Abstract: for 5th ICG Tokyo,
1) Symposia (S24 Glaciation and periglaciation of Asian high mountains), Oral
2) Narama, Chiyuki (C. Narama)
3) Department of geography
4) Tokyo Metropolitan University
5) Minamiosawa 1-1, Hachioji, Tokyo, Japan 192-0397 tel./81-426-77-1111 (3835)
6) Japan
7) narama@comp.metro-u.ac.jp

Glacier variations and snowline decline since the late Pleistocene in Pamir-Alai
and West Tien Shan
C. Narama
Department of Geography, Tokyo Metropolitan University
narama@comp.metro-u.ac.jp

The moraines in the Holocene and the late Pleistocene were mapped in the Turkestan
Range of the Pamir-Alai and the Maidantal Range of the West Tien Shan. In the
Turkestan Range, the ages when the glacial advances occurred four times in both the
Little Ice Age and the middle-late Holocene were defined by 14C dating; e.g.
470±15yBP, 370±15yBP, 300±30yBP and 250±15yBP. These advances and retreats
of the glaciers were repeated in proglacial areas to the same extent, and the glaciers
largely expanded downstream in the late Glacial and the late Pleistocene. The
snowline decline since the late Pleistocene in this area indicates the same range as the
Abramov Glacier in the Alai Range of the Pamir-Alai. The results show that
climatic variations since the late Pleistocene in these two areas of the Pamir-Alai have
almost the same tendency. In the Maidantal Range, the moraines of two substages in
the late Pleistocene were defined by relative dating. This fact suggests that the
snowline decline of the Maidantal Range in the West Tien Shan slightly exceeds that
of the Pamir-Alai. As the glaciers in these two areas are intensely influenced by the
westerlies, these two areas seem to belong to the same glacial-climatic region.
Key words: glacier variations, snowline, moraines, Pamir-Alai, West Tien Shan
Abstract: for 5th ICG Tokyo, Symposia S24

Last Glacial Glaciations in the Southeastern Part of Himalaya-Tibet Massif
S. IWATA
Department of Geography, Tokyo Metropolitan University
iwata-s@comp.metro-u.ac.jp

Mapping of glacial landforms in the field and by aerial photo-interpretation indicates considerable large glacial extent in the Last Glacial period in the following areas: Khumbu Himal, Nepal; Bhutan Himal; the southeastern part of Tibet's Autonomous Region; the Hengduan Mountains, Yunnan Province, China. The completed maps of the glacier distribution show that glacier types in the Last Glacial period were networks of large transverse valley glaciers in the Tibetan area, and valley glaciers with small plateau glaciers in the marginal mountains. ELAs of existing and Pleistocene glaciers were measured from maps using AAR, THAR, highest altitudes of lateral moraines, and minimum altitudes of cirque floors. ELA depressions during the Last Glacial period were about 1000-1200 m on the south slopes of marginal mountains, but about 600-800 m on the north slopes and in the Tibetan Plateau. The gradient of the past ELA was steeper than that at present.

Key words: glacial extent, ELAs, eastern Himalaya, southeastern Tibet, Yunnan
Late Quaternary Glaciations in the Nepal Himalayas: a Framework for Reconstruction of the Climate Changes between Monsoon and Westerlies

K. ASAH1* and T. WATANABE2*

1 Central Department of Geography, Tribhuvan University, Kirtipur
2 Graduate School of Environmental Earth Science, Hokkaido University
* kasahi@mos.com.np

Summer monsoon precipitation plays an essential role in glacier accumulation of the Nepal Himalayas. However, summer monsoon is relatively more intensified toward the east, and glaciers are maintained by both monsoon and winter westerly rainfall in the west. Accordingly the differences of the style and timing of the glaciations between western and eastern Nepal can reveal the climate changes between monsoon and westerlies. On north-facing slopes, older glaciers had extended larger than the present glaciers, with the maximum extension occurred in the LGM. In contrast, glaciers on south-facing slopes had extended almost to the same positions from the LGM to the LIA. In eastern Nepal, valley glaciers had extended nearly to the same termini from the Late Glaciation to the LIA. Even in the LGM and MIS3, the termini were enlarged somewhat larger than those of the Late Glacial. These facts suggest general arid conditions, or weakened monsoon, in the Last Glaciation in the Nepal Himalaya, and relatively strengthened westerlies in western Nepal.

