THE GROWTH OF AVALANCHE EDUCATION IN JAPAN

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ABSTRACT

The history of avalanche accidents involving Japanese alpinists and skiers is reviewed. The levels of avalanche awareness among Japanese alpinists are also discussed in an historical context. Development of avalanche education under the direction of the Japan Workers' Alpine Federation (JWAF) was stimulated by avalanche accidents during the winter of 1984-1985. A field curriculum was developed to address specific needs of Japanese climbers and to certify qualified instructors. Recently, public avalanche education was initiated on the northern island of Hokkaido, and the use of avalanche transceivers was introduced. Future developments include the production of a Japanese transceiver, use of Gaz-Ex avalanche control systems, training of avalanche dogs, and further growth of avalanche education programs throughout Japan.

EXPEDITION HISTORY

In the forty years from 1952 - 1991 a total of 8476 Japanese alpinists visited the Himalaya to climb peaks over 6000 meters. Including Sherpa support teams and participants of other nationalities in Japanese expeditions 209 climbers were killed during this period. Avalanches were the cause of 102 of these deaths (49%), while 75 deaths (36%) were the result of falls and 15 (7%) were due to altitude sickness. From 1989 - 1991 80% of fatalities were attributed to avalanches (Yamamori, 1991). Figure 1 shows the distribution of the cause of death of the 209 climbers during this period (Fukuzawa, in press).

In January, 1991 the Japanese climbing community was stunned by the avalanche deaths of 17 alpinists attempting the unclimbed peak of Meili-Suei Shan (6740 m) in southwest China. The 17

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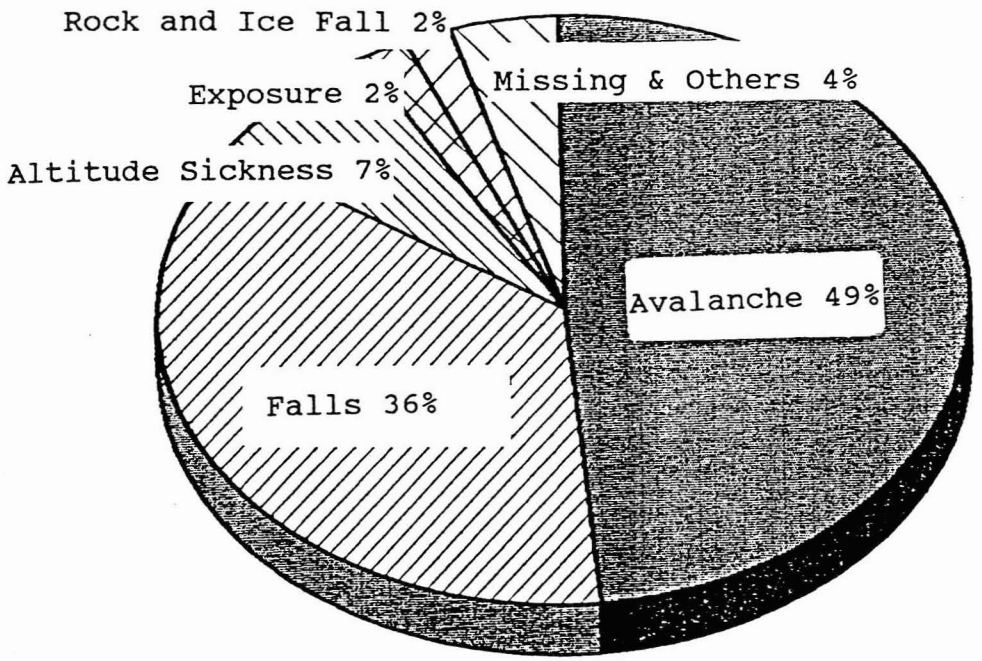
climbers, constituting most of the team, were buried in an advanced camp. None survived, and to date, no bodies have been recovered.

Figure 1.

