Notes to the localities, map and photos

33. IGC Excursion 23

15. -17. August 2008

The Carboniferous – Permian Oslo Rift, The northernmost Rotliegendes and Variscan in Europe

Bjørn T. Larsen (DetNorske) , Snorre Olaussen (Eni Norge), and Bjørn Sundvoll (UiO)

Excursion 23. **The Carboniferous – Permian Oslo Rift, the northernmost Rotliegendes and Variscan in Europe**

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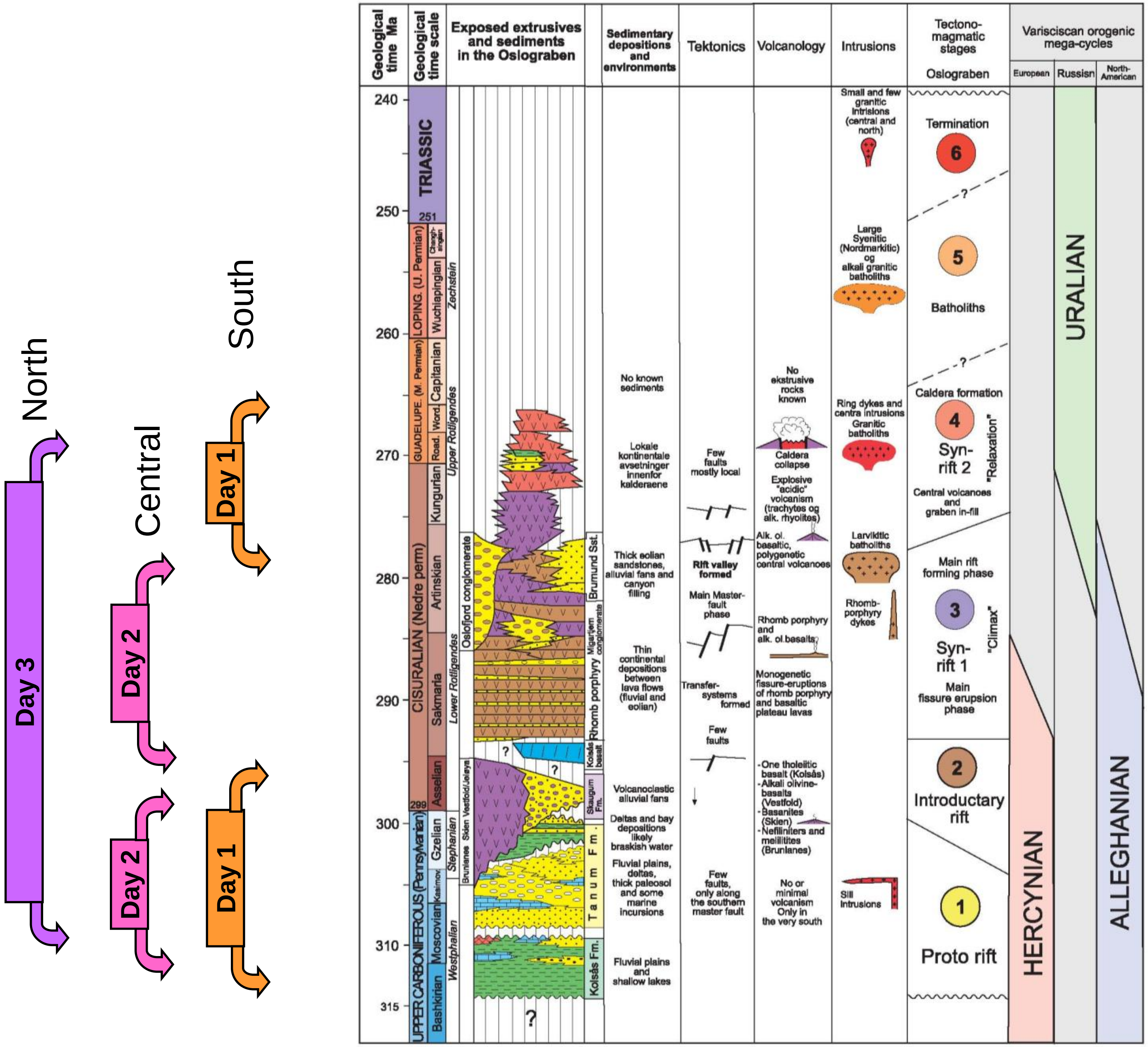
August 15. (Friday) – 17. (Sunday) 2008. Bus departure to Ringerike from Old University, Karl Johansgt. city center of Oslo at 08:00

Day 1:	**15.08.08**	***The central Oslo Rift. The Krokskogen lava plateau and the transfer fault***		
		Stop 1	Dronningveien, Hole	A section from the Asker Group sediments to the first volcanics, (basalt and rhomb porphyry lavas), Stages 1, 2 and 3.
		Stop 2	Retthelltjern, Hole	Rhomb porphyry lavas and sediments. (RP2 /3 sequence) Rift climax, stage 3
		Stop 3	Fjeldstadhytta, Hole	Rhomb porphyry lavas and sediments.(RP7 sequence) Rift climax, stage 3.
		Stop 4	Gyrihaugen, Ringerike	Canyon cut in the lava plateau, and filling of debris flows and lavas, stage 3
		Stop 5	N. Gaupeskard, Ringerike	Eolian and fluvial sandstones between lava flows. Initial rift, stage 2 Another section from the Asker Group sediments to the first volcanics.
		Stop 6	Vollgata, Hole	Large north-south striking rhomb porphyry dykes, fissure eruptions and plateau lavas, stage 3
			To Sundvolden hotel	
Day 2:	**16.08.08**	***Outer Oslofjord, the southern part of the Oslo Graben***		
		Stop 1	Jeløya north, Tangen	View from sea. Upper Carboniferous Asker Group. The forerunner to rifting
		Stop 2	Gullholmen, Jeløya	Basaltic lavaflow from the first stage of volcanism. Alkali olivine basalts.
		Stop 3	M. Sletter Island, Larkollen	Lower Permian conglomerates deposited as large alluvial fans along the Oslo Graben master fault on the eastern side of the rift. Rift climax, stage 3
		Stop 4	Ramvikholmen, Hurum	Alkali gabbro inrusions with layered gabbro structures. Rift relaxation, stage 4
			To Tofte, Bus back to Sundvolden	
Day 3:	**17.08.08**	***Caldera volcanoes and the northern part of the Oslo Graben***		
		Stop 1	The Krokskogen calderas, 1, basalts	Alkali olivine basalts in the Øyangen caldera. Example of a stage 4 central volcano
		Stop 2	The Krokskogen calderas, 2, Ring dyke	The syenitic ring dyke of the Øyangen caldera, explosive volcanism of stage 4
		Stop 3	Kistefoss, Jevnaker	Syenitic sill intrusions. The earliest magmatism in the Oslo Graben. Magmatism of stage 1, forerunner to rifting
		Stop 4	Brandbukampen, Hadeland	Small gabbro neck intrusions og stage 4. view to the master fault
		Stop 5	Reinsvoll, Toten	The northern master fault of the Oslo Rift, rift and fault polarity.
		Stop 6	Brumunddal	The sediments and the lavas in the northernmost segment of the Oslo Rift Thick eolian and fluvial Permian red-beds. Northern development of rift climax
			Return to Gardermoen and Oslo	