Key words: Nepal Himalaya, glacial landforms, glaciation, monsoon, westerly
Timing of Past Glaciations in Kanchenjunga Himal, Nepal
by Optically-Stimulated Luminescence Dating of Tills
S. TSUKAMOTO¹, K. ASAHI², T. WATANABE³, and W. J. RINK⁴
1 Department of Geography, Tokyo Metropolitan University
2 Central Department of Geography, Tribhuvan University
3 Graduate School of Earth and Environmental Science, Hokkaido University
4 School of Geography and Geology, McMaster University
*sumiko@comp.metro-u.ac.jp

Optically stimulated luminescence (OSL) was used to date supraglacial melt-out tills and deforming bed tills to elucidate ages of past glacial advance in Kanchenjunga Himal, eastern Nepal. The OSL dates of quartz grains extracted from the tills indicate that the glaciers have been expanded ~6,000 yr, ~9,000 yr, 22,000-23,000 yr, and possibly 37,000-38,000 yr in the Kanchenjunga Himal. The method appeared to provide a powerful tool to estimate the timing of late Quaternary glaciations, using sediments collected directly from moraines.

Key words: OSL dating, supraglacial melt-out till, deforming bed till, late Quaternary glaciations, quartz, Kanchenjunga Himal

O K
Late Pleistocene Glaciation in the High Mountain Range of Taiwan, 
Dated by Optically Stimulated Luminescence (OSL) 
R. HEBENSTREIT & M. BOESE 
Institute of Geographical Sciences, - Physical Geography -, 
Freie Universitaet Berlin 
hebenstr@zedat.fu-berlin.de, mboese@geog.fu-berlin.de 

In spring and autumn 2000 glacial and meltwater deposits were sampled for optically stimulated luminescence (OSL) dating in two mountain massifs in Taiwan. In Hsueh Shan, a pair of samples were taken from a lateral moraine at 3050 m asl, using the fine matrix material from the outside of the moraine wall. Both samples indicate an age of OSI 4. Another sample from a lateral moraine in Nanhuta Shan at 3370 m asl was taken in the same way and dated to an age at the Late Glacial to Early Holocene transition. Glaciofluvial and glaciolimnic sand and silt were sampled from a moraine-dammed proglacial lake at 3150 m asl indicating a Late Glacial stage of the moraine. All the obtained ages are consistent with each other and with the geomorphological data in the study areas. The dose rates of the sediments as well as the bleaching of the grains in lateral/end moraines and melt water environments seem to be sufficient for dating by OSL.

Keywords: OSL dating, glacial deposits, high mountain area, Taiwan
Quaternary Glaciation in the Southern Part of the Northern Japanese Alps

H. HASEGAWA
Department of Geography, Meiji University
hasegawa.hirohiko@nifty.ne.jp

The purpose of this study is to review the Quaternary glaciation in the southern part of the northern Japanese Alps, central Japan. In this region, six glacial stages are recognized: stage a, b, c, d, e and f, in order from the oldest to the youngest. Their stages are correlated with worldwide stages as follows: stage a, the penultimate glacial period; stage b, the early stage of the Last Glacial period; stage c, 25 ka; stage d, the Last Glacial Maximum; stage e, the Late Glacial; stage f, the Neoglacialation. The extension of the glaciers in each stage was greater in the older stages. Snow-line altitudes of the reconstructed glaciers in each stage from the older to the younger, indicates altitudes of approximately 1200 m, 950 m, 800 m, 600 m, 400 m and 300 m respectively, below present levels of the minimum presumed snow-line altitude.

