Late Paleozoic tectonic and magmatic evolution of the Chinese West Tianshan

Bo Wang, Michel Faure, Liangshu S. Shu, Dominique Cluzel, Jacques Charvet

Geophysical Research Abstracts, Vol. 7, 00402, 2005
SRef-ID: 1607-7962/gra/EGU05-A-00402

Late Paleozoic tectonic and magmatic evolution of the Chinese West Tianshan

B. Wang (1, 2), M. Faure (1), L.S. Shu (2), D. Cluzel (1) and J. Charvet (1)

(1) Institut des Sciences de la Terre d'Orléans, Université d'Orléans, F45067, Cedex 2, France
(2) Department of Earth Sciences, Nanjing University, Nanjing, 210093, China
(bo.wang@univ-orleans.fr)

In Xinjiang Province of NW China, the Tianshan Belt belongs to the Late Paleozoic Variscan orogens that shaped up the Eurasian continent. Most of geologists drew to a conclusion that the Tianshan Belt was built during Paleozoic times through oceanic subduction, accretion and collision between the main Precambrian cratons such as Tarim, Junggar and Kazakhstan and some intervening microcontinents such as the Yili Block. However, there are still some controversies on the geodynamics of Paleozoic Tianshan, especially the West Tianshan (WTS), which was less studied than the East Tianshan. In particular, the tectonic significance in terms of heat transfer and crustal rheology of the huge magmatic rocks that develop in WTS is rarely taken into account in the lithosphere-scale evolution models.

Our work focuses on the igneous rocks, namely plutons and lava flows which are widespread in the Yili area of WTS. More than eight sections of the Yili area have been studied in detail, from there eighty samples of igneous rocks were collected for petrological and structural studies. Geochemical analyses for major elements (XRF), REE and other trace elements (ICP-MS) were performed on twenty representative samples from three sections of the WTS.

The lavas from each of the three sections are dated as Early to Middle Carboniferous. These volcanic rocks are of complete basic-medium-acid volcanic rock series ranging from basalt, trachybasalt, basaltic andesite, basaltic trachy-andesite and andesite to rhyolite, dacite and trachyte. The results of geochemical analysis on major and trace elements show that (1) most of analysed samples have high K_2O contents although relatively lower than Na_2O contents, Alkalis increase while CaO decreases with de-

creasing MgO; (2) all volcanic rocks have higher concentrations of LREE with respect to those of HREE, and the total REE concentrations ranging from 66 to 219 ppm; and (3) they are relatively enriched in Th, K and Rb, whereas depleted in Nb, Ta, Ba, Zr and Ti. Major element triangular diagrams and chondrite normalized REE patterns show typical geochemical feature of calc-alkaline or alkaline volcanism, Hf/3-Th-Ta and Ti/100-Zr-Y$\times$3 triangular diagrams indicate that these samples are volcanic-arc related rocks. The volcanic rocks in Yili area are quite similar to the island-arc lavas instead of within plate or continental rift ones. They correspond to high-K subduction related rocks derived from mantle melting and contaminated by continental crust. Results of analysis on intrusive rocks, diorite, gabbro, granodiorite (mainly sampled in the Yuxi section) also indicate that they formed in the setting of continental volcanic arc.

The ophiolitic mélange (e. g. newly discovered Erdaogou, Bayingou) support the view that the northern boundary of the Yili Block represents a Late Paleozoic suture in the WTS. Taking into account the facts that (1) the ophiolite mélange composed of serpentinite, peridotite, diabase, basalt, pillow lava and cherts outcrops as blocks and tectonically contacts with flysch matrix in the Erdaogou-Bayingou zone, and (2) the basalts in ophiolite mélange have REE distribution characters of OIB, MORB and P-MORB, a southward subduction is likely responsible for the formation of a magmatic arc.

Kinematic analyses demonstrate both a top-to-the-north thrusting and a ductile dextral wrenching. A long lasting subduction induces several mechanical and thermal effects in the upper plate. Strain localization, rock softening and possibly crustal melting are the likely consequences of the magmatic activity. In order to better understand the evolution of the West Tianshan Belt during the Late Paleozoic, a possible geodynamic model involving strain partitioning between frontal subduction and lateral escape is discussed.

Keywords: Magmatic rocks, Ophiolite, Continental Geodynamics, Crustal deformation, Geochemical analysis, Carboniferous, Tianshan Belt