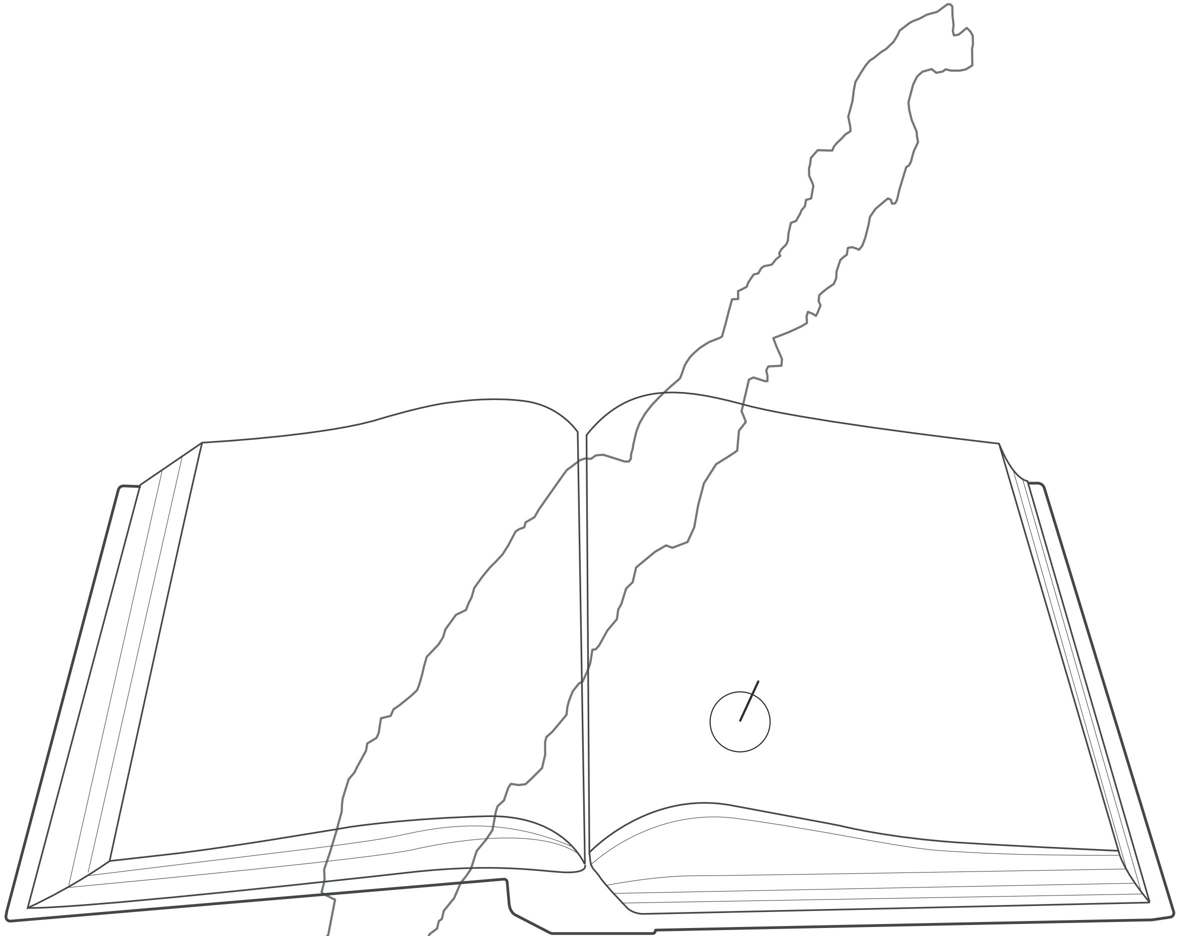

Stories of an Island

An investigation of how geological systems can be translated into to architectural structures.

CHALMERS
UNIVERSITY OF TECHNOLOGY

Linnéa Forsmark
Chalmers School of Architecture
Department of Architecture and Civil Engineering
Examiner: Jonas Lundberg
Supervisors: Jonas Runberger
Kengo Skorik

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- Jonas Lundberg

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Student Background

Linnéa Forsmark
+46 73 073 08 77
linnea.forsmark@gmail.com

Relevant Education

2022 — Master of Architecture,
Architecture and urban design,
120 hp
Chalmers University of Technology

2019 — Bachelor of Architecture
180 hp
Chalmers University of Technology

Relevant Experience

2019-2021 — *Malmström Edström*
Arkitekter Ingenjörer AB
Internship

2019 — *Atrio Arkitekter AB Kalmar*
Internship

Abstract

Architecture tells stories. Stories of historical, present, and future aspirations. For the past century, economic considerations have held the role as main character. This is a global trend. The result is unstimulating buildings and urban settings. Perhaps, to ensure the habitability of future architecture, is time to recruit a new main actor?

Humans have an inherent need to connect with nature. It is our natural habitat, and the environment our brains were developed for. Perhaps, by gaining inspiration from nature, architecture can bring inspiration and excitement to its users?

This thesis investigated how the logic of local geological systems on Öland can be translated into an architectural structure with the affordance of a historical museum. On Öland, the limestone bedrock is of great importance. It has provided the island with a unique landscape, containing various types of nature. On the alvar, an open and dry moorland, the limestone bedrock is exposed. This area, and its visible geological systems, was chosen as subject for translation into a building.

The thesis presents developed methods for translation between these geological systems and architectural design strategies. The result was a museum proposal, inspired by the limestone joint systems and the limestone scarp systems of the bedrock.

Key words: Geomorphic architecture, limestone, biophilia, Öland

1. Introduction

- Thesis Aim
- Main Questions
- Delimitations
- Background
- Location and Material
- Method

Thesis Aim

- The aim of the thesis was to explore how local natural structures can be translated into a site-specific design concept for a building meeting the requirements of a certain building typology.

Main Questions

- How can the geological features of Öland, a result of geological processes over millions of years, be translated into architectural design strategies?
- How can these strategies be employed for the design of a historical museum located on the same island?

Delimitations

- Economic aspects were not taken into consideration in the design proposal of the thesis.
- The design proposal is not linked to the actual investigation of the possibility to build a historical museum on Öland. It's a free-standing proposal with its own suggestion for site and program.

Background

Historically, architecture has told the story of power. Often as a religious statement. For the past century, though, economic considerations have played the biggest part. (Yasong, 2014) This is a global trend. The result we see today are built environments offering little spatial and social stimuli to its inhabitants. As economic aspects in the lead role have failed to produce good architecture, it is time to find a new ruler of design. (Guallart, 2008)

Money has proven to be one of the most successful tools for human cooperation. It is a system for trade accepted by all countries worldwide. Historically, the strive for economic growth has drastically changed the lives of people to the better. Therefore, the economic aspects of the building process are not the villains of the drama. Quite contrary, they are enablers, making architectural projects possible in the first place.
(Harari, 2015) Although, as mentioned, letting economical aspects be the main influence of design have resulted in spaces no longer enriching peoples' experiences of them. Then, what could do? (Guallart, 2008)

The theory of biophilia implies that human beings have an inherent need to connect with nature. We have spent a significant majority of our history on the savannah. Therefore, we are not evolutionary designed to inhabit the environment that most of us see as our natural home today. To create spaces that nourishes people's minds, we must find inspiration in nature.
(Kellert, 2008)

Being the results of millions of years of developement, structures found in nature are highly complex and in deep correlation with its surroundings. No building has yet proven to be more intelligently designed than any compositions found in nature. Therefore, great opportunities can arise if we choose to learn from our surrounding nature. By telling the story of local natural structures, buildings have the potential of becoming rich and complex designs, stimulating, and nourishing the minds of its users. (Guallart, 2008) This thesis aimed to explore how these structural stories can be told, while simultaneously filling the criteria for a certain building

Location and Material

As this is written, investigations concerning a new historical museum on Öland are taking place. Öland has a rich history that has left the island with a great treasure of archaeological findings. Today, most of these objects are displayed in Stockholm. A wish from the inhabitants of Öland has now raised the question of bringing the historical artefacts back to the island. (Länsstyrelsen Kalmar län, 2020) This museum stood as subject for application of research in this thesis.

Öland is a Swedish island situated in the Baltic Sea. Since 1972 it is connected to land by a bridge, stretching from Färjestaden on Öland, to Kalmar on the mainland. Despite being only six kilometres away from the mainland, the nature on the island differs from the rest of Sweden. On the rather small area that makes up Öland, several different types of nature can be found, such as deciduous forests and wetlands.

The museum design proposal in this thesis is situated in the nature type alvar. The alvar is a dry, open moorland that stretches over large areas of Öland. What gives the alvar its specific character is the limestone bedrock, that in these areas is covered only by a thin layer of soil. The fact that the surface of Öland consist of limestone is what makes it different from adjacent mainland. (Nender, n.d.)

Because of how it distinguishes Öland from the rest of Sweden, and how it generates the unique landscape of the alvar, the limestone bedrock was chosen as the natural structure to be studied in the thesis. This raised the question of how geological structures on Öland can be translated into architectural structures?

Throughout history, limestone has been of great importance for the culture, architecture and economy of Öland. For more than 1500 years, the inhabitants have mined limestone to use it as building material. Old, no longer used limestone quarries are common. Across the island, historical structures consisting of limestone are regular features. This includes castles and fortifications, long stretching stonewalls, churches and more. The first export of the stone can be traced back to the Middle Ages. Then, ships brought it to the areas surrounding the Baltic Sea, where it was used for monumental buildings. (Länsstyrelsen Kalmar Län, 2005)

To this day, limestone remains a product of importance on Öland. It is still used as building material. Both in its stacked, traditional form, and as the

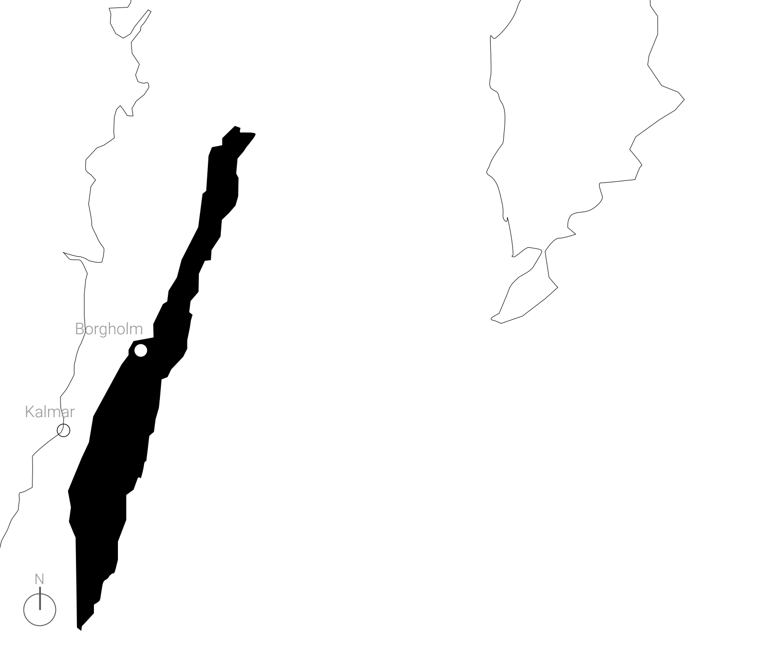


Fig 1.1 Öland in the context of southern Sweden. (Own illustration. (Reference Google n.d.))