The Upper Palaeozoic stratigraphy of the Oslo Region. Units to be visited during the excursion

Day 3 The northern Oslo Graben

The Akershus and Rendalen grabens.

- Stage 1, Upper Carboniferous sill intrusions

- Stage 3, Rift climax, tectonic polarity changes, master faults, northward decrease in volcanicity, sediments filling the northern graben segment

- Stage 4, Large and small basaltic central volcanoes, explosive volcanism, caldera formation, small gabbro intrusions

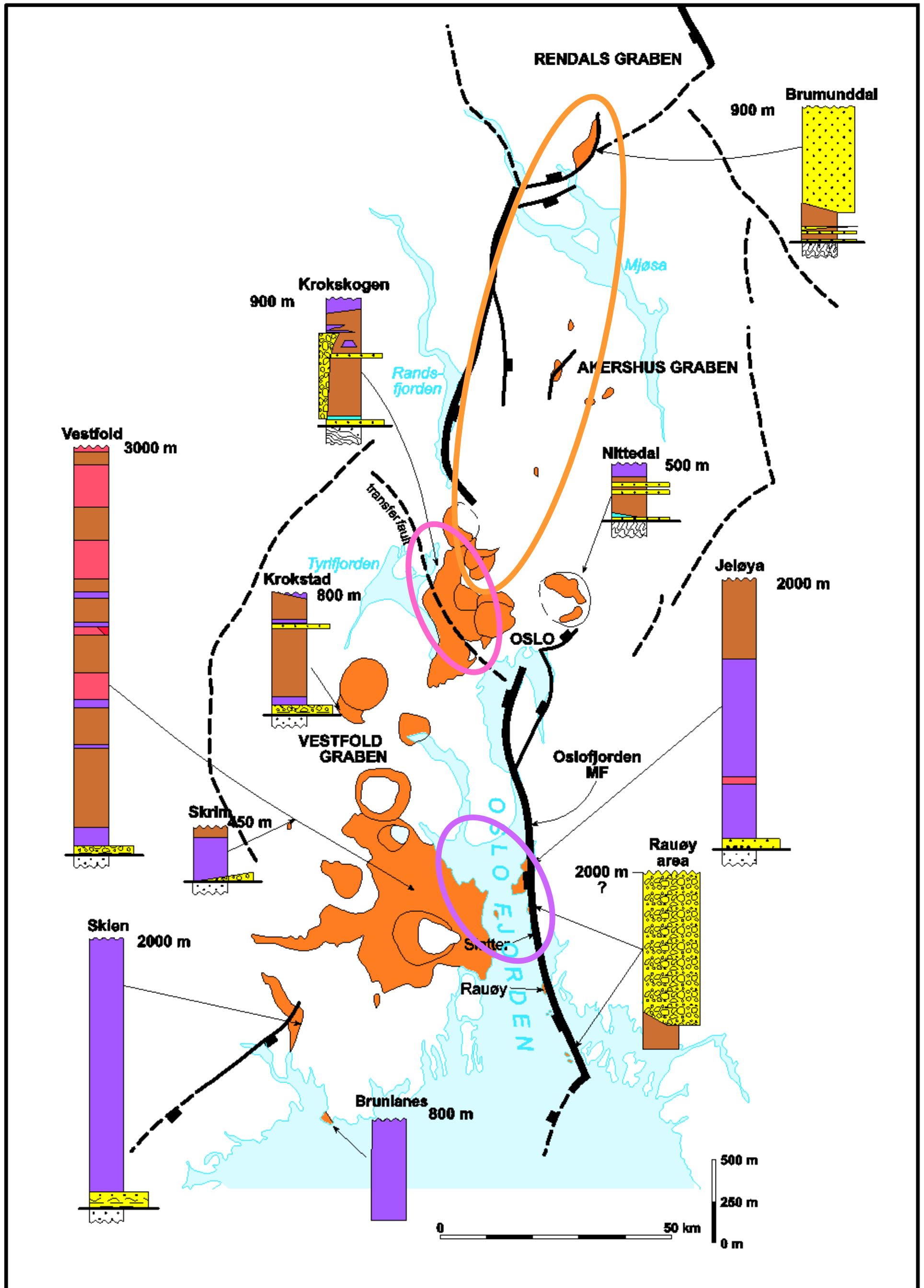
Day 2 The Krokskogen lava plateau

The central Oslo Rift and the transfer fault.

- Stage 1, The rift forerunner sediments, the Asker Group

-Stage 2, Rift introduction, the first basalts. Here one single tholeiitic basalt flow

- Stage 3, Rift climax, rhomb porphyry volcanism, canyon formation into the lava plateau



Day 1 Outer Oslofjord.

The south central part of the Oslo Rift.

