Excursion 2

Nittedal Cauldron (Alnsjøen Area)

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The Alnsjøen area forms the southern sector of the Permian Nittedal cauldron (Naterstad 1971) (Fig. 1). The cauldron structure has a diameter of 11–12 km with a subsidence of 800–1000 m along a ring fault. It cuts through the Precambrian gneissic basement, the folded Cambro–Silurian sequence and the lavas and plutonic rocks of Permian age.

An initial sinking, followed by the later rise of a central nordmarkite pluton which destroyed the western part of the cauldron, forced the Alnsjøen supracrustals into a marked synclinal structure along the cauldron rim. In the Alnsjøen area we find the youngest caldera fill material. A schematic presentation of the various sediments and extrusive and intrusive products found within and adjacent to the cauldron, and of the suggested processes involved, is shown in Fig. 2.

Road log (Excursion 2)

1. Road-cuts north of Ammerud subway station (connection to centre of town).
   Here one meets an elongated pluton of ordinary syenite, the Grefsen syenite, which occupies the site of the former ring dyke. Two varieties of the syenite occur: one even-grained, coarse to medium-grained type, and one porphyric type with phenocrysts of grey plagioclase. In the syenite there are numerous xenoliths of the cauldron's wall-rock types. In this area one mostly finds hornfelsed Cambro-Silurian sediments partly assimilated by the syenite.
2. Road-cut with one of the larger xenoliths of metamorphosed Cambro-Silurian interlayered shale and limestone.
3. Intrusive contact between the Grefsen syenite and the Alnsjøen supracrustals. A series of north-dipping porphyritic basalt flows (lava from the 'B_3' central volcano stage, Fig. 2) are cut and slightly metamorphosed by the syenite.
4. Sediments, tuffs and agglomeratic zones are frequently found between the flows of porphyritic basalt building up this complex. At this locality two typical representatives of the numerous late (Triassic?) diabase (dolerite) dykes are also seen.
5. The Alnsjøen supracrustals are offset by numerous faults. Dykes have intruded along some of these. At stop 5 a syenite porphyry dyke has