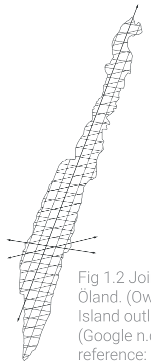


Fig 1.2 Joint systems on Öland. (Own illustration. Island outline reference: (Google n.d.) Direction reference: (Königsson 1968))

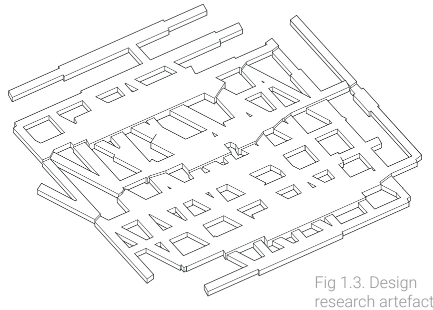


Fig 1.3. Design research artefact.

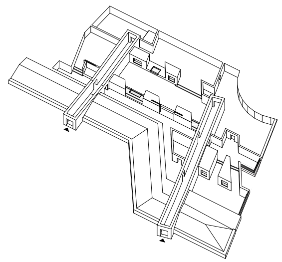


Fig 1.4. Design proposal axonometry.

Method

PHASE 1.
The initial phase of research consisted of studies of the geological structures of Öland. By reading reports and on the subject, two main factors were chosen as subjects for further investigations: the limestone joint system and the limestone scarp system. As a complement to the literal studies, a site visit on Öland was done for closer studies of the two systems.

PHASE 2.
In the second phase, a method was developed to translate to the geological systems into architectural structures. For this the software QGIS was used for spatial analysis. Geometrical studies were performed in Rhinoceros 3D with the plugin Grasshopper. The phase resulted in an artefact, inspired by the logic of the limestone joint system and scarp system.

PHASE 3.
A design proposal for a historical museum of Öland was composed. The finished structure was the result of the combination of the prototype from phase two, and the museum program. To communicate the proposal, representations in the form of drawings, digital models, renderings, and diagrams were composed. Software utilized included Rhinoceros 3D, Twinmotion, Photoshop, Illustrator and InDesign.

2. Design Proposal

- Proposal Introduction
- Site Introduction
- Entering the Museum
- Plan
- Spatial Organisation
- Materiality
- Outlooks
- Outdoor Corridors
- Exhibition Room 2.

Fig 2.1 Reference map (Own illustration. (Reference Google n.d.))

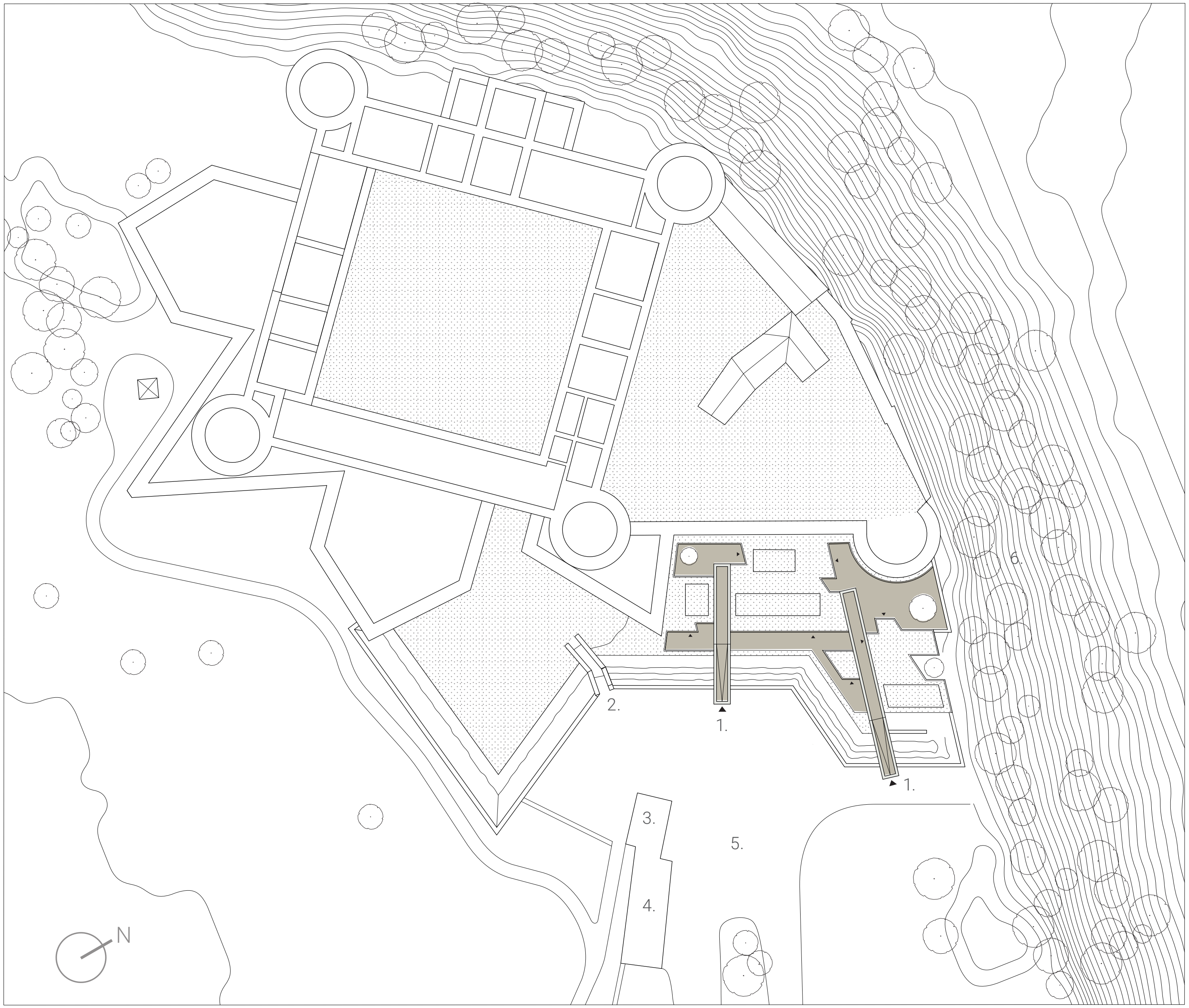


Fig 2.2 Siteplan, scale 1:1500

1. Museum Entrance
2. Castle Ruin Entrance
3. Reception and Giftshop
4. Admin
5. Parkinglot
6. Landborgen

Fig 2.3 Present siteplan, scale 1:1500

Site Introduction

At the very edge of the limestone bedrock, the castle ruin of Borgholm was built sometime between the 12th and 13th century. Today the ruin is a popular tourist destination.(Ringbom, 2021)

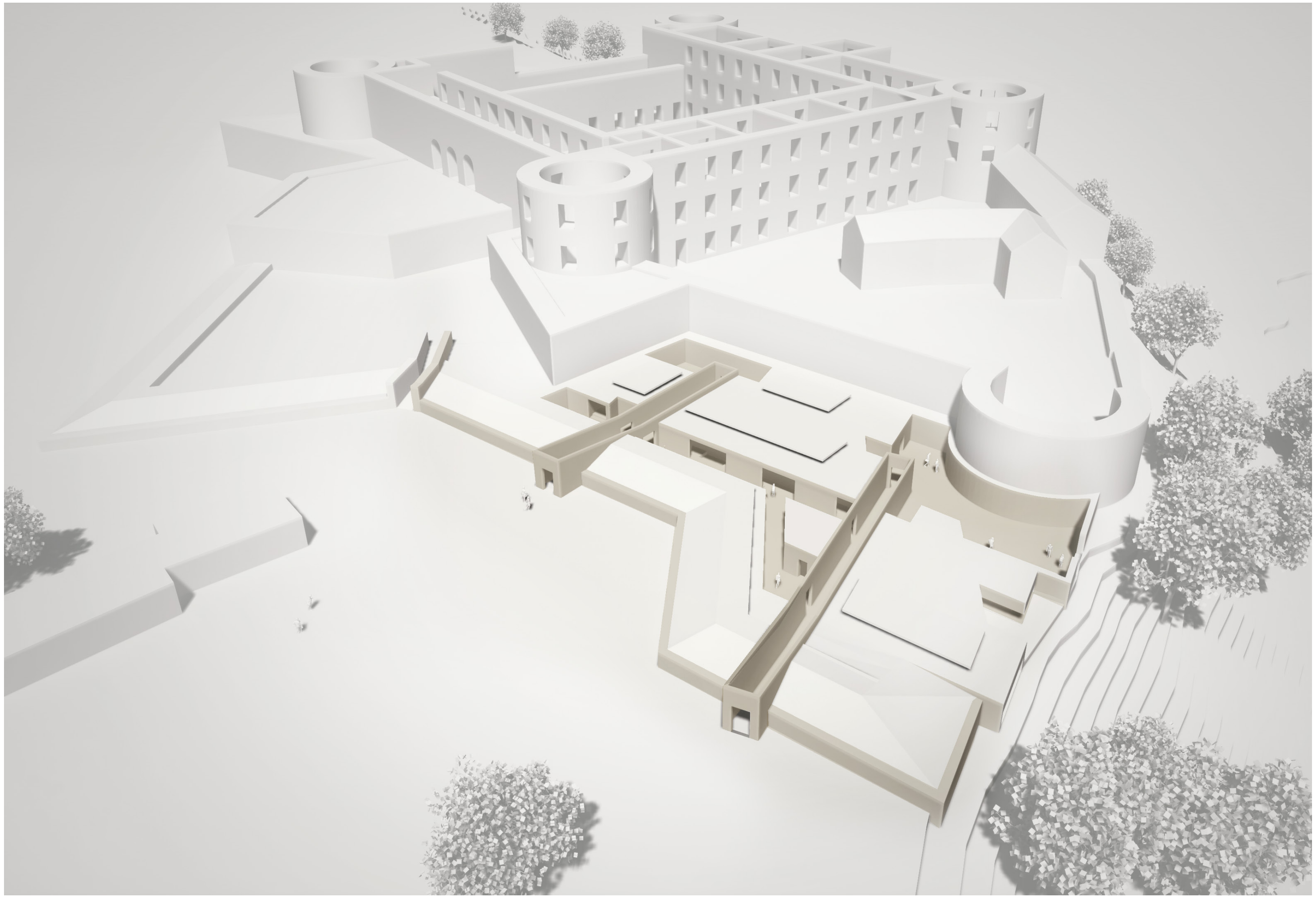


Fig 2.4 Museum proposal seen from above.

Fig 2.5 Perspective of museum entrances.

Entering the Museum

When first arriving at the location, the only signs of the new museum are two black, wooden boxes. These are breaking their way up the ground, and over the castle walls. If entered, the boxes reveals to be long passages, leading its visitors down to the museum hiding in the limestone bedrock.

Fig 2.6 Perspective from hallway corridor.

As visitors make their way down the passages, they are descending away from the history of the castle ruin. Instead, they find themselves in an even older moment of time. As the ruin grow higher and higher above the prospectors, a story of the island, its geological creation and its early settlers, is told.

