Experimental Report

Proposal: **5-26-169** **Council:** 10/2003

Title: QUANTITATIVE TEXTURE ANALYSIS OF HIGH STRAINED ROCKS FROM THE ALPINE BELT: MINERO-CHEMICAL VS. MECHANICAL RE-EQUILIBRATION STUDIED BY NEUTRO

This proposal is a new proposal

Researh Area: Other

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Experimental Team: ZUCALI Michele
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Local Contact: OULADDIAF Bachir

Samples: Mg, Fe, Al, Na, Ca silicates

Instrument	Req. Days	All. Days	From	To
D20	5	2	26/04/2004	28/04/2004

Abstract:

Quantitive Texture Analysis allows to define relationships between crystallographic orientation of rock-forming minerals and meso-, microstructures developed in different geodynamic settings and under evolving pressure, temperature and strain conditions. High strained rocks better record mechanical and mineralogical re-equilibrations.We propose to study polymineralic samples from the Alpine belt developed during the Cretaceous subduction of continental crust at ?70km depth. These rocks are optimal to study deformation mechanisms active during fabric development and unreveal links between chemical transformations and mechanical re-equilibrations in natural rocks. Using X-Rays diffraction and EBSD techniques monomineralic rocks can be studied but many difficulties arise with polymineralic rocks; better statistic, obtained by neutron diffraction-based texture analysis, allows quantitative studies of monomineralic and polymineralic (natural) samples; QTA by neutron diffraction is the most reliable approach to reconstruct the Orientation Distribution Function for most of rock-forming minerals under different finite strain states.

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Neutron diffraction is the best technique capable to reach high statistic in order to completely cover the ODF in polymineralic low symmetry rocks and apply it in structural geology [1, 2, 3].

Optical, SEM and microprobe analyses have been carried out on analyzed samples of natural rocks, in order to quantitatively define chemical composition of mineral phases supporting rock texture and to estimate pressure and temperature conditions occurred during rock deformation. Rock deformation occurred during Alpine subduction (60-45 Million years). X-Rays diffraction texture analysis has also been carried out before using neutron.

We tested the results obtained at D20 with respect to D1B (**Figure 1**) using a previous studied sample [1]. These results show that using D20 we may gain up to 30% of time during acquisition processes, increase 2theta range and consequently improve refinement quality in terms of reliability factors (RP and Rw values)(**Figure 2**)

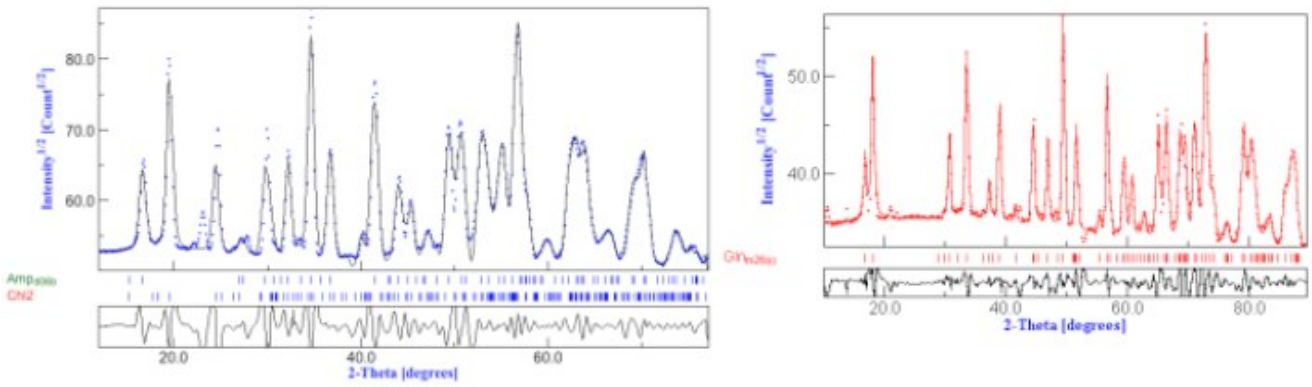

Figure 1 - comparison of summed diffracted pattern and refinement between D20 (left blu) and D1B (right red)

Results

5-26-169 experiments allowed the identification of mineral phases NEVER resolved at D1B. These phases are High Pressure mineral (e.g. **coesite in Figure 3)**) still preserved within these rocks as structural relicts even if in small modal amount (**Figure 3**). The 5-26-169 ”incomplete” experiment thus shows the

possibilities to explore relic minerals within recrystallised rocks using neutron diffraction. It may reveal as a new use of neutron diffraction in geology and in reconstruction of the tectonometamorphic evolution of the Alpine belt.
Future experiments will focus on defining the best approach to refine relic phases QTA.

