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Petrogenesis Significance of Chromian Spinels from Northeastern Jiangxi Province Ophiolite (NEJXO), China: Paleogeodynamic Implications

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1 Introduction

The northeastern Jiangxi Province ophiolite is located in the SE margin of the Yangtze Block, along the Zhangshudun (Yiyang) - Xingangshan (Dexing), ophiolite belt extending northeast for about 100km (Zhou, 1989; Li et al., 1997). The original sequence of the NE Jiangxi ophiolite suite has been structurally disrupted and enclosed by a strongly foliated flysch sequence. Most of the dismembered peridotites of NEJXO are highly serpentinized, requiring care in applying petrochemistry and geochemistry to distinguish their tectonic setting, especially when part of such an old, dismembered and metamorphosed ophiolite.

Chrome spinel is usually used as a petrogenetic indicator because the chemical composition of spinels are influenced by geological factors such as magma compositions, crystallization sequence, oxygen fugacity and pressure-temperature conditions, and because they are usually stable even in highly serpentinized rocks (Dick and Bullen, 1984; Ahmed et al., 2005). This present work mainly describes the compositions of chromian spinel and its associated assembly minerals in attempt to provide insights into the paleogeodynamic setting of Northeastern Jiangxi Province Ophiolite. *

2 Mineral Chemistry

The serpentitized peridotite of the NEJXO complex is characterized by dunite, harzburgite and clinopyroxene-bearing harzburgite. No lherzolite is present, indicating generation from a relatively high degrees of melting. The chromian spinel occurs between the serpentine with a variety of morphologies, exhibiting vermicular, anhedral, and rarely euhedral habits in the serpentinized harzburgite. The spinels in NEJXO have high Cr_2O_3 (ranging from 42.82 to 62.54 wt.%, average 56.61 wt.%), low Al_2O_3 (ranging from 8.48 to 25.23 wt.%, average 13.61 wt.%) and low TiO_2 content (below 0.2 wt.%), and show systematically variations from dunite, harzburgite to clinopyroxene-bearing harzburgite. The spinel in these serpentines displays a large range in $Mg^{\#}$ [100×Mg/(Mg+Fe)] (40.6-64.1) and $Cr^{\#}$ [100×Cr/(Cr+Al)] (53.2-82.9), and the $Cr^{\#}$ and TiO_2 contents increase from clinopyroxene-bearing harzburgite to harzburgite, to dunite.

The olivine shows Fo ranging from 90.9 to 93.9, and an average NiO content of 0.41 wt.% for clinopyroxene-bearing harzburgite, 0.38 wt.% for harzburgite and 0.44 wt.% for dunite.

3 Paleogeodynamic Implications

Mineral compositions between olivine and chormian spinels resemble those from residual mantle peridotites, implying formation in a supra-subduction zone setting (Arai, 1994), probably a fore-arc. The estimated temperature using coexisting ovivine and chromian spinle for dunite, harzburgite and clinopyroxene-bearing harzburgite is 1120℃, 972℃ and 923℃, respectively (Ballhaus et al., 1991). The NEJXO shows $\Delta \log fO2$ (FMQ) of the peridotites which range from -3.5 to -0.1 (Fig.1), which are all lower than the FMQ buffer. This is different from the typical SSZ environment, which is

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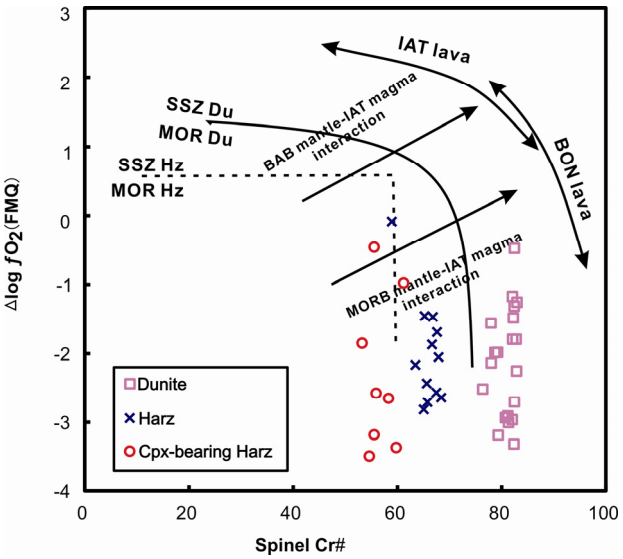

Fig. 1. Plot of Δlog$f$O2 (FMQ) vs. Cr# of chromian spinels from NEJXO (Dare et al., 2009; Pearce et al., 2000)

usually more oxidized (Dare et al., 2009). The reason for that may be explained by rapid slab retreat at the start of subduction, or a back-arc setting with limited subduction input. (Parkinson and Pearce, 1998). This is consistent with the viewpoint that Yangtze and Cathaysia were separated by Tethys during the late Proterozoic and collided in 880Ma forming Xiwan lenses leucogranites (Zhao 2015; Li et al., 2008).

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