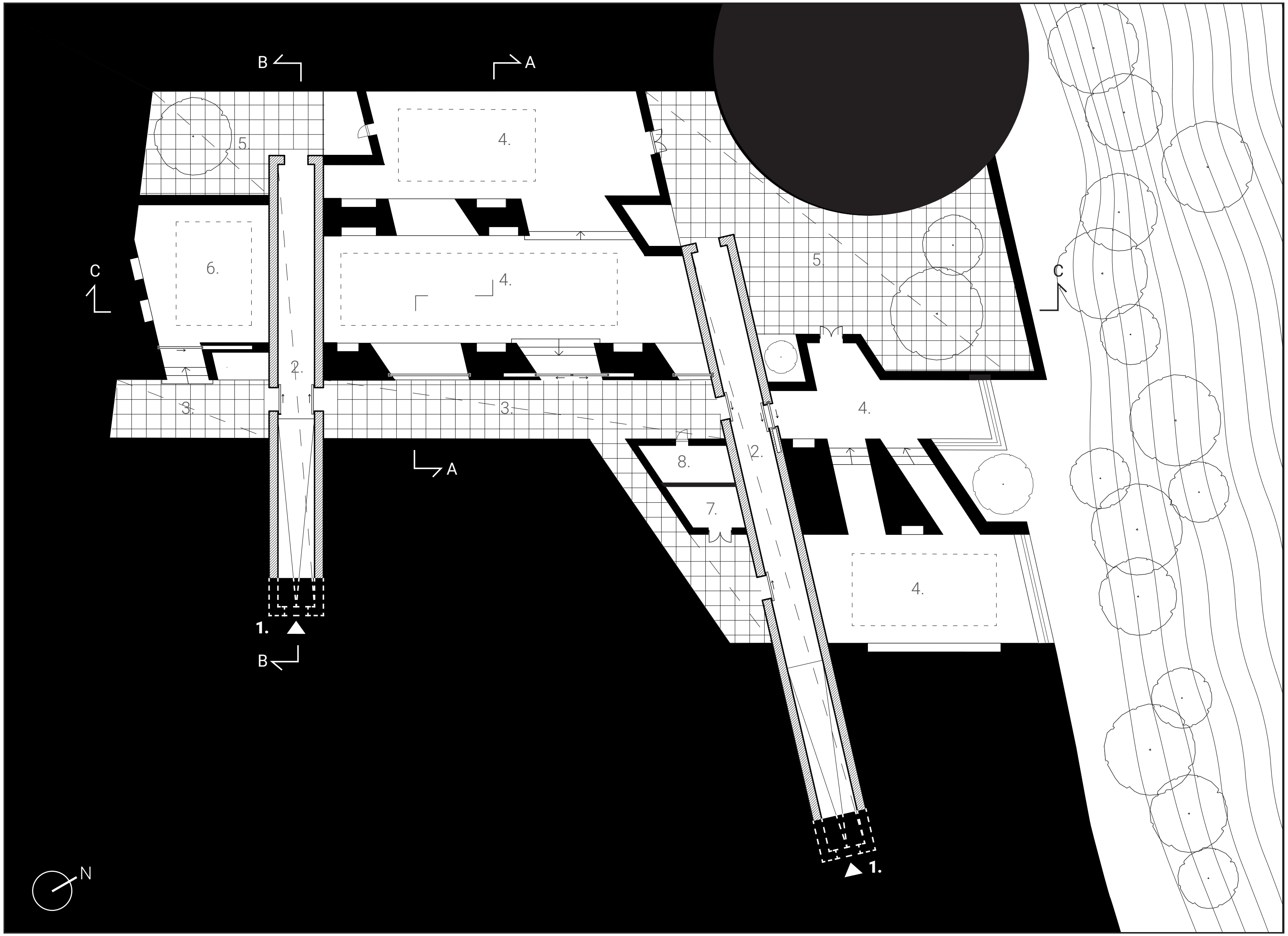


Fig 2.7 Plan 1, scale 1:400.

Plan

The plan structure is the result of research of the limestone bedrock. Joint systems, stretching across the island, inspired this non-perpendicular layout.

Long rooms and sight-lines stretch parallel to the island shoreline whereas lines extending from east to west are more likely to be abrupted. This concept mimics the landscape terrain and how one would most likely travel on the island.

1. Entrances
2 Communication Hallways
3. Outdoor Corridors
4. Exhibition rooms
5. Garden Areas
6. Open Workshop & Archive
7. Visitor WC
8. Storage

Spatial Organisation

Like the plan, the 3-dimensional structure it the result of geological studies. Parallel to the length of the building, the volume runs smooth with a constant level in floor height. In opposite direction, the spaces become more irregular. The walls are different in width, the ground level fluctuates and features, too high to be part of the floor, form podium like geometries. The alvar landscape has little differentiation in terrain. The few shifts in height are small, but significant for the biological diversity in the areas. These shifts, or scarps, allows rainwater to be dammed up against them. Most commonly, they run parallel to the island. Hence, most shifts in terrain in the alvar occurs in the same directions as in the building.

Materiality

The main material used in the museum is rammed earth. Its layered qualities are referencing to the layering of the sedimentary limestone bedrock. Used throughout the entire building, the rammed earth gives the building the appeal of being the result of excavations in the bedrock.

Many display windows and boxes for archaeological findings are integrated in the rammed earth structure. They symbolise the original finding places of the artefacts. Being discovered during historical excavations on the island, the archaeological findings are once again found incorporated in the ground.

Fig 2.8 Perspective from exhibition hall.

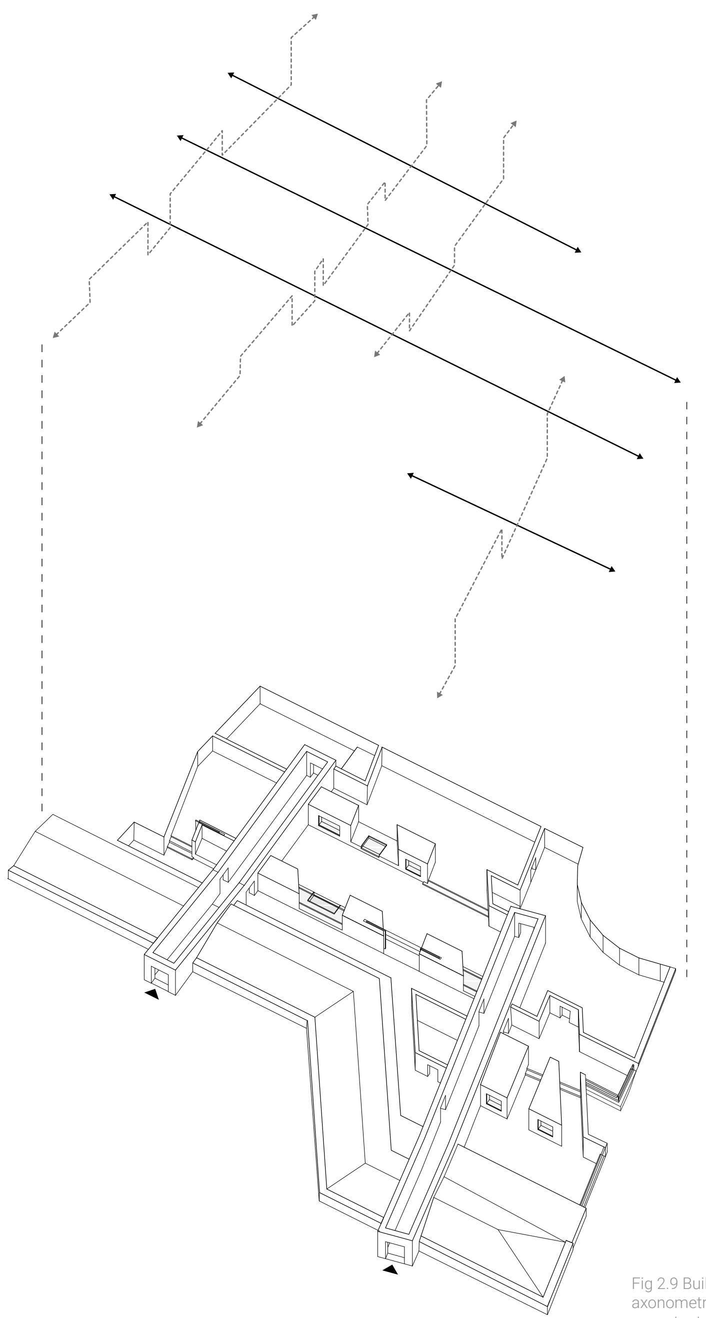


Fig 2.9 Building axonometry with accentuated volume lines.

Fig 2.10 Perspective view from exhibition hall.

Outlooks

Like the limestone bedrock, the building ends at the edge of Landborgen. Where the museum is cut, large windows frame the view. Here it is possible to see cross the steep Landborg-scarp and its vegetation (here in the same level as the eye of prospector).

Fig 2.11 Perspective view from exhibition hall.

Outdoor Corridors

Getting from one exhibition hall to another, communication happens outdoors. Materials are the same as insidoors, but the cieling is replaced by the sky. This is a feature inspired by the open cracks of the bedrock. When exposed to water, the joints in the limestone are dissolved. This makes them open, leaving room for more water to run, and as a result, places for plants to grow. In the historical museum, visitors become the water, streaming through the opened joints, giving the oppurtunity for raised a raised knowlede and interest in the history of Öland.

Fig 2.12 Perspective view from outdoor corridor.

