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VIOLENT PHREATOMAGMATIC ERUPTIONS THAT FORMED MAARS IN AN INTRA-MOUNTAIN BASIN AT ARXAN-CHAIHE VOLCANIC FIELD, INNER MONGOLIA, CHINA

A thesis presented in partial fulfilment of the requirements for the degree of
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Look up at the stars and not down at your feet. Try to make sense of what you see and wonder about what makes the universe exist. Be curious. And however difficult life may seem, there is always something you can do and succeed at. It matters that you don't just give up.

– Stephen Hawking

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Abstract

Two large depressions contain Wusulangzi Lake and Tongxin Lake in the Arxan-Chaihe Volcanic Field (ACVF), which preserves at least 27 volcanoes in NE China in about a 1000 km² area. Due to the preliminary research on both Wusulangzi and Tongxin, two sample groups (Sample 1 and Sample 2) were collected and field observations were held on both sites. Sample 1, representing Wusulangzi, was collected from the SE part of the lake where the lava flow is suspected to cover and preserve medial to distal sections of the tuff ring. Sample 2, representing Tongxin, was collected from the SW rim of the crater from the proximal area, as well as the eastern side in regard to the distal region. Specifically at Tongxin Lake, the pyroclastic successions and beddings contain a series of horizontal and laminated structures, with dune beddings, cross-beddings, as well as a chute-and-pool structure. Pyroclastic deposits of the tuff rings can be traced from the crater rim about 3 km. The various methods of microscopy reveal that glass shards are distributed differently in both sample groups. Mineral diversity is shown to a large extent, and the mineralogical alteration can be observed under petrographic microscopy. SEM and BSE for 2D and 3D images indicate a relatively high fragmentation of juvenile particles. The grain-size distribution also implies medium-to-high explosive energy. Geochemistry data of both major and trace elements reveals a diversity of magma in relation to fractional crystallisation (olivine, clinopyroxene and plagioclase crystallisation) and magma evolution processes, which are depicted by Harker variation diagrams. The AFM plot reveals a primitive stage of magma evolution. The multi-element diagram shows uranium as abnormal, which is suspected to be a U-rich mantle source.

Keywords: phreatomagmatic eruption, maar crater, major and trace elements, SEM, BSE, petrographic microscopy, grain-size distribution, ternary plot, Harker diagram