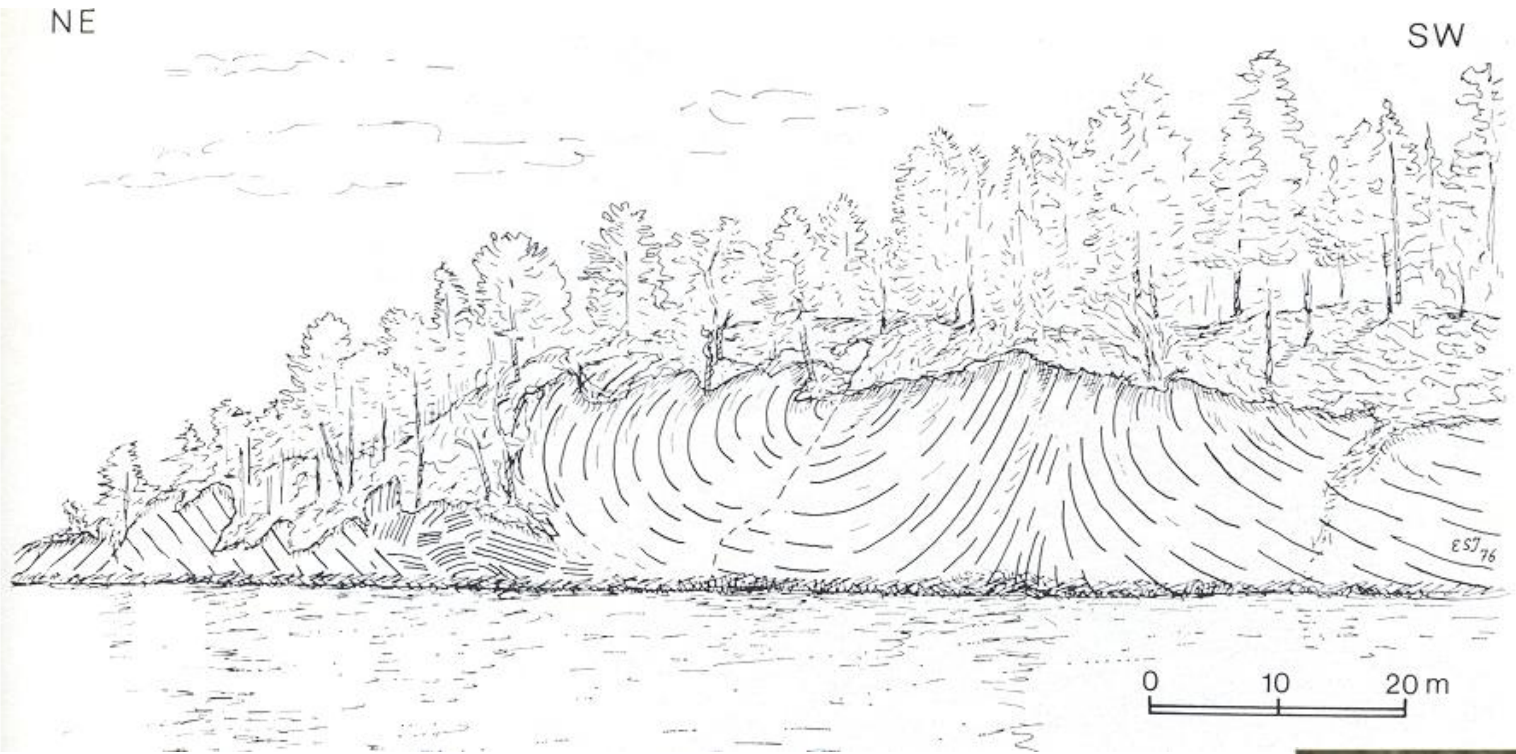
- Stage 1, The rift forerunner sediments, the Asker Group

- Stage 2, Introduction to rifting, the first volcanism, alkali olivine basalts

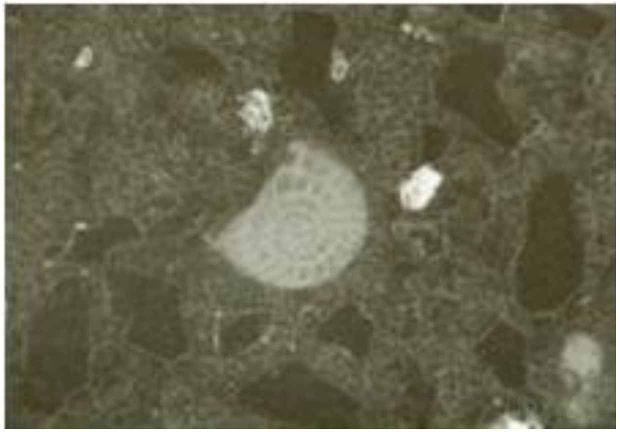
-Stage 3, the rift climax, the Oslofjord master fault, coarse volcanoclastic conglomerates in alluvial fans

-Stage 4, rift relaxation, small layered gabbro intrusions

Day 1 Stop 1. Tangen, Jeløya north. No landing, view from the ship
The Asker Group, The Upper Carboniferous sediments in the Oslo Graben



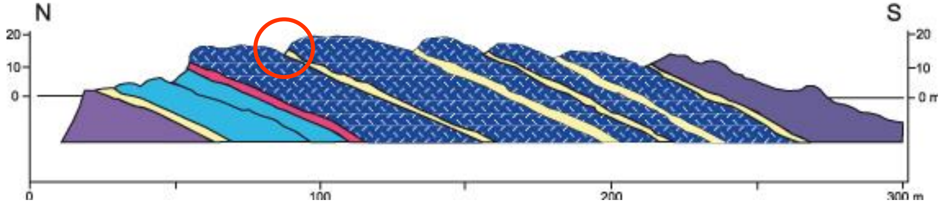
Brecciated and folded Ringerike Group sandstones (Upper Silurian) in Asker Group (Upper Carboniferous) debris flows at Tangen, Jeløya.
Sketch from E. Schou Jensen (1976)



Fusilinid in the Asker Group sediments at Jeløya, Olaussen 1980

Deposited on a hiatus surface, the Asker Group sediments initiate the Carboniferous/Permian geology in the Oslo Graben. Conglomerates and sandstones deposited in braided streams dominate, rarely marine incursions occur.

Day 1 Stop 2. Gullholmen, Jeløya. Alkali olivine basaltic lava flow with red sandstones interbedded. Stage 2, the introduction to rifting.

