

A BRIEF REVIEW OF THE MASEGUCHI AVALANCHE
IN JAPAN IN 1986

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A big powder avalanche occurred at 23:00 on January 26, 1986 at Maseguchi, Niigata Prefecture in Japan. Thirteen people were killed, eleven people injured, eight houses crushed and three houses partially destroyed by this avalanche. The avalanche occurred on the east slope of Mt. Gongen (1,108 m a.s.l.). The relative height of Mt. Gongen to Maseguchi Village was 800 m. and horizontal distance between them was 2000 m.

The location of Maseguchi Village, Nou Town, Niigata Prefecture is shown in Fig. 1, and the profiles of the avalanche track and slope are shown in Fig. 2. The angles of a steep mountain slope and a gentle mountain foot were 45° and 12° respectively. At once we organized a research party as shown in Table 1, and it was supported by the Grant-in-Aid for Cooperation Research and Science Research of the Ministry of Education, Science, and Culture, Japan, and we published a report including 14 papers written by Japanese at the end of March, 1986 (Kobayashi et al., 1986).

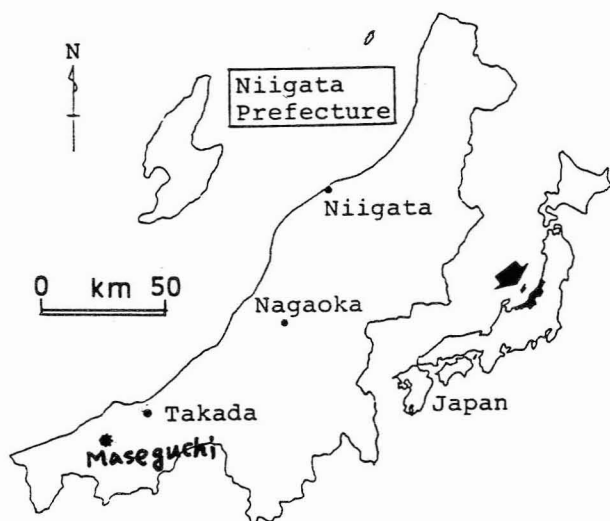


Fig. 1 Location of Maseguchi.

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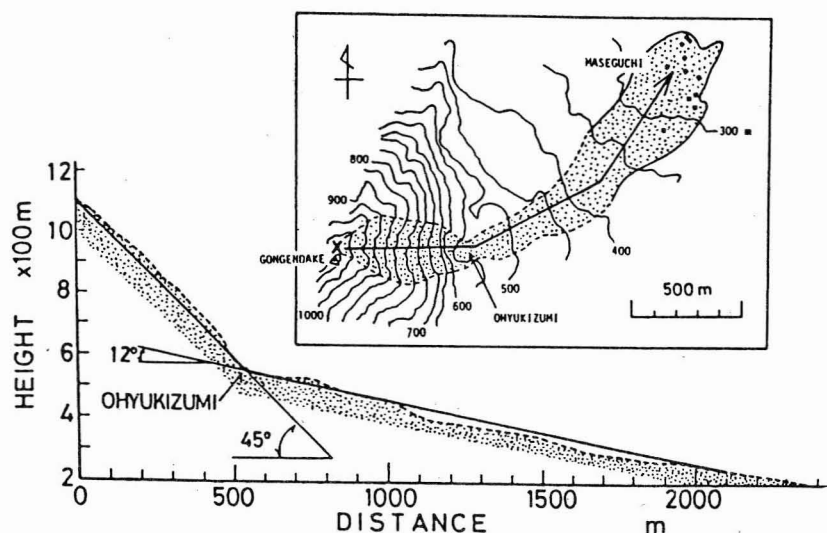


Fig. 2 Track profile of Maseguchi Avalanche, 1986.

TABLE 1
Members and Titles of Those Studying the Maseguchi Avalanche

NAME OF MEMBER	TITLE OF STUDY
S. Kobayashi (Niigata University)	Principal Investigator
K. Izumi (Niigata University)	Glaciological Aspect
K. Kawada (Toyama University)	Glaciological Aspect
K. Tushima (Toyama University)	Glaciological Aspect
K. Yano (Yamagata University)	Glaciological Aspect
K. Sato (Nagaoka Tech. College)	Glaciological Aspect
O. Sato (Niigata University)	Glaciological Aspect
N. Takahama (Niigata University)	Topographical Aspect
Y. Fujita (Niigata University)	Topographical Aspect
K. Suzuki (Niigata University)	Topographical Aspect
K. Aoyama (Niigata University)	Impact Force (Engineering Aspect)
H. Ohkawa (Niigata University)	Impact Force (Engineering Aspect)
J. Endo (Niigata University)	Avalanche Wind (Forest Aspect)
N. Maemo (Hokkaido University)	Dynamics (Model Experiment and Theoretical Aspect)
R. Naruse (Hokkaido University)	Mechanism (Theory)
Y. Endo (Hokkaido University)	Meteorological Aspect
K. Nishimura (Hokkaido University)	

In January of 1986, twice heavy snowfall occurred in the western Niigata Prefecture. According to the meteorological observations at Tamugidaira Village 0.6 km SE of Maseguchi, successive heavy snowfall started late on January 20, and the snow depth reached 440 cm at 9:00 a.m. on January 27, as shown in Fig. 3.

