this is merely because it was the obvious place for me to go when gaining further knowledge and material. It is the home of the Federal Institute for Snow and Avalanche Research, and also of the Parsenndienst; and it must not be thought—just because I mention so many avalanche accidents there—that it is any more dangerous than other places. If anything, the contrary is true, and attention is focused on Davos owing to the excellence of the safety measures and the importance of the research carried out there.

CHAPTER 1

Avalanches in the Past

Avalanches, which must be ranked with other great destructive phenomena like earthquakes and hurricanes, have terrorized mountain people for centuries, especially after great snowstorms like those of 1951. Fortunately, storms of such magnitude occur infrequently, but this is one of the reasons for the death and destruction that they still bring. In the past, the avalanches that killed a family here and there or destroyed the odd house each winter were considered to be among the unavoidable and not very grave hazards of living in the mountains. After one of the less frequent major disasters, which had perhaps killed several hundred people—and left no doubt as to the gravity of the hazard—the survivors considered themselves safe for a number of years to come, at least by the law of averages. They therefore shrugged the catastrophe off fatalistically and rebuilt their houses where they had stood before.

It is a quite recent idea that avalanches are not entirely irresistible, indeed that measures can be taken against them, and it was this realization which sparked off modern research into their complex nature, on the basis that knowledge of an enemy is the best defence. However, our forbears can well be excused their fatalistic attitude when one considers the destructive force of avalanches and their very high speed of movement. Airborne-powder avalanches (see photographs 1a, b, c), in which clouds of snow lift from the slope and flow through the air, can reach speeds in excess of 200 m.p.h.

The so-called Great Glärnisch avalanche is a classic example of an avalanche that moved at very high velocity. It occurred on March 6th, 1898 at 11.20 a.m. and was observed and reported on by Dr. Beuss, the pastor of a village near Glarus, Switzerland. He was conducting a funeral at the time. The enormous avalanche broke away near the summit of the Vorderglärnisch. The snow-cloud was vast with the sun lighting up the glinting particles near the fringe

of the swirling mass. The centre was like a gigantic waterfall, while the turbulent clouds spread out either side as if wanting to start their own streams. The swirling of the snow was creating ever changing ring patterns illuminated by the sun. The ground shook as in an earthquake, and the noise as the snow crashed down over the rocks into the valley was overwhelming.

The noise took on the tone of distant thunder as the avalanche shot across the valley floor, hit the slope of the Buttenwand opposite and then surged upward many hundred feet before recoiling in a curve through the air. The sky went dark as the snow-cloud blotted out the valley and the surrounding peaks. Though the people of the village were well used to avalanches, Dr. Beuss wrote that 'the immensity of this one set the women screaming and running for their houses, while many of the men were noticeably pale'.

The vertical drop of the avalanche was at least 5,750 feet and it ran about $4\frac{1}{3}$ miles, which included $1\frac{1}{2}$ miles of level valley floor, in a little over a minute. It was another 7 minutes before all the snow had settled. The avalanche had travelled at $3\frac{3}{4}$ miles per minute, 225 m.p.h., a speed which Dr. Beuss described as being 'more than four times faster than the fastest English train'.

Modern measurement has shown that speeds of 110–180 m.p.h. can generally be expected from airborne-powder avalanches, while especially large ones may travel at over 220 m.p.h., so Dr. Beuss was surprisingly accurate in his estimate.

There is a blast of wind associated with airborne-powder avalanches which can lay waste acres of full-grown forest in a few seconds (see photographs 2a and b) and Sir Arnold Lunn saw a large iron bridge section thrown 150 feet into the air by avalanche blast. There are many instances too of men being plucked up and flung quite considerable distances.

In recent years attempts have been made to measure the impact pressures of avalanches by erecting gauges in known avalanche paths. The anticipated pressures were well short of reality and many gauges have been ripped out of their concrete foundations. But, in the relatively short time that successful results have been obtained, an impact pressure of no less than 22,000 pounds per square foot has been recorded. This was in the notorious avalanche gully of the Val Buera (see photograph 26) near Zuoz, Switzerland, in 1961.

To put this destructive power into perspective, it is interesting to record the damage caused by a much smaller avalanche whose impact pressure, according to Dr. Voellmy, a Swiss expert in avalanche destructive power, did not exceed 485 pounds per square foot.

In the stormy night of January 11th, 1954, a train was standing before the station at Dalaas in Austria when the avalanche struck. It lifted the 120-ton locomotive off the rails and slammed it against the station; it hurled the passenger carriages about, tossing one down a slope, and it demolished several buildings.* Ten people lost their lives as a result of this small avalanche, small because it was 45 times less powerful than the one measured in the Val Buera.

Wherever snow lies on slopes the latent threat of avalanches exists, and even England has had an avalanche accident. It is commemorated now by the Snowdrop Inn in Lewes, Sussex, for on this site a number of cottages called Boulder Row were swept away by an avalanche on December 27th, 1836. Eight of the 15 people buried lost their lives.

An account in the *Sussex Weekly Advertiser* at the time read: 'A gentleman who witnessed the fall described it as a scene of the most awful grandeur. The masses appeared to him to strike the houses first at the base, heaving them upwards and then breaking over them like a gigantic wave to dash them bodily on to the road, and when the mist of snow, which then enveloped the site, cleared off, not a vestige of habitation could be seen—there was nothing but an enormous mould of pure white.'

But it is in the Alps and the Himalayas, in the Rockies and the Caucasus, the Andes, the Pyrenees and the many other mountainous areas of the world covered by snow in winter that avalanches exert their main influence. They claim human lives as far apart as Norway and New Zealand, Persia and Japan. The largest avalanches doubtless take place in the Himalayas, where climbing expeditions have reported that they reach stupendous proportions and are unbelievably vicious in their frequency. But in terms of human suffering, avalanches have afflicted the inhabitants of the Alps of Europe to a greater extent than anyone else. This is simply because nowhere else in the world is a mountain range with winter snow so

* Buildings are usually designed to withstand only 14 pounds per square foot on their walls, the pressure imposed by Storm-Force winds.

densely populated. In the Alps there is a rich harvest of life and the White Death has reaped, and still reaps, in plenty.

* * *

The first mention of avalanches was by Strabo, a wealthy man of Greek upbringing who lived from 64 to 36 B.C. He devoted his life to travel and wrote a massive work called *Strabo's Geography.*

When writing of the Alpine passes he describes the horrors 'of falling into chasms abysmal' if one makes a slight misstep, of the 'dizziness which comes to all, including the beasts of burden, who travel the passes on foot' and ends up by saying: 'Accordingly these places are beyond remedy; and so are the layers of ice that slide down from above—enormous layers capable of intercepting a whole caravan and of thrusting them all together into the chasms that yawn below. For there are numerous layers resting one upon another, because there are congelations upon congelations of snow that have become ice-like; and the congelations that are on the surface are from time to time easily released from those beneath before they are completely dissolved in the rays of the sun.'

Evidence suggests that avalanches were among the troubles which beset Hannibal's army on its epic crossing of the Alps in 218 B.C. The two main accounts of the crossing, those of Polybius and Livy, do not mention avalanches specifically but they do describe circumstances which make them a strong possibility. Which pass Hannibal crossed remains one of the great unsolved problems of history but it is known that he set out with 38,000 soldiers, 8,000 horsemen and 37 elephants. On the crossing he lost no less than 18,000 men, 2,000 horses and several elephants.

On the climb to the summit of the pass they were harried and attacked constantly by local tribesmen and finally reached the top at 'the setting of the Pleiades' or late October. They were exhausted, but Hannibal cheered his men by pointing out the plains of Italy spread below, after camping for two days, they began the descent.

This descent proved even more disastrous than the climb. They were no longer under attack, but of the total losses sustained more than half were due to the natural difficulties encountered while the army tried to make its way down from the pass. There was fresh

snow on a crust of old snow, which the animals kept breaking through and sticking in, and a landslide had carried away 400 yards of path; the new snow made a detour difficult. Men and beasts in their thousands slid scrabbling and screaming into the abyss.

The snow conditions described can easily lead to avalanches and the poet Silius Italicus (25–101 A.D.) certainly describes them in his version of the crossing in the epic poem *Punici*, a somewhat dramatized and perhaps not over-reliable account of the Punic Wars. The relevant verse of the poem runs, in free translation:

'There where the path is intercepted by the glistening slope, he (Hannibal) pierces the resistant ice with his lance. Detached snow drags the men into the abyss and snow falling rapidly from the high summits engulfs the living squadrons.'

Another point is that a great many scholars have persuasive arguments in favour of the Col de la Traversette as the pass used by Hannibal. It is therefore interesting that a document of 1475 states that the tunnel pierced near the top of the pass in 1470 was designed to protect travellers from avalanches on the final slopes. Overall then, it would seem that avalanches were almost certainly among the hazards which caused such terrible losses to that bold and brilliant general.

