From lab strain rates of quartz to geological strain rates of granites

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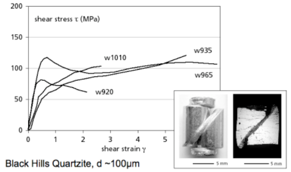
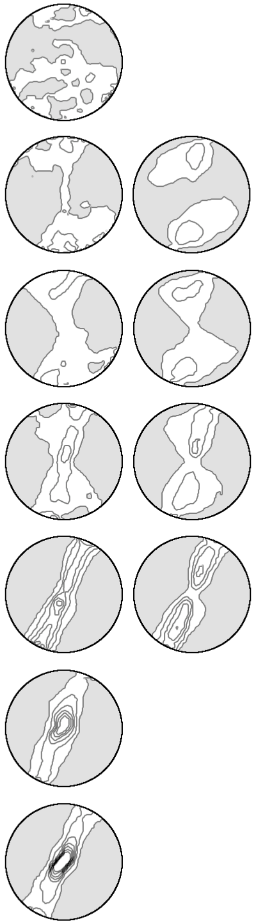
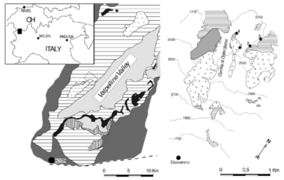
EXPERIMENT

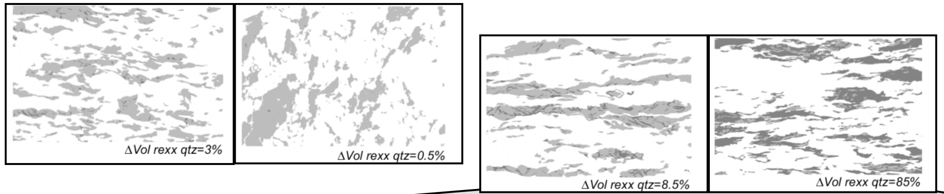


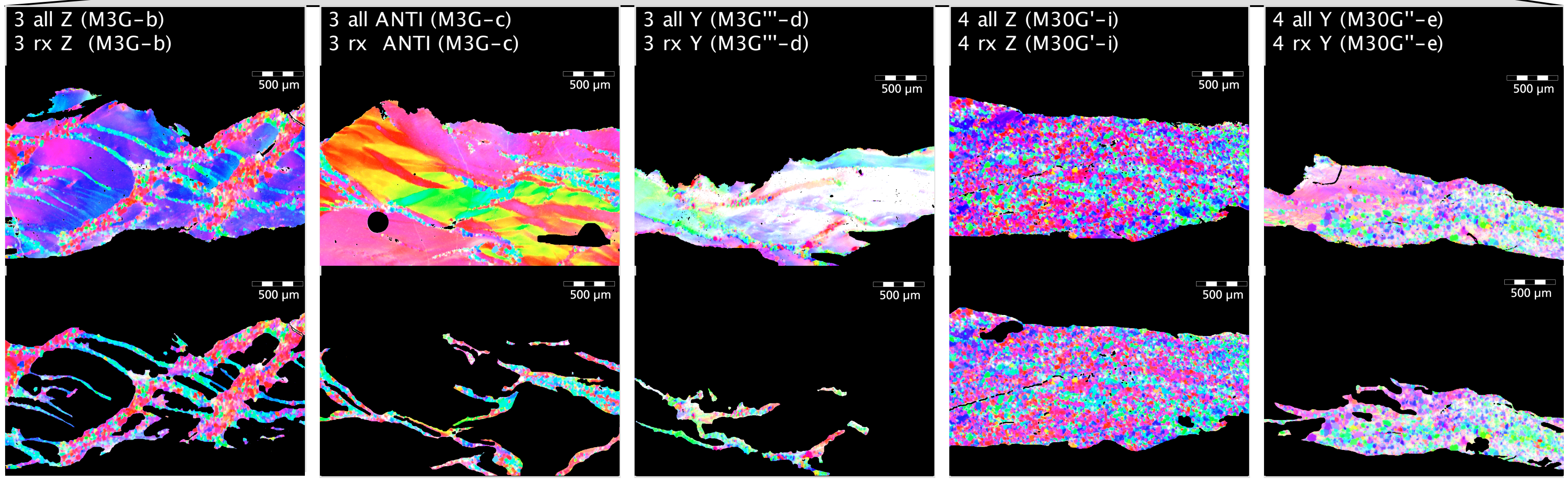
Black Hills Quartzite, d ~100µm
pc=1.5GPa (NaCl solid medium), T=900°C

