Excursion guide NW Skåne, NGEA 01 Ht 2017

PART 2 Description of the STOPS

By

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Contents

Innehåll

PART 2 STOPS

STOP 1. THE VALLEY OF KÄVLINGE ÅN RIVER

Coordinates app. 55°47'8.59"N 13° 7'57.74"E

This is a stop that is optional according to weather, agricultural timing, traffic etc. We will just have a first hand on with the soils of the Lunda-slätten plain. View the wide valley of the Kävlingeån River and compare the morphometric and the present-day flow in the river. On the way to this stop we have discussed the Romeleåsen horst, the soils of the Lunda-slätten plain a little about the agricultural landscape, land-use etc.

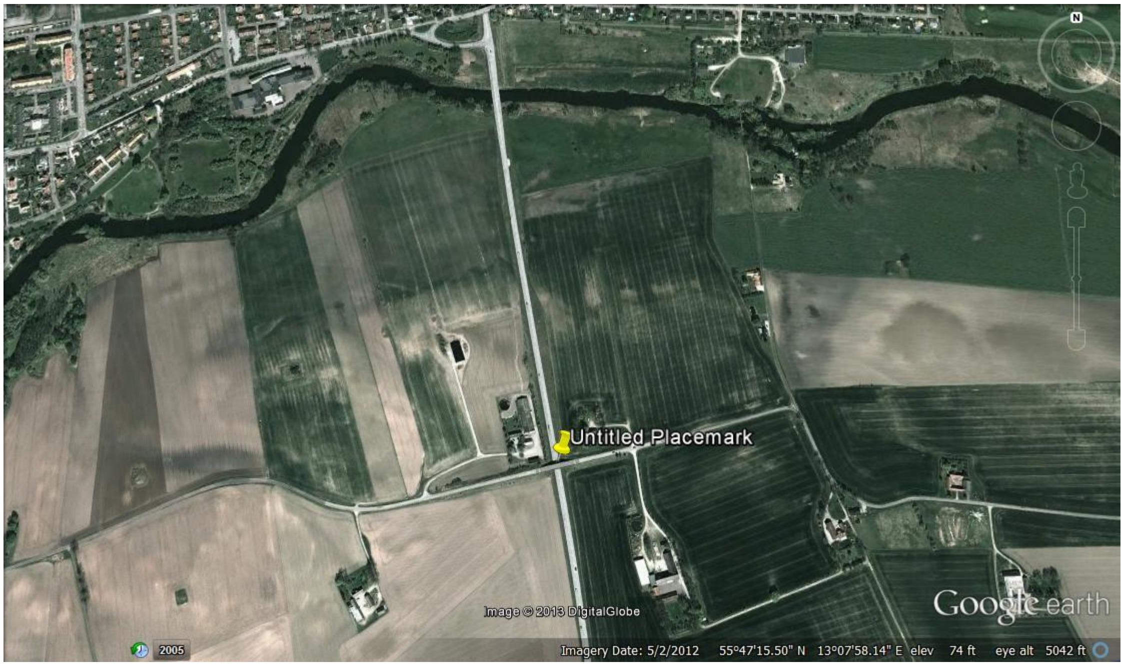

Figure 21. Stop 1. With a view north across the Kävlingeån river.

1. WHAT TO DO AND OBSERVE!

1. Just observe the soil and the land use.
2. Take a soil sample in your hand and see if you can role it into a small ball or cylinder. Wet it if needed.
3. Which crops are grown?
4. What is the field and farm size?
5. How are the field boundaries “marked”?
6. What is the relation between the river and the valley?

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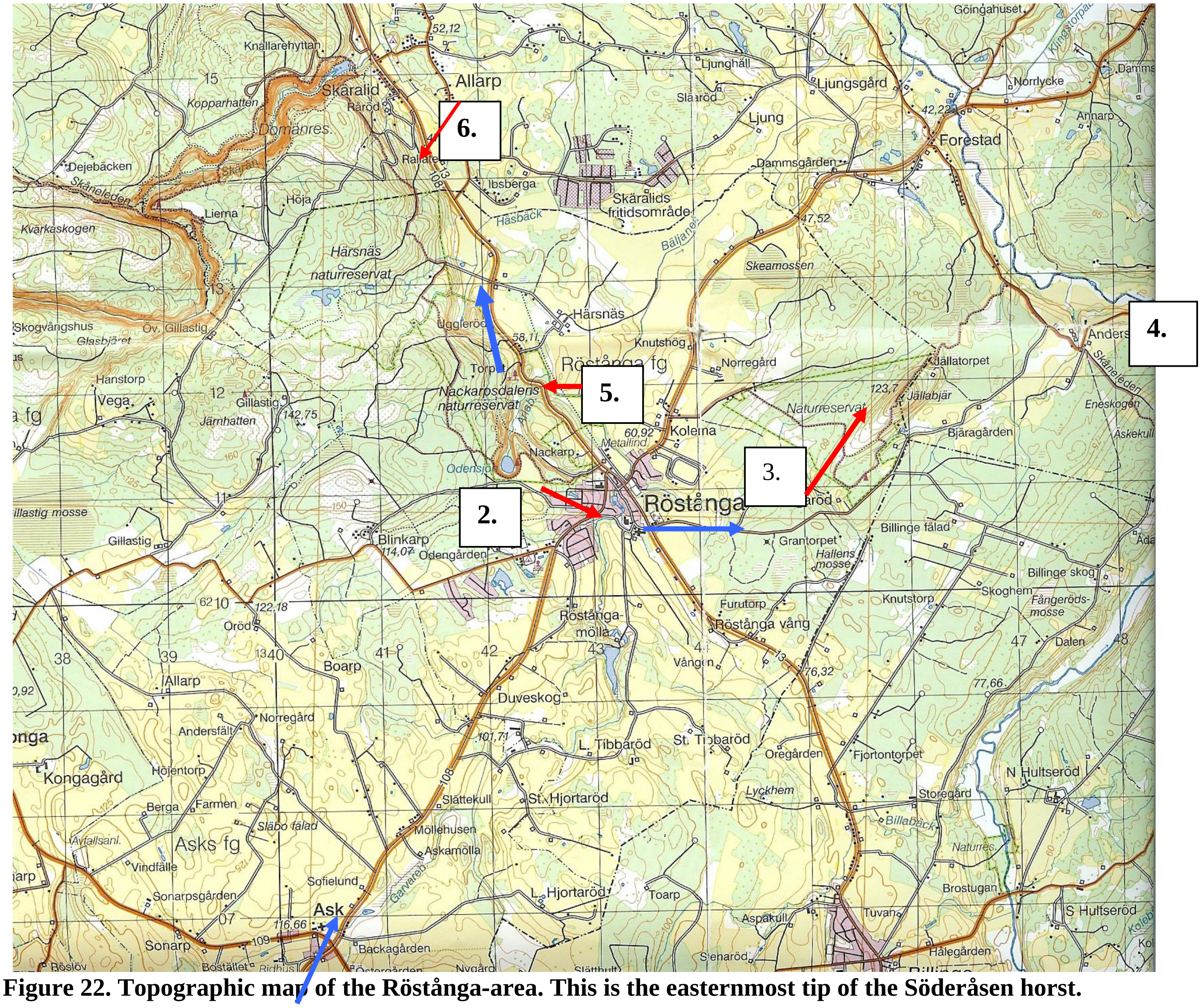

Figure 22. Topographic map of the Röstånga-area. This is the easternmost tip of the Söderåsen horst.

Stop 2. RÖSTÅNGA

Coordinates 56° 0'5.02''N 13°17'29.49''E

Basalt and Breccia

Just in the Centre of the small village Röstånga there is an exposure of a basalt dyke and also one of very few south Swedish breccia localities. The basalt dyke can be followed several km and the contact zone between the basalt and the surrounding gneiss has been a weak zone where the small rive has eroded its course.
There are also good examples of weathering!

NB: THE SITE IS ON PRIVATE GROUND SO FOLLOW MY INSTRUCTIONS!!!!!

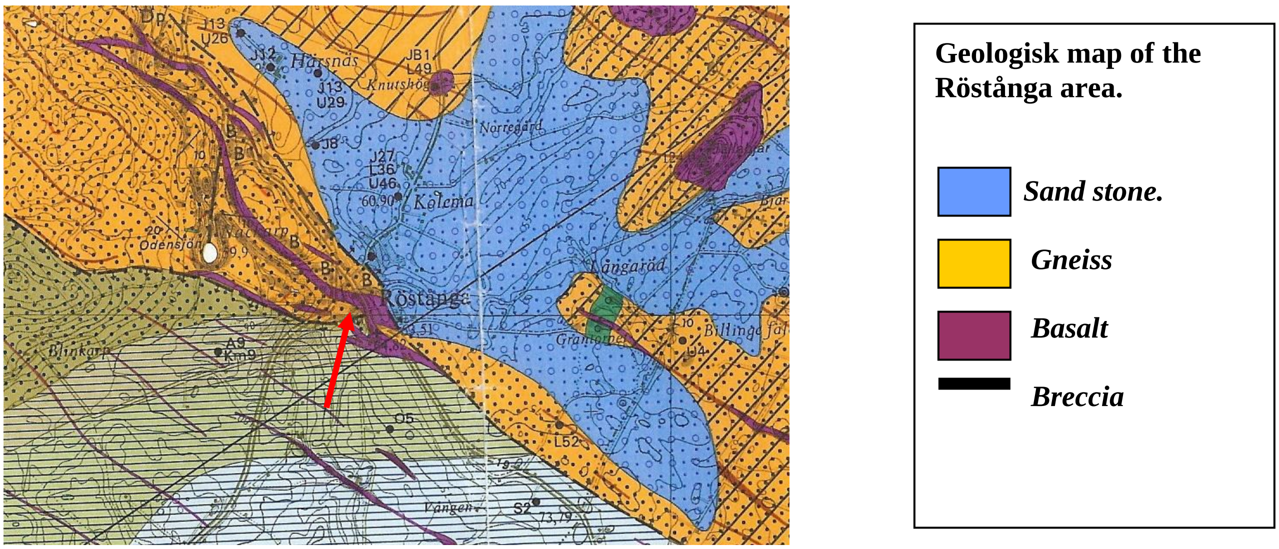

Figure 23. Geological map of the Röstånga area.

The breccia.

At a width of almost 40 meters, the bedrock is broken and crushed into small angular fragments. The material is properly weathered and to the untrained eye it may look like stones mixed in a soil or a dark concrete with sharp-edged stones. (or porphyrite!) The zone of crushed rock can be followed towards SE to the old railway cutting and to the NW it can be until Uggleröd, making it to an rock exposure of more than 2 km.
Breccia is rock composed of angular fragments of varying size are commonly called breccia (pronounced "bräkksia"). It is an Italian word that originally used to describe certain types of marble. Crushing of rock can be done in several ways: through volcanism, and through movements in the earth's crust during tectonic movements. The crushed rock in Röstånga is a beautiful example of breccia formed by crustal movements. This is a so called tectonic breccia. Since breccia's are formed by broken crushed rock they are generally much softer and fragile than the surrounding rocks. The special with the breccia at Röstånga is that it stands out as steep cliffs. That's because it has been hardened by the fact that the voids between the angular rock fragments have been filled out by almost pure quartz. It is even possible to see the intersecting veins of quartz, which shows that the breccia ruptured up several times and the finally cemented. The cemented quartz may have come from groundwater saturated with silicon, which has been precipitated during cooling. The heat would then have come from the nearby diabase, which therefore should be younger than the breccia. But if the diabase is the youngest it should also somewhere has broken through the breccia.