By the 12th century, pilgrims on their way to and from Rome began to report on the horrors of the Alpine passes in winter. In December 1128, Rudolf, the Abbot of St. Trond near Liège, crossed the Great St. Bernard, and he left a most interesting account which is preserved in the records of the monastery.

With his party he reached Restupolis (Etroubles) above Aosta with 'difficulty that was next door to death'; and they were then held up by snowdrifts until a way through was shown to them, and they reached Saint Rhémy 'on the Mount of Jove itself, after a distance of two German miles. Here,' he wrote, 'as though fixed in the jaws of death we remained in peril of death by night and by day.

'The small village was overcrowded by the throng of pilgrims. From the lofty and rugged heights above it fell often huge masses of snow, carrying away everything they encountered, so that when some parties of guests had found their places, and others were still waiting near the houses, these masses swept the latter away and suffocated some whilst crippling others of those in the buildings.

In such a continual state of death we spent several days in the village.'

During these days the *marones*, as the local guides were called, refused to lead the pilgrims over the Pass; but finally the payment offered became large enough to tempt them and they agreed to open the track. They wrapped themselves and their heads in felt, put rough mittens on their hands and pulled on high spiked boots while the travellers went into the church to pray. Rudolph of St. Trond continues:

'When these fervent devotions were taking place in church a most sorrowful lament sounded through the village, for, as the marones were advancing out of the village in one another's steps, an enormous mass of snow like a mountain slipped from the rocks and carried them away, as it seemed to the depths of Hell. Those who had been aware of the mysterious disaster had made a hasty and furious dash to the murderous spot and having dug out the marones were carrying back some of them quite lifeless, and others half dead upon poles, and dragging others with broken limbs.'

It is hardly surprising that when the pilgrims came out of church and saw the tragic procession they hesitated hardly a moment before fleeing back to Restupolis in terror.

Another report was written by John de Bremble, a monk from Canterbury who crossed the Great St. Bernard in February 1188. He did not mention avalanches, but what he did say now seems so amusing that I cannot resist quoting from the letter he wrote to his sub-prior, Geoffrey:

'Pardon me for not writing. I have been on the Mount of Jove; on the one hand looking up to the heaven of the mountains, on the other shuddering at the hell of the valleys, feeling myself so much nearer heaven that I was more sure my prayers would be heard. "Lord," I said, "restore me to my brethren that I may tell them that they come not into this place of torment." Place of torment indeed, where the marble pavement of the stony ground is ice alone and you cannot set your foot safely; where, although it is so slippery that you cannot stand, the death (into which there is every facility for a fall) is certain death. I put my hand in my scrip that I might scratch out a syllable or two to your sincerity—lo, I found my ink bottle filled with a dry mass of ice; my fingers too refused to

write; my beard was stiff with frost and my breath congealed into a long icicle. I could not write the news I wished.'

John de Bremble seems to have had a better excuse than most people for tardiness in dealing with correspondence.

* * *

By the Middle Ages, countless migrations of people had populated the mountain valleys to a surprising extent and, from this time on, life in those remote villages was ordered to a great degree by avalanche danger. From the 15th century onwards there are numerous records of terror and disaster in those idyllic valleys of the Alps.

Early documents from the Dauphiné area of the French Alps are full of complaints about avalanches and the catastrophes they caused. Near Oisans, in particular, people dared not leave their parishes for the six months or more that snow lay on the ground; and many were killed on their way to the cow-stalls or Mass on Sunday.

A translation of a typical Latin text of 1450 runs: 'In the hamlet of La Pouture d'Ornon there was such an abundance of avalanches that all the hamlet was destroyed with all the surrounding properties. Fourteen or fifteen people who lived in the hamlet were killed and now there is but one family which continues to live there with great difficulty. In addition, inhabitants state that last year, 1449, there was such an abundance of avalanches near the houses of the hamlet du Rivier that nearly all the dwellings were destroyed: they believe that if the avalanches had not brought with them the large amount of timber, which by the grace of God they did, the complete hamlet and all its people would have been annihilated.'

The Latin words used to describe avalanches in these early texts are interesting and help to trace the origin of our present word. They were usually called *labinae* or *lavanchiae*. *Lavanchiae* is probably of pre-Latin origin, perhaps Ligurean, and is of the same root as *lave* which is the flowing of mud or lava. Much later confusion with the French *aval*, towards the valley or downwards, crept in and produced our present word *avalanche*, which we have taken from the French. It can of course be applied to any material falling down a slope, but by common usage the word alone has come to

mean a snow avalanche, while the words stone or ice usually prefix it when these other materials are involved.

The other Latin word *labinae* comes from *labi*, the Latin for slide or slip. Later, the partial interchangeability of the letters *b*, *v*, and *u* produced many local words in the Alps like *lauie*, *lavina*, *lauina* and finally the present German word for avalanche which is *lawine*, brought into general use by Schiller and Goethe.

After 1450, recorded avalanche disasters became ever more numerous. Villages were smashed, some of them repeatedly, and hundreds upon hundreds of lives were claimed by the inexorable snow.

The area around Disentis in central Switzerland figures prominently in the catalogue of disaster. In 1459 the Church of Saint Placidus just outside Disentis was destroyed completely. By then it had stood for no less than 655 years—the case *par excellence* of avalanches biding their time. The same avalanche destroyed a number of houses and killed 16 people; but ecclesiastical buildings in Disentis seem to have been the favourite target. In 1754 a large airborne-powder avalanche came down into the valley, and the air blast, apart from hurling a granite trough a 'quarter of a league' (¾ of a mile) also blew the cupola off the convent tower, 400 yards distant from the avalanche path.

The nearby village of Trun suffered in 1808 when a blizzard lasting only three days deposited 15 feet of fresh snow in the mountains and nearly 10 feet in the village. An enormous avalanche from Kluka, on the east side of the Punteglias Valley above Trun, destroyed the chalets of Zeniu, swept up the opposite slope of the valley and devastated a large forest. It recoiled to the east slope and tore up some more woodland. It returned to the west, then back to the east where it pulverized six cowsheds. It went back to the west again, for the third time, burying a farm full of cattle; then it went east again, where part of the mass flowed over some low hills. However, enough remained to flow west again for a fourth and final onslaught in which the houses of Trun were buried to their rooftops. It is unusual for avalanches to recoil so many times and it could be that fresh avalanches were being released each time the masses crossed the valley. In any event, such stupendous destructive energy must have been terrifying.

By the 16th century the taking of medicinal baths was already popular; such places as Leukerbad in the Wallis (Valais) of Switzerland, St. Moritz and Pfäffers were visited by many of the wealthy of Europe. Yet, the little village of Leukerbad, set in a hollow at the head of a lovely valley, has had to pay dearly and repeatedly for its gift of curative waters; for it has been ravaged and scourged by avalanches for centuries. In most winters they seethed right to the outskirts of the village, occasionally claiming some victims and houses, but in 1518 the snow hurtled into the village itself and laid it waste. Sixty-one people were killed.

In 1718, the same thing happened again and an inhabitant of the time, Stephen Matter, left a good account of the disaster. In December 1717 it snowed non-stop for ten days, a light, fine powder snow; then in the night of January 16–17th it snowed again, and rained. At about 10 a.m. on Monday the 17th an avalanche swept into the village outskirts and buried three young men, Johan Roten, Stephen Meichtry and Matthias Andry. Only at dusk were they missed, however, and the whole village then hurried to the rescue with lamps and sounding rods (rods pushed down into the snow to feel for bodies). They could find nothing and returned tearful and grief-stricken to the village at about 7 p.m., but an even greater disaster awaited them there.

Just before 8 p.m., of the same evening, a monstrous powder avalanche struck the village. There was a single crash as if just one house had been hit; but in that instant houses near and far, weak and strong—'strong like the Sommer house whose firm walls had appeared as though they could withstand any avalanche'—were thrown down and swept away. Fifty-two people lost their lives and nine horses were killed, though there was luckily little livestock in the village at the time.

The St. Laurentius Chapel, all three baths, all the inns, over 50 houses and many stables were destroyed. Two houses east of the church were left standing, though ringed by avalanche debris, but apart from these a mere handful of houses above the church were left unscathed.

The church-bell summoned the survivors and with the pastor, Johann Plaschin, an attempt was made to find those buried but still alive. A few were saved but by morning, weeping with fatigue and

sorrow, they doubted that any more survivors could be found. At midday, 12 people were dug out dead near the church. Joseph Brunner and his wife had been killed praying in the chapel while their four children were killed in their home. The house was so shattered that one child was found in a meadow some distance away, tucked up in bed as if by human hands. In a house above the chapel lived Noe Loretan, his daughter Christina and her husband Stephan Brunner with their three children. The family was found on the fourth day after the avalanche. Stephan Brunner and Christina were still alive but she died shortly after her rescue.