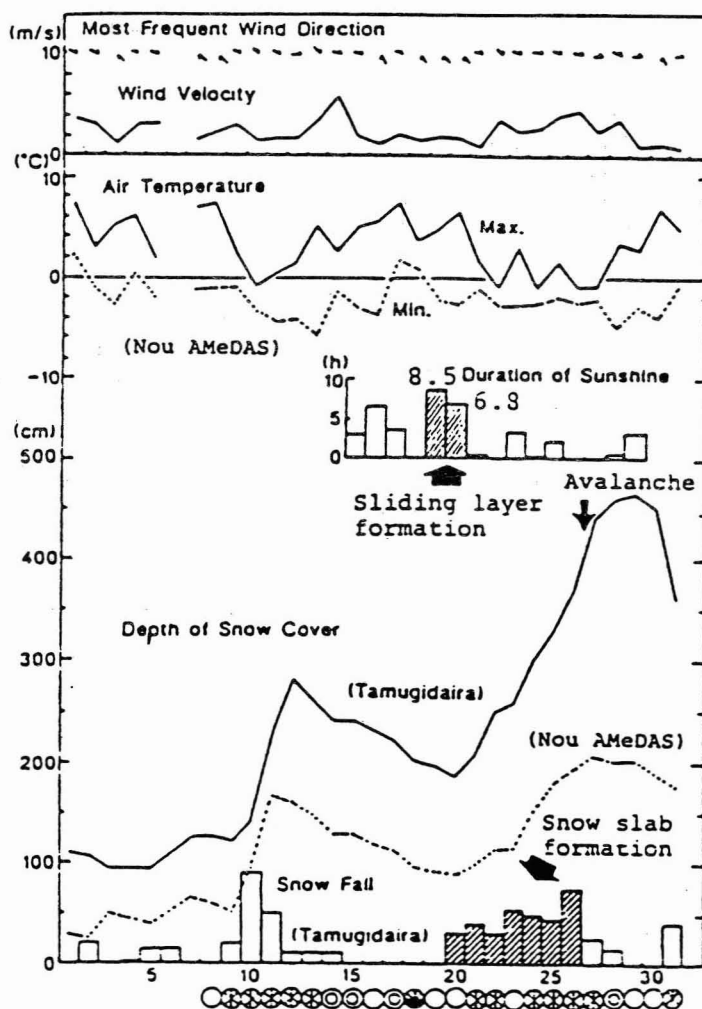


Fig. 3 Daily meteorological data at Nou AMeDAS station and Tamugidaira village observatory. ●, ⊙, ⊚ and ⊛ indicate fine, cloudy, snowy and sleety weather respectively, at Tamugidaira at 9:00 a.m.

Of all involved who lived in the houses, 13 persons were completely buried and found dead; 11 persons were completely buried and found alive; 12 persons were partially buried and not injured. Figure 4 shows the relation between the survival rate of people involved in the avalanche and the time passed after the avalanche occurrence. The survival rate of people involved seems to be closely related to buried time and properties of debris.

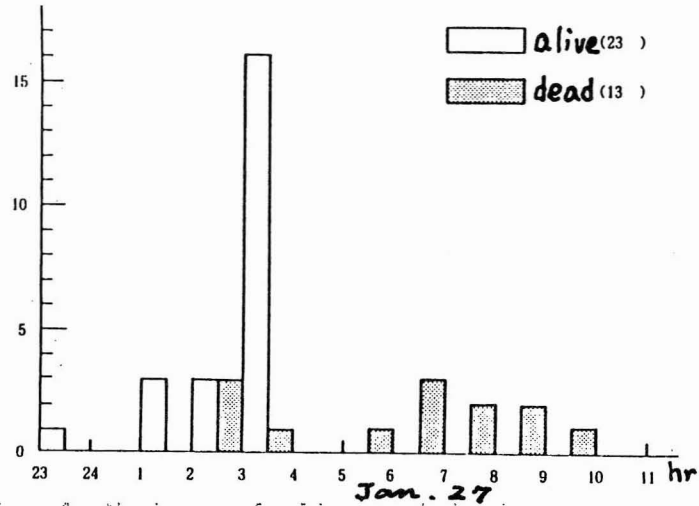
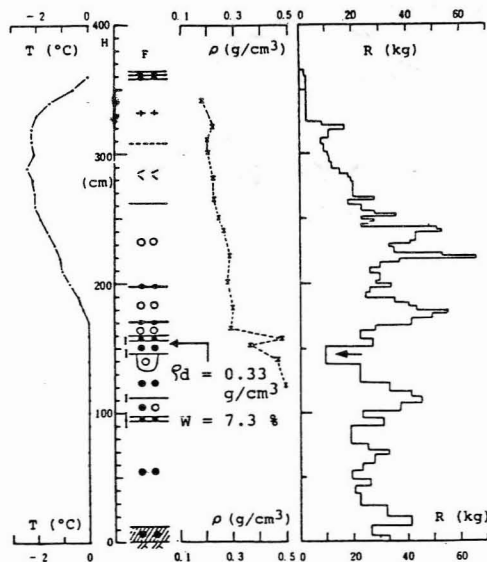


Fig. 4 Numbers of alive and dead persons based on time passed after the avalanche occurred.

