Permafrost at the Summit of Mount Fuji, Japan

THE existence of permafrost at the summit of Mount Fuji, Japan (35° 21′ N, 138° 44′ E, 3,776.3 m above sea level), was suspected by some of the staff members of the Japan Meteorological Agency who work at the Fuji-san Weather Station located at the summit, and also by some of the workers who constructed the station building (personal communication from I. Fujimura). But no official report has previously been published because the observation of permafrost was made only within the small area where the building was constructed. Now, observations on the distribution of permafrost at the summit have been made, during the period from July 31 to August 7, 1970, when the air temperature at the summit is near the maximum. We report here the first definite detection of permafrost in Japan.

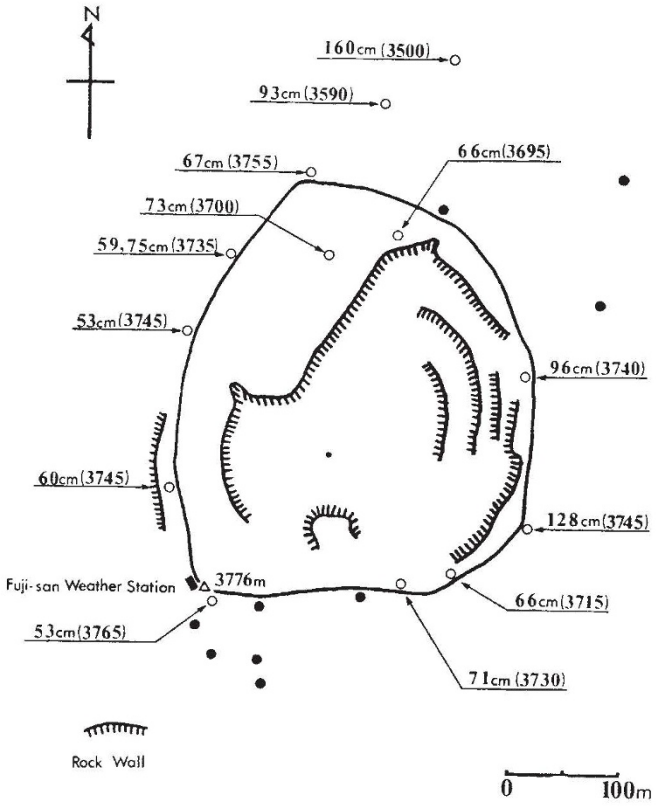

Fig. 1 Depth to the permafrost table around the crater rim at the summit of Mount Fuji (July 31–August 7, 1970).

The depth to the permafrost table was measured by sounding the hardness of the surface layers with an iron bar, the hardness changing discontinuously from an unfrozen layer to a frozen layer. To check the depth obtained by this method, we dug holes deep enough to see the frozen rocks at several points where the soundings were made. The observational results are summarized in Fig. 1, which is a sketch of the crater rim of the summit, the highest point being shown by a triangle at the south-west corner of the crater. The observation points are shown by circles: a white circle indicates a place where permafrost was observed, and a black one a place where it was not. The depth to the permafrost table is shown in cm along the arrows pointing towards the white circles. The altitude of each observation point is shown in m in parentheses.

The existence of permafrost at the summit of Mount Fuji is in agreement with a comparison of climatic conditions at the summit with the relation between the distribution of permafrost and air temperature in Canada and the USSR[1]. At the summit of Mount Fuji the annual mean air temperature is −6.6° C, and the total of the daily average temperatures below 0° C ("freezing index") is 2,810 degree days, while the total of the daily average temperatures above 0° C ("thawing index") is 390 degree days. The average of the maximum depth of snow cover is 84 cm.

As Fig. 1 shows, permafrost was not found on the south facing slope. Brown[2] reported east–west oriented valleys in which there is permafrost on the north facing slope, but not on the opposite south facing slope in the Cordillera in British Columbia. He explained this difference as due to variations in net radiation on each slope; the absence of permafrost on the south facing slope of Mount Fuji may be explained in the same way. At several points on the east slope permafrost was not found, possibly because the depth to the permafrost table there is comparatively deep. It may be possible to explain this difference by a variation in geothermal conditions, since the existence of the weak fumaroles was reported in this area. But a detailed study of this problem will be necessary.

The mean value of the depth to the permafrost table at the ten observation points at the crater rim, omitting the two points on the east slope, is 64.3 cm, the mean value of their altitude being 3,732 m. The depth to the permafrost table at places lower than the summit was observed along a ridge extending north-east from the crater rim, as shown in the upper part of Fig. 1. The permafrost table was, however, too deep to measure by the simple sounding method at places lower than 3,500 m. Retzer[3] described the areas in which there is permafrost in the high mountains of the west of the United States of America. These areas are on mountain ridges generally above 3,200 m in mid-latitudes further north than 36° N. Therefore, the lower limit of permafrost at Mount Fuji could be expected to be nearly the same.

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Submillimetre Wave Absorption Anomalies in the Lower Atmosphere and the Existence of Water Dimers

THERE is growing evidence[1–6] that the presence of a finite concentration of vapour phase dimers of water has to be considered if atmospheric absorption in the submillimetre region is to be satisfactorily explained. So far all the observations of the open atmosphere in this wavelength region, where there are features attributable to dimers, have been made with radiation from the Sun coming through the whole atmosphere in a slant path.

If the concentration of dimers in the atmosphere reaches equilibrium, it should vary as the square of the water vapour pressure, and because water vapour is normally concentrated low in the atmosphere, it is to be expected that dimer absorption will be predominantly a low altitude phenomenon. It is therefore of considerable interest to make observations over a horizontal path in the open atmosphere to determine whether the same features are present that we find in slant path observations. The conditions in which these spectral features are seen are restricted because they overlap with much stronger features of the water monomer. We have therefore closely