Bergvesenet
Postboks 3021, 7002 Trondheim

Rapportarkivet

Bergvesenet rapport nr	Intern Journal nr	Internt arkiv nr	Rapport lokalisering	Gradering
BV 3733			Trondheim	
Kommer fra ..arkiv	**Ekstern rapport nr**	**Oversendt fra**	**Fortrolig pga**	**Fortrolig fra dato:**

Tittel

A structural analysis of multifolded metasediments within the Rødingsfjel Nappe in the Central Scandinavian Caledonides, Nordland, Norway

Forfatter	Dato	Bedrift
Larsen, Poul-Henrik Olsen, Steffen Bjørn	1984	Bleikvassli Gruber A/S

Kommune	Fylke	Bergdistrikt	1: 50 000 kartblad	1: 250 000 kartblad
Hemnes	Nordland	Nordlandske	19261	

Fagområde	Dokument type	Forekomster
Geologi		
Råstofftype	**Emneord**	
Malm/metall		

Sammendrag

BV3733 USB Boks 34

DET KONGELIGE INDUSTRIDEPARTEMENT

KONTOR: AKERSGT. 42 - TLF. 11 90 90 - RIKSTELEFONER OG FJERNVALG TLF. (02) 41 90 10
POSTADRESSE: POSTBOKS 8014 DEP., OSLO 1 - TELEX 17241 NSBDP N - TELEFAX 11 60 03
BERGVERKSKONTORET

Undersøkelse av statens berg-
rettigheter
Postboks 3006

7001 TRONDHEIM

30/10 84
G.G

Deres ref.	Vår ref. (bes oppgitt ved svar)	Dato 29.10.84
USB 61/84	ID 4976/84 S AP/LM	

A/S BLEIKVASSLI GRUBER - HÅNDGIVELSESAVTALE AV 21. NOVEMBER 1978 (AVTALE NR. 60). SPØRSMÅL OM NY AVTALE

Deres brev av 19. september 1984 (Heading og første avsnitt gjaldt Bergverkselskapet Nord-Norge, mens resten av brevet gjaldt A/S Bleikvassli Gruber).

.//. Vedlagt følger kopi av brev av 15. oktober 1984 fra A/S Bleikvassli Gruber med bilag. Selv om sluttrapporten (nr. 8308) ennå kan la vente på seg en tid, er vel saken nå såpass avklart så avtale for en ny femårs periode kan inngås.

Hans Im. Ross

Arne Parmann

A/S BLEIKVASSLI GRUBER

Hovedkontor:
Essendropsgt. 5
Postboks 5250, Maj. Oslo 3
Telefon 02/466860

Telegramadr.: Sinkmalm
Telex: 11179 sydv n
Bankgiro: 5001.05.01005

Bedriftskontor:
8647 Bleikvasslia
Telefon: 087/96101

S. 310.01

Det Kongelige Industridepartement
Bergverkskontoret
Postboks 8014 Dep.

OSLO 1

04976 17.OKT84

Deres ref.: ID 4554/84 S AP/LM Deres brev av:

Vår ref.: AK/IC S-61g

Bleikvasslia, 15. oktober 1984

HÅNDGIVELSESAVTALE AV 21. NOVEMBER 1978. (AVTALE NR. 60).

Vi kan bare beklage at oversendelsen av kopier av den siste rapporten, intern rapport nr. 8308, vil bli ytterligere forsinket, men vi forventer at disse vil være ferdig kopiert i løpet av november 1984.

Intern rapport 8119 av P.H. Larsen & S.B. Olsen, 1981, er imidlertid erstattet av et endelig manuskript: "A structural analysis of multifolded metasediments within the Rödingsfjell Nappe in the central Scandinavian Caledonides, Nordland, Norway", by P.H. Larsen & S.B. Olsen. (Intern rapport nr. 8123). 2 kopier av dette manuskript følger vedlagt.

De interne rapporter 8123 og 8308 gir de siste undersøkelsesresultater, og er således representative for vår forståelse av området de behandler. Disse rapporter kommenterer og delvis sammenfatter tidligere rapporter.

Vi går ut fra at kopi av følgende rapporter fra før 1978 finnes i Bergarkivet:

I.B. Ramberg 1967 (NGU 240).
I. Lindahl (Diplomoppgave 1968).
K. Rieck 1969 (Dissertation Clausthal).
NGU-rapport nr. 1515.

Med hilsen
for A/S Bleikvassli Gruber

U. Smith-Meyer

Aart Kruse

Vedlegg: 2 kopier av intern rapport nr. ~~8308~~ 8123
Kopi: A/S Bleikvassli Gruber, Bleikvasslia.

A structural analysis of multifolded metasediments within the Rödingsfjell Nappe in the central Scandinavian Caledonides, Nordland, Norway.

Poul-Henrik Larsen & Steffen Bjørn Olsen, Institute of General Geology, Øster Voldgade 10, DK-1350 Copenhagen K.

Abstract

The structural evolution of the Bleikvassli area, situated within the southernmost part of the Rödingsfjell Nappe, is described. The evolution, in contrast to earlier interpretations, comprises four episodes of folding (F_1-F_4) and two episodes of major thrusting. Transverse E-W trending tight to close fold structures developed during the F_1-F_3 fold episodes and only during the last fold episode (F_4) were these structures refolded by folds parallelling the present mountain chain.