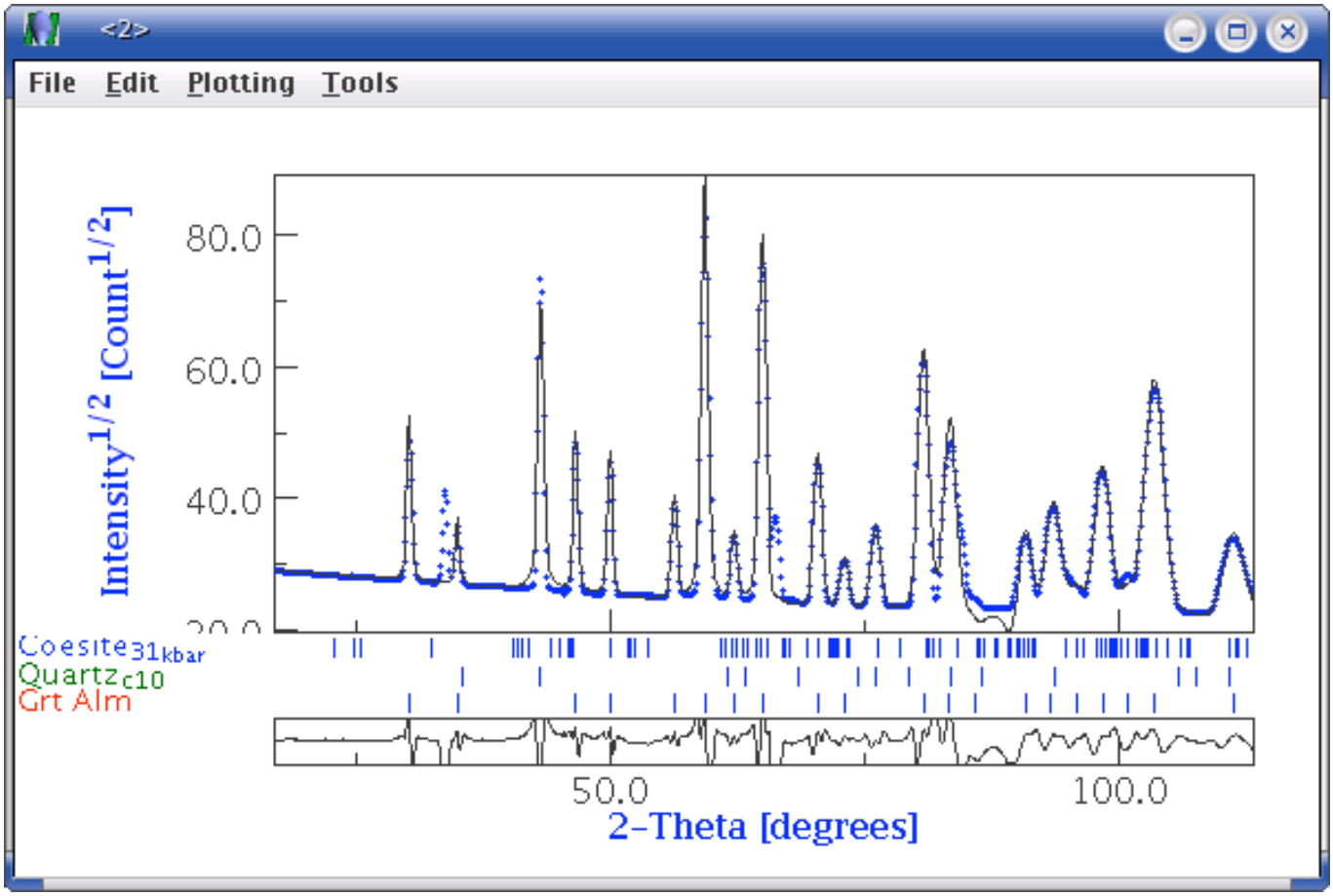

Figure 2 Refined pattern of high pressure coesite-bearing quartzite.

References:

[1] Zucali M., Chateigner D., Dugnani M., Lutterotti L. and Ouladdiaf B. - 2002. Geological Society, London, Special Pubblications, 200, 239-253.
[2] Leiss B., Ullemeyer K. & Weber K. - 2000. J. Structural Geology Special Issue. Pergamon. Oxford, International. Pages: 542.
[3] Spalla M. I., and Zucali M. – 2004. Periodico di Mineralogia, v. 73, p. 249-257.
[4] Spalla, M. I., M. Zucali, di Paola S. and Gosso G. – 2004 -. Deformation Mechanisms, Rheology and Tectonics: from Minerals to the Lithosphere. Journal of the Geological Society Special Pubblication.