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Research Advances

New Discovery of the Quaternary Glaciation Remains in Tala Mountain of Ar Horqin Banner, Inner Mongolia

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Objective

Northeast China is located in a cold region with high latitude. In the mid-low mountain areas, the existence of Quaternary glacier as well as its range and nature are always controversial. The glacial paleogeomorphology of Northeast China had been extensively studied and explored. The results revealed that Quaternary glaciers was developed in the northern part of Great Hinggan Ranges and Changbai Mountains. However, some scholars believed that the development of the Quaternary glaciers in China resulted from tectonic coupling and close relation with the elevation of mountains. In Northeast China, glaciation did not occur in any mid-low mountain areas during the Quaternary except the Changbai Mountains where the elevation is more than 2600 m. The question is whether glaciation occurred in the mid-low mountain areas of Northeast China during the Quaternary? In order to clarify this question, this paper reports the Quaternary glacial remains of Tala Mountain, which were newly discovered in Ar Horqin Banner, Inner Mongolia and their age dating.

Methods

In the field, the glacial remains discovered in Tala Mountain were elaborately sketched and photographed using realistic writing and delineative method. At the same time, different types of glacial remains were numbered, collected and recognized in order to clarify the identification characteristics of glacial remains. The OSL age dating of glacial deposits was carried out, so as to constrain the time of glaciation. All laboratory work was completed at the Key Laboratory of Quaternary Chronology and Hydrological Environment Evolution, Chinese Academy of Geological Science. Sample equivalent dose measurements were performed using American Daybreak 2200 OSL measuring instrument. Please refer to related literature for detailed test analysis methods and procedures.

Results

The elevation of the main peak of Tala Mountain was 796 m. The valley was straight and steep, with a length of 3 km. It was gentle and wide at the bottom and represents "U" shape in cross-section (Fig. 1a). (2) The granitic dike with standardized horizontal cleavage appearing in the crest was glaciated dike, which was formed as a result of glaciation of valley (Fig. 1b). Glacier scratches were discovered in the dike, which consists of several shallow grooves (Fig. 1c). (3) The moulin swarms of Tala Mountain were mainly distributed in a NEE-trending ridge with an elevation of 550-620 m. The moulin was well-preserved and its morphology was completed. It had smooth steep walls and spiral stripes (Fig. 1d). The mouth of the moulin shows elliptical, petal or irregular shape (Figs. 1e, 1f). (4) Residual glacial deposits were discovered at the bottom of the valley, within which, typical traces of glaciations, such as streak rock, flatiron boulder and fracturing rock, could be observed (Figs. 1g, 1h, 1i). (5) Glacial deposits appear above the Chifeng loess of the Middle Pleistocene and below the tawny sand loam of the Late Pleistocene Urji Formation. The ages of the two collected samples were 100.1±6.8ka and 74.8±4.9ka (Appendix 1), which is the early Late Pleistocene.

Conclusions

(1) A large amount of Quaternary glacial remains were discovered in Tala Mountain of Ar Horqin Banner, Inner Mongolia for the first time, which expanded the distribution of Quaternary glacial remains of Northeast China.