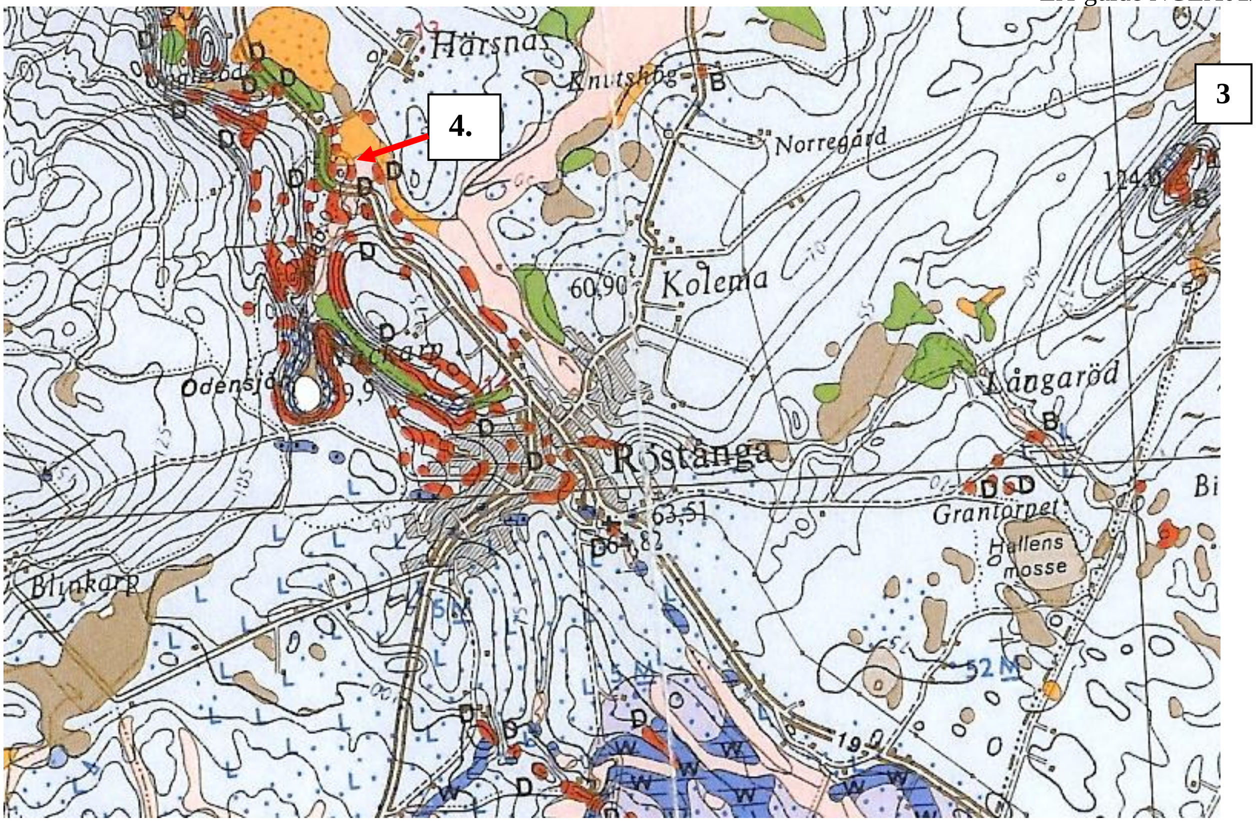

Figure 24. Soil map of the Röstånga area

2. WHAT TO DO AND OBSERVE!

7. Identify the basalt and the breccia.
8. Find a sample to hit with the hammer so you get a fresh surface – only loose blocks!!!!!
9. Observe the weathering that is seen in the basalt

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Stop 3. JÄLLABJÄR" - The largest volcano in Sweden"

Coordinates; 55°59'57.91"N 13°18'6.40"E

Jällabjär may be accessed from the road between Röstånga and Anderstorp. Next to the road, there are clear signs of a good and orderly parking – but not for buses so we cannot go there. It is approximately 2 km walk to the top of Jällabjär. We remain, however, at a distance and just observe the topographical feature as such in the landscape. There are not so many good places just looking at a volcano from a distance in Sweden.

Jällabjär rises about 60 m above the surrounding area. It is almost everywhere covered with dense forest (beech) and it is only at a few places at the top of the underlying bedrock is visible. The rock is basalt, which is formed in connection with volcanic activity as described earlier. Basalt is a dark, fine-grained and homogeneous rock. It contains relatively large phenocrysts of pyroxene. This is best seen in the loose blocks that WE WILL ENCOUNTER AT A FOLLOWING STOP!

In Skåne there are more than 50 clearly identified basalt outcrops. Through a careful and frequent measurement of the geomagnetic field has an additional 150 occurrences have been indicated. Basalt is weakly magnetic and easily found during geomagnetic surveys. Jällabjär are highly elongated in the direction of NNE - SSW, which is the same direction as the main ice had during the last glaciation. It has therefore been assumed that Jällabjär in fact a giant drumlin whose shape is mainly due to a cap of till that is covering most of it. It is very likely that the ice eroded away looser layers of tuff and ash, so that today only the volcano's middle and harder part remains. Drilling has shown that such rocks and underlying kaolin can be found along the sides of Jällabjär, especially at the leeward to the southwest.

However, there are a number of small outcrops of basalt near Jällabjär and these suggest that the volcano itself is stretched in the direction NNE - SSW, which is one of the dominant tectonic lines in Skåne.

Figure 25. Jällabjär i vy från SW. ***(Photo J. Åkerman)***

3. WHAT TO DO AND OBSERVE!

10. Just note the impressive geomorphological form not at all typical for this part of SWEDEN.

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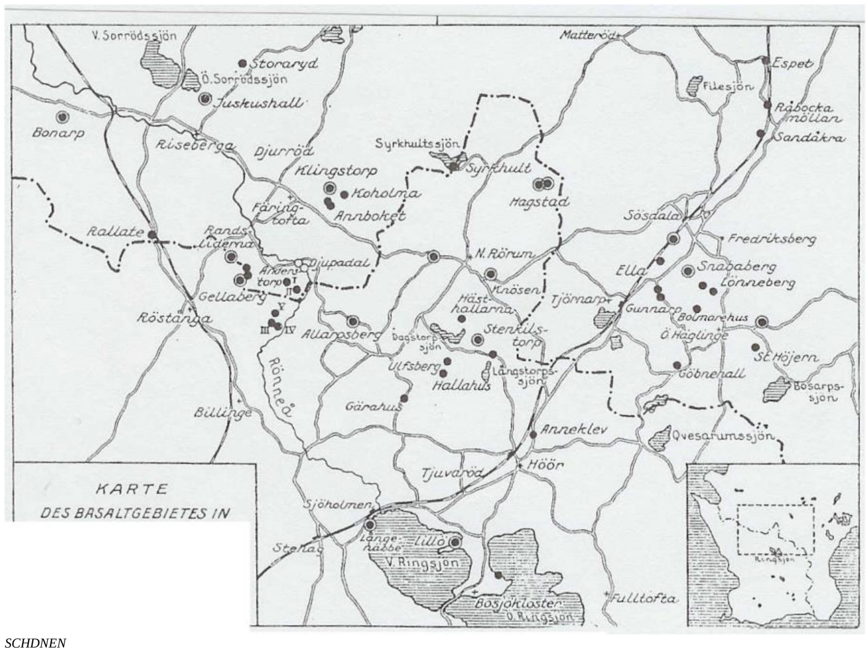

Figure 26. Map of the distribution of volcanic necks in Skåne.. Map by Rolf Norin, 1934.

Stop. 4. DJUPADAL- volcanic tuff (OPTIONAL)

Coordinates; 56° 1'8.51"N 13°23'0.22"E

Djupadal lies about 6 km east of Röstånga, towards Hallaröd (Fig.). The place has for many centuries been one of the best crossings of the Rönneå river because the valley here is narrow and has hard erosion resistant flanks. The Basalt tuff is fund about l00 m west of the old bridge, only some ten meters from the grazing fields on the south side. One has to pass through a pasture paddock to get there but the animals are friendly. Respect the landowner's signs and the animals. The volcanic tuff at Djupadal looks most like a type of slag heap and is also relatively weathered and loose. At first glance, the place looks pretty boring, but it is very special and beautiful for a geologist. Tuff is a soft rock and easy dug into material because of weathering and erosion. Tuff has been detected in wells at several places in Skåne, but this is one of the few occurrences that are visible on the surface in more extensive formations.

Volcanic tuff is formed of material that has been explosively ejected from a volcano crater - tephra. Tuff has not been formed from lava that flows more or less coherent. The fine particles from the volcano eruption called ash or tephra contains larger lapilli fragments and even greater bombs. The layers seem more or less unsorted and deposited in the volcano's vicinity.

In 1879 the geologists Nathorst and Tullberg found lignite with wood fragments embedded in the tuff. The discovery aroused great attention among Swedish geologists. The wood was determined as a coniferous tree of the genus *Cedroxylon*, which lived during the Tertiary and thus was the volcanic activity dated to some point between 10 and 70 million years. For almost a hundred years that age was undisputed and only in connection with the use of the updates using the radioactive decay could it be demonstrated that the volcanism was much older - 167 and 108 million years ago.

Increased knowledge about *Cedroxylon* has shown that it was a persistency genus that lived for hundreds of millions of years. Therefore, the wood residues could not be used any more as an exact dating species. Renewed investigations of plant material in tuff at Djupadal showed that there were large amounts of pollen which are all descended from Jurassic carbonates from 140-200 million years ago.

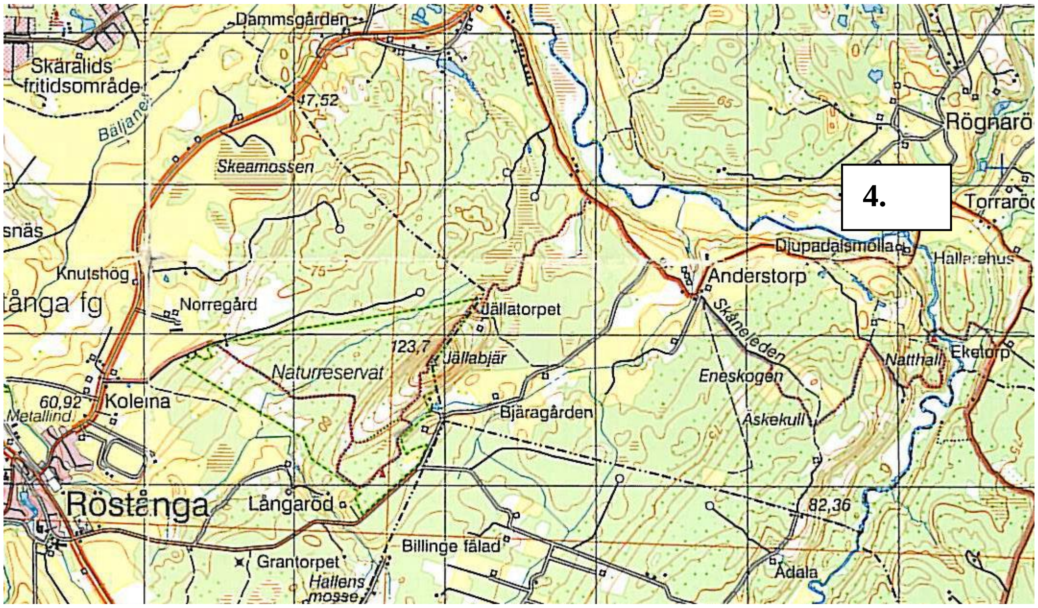

Figure. 27. The area around Djupadal, East of Röstånga.

4. WHAT TO DO AND OBSERVE!

11. Locate the tuff in the river bank
12. Try to find fossils
13. Compare with tuff that you have seen in the lab

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Stop 5.The NACKARP valley. Cone shaped mounds (OPTIONAL)

Coordinates; 56° 0'43.79"N, 13°16'40.36"E

Just west of Röstånga, by the road towards Ljungbyhed there are some odd features that has not been properly understood. Nackarps valley is the name of the beautiful valley leading from Röstånga to the Odensjön Lake. At the mouth of the Nackarp valley there are some cone shaped features 1-5 metres high. The whole area has an undulating morphology which forces the road to several sharp turns. There are about twenty small mounds and most of them are elongated. Some of them are so regular cones that it is difficult to explain the origin. Especially as they contain solid rock – mainly gneiss, basalt and breccia. The conical hills are hence not an accumulation

form or mini volcanoes. Nor is it some kind of small kames built by till and it is not a glacifluvial deposit.
Rock cores drilled are far from hard or fixed coherent. Instead, they seem everywhere to be broken into pieces that are hardly bigger than a matchbox, and moreover, all materials are heavily weathered. But a definitive explanation is not yet available.
In Ugglerödsdal, 1 mile north, there are similar cone-shaped hills. Such are also found on the south side of Söderåsens, 400 m NNE Hallagården, about 3 km southwest Stenestad.

5. WHAT TO DO AND OBSERVE!

14. Try to find the bedrock
15. What rock is it?
16. Do you have any ideas?

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Stop 6. RALLATE. A small volcanic neck with nice crystal forms.

Coordinates: 56° 1'40.02"N 13°15'55.52"E
Rallate is easily accessible at the south side of the road between Röstånga and Ljungbyhed just before the entrance to the Söderåsen national park. Right next to the road a small stream is coming out and joining the road side ditch. Follow the small brook 20 meters, and then look to the left. Here we find a small volcanic neck outcrop of nice hexagonal crystals. It is basalt hexagonal columns of a dark, almost black rock. The pillars are 10-30 cm in diameter and one meter or more long. The rock is homogeneous and fine-grained and contains some mm-sized grains of a green mineral - olivine. Through the black base material we can also find bands of white fracture fillings. Rallate is the remains of an ancient volcano. What one sees is that of a basalt filled-crater pipe. Basalt in Rallate exhibits a very elegant hexagonal crystal forms in pillars. These pillars are formed when the basalt is cooling off. Initially the basalt has high temperature and as it cools and solidifies and at the further cooling reduces the rock volume, wherein cracks develop in a regular pattern. The basalt columns do not stand up straight but have a dips approximately 40 degrees to the SSW. Some geologists have assumed that the columns have been tilted by an ice flow, but there are no known ice stream with a direction which would be achieved this.
The most likely explanation is that is has been a side went of a minor channel of a volcano.
Oblique crystal formation like this one is quite common. Fracturing occur perpendicular to the coldest surface, which need not have been horizontal.
Many of the basalt columns are clearly rounded, and in some blocks, one can see how the pillar outer layer flakes off. These are signs of a weathering process and there are fine examples of a weathering rind on blocks. When Rallate was formed the area was probably a true flat plain. The Southern Horst Söderåsen first occurred many millions of years later. However, it is likely that the fault followed the same zone of weakness in the bedrock that magma intruded up through. The same structure occur in basalt also at other basalt outcrops of the area. The regular pattern gives the impression of being artificial. Some similar occurrences elsewhere in the world are known as nature's wonders, such as the Giants Causeway in Ireland, Devils Rock in Wyoming, USA and Los Organos the Canary Islands.

