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Magnetic Fabric Studies of Xiong'er Volcanic Rocks in Southern Margin of the North China Craton and its Implications

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The Paleoproterozoic Xiong'er Group is composed of mafic to felsic volcanic rocks and minor sedimentary rocks, distributed along the southern margin of the North China craton (NCC). It is a key marker for regional tectonic studies, owing to its massive volume and also its eruption period, and close related to the evolution of the Columbia Supercontinent. Its geological significance has been controversial for long with two dominant schools: one is continental rift model and the other is subduction-related arc. Previous studies on the Xiong'er volcanic rocks mainly focused on its geochemical, petrological and geochronological characteristics. In this study, we tried to identify the controversial issues in the geological settings of the Xiong'er volcanics related to the history of the Columbia based on the analyses of anisotropy of magnetic susceptibility (AMS).

The AMS method has been used as an excellent indicator for magma flow in igneous rocks and even the location of potential magma reservoirs. Two models for the Xiong'er volcanics correspond to different eruption pattern, and so, in order to characterize the magmatic flow pattern that was probably related to the origin of the igneous province, we measured 31 lava flows and one sedimentary interlayer from Xiong'er Group in the three sections (SL, TG and LL) in north and west of Henan Province, roughly around the assumed eruption center in continental rift model.

Detailed rock magnetic experiments in room temperature and high temperature were conducted on representative samples. Magnetization versus temperature (J-T) and room-temperature hysteresis curves identified three different magnetic minerals, namely magnetite, maghematite and hematite. Hysteresis parameters plotted in Day diagram indicates a series of mixing states in different samples by single-domian (SD) and multi-domain (MD) magnetite. Anisotropy of magnetic susceptibility of these samples can be classified into five kinds: random, normal, "false" normal, intermediate and inverse AMS fabrics according to the division in Rochette et al. (1992). The competition between shape-preferred orientation/crystallographic- preferred orientation fabrics may cause the random fabric and an increasing SD grains may cause the "normal" false, and intermediate fabrics. This is consistent to the rock magnetic results in relative lavas. The anisotropy degree of the samples indicates primary magmatic flow fabrics (1.01). The anisotropy ellipsoids are dominantly oblate in SL and TG sections. The K_{max} axes of the normal and "normal" false AMS fabrics are used to calculate the mean direction of the magma-flow direction in each section. The lineation of K_{max} from three sections presents a radial flow pattern and the intersection of mean K_{max} axes is located near Xiong'ershan and Xiaoshan Mountains, implying the eruption center of the lavas was center-based. The AMS analyses suggest an outstretched background, probably a plume-related LIP for the formation of the Xiong'er Group.

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