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Comparing Climate Risk of Coastal Heritage Sites: Skara Brae and Roca Vecchia

Time is said to take away all, and due to the changes in the Earth's climate in recent years the effects of time have been amplified. These changes therefore have put historical sites at a higher risk of being lost beyond recovery or detrimentally damaged. This is especially true for sites that sit on coastal regions or other environmentally sensitive locations where they are forced to contend with soil erosion and a higher risk of storm damage. It would be a tragedy to lose these sites considering many were only recently rediscovered in their long history and still have truths to uncover about those who built them and carried out their lives in the walls of these structures. Their loss would be an undeniable hit to global heritage. Multi-hazard risk assessments conducted using data collected from the Adriatic coast showed that in comparison to inland locations, historical sites located on coastal regions and other water adjacent areas such as river mouths and wetlands scored much higher in terms of their vulnerability to the effects of climate change. Locations on beaches or directly on the coast were rated sixty percent higher than other areas with multi-risk factors such as events like storm surges, soil erosion, and rising sea levels.¹

Two comparable examples of risk sensitive sites can be found on the coastlines of Italy and Scotland where two Bronze Age villages were uncovered. Scara Brae in Scotland was uncovered after a storm around 1850 that washed away some of the earth it was buried under, revealing it to a local landowner named William Watt. The village was revealed to be comprised of at least nine stone buildings that appeared to most likely be living dwellings as well as passageways that interconnected all of the homes. It is thought that this was to travel between the buildings during the harsh Orcadian winters without residents having to subject themselves to the outdoors. The oldest buildings are estimated to have been built around 3100 B.C. and the village itself is estimated to have been abandoned completely by 2500 B.C. It may have been home to some one hundred people during its most active time, however there is mixed theories on if its residents were family units who farmed the surrounding area or if the village was a separate home for elite religious figures from surrounding communities.² The residents left behind some furnishings such as stone bed frames, dressers, cupboards, and boxes that were found

¹ Valentina Gallina, *A Multi-Risk Methodology for the Assessment of Climate Change Impacts in Coastal Zones*, pg. 1-2

² Caroline Wickham-Jones, *Between the Wind and The Water: World Heritage Orkney*, pg. 6-11

along with other smaller items.³ This discovery was and still is a massive find in the world of archeology and in creating a better understanding of how people lived in the past. Unfortunately, Watt proceeded to explore the site alone and take relics from it. The site has since seen its fair share of mishandling as antiquarians conducted excavations of the village without proper methodology or recording of their findings. In 1924 the site was finally taken into the care of the state, however at first, they made no moves to create protective barriers to protect Skara Brae from the elements.⁴ It wasn't until 1927 when a team of researchers led by archeologist Gordon Childe began work on properly clearing out the site and putting a system in place to prevent further environmental damage to Skara Brae in the form of sea walls, that the site was handled with tangible care.⁵ This new team being brought in by the state as a reaction to major storms that destroyed parts of the site in December of 1925 in order to rectify the lack of precautions in place to ensure against any further loss to the village by environmental causes.⁶ The storm destroyed most of house three and afterwards the state realized the importance of adding sea walls and consolidating the structure's walls in order to reinforce them.⁷ The majority of what is left of Skara Brae today would have most likely been subterranean during its time of use as they are believed to be part of later constructions during the time the village's over six hundred year residential history.⁸ There is evidence to suggest that the reason the village became abandoned in the first place was because of a major storm surge that required them to flee the village. The village was then covered by a large sand dune until it was discovered once again in 1850 after another major storm washed away the sand dunes revealing the village.⁹ Another theory on the abandonment of Skara Brae is that rising tidal conditions and wind increasing the salt content of the soil made farming the land difficult and may have been an alternative reason as to why the residents left over time. This eventually leading to the village becoming entirely empty.¹⁰ These theories show that Skara Brae's location has made it particularly susceptible to climatic disruptions throughout its history and that the onslaught of changes brought on by climate change pose a significant threat to the site as it has already struggled against them in the past.