Key words: glacial landform, glacial deposit, glaciation, gradient of snow-line altitudes, Japanese Alps
Subglacial Deformation Structure by the Late Quaternary Glaciation in the Hidaka Mountains, Hokkaido, Japan

S. IWASAKI*, T. SAWAGAKI† and K. HIRAKAWA†

†Graduate School of Environmental Earth Science, Hokkaido University
*shogo@ecs.hokudai.ac.jp

Late Quaternary glaciation in the uppermost Tottabetsu valley, Hidaka Mountains, Hokkaido, northern Japanese Islands was examined based on the distribution and stratigraphy of glacial landforms, glacial sediments and marker tephras. Subglacial till layers accompanied by deformation structure, such as shear and fracture zones, were observed in several exposures. A certain till layers is divided into two different components; the upper part is a breccia containing little matrix, the lower part is a matrix-supported argillaceous sediment in which braided shear planes are well developed. The most characteristic feature of the two-layered tills is a zone filled fine fractured materials which continuously distributed from upper to middle part in the lower layers. This feature was interpreted as a fracture zone intruding along the Decollement surface between glacier sole and underlain subglacial deforming bed. These deformation structures are instructive to reconstruct the strain history leading to reveal the glacial fluctuation in the Last Glacial period in this area.

Key words: Quaternary glaciation, subglacial deforming bed, subglacial environment, deformation structure, Hidaka Mountains
Holocene Glacial History of the Kamchatka Peninsula
K. YAMAGATA¹, T. SONE², S. SAWAGUCHI³, Y. OTSUKI⁴, Y. D. Muravyev⁵
1. Joetsu University of Education,
2. Institute of Low temperature Science, Hokkaido University
3. Niigata University of International and Information Studies
4. Institute of Geography, Tohoku University
5. Institute of Volcanology, Russian Academy of Sciences
*kotaro@juen.ac.jp

Holocene glacial fluctuations in the Kamchatka Peninsula were reconstructed by means of tephrochronology. The glaciers in the Kamchatka Peninsula are important for the paleo-environmental reconstruction of the northern part of the circum-Pacific region. Furthermore, the Kamchatka Peninsula is an active volcanic region, and many valuable Holocene marker tephas are found that indicates the chronology of glacier-related landforms. Three glaciers were investigated: the Koryto, Bilchenok, and West Ichinsky Glacier, in the eastern, central, and western parts of the Kamchatka Peninsula, respectively. Three periods of glacial advance during the Neoglacial period were evident, estimated as 8 ka, 3 ka, and 1 or 1.5ka. Little Ice Age (LIA) glacier advances were also evident in the Koryto Glacier and the West Ichinsky Glacier. These advances were smaller than those of other Neoglacial period. Similar evidence of LIA advances by the Bilchenok Glacier was probably destroyed by recent surge activity.

Key words: glacial fluctuations, Kamchatka Peninsula, Holocene, Little Ice Age, tephrochronology
Mountain Permafrost in central Kamchatka

T. Sone 1*, Kotaro Yamagata 2, Y. Otsuki3, Y. Sawada4 and N. Kazakov5
1Institute of Low temperature Science, Hokkaido University, 2 Joetsu University of Education, 3Institute of Geography, Tohoku University, 4Graduate School of Earth Environmental Science, Hokkaido University, 5Kamchatka Institute of Ecology and Nature Management, Russian Academy of Sciences
*tsone@pop.lowtem.hokudai.ac.jp

The information on permafrost of Kamchatka is very limited. We investigated permafrost by measurements of ground temperatures from the surface down to 1 – 3m in different mountain regions of central Kamchatka in 1997-2000. Study sites include Mt. Otdel'naya in the Kronotsky Peninsula near the Pacific Ocean, Mt. Ushkovsky and Esso region inland Kamchatka, and Mt. Ichinsky near the Sea of Okhotsk. The lower limit of discontinuous permafrost is estimated to be 700-1000m a.s.l. The mean annual air temperature of –2 degrees C seems to be a good indicator for the altitudinal limit of discontinuous permafrost. The glaciation limit and the treeline rise with increasing continentality, whereas the lower limit of permafrost falls with continentality. Periglacial landforms such as frost crack polygons, solifluction lobes, rock-glaciers, and patterned ground are observed above the treeline.