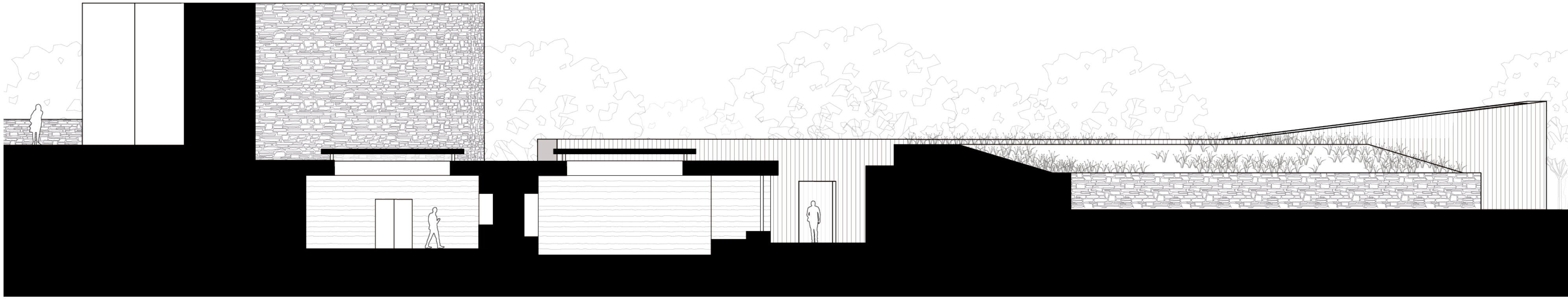


Fig 2.13 Section A-A, scale 1:250

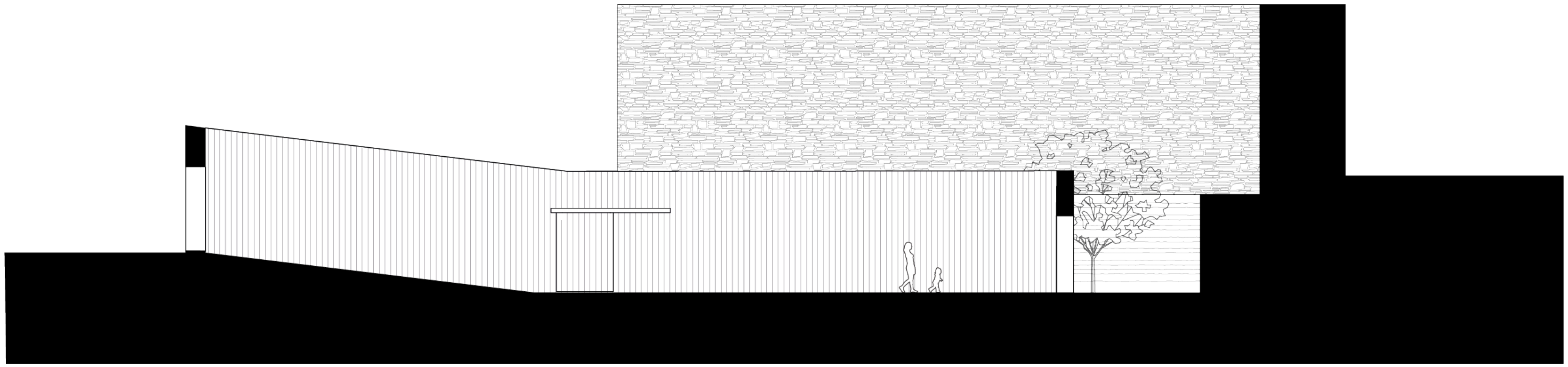


Fig 2.14 SectionB-B, scale 1:250

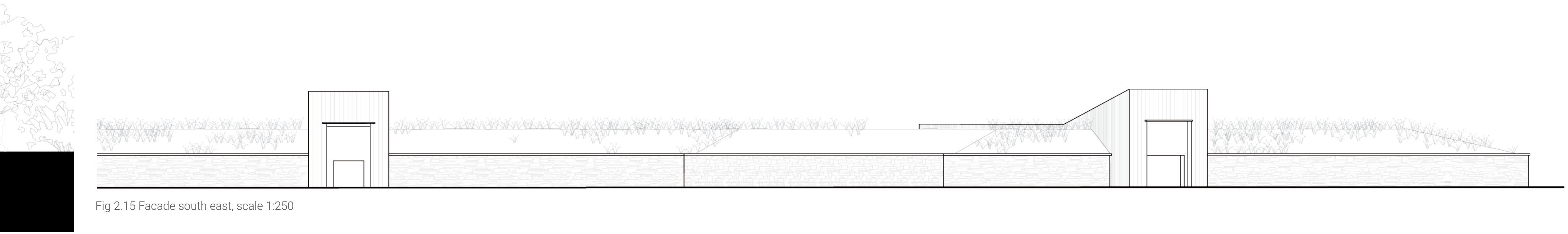


Fig 2.15 Facade south east, scale 1:250

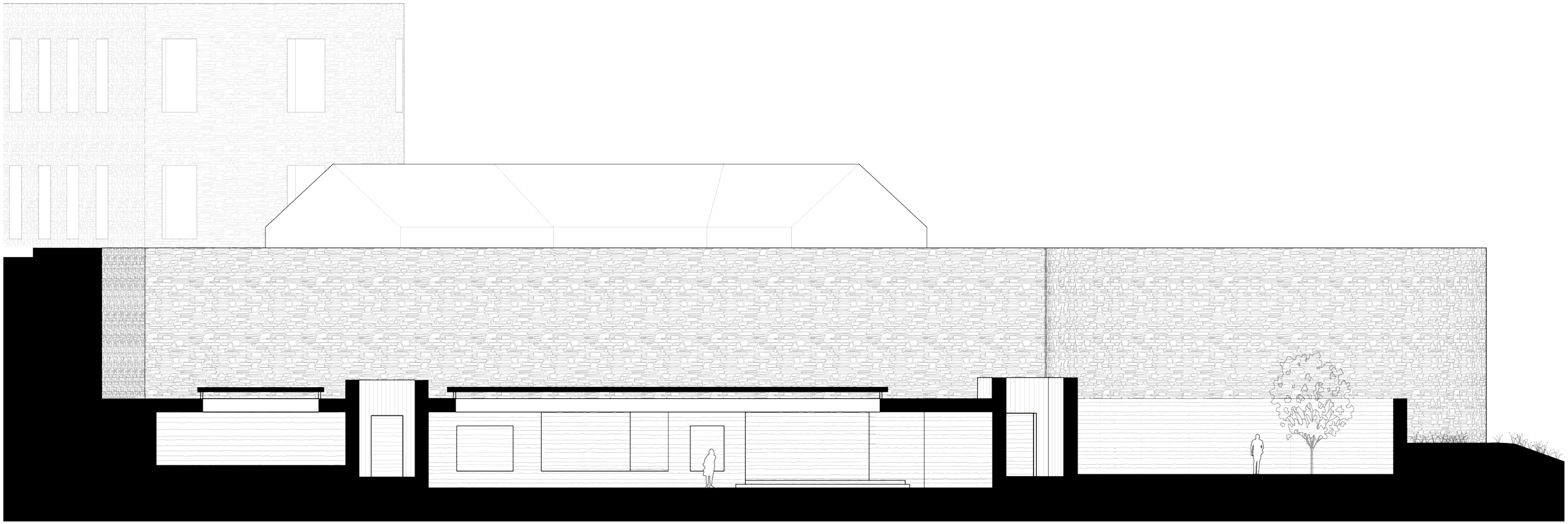


Fig 2.16 Section C-C, scale 1:250

3. Research & Process

- The Sedimentary Bedrock
- The Alvar - Area of Transltion
- Translation Summary
- Limestone Joint System
- Limestone Scarp System
- Translation Concept
- Analysis Method
- Defining Analysis Boundaires
- Translation Operation
- Final Structure Trends
- Moment Prototypes

The Sedimentary Bedrock

Öland is younger than its adjacent mainland. In most areas in Sweden, the bedrock consists of basement rock. This is rock that was created in the very beginning of Earth's history. It is an igneous rock type, meaning it was made from magma. Öland, on the other hand, has a younger, sedimentary bedrock. (Wik et al. 2005) Sedimentary rocks are sediment that have been lithified due to high pressure. They form layered bedrocks. (Sveriges geologiska undersökning, [SGU, 2021)

To understand why Öland differs in geological structure one must look at the basement. In the regions underneath the Baltic Sea, the basement bedrock slopes downwards. The recession creates, what could be described as, a bowl. In this bowl, sediment consisting of decomposed lifeforms began to gather approximately 540 million years ago. The sediment eventually formed layers of sedimentary rocks. (Wik et al. 2005)

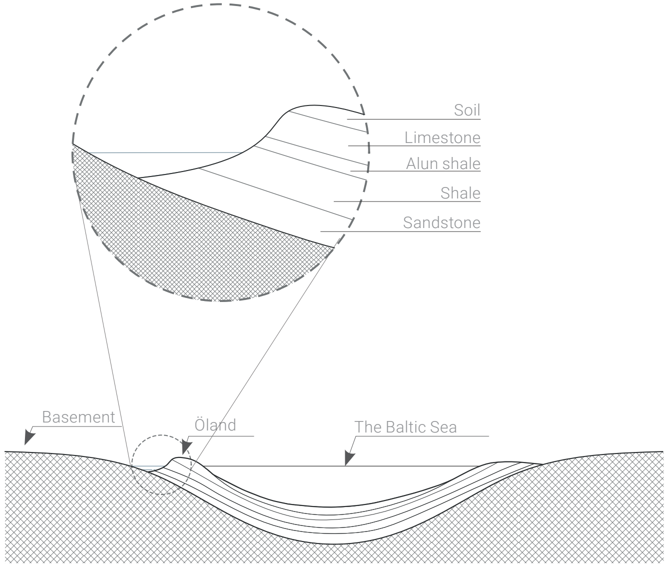


Fig 3.1 Illustration of how Öland is built on a sedimentary bedrock and the different layers that makes up the island. (Own illustration, reference: (Wik et al. 2005))

Set on the northwest edge of the "Baltic bowl", we find Öland. Öland marks the very end of the sedimentary layers created in the recession. West of the island, the sediment ends abruptly, leaving the basement as main bedrock. (Wik et al. 2005)

The layered bedrock of Öland consist of four different sedimentary rock types. These are sandstone, shale, Alun shale and limestone. With the limestone being the youngest, this rock is what makes up the surface of the island. The limestone on Öland is called Ordovician Limestone. The name refers to the Ordovician period in which the stone was created (ca 450 million years ago). Sediment from this period mainly consisted of lime particles. The lime particles came from degradation of organisms with shell. In parts of the limestone where the degradation was not completed, fossils from these organisms can be found. (Wik et al. 2005)

The Alvar - Area of Translation

The site of the proposed museum design is situated in the nature type alvar. In this open moorland, the limestone bedrock is exposed du to the very thin, or even non-existing layer of soil laying on top of the bedrock (Nender, n.d.). Vegetation in these areas is sparce. The lack of soil makes it difficult for large plants to grow, making high trees are rare features. Also, rainwater tends to disappear into the open features of limestone. This makes the alvar very dry. Therefore, any place where water can gather is of high importance for the vegetation in the areas. Often, what enables gatherings of water are conditions given by the limestone formations in the bedrock. (Königsson, 1968)

Two of the most important geologic features for water gatherings are limestone joints and limestone scarps. (Königsson 1968) Information about these two phenomena was gathered to make them translatable into architectural structures.

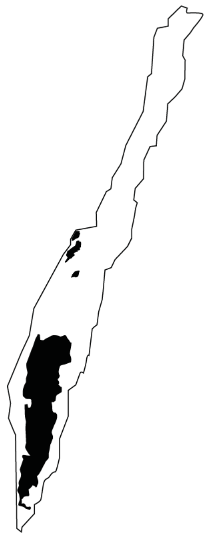
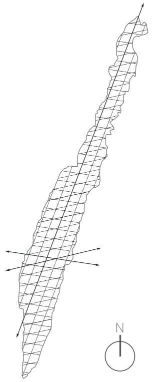
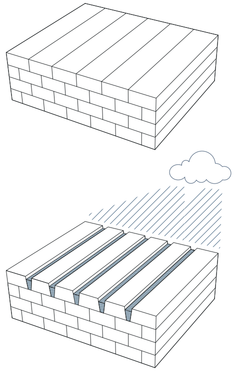
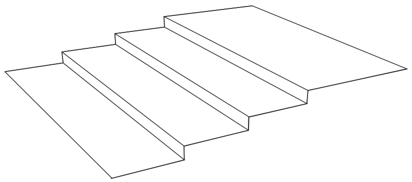
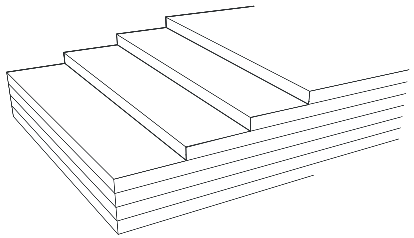


Fig 3.2 Öland and a selection of the alvar areas marked with black. (Own illustration. Reference: (Neander, n.d.))

