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Syn-kinematic emplacement of the Pangong metamorphic and magmatic complex along the Karakorum Fault (N Ladakh)

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ABSTRACT

This paper investigates the age, *P–T* conditions and kinematics of Karakorum Fault (KF) zone rocks in the NW part of the Himalaya–Karakorum belt. Granulite to greenschist facies assemblages were developed within the KF zone during strike-slip shearing. The granulites were formed at high temperature (800 °C, 5.5 kbar), were subsequently retromorphosed into the amphibolite facies (700–750 °C, 4–5 kbar) and the greenschist facies (350–400 °C, 3–4 kbar). The Tangtse granite emplaced syn-kinematically at the contact between a LT and the HT granulite facies. Intrusion occurred during the juxtaposition of the two units under amphibolite conditions. Microstructures observed within the Tangtse granite exhibit a syn-magmatic dextral S–C fabric. Compiled U–Pb and Ar–Ar data show that in the central KF segment, granulite facies metamorphism occurred at a minimum age of 32 Ma, subsequent amphibolite facies metamorphism at 20–18 Ma. Further shearing under amphibolite facies (650–500 °C) was recorded at 13.6 ± 0.9 Ma, and greenschist-facies mica growth at 11 Ma. These data give further constrains to the age of initiation and depth of the Karakorum Fault. The granulite-facies conditions suggest that the KF, accommodating the lateral extrusion of Tibet, could be at least a crustal or even a Lithosphere-scale shear zone comparable to other peri-Himalayan faults.

1. Introduction

North of the Himalayan belt, in response to the India–Asia collision, the eastward extrusion of the Tibetan bloc is accommodated by major strike-slip faults (Red River Fault, Altyn Tagh Fault, Karakorum Fault (KF); Tapponnier and Molnar, 1977; Tapponnier et al., 1986; Peltzer and Tapponnier, 1988; Armijo et al., 1989). Some of these strike-slip faults have recently been shown to be deeply rooted. Actually, seismic tomography across the Altyn Tagh Fault has evidenced a negative *P*-wave anomaly below the fault down to 140 km depth, interpreted as lithospheric scale shearing (Wittlinger et al., 1998). Along the Red River Fault, syn-shearing formation and exhumation of HT rocks is indicative of at least a crustal-scale structure (Harrison et al., 1992; Lacassin et al., 1997; Leloup et al., 1995). The trans-crustal to trans-lithospheric character of these faults may allow thermal advection by magma guided along the fault ("leaky" transcurrent fault), but shear heating may also be invoked (Leloup et al., 1999). However, the scale of the Karakorum Fault, SE boundary of Tibet, is unknown, and the importance of lateral extrusion of Tibet along this fault is much discussed. The published estimates of right-lateral motion range from 66 to 1000 km (Peltzer and Tapponnier, 1988; Liu et al., 1992; Liu, 1993; Searle, 1996; Searle et al., 1999; Murphy et al., 2000). More recently, several studies focussed on the central part of the KF have proposed right-lateral displacements of 280–300 km based on the offset of suture zones (Rolland and Pêcher, 2001; Lacassin et al. (2004a,b)). These estimates are opposed to smaller estimates of 120 km based on the correlation of the Baltoro Batholith in Karakorum and the Tangtse granite in the Pangong Range (Searle, 1996; Searle et al., 1999; Searle and Phillips, 2004; Phillips et al., 2004). However, some authors consider that the Tangtse granite is not offset by but is rather emplaced within the KF (Lacassin et al., 2004). In this paper, we present additional structural, metamorphic, geochronological and geochemical data on the Tangtse granite as well as on adjacent HT metamorphic rocks within the Pangong Range. The following questions are addressed by this paper: (1) is the Tangtse granite offset by or emplaced within the KF?; (2) What is the significance of the HT metamorphism?

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