The basalt columns at are located within a large circular pit with a diameter of about 40 m. The pit is partly formed by the farmers during the late 1800s when marl was mined to be used as a fertilizer to on sandy fields in the environment. Right next Rallate are another couple of old marl pits. It is very possible that there are deposits of volcanic tuff used for soil improvement. In the pit opening a spring with piping is further enlarging the pit.
The name "Rallate" is a call with the meaning "Come in". Probably there has once been a road tavern nearby.

Figure 28. Rallate with the hexagonal basalt pillars.
(Photo J. Åkerman)

6. WHAT TO DO AND OBSERVE!

17. Get a fresh sample with a clear cut surface
18. Use loose blocks only –we are in a National Park
19. What rock is it?
20. What can the white crack fillings bee?
21. Is there any water in the brock?
22. Can the springs be located?
23. What is piping?

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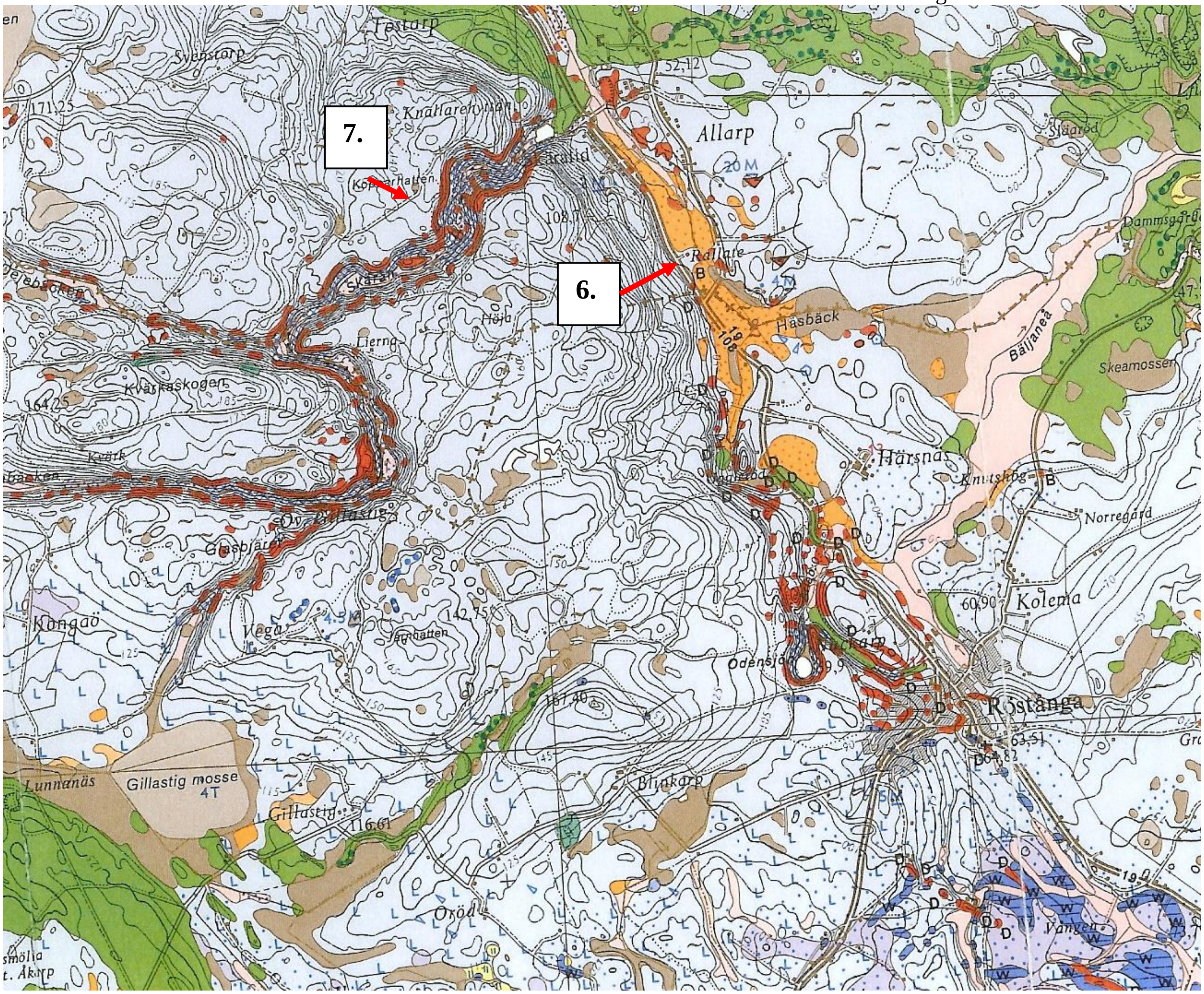

Figure 29. Soil map of the Skäralid area.

Stop 7. SKÄRALID. The Grand Canyon of Skåne

Coordinates; 56° 2'4.74"N, 13°14'19.44"E

Orientation

Skäralid located on the northern slope of Söderåsens, easily accessible from the road between Röstånga and Ljungbyhed. The road all the way to the best vantage points at Copper Batten. Here we have one of our longer stop on this excursion. A few kilometres to the west are the Klöva Hallar which is a very similar valley with the same background and genesis.

Description

Skäralid is a very untypical south Swedish valley which reminds a lot more about high mountain terrain. It is a wilderness area, steep, deep and winding and is therefore not in line with the preconceptions about Skåne. The

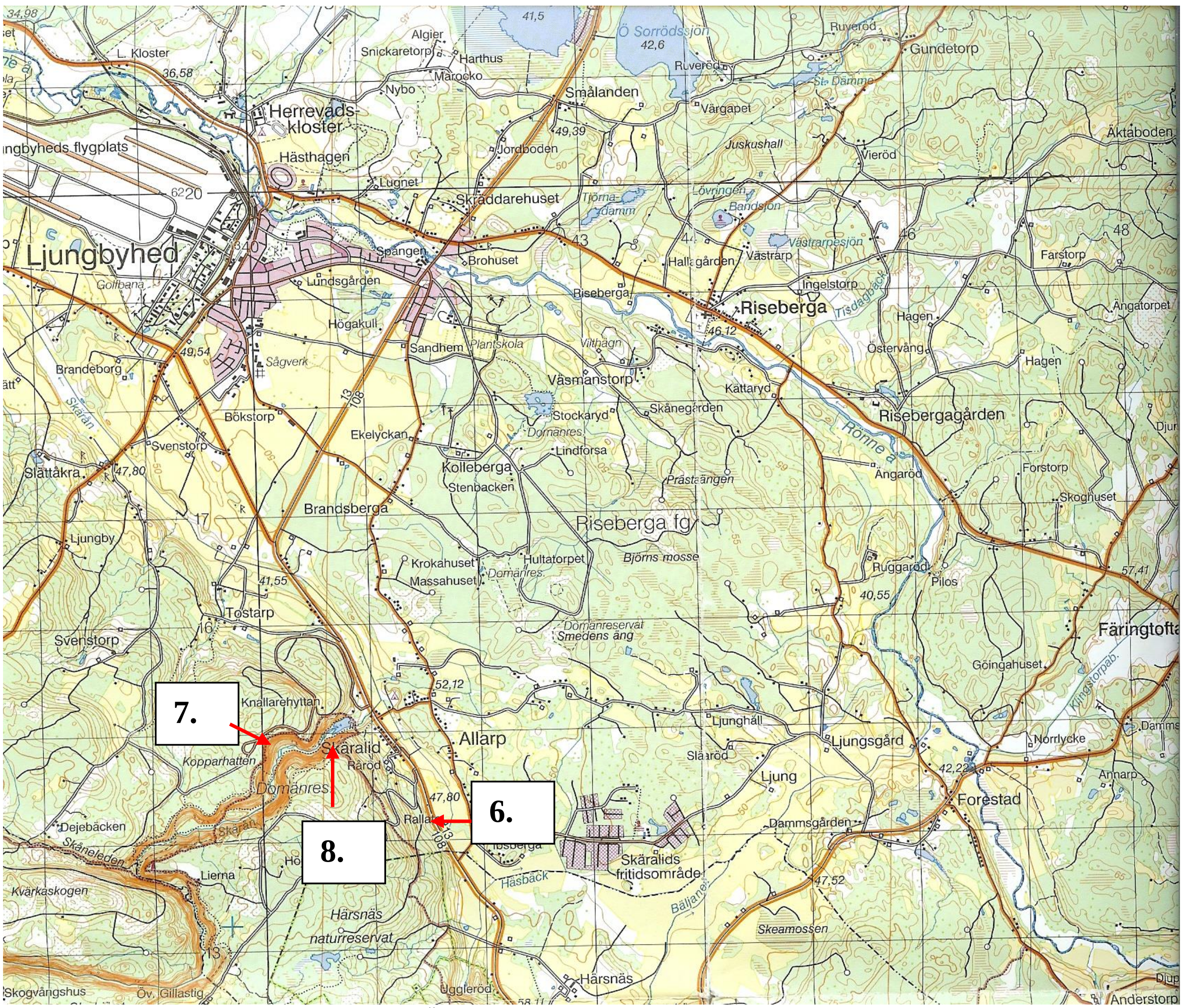

Figure 30. Topographic map of the SKÄRALID area

valley opens towards the north where the Ljungbyhed plain area is visible at the horizon. The valley sides of the canyons are covered with rubble, angular boulders and stones in large bodies which take your mind to the mountain slopes of northern Sweden **- talus** .The steep valleys, the Skäralid, Nackarpsdalen and the Klöva Halls, on the north slopes of Söderåsen has raised many concerns and lively discussion among geologists and geographers. They are often described as rift valleys, but their meandering shape belies the idea that they would be dominated by any particular fracture in the bedrock.

The low water flow in the valleys bottom makes it clear that it is not the current stream that formed them. They cannot be called erosion ravines, because this name is used mainly on steep valleys in soft soils , instead they are more considered as canyon walleyes .Emergency tapping's of melt water during the latest Ice age cannot have created these valleys , as shown by sediments and tills at the bottom . The valley must have been filled with ice at during the glaciation. Remnants of protalus ramparts and till ridges are clearly visible at the edge of the Klöva hallar Valley. There has obviously been an intense frost weathering for a long time before and after the ice age, which has given rise to the majestic rocky slopes with coarse angular aggregates **talus**. Frost weathering is not alone enough to explain valleys as such. However, there have been four ice ages in the last millions of years, and each glacial event may have contributed to the design. So the forms may be thought to be very old and may have been formed by rivers that worked its way down through the overlying sedimentary rocks and down into the crystalline bedrock gneiss during long time.

The sedimentary rocks are now completely gone but the valley got its winding shape from there. This last statement also applies to the Grand Canyon in the USA, which was formed when the river eroded down into the Colorado Plateau, which was raised slowly and continuously over a very long period. Skäralid and Klöva halls can therefore be said to be Skåne counterpart in miniature Grand Canyon in the USA.

Still there are more explanations at hand!!!

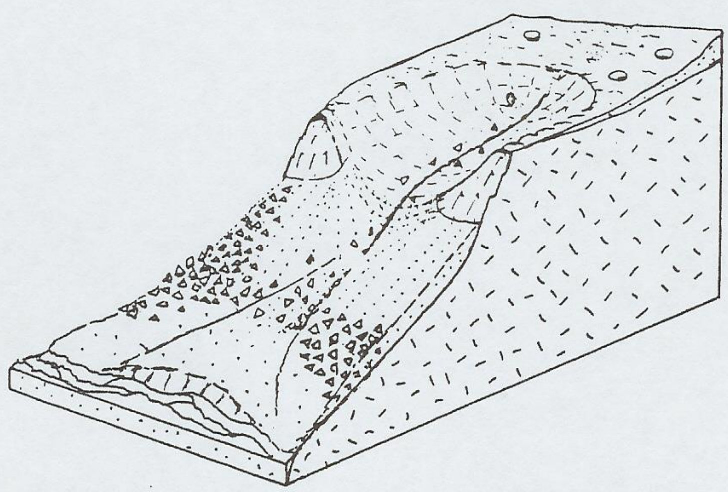

FIGURE 31. *Skiss av dalsida i Skäralid norr om Kopparhatten. Upptill nischform sannolikt bildad genom vittring och erosion i samband med snölega, till vänster talusbrant av frostsprängda block samt en svämkägla som genomskärs av ån i dalbottnen. Delvis efter Rapp (1984).*

Nivation niche and talus on the west side of the Skäralid canyon. We will walk across it in the field.

7. WHAT TO DO AND OBSERVE!

24. The shape of the horizon to the north.
25. What bedrock do we have?
26. What soil is it?
27. Note the talus slopes and talus cones?
28. Vegetation?
29. Theories of formation?
30. Nivation hollows!

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Stop 8. TALUS on the west facing slope of the outer Skäralid valley.
Coordinates; 56° 2'14.97"N 13°14'59.37"E

We stop at the Skäralid's National park Information Centre. If this is open there is a small museum and a lot of information material available free of charge. There is also access to toilets. We will take a short walk along the valley side up to the first talus slopes on the valley's east side. Much is hidden by vegetation, but it is opening up so that we can get a view of a nice talus. Note the sorting of coarse blocks at the bottom and finer further up the Slope.