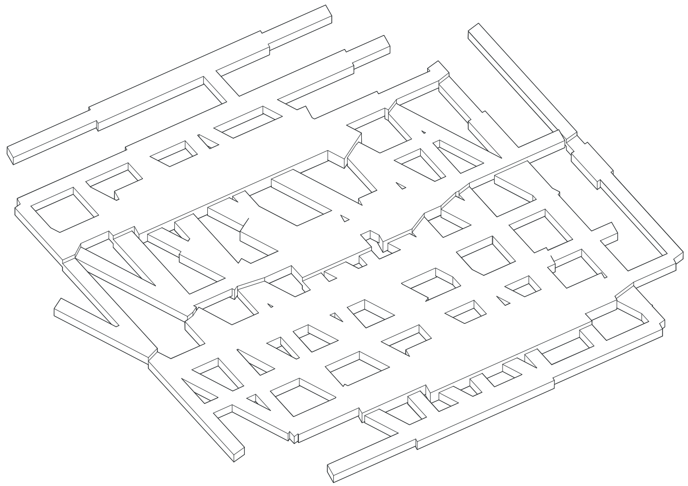
Translation Summary

GEOLOGY Introduction of the geological feature.	GEOMETRY Description of geometrical characteristics of the geological feature.	LOGIC Explanation of why the geometrical characteristics occurs.
 VISIBLE LIMESTONE JOINTS	 VISIBLE JOINT DIRECTIONS	 SOUR RAIN OPENS UP JOINTS
 LIMESTONE SCARPS	 TERRACING TOPOGRAPHY	 ELEVATED BEDROCK LAYERS

Method and diagram inspired by Guallart, 2008.

STRUCTURE

Proposition of how a logic of the geology can be translated into an architectural structure.



TERRACED INFRASRUCTURAL SYSTEM FOLLOWING THE JOINT GRID

Limestone Joint System

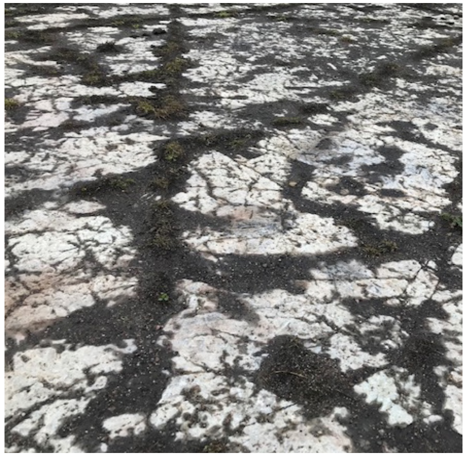


Fig 3.3 Visible limestone joints. (Own picture)

GEOLOGY

Joints are fractures in rocks. They occur when the rocks are exposed to tension due to mechanical processes. A joint system is a gathering of multiple parallel joints with an equal distance to each other. They are often visible on the surface of bedrocks where they can be seen as straight, parallel lines. (Mandl, 2005)

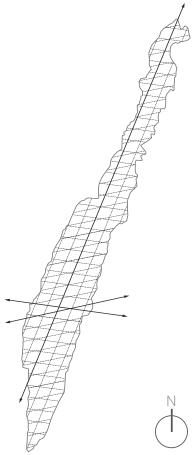


Fig 3.3 Joint systems on Öland. (Own illustration. Island outline reference: (Google n.d.) Direction reference: (Königsson 1968))

GEOMETRY

On Alvaret on Öland, three major joint directions dominate. The most prominent one follows the axis of the island. This structure is crossed almost orthogonal by the second system. The third one stretches in a south to north direction. These three systems are suggested to be parts of an even larger system, reaching all the way to Gotland. (Pousette, 1972)

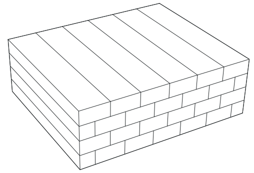


Fig 3.4. Mechanical processes creates fractures in the rocks. The fractures make up joint systems. (Own illustration).

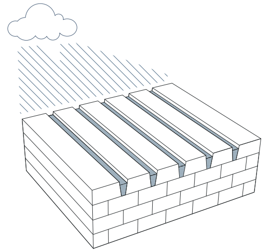


Fig 3.5. When exposed to rain, the fractures open. (Own illustration).

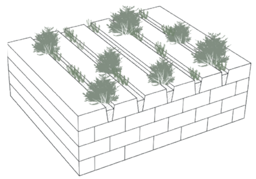


Fig 3.6. In the open joints, soil might gather, enabeling plants to grow in the cracks. (Own illustration).

LOGIC

The joints are packed with calcite. However, when exposed to rainwater the calcite dissolves. This opens the joints and make them wider. Open joints are common features in the superficial limestone bedrock of Alvaret. Some of them are filled with soil. As the open joint systems handles water drainage, the soil filled joints makes places suitable for bushes and other plants to grow. Looking from far above you can see how junipers form straight lines in the alvar landscape. From the same view, prominent mosaic-like patterns can be spotted. These are the parts of the open joint systems left empty. (Königsson 1968)

Fig 3.7 Scarps in the alvar area of the castle ruin of Borgholm (Own picture)

GEOLOGY

Scarps are steep parts of rocks. They mostly occur at the edge of zones where the rock ends. (Allaby, 2018)

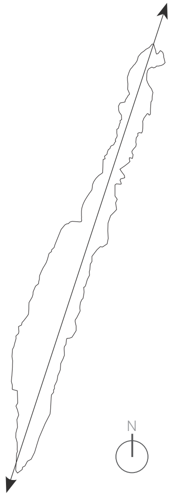


Fig 3.8 Main direction of the scarp system on Öland. (Own illustration. Island outline reference: (Google n.d.) Direction reference: (Königsson 1968))

GEOMETRY

The scarps on Alvaret are very shallow. However, being so flat, every shift in the topography has great impact on the landscape morphology. The scarp system on Alvaret follows the direction of the limestone layers. This means that they stretch from southwest to northeast, following the axis of the island. They also tend to face against west. (Königsson 1968)

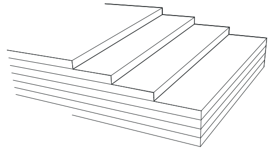


Fig 3.9. Elevated layers in the bedrock makes terracing fetures in the landscape. (Own illustration).

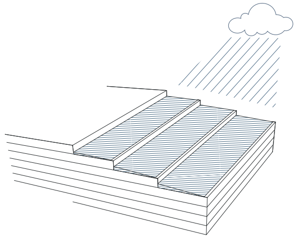


Fig 3.10. Superficial wate drainage gather towards the scarp walls. (Own illustration).

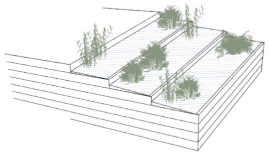


Fig 3.11. The water gathering enables vegetation to grow alongside the scarps. (Own illustration).

LOGIC

The terraced formations are reults of glacial movements. As these occured, they caused the layers of the sedimentary bedrock to rise from the flat surface of the island. Today, their ability to gather superficial rainwater makes scarps important features in the landscape. When rainwater hits the surface of the limestone bedrock, it often falls against a scarp wall. There the water is dammed up, resulting in temporary lakes and fens. Hence, the scarps are important for the biological systems of the island. (Königsson 1968)

Translation Concept

As mentioned, water movement and water gatherings are important elements on Alvaret. The sparse vegetation of the area and the formation of the limestone structure both depend on water. Because of this, the translation from geological feature to architectural structure was chosen to evolve around the subject water movement.

In the joint system, the parts meeting a lot of rainwater dissolves and opens up. The more water, the wider the open joints become. In the translation, water exposure was exchanged for the expo sure of people.

If people were to walk in an infrastructural system, mimicking the joints and their directions, where would people walk the most? This question was asked in the operation of translation. Since the amount of rainwater indicates to what extent the joints open up, the amount of people walking through an area would indicate how wide the different parts of the system would be. This, in turn, would lead to a differentiation in spatial qualities throughout the system.

To what extent different places in the structure would be used was also set to generate a variation of depth. As a result, the infrastructural system would obtain terraced features, reflecting the scarp terrain of the alvar landscape. The more movement, the deeper the terrain. This meant that the deepest parts of the structure would also be the widest. Being the absolute largest spaces in the system, they were later decided to become the gathering places within the infrastructure. This was too a way to mimic the gathering qualities of the scarp features.

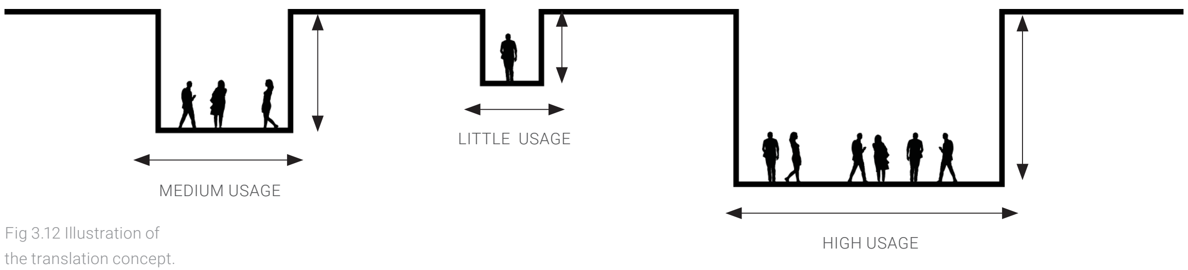


Fig 3.12 Illustration of the translation concept.

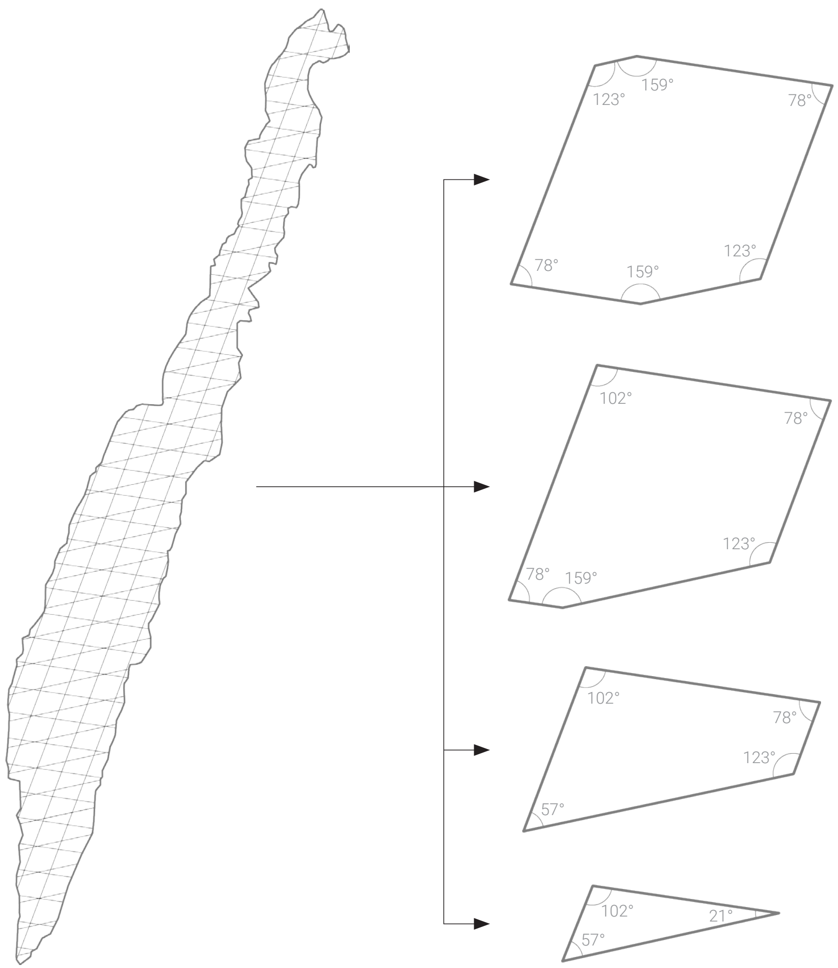


Fig 3.13 Archetype shapes of the joins system grid.

