Glacial landforms and Palaeo-glaciation in Japanese Alps
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At present, there is no active glacier in Japanese Islands, but some glacial landforms, such as cirques and glaciated valleys are found on the central high mountains called “Japanese Alps”. The existences of these glacial landforms were pointed out, at first, in the late 19\(^{th}\) century. During 20\(^{th}\) century, distribution of these landforms and fluctuations of palaeo-glaciation were discussed in detail. The age of glacial advances were detected by the tephrachronology, carbon dating, relative dating, luminescence dating and cosmogenic dating. Four stages during the Last glacial Age, one advance in MIS-4 and three advances in MIS-2 were recognized widely. Moreover, advances during MIS-6 (?) and the Neoglacialization also pointed out in the Northern Japanese Alps. The most of glacial landforms in Japanese Alps located on the eastern side of the mountain ridge and the elevation of the palaeo-ELA, especially during the Younger Dryas stage controlled by the elevation of mountain ridge. Moreover, palaeo-ELA decreased toward the Sea of Japan side where have the heaviest snow in the world. These facts mean the distribution of glacial landforms in Japanese Alps strictly controlled not only temperature but also distribution of snow accumulation.

Key words: Japanese Alps, Glacial Landform, Glaciation, Last Glacial Age
Chronology of the Late Quaternary Glaciation in the Hidaka Mountains, Hokkaido, Northern Japan

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The chronology of Late Quaternary glaciation in the Hidaka Range was examined based on the distribution of glacial landforms and stratigraphy of glacial sediments, and some marker tephas. Toya tephra (100 ~ 106 ka yBP), Kuttara - 6 tephra (86 ka yBP) and Rakko 3 tephra (75 ka yBP) are found in the nonglacial deposits overlain by the subglacial deformation till. Of the previously known stadials of the Last Glacial Stage, the older Poroshiri Stadial terminal moraine is mantled by Shikotsu-1 tephra (40 ka yBP) indicating the maximum advance in the Oxygen Isotopic Stage 4. On the contrary, the glacial advance during the Tottabetsu Stadial in the Oxygen Isotopic Stage 2 (LGM) represented by Eniwa-a tephra (18 ka yBP) was far restricted within the cirque floor. Older glaciation occurred prior to the Toya tephra is regarded as the penultimate glaciation, named the Esaoman Glaciation. The glacier during this stage formed a clear U-shaped valley and extended lower than that during the Last Glacial stage.

Key words: Quaternary Glaciation, Tephra, Oxygen Isotopic Stage
Geomorphological Indicators of a Tibetan Ice Sheet during the LGM
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Field- and laboratory data from Central- to West-Tibet, the east- and west-
margins of Tibet and the Karakorum are introduced (7 field campaigns:
1996-2000). Starting from presentday glacier margins, groundmoraines
have been followed down-valley and the corresponding lateral- and endmo-
raines were mapped according to geomorphological and sedimentological
(300 samples) criterions. Geomorphologi-cal evidence provides the arrange-
ment of the positions of accumulation forms and high deposited erratics (up
to 1600 m) in relation to definitely glacial erosional forms. Especially in the
Minya Konka Shan it is important to differentiate between mudflows and
moraines and to preclude the transport of erratics by megafloods. Whether
the roundings of hills and mountain ridges are periglacial or glacial stream-
lined hills is also analysed. The observations are demonstrated by 7 glacier
maps on a scale of 1 million. According to absolute age determinations
(14C & TL) between 48 and 8 Ka the glacier area has been classified as be-
ing LGM to Late Glacial (Similar to prehistorical ice sheet of NW-Europe).
Key words: Glacial Geomorphology, Tibetan Ice Sheet, Paleoclimatology.
Late Quaternary Glaciation in the Mongolian and Russian Altai
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The kind and distribution modern and Late Quaternary Glaciers and Glaciation in the Mongolian and Russian Altai is described. The glacial landforms comprise mainly cirques, U-shaped valleys, hanging glaciers and small ice caps. In the ablation areas different types of moraines are present. Whereas in the Khangay area the main type of Pleistocene glaciations is of smaller and larger ice caps on the old peneplains and ice stream nets in the valleys surrounding the highest areas, in the Mongol Altai, alpine glaciations with cirques-glaciers and U-shaped valleys were dominant. In Mongolia the terminal moraines of the LGM reached altitudes down to 2,000m in case the catchment area has elevations of more than 3,700m. In addition, there was a small ice sheet in the northern part of the Russian Altai, reaching elevations below 600m asl. Based upon the results of the fieldwork, in Mongolia two major Pleistocene glaciations can be separated due to different degrees of weathering of sediments and the connection with different gravel floors and terraces. First results of luminescence dating shows evidence for higher lake levels and the deposition of loess-like deposits during the Interstadial of the Last Glaciation (about 40 to 30 ka) and Late Glacial to Early Holocene periods.

