ZHAGN Pengfei, ZHOU Meifu, SU Benxun, Ibrahim UYSAL, Paul T. ROBINSON, Erdi AVCI and HE Yongsheng, 2017. Iron Isotopic Fractionation and Origin of Chromitites in the Paleo-Moho Transition Zone of the Kop Ophiolite, NE Turkey. *Acta Geologica Sinica* (English Edition), 91(supp. 1): 53.

Iron Isotopic Fractionation and Origin of Chromitites in the Paleo-Moho Transition Zone of the Kop Ophiolite, NE Turkey

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1 Abstract

The Kop ophiolite in NE Turkey is a fragment of Neo-Tethyan forearc. It can be mainly divided into a paleo-Moho transition zone (MTZ) in the North and a harzburgitic mantle sequence in the South. Dunites are predominant in the MTZ of the Kop ophiolite, and they are locally interlayered with chromitites and enclose minor bodies of harzburgites near the petrological Moho boundary. Large Fe isotopic variations were observed for magnesiochromite (-0.14‰ to 0.06‰) and olivine (-0.12‰ to 0.14‰) from the MTZ chromitites, dunites and harzburgites. In individual dunite samples, magnesiochromite usually has lighter Fe isotopic compositions than olivine, which was probably caused by subsolidus Mg-Fe exchange between the two mineral phases. Both magnesiochromite and olivine display an increasing trend of δ^{56}Fe along a profile from chromitite to dunite. This trend reflects continuous fractional crystallization in a magma chamber, which resulted in heavier Fe isotopes concentrated in the evolved magmas. In each cumulative cycle of chromitite and dunite, dunite was formed from relatively evolved melts after massive precipitation of magnesiochromite. Mixing of more primitive and evolved melts in the magma chamber was a potential mechanism for triggering the crystallization of magnesiochromite, generating chromitite layers in the cumulate pile. Before mixing happened, the primitive melts had reacted with mantle harzburgites during their ascendance; whereas the evolved melts may lie on the olivine-chromite cotectic near the liquidus field of pyroxene. Variable degrees of magma mixing and differentiation are expected to generate melts with different δ^{56}Fe values, accounting for the Fe isotopic variations of the Kop MTZ.

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