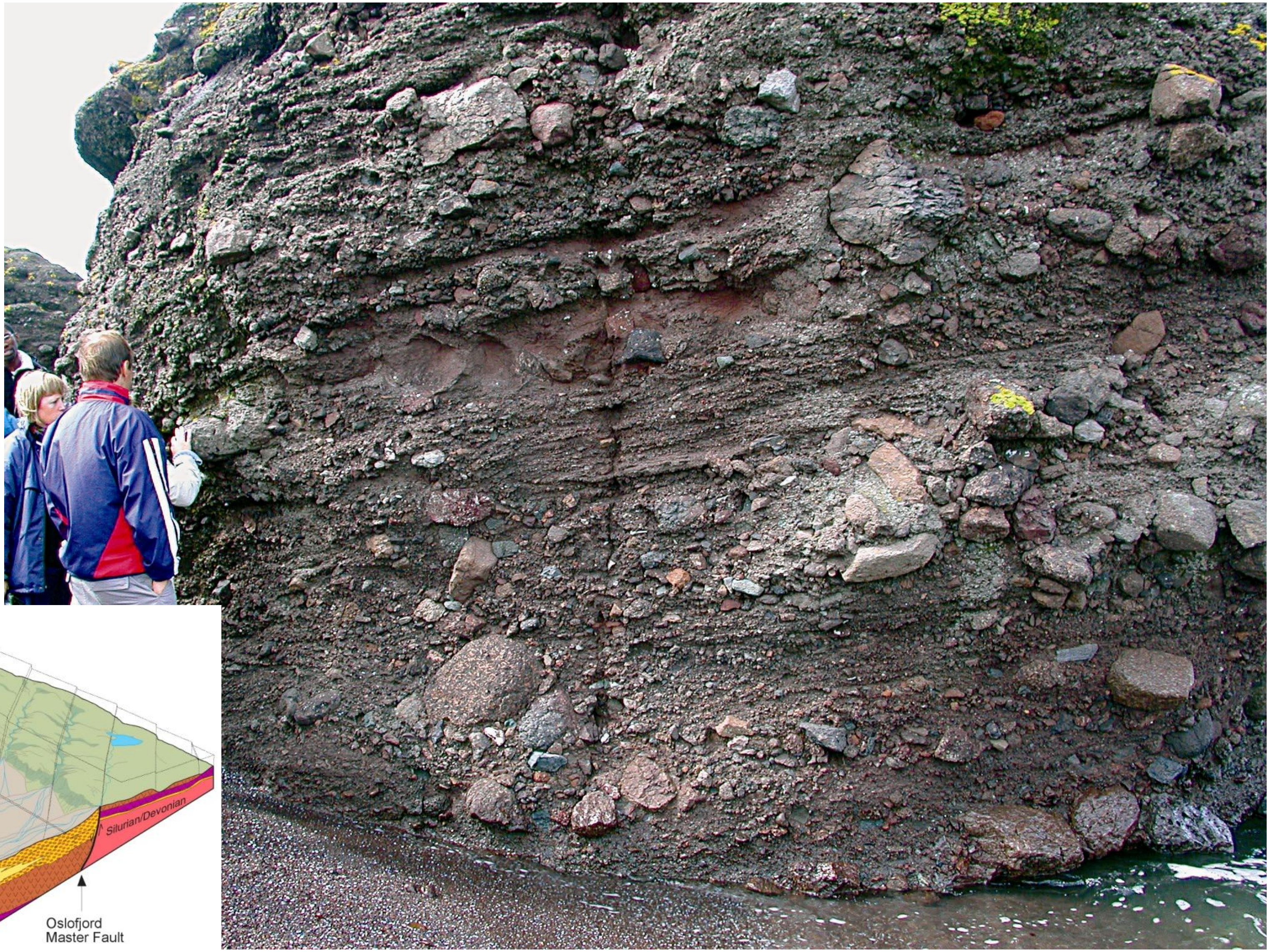


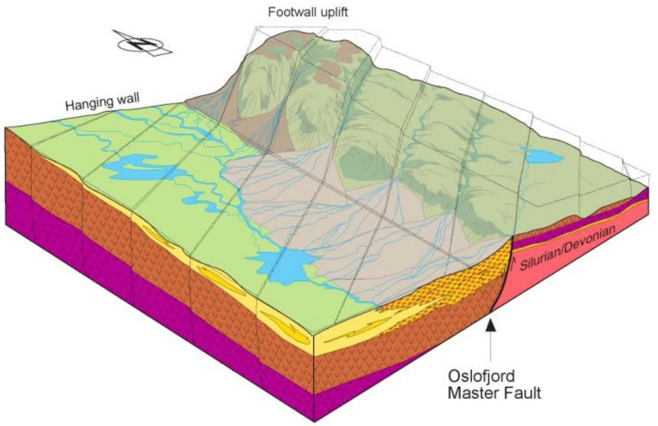
N-S profile across the small island of Gullholmen showing different types of basaltic lavas and thin sandstones. (from Schou Jensen & Neumann ,1988)

Interbedded thin eolian/fluvial sandstones between two alkali olivine basalt lava flows.

Basaltic lava flows with interbedded red sandstones. The basalts erupted during Stage 2, and have an alkali olivine basaltic composition, and these flows have clinopyroxene pheocrysts. The top surface of the flow shows pahoehoe structures. The red sandstones are partly eolian, partly fluvial.