The Helgeland Nappe is shown to have been emplaced on top of what came to be the Rödingsfjell Nappe in the period immediately before or during the third fold episode. Both nappes later acted as one coherent unit, the Helgeland--Rödingsfjell Thrust Nappe, which during late Caledonian eastward thrusting was emplaced upon the Seve-Köli Nappe Complex.

In accordance with recent structural studies around Mo i Rana, the F_2-F_4 fold episodes are correlated with the Caledonian orogeny, while the earliest fold episode (F_1) is ascribed to the Sveconorwegian orogeny, suggesting a Precambrian age for the metasediments.

As part of the prospecting programme around Bleikvassli Pb-Zn mine (Vokes 1963), Nordland, Norway, initiated by the A/S Sydvaranger mining company, new detailed mapping (1:5.000) has been carried out during the three field seasons (1979-1981). Areas of great structural complexity have been selected for special study, which has lead to the proposal of a new structural model involving four successive episodes of folding and two episodes of major thrusting. The new model requires a reinterpretation of the regional geological map (Ramberg 1967) and it seems to agree with recent structural studies carried out within the Rödingsfjell Nappe farther to the north around Mo i Rana (Graversen, Marker & Søvegjarto, in prep.).

Geological setting

The Bleikvassli area is situated within the southernmost part of the Rödingsfjell Nappe, which together with the overlying Helgeland Nappe to the west and southwest forms the highest tectonic units within the central Scandinavian Caledonides (Gustavson 1978). Both nappes consist of high grade metamorphic rocks, while the underlying tectonic unit, the Seve-Köli Nappe Complex, generally comprises low-medium grade metamorphic rocks (Gustavson 1978).

The area in consideration is mainly built up of metasediments together with basic and granitic igneous rocks metamorphosed under amphibolite facies conditions. Ramberg (1967) subdivided the rocks into two lithological groups: The Anders-Larsa Group and the Kongsfjell Group, separated by a minor thrust passing close to the Bleikvassli Pb-Zn mine (figs 1, 2). The Anders-Larsa Group is dominated by dolomite and calcite marbles, garnet-mica schist and amphibolite. The Kongsfjell Group is composed mainly of garnet--mica schist, calcareous mica schist and amphibolite, marbles being subordinate.

The geological map (fig. 2) is based on Ramberg (1967), but due to the recent work it is revised in the northern part and in a few other places. Contours at 150 m intervals have been added to facilitate the reading of the map.

The detailed mapping and observations on single outcrops have revealed interference patterns showing isoclinal F_1 folds being refolded by close F_2 fold structures. Stereographic plotting of structural data shows that the F_2 axial surfaces were folded during a later deformation (F_3) resulting in large scale close, inclined folds of km-size (Larsen & Olsen, in prep.).

The axial traces of the west-plunging F_3 folds are shown in the geological map (fig. 2). The axial surfaces dip towards the west and strike about 15°. The dip is greatest in the western part of the area, about 25°, decreasing towards east to about 10° at Rössvassbukta. Immediately east of the lake Rössvatnet the axial surfaces are probably nearly horizontal. This variation is due to a fourth folding episode (F_4), during which the F_3 structures are weakly deformed by open, upright folds with subhorizontal NNE-SSW orientated fold axes. However, these are of a regional scale and within this area can only be distinguished by the variation of the F_3 axial surfaces (fig. 2).

The orientation of the F_3 fold axes changes in accordance with the F_3 axial surfaces from about 270 25 in the western part of the area to about 270 10 at Rössvassbukta. The direction of plunge of the F_2 folds varies from 240° to 315°, the plunge being gentle to moderate.

The F_1 folds show the greatest variation of orientation which is due to the highest degree of refolding. Generally the direction of plunge is in the range 180°-360°, the plunge being gentle to moderate.

It is now possible to reinterpret the regional geological map (fig. 2) and to establish a new structural model involving four successive episodes of folding.

The structural model

To illustrate the structural model a profile covering the Kongsfjell area and the area to the south has been constructed perpendicular to the west-plunging F_3 fold axes (figs 2, 3a). By building up the profile fig. 3a from a series of subprofiles, the effect of the variation in plunge of the F_3 fold axes and the influence of the F_4 fold episode have been eliminated. The profile is orientated north-south and is viewed in the plunge direction of the F_3 fold axis, i.e. from east to west. The irregular traces of the F_3 axial surfaces in the map (fig. 2) are caused by topographic effects, while in the profile (fig. 3a) they appear as straight lines. To simplify the profile it is drawn somewhat schematically and the recumbent (inclined), close F_3 folds are shown as open structures. This allows an easier comparison of the profile (fig. 3a) and the map (fig. 2).

Like most profiles constructed in multifolded areas, the profile in fig. 3a is something of a comprimise, and there are inaccuracies in detail. F_1 and F_2 structures have been projected parallel to the F_3 fold axes into the profile, although the older fold axes are not parallel to the F_3 fold axes. The older structures should in fact have been folded around the younger axes during the projection from the map into the profile. The error is greatest for the oldest structures (F_1) and especially those situated farthest from the profile. Also the topography in part reinforces the inaccuracies in the presentation of the older structures because the topographic correction in fig. 3a is valid only for projections of the F_3 folds.