Stephen Roten, a healthy and strong young man, was fetching wine from the cellar in an inn when the avalanche struck. He was found alive after eight days, though snow had filled the cellar so that he had no food. He lived a further eight days but then died owing to the fearful frostbite of his feet and legs. It was hardly hoped that all the bodies would be found before spring, but help came from a wide area and after ten days everyone had been recovered except the little girl in her bed in the meadow. She was only found in spring. In all, 55 people died in Leukerbad in those few days.

By 1720, two years later, the stricken but valiant people of Leukerbad has rebuilt the baths, several inns and some houses only to have them destroyed when the mortar was barely set. And again in 1758, for the third time in 40 years an avalanche plunged into the village.

Not only did Leukerbad suffer in 1720; it was a year of avalanches of the intensity still dreaded today throughout the Alps, a year of the 'big snows'. At Obergesteln, near Gletsch in the Rhone Valley, the much-feared Galen avalanche came down with unprecedented violence and killed 88 people and 400 cattle, as well as destroying 120 buildings.

'God! What grief! 84 in one grave.' This was the original inscription on the headstone of the communal grave in which all but four of the victims were buried. Unfortunately, it has since been replaced by an inscription in verse which lacks the stark and moving simplicity of the original, and which conveys less well the shock in a small village when a disaster kills a major part of the population. In 1852 a small avalanche from the Galen slope attacked Obergesteln in a subtle way: it only destroyed the bakery, but the resultant fire

razed the village. In 1915 the Galen avalanche came down yet again and destroyed a dozen houses.

But reverting to 1720: the children in the small village of Ftan in the Lower Engadine had all gathered in one house to sing when an avalanche came down and destroyed it; 32 young lives were lost.

At Rueras, in the Tavetsch Valley above Disentis, 100 people and 237 head of cattle were killed, and 60 houses were destroyed. After a later disaster it was almost decided to abandon the village—the only case to my knowledge in which the mountain people nearly gave up their stoic struggle for survival.

Still in this same winter, 40 people were killed near Brig, 7 in the Fieschertal, 23 on the Great St. Bernard, and 12 in Randa, near Visp.

In Graubünden (Grisons), the most easterly canton of Switzerland, avalanche disasters have been especially well documented. Among the earliest was one in 1440 at Davos when two houses near the lake were destroyed and 11 people killed, though a Martin Schlegel was dug out alive after 24-hours burial. In 1569, an avalanche down the same track killed seven and smashed through the ice of the lake. A large number of fish, killed by the concussion, were thrown out on to the land.

In 1598, over a hundred people died in avalanches in Graubünden, and in 1606 and 1609 the area around Davos was again terrorized. Hans Arduser wrote a chronicle of the area in which he enumerated the avalanche disasters between 1572 and 1614. In 1606, according to Arduser, it snowed for three weeks and by January 16th there were 12 feet of fresh snow. Just before midnight 'the mountains and valley trembled and shook'. Seventy buildings were destroyed and damaged at Davos-Frauenkirch, including the church, and the rescue work continued for three days and nights. Seventeen people died though five, among them a 14-year-old girl, were rescued alive after 36 hours.

Arduser also wrote that in 1609, on Ash Wednesday, March 13th at 10 a.m., the people of Davos-Dorf had just sat down to breakfast when a 'gruesome, grisly snow avalanche' came down and killed 26.

The Prättigau Valley of Graubünden, in which the famous resort of Klosters lies, has also been the scene of many days spent in mortal fear while a blizzard raged, of rumbling and crashing in

the night, and of long days spent searching for loved ones in their winding sheets of snow. In 1689, at 8 a.m. on Saint Paul's Conversion day, an avalanche from Calmur killed 16, and a second at midday knocked down 155 buildings and caused the death of 57 people in the village of Saas. A poem was written to commemorate the disaster but, of course, the occurrence is now lost in the mists of time as far as the population of Saas is concerned. Anyone passing through the village, however, or skiing down into the Prättigau Valley from the Parsenn area, will see the steep, wide-open slopes above the village of Saas. If they know of the disaster in 1689, they will gaze at those slopes in fascination. And they will realize, with a pang of foreboding, that Saas can be annihilated again at any time an avalanche chooses. It is a sobering and spine-chilling realization, even for those who do not live in Saas and have no intention of doing so; yet there are thousands of villages throughout the Alps where the same menace lurks.

* * *

The disasters mentioned here are, in the main, just a few of the gravest taken from the almost endless catalogue of death and devastation wrought by avalanches throughout the centuries in that part of the Alps now covered by Switzerland. The Austrian, German, French and Italian Alps have similar catalogues; as isolated examples, 200 people died in Savoie, Nice and Aosta in 1755, and from the famous *Montafon Letter* it is known that more than 300 people were buried by avalanches in the Montafon Valley of Austria in 1689. Nor must it be forgotten that, winter after winter, smaller avalanches, though still 'gruesome' and 'grisly' ones, snatched victims here and there.

It should be recognized, however, that the mountain people were not always blameless victims of an act of God when avalanches struck them down: they often brought avalanches on to their heads through their own thoughtlessness.

The woods above their houses afforded them natural protection from all but the mightiest avalanches—yet the people plundered and ravaged the timber outside their back doors as firewood and building material. It is known that the Urserental, a valley leading

towards the Furka Pass from Andermatt, was once densely forested; and yet by 1870 the 4-mile-long valley was denuded and such an avalanche inferno that the inhabitants scarcely dared to remain. Moreover, the Alps were the livestock-raising area of Europe during the Middle Ages, and indiscriminate grazing of young tree shoots was doubtless a factor in the deforestation, as well perhaps as a certain amount of timber felling to provide pastures near the villages.

However, apart from the factor of timber, houses were often sited in suicidal places and rebuilt in the same place when destroyed. But even the inhabitants of the safest houses had to go out to their work in the forest or stalls, or to attend church, and they were then exposed to danger. For this reason, avalanches have often had odd side effects on the way of life of a village.

In the Kleinwalserthal of Austria, for example, the pastor of Mittelberg wrote to his deacon in December 1710 to tell him that the part of his congregation from the hamlet of Baad refused to come to church, because of the avalanches which menaced the path. The bishop agreed that Baad should have its own small church, and so it became ecclesiastically independent. But the avalanches had the last say because one tore the steeple and bells off the new church in 1789.

Another curious consequences of an avalanche occurred in the Maurienne area of the French Alps in 1579. A feud developed between the villages of Albiez and Villargondran when an avalanche had ripped out a forest in one parish and deposited the shattered remains in the other. The dispute as to whom the timber then belonged became so acrimonious that legal judgement was sought.

* * *

Avalanches have probably claimed an even heavier toll of human life from armies who ventured into the mountains in winter than they have from the civilian population. Although it is quite possible that the first in the long series of military avalanche accidents took place during the Retreat of the Ten Thousand, across the Armenian highlands in 401 B.C., or during Alexander the Great's crossing of the mountains of Persia, the Hindu Kush and Chawkpass, the first

definite evidence is that mentioned earlier in connection with Hannibal. Thereafter, the first military avalanche accident of any magnitude occurred during the private war between the Dukes of Milan and Uri in 1478. The Zürchers, as allies, rushed to the assistance of the Milanese. During their crossing of the St. Gotthard Pass '60 soldiers were wretchedly devoured by an unexpected snow avalanche which rushed upon them'.

During the Swabian War, in 1499, two more accidents took place. As a result of the Swiss Federation's alliance with France, many mercenaries came into Switzerland and crossed the Great St. Bernard Pass on their way to attack the Milanese in the cause of Louis XI. They were surprised by a large avalanche and 100 men died. At about the same time, Kaiser Maximillian was climbing the Ofen Pass towards Zernez in the Engadine with 10,000 soldiers when 400 were suddenly buried in snow. The avalanche must however have been very shallow and slow-moving for none was killed, though several were injured. There was apparently much laughter as they extricated themselves—most probably the laughter of relief.

In 1799 and 1800, the area in and around the Alps became a cockpit as the French Revolutionary Armies waged war against their enemies. The Russian general Suvarow fought a fantastic campaign through central Switzerland in the autumn of 1799. By then he was 69 years old and had been called out of retirement to lead the Cossacks; but he was as massive and erect a figure as ever. There was a pitched battle with the French on the St. Gotthard Pass and, when Suvarow saw one of his lines fall back before an attack, he rolled off his horse in rage shouting: "Bury me here! They are no longer my children!' His men rallied at once, stormed to the top of the Pass, routed the French down the Schöllenen Gorge and followed them to the Lake of Four Cantons, only to find insufficient boats left to carry them across.