8. WHAT TO DO AND OBSERVE!

31. Note the dam and the use of the small river.
32. What signs of slope processes do you observe?
33. Check the vegetation – trees.
34. Climb the talus and observe the sorting of the material.
35. Is the talus active or dormant or fossil?
36. Think about the micro climate down in the valley.
37. Collect info. material at the centre.

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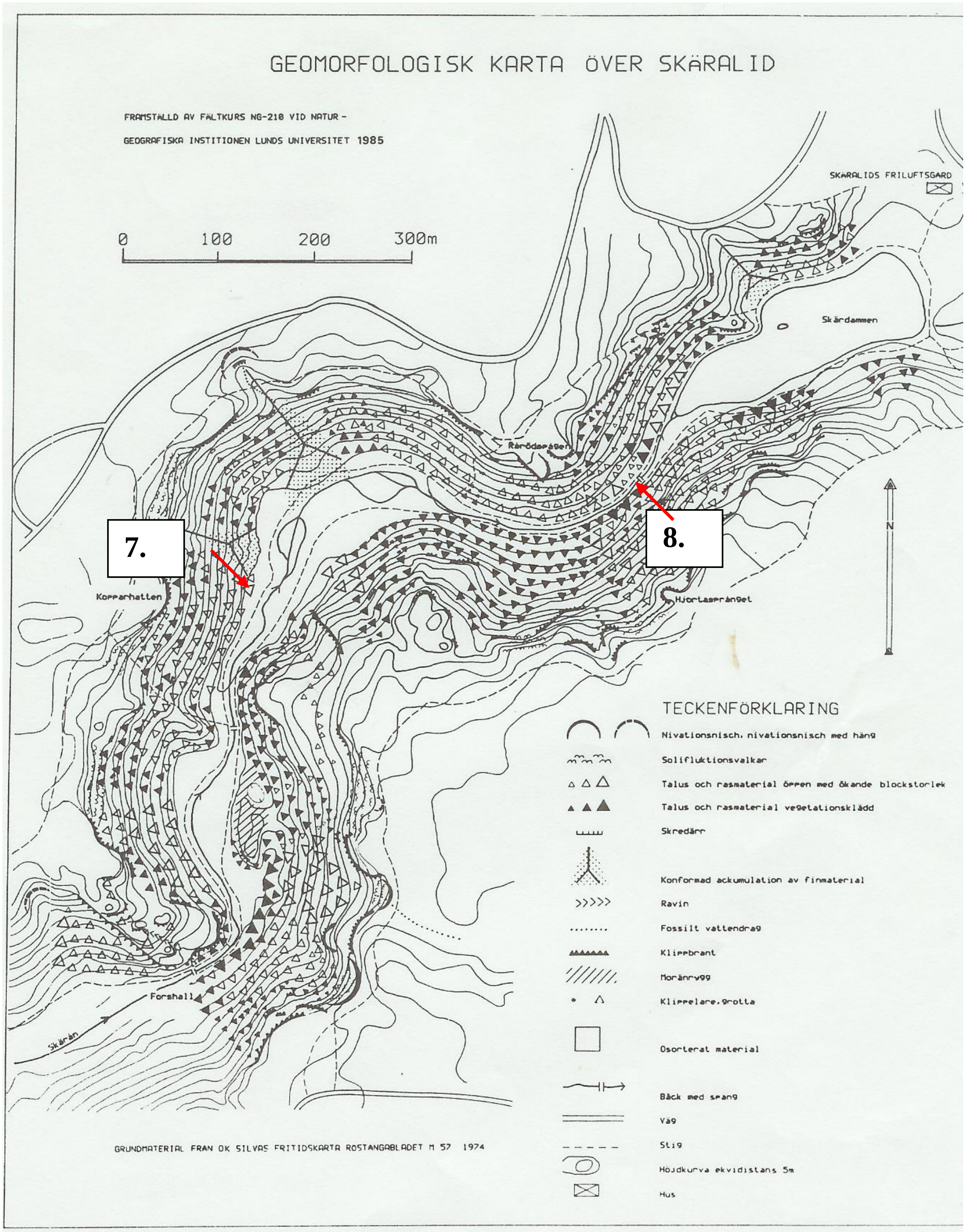

FIGURE 32. Geomorphological map of the terminal parts of the Skäralid canyon.

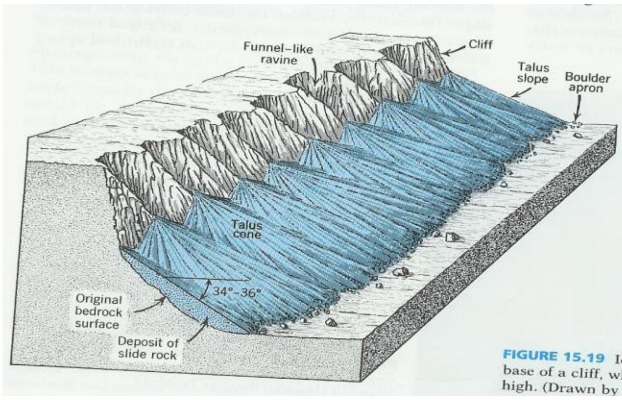

Figure 33. Schematic illustration of a talus slope

Figure 34. Talus on the east slope of the Skäralid canyon. ***(Photo J. Åkerman)***

Stop 9. TORS on the highest sites of Söderåsen. (time permitting)
Coordinates; 56° 2'35.00"N, 13° 9'11.95"E

SNUVEHALLAR

Snuvehallar is one of the better developed **tor** features in South Sweden. Snuvehallar are located 800 m northwest of Höjehall at Söderåsen. Snuvehallar is a very steep rock formation is fractured in such a way that it looks like it could be blocks that are stacked on top of each other. Snuvestuan is a smaller rock cave just at the base of this formation. Snuvehallar has for many since long been a somewhat puzzling formation. Today this formation is well known all over central and north Skåne. All of Skåne has been covered by an inland ice less than 15,000 years ago and everywhere it is clearly seen how it has affected the landscape forms. The strange thing with tors are that they are so steep that the easily would have be overturned by land ice long ago. Still they are there!

The sharp protruding rock pillars a steep rock formations considered to be formed by weathering processes that dissolved material deep down leaving only fresh mountain parties standing and reaming within a weathering soil. This weathering material around the solid interior has then been removed by water erosion or earth flows during the Arctic environments that terminated the last glaciation. Another possibility is that the rock formations are very old, and that the great land ice in some areas had very little power to erode loose rock material. One can imagine, for example that the tors in the early glacial stages were covered with stagnant ice and thus protected from large ice movements. Snuvehallar is thus a type of rock formation called tors. There are several tor formations the Söderåsen, for example at Klövahallar at Skäralid and Skorstensdalen, which lies about 1200 m southeast of Klåveröd. Also in north-eastern Skåne there are several tor features. Some of these have been protected under a blanket of limestone or a weathering coat of kaolin from the Cretaceous period, which shows that they are very old.

Many of the pillars on the beach Kullaberg and at Hovshallar may originally have been created as tor- formations . More about this theme in NE Skåne excursion.

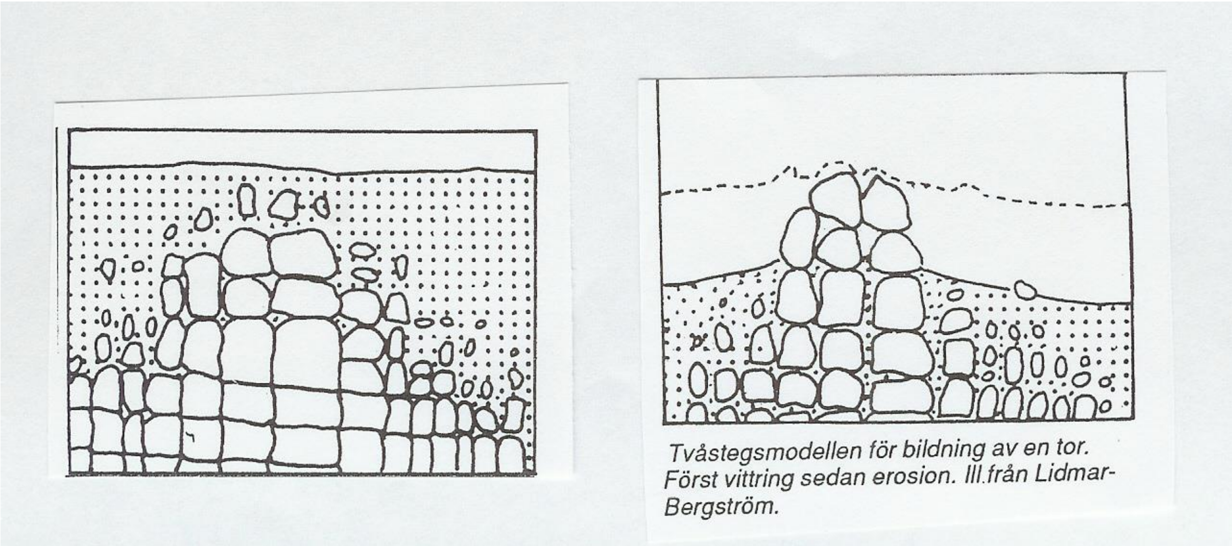

FIGURE 35. The principal formation of tors.

9. WHAT TO DO AND OBSERVE!

38. Note the bedrock type.
39. Compare the forms with the theoretical formation

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From here we have a long bus ride of about 35 min.

Figure 36. Route around Ljungbyhed.

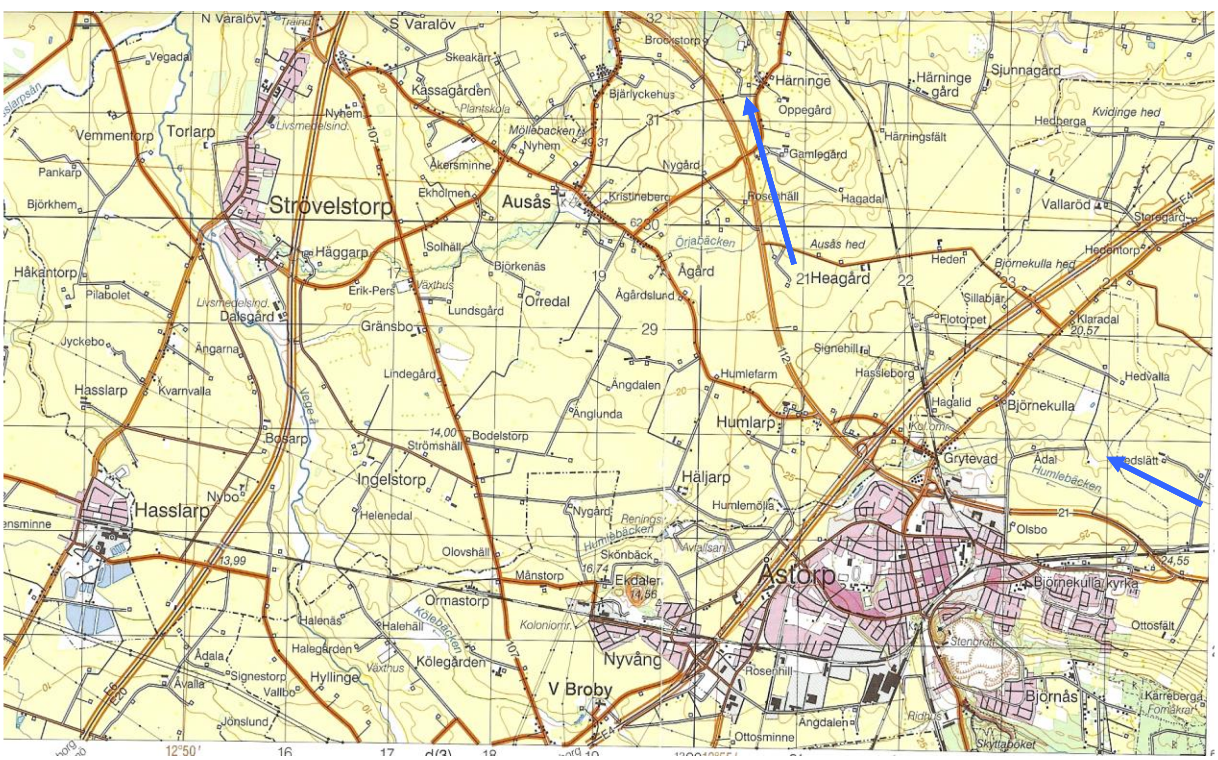

Figure 37. Route around Åstorp.