The profile in fig. 3a shows the F_3 folds and the refolded older structures. The traces of the F_2 and F_3 axial surfaces have been added. In relating the profile fig. 3a to the map fig. 2, the northern central part of the profile includes the Kongsfjell area, while the southern part corresponds to the area around the lakes Tustervatnet and Rössvatnet. The structure underneath the lowest F_3 axial surface in the profile is situated partly outside the geological map (fig. 2), but according to the structural model, this structure should be found in the area north and east of Rössvatnet.

An attempt to reconstruct the F_2 folds is shown in fig. 3b, where the effects of the F_3 folding have been eliminated. This reconstructed profile is also schematic and is orientated north-south and viewed in the direction of plunge of the F_2 fold axis, i.e. towards the west.

The rather long closed structure in the southern part of fig. 3b is a cut through the F_1 antiform shown in the tectonogram fig. 4a. Looking at the geological map (fig. 2) this closed structures corresponds to the marble formation outcropping from Rössvassbukta via Jörentinden to the area just northeast of Tustervatnet.

The tectonogram fig. 4a illustrates the F_1 and F_2 folding of a datum surface situated between the garnet-mica schist and the calcareous mica schist in fig. 3b. The cross-section marked in the tectonogram corresponds to the structure made up by the amphibolite in the northern part of fig. 3b. Elimination of the F_2 folds in the tectonogram allows the F_1 fold structure to be reconstructed. This structure is the oldest recognizable megascopic structure within the area.

The structural model can now be summarized in a series of cross-sections as shown in fig. 5. Each cross-section is schematically drawn, but in contrast to figs 3a and b it is corrected for topography. Fig. 5a shows the initial situation, where the rocks belonging to the Kongsfjell group have been folded during the F_1 fold episode. The marble formation in the core of the minor southward closing fold in the hinge area of the larger northward closing fold corresponds to the marble formation forming the central part of the rather long, closed structure in fig. 3b. The situation after the second and the third fold episodes is shown in figs 5b and c respectively.

The effects of the fourth fold episode (F_4) are not shown in fig. 5.

Local implications of the model

The structural model developed in the Kongsfjell area has required a reinterpretation of the geological map (fig. 2) that is in conflict with the structural solution put forward by Ramberg (1967: figs 35, 36, 37).

The previously mentioned thin marble formation outcropping from Rössvassbukta via Jörentinden to the area immediately northeast of Tustervatnet (fig. 2) is placed in the core of an F_1-antiform (figs 4, 5) and not in a synform as suggested by Ramberg (1967). The strange outline of the closure in the marble northeast of Tustervatnet is caused by interference between F_1 and F_3 fold structures. The minor F_1 folds are distributed inside and outside the hinge area of a major F_3 fold. The southernmost F_1 folds are situated on the lower limb of the F_3 fold, while the minor folds to the north reach the hinge area and the upper limb of the F_3 fold. Thus the refolding results in the horsetail--like pattern seen in the map.

According to the present model the marbles on Jörentinden, at Rössvatnet and on Anders-Larsa Fjell all belong to one and the same marble formation (figs 2, 3, 5). This conflicts with the lithological subdivision of the area made by Ramberg (1967) (fig. 1). As suggested by Ramberg (1967: 72) the Kongsfjell Group comprises rocks which are also contained in the Anders-Larsa Group. This inconsistency is due to the fact that the subdivision made by Ramberg (1967) is based on a tectonic boundary, i.e. the minor thrust passing just west of the mine area in Bleikvassli (fig. 1). But, as described later, this thrust was formed between the second and the third fold episode, thus dividing the original and already folded rock sequence in two parts. Accordingly the Kongsfjell Group and the Anders-Larsa Group have to be considered as tectonic units developed from one and the same lithological sequence. This sequence comprises in relative stratigraphic order: calcareous mica schist, amphibolite, garnet mica schist and marble. Way-up structures do not exist. The amphibolite is included in the stratigraphical column as it takes part in all folding episodes and therefore was formed prior to the first folding episode (F_1).

Thrusting

The F_2 fold episode is succeeded by a phase of thrusting, during which the Helgeland Nappe was emplaced upon the future Rödingsfjell Nappe at the same time as the formation of the minor thrust between the Kongsfjell Unit and the Anders-Larsa Unit. The thrusting episode predates the F_3

fold episode as both thrust planes are involved in the F_3 fold structures, but is subsequent to the F_2 fold episode as the thrust planes are not involved in the F_2 structures (figs 6a, 6b).

