preferable to fixing a catastrophe. Dealing with problems after they arise almost always leads to losing irreplaceable material. The ancient artifacts which have survived for thousands of years come often from archaeological contexts. They have been buried, sealed away, or otherwise protected from the atmosphere and elements. A bronze or copper statue in a modern city is much more exposed to the elements than a bronze bowl underneath meters of volcanic ash in Pompeii. Simply put, it cannot be expected that public art works have the lifespan as archaeological bronze unless a system or plan is put into place that does the job of meters of volcanic ash. Furthermore, these statues are real connections to the history of the area they are located in. If they are allowed to simply corrode and deteriorate until they are nothing, then a major injustice has been done to the future. Without exaggeration or hyperbole, it can be said that some part of the past has been stolen through inactivity. Thus, it is of great importance to keep these statues around for as long as possible. The best tool with which to do this is a solid conservation plan.

Ethical Concerns and Limitations

This begins to touch on a subject which it is important to think about when doing any sort of science. This is the problem of behaving ethically while doing science. When performing any sort of conservation work, a primary pitfall is the danger of damaging the object that is being conserved. However, when dealing with public artworks, there is an additional concern. Public art is a visual medium, so if the conservation strategies which are implemented mar the appearance of the artwork, then a major disservice has been done to the community if the change in appearance was not agreed too. There must be extreme danger to the long term stability of an artwork before any process which changes the color, visual texture, or overall appearance of the subject can be used, unless the color change is desired by the stakeholders. The risk of damaging an artifact also falls into this. Damaging an artifact in this case will not only make it less useful from a scientific standpoint by removing information from it, but it will also change the appearance of the artwork. Thus, extreme care must be taken.

An artwork in the public sphere is seen as the shared property of the people who make up its public. As such, it is critical to take the public's opinion into account. There are often multiple stakeholder groups involved with public artworks, and it is important to seriously consider all of their viewpoints. It might actually be preferable to leave a statue unconserved than to implement a process if the public associated with the statue do not want to put the process into effect. This is often seen when a green Copper Sulfate patina is thought be aesthetically pleasing. It is important to respect the wishes of the people who represent and own the statue. This is different than working with archaeological artifacts. With artifacts in a

lab setting a conservator might have free reign to do what needs doing to maintain the artifacts current condition. In the public sphere however, the conservator must be beholden to the wishes of the community they are working with or for.

This ethical concern also relates to one of the primary limitations of this project. When the time comes to implement the plans developed, there is a very real possibility that the stakeholder groups for these statues will simply not be interested in pursuing them. They might have concerns about cost, effect on the artworks, or they simply might not see the need for any work to be done. There is also the very real possibility that they will be correct. The statues are, after all, theirs. That all being said this is not a reason to not pursue conservation research in this situation. Even if the stakeholder groups do not think it is worthwhile to implement any of the plans currently, they will still have them on hand in the future. This could provide valuable information when they do decided the statues need to be conserved. Even if the plans are never utilized; attempting to implement them will raise awareness in the community about the issue, and could help people to view the statues in a new way.

There are other limitations to this study. Most of these revolve around what can and cannot be done to these pieces of public art. It will not be possible to take samples of the statues to determine exactly the alloy they are made of. Nor is it feasible to acquire a portable XRF to determine the makeup, due to the prohibitive cost of this equipment. Instead, the project will be relying on historical records to determine composition and construction details.. Furthermore, any treatments recommended must be things that can be done in public. This limits the project from using anything to aggressive or potentially dangerous for the public

(Morris and Krueger 1979). Finally, it is important to keep in mind the limitations of the research and the researcher. The pieces cannot be taken into the lab, as they are too large. The budget is more or less limited to whatever can be borrowed or used in good faith. Additionally, the researcher is only a student, and does not have a complete knowledge of what bronze conservation is capable of.

This plays into an important thing to keep in mind. These statues both have long term goals which the researcher cannot fix. They will require professionals in order to address these problems. What will be laid out in this paper are methods for maintenance and short term problem solving. However, this is within the scope of the project, due to the nature of this maintenance. In order for the statues to be kept around in the long term, short term fixes and preventive care must be employed. Preventing the spread of corrosion, and protecting the bronze of these statue will allow them to exist in their current states well into the long term. This will be cheaper and more effective than trying to fix serious problems in the future.