Key words: mountain permafrost, periglacial environment, ground temperature, Kamchatka
Distribution of Mountain Permafrost in the Daisetsu Mountains, Central Hokkaido, Northern Japan

M. ISHIKAWA
JSPS Research Fellow, Graduate School of Environmental Earth Science, Hokkaido University
ishikawa@ees.hokudai.ac.jp

The extent and thickness of mountain permafrost were investigated at a number of sites in the Daisetsu Mountain. The MAAT at different altitudes and the permafrost thickness estimated by DC resistivity soundings were correlated. Permafrost is distributed above 1,600 m ASL where MAAT is −2°C and varies with several m to 25 m in thickness. Intensive researches by DC resistivity imaging and ground temperature measurements indicated that permafrost is distributed in the subsurface of the wind-blown flat terrain and the steep block slopes, where winter frost penetrates to the deep depths. The situation of snow cover during winter, therefore, plays a dominant role for determining local scale distribution of mountain permafrost in the Daisetsu Mountains. Both regional and local scale of mountain permafrost distribution were modeled on the basis of DEM analysis and vegetation distribution, which represents the duration of snow cover.

Keywords: Permafrost distribution, Daisetsu Mountains, DEM analysis, DC resistivity investigation, MAAT
Results of permafrost investigation in Kuranosuke Cirque, northern Japanese Alps

K. FUKUI
Department of Geography, Tokyo Metropolitan University
pukuun@comp.metro-u.ac.jp

I have been studying mountain permafrost in Kuranosuke Cirque, Mt. Tateyama (36°35'N, 137°37'E), central Japan, since 1998. Mean annual air temperature measured near the cirque was -2.8°C, which suggested that permafrost might occur in the north-facing slope in the cirque. Permafrost was found by pit surveys in October 1999 and 2000 on a protalus rampart (2,720 masl) in the cirque. The pit surveys showed that the active layer was about 100 – 120 cm thick. Ground surface temperature measurements between October 1998 and August 1999 showed that frost penetration in autumn before snow accumulation was deep and that no ground thawing occurred until late summer, after the snow had disappeared. In and around the protalus rampart, about 15 m of snow accumulates in early spring, and lasts year around. Thus, deep-freezing in autumn and protection by snow cover perform important roles in forming and preserving this permafrost.

Keywords: protalus rampart, mountain permafrost, Japanese Alps, snow-cover, pit survey
Rock glaciers in the Japanese Alps
M. AOYAMA
Department of Geography, Tokyo Metropolitan University
aoyama@geog.metro-u.ac.jp

Although only a few rock glaciers have been recognized in the Japanese Alps, aerial photograph interpretation, which is based on morphological features of rock glaciers, revealed that many rock glaciers are distributed in deglaciated cirques. Almost all of them are presumed to be fossil or inactive rock glaciers from morphology and vegetation. Rock glaciers that indicate typical active forms do not exist. The lower limit of occurrence of fossil rock glaciers is about 2,300 m a.s.l. in the northern Japanese Alps and 2,600 m a.s.l. in the southern Japanese Alps. Morphological features, which are shown by detail geomorphological maps constructed using the Photogrammetric Workstation, and the result of field observation about ground surface materials suggested that these landforms were identified fossil rock glaciers, although such landforms were believed to be recessional moraines, protalus ramparts, small morainic ridges. In the Yari-Hotaka Mountain Range, northern Japanese Alps, the weathering rind thickness of rock glaciers and moraines clasts show that rock glaciers were formed during the Holocene.