The thrust between the generally low grade Seve-Köli Nappe Complex to the east and the high grade rocks of the Helgeland Nappe and the Rödingsfjell Nappe to the west can be followed from the basement culmination at Grong in the south to the Nasafjell basement window in the north (Ramberg 1967, 1981, Gustavson & Gjelle 1981). In Rössvatnet this thrust meets the thrust between the Helgeland Nappe and the Rödingsfjell Nappe (Ramberg 1967, 1981, Häggbom 1980) (fig. 2). The relation between these two thrusts is illustrated in fig. 6b, which is a cross-section perpendicular to the F_3 fold axis (compare with fig. 3a). The thrust between the Helgeland Nappe and the Rödingsfjell Nappe transects F_2 and older structures, but is itself involved in the subsequent F_3 fold episode. There is no evidence that the thrust between the high grade nappes and the underlying Seve-Köli Nappe Complex is involved in the F_3 fold structures. It therefore seems reasonable to regard the high grade nappes acting as one coherent unit, the Helgeland--Rödingsfjell Thrust Nappe (fig. 6b), which during ESE--directed thrusting was emplaced on top of the Seve-Köli Nappe Complex subsequent to the F_3 fold episode.

This evolution is consistent with the facies relations of the rock in the thrust zones. The mylonites in the shear zone separating the Helgeland Nappe and the Rödingsfjell Nappe consist of amphibolite facies rocks, while the shear zone between the Helgeland-Rödingsfjell Thrust Nappe and the Seve-Köli Nappe Complex is made up by low grade rocks (Gustavson & Gjelle 1981). Accordingly amphibolite facies conditions must have prevailed during or after the thrusting of the Helgeland Nappe upon the Rödingsfjell Nappe, while low grade conditions prevailed during the emplacement of the high grade Helgeland-Rödingsfjell Thrust Nappe upon the generally low grade Seve-Köli Nappe Complex.

Granitic intrusions

Four granitic intrusions occur within the Bleikvassli area (Ramberg 1967): a granitic microcline gneiss around Bleikvassli Pb-Zn mine, an aplite outcropping on Anders-Larsa Fjell and two granites outcropping at Rössvatnet and Möllevatnet respectively. The structural relations between the granitic intrusions and the enclosing metasediments cannot be fully explained at present, and their exact ages relative to the structural sequence cannot be given. However, the intrusions are all deformed and distinctly foliated, indicating emplacement prior to the third fold episode (F_3) and the accompanying phase of thrusting.

Summary and timing of the geological evolution

The geological evolution within the Bleikvassli area is summarized in fig. 7. Rb-Sr whole rock dating of the granitic microcline gneiss around Bleikvassli Pb-Zn mine has yielded an age of 464 ± 22 Ma (Råheim & Ramberg, in prep.). As mentioned above this intrusive event is prior to the thrusting episode and the subsequent F_3 folding, and we interpret the intrusion as succeeding the second fold episode (F_2) because no evidence at present indicates an older structural age.

The structural evolution presented here for the southernmost part of the Rödingsfjell Nappe matches the structural evolution described in the central part of the Rödingsfjell Nappe around Mo i Rana 40 km to the north (Graversen et al., in prep.). At Mo i Rana the oldest fold episode (F_1) is ascribed to the Sveconorwegian orogeny and is separated from the Caledonian deformations (F_2-F_4) by a granite intrusion dated at 572 ± 32 Ma (Graversen & Pedersen, in prep.). As in the Bleikvassli area, transverse structures were formed during the F_1-F_3 fold episodes, and these were refolded by folds parallelling the present mountain chain only during the latest deformation (F_4). At Mo i Rana the F_2 and F_4 deformations are correlated respectively with the Finnmarkian and the Main Scandinavian phases of deformation within the Caledonian orogeny (Sturt, Pringle & Ramsay 1978, Sturt, Andersen & Pedersen, in prep.). A similar timing of the structural evolution can be adopted for the Bleikvassli area, because both the Mo i Rana and the Bleikvassli areas are situated within the same tectonostratigraphic unit, the Rödingsfjell Nappe, and no overall tectonic or lithologic differences seem to exist between the areas. Furthermore the radiometric age of the granitic microcline gneiss around Bleikvassli Pb-Zn mine falls in the time interval of the Finnmarkian phase of deformation (Sturt et al., in prep.).

The intensity of the F_3 folding tends to decrease towards the north; F_3 folds are recumbent around Bleikvassli and overturned to upright, open around Mo i Rana (Graversen et al., in prep.). This indicates that the E-W trending F_3 fold structures could have been generated by the northwards thrusting of the Helgeland Nappe on top of the future Rödingsfjell Nappe.

Late Caledonian thrusting translated both nappes as one coherent unit, the Helgeland-Rödingsfjell Thrust Nappe, towards ESE over the Seve-Köli Nappe Complex. This late Caledonian thrusting is, together with the gentle F_4 fold episode, ascribed to the Main Scandinavian phase of deformation in accordance with Graversen et al. (in prep.). The gentle F_4 folding affected not only the high grade Helgeland-Rödingsfjell Thrust Nappe as here described and shown by Graversen et al. (in prep.), but also the underlying generally low grade Seve-Köli Nappe Complex. A great F_4 antiform can be traced from the basement culmination at Store Börgefjell, the Börgefjell window, in the south to the Nasafjell window in the north. This F_4 antiform causes the variation in the orientation of the F_3 structures within the Bleikvassli area resulting in flat lying F_3 axes and axial surfaces north and east of Rössvatnet.