Analysis method

To measure the degree of movement in the infrastructure, the software QGIS was utilised. QGIS is more commonly used when doing spatial analysis at city level but works just as well for the purposes of this thesis.

The analysis performed for the translation was a Network Betweenness Analysis. This analysis calculates how often every individual segment of the infrastructure is used when going the shortest rout from every point in the system to every other point. A higher number of passings indicate higher usage and vice versa.

Defining Analysis Boundaries

Before performing the analysis, a boundary for the infrastructure was set up. To make is as naturally integrated with the joint system as possible, this boundary was decided to consist of the directions of the joints. By observing the joint system grid, four archetype shapes were detected (referred to as A, B, C and D to the left). They could vairy in size and length per side, but the angular relationship between all edges remained constant.

Translation Operation

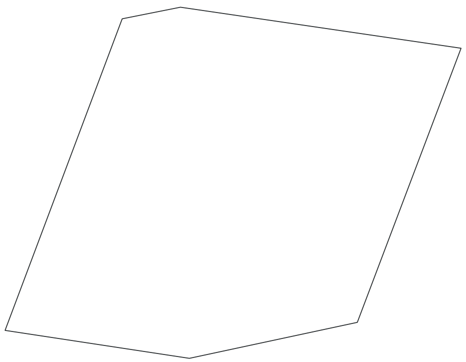


Fig 3.14
STEP 1. Defining analysis boundary.

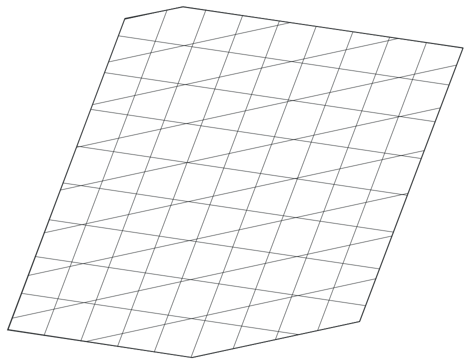


Fig 3.15
STEP 2. Inserting the joint system grid.

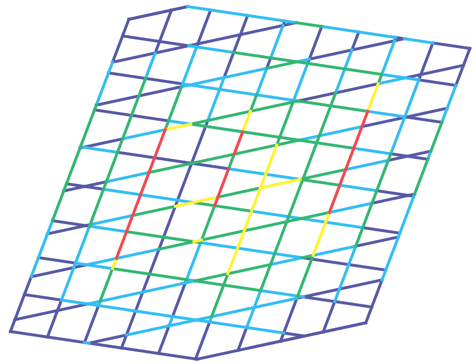


Fig 3.16
STEP 3. Performing analysis in QGIS.

- VERY HIGH USAGE
- HIGH USAGE
- MEDIUM USAGE
- LOW USAGE
- VERY LOW USAGE

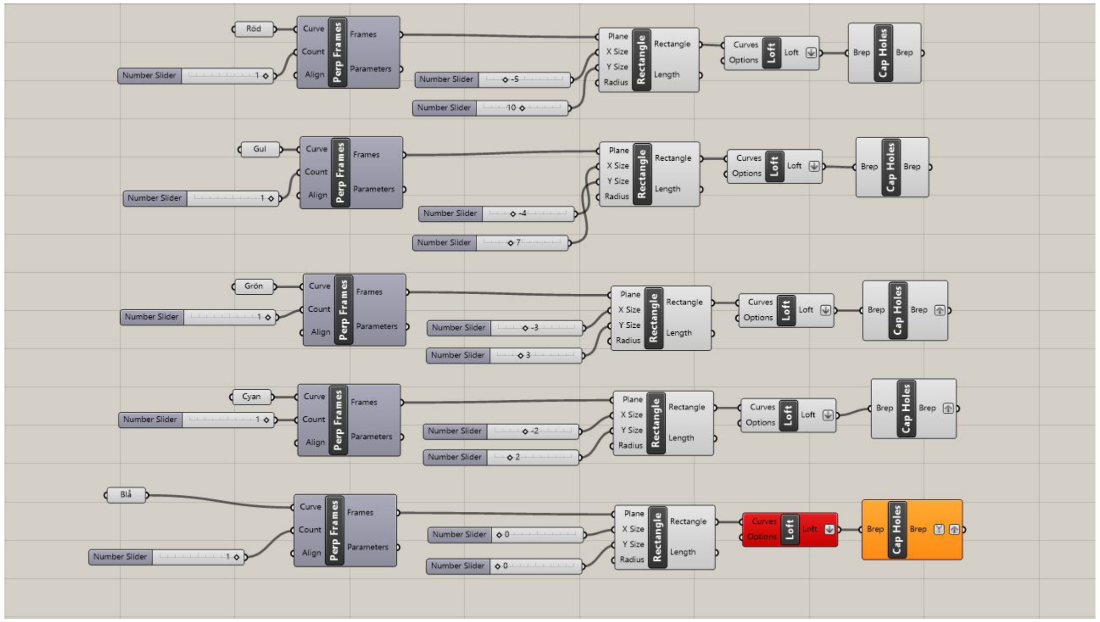


Fig 3.17
STEP 4. Translating colours in the grid into volumes. A script was created in Grasshopper 3d for Rhino. In the script, the colors generated in the analysis of the grid were translated into para-meters for width and height blocks, sweeping along the curves.

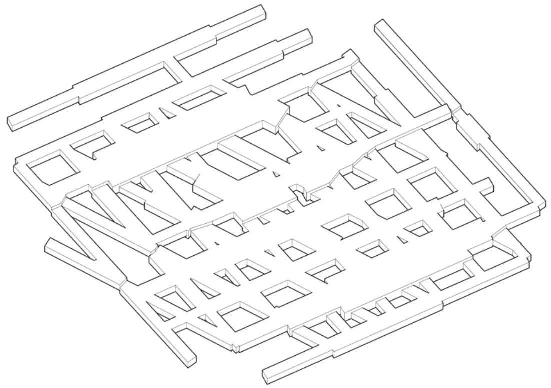


Fig 3.18
Step 5. Final structure. Small adjustments were made to fix minor imperfections. An additional terracing feature was added to bring a further reminder of the scarps to the model. This was done by raising the model ca 2/3 of a level along the the most used (red) lines.

Final Structure Trends

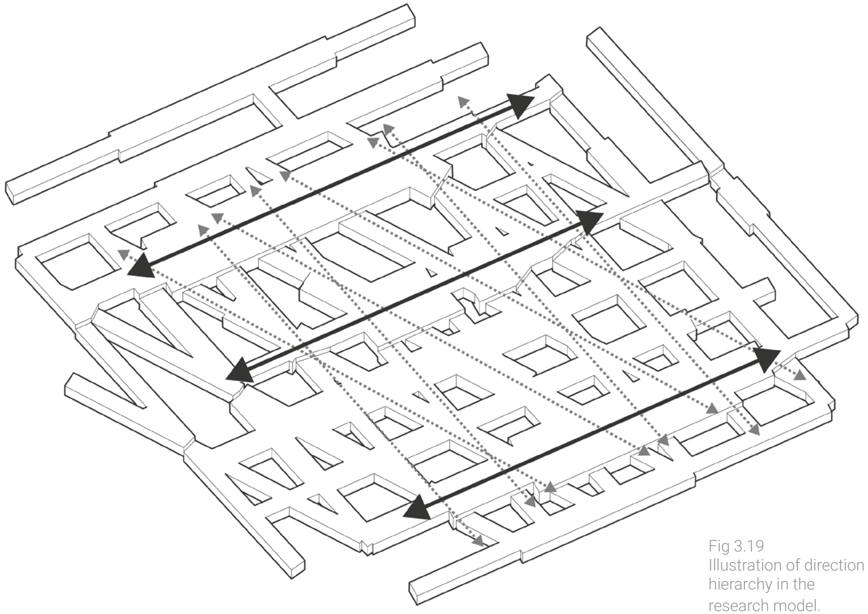


Fig 3.19
Illustration of direction hierarchy in the research model.

TREND 1. DIRECTION HIERARCHY
When the final structure was observed, it came clear that there was a hierarchy the system regarding the line directions. The lines stretching parallel to the island proved to be used to a larger extant than the others. This meant that all larger spaces was situated in this direction. The large spaces where in their turn connected by less used lines going in the other two direction. This made for a pattern that could almost be described as if the large spaces where sewed together by the orthogonal lines. Not much unlike the road system on Öland. See Fig 3.19. (Trafikverket, 2021)

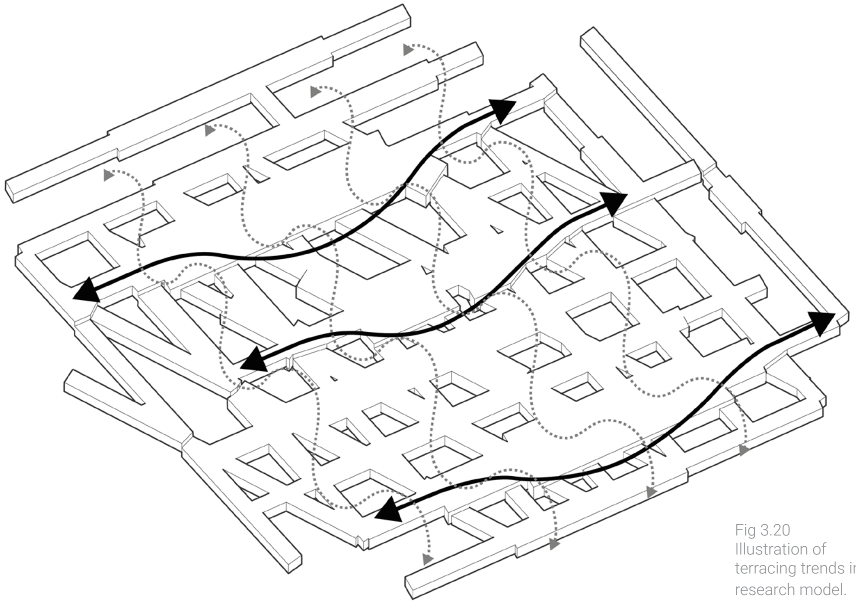


Fig 3.20
Illustration of terracing trends in research model.