Literature review

There has been a great deal of research done into bronze conservation, and it tends to come in three distinct varieties. There is the perspective of art curators, there is the research done by archaeological conservators, and there are the practical efforts of government agencies. These communities have done some very good research, and for this project all are applicable. The artistic community has provided a good framework for theoretical work, and some very practical methodologies. The archaeological community has outlined a variety of best practices, and scientific methods for approaching conservation problems. Finally, the

government entities lay out how statue conservation is really done, along with best practices. These distinctions are pointed out solely for the reason that it is important to keep in mind where this research comes from.

Almost all of the scholarly sources referenced thus far in the project have been published in the journal Studies in conservation. Besides this, the journals APT bulletin and Journal of the American Institute for Conservation are also referenced. This is due to the fact that this journal focuses much more on bronze and bronze artworks than other journals, which more concern themselves with iron and organics. This is pointed out to explain what could seem as a weakness in the conducted research.

The first group of research that has been examined is what will be termed methods of analysis. Even though this project will mostly rely on historical resources to discover the alloys of the subject statues, and visual investigation to judge the patina, it is important to know about other methods. For example, the first thing that a professional conservator will likely do when approaching a new project is to take a surface sample. This can be used, and is used, to determine the alloy of the statue at the patina at all the same time through this very direct method (Selwyn, et al. 1996). This is an extremely common practice, and likely one that this project will not be able to use. If a larger budget is available, or a statue is too valuable to take a surface sample from, then what is called an XRF will be employed. An X-Ray fluorescence spectrometer uses spectrometry to determine the specific metallurgical make up of a statue without doing any damage to the statue. It uses X rays to excite the material, which then fluoresces, and can be analyzed by the handheld device(Ferretti, et al. 1997). Finally, there are

also specific methods for analyzing the patina or other coatings on a statue. A typical method for the modern conservator who does not wish to or cannot do a surface sample is electrochemical impedance spectroscopy. It is very similar to XRF, but is more functional on coatings (Ellingson, et al. 2004) (2004).

Next, there are articles which explore the scientific and theoretical ideals behind conservation technology. They may deal in specific methodologies, but overall they are more focused in understanding why practices are in place, and what best practices are in a given situation. In addition to this, they will also provide scientific information for testing new practices or assessing the need for conservation. One critical article by Zycherman and Veloz about an, at the time, fifteen year old statue of Theodore Roosevelt is of particular importance to this project. It is so important because it lays the groundwork for beginning conservation and preservation while the statue is still in excellent condition as opposed to waiting for it have started to degrade (Zycherman and Veloz 1979). This is relevant when one of the statues in this project was installed a mere 36 years ago. Another important work is in using broad quantitative methods from samples taken from copies of the same statue to judge the varying effects of atmospheric pollution in different cities. This lays the groundwork for focusing on the contaminates in an environment as a source of degradation (Meakin, et al. 1991). There are many additional articles which base themselves in scientific testing to determine the nature of bronze and how it corrodes under different circumstances. These tend to focus on the varying types of corrosion, such as pitting (Angelucci, et al. 1978). There is also time based corrosion (Scott 1985), which is very common in older artifacts, and relates simply to exposure to oxygen and water. Finally, there are tests in removing chlorides, which lead to and perpetuate bronze

disease (Uminski and Guidetti 1995). Bronze disease is one of the worst things that can happen to a statue, and can lead to rapid and uncontrollable degradation.

The final category of relevant literature is that which deals with practice in the field. That is, the actual methods for carrying out conservation on a statue. These tend to be case studies, guides for government employees, or the introduction of new methods. Almost every article in the field will speak to this somehow. Many methods revolve around corrosion inhibitors. These are chemicals which remove some part of the equation which results in corrosion. Another common solution is sacrificial layers of materials. These both work through blocking oxygen, water, or whatever the specific treatment is designed to combat. For example, a broader look at corrosion inhibitors was done in 1999. The test looked at how copper and copper based archaeological artifacts reacted with different inhibitors (Faltermeier 1999). Generally, tests are more specific than this. They tend to look at a single compound which they developed, support, or are critical of. A 1995 article by Fox looked at coatings of Alkaline Dithionite, and found it positive in the treatment of ancient bronze (Fox 1995). If this is transferable to modern bronze sculpture is not known yet. AMT is another chemical often used in conservation, and it is not uncommonly used on sculpture. It has recently undergone some criticism, but is still seen as being positive overall (Junior, et al. 2007). Finally, there are mechanical methods for cleaning away corrosion from statues. These range from very unintrusive processes, such as light sanding or washing with a non-ionic detergent, all the way up to very aggressive techniques such as glass bead peening (Morris and Krueger 1979).