The present work together with the recent structural work around Mo i Rana suggests that the genesis of the high grade rocks in the Rödingsfjell Nappe goes back into the Precambrian. Furthermore northward-directed tectonics seems to play an important part in the early history of the Caledonian orogeny, requiring a varied and detailed plate tectonic model to explain the complex structure of the Caledonian mountain range.

Acknowledgments

The mining company A/S Sydvaranger is gratefully acknowledged for permission to publish our results. Separate thanks are offered to A.Kruse, Bergverkselskapet Nord-Norge A/S and W.Zobel, A/S Bleikvassli Gruber for valuable support in the field. We also thank A.Berthelsen, B.Hageskov, O.Graversen and M.Marker for improvements in the manuscript and T.C.R. Pulvertaft for improving the English language.

References

Gustavson, M. 1978: Caledonides of North-Central Norway. IGCP Project 27, Norwegian Contribution No. 5c. Caledonian-Appalachian Orogen of the North Atlantic Region. Geol.Surv.Canada.

Gustavson, M. & Gjelle, S. 1981: Regional Geology of Central Nordland. Earth Evolution Sciences 1, 6-13.

Häggbom, O. 1980: Polyphase Deformation of a discontinuous Nappe in the Central Scandinavian Caledonides. Geol.Fören. Stockholm Förh. 100, 349-354.

Ramberg, I.B. 1967: Kongsfjell-Områdets geologi, en petrografisk og strukturell undersøkelse i Helgeland, Nord--Norge. Norges geol.Unders. 240, 1-152.

Ramberg, I.B. 1981: The Brakfjellet tectonic lens: evidence of pinch-and-swell in the Caledonides of Nordland, north central Norway. Norges geol.Tidsskr. 61, 87-91.

Sturt, B.A., Pringle, I.R. & Ramsay, D.M. 1978: The Finnmarkian Phase of the Caledonian Orogeny. J.Geol.Soc.Lond. 135, 597-610.

Vokes, F.M. 1963: Geological Studies on the Caledonian Pyritic Zinc-Lead Orebody at Bleikvassli, Nordland, Norway. Norges geol.Unders. 222, 1-126.

Captions

Fig. 1. The location of the Bleikvassli area and its subdivision into the Anders-Larsa Group and the Kongsfjell Group. The Bleikvassli Pb-Zn mine is indicated by a ♀ . (After Ramberg 1967).

Fig. 2. Geological map of the area around the Bleikvassli Pb-Zn mine. Traces of axial surfaces for the third fold episode (F_3) are shown. (Revised after Ramberg 1967).

Fig. 3. Geological profiles based on the geological map (fig. 2) including Kongsfjell and the area to the south: a) after folding F_3, b) after folding F_2. Topographic effects influence the profiles (see text). The vertical scale is exaggerated ca. 3 times. Symbols as in fig. 2.

Fig. 4. Tectonograms showing the situation after the F_1 folding (a) and the F_2 folding (b) respectively. The folded datum surface is located between the garnet mica schist and the calcareous mica schist (compare with figs 3 and 5).

Fig. 5. Schematic cross-section of the southern part of the Bleikvassli area according to the structural model after a) first fold episode, b) second fold episode and c) third fold episode. Symbols as in fig. 2.

Fig. 6. Location of the thrusts in the geological profiles (fig. 3) a) before F_3 folding, b) after F_3 folding.

Fig. 7. Diagram showing the geological evolution within the Bleikvassli area related to the main phases of deformation during the Caledonian orogeny in Scandinavia.

Dansk sammendrag

Den strukturelle udvikling af Bleikvassli området i den sydligste del af Rödingsfjell Nappen er beskrevet. Udviklingen omfatter fire foldefaser (F_1-F_4) og to overskydningsfaser. Transverse øst-vest orienterede tætte foldestrukturer er udviklet under de tre første foldefaser (F_1-F_3), og kun under den sidste foldefase (F_4) genfoldes disse strukturer om akser parallelle med den nuværende foldekæde.

Det vises at Helgeland Nappen overskydes på det, der senere bliver til Rödingsfjell Nappen, i perioden umiddelbart før eller under den tredje foldefase. Under en sen-kaledonsk overskydningsfase er disse to napper som en sammenhængende enhed, Helgeland-Rödingsfjell Thrust Nappen, blevet overskudt mod øst på Seve-Köli Nappe Komplekset.

I overensstemmelse med nye strukturelle undersogelser omkring Mo i Rana korreleres F_2-F_4 foldefaserne med den Kaledonske Orogenese, mens den tidligste foldefase (F_1) henføres til Prækambrium (den Sveconorvegiske Orogenese?), hvilket samtidig implicerer en prækambrisk alder på metasedimenterne.