TREND 2. TERRACING

Not only did the directions of the artefact differ in amount of usage. They were also different in terms of terracing structure. If people would move along the main direction, they would experience a quite soft gradient of height difference with few changes in y-direction. If they would move along the less used lines, on the other hand, the ride would be a lot more uneven. In this direction the changes in y-direction would be common, occurring almost every time a new line segment would be past. This trend too could be compared to the actual movement on Öland. As mentioned, it is the scarps that causes changes in the terrain. They are most commonly stretching parallel to the island. Most significant shifts in terrain are therefore experienced when moving from east to west and vice versa, just like in the final structure. (Königsson 1968)

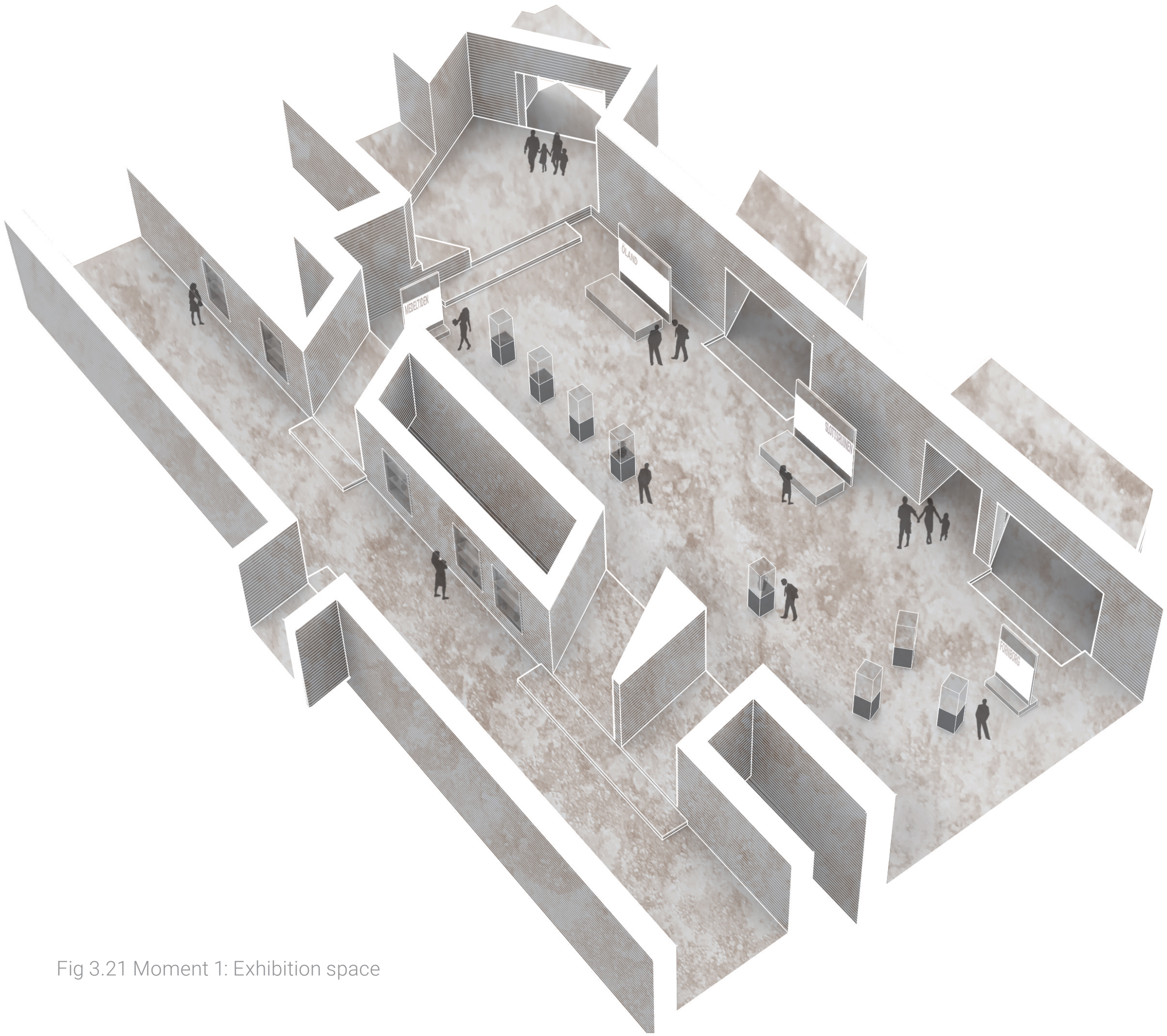


Fig 3.21 Moment 1: Exhibition space

Moment Prototypes

In the phase that followed the translation, research of how the structure could obtain the affordance of a historical mu-seum commenced. To answer the question, close studies of the artefact were performed. By diving into the volume and observing its spatial qualities, several different spaces. and geometrical features were chosen for further investigation. These were spaces that held one or several qualities that made them appear interesting to developed.

The result of the investigation and the development of the chosen spaces were four" moment prototypes". The reason they were referred to as moments was because they wrer only partly defined. They were glimpses, or moments, that possibly could be found in the upcoming museum design. Being prototypes, they were not to be seen as literal places. Instead, they acted as inspiration. They gave a preview of qualities that could emerge if using the artefact as starting point.

With these moments, the design research came to an end and the design of the actual museum begun.

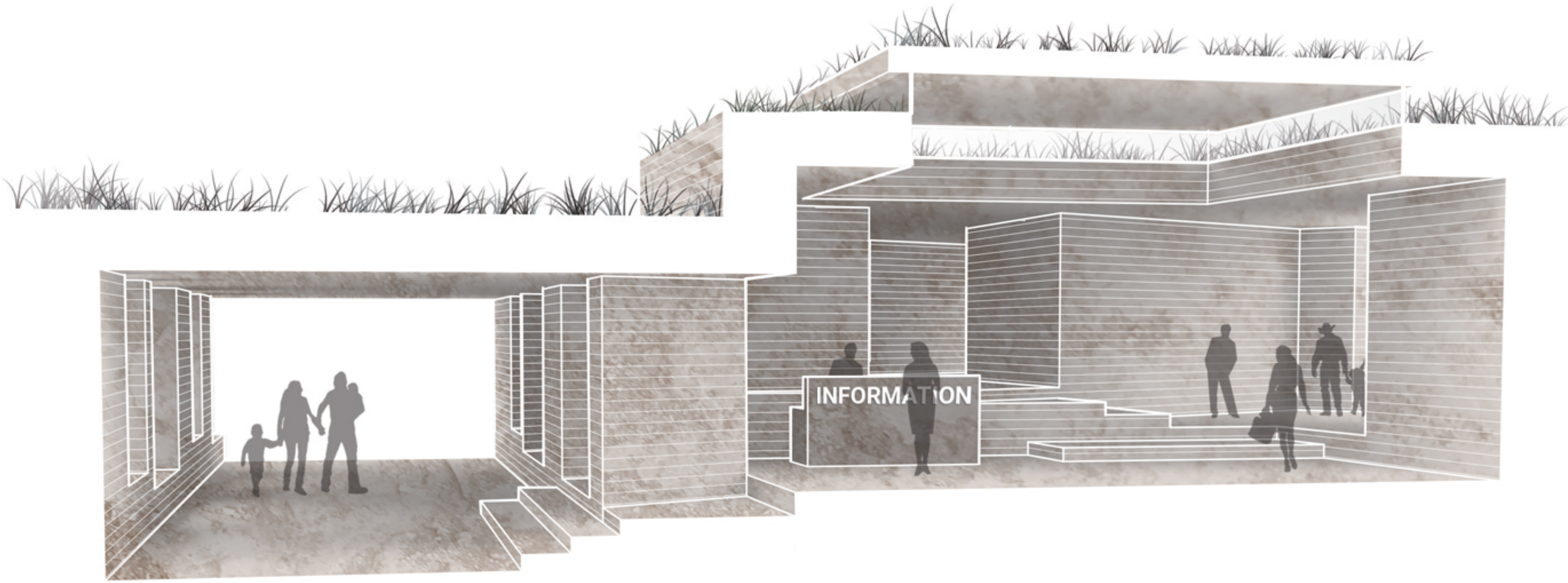


Fig 3.22 Moment : Museum reception.

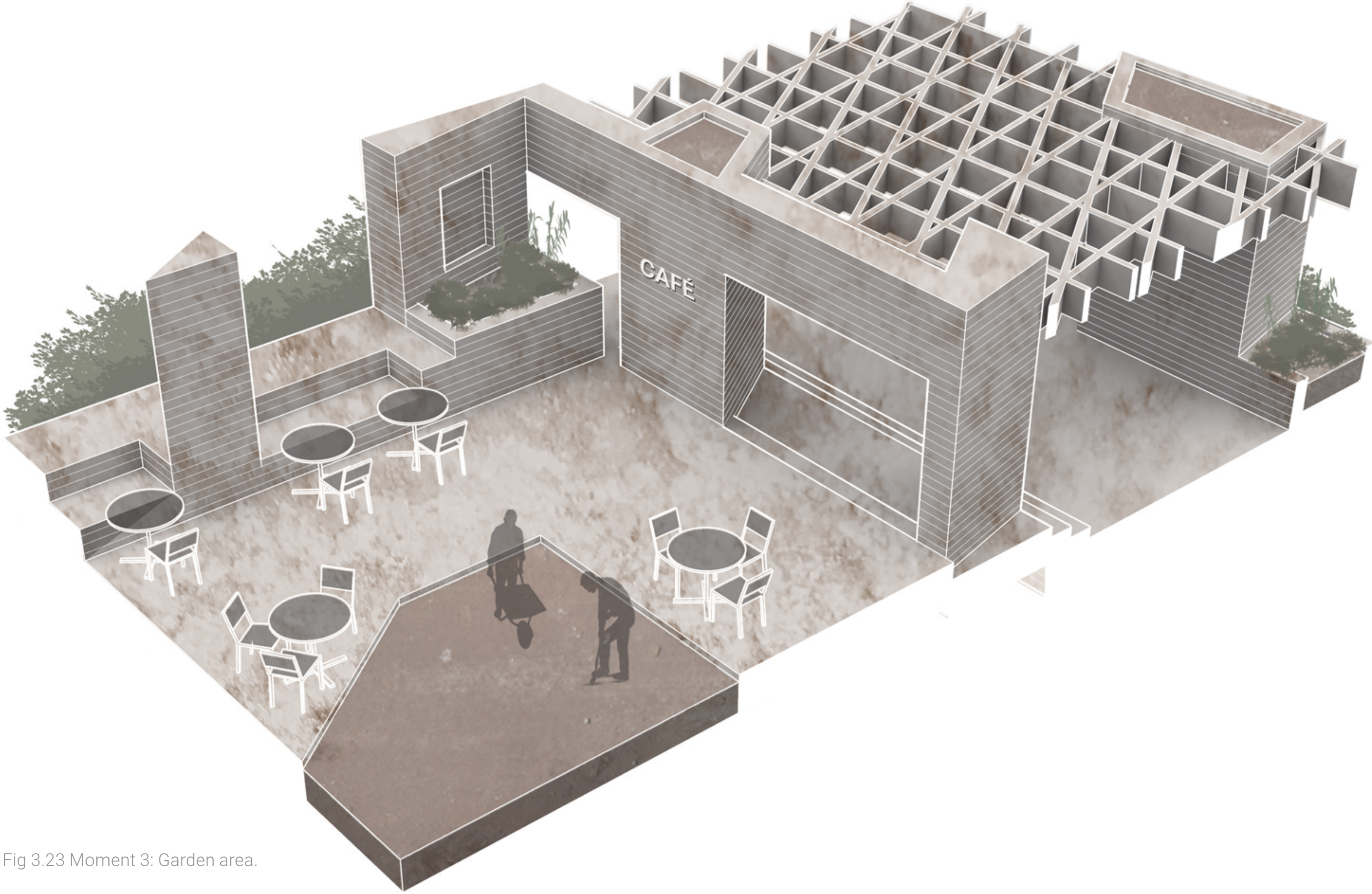


Fig 3.23 Moment 3: Garden area.

