

Heritage Cities and the Encroaching Seas: The Preservation of Venice with Reference to
Rhodes Town, Edinburgh Castle, and Old San Juan

Kelly Lee Cooper

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LaDale Winling, Committee Chair
Ann-Marie Knoblauch
Humberto Rodriguez-Camilloni

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ABSTRACT

This thesis examines the preservation challenges heritage cities face because of climate change, with Venice as a case study and references to Rhodes Town, Edinburgh Castle, and Old San Juan. Dominant literature and scholarship on Venice compete with one another, restricting opportunities for interdisciplinary collaboration and dialogue in producing a more efficient preservation approach to the city. Through a study of the brief history of Venice, the materials, and past and present approaches to preservation, this research signifies the need to understand and preserve building materials. Following an analysis of the scholarship on Venice, this paper reveals the role of building materials in discourse on the city, as materials can bridge the gap among competing literature. Therefore, this thesis makes a key contribution to the understanding of urban history and preserving historic cities.

In exploring preservation techniques and considering how the discourse can more effectively address the challenges of sea level rise of historic cities, this thesis argues the history of materials is key to a cohesive preservation approach for Venice's built heritage. The building materials are at the center of the preservation issue, and by serving as the core of dialogue and interdisciplinary collaboration, a more efficient approach to preserving the city's local and global heritage will occur. This thesis shows historic building materials can become central to Venice's preservation approach with increased vocal concerns about the building materials from restorers/conservators,

non-governing residents, art historians, scientists, and global onlookers to Venice's local government, the Italian government, and international preservation bodies.

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GENERAL AUDIENCE ABSTRACT

This thesis examines the preservation challenges heritage cities face because of climate change, with Venice as a case study and references to Rhodes Town, Edinburgh Castle, and Old San Juan. Literature on Venice compete with one another, restricting opportunities for conversation on producing an efficient preservation approach to the city. Through a study of the brief history of Venice, the materials, and past and present approaches to preservation, this research signifies the need to understand and preserve the building materials. The role of building materials in discussions and debates on the city is necessary as materials can bridge the gap among competing literature. With building materials at the center of the preservation issue and the core of conversation among different disciplines, a more efficient approach to preserving the city's local and global heritage will occur.

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Content

| | |
|---|-----|
| Acknowledgements..... | iv |
| Glossary..... | vii |
| Introduction..... | 1 |
| Chapter 1: Context and Histories..... | 15 |
| Chapter 2: The Materials..... | 47 |
| Chapter 3: How We Got Here: Historic and Current Preservation Approaches..... | 77 |
| Conclusion..... | 101 |
| List of Figures..... | 104 |
| Works Cited..... | 108 |

Glossary

Acqua Alta: Italian for acute phases of flooding

Administrative Body: Individuals with power to enact laws and policies; they are responsible for the care of the public.

Built Heritage: The cultural and material significance of the built environment

Calcium Carbonate: Chemical compound, CaCO_3 , found in rocks and stone.

Civil Society: Individuals who are not part of the ruling body, they are the non-governing residents, workers, craftsmen, restorers/conservators, geologists, etc.

Climate Change Strategies and Archaeological Resources Committee (CCSAR): A committee which examines archaeological sites and records facing issues brought about by climate change.

Constructivist History: Interpretation of events

Fabric: The materials and structural elements of a building

Historic Environment Scotland (HES): A leading public body in charge of maintaining and preserving Scotland's historic sites.

International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM): An intergovernmental organization focused on the conservation/preservation/restoration and education of international cultural heritage.

International Council on Monuments and Sites (ICOMOS): An international body which works to conserve and protect heritage sites.

La Serenissima: Italian nickname for Venice, meaning "the most serene"

Materiality: The building fabric of Venice and the relationship between society and historic materials

Minimalist Conservation: A hands-off approach to conservation and restoration, meaning you only restore when it is absolutely necessary.

Mohs scale: Scale of measuring the hardness of a mineral. Scale ranges from 1-10, with 1 being the softest and 10 being the hardest. Talc rates as a 1, but a diamond rates as a 10.

Narratives: The interpretation of history

National Trust for Scotland: A conservation charity which protects the natural and built landscape and cultural heritage of Scotland.

Porosity: Pores or voids in the stone

Positivist History: Historical events, facts, actors

Public Sphere: Space which contains civil society, the administrative body, and proprietary economy. In the public sphere, individuals in these groups have agency.

Rhodes International Culture and Heritage Society (RICHeS): A non-governmental organization and registered charity focused on bringing awareness to the heritage to Rhodes and preserving Rhodes Town and the island.

Save Venice: An American organization which works to protect and preserve artwork in Venice.

Science, Management, and Policy Committee of the Latino Climate Action Network (ELAC): A non-governmental organization focused on challenges brought about by climate change and limiting human causes. The organization works to aid Puerto Rican/Latino communities and instigate governmental policy action.

Scottish Coastal Archaeology and the Problem of Erosion Trust (SCAPE): A charity that works to research, educate, and conserve Scotland's coastal archaeological heritage.

Sestieres: Italian for neighborhoods

Society for the Protection of Ancient Buildings (SPAB): Society founded by William Morris which began in reaction to restoration practices of historic sites during the 19th century. It is a registered charity and members produce research and educate the public on the protection/repair of historic sites for continued use.

Society of American Archaeology (SAA): An international organization centered on the protection, education, and research of North and South American archaeological sites and heritage.

Telos: The point in time from which one views history

The United National Education, Scientific, and Cultural Organization (UNESCO): An agency under the United Nations responsible for fostering international collaboration in education, science, and culture.

U.S. National Park Service: A national agency part of the U.S. federal government focused on the protection and care of national parks and sites.

Venice in Peril: A British charity that works to draw attention to issues in Venice, such as climate change.

World Heritage Committee (WHC): A committee part of UNESCO which is responsible for choosing and overseeing World Heritage sites.



Figure 1. High water discomforts. Venice, partially submerged monument, 11-2010. MOSE. <https://www.mosevenezia.eu/my-product/acqua-alta-novembre-2010/>.

“Today, city and sea are still as intimately bound together as ever. But theirs is a marriage in crisis.”¹

¹ C. Fletcher and J. Da Mosto, *The Science of Saving Venice* (Torino, Italy: Umberto Allemandi & C., 2004), 9.

Introduction

Venice is sinking. The phrase is a common one that appears in almost every article, book, or publication about the floating city. The three words taken out of context are puzzling, for how can a city drown? But Venice's urban map is well known around the world, not least because of its unique position as a city on water. "Venice is sinking" serves to strike fear into those who hear or read these words, stirring the feeling one needs to reach a hand towards the city to pull it up. It creates an image of a city sinking inch by inch until the water completely consumes Venice, as though it is the next Atlantis (Fig. 1). The phrase dramatizes what is going on and does not address the complexity of Venice's struggle against the sea or add to the discourse on how to preserve the city's fabric.

Discourse on Venice's struggle against sea level rise is dominated by three key approaches: aesthetic/architectural, social/cultural, and scientific. Scholars, heritage professionals, and government officials who attach themselves to one of these themes can find themselves at odds with individuals who espouse another theme, halting progress on Venice's future preservation techniques. However, at the crux of these three themes is the materiality of the city. In this paper, materiality refers to both the building fabric of Venice and the relationship between society and historic materials. To understand Venice's cultural heritage, it is essential to understand the building materials and their history.

I argue the history of the materials is key to a cohesive preservation approach for Venice's built heritage. The building materials are at the center of the preservation issue and reconcile the different themes in discourse on Venice's preservation. Scholarship focuses on one or, at most, two of the following: how the stone, wood, bricks, and other materials are affected by sea level rise and resulting changes in the lagoon; how the architectural significance of major

structures are endangered; and the effects to society and culture in Venice as residents leave for the mainland in increasing numbers. My argument serves to bridge the gap. The building materials reveal damage by sea level rise; they are the makeup of Venice's architectural heritage; and craftsmen, laborers, and patrons incorporated symbolism and meaning within the objects that has produced multiple narratives of the city in past and present communities. I theorize the development of effective preservation approaches in Venice and coastal sites will emerge if individuals in civil society, residents, non-residents concerned with Venice's preservation, heritage professionals, restorers/conservators, scientists, historians, and architects, stress the power and significance of the historic materials.

Venice serves as the case study because the notion of the city "sinking" into the lagoon has captivated writers, poets, artists, photographers, travelers, and more since the 19th century. The desire to preserve and protect the city since this period has established Venice as a precedent and a model for coastal cities facing the effects of climate change and sea level rise. Venice is also important because not only it is a heritage city of global value, but it has local significance too for the inhabitants who still call it home. It is essential to preserve the building materials of residences, footbridges, and structures because they are tied to Venetian identity, and these structures allow people to continue living in the city. Venice is more than just St. Mark's Basilica and Piazza. To address my theory fully, I analyze Venice in three ways. First, I investigate the city's building history and the relationship between past laborers/craftsmen, wealthy patrons/nobility, and the historic materials. Second, I focus on the degradation and preservation of the materials affected by sea level rise. Third, I look at how craftsmen/laborers, artists, poets, writers, scientists, government officials, and heritage organizations have reacted to the deterioration of Venice's fabric in the past, as well as past and current preservation approaches.

Finally, I will synthesize the chapters to highlight how the materials are crucial to an effective preservation approach to the city. I will also refer to The Old Town of Rhodes (Greece), Edinburgh Castle (Scotland), and La Fortaleza and San Juan National Historic Site in Old San Juan (Puerto Rico) in each of these chapters. Rhodes, Edinburgh Castle, and La Fortaleza and San Juan National Historic Site are also World Heritage Sites (or in the case of Edinburgh Castle, part of a World Heritage Site) found on the coast and are threatened by the effects of sea level rise. I chose these sites as other examples of how the materials are important to historic and present communities, how sea level rise is harming the fabric of these cities, and how they have and are approaching the preservation of the building materials.² International collaboration is necessary for the development of preservation practices to create the best approaches to protecting a heritage site. It is essential for scientists, restorers/conservators, and political/governmental figures in coastal heritage sites to communicate and look at the approaches of other individuals in these towns/cities to obtain effective preservation methods. As a result, I am incorporating this approach into my paper.

John Ruskin's *The Stones of Venice* (1851-53) serve as the foundation for Venice's discourse on architectural/aesthetic history.³ Ruskin, an English art critic, wrote on the fabric of Venice, highlighting the possible histories of the bricks, stone, glass, and more. He often expresses his appreciation for how the materials came together to make the decorative forms and structural features of Venice. Firmly against restoration practices of the 19th century which incorporated modern materials into historic buildings, Ruskin stresses the importance of the building fabric. However, he often praises the aesthetics/architectural features of Venice and

² It is worthwhile to note that while only a small percentage of heritage sites are listed under UNESCO's World Heritage list, the listed sites can help provide a greater understanding of the threats to other coastal sites which have not received the same kind of attention.

³ John Ruskin, *The Stones of Venice*, Vol. 1-3 (New York: J. Wiley, 1872).

rarely discusses local relationships with the buildings and sites, unless he is criticizing decisions made on the restoration of the structure. He also consistently puts the materials in conversation with global cultures. For example, he muses over how marble blocks on the Pillars of the Piazzetta come from 6th century Greek sculpture and how yellow bricks on the Church of San Donato on Murano are darker than English light brick.⁴ Ruskin is often subjective in his praise for materials and structures and incorporates them into a Euro-centric, global discourse. Ruskin's work dates to the mid-19th century, but it continues to influence the approach of scholars of Venice's architectural history as they focus on how the architectural styles highlight the city's exchange with different cultures.

In the scientific branch of discourse, *The Science of Saving Venice* (2004) by Caroline Fletcher and Jane Da Mosto is repeatedly included in scholarship on Venice. The book was published for one of the leading organizations that draws attention to the issues present in Venice, "The Venice in Peril Fund: The British Committee for the Preservation of Venice." Science communication consultants put the book together and emphasize the need for greater scientific collaboration and understanding of the lagoon and built materials. The authors critique an aesthetic approach to the preservation of Venice, that is to say, work that only fixes the city on the surface as opposed to trying to understand the underlying issues more fully in both the natural and built environments.⁵ Their work supports Venice in Peril's decision in 2001 to divert attention from preserving the structures to protecting the city.⁶ While Venice in Peril sought to preserve works of art in the city prior to 2001, they have since adopted a more holistic approach focusing on protecting the entire city and lagoon from flooding and sea level rise via mobile

⁴ Sarah Quill, *Ruskin's Venice: The Stones Revisited* (UK: Sarah Quill, 2000), 47; 60.

⁵ Fletcher and Da Mosto, *The Science of Saving Venice*, 10.

⁶ *Ibid.*, 10.

barriers. The book presents the geological, biological, and chemical issues in a concise manner specific to Venice but does not include the history behind the materials or their meanings/symbols.

Venice's social and cultural history is arguably the most popular of the three discourses, especially after the flood of 1966. In reaction to the event and continued fears for Venice's future, scholars have generated numerous dissertations, books, and articles on the topic. Frederick Lane's work on *Venice: A Maritime Republic* (1973) supplies a foundation for the comprehensive history of Venice. His work looks at the city from its beginnings to the end of the Republic. One of the more recent works on Venice's social and cultural history is Joanne Marie Ferraro's *Venice: History of the Floating City* (2012). Ferraro focuses on social history, culture, gender, and sex in Italy. This specialization is clear in her book. As she analyzes space in Venice, she continually looks to how it reflects social practices, beliefs, traditions. However, she works to provide a deep understanding of the construction of the floating city and the significance of the environment. As a result, the book reveals how the built environment is tied to the social atmosphere and politics of the city. Her work, like Lane's, focuses on Venice from the time of its founding to the fall of its Republic. She suggests Venice is continuously revered because it has been in a state of continual disintegration both physically and socio-politically.

My thesis is influenced by the theoretical approaches present in David Freedberg's *The Power of Images: Studies in the History and Theory of Response* (1989), Lambert Zuidervart's *Art in Public: Politics, Economics, and a Democratic Culture* (2010), Michel Rolph-Trouillot's *Silencing the Past* (1995), and Jorge Cañizares-Esguerra, *How to Write the History of the New World: Histories, Epistemologies, and Identities in the Eighteenth-century Atlantic World* (2001). Historic materials convey intangible ideas, for "heritage does not only consist of objects:

it consists of memories of objects and of memories of activities.”⁷ Freedberg’s work describes how there is power inherent within images using examples of traditional fine art forms, such as painting and sculpture.⁸ Historic materials can apply to his approach as well. A key excerpt from his work states:

*“People are sexually aroused by pictures and sculptures; they break pictures and sculptures; they mutilate them, kiss them, cry before them, and go on journeys to them; they are calmed by them, stirred by them, and incited to revolt. They give thanks by means of them, expect to be elevated by them, and are moved to the highest levels of empathy and fear.”*⁹

UNESCO and academic institutions emphasize global values of a city, such as Venice, Rhodes, Edinburgh, and San Juan. Global values are academic merits attached to heritage sites that do not take into multiple perspectives or narratives into account. There is an emphasis on macro-history as opposed to micro-history of the community or symbolisms of various building materials. Academic values detaches, abstracts, and bureaucratizes the significance of the object away from the community with little to no input on the public’s view of the built heritage.¹⁰ When non-local and international institutions place value on an object, what is missing are local values placed upon materials “born” into the community, for historic objects are seen as belonging to and part of the community.¹¹ Academic values can be dictated or influenced by power valences and dominant narratives, as Michel-Rolph Trouillot noted in his *Silencing the*

⁷ John Carman, “Where the Value Lies: the importance of materiality to the immaterial aspects of heritage,” in *Taking Archaeology Out of Heritage*, ed. L. Smith and E. Waterton (Cambridge Scholars Publishing, 2009), 197.

⁸ Freedberg is the Pierre Matisse Professor of the History of Art at Columbia University. He focuses on understanding emotion and physical reactions to art.

⁹ David Freedberg, *The Power of Images: Studies in the History and Theory of Response* (Chicago: University of Chicago, 1989), 10.

¹⁰ Carman, “Where the Value Lies,” 203.

¹¹ Carman, “Where the Value Lies,” 204.

Past.¹² The built environment and historical building materials can both support a dominant narrative and problematize it.

There is power inherent in building materials which allow communities to link together and form cultural identities and alternative histories in addition to global narratives. Trouillot reveals how Sans Souci, a citadel and historic palace in Haiti belonging to King Henri, helped silence the story of a man named Sans Souci killed by Henri. By naming the citadel Sans Souci, he silenced the memory of the man as the name became linked to the structure and not the person.¹³ History is a set of narratives driven by power valences, and historic structures can be powerful silencers of narratives or empirical history.¹⁴ Trouillot critiques historians and individuals for focusing solely on a constructivist approach to history, that is the interpretation of events. He argues for an integration of a constructivist and positivist approach, the positivist being historical facts, events, actors, etc. Because Venice, Rhodes, Edinburgh, and San Juan are World Heritage Sites, they are assumed into a larger global, dominant narrative. The practice of interlocking different narratives from multiple places to create a dominant, global narrative stems from western traditions. Britain, France, Spain, and other countries historically used non-Western cultures to reaffirm the power of their own state. The materials of Venice can easily play into the global narrative as the structures reflect Islamic, Romanesque, Gothic, and Byzantine influence. However, the historical materials and buildings can also allow for local, positivist and constructivist approaches along with the global interpretation because the materials are tangible connections to the historic cities.

¹² Michel-Rolph Trouillot, *Silencing the Past* (Boston, MA: Beacon Press, 1995). Trouillot was an anthropology professor at the University of Chicago and a leading scholar on Caribbean history and anthropology.

¹³ Trouillot, *Silencing the Past*, 60.

¹⁴ Empirical history refers to factual information about the past, such as individuals, dates, etc.

For those who live in Venice, there is an attachment to the built heritage because these are sites seen by residents daily. They know how the city looks both when the lagoon is peaceful and when the water has passed the ground floor.¹⁵ Jorge Cañizares-Esguerra's work is important for understanding the relationship between residents and a physical city in theory.¹⁶ In Cañizares-Esguerra's *How to Write the History of the New World*, he reveals how Europeans exploited the materiality of cultures in Mesoamerica. Europeans argued the cultures provided a snapshot of what European society and life was like before the rise of civilization, emphasizing their savage qualities.¹⁷ The telos of the Europeans inserted the built environment of Mesoamerica into the narrative that emphasized European power and authority. Cañizares-Esguerra states Creole authors, those of European descent born in Spanish and Portuguese colonies, sought to alter the European perception of the materiality of pre-conquest Mesoamerica to prove "those who called ancient Mesoamericans savages were wrong."¹⁸ The Creole authors highlighted how material objects revealed the traditions and cultures of Mesoamerica and offered a new interpretation using positivist methods. While the authors were of European descent, there was a connection to the place of their birth and its materiality. They wished to emphasize their worth in society by stressing the importance of Mesoamerican cultures. Past and present communities of Venice have local and alternative histories, and the city's urban fabric supports these interpretations. The materials and historic structures of residential neighborhoods, in addition to monumental buildings like St. Mark's Basilica, help communities hold onto these narratives.

¹⁵ Again, a recognized limitation of this research is the lack of correspondence or interviews with residents or former residents.

¹⁶ Cañizares-Esguerra is the Alice Drysdale Sheffield Professor of History at the University of Texas at Austin.

¹⁷ Jorge Cañizares-Esguerra, *How to Write the History of the New World: Histories, Epistemologies, and Identities in the Eighteenth-century Atlantic World* (Stanford University Press, 2001), 51; 209-210.

¹⁸ Cañizares-Esguerra, *How to Write the History of the New World*, 271.

Lambert Zuidervaat's work displays the relationship between civil society, art, administrative body, and proprietary economy within the public sphere.¹⁹ The public sphere is the space where individuals have agency. Civil society refers to individuals who are not part of the ruling body, they are the non-governing residents, workers, and craftsmen. The administrative body are those who have the power and responsibility to enact laws and institute policies and guidelines. Zuidervaat's work is focused on the role of art in the age of capitalism, and he discusses the issues of viewing art as just a commodity and independent from civil society or the administrative body. Zuidervaat highlights how it is important for individuals in civil society to use artwork to foster change and convey ideas to the governing branch. For example, the Creole authors were members of civil society and they used the built heritage surrounding them to argue the legitimacy of Mesoamerican tribes as civilized cultures. The building materials and other material objects were a tangible link to Mesoamerican culture and memory, and the Creole authors asserted a new regional narrative that challenged the dominant one. Zuidervaat's approach is a key step towards implementing new, effective preservation practices for coastal heritage cities as people recognize the importance of historic materials to the community.

Venice is often tackled as a totality, with a focus on its global significance. Several scholars try to tackle preservation issues by discussing the role of human decisions which have accelerated Venice's sinking. They typically note how the sea has always threatened Venice, how sea level rise and flooding is a direct correlation to climate change, etc. However, can a discussion occur on how to preserve the city without looking deeply into the fabric of Venice,

¹⁹ Zuidervaat is a Professor of Philosophy Emeritus at the Institute for Christian Studies.; This paper does not have a key focus on economy, especially proprietary economy, in the public sphere because Zuidervaat is drawing on art in the age of capitalism in his work. However, the relationship between individuals in civil society and the administrative body is present throughout history, even when the economy changes and shifts.

the materials which hold it up? The identity of Venice and its history is preserved within the building materials, for “like animal fossils petrified in layers of rock, so the life of the Venetian people through the ages is recorded in the architecture of the archipelago.”²⁰ A more focused historical approach to understanding the materials of the city and what those materials represent can offer a new light in the discourse regarding what form of preservation Venice should pursue. The “memory” attached to the building materials refers to narratives, symbolisms, and craftwork embedded in the objects. Craftsmen of the *minuto popolo* (common people), civic and wealthy patrons, and the ruling body of Venice helped give meaning to the materiality of structures and the urban fabric. The materials provide multiple narratives on the architecture and culture of Venice that are not considered in global explanations of the city’s significance.