The United States General Services administration has a large library of technical procedure document designed to help members of the government deal with maintenance and conservation of historic government properties. These documents are all available to the public, and are based on real world practice. Their resources on bronze are invaluable to this project, as they lay out step by step procedures for treating and identifying problems with bronze statues. Additionally, they recommend by name brands and varieties of products which they have had success with. This is made better by their general shyness about high cost procedures, and an emphasis on practicality. It is a very brass tacks thing that are necessary to know resource, and an excellent starting point. They lay out best practices for hot and cold waxes, Benzotriazole, and the removal of corrosion products (General Services Administration 2012). Furthermore, they provide limited information on identifying causes of corrosion, such as atmospheric pollutants. The National Park Service also does a good job of making their case studies and research available on the subject of bronze statues (Montagna 1989).

The Statues

The Miner statue is located on U.S. Highway 41. It was completed in 1979, and installed the same year. The statue was created by the Alaskan artist Elizabeth “Liz” Biesiot. It is meant to represent the proud mining heritage of the region, and is equipped with all the various accoutrements that a miner going to work would need. He has a lunch pail, a pick, and a helmet with a candle lantern. It is an image that is familiar throughout the region, and his proud stride is used as a metaphor for the town entering the future. The statue is made of a standard

statuary bronze, composed of approximately 97% copper, 2% tin, and 1% other materials, generally lead.

Overall, the statue is in good condition. However, its location at the entrance to downtown and its use in many city events put a lot of stress on the artwork. The statue is fairly young, and the patina, likely an ammonium based brown, which it was coated with in the factory is generally stable. It does display small areas of pitting and corrosion in certain areas of the statue however. Areas of concern include the pick head, the jacket lapels, and the backs of the legs. These areas display what is likely Copper Sulfate (II), caused by exposure to large quantities of car exhaust and weathering over time. This is minor however; the real problems manifest themselves in human interaction. It is not known what the impact of repeated applications of heavy duty duct or gaffers tape may do to the patina, but it is likely to have an effect. Additionally, the Miner seems to have been the victim of a serious accident or outright vandalism. Almost the entirety of his pick handle has been broken off, with little evidence as to how or why. It does allow an interesting window into what is inside that section of the statue though, as the handle appears to have been cast around an actual wooden pick handle wrapped in heat resistant foam. It is not known what impact this damage will have on the long term integrity of the statue, but fixing it would require a major undertaking which is beyond the scope of this project. This is work that would require professional conservators of bronze, and a concerted effort to replicate the original handle in terms of shape and color.

The civil war soldier is now part of the Houghton Veteran's park, which is located at the west end of downtown. It has been moved three times in its lifespan. First erected in 1912, it

was original located on Pearl Street. It was then moved to a small park on College Avenue, and then to its current location. The artwork was designed and created by Frederick Hibbard, an artist from Missouri who produced many civil war statues throughout his career, both of Northern and Southern soldiers and generals, in addition to a few of Mark Twain. The statue was commissioned and paid for by Graham Pope, a captain in a volunteer regiment from the region. He paid $5,000 for the statue, which adjusted for inflation approximately represents $118,000.

The statue itself is about eight feet tall, mounted on a six foot stone plinth. It has a bronze base onto which the soldier is mounted. The soldier is shown in motion, as though walking or marching, his tall posture suggesting marching. He is fully equipped and in uniform, his rifle on his shoulder, a canteen, bayonet, and ammunition pouch on his belt. The statue is a good depiction of a Union soldier, and a traditional war memorial. It is a proud soldier heading for battle, which is most likely what the captain wanted.

