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A New Age Constraint on Sturtian Glaciation: SHRIMP U-Pb Zircon Geochronology Of Neoproterozoic Altungol Formation in Tarim Basin, NW China

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Neoproterozoic glaciations with a wide distribution (Hambrey et al., 1981), punctuated the largely ice-free Precambrian world within tropical latitudes (Evans et al., 1997), interpreted as evidence record the cold paleoclimate intervals which made a Snowball Earth with the frozen ocean (Kirschvink, 1992; Hoffman et al., 1998).

More recently, Quruqtagh of Northeast Tarim Basin (Fig.1), Northwest China, catches the increasing eyes, not only because of its three or four Neoproterozoic glacial periods in China (Cao, 1991; Gao et al., 1984, 2003), but also its significance for tectonic in supercontinent breakup. The reported ages (Fig.2) without Altungol glaciation age are all focused on the north Quruqtagh (Gao et al., 2010; Xu et al., 2005, 2008, 2009) and conversely in South Quruqtagh without reported glaciation age.

Based on field investigation of Nanhua System (Cryogenian) in NE Tarim Basin, we offer the first set of Sturtian glaciation age in the form of SHRIMP (sensitive high-resolution ion microprobe) U-Pb zircon age dating of volcanic interbedded near the top of Altungol Formation tillites, South Quruqtagh, which provides a new constraint on the Sturtian glaciation from global perspective.

There are many Neoproterozoic glaciation strata exposures in Quruqtagh. The Nanhua System is divided into the Bayisi, Zhaobishan (absent in south area), Altungol and Tereeken formations. Thick tillites were found in Bayisi (Xu et al., 2008), Tereeken, and Hankalchough formations, while minor was found in Altungol Formation (Xiao et al., 2004). After the field investigation of the south Yaerdang Mountain in the South area, it is suggested that the Altungol Formation in the South area differs from that the North area. In the North, it is a set of littoral-neritic clastic facies sediment with few volcanic rocks and marine tillites in the bottom. In South Quruqtagh, it consists of 45m-thick gray-green tillites in

the bottom with different size and complex components gravels, volcanic interbed near the top of tillites, overlying strata is cap dolomite of 15m thickness, with abundant drop-stones, the upper is black shales and gray to black thin-interbedded siliceous rock.

Three Neoproterozoic SHRIMP U-Pb ages of volcanic interbed in Baysi Formation have been reported, including 739 ± 6 Ma in the middle-lower part (Gao et al., 2010), 740 ± 7 Ma near the bottom and 725 ± 10 Ma near the top (Xu et al., 2009), as a good limitation of Bayisi glaciation age. Besides with a 705 ± 5 Ma age of volcanic rocks on top of Tereeken Formation (Gao et al., 2010), they limit both the Altungol and the Tereeken glaciation with an interval between 725 ± 10 to 705 ± 5 Ma. The new 729.4 ± 6.6 Ma is enable to provide more precise age of the Altungol glaciation, closer to its ending. Meanwhile, the Sturtian glaciation ceiling can reach to 729 Ma.

Key words: Tarim Basin, Tillite, Sturtian, Nanhua System, Glaciation, Quruqtagh

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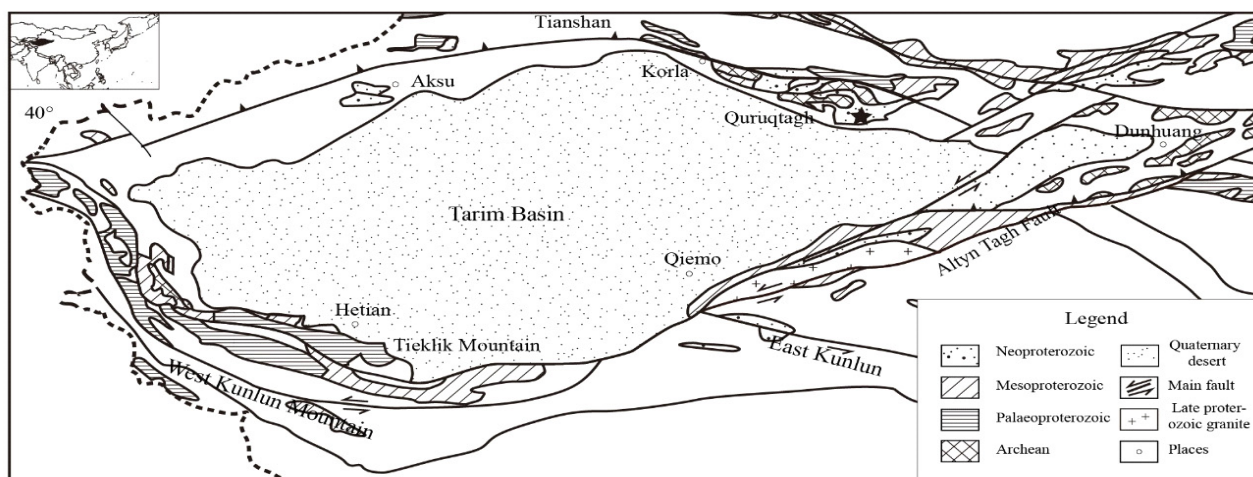


Fig. 1. Simplified Precambrian geological map of Tarim Basin and adjacent areas(modified after Tarim Oil field). The star shows the location of samples, South Yaerdang section of Quruqtagh, NE Tarim. Inset shows the location of Tarim basin.

System		Formation	South aera	thick- (m)	North aera	thick- (m)	Ages	Legend	
Neoproterozoic	Sinian System	Upper Sinian	Hankalchough Formation		85		143-467	<i>Gaskier</i>	Dolomite Limestone Conglomerate Sandstone Siltstone Mudstone Sandy mudstone Shale Siliceous shale Tillite Volcanic rocks Basalt Acid extrusive rock Granite Discontinuity contact Unconformity contact Glaciation
		Lower Sinian	Shuiquan Formation		42		135-308		
			Yukkengol Formation		131		80-567		
	Nanhua System	Lower Sinian	Zhamoketi Formation		142		559-793	615±6Ma (Xu, 2009)	
		Upper Nanhua	Tereeken Formation		741		689-1815	705±10Ma (Gao, 2010) <i>Marinoan</i>	
		Lower Nanhua	Altungol Formation		72		484-1175	729±6.6Ma (this paper) <i>Sturtian</i>	
Zhaobishan Formation				Absent		358-570	725±10Ma (Xu, 2009) <i>Kaigas</i>		
Bayisi Formation			1073		640-1670	739±6Ma (Gao, 2010) 740±7Ma (Xu, 2009)			
Qingbaikou System									

Fig.2. Neoproterozoic Strata of NE Tarim, including north aera and south aera(lithostrata coloums modified after Tarim Oil field and Xu et al, 2009). All the cited ages are in the North Quruqtagh.

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