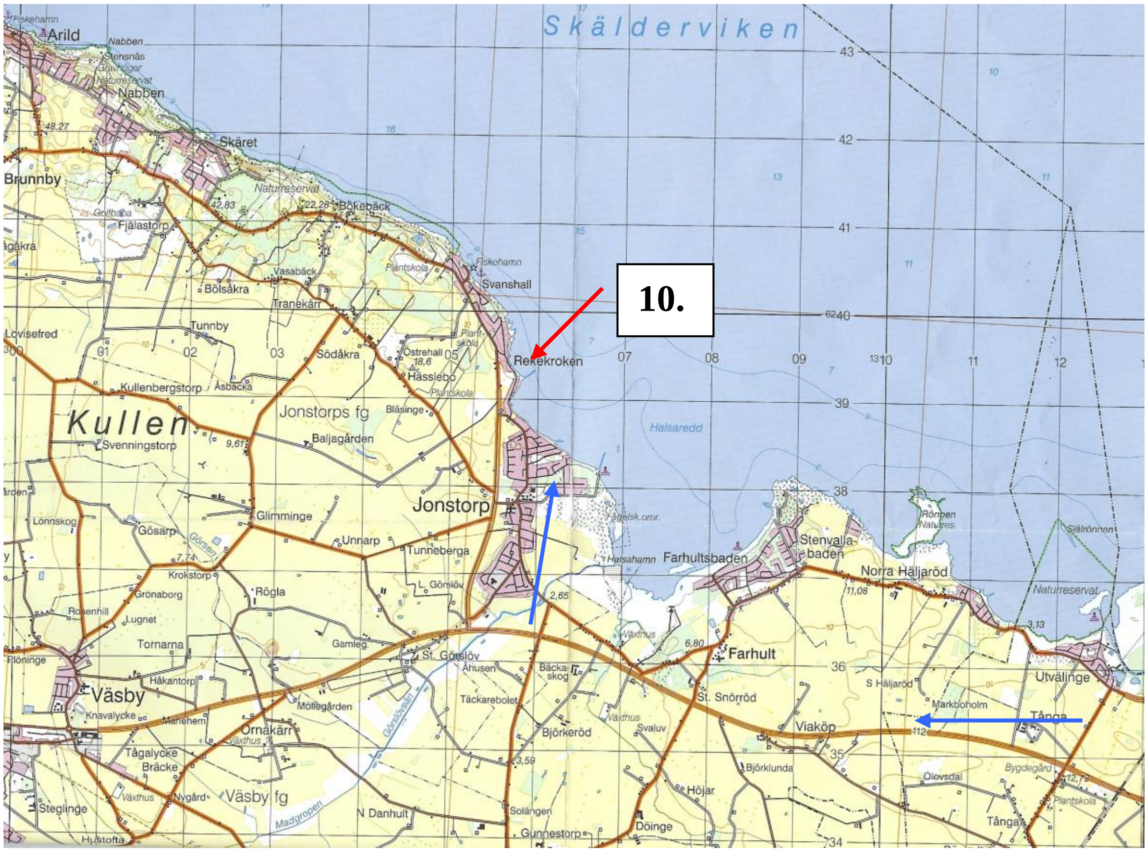

Figure 38. Map of the inner parts of the Skälderviken bay and the position of REKEKROKEN.

Stop 10. REKEKROKEN.

Coordinates; 56°14'31.57''N, 12°40'18.35''E

At Rekekroken there is a fine outcrop section of Cambrian sandstone. It is clearly visible on the shore at low-water levels with slightly dipping layers. The layers can at very low water levels be followed all the way to the contact with the underlying gneiss. At this contact, the sandstone is a coarse basal conglomerate, but it soon turns into dense quartzite rich sandstone. In the sandstone there are clear U-shaped tunnels of a sand worm "Diplokaterium".
This Cambrian quartzite rich sandstone is the same (age and composition) as we will find at sites along the south east coast of Skåne. Some of these we will visit during our 3rd excursion later during the course. So remember this site and link it to future sites that you will visit.

The beach at the site here is also rich in beach cobbles of various rock types including a lot of erratic's (swe. led block) from the north and north east - including many unique rocks from the Oslo area.
From Rekekroken we first follow the north coast of the Kullaberg peninsula but at the level of Arild (Fig. 40) we will transvers the horst and approach the westernmost parts on the south side

Figure 39. The Cambrian sandstone – a quartzitic sand-stone, at REKEKROKENS *(Photo Jonas Åkerman)*

10. WHAT TO DO AND OBSERVE!

40. Note the bedrock type.
41. Try to get a fresh cut in the rock. No restrictions!
42. Observe the layered structure.
43. Determine the strike and dip. Use the Compass.
44. Do you find fossils?
45. Investigate the erratic’s on the beach?
46. What rock types do you find?
47. Where do they come from?

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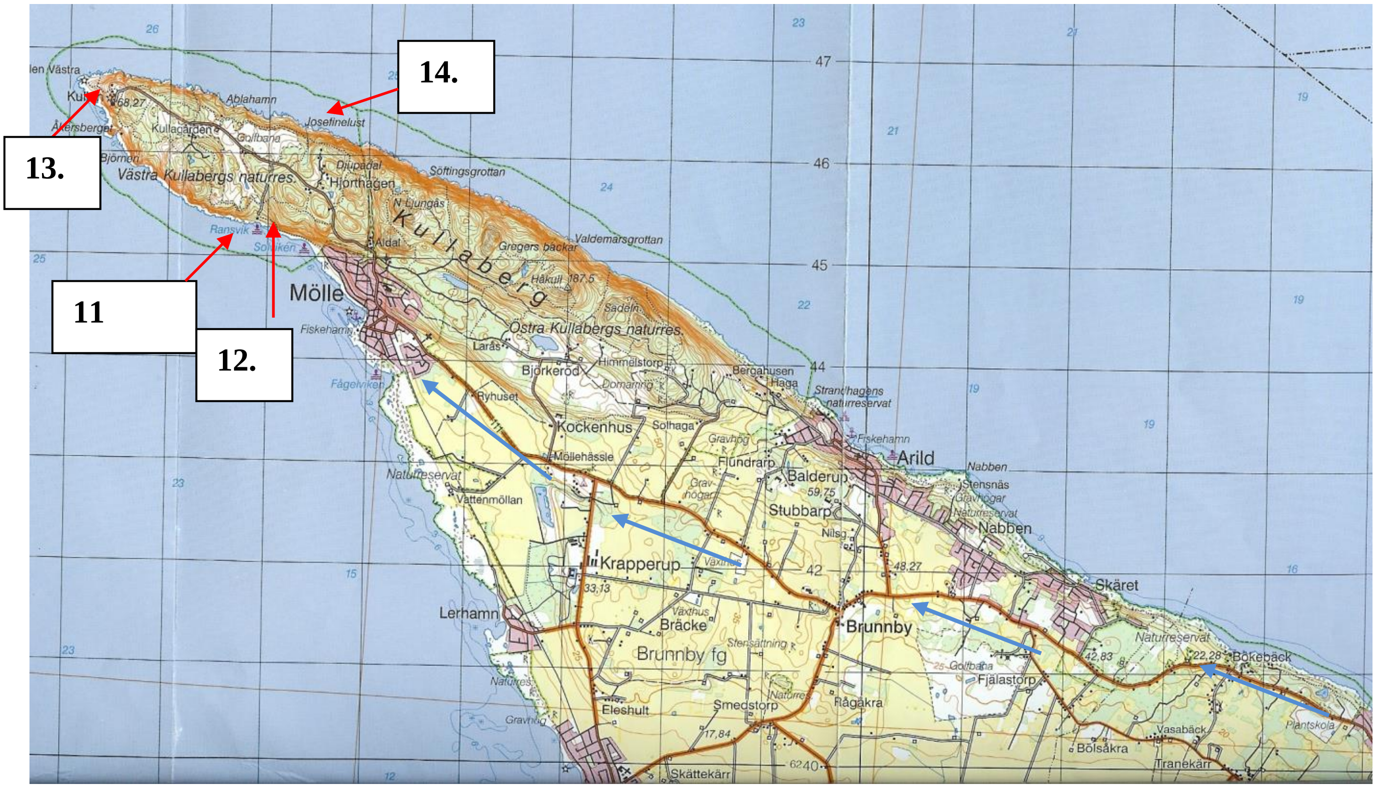

FIGURE 40. MAP OF KULLABERG AND SURROUNDINGS.

Stop 11. RANSVIK. Traditional bathing site from the late 1800th.

Coordinates; 56°17'27.96"N, 12°28'35.10"E

Ransvik is located on the south side of Kullaberg. The access the popular cove is well signposted on the road between Mölle and the Kullen lighthouse. Everywhere on Kullaberg you may encounter the exposed bedrock either on exposed cliffs or under a very thin soil cover. Here at Ransvik we see the very well exposed bedrock all along the coast only with small sections covered with boulders. Most of the coastline is dangerously steep and inaccessible but here a road leading down to a parking lot and a stair case leading down to a café make the place a popular site for visitors since long. Ransvik was known as a den of sin at the turn of the 1800-1900. "When grandfather bathed in Mölle." Men and women bathed together wearing only striped “wrestling” suits (fig. 42). That was indeed an improper behaviour at that time and a lot of discussions took place and laid the foundation for the “Swedish sin”.

The rock here is a bright reddish greyish gneiss – Biotite-gneiss but also Hornblende-gneiss is common.

Gneiss is a metamorphosed rock, which may originally originate from a slate, a sand-stone, a volcanic rock or a fine-grained granite. The gneisses at Ransvik are so greatly transformed that it is often impossible to determine their origin. Formerly they were known as "veined gneiss", but nowadays it is called "gneiss of unknown origin”." Similar gneisses are found in large parts of western Sweden.

RANSVIK IS ONE OF OUR TWO POSSIBLE LUNCH SITES!!!!

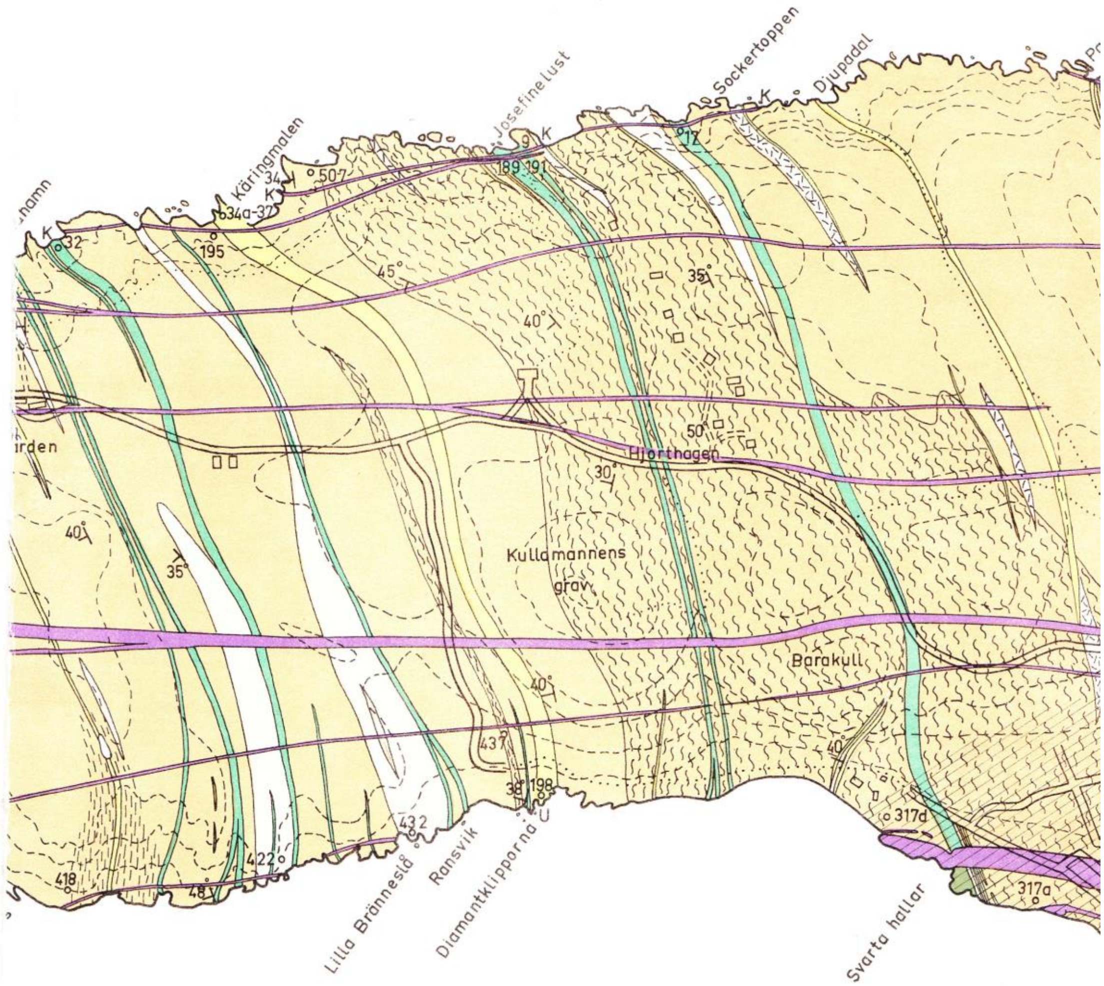

FIGURE 41. **GEOLOGY OF THE RANSVIK AREA. yellow = hornblende-gneiss, whitish yellow = hornblende gneiss, yellow with hatching = schistose hornblende gneiss, light green =amphibolite with garnets, green = porphyrite, lilac = diabase, lilac with k = kullaite and red =pegmatite**

11. WHAT TO DO AND OBSERVE!

48. Note the basic surrounding bedrock type.
49. Find the younger dykes.
50. Which are the most resistant against wave erosion?
51. Investigate the beach boulders. What bedrock are they?
52. Where do they come from?
53. Try to find small dykes – 1-10 wide. What rocks are they?
54. Have lunch and take a swim.