As the sea level rises and flooding becomes more frequent due to climate change, Venice’s future lays in the hands of people in civil society, locally and globally. They have the ability to bring the historical significance of the building materials into the discourse of how to preserve the city. Venetians established a precedent in international preservation approaches when the city put forth the Venice Charter in 1964. The precedent was influenced by individuals in 19th and 20th century, and their rhetoric on the “sinking” of the city. Now Venice’s future as a preservation leader is at a pinnacle as materials are degrading and the public fights the rising sea. Once again, residents, non-residents concerned with Venice’s preservation, historians, heritage professionals, restorers/conservators, scientists, architects and more can influence actions toward the preservation of historic cities and towns threatened by sea level rise by understanding the history of the building fabric and the narratives attached to the materials, as opposed to just

²⁰ Deborah Howard, *The Architectural History of Venice* (New York, NY: Holmes and Meier Publishers, Inc., 1981), 14.

controlling the aquatic environment. Local and global individuals' relationships to the materiality of Venice, conveyed through literature, photography, and news sources, can incite a proactive approach for the preservation of historic materials in coastal sites. The first step is to consider the materials from a historical perspective to move forward with the preservation of built structures in Venice.

What do the materials of Venice, Rhodes, Edinburgh, and San Juan mean to the local community as well as the rest of the world? By presenting Venice, Rhodes, Edinburgh, and San Juan as World Heritage Sites, UNESCO is highlighting the notion these cities belong to the global population.²¹ They assume the building materials in these cities under the global narrative. However, the materials can also reveal alternate narratives which highlight the identity of those who live in or have lived in these cities. Why have locals chosen to keep certain building materials long before these cities were designated World Heritage Sites? What do the stones, brick, and wood mean to these individuals? Do they remain because inhabitants were not in the financial position to replace them with something else? Or do they have a memory/narrative attached which reflects the culture and local history of the inhabitants? Venice, Rhodes, Edinburgh, and San Juan are blends of the natural environment and man-made construction. If stones, mortar, bricks, and other materials are compromised by sea level rise/erosion/flooding, how can they exist outside of memory? These cities are often admired for their iconography and architecture which reflect their history, but their cultural heritage goes deeper than just the detailed facing of a stone or the decorations of a façade.

²¹ World Heritage status is designated for sites which meet criteria such as a building or landscape is significant in human history, has “outstanding universal significance,” representative of “a masterpiece of human creative genius,” etc. “The Criteria for Selection.” UNESCO. Accessed May 10, 2019. <https://whc.unesco.org/en/criteria/>.

To better understand the impact of sea level rise and flood waters on historic building materials in coastal cities, it is important to consider the bigger issues of climate change. Climate change is an alteration in the Earth's climate. Alteration can mean a change in Earth's temperature or change in where snow and rain fall because climate change also refers to a difference in the typical weather of an area.²² Sea level rise is a direct result of global warming. Sea level rise stems from the warming of water which then expands, and increase in the water level due to glaciers and ice sheets melting.²³ There are multiple factors in climate change in addition to results from human activity, such as changes in the Earth's atmosphere, alterations in the axis of the planet and its orbit around the sun, meteors, plate tectonics, volcanic activity, changes in greenhouse gases, etc.²⁴ However, it is significant that "only in this century have human activities begun to influence the climate-and scientists are still struggling to understand what the consequences might be."²⁵ Thus, the rise in sea level, the increase in storms and floods and erosion, is a result of a human activity. Around the mid-to-late 1800s, people burned coal, gas, and fossil fuels, sending greater amounts of carbon dioxide into the air. Carbon dioxide is one of the primary greenhouse gases, and it absorbs heat from the sun and warms the atmosphere. The increase in carbon dioxide in the atmosphere is warming the Earth more significantly, and the "resulting rise in sea level is likely twice what we would have seen without the increase in greenhouse gasses."²⁶ In short, "the number one cause of sea level rise is climate

²² "What is Climate Change?" NASA, May 14, 2014. <https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-climate-change-k4.html>.

²³ "Sea Level," NASA: *Global Climate Change*, accessed January 12, 2019. <https://climate.nasa.gov/vital-signs/sea-level/>.

²⁴ "Climate change," National Geographic, accessed January 12, 2019. <https://www.nationalgeographic.org/encyclopedia/climate-change/>.

²⁵ "Climate change," National Geographic.

²⁶ The Ocean Portal Team, "Sea Level Rise," *Smithsonian: Ocean*, accessed January 12, 2019. <https://ocean.si.edu/through-time/ancient-seas/sea-level-rise>.

change,” and it is currently in action.²⁷ As storm surges and floods happen more often as a result of sea level rise, the building materials suffer from its constant submersion under water and drying out process as these events come and go. The urban fabric of coastal cities and its materials are in danger now.

It is a city on water, but there is something more, an essence imbued in the stones, plaster, wood, glass, and bricks which stirs emotions. Venice is a city which has inspired numerous proclamations, poems, love letters, and films. Anna Somers Cocks, former chairman of the British charity Venice in Peril, has often remarked on it as “incomparable” and the “loveliest of cities.”²⁸ Why? What is it about this medieval and Renaissance city which has invoked its citizens and the rest of the watchful world to cry “Save Venice!”²⁹ For those who have never visited or lived in the city, what brings them to proclaim such words? What is the Venice they picture? Is it St. Mark’s Square (Piazza San Marco), the canals with gondolas passing under a bridge, or the seemingly unchanging facades of the city? Do they only see the picturesque views and imagine Venice as a whole, trapped in time? Do they fear the disappearance of the whole city, a second Atlantis, without considering the individual stones, the planks of wood, layers of mortar, and pieces of glass which make up the fabric of the city? The broad view of Venice stems from 19th and 20th century fantastical and dramatic interpretations of the city and its fate, enhanced by discourse which focuses on the potential loss of the architectural aesthetics and culture of the city.

²⁷ “Get the Facts: Why Are Sea Levels Rising?” *The Climate Reality Project*, October 31, 2018. <https://www.climateRealityProject.org/blog/get-facts-why-are-sea-levels-rising>.

²⁸ Fletcher and Mosto, *The Science of Saving Venice*, Foreword.

²⁹ “Save Venice,” *Save Venice*, accessed April 1, 2019. <https://www.savevenice.org/>.

While the three major discourses, architecture/aesthetics, science, and society/culture, are avenues people should consider in preservation approaches, they need to come together with dialogue on the material history and conditions of the city. Giulia Foscari, an architect and professor at the University of Hong Kong, has noted the sweeping generalizations which heavily romanticize the city's "peril" in *Elements of Venice*. She criticizes these statements, saying "Venice is not a perfectly round, gleaming 'pearl'; it is not the 'Serenissima' that survived, unchanging, even when it had been demoted from the ranks of the world's capital."³⁰ The built environment and materials are in a dangerous relationship with the sea and need to be a key concern in conversations regarding threats of flooding to historical sites. Climate change symptoms continue to endanger the materials which make up the built environment of sites, such as Rhodes (Greece), Edinburgh (Scotland), and San Juan (Puerto Rico). Individuals in Venice's early history and again in the 19th century influenced local and global relationships with the city's materials or lack thereof. Conservators/restorers, construction workers, scientists, residents, and global on-lookers can alter the path of Venice's preservation and other coastal cities by pushing for a greater understanding of the history of the materials.

³⁰ Giulia Foscari and Rem Koohlaas, *Elements of Venice* (Lars Muller, 2014), 10.

Chapter 1

Context and Histories

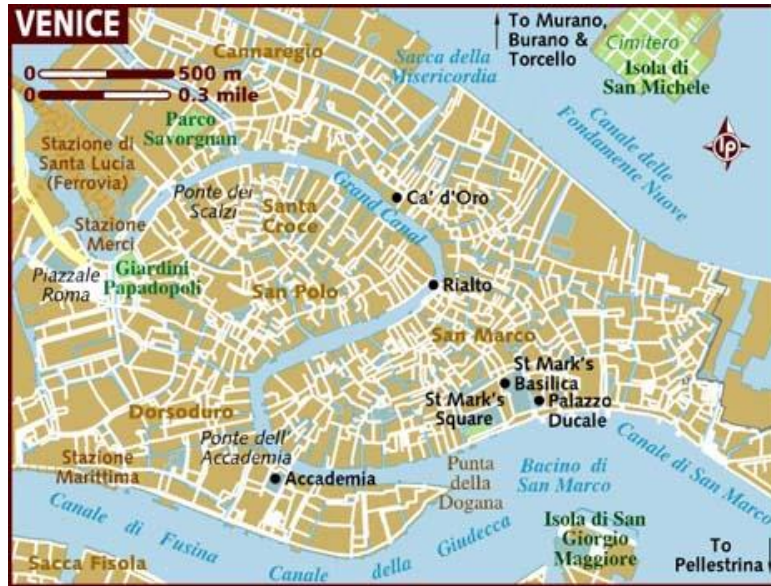


Figure 2. Venice: Map of Venice. Accessed May 11, 2019. Lonely Planet.
<https://www.lonelyplanet.com/maps/europe/italy/venice/>.



Figure 3. Venice. Accessed April 2, 2019. [Public Domain], via PixaBay.

Venice, Italy

To better understand the history of Venice's building development and why the city's preservation is critical and the relationship among builders and patrons/governing officials, I will highlight the activities, interactions, and relationships among builders and patrons/governing officials. As fishermen and refugees work among wooden stilts anchored by mud flats, they are setting up the first foundations of the city known as "La Serenissima" (Fig. 2-3). After escaping the Lombard tribes colonizing the mainland in the northern Italian peninsula during the 6th century following the fall of the western Roman Empire, these first Venetians worked to create a stable home on the lagoon.³¹ While we may not know the names of the craftsmen who worked on the development of the city, we can recognize the work of these laborers who drove piles into the mud, "to the rhythm of song" (Fig. 4)³² These laborers are key figures in the city's history, for they established the foundations of Venice.

³¹ Joanne Marie Ferraro, *Venice: History of the Floating City* (New York: Cambridge University Press, 2012), 2.

³² Ferraro, *Venice*, 25.



Figure 4. Giovanni Grevembroch. *Pile Driving*. 18th century. Watercolor. In R. J. Goy, *Building Renaissance Venice: Patrons, Architects and Builders c. 1430-1500*, page 78.

Venice's history starts in the 6th century C.E. Like Rome, Venice began as a city of huts occupied by refugees. The buildings were supported by stilts or mud flats (Fig. 5-6).³³ The lagoon supplied a natural landscape from silt, reeds, swamps, and salt marshes.³⁴ The materials, which make up Venice's appearance today date to the medieval period and later. There is little, if any, resemblance to Venice's early days in the 6th century.

³³ Ferraro, *Venice*, 2,

³⁴ *Ibid.*

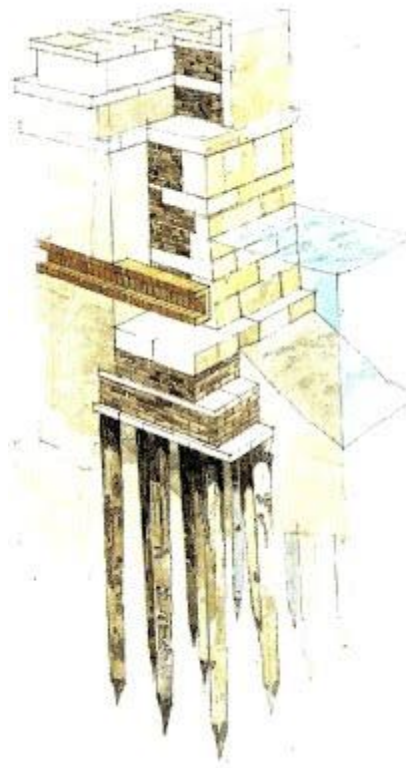


Figure 5. *The Foundation of Venice*. In Caroline Fletcher's *The Science of Saving Venice*, page 35.



Figure 6. Rio di Santa Marina (October 1998) and Rio del Trapolin (July 2004). Venice Backstage.
<http://www.venicebackstage.org/en/363/le-fondazioni-dei-palazzi-veneziani/>.

Despite appearances, architects and laborers did not construct Venice's buildings out of stone during the Middle Ages and Renaissance. They used wooden beams, bricks, and plaster. When craftsmen and laborers did later use stone, it served as either the base for the structures or as the cladding/decoration on many buildings. The workers began the construction of the buildings in Venice by laying wooden pilings into the mudflats on the barrier islands. The pilings were situated 12 to 15 feet in the natural mudflats. Workers would then lay planks on the pilings and solidify it with stone and brick on top. They chose to use stone as the base of the structures, and wooden floors sat on top of the stone support. Laborers then incorporated stone and pieces of marble into a sheet of mortar. Workers usually worked with various limestones, which are sedimentary rocks made up of calcium carbonate. Limestone is a common type of stone. It was a preferred building stone because of its abundance and workability, as it only rates about a 3 on the Mohs scale. While marble was less commonly found than limestone and more expensive, it was still a workable material as it has a grade of about 3-5 on the Mohs scale. Marble has the same chemical makeup as limestone, since it is made up of calcium carbonate, but it is a metamorphosed stone with less porosity than limestone. Afterwards, workers tackled the facades, walls, and roofs with bricks and terracotta tiles. Workers turned to crushed brick, pieces of marble, and lime to cover brick coursework with stucco. At the end of the construction, if the contract between the patron and architect/stonemasons conveyed the patron wanted stone cladding, the workers used thin slabs as a facing to cover the brick. Stonemasons also sculpted stone decoration for doorways, capitals, cornices, friezes, and more.

Over the centuries, generations of workers and immigrant laborers/craftsmen continued to erect structures in the lagoon, creating about seventy island parishes by the 12th century. Venice's beginnings as a refugee town continued, attracting immigrants from the mainland and

around the Mediterranean. The very Lombards who drove many to seek safety in the lagoon produced a dominant proportion of the stonemasons in Venice generations later. At a work site during the medieval period or Renaissance, one could find an architect overseeing the project and laborers from the Veneto, as well as Tuscany, Lombardy (specifically Lugano), Como and Bergamo.³⁵ Some artisans and craftsmen came from outside the Italian peninsula, in the regions controlled by Venice, such as Istria and Dalmatia.³⁶ Much of the built heritage of Venice reflects the work of craftsmen transplanted from other regions.

The laborers and craftsmen in Venice helped solve issues of how to build a city on water as they erected more structures to keep up with the growing population. Every day, as laborers worked with wood, stone, bricks, and plaster, they incorporated knowledge and solutions to erecting stable structures in Venice's unique environment. The Gothic style dominated architecture from the 12th to the 16th centuries in northern Europe. However, it proved impractical for Venice as the city's foundations could not support the weight of vaulted ceilings, so the Gothic style was reserved for the facades of wealthy families.³⁷ It served little more than an aesthetic purpose. Many churches ended up with flat ceilings with exposed wooden beams, a continuation of the Early Christian tradition.³⁸ Classical influences which became more popular in the Renaissance fared better in the watery city than the Gothic. Venetian architect Andrea Palladio helped ensure Venice's characteristic Renaissance heritage. Rather than try to incorporate a popular feature among buildings in Europe, workers incorporated assorted styles

³⁵ Antonio Salvadori, *Architect's Guide to Venice* (Venice, IT: Renzo Salvadori, 1990), 14.

³⁶ Richard J. Goy, *The Building of Renaissance Venice: Patrons, Architects, and Builders* (Singapore: Richard Goy, 2006), 67.

³⁷ Ferraro, *Venice*, 24.

³⁸ *Ibid.*; St. Mark's Basilica is an exception in that the architects created multiple domes instead of a flat ceiling. However, multiple domes do not exert the same amount of weight as one, large, vaulted ceiling.

and features based on both a patron's wishes and the unique makeup of Venice's watery environment.

While the craftsmen may not have any role in the government itself, most formed a relationship to the ruling body. The builders of Venice, the pile-drivers, blacksmiths, stonemasons, and carpenters were not usually members of the elite.³⁹ The craftsmen, in addition to joining their own crafts' guilds (which were controlled by the state), often became members of the *Scuole Grandi* if they were citizens of Venice.⁴⁰ Membership allowed them to identify with the Republic and the city, present themselves as those with an elevated civic duty and responsibility and form contacts with Venetian nobility and wealthy patrons.⁴¹ Venice boasts a strong history of craftsmen and guilds as the city once had as many as two hundred specialized guilds, a number beyond any city in the Italian peninsula.⁴² The example of Pietro Baseggio in the following paragraph highlights the role of materials in the relationship between craftsmen and the ruling body.

³⁹ Goy, *The Building of Renaissance Venice*, 65.

⁴⁰ Scuole Grandi were confraternities for the non-nobility citizens of the city.

⁴¹ Goy, *The Building of Renaissance Venice*, 65.

⁴² *Ibid.*, 67.



Figure 7. Istrian Stone and Red Verona Marble on the Doge's Palace. Accessed April 13, 2019. [Public Domain], via Pixabay.

To set the scene, Pietro Baseggio could be found nearby the site of the Doge's Palace during the mid-14th century in Venice as he served as the superintendent of the construction of the palace. As an architect and sculptor, Baseggio conducted work on the palace for the then-current Doge of Venice. There was a significant turnover of Doges, as many were already older and served until their deaths.⁴³ Giovanni Dolfin died the year Baseggio became superintendent, and Lorenzo Celsi succeeded Dolfin. Baseggio is one of the many architects and craftsmen who worked with the elite and noble individuals to construct the buildings of Venice. One can imagine Baseggio watching the new loads of stone and marble come into Venice as laborers

⁴³ The bubonic plague outbreaks of the 14th century are examples of the prominence of disease during this time. One could theorize disease is the key reason few individuals held seats of power for longer than a few years.

transported them to the sites for cladding and decorative features. Constructing a building in Venice took workshops of laborers, artisans, and craftsmen. In the 14th century, the façade of the Doge's Palace entered a phase of Gothic reconstruction (Fig. 7). The Gothic helped convey "austerity, even parsimony" before a new classical trend appeared which emphasized Venice's supposed past with ancient Rome.⁴⁴ While few contracts survive, there would have been an indication that stone was to be a key material for the structure of a powerful individual like the Doge. In contrast to brick and timber, the patriciate gave stonemasons more control over the acquisitions of stone.⁴⁵ Much of the stone used in Venice was either red Verona marble or white Istrian limestone. Some other stonework were looted materials taken from Constantinople to Venice during the Fourth Crusade.⁴⁶ The masons would go to quarries to select the stone, based on the funds given to them, and ensure the transportation of the material.⁴⁷ While an elite figure, such as the Doge, may require stone cladding or a kind of stone, it is the workers who were in charge of implementing the wishes of the patron and putting together the materials to create a new structure.

Architects, laborers, and craftsmen and government figures gave meaning to the materiality of Venice in the early years of the city's urban history. During the 19th century, the relationship changed. The materials represent the work of artisans and craftsmen within the broader history of Venice. The significance of Venice's urban fabric is questionable without considering the people and the meanings they gave the historic building materials.

⁴⁴ Ferraro, *Venice*, 135.

⁴⁵ Goy, *Building Renaissance Venice*, 79.

⁴⁶ Ferraro, *Venice*, 26.

⁴⁷ Goy, *Building Renaissance Venice*, 80.

Venice's marked difference in comparison to other cities is reflected in the use of its building materials and architectural features. Whereas other Italian cities needed strong, stone fortification and city walls, the body of water protected Venice. While other cities used funds for precious materials, like stone, for protection, Venice could utilize the material more lavishly in its decoration. Venice appeared grand and opulent to non-Venetians, for "only Venetians could enjoy the tranquillity [sic] of an arcaded water frontage-ephemeral facades, narrow bays, slender columns, and tall stilted arches, just the opposite of the heavily fortified palaces of central Italy."⁴⁸ The individual materials used in the built environment of the floating city also has a rich narrative, as the reader will see in the case study on St. Mark's Basilica.

Venice still bears early forms/structural elements from its Byzantine past. After the Western Roman Empire fell, the Eastern Empire lived on. After Roman Emperor Constantine the Great moved the capital of the Empire to Byzantium in 330 CE, he changed the name to Constantinople (today known as Istanbul). Venice's served as a gateway to the East, and its location along the Mediterranean between empires fostered an urban style reflective of "the exchange with Byzantium, the Islamic world, and the Gothic in northern Europe."⁴⁹ These features and buildings were established on a managed lagoon. The seventy island parishes of 12th century Venice have become more defined over the centuries with the continued deposit of silt.⁵⁰ As structures were built over these islands, they took on the appearance of Roman and early Christian architectural traditions, "but they also adapted the Byzantine idiom of patterned brick exteriors and still-life interiors of two-dimensional gold mosaics, an ancient technique from the

⁴⁸ Ferraro, *Venice*, 22.

⁴⁹ *Ibid.*, 11.

⁵⁰ *Ibid.*, 6.

Greco-Latin era.”⁵¹ Thus, early on Venice integrated both Eastern and Western influences, so often mentioned by writers like Ruskin.

In the 6th century, the first inhabitants saw the need to manage their watery environment for stable living. Over many generations, inhabitants learned how to work with the sea by channeling fresh water from the salt water lagoon.⁵² By the 14th century, people altered the natural environment in order to preserve Venice’s unique identity and urban fabric.⁵³ In describing Venice’s relationship to the sea, Fletcher and Da Mosto have noted, “Today, city and sea are still intimately bound together as ever. But theirs is a marriage in crisis.”⁵⁴ Flash forward to the 20th century and the architecture of Venice is under threat from one of the worst natural disasters the over-thousand-year-old-city has seen. After centuries of growth and changes in the natural environment, “the imbalance in its ecology has threatened to bring about its ruin.”⁵⁵ The flood which hit Venice in 1966 brought about a media storm and growth of organizations who vowed to save the city and its art/architecture both from the immediate danger and in the future. In truth, the city’s struggles have been a collaboration of natural and man-made issues which have worsened over centuries. From Venice’s start as an inhabited lagoon during the 6th century, its locals sought to preserve the nature of the lagoon by altering it. However, by trying to hold on to the lagoon, they have continuously damaged its ecosystem. Sea-level rise is now exacerbating issues in the lagoon as people continue to try to alter the impact of flooding and increasing *acqua*

⁵¹Ferraro, *Venice*, 4.

⁵² Foscari and Koolhaas, *Elements of Venice*, 12.

⁵³ Ibid.

⁵⁴ Fletcher and Da Mosto, *The Science of Saving Venice*, 9.

⁵⁵ Ferraro, *Venice*, 212.

alta with mobile flood barriers, such as the MOSE Barrier (Modulo Sperimentale Elettromeccanico, or experimental electromechanical module).⁵⁶

A lagoon is an ever-changing body of water. The barrier islands enclose the lagoon from the ocean, but it is still connected to the larger mass of water by inlets. The islands of a lagoon can decrease or increase in size. They become a landmass, connect to a nearby mainland, or become part of the ocean/sea. It is an ecosystem meant to change. However, Venetians have sought to retain the lagoon in the same state it has existed as since the 6th century by altering of the canals and directions of the tides to manage the lagoon's activity.⁵⁷ This issue is also part of other problems in Venice, including the draining of water in Marghera for oil and chemical purposes in the mid-20th century, the admittance of oil tankers, water/air pollution, industrial smoke, and the influx of tourists on artificial land that cannot support the weight of both the city and the visitors.⁵⁸ The most direct threat however is the rising sea-level. Venice cannot solve the issues listed above if there is no longer a Venice.