Roca Vecchia in Italy was discovered even later in 1983 when the Grotta Poesia cave-sanctuary was uncovered during a rockslide. However, both cavities that make up the Grotta Poesia, named the "Grotta Poesia Grande" and "Grotta Poesia Piccola," are now subject to the elements as both of their roofs have collapsed and the area is frequently flooded by sea water. This part of Roca Vecchia has significant archaeological worth as located within the cave-sanctuary are thousands of religious inscriptions and

³ R.J Berry, *The People of Orkney*, pg. 20-21

⁴ Anna Ritchie, *Prehistoric Orkney*, pg. 28

⁵ Gordon Childe, V. *Skara Brae: A Pictish Village in Orkney*, pg. 4-7

⁶ Caroline Wickham-Jones, *Between the Wind and The Water: World Heritage Orkney*, pg. 28

⁷ Anna Ritchie, *Prehistoric Orkney* pg.28

⁸ R.J Berry, *The People of Orkney*, pg. 20-21

⁹ Liv Kjorsvik, *The Islands of Orkney*, pg. 237

¹⁰ Howie Firth, *Orkney*, pg.162

carvings dating back to the neolithic period and up to the time of the Roman Republic.¹¹ The two cavities are only part of the structure however as the site also includes fortification walls and posterns that were partially destroyed during a siege and the other most likely incorporated into the structure of a living dwelling later on. In fact, the skeletons also found at the site are the earliest evidence of war casualties found in Italy further adding to the historical significance of the site and its long history.¹² Roca Vecchia offers a wealth of insight into those who lived in Italy during this long span of time, especially their religious practices and how wars were conducted.

The discovery of these two sites and the struggles surrounding their stewardship highlight their likenesses despite the over thousand-mile distance between them. For example, the placement of both locations show that coastlines have always been a favorite of humans to settle near due to the resources available. Unfortunately, this also means these sites share the same threats such as the rising sea levels and soil erosion previously mentioned as the surrounding waters wear on the shoreline potentially chipping away at the sites. It is a miracle in itself that the two locations were discovered before time could stake its permanent claim on them or some major storm that would have potentially obliterated them without any preventive measures in place. Thus, losing them forever without historians and archaeologists ever knowing the existence of these two important world heritage sites. The village's locations being in particularly susceptible spots when it comes to natural disasters and the effects of climate change show the need for new creative methods of protecting archeological culture from the growing climate crisis.

The storms that damaged Skara Brae in the 1920's, taking much of house three and other parts of the village along with it, show how easily and quickly the environment can cause damage or potentially demolish entire historic structures. Especially those in at risk locations like the coast.¹³ The roof cave in and flooding of Roca Vecchia also serves as a warning of the issues coastal archeological sites face in maintaining structural integrity. In a study done to assess the climate risk to Skara Brae in 2019, researcher Jon Day stated that climate change is the fastest growing global threat to world heritage sites.¹⁴ This means sites like Skara Brae and Rocca Vecchia have a particularly small and limited window when it comes to ensuring the correct measures are taken to prevent the complete loss of the sites. A study using Ground Penetrating Radar on the archeological site of Le Cesine located in Lecce, the same area as Roca Vecchia, was able to indicate the presence of a previously unknown roman harbor without previous excavations being done on the area and despite the estimated rise of sea level since the time of the romans which was about two meters and masked the harbor. The ability of GPR technology to do so could mean that its use might be able to be expanded as a way of measuring the loss of difficult to reach areas in historic sites due to causes such as erosion or collapse as a

¹¹ Ferdinando Cesaria, *Interactive Archaeological Storytelling: Using Immersive Technologies to Visit the Ancient Site of Roca Vecchia*, pg. 33-34

¹² Fabbri, Pier. *Warfare and Aristocracy in Bronze Age Italy*, PG. 17

¹³ Caroline Wickham-Jones, *Between the Wind and The Water: World Heritage Orkney*, pg. 28

¹⁴ Jon Day, *Climate Risk Assessment for The Heart of Neolithic Orkney World Heritage Property: An Application of the Climate Vulnerability Index*, pg. 5

result of natural disaster.¹⁵ It would not be unsimilar to current methods being used to monitor the sea walls of Skara Brae and its use could potentially help in the preservation of multiple sites. The caretakers of Skara Brae as precautionary measures have implemented regular monitoring of the sea wall as well as a program being put in place to tackle repairs and improvements to the wall. The sea wall is scanned using terrestrial lasers every two years to track any loss or gain of coastal material in an effort to mitigate risk. Overall studies have shown that since the year 2000 the rate at which sea levels are rising globally has accelerated. Scotland was able to determine the rate in which their coastal regions are experiencing rises and found via tide gauges that their current rate is around 3mm per year.¹⁶ At this continued rate, it is safe to assume that the sea walls will most likely need to be expanded in order to keep up with the rising levels in the near future or some other barriers created. The use of lasers and radars could prove to be fundamental in laying out conservation care methods of at-risk sites and increasing the survival rate of Skara Brae and Roca Vecchia when it comes to combating environmental issues.