Undaunted, Suvarow led his army across three passes, the Kinzig Kulm, Pragel and Panixer, a feat of mountain warfare to match any in history. But the Panixer Pass was almost his undoing for new snow was falling as he set out on October 5th. The losses of the army were appalling. Their boots were already worn out, their clothes were in tatters, and they were exhausted by their

previous exertions. Though the leaders of the army reached Panix on October 6th, it was four days before the last of the survivors reached safety. As the blizzard raged and avalanches swept hundreds of men away, hundreds more just lay down in the snow and died. About 300 pack animals were lost, and so were the remnants of the artillery.

Neither did Napoleon's army escape unscathed when crossing the Great Saint Bernard Pass on its way to the Battle of Marengo in May, 1800, even though the danger from avalanches was known. In his instructions to the advance guard General Lannes said: 'No one is to cry or call out for fear of causing a fall of avalanches.' But it was Marmont's artillery that released an avalanche as they dragged their dismantled field pieces up the Pass in hollowed out tree trunks. Quite a few men were buried under 50 feet of snow.

Then, in November of 1800, Napoleon ordered Maréchal MacDonald to take the Army of the Grisons over the Splügen Pass into Italy, and this Scottish emigrant's son who became a marshal in the French Revolutionary Army was taught the lessons of snow and avalanches the hard way. He wrote in his memoirs: 'I had more natural difficulties to surmount than enemies to conquer. Avalanches had swallowed whole squadrons.'

One of MacDonald's officers, Count Matthieu Dumas wrote *Memoirs of his own Time* in which he described an avalanche which struck the first part of the army:

'An enormous avalanche loosing itself from the highest summit, rolling with a fearful noise and gliding with the rapidity of lightning, carried off 30 dragoons at the head of the column who, with their horses, were swept away by the torrent, dashed against the rocks and buried under the snow. I was not above 150 paces from the spot and thought for the moment that General Laboissière and his officers had likewise been swept away.'

The Army was forced back by the three-day blizzard and by numerous avalanches, and the guides refused to make a second attempt to cross the Pass until MacDonald himself led the column. He made the soldiers clear away the walls of snow in which, from the first attempted crossing, 'many men were entombed'. Then, by his own example, he made the men forget their fear and follow him through the storm while avalanches threatened from all sides.

There is also an anecdote about a drummer swept into the Cardinal Gorge on this march. He was not killed and he drummed for several days in the hope of attracting rescue. Potential rescuers were too busy looking after themselves, however, and he finally died of exhaustion.

But these and later incidents of history all pale before the incredible avalanche catastrophes which overtook the Austrian and Italian armies in the Tyrol during the First World War. A conservative estimate is that 40,000 troops died in avalanches between 1915 and 1918. Other estimates have been as high as 80,000, but the true facts are hard to establish. They were suppressed by censorship at the time but Matthias Zdarsky, the famous skiing pioneer who was training Austrian Alpine troops and became an avalanche expert, wrote: 'The mountains in winter were more dangerous than the Italians.'

On December 12th, 1916, a snowstorm began which continued for two weeks. Avalanches swept whole barracks away; 253 men were killed by one avalanche on the Marmolada. Then, avalanches were used as weapons, both sides releasing them onto the enemy below by firing a shell into a slope laden with snow. As a means of mass-murder this was far superior to artillery alone. Zdarsky states that 3,000 Austrian troops were killed in one 48-hour period and that the Italian losses were at least as heavy. The total of Austrian troops in the mountains at the time was only 80,000, so avalanches claimed a high proportion.

Even though the true facts and figures of the avalanche catastrophes in that tough Tyrolean campaign are hard to unearth, the following quotation from W. Schmidkunz's book *Kampf über die Gletschern* (Battle over the Glaciers) gives a good indication of the horrors which avalanches added to the struggle. It was written by one who took part.

'The White Death, thirsting for blood, claimed countless victims in the mountains. Whole barracks filled with happy men, dashing patrols and marching columns, were buried in the raging avalanches which followed the blizzards. Hundreds upon hundreds were the men gripped by the white strangler. Here and there some were quickly rescued, while others remained for a terror-filled day with both feet in the grave. But these were rare occasions. The snowy

torrents are like the deep sea; they seldom return their victims alive. The bravest of the brave are covered by the heavy winding sheet of the avalanche. It is no glorious death at the hands of the enemy; I have seen the corpses.

'It is a pitiful way to die, a comfortless suffocation in an evil element, an ignominious extinction for the Fatherland.'

CHAPTER 2

The Coming of the Tourist

In recent years, most of the Alpine villages which have been devastated by avalanches time and again through the centuries have lavished money on protective measures, a subject to be covered in a later chapter. But, in winters of exceptional snow-fall, disasters still occur as, for example, in the aforementioned winter of 1950/51 when nearly 300 people were killed in the Alps and as many more injured. In 1954, another series of violent avalanches killed 160 people, mainly in Austria. But the fact remains that, in more normal winters, 80% of all avalanche victims are now tourists, usually skiers.

The boring of the Alpine tunnels in the 19th century made winter travel safer; the building of avalanche defences has made villages safer; but the development of Alpinism and the building of ski-lifts and cable-cars has taken hordes of people right into the lair of the enemy. The last 50 years have, in general terms, brought a shift in emphasis: today it is no longer among the travellers and in the villages that the plunging snow finds its principal prey—it is among those who go to the mountains for pleasure.

Climbing and tourism developed quite late in the Alps. The local people, apart from the odd chamois or rock-crystal hunter, never ventured further than the grassy slopes immediately above the valleys, for they were obsessed by all manner of superstitions about malevolent spirits inhabiting the high places and dangerous animals roaming the crags. It was believed, for example, that a ruined city lived in by the souls of the dead was perched on the summit of the Matterhorn. And Scheuchzer, the famous Alpine traveller, scientist and Fellow of the Royal Society, wrote in his *Itinera Alpina* of 1723 that although 'some dragons were fables' he held, nevertheless, 'from the accounts of Swiss dragons, and their comparison with those of other lands, that such animals really do exist'.

As an illustration, too, of the fanciful beliefs that kept the people in the valleys, the legend of Pontius Pilate is classic. The legend ran

that after Pilate's suicide his body was thrown into the Tiber, but such a bout of storms and rain resulted that his body was promptly removed and dropped into the Rhone at Vienne. Storms again declared his displeasure. After a similar experience at Lausanne, on the Lake of Geneva, it was decided that he should be banished once and for all to the little lake on Mount Pilatus near Lucerne. The weather there immediately began to deteriorate in the established manner, but Pilate was quickly exorcized. He agreed to remain quiet for ever except on Good Fridays when, dressed in his scarlet judgement robes, he would sit on a throne in the centre of the lake. Anyone who set eyes on him would perish within the year. Nor was anyone to tease him by throwing stones into the lake, or great storms would again result.

The government of Lucerne took the legend so seriously that they expressly forbade anyone to go near the lake and six clerics who tried to climb Mount Pilatus in 1387 were very severely punished. Not until 1585 was the legend finally brought to ridicule by a Johann Müller of Lucerne: he hurled stones into the lake, and shouted taunts at Pontius Pilate, without there being any sequel other than continued fine weather.

So it was left to outsiders to climb the peaks. In 1492 Charles VIII of France ordered his chamberlain, de Beaupré, to climb the Mont Aiguille near Grenoble, erect three crosses on the summit and say a Mass—a feat which certainly only a royal command could have induced him to carry through. But, in the late 18th century, scientists, botanists and geologists began climbing in the current quest for knowledge of nature. In 1765, the de Luc brothers of Geneva attempted to climb the Buet with a barometer and thermometer to test the boiling point of water. They broke the thermometer and can hardly have been captivated by the joys of mountaineering, for five years were to pass before they repeated the climb, this time successfully.

The first man to climb for no other reason than his own pleasure was Father Placidus à Spescha, a Benedictine monk from Disentis. He made the first ascent of several peaks in Graubünden (Grisons) in the late 18th century and has attracted the title of 'the father of mountaineering'.

Most early mountaineering activity, however, was centred around

Mont Blanc, which had been so named by Pierre Martell of Geneva in 1742, when he also stated that it was perhaps the highest peak in the Alps. Then de Saussure, a Genevese scholar, fell in love with Chamonix in 1760 after he had walked and scrambled in the area. He offered a reward for the first climb of Mont Blanc. This attracted the first serious attempt, in 1775, by four local men; but they failed and returned almost snow-blind. Not until June 1786, did Dr. Paccard and Jacques Balmat, a local chamois- and crystal-hunter, succeed in reaching the summit.

Eight further parties then climbed Mont Blanc before August 20th, 1820, when the first avalanche accident, indeed the first accident of any kind involving Alpine tourists, took place.

Dr. Hamel, Aulic councillor to Alexander the First, Emperor of Russia, decided to climb Mont Blanc with a Genevese optician called Selligue who hoped to try out a new barometer he had made. They were joined by two Oxford students of Brasenose College, Joseph Durnford, later to become a clergyman, and Gilbert Henderson. Together they engaged 12 guides, and during the first day they climbed to the Grands Mulets, where there is now a modern climbers' hut. A violent storm broke out in the night, which continued through most of the next day and forced them to stay where they were for a second night.

