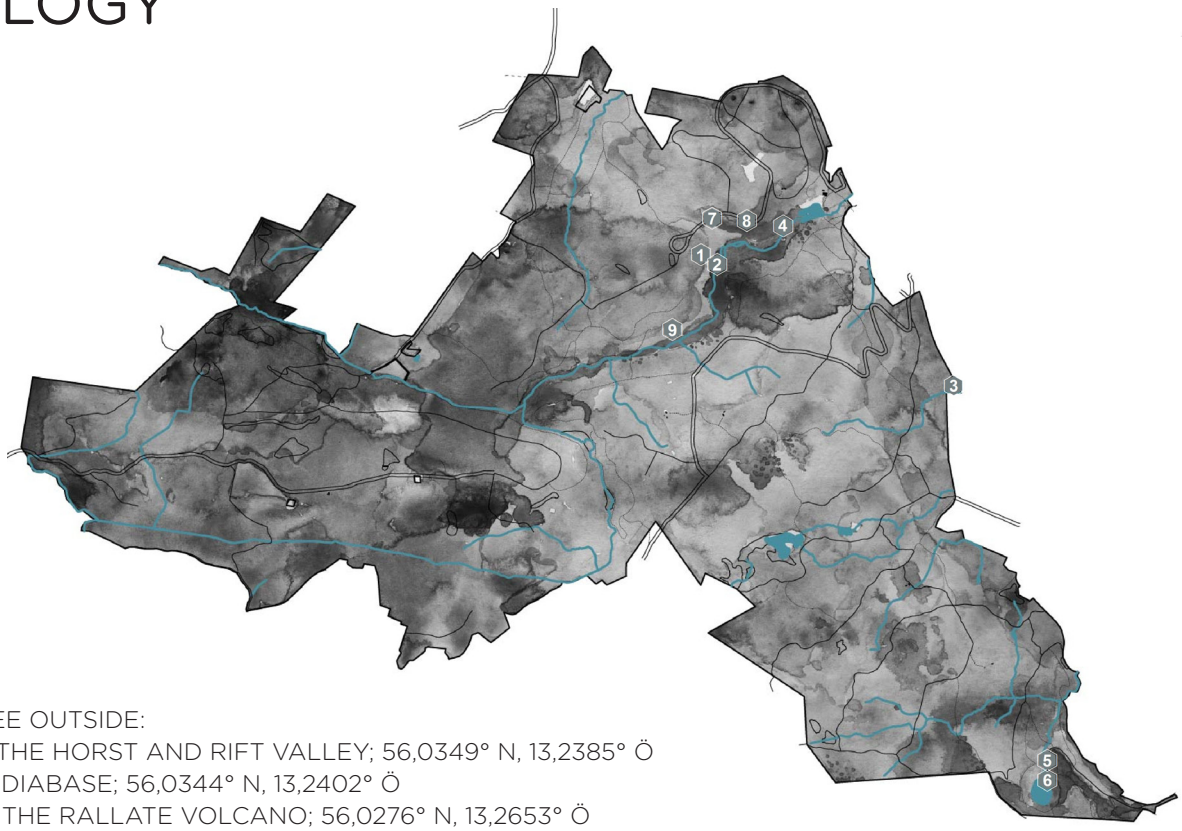
GEOLOGY



SEE OUTSIDE:
1. THE HORST AND RIFT VALLEY; 56,0349° N, 13,2385° Ö
2. DIABASE; 56,0344° N, 13,2402° Ö
3. THE RALLATE VOLCANO; 56,0276° N, 13,2653° Ö
4. RIFT VALLEY AND COLLAPSED PRECIPICE; 56,0366° N, 13,2470° Ö
5. RIFT VALLEY AND COLLAPSED PRECIPICE; 56,0058° N, 13,2761° Ö
6. ODENSJÖ LAKE; 56,0046° N, 13,2762° Ö
7. SNOWDRIFT NICHE; 56,0371° N, 13,2396° Ö
8. ICE-AGE SAND; 56,0370° N, 13,2432° Ö
9. TERMINAL MORAINE; 56,0305° N, 13,2357° Ö

THE REGION OF SKÅNE CRACKED FROM EDGE TO EDGE

The earth's crust consists of continental and oceanic plates that are constantly moving. The edge of our plate became fractured during a prehistoric plate collision. The fractured zone runs right through Skåne, from Kullaberg in the north west to Stenshuvud in the south east, and is called the Skåne fault zone. Things have been happening along this diagonal line over millions of years. Rocky ridges, horsts, shot up and land masses sank several kilometres. Hot lava thrust up through cracks and volcanoes.
The ice ages came and went, carving out the details of the landscape. And the geological movements keep on changing, slowly but surely...