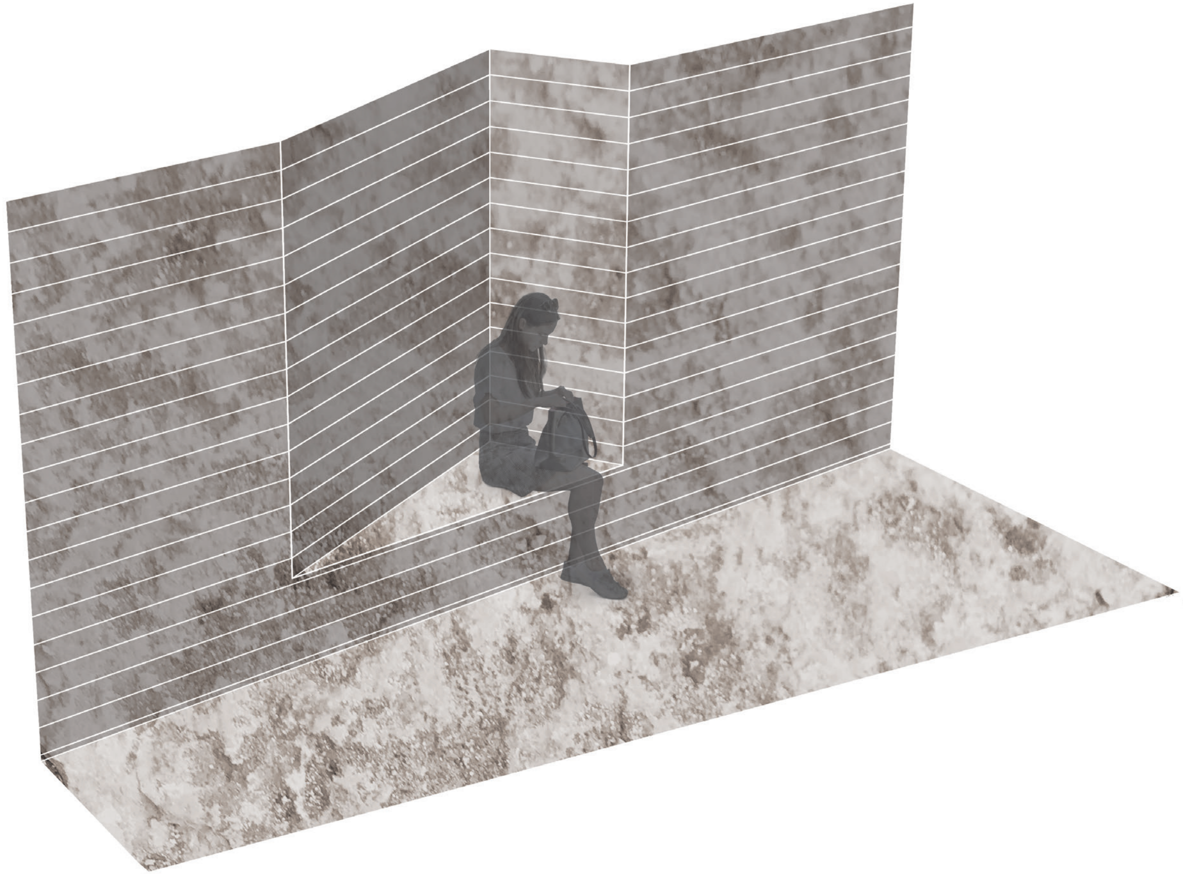


Fig 3.24 Moment 4: Seating formation.

Personal Reflections

The question of how geological systems on Öland can be translated into architectural structures can, of course, be answered in several different ways. By narrowing the subject down to two systems, joints and scarps, the thesis attempted to create a structure that was complex, and yet graspable. The hope was that the result would be a nourishing, interesting and educational environment, strongly influenced by its surrounding nature. To reach a conclusion of to what degree the final design proposal lived up to the thesis aim , direct comparisons between Alvaret and the proposal were contemplated. The comparisons concerned geometry and movement, and how well the design managed to mirror the nature of Alvaret.

I believe the different phases of the thesis reached various levels of success. The artefact created in the translation process was an interesting structure. When studying its in-side, several features that reminded of the actual bedrock of the island emerged. It was a fun space where nothing had a true purpose. It was simply the consequence of research and parametric modelling. No feature consisted of even one 90-degree angle, much like nature. Still, one could quite easily imagine how the spaces could be used in the context of a building. A low-level block could have the affordance of a step in a staircase. Large, open rooms had the possibility of becoming exhibitions, and column-like features divided the spaces into different sections. The structure inspired me and triggered my imagination. When developing the structure into moment prototypes, the process felt natural and easy-going. All interventions were somehow related to the origional geometry. If a stair was to be added, its angles and shape followed the logic of the research prototype. If additional space was needed, this was simply digged out from the artefact volume. It was like carving in the ground, or scultpuring with clay. The oppurtunities were many, but they were all restricted to the logic of the origional prototype. This made for a rich results. The moment proto-types wrer all a combination of accidents in the research-model, and intentional interventions.

The design of the museum did not, in my opinion, correspond enough with the qualities of the prototype. It is as if during the process of adapting it to the museum program and the site, the cleansing of the structure was taken one step too far. In the museum, only features with a purpose were saved. The direction hierarchy stayed true to the prototype. So did the terraced structure to some extent. What was lost, though, were all the small kinks and imperfections that was found in the original artefact. Programmatically, the museum worked just as well without them. Perhaps, even more efficient. Although, left missing was the true feeling of the limestone formations and the irregularity of nature. When these, programmatically insignificant features were taken away, the museum slowly begun to give the impression of being the result of a restricting budget. Almost as if saying “if it has no economic value, loose it”.

Perhaps, the phenomenon of simplification is a sign of how deep the strive for efficiency is rooted inside me as a designer. Or maybe, my previous perception of successful aesthetic doesn’t allow irregular kinks and twists? When taken out of the thesis context and its aims, I am pleased with the visuals of the museum and its structural arrangements. To me, there are several moments of high spatial qualities, like long sightlines, the framing of outside views etc. Many of these moments, however, would not have occurred without the translation from geological structure to architectural structure. Despite that the museum didn’t become as naturally rooted and complex as hoped for, there is still a lot I take with me from this way of working. By studying natural structures and the logic that causes them, I have had the opportunity to work with architectural features unlike many I have designed before. Both in the research phase and the museum design phase. I have enjoyed the process of having such close cooperation with nature. I can see how this way of working can bring more interesting, inspiring environments to the future, if developed further. It would be interesting to include geologists and other experts into the process. Then the understanding of the logic of the natural structure could get even deeper, perhaps resulting in even more intelligent, nourishing buildings. Although for now, I am happy to have had the opportunity to scratch the surface of the vast subject of bringing architecture closer to nature.

Bibliography

WEBSITES

Google. (n.d.). Google maps. Retrieved May 11, 2022, from https://www.google.com/maps/place/Sverige/@62.0329754,17.378555,5z/data=!3m1!4b1!4m5!3m4!1s0x465cb2396d35f0f1:0x22b8eba28dad6f62!8m2!3d60.128161!4d18.643501

Länsstyrelsen Kalmar Län. (2020, September 25). *Planer på ett nytt historisk museum på Öland.* Retrieved March 14, 2022, from https://www.lansstyrelsen.se/kalmar/om-oss/nyheter-och-press/nyheter---kalmar/2020-09-25-planer-pa-ett-nytt-historisk-museum-pa-oland.html

Neander, M., Svanaeus, S. *Hitta på Karta* (n.d.). Allt på Öland. Retrieved May 10, 2022, from https://alltpaoland.se/~alltpaol/hitta-pa-karta/alvar?kategori=1

Neander, M., Svanaeus, S. *Om Öland*. (n.d.). Allt på Öland. Retrieved March 14, 2022, from https://alltpaoland.se/artiklar/oland-i-varlden/

Ringbom, N. (2021, March 30). *Borgholms Slottsruin*. Sl ottsguiden. Retrieved May 11, 2022, from https://www.slottsguiden.info/slottdetalj.asp?id=67

Sveriges geologiska undersökning, SGU. (2021, March 8). *Bergarter*. Retrieved March 15, 2022, from https://www.sgu.se/om-geologi/berg/bergarter/

BOOKS

Harari, Y. N. (2015). *Sapiens en Kort Historik Över mänskligheten*. Natur & kultur.

Guallart, V. (2008). *Geologics: Geography, information, architecture.* Actar.

Kellert, S. R., Heerwagen, J. H., & Mador, M. L. (2008). *Biophilic Design: The theory, science, and practice of bringing buildings to life*. John Wiley & Sons.

Mandl, G. (2005). *Rock Joints: The mechanical genesis.* Springer.

Yasong, M. (2014). *Shanshui City.* Lars Muller Publishers.

BROCHURES

Länsstyrelsen Kalmar län. (2005). *Kalksten och Fossil Öland* [Brochure]. https://www.lansstyrelsen.se/download/18.1dfa69ad1630328ad7c2fd4b/1606898838373/fossil_svenska.pdf

DISSERTATIONS

Königsson, L.-K. (1968). *The Holocene History of the Great Alvar of Öland*. Acta Phtogeographica Suecia 55, Svenska växtgeografiska sällskapet. (Dissertation, Royal University of Uppsala).

REPORTS

Pousette, J. (1972). *Grundvattenundersökningar på Ölands Stora Alvar.* (Ser C Nr 975, ISBN 91-7158-011-5) Stockholm, Sweden: Sveriges Geologiska Undersökning.

Wik, N.-G., Bergström, U., Bruun, Å., Claeson, D., Jelinek, C., Juhojuntti, N., Kero, L., Lundqvist, L., Stephens, M. B., Sukotjo, S., Wikman, H. (2005). *Beskrivning till regional berggrundskarta över Kalmar län* (ISSN 0373-2657). Kalmar, Sweden: Sveriges geologiska undersökning.

DIGITAL FILES

Trafikverket. (2021, August 25). *Driftområdeskarta Öland*.

ENCYKLOPEDIAS

Allaby, M. (2015). *Scarp*. In A dictionary of ecology. Oxford University Press.
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