The following day dawned fine, and there are two stories about the decision to continue the climb. Durnford said in his account that the guides were eager to go on, as was the whole party with the exception of Selligue. He 'had decided that a married man had a sacred and imperious call to prudence where his own life seemed at all at stake; thus he had done enough for glory in spending two nights perched on a crag like an eagle and that it now became him, like a sensible man, to return to Geneva'.

On the other hand, Julian Devouassouds, one of the guides who survived the climb, told the Comte de Tilly the following year that the guides wanted to return to Chamonix when the storm finally cleared. They were forced, however, to give way before 'the stubborn insistence of Dr. Hamel who accused them, and the two Englishmen, of cowardice, so precluding any sensible consideration or discussion of the matter'. Devouassouds related too that Auguste Tairiez, one of the guides who was killed, had a presentiment of

death and several times during the preceding night threw himself into the arms of the friend beside him, weeping and crying out: 'It's all over with me! I shall be killed up there.'

Whatever the truth, the party set out on a beautiful morning, leaving Selligue and two guides at the Grands Mulets. They stopped for breakfast on the Grand Plateau and continued at 9 a.m. for the final part of the climb.

Hamel wrote: 'We were full of hope and joy at seeing ourselves so near the end of our laborious journey. The glorious weather which prevailed, the awful stillness which reigned and the pure celestial air which we inhaled gave birth in our souls to feelings which are never experienced in those lower regions.'

The sun went in behind a cloud and Joseph Durnford, who had been second in the column, stopped to tuck his veil up under his straw hat. Three guides and Henderson came by him, and Henderson remarked that he thought there should be a guide between them in case of accident. But Durnford replied that there was no danger, and he made no attempt to regain his original position in the column. He in fact preferred the sixth position because it was easier walking where the track through the new snow was better stamped. His veil and his idleness were to save his life.

The party was carrying a pigeon in a cooking pot which served as a cage, and the bird was cooing contentedly. Dr. Hamel was looking down and counting his steps, breathless and lightheaded, when the snow suddenly gave under his feet, and the whole party was flung down the slope.

The avalanche was only about 70 yards wide, but it carried them over 100 yards. The first three in the column, Pierre Balmat, Pierre Cairriez and Auguste Tairiez, were swept into a crevasse and buried. Devouassouds and Joseph-Marie Couttet, who were fourth and fifth, were flung across the first crevasse and into a second, half filled with snow. Devouassouds came to the surface three times during the downward rush and saw Tairiez's black gaiters disappear into the first crevasse at the moment of Tairiez's fatal burial. Couttet and Devouassouds were able to escape from their crevasse with nothing worse than bruises.

The remainder of the party were only partly buried and did not take the incident seriously, until it was realized that three guides

were missing. A chaotic, unsystematic search ensued, during which they jumped down on to the snow in the crevasse, prodded with their poles, and shouted down the holes they made. The only reply was a mournful echo from the Grand Plateau. The cold finally drove them down to Chamonix where a hotel-keeper had seen the accident.

The following morning the relatives of those killed were sent for. Old Balmat wept at the loss of his son and Durnford wrote: 'The sympathy which we could not help displaying in the grief of the surviving relatives wrung all the inhabitants' honest hearts.' The two Englishmen left all the money they could spare at the time to provide for the bereaved families and later opened a subscription in Geneva. Dr. Hamel, according to Devouassouds, gave nothing.

Forty-three years later a macabre selection of human fragments appeared in the Glacier des Bossons just above Chamonix. Among them were pieces of skull complete with hair, an arm, a foot severed below the calf and a large piece of a man's back, not to mention a frozen pigeon in a pot and Dr. Hamel's compass, which was still in perfect condition.

This accident occurred in what is called the Ancien Passage, a place usually by-passed by climbing parties after the discovery in 1827 of the Corridor, a longer but safer route. But, in 1866, Captain Henry Arkwright, aide-de-camp to the Lord Lieutenant of Ireland, his guide and two porters decided to save two hours by using the Ancien Passage. They too sprung the waiting trap of poised snow and ice. Captain Arkwright's body was not found despite a ten-day search; it too appeared in the Glacier des Bossons, this time after 31 years.

From the mid-19th century the 'Golden Age of Mountaineering' was in full bloom, and most of the prominent figures were British. Men like Tyndall, Tucket, Hudson, Whymper, Mummery, Dent, and many others whose names have immortal status in Alpine circles, led in the discovery of the exhilaration and satisfaction to be found in the struggle with rock and ice amid the splendours of mountain scenery.

Travels in the Alps of Savoy, the famous book by Forbes, appeared in 1843, right at the opening of the 'Golden Age'. It is interesting, therefore, to see what Forbes then wrote about avalanches. He described them as the 'greatest and most resistless of catastrophes

which can overtake the Alpine pedestrian', and went on to write of the 'thousands of humble travellers, of hardy peasants who have fallen prey to this unforeseen and appalling messenger'. He then stated that very few casualties had been occasioned by it (the appalling messenger) among amateur frequenters of the mountains. But it is significant that when Forbes' book was re-edited in 1900, at the close of the 'Golden Age', Coolidge added the footnote: 'Unfortunately many amateurs have since perished by reason of avalanches.'

Indeed, avalanches took more lives among the great climbers than did falls. This was probably because of the tendency to climb snow slopes rather than the safer rock ridges. Sir Leslie Stephen, for example, on his crossings of the Oberland passes, used to go up and down on snow rather than rock. And Tyndall wrote of an avalanche which almost killed his party when they could have been safely on rock.

In July 1864, Tyndall climbed the Piz Morteratsch with the big and ugly Pontresina guide, Jenni, another guide called Walther and two Englishmen, Hutchinson and Lee-Warner. On the way down Tyndall wanted to stay on rock but Jenni chose a snow gully.

It broke away in a small avalanche and they were all carried with it. Tyndall ineffectively tried to drive his baton into the underlying ice to stop them. Their velocity pitched them across a crevasse and Jenni, who was at the rear, jumped into the next crevasse in the hope of braking their headlong plunge. Even though he weighed 13 stone he was jerked smartly out and almost crushed by the rope.

The men at the front were being tumbled and buried by the snow while Jenni at the rear kept struggling to his feet, digging in his heels and yelling:

'Halt, Herr Jesus! Halt!'

They were being carried rapidly towards another group of evil looking crevasses when they slowed on a flatter spot, and Jenni's exertions stopped them. They were two or three seconds away from the first of the gaping crevasses.

Many climbers were less fortunate, men like William Penhall and Andreas Maurer who were killed by an avalanche on the Wetterhorn in 1882. Penhall was only 24, a medical student who was

already numbered among the great climbers, and Andreas Maurer was a modest and quiet guide of great competence who had already climbed in the Himalayas. In the best traditions of self-sacrifice, Maurer once stripped to the waist to try and keep an English client warm when benighted in a storm on the Aiguille du Plan. Strangely, when Penhall and Maurer set out from the Bear Hotel in Grindelwald for their last climb, Maurer gave his pipe to Emile Boss, the hotelier, and said calmly:

'Take it. I shall probably never ask for it back.'

Some of the most famous guides of the epoch suffocated in avalanches after many years of mountaineering experience. Joseph Bennen, who was called the 'Garibaldi of guides' by Tyndall, was among them. Bennen came from Laax in the Upper Rhone valley and he was a somewhat strange and lonely man who lived with his mother and sisters after his wife's early death. He had a wide forehead, narrow chin and goatee beard. From Whymper's engraving he appears almost frail in comparison to the bear-like men who were the other famous guides of the time.

Tyndall and Whymper both thought highly of him, though they also thought him incautious and sometimes indecisive, but these views were not held by other clients. They built him into something of a superman in their descriptions, seeming to ignore the weaknesses he must have had—weaknesses which finally killed him and one of his party.

There is no doubting his courage, however, for he was the first guide to attempt the Matterhorn while it was still believed haunted, an attempt which made him famous. Vaughan Hawkins, who employed him on that occasion, described him as 'a perfect Nature's gentleman' and praises his boldness, prudence and cheerfulness.

Bennen had a favourite expression when faced by a difficulty which seemed to block further progress:

'*Es muss gehen!*' (It must go!) he would say, before tackling the problem with renewed determination. The origin of this motto was the story he loved to tell of a Tyrolean who complained to his priest in the confessional that an overriding passion for women struggled with the religion inside him.

'Son,' said the priest, 'to love women and get to Heaven, that doesn't go!'

'Father,' said the Tyrolean, 'it must go!'

By 1864 Bennen was among the most sought-after of guides. He was 45, at the height of his powers, and had made several first ascents when Phillip Gosset asked him to lead a party on a winter climb of the Haut de Cry, a very minor summit above the Rhone Valley. It is said that Bennen needed money as he planned to marry again, and although he had never climbed in winter he agreed to lead.