SÖDERÅSEN'S ROUND-THE-WORLD JOURNEY

The earth's crust is a jigsaw puzzle of plates that float on the hot lava inside the earth. When the plates slide away from each other the gap is filled by lava that cools; the land mass expands. When they collide they fold into mountain ranges. Look how Söderåsen has travelled across the earth over millions of years! Where will we be in a hundred million years from now?

1 800–1 600 MILLION YEARS AGO

Söderåsen's bedrock of granite and gneiss is created, but far away from Söderåsen's current location.
Granite is a reddish, prehistoric rock species, which to a great extend consists of quartz and feldspar. When it is subjected to high pressure or heat, granite can be transformed into gneiss. If the transformation is interrupted and incomplete, gneiss granite is the result. There is a lot of this reddish gneiss granite to be seen in the national park.

1100 MILLION YEARS AGO

The process continues. A mountain chain forms in what is now the region of Halland - as high as today's Himalayas.

900 MILLION YEARS AGO

All land on the planet is gathered in the giant continent of Rodinia. At this stage it starts to break up. Today's Sweden moves towards the South Pole, and gets covered with ice. The mountain chains crumble away; Sweden becomes a lowland.

540 MILLION YEARS AGO

Sweden nears the equator again, and is now

covered by an ocean, full of sand and clay.

420 MILLION YEARS AGO
Sweden rises above the ocean surface once more. Our plate Baltica collides with the North American plate, pushing up from the west. The Scandinavian mountain range is formed, and also the mountainous regions of northern Scotland and the Appalachians in the USA - the Caledonian mountain range formation (SILURIAN). Another plate pushes in from the south west, creating cracks in the south-western edge of the Baltic plate – a rift zone running across Scania – the Scanian Diagonal or Tornqvist zone. Skåne moves from the present south American tip towards today's Congo.
A dry, warm desert spreads out. Kopparhatten at that time lay in a depression on the land.

DIABASE - VEINS OF BLACK
300 MILLION YEARS AGO
All the continental plates close in on each other, on their way to forming the supercontinent of Pangaea – the Variscite mountain range formation (CARBONIFEROUS). The African plate then collides with the European plate , forming the Ardenne mountains in central Europe. (Collision 1: Africa-Europe-Baltic).
Scania becomes several kilometres wider when the rifts along the Diagonal fill with lava and widen. The lava or magma in the rifts petrifies to form the black rock species of diabase. Several veins of diabase run through the national park. All the diabase veins in Scania run in parallel with the Diagonal fault. Diabase has the same origin and content as basalt, but diabase's slow cooling and petrification deep inside the bedrock has rendered it more easily worked and less resistant than basalt.
At the same time the mainland rises and we see a hint of horst formation. 'Kopparhatten' is now a peak on land. Skåne lies where Nigeria is today.

DINOSAURS AT SÖDERÅSEN
200 MILLION YEARS AGO
The age of the dinosaurs started 230 million years ago (TRIASSIC) and a luxuriant vegetation with large ferns takes precedence. The abundant vegetation has left traces in the Söderåsen area in the form of plant fossils, such as the Cycadophyta in the exhibition. The fossil is 200 million years old. There are traces of three different dinosaurs in Scania. The first was a large carnivore, Grallator, who lived 210 million years ago in the Helsingborg-Höganäs area. There were dinosaurs walking around here at Söderåsen 200 million years ago (JURASSIC). Petrified footprints from the herbivore Plateosaurus, the "Vallåkra dinosaur", have been found in both Vallåkra and Bjuv. A fossil from a young dinosaur can be found in the exhibition. Plateosaurus was the commonest dinosaur in north and central Europe. The third dinosaur, Leptoceratops, was a herbivore in the Kristianstad area around 80 million years ago (CRETACOUS). The dinosaur age ended 65 million years ago. 80 % of all animal species died out, presumably due to a meteorite strike in what is now Mexico.

