ESRF	**Experiment title:** Texture analysis of experimentally deformed albite	**Experiment number:** HS 647
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Report:

Introduction: The tectosilicate albite represents the Na-rich and Al-poor endmember of the plagioclase solid solution series between $NaAlSi_3O_8$ (albite) and $CaAl_2Si_2O_8$ (anorthite). Due to their abundance in the Earth's crust they are of great importance when it comes to determining its deformation behaviour (rheology) and anisotropy, particularly in rocks of the middle and lower crust (e.g. amphibolites and granulites). The investigation of the crystallographic preferred orientation (texture) of plagioclase has therefore a long tradition in the geological literature (e.g. [1]), but the interpretation of these data has been hampered by the complex triclinic structure of these minerals as well as the continuous change in structure with chemical composition. In the present project, we have approached the question of texture development in plagioclase by experimentally deforming polycrystalline albite aggregates to high shear strains (up to $\gamma = 11$) and then analyzing their crystallographic preferred orientation with an experimental setup recently established at the microfocus beamline [2].

Samples: The samples were deformed in a Griggs-type apparatus modified for simple shear deformation: in ths setup the pistons are cut at 45° to the compression direction and the sample (a fine grained layer of about 200μm thickness) is placed between them. The temperature was at 900°C, the confining pressure 15kbar and the strain rate about $10^{-5}sec^{-1}$. The amount of shear strain was determined from the lateral displacement of the pistons after the experiment [3].

Experimental setup and analysis: The monochromatic (λ=.78Å, Pb L3 absorption edge) and focussed beam was collimated with a 30μm collimator and then aligned with the crossing point of the rotation axes of the Kappa goniometer available at ID13. The samples were prepared as slabs of 100 micron thickness. The sections were also optically aligned on a goniometer head and centered at the crossing point of beam and goniometer axis. The experiment was carried out in transmission so that the 2D CCD detector was positioned stationary at $2\Theta=0°$ and a distance of 152.4 mm, recording the complete Debye powder rings of 14 reflections, 6 of which were overlapped. The sample was rotated parallel to ϕ of the Kappa geometry around ±60° in 5° steps in order to cover a large area in pole figure space. The intensity variation along Debye ring was extracted from the 2D image by integration and the transferred into pole figure angles. The partial experimental pole figures were then used as input for the calculation of the complete orientation distribution function (ODF) with the WIMV algorithm [4], which also allows to separate overlapped peaks. From the ODF complete pole figures were derived.

Results: All three investigated samples show a similar type of texture, which is shown in the pole figures of one sample in Figure 1. The poles of the (001) planes form a girdle perpendicular to the shear direction whereby the strongest concentration of planes is subparallel to the macroscopic shear plane. The poles to the (100) planes (as well as the [100] direction) form maxima in or close by the macroscopic shear direction. Upper and lower hemispheres show rather similar distributions reflecting the monoclinic symmetry of the strain path.

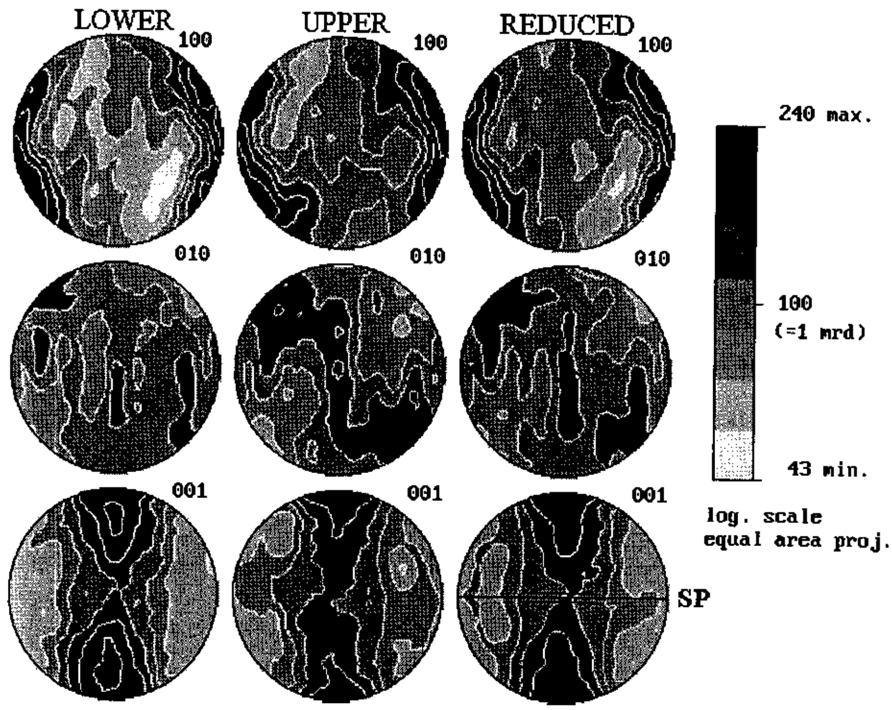

Figure 1: Recalculated pole figures of sample W799 ($\gamma = 7.5$); SP = shear plane; lower and upper hemispheres are different due to the triclinic symmetry of albite; in the right column they have been reduced into the lower hemisphere.

Discussion and conclusions: The texture pattern found in all samples indicates intracrystalline glide on the (001)<100> slip system as an active deformation mechanism. The textures remain however relatively weak (maxima around 2.5 multiples of random distribution, m.r.d.) for the high amounts of shear strain, indicating that other mechanisms (e.g. diffusive processes, dynamic recrystallization) were also active during deformation. Very similar crystallographic preferred orientations have been reported in the literature from naturally deformed plagioclase rocks (e.g. [5]), but extrapolation of these data to natural conditions has to be taken with great care due to the large differences in strain rate. The results of this study represent the first success in determining the ODF of experimentally deformed plagioclase from X-ray diffraction patterns. With an increased number of similar studies we hope to reach a more quantitative interpretation of the complex deformation behaviour of the feldspar minerals.

References

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