The Soldier is covered in a reasonably uniform light green colored patina. This is most likely Copper Sulfate (II). Though the whole statue is covered in this compound, there are some areas where the patina is streaking due to rain water. This indicates the corrosion is occurring underneath this patina, and that material is being lost from the statue. Material that is lost is difficult if not impossible to replace. Additionally, the statue appears to have a very serious long term problem. Around the ankle of the right (east) foot, there appears to be core migration. Core migration occurs when a part of a core which the statue is cast around is left inside the statue after it is assembled. These cores are often made of gypsum or plaster-of-Paris. Over

time, this material can actually push its way through the bronze of the statue, causing immense damage to the artwork. If this is indeed present in the soldier statue, it is a very serious issue which will require professional conservators in order to combat. It could realistically cause immense damage to the overall integrity of the leg, and the statue as a whole.

Methodology

Public artworks have specific needs in their conservation. Careful attention must be paid to maintaining the desired aesthetics of an artwork. Processes undertaken should also be reversible, unless the need is considered dire enough. The end goal must always be the long term stability of a subject. If there are methods which do not alter the appearance of an artwork, these must be given presence over practices that do alter the aesthetics. It is with these goals in mind that recommendations for technique, materials, and practice are made.

Corrosion, such as the patina of the soldier or the pitting of the miner, occurs due to exposure to the elements. Oxygen, water, and other environmental factors play heavily into the corrosion of bronze or other copper alloy materials. The process is greatly accelerated by atmospheric pollutants that are common in industrial and post industrial societies. There are very interesting records which suggest that before the burning of fossil fuels, statues would maintain a bronze exterior for long periods of time without forming a patina. These are difficult to validate. While removing corrosion products such as Copper Sulfate (II) alleviates aesthetic problems, it will come back over time. The most common solution to this is to coat the exterior of a statue with something that will block access by air and other compounds to the surface. This is called a sacrificial layer, as it erodes so the statue does not. The most common way to do

this is with wax. There are different waxes available for this. Benzotriazole (BTA) is a chemical with interesting, if limited, applications to bronze conservation. There have also been experiments in using polymers or plastics to cover the surface. These tend to be new and relatively untested however. In addition to this, polymers tend to be proprietary to organizations and companies, and can be difficult to obtain on a small scale.

Wax has several advantages and disadvantages. It has been used for a very long time in statue conservation, and as such is well understood in how it functions. It is relatively cheap, and can be acquired in varying grades. Some waxes are applied hot, others are applied cold, and it is possible to double or even triple coat for a longer lifespan. These traits make wax a flexible option. Some waxes can be applied by people who do not have much, if any, specialized training or experience (General Services Administration 2012). This decreases the overall cost of a conservation procedure. All of that being said wax is not without its problems or more accurately it has a single large problem. This is that wax is a fragile material. After application, touching it with force can easily wipe away wax from the surface of the statue. This limits public use of the statue, which could be a serious issue for the miner statue, as it is regularly dressed up by members of the community. Furthermore, even if it is undisturbed by people, wax coatings have a limited lifespan due to simple weather and exposure (General Services Administration 2012). A good coating of quality wax has a maximum lifespan of three years. Realistically, especially in areas of intense sunlight or rainfall, a coating is more likely to last one year. This can be problematic, as it means yearly maintenance is required. However, statues tend to be valuable monetarily and culturally, so the relatively small expense of repeated wax treatments is easily justified, even from tight budgets.

BTA is a coating that reacts with the bronze to form a layer protecting the metal beneath the surface from the elements (Montagna 1989). It has a longer lifespan then wax, but is more expensive, and is mildly toxic and very flammable. After a statue is cleaned, a mixture of ethanol, 3% BTA, and distilled water can be sprayed evenly over a statue (General Services Administration 2012). This is then brushed into the crevices of the statue to ensure complete coverage of the artwork. This, if left alone will not form a particularly long lasting coating, however, it does not have to be so exposed.

On exterior artworks and public statues, it is generally recommended that the BTA layer is given an overcoat of another substance. This double layer is more protective than any single layer. Additionally, the process of applying wax over a dried BTA layer is no different than applying wax regularly (General Services Administration 2012). This double method should be preferred over adding just BTA to a statue, as it is a good mix of methods that is known to be reliable.