The party included three local guides, Bevard, Nance and Rebot, and Gosset's friend Boissonet. They set out on February 28th and climbed until only a snow field some 800 feet high separated them from the summit ridge. The slope was steep, and wider at the bottom than at the top; it was like a couloir on a large scale.

Bennen, who had been laughing at their struggle through the deep fresh snow, became anxious and asked the local men whether this slope ever avalanched. They said that it was perfectly safe. Bennen, with his great experience, should have insisted on turning back at that point, but they climbed up the north side of the couloir until they were 150 feet from the top. They then began to cut horizontally across the slope to reach the east ridge.

Bennen had been uneasy all the way up the slope, and when they began the traverse he said that he was afraid of starting an avalanche. The local men took his caution for cowardice and Bevard and Nance led until, three-quarters of the way across, they suddenly sank up to their waist in snow. They struggled on, cutting a deep furrow, until after a few steps they reached firmer snow again.

Gosset wrote: 'Bennen, undecided, had not moved but when he saw the snow hard again he crossed parallel to, but above the furrow made by the Ardon men. Strangely, the snow supported him. I tried his footsteps but sank up to the waist at the first one, so I went through the furrow with my elbows tucked in to prevent touching the sides. The furrow was 12 feet long and as the snow was good on the other side we had concluded that the snow was accidentally softer there than elsewhere. Bennen advanced: he had made but a few steps when we heard a deep cutting sound. The snow-field split in two some 14–15 feet above us. The cleft was at first quite narrow, not more than an inch broad. An awful silence ensued and then it was broken by Bennen's voice: '*Wir sind alle verloren*' (We

are all lost). His words were slow and solemn and those who knew him felt what they really meant when spoken by such a man as Bennen. They were his last words.

'I drove my Alpenstock into the snow and brought the weight of my body to bear on it. I then waited. It was an awful moment of suspense. I turned towards Bennen to see whether he had done the same thing. To my astonishment I saw him turn round, face the valley and stretch out both arms.

'The ground on which we were standing began to move slowly. I soon sank up to my shoulders and began descending backwards. The speed of the avalanche increased rapidly and before long I was covered up with snow. I was suffocating when I suddenly came to the surface again. I was on a wave of the avalanche and saw it before me as I was carried down. It was the most awful sight I ever saw. The head of the avalanche was already at the spot where we had made our last halt. The head was preceded by a thick cloud of snow-dust; the rest of the avalanche was clear. Around me I heard the horrid hissing of the snow and far before me the thundering of the foremost part of the avalanche.

'To prevent myself sinking again I made use of my arms in much the same way as when swimming in a standing position. Then I saw the pieces of snow in front of me stop at some yards distance; then the snow straight before me stopped and I heard on a grand scale the same creaking sound that is made by a heavy cart passing over frozen snow in winter. I instantly threw up both arms to protect my head in case I should again be covered up. I had stopped but the snow behind me was still in motion; its pressure on my body was so strong that I thought I should be crushed to death. I was covered up by the snow coming from behind me. My first impulse was to try and uncover my head—but this I could not do for the avalanche had frozen by pressure the moment it stopped, and I was frozen in.'

Gosset was lucky in that his hands were above the surface and that Rebot, who had been able to extricate himself, soon came and freed his head. The rest of his body had later to be cut free with an ice-axe.

Gosset's friend, Boissonet, was buried with his feet out but was already dead when released. The rope which led to Bennen dis-

appeared vertically into the snow. They could not move it and Gosset wrote:

'There was the grave of the bravest guide the Valais ever had, and ever will have. The cold had done its work on us; we could stand it no longer and began the descent.'

Bennen's body was dug out three days later from beneath 8 feet of snow. Seven months later his watch was found, and it worked perfectly when wound. Bennen's mother almost went out of her mind when told of her son's death, and only a collection of 3,000 Francs subscribed by previous clients saved her and her three daughters from abject poverty.

Ferdinand Imseng, another famous guide, deliberately exposed himself to avalanches but twice in his lifetime. On the first occasion the avalanches played around him but spared his life; on the second, an enormous avalanche annihilated him and his party with vindictive violence, as if to make amends for allowing his previous temerity to go unpunished.

Imseng was a hunter who lived in Macugnaga, the village below the towering Italian face of Monte Rosa, a 9,400-foot wall visible even from the Gulf of Genoa. The face is swept by avalanches and in particular, there is a couloir, a white gash down which avalanches rumble ceaselessly. An ascent of the face meant crossing this couloir.

Imseng had gazed at the mighty wall for years, and finally he became obsessed by a burning ambition to climb it, even though all the other guides, the greatest among them, had declared it too dangerous to warrant serious consideration. But Imseng studied the face and dreamed of glory until, in 1872, he persuaded the Pendlebury brothers and the Reverend C. Taylor to employ him for an attempt.

At 2 a.m. they set out, with even Imseng's jaunty confidence shaken by the thunder of an avalanche which had just hurtled down. But the climb went well and they crossed the couloir without incident. Luck was truly with them though, for an avalanche broke just below them on one snow slope; and near the summit the snow slid beneath their feet without avalanching properly.

The fame Imseng had dreamt about was his overnight: he had succeeded where nobody else had even dared to try. The impetuous,

energetic, likeable Imseng, the gay bachelor with his feather in his hat, his bow tie and his bright blue jacket, the man 'who would have climbed until every vein in his body burst rather than have yielded to another', was the brightest star in the Alpine sky for several years. He made several other great climbs before August 8th, 1881, when he was drawn fatefully back to the scene of his first great triumph.

He was to lead Damiano Marinelli, a pioneer of the Italian Alpine Club, a wise, kindly man and a fervent patriot, who wished to climb the Macugnaga wall of Monte Rosa and so become the first Italian to do so. It had been climbed but once since Imseng's first assault nine years earlier, and then by an Austrian. The Marinelli party was completed by an Italian, Battista Pedranzini, as second guide, and by a porter with wood and blankets. The August day on which they set out was overwhelmingly beautiful.

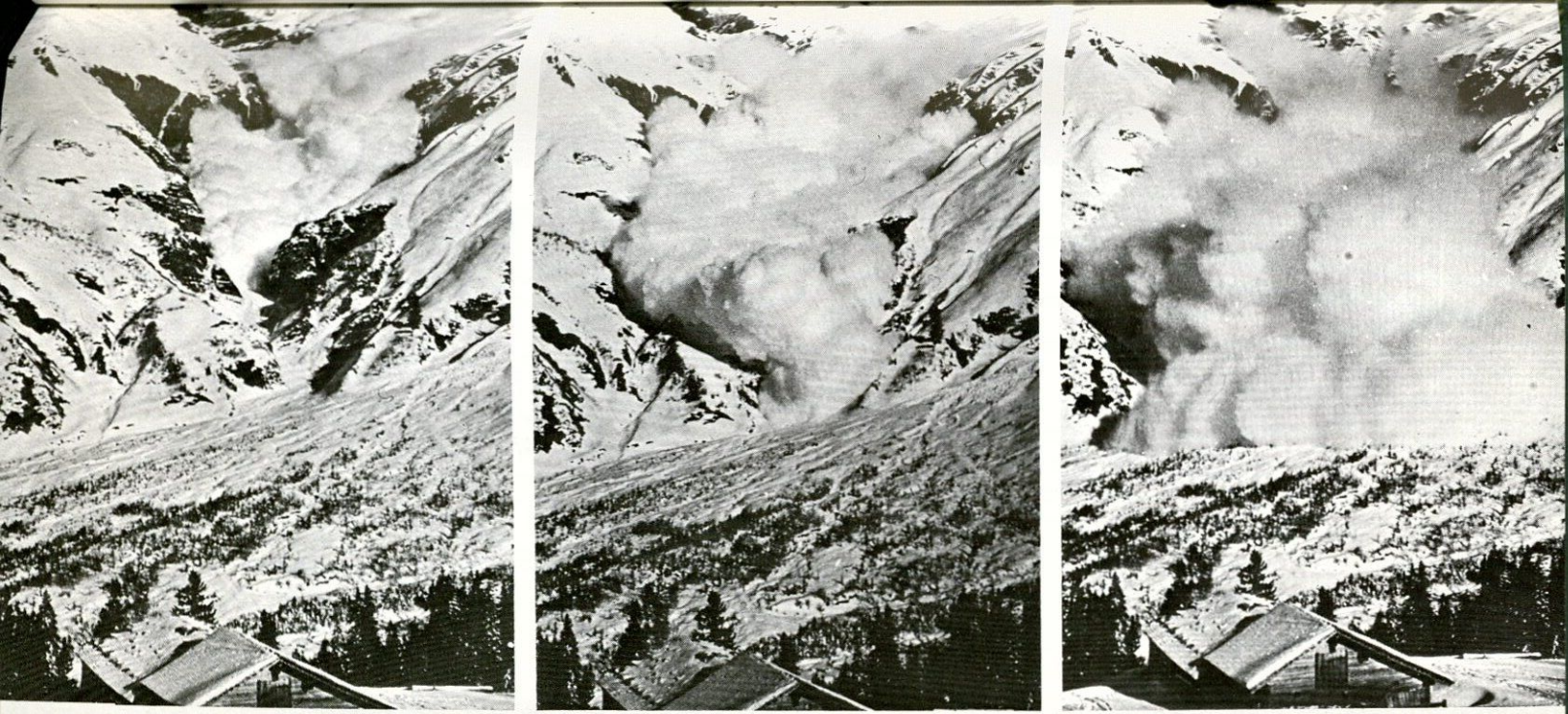
As they climbed, Imseng became anxious about the crossing of the couloir. He pointed out his bivouac site of nine years earlier but insisted on climbing higher this time. At about 5 p.m. they crossed the couloir with their hearts in their mouths and reached rock again with great relief, even though it was rock which the larger avalanches swept from time to time.