A re-occurring issue Venice must face is the *acqua alta*, which are as firmly enmeshed in Venice's history as the urban fabric itself. *Acqua alta*, "or 'acute phase' flooding occurs approximately twenty times a year."⁵⁹ The *acqua alta* is not the same issue as sea level rising. They are the result of high tides when the moon is close to Earth, when the scirocco wind blows in the same direction as the Adriatic Sea (especially after a period of heavy rain), and the di sessa wave which acts as a pendulum in the Adriatic.⁶⁰ However, *acqua alta* is happening more

⁵⁶ The MOSE barrier is made up of metal barriers connected to the seabed by marine concrete blocks.

⁵⁷ Ibid.

⁵⁸ Ferraro, *Venice*, 212.; Venice did sink exponentially during the 20th century as a result of groundwater extraction from the bedrock of the Venetian municipality of Marghera for the oil facilities and chemical companies. The unregulated pumping of artesian water caused the city to sink twice as much as it had in centuries prior and could not be reversed even when pumping stopped in the 1970s. Fletcher and Da Mosto, *The Science of Saving Venice*, 63.

⁵⁹ Foscari, *Elements of Venice*, 446.

⁶⁰ Ibid.

frequently and severely with climate change and sea level rising. The rising water level because of the rise in global warming and greenhouse gases is damaging not only the livelihood of those in Venice, but the fabric of the city itself.

Following the flood of 1966 and the pumping of oil in the Marghera, Venice sought ways to address the concerns of protecting the built city. In 1987 the city became a UNESCO World Heritage Site, bringing the rising sea issue under a global spotlight. The city government worked to establish a plan to protect the city. It took twenty-five years (in 2012) for the city's government to present a management plan to the public. In the interim, Venice began its MOSE project in 2003. The MOSE barrier consists of metal barriers 24 meters high and it is attached to the seabed by marine concrete blocks in a width of 1.5 kilometers.⁶¹ MOSE is not the solution to Venice's battle with the rising sea, for while it "may hypothetically protect Venice from floods, it is not the sole solution to the ecological decline that threatens the continued existence of Venice."⁶² At best, it is a band-aid that will barely stand against the Adriatic. The MOSE project is meant to help against *acqua alta*, not rising sea-level. Still, the materials of St. Mark's Square continue to be underwater repeatedly. Additionally, it is meant to only rise when the *acqua alta* reaches 110 centimeters, and St. Mark's Square currently floods when the tide reaches 80 centimeters.⁶³ Since increase of storm surges is a symptom of sea-level rise, the barrier that already suffers from structural issues will be opened increasingly in the future.⁶⁴ As a result of climate change, the Mediterranean Sea is predicted to possibly rise by five feet prior to 2100.⁶⁵ With the water level rising to 110 centimeters, Venice may flood twice every day at high tide

⁶¹ Foscari and Koolhaas, *Elements of Venice*, 451.

⁶² Gray, "If These Walls Could Talk," 121.

⁶³ Marcello Rossi, "Will a Huge New Barrier Save Venice?" *CityLab*, April 3, 2018. <https://www.citylab.com/environment/2018/04/will-a-huge-new-flood-barrier-save-venice/556226/>.

⁶⁴ Rossi, "Will a Huge New Barrier Save Venice?" *CityLab*.

⁶⁵ *Ibid*.

alone.⁶⁶ The MOSE barrier may help for the next few decades, but it is a short-term aid to a much larger problem. The barrier's hinges are already corroding, and erosion caused by MOSE is damaging the lagoon.⁶⁷ As sea level rises and flooding increases, the length of time the MOSE barrier would remain up could seriously damage the lagoon's ecosystem. In the meantime, the fabric and materials of Venice continue to face severe damage by the floods MOSE cannot protect the city against. Regularly, floodwaters continue to reach St. Mark's Square, Basilica, and residential *sestieres*. After decades of debate and changes in design, Venice's survival as an aquatic city is part of what makes it so unique compared to the multiple land-locked or coastal cities of the Italian peninsula.

⁶⁶ Rossi, "Will a Huge New Barrier Save Venice?" *CityLab*.

⁶⁷ Roberto Giovannini, "Venice and MOSE: story of a failure," *La Stampa* (Turin, IT), December 10, 2017. <https://www.lastampa.it/2017/10/12/esteri/venice-and-mose-story-of-a-failure-2XRaxsCgFhcmKEXidalYxJ/pagina.html>.

St. Mark's Basilica, Venice



Figure 8. Begun 1063; mosaics: 12th C and later. Venice, St. Mark's, Interior, Nave. Architecture. Accessed March 30, 2019. https://library-artstor-org.ezproxy.lib.vt.edu/asset/LESSING_ART_10311442140.

“The floor of it is of rich mosaic, encompassed by a low seat of red marble, and its walls are of alabaster, but worn and shattered, and darkly stained with age, almost a ruin,—in places the slabs of marble have fallen away altogether, and the rugged brickwork is seen through the rents, but all beautiful; the ravaging fissures fretting their way among the islands and channelled [sic] zones of the alabaster, and the time-stains on its translucent masses darkened into fields of

rich golden brown, like the color of seaweed when the sun strikes on it through deep sea.”-John Ruskin, “Description of St. Mark’s”⁶⁸

Due to the extensive history of Venice, I will focus on choice areas to better investigate the built materials and preservation approaches. We will look at St. Mark’s in this chapter and the residential district of the *Cannaregio* in Chapter 2 to investigate the impact of sea-level rise in an area considered globally significant in architecture and one locally significant as it is the home to many Venetians.

For Venice, a key feature which is recognizable for both Venetians and the world is St. Mark’s Basilica and Square. St. Mark’s Basilica (Fig. 8) has kept a continual presence in Venice since the 11th century, tying the structure firmly to Venetian narratives.⁶⁹ The structure today is the third church built on the site. The history of St. Mark’s extends back to 828 CE. Venetians built the original church to house the relics of St. Mark, whose remains are said to have been stolen by Venetians from Alexandria.⁷⁰ Like many earlier churches, the first St Mark’s perished in a fire. The third church was consecrated in 1094, but it was modified and embellished over the centuries. Artisans heavily decorated the interior of the church with mosaics. Builders incorporated architectural features which dominate the structure, such as the five cupolas, Greek-cross plan, columns, capitals, and cornices drawn from Byzantine influence in the East and the Romanesque in the West.⁷¹ Masons added the multi-colored stones and marble from

⁶⁸ John Ruskin, “St. Mark’s,” in *Stones of Venice Vol. 2 (The Project Gutenberg E-book, 2010)*, <http://www.gutenberg.org/files/30755/30755-h/30755-h.htm>.

⁶⁹ This is not to suggest this is the only building of note in Venice or this is seen as the only/most identifiable structure to Venetian identity. A recognizable limitation to this thesis is the struggle to ascertain what structures and what features Venetians connect with the most. This may differ among locals. It is possibly to conduct a survey to determine such a question, but it is not the focus of this research.

⁷⁰ “Theft,” Basilica San Marco, accessed May 14, 2019. <http://www.basilicasanmarco.it/storia-e-societa/san-marco-evangelista/il-trafugamento/?lang=en>.

⁷¹ “The Building Phases,” Basilica San Marco, accessed January 2, 2019. <http://www.basilicasanmarco.it/basilica/architettura/fasi-costruttive/?lang=en>.

Constantinople during the Fourth Crusade. During the temporary establishment of the Latin Empire following the sack of Constantinople in 1204, a number of structures were looted, and architectural features were taken back to Venice. Columns, capitals, marble slabs and features, were incorporated into the built heritage of the city on water, St. Mark's in particular. Adorning a church in "polychrome marble and mosaics . . . in a red brickwork piazza while the facades of the surrounding buildings were mostly frescoed" served to make St. Mark's stand out from the 13th century on.⁷² As the church expanded, architects and laborers enlarged the cupolas to make it more visible from the sea.⁷³ Such changes reveals the continuous relationship between the building features and the surrounding water. St. Mark's became "a kind of living organism in continuous mutation down through the ages of its history. Each period left important marks that contributed to creating a highly singular 'summa of precious artistic elements.'"⁷⁴ Therefore, there is a significant mix of Byzantine, Islamic, and Western influence in the architecture of St. Mark. For example, the inflected arches and dome lanterns/cupolas capping the domes are drawn from Islamic traditions. The interior mosaics reflect both Byzantine and Islamic traditions, and the Greek-cross plan is drawn from the Byzantine style. The heavy exterior architectural ornamentation is an element of the Gothic. Even as elements and features of the church continued to be updated to fit in with the latest styles, the materials highlight St. Mark's role as a palimpsest and its connection to the sea and lagoon. St. Mark's is an example of a building which is often signified by its aesthetics/architectural significance and its symbolisms. Yet the materials help give fruition to local meaning and symbolism to the local community too.

⁷² "The Building Phases," Basilica San Marco.

⁷³ Ibid.

⁷⁴ Ibid.

While it still bore traces of the 13th century church, it was continuously changed in order to serve the needs or wishes of Venetians until the fall of the Republic at the end of the 18th century. When the Republic ended, the church took on a new role when Napoleon separated the church from the Ducal Palace. The ducal chapel became the cathedral of Venice and new preservation programs began. The Basilica was modified, altered, and shaped by the Doge and the inhabitants who worked on the structure. The active preservation efforts began with the introduction of a foreign power. The preservation techniques of the 19th century follow two entirely different approaches. Director of works at St. Mark's Basilica, Giovambattista Meduna, abided by a practice of replacing features or elements that degraded.⁷⁵ Meduna followed an approach similar to that of Viollet-le-Duc, as the latter focused on restoration of aesthetics, holistic appearances.⁷⁶ Viollet-le-Duc's approach to restoration was not to bring a building back to its original state, but to complete it as it was meant to be finished.⁷⁷ The "Father of Restoration" was more concerned with structural function and completeness than the materials themselves. Pietro Saccardo, Meduna's successor, was a greater proponent of the ideas of preservation espoused by John Ruskin, "who recognized in the materiality of monuments the signs of the passion and technical skills of the builders of the past."⁷⁸ Rather than destroy or replaced damaged areas of the Basilica, Saccardo focused on understanding the

⁷⁵ "The Building Phases," Basilica San Marco.

⁷⁶ Viollet-le-Duc was a French architect and is often called the "Father of Restoration." He was responsible for the restoration of Cathedrale-de-Notre Dame in Paris during the 19th century. His theory and Ruskin's are arguably polar opposite approaches to restoration/conservation.

⁷⁷ Eugène Viollet-le-Duc, *The Architectural Theory of Viollet-le-Duc: Readings and Commentary*, ed. M.F. Hearn (MIT Press, 1990).; Famously, Viollet-le-Duc added new elements to Cathedrale-de-Notre Dame in Paris, the first site where he applied his theory. The gargoyles and spire, while molded to the identity of Notre Dame, were 19th century additions.

⁷⁸ "The Building Phases," Basilica San Marco.

history/significance of the materials and restoring the areas that were damaged.⁷⁹ Similarly, Ruskin made the connection between the materiality of building fabric and the past it signified.

Ruskin and his *The Stones of Venice* are key to understanding the built heritage and materials of Venice. Englishman William Morris based his “Society for the Protection of Ancient Buildings” (SPAB) drew upon Ruskin’s work and led a campaign to stop Meduna’s restoration of St. Mark’s Basilica, with the leading document named “St. Mark’s Memorial,” with Ruskin as one of the signers.⁸⁰ However, the campaign was mishandled. SPAB’s approach was adversarial as Englishmen attempted to control the preservation of St. Mark’s Cathedral, but the issue was worsened as the Memorial was given to the wrong government department.⁸¹ The incident was widely publicized and critiqued by the British and Italian public and Italian government.⁸² Meduna’s restoration did come to a halt as publicity drew attention to Meduna’s approach and after SPAB addressed their blunder to the Italian government.⁸³ Saccardo succeeded Meduna shortly afterwards. While he is heavily focused on aesthetics, Ruskin prized the materials for their history and relationship to the individuals who produced them. For Meduna, they appearance and structural stability of the site was of greater importance than where the materials came from, and how long they adorned or upheld the structures. It is important to understand the history of the materials and consider their significance in developing a preservation approach, for both monumental buildings and residential structures.

⁷⁹ “Restoration,” Basilica San Marco, accessed May 9, 2019. <http://www.basilicasanmarco.it/basilica/mosaici/i-restauri/?lang=en>.

⁸⁰ “The SPAB’s early campaigning in Venice,” SPAB, April 4, 2019. <https://www.spab.org.uk/news/spabs-early-campaigning-venice>.

⁸¹ “The SPAB’s early campaigning in Venice.”

⁸² Ibid.

⁸³ Ibid.

Rhodes Town, Greece



Figure 9. Rhodes, Greece. Accessed May 10, 2019. On the World Map. <http://ontheworldmap.com/greece/city/rhodes/rhodes-city-old-town-map.html>.



Figure 10. Rhodes. Accessed April 10, 2019. [Public Domain], via PixaBay.

It is important to consider other heritage sites facing issues of sea level rise and understand why they are important both globally and locally. Like Venice, much of the ancient and early medieval world was found along the coast or near rivers. Long before Venice was inhabited and altered by its residents, Rhodes, Greece (Fig. 9-10) already established a built environment on an island in the Aegean Sea. With multiple Greek mythological connections, which help inform the city's identity, the city's past extends back in time to the Bronze Age. Archaeological evidence reveals people on Rhodes had contact with the Minoans on Crete and the Myceneans on mainland Greece.⁸⁴ An important island on trade routes during much of antiquity, Rhodes also had a well-established sculpture school by the Hellenistic period.⁸⁵

The artistic and architectural tradition continued in Rhodes past the Hellenistic age and death of Alexander the Great when changes ensued in the Mediterranean world. Later Roman influence and Rhodes' continued importance along the trade routes brought forth a varied mix in architectural and artistic styles. Like much of Western Europe, Rhodes also fell victim to raids after the fall of the Western Roman Empire. Arab raids created instability in Rhodes for centuries until the Ottomans assumed control in the 16th century. In between these centuries, Rhodes became a key site for the Knights of St. John. Due to the raids and Crusade activity, the Knights

⁸⁴ This island with multiple names, Aithrea, Ophiorisa, and Felchinia, is the largest of the islands in the Dodecanese. The Dodecanese is a group of islands in the Aegean. Three main cities existed on the island in antiquity: Kos, Cnidos, and Halicarnassus.

⁸⁵ The city of Rhodes developed as one entity around 408-407 BCE after the three earlier cities flourished due to the creation of trade routes in the Mediterranean. Growing in power, Rhodes then established colonies in the Dodecanese and strengthened ties with Egypt. With a strong urban area in the middle of trading routes along the Mediterranean, Rhodes grew to become the first Aegean naval power. In this same period, the art and architecture which helped identify Rhodes' architecture and culture, grew. Sculptors, such as Chares of Lindos, contributed to the art and sculpture that became part of the history of Rhodes and its narrative. Chares and his teacher, Lysippos of Sicyon, worked during an age when Greek art and architecture shifted from the Classical to the Hellenistic period. Lysippos served as a sculptor for Alexander the Great, the Macedonian king whose conquests in the east are seen as a major influence on Greek art as different cultural, stylistic traditions were absorbed into the art. Chares was one of Rhodes' own sons as he was born on the island and his Colossus of Rhodes, one of the Seven Wonders of the Ancient World, helped keep Rhodes enmeshed in legend.

used Rhodes as a check against encroaching control of the Aegean and Mediterranean by the Arabs. The presence of the Knights of St. John translated strongly into the architecture and features of the historic Old Town Rhodes (Rhodes Town).

The urban area Rhodes is divided into a high town and a lower town, with the former bearing most of the remains of the medieval and early modern city. The separation of the high town and old town is seen through the presence of a 4 km fortified wall.⁸⁶ The high town shows the clearest evidence of the history of the Knights in Rhodes. They built largely in the Gothic style as the Knights came from Western Europe, particularly France and Spain.⁸⁷ The early examples of Gothic (1309-1480) highlight the local masons' unfamiliarity with the style and their continued inclusion of Byzantine features. However, from 1476-1503, the Gothic is much more Westernized, for the "forms are more harmonious, the execution surer, and the decoration naturalistic or cleverly stylised [sic]."⁸⁸ Throughout the high town, there is evidence of the Gothic in the use of ribbed vaults, pointed arches, stone ceilings, heavy masonry, and clustered columns and piers. However, the Greek and Roman and Byzantine style continued with mathematical symmetry and the lack of grand sculptural ornamentation oft associated with the late Gothic. The presence of the Knights may be most apparent in the crenellated towers and gates along the wall which highlight the space as a fortress against Arab raiders. The Gothic style continued in use during the 16th century in Rhodes Town, even while Italy and Venice were in the throes of the Renaissance,

The fortifications finally failed in 1522 when the rule of the Knights ended following a siege led by Suleyman II, the Ottoman sultan. The Ottoman Empire took control of Rhodes until

⁸⁶ "Medieval City of Rhodes," UNESCO, accessed January 4, 2019. <https://whc.unesco.org/en/list/493>.

⁸⁷ McGilchrist, "Rhodes."

⁸⁸ Ibid.

1912 when the Kingdom of Italy occupied it. The Ottomans kept much of the medieval fabric of the city, while adding or converting buildings into mosques, houses, and baths.⁸⁹ After 1522, the Ottoman Empire brought forth new styles and architecture to the existing urban space. The resulting appearance in Rhodes is a blend of Eastern and Western styles, much like Venice.

While Rhodes Town is on the largest island of the Dodecanese, Rhodes is still an island and much of the materials in the medieval town are exposed to water from the sea and salt air. The urban fabric of Rhodes Town is made of sandstone. Sandstone is carbonatic, meaning it is made of calcium carbonate. Limestone and marble are carbonatic too. However, sandstone, despite the fact it is harder than limestone or marble, is vulnerable to water damage. With the rising sea level, sea salt spray is increasingly harming the sandstone.

The built city is a palimpsest as it grew during the Classical period of ancient Greece, became a powerful port city characterized by one of the ancient Seven Wonders of the World, served as a military stronghold/hospital during the Gothic age by the Knights of St. John, became part of the vast Ottoman Empire, and bears evidence of Italian nationalism during the 20th century before it became part of Greece. The inclusion of Ottoman structures and alterations signify the changing history of Rhodes and of the Mediterranean.⁹⁰ The significance of Rhodes Town's built environment and history led to the listing of the medieval city as a UNESCO World Heritage Site in 1988. Like Venice, the city is listed as threatened by not just climate change, but "the tourist development and the commercial overexploitation of the property, the modification of land use and of building regulations [requiring] that the strategic management of the property

⁸⁹ "Medieval City of Rhodes."

⁹⁰ WHC/16/40.COM/8E.

be continuously strengthened.”⁹¹ Therefore, the medieval city of Rhodes also falls under environmental threats, such as from sea level rise, in addition to its development and tourism.

Edinburgh Castle, Scotland

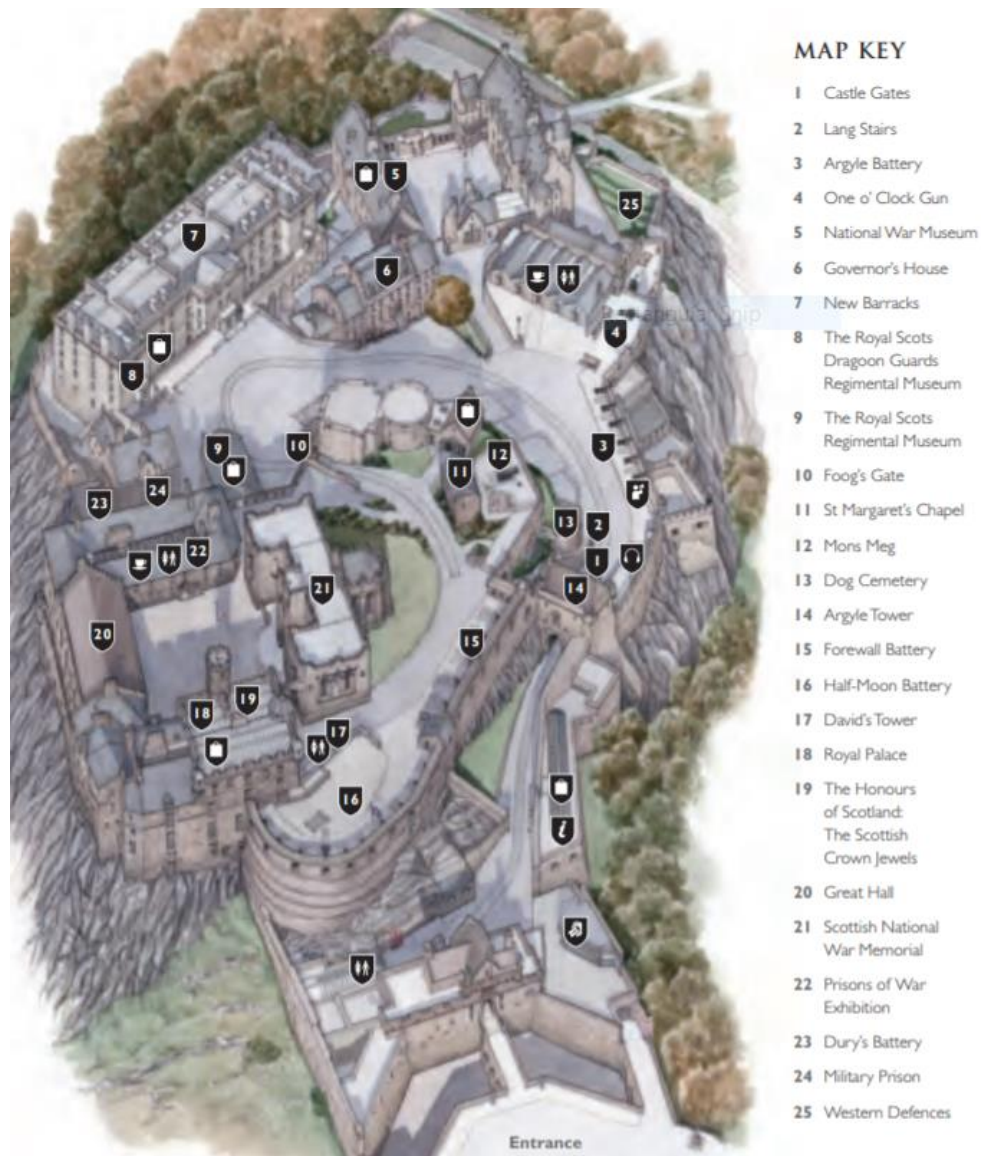


Figure 11. Edinburgh Castle. Accessed May 10, 2019. Edinburgh Castle.
<https://www.edinburghcastle.scot/media/1116/orientation-map.pdf>

⁹¹ WHC/16/40.COM/8E.