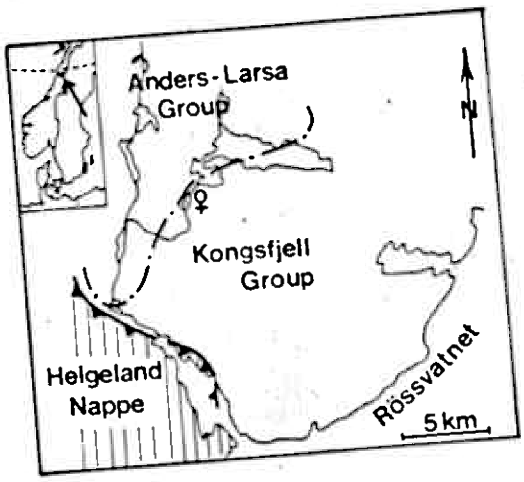
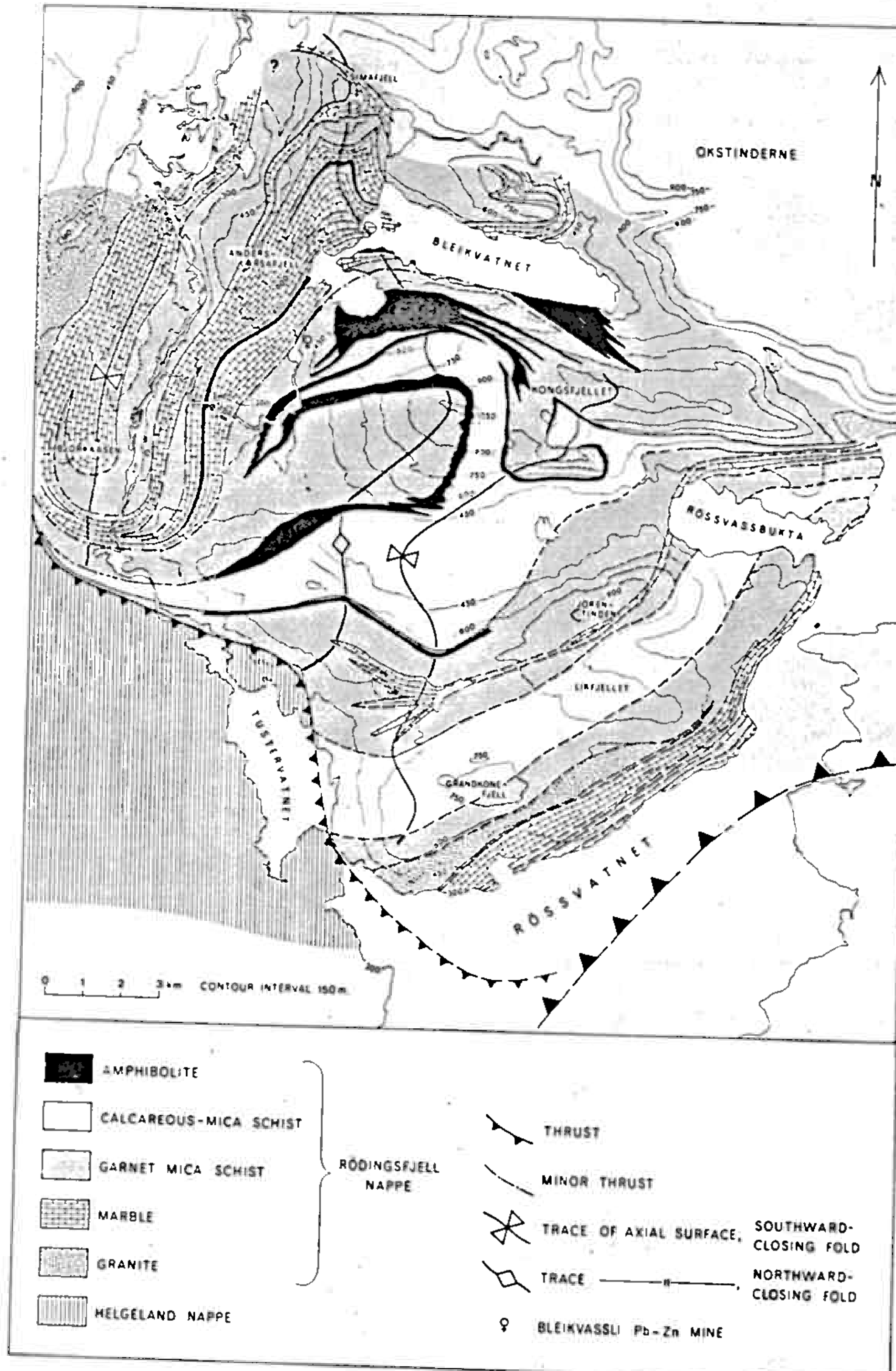

Anders-Larsa
Group
N
Kongsfjell
Group
Helgeland
Nappe
Rössvatnet
5 km

Fig 1



Geology: I.B. Ramberg (1967), partly revised
Structural interpretation: P-H. Larsen & S.B. Olsen (1982)

Fig 2.