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FIGURE 42. SINFUL LIFE AT RANSVIK 1910.

Stop 12. THE DIAMOND CLIFFS. Black rocks with hornblende and garnets.

COORDINATES; 56°17'27.00"N, 12°28'39.08"E

The diamond cliffs are located on Kullberg’s south side, approximately 800 m west of the city of Mölle, immediately east of the Ransvik cove. the diamond rocks are glistening and jet-black rocks in a small dyke parallel to a main dyke cutting through the horst and reach the coastline right at the shore both on the north and south sides (41). The rock is variable but usually dark, shiny and with large well defined crystals of hornblende. in some parts of the dyke there are a dominating proportion of dark red garnets, which can be several centimetres large. Unfortunately these garnets are not so pure that they can be used for jewellery but still they are nice for a mineral collector. The mineral that gave the rock outcrop its name is the centimetre-sized crystals of black hornblende, which in sunny weather gives rise to strong reflections. The diamond cliffs are a part of an only two meter wide side dyke within the surrounding gneiss bedrock. just east of the diamond cliffs lies the main dyke which is a 15 meter wide dyke of a typical ordinary amphibolite (no garnets!), which is the one continuing across the entire Kullaberg right to the north side.

Figure 43. The Ransvik cove with Mölle in the background. The route to the diamond cliff is indicated with an red arrow. On top of the ridge you will see the black cliffs!

Hornblende is a kind amphibole and a rock rich in amphiboles called amphibolite. amphibolite's , which is a form of "greenstones" are very common as dykes or veins in gneiss bedrock .the origin of a amphibolite is usually a dark volcanic rock like diabase, which mainly consist of pyroxene and plagioclase. During a metamorphosis pyroxene is transformed to amphibole and the plagioclase gets a new crystal structure. The diamond cliffs consists mostly of pyroxene, and therefore now after metamorphosis rich in hornblende.

The material in the rocks should actually more accurately be called for "ultra-alkaline garnet - amphibolite." amphibolite is a metamorphic rock, which is converted under high pressure and high temperature. For amphibolite formation an equivalent pressure at a depth of about 10 kilometres and a temperature around 600 degrees is needed. it is thus obvious that weathering and erosion have stripped away thick layers of rock before the diamond cliffs came to the surface.

On Kullaberg there are several different types of amphibolite. The younger ones are straight, slightly weathered and less fractured while the old amphibolite's is veined, folded, torn and heavily converted. Each generation of dark dykes suggest a period of volcanic activity and that means Kullaberg has a very interesting history even further back in time. Both intrusion and metamorphism of the rock in the diamond cliffs occurred over a billion years ago. The modern form has been created by erosion and weathering over the past millions of years.

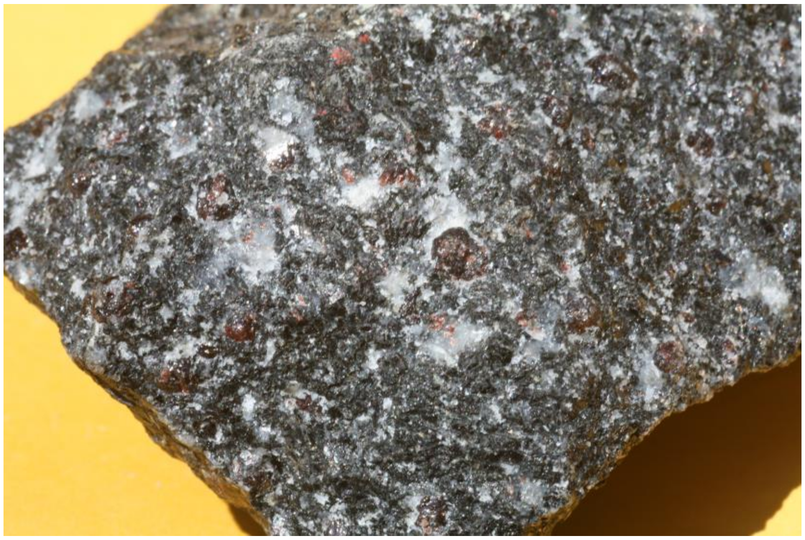

Figure 44. A sample of a garnet rich amphibolite. (Photo J. Åkerman)

12. WHAT TO DO AND OBSERVE!

55. Climb over to the Diamond cliffs. (see fig 43)
56. Try to find a loose block and split it to find nice garnet crystals
57. Do not take samples form the mother rock! **restrictions**!
58. Observe the differences between the different types of dykes and the surrounding gneiss.
59. Determine the strike and dip. Use the Compass.
60. Do you find fossils?
61. Investigate the erratic's on the beach?
62. What rock types do you find?

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Stop 13. THE SILVER CAVE - A SILVER MINE WITHOUT SILVER.

Coordinates; 56°18'2.73"N, 12°26'56.96"E

The Silver Cave is situated along the coastline southwest of the Kullen lighthouse. The road from the light house to the cave is well signposted. You go down there in the group while I'm waiting at the lighthouse. The cave is approximately 2 meter high and 0.7 m wide at the entrance. It goes 15 m into the mountain and gradually tapers off. The "cave" is not a natural cave but a mine opened in search of precious metals. The possible "ore - dyke"

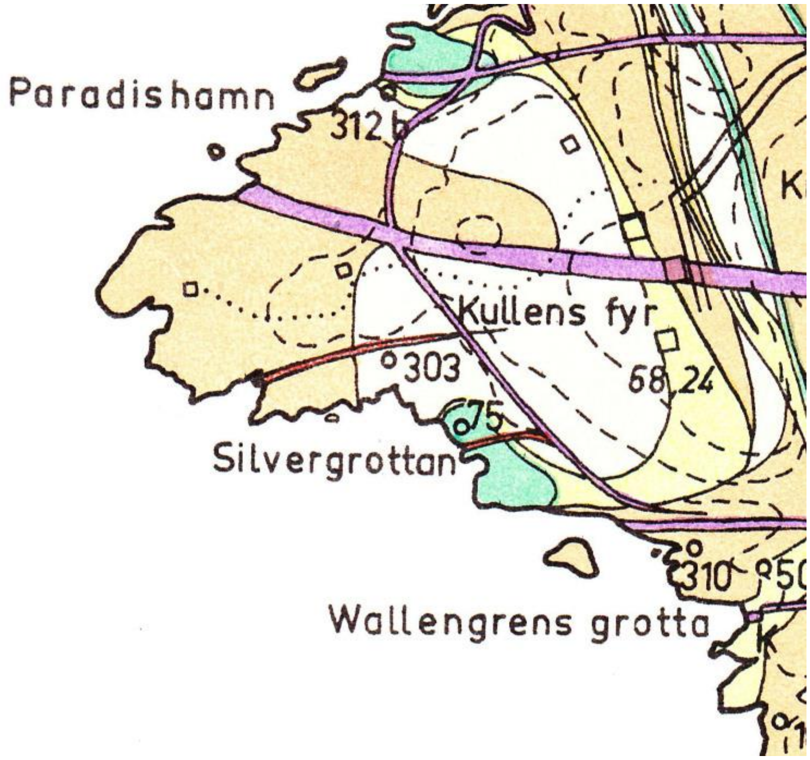

Figure 45. Section of the geological map of western most Kullaberg. **yellow = hornblende-gneiss, whitish yellow = hornblende gneiss, light green =amphibolite with garnets, green = Porphyrite, lilac = diabase, lilac with k = kullaite and red =pegmatite**

followed a dyke of pegmatite (Fig. 46). What attracted the early miners are the large mica crystals that is a common component of the pegmatite and you can still see the bright coarse-grained pegmatite rock that has flakes of mica or muscovite. The muscovite mica mineral is also called cat silver or crow silver.

Pegmatite is a coarse rock type (coarse granite) that mainly consists of reddish feldspar, mica, fat shiny off-white quartz and plagioclase. Mineral grains are often a centimetre large or more as can be seen in figure 46. Pegmatite is not an unusual type of rock in the Kullaberg area. It often occurs as decimetre wide dykes with a little fuzzy connection to the surrounding gneiss. This type of pegmatite is formed by minerals "sweated out" from the surrounding rock in connection with metamorphosis (change at high pressure and temperature).

The pegmatite at the Silver Cave is different however; it is wider and has sharp contacts with the surrounding gneiss. This type of pegmatite is found in at least three places on Kullaberg. Most of the pegmatite dykes are running WSW - ENE.

The most recent surveys of the western Swedish gneiss have shown that they underwent a significant transformation for about 900 million years ago. The metamorphosis was probably related to the formation of the granites in Bohuslän. During this process Kullaberg was then subject to heating to about 700 degrees and under very high pressure. During this metamorphic process small lenses and dykes of pegmatite was formed. Even water-rich mixtures of quartz and feldspar may have been re-melted and formed the pegmatite at the Silver Cave. The pegmatite dykes may also have been formed in connection with the intrusion of granites at Kullaberg some 1600 milj years ago.

You walk down to SILVERGROTTAN on your own and try to observe as much as possible (see below)

Figure 46. Small section of a pegmatite dyke at Ransvik. (Photo J. Åkerman)

13. WHAT TO DO AND OBSERVE!

63. Note the bedrock type in general.
64. Try to get a fresh cut in the rock. No restrictions!
65. Observe the character and structure of pegmatite.
66. Determine the strike and dip. Use the Compass.
67. Find a piece of mica crystal?
68. Investigate the erratic's on the beach?
69. What rock types do you find?

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Stop 14. JOSEFINELUST OMRÅDET

Coordinates; 56°17'58.41"N, 12°28'59.59"E

Josefinelust located on the north side of the Kullaberg peninsula, about 2 miles northwest of Mölle. It's a busy and often visited place and a long staircase of variable quality is leading down to the sea. The geology and geomorphology is rich with a lot of good examples of both recent processes and old geological formations of various age.

Josefinelust area bounded on the east and west sides by high rock walls of gneiss. The beach area is exposed to the NE and have a cover of coarse beach block accumulation with rounded blocks in constant move. A smaller ridge, also of gneiss, bisects the open beach and several intrusive rock dykes are passing the area (Fig. 47). To the west there is a more or less unbroken stretch of rocky shore. Along the shore eastwards there are minor bays with blocks and also bays with beach gravel and shingle. The bedrock has colours and patterns that clearly show that there are several different types of rock both from the local rocks and from erratic’s.

The area is rich in marine “caves”. These are shallow and situated at higher levels than the present sea level.

In the western rock wall is the Frederick VII's cave and in the eastern rock wall the Josefinelust caves, the larger of which is furnished with benches.

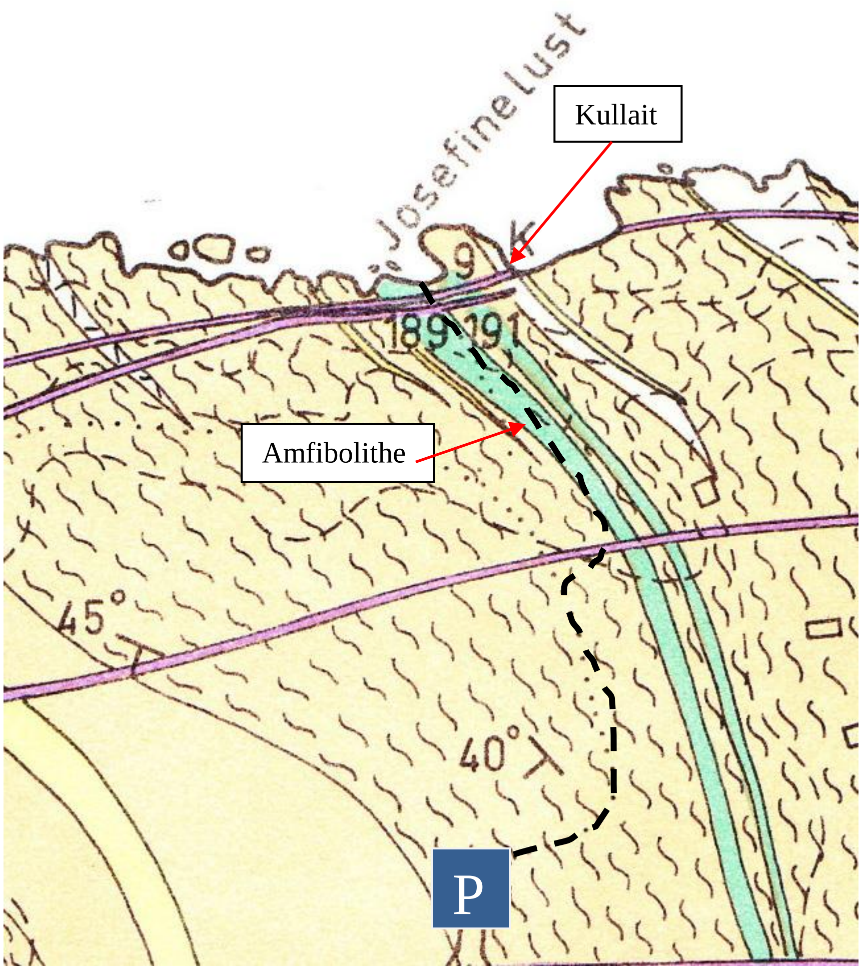

Figure 47. **GEOLOGY OF THE JOSEFINELUST AREA. yellow = hornblende-gneiss, whitish yellow = hornblende gneiss, yellow with hatching = schistose hornblende gneiss, light green =amphibolite with garnets, lilac = diabase, lilac with k = kullaite and red =pegmatite**

Most of the rocks of the site is, as well as the majority of Kullaberg is a reddish greyish gneiss. The structure dips approximately 30 degrees to the west and in the gneiss are (parallel to the gneiss layering) layers and dykes of dark amphibolite, which on an average have a thickness of about 5 m. Across both the gneiss and amphibolite dykes there is a meter wide steeply dipping grey/green/red rock. It is a variant of diabase, but it has such a distinct appearance that it has been given a specific rock name **-kullaite**. A unique mineral that is very popular with mineral collectors. **The rock is protected so you are not allowed to take samples directly from the dyke but it is easy to find lose boulders and fragments around it!!!!**

Josefinelust is mainly formed by mechanical weathering and marine erosion. These forces have been operating in the bedrock reflecting the areas of different weaknesses. At Josefinelust it is clearly visible that weathering and erosion has strongly attacked the dark amphibolite. While the "pure gneiss" is appearing as sharp, protruding parts. Even the green- red kullaite and the black diabase are affected relatively strongly from weathering and erosion and have partly been eroded away (Fig.49). The rock material and its structure have also governed the position and formation of the caves. The big Josefinelust cave has been developed in a section of gneiss, which is particularly rich in cracks.

