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Late Quaternary development of terraces in the Kumkol Basin at the northeastern Tibet as constrained by in situ CRNs

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In the Kumkol Basin at the northeastern margin of the Tibetan Plateau are well developed fluvial and fluvio-glacial fans and terraces, which have been deformed by many faults and folds in association with the lateral growth of the Plateau. Therefore the Kumkol Basin is one of the most important areas to understand the ongoing tectonics of the Tibetan Plateau, but has rarely been studied because of difficult accessibility. Our work is the first attempt to reveal the geomorphological development of the Kumkol Basin.

Our first field suevey was carried out about fluvial and fluvio-glacial terraces (Sijiquan terraces) along the Sijiquan River, where is easier to access than other areas in Kumkol Basin. In this presentation we report the results of geomorphological analysis of the Sijiquan terraces and analyses of in situ cosmogenic radionuclides in terrace deposits, and then we discussed about the development of fluvial and fluvio-glacial landforms of this area in late Quaternary time.

Our satellite-image interpretation of the Sijiquan area revealed that terraces are classified into H, L1 and L2 groups in descending order. Morphological characteristics indicate that L1 and H groups were formed by aggradation in different periods and L2 was formed by degradation. As aggradation processes are strengthened in glacial periods because of increasing production rate of clastic materials under glacial and periglacial environments, H and L1 groups are likely to have been formed in the Penultimate-glacial and the Lastglacial periods, respectively.

We collected samples from H and L2 surfaces and present river floor (PRF) for measuring cosmogenic ^{10}Be concentration. More than 20 quartz grains collected at the surface of each sampling location were amalgamated and then measured. The measured ^{10}Be concentration in the PRF sample was higher than those in some samples collected from terrace surfaces, indicating that the initial value (inheritance) of ^{10}Be concentration (i.e., the value at the time of deposition) has not been constant during the formation of the Sijiquan terraces. We estimate that present-day river gravel contains higher amount of reworked grains derived from older terraces in the drainage due to dramatic change in erosion-deposition processes. This estimation is supported by a satellite-image observation that present-day first-order gullies originate mainly from older aggradational fans within the drainage whereas the source area of aggradational fan deposits extends higher in bedrock slopes.

In order to estimate the inherited ^{10}Be values for aggradational terrace deposits, we carried out grain-by-grain measurements of ^{10}Be concentrations for the PRF sample; the minimum value among 15 grains can be considered as maximum value of inheritance. By using it, we calculated the minimum age of each sample, on an assumption of no surface erosion. The minimum ages of H and L2 terraces are found to be 94 ka and 15.5 ka, respectively. These ages are not in contradiction with our morphological age estimation.

In conclusion, it is likely that, in the Kumkol Basin, the fluvial regime changes from aggradational in glacial periods to degradational in interglacial periods.

Keywords: Tibetan Plateau, Qaidam Basin, Tectonic landform, Surface Exposure Dating, Fluvial terrace