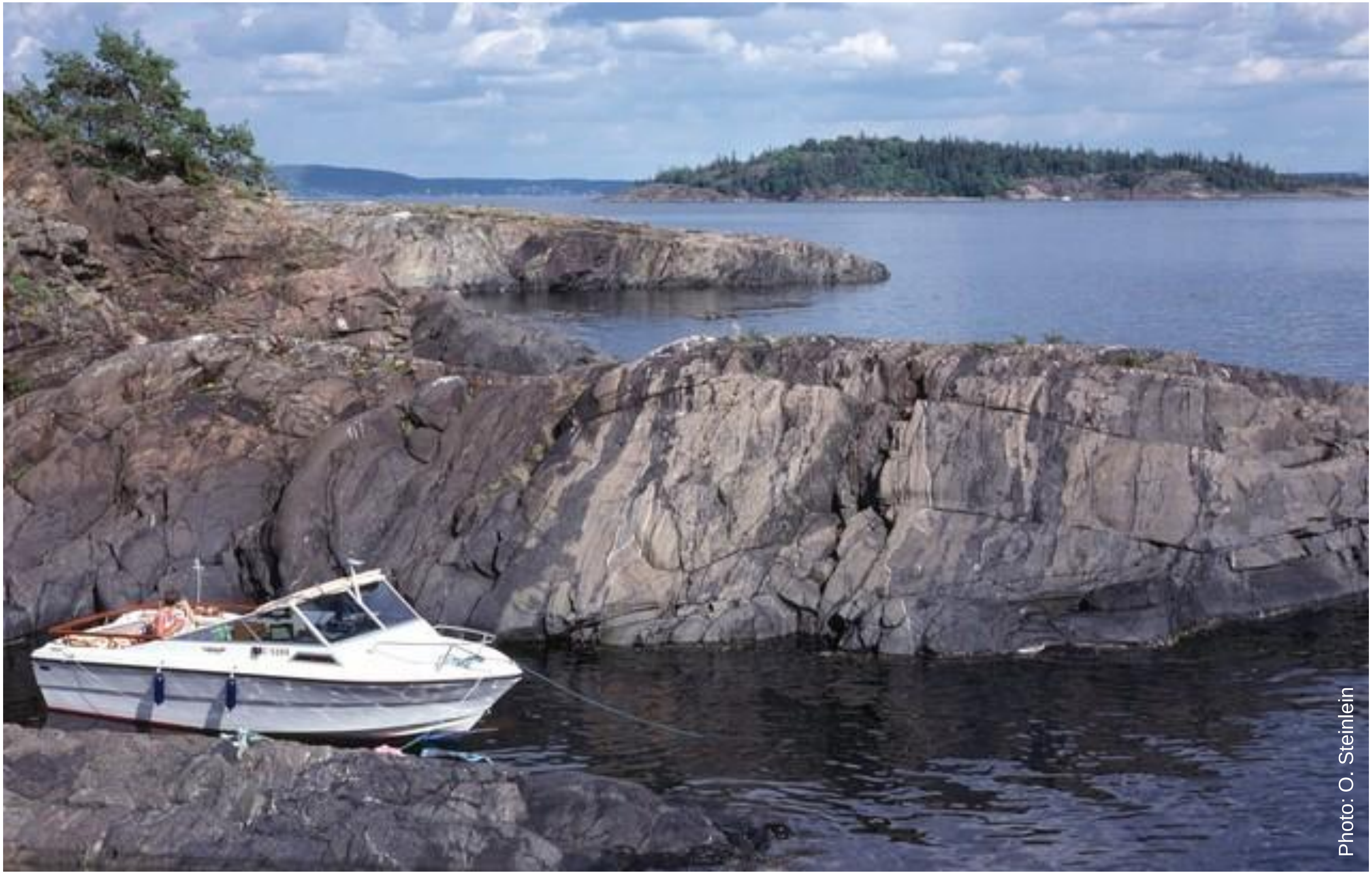
Day 1 Stop 3. M. Sletter island. Rift climax. Lower Permian conglomerates. Large alluvial fans along the east-bounding master fault of the Oslo Graben





Deposition of very coarse conglomerates are found all along the eastern side of the Oslo Fjord, representing alluvial fans along the eastern side of the rift. The conglomerates are volcanoclastic with about 70% rhomb

Day 1 Stop 4. Ramvikholmen. Small intrusion of alkali olivine gabbro with layered gabbro structures



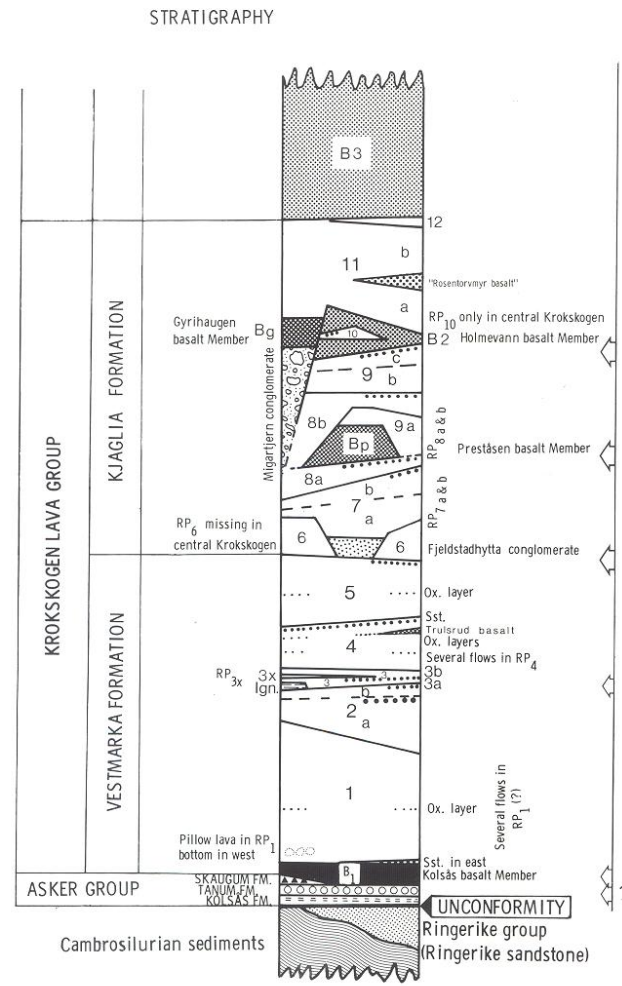
Small gabbro intrusions of only 0.5 to 2 km in diameter exists along tectonic lineaments in the Oslo Rift. The compositions are alkali gabbros, and they most likely represent small floored magma chambers below small central volcanoes. They intruded during stage 4.

Day 2 Stop 1. Dronningveien, Hole. The first sediments (Asker Group) and the first lavas (basalt and rhomb porphyry) in the central part of the Oslo Graben