Figure 12. Edinburgh Castle. Accessed April 10, 2019. [Public Domain], via Pixabay.

Looming high above the cityscape of Edinburgh is an ever-present reminder of Scotland's medieval past. The World Heritage Site of Edinburgh is identified in two halves, much like Rhodes. The Old Town of Edinburgh represents the medieval streetscape and structures. The New Town is largely a product of the Georgian era. This paper will focus on Castle Rock partly due to the strong connections Venice and Rhodes have to their built medieval past as well. However, Edinburgh Castle is affected differently by sea level rise because of groundwater flooding, leading to erosion.

Edinburgh Castle (Fig. 11-12) sits on a natural igneous and sedimentary formation. Castle Rock, upon which the castle sits, is the result of a million-year-old volcanic activity and has thus been dubbed the "Grey Athens of the North" because of its distinctive stone.⁹² Its prominent appearance is because, historically, the site, or plug, was not as susceptible to erosion from glacial activity. As seen throughout pre-historic Europe, settlement was established on the high ground, due in part to the security it afforded. There is evidence of an Iron Age settlement.

⁹² Andrew McMillan and Ewan Hyslop, "The City of Edinburgh-Landscape and Stone," British Geological Survey, ICOMOS 2008 Scientific Symposium. https://www.icomos.org/quebec2008/cd/toindex/77_pdf/77-KoCo-73.pdf.

Eventually, the Romans made their entrance in what is now the lower part of Scotland. Once known as Din Eidyn, the English name of Edinburgh became more commonly used beginning in 638 CE due to Anglo invasion.⁹³ With the growth in population afterwards, the town extended beyond Castle Rock. The site became connected to royalty and military activity in the medieval period. Thus, the built environment upon the rock formation changed from what may have been wooden huts or small stone structures during the Iron Age and later to a castle in the 12th century. The natural formation of the plug is further emphasized by the Castle and the city's continuous use of stone over the centuries. Even as styles changed, the use of the local sandstone served as the dominant material until the 19th century. As a result, the "buildings are dominated by locally quarried sandstone so that the stone-built heritage literally grows out of the bedrock foundations of the city."⁹⁴ Edinburgh's use of sandstone created a city with strong connections to its environment. Edinburgh is both city and stone, built environment and landscape. The exposed bedrock of Castle Rock is part of the foundations of multiple structures of Edinburgh Castle, making groundwater flooding a direct issue as water seeps from the bedrock into the foundations of the buildings.

During the Middle Ages, the structures became increasingly grand and fortified. This period saw Castle Rock become "Scotland's chief royal castle in the Middle Ages, taking the role as headquarters for the sheriff of Edinburgh; military troops were stationed there, along with the royal gun train, and the crown jewels were stored."⁹⁵ However, over time the appearance and elements of the built environment on Castle Rock changed due to the many political changes and military action at the Castle. Like Rhodes, Edinburgh Castle was often threatened with siege

⁹³ "Edinburgh," *Historic UK*, accessed January 4, 2019. <https://www.historic-uk.com/HistoryMagazine/DestinationsUK/Edinburgh/>.

⁹⁴ McMillan and Hyslop, "The City of Edinburgh."

⁹⁵ "Edinburgh," *Historic UK*.

throughout the Middle Ages and Early Modern periods. Ownership of the castle has gone back and forth between the Scots and English as well as among different political factions. For example, a structure known as David's Tower was destroyed during a rebellion against the martial union between Mary, Queen of Scots, and James Hepburn, Earl of Bothwell. With James I's reign of both Scotland and England, he moved the court to London and the castle served as a military fort.⁹⁶ As such, the castle was oft seen as a physical embodiment of authority and was continuously subject to siege, especially during the Scottish Wars of Independence. The castle now serves as a military station and a museum, presenting a narrative of power and authority.

The local stone and Castle Rock are essential to Edinburgh's identity. The challenge in conserving Edinburgh's stone heritage has brought the Scottish Stone Liaison group to reopen a quarry which matches the local sandstone in an effort to repair structures with unstable masonry features.⁹⁷ Therefore, the stones used for restoration are important because "the buildings themselves are in the main constructed of the very stone which underlies the City, such that the links between geology and the people can seldom be stronger."⁹⁸ However, groundwater flooding is damaging the material conditions of the Castle because of the physical connection between the bedrock and the sandstone buildings. The next chapter will address how to protect Edinburgh's built heritage and materials from effects of sea-level rise.

⁹⁶ "Edinburgh," *Historic UK*.

⁹⁷ McMillan and Hyslop, "The City of Edinburgh."

⁹⁸ *Ibid.*

Old San Juan, Puerto Rico

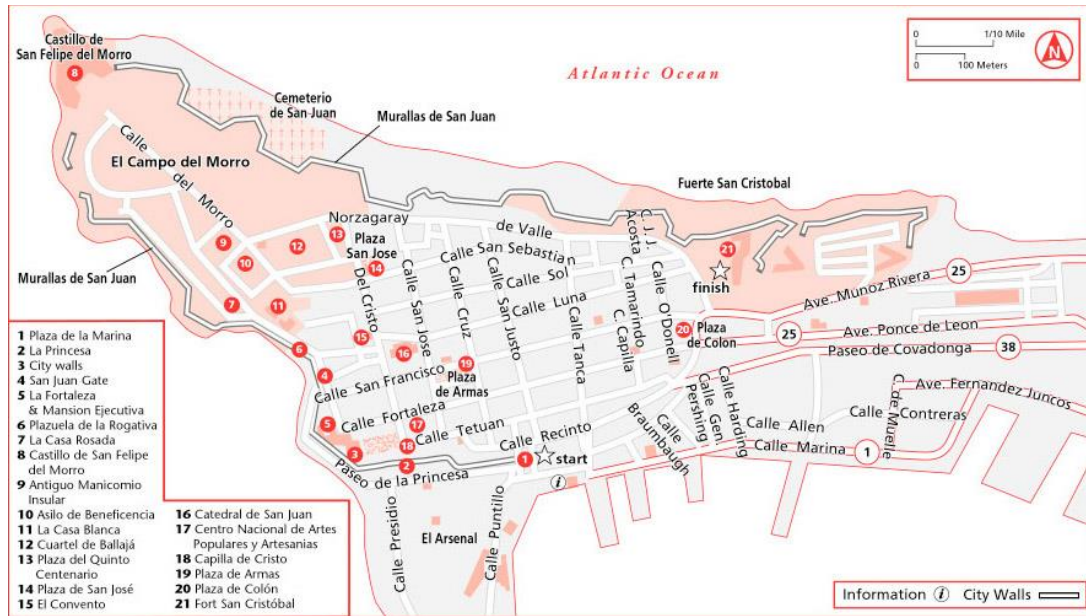


Figure 13. Old San Juan. Accessed May 10, 2019. Welcome to Puerto Rico. http://welcome.topuertorico.org/maps/323_walkingtouroldSanjuan.jpg.



Figure 14. San Juan National Historic Site. Accessed April 10, 2019. [Public Domain], via Pixabay.

Old San Juan has a complex history as its built heritage is strongly linked to colonialism following the Spanish invasion of the island and the Tiano indigenous people. In San Juan (Fig. 13), Puerto Rico, many buildings and materials have undergone severe damage as a result of Hurricane Maria in October 2017. I look at San Juan because it is important to recognize severe destruction coastal heritage sites have already faced. Puerto Rico is located between the Atlantic Ocean and the Caribbean Sea. The fortifications are on the Bay of San Juan along the north of Puerto Rico, facing the Atlantic. While the hurricane is certainly different than the *acqua alta* and repeated flooding which plagues the building materials in Venice, one of the key signs of sea level rise is “increased damage from hurricanes and other storms,” in addition to high tides.⁹⁹ The areas labeled a UNESCO World Heritage Site are La Fortaleza, Castillo San Felipe del Morro, Castillo San Cristóbal, San Juan de la Cruz fort, and part of the city wall of San Juan.¹⁰⁰ The architectural features date from the 16th to the 20th centuries. La Fortaleza, the forts, and the city wall of San Juan received World Heritage because the structures’ connections to Europe are considered globally significant. Ultimately, the site “outstandingly illustrate[s] the adaptation to the Caribbean context of European developments in military architecture. . . They represent the continuity of more than four centuries of architectural, engineering, military, and political history.”¹⁰¹ UNESCO appears to measure San Juan’s historic sites based on a dominant, Euro-centric narrative.

Before discussing the issues at the site, it is important to briefly discuss the history of the heritage site. During the 16th century, San Juan served as the most important outpost for the Spanish empire as it was a final stop for ships carrying precious metals, such as gold and silver,

⁹⁹ The Ocean Portal Team, “Sea Level Rise,” *Smithsonian: Ocean*.

¹⁰⁰ “La Fortaleza and San Juan National Historic Site in Puerto Rico,” UNESCO, accessed January 13, 2019. <https://whc.unesco.org/en/list/266/>.

¹⁰¹ “La Fortaleza and San Juan National Historic Site in Puerto Rico,” UNESCO.

from the colonies to the Old World.¹⁰² The fortifications in San Juan began with El Morro in 1539 as protection for the fort which attracted pirates. It was built 40 meters above sea level and with walls six feet deep.¹⁰³ One of the more distinctive features of the fortress are the stone watchtowers which jut from the exterior of the wall (Fig. 14). Like the urbanscape of San Juan, the fortress reflects 16th century Spain and serves as a reminder of Spanish presence in Puerto Rico prior to Spain ceding possession of the island to the U.S.¹⁰⁴ One hundred years after the erection of El Morro, San Cristobol was built to the east on a grander scale, three times the size of El Morro.¹⁰⁵ The fortress attached to El Morro via tunnels, but a wall eventually extended around the city of San Juan itself. San Juan's position in the Greater Antilles as an "impenetrable, fortified city" can be seen physically by the stone fortifications rising from the sea.

San Juan's tropical environment has both shaped its architectural features and brought forth conservation issues to the materiality of the sites. The materials include sandstone, brick, and plaster, as well as concrete which was utilized in some restoration efforts.¹⁰⁶ Sandstone is easily affected by water, salt, and pollutants, and the other materials have faced issues with the erosion and air pollution.¹⁰⁷ Maintenance has been key for the conservation of this structure.¹⁰⁸ Hurricane Maria caused significant damage to San Juan. Since the U.S. National Park Service (NPS) manages San Juan National Historic Site, it was closed by the NPS in an effort to repair it. The National Park was continuously preserved by a maintenance division, though the last report

¹⁰² "La Fortaleza and San Juan National Historic Site in Puerto Rico: Video," *UNESCO*, accessed January 17, 2019, <https://whc.unesco.org/en/list/266/video>.

¹⁰³ "La Fortaleza and San Juan National Historic Site in Puerto Rico: Video."

¹⁰⁴ *Ibid.*

¹⁰⁵ *Ibid.*

¹⁰⁶ "La Fortaleza and San Juan National Historic Site in Puerto Rico," *UNESCO*.

¹⁰⁷ *Ibid.*

¹⁰⁸ *Ibid.*

on the division by NPS was only updated in 2015.¹⁰⁹ It is difficult to determine the multiple issues regarding preservation of the fort since Hurricane Maria, and the actions of the maintenance division.

The fortresses and city wall are made of sandstone, along with lime and brick. The maintenance division practices traditional construction and preservation methods as they restore features of the historic fortresses using materials utilized during the original building of the fort. Therefore, they utilize mortar and masonry that follows the building techniques of the 17th and 18th centuries. NPS describes the use of cement and other modern materials “as incompatible with the old structures and can ultimately cause damage to the historic fabric.”¹¹⁰ However, cement was used in the 20th century and is still present in areas of the site. NPS’s approaches are similar to those employed in Europe, especially due to the popularity of minimalist conservation. Thus, the maintenance crews avoid using cement, and instead use mortar made of lime, sand, water, and (when called for) powdered brick.¹¹¹ If modern materials are introduced, it can have extremely damaging effects on a historic structure. Even if the materials appear to do little or no damage over a brief time frame, the destruction may not appear until months or years later, when it is too late to alter the damage. Nevertheless, while maintenance may have been consistent at San Juan Historic Park prior to Hurricane Maria, what of the issues of flooding or erosion to the materials? What of the aftermath? How badly were the historical materials of El Morro Castillo San Cristobal damaged? While replacing and repairing the mortar may have aided the stability of the structure, what of the loss to the historical masonry and architectural features? Has the identity of the fort changed and if so, how? Without updated reports and information following

¹⁰⁹ “Maintenance Division,” National Park Service: San Juan, last updated April 14, 2015. <https://www.nps.gov/saju/learn/management/maint.htm>.

¹¹⁰ “Maintenance Division,” National Park Service: San Juan.

¹¹¹ Ibid.

Hurricane Maria, it is difficult to know the current damage. The architecture and aesthetics in San Juan are presented by UNESCO within a Euro-centric, dominant narrative that is presented for the global population, with little attention on the local society and culture. The material conditions of the fort are threatened by the aftermaths of Hurricane Maria. If these stone materials are compromised, the heritage of the site is in danger as well as the possibility of a stronger relationship between the community and the materials as they acknowledge its history and preservation.

Chapter 2

The Materials



Figure 15. Venice: Piazza S. Marco Map. Accessed March 15, 2019. https://library-artstor-org.ezproxy.lib.vt.edu/asset/ARTSTOR_103_41822003336771.

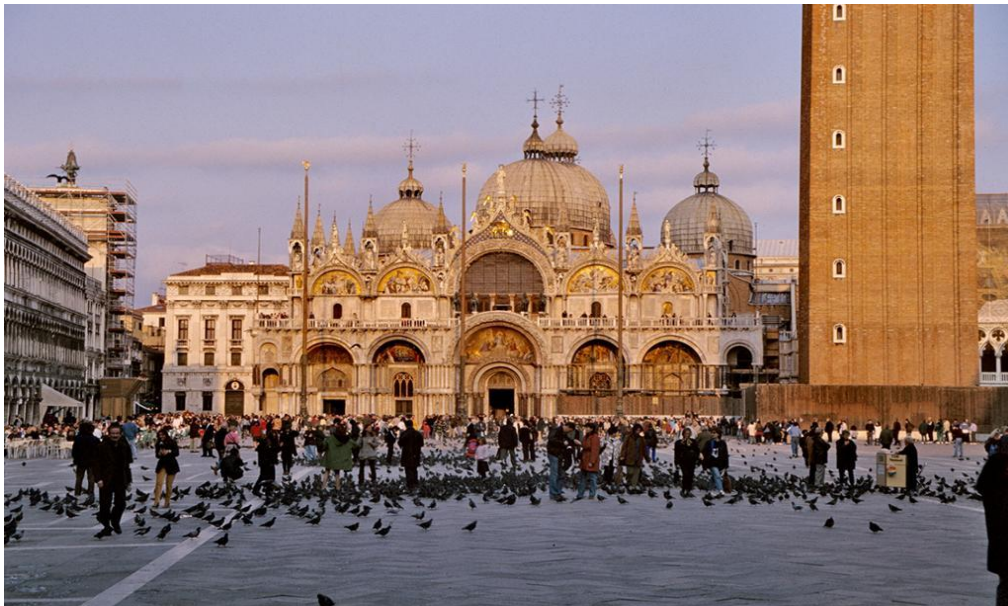


Figure 16. Piazza San Marco and Basilica of St. Mark. Accessed March 10, 2019. https://library-artstor-org.ezproxy.lib.vt.edu/asset/QUILL_1039907969.

Venice, Italy

Each type of structure in Venice, the monumental, structural, and the everyday have a meaningful connection to the history of the city. In the following paragraphs, I will call attention to how the materials of both monumental buildings and residences are meant to evoke emotions in a viewer. This approach is essential to see why the materials are so significant and why it is so important to preserve them.

Standing on the white and gray stones in the middle of the Piazza San Marco (Fig. 15), your eye is drawn down vertically from the brick campanile to the domes of the Basilica of St. Mark (Fig. 16). On every side of the Piazza are the many arcades and loggias of the Procuratie Vecchie and Procuratie Nuove. Nearby the Piazza, water laps at the Piazzetta dei Leoncini where two marble lions stand on lone columns. Venice is also comprised of alleys and structures which reflect the everyday fabric of the city. The structures in such areas have exteriors of brick, plaster, or stone facings. Few have marble facades. All of these structures are currently undergoing damage from sea-level rise; it is not a matter of when it will happen, for materials in these structures are already becoming compromised.

St. Mark's draws from multiple architectural/artistic traditions in various cultures in regions around the Mediterranean, and this allows for UNESCO to draw it easily into the folds of a global narrative. Upon entering St. Mark's Basilica, one's eye is drawn towards the walls and the ceiling. The mosaics are made of colored or gold-leaf backed pieces of glass. The mosaics extend to the cupolas, or domes. At the rim of each cupola are a series of windows. The effect of the windows creates a kind of halo of light, which bounces off the gold and multi-colored mosaics. As a result, St. Mark's becomes infused with light despite the lack of large casements. These architectural features are not unique to St. Mark's, as this was a common trend among

Byzantine churches. There are multiple similarities between the mosaics, domes, and windows at St. Mark's and the Hagia Sophia in Istanbul, formerly known as Constantinople, when it was the capital of the Byzantine Empire. The mosaics in St. Mark's, like in Hagia Sophia, help invoke a heavenly atmosphere meant to transport a visitor into a more spiritual frame of mind aided by the Christian iconography and figures present in the mosaics. The mosaics also invoke traditions from the Middle East, through "the interaction of the decoration with a dim, but ever changing light, according to the time of day, [creating] a range of evocative and intense effects."¹¹² In comparison, the Dome of the Rock in Jerusalem also has an intensely decorated mosaic interior. However, the symbolism and history of the materials is what helps keep St. Mark's ingrained in Venetian identity.

¹¹² "Mosaics," Basilica San Marco, accessed January 2, 2019.
<http://www.basilicasanmarco.it/basilica/mosaici/?lang=en>.



Figure 17. John Singer Sargent. Pavement of St. Mark's. 1898. Oil on Board. 53.34 x 72.39 cm.

As your eyes drift upward, your feet slowly and softly tread over the uneven waves of the marble below (Fig. 17). Drawing your gaze down from the domes, down the golden mosaics, and the stone columns, you finally spot the colored sea of marble. The materials of the floor in St. Mark signify another realm. The marble and stone floor represent the earthly space.¹¹³ The floor of St. Mark's Basilica is a mosaic of marble, and like a mosaic, the marble function as individual tesserae. The marble in the church include Greek Proconnesian marble, red porphyry, lassense, docimeum, serpentine, and Aquitaine white and black marble. The muted colors of the distinct types of marble in comparison to the brightly illuminated mosaics help emphasize the contrast

¹¹³ "The Tessellated Floor," Basilica San Marco, accessed January 2, 2019.
<http://www.basilicasanmarco.it/basilica/architettura/il-pavimento-tessulare/?lang=en>.

between the earthly and heavenly realms. The floor of St. Mark's clearly bears the evidence of time. Shadows easily bounce off different pieces of marble tesserae and slabs because of the varying depths of the stones in adjacent to the floor level. After the construction of St. Mark's Basilica, the soil below the structure shifted, creating "waves."¹¹⁴ However, centuries of visitors' footpaths created uneven flooring. The marbles which make up the mosaic flooring include fine veins that is meant to symbolize the sea. By "walking on water," Venetians and visitors were reminded of biblical references to the world's "watery" beginning and its "apocalyptic destiny in a glacial purity," with purity emphasized by the white Proconnesian marble placed in front of the iconostasis and altar.¹¹⁵ The mosaic flooring served to represent the sea when it was created and the effect is further enhanced by its uneven plane. Some of the stones, especially red porphyry and serpentine, are harder than other types. As a result, they wear down less than softer kinds of marble. The architects did not intend for the uneven flooring to occur, but "history and memory, whose full meaning only artists can grasp, much be protected as treasures," leading to the carpeting of the floor in St. Mark's.¹¹⁶ However, are the footsteps of intrepid travelers, tourists, and faithful visitors all that St. Mark's needs to be protected from? The waters just outside the church loom as an ever-present threat.

¹¹⁴ Foscari and Koolhaas, *Elements of Venice*, 300.

¹¹⁵ Fabio Berry (2007), in *Elements of Venice*, Foscari and Koolhaas, 296-7.

¹¹⁶ Foscari and Koolhaas, *Elements of Venice*, 300.



Figure 18. Royal San Marco Hotel. Venice's Piazza San Marco flooded on Monday, October 20, 2018. In Sarah Cascone's "Venice Museums Reopen After Dangerously High Tides and the Worst Flooding in Decades." *The Telegraph* (London, UK). <https://news.artnet.com/art-world/venices-flooding-piazza-san-marco-1382980>.

The physical and chemical makeup of the materials present in the city of Venice are fighting a battle with continuous flooding. When the lagoon floods, the stone floor and lower infrastructure of St. Mark's is consistently under water. The flooding of St Mark's Basilica begins with the square, as the water comes forth from storm drains onto the pavement (Fig. 18).¹¹⁷ In St. Mark's Basilica, increased flooding and *acqua alta* subject the stone floor to moisture. When it comes to issues regarding the conservation of stone, "water is the single most important factor in stone deterioration."¹¹⁸ Building materials, especially stone, are strong in environments, such as extreme heat, underwater, etc. Because of the hardness of Istrian stone, and the small pores, it is more resistant to water than Red Verona marble (which in contrast to its

¹¹⁷ Fletcher and Da Mosto, *The Science of Saving Venice*, 43.