A VOLCANO IN THE NATIONAL PARK
190 - 180 MILLION YEARS AGO
The supercontinent Pangea breaks up and the Atlantic opens up. Fragments from Gondwana (the southern continent) collide with Eurasia (our northerly continent). The Scanian horsts rise markedly with volcanoes erupting (Collision 2: Africa-Europe-Baltic). The majority of Scania's 100 volcanoes are active along the Scanian Diagonal. Remains are visible today in the form of hills formed by the black rock species basalt. Basalt is lava that has been quickly cooled and petrified in the crater opening of the volcano. The hills or columns consist of tightly-packed hexagonal pillars of basalt - basalt columns. These are unique to Sweden. Basalt is an alkaline but hard rock species, which has resisted the ravages of time. This is the reason that traces of the ancient volcanoes are still here today. Most of the columns are found in central Scania.
Jällabjär (just outside the national park) is a volcano from this time. Skåne now moves from where Morocco to southern France.
The national park's own volcano Rallate was first active 110 million years ago. Here you can clearly see the tightly-stacked hexagonal basalt columns a couple of metres tall. This basalt formation lies by route 13, just south of Skäralid.

A HORST IS BORN
200-150 MILLION YEARS AGO
When fragments from Gondwana (the southern continent) collides with Eurasia (our northerly continent) in connection with the break-up of the supercontinent Pangaea, not only volcanoes are formed in Scania This also results in the Scanian horsts being

raised higher (Collision 2: Africa-Europe-Baltic). When the continental plates are pressed together the land that is being pinched in the middle has to go somewhere Along the Scania Diagonal line the rock was forced up along the rifts and became horsts. The most intensive phase in the formation of the Scanian horsts took place between 150 - 200 million years ago. The Scanian horsts are Hallandsås, Kullaberg, Söderåsen, Nävlingeåsen, Matterödsåsen, Linderödsåsen and Romeleåsen. Kopparhatten is now high up on Söderåsen. Skåne now moves from where Morocco is today to southern France.

THE HORST THAT BURST

The prehistoric serial collisions in the earth's crust have also given rise to Söderåsen's unique rift valleys. The rift valleys run along ancient weak spots in the Archaen rock. The valleys at Skäralidsdalen, Nackarpsdalen-Odensjön, Ugglerödsdalen in the national park, and Klövadalen outside. Rift valleys are formed where the solid Archaen rock in the horst cracks due to movement in the earth's crust - like ravines - which are created when running water undermines the bedrock.

80 million years ago

The Alpine mountain range formation (CRETACOUS) - the African plate collides with the European plate so powerfully that the Alps were formed (a process still on-going but on a far smaller scale). The powerful collision 80 million years ago was felt up in the far north – Söderåsen rises up further and attains its present height, at the same time as the horst bursts and Söderåsen's winding rift valleys are formed (Collision 3: Africa-Europe-Baltic). At that time the valley walls were nearly vertical cliffs; today you can only see craggy rocks there.

Skåne's horsts are surrounded by water and lie by the present southern England.

THE ICE SCULPTED SKÅNE

50 MILLION YEARS AGO

A long period of gradual cooling of the Earth starts.

2.5 MILLION YEARS AGO

The latest ice-age starts. Continental glaciations alternate with tundra periods and warmer climates. The progression of the ice has a big effect on the landscape. Remnants can be hard to see as they are often destroyed by subsequent ice masses.

The sharp and coarsely broken rock has been gouged and polished by various inland ice masses during the last 2.5 million years. Small gravel ridges and rounded pits across the landscape are the work of the ice. Even the valley walls' vertical cliff faces were worn down to enormous precipices with boulders and stones during this period. Between the ice ages it was warm and lush. The most recent ice age retreated from Söderåsen 13 000 years ago.

115 000 MILLION YEARS AGO

The latest ice masses start to spread over Sweden. But they won't be coming to Skåne for a while yet.

60 - 55 000 YEARS AGO

In Skåne the climate is warm. Lots of animal life and lush vegetation. You can find a stick from this time in the exhibition. It was found at Stenberget's quarry at Romelåsen; one of Sweden's few locations with plant material from this time. However the ice is drawing closer and the vegetation disappears...

21 500 years ago

Skåne is covered by the latest inland ice mass.

16 000 YEARS AGO

The ice starts to melt in Skåne. Kullaberg is ice-free, but Söderåsen is still covered by the ice.

14 000 YEARS AGO

Söderåsen is now free of ice and is poking up as an island in a sea of ice. The rift valleys are still filled with ice...

13 000 YEARS AGO

The ice border follows a line from Kristianstad to Hallandsåsen. South and central Scania, including Söderåsen , is completely ice-free, but the ice is visible to the north as a background wall.

NO, IT IS NOT A QUARRY

The valleys run in a zig-zag and have been filled by an immovable local ice mass after the main glacier has receded. This ice remained after the ice above it had disappeared, leaving a protective mass!

