Ion microprobe U-Pb ages of the Khunjerab granodiorite and some granitoids from Karakoram, Pakistan

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The Karakoram block was located at the southern margin of Asian continent before the Late Cretaceous amalgamation of the Kohistan block to Asia. The northward subduction of the ocean under the Asian continent was considered to form Early Cretaceous continental arc magmatism in the Karakoram block. The Karakoram Batholith is a major granitic body in the Karakoram block, extending from Baltoro to Chitral regions. However, several smaller granitic bodies are present to north of the Karakoram Batholith, which comprise the Khunjerab-Tirich Mir granite belt. Ogasawara et al. (1992) investigated several granitoids of this belt in the Khunjerab valley. They reported hornblende and biotite K-Ar ages of the granitoids. As the Karakoram block received continued tectonic activity since the Cretaceous to Cenozoic, the K-Ar ages may not provide clear timing of the primary igneous events. Some U-Pb zircon ages are available for the Karakoram Batholith, however, the U-Pb ages for the granitic rocks in the Khunjerab-Tirich Mir granite belt are limited (Hildebrand et al. 2001). It is important to have precise U-Pb zircon ages of the granitic rocks to understand timing of igneous activities and related tectonism of the region. Thus objectives of this study are (1) to provide precise timing of the igneous activity and (2) to search for the inherited core of the zircon and its age to understand source rock characteristics of the granitoids.

The Khunjerab granodiorite occurs around the Khunjerab Pass 60 km north of the Karakoram batholith, mainly along the northern side of the Khunjerab valley. Small outcrop of the granodiorite is found 10 km west of the Khunjerab Pass along the Karakoram Highway, and a sample was collected for the analysis from this outcrop. North Sost pluton is found in a 3.8 km section along the Karakoram Highway in the Khunjerab valley, 8 km north of Sost. Although outcrops of the granitoids are limited in the Khunjerab valley, the granitoids are exposed extensively to the north of the Misgar, west of the Khunjerab valley. This pluton is also evaluated in this study. However, the granitoids contain very small amount of zircon grains.

A high resolution ion microprobe (Cameca ims 1270) at the Geological Survey of Japan was used to obtain U-Pb zircon ages. Primary ion beam was about 25 micron diameter with intensity of 2 nA. Mass resolution was set at about 5000. A standard used for the U/Pb calibration is AS-3 from Duluth complex. Zircons were separated with magnetic and heavy liquids methods. Abundant zircon grains were obtained from the Khunjerab granodiorite. Typical size of the zircons from the granodiorite ranges 200 to 400 micron meters in length. Those grains show weak oscillatory zoning, however, inherited core is not common. $^{206}Pb/^{238}U$ ages of the zircons range from 107 to 120 Ma, with mean value of 112 Ma. Further ion microprobe analysis will be perform to obtain statistically more precise age and to search inherited core of zircons from the Khunjerab granodiorite.

Ogasawara et al. (1992) obtained K-Ar hornblende and biotite ages, 107±5 Ma and 96.9±4.8 Ma, respectively. Zircons were separated from the same sample for the K-Ar dating. Treloar et al. (1989) presented two K-Ar biotite ages of 105±5 Ma and 107±5 Ma for the Khunjerab granodiorite. The biotite age of Ogasawara et al. (1992) is 10 million years younger than the ages obtained by the Treloar et al. (1989). As the sample for the dating has been collected from a small granodiorite dyke present 10 km west of the Khunjerab Pass, the granodiorite dyke may have slightly younger age than the main body of the pluton due to rapid cooling. The hornblende age of Ogasawara et al. (1992) is identical to the biotite ages presented by Treloar et al. (1989). Hornblende has a higher closure temperature of about 500 °C, and it is considerably higher than that of biotite (about 300 °C). Although no hornblende K-Ar data of the samples analyzed for biotite ages have been presented by Treloar et al. (1989), the granodiorites analyzed by Treloar et al. (1989) might have slightly older crystallization age than 107 Ma. The new zircon U-Pb ages are slightly older than the K-Ar ages. The mean U-Pb age (112 Ma) is considered as magmatic crystallization age of the granodiorite. This U-Pb age is consistent with slightly younger K-Ar ages as the hornblende and biotite K-Ar are considered to be cooling ages.

The new U-Pb age of the Khunjerab granodiorite suggests presence of continental arc magmatism along the southern margin of the Asian continent at about 110 Ma. Rb-Sr whole rock age of the Tirich Mir granite show similar age to the Khunjerab granodiorite. The Early Cretaceous continental arc magmatism took place in regional scale along the southern margin of the Asian continent.

References

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