Uplift of Northwest Margin of Tibetan Plateau: Indicated by Zircon LA ICP-MS U-Pb Dating of Conglomerate from Mazartagh, Tarim Basin

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ABSTRACT: Radiometric age dating of detrital zircons is highly advantageous for analysis of the depositional environment and to identify source areas. Aiming at the uplift and denudation of the surrounding ranges, LA ICP-MS U-Pb analysis has been performed on zircon grains from a conglomerate collected at the Lower Pliocene of Mazartagh, which is in the center of the Tarim basin, Xinjiang (新疆), China. A wide range of ages mainly falling into three groups was yielded: 200–500, 800–1 100, and 1 800–2 000 Ma. Zircon features principally indicate magmatic origin. According to the comparison between the analyzed zircons with those from surrounding orogenic belts, the younger grains are mainly related to the west while the older ones are to the regions more eastward. The variations might imply the W-E propagation tectonic activation and uplift of the surrounding orogenic belts. The west segment uplifted and was denuded firstly, driven by the approximate W-E height difference, upon the denudation, transportation and deposition, acting as the source of young zircons analyzed. With the eastward spreading of tectonic movement, the segment more to the east rose, the meridional relief increased rapidly and began to control the flow direction, then more zircons joined in the Pliocene in Mazartagh. It is difficult to definitely explain the source of grains with similar values to that from the Altyn Mountain region, more detailed data and chronological ages with higher precision will be helpful for making more credible conclusion.

KEY WORDS: LA ICP-MS, detrital zircon, Mazartagh, uplift, northwest margin, Tibetan plateau.

INTRODUCTION
The northwest margin of the Tibetan plateau is mainly composed of the West Kunlun Mountain and the Altyn Mountain, and the Tarim basin lies to its north. The totally different geological and geographic
features between high mountains and vast basin reveal two distinctive dynamic processes: uplifting-mountain building and depression-basin formation. Various researches have been performed on the Cenozoic uplift of this region recently (Li et al., 2006; Sun and Liu, 2006; Zheng et al., 2006, 2003, 2000; Li and Yang, 2004; Jin et al., 2003). Besides the researches on the general stage-by-stage uplift, a successive characteristics of the Cenozoic uplift from west to east is also being revealed gradually from sedimentary evidence (Si et al., 2007), morphotectonic features (Pan et al., 2007) and paleomagnetic study (Pei et al., 2008).

Heavy minerals in sediments are generally used for analysis of the depositional environment and to identify source areas of grains, of which zircons are highly advantageous in understanding provenance characteristics (Harald, 1998), as detrital zircons are highly susceptible to sedimentary recycling given their resistance to mechanical abrasion (Gehrels, 2000). Radiometric age dating of zircons may contribute to knowing the location and characteristics of source areas. For two methods including SHRIMP and LA ICP-MS, the latter is favored for detrital zircons. This study is an attempt to use detrital zircon geochronological data from sedimentary rocks of the Tarim basin to recognize its provenances, to help unravel the denudation history of the ranges surrounded, and to provide certain possible information for understanding the uplift process of the northwestern margin of the Tibetan plateau. Our work is based on more than one thousand zircon grains separated from a layer of conglomerate at the bottom of the Pliocene in Mazartagh in the Tarim basin. Our primary tool is using LA ICP-MS U-Pb geochronological analyses of detrital zircon grains as a means of resolving provenance changes with various ages.

GEological SETTING

Mazartagh fault zone lies in the middle of the Tarim basin (Fig.1) and is composed of Haimiqitagh, Luositagh, Niaoshan, Gudongshan and Mazartagh.

Figure 1. Satellite image and photo of Mazartagh. (a) Satellite image of Mazartagh fault zone showing the various segments; (b) field photograph showing the Middle Mazartagh range.