26th Goldschmidt Conference,
Yokohama, Japan, June 26 – July 1, 2016

Paleoarchean mantle hydrous reservoir beneath South Africa?

E. V. ASAFOV[1], A.V. SOBOLEV[1,2], A. A. GURENKO[3], N. T. ARNDT[2], V.G. BATANOVA[1,2], M.V. PORTNYAGIN[1,4], DIETER GARBE-SCHÖNBERG[5], S. P. KRASHENINNIKOV[1], A. H. WILSON[6] AND G.R. BYERLY[7]

[1] Vernadsky Institute, Moscow, Russia; evasafov@gmail.com
[2] ISTerre, France; alexander.sobolev@univ-grenoble-alpes.fr
[3] CRPG, Nancy, France, agurenko@crpg.cnrs-nancy.fr
[4] GEOMAR, Kiel, Germany; mportnyagin@geomar.de
[5] CAU Kiel Uni, Germany; d.garbe-schoenberg@gmx.de
[6] University of the Witwatersrand; Allan.Wilson@wits.ac.za
[7] LSU, Baton Rouge, USA; glbyer@lsu.edu

Recent study of melt inclusions in high magnesian olivines (Fo 92.4-Fo 94.2) from the 2.7 Ga komatiites of the Abitibi Greenstone Belt, Canada [Sobolev et al, Nature, 2016] demonstrates an early contamination of melts by seawater brines indicated by elevated concentrations of Cl. Yet the melt inclusions in the most magnesian olivines (Fo 94-94.5) that have not been affected by the seawater contain up to 0.8 wt.% H_2O suggesting presence of hydrous reservoir in the deep mantle at Neoarchean time. The present contribution may extend the age of this reservoir by 800 million years.

We report contents of water and other volatile components and major and trace elements in melt inclusions in highly magnesian olivines (Fo 93-95.8) from the komatiites of the Barberton Greenstone Belt, South Africa (3.5 Ga Komati and 3.3 Ga Weltevreden Formations) measured by EPMA, SIMS and LA-ICPMS. Inclusions were heated for 5 minutes at temperature 1450°C at QFM buffer and quenched. Measured so far melt inclusions originally contained 0.2- 0.8 wt.% H_2O and 50 ppm to 2.5wt.% Cl at MgO concentrations between 23-30 wt.%. The most Cl rich inclusions (>1000 ppm Cl) demonstrate positive correlation between water and Cl contents suggesting seawater derived brine contamination. The inclusions with lower Cl contents (250-1000ppm) show no correlation between these components and thus could potentially represent the source water from the ancient 3.3-3.5 Ga mantle hydrous reservoirs.

Melt inclusions with the lowest Cl contents (less than 100 ppm) were discovered in the most Mg-rich olivines from the Weltevreden Formation (Fo 95.3-95.8) and in olivine Fo 92 of Komati Formation. These melts were not affected by seawater contamination and thus should represent composition of primary melts and their mantle sources. Data on their composition (volatile, major and trace elements) and P-T conditions of origin will be presented at the report.