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MY SEVEN YEARS IN TIBET

HEINRICH HARRER

WHEN I left Europe in 1939, as a member of the German Nanga Parbat Expedition, I certainly never thought that I would stay in Asia for thirteen years. The leader of the expedition was another Austrian, Peter Aufschnaiter, and we were to reconnoitre the Diamir face of that difficult mountain. The Diamir side of Nanga Parbat is well known in the history of the Himalaya, for it was here that Mummery and his Sherpas lost their lives at the end of the last century. Actually we found a trace of the disaster—just a piece of wood at an altitude of 20,000 feet.

After several months' reconnaissance, we returned to Karachi where we waited in vain for our freighter to take us back to Europe. The clouds of the second World War were gathering so we made an attempt to reach Persia, but were caught after traversing several hundred miles of desert. Soon we were all behind barbed wire and fortunately nobody had an idea for how long.

Personally, I contemplated escape from the very first day. When we were transferred to another camp, I jumped off our lorry convoy, but was discovered immediately. In 1941 we were brought to a camp near Dehra Dun at the foot of the Himalaya, whose very situation was to me an invitation to escape. The proximity of the Himalaya, and beyond them secret Tibet, was too great a temptation to someone who had roamed through those mountains before. All my life I had been interested in that mysterious country and had devoured all the books about it. Now I had the chance to get there, and perhaps beyond, to China and maybe even the Japanese lines. Plans for such an escape needed careful preparations. I started drawing maps, making shoes and rucksacks and other essentials. I studied a bit of Japanese, Hindustani and Tibetan, all of which saved me from boredom. By the spring of 1943 I was ready, and one night an Italian General and I climbed over the barbed wire. For a few ghastly seconds we got entangled, but by the time the Gurkha guards started shooting we had reached the jungle. For three weeks we marched only by night. Then, a few days short of the Tibetan border we were caught and brought back to the camp. On our return journey I made another attempt, dropping down from the second storey of a forest bungalow, but after forty-eight hours I was rounded up again.

Back at the camp I passed twenty-eight days in solitary confinement, the regular penalty for breaking out. Then I started preparations all over again. For months I drew maps and collected the necessary paraphernalia. Winter passed swiftly and when spring—and with it the "escape season"—began, there were quite a number of candidates for the Escapers' Club. Two friends of mine, who spoke fluent English, aimed at reaching Burma by crossing the plains of India. But the remaining five, including myself, wanted to win through over the Himalaya to Tibet. We planned a common escape, and agreed that once outside everybody should go his own way.

In April 1944 five of us dressed up as Indians, and two as English officers. Ostensibly, we were members of one of those (to us) familiar squads for

repairing the barbed wire. When we looked at our make-up, we could hardly repress our smiles: we carried ladders, pots of tar and rolls of barbed wire, and could hardly believe that everything had gone so smoothly when at last we stood in the jungle and got rid of our stage properties. The others went in twos but I decided to try alone. After crossing several passes (see Route 1) I came to the upper regions of the holy Ganges, here called the Bhagirati. Following the pilgrims' route, made famous by Kipling's Kim, I reached the last village this side of the Himalaya. It had taken me ten nights and the name of the place was Nelang, standing at 11,000 feet. At this time of the year it was still uninhabited. But to my delight my four camp comrades had chosen the same route and we were all united again, until one of the party had an attack of mountain sickness and decided to return to the prison camp.

After a day's rest, during which each told his story, Kopp from Berlin, Treipel from Salzburg, my friend Aufschnaiter and myself set off. During our earlier journeys we had all of us encountered leopards and bears, but now the greatest difficulty became the shortage of food. On top of that each of us carried between 80 and 100 lb. on our backs and we were feeling the effect of the rarefied air. Once we went up the wrong valley and lost several precious days, but at last on May 17 we stood, the four of us, on top of the Tsangchok La, a 17,200 feet high pass over the Himalaya. Here at last we were on the frontier between India and Tibet, for so long the object of our dreams. As the stone cairns and prayer flags showed, we stood at the gates to an entirely new world. We were near starvation and our only wish was to reach some inhabited place and get something to eat. All round us we saw nothing but mountains, gorges and again mountains. We intended to present ourselves to the Tibetans as neutrals and as such we hoped soon to meet some district officer. But it took us several more days walking before we reached the first Tibetan village, a group of six houses called Kasapuling. Here everything was exactly as we had read so often in travel books on Tibet. The people were extremely inhospitable and even denied us entry into their houses. They refused to sell us any food, and only by threats did we succeed in buying the oldest billy-goat available. We had to pay a shamelessly high price, to which we agreed only because we wished to enter the country in a friendly way. The first Tibetan officer we met wouldn't hear of our staying; the word "neutrality" was of course unknown to him. We appealed to the higher authority of the Abbot at nearby Thuling, but to no avail. Accompanied by a Tibetan soldier, we were escorted back over the Himalaya to the Indian border at Skipki. Here we passed ourselves off as American soldiers, bought fresh supplies, and Aufschnaiter, Kopp and myself made a new attempt. Treipel however had had enough and returned to the camp via Simla.

