Any supernova ^{60}Fe excess on Earth? Evidence from ^{3}He in ferromanganese crust

S. BASU[1], F.M. STUART[1], C. SCHNABEL[1] AND
V. KLEMM[2]

[1]Isotope Geosciences Unit, SUERC, East Kilbride G75 0QF (S.Basu@suerc.gla.ac.uk)
[2]Department of Earth Sciences, ETH-Zurich, Clausiusstrasse 25, CH 8092, Switzerland (klemm@erdw.ethz.ch)

Supernova (SN) explosions within 30 parsecs of Earth have the potential to affect the biosphere. Identifying SN debris on Earth allows models of SN frequency to be tested and assess their role in global environmental change. Identification of rare SN-produced isotopes in slow accumulating terrestrial archives is one method. The detection of ^{60}Fe in 2.4-3 Ma layers in a ferromanganese crust from the deep Pacific Ocean (237KD) has been attributed a SN source [1]. However ^{60}Fe is also produced by galactic cosmic-ray (GCR) interaction with Ni in extraterrstrial material. Helium isotopes offer a way of testing the source of the ^{60}Fe in 237KD. ^{3}He is produced by GCR reactions and delivered to Earth in extraterrestrial dust, but SN-helium is not predicted to make it to the Earth. We have quantified the GCR-He contribution in 237KD, and, by comparing production rates in possible extraterrestrial material, we estimate the GCR-^{60}Fe from micrometeorites to test the SN hypothesis [2].

^{3}He/^{4}He (5.5 to 4440 R_A) is a mixture of extraterrestrial He (implanted solar ions + GCR-He) and radiogenic He in terrestrial dust. Prior to 4-5 Ma ^{3}He concentrations vary little and no ^{3}He/^{4}He was higher than the solar wind value (290 R_A). In the last 4 Myr average ^{3}He increases significantly, six samples have ^{3}He/^{4}He higher than solar wind and the average ^{3}He/^{4}He (330 R_A; n = 32) is higher than the average of the older samples (54 R_A; n = 36). The statistical variability of ^{3}He between replicates of < 4 Myr samples indicates that a small number of extremely GCR-He-rich micrometeorites have been incorporated. The ^{3}He/^{60}Fe of 237KD (80-850) is comparable to the measured GCR ^{3}He/^{60}Fe production rate ratio (400-500) in Ni-rich minerals in iron meteorites. The ^{60}Fe in 237KD can be explained by a small number of FeNi-rich micrometeorites and rules out the need for SN debris.

To test whether the ^{3}He in crusts reflect normal micrometeorite flux or ablation debris from entry melting of large meteorites we are analysing sections at the KT boundary from crusts with low ^{187}Os/^{186}Os excursions that are temporally associated with enhanced meteoritic flux.

References

[1] Knie K., Korschinek G., Faestermann T., Dorfi E.A., Rugel G. and Wallner A., (2004), *Phys. Rev. Lett.* **93,** 171103-1 - 171103-4.
[2] Basu S., Stuart F.M., Schnabel C. and Klemm V., (2007), *Phys. Rev. Lett.* **98,** 141103-1 - 141103-4.

Fractionation of HSE during melt transport processes in supra-subduction mantle

VALENTINA BATANOVA[1], GERHARD BRÜGMANN[2],
GALINA SAVELIEVA[3] AND ALEXANDER SOBOLEV[1,2]

[1]Vernadsky Institute of Geochemistry and Analytical Chemistry RAN, Moscow, Russia (batanova@geokhi.ru)
[2]Max-Planck-Institut fur Chemie, Mainz, Germany (bruegmag@uni-mainz.de)
[3]Geological Institute RAN, Moscow, Russia

Highly siderophile elements (HSE) represent powerful tools for monitoring and dating mantle processes. Here we report a detail study of HSE and Re-Os isotopes of lithologies from the Voykar Ophiolite (Polar Urals) which formed in a subduction tectonic environment. The Voykar mantle rocks are extraordinary fresh and often free of serpentine. Even primary sulfides are preserved. This suggests that the original PGE distribution and the Re-Os isotope systematics have not disturbed by low temperature secondary alteration processes.

Our data suggest that old, more than 2 Ga old refractory harzburgite was percolated by suprasubduction melts about 0.6 Ga. These melts have formed dunite reaction channels and pyroxenite veins and locally redistributed the HSE in the surrounding harzburgite. In dunite channels and pyroxenite veins numerous sulfide globules transported by silicate melts have been observed. These sulfide globules make up the HSE budget of the pyroxenites and they are characterized by low concentration of Os, Ir and Ru compared to Pt, Pd and Re. High Re abundance in the pyroxenite (up to 2 ppb) suggest contribution from subduction slab.

HSE composition of dunites results from reaction between percolating melt and host peridotite. Close to the contact, residual peridotites become enriched in Pt, Pd and Re. But primary HSE features of the harzburgite, such as Pd, Pt, Re depletion relative to Ir, Os and Ru appear to be preserved in a distance of about 1 m away from the contact with dunite channel.

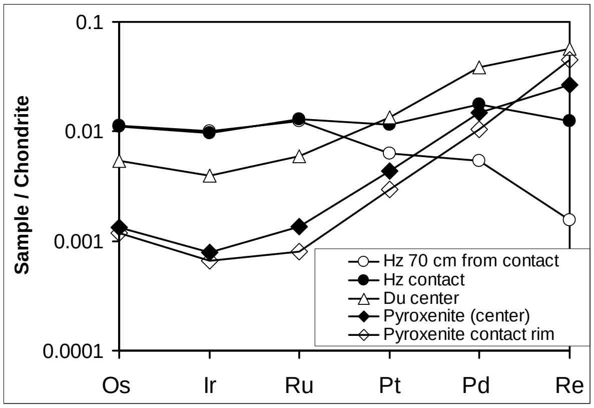

Figure 1: HSE distribution through the dunite channel.