Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.16919

Comminution age method providing a new perspective for the glacial history in northeastern Tibetan Plateau

ZHIFEI DUAN[1], CHAO LI[1], FUYUAN AN[2], NICHOLAS CHIA WEI NG[1] AND SHOUYE YANG[3]

[1]State Key Laboratory of Marine Geology, Tongji University, Shanghai, China

[2]Key Laboratory of Physical Geography and Environmental Processes of Qinghai Province, School of Geographical Science, Qinghai Normal University, Xining, China

[3]Tongji University

Presenting Author: dzf1102@tongji.edu.cn

As the most glaciated regions outside of the polar realm, the Himalaya and Tibet have attracted great attention on the interaction between the climate, glaciation and sedimentation process. The Qarhan Salt Lake, located in the Qaidam Basin, northeastern Tibetan Plateau, serves as a sink for fluvial sediments from the Kunlun Mountain and records valuable information on the evolution of river drainage basin. In this study, we measured elements and $^{234}U/^{238}U$ activity ratios of silicate fraction in 16 ISL1A core sediments from Qarhan Salt Lake and 11 dammed-lake sediments in Golmud drainage basin, Kunlun Mountain. The comminution age model, which constrains the time a detrital particle is produced from the physical erosion of bedrock, was applied to provide insights into the time of glaciation and its influence on fluvial processes.

Results show that the dammed-lake sediments have comminution ages ranging from 37 to 83 ka, which may mark the time of glacier advance with significant detritus production. Additionally, the $^{234}U/^{238}U$ activity ratio and comminution age in the core sediments can be divided into three stages:

1) 93-51 ka, significant ^{234}U depletion and old comminution ages indicate moderate fluvial erosion with most solids to the lake eroded from developed topsoil.

2) 51-31 ka, the sediments are marked by ^{234}U excess, imply massive authigenic salt minerals enriched during this period, likely caused by river-channel blockages by glacial-induced alluvial fans, which could reduce the fresh water and fluvial sediment supply to the lake.

3) Since 31 ka, the sediments are characterized by moderate depletion of ^{234}U and have similar comminution ages with dammed-lake sediments. The time of transition is consistent with the time of alluvial fan incision in the Golmud drainage basin in a previous study (~30 ka), indicating that glacial-induced alluvial fan and dammed lake sediments become a major sediment source to the lake.

This study provides new evidences of glacial evolution in Kunlun Mountain since 93 ka and sheds new light on application of the comminution age model for constraining the diverse earth surface processes.