1. Summary

Many major problems of the geological development of southwestern Sweden still remain unsolved. An investigation, of which the present study is a part, is aimed at increasing our knowledge about the metamorphic processes, from which the rocks in this region have suffered. The present study is devoted to the structural state of the potash feldspar in two different rock types. The first rock type is the Varberg Charnockite, which Quensel (1951) and Hubbard (1975, 1978) have described from the southern part of the Swedish westcoast. The second rock type is the Hinneryd granite (Lindh and Johansson, 1991) situated in the southwestern part of the county of Småland, Sweden.

The Varberg region can be divided into three distinct lithological groups: 1.) The Varberg series, which is a sequence of granitic gneisses including zones of mixed granulites, 2.) The Bua series, which according to Hubbard (1975) consists of clearly banded metasupracrustal gneisses and migmatites, 3.) The Charnockite—Granite Association, which is a composite association of plutonic rocks. This association can be futher divided into four components called the Varberg Charnockite (VC), the Apelviken—Getterön Charnockite (AGC), the Trönningenäs Charnockite (TC), and the Torpa Granite (TG; Hubbard 1975). The potash feldspars investigated are from the AGC unit. It is possible to follow a change in colour from a greyish green, typical orthoclase feldspar via a feldspar with a greyish green core surrounded by a reddish mantle to a completely reddish brown potash feldspar. The object of the investigation was to establish whether there was a structural change in the potash feldspar. If there is a change, it should be tested whether this change could be correlated to macroscopic appearance and results from the microscopic observations.

The Hinneryd granite massif occupies an area of about $1.3 \cdot 10^3$ km^2. It is a strongly deformed reddish grey rock. Its composition is adamellitic. The rock is medium grained and has megacrysts of perthitic potash feldspar. Sometimes the megacrysts show microcline twinning, but *twin-free* potash feldspar also occurs. The object of this part of the investigation was to determine the structural state of the potash feldspars and to study them under the petrographic microscope. A comparison between the X-ray results and the optical results is performed.

The samples from the AGC were taken to include all transitional phases. All samples were taken from a very small area on Getterön — approximately $1 \cdot 10^{-2}$ km^2. The samples from the Hinneryd Granite were taken from a much larger area than those from the AGC. The distance between the eastermost and westermost sample was approximal 40 km.

From both rock types the alkali feldspars were separated by handpicking under the microscope. Then the material was ground to a fine powder. The structural state of the feldspar was obtained from X-ray diffraction studies, by measuring the "triclinicity". The "triclinicity" is a measure of the deviation of the interaxial angles α and γ from 90°. In the monoclinic potash feldspars — orthoclase and sanidine — α and γ are equal to 90°. However, in the triclinic feldspar they are not. The interaxial angle β is obtuse and

assumed to be constant irrespective of structural state. To determine the "triclinicity" the splitting of the peak (131) was studied. In monoclinic feldspars, it consists of one peak (131). In triclinic feldspars it splits into two separate peaks (131) and $(1\bar{3}1)$. The "triclinicity" (Δ) was calculated with Goldsmith's and Laves's (1954) formula: $\Delta=12.5[d_{(131)} - d_{(1\bar{3}1)}]$. The "triclinicity" is a function of the Al distribution over the available tetrahedral sites. In the monoclinic phase, Al is equally distributed over all sites but in the triclinic phase, Al prefers the T_1O site. The T stands for tetrahedral site. T_1 sites are the positions closest to the large cations and O is a site not affected by any symmetry operation.

All powdered potash feldspar specimens were examined on a Philips X-ray diffractometer PW 1710 (λ= 1.5405Å, 50kV, 25mA, CuK_{α} radiation). MgO was used as an internal standard. The investigation required a slow stepscan with steps of 0.005° 2Θ. The counting time at each step was 10 seconds. The obtained intensities were plotted versus the angle 2Θ in scattergrams. These scattergrams show different types of reflexes. There are three types of reflexes identified:

1. *One single (131) reflex —orthoclase.* This reflex may be more or less broadened.
2. *Two (131) and $(1\bar{3}1)$ reflexes —microcline.* The reflexes may be more or less well-separated.
3. *A combination of type 1 and 2.* This indicates a transitional state between orthoclase and microcline. This type of reflexes is often diffuse.