Finally, there are polymer coatings for statues. As mentioned earlier, these methods tend to be new and relatively untested. Additionally, they can be difficult to obtain, and are often proprietary to the companies or organizations which invented them. This adds an additional layer of difficultly to their use, further complicated when they are wanted for a small scale project, such as the coating of two statues. Theoretically, a polymer coating will last much longer in the elements than a wax coating. Plastics are simply much more resistant to rain and sunlight then waxes. A layer of polymer would also not need to be as thick as a layer of wax might need to be, which is great for alleviating aesthetic concerns about a coating. However, if

there is a mistake in coating something with polymer, it may require retreatment of an entire statue, where as with wax it would be a much simpler matter. Some research with polymer coatings has been done with tentative success on iron artifacts; as such there is likely a future in bronze statue polymer coatings. However, all research done so far has been with smaller artifacts that can be completely submerged, which cannot be practically done to the statues in Houghton. Furthermore, the application of polymers requires specialized knowledge and equipment, which simply may not be available.

With these things in mind, and the goals of conservation as a practice, the recommended procedures will involve a program of cleaning and waxing for the statues in downtown Houghton. Cleaning is a critical step that much be accomplished before any protected coating can be applied to a statue. If this step is neglected, then the integrity of a coating will likely be impaired quickly. If a large amount of corrosion product is left under a coating of wax, the corrosion product will likely retain large amounts of water, oxygen, and atmospheric contaminants. This will lead to continued degradation of the statues underneath the coating. Dirt or grime trapped under a layer of wax can also threaten the integrity of the wax layer, which puts the entire effort at risk. As such, great care must be taken when cleaning. Fortunately, cleaning is simple. Various levels of abrasive can be used in conjunction with non-ionic detergents. Abrasive can mean simple rags, brillo pads, or steel wool. Statues can also be sandblasted, though not often with sand. Small glass beads can be used (Morris and Krueger 1979) as can walnut shells (General Services Administration 2012). Walnut shells have the benefits of being softer than glass or sand, thus allowing for more control over the effects of

the procedure. Also, they are biodegradable, which makes clean up optional. Having now outlined procedures and requirements, the actual plans for the statues will be discussed.

Plans and Cost

The miner will not require much cleaning. It does not need sandblasting or pressure washing, a good scrub with mildly abrasive materials will likely be more than sufficient for cleaning it. Non-ionic detergent sounds intimidating, but really means specific brands of dish soap. These are easily procured and inexpensive. This should be done before anything else is done. There are, once cleaning is done, four options than can be pursued for the miner if the choice is made to conserve it. Option A is a coat of cold application wax, this is the minimum effort. Option B is BTA followed by cold application wax. Option C is hot waxing followed by cold waxing. Option D is a BTA treatment followed by hot waxing followed by cold waxing. This is the most expansive procedure.

Option A: Simply put, the statue is washed, and two layers of cold application wax are applied over the surface to protect the statue from the elements. A one pound container of Trewax clear (General Services Administration 2012) can be obtained for less than twelve dollars. Assuming three pounds would be needed for the statue, this is not particularly expensive. This wax would be rubbed onto the surface of the statue using soft cloths or rags. The total cost for this (3lbs Trewax clear, 38 ounce dawn dish soap, cloth) would be in the range of $50 per application. Labor would likely be around ten hours, and this treatment would last for up to a year, though it should be inspected from time to time.

Option B: This is the same procedure as option A, however, before applying the wax a layer of BTA is applied to the statue. The BTA could either be painted on, or applied using a sprayer. The formula for a 3% BTA solution is two liters of distilled water with one liter of ethanol. 3% of this is 30mL of BTA. Three liters is likely not enough to cover the statue, whereas nine liters likely would be. Thus, 6 liters water, 3 liters ethanol, and 270mL of BTA. Ethanol can be acquired in 5 gallon drums, which would supply the statue for several years. BTA would need to be bought in 500mL bottles. This does increase the cost of the procedure greatly. The total budget for option B would likely come to around $340, and fifteen hours of work.

Option C: An application of hot wax before the cold wax is applied complicates the procedure, but also produces a better and stronger protective layer. It does necessitate the use of a heat supply to warm the surface of the statue before the wax can be applied. The wax is heated before hand, and mineral spirits are added to it to make a paste like consistency. This is applied using soft brushes while the surface of the statue is heated to create a stronger bond between the wax and the surface. Following this, two layers of cold wax are applied. Two kilograms of Outdoor Sculpture Wax can be purchased for a reasonable fee. The total cost of this procedure would likely be around $120, with 20 to 25 hours of labor to be expected.

