Mushroom garnet from the Mt. Mucrone, Italian Alps

B. DARBELLAY[1], M. ROBYR[2] AND L. BAUMGARTNER[1]

[1]Institute of Mineralogy and Geochemistry, University of Lausanne, L'Anthropole, 1015 Lausanne, Switzerland
[2]The University of Texas at Austin, Geol Science Dept., 1 University Station C1100, Austin, TX 78712-0254, USA

Garnets have a cubic symmetry, a simple shape and prograde zoning is preserved in low to medium grade rocks. This makes garnets an excellent object for determining PT-t paths and for studying crystal growth mechanisms. But not all zoning patterns are readily understood. Below we present some fascinating and intriguing garnet textures from the Alpine high pressure Mt. Mucrone area (Sesia, Italian Alps).

Pelitic eclogites preserve relic pre-alpine amphibolite to granulite facies mineral assemblages and associated structures. They were overprinted by the alpine high-pressure event(s). Quartz rich layers contain also omphacite, garnet and phengite. High-resolution X-ray tomography images reveal that many garnets are mushroom-shaped in 3D. The garnet core is roundish and poorly connected to the "hat" of the mushroom by a skeletal garnet network grown along quartz-quartz boundaries. The rim totally encloses the core in some cases resulting in a perfect dodecahedral garnet morphology. All intermediate stages between a hat and an atoll garnet structure can be observed.

Garnets are strongly zoned (gros. 19-33%, spes. 0.2-1%, alm. 54-61%, pyr. 7-19%). Three domains can be distinguished: 1) a roundish core at the centre with multiple islands of high Mn concentrations, 2) a middle zone with an extremely complex zoning which is principally composed of an alternation of thin Mg and Fe-rich bands, radiating outwards, perpendicular to the garnet faces, 3) a homogeneous Mn-rich rim. The latter has compositions corresponding to the islands cores located inside the garnet. No miss-orientation between individual zones was detected by EBSD analysis.

These observations suggest: a) multiple garnet generations, with the center being the oldest, which stands in contrast to previous works which suggested dissolution and re-precipitation of the centre; b) garnet rims grew outward and faces also grow sideways; c) garnet growth might have continued inside the rim, even once it crystallized, replacing progressively quartz by widening the initially skeletal network (which followed grain boundaries) and by filling in fractures.

Crystallinity and grain contact mechanics - Neutron TOF scattering in sandstones

T.W. DARLING[1], J.A. TENCATE[2], TH. PROFFEN[3] AND S. VOGEL[3]

[1]Physics Dept., UNR, Reno NV 89557 (darling@unr.edu)
[2]EES-11, LANL, Los Alamos NM 87545 (tencate@lanl.gov)
[3]LANSCE-12, Lujan Center, LANL Los Alamos NM 87545

Previous results on the microscopic distribution of strain in sandstones, as measured by neutron Bragg scattering, compared to the macroscopic sample strain [1] show excess and nonlinear macroscopic strain. We attribute this to deformation of the highly stressed contact regions, not visible to neutron Bragg scattering either due to the smallness of the volume concerned or to a lack of long-range order at the contacts. PDF measurements on the NPDF beamline at LANSCE's Lujan Center have indicated the presence of non long-range ordered silica in sandstones [2], a measurement not in general supported by thin section petrology examination or XRD [3]. We have attempted to verify this result by comparison with neutron signals from nominally completely crystalline, non-bonded assemblages of various sized quartz grains. We present this data which generally supports the existence of non-crystalline silica. The presence of this material at the grain contact may also influence the mechanics of the sample, particularly in the creep, hysteresis, elastic after effects and high frequency nonlinear behaviour, since it occupies a region of high stress around the small grain contact area. We have used the high flux and count rates available at the HIPPO [4] beamline to make (relatively) fast measurements on the response of sandstone samples to temperature changes, while simultaneously measuring the macroscopic elastic properties by a rod-resonance technique. We present this data and discuss the possible influence of non-crystalline contact cementation on the mechanical response of sandstones.

[1] Darling *et al*. (2004) *GRL* **31**, L16604. [2] Page *et al*. (2004) *GRL* **31**, L24606. [3] Private comm. R. Warren / S. Chipera. [4] Vogel *et al*. (2004) *Powder Diff.* **19**, 64-68.