Rhomb porphyry 1,
The first of the RP lava flows

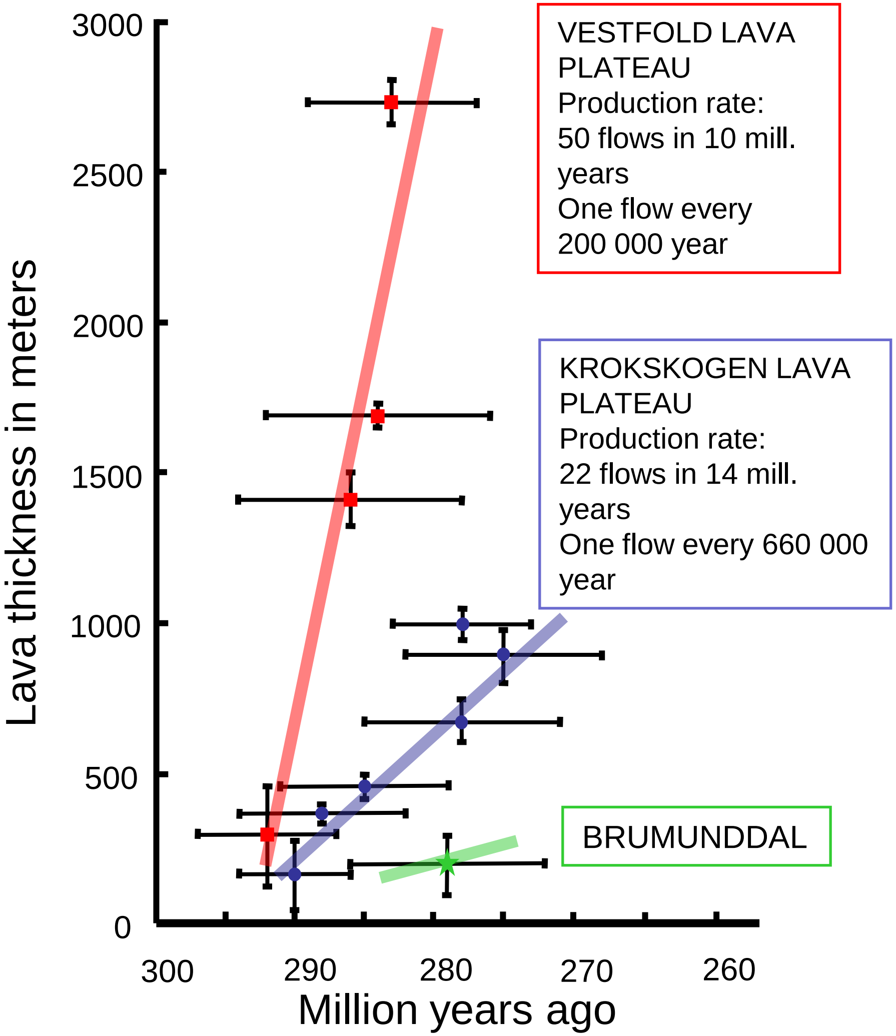
The Upper Carboniferous Asker Group sediments represents the forerunner stage to rifting (Stage 1). The two first formations, the Kolsås Formation and the Tanum Formation represent this stage, here seen as red mudstones with gypsym rich evaporites above (left) and quartz sandstones and conglomerates (right), on both sides of a normal fault with drag. Above the sediments are an unfaulted tholeiitic basalt flow. The Kjaglidalen-Krokkleiva transfer fault. Structural evidences of this transfer-fault are found as horizontal striations, and the large transfer-fault runs about 0.5 km to the south of us.

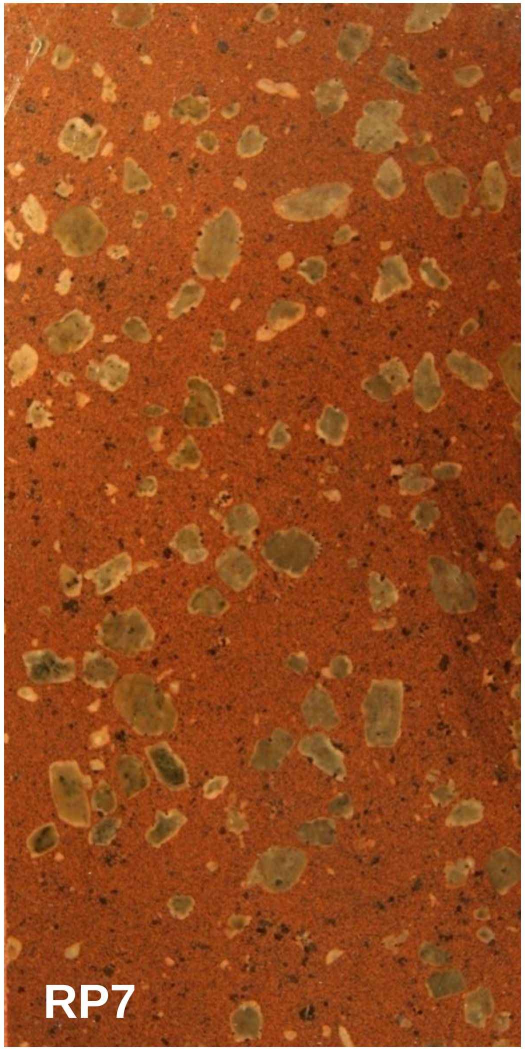
Day 2 Stop 2. Retthelltjern Rhomb porphyry lavas RP3 and sediments between the lavas



The rhomb porpyry (RP) lavas most likely erupted from large fissures. Most RP lavas look different from each other in the phenocrysts size, shape and number. Their volcanological appearance indicates a relatively low viscosity lava flow with no indications of explosive eruptions and pyroclastic debris.

Day 2 Stop 3. Fjellstadhytta Rhomb porphyry lavas RP7 and sediments below the lava



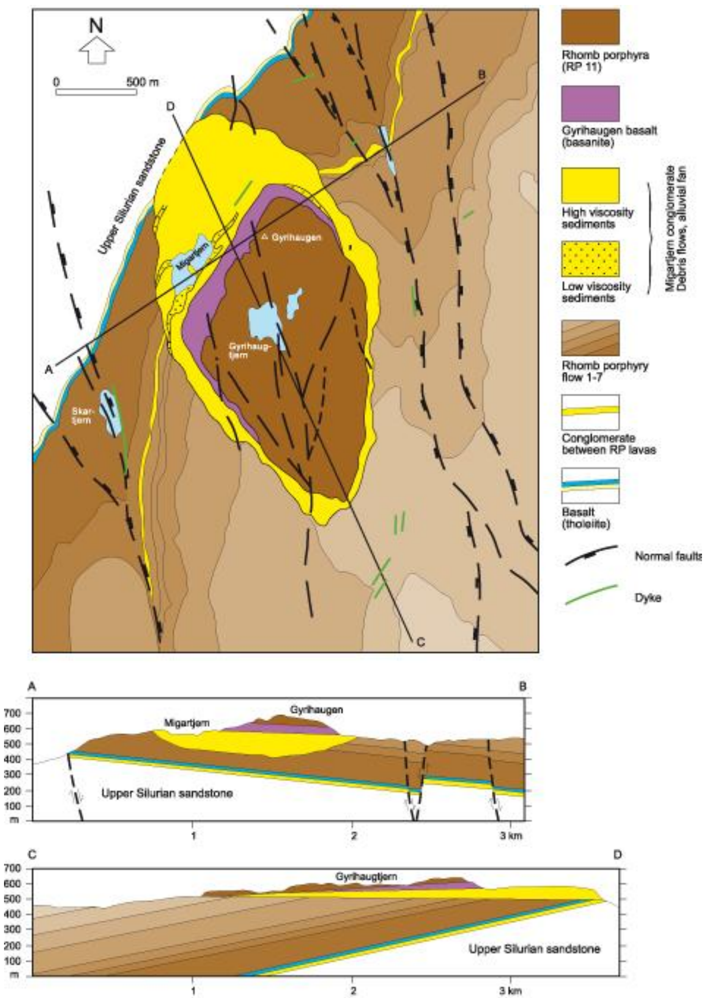


Rhomb porphyry flow 7, RP7

The long side is 20cm

Below RP7 at this location is a volcanoclastic conglomerate named Fjellstadhytta conglomerate. The eruption rate of RP-lavas are different in the three principal lava plateaus in the Oslo Graben. The first flow are the same over the central and southern part. The fist flow in the very north is much later. The production rate is more than three times higher in the south than in the central part.