Key words: Quaternary Glaciation, glacial landforms, Mongolian Altai, Russian Altai
Geomorphologic Evidence of Late Pleistocene Glaciation in the
High Mountains of Taiwan
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The mountain range of Taiwan is unglaciated at present, but studies in two massifs, Hsuch Shan (3884 m asl) and Nanhuta Shan (3742 m asl), show evidence of Late Pleistocene glaciation. Above 3000m, various glacial landforms such as U-shaped valleys, a cirque, roches moutonnées, lateral and end moraines as well as glaciolacustrine deposits have been mapped. Landforms are analysed by size, geometry, location and composition. Sediment analyses include lithology, grain size, fine and coarse grain morphology and sediment fabric. In the Hsuch Shan, a lateral moraine at 3050 m asl in a NE-trending valley belongs to the probably most extensive glaciation of the last glacial cycle and represents the glacial advance during OIS 4. In the Nanhuta Shan, a plateau glacier covered a flat area at 3500 m asl, southeast of the main peak. The trimline in U-shaped valleys, and striated quartzitic erratics indicate an ice thickness of at least 200 m during the maximum stage, with an ELA at about 3100 m. Well preserved lateral and end moraines in U-shaped valleys between 3300 and 3400 m asl at the W-facing part of the massif and at 3100 m asl in a SE-trending valley belong to Late Glacial stages with an ELA at 3500 m asl.

Key words: Glacial landforms, high mountain area, Late Pleistocene, Taiwan
Distribution and types of ice-marginal sediments in the Karakoram (Pakistan)

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The Karakoram Mountains are unique among the mountain areas in High Asia for their high debris volume and the variety of accumulation forms. The glacier tongues reach remarkable low in this subtropical mountain region. Therefore the recent ice-marginal sediments occur between 2400m and 5200m. A very heterogenous geomorphological assemblage is developed along glaciers which reach lengths up to 60km. Characteristic types of ice-marginal sedimentation forms will be presented. Due to the existence of the lateral moraines which can reach an height of up to 100m the debris accumulation development is well protected in those lateral moraine valleys. Thus during the glaciation a very active debris morphodynamic took place and still takes place, namely mostly independently from the glacier activities. Relict lateral moraine valleys in unglaciated valley sections were discovered between 3800m and 4000m. Main questions will be: What kind of ice-marginal depressions exist? Which factors influence the development of lateral moraine valleys? Is the distribution of lateral moraine valleys dependent on exposition? Where is the main source of debris supply for the development of lateral moraine valleys? Are they a product of the debris supply of the tributary valleys or of the glacier margins?

Keywords: ice-marginal sediments, lateral moraine valley, Karakoram
Lake Thulagi/Nepal: rapid landscape evolution in reaction to climatic change.

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Thulagi Glacier descends from the northern face of the 8169 m high Mt. Manaslu/ Western Nepal. Climatic warming during the last decades caused the glacier to retreat and to form at the glacier front Lake Thulagi (4000 m a.s.l.), a more than 2.3 km long melt water lake. Unlike other glacier lakes in Nepal, Lake Thulagi is not dammed by a terminal moraine, but by an at least 500 m by 600 m wide and 100 m thick dead ice body, mapped in 1996 independently by a geo-radar and a geoelectrical survey. The dead ice body is covered by 10 – 35 m massive lacustrine sediments and a thin veneer of supraglacial deposits, which serve as thermal insulator. The spillway of the lake is cutting into this complex by melting into the buried ice at a current rate of ≤40 cm a⁻¹.

The melt rate is considerably lower, where thick sediment cover reduces the heat transfer from the surface. A data logger was installed in 2000 to measure climate data and heat exchange in the soil. The results of a model on the future meltdown of the dead ice body and the likely future development of the landscape are presented.

Key words: glacial lake, dead ice body, climatic change, heat exchange
Analysis of ASTER Imagery and DEMs for Assessing Glaciation in the Western Himalaya

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The topographic evolution of mountains involves the complex interactions of climate, tectonic and surface processes. In the western Himalaya, rapid exhumation and denudation rates have been found to be associated with extreme relief, although numerous issues regarding the role and distribution of glaciation remain with respect to denudational unloading and relief production. The purpose of this research is to evaluate the use of multispectral imagery and DEMs to map modern-day alpine glaciers and assess the topography, thereby providing additional information on former glacial events and the role of glaciation in mountain geodynamics. Analysis of ASTER satellite imagery and a high resolution DEM indicates that glaciation has had a significant affect on the landscape. Furthermore, geomorphometric analysis indicates that surface processes at Nanga Parbat are adjusting to tectonic forcing and deglaciation. These results indicate that glaciation plays an important role in the polygenetic nature of topographic evolution in the western Himalaya. More research is required to establish chronologies for erosion surfaces and landforms identified at various altitudes.

Key Words: Alpine Glaciers, Remote Sensing, DEM, Geomorphometry, Himalaya