These efforts have created somewhat of a safety net and a starting point; however, they are still considered short term solutions as these methods allow for monitoring and negate some of the effects of rising sea levels and the wear and tear from coastal erosion but do little to help against other major risk. For example, these methods do not tackle the threat of major storm surges that could bypass the sea wall and preventative measures that are currently in place. These storms could potentially hit sites like Skara Brae and would cause severe damage to the site.¹⁷ The climate risk assessment of Orkney does mention that the frequency and intensity of these potential storms surges is uncertain. However, as storms are affected by other factors such as rising sea levels it is anticipated that the potential for damages and the impact that they could have on coastal regions is increased.¹⁸ According to Orkney's climate risk assessment it would take only one extreme storm to seriously damage and destroy parts of Skara Brae. An example of the reality of this threat to Skara Brae and by extension sites like it can be found in the case of a fellow Orcadian monument where in 1980 a lightning strike hit one of the stones in the Ring of Brodgar, a neolithic site. The stone was split into two and then toppled to the ground.¹⁹ While this could happen as a result of any major storm even without the increased risk from climate changes, the likelihood of similar events happening is heightened. This is concerning as Skara Brae's home of Orkney is also home to the largest concentrated number of prehistoric sites in Northern Europe and some of the most unique structures as well, many of which are also near water.²⁰

¹⁵ Emanuele Colica, *GPR Investigation at the Archaeological Site of Le Cesine, Lecce, Italy*, pg.12

¹⁶ Jon Day, *Climate Risk Assessment for The Heart of Neolithic Orkney World Heritage Property: An Application of the Climate Vulnerability Index*, pg. 35

¹⁷ Jon Day, *Climate Risk Assessment for The Heart of Neolithic Orkney World Heritage Property: An Application of the Climate Vulnerability Index*, pg. 22-23

¹⁸ Jon Day, *Climate Risk Assessment for The Heart of Neolithic Orkney World Heritage Property: An Application of the Climate Vulnerability Index*, pg. 37

¹⁹ Jon Day, *Climate Risk Assessment for The Heart of Neolithic Orkney World Heritage Property: An Application of the Climate Vulnerability Index*, pg. 50

²⁰ Liv Kjærsvik, *The Islands of Orkney*, pg. 13

A recent outlook given by the Intergovernmental Panel on Climate Change (IPCC) conducted in 2021 showed that anthropogenic global warming is accelerating passed previous estimations and that the Mediterranean area and heritage sites located in coastal regions are the most vulnerable to its effects. Sites located along the Adriatic Sea such as Roca Vecchia were pointed out to be vulnerable to material degradation due to extreme precipitation, landslides, seismic activity in the form of earthquakes, and flooding from rising sea levels. All of these potentialities have become more likely due to global warming. This could cause cracking, splitting, or toppling of heritage structures or the preventive measures in place if they are lacking in some way. Sites like Roca Vecchia could succumb to a number of these potential risks given they are already exposed to the elements via past damages.²¹ In the same outlook it was projected that the Adriatic coastline would see a significant increase in its sea level as it has the highest projected estimates of the Mediterranean and would suffer under the same threat of high earthquake hazards that Italy as a whole will most likely have to deal with in the future. It stated that world heritage sites in these regions would be particularly susceptible to the effects.²² In another related assessment measuring regional risk for locations along the Adriatic Sea using tide gauges sea levels were proven to be rising and the area was shown to be a potential hotspot for disaster, as were other low-lying areas. This means sites located there are storm prone and that the seismic activity coupled with flooding risk create a high hazard situation for heritage sites such as Roca Vecchia.²³

This is less than ideal considering older sites like Roca Vecchia already have an even higher risk to their preservation due to their age and worries that any physical additions made to these sites could potentially diminish their historical value and authenticity. This worry extends to replacing any old systems that were put in place such as drainage pipes or replacing old reinforcement walls and structures with those made of more modern materials that could help the sites handle the quickly changing environment.²⁴ An example of this could be replacing the missing roofs of the Grotta Poesia Grande and Grotta Poesia Piccola in Roca in order to help combat the effects of storm surges or creating barricades to prevent more sea water from filling the cavities. Another example could be argued to be any future additions to Skara Brae's Sea walls. While these measures could potentially prevent the site from being destroyed over time or completely by a sudden disaster, the missing parts of Roca Vecchia are a part of the sites history as they were brought on by major wars and the idea of replacing them brings into question whether or not complete authenticity is as important as preserving what is

²¹ J. Kapsomenakis, *Climate change threats to cultural and natural heritage UNESCO sites in the Mediterranean. Environment, Development and Sustainability*. 25, pg. 14531-14534

