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Preliminary Study on the Metallogenic System of Mafic Large Igneous Provinces (MLIPs)

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Large igneous provinces (LIPs) generally refer to the different types of the igneous rocks, which intrude in a short time, ranging in area from 50000 to 100000 km² (Sheth, 2007; Bryan et al., 2008). While the mafic large igneous provinces (MLIPs), one of the LIPs, consists of a large amounts of mafic extrusive rocks (>95%) and intrusive rocks (Sheth, 2007; Xiao et al., 2007). MLIPs are always resulted from the participation of extremely and abnormally high mantle heat flow. Typical characteristics of MLPs are to: 1) dominantly consist of extensive basic lava flow (Zhu et al., 2007; Qiu et al., 2010); 2) that the coverage of the basalt is roughly defined by the crust uplift and the area of the vertical amplitude of 1 km of the uplift zone before the eruption of basaltic magma (Xiao et al., 2007); 3) have a great isotopic composition variation with the ranging from that of oceanic island basalt to that of old continental crust (Zhu et al., 2009); 4) have many different tectonic settings, such as intra continent (such as the Deccan plateau, Siberia and the Emei Mountain flood basalts, etc.), passive volcanic margin (such as Voring edge), ocean ridge highland (such as Ontong Java highland), oceanic basis (such as the Caribbean basin flood basalts) and volcanic island chain (such as the Hawaii – Emperor Seamounts chain).

The melting of mantle requires a huge amount of heat source or dehydration of subducting plate, and result in the formation of the basic magma that intrude into between the lower crust and subcontinental lithospheric mantle, which leads to the melting of the overlying crust (Pirajno, 2000). So the MLIPs are formed in the environment that is full of strong magmatism. Undoubtedly, strong magmatism

will cause a multi-level exchange of material and energy, and this is exactly what makes the metallogenic substance gather and mineralize. Therefore, MLIPs is a huge metallogenic province, and because of the diversity of metallogenic substance source, temperature, pressure, fluid and oxygen fugacity, etc., it will experience distinct magmatic evolutionary histories and form different types of deposit, which constitute a typical metallogenic system.

MLIPs are closely related to the mantle plume tectonics, so the metallogenic system is strictly constrained by the dynamic processes and chemical structure of the mantle plume. The melting processes of the center and surrounding of the mantle stigma are totally different, so do the metallogenic conditions of the magma chamber, magma channel and flood basalt. On the whole, the center of MLIPs tends to form magmatic Cr-Cu-Ni-PGE sulfide deposits and V-Ti-Fe oxide deposits, whereas the outer are the hydrothermal Cu-Pb-Zn-Au-Ag deposits and distal epithermal deposits. As Emei Mountain MLIPs in China (Song et al., 2005; Hu et al., 2005), magmatic Cu-Ni sulfide deposits are formed in the center of MLIPs, outward, in turn, V-Ti magnetite deposits, hydrothermal Pb-Zn deposits, basalt-type copper deposits, carlin-type gold deposits and oil, gas resources, etc.

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