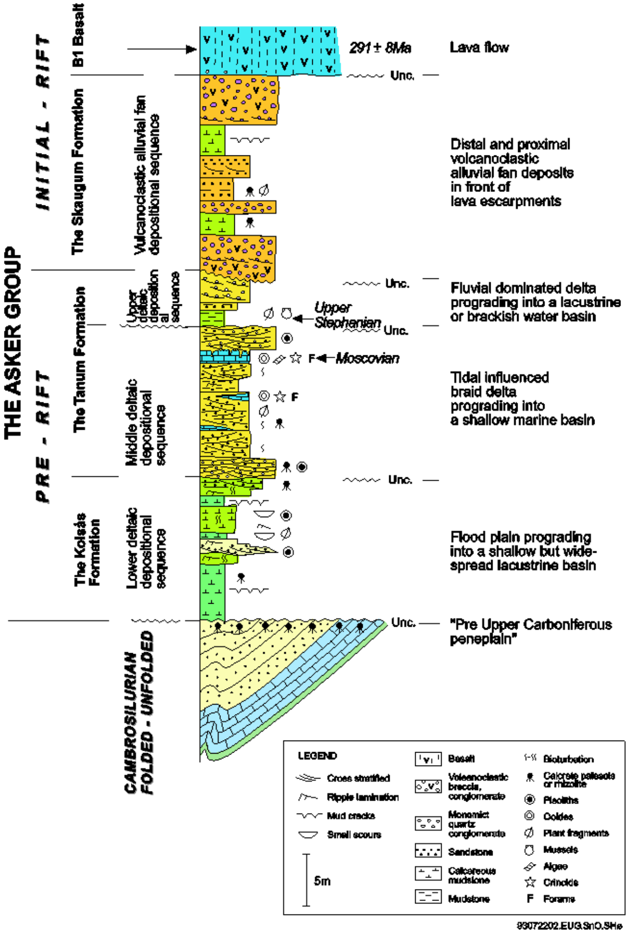
Day 2 Stop 4. Gyrihaugen A canyon cutting the lava plateau, and filled vith debris flows and lavas, both basalts and rhomb porphyry lavas



Large RP-boulder in a debris flow in the Migartjern conglomerate

In the Gyrhaugen area at Krokskogen a more then 500m deep canyon was cut into the lava plateau. This canyon was oriented towards NNW. A coarse conglomerate with purely volcanic clasts partly filled the canyon. The rest of the canyon fill was one basanitic basalt flow and the rhomb porphyry flow RP11.

Day 2 Stop 5. N. Gaupeskard The first sedimets (Asker Group) and the first lavas (basalt and rhomb porphyry) in the central part of the Oslo Graben

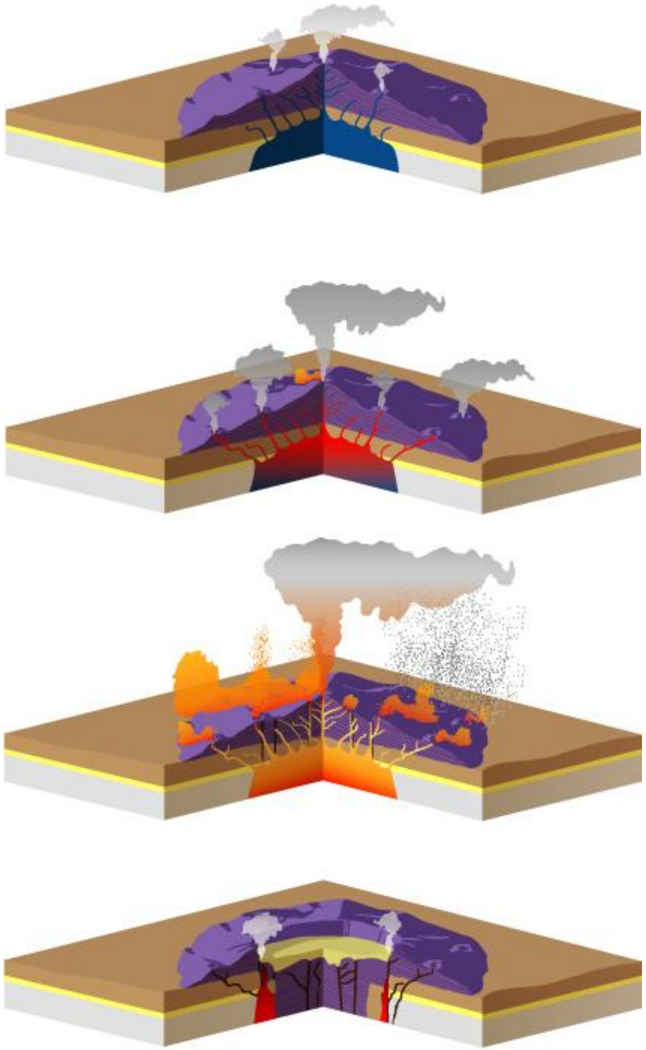


We return to the lowest part of the Upper Carboniferous/Lower Permian stratigraphy with the Asker Group sediments, the first basalt (here tholeiitic) and the first RP lava flow. The two contacts are well exposed and we clearly get the impression that the top of the Asker Group sediments is an erosional surface. In this location the the Tanum Formation is conglomeratic with some partly kartified non-marine limestones.