The porter stopped to drink from a cascade slightly off the line of ascent which the others were on. Suddenly he heard the shout: 'Avalanche!'. He looked up and was just in time to see the three men blasted off the mountainside by an enormous avalanche which had dropped from the semi-circle of peaks above.

The men were hurled like chaff; the air was full of gigantic snow tentacles and flying boulders. Three days later the barely recognizable bodies were found at the foot of the wall. The flamboyant Imseng had stretched his luck too far.

Early mountaineering literature is filled with warnings about avalanches, of accounts of avalanches that rushed by just in front of a climbing party, or obliterated their tracks just behind them. And finally the greatest of all the early guides—the 'high priest' among them—Alexander Burgener, fell to the choking clutches of an avalanche.

His death proves that even guides of great experience and judgement cannot always know what slopes are dangerous. Alexander Burgener had climbed with men like Mummery and Dent; he had



1a, 1b, 1c. Airborne-powder avalanche in three stages of development

2a. Part of the 250 acres of woodland destroyed by an airborne-powder avalanche at Vinadi, Lower Engadine, in February 1962 (see page 81)

2b. Detail of the damage at Vinado. Note how the air blast has stripped the branches and snapped the tops of the few trees left standing

led them up some of the most terrible climbs in the Alps. He had climbed in the Caucasus with the Hungarian, Déchy, and again with Donkin and Dent, and he had also climbed in the Andes with Güssfeldt. He was a legend in his own time, a man whose daring and exuberance, whose agility and strength, took him up places others thought impossible.

He was stocky and well-knit with a luxuriant beard, and eyes set deep in a face which showed clearly his immense will-power and dignity. Yet he had humour and a weakness for the good things of life, especially the Bouvier which he and Mummery used to drink when about to climb a difficult pitch, or when one had just been completed. On the Grépon, one of their great first ascents together, they came to an apparently bottomless crack, and in Mummery's words:

'We had to hotch ourselves along with our knees against one side and our backs against the other. Burgener at this point exhibited the most painful anxiety and his '*Herr Gott, geben Sie Acht!*' (Good God, be careful!) had the very ring of tears in its entreaty. On my emergence into daylight his anxiety was explained. Was not the knapsack on my back, and were not sundry half bottles of Bouvier in the knapsack?'

Burgener's snow-craft was exceptional. He and Mummery often waited through a night in the rocks rather than risk a descent on sun-softened snow. Yet on July 8th, 1910, when Burgener was 66 but still immensely strong and active, he was leading a party to the Bergli Hut in the Bernese Oberland after a blizzard which had lasted several days. Outside the Eismeer railway station he gazed in silence at the glaciers for a moment and remarked that he was worried about avalanches. It was muggy and the *Föhn* (a warm southerly wind) was blowing. Snow was sliding off the station roof and thaw-water gurgling in the gutters when they set out.

The party was labouring up the final gully just below the hut. Christian Bohren from the Concordia Hut, who happened to be at the Bergli at the time, went out to meet them, while Kaufmann, the Bergli hutkeeper, was preparing a hot drink for the new arrivals.

At 6 p.m. Bohren and Burgener were exchanging the greetings of old friends who have not met for a while. They were 6 feet apart and

almost outside the door of the hut when the avalanche broke beneath them. With a monstrous roar it carried away the whole party, and Christian Bohren too. Kaufman dashed out with brandy bottle in hand; where nine men had stood a moment before there was now no one.

He rushed down the slope and found three bodies on the surface, all cruelly injured. One of the porters, Rudolf Inäbnit, had a leg almost ripped off; it was only held by some skin, which he wanted to cut with his knife.

Late that night, when the six other bodies had been found, a cortège lit by acetylene lamps wound its way sadly downwards. Inäbnit died on the way. Of the nine men swept away by the avalanche, which had broken off at a point where the snow was no less than 8 feet thick, only two survived. One of these survivors was Alexander Burgener (junior), but, to the loss of his father and brother Adolf beneath the raging snow, was added the loss of an eye.

It was an ignominious death for Alexander Burgener. As the *Alpine Journal* said at the time: 'If any party of mountaineers can be safe his ought to have been. One can only call it fate which in a perfectly easy spot, in one mad, surging rush, hurled the great guide and his companions to their doom.'

Fate or not, I prefer to regard the accident as an illustration of the essential unpredictability of avalanches, even for guides of vast experience.

* * *

On January 2nd, 1899, two men, Ehlert and Mönnichs, both well-known Alpinists of the epoch, were crossing the Süsten Pass near Meiringen in central Switzerland, when they released an avalanche which killed them both. The importance of this accident is that both men were on skis and skiing had been but recently introduced to the Alps. This avalanche on the Süsten Pass ushered in a new era of plenty for the White Death, an era which we are still in today; for skiers are under a greater threat from avalanches than are climbers. They need the snow slopes for their sport, while climbers can stay on rock; and skis are usually more likely to release an

avalanche than are boots alone. In addition, of course, skiers frequent the mountains in winter when snow is more plentiful and avalanches more numerous.

Between 1899 and 1919, 86 skiers were killed in avalanches. This figure excludes Alpine troops, needless to say. Eighty-six may not seem many in 20 years but it must be remembered that skiing was in its infancy with few adherents in those years. And the period also includes four war years which were lean for the Alpine tourist industry.

Today it is a rare year in which 20–30 skiers are not claimed by avalanches in the Alps, and to protect skiers from avalanches becomes ever more difficult. Every resort is aware of its responsibilities and has an avalanche safety and rescue organization, usually coupled with the rescue service for injured skiers. Yet, despite all their efforts, skiers are killed in increasing numbers.

Hosts of lowlanders invade the mountains each winter: hundreds of thousands strong they come. On Friday evenings, trains, buses and cars bring happy hordes from all the major cities of the Continent. They fly from London, New York, Chicago, even Sydney or Capetown, for a few weeks in the glittering Alps. They are whisked up into the realms of snow by the immense network of ski-lifts and cable-cars, a network which is being expanded year by year.

These happy, but often foolhardy skiers from the lowlands generally see snow only as a source of pleasure and delight. They have little inkling of the menace it also holds. True, they realize that a leg can be broken or an ankle sprained while skiing, but few connect with snow the hideous possibility of being buried alive, crushed and suffocated.

It is far from the purpose of this book to wave a finger of admonition, and it would be entirely wrong to conclude from what is to follow that anyone who fixes skis to his or her feet is immediately in mortal danger. An examination of the facts, however, shows that almost all the skiers who die in avalanches today do so as a direct result of flagrant disregard for warnings from the local avalanche safety organization, either through ignorance of the possible consequences or through sheer perversity. In an action tantamount to suicide they offer themselves to the snow as living sacrifices. This is a strong statement but one which is based on ample evidence from

almost every ski-area in the Alps. As examples I shall cite some instances that have occurred in the Parsenn area at Davos.

The safety and rescue organization for skiers in this area, the aforementioned Parsenndienst, is one of the biggest and best of its kind in the world. It was among the first to be formed and it pioneered techniques for protecting skiers from avalanches. These techniques have been copied in ski-resorts everywhere.

After a snow-fall patrolmen render ski-runs safe by controlling with explosives, avalanches which endanger them; but until such time as this can be done certain runs are declared closed. Notices to this effect are displayed at every ski-lift and cable-car station, and at every mountain restaurant in the whole Parsenn area.

Time and time again these warnings are ignored with tragic consequences. Many are the skiers who have died in this magnificent skiing area because they took warnings lightly or were blissfully ignorant, as they set off down a closed run, of the gruesome death to which they were exposing themselves.

Two examples of accidents caused by this sort of behaviour occurred in 1961. After a period of fine weather, a blizzard set in on January 31st, and by February 1st the Parsenndienst were forced to close certain runs. By the morning of the 3rd there were nearly 2 feet of fresh snow, and only a few carefully patrolled runs were still open.