So it was that, striking north from Skipki, we crossed the Himalaya for the third time over two passes of 18,000 feet, and came eventually to the upper regions of the Indus. Here we turned southwards again and reached Gartok, the capital of Western Tibet. The name "capital" is rather pretentious for the two hovels of which Gartok consisted, but the two viceroys who lived there ruled over a country at least as large as Great Britain. They were the first cooperative officials we had met, and after ten days' negotiations, we continued our march with the help of travel permits. We had to give our word of honour that under no circumstances would we go to Lhasa from their

province. Nevertheless, we were very happy because our permits took us roughly in the right direction, south-east through Tokchen to Tradun. And at last we had official transport.

For a whole month we saw no inhabited place of any size. Our route took us through desolate country, past nomad camps and isolated *tasam* houses where one could change yaks and find a lodging. After some weeks we came within sight of Mount Kailas (22,000 feet), the holy mountain where many pilgrim roads converge. We passed many cairns built, a few stones at a time, by passing pilgrims, and also the typical *chortens* of Tibet which mark the tombs of the high lamas. Some pilgrims come thousands of miles and spend a lifetime on the way, covering the route by the length, or even by the breadth, of their bodies. We met two such holy travellers who had come from the Province of Khan, 2000 miles distant. Prostrated, face downward, they creep the same way back, and some never see their native land again. Their only food is flour or butter tea which they get from nomads or other pilgrims. Sometimes rich men pay a "professional prostrator" to do the journey for them—this member of "The Club of Queer Trades" wears wooden iron-lined gloves and a great leather apron. Among the people we met on our way was a young couple on their way to Kailas: round their necks they wore silk scarves, and the woman had a brocade sunshade and shawl, for Tibetan women do not like to appear sunburnt, even powdering their faces to simulate a fair complexion.

Over several more passes we came to the source of the Brahmaputra, here called the Tsangpo. Always marching along the northern face of the Himalaya we reached Tradun, the terminus of our Tibetan travel permit. From here we had the most beautiful view of Dhaulagiri, Annapurna and Manaslu, and Aufschnaiter and myself decided to stay as long as possible. Kopp accepted an invitation from the Nepalese Government, went to Katmandu and of course ended back in the prison camp soon afterwards. We sent applications to Lhasa, but the Tibetans permitted us only to travel a few hundred miles further east, and again crossing the Himalaya, we came to the village of Kyirong, eight miles from the Nepalese border. The district officers expected us to leave Tibet immediately for Nepal, but they had not counted on our persistence, and Aufschnaiter and myself stayed eight months in this most wonderful place. Amidst the Himalaya 9000 feet high, the contrast between the glaciers which flow right down to the village and the flowering rhododendron woods through which they pass, is incredibly beautiful. In the thick woods you find a number of hot springs and on one of our daily excursions I found tracks of some being above the tree line. Though Tibetans often told me of the *khangmi* or *migo*, which is what they call the mysterious "abominable snowman," personally I believe the tracks to be of bears in winter and of the huge langur monkey during summer.

Around Kyirong were about sixty monasteries, some of them perched on rock faces like birds' nests. Milarapa, the famous Tibetan poet-saint, lived here in the twelfth century, and that is why Kyirong is especially holy. We had plenty of time to observe the peasants who, like most other Tibetans, live mainly on *tsampa* and butter tea. *Tsampa* is made by parching barley in hot sand and then grinding it to a tasty flour with a handmill. It can then be mixed with beer, milk or curd, but Tibetans really prefer butter tea. They

boil coarse tea with salt and soda for hours on end and put the brew in a churn. A lump of butter is added, and the resulting emulsion is the famous butter tea. Unfortunately the butter is always rancid and the brew tastes unpleasant at first, but one gets used to it and even comes to love it. The Tibetans would prefer fresh butter, but it sometimes takes months and often years to reach its destination. They get milk and butter from the female yak, the yak being a long-haired sort of oxen, which likes the cold and rough climate.

In Kyirong we heard from Nepalese merchants that the war was over. But Aufschnaiter and I didn't think of giving up our freedom so easily. As Europeans of the twentieth century, it was far too fascinating to live