Key words: rock glaciers, moraines, protalus ramparts, Japanese Alps
Rock Debris Volume of Rapid Mass Movements in a Japanese Alpine region.

M. IWAFUNE
Department of literature, Shigakukan University
iwafune@kwo-u.ac.jp

This study attempts to made quantitative and systematical examination of rapid mass movements on rock cliffs and surrounding slopes in the Karasawa-cirque, Japanese alpine region, based on investigation and observation of geomorphic processes of rapid mass movements. Estimate volume transported by them in the south half of the cirque in 10 years is as follows. Debris volume transported from cliffs to middle and lower slopes of talus by rockfalls is a latter rate in the order of $10^3 \text{m}^3$. Rock avalanches transport rock debris about $10^3 \text{m}^3$ in volume to middle of talus slopes. And big rock avalanches do about $10^5 \text{m}^3$ to upper and middle. On the other hand, small particles of rock debris are transported to top of talus slopes by a rockfall and so on. The volume of debris supply to the top by small rockfall is a little more than about $10^2 \text{m}^3$ which is almost the same rate at the volume removed from the top to middle or lower of talus slopes by slush debris flow with big magnitude and low frequency (once in 10 years). Balance of volumes between debris supply and removal at the top of talus prepares the condition to allow occurrences of big slush debris flows cyclically.

Key words: debris volume, rockfall, debris flow, talus, Japanese alps
Snow Gliding in Snowy Subalpine Mountains in Northeastern Japan

H. DAIMARU
Kyushu Research Center, Forestry and Forest Products Research Institute
daimaru@ifpri-thk.affrc.go.jp

Snow gliding and snow erosion were measured in leeside slopes in Hachimantai Area in northeastern Japan. Snow gliding usually occurs at sites steeper than 26° and occasionally accompanied by small patchy bare grounds. Micro landform plays an important role in controlling snow gliding in mountain slopes, because snow layers occasionally fix at the break lines. These break lines play as constraint of snow gliding and induce occupations of *Abies Mariesii* which is the most typical subalpine conifer tree and has little adaptability to snow glide. After some exceptionally snowy winters, however, large full depth snow avalanches occurred in the upper slope of a break line and destroyed subalpine forest on foot slopes. Surface erosion was measured using erosion pins in a bare ground at a leeside slope. Erosion induced by gliding snow pack was relatively small compared with rainsplash erosion in summer season. In some snowy years, however, significant snow erosion occurred due to full depth snow avalanches, which removed topsoils and made lots of patchy bare grounds.

Key words: snow glide, snow erosion, subalpine forest, snow avalanche
In Japan, an alpine zone is distributed around the Daisetsuzan Mountains of central Hokkaido and the Japanese Alps of central Honshu. The alpine zone is bounded on the lower by the forest limit situated around 1500 m a.s.l. to 1700 m a.s.l. in the Daisetsuzan Mountains and around 2500 m a.s.l. to 2700 m a.s.l. in the Japanese Alps. Many kinds of periglacial landforms are formed in the alpine wind-blown bare ground. Permafrost also occurs in the alpine zone of the Daisetsuzan Mountains, where the only palsa mire in Japan is located, and around the summit of Mt. Fujisan. In the Daisetsuzan Mountains, the mean annual air temperature of the alpine zone (2000 m) ranged from -3.6°C to -5.0°C (1996 - 99). In the alpine zone (2800 m) of the northern Japanese Alps, that ranged from -2.7°C to -1.0°C (1995 - 99). Although these air temperature conditions correspond to that of a discontinuous permafrost zone, permafrost forming has not been recognized in the Japanese Alps. Because, there is a remarkable rainy season around June in Honshu, and the thawing of frozen ground is accelerated by the penetration of warm rainwater. Freeze-thaw process in the superficial layer, an important factor in the development of periglacial landforms, occurs conspicuously in spring and autumn.

Key words: periglacial environment, periglacial landform, permafrost, the Daisetsuzan Mountains, the Japanese Alps