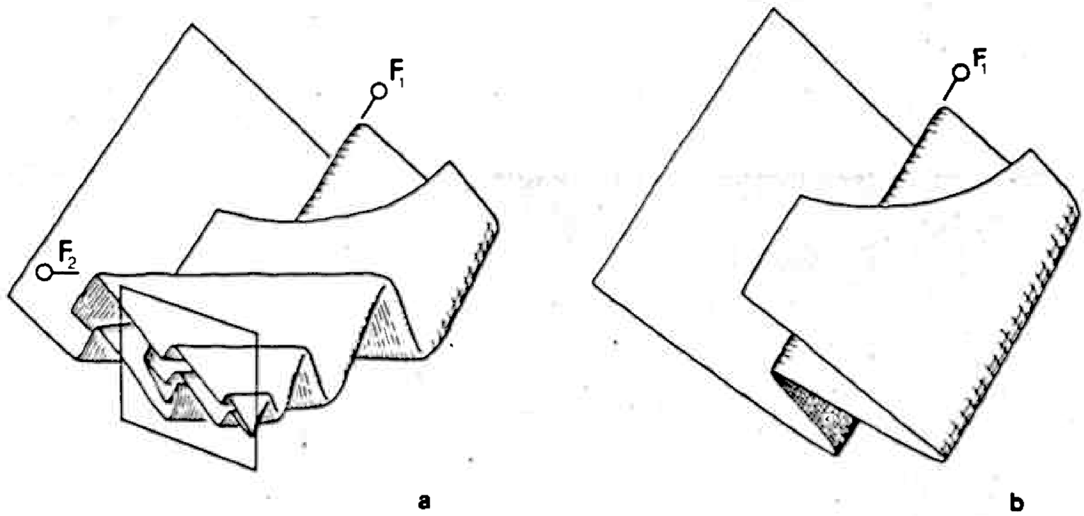

F1
F2
a
F1
b

Fig 4.

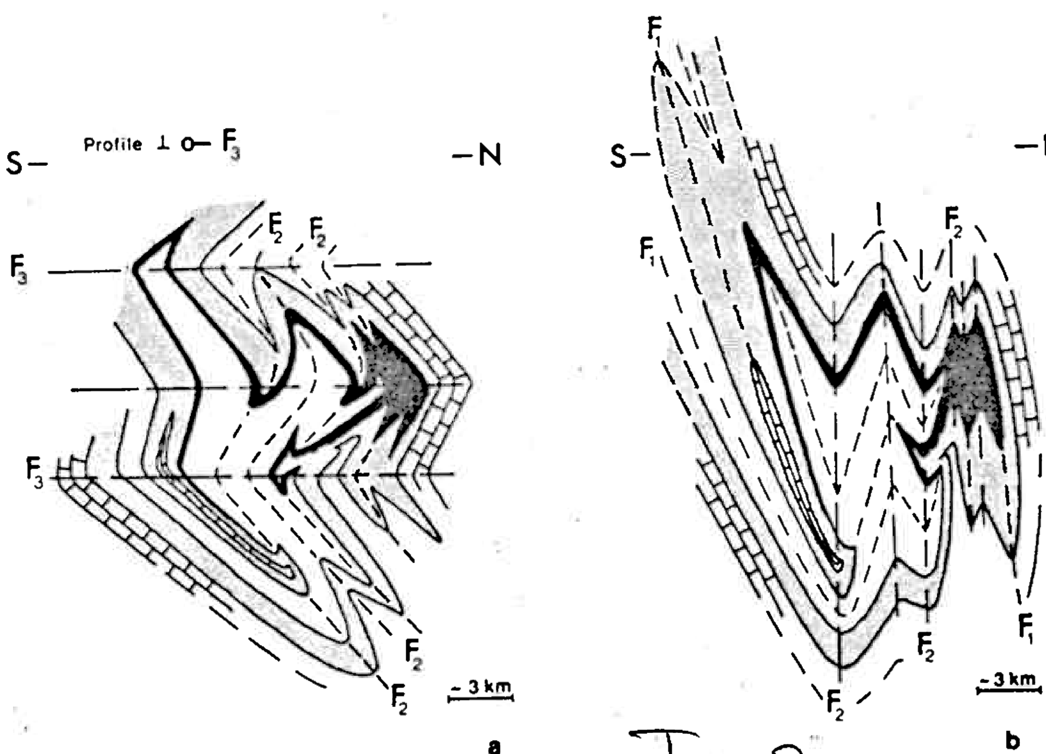

S–
Profile ⊥ o– F3
–N
F3
F2
F2
F3
F2
F2
~3 km
a
F1
S–
–N
F1
F2
F1
F2
F2
~3 km
b

Fig 3.