A married couple from Vienna, Robert and Leopoldine Thalhammer aged thirty-one and thirty-three respectively, set out with a relative, J.G., from the top station of the Parsenn railway to ski down to Wolfgang in the valley. Before putting on their skis they passed two large notices saying in English, French and German: 'Avalanche Danger—Do not leave marked runs.'

They knew the run to Wolfgang well, and by 10.50 hours they were outside the Parsenn Hut, a restaurant about half-way down. They conferred for a moment and the hut-keeper watched them. Then he saw that they were about to branch off the proper run and ski down into a gully called Stutzalp. He hurried to them and warned them of the danger of avalanches. He advised them very strongly to stay on the run, which was marked by stakes driven into the snow and well tracked by earlier skiers.

But the trio did not heed the advice. They were in a hurry because

Robert Thalhammer, who had had a car accident on the way to Davos, was due to visit a doctor that morning. The Stutzalp gully was the quickest way to the valley and so, when the hut-keeper had left them, that is the way they went.

The two men were skiing in front, but they both came to a sudden halt when their ski-tips dug into some deep snow which had drifted against a hump a few feet high. They laughed and extricated themselves. J.G. climbed on to the hump, while Robert Thalhammer brushed the snow off himself and waited for his wife, who was making her way towards him.

J.G. suddenly heard a sharp crack behind him, then a hissing noise. He turned. Where the young couple had stood a moment before there was now nothing but a fast-moving wave of snow. J.G. rushed to the avalanche debris as soon as it stopped, but there was no sign of the missing pair. With dread in his heart, he called for help.

About one and a half hours later the rescue team of the Parsenndienst finally uncovered the victims from under 6 feet of snow. They were beyond the help of artificial respiration or heart injections.

That very same evening, at 16.00 hours a Parsenndienst patrolman received a message that a solitary skier was setting out from the top station of the Gotschnagrat cable-car above Klosters, and that he was heading towards the Cassana High Route, closed for two days past. The patrolman snatched up his skis and chased the skier through the gathering dusk. He shouted desperately, but if the skier heard he paid no attention. The patrolman returned and raised the alarm.

He was joined by two colleagues, and together they set out on a reconnaissance of the avalanche slopes which the skier was bound to cross. The blizzard had begun again; fog swirled in and their lamps lit up the single track a bare 6 feet ahead of them. At great risk they followed the track, but after three avalanches had narrowly missed them they decided that the danger was too great and turned back. With the storm increasing in intensity they were fortunate to reach safety at 19.45.

The next morning it was announced that Pierre Imer, a 21-year-old Swiss, was missing and the rescue attempt began. His body was found buried 2 feet deep in one of the several avalanches which had

scoured the slope he crossed. On the way to his almost certain death, Pierre Imer passed three general avalanche warning notices and also four signs informing him that the run of his choice was closed.

It would be agreeable to dismiss such disregard for the warnings of the safety organizations as rare occurrences, but it is unfortunately not possible to do so. During a particularly dangerous weekend when much new snow had fallen, and when the whole Parsenn area had seethed with avalanches for many days, six different closed runs were used, some of them on several occasions. And there were many instances of people straying right away from the marker stakes of those runs which were open. A party of 60 climbed across a certain slope on the Saturday morning; that evening an English student of 19 was killed on the same slope, and a large section of the track made by the climbing party was obliterated.

The strange obstinacy of skiers in skiing down closed runs would be understandable were no other runs available for their enjoyment; but there are nearly always safe runs open. At Easter 1963, the Parsenndienst closed the Drostobel run above Klosters. In avalanche times this run is a deathtrap, for it consists of a large catchment area feeding into a single gully. An avalanche from anywhere in the upper part rushes into the gully, and anyone in the gully at the time would be lucky to survive.

The conditions which dictated the closure of the Drostobel at Easter were very similar to those which had prevailed only three weeks before: a sudden rise in temperature around midday which softened the snow and made it unstable. On that occasion the run had also been closed, but a number of skiers continued to use it. Seeing other people on the run, a ski-instructor with his pupil also set out down it, even though they had walked by several notices saying the run was closed. The pupil, a young Englishwoman, ran rather high into a slope, and she released an avalanche which killed her.

Therefore, at Easter, determined to prevent a repetition of such tragedy, two patrolmen were picketed at the start of the run to point out verbally that it was closed and to direct skiers down an alternative route. Skiers arrived and began to argue; they tapped their heads significantly with a forefinger and shot off down the run

when the patrolmen's heads were turned. Only the summoning of uniformed police finally called a halt to the skiers' folly.

Other organizations have similar experiences to those of the Parsenndienst, though it must be admitted that some of the lesser bodies abuse the 'Avalanche Danger' placards by leaving them out too long, almost as an insurance policy against an accident. Crying wolf in this way is bound to damage skiers' respect for warnings in all resorts, even in those where the organization takes great pains to assess the danger accurately and to warn accordingly.

In fact, organizations that cry wolf are few and far between and it must be stressed that avalanches are a minor threat to those who care to cooperate with the safety authorities of a ski-resort. It is a tragedy that those skiers who do lose their lives each winter could usually have enjoyed many more years of this exhilarating sport—had they been prepared to heed those trying so hard to help them.

Not only do heedless skiers endanger themselves; though they may escape unharmed when they ski down a closed run after a fresh snow-fall, they leave tracks which are like a magnet drawing others into danger. The next skier believes the run to be open when he sees the tracks. He may take a slightly different line down a slope, or he may fall, and the concussion will set the snow masses in motion. A moment later he is in their cold embrace and living his last terror-filled minutes. Those in part responsible for his pitiful death may be supping a hot drink in the valley and congratulating themselves on having once again proven that a safety organization had needlessly closed a run.

So far, of course, reference has only been made to avalanches in the downhill-skiing areas, areas controlled by safety organizations. Skiers who quit these areas and tour joyfully among the peaks and glaciers *ipso facto* run a higher risk from avalanches. This minority are usually protected to some extent by a fair knowledge of snow-craft, or if not they employ a guide. They also carry, or should carry, a bare minimum of safety and rescue equipment.

It is too much to expect those far greater numbers of skiers today, who confine themselves to downhill skiing, to have much knowledge of snow-craft, but *respect* for avalanches would help to reduce the number of skiers killed. On April 12th, 1964, as this book was being prepared, a group of international Olympic skiers was making a film

at St. Moritz. They ignored several warning notices and one verbal warning about a certain area, and shortly afterwards several of them were buried in an avalanche. Bud Werner, the charming and brilliant American, and Barbi Henneberger, a young member of the German women's Olympic team, paid with their lives for the collective irresponsibility of the group. These people had skied since childhood and perhaps thought their knowledge greater than that of the safety organization. It may have been so, but it is never worth trying to prove it.

It is a sad and bitter truth that those happy groups in the cable-cars who poke fun at the 'Run Closed' signs, often see a dead skier dug from an avalanche before they realize the true nature of the risk they run. They often see the repulsive ravages wrought by an avalanche on a dead friend or loved one before they realize that (in the ski-pioneer Zdarsky's words): 'Snow is not a wolf in sheep's clothing—it is a tiger in lamb's clothing.'

CHAPTER 3

Witchcraft and Research

Considering the devastation caused by avalanches in the Middle Ages and the number of lives they took, it is not surprising that superstitions and strange beliefs grew up around them. People thought avalanches omnipotent and incontestable. At best, therefore, they were believed to be acts of God as He worked His divine, albeit abstruse purpose for the world; but more usually they were thought to be diabolical weapons of the powers of darkness.

Doubtless, the arbitrary and whimsical behaviour of avalanches gave added credibility to these beliefs; for avalanches sometimes do the most curious things. Mention has already been made of the child found dead in a field, tucked up in bed as if by human hands. The wreckage of her home was several hundred yards away. There are numerous instances too of houses being smashed to rubble, while china-cupboards with contents undamaged, clocks that still run, and other breakables, have been set gently down hundreds of yards distant. The *Montafon Letter*, which relates that 300 people were buried in the Montafon Valley in 1689, also reports that while a priest was taking the sacrament to the dying he was buried by one avalanche and promptly unburied by a second.

In the Kalanka Valley of the Grisons in 1806, a whole forest was brought down. The flying tree-trunks shot over a village without doing any harm, but a single tree was pitched upright on the roof of the pastor's house as if growing there. The possible significance of this occurrence was the talking point of the village for months.

Avalanches may single out a house for destruction while others close by are untouched, as happened at Göschneralp in Switzerland during the winter of 1951. In January an avalanche came down from the south side of the valley and a pile of snow some 20 feet high was left between the village and the head of the valley. On February 13th a second large avalanche came down, this time from the head of the valley and at right angles to the first. It leapt across