¹¹⁸ English Heritage, *Practical Building Conservation: Stone Vol. 9*, ed. by David Odgers and Alison Henry (London: Ashgate Publishing Limited, 2012), 63.

name, is actually a limestone). However, problems still arise when the environment changes too rapidly for the material to have a chance to respond. However, the medieval and Renaissance laborers did not intend for the bricks and stones above the foundations to consistently absorb moisture from *acqua altas* and floods for a few hours before drying out again. Stone materials are not necessarily vulnerable in damp environments, but in the case of increasing flooding and *acqua alta*, where the water is constantly coming and going, the stones do not have enough time to react to the change.



Figure 19. Andrea Merola/EPA. The Interior of St. Mark's Basilica, Venice, was flooded. November 2, 2018. In Paul Simon's "A catastrophic threat to the Venetian way of life." *The Times* (London, UK). <https://www.thetimes.co.uk/article/a-catastrophic-threat-to-the-venetian-way-of-life-75pbz08l7>.

In October of 2018, Venice suffered from a flood considered the worst since 1966, aging St. Mark's 20 years more in a single day.¹¹⁹ The floor of St. Mark's was damaged as the salt in

¹¹⁹ Josephine McKenna, "St Mark's Basilica calls for help to save mosaic floor after Venice flood causes '20 years of damage in a day,'" *The Telegraph* (London, UK), November 11, 2018. <https://www.telegraph.co.uk/news/2018/11/11/st-marks-basilica-calls-help-save-mosaic-floor-venice-flood/>.

the water corroded the stone and seeped into the cavities in the mosaic floor (Fig. 19).¹²⁰ The water which floods San Marco enters into the capillaries of the stone, is carried through material, and as water attempts to exit the materials to evaporate, it forms further channels in the stone. The channels damage the physical makeup of the stone, making it vulnerable. Marble is metamorphosed limestone which has recrystallized; thus, they have smaller pores (channels) and are not as vulnerable as limestone.¹²¹ Because Istrian stone is similar to marble in hardness and porosity, it also has smaller capillaries. Yet, if water does enter the stone and tries to exit quickly, it can have extremely damaging effects. Because the channels are smaller, the water goes deeper into the stone, creating new channels and leaving salt behind in the middle. The porosity of marble is not as high as that of limestone, such as Red Verona marble, which is much softer and has a greater porosity. Numerous limestone types have the name “marble” attached to it, and the name has simply stuck over the centuries. In the case of the mosaic floor in St Mark’s, it is a veritable sea of marble, but marble is not impermeable. Salt is already present in the stone from sea spray, pollution, biological matter, construction, groundwater, etc. If water enters the stone and transports the dissolved salt, the salt is deposited elsewhere within the stone.¹²² If salt is trapped in the pores of the marble and is not able to exit the exterior of the stone, the salt which sits under the surface crystallizes and heavily damages the pores. Spalling is a common result, meaning the surface breaks into fragments. As the surface of the stone is the area which contains the greatest level of detail or markings from past interactions, it the most artistically valuable aspect of the material. If the surface is lost, much of the history and the sense of identity disappears.

¹²⁰ “McKenna, “St. Mark’s Basilica calls for help to save mosaic floor.”

¹²¹ English Heritage, *Practical Building Conservation: Stone Vol. 9.*, 41.

¹²² Ibid.

St. Mark's is significant in the context of global architectural history and culture, but the materials help bring local and global architectural history and society/culture together. As an introduction into his book, *Time Honored: A Global View of Architectural Conservation*, John Stubbs, a preservationist and scholar on international preservation history and methods, asks "How would the lives of the world's population be different if there were no great historic buildings or sites," and goes on to ask the reader to consider if there was no historic structure or built environment to remember the history of what came before.¹²³ In answer, Stubbs remarked people, he doesn't specify locals or the global population, would not have a sense of place and history connected to their identity. He even goes as far as to say the current concept of civilization, distinguished cultures, would not exist.¹²⁴ This statement can be extended to the building materials themselves. The foundations and stones were used for a purpose, whether the color of a stone evoked wealth and power, whether the patterns reflected a notion of the "Deep and Celestial"¹²⁵ sea, the shapes of materials cut to represent an idea, etc.

In St. Mark's, the visitors who walked over the floor walked on water and memory, and it is necessary to understand the history of the marble floor to preserve those narratives and meanings. Not only does the marble reflect the lagoon and sea just outside the doors of the church, but the burial slabs and carvings brought to life the figures and events of Venice's *contradas*, giving "the sense of being, almost floating, in the memory of one's own neighborhood and family."¹²⁶ The stones and materials in St. Mark's, as well as other building materials in Venice, play a role in providing an identity to the Venetians. The rest of the world

¹²³ John H. Stubbs, *Time Honored: A Global View of Architectural Conservation* (Hoboken, NJ: John Wiley and Sons, 2009), 3.

¹²⁴ Stubbs, *Time Honored*, 3.

¹²⁵ Fabio Berry (2007), in *Elements of Venice*, Foscari and Koolhaas, 297.

¹²⁶ Foscari and Koolhaas, *Elements of Venice*, 303.

may claim Venice as a heritage city which belongs to all, but it has local narratives as well. The reports of a sinking city or a city inundated with floods due to climate change in articles in the UK, US, and organizations like Venice in Peril highlight the focus on the city as a whole. The materials themselves, whether structural in the case of bricks or artistic with regards to St. Mark's golden tesserae, serve as part of the city's history. The mosaic floor of San Marco dates to the 12th century and third incarnation of the church. It has been repaired and restored numerous times over the centuries in an effort to maintain it. While it may be difficult to determine what areas of the floor are truly original, the practice of repairing the floor shows Venetians' desire to keep the feature intact.

Prior to the 19th century, Venice continued to modify its buildings and structures as stylistic trends came into fashion and as merchants, artisans, goldsmiths, and more exchanged with cities, such as Constantinople, Aleppo, Tripoli, Cairo, and Alexandria.¹²⁷ Venice grew and fell on hard times before prospering again, as is common in cities so reliant on trade and their naval power. The practice of restoring Venice's built heritage came after the fall of the Republic and governmental control from Napoleon, the Bourbons, and Hapsburgs.¹²⁸ The idea of an entire medieval city, unchanged in appearance, is not native to Venice. Venice had previously worked to maintain its structures, such as St. Mark's. The 12th century floor underwent continuous repair as well as the Italo-Byzantine golden mosaics which adorned the basilica's ceiling. The whole city did not remain in a medieval state, it developed and changed. The Republic and the church

¹²⁷ Ferraro, *Venice*, 135.

¹²⁸ *Ibid.*, 201.

ensured structures were maintained with materials that display Venice's wealth, sea-faring past, and its power.

After Napoleon Bonaparte's invasion of Venice, Europe began to take greater control of Venice's heritage in the 19th century. It was Venetian authorities in 1964 who called for the Venice Charter, but they drew on outside influences from the 19th century.¹²⁹ What is important to note in this chapter is the historic materials maintained, repaired, and later restored, make up the Venetian fabric of the 21st century. They bear the marks of the builders, represent changing narratives, and uphold the physical structures. Venice is not a floating city. It rests on bricks, wood, mortar, with features in marble and stone. The rising damp in St. Mark's has gone far beyond the marble floor, reaching the golden tesserae in the interior. The moisture and water have risen above the protective stone foundations in multiple neighborhoods and is seeping into the bricks not normally exposed to water. The bricks are spalling and the mortar is weakening, meaning decorative features are falling onto ground floors and canals below.¹³⁰ With these materials in danger, Venetians not only risk the city's structural stability, but the physical representation of the city's history and identity. Venice is not sinking, not any more than it normally does, but the materials are degrading.

Venice is a city of illusions, sometimes called the "City of Masks," and it lives up to the nickname as residents have often hidden the core material of Venice, the bricks, behind stone slabs and colorfully painted plaster. The marble in San Marco is significant as Venice is not a city of stone.¹³¹ Venice has a long architectural tradition of making the buildings appear built

¹²⁹ "Conservation and Restoration: What's the Difference?" Venice: An Online Exhibit Produced by the University of Mary Washington, December 11, 2008. <http://venice.umwblogs.org/exhibit/the-conservation-of-venetian-building-materials/conservation-and-restoration-whats-the-difference/>.

¹³⁰ Anne Somers Cocks, in *Elements of Venice*, Foscari and Koolhaas, 44.

¹³¹ The only buildings made entirely of stone in Venice are the prison walls.

from stone. Venice is mostly constructed of brick, far cheaper and lighter than stone.¹³² Brick is stable in saltwater and in exposed climates, making it a desirable and fundamental material throughout the Western world. However, brick and terracotta, like stone, suffer when subjected to repeated encounters with water. The salt which is left behind on or under the surface of brick crystallizes and causes spalling. As the crystals adheres to and becomes part of the material, it brings sections of the brick coursework down. The brick facing is destroyed and the material becomes vulnerable and unstable. Imagine the brick materials, which have so long been part of the fabric of the floating city, crumbling into the canals. The use Istrian stone or Verona marble plays homage to antiquity and recalls the narrative of Venice as a remnant of the ancient Roman Empire, but bricks are the core of most of Venice's built heritage.¹³³ Part of the issue regarding the rest of Venice, is the plaster which once formed a protectant for the brick is no longer doing this work as it has deteriorated. Without the plaster, the brick is vulnerable to the water and the rise in the humidity and moisture in the walls due to the impervious membrane of the floors and foundations.¹³⁴ The rise in sea level means the water is rising above the foundations and materials meant to exist above the water line. The level has risen to the main facades and ground floor, above the stable Istrian stone and seeping beyond the plaster and into the brick.¹³⁵ The repeated floods and the higher salinity of the lagoon due to the greater exchange between tides in the Adriatic and smaller body of water only exacerbates the issue. The saltwater comes into more contact with building materials never meant to be under the lagoon.¹³⁶ Multiple buildings throughout Venice have mobile barriers at their entrances to the ground floor level, but it is not

¹³² Foscari and Koolhaas, *Elements of Venice*, 642.

¹³³ Ibid.

¹³⁴ Foscari and Koolhaas, *Elements of Venice*, 609.

¹³⁵ Fletcher and Da Mosto, *The Science of Saving Venice*, 42.

¹³⁶ Fletcher and Da Mosto, *The Science of Saving Venice*, 42.

enough to stop the sea. These barriers only function as a band-aid, for while they may stop the water from entering the building, the building materials themselves are left to their own defenses.

Cannaregio *Sestiere* and the Structures Beyond St. Mark's Basilica



Figure 20. De Turreil, Paul. Cannaregio District. In "Cannaregio, the Hidden Venice Reveals its Secrets." December 12, 2018. Italia Rail. <https://www.italiarail.com/cities/cannaregio-hidden-venice-reveals-its-secrets>.

Away from the Piazza San Marco and further north via the canals and foot bridges is the *sestiere* of Cannaregio (Fig. 20). The district is one most populated with residents. The *sestiere* includes churches, such as the 13th century Church of Santi Geremia and Lucia, 15th century Church of San Giobbe, and more.¹³⁷ However, the district has an abundance of brick buildings and facades covered, not in stone, but plaster and paint, as one can see from the above image.

¹³⁷ "Cannaregio West," Città di Venezia. October 2017. <https://www.comune.venezia.it/it/node/3689>.

The neighborhood once served as the Jewish ghetto, before Napoleon's takeover. The city forced Venetian Jews to live here with restricted access via two bridges which were only accessible during the daytime.¹³⁸ The *Cannaregio* is an example of the built heritage of the Jewish ghetto and residents, as opposed to elite who lived closer to the Doge's Palace. The bricks which make up the facades of the structures on the *Cannaregio* are an identifiable feature of this district. Therefore, it is important to understand the history of the bricks in Venice.



Figure 21. High water discomforts. Venice, tide level + 136 cm, 03-12-2010. MOSE. <https://www.mosevenezia.eu/my-product/acqua-alta-dicembre-2010/>.

The materials and construction of Venice were all created for a purpose, even the everyday fabric of the city. Some materials were chosen for meaning, and others for structural stability on a lagoon. Constructing a brick arch (Fig. 21) in Venice alone required a delicate

¹³⁸ Paul De Turreil, "Cannaregio, the Hidden Venice Reveals its Secrets," Italia Rail. December 12, 2018. <https://www.italiarail.com/cities/cannaregio-hidden-venice-reveals-its-secrets>.

understanding of the soil in the lagoon and the foundations.¹³⁹ In describing a connection to the materials, Louis I. Kahn remarked:

*“If you think of Brick, you say to Brick “What do you want, Brick?” And Brick says to you, “I like an arch.” And if you say to Brick, “Look, arches are expensive, and I can use a concrete lintel over you. What do you think of that, Brick?” Brick says, “I like an arch.” And it’s important, you see, that you honour the material that you use. [...] You can only do it if you honour the brick and glorify the brick instead of short-changing it.”*¹⁴⁰

Bricks provided Venetians with the option of using a lighter material the soil in the marsh could support. Venetians used stone because people, such as the Doge, wanted to attach themselves to the narrative of the ancient Romans and present themselves as descendants of the former Western Empire. The 57th Doge of Venice, Giovanni Delfino, was from an ancient family, and he likely would have wanted to form a connection to Rome. Stone “evokes the building techniques of antiquity,” but it is heavy and impractical for a city on water.¹⁴¹ Almost every building in Venice was constructed with brick, and then if one could afford it, stone cladding was added. Otherwise, laborers added plaster to the façade. When the glassmakers were forced by the Venetian government to move their production to the island of Murano in 1291 for fear of fires, the city officials allowed brick kilns to stay in Venice because they were popular and in demand. Limited to using slabs rather than blocks of stone, Venetians were able to extend their expenses to decorating the city and giving it the appearance of wealth, even if the interiors of the walls tell another story.

¹³⁹ Foscari and Koolhaas, *Elements of Venice*, 234.

¹⁴⁰ Ibid., 609.; Kahn is a renowned American architect of the modernist style who incorporated classical traditions into his work.

¹⁴¹ Foscari and Koolhaas, *Elements of Venice*, 642.

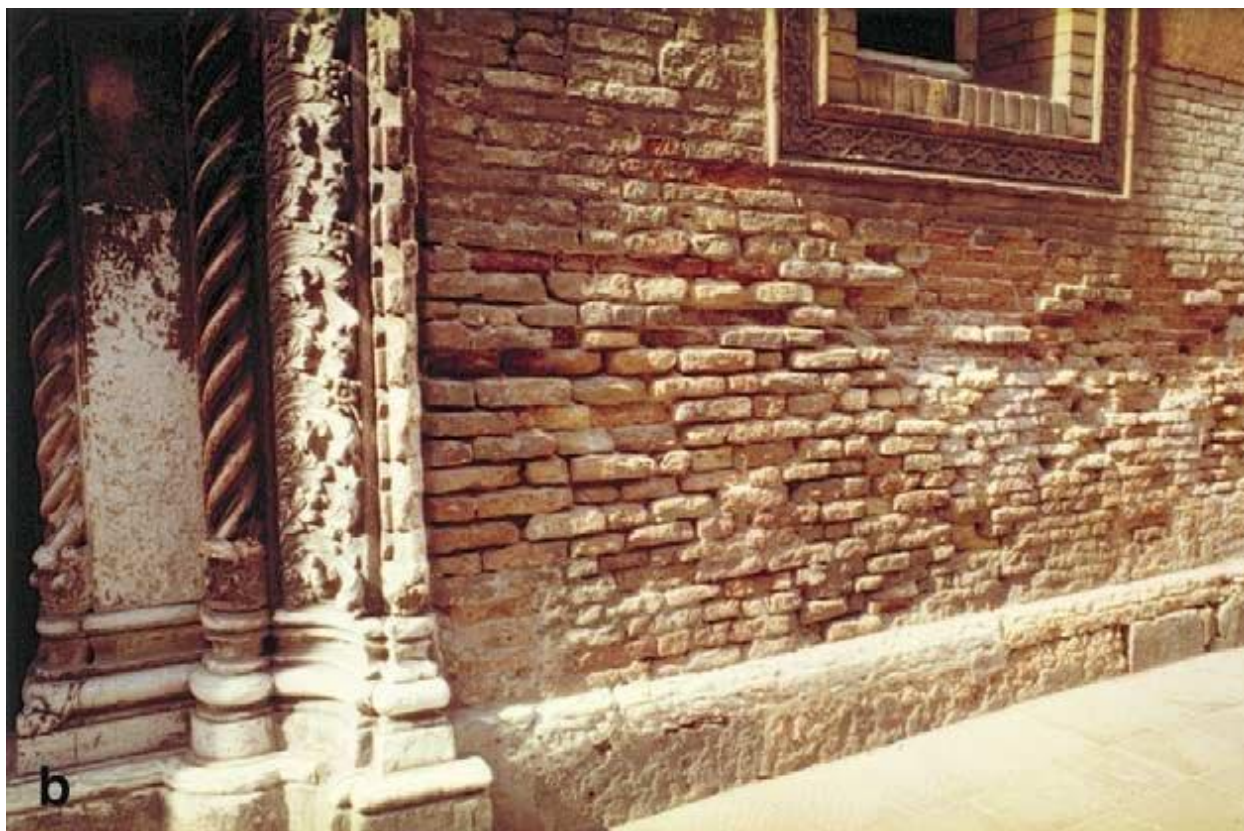


Figure 22. Camuffo, Dario. "The bricks of the San Polo Church are severely damaged by the action of sea salt crystals, which become evident as a white efflorescence in dry periods. The rendering has been partly lost or is coming off bricks impregnated with sea salt." 2001. In "Canaletto's paintings open a new window on the relative sea-level rise in Venice." *Journal of Cultural Heritage* 2, no. 4: 278. 10.1016/S1296-2074(01)01128-1.

Bricklayers paired bricks with lime mortar, and the mortar gave bricks enough flexibility to move above the marsh without damaging the material. Bricks are clay fired using additions of sand and crushed limestone. Because of the significant human activity which goes into making bricks, they are extremely vulnerable to human error, more so than stone or wood. The bricks can then end up too soft if not fired properly or too brittle if they are over-fired. A property of clay is it soaks up water and expands as a result due to its crystal-layered form. If the bricks are in a constant process of absorbing water, the salt from the canals will continuously enter the large pores of brick. The salt is then left behind.¹⁴² As the water moves through the channels of

¹⁴² While this thesis is focused on the impacts of climate change and flooding on Venice, the bricks are also heavily affected by the splash of motor boats which kick the water up towards the bricks.

the brick to find an exit and evaporate, it carries the salt with it. The salt is then left behind on the surface or just under the brick surface when the water leaves the material. The salt causes damage to the brick as it causes separation within the material (Fig. 22). Much of the bricks in Venice are degrading, and they are rarely found in the process of conservation or consolidation.¹⁴³ If the bricks are heavily damaged, it compromises the structure. In one approach, restorers/conservators may cut the damaged area out and replace the bricks with those a close color, size, and texture. If the bricks are not damaged enough to require such an invasive restoration process, the bricks may be cleaned and consolidated. However, to consolidate all of the bricks in the urban area of Venice is expensive, timely, and does little if the bricks continue to absorb the rising water and dry out.¹⁴⁴ However, the bricks are a key material to Venice's built heritage and cannot be ignored.

¹⁴³ "Brick," Venice: An Online Exhibit Produced by the University of Mary Washington, December 11, 2008. <http://venice.umwblogs.org/exhibit/the-conservation-of-venetian-building-materials/brick/>.

¹⁴⁴ "Brick," Venice: An Online Exhibit.



Figure 23. Camuffo, Dario. "Disintegration of Red Verona Marble in Venice for the action of marine salts mobilized by water." 2004. In "Thermodynamics for Cultural Heritage." Physics Methods in Archaeometry. Ed. M. Martini, M. Milazzo, M. Piacentini (Amsterdam, IOS Press): 95.

The stone masonry which serves as the cladding and foundation for many Venetian buildings suffers from similar issues with water and salt, however it is less vulnerable than brick. Istrian stone is a type of dense limestone, so it is not as porous as some other limestones. Its porosity is similar to marble. It is an expensive building material and was valued for its durability, but it is still impacted by saltwater entering the stone or mixing with salts already

present in the construction of the building. Istrian stone is not the only stone used in Venice. Red Verona marble was another popular stone, but as a limestone it is not as durable as Istrian stone and is more prone to damage (Fig. 23). For residents who could not afford Istrian stone, but wanted more than a stucco façade, Verona marble was a suitable option. There are many surfaces throughout Venice which use several types of masonry, which both highlight the history of the city and make conservation challenging and expensive. However, restoration often favors stone masonry because of the expense of a quality limestone like Istrian stone and the value placed on it by Venetians as a symbol of their wealth or stability. Preservation and restoration prioritize marble and stone over brick “to preserve its integrity.”¹⁴⁵ The two main choices for preserving stonework is to repair or replace the stone. Chemical, mechanical, and biochemical methods are viable options, but these methods can remove a thin layer of stone and these techniques should not be used on decorative features or stones with distinguishable characteristics. Consolidants can help strengthen the stone and provide a water-repellant that will not change the appearance of the stone as is the case of some traditional water repellants.¹⁴⁶ Expenses must be considered when analyzing preservation practices, and this paper does not argue the city should start preserving all of the bricks in addition to the stone. Rather, I am arguing the history of the different building materials, including stone, brick, wood, and other materials must be considered and understood in order to create a more effective preservation plan that brings the different discourses on architecture/aesthetics, society/culture, and material conditions in Venice together.

¹⁴⁵ “Istrian Stone,” Venice: An Online Exhibit Produced by the University of Mary Washington, December 11, 2008. <http://venice.umwblogs.org/exhibit/the-conservation-of-venetian-building-materials/istrian-stone/>.

¹⁴⁶ “Istrian Stone,” Venice: An Online Exhibit.

