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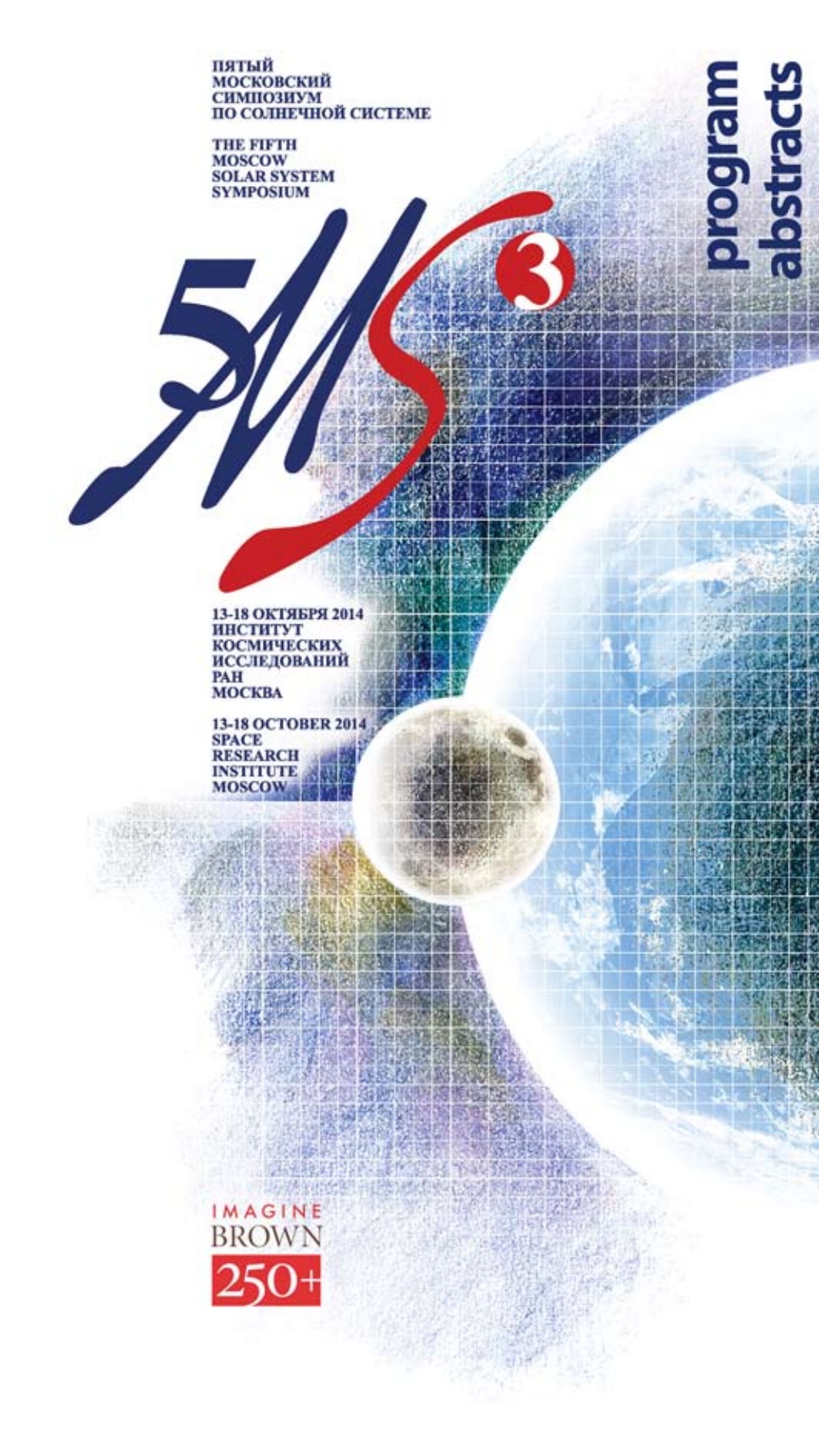

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CORRELATED STUDY OF PARTICLES RETURNED BY THE HAYABUSA SPACE PROBE FROM THE 25143 ITOKAWA ASTEROID BY SRXTM, NG-MS, IR AND RAMAN MICROSCOPY

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A correlated study with Raman micro- and infraredspectroscopy, noble gas mass spectroscopy (NG-MS) and Synchrotron Radiation X-ray Tomographic Microscopy (SRXTM) has been implemented for the determination of cosmic-ray exposure (CRE) ages and trapped Xe content in a few particles returned by the JAXA's Hayabusa space probe from the near-Earth asteroid 25143 Itokawa, the first successful sample return mission to an asteroid [1]. We analysedsix olivine-rich particles allocated for the study by JAXA [2]. The CRE age gives information about asteroid dynamics as well as surface processes. Raman (DLR Berlin, Germany) and SRXTM (TOMCAT beamline of the Swiss Light Source at PSI Switzerland) microscopy revealed mineral composition, particle volume, and the density distribution of the material. The helium and neon analysis was done on the compressor-source noble gas mass spectrometer at ETH Zurich. The correlated study by Raman spectroscopy and X-ray tomography allows reconstruction of spatially resolved mineral topographic images of individual particles (Fig. 1), including mineral orientation. The particles have volumes between 17800±900 μm^3 (RA-QD02-0187, #0187) and 442700±5900 μm^3 (#0049-1) [3]. Theforsteritecontent (#Mg) as determined by Raman spectroscopy is between 58±10 (#0049-1) and 72±8 (#0158), compatible with LL chondrite chemistry within errors [4]. A CRE age of 1.5±0.4 Ma, calculated from cosmogenic He and Ne, for the surface of Itokawa is very short compared to the CRE ages of most LL chrondrites, which are typically 5-50 Ma [5].

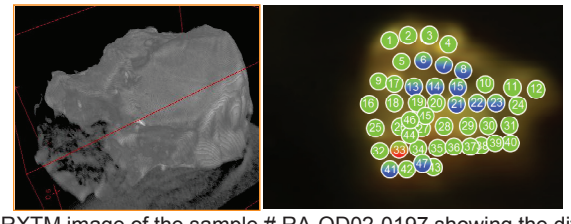

Fig. 1. Left: SRXTM image of the sample # RA-QD02-0197 showing the different density distribution; right: localization of Raman spectra, showing different mineral phases in the particle.

[1] T. Nakamura et al., Science 333, 1113-1116 (2011).
[2] H. Busemann et al., LPSC XLIV, Abstract #2243 (2013).
[3] M. M. M. Meier et al., LPSC XLV, Abstract #1247 (2014).
[4] U. Böttger et al., LPSC XLV, Abstract #1411 (2014).
[5] K. Marti and T. Graf, Ann. Rev. Earth Planet. Sci. 20, 221-243 (1992).