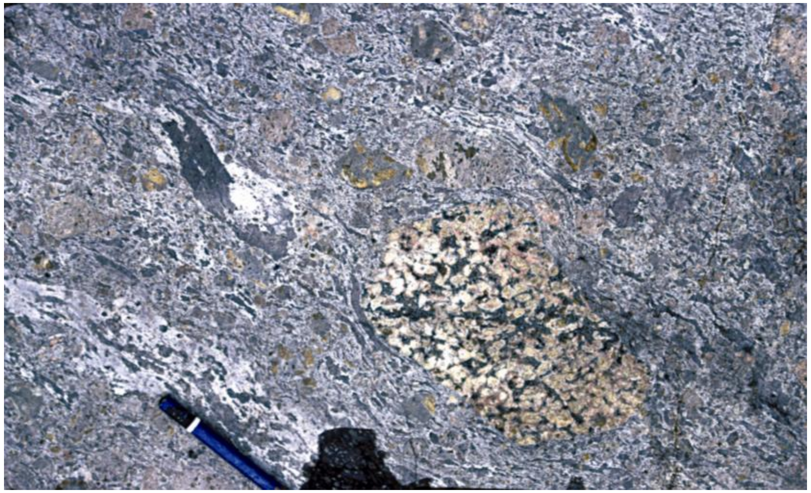
Day 2 Stop 6. Vollgata (short stop) Large inrusions of rhomb porphyry dykes

A 15-20m wide and NS-striking RP-dyke can be seen standing up like a wall in the terrain of Silurian sediments. Generally we assume that the RP lava-flows erupted as fissure eruptions from similar vents, and erupted as mono-genetic fissure eruptions. However, we can not link any of the flows to particular dykes, and our interpretation is that the dykes feeding the Krokskogen lava plateau are hidden below the lava-plateau itself.

Day 3 Stop 1. The caldera 1. Alkali basalt central volcano of stage 4 developed as large calderas erupting thrachytic explosive ignimbrites and tuffs during their collapse



Ignimbrite with lithic fragments, Oppkuven caldera



Air fall tuff, Øyangen caldera

The Øyangen caldera is one of about twenty calderas in the Oslo Graben. Their diameters are from 6 to 12 km, and most of them started as basaltic central volcanoes (mostly as alkali olivine basalts) during stage 4, the relaxation stage.

Day 3 Stop 2. The calderas 2 Central pluton and ring dyke intrusions late in the formation of calderas

In this caldera the ring dyke and the central intrusions are grey medium grained syenites often with flow banding

After a long history of maturation of the magma chamber below the central volcano, fractional crystallization caused a differentiation of the magma and formed a felsic and gas-rich upper level that finally exploded and the caldera collapsed. After the collapse ring-dykes and central-domes formed with the same composition as the explosive trachytes.

Day 3 Stop 3. Kistefoss, Jevnaker. Upper Carboniferous sill intrusions from Stage 1, the forerunner stage to rifting.

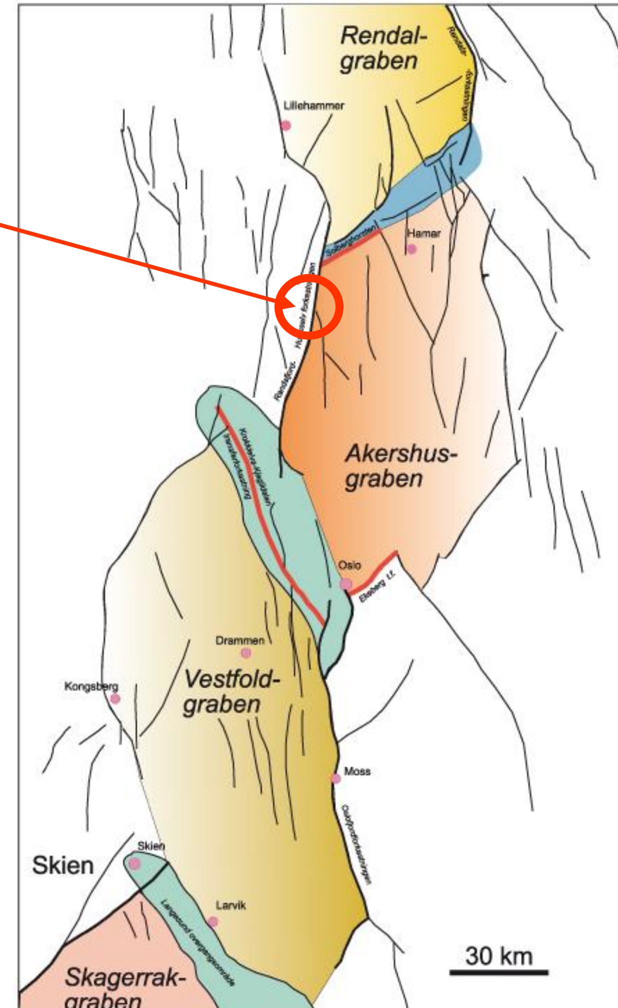
Stage 1 (the forerunner stage to rifting) is not only shown as sediments. At a depth of about 1 km deep below the surface sills intruded. These sills are either of felsic or mafic composition. At Kistefoss we see a good and typical example of felsic sills (called maenaites) intruding into Middle/Upper Cambrian black shales (the Alum Shale Formation)

Day 3 Stop 4. Brandbukampen, Hadeland (View) A string of five small NS-striking gabbro intrusions at Hadeland are the type examples of the Stage 4 gabbro intrusions

At Hadeland we again can see the small gabbro intrusions. There a string of five small inrusions can be seen rising as steep hills from the sedimentary host rock surface. The five inrusions form a curved NS-line, more or less following the trend of the Oslo Graben structure. The gabbros were emplaced during the saqme stage as the large calderas were formed, during Stage 4.

Day 3 Stop 5. Reinsvoll, Toten The graben master fault of the Akerhus Graben follows the western side of the graben along the river Hunnselv, and is named the Randsfjorden – Hunnselv master fault

Red Silurian shales of the Reinsvoll Formation on the downfaulted eastern side of the Randsfjord – Hunnselv fault



The western boundary fault of the Akershus Graben follows a prominent scar in the terrain, either along the southern part of lake Randsfjorden, or along a river called Hunnselv running into lake Mjøsa at the town of Gjøvik. The Akershus Graben has an opposite polarity of faulting to both the grabens in the south and in the north.

Day 3 Stop 6. Brumunddal Eolian and fluvial sandstones deposited on top of four RP lava flows in the Rendalen Graben in the north of the Oslo Rift

The sandstones of the Brumund Formation occur in the upper part of a lava – sandstone group, the Brumunddalen Group. The lava part below the sandstones is named Bjørgeberget Formation and consists of four RP lava flows. The eruptions of RP-lavas in the north started most likely about 10 m.y. later than in the south.