The Rialto bridge
Deterioration of the wooden structure, before restoration

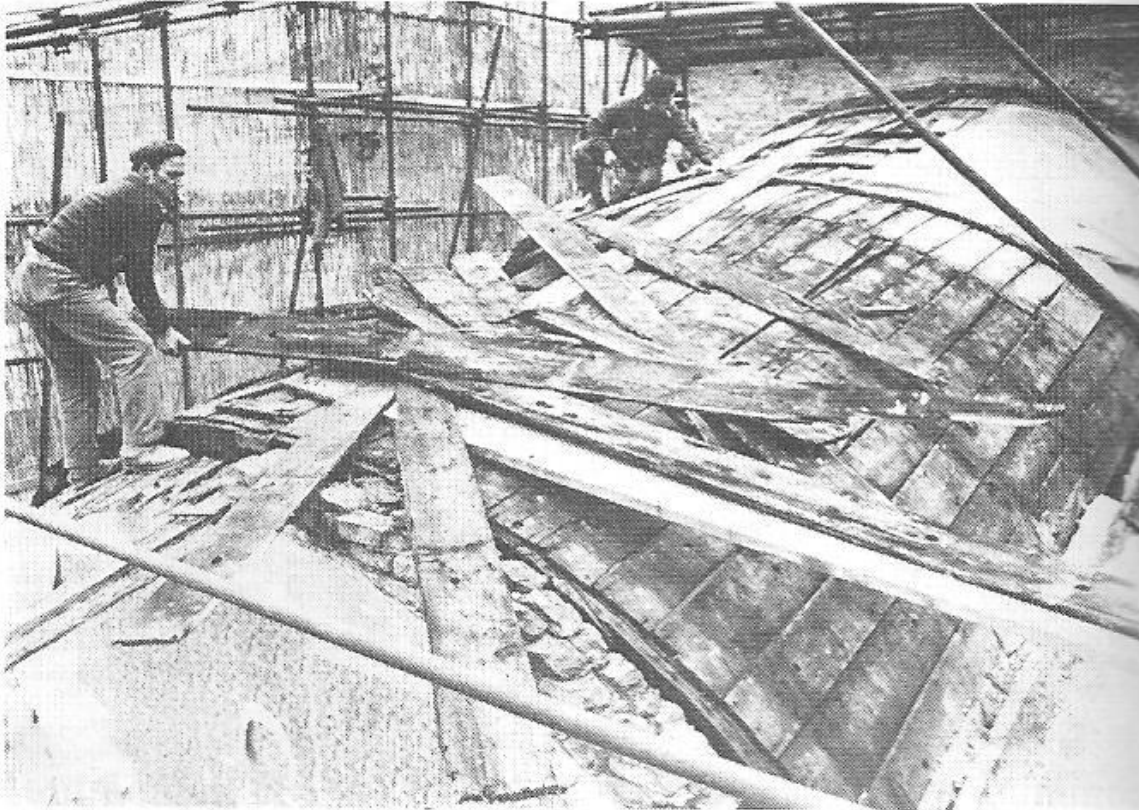


Figure 24. The Rialto Bridge: Deterioration of the Wooden Structure Before Restoration. 1973. UNESCO, Venice Restored, 86.

The rising sea level is also affecting the wood used throughout the city. The wood used for Venice's foundations is often well preserved because they are buried beneath muddy soil that cuts off the air and naturally preserves it. However, the wood above the foundation is impacted by its repetitive contact with the rising water as the wetting and drying out process is causing the wood to contract and expand, leading to warped and cupped wood (Fig. 24).¹⁴⁷ Because wood is part of almost every structure in Venice, the structural instability of the material due to sea level

¹⁴⁷ "Wood," Venice: An Online Exhibit Produced by the University of Mary Washington, December 11, 2008. <http://venice.umwblogs.org/exhibit/the-conservation-of-venetian-building-materials/wood/>.

rising is a concern. Like brick, wood is a cheaper material than stone and more fragile when exposed to a changing environment. It is also rarely conserved and is often repaired since it was a structural element in Venice as opposed to an aesthetic one like stonework.¹⁴⁸

The repair/replacement process does not mean brick and wood are not valuable building materials. If the materials were not degrading due to rising sea level, there would be little need to replace them, in keeping with minimal conservation trends in the preservation field. However, the stonework, wood, brick masonry are damaged by the rising sea level due to marine salt, water saturation, freezing/thawing cycles, meaning the “flooding of Venice has the capability to damage almost every structural component above water in the city.”¹⁴⁹ If the material is compromising the surrounding building materials and the structure, it may have to be replaced. It is also admittedly easier to replace brick and wood. While Venice has a significant construction history due to its unique location, brick and, certainly, wood materials are not always objects seen every day by the locals or visitors. Istrian stone and the multiple kinds of marble throughout Venice were prized for their durability, ability to convey wealth, power, a narrative of Venice’s relationship to the sea, and more. Brick and wood do not convey messages about the power and wealth of a city like stoned, but they are a key part of Venice’s identity as they serve the local history and narrative. While consolidating multiple areas of the city would be a conservation challenge and expensive, the cost of maintaining and strengthening the structures of Venice should be considered in comparison with the cost of the MOSE barrier.

Drawing from Trouillot, materials contain memory and narratives which should be considered for further conservation approaches. Here, conservation is the key word. Because of

¹⁴⁸ “Wood,” Venice: An Online Exhibit.

¹⁴⁹ “Brick,” Venice: An Online Exhibit.

the connection between the stones and Venetian, European, or global heritage, the age of the objects and their historic, older appearance “contributes to the experience of authenticity, providing a tangible mark of age and ‘the real.’”¹⁵⁰ When Gothic cathedrals are extensively cleaned on the interior or exterior, the final result is a much lighter color than the gray, dark appearance so often connected to Gothic architecture. Many individuals remark how the cleaning makes the space unaesthetically appealing because it is too bright, or appears “fake,” even if it is more closely represents a structure’s original appearance.¹⁵¹ The passage of time and the weathering of stone, impact by pollution, evidence of human activity ages a building creates a perception that the object always had that appearance. A problematic notion in preservation is that something will acquire “age value” or “authenticity” if its original appearance is altered by weathering or environmental damage.¹⁵² Abhorring restoration, Ruskin appreciated when materials revealed their “age.” However, it is necessary to consider not just what is best for a material from a science conservation point of view, but how the community also views the space and identifies it when conducting preservation projects. The city cannot allow the materials of Venice to decay because they are the key elements of the city’s history and urban structure. Tangible objects are seen as part of heritage because of the notions they reflect to individuals, such as one’s place in human history, location in relation to the local or global environment, and one’s cultural identity.¹⁵³ Historic materials helps form human identity, both individually and collectively.¹⁵⁴ Historic sites, and by extension, historic materials are a “source of resilience for

¹⁵⁰ “Case Study 8: Materiality, Authenticity and Value: the wider implications of science-based conservation of carved stone,” ScARF, accessed February 4, 2019. <https://scottishheritagehub.com/content/case-study-materiality-authenticity-and-value-wider-implications-science-based-conservation->.

¹⁵¹ Benjamin Ramm, “A Controversial Restoration That Wipes Away the Past,” *The New York Times*, September 1, 2017. <https://www.nytimes.com/2017/09/01/arts/design/chartres-cathedral-restoration-controversial.html>.

¹⁵² “Case Study 8,” ScARF.

¹⁵³ Carman, “Where the Value Lies,” 194; Stubbs, *Time Honored*, 3.

¹⁵⁴ Stubbs, *Time Honored*, 3-4.

communities.”¹⁵⁵ Historic materials have a kind of power within them to stir emotions and feelings within an individual or community.

While each of the sites, Venice, Rhodes, Edinburgh, and San Juan all have several types of materials, such as stone, they each face similar problems. The materiality of the buildings at these sites are threatened by rising sea level, which in turns impacts the ideas and narratives within the objects and the identity of the surrounding population. Each of these sites are impacted by climate change and current conditions foreshadow the ongoing struggles. The Woods Hole Research Center has stated a warmer climate brings forth more extreme cases of precipitation, greater wind speeds, and higher sea level, leading to a greater chance of severe storms. The storms in turn heavily impact the materials of historic sites on water or on the coast via flooding or erosion.

Venice’s “core being” is endangered as more Venetians leave for the mainland due to an influx of tourists and improvement of property and structures hike tax rates further, discouraging home owners who are part of the population departing Venice, relegated to serving as absentee landlords.¹⁵⁶ As stated above, it was the Venetians who instituted the Venice Charter in 1964, international guidelines aimed at presenting a standard foundation for conservation and restoration approaches. However, the field of conservation has grown exponentially over the past 50 years with no new policies or guidelines produced out of Venice. Therefore, will figures in Venice produce new guidelines? Who will do so? Who would the conservation measures be for? The reducing Venetian population or the tourists? How would a changing community affect

¹⁵⁵ “ICOMOS Passes Resolution on Climate Change and Cultural Heritage,” US/ICOMOS, December 19, 2017. <https://www.usicomos.org/icomos-passes-resolution-on-climate-change-and-cultural-heritage/>.

¹⁵⁶ John H. Stubbs and Emily G. Makas, *Architectural Conservation in Europe and the Americas* (New Jersey: John Wiley and Sons, 2011), 28.

those conservation policies? As more Venetians leave the lagoon, will the city's materiality lose its local/regional significance? What will happen to the local memory infused within the stones? Will the memories of the built environment only exist in the form of a global narrative?

Rhodes Town, Greece



*Figure 25. Schnarr, Tim. Medieval City of Rhodes. August 15, 2015. UNESCO. Limes Media.
<https://whc.unesco.org/en/documents/138004>.*

Understanding the history of materials is key for multiple cities and towns located along the coast. Stonemasons constructed Rhodes' Old Town out of sandstone (Fig. 25), creating a distinctive urban fabric enhanced by the Gothic and Ottoman styles. Stones and other materials

which make up the architecture preserve meaning and symbols. Historic cities located near the water keep a unique identity as there is a historic relationship between city and water as people learned to build near the water, create defenses, interact with traders from different regions and cultures, establish a maritime economy, etc. However, water is also the primary reason for stone deterioration.¹⁵⁷ Rhodes Town, especially the “Street of the Knights,” has kept the color of the stone and “remains one of the completest and most homogeneous medieval streets in the Mediterranean.”¹⁵⁸ Sandstone is a sedimentary rock and is made of layers of sand-like rock particles.¹⁵⁹ Because stones are so attracted to water and sponge up moisture, and because sandstone is so porous, it will absorb water deep within via capillary action.¹⁶⁰ Additionally, water will enter cracks and fractures in the stone, and for cities with ancient and medieval stone, it is inevitable there will be open fissures.

Water can damage the stone in multiple ways. As explained earlier, water can create channels in the stone and carry salt with it. Many ancient and medieval structures have iron clips to hold the individuals stones together, and water can corrode the iron. By damaging the iron in Rhodes’ medieval structures, the masonry becomes structurally instable. Algae, moss, and other plants can grow on the stone. While, plants are not as much of a concern as they may only cause minor cracks and they do not usually go deeper than 1 mm of the stone, it is still an issue to consider. The presence of salt on or just below the surface is far more damaging. However, sandstone is harder than many limestones, as sandstone has a hardness of 6-7 on the Mohs Scale and limestone has a hardness of 3-4. Interestingly, marble has the same hardness as limestone, but it is more resistant to weathering. Stonemasons valued sandstone because it is a material that

¹⁵⁷ English Heritage, *Practical Building Conservation: Stone Vol. 9*, 63.

¹⁵⁸ McGilchrist, “Rhodes.”

¹⁵⁹ Sandstone formations are so porous, they often serve as aquifers.

¹⁶⁰ English Heritage, *Practical Building Conservation*, 63.

was easy to construct, but more resistant to weathering and disfigurement than limestone. Sea level rise and flooding will endanger the material conditions of the stones in Rhodes' Old Town and thus affect the architectural and cultural identity of the city if greater consideration is not taken in incorporating the history of the materials into a preservation plan.

Edinburgh Castle, Scotland



Figure 26. Edinburgh Castle. Accessed April 16, 2019. Visit Scotland. <https://www.visitscotland.com/info/see-do/edinburgh-castle-p245821>.



Figure 27. Jefferson, A. Stonework on St. Margaret's Chapel, the oldest extant building in Edinburgh Castle. August 23, 2010. From Highly Allochthonous: "Castle Geology." <http://all-geo.org/highlyallochthonous/2010/08/castle-geology/>.

The structures on the prominent landscape of Castle Rock have become part of the identity of Edinburgh. However, as with Venice and Rhodes, water is the main enemy of the stones. Ancient and medieval stonemasons and architects recognized the resilience of sandstone and valued its workability as it became the most important stone for builders in Edinburgh as well (Fig. 26-27).

Historic Environment Scotland, a leading public body in charge of maintaining and preserving Scotland's historic sites including Edinburgh Castle, produced a Climate Change Risk Assessment report in 2017 which lists Edinburgh Castle at a current risk of impact from groundwater flooding and landslides.¹⁶¹ The site was given a red rating before "Historic

¹⁶¹ "A Climate Change Risk Assessment of the Properties in Care of Historic Environment Scotland," (Historic Environment Scotland, 2017), 87.

Environment Scotland” (HES) took into consideration current site maintenance and operation. In a color-coded system, from green to red, Edinburgh’s final grading was orange. HES noted the risks will likely increase because of climate change due to the connections of the risks to precipitation and sea level rise.¹⁶² With a possible rise in sea level by 50 to 100 cm by 2100 forcing groundwater upwards and increased rainfall can cause increased flooding, soil erosion, and extreme damage to the stone.¹⁶³ The bedrock of Castle Rock has been incorporated into the foundations of the structures. As mentioned earlier, stone is hygroscopic and easily absorbs water. The masonry foundation at Edinburgh already poses an issue because will soak the groundwater pushed upwards because the bedrock is also part of the foundations for many structures. What is more is most of the structures are made out of sandstone. Because of the extensive use of sandstone in Edinburgh and its distinctive appearance, there is a connection to that material as it makes up the fabric of the city. However, sandstone is subject to increased rates of decay, so “groundwater flooding has the potential to alter the historic fabric and appearance of our properties.”¹⁶⁴ Like Venice and Rhodes, as the materials of Edinburgh come into water contact with greater frequency, salt crystallization can heavily damage the stone; quick periods of moisture and drying out will alter the stone and fracture it, and any iron within the stones will corrode. It is key Historic Environment Scotland and consulting organizations understand the history of the materials to understand how to protect them from impacts of climate change.

¹⁶² “A Climate Change Risk Assessment HES”, 35.

¹⁶³ Ibid., 37.

¹⁶⁴ Ibid., 32.

Old San Juan, Puerto Rico



Figure 38. San Juan Lookout Tower. Accessed April 12, 2019. [Public Domain], via Pixabay.

As the historic sites in San Juan sit on cliffs overlooking the water, the materials are in close proximity to the sea, making them vulnerable to sea level rise and flooding (Fig. 28). The materials which make up the fabric of La Fortaleza, Castillo San Felipe del Morro, Castillo San Cristobal, and San Juan de la Cruz, and the city wall of San Juan are brick, plaster, and

sandstone.¹⁶⁵ As noted with the earlier case studies, water can have a severely damaging impact on sandstone and brick if it is not maintained and conserved.

The material surrounding the sandstone and brick is of equal concern. While Portland cement is no longer used by the maintenance crew for preservation, it was previously employed because stonemasons and workers used hydraulic lime mortar until the beginnings of the twentieth century when they turned to Portland cement.¹⁶⁶ The cement is so hard that when water enters the masonry, it cannot exit through the cement joints that hold the stones together. If water enters the brick or stone, it is going to move through the stone and carry salts from the outside environment, the water, or from the masonry itself. Due to evaporation, the water will need to exit the stone. Because lime mortar is not as hard as brick or stone, the water can more easily exit the mortar. When choosing between the loss of mortar and stone/brick, the choice should be the mortar because it has far less historic value than masonry. However, Portland cement is so hard the water cannot move through it. The water is forced to exit through the historic masonry rather than the binding agent. With the rise in sea level and flooding, stones and bricks are taking the brunt of the damage from salt crystallization and wetting and drying out periods in the materials. The issue is worsened by the presence of Portland cement. It is imperative to understand the history and significance of historic materials and ensure steps are taken to protect the structure's fabric from effects of climate change.

¹⁶⁵ "La Fortaleza and San Juan National Historic Site in Puerto Rico." UNESCO.

¹⁶⁶ Beatriz Del Cueto, "The Development of Hydraulic Mortars, Cement, and Concrete in Puerto Rico," APT Bulletin 42, no. 1 (2011): 51. <http://www.jstor.org/stable/41203184>.

Chapter 3

How We Got Here: Historic and Current Preservation Approaches

Venice, Italy

Patrons and laborers chose the materials of Venice for their symbolism, for the veins of the marble could reflect the sea and Venice's naval power. Sometimes, craftsmen chose materials because of their structural support, for example bricks are light enough for the mudflats supporting the city, but able to support houses, palaces, bridges, etc. Whatever the purpose and underlying meaning, whether artistic or structural, the materiality of Venice's structures has served as the crux of the relationship between craftsmen, patrons, and the government officials, like those in the city council, since the medieval period. Through the Renaissance and following centuries, this relationship continued as Venice expanded and altered existing structures. This chapter will highlight how artists, poets, writers, scientists, government officials, and heritage organizations responded to Venice's fabric following the fall of the Republic in the past and how this led to current preservation methods.

The tone of the relationship shifted in the 19th century after the Republic fell and foreign powers took control. The recognition of Venice's architectural heritage by poets, painters, artists, and photographers influenced the preservation of the city at a time when multiple authorities outside of Venice ruled the city. For example, Napoleon seized Venice after the fall of the Republic, then it was annexed by the Austrian Empire, and then brought under the Kingdom of Italy all during the last few years of the 18th century and the 19th. During this time, the Podestà of

Venice took control of the maintenance of the city.¹⁶⁷ Prior to the 19th century restoration practices which focused on maintaining the aesthetics of the city and holding on to it as a time capsule, the city underwent consistent maintenance as the urban layout and fabric changed depending on the water levels as some canals were filled in, some buildings demolished and others erected to establish a museum city.¹⁶⁸ In the 20th century, following the flood of 1966, Venice was absorbed in a global narrative as the public cried over the importance protecting the city, leading to its establishment as a World Heritage Site.

The idea of Venice as belonging to a global population created a strong international following and as a result, the Metropolitan City of Venice, and international organizations such as UNESCO, had the most say over how Venice should be preserved. Venice's architectural heritage created a boom in voices, in the 19th and 20th centuries, with increasing numbers of poetry, paintings, photographs, films, and more that focused on or were set in Venice. Such literature and art continuously put Venice in a spotlight. While many of the artworks marveled at the materials and the city as a whole, it also often mourned the city, presenting Venice as the next Atlantis. Builders and craftsmen in the 19th and 20th century no longer dominated the discourse over the fabric of Venice, instead it was poets and artists. The change of voice among writers, artists, and travelers combined with the strengthened power of the Mayor and Council of Venice and UNESCO, instigated a preservation program which targeted the preservation of the city in its totality. The MOSE barrier established in 2001 has been met with severe criticism and does not address the conservation issues of the building materials. There is a memory/history within the historic materials which help shape the identity of the local population.

¹⁶⁷ The Podestà of Venice was the chief official or magistrate of the city, appointed by the government ruler. When the Kingdom of Italy formed, the position of Mayor of Venice replaced the Podestà.

¹⁶⁸ Fletcher and Mosto, *The Science of Saving Venice*, 42.



Figure 29. Turner, William. *The Dogana and Santa Maria della Salute, Venice*. 1843. Oil on Canvas. 62 x 93 cm. The National Gallery of Art, Washington, D.C.

Standing surrounded by J.M.W. Turner's paintings in the National Portrait Gallery of Art in Washington D.C., one's eyes are drawn towards Turner's canvas painting of *Venice: The Dogana and Santa Maria della Salute* (Fig. 29). The scene absorbs the viewer and transports them on the edge of the sidewalk gazing at the Santa Maria della Salute, as the multiple domes break the calm, tinted blue and white sky. The Dogana, a former customs house turned art museum, is just visible in the haze. The water almost seems to extend to the sky, leaving the church and Dogana to appear as a mirage, for it seems to float along the water without an anchor below. Turner's paintings are a product of Romanticism, as they are characterized by emotion, imagination, and the sublime as he plays with the relationship between the awe-inspiring natural environment and man-made world. Turner's soft, muted colors, sfumato-like scene, and serene depiction where the water is the most active element, serve to create a Venice of fantasy and dreams. While the hazy quality is a hallmark of many of Turner's paintings, in this scene it

highlights the notion that Venice's future is threatened by the surrounding waters. As it was presented at the Royal Academy of Arts in London in 1843, this work was not meant to be seen by Venetians, but those in London and elsewhere in Europe and the U.S. The scene stirs both an appreciation outside of Venice for the unique city along with emotional idea Venice could disappear below the waves. Another one of Turner's earlier works, *Venice: The Dogana and San Giorgio Maggiore*, has a greater emphasis on lines and form, but reveals the consistent relationship between the city and the water. In going forward, we will see individuals of multiple disciplines exert reoccurring themes of beauty and despair in paintings, photography, and poetry on Venice.



Figure 30. Turner, William. *Venice: The Dogana and San Giorgio Maggiore*. 1832. Oil on canvas. 91.5 x 122 cm. The National Gallery of Art, Washington, D.C.

In Turner's *Venice: The Dogana and San Giorgio Maggiore* (Fig. 30), the English artist's sky is an azure blue dotted with cirrus clouds above a linear urban scape sitting upon a glassy

depiction of the canals. The island is enclosed by Saint Mark Basin, Canale delle Grazia, Canale della Guidecca, Canale di San Marco and the southern lagoon. As the multiple gondolas and watercraft extend beyond the frame of the scene, the viewer feels as though they are on the canal itself gazing upon the façade and dome of San Giorgio Maggiore. Completed eleven years before *Venice: The Dogana and Santa Maria della Salute*, the scenery is clearer as Turner emphasizes the buildings, the ripples of water, society, and work on the canals. The water and buildings are doubly stressed as the water reflects the buildings above and the sky mirrors the water below with the clouds echoing the ripples of water. The painting was presented at the Royal Academy of Arts in London *The Dogana and Santa Maria della Salute* during 1834. In both paintings and multiple others, Turner highlights the intertwining and semiotic relationship of the buildings and the water. It is uncommon to see one without the other when presenting a scene of Venice.

William Cox Bennett wrote on Venice in 1862, clearly informed by the representations of Venice in art. The author begins by a similar exclamation of Byron's "Venice!" before going on to ask how his friends view Venice through their eyes. He poses the possibilities of how they may perceive the beauty of Venice, asking if the city appears as a vision of Aphrodite born from the sea or "as Turner painted her, before you rise," referencing Turner's play of sunlight on his many paintings, in Venice and elsewhere.¹⁶⁹ In the next two lines, Bennett ponders whether those friends may instead see the gondola making its way through the "ruin[ed]" palaces.¹⁷⁰ The poet considers the ruins part of the beauty of Venice, it is part of the art, just as he seems to consider the art of Venice part of the city's identity.