²² J. Kapsomenakis, *Climate change threats to cultural and natural heritage UNESCO sites in the Mediterranean. Environment, Development and Sustainability*. 25, pg. 14531-14534

²³ J. Rizzi, *Assessing storm surge risk under future sea-level rise scenarios: a case study in the North Adriatic coast*, pg. 1

²⁴ J. Kapsomenakis, *Climate change threats to cultural and natural heritage UNESCO sites in the Mediterranean. Environment, Development and Sustainability*. 25, pg. 14520-14521

left of these heritage sites. It also puts forth the notion that when creating these measures that those building the additions should take in consideration the potential effects on the sites authenticity and if there are methods that could be done that would not sacrifice historical authenticity or highlight the original structures in some way while protecting them. While this is not a study on how to carry out the large task of such an endeavor it is important to consider when discussing and comparing the shared struggles of heritage sites in the face of climate change. It is also important to remember and point out that each heritage site comes with its own set of issues in regard to construction and climate variables. Therefore, sites must be looked at from not only a general conservation standpoint, but from a customized approach as well that tailors to the problems each specific site may face as well as taking cultural and historical aspects into account when creating solutions.²⁵ This does not infer a certain methodology that works for one location would not work for another, but instead shows that solutions must be mixed and matched accordingly and that those with shared struggles can and should learn from one another. For instance, sites with wetlands nearby or other natural boundaries such as dunes and even some man-made ones were shown to increase their resistance to flooding even during a storm surge when these habitats were properly taken care of and supported. The same effect was achieved when introducing native species to surrounding areas that were resistant to temporary flooding. This means that for those locations making sure its surrounding natural barriers are insured and protected in the form of habitat protection laws and directives is another method that could reduce their risk of being swept away or damaged. It would also add to the overall sustainability of the sites in question.²⁶ Plants like those mentioned above could be added to the surround landscape of Skara Brae to act as a secondary natural barrier alongside the man-made sea wall.

When using risk assessments built from and expanding upon the Climate Vulnerability Index (CVI), a tool created for world heritage sites, the results showed that historic sites in Orkney like Skara Brae were rated high on the risk scale due to the changes in sea level, precipitation, and storms. This score was after the current preventative measures were taken into consideration. The results of this also showed that damage to these sites would lead to negative effects on local communities due to the impact their loss would have on social, economic, and cultural aspects of the lives of local populations.²⁷ This is largely due to how much tourism fuels the areas economy as well as the level of engagement Orcadians have with their own cultural heritage as shown in workshops held at Orkney College UHI that were led by specialist in related fields such as archeology, climate science, academia, and tourism. The workshop sought to tackle the issue of climate risk to the island's heritage sites. There were thirty-six participants total who took part in this workshop with half of the participants being from

²⁵ J. Kapsomenakis, *Climate change threats to cultural and natural heritage UNESCO sites in the Mediterranean. Environment, Development and Sustainability*. 25, pg. 14537

²⁶ J. Rizzi, *Assessing storm surge risk under future sea-level rise scenarios: a case study in the North Adriatic coast*, pg. 14

²⁷ Jon Day, *Climate Risk Assessment for The Heart of Neolithic Orkney World Heritage Property: An Application of the Climate Vulnerability Index*, pg. 39-45

the local communities of Orkney themselves. During the workshop multiple aspects of heritage management were looked at in relation to climate change such as prehistoric cultural landscapes and architecture. Participants were asked to consider these key aspects as they worked through assessing risk levels. They were given a system in order to rank the climate issues facing these historical locations and what they thought posed the highest risk. This was determined to be sea level rises as the highest, then increasing precipitation and storm intensity and frequency ranking second and third. After these threats were then taken in consideration when determining the potential for them to cause major loss or substantial alteration to historical sites.²⁸ The last assessment the workshop laid out was how local communities would be effected by damages done by climate change to their historical landmarks as it would effect much of their every day lives in the way in both tangible non-tangible ways.²⁹ The community's active engagement with the workshops and the assessments recorded after showed that this engagement actually helps to lessen the potential effects caused by environmental risk factors to historical sites and their communities. This decline in potential effects comes from their willingness to adapt and find solutions to the problems facing them.³⁰ It highlights that another method of prevention and a necessary building block of creating a solid conservation plan should be getting the community to engage with and care about their local history. This data also shows that if the caretakes of sites like Roca Vecchia and other coastal sites who face the same climate issues as Skara Brae were to use the same or a similar framework to assess their own heritage sites that a gateway for creating productive preventive measures could be established that would not only aid in maintaining the physical historic sites but allow for community participation in conserving their own history.³¹ The workshop shows that this is an incredibly important tool when increasing the survivability of global heritage.