Möllebäcksmal is an older name for Josefinelust. The valley that leads down to the beach here runs along a stream that in the old days had a water mill. "Mal" is the name (in Swedish) of the accumulation of coarse beach blocks that are extremely well rounded by the wave action. The mal contain both local material and erratic's.

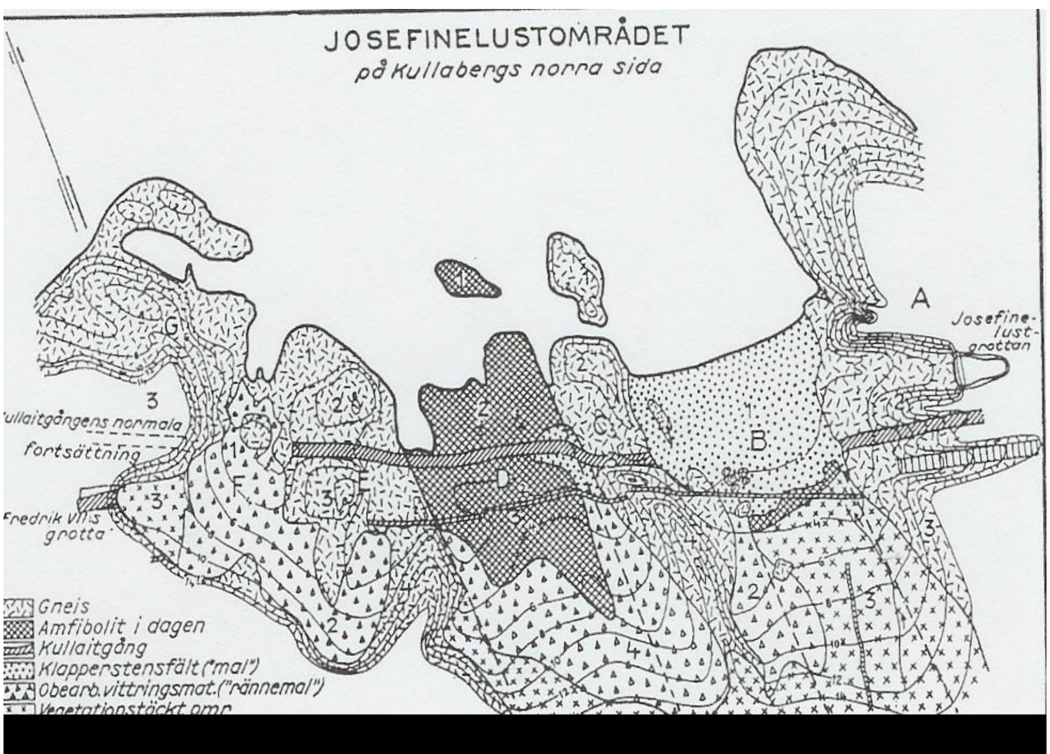

Figure 48. The geology of the JOSEFINELUST area.

Figure 49. The Kullaite dyke in the eastern side of the Josefinelust cove. Caves to the left and the stair lead up to a good view point of the coast to the east and to some active talus slopes. (go up there!!)

14. WHAT TO DO AND OBSERVE!

70. Walk down to the cove following the path (Fig 47.) – keep right at the T- junction and walk down following the small stream and valley and the stairs.
71. What is the "reason" for the small stream and valley?
72. Note the bedrock type in general.
73. Try to get a fresh cut in the surrounding rock!
74. Locate the different dykes of intrusive rocks. Use Figs 47 & 48.
75. Determine the strike and dip. Use the Compass.
76. Can you date the different dykes -relatively?
77. **Try to find a loose piece of Kullaite – it is unique!!!**
78. Investigate the erratics on the beach?
79. What rock types do you find?

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Stop 15. LANDBORGEN Old coastal cliffs (time permitting)

Coordinates; 56° 3'1.84"N, 12°41'32.83"E

The old raised costal cliffs “Landborgen” are clearly visible as characteristic feature running N-S in the city of Helsingborg. The best locality to visit is in a park centrally located about 200 meters north of the City Theatre and Concert Hall and only 100 meters from the present coastline. The bedrock in the cliff in Helsingborg consists of light yellow to brown sand-stones. The steep cliff is nearly 10 m high. The abrasion platform at the foot of the slope is 2-7 m above the present sea level. The Landborgen begins south of Helsingborg and continue about 12 km to the north and northwest where the sharp edge is becoming less marked in the terrain. We will see part of it on route.

These types of coastal forms are not so common along the Swedish coasts. Good examples are found on the islands of Öland and Gotland and the similarity is here expressed as a narrow beach plane and a sharp steep cliff of solid rock behind it. Here on Öland and Gotland the bedrock is limestone.
On the Danish side where there are similar forms where the bedrock is consisting of limestone while the bedrock in Helsingborg consists of sand-stones.

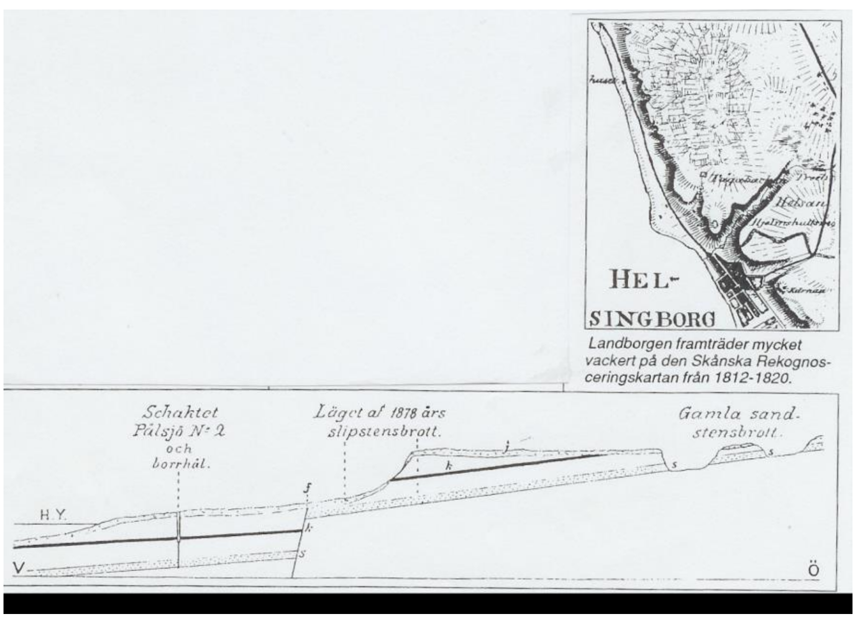

Figure 50. Old map of the structure in the area near Helsingborg.

15. WHAT TO DO AND OBSERVE!

80. Note the bedrock type.
81. Try to get a fresh cut in the rock. No restrictions!
82. Observe the layered structure.

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Stop 16. Rönnarp. Quarry in diabase with crystals /(Time permitting)

Coordinates; 55°56'56.98"N, 12°56'53.99"E

The quarry in Rönnarp is located approximately 2 km north of the village of Tågarp, located about 20 km east of Helsingborg. The quarry is barely seen from a distance as it is a deep hole in a flat agricultural region. Adjacent to the quarry there is a large recycling station. Parking space is available along the road.
In the quarry a brownish-black rock has been mined, found in a fifty meter wide sill (horizontal layer). The quarry is about 400 m long and 20-30 m deep. The mined rock is a diabase, a dark volcanic rock, which here has cut through shale rather close to the surface. The otherwise soft shale has been "baked" by the high temperature of the diabase magma so that it became metamorphosed and became stiff and tight. It is a typical contact metamorphism.
Typically, the shale is uniformly greyish, but in connection with this heat metamorphism the layers of fine sand have become bright while and muddy parties have become dark. Therefore a variety of interesting structures that otherwise are easy to miss can be seen.

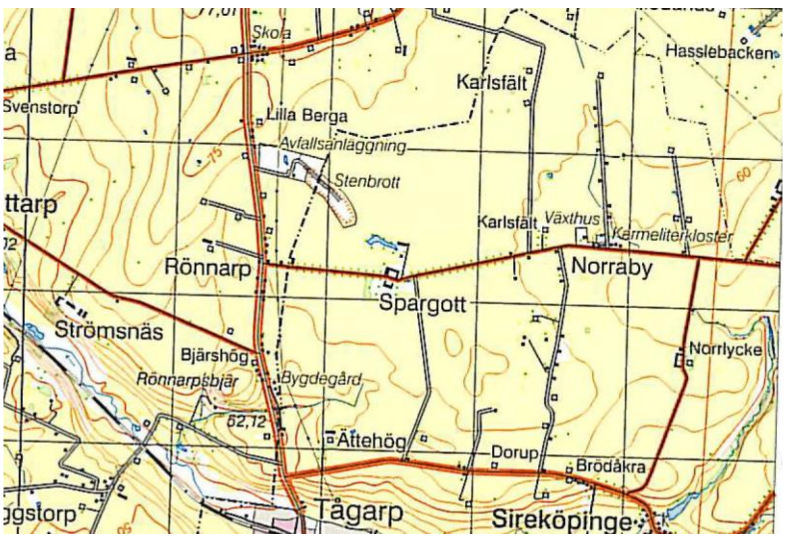

Figure. 51. The area around the Rönnarp quarry.

The Rönnarp diabase is not quite like the other Skåne diabases. In some areas for example, it has a variety of small cavities, which can be partly filled by calcite. In some sections there are millimetre sized crystals of dark augite in a more fine-grained matrix. There are several different types of diabase in the quarry. This is because there have been intrusions repeatedly along the same weakness in the surrounding mother rock. Inside the cavities there are also found small voids filled with small, but beautiful quartz crystals.

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16. WHAT TO DO AND OBSERVE!

83. Note the surrounding bedrock type.
84. Find the diabase sill or dyke.
85. Try to get a fresh cut in the rock. No restrictions!
86. Try to get a fresh sample of the shale, the diabase, the augite and the quartz.
87. Do you find fossils?

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Stop 17. The river valley of Råån. (Optional)

Coordinates; 55°59'57.09"N, 12°46'49.63"E

The river Råån starts just west of Svalöv and flows westwards south of Helsingborg. The valley is most marked from near the village Tågarp and downstream. In comparison with most other rivers in southern Sweden this small river is cut down deep in the sediments and rocks forming a deep and steep valley. In many places the bedrock, which is sandstone and shale, may be exposed in the valley sides. But generally they are covered with a thin soil cover. Råån has a peculiar stretching. It runs more or less parallel to the coast for a distance of nearly 15 km, instead of taking the shortest route to the sea. The underlying bedrock slopes sharply to the southwest, which should facilitate such a shortcut.