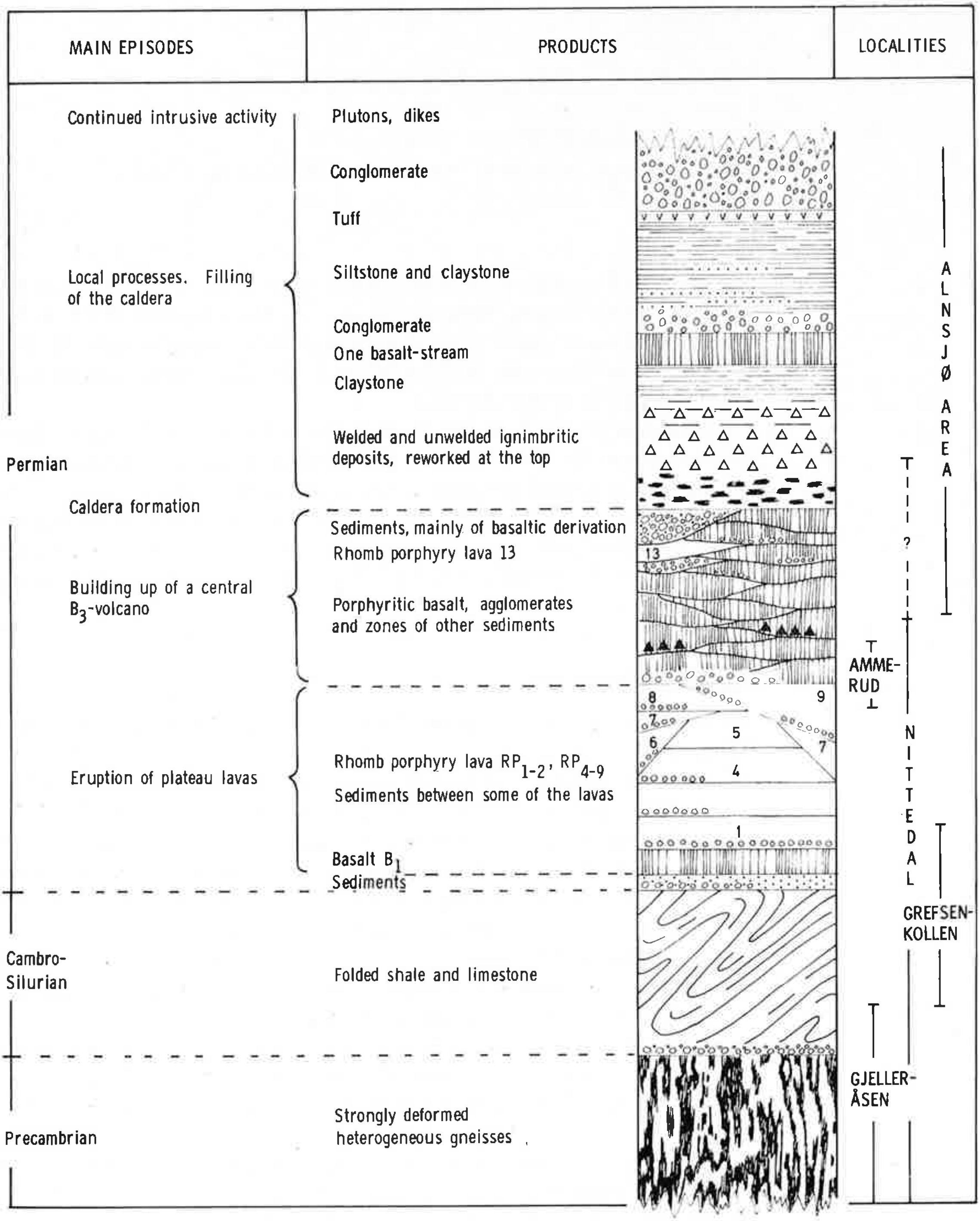

Fig. 2. Diagrammatic representation of the main episodes and the various sedimentary, extrusive and intrusive products found within and surrounding the Nittedal cauldron.

intruded an extensive fault zone. The dyke is completely altered by late hydrothermal and pneumatolytic activity to a dense greenish rock consisting of quartz and white mica.

6. Structural details in the porphyritic basalt and a representative of the numerous lamprophyric dykes of the area can be studied in cuts along the forest road just north of the road-bar at the parking lot.
7. When the main eruption of porphyritic basalt came to a halt, erosion set in. Alkali-rhyolitic ignimbrite and breccia was then emplaced during the ensuing caldera formation, covering the erosional products and the topographic features formed. Observations around the small depression west of the road at locality 7 are interpreted as showing a section through a small Permian valley carved in the porphyritic basalt. Talus, sand and silt in the former valley bottom and basalt in the valley sides was covered by very densely welded ash-flow tuff (rhyolitic ignimbrite) at the time of caldera collapse.
8. Along the road one can see brecciated porphyritic basalt in a SW-NE striking fault zone. Where the road turns north again, probable feeder dykes of more coarsely porphyritic basalt (marked B in Fig. 1) cut through the basalt lavas.
9. In the basalt there are offshoots of nordmarkite porphyry from the main nordmarkite massif to the north. At the same locality a representative of the alkali–granitic grorudite dykes (marked G in Fig. 1) may be seen (cf. stop 16). Along the northern side of the road a diabase dyke rich in xenocrysts may be studied. The road between stops 9 and 10 runs close to the contact between nordmarkite and basalt. Mylonite zones in the fine-grained nordmarkite porphyry parallel to the contact testify to movements in the area even after solidification — perhaps as the magma of the central pluton still forced its way upwards.
10. Typical nordmarkite.
11. In older days, several copper mines have been worked on mineralization along a NE–SW fault zone in volcanic breccia similar to the ignimbrite of stop 7, but unwelded.

    Near the contact between this breccia and the nordmarkite a spherulitic texture has developed in the fine-grained nordmarkite porphyry. This rock-type is exposed in a small road-cut just northeast of the first mine.