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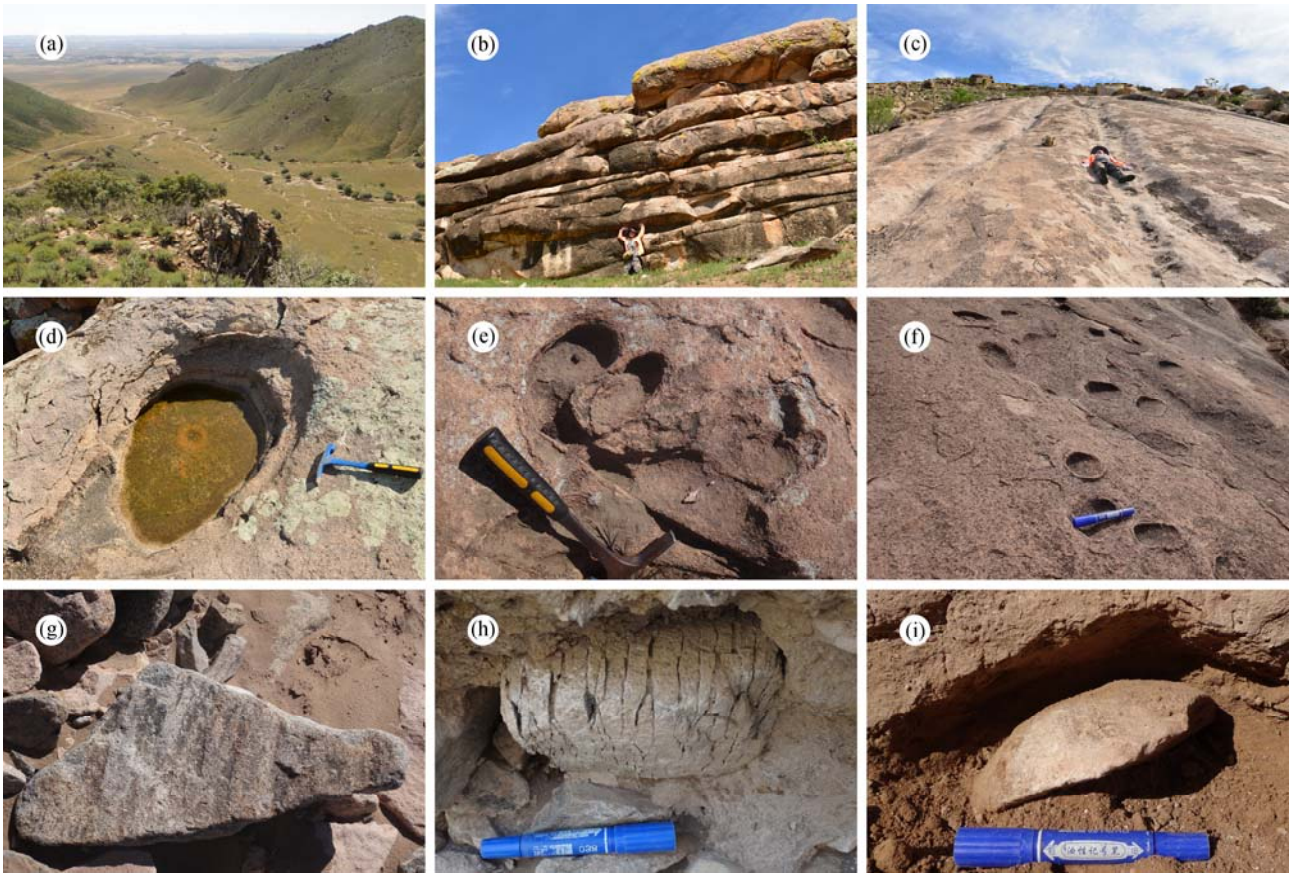

Fig. 1. Assemblages of glacial remains of Tala Mountain in Ar Horqin Banner, Inner Mongolia.
(a) Glacial trough; (b) glacial dike; (c) glacier scratches formed by glaciation; (d) moulin with spiral stripes; (e-f) petaloid and irregular moulin; (g) streak rock; (h) fracturing rock; (i) flatiron boulder.

(2) The OSL age dating results showed that the age of glacial deposits ranged from (100.1±6.8) to (74.8±4.9) ka, which is the early Late Pleistocene. This data not only enriched the age data of the glaciers in Northeast China, but also confirmed the fact that glacial remains existed in the mid-low mountain areas of Northeast China in the Late Pleistocene in terms of chronology.

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Appendix 1 Sample information and results of OSL dating from the study area

Sample No	Sampling horizon	Depth (m)	K (%)	Th (ppm)	U (ppm)	Water content (%)	Dose rate (Gy/Ka)	Equivalent dose D_e (Gy)	OSL Age (ka)
18G-76	Urji Formation	1.2	2.19	7.67	1.60	6.1	3.63±0.15	89.46±0.68	24.6±1.8
18G-75	Urji Formation	1.8	2.20	7.28	1.54	8.8	3.51±0.14	98.24±5.74	28.0±1.3
18G-74	Glacial deposit	2.6	2.03	3.98	0.88	7	2.90±0.12	216.80±11.36	74.8±4.9
18G-73	Glacial deposit	3.8	22.7	5.63	1.11	3.5	3.36±0.13	336.50±18.52	100.1±6.8