CAUSE OF DEATH OF HIMALAYAN CLIMBERS
IN JAPANESE EXPEDITIONS

(1952-1991)
209 total fatalities



Adapted from Fukuzawa (in press)

Data provided by Yamamori (1991)

DOMESTIC HISTORY

Once common, avalanche deaths in villages and on transportation routes have been greatly reduced in the second half of the 20th century. However, over 600 alpinists and skiers were

killed in avalanches during the 50 years prior to 1985. Two thirds of these victims were concentrated in the region of the Japan Alps, which extends about 200 km north from Mount Fuji (3776 m). The Japan Alps contain several peaks exceeding 3000 meters, and are divided into three ranges called the Northern, Central, and Southern Alps. In the Northern Alps (60 km long in a N-S direction) high winds and heavy storms combine with steep slopes and deep, narrow valleys to create a particularly hazardous situation. This very small region claimed nearly 300 victims between 1936 and 1985.

Between 80% and 90% of the domestic avalanche victims were travelling on foot. Only on the northern island of Hokkaido, where abundant powder snow and ideal terrain have promoted the growth of backcountry skiing, does the proportion of victims on skis approach 50%. Avalanche forecasting is provided by the Japan Meteorological Agency, but only over very broad areas and without any data concerning the snowpack. Hence, Japanese alpinists and skiers have no dependable forecast service available to them.

AVALANCHE AWARENESS IN THE 1970s

Twenty years ago avalanche awareness among Japanese alpinists was very low. Although some large alpine organizations have been successful in promoting avalanche awareness for their members, live recovery remains problematic. Three reasons may be cited for this. First, as stated above, most slopes in the Japan Alps descend steeply into very narrow valleys where the possibility of subsequent avalanches is high. Therefore, parties frequently seek to escape these confined locations immediately after an accident. A second factor contributing to the need for rapid escape is notoriously bad weather, especially in the Northern Alps, which face the Japan Sea directly and intercept the heavy snow which accompanies persistent, cold winds blowing out of Siberia. Finally, avalanche transceivers have been largely unavailable in Japan. In 1974 100 transceivers were imported from Austria. Unfortunately, they proved difficult to market to Japanese consumers because the Yen was very weak at that time, rendering the transceivers prohibitively expensive. Also, Japanese alpinists often found it difficult to recognize the possibility of live recovery, having been conditioned by bitter experience to perceive burial fatalistically.

DEVELOPMENT OF AVALANCHE EDUCATION IN THE 1980s

The Japan Workers' Alpine Federation (JWAF) is a large consortium of mountaineering clubs, comprised of 600 groups and 20,000 members in a network covering all of Japan. In the winter of 1984 - 1985 season more than ten of its members were killed in three avalanche accidents. Since that time JWAF has promoted

avalanche education seriously with the assistance of avalanche specialists. Japan's first avalanche accident atlas was compiled using accident data, including date, party name, number in party, number dead, and number injured (Nitta, 1986). This was the first avalanche atlas specifically concerned with Japanese mountaineering areas. JWAF also designed a training curriculum to produce qualified avalanche instructors. In 1986 a three day avalanche course was initiated, and over the next seven years a community of dedicated avalanche safety instructors began to grow. To date, 31 instructors have been certified and total of 600 JWAF members have participated. Today instructors teach several local courses so JWAF is propogating effectively. The central avalanche course of JWAF is divided into five classes, from a basic course through the instructors' course (JWAF, 1991). JWAF does not presently conduct courses specifically designed for skiers, although Mr. Tatsuo Nakayama and the senior author of this paper (both of JWAF) were instrumental in the development of a public avalanche seminar in Hokkaido, where backcountry skiing is most popular (discussed below).

FIELD CURRICULUM

The JWAF field curriculum was developed to provide very practical learning experiences for Japanese alpinists. The course begins with a demonstration of cornice collapse because in Japan many accidents are associated with cornice collapse. Avalanches and falls are induced when unstable cornices are disturbed by climbers travelling over unsupported snow. In the JWAF course trenches are dug into a cornice and the stratigraphy of the cornice is profiled by spraying the trench wall with dye. The purpose of this exercise is to demonstrate the presence of hidden weak layers formed by kinetic metamorphism, gravity induced discontinuities in the stratigraphy which may shear vertically, and the presence of small cavities within cornice. Cornice collapse is induced by an instructor jumping on the cornice with skis while on belay. Figure 2 shows the method of inducing snow cornice collapse while on belay.