    In the Alnsjøen area the top of the acid ignimbrite/breccia deposit was reworked and levelled out and a laminated siltstone or claystone appears above it (cf. Fig. 2). This marks the beginning of a relatively quiet period of sedimentation, probably in lakes dammed inside the southern caldera walls. The sequence of 70–100 m of silt and clay sediments contains one single flow of aphyric basalt. At a marked bend in the road just west of stop 11 these relations can be studied in a road-cut. The rocks are strongly contact-metamorphosed by the nordmarkite.
12. From the bend and southwards the road runs along a rather complex fault-zone that offsets the whole series mentioned above. A couple of late lamprophyric dykes (L in Fig. 1) may be seen to cut the fault.

13. Along the footpath leading from the road eastward to the lake Alnsjøen the red siltstone and claystone deposits above the aphyric basalt are seen to be cut by several dykes.
14. At the western end of the Alnsjøen lake one can observe the aphyric basalt overlain by a conglomerate with pebbles derived from the scoracious top of basalts.
    Stop 14 may also be reached by a footpath leading south from stop 11 along a marked scarp made by the basalt. A remarkable decrease in contact metamorphism is observed as one moves away from the nordmarkite. The black shale below the basalt west of stop 11 gradually attains a more reddish colour away from the contact and becomes brick-red at the lake. The more extensive contact metamorphism at the nordmarkite contact compared with the Grefsen syenite contact in the south, probably reflects differences in intrusion mechanisms and cooling histories of the two plutons.
15. From stops 13 and 14 the excursion continues west along the road to the bend just south of stop 15 where a footpath leads north up to the top of the hill Storhaug. All the way up to a small ledge just below the hilltop one walks on the fine-grained red sediments. The ledge marks a rather drastic change in sediment type; the fine-grained sediments give way to coarse gravelly sandstones and conglomerate at the top. A deposit of light grey ash-fall tuff can be seen cropping out between the two sediment types if one follows a small side path 50 metres to the west from the ledge. The tuff probably marks a drastic volcanic episode in the caldera leading to the change in relief responsible for the formation of the conglomerate.
16. One of the larger grorudite dykes. A dense felt of acicular crystals of aegirine growing through the texture of alkali–feldspar and quartz makes the rock very tough even in thin slices, a property discovered by pre-historic man who used this rock-type to make implements.
    From stop 16 one can end the excursion either by taking the easternmost of the two forest roads down past the quarry north east of Stig (see description to excursion 1, this publication) and take a bus to the city centre, or continue north from stop 16 out into the nordmarkite at Linnerudkollen and get a bus from Solemskogen.
    A third possibility is to take the westernmost forest road south past stop 17 to the fork, and immediately after the sharp south bend take to the footpath leading over to and along the west side of the small lake Trollvann. From the northern end of the lake one takes the road up along the ski-lift to the top of Grefsenkollen where one meets the locally highest part of the sequence outside the cauldron.
17. By passing out of the southern part of the cauldron one crosses some ring dyke-like syenite porphyries separating narrow screens (fault lamellae) of wall rock. The outermost screen consists of a conglomerate that might represent a lamella of the talus formed along the former caldera wall to the south.

18. In the small hill immediately south-east of the restaurant 'Grefsenkollen' and also just south of the parking lot one meets the lowermost of the rhomb porphyry lavas, the RP_1, truncated to the north by Grefsen syenite.
19. Below the RP_1, separated from it by a thin zone of quartzite, appears the basalt B_1. This is easily seen either in the path at stop 19 or on the east side of the forest road winding down the hill from the parking ground.
20. The basalt B_1 overflowed Permian sand and gravel deposited on an erosional surface cut in folded Cambro–Silurian shales and limestones. Due to contact metamorphism the Permian sediments now appear as quartzites and conglomerate and the Cambro–Silurian rocks as hornfelses. A syenite sill has intruded the Permian deposits.
    In the hillside south of Grefsenkollen a series of north dipping syenitic cone-sheets cuts the Cambro–Silurian sediments. Another set of cone-sheets cuts the Alnsjøen supracrustals in the area east of Linnerudkollen. The two sets are similar but may belong to different stages in the magmatic evolution of the cauldron. The northern set, which is the younger one, is probably associated with the rise of the central nordmarkite pluton.

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