Option D: In this operation BTA is added to the initial hot wax mixture. This decreases the cost of the BTA, as ethanol is no longer required. This would have a cost of around $250, and likely involve 25 hours of labor.

The civil war soldier has much different cleaning needs than the miner. Simply put, it needs more cleaning, as it has much more corrosion on the surface of the statue. Additionally,

it would require that scaffolding be erected in order to reach the statue due to its high mounting. If it is scrubbed, which is doable, it will simply take a very long time to accomplish. It would likely require the use of stiff brushes or steel wool. As such, it would be reasonable to budget $100 for cleaning supplies if this method is pursued. This could take in excess of 25-30 hours to complete. If a sand blaster is available, using walnut shell media would speed the process up greatly. 25lbs of walnut shell media can be purchased for $25, so costs would likely be the same, but the amount of time required would be greatly reduced for initial cleaning. This does require equipment which cleaning with cloth or brushes does not. Due to the more serious corrosion of the statue, a simple cold waxing seems out of the question. Once cleaned, the statue would benefit greatly from options C or D. However, the costs and time of these would both be increased as the statue is much large. Option C would likely run closer to $175, and option D would more likely be $300, with a time estimate of 30 hours.

The Long Term

In the long term, both statues have issues that are simply out of the scope this project, and will require appraisal by professional conservators of art. The repair of the miner's pick handle will require professional art conservators and restorers to assess the needs of the statue, and then have a new handle cast. This would then need to be welded onto the existing statue, likely with a desiccant inside the hollow area so as to combat the moisture which has infiltrated it since the break. This is the only long term concern for the miner if a plan is chosen and revisited every year or so. While higher cost and intensity procedures might secure more time between retreatment procedures, it is better to think of them as ways to better protect

the statue. The statues should be checked every year, with special attention paid to the tops of the statues which are exposed to the most sunlight and rain. When the wax at the top has dissipated, the statue should be retreated.

Core migration is something that can destroy or severely damage a statue. If the civil war soldier has core migration in its foot, this is something that must be dealt with as soon as possible in order to protect this important memorial. The city of Houghton should either pursue conservators of statues on their own, or with the help of the NPS, as the NPS has preexisting connections with conservators. Additionally, if plans C or D are put into use careful attention, through pictures and written descriptions of the statue, should be paid to the extent and color of the patina. If there is continued streaking, this indicates that corrosion is still occurring, and new strategies should be pursued. Additionally, the statue should be cleaned as needed. This should be determined at the time that the statue is due to be recoated with the protective layer. Theoretically, cleaning should not be required on a regular basis, must less intensive cleaning such as simple washing should be more than sufficient. If more intensive cleanings are required, new coatings should be investigated, or the methodology for applying coatings should be examined. It is of the utmost important that the statue be carefully monitored, and corrosion be arrested, if the statue is to stay in its current condition for future generations. This is the primary concern of this project, and the plans outlined within.

Conclusions and Future work

In the future, not only should the long term problems be addressed, by other statues throughout the region should be considered for treatment. The new husky statue on the Michigan Tech campus is one of those. Even though it is less than a year old at the time of writing, prevention is always preferable to attempting to mitigate a crisis. The largest threat to this statue will be human interaction, and this is something that the university administration will have to grapple with. A wax sacrificial coating applied to the husky may soon be worn off by the repeated touching a students and visitors to the university. It will eventually wear down the bronze itself.

There is a great deal that can be said about the importance of doing conservation work. The kind of preventative work which is laid out here can be done with little to no training, and is not particularly expensive. However, if the time I not taken to do this small amount of work, then a great deal more work will likely be required down the line. It is better to maintain then is it to replace. This is extremely true when we are talking about important heritage objects such as the statues in Houghton. The civil war soldier was purchased by a local civil war veteran. There are no more civil war veterans to purchase such statues, and that statue has been a part of the community for over a hundred years. This is a legacy, and a very real connection to the past. The miner is the symbol of the town, and a representation of why the town is here. To lose either of these would be a blow to the community. The plans outlined here are not expensive, and yet the cost for not doing something in very expensive.

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Appendix, relevant images.

The Civil War Soldier, Streaking Visible


Core migration visible as light grey


Corrosion products on the pick head of the Miner

Damage to the pick handle of the Miner