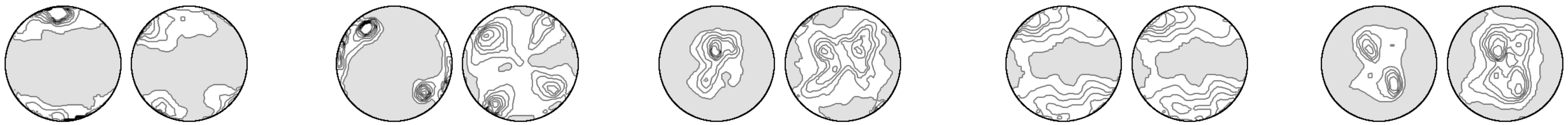


NATURE

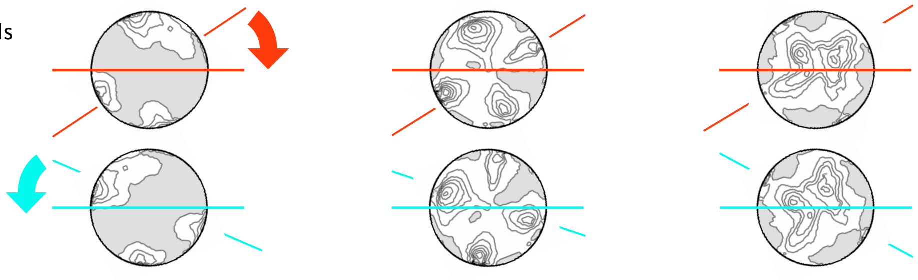








shear bands
horizontal



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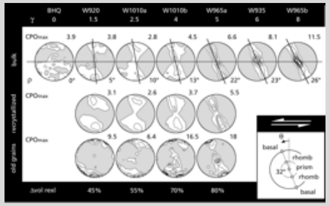
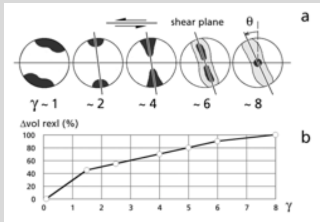
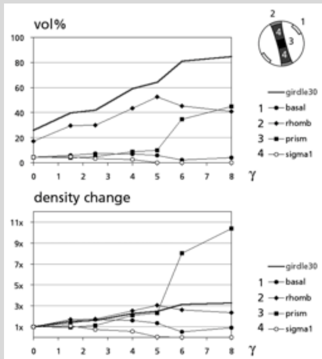
COMPARISON WITH EXPERIMENTAL DEFORMATION: DISLOCATION CREEP







see Poster 09012:
"Texture dependent grain size in experimentally deformed quartzite"

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From lab strain rates of quartz to geological strain rates of granites

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When comparing rock deformation experiments and field data, experimentalists and field geologists are faced with the problems of extrapolation (spatial and temporal) and integration (from simple systems to complex ones).

While the extrapolation from experimentally deformed quartzite to naturally deformed quartzitic rocks or quartz veins is straight forward (requiring one flow law for one mineral) the extrapolation to naturally deformed granites can follow one of a number of different paths:

(a) using experiments and flow laws of granites
(b) using experiments and flow laws of the weakest mineral (quartz)
(c) extrapolating along the flow laws of each of the constituting minerals.

This contribution follows option (b) presenting a comparative analysis of the texture and microstructure evolution of experimentally and naturally deformed monophase and polyphase quartz bearing rocks.

Using computer integrated polarization microscopy (CIP) the bulk textures of experimentally sheared Black Hills Quartzite (BHQ) and the bulk quartz textures of naturally deformed Arolla Gneisses (Western Alps) are analyzed. Partial CPOs of the deforming old grains and of the recrystallizing new grains are calculated also.

The CPO of the recrystallized grains of the naturally deformed Arolla Gneiss and the CPO of the recrystallized grains of the BHQ are approximately identical and develop in an analogous fashion.

However, in the gneiss, the development of the CPO appears to be delayed, requiring larger bulk strains for a given fabric strength than the pure material.

The poster presents the comparative analysis of the deformation of quartz in mono- and polyphase rocks and invites discussion on the question: what is the definition of the "bulk rock" and what is the meaning of an average, extrapolated (geological) strain rate.

http://www.unibas.ch/earth/micro/