¹⁶⁹ William Cox Bennett, "Venice! Dear friends, how comes she to your eyes?" in *Poems*, (London-New York: Routledge, Warne, and Routledge, 1862), lines 1-4.

¹⁷⁰ Bennett, "Venice!" lines 5-6.

At the start of the 19th century, William Wordsworth romanticized and despaired over the end of the Venetian Republic which occurred 1797 in his poem “On the Extinction of the Venetian Republic.” Wordsworth recalls Venice’s long history and power, a maiden who could not fall. After the fall of the Republic and introduction of outside powers, greater preservation efforts were instituted in the 19th century as explained in the first chapter. The involvement of European powers instituted a greater interest in the city, leading to the influx of poetry and art on Venice, and proclamations of its limited life span as a city on water.

Lord George Byron remarked on Venice in 1819 crying:

“OH Venice! Venice! when thy marble walls
Are level with the waters, there shall be
A cry of nations o'er thy sunken halls,
A loud lament along the sweeping sea!
If I, a northern wanderer, weep for thee,
What should thy sons do?-anything but weep.”¹⁷¹

He acknowledges Venice will be overcome by water with the word “when.” The exclamation of Venice twice at the start of the poem is written with a sense of urgency to make the reader believe it will happen soon. In his poem, Byron also states individuals of multiple countries, the “nationals,” will cry for Venice and what can “thy son do?” His presentation of Venice is that which is in a perilous state, already in the act of sinking, and there is no hope of saving it. The mood is further exaggerated by the line “thirteen hundred years/ of wealth and glory turned to dust and tears;/ and every monument the stranger meets, church, palace, pillar, as a mourner greets.”¹⁷² Byron’s Venice is already decaying, the materials and built heritage turning to “dust,” and he is treating the city as though it is in a funereal state. The tone of Byron’s poem

¹⁷¹ George Gordon Byron, “Ode on Venice,” in *The Works of Lord Byron*, Vol. 4, ed. E.H. Coleridge (Project Gutenberg. December 22, 2006), lines 1-6.

¹⁷² Byron, “Ode on Venice,” lines 15-18.

is one of despair and distress over the deterioration of Venice which would echo throughout the 19th century.



Figure 31. Steiglitz, Alfred. Reflections-Venice. 1894. Photogravure print. 21.1 x 29.1 cm. George Eastman House, Rochester, NY.

Later in the century, when photography was developing and became more popular among artists, scenes were often captured in an artistic way that was similar to a painting. In a photogravure print by Alfred Stieglitz, he captures a scene split in half with the canal below and ground floor of buildings above (Fig. 31). The angle and placement of the camera captured a small scene, dominated by the water, but which reflects the buildings above. Like Turner, Stieglitz's print interweaves the two elements together. The theme of tying together the water and the city continued into the 20th and 21st centuries as seen in Nikos Economopoulos and Peter Marlow's photographs (Fig. 32-33).



Figure 32. Economopoulos, Nikos. Italy, Venice, San Marco Square. 1998. Economopoulos/Magnum Photos, NY.



Figure 33. Marlow, Peter. Italy. Venice. Gondola and Gondolier. 2005. Peter Marlow/Magnum Photos, NY.

Edwin Arnold, a contemporary of William Cox Bennett, wrote on the floating city in his “Venice” in a manner much like Byron. His poem is one of grief and heartache for La Serenissima. His Venice is one which is not yet buried, but the traveler will still be moved by grief and let tears “at sight of her who reigned, the sweetheart of the sea,” especially understanding her long, rich history.¹⁷³ Arnold’s poem shows a common trend, especially among English poems, to present Venice in a sorrowful way. Many see her as just barely alive, soon to succumb to the waters below.

In the latter 19th century, Ada Cambridge, an English and Australian writer wrote on “A Dream of Venice.” Cambridge talks of Venice as being both “ghostly” and “like a queen.” Like the sunrises in a Turner painting as mentioned by Bennett, she describes Venice in the dawn lighting the vegetation on the “decaying walls”:

“The broad day staring in her palace-fronts,
Pointing to yawning gap and crumbling boss,
And colonnades, time-stained and broken, flecked
With soft, sad, dying colours---sculpture-wreathed.”¹⁷⁴

Cambridge presents a decaying Venice as one of beauty. The theme has resonance of the Gothic literature popular in the 19th century, which romanticized mystery, dark and dramatic scenery often characterized by ruins. Her poem reveals a common fascination among English writers for melancholy atmospheres, exaggerated by language, tone, and mood. Two lines which convey the duality of beauty and gloom is the description of Venice as “Sad, faded, and unutterably forlorn!--/ But still unutterably beautiful.”¹⁷⁵ Wordsworth, Byron, Bennett, Arnold, and Cambridge present Venice in remarkably similar ways as each author laments the Venice of the past, the

¹⁷³ Sir Edwin Arnold, “Venice,” in *Poems: Narrative and Lyrical* (Oxford: Francis MacPherson, 1853), lines 5-11.

¹⁷⁴ Ada Cambridge, “A Dream of Venice,” in *The Manor House and Other Poems* (London: Daldy, Isbister, & Co., 1875), lines 31-38.

¹⁷⁵ Cambridge, “A Dream of Venice,” lines 54-55.

physical remnants, and often romanticizes the idea of Venice in a state of deterioration, believing the city will not last much longer. The latter may stem from a kind of disbelief among these English authors regarding the long life of a city on water and questions of just how the city is maintained in the lagoon. Nevertheless, there has often been a fascination with Venice by non-Venetians. Shakespeare famously set his plays, *The Merchant of Venice* and *Othello*, in the city. His work is one among many as multiple writers, many of those who had never been to Venice, embraced the city as the setting of a play, scene, or utilized it in some way. The interest in Venice, and the practice of enhancing its status to one of legend, flourished with pre-Romantic/Gothic and Romantic writers. To these individuals, Venice was somewhere to consider the long-gone legends of antiquity, “to muse gloomily on the passing of all mortal things and to ponder the eternity of the poetic spirit.”¹⁷⁶ These authors helped mythicize Venice, stressing the city’s ability to put the viewer under a spell or a trance, creating a city of dying power. However, this mythical pedestal upon which the authors placed Venice helped create a city which continued to enrapture the public internationally and view the city as a whole, “a city of love and death.”¹⁷⁷ The notion leads the idea that in a city so long associated with these two themes must one day fall, or “sink.”

Venice continued to be connected to themes of death, especially after the 19th century. In tracing the themes of love and death in literature on Venice, Erica Jong noted modern writers, contemporary films and novels continue to have an element of the Gothic about it. The romantic melancholy so pervasive throughout 19th century English and American texts bled into the 20th and 21st centuries, so that the mood and theme has become an identifier of Venice for the rest of

¹⁷⁶ Erica Jong, “A City of Love and Death: Venice,” *The New York Times*, March 23, 1986.
<https://www.nytimes.com/1986/03/23/magazine/a-city-of-love-and-death-venice.html>.

¹⁷⁷ Jong, “A City of Love and Death: Venice.”

the world. However, the focus on the mythical Venice and the tradition of mourning the city before it is even physically gone has allowed the real issue to go on little noticed. Jong noted the stories of Venice would allow it to live on in memory and narratives but criticizes the inaction of the Metropolitan Mayor and Council and dooming “the city to the fate of Atlantis.”¹⁷⁸ However, her article shows poets and artists during the 19th century played just as much a role in the current issue facing Venice.

Builders, craftsmen, and workers are some of the first individuals to enact preservation approaches in Venice, for not only is the built city man-made, but so is much of the aquatic environment. During the 14th century, the lagoon was altered as they redirected the rivers in Venice via canals and locks, allowing the water to flow into the larger Adriatic, but changing the marine setting. This disrupted the alluvial deposit which used to flow into the lagoon. The builders used the deposit, or soil, to support their structures, later strengthened by pylon construction. Seawater from the Adriatic then mixed with the river at the mouths.¹⁷⁹ The approach toward the lagoon was much different in the late Middle Ages, before Venice expanded and needed stronger structures to support the city. Inhabitants avoided altering the natural lagoon such as barrier islands acting as natural seawalls, materials protecting the shoreline, sand and vegetation from dunes, etc.¹⁸⁰ Now with the impact of climate change on sea-level rise in addition to the earlier transformation of the lagoon, there is increasing erosion in Venice and exchange with water from the Adriatic.¹⁸¹

¹⁷⁸ Jong, “A City of Love and Death: Venice.”

¹⁷⁹ Giorgio Bellavitis and Giandomenico Romanelli, in *Elements of Venice*, Foscari, 294-5.

¹⁸⁰ Gray, “If These Walls Could Talk,” 61.

¹⁸¹ Fletcher and Da Mosto, *The Science of Saving Venice*, 29.

The fall of the Venetian Republic altered the roles of individuals in the government, and thus the relationship between the government, residents, and the materiality of Venice. When the nobility lost their status and were forced out of the Republic, many went to work in manufacturing, tourism, or lived on inherited wealth, as the Hapsburgs and Bourbons took the reins.¹⁸² With Napoleon's takeover of the city and the relegation of Venice into a province, the outside power instituted both destruction of historic buildings to make room for modern businesses and later reversed the notion by advocating for the preservation of Venice as a "museum-city."¹⁸³ By the time it became part of Kingdom of Italy in 1866, Venice seems to have already been heavily affected by other European influences at the same time it enraptured much of the Western world. When the Venetian government called for the Venice Charter in 1964, they instigated a document which would serve as the international guiding principles for the restoration and conservation of historic monuments. The first article of the charter states:

*"The concept of a historic monument embraces not only the single architectural work but also the urban or rural setting in which is found the evidence of a particular civilization, a significant development or a historic event. This applies not only to great works of art but also to more modest works of the past which have acquired cultural significance with the passing of time."*¹⁸⁴

The above statement matches the traditional academic value oft given to heritage sites, as the first article emphasizes the significance of a building to the larger environment and correspond to a greater narrative. After the flood of 1966, there were strong influences and interventions from

¹⁸² Ferraro, *Venice: History of the Floating City*, 201.

¹⁸³ Ferraro, Venice, 201; "Conservation and Restoration," Venice: An Online Exhibit.

¹⁸⁴ 2nd International Congress of Architects and Technicians of Historic Monuments Committee, *International Charter for the Conservation and Restoration of Monuments and Sites (The Venice Charter 1964)* (ICOMOS, 1965), 1. <https://www.icomos.org/venicecharter2004/>.

that outside of Italy in Venice's preservation activity. Sir Ashley Clarke, once a British ambassador to Italy, began the Venice in Peril Fund as a relief effort to conserve Venice's heritage.¹⁸⁵ Having served as ambassador for nine years, he appears to have established a connection with Italian society, culture, art, and politics. When he died in Venice, he was buried on the island of San Michele. The Venice in Peril Fund was one of many conservation efforts, but they often focused on traditional art works and religious art, as opposed to architectural materials and structures. When understanding Venice's role in Western traditions of art, the focus is on the styles and plan of religious buildings, such as St. Mark's Basilica, or Venice's role in introducing oil on canvas during the Renaissance. Therefore, there is a pattern among such conservation efforts to preserve and protect elements of Venice seen as belonging to a larger, Western narrative and public.

"Save Venice" is an American organization which formed after the 1966 flood in an effort to protect artwork in Venice. The organizations website has already prefaced the question of "Why Should Americans Save Venice?" They answered it by stating Italians do not have the ability to preserve all of their patrimony, thus it is the "shared responsibility" for Americans to protect "these treasures [the Italians] in trust for all of us who descend from the Renaissance."¹⁸⁶ Increased interest, especially during the 19th century, developed and escalated after the flood of 1966. As a result, numerous preservation organizations dedicated to preserving Venice are run by non-Venetian or Italian individuals. As Venice loses more residents and is flooded by tourists, the meaning of the buildings and materials is placed in a questionable state. If the residents are leaving and the tourists are the majority population, what will happen to the narrative and

¹⁸⁵ Stubbs, *Time Honored*, 247.

¹⁸⁶ "Save Venice: About." *Save Venice*. March 22, 2019. <https://www.savevenice.org/about>.

symbolism of the built materials as Venice becomes more enmeshed into a larger, dominant narrative and farther from local history.

The increasing preservation efforts since 1966 have also played a role in driving away the residents. Improvements to sea walls and structures lead to increases in taxes, so residents find they are not in a financial position to take on restoration projects. As the residents and homeowners move out of Venice or function as absentee landlords, the projects are either not pursued, leaving structures in danger of deterioration or they are conducted by wealthy, non-Venetians. With a Venetian community abandoning the floating city, how will the historic materiality and different, local narratives be preserved?

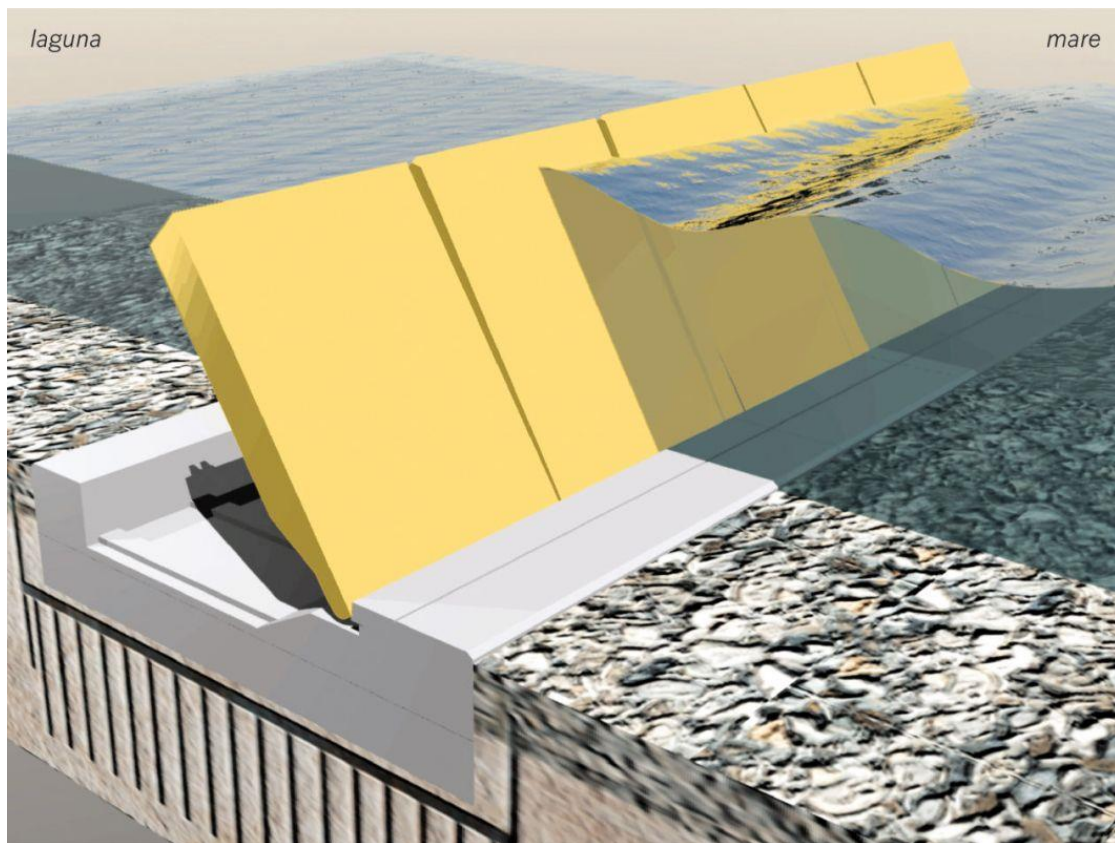


Figure 34. Sluice gates operating scheme. Accessed April 13, 2019. MOSE. <https://www.mosevenezia.eu/progetto/>.

From the first MOSE prototypes in the late 1980s and early 1990s to the final design in 2002, the project was often espoused in multiple articles as the solution to protecting Venice' from floods and thus ensuring its survival. However, the project cost over €6 billion and is not expected to be completed until 2022, eleven years after the original completion date of 2011. The numerous setbacks on the project and the lack of a working barrier after several years has drawn severe criticism from both inhabitants and other members of the public as people question whether it is a failure. 36 individuals, including Venice's Mayor Giorgio Orsoni were accused and arrested for corruption in 2014.¹⁸⁷ Orsoni, though absolved in 2017, was charged with taking bribes for contracts related to the project.

The situation created further tensions between citizens, heritage professionals, and political figures regarding ethical decisions in protecting Venice. Anna Somers Cocks was the former chairman of the Venice in Peril Fund from 2000-2012.¹⁸⁸ She resigned over frustration of the politicized environment surrounding the preservation of Venice.¹⁸⁹ Cocks also disagreed with the Venice in Peril Fund's approach to focus on the city as a whole and on mobile barriers.¹⁹⁰ She has noted "what concerns me most is that the authorities are not thinking long-term and that the decision-making process is deeply inefficient and highly politicized," and she noted guidelines in England and the Netherlands are examples of clear policies that could be

¹⁸⁷ Aria Bendix, "A \$6.5 billion sea wall was supposed to stop Venice from flooding. Now, most of the city is underwater," *Business Insider*, November 2, 2018. <https://www.businessinsider.com/venice-mose-flood-gates-storms-2018-11>.

¹⁸⁸ Cocks was born in Rome and has a personal connection to Venice, first visiting when she was seven years old at her grandmother's villa in Dorsoduro, a sestieri of Venice Kimberly Lisagor, and Heather Hansen, *Disappearing Destinations: 37 Places in Peril and What Can be Done to Help* (New York: Vintage Books, 2008), 270.; She has continued to be heavily involved in drawing awareness to the impact of sea-level rise on historic cities, especially the Mediterranean.

¹⁸⁹ Rozalia Jovanovic, "Anna Somers Cocks Resigns From 'Inefficient' and 'Politicized' Venice in Peril Fund," *The Observer* (London, UK), July 20, 2012. <https://observer.com/2012/07/anna-somers-cocks-resigns-from-venice-in-peril-fund/>.

¹⁹⁰ Jovanovic, "Anna Somers Cocks Resigns."

emulated.¹⁹¹ As for the project's success, there is concern it could do more harm than good. As the gates are meant to close during high tides and during sea level rise (Fig. 34), the structure could close off the lagoon for several weeks before it reopened.¹⁹² The consequences of this action could remove the oxygen in the lagoon and bird/fish species, essentially altering the character and health of the lagoon.¹⁹³ To avoid this, the city would have to reduce the length of time the gates could remain open, effectively choosing whether to protect the city from floods and sea level rise or protect the lagoon. To describe the intensity of the discourse on the MOSE barrier, the project has "divided the citizens of Venice and Italian politicians into camps so fiercely opposed that one is reminded of the Montagues and Capulets."¹⁹⁴ Fletcher and Da Mosto acknowledge the tense debate, but at the same time explain the solution still remains in developing a barrier against the sea.¹⁹⁵ Also, they criticize the competition among national, Italian politicians and the Mayor and Council to claim control over decision regarding actions taken to protect Venice, but then argue scientists need to take a leadership role and work collaboratively to present alternative solution.¹⁹⁶ While interdisciplinary collaboration is key, how does this solve the issue of competing authority? The idea of physically preventing floodwaters from entering the lagoon and the city does not address the materiality of the city, the physical environment which holds and support the history and society/culture of Venice. It is essential to address the materials and their history when preparing preservation approaches for Venice.

¹⁹¹ Jovanovic, "Anna Somers Cocks Resigns."

¹⁹² Lou Del Bello, "Venice anti-flood gates could wreck lagoon ecosystem," *Nature: News*. November 28, 2018. <https://www.nature.com/articles/d41586-018-07372-3>.

¹⁹³ Bello, "Venice anti-flood gates could wreck lagoon ecosystem."

¹⁹⁴ Fletcher and Da Mosto, *The Science of Saving Venice*, 7.

¹⁹⁵ *Ibid.*, 59.

¹⁹⁶ *Ibid.*, 7.

Rhodes Town, Greece

Governments currently wield the most power and say regarding the preservation of a historic site not only exist in Venice, but in Rhodes and much of the world. In August 2017, the Culture Minister Lydia Koniordou announced the appointment of a committee to help preserve the Medieval City of Rhodes.¹⁹⁷ Local government figures and culture ministry made up the group and are in charge of forming proposals for the city's preservation. Moropoulou argues for a new program to address the preservation issues in the Medieval City of Rhodes via renovation and reuse of listed historic buildings. She is more focused on preserving the cultural heritage of Rhodes, as she argues the new program will revitalize the economy as the renovated buildings will be used for "Tourism and Recreation, Private use of emblematic buildings by international and other organizations to promote extroversion, commercial use to revitalize traditional arts and crafts and Public housing."¹⁹⁸ Greece has traditionally struggled with balancing development and preserving their historic sites because of the significant number of ancient, medieval, and early modern structures and landscapes present on the islands and regions of Greece. Born in Rhodes, Moropoulou has advocated for and applied to the sites she has worked on sustainable preservation. Therefore, it is understandable why she seeks to bring greater economic stability to Rhodes through the city's preservation. However, she does not define what approaches will be taken to "renovate" and "reuse" the buildings in the Medieval city. While often intertwined with restoration, renovation can also mean the rebuilding and reconstruction of a site, so it is unclear

¹⁹⁷ GTP Editing Team, "Working Group Set Up to Preserve, Promote Rhodes Medieval City," *Greek Travel Pages* (Athens, Greece), August 9, 2017. <https://news.gtp.gr/2017/08/09/working-group-set-preserve-promote-rhodes-medieval-city/>.

¹⁹⁸ A. Moropoulou, N. Moropoulos, G. Andriotakis, D. Giannakopoulos, "A Programme for Sustainable Preservation of the Medieval City of Rhodes in the Circular Economy Based on the Renovation and Reuse of Listed Buildings," in *Transdisciplinary Multispectral Modeling and Cooperation for the Preservation of Cultural Heritage*, ed. A. Moropoulou, M. Korres, A. Georgopoulos, C. Spyarakos, C. Mouzakis C. (Springer, Cham, 2019), abstract. https://doi.org/10.1007/978-3-030-12960-6_20.

what kind of preservation techniques she is arguing for. When the author discusses the deterioration of materials in Rhodes, she extensively describes the damage from sea salt spray, use of cement on masonry joints during the Italian occupation, and substituted materials ill-matched with the historic materials.¹⁹⁹ However, the paper lacks any information regarding preservation plans to maintain the historic materials. If the historic materials are currently deteriorating, it is essential to understand their history and condition and develop a plan to preserve the city with the materials as a key focus. Rhodes cannot be allowed to deteriorate further or else Rhodes and Greece risk losing the historic significance of the architecture and fabric. They also risk creating a rift in the relationship between the community and urban medieval city.

