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NVP melt/magma viscosity: insight on Mercury lava flows

Stefano Rossi (1), Daniele Morgavi (1), Olivier Namur (2), Francesco Vetere (1), Diego Perugini (1), Paolo Mancinelli (1), and Cristina Pauselli (1)

(1) Dipartimento di Fisica e Geologia, Universita` di Perugia, piazza Universita` 1, 06123 Perugia, Italy (stefano.rossi1@studenti.unipg.it;daniele.morgavi@unipg.it;francesco.vetere@unipg.it;diego.perugini@unipg.it;pamancinelli@gmail.com;cristina.pa
(2) Uni Hannover Institut fu¨r Mineralogie, Leibniz Universita¨t Hannover, Callinstraβe 3, 30167 Hannover, Germany (o.namur@mineralogie.uni-hannover.de)

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Mercury | PICO Session

Convener: Johannes Benkhoff
Co-Convener: Joe Zender
Abstract submission Convener Login
After more than four years of orbiting Mercury, NASA's MESSENGER spacecraft came to an end in late April 2015. MESSENGER has provided many new and surprising results. This session will again highlight the latest results on Mercury based on MESSENGER observations or updated modelling.
The session will further address instrument calibration and science performance both retrospective on MESSENGER and on the ESA/JAXA BepiColombo mission.
Papers covering additional themes related to Mercury are also welcomed.

Please be aware that this session will be held as a PICO session. This will allow an intensive exchange of expertise and experience between the individual instruments and mission.

NVP melt/magma viscosity: insight on Mercury lava flows
S. Rossi1, D. Morgavi1, O. Namur2, D. Perugini1, F.Vetere1, P. Mancinelli1 and C. Pauselli1
1 Dipartimento di Fisica e Geologia, Universita` di Perugia, piazza Universita` 1, 06123 Perugia, Italy
2 Uni Hannover Institut fu¨r Mineralogie, Leibniz Universita¨t Hannover, Callinstraβe 3, 30167 Hannover, Germany

In this contribution we report new measurements of viscosity of synthetic komatitic melts, used the behaviour of silicate melts erupted at the surface of Mercury. Composition of Mercurian surface magmas was calculated using the most recent maps produced from MESSENGER XRS data (Weider et al., 2015). We focused on the northern hemisphere (Northern Volcanic Province, NVP, the largest lava flow on Mercury and possibly in the Solar System) for which the spatial resolution of MESSENGER measurements is high and individual maps of Mg/Si, Ca/Si, Al/Si and S/Si were combined. The experimental starting material contains high Na2O content (≈7 wt.%) that strongly influences viscosity.
High temperature viscosity measurements were carried out at 1 atm using a concentric cylinder apparatus equipped with an Anton Paar RheolabQC viscometer head at the Department of Physics and Geology (PVRG_lab) at the University of Perugia (Perugia, Italy). The change of melt viscosity induced by crystallization of a NVP composition was measured in the temperature ranges from 1463 to 1229 °C. Results showed an increase in effective viscosity from 4.3 Pa s to 1090 Pa s as the crystal content increased from 0 vol% to ca. 25 vol.%. The crystallization processes in the nominally dry NVP began at 1308 °C. Interestingly, melts viscosity changes from 4 to 16 Pa s as temperature varies from 1463 to 1327 °C. The extreme Mercurian lava fluidity experimentally measured has revealed the potentiality of NVP lavas to cover huge areas as shown by satellite data.

Keywords: Viscosity, Concentric cylinders, NVP, Mercury.