There has been recent research regarding Roca Vecchia involving the use of augmented reality in telling the site's history. This could very well be beneficial to Skara Brae and related coastal locations through further raising awareness of what has already been lost due to climate changes and time. This technology could show a physical representation of the parts of these historical sites that are no longer around due to events like the storms at Skara Brae in the 1920s or the collapses at Roca Vecchia and potentially further engage local communities as well as rally visitor support in creating solutions to avoid further loss.³² The augmented reality technology would give viewers something tangible to look at and measure with their own eyes. It would do this by using

²⁸ Rebecca Jones, *Developing Climate Risk Assessments for World Heritage: The Climate Vulnerability Index*, pg.5

²⁹ Rebecca Jones, *Developing Climate Risk Assessments for World Heritage: The Climate Vulnerability Index*, pg. 5-7

³⁰ Jon Day, *Climate Risk Assessment for The Heart of Neolithic Orkney World Heritage Property: An Application of the Climate Vulnerability Index*, pg. 51

³¹ Jon Day, *Climate Risk Assessment for The Heart of Neolithic Orkney World Heritage Property: An Application of the Climate Vulnerability Index*, pg. 52-53

³² Ferdinando Cesaria, *Interactive Archaeological Storytelling: Using Immersive Technologies to Visit the Ancient Site of Roca Vecchia*, pg. 35

the technology to create a digital interpretation and reconstruction of the sites using information found through extensive research by specialists in fields such as heritage, history, and archaeology. With this programmers and designer teams could then build experiences that allow users to explore the sites as they were before the damages. This could go beyond just rebuilding the sites visually in terms of physical structure, but also allow for the daily lives and struggles like war of those who built these sites and used them to be shown through animations and 3d models. Users could travel through the passageways of Skara Brae or see a reenactment of the siege of Roca Vecchia. Thus, building emotional involvement in locals and visitors that might spur them into action when it comes to preservation of heritage sites.³³ This in tandem with workshops such as the ones carried out in Orkney would create a solid foundation in using community outreach to expand the success rate of conservation methods as it may increase the likelihood of them offering support to the cause. Especially in the wake of rising conservation costs due to the rate at which the climate is changing and the problems it is creating as repairs, barriers, and additions to old sites like air conditioning need to be implemented in ways that still uphold the integrity of the sites.³⁴ The workshop in Orkney also showed that this method of community engagement allowed stakeholders to point out gaps in what was needed in terms of research and policies that would help in the process of preserving the sites and spawned media attention which further bolstered support for preservation projects. This was proven as the workshop became a sort of catalyst for amplifying conversations about conservation in the wake of climate change and resulted in radio and television interviews being conducted and several media articles discussing the assessments were written. When Orkney College hosted an event to present all of the results the event was at capacity showing the intensity in which attention had been drawn to the issue and the scope of public interest in supporting solutions.³⁵ This puts the weight of saving these historic sites on not only academic and professional researchers but communities as a whole and increases the chances of creating lasting preventative measures. If people are made to care about their history and are shown their connections to it in the modern day, they are far more likely to want to preserve it.

The climatic elemental risk factors that both sites face directly impact the livelihood of these two historic sites and the ability they have to teach humanity about its distant past. Despite the distance between them their shared difficulties could become a gateway into ensuring their preservation if those who oversee their care create productive conversations regarding conservatory methodology. Caretakers could use both the knowledge gained from the mishandling of these sites as well as the beneficial discoveries such as community engagement and technological tools to build a path that continues the preservation of both Scara Brae and Roca Vecchia without compromising

³³ Ferdinando Cesaria, *Interactive Archaeological Storytelling: Using Immersive Technologies to Visit the Ancient Site of Roca Vecchia*, pg. 36

³⁴ J. Kapsomenakis, *Climate change threats to cultural and natural heritage UNESCO sites in the Mediterranean. Environment, Development and Sustainability*. 25, pg. 14520-14521

³⁵ Rebecca Jones, *Developing Climate Risk Assessments for World Heritage: The Climate Vulnerability Index*, pg. 5-8

their value as a part of humanity's global culture. Both of these sites highlight life in eras where researchers and historians are still making new discoveries that further humanity's understanding of itself. They point out the necessity of defending archeological culture from the erosion of time and how easy it is to lose these important and sensitive locations if populations are not careful.

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