max 168mm
max 208mm

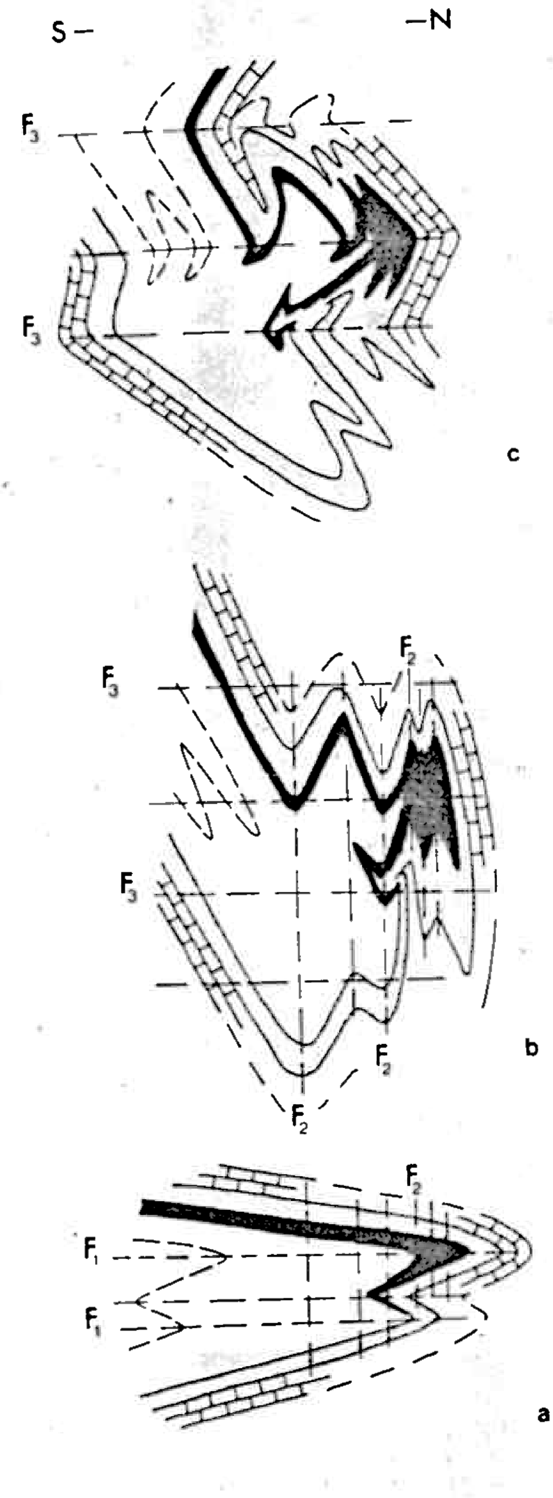
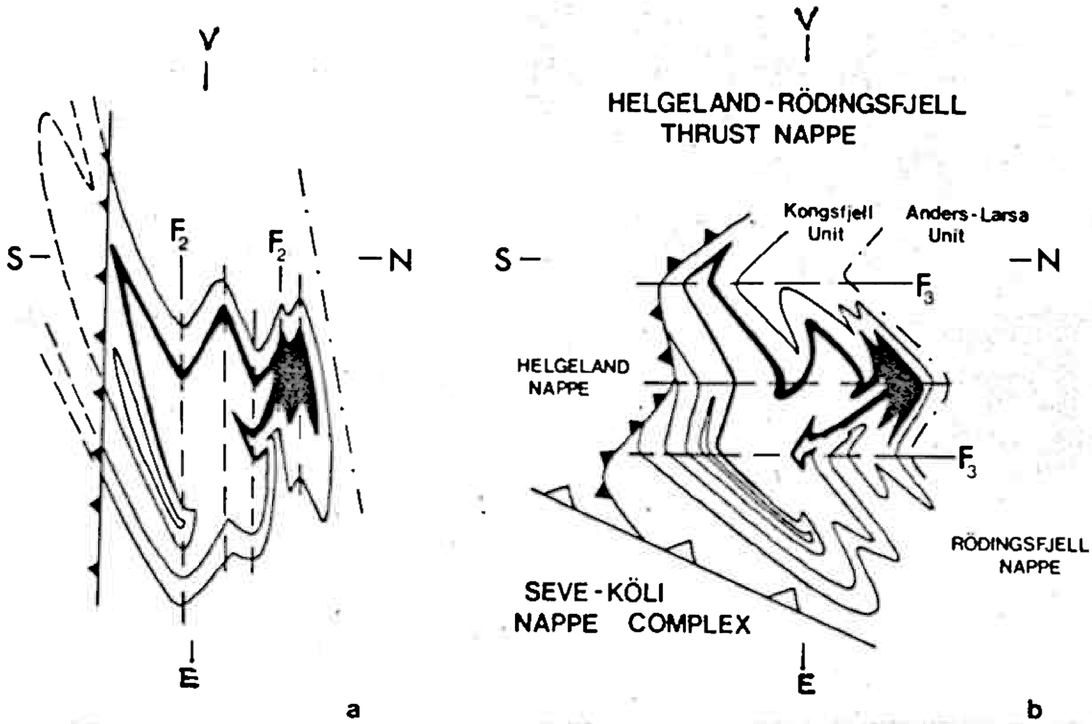


Fig 5.

"Map" of the structural evolution of the Bleikvassli area (Amphibolite in black).



After the 2nd fold episode After the 3rd fold episode.

P.H. Larsen & S.B. Olsen (1982)

Fig 6.

F4	Open, upright folds	MAIN SCANDINAVIAN PHASE	CALEDONIAN OROGENY
	Eastward thrusting of Helgeland-Rödingsfjell Thrust Nappe upon Seve-Köli Nappe Complex		
F3	Close, inclined folds		
	Thrusting of Helgeland Nappe upon Rödingsfjell Nappe and Kongsfjell Unit upon Anders-Larsa Unit		
	Intrusion of Möllevanns Granite, Anders-Larsa Aplite and *Microcline gneiss (464 ± 22 m.y.)	FINNMARKIAN PHASE	
F2	Close folds		
(F1)	Tight folds	SVECONORWEGIAN OROGENY ?	
	Sedimentation and basic magmatism		

* The intrusive nature of the microcline gneiss is questionable.

Structural evolution (P.H. Larsen & S.B. Olsen 1982).

Fig 7.