The snow pit observations of natural snow cover and debris were made at Maseguchi on January 30, 4 days after the avalanche occurrence. The natural snow cover was 384 cm in depth and the upper half of it was composed of dry snow. At the level between 151.5 cm and 154.5 cm above the ground, a very fragile wet snow layer was observed as shown in Fig. 5. The weak layer was 3 cm in thickness, and was composed of wet coarse-grained granular snow with 7.3% water content, 0.33 g/cm^3 of dry density and 22 gw/cm^2 of Shear Frame Index (Izumi, 1987). Also, the Ram hardness profile of snow cover showed a remarkable depression at the level, suggesting clearly the existence of a weak layer here. It was presumed that the weak layer provided a sliding plane in the starting zone of the avalanche.



Denomination of deposited snow	Graphic symbol
New Snow	+ +
Lightly compact snow	< <
Fine-grained compact snow	○ ○
Coarse-grained granular snow	● ●
Solid-type depth hoar	□ □
Skeleton-type depth hoar	^ ^
Ice crust	I

Fig. 5 Pit observation of the snow cover on flat ground at Maseguchi. T: snow temperature, ρ : snow density, R: ram hardness, W: water content, F: snow stratification, H: snow height.

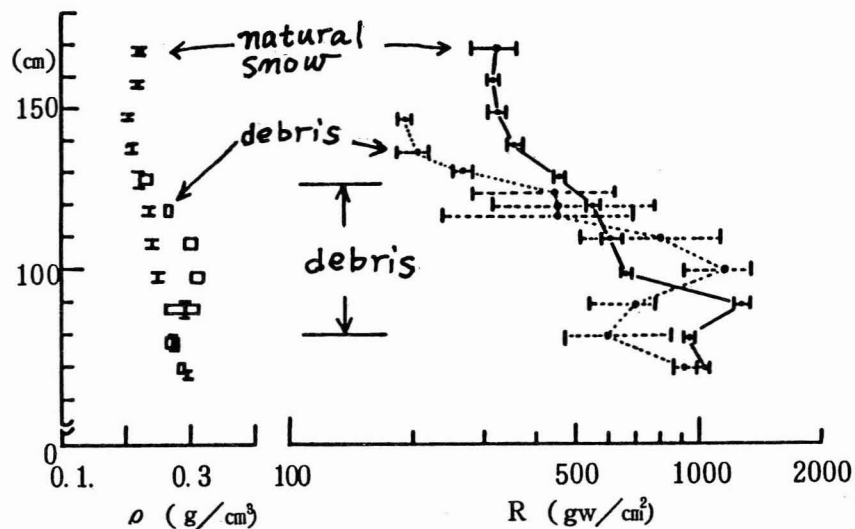


Fig. 6 Comparison of characteristics of natural snow cover and debris.

Figure 6 shows a comparison of characteristics of natural snow cover and debris. The density of debris is somewhat larger than that of natural snow cover, and the value of Ram hardness in debris showed large fluctuations. Also, a lot of snowballs included in the debris were found to range from 1 to 10 cm in diameter.

From laboratory testing of wooden pieces of broken house pillar, minimum impact force was found to be 2 ton/m^2 , and this agreed with a 45 m/s velocity of the avalanche, which is comparable with the fluid model of avalanche proposed by Voellmy (1955).

On the other hand, another powder snow avalanche occurred in Shimamichi-Kosen about 3.5 km away from Maseguchi. This avalanche only caused damage to trees and four electric poles, but its movement happened to be recorded by chance on a vertical seismograph which was set in the Shimamichi-Kosen Inn, only about 5 m from the avalanche track (Izumi and Kobayashi, 1986). Tsukuda and Mizoue (1988) analyzed it in detail and have estimated the velocity of the avalanche and its impact force on the ground surface; i.e. the final velocity was 45 m/s and the force exerted on the ground was 1.2×10^{13} dyn with a duration time of 0.033 seconds for the first prominent impulsive motion.

Besides the above event, they had identified 22 avalanche events which occurred from January 22 to January 26. They also found that a study at the time series of these events showed forerunning activities of small avalanches before a large one.

On the basis of these facts, it was pointed out that the occurrence, speed and route of the avalanches could be caught by the arrangement of several seismographs.

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