It is necessary for residents, conservator/restorers, historians, architects, and concerned non-residents to speak about the importance of the historic materials of the Medieval city and balance the one-sided discourse dominated by the government. Moropoulou is closely tied to the government as she is an advisor to the Prime Minister's Office and Ministries of Culture and Foreign Affairs and other institutions, such as UNESCO and ICOMOS. She addresses the need for networking among the public and private sector to bring together different resources, but there is no suggestion on how to do so. Rather, the paper lists the inclusion of third parties who are public interest entities affiliated with or part of the local/national government.²⁰⁰ Non-profit organizations, residents, and restorers/conservators need to insert themselves or be incorporated into the discussion and activity of preserving Rhodes because the new program appears to have little connection to the public. A non-governmental organization established in 2009 called

¹⁹⁹ Moropoulou, Moropoulos, Andriotakis, Giannakopoulos, "A Programme for Sustainable Preservation of the Medieval City of Rhodes."

²⁰⁰ Moropoulou, Moropoulos, Andriotakis, Giannakopoulos, "A Programme for Sustainable Preservation of the Medieval City of Rhodes."

“Rhodes International Culture and Heritage Society” (RICHeS) is a group of about fifty volunteers with a Board of members who work with private and public organizations to receive funding and draw awareness to the cultural heritage and preservation of Rhodes.²⁰¹ They are also interested in presenting an alternate narrative of Rhodes by highlighting the exchange between Rhodes and other cultures, not just how Rhodes was influenced.²⁰² In 2018, a petition starter asked 10,000 people on the petition website, Change.org, to “Urge the Greek Ministry of Culture to protect Rhodes Old Town from deliberate destruction.”²⁰³ The petitioner, Kay Good, described the development of a hotel near and partially on an archaeological site in Old Town and the “destruction by hotel construction workers.”²⁰⁴ Good stated locals did not feel they could stop the activity and asks the Ministry of Culture to understand if the activity did not stop, “it signals to Greeks and the millions of visitors to the Old Town alike that Greece’s ancient history has no place in this century.”²⁰⁵ These individuals are already taking action to address the preservation of Rhodes.

RICHeS is focused on drawing more awareness to the heritage of Rhodes and the preservation of the island, but they are interacting with ICOMOS by holding ICOMOS-Day education events for school children and working with other institutions and organizations to draw as many resources as possible for the preservation of Rhodes. The petition reveals the Good’s anger towards development that does not respect the historic materials and heritage of

²⁰¹ “RICHeS - Rhodes International Culture & Heritage Society,” Anna Lindh Foundation, accessed April 11, 2019. <https://www.annalindhfoundation.org/members/riches-rhodes-international-culture-heritage-society-gia-ti-diethni-politistiki-klironomia>.

²⁰² “RICHeS - Rhodes International Culture & Heritage Society.”

²⁰³ Kay Good, “Urge the Greek Ministry of Culture to protect Rhodes Old Town from deliberate destruction,” Change.org, accessed April 10, 2019. <https://www.change.org/p/lydia-koniordou-minister-of-culture-urge-the-greek-ministry-of-culture-to-protect-rhodes-old-town-from-deliberate-destruction>.

²⁰⁴ Good, “Urge the Greek Ministry of Culture to protect Rhodes Old Town from deliberate destruction.”

²⁰⁵ Good, “Urge the Greek Ministry of Culture to protect Rhodes Old Town from deliberate destruction.”

the city. If residents and those concerned about the preservation of Rhodes' fabric can continue to address the Ministry of Culture and local/national government, they can draw a diverse range of discourse on the preservation of Rhodes and bring attention to the importance of its fabric and alternate narratives of its cultural heritage.

Edinburgh Castle, Scotland

Edinburgh is an example of how the governing body, heritage professionals, and the locals/nearby residents can come together to implement an effective preservation approach which recognizes the value of the historic materials. While Old and New Town Edinburgh is a UNESCO World Heritage Site, Historic Environment Scotland controls Edinburgh Castle. HES is active in conducting conservation work and maintaining the materials and landscape of the castle. HES employs specialists and technicians to maintain, conserve, and (when needed) repair Edinburgh Castle, along with their other 300-plus properties.²⁰⁶ The public body is linked to the Scottish Ministers as the Ministers appoint a board of trustees who then oversee Historic Environment Scotland.²⁰⁷ HES works with other government heritage organizations, such as the "National Trust for Scotland." However, they also work with charities, or non-profit organizations, such the "Society for the Protection of Ancient Buildings" and "Scottish Coastal Archaeology and the Problem of Erosion" (SCAPE). HES regularly provides spaces to converse with the public. Historic Environment Scotland began a conservation hub in 2017 called the Engine Shed for professionals in conservation and building, those who wish to learn hands-on skills, and for the public to learn about the issues facing built heritage and preservation

²⁰⁶ "Our role in conservation," Historic Environment Scotland, accessed April 18, 2019.
<https://www.historicenvironment.scot/about-us/what-we-do/conservation/our-role-in-conservation/>.

²⁰⁷ The Scottish Ministers are government officials elected by the Scottish Parliament.

methods.²⁰⁸ Morris, founder of SPAB, and Ruskin criticized the restoration practices of the 19th century as restorers used modern tools and materials on historic buildings. Ruskin and Morris initiated an architectural conservation movement that grew with SPAB and spread to Europe during the 20th century. The conservation movement's early beginnings in the England set the foundations for the U.K. as a global leader in building conservation. Ruskin's influence helped create a materials-oriented preservation approach. The case of Edinburgh Castle and Historic Environment Scotland is an example of the balance between heritage organizations, residents/interested non-government individuals, and politicians to understand and preserve historic building materials.

Old San Juan, Puerto Rico

When looking at the information UNESCO provides on La Fortaleza and San Juan National Historic Site and other UNESCO sites, there is a significant gap in the documentation compared to European sites. While Rhodes has less information and has not been updated as much as Venice or the Old and New Town of Edinburgh, it still surpasses San Juan. For example, there are 49 photographs in UNESCO's gallery of Rhodes to San Juan's one photograph of La Fortaleza. The World Heritage Committee has not made any reports on La Fortaleza and San Juan National Historic Site since 2007.²⁰⁹ Meanwhile, the World Heritage Committee conducted 10 or more reports per year on Venice and its Lagoon since 2013; Edinburgh has also had 10 or more reports (up to 50 reports in 2011 and 2012) per year since

²⁰⁸ "The Engine Shed," Historic Environment Scotland, accessed April 19, 2019.

https://www.historicenvironment.scot/learn/the-engine-shed/#about-the-engine-shed_tab.

²⁰⁹ "La Fortaleza and San Juan National Historic Site in Puerto Rico: Indicators," *UNESCO*, accessed January 13, 2019. <https://whc.unesco.org/en/list/266/indicators/>.

2004.²¹⁰ Rhodes, similar to La Fortaleza and San Juan, shows no indicators of consideration by the World Heritage Committee since 2009.²¹¹ Even in the aftermath of Hurricane Maria, there seems to be little acknowledgement from UNESCO regarding the impact of the storm on the site and its materiality.

UNESCO appears to focus on the appearance of the site in relationship to the modern San Juan. UNESCO's webpage on the World Heritage Site at San Juan has noted the concerns regarding the management of "urban encroachment near the City Wall" so as to preserve the walls.²¹² Locals who live near the walls in La Perla are distressed at seeing the destruction of the houses to provide a "buffer zone."²¹³ The report notes 26 houses that federal authorities marked for destruction as they sit within 10 meters of the San Cristobal fortress, with authorities citing the space is needed for maintenance workers to bring in machines to work in the preservation of the fortress.²¹⁴ While the article notes the authorities are waiting until the houses are abandoned, they are also putting measures in place which prevents relatives from taking the house after another relative's passing or for the owner to sell the house if it is on federal land.²¹⁵ While it is understandable that greater access to the fortress for maintenance requires the space to do so, the conflict between nearby residents and the federal authorities can affect their relationship to the historic site and how they identify with it. If the community views the site as only belonging to

²¹⁰ "Venice and Its Lagoon: Indicators," UNESCO, accessed May 10, 2019.

<https://whc.unesco.org/en/list/394/indicators/>; "Old and New Towns of Edinburgh: Indicators," UNESCO, accessed May 10, 2019. <https://whc.unesco.org/en/list/728/indicators/>.

²¹¹ "Medieval Town of Rhodes: Indicators," UNESCO, accessed May 10, 2019. <https://whc.unesco.org/en/list/493/indicators/>.

²¹² "La Fortaleza and San Juan National Historic Site in Puerto Rico," UNESCO.

²¹³ Yaisha Vargas, "26 La Perla houses marked for demolition Feds: Homes obstruct maintenance work on San Cristóbal fortress," *San Juan Star* (San Juan, Puerto Rico), September 13, 2007.

²¹⁴ Vargas, "26 La Perla houses marked for demolition."

²¹⁵ Ibid.

an international organization and Euro-centric narrative, preservation discourse in San Juan could become one-sided.

It is imperative residents, concerned non-residents, and heritage professionals draw attention to the importance of San Juan's materials because the apparent lack in attention to the city and its historic fabric in comparison to Venice, Edinburgh, and even Rhodes. Prior to Hurricane Maria, some activity had begun. In a report in support of a week of heritage activism during 2017, US/ICOMOS endorsed and supported local heritage professionals and organizations working to address climate change and sea level rise in Puerto Rico. Organizations include "Climate Change Strategies and Archaeological Resources Committee" (CCSAR), "Society of American Archaeology" (SAA), "Science, Management, and Policy Committee of the Latino Climate Action Network" (ELAC). A strong example of international collaboration among heritage professionals, Professor Isabel Rivera-Colazzo, professor at the University of Puerto of Environmental Archaeology joined efforts with Tom Dawson of the Scottish Coastal Archaeology and the Problem of Erosion Trust.²¹⁶ Dawson often works with Historic Environment Scotland, who are in charge of Edinburgh Castle, to seek approaches to addressing sites threatened by sea level rise and flooding.²¹⁷ The number of local professionals and consulting professionals who are members of/employed by climate change and/or archaeological organizations highlight the need to focus on the history of the historic materials and their conditions.

It is useful and important to consider the current political environments which surround the built heritage. Despite their historical significance, the physical structures still find

²¹⁶ "Puerto Rico's Heritage Community Rises to the Sea's Challenge."

²¹⁷ "Puerto Rico's Heritage Community Rises to the Sea's Challenge."

themselves subject to the winds of the current political climate. Scholarly research reveals significantly more information on Edinburgh's Old Town and the Castle in comparison to the lack of scholarship on Rhodes' heritage. They are both sites threatened by environmental impacts of climate change. They have a narrative regarding their urban fabric which extends beyond the Middle Ages. A major difference is their location in two countries on opposite sides of the European Union crisis. Where countries, such as the UK, have fared better than Greece and Italy, the impact of the political and economic situation on these World Heritage Sites is evident.

While Italy has, like Greece, also fallen on hard times due to the EU crisis, there is a great deal of scholarship on Venice and its conservation/restoration. Venice has been a global topic since the 1966 flood. Therefore, it has received much outside attention in contrast to Rhodes Town. While Edinburgh Castle is well known and there is more material to consider there than at Rhodes, it too, there is not the same amount of research as Venice. Edinburgh Castle has had the privilege of receiving aid from officials and individuals concerned about climate change on heritage sites because the United Kingdom is able to better fund projects on the protection of historic sites. The UK has a number of strong conservation/restoration organizations in place, apart from private institutions. This approach follows a precedent established by John Ruskin in the 19th century. The UK has remained a leading figure since then on conservation. This is not to say it is not a key concern in Italy and Greece, but they struggle to balance economic growth and development while maintaining control over their historic places.

Conclusion

To protect numerous structures in Venice from deteriorating due to sea-level rise, it is necessary to create new preservation approaches which will protect its built heritage for the next 100 years. The materials of Venice are the core foundation which can provide a sound and effective preservation practice. Understanding the history of the materials supplies a link to the discourses on architecture/aesthetics, society/culture, and material conditions impacted by sea-level rise. Restorers/conservators, residents, global on-lookers, construction workers, and scientists can implement changes to Venice's preservation. By arguing the importance of the history of the materials locally and globally, necessity to culture and architectural aesthetics of Venice, and essential practice of knowing the material conditions of the floating city, a preservation plan centered on Venice's materiality will occur.

Venice exists as both a physical city as well as an idea due to the legendary and mythical-like nature of it. The city and its fate were highly dramatized in the 19th century and the major flood of 1966 enhanced global fascination with the city. However, Venice's status has caused the city to serve as a precedent for preservation approaches to coastal cities. Any changes to Venice's preservation approach will be scrutinized closely and serves as an example for other heritage sites near the water. There have been no updates to the Venice Charter (1964) and a revision is long overdue.²¹⁸ This is not to say that the next preservation plan needs to be the definitive version for centuries. Conservation/Preservation/Restoration is a constantly evolving

²¹⁸ This statement does not ignore other charters, such as the Norms of Quito of 1967, Florence Charter of 1982, the Charter of Machu Picchu of 1977. Yet, the Venice Charter provides an international framework for methods of conservation and restoration. Respectively, the others may focus on the protection of cultural heritage from tourism and urban development in the Americas, the preservation of historic gardens, and merging cultural heritage with urban design and planning. These documents should be seriously considered and consistently maintained. For the preservation of historic materials, it is imperative the Venice Charter on international conservation and restoration be updated to reflect current concerns.

field and new methods are consistently developed and new conservation theories are implemented. However, the methods should be reassessed at least every ten years to ensure best practices are employed. Additionally, if a method becomes outdated or new environmental threats occur, it is important to update the plan for effective preservation. To establish effective approaches, residents, global non-residents, scientists, historians, architects, and restorers/conservators need to act now to convey the importance of the materials to local and global conservation institutions, global heritage institutions like UNESCO, ICCROM, and ICOMOS, to the Mayor and Council in Venice, and politicians in Italy. Drawing from approaches by artists and writers of the 19th century, this effort will require people to speak about the importance of building materials in preservation through literature, articles, artwork, digital media, social media, photographs, lectures, and papers like this one to stimulate the conversation.

Venice has occupied a unique position in the lagoon of the Adriatic Sea since the 6th century. Venetians erected a city on water as a method of protection, and it has become one of the most unique sites in Italy and the world as a result. However, it is still a home to many and the culture, while ever evolving, is rooted in the narratives and structures of the city. The veins in the marbles on the floor of St. Mark's still echo the sea just outside the basilica's doors. Wooden pikes made from local wood driven into the mud below by workers over a thousand years ago still hold the city up. Bricks fired on the man-made islands serve as the walls for most of the structures in the lagoon. Stones from the mainland, Greece, or other countries clad the structures of previous wealthy citizens, highlighting Venice's former power. The materials of Venice help shape the identity of the city and remind residents and visitors of local histories. The full consequences of climate change are unknown, and it is not enough to try to control the sea and lagoon. The relationship between building materials and residents and those working for/on

Venice's heritage have changed multiple times since the 6th century. To change it again for a better preservation approach, residents, restorers/conservators, scientists, heritage, architects, and more must argue for a greater understanding of the history of Venice's materials.

With a new preservation plan for Venice, other coastal heritage sites, such as San Juan and Rhodes, can develop plans drawing from the history of their materials as well. The multiple organizations in Edinburgh focusing on conservation of materials, such as stone, have influenced the city's recognition that preserving and protecting the stones is key. Edinburgh serves as an example of ongoing-action to protecting building materials. Other cities do not need to follow an exact plan developed for Venice specifically, but they should recognize the value of their historic building materials. They can then develop an approach tailored to their issues and materials as well. If Venice can implement changes, multiple other coastal cities will follow.

List of Figures

Figure 1. *High water discomforts. Venice, partially submerged monument, 11-2010. MOSE.*

<https://www.mosevenezia.eu/my-product/acqua-alta-novembre-2010/>.

Figure 2. *Venice: Map of Venice.* Accessed May 11, 2019. *Lonely Planet.*

<https://www.lonelyplanet.com/maps/europe/italy/venice/>.

Figure 3. *Venice.* Accessed April 2, 2019. [Public Domain], via *Pixabay*.

Figure 4. Giovanni Grevembroch, *Pile Driving*. 18th century. Watercolor. In R. J. Goy, *Building Renaissance Venice: Patrons, Architects and Builders c. 1430-1500*, page 78.

Figure 5. *The Foundation of Venice.* In Caroline Fletcher's *The Science of Saving Venice*, page 35.

Figure 6. Rio di Santa Marina (October 1998) and Rio del Trapolin (July 2004). *Venice Backstage*. <http://www.venicebackstage.org/en/363/le-fondazioni-dei-palazzi-veneziani/>.

Figure 7. *Istrian Stone and Red Verona Marble on the Doge's Palace.* Accessed April 13, 2019. [Public Domain], via *Pixabay*.

Figure 8. *Begun 1063; mosaics: 12th C and later. Venice, St. Mark's, Interior, Nave. architecture.* Accessed March 30, 2019. https://library-artstor-org.ezproxy.lib.vt.edu/asset/LESSING_ART_10311442140.

Figure 9. *Rhodes, Greece.* Accessed May 10, 2019. On the World Map. <http://ontheworldmap.com/greece/city/rhodes/rhodes-city-old-town-map.html>.

Figure 10. *Rhodes.* Accessed April 10, 2019. [Public Domain], via *Pixabay*.

Figure 11. *Edinburgh Castle*. Accessed May 10, 2019. *Edinburgh Castle*.

<https://www.edinburghcastle.scot/media/1116/orientation-map.pdf>

Figure 12. *Edinburgh Castle*. Accessed April 10, 2019. [Public Domain], via *Pixabay*.

Figure 13. *Old San Juan*. Accessed May 10, 2019. *Welcome to Puerto Rico*.

http://welcome.topuertorico.org/maps/323_walkingtouroldSanjuan.jpg.

Figure 14. *San Juan National Historic Site*. Accessed April 10, 2019. [Public Domain], via *Pixabay*.

Figure 15. *Venice: Piazza S. Marco Map*. Accessed March 15, 2019. https://library-artstor-org.ezproxy.lib.vt.edu/asset/ARTSTOR_103_41822003336771.

Figure 16. *Piazza San Marco and Basilica of St. Mark*. Accessed March 10, 2019. https://library-artstor-org.ezproxy.lib.vt.edu/asset/QUILL_1039907969.

Figure 17. John Singer Sargent. *Pavement of St. Mark's*. 1898. Oil on Board. 53.34 x 72.39 cm.

Figure 18. Royal San Marco Hotel. *Venice's Piazza San Marco flooded on Monday*. October 30, 2018. In Sarah Cascone's "Venice Museums Reopen After Dangerously High Tides and the Worst Flooding in Decades." In *The Telegraph* (London, UK). <https://news.artnet.com/art-world/venices-flooding-piazza-san-marco-1382980>.

Figure 19. Andrea Merola/EPA. *The Interior of St. Mark's Basilica, Venice, was flooded*. November 2, 2018. In Paul Simon's "A catastrophic threat to the Venetian way of life." *The Times* (London, UK). <https://www.thetimes.co.uk/article/a-catastrophic-threat-to-the-venetian-way-of-life-75pbz08l7>.

Figure 20. De Turreil, Paul. *Cannaregio District*. December 12, 2018. In “Cannaregio, the Hidden Venice Reveals its Secrets.” *Italia Rail*.

<https://www.italiarail.com/cities/cannaregio-hidden-venice-reveals-its-secrets>.

Figure 21. High water discomforts. Venice, tide level + 136 cm, 03-12-2010. *MOSE*.

<https://www.mosevenezia.eu/my-product/acqua-alta-dicembre-2010/>.

Figure 22. Camuffo, Dario. “The bricks of the San Polo Church are severely damaged by the action of sea salt crystals, which become evident as a white efflorescence in dry periods. The rendering has been partly lost or is coming off bricks impregnated with sea salt.” 2001. In “Canaletto’s paintings open a new window on the relative sea-level rise in Venice.” *Journal of Cultural Heritage* 2, no. 4: 278. 10.1016/S1296-2074(01)01128-1.

Figure 23. Camuffo, Dario. “Disintegration of Red Verona Marble in Venice for the action of marine salts mobilized by water.” 2004. In “Thermodynamics for Cultural Heritage.” *Physics Methods in Archaeometry*. Ed. M. Martini, M. Milazzo, M. Piacentini (Amsterdam, IOS Press): 95.

Figure 24. *The Rialto Bridge: Deterioration of the Wooden Structure Before Restoration*. 1973. In UNESCO, *Venice Restored*, page 86.

Figure 25. Schnarr, Tim. Medieval City of Rhodes. August 15, 2015. *UNESCO*. Limes Media. <https://whc.unesco.org/en/documents/138004>.

Figure 26. *Edinburgh Castle*. Accessed April 16, 2019. *Visit Scotland*. <https://www.visitscotland.com/info/see-do/edinburgh-castle-p245821>.

Figure 27. Jefferson, A. *Stonework on St. Margaret's Chapel, the oldest extant building in Edinburgh Castle*. August 23, 2010. From *Highly Allochthonous: "Castle Geology."*
<http://all-geo.org/highlyallochthonous/2010/08/castle-geology/>.

Figure 28. *San Juan Lookout Tower*. Accessed April 12, 2019. [Public Domain], via Pixabay.

Figure 29. Turner, William. *The Dogana and Santa Maria della Salute, Venice*. 1843. Oil on Canvas. 62 x 93 cm. The National Gallery of Art, Washington, D.C.

Figure 30. Turner, William. *Venice: The Dogana and San Giorgio Maggiore*. 1832. Oil on canvas. 91.5 x 122 cm. The National Gallery of Art, Washington, D.C.

Figure 31. Steiglitz, Alfred. *Reflections-Venice*. 1894. Photogravure print. 21.1 x 29.1 cm.
George Eastman House, Rochester, NY.

Figure 32. Economopoulos, Nikos. *Italy, Venice, San Marco Square*. 1998.
Economopoulos/Magnum Photos, NY.

Figure 33. Marlow, Peter. *Italy, Venice, Gondola and Gondolier*. 2005. Peter Marlow/Magnum Photos, NY.

Figure 34. *Sluice gates operating scheme*. Accessed April 13, 2019. MOSE.
<https://www.mosevenezia.eu/progetto/>.

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