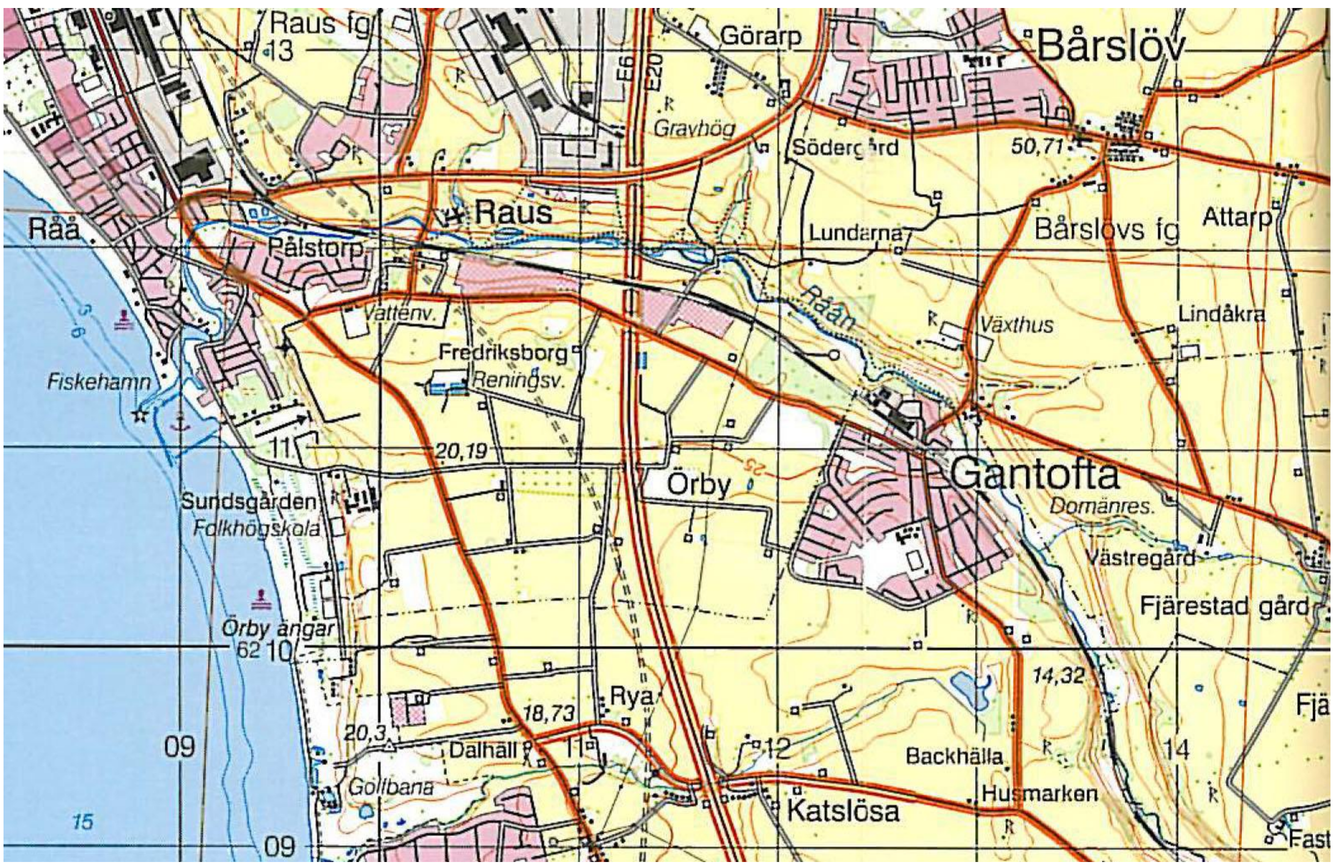

Figure 52. The valley of Råån near the outflow in the sea south of Helsingborg.

17. WHAT TO DO AND OBSERVE!

88. Observe what you can from the bus as we cannot stop here at the motorway.

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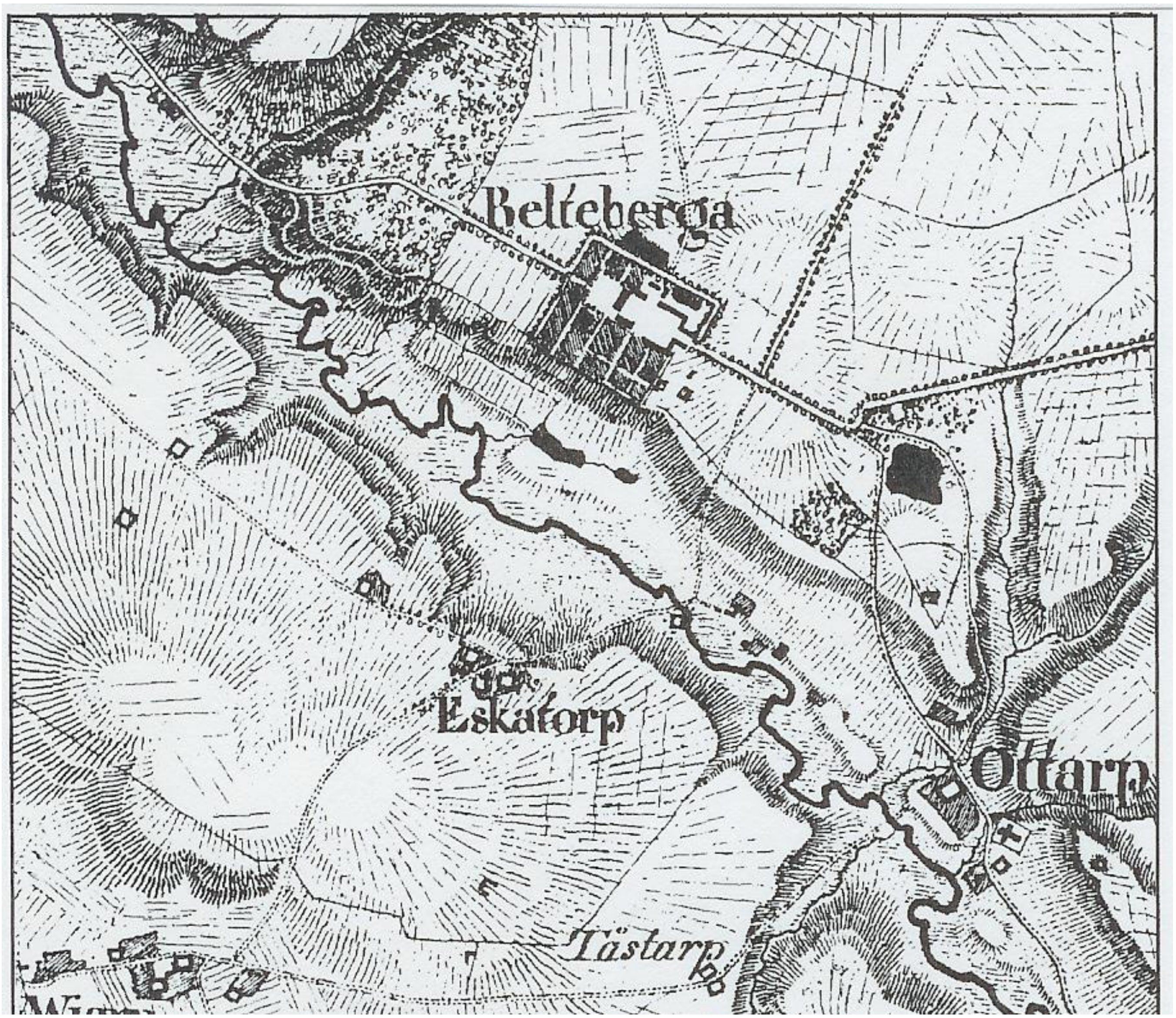

FIGURE 53. Part of the valley of Rååån. From the old army map from 1812.

Stop 18. The Glumslövs Hills/Glumslövs backar/

Coordinates; 55°56'16.51''N, 12°49'6.91''E

The Glumslövs hills are a comparatively high set of hilly terrain in a low flat lowland plain surrounding between Landskrona and Helsingborg. Every day, thousands of people pass it highest parts as the highway E6 and the main N-S rail road pass over and under it. The area is rich in Bronze Age archaeological sites and has beautiful views of the Ven Island. Drillings have shown that the hills are composed predominantly of glacifluvial sands and gravels. The costal bluffs along the coast show that these sand and gravel layers are not horizontal but very messed up through pressure form the inland ice.

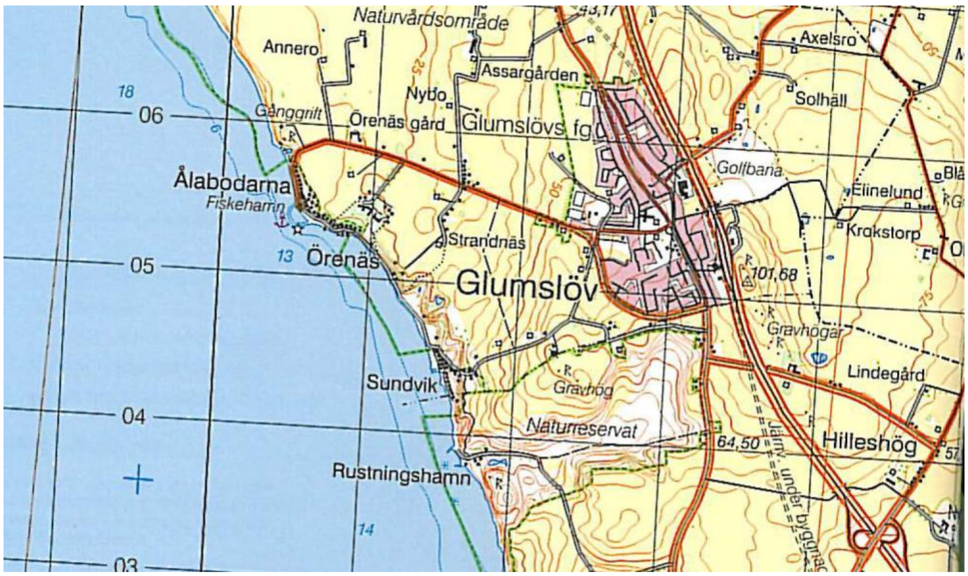

Figure. 54. The area around the Glumslövs hills.

Even 130 years ago geologists realized that the Glumslövs hills were formed by glaciation processes with depositions from different directions by glacifluvium and till. Exactly how this process too place was difficult to sort out. Very careful studies combined with recent findings on the sedimentology and tectonics of the sediments has shown the following.

The fine-grained sands were deposited in a vast lake with varying depths over a period of about 300 years. These layers were then compressed by a glacier from the south so they were piled up on top of each other like sheets roof tiles to its present height. Some of these processes occurred when the material was frozen. On top of these layers then thin layers of till was deposited by other ice streams (from NE). The material in the hills was then squeezed between the two ice streams (see fig. 55 below).

18. WHAT TO DO AND OBSERVE!

89. We will stop and get out of the bus to get a better view.
90. Locate the island of Ven if weather permits.
91. Note the specific coastal bluffs along the shores of Ven
92. Get an overall view of the hill system.
93. Note the archaeological sites.

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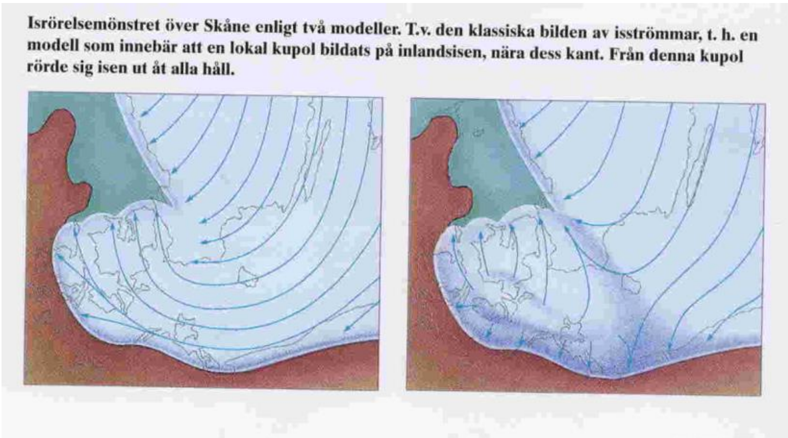

Figure 55. Two deglaciation models for Skåne and South Sweden

Stop 19. The Saxån River. A small stream with a deep and wide valley. (Optional stop)

Coordinates; 55°51'18.97"N 12°53'32.13"E
The Saxån River is a mediums size gentle river that empties into the Öresund a few miles southeast of the city of Landskrona. The main highway E6 crosses over the river on a high road bank so that you may have a beautiful view of the wetland delta area and the river estuary. The area is a very interesting bird area all year around and it is a Nature reserve. Anyone wishing to visit the area on foot, however, must make a significant detour from the road to Häljarp to reach the trails and watch towers of the area. The most peculiar feature with the Saxån River is that it has a submarine channel that can be followed 5-6 km out into the Sound. The coast here is very shallow and even at 3 km distance from the shore the depth is less than 1 m. From this shallow plateau the channel is widening from 20m to 150-180 m and its depth increases to 15 m where it enters deeper parts. Inland the valley is also more powerful than the present water discharge may indicate.
It is obvious that the Saxån valley cannot have been formed by the current water discharge and climate. Water's erosive forces ceases at sea level, which therefore must have been almost 15 m lower than at present when the valley was formed.
On the shallow sea floor in the Sound fixed roots of oak has been found in numbers. This proves that the sea once stood considerably lower than now. The water level changes were large with height difference of 15 meters during time when Skåne and Själland were linked with a land bridge. In the Baltic region this time called **preancylus** time. During this period forests grew far out on the Baltic seabed at many places along the Baltic coast. Accurate dating of these tree trunks has shown that 10, 000 years ago, the sea level rose by an average of one centimetre a year. It is not overwhelmingly fast but after two thousand years, it was 20 m in the Saxån River estuary deep channel area. This made the background to the formation of the Landskrona harbour, which is the only “natural” harbour in Skåne.

19. WHAT TO DO AND OBSERVE!

94. Just try to get a view and impression from the bus.

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SEN ÄR VI SNART HIMMA I LUNN IGEN!!

<u>Litterature</u>

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