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Composition of Titanomagnetite and Microstructure of Banded Type Ore in Weiya Fe-V-Ti oxide Deposits and its Implication on Metallogenesis

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1 Introduction

Weiya Fe-Ti-V oxide deposit is the biggest one in North Xinjiang, and lots of work on petrology, mineralogy, chronology and isotope geochemistry have been done by previous workers. However, the formation mechanism of massive ore type and banded type ore is not clear.

Banded type Fe-Ti-V oxide ore not only is an important ore type in Weiya deposit (Wang et al., 2005, 2008), but also could give some clues in understanding the petrogenesis and metallogenesis of Fe-Ti-V oxide deposits. Therefore, systematic observation was carried on to explore the petrogenesis and metallogenesis process. At the same time, chemical composition of titanomagnetite in four types of rocks including two types of host rocks and two types of ore were analyzed to discuss the origin of Fe-Ti-V oxide.

2 Banded type ore and Chemical Composition of Titanomagnetite

2.1 Two sub-units of the banded type ore

Based on microscopic observation, two sub-units with distinctive features are recognized: anorthositic layered units and Fe-Ti oxide layered units. These two types of sub-units are integrated contacted, comprising different mineral assemblages and structure.

Plagioclase is the primary mineral in anorthositic layer, while minor biotite, hornblende, pyroxene and titanomagnetite are the minor minerals, displaying cumulating structure. The massive ore displays flowing structure, contains a large proportion of rounded isolated olivine and pyroxene, and fragments of anorthosite. Myrmekitic orthopyroxene-magnetite intergrowth is also observed in the Fe-Ti oxide layered units.

2.2 Chemical composition of titanomagnetite

The chemical composition of titanomagnetite in troctolite and anorthosite display significant difference. The former is characterized by high amount of TiO_2 , and the later is featured by significant low amount of TiO_2 . There is no overprinted composition area of these two types of oxide. The composition of titanomagnetite in massive ore and banded type ore are totally overprinted and similar to the equivalent in troctolite.

3 Discussion and Conclusion

It is known to us that the anorthosite is SiO_2 -saturated, while a large proportion of rounded isolated olivine grains are found in the Fe-Ti-V units indicating that the ore units are SiO_2 -unsaturated. Compared with the anorthositic layers, the massive ore layers are more mafic and SiO_2 -unsaturated, implying that the ore layers could not be differentiated from the anorthositic units. The systematic comparison of titanomagnetite of ore and host rocks demonstrate that titanomagnetite of ore probably derives from the olivine-bearing mafic-ultramafic rocks and displays significant difference to that of anorthosite.

The anorthositic xenoliths captured in the ore units and some myrmekitic orthopyroxene-magnetite intergrowth found in the massive ore units suggest the Fe-Ti-V ore are characterized by liquid properties (Ambler and Ashley, 1980; Daval, 1987). Reoccurrence of Fe-Ti-V units indicate that multistage of massive Fe-Ti-V ore were injected into the shallow magma chamber during the formation of anorthosite.

Microstructure of the banded ore type in Weiya suggests two types of magma with distinctive chemical features were injected into the shallow magma chamber alternately. One is SiO_2 -saturated anorthositic magma, while the other is SiO_2 -unsaturated ore liquids containing large amount of Fe-Ti oxide.

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Together with chemical composition of titanomagnetite of ores and host rocks, the microstructure and mineral assemblage of the banded type ore matches well with the immiscible liquid separation hypothesis proposed in other oxides deposits, such as Panzhihua (Zhou et al., 2004, 2013). Two stages of immiscible magma separation had taken place in the Weiya petrogenesis and metallogenesis process. First stage of immiscible liquid separation produces a silicate rich magma end member, and a mafic-ultramafic magma end member. The former end member probably forms the anorthotic units, while the later end member likely produce an ore end member and a mafic-ultramafic end member comprising olivine and pyroxene by a second stage of immiscible liquid separation.

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