The following results were obtained for the **Varberg Charnockite**:

1. One narrow (131) reflex, with or without shoulder. When a shoulder occurs, this shoulder is either on the high - or the low angle side. This type of reflex was obtained from the completely greyish green potash feldspar and from some of those which have a greyish green core and a reddish brown mantle. The potash feldspar is orthoclase.

2. One broadened (131) reflex with or without shoulders. The shoulders occur either on the high - or the low angle side. This type of reflexes is obtained from potash feldspars, which have a greyish green core and a surrounding reddish brown mantle. Both twinned and untwinned potash feldspar occurs. The twinned feldspars show both Carlsbad twinning and microcline cross-hatched twinning. Most of the potash feldspar is orthoclase, but microcline occurs in minor amounts.

3. One strongly broadened (131) reflex, which has many shoulders. Sometimes there are signs of *three* diffuse reflexes. The shoulders mostly occur on both sides of the peak. The potash feldspar is completely reddish brown. This is interpreted as a transitional state between orthoclase and microcline. No "clean" microcline can be identified.

The X-ray investigation shows together with the optical examination that the dominating potash feldspar is orthoclase. When the colour changes, a structural change starts. This structural change almost reaches intermediate microcline structural state.

For the **Hinneryd Granite** more complex results have been obtained:
1. One narrow (131) reflex with no shoulders —orthoclase. The colour of the potash feldspar is red. No microcline is found.
2. One broadened (131) reflex with or without shoulders. The shoulders can be single or double sided. The colour of the potash feldspar is red. The broadened reflex shows that a structural change from orthoclase to microcline has started. However, this structural change has not gone sufficiently far to split the reflex into a doublett. Optical investigations show that both Carlsbad twins and microcline cross - hatched twins occur. Potash feldspar without twinnig occurs.
3. A very broad reflex on which three or more peaks can be distinguished. The colour of the potash feldspar is red. The peaks show that the feldspar is in a transitional state between orthoclase and microcline. Both twin-free and twinned feldspar occurs.
4. Two separate reflexes (131) and ($1\bar{3}1$), which prove that this is microcline. The degree of splitting indicates an intermediate microcline. No orthoclase is found.

In the Varberg Charnockite, the potash feldspar crystallized as orthoclase at high temperature. After the crystallization the charnockite was deformed and probably during this deformation tiny joints were formed in the feldspar megacrysts. The joints were high energy areas where transformation to microcline started. Possibly, the transformation was initiated by water acting as a catalyst. Otherwise, transformation started at the margins of the crystals and slowly spread inwards. The sampling was performed within a very restricted area. Consequently, the rate of cooling was nearly the same for all samples, and thus the change in structural state cannot have been affected by differing cooling rates. The structural change is followed by a colour change in the potash feldspar.

The potash feldspar of the Hinneryd Granite is always red or reddish pink. Originally the potash feldspar crystallized as orthoclase at a high temperature. The survivel of theorthoclase structure within the Hinneryd granite indicates that the rock was deformed at a high temperature. Some of the feldspar retained its orthoclase structure during cooling and deformation. Some feldspar megacrysts show an incipient structural change, which results in the broadened peaks. The broadened peaks are interpreted as two unresolved peaks situated close together. The structure is "more" monoclinic than triclinic. This change is caused by cooling after crystallization.

The samples come from a large area. It is thus not possible to exclude the possibility that varying cooling rates could have influenced the change of the structural state. However, it can be concluded that uplifting and cooling was rapid, otherwise the structural state of the potash feldspar would have been triclinic and not monoclinic.