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Melt Viscosities in hydrous Granites determined by the Falling Sphere Method at magmatic Temperatures in a Centrifuging Piston Cylinder

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Studies on magma-viscosities are important for a better understanding of magma rheology and their behaviour. The "falling sphere" method allows to determine the viscosity (Shaw, 1963, $Geophysical Research$, 68) of Newtonian fluids, as in such fluids, viscosity is inversely proportional to the velocity of a sinking sphere (Stoke's law). With a sphere size of 100-200 μm (determined by SEM) and an inner capsule diameter of 3.5 mm, the boundary correction becomes small.

We use Pt-spheres in $Au_{80}Pd_{20}$ capsules which are welded in a can-like fashion to conserve cylindrical geometry. The starting position of the Pt-Sphere is marked by a thin layer of metal powder (Ag, Au, Mo or Pt with ø$<$ 2-3 μm) that can be recognized after the experiment. The end position is first determined by X-ray imaging in the dental clinic, and then precisely measured after careful doublesided polishing of the capsule.

The investigated material is a powder of a standard synthetic haplogranite composition with varying amounts of water (at present 2 or 3 wt%). The expected viscosity range of $10^{4.5}$ - $10^{6.1}$ (Pa$\times$s) requires acceleration of the sinking process that otherwise would place at 0.6-1.9 μm/h. We thus mounted a piston-cylinder (pressure being necessary to maintain H_2O in the melt) onto a centrifuge which at present was used to a maximum acceleration of 1000 g.

Up to now we measured the viscosity of the haplogranite at temperatures of 820 -

1000 °C resulting in values between 10^4 and 10^6 Pa$\times$s. The first experiments yield the expected decrease of viscosity with temperature and with increasing H_2O (at constant pressure). The first results at 820-1000 °C broadly confirm the viscosity prediction of Hess and Dingwell (1996, $American Mineralogist$, 81) (model 4, based on the Vogel-Fulcher-Tamman equation), but suggest lower values than predicted by their model at lower temperature or higher H_2O contents.