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The Spatial-Temporal Distribution Patterns of Dyke Swarms in Central Asia and their Tectonic Significance: Case Studies in Eastern Tianshan and Western Junggar

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Dykes are a special kind of intrusive rocks which were formed by deep magma intruded into the existing brittle fractures in the crust. Dykes swarms in different tectonic environments are very significant to re-construct the paleo-geodynamic conditions in which the dyke-filled fractures were occurred; meanwhile dykes are the geochemical messengers containing information of deep-originated magma activities. From the viewpoint of brittle deformations, dyke swarms not only mark the spatial distribution patterns of the dyke-filled fractures (usually extensional or shear), but also give the upper temporal limit of when these fractures were formed (accordingly the lower limit can be given by host rocks).

Inspired by previous IDCs (1-6) and other studies on dykes in recent years (e.g.: Park et al., 1995; Peng et al., 2010), our research focuses on spatial-temporal distribution patterns of large amount of dykes in Central Asia, and specific kinematic and dynamic analyses have been carrying out in major dyke-concentrated regions in Central Asian to play important roles in regional tectonic issues.

By means of remote sensing interpretation and filed survey, the distribution patterns of dyke swarms in overall Central Asia are revealed for the first time. Spatially, there is obvious relevance between the distribution of dykes and regional tectonic boundaries, and most of them concentrated in some regions, include west and north coast of Balkhash Lake, Chingis-Taerbahatai, western Junggar, eastern Junggar, Mongolian Altai, eastern Tianshan and Beishan. Temporally, most of the darks were formed in the Late Paleozoic and minorities of them were formed in the Mesozoic, except for the Neoproterozoic dykes in Kuruktage of eastern Tianshan (Zhang et al., 2009).

Eastern Tianshan is the most dyke-concentrated area including nearly 60% amount of dykes in the whole Central Asia. Large amount of dykes formed in the Permian (Pirajno et al., 2008; Qin et al., 2011) are emplaced in different aged (D-P) granitoid plutons. According to statistical strike superiority and cutting relationships between different trending dykes, the dyke-filled fractures were occurred by regional N-S compression in the Late Carboniferous to Early Permian. And the later deformations act on dykes along the major shear zones reveals dextral movement (especially the Kangguertag Fault) occurred in the Permian.

In western Junggar, the diorite dykes intruded into the granitoid plutons were formed in the late Carboniferous, according to chronology study and their field occurrence (Feng et al., 2012a, b; Ma et al., 2012). Dykes emplaced in the Karamay plutons can be classified into 3 groups by different strike. The group 1 with NW/SE strike was intruded in sinistral dextral shear fractures, and the group 2 with NE/SW strike was intruded in sinistral shear fractures. The group 3 was formed in approximately N/S strike extensional fractures. The stress interpretation indicates a NNW-SSE direction of planar maximum principal stress during 319-303Ma when these fractures were occurring. In Hongshan pluton, the dykes can be classified into the eclipse shaped ring dykes and the non-ring dykes with different strikes. According to structural molding, these dykes were occurred by superposition of vertical magma uplift and horizontal NNW-SSE compression during 304-301Ma. In Miaoergou pluton, the overall arc-shaped dyke-filled fractures may be formed by regional sinistral shear and attendant anti-clock rotation of this pluton in the Late Carboniferous to early Permian.

The mutual displacement between different trending dykes and their kinetic analysis reveal that dykes cannot

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be simply generalized as formed in extensional conditions. However, the complexity of their dynamic mechanisms calls for further comprehensive research.

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