Geophysical Research Abstracts, Vol. 8, 08711, 2006
SRef-ID: 1607-7962/gra/EGU06-A-08711

Extreme upper mantle depletion in the Archean: evidence from Hf-Nd isotope compositions of Neoarchean peridotites, N China craton

C. Münker (1,2), A. Polat (3), T. Kusky (4), J. Li (5)

(1) Mineralogisch-Petrologisches Institut, Universität Bonn, Germany, (2) Institut für Mineralogie, Universität Münster, Germany, (3) Dept. of Earth Sciences, University of Windsor, Windsor, Canada, (4) Dept. of Earth and Atmospheric Sciences, Saint Louis University, USA, (5) Dept. of Geology, Peking University, China (muenker@uni-bonn.de / FAX: ++49 228 73 2763)

In conventional view, there is no clear evidence for Hadean crust-mantle depletion preserved on Earth. This view has been challenged by a recently reported spread of initial Hf isotope values in Hadean and early Archean zircons from western Australia. The spread in initial Hf isotope values suggests that early crust-mantle differentiation occurred (1) very early and (2) at a larger scale. So far, direct isotope evidence from Archean mantle rocks was scarce due to the lack of preserved ophiolite sequences. Here we present Hf-Nd isotope and high precision HFSE concentration data for ca. 2.55 Ga old peridotites from the Zunhua belt within the central orogenic belt of the North China craton. These peridotites include chromite and clinopyroxene bearing harzburgites and lherzolites, displaying whole-rock Mg numbers of 83-87. Together with LREE enrichment and negative Nb anomalies, these features indicate a supra-subduction origin of the Zunhua peridotites.

Initial epsilon Hf values for whole rock peridotite samples range from +7.9 to +10.4 and overlap to within 1 epsilon unit with values obtained from clinopyroxene separates. In Lu-Hf isochron space, the samples yield an age of 2528 $\pm$130 Ma (2 sigma). Initial epsilon Nd values obtained for whole rock and clinopyroxene separates display a larger scatter from -1.5 to +6.0. Together with trace element systematics, the observed decoupling of Nd from Hf isotope values suggests that significant amounts of the Nd was added by slab derived components, whereas the Hf isotope compositions reflect those of the pristine mantle wedge. At 2.55 Ga, the initial epsilon Hf values

for the Zunhua peridotites plot well above the depleted mantle curve, suggesting an extremely depleted mantle composition. Even the most radiogenic epsilon Nd values lie above values predicted from currently used mantle growth curves, suggesting a depleted endmember in the sources of the subduction components. Altogether, the Hf-Nd isotope relationships indicate the presence of highly depleted mantle domains early in the Archean.

Measured Nb/Ta and Zr/Hf ratios in the Zunhua peridotites range from 11.6 to 15.6 and 30.6 to 36.3, respectively, overlapping with values for the present day silicate Earth (ca. 14 and 34, respectively). These observations indicate that the silicate Earth has not been depleted in Nb since the end of the Archean, confirming earlier models that post-Archean subduction processes had a negligible impact on the Nb-Ta budget of the Earth's upper mantle.