A tundra climate ruled before and after each ice period (much as Siberia today), with significant diurnal temperature changes.

The joint valley's original vertical cliff faces are today edged by enormous scree slopes of boulders and stones. With the aid of frost, the stone blocks have come loose from the rockface and landed on the ground below. Water that makes its way into the rockface's small fissures becomes an explosive force

when it freezes to ice! The majority of the slopes were created during the final phase of the ice age, when temperature variations between day and night increased. But we can still see this happening today!
A part of the precipices still form a vertical cliff which can refill with more stone (active precipice). Other precipices are called ”mature”, meaning the the precipice has already crumbled away, with trees successively taking over. There are collapsed precipices under other precipices where you can see vegetation and foliage.
You can see that it’s a natural collapsed precipice and not a quarry as the stones are sorted by size, i.e. the largest having fallen the furthest, whilst the finer material lies just under the cliff above. The angle of collapse is around 35 degrees.

THE HANGING VALLEYS OF SÖDERÅSEN

A tundra climate prevailed at the end of the ice age. The joint valleys were still filled with ice and the bare rock above was lashed by sand and snowstorms. In places the snow found shelter along the crown of the valley. Over time, the hard-packed snow gouged out rounded depressions in the ground.
Every tundra summer the melting water emptied the pits of loose earth and stones. These small U-shaped openings remained, “hanging” at the upper edges of the joint valleys.
They are only to be seen in the north-south runs of the valleys. In east-west directions the wind could not find lee. In most snowdrift niches there is moraine material and boulders transported from afar by glaciers after the niches were formed, indicating that they are indeed older than the last ice age.
A large and obvious snowdrift niche lies between the viewpoints of ”Kopparhatten” and ”Utsikten”, and a couple of smaller ones along the Odensjö lake’s precipices (red track, to the left of the lake). They run into ”hanging valleys” in the great valley of Skäralidsdalen, and in the Odensjö lake precipices, i.e. valleys that are higher than the valley and the lake below.
Odensjön itself resembles a snowdrift niche, but it much deeper and older - a niche glacier.

A BOTTOMLESS LAKE?

Odensjön is a round lake that lies furthest in along a joint valley near Röstånga.
The formation of the lake is similar to that of the snowdrift niche’s, but instead of packed snow it was the glaciers that carved out the giant cauldron over a number of ice ages. The giant cauldron was filled with water from underwater springs.
This cold-water lake is surrounded by high scree slopes that meet far below the surface of the water. Above the boulders and stones at the bottom of the cauldron lies a 4 metre thick layer of silt. The actual water depth of the lake is 20 meters. However it is 60 meters down to firm bedrock. This rock has plenty of fissures that fill the lake with clean, cooled groundwater.
The volume of water in relation to the surface, and the flow in the form of approx 6ºC groundwater makes the water cold.

THE ICE AS A ROAD SCRAPER

Terminal moraines are small gravel ridges formed in front of smaller glaciers during the last part of the ice age. Stones, gravel and soil were all scraped together and pushed in front of the ice for as long as it continued to grow. When the ice melted, the scraped-together gravel ridges were left behind. They are around 10 metres high and 100 metres long. Terminal moraines and eskers are similar in age and appearance. Both were formed by the ice.

12 000 YEARS AGO

Scania’s terminal moraines are around 12 000 – 12 800 years old from the Younger Dryas stadial. Scania’s landscape was cooled after the last ice age and a tundra climate prevailed at Söderåsen. There is no evidence that large ice rivers ran through the valley, as protective glaciers remained after the great ice melted away.

HORST VS BOULDER RIDGE

Horsts and boulder ridges aren’t the same thing! A horst is high, more than 100 meters, a boulder ridge is smaller, around 10 m. Horsts are ancient formations, > 100 million years old, whilst boulder ridges are young, being around 10 000 years old. Horsts consist of solid bedrock whilst boulder ridges are made up of stone and gravel from the ice age.

SÖDERÅSEN’S FORMATION IN SHORT

The horst of Söderåsen started its slow formation around 300 million years ago (Collision 1), and was at its most intense 200-150 million years ago (Collision 2), and its present formation (incl. rift valleys) is from around 80 million years ago (Collision 3).

THE SKÅNE FAULT ZONE, THE HORSTS, DIABAS AND VOLCANOS

RIFT VALLEYS AND SNOWDRIFT NICHES IN SÖDERÅSEN NATIONALPARK