A unique test for weak layers near the surface (jakusoh test) is practiced in JWAF avalanche courses because alpinists often don't have time for rutschblock or shovel tests. Figure 3 shows the procedure for performing the jakusoh test (Nitta, 1986). 1- after sweeping loose new snow aside, a cylindrical column of snow with a diameter 40-50 cm is isolated by digging a trench using arms and hands. 2- the depth of the trench should be no greater than that allowed by the reach of the hands. This is to avoid disturbing the column with the body. 3- reaching around the column, the upper layer is gently pulled towards the body, feeling the resistance of the snow to the applied shearing force as a large disc of snow is removed. 4- as the process is repeated one layer at a time the locations of weak layers will become readily

Figure 2.

METHOD OF INDUCING CORNICE COLLAPSE

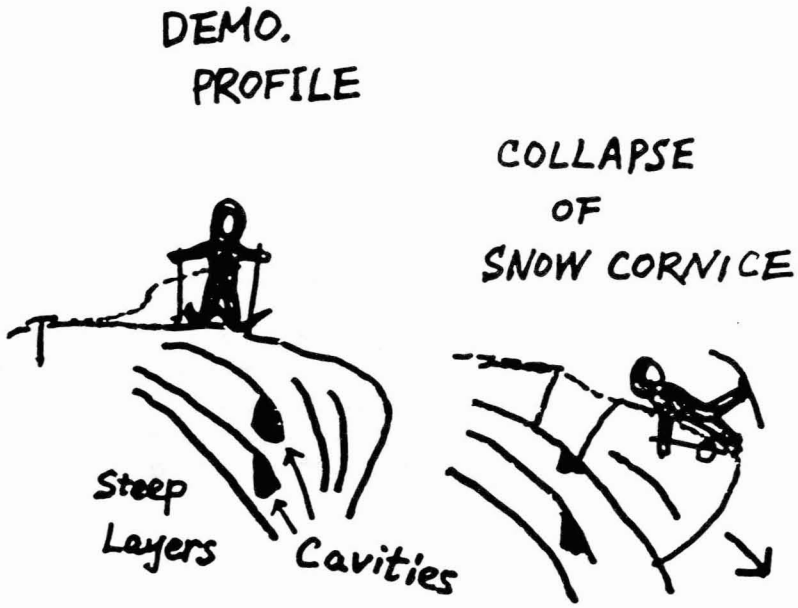
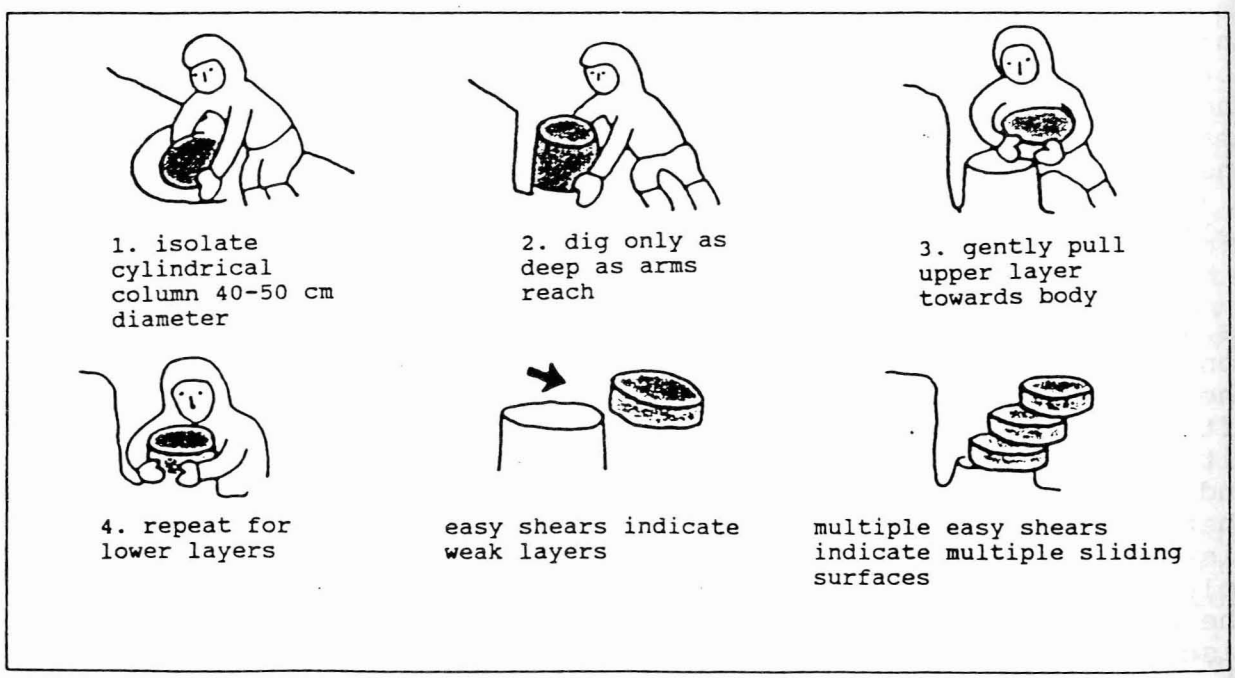


Figure 3.

PROCEDURE FOR JAKUSOH WEAK LAYER TEST



apparent. If a weak layer is released very easily then alpinist-triggered avalanches are considered possible. Similarly, if 2 or 3 layers are released in the same easy manner then multiple sliding surfaces may be indicated. By performing the jakusoh test frequently, alpinists can continuously re-evaluate the avalanche hazard and use the information provided to aid decisions on climbing and route-finding strategy.

Historically, avalanche transceivers have not been available to Japanese alpinists for the reasons discussed above. Therefore, a frightening exercise has been employed to demonstrate the sensation of burial to students. At some time during the JWAF training each student is buried beneath about one meter of snow. The following precautions are taken to ensure the safety of the student: 1- an adequate air space is created around the student's head, 2- the student lies on a pad and is wrapped in extra clothing to prevent hypothermia, 3- the student is given a two-way radio to enable communication with the surface, and 4- a team of students and instructors stands ready with shovels to extricate the buried student quickly if the slightest problem is indicated. In addition to feeling the weight of the snow on their backs, the students consistently report a feeling of lonely desperation while buried.

For the initial search and to demonstrate to searchers how difficult it is to hear the response of the buried victim the "scuff and call" drill is performed. Students learn that although the victim can hear their call quite well, it is nearly impossible to hear the response, even if the victim is conscious and able to respond. This method developed because of the lack of beacons and because alpinists tend not to cary probe poles or other active means of self-rescue. Historically, Japanese climbers have been forced by circumstances to rely only on their senses when searching for buried victims. Hence, it is critically important to impress upon students that their most prudent course of action is to avoid burial in the first place. Students educated in this manner have no difficulty in understanding that transceivers do not provide a guarantee of live recovery because they have experienced the sensation of burial. The students learn that even when buried with safety precautions they could not suvive for long without the assistance of others. It is a powerful experience.

In 1991 exercises in terrain analysis, routfinding, and protocall for travelling in avalanche terrain were introduced to the JWAF field curriculum. The students are divided into small groups and decision-making is practiced in various parts of the Senjoujiki Bowl, in the Central Alps. Close supervision and occasional intervention by the instructor are diligently maintained to keep students from turning this experiential exercise into a real life or death emergency.

Students of the JWAF avalanche course must also pass written exams each morning before breakfast if they wish to advance to a

higher level of certification.

RECENT DEVELOPMENTS IN HOKKAIDO

The northern island of Hokkaido is just cold enough that the temperature rarely exceeds freezing during the winter months. Snow falls nearly every day in the coastal mountain ranges facing the Japan Sea. The terrain west of Sapporo (pop. 1,600,000) is volcanic in orign, with moderate to steep slopes and a sparse forest of beech and birch reaching treeline between 900 and 1100 meters. Consequently, many people in Hokkaido have developed a passion for ski mountaineering and backcountry ski touring. Members of several outing clubs at Hokkaido University have been involved in serious avalanche accidents over the years. From 1973 through 1978 this paper's senior author taught avalanche safety to these student clubs. After the senior author moved away from Hokkaido avalanche education for Hokkaido University students decreased. However, faculty and staff at Hokkaido University's Institute of Low Temperature Science (ILTS) maintained a level of interest in avalanche education, principally through club activities. Naruse (1989) compiled and published fifty years of avalanche accident data from Hokkaido. In January, 1991 Hokkaido's first public avalanche seminar, sponsored by ILTS and Hokkaido University ski mountaineering clubs, was held after suggestions by this paper's junior author and the Hokkaido University Ski Mountaineering Club. This avalanche seminar was directed by Dr. Ryuzo Nitta, Mr. Tatsuo Nakayama, Mr. Takuya Fukuzawa and Mr. Charlie Ziskin. The seminar received wide coverage in the Japanese mass media. JWAF added transceiver rescue training after the Hokkaido seminar and the Hokkaido University ski mountaineering club purchaced 40 Ortovox dual frequency beacons. The effectiveness of beacons and the need for avalanche education were reported by national television networks and national in the climbing magazine Gakujin, which has a circulation of 200,000 (Nagata, 1991). The Hokkaido avalanche seminar is being continued under the direction of Mr. Takuya Fukuzawa. Additionally, Fukuzawa (1991) has published an avalanche atlas for Hokkaido using Naruse's (1989) data, as well as new data provided by other colleagues.

FUTURE DEVELOPMENTS

Three years ago Japan's first avalanche rescue dogs (German Shepards and St. Bernards) were trained by a professional dog trainer in the Northern Alps of Nagano Prefecture. Two other trainers are also active in the Northern Alps. Although they have not yet been used in actual rescues these dogs have performed effectively in simulation exercises designed to find buried people.

The use of explosives is heavily regulated because of some small, but militant terrorist organizations. Therefore, their use

in Japan for avalanche control is nearly unknown. Explosives may only be used occasionally for protection of transportation infrastructure. The use of powder and plastic explosives is not allowed for the ski industry. During the winter of 1991-1992 the Arai ski area (under development) tested four Gaz-Ex avalanche control systems. One season of testing has demonstrated that the Gaz-Ex system is effective, even in the wet snow conditions of Niigata Prefecture. Future plans are to employ more Gaz-Ex avalanche control systems at this new ski area. Additionally, other applications are planned for the Gaz-Ex to be used in avalanche education and research such as studying the fluid dynamics of avalanche flow, burial depth and location of a dummy, and avalanche transceiver testing and development.

In February 1992 at a JWAF avalanche course Mr. Thomas Wiesinger, an Austrian alpine guide and snow scientist presented a comparison of several European avalanche transceiver. JWAF decided to manufacture a Japanese avalanche transceiver. This beacon will use a single frequency (457 kHz) and is expected to reach the market in December 1992. This new beacon must satisfy specific conditions unique to Japan. Three features are particularly important. 1- the beacon will use a 6 volt lithium battery with a guaranteed life of 1500 hours. This feature will enable the beacon to be used in very long searches or in situations where the victim's body cannot be recovered for several weeks (e.g. when buried deeply in the bottom of a narrow valley). 2- four ranges of reception sensitivity are used (50 m, 30 m, 10 m, 5 m). To protect searchers in the event of multiple avalanches the beacon automatically switches back to transmitting mode five minutes after any range is selected. If high wind or other ambient noise delays the search, the receiving mode can be easily re-activated. 3. Four diode lights and an integral speaker are used instead of an earphone. The first diode light is simply an on-off indicator which blinks during transmission. The other three diode lights indicate the strength of the received signal. One light means the signal is weak, two lights indicate a medium strength and three lights means the signal is strong enough to change to a smaller range. The diode lights alone are sufficient to conduct a rescue if wind noise renders the speaker inaudible.

Finally, international cooperation is helping the Japanese avalanche community to find more effective ways of managing avalanche hazards, increase the level of avalanche awareness and share considerable Japanese research expertise with avalanche workers around the world. Conferences such as the ISSW are providing opportunities for exchange of information that is crucial for Japanese alpinists and scientists. The recent developments described in this paper signal continued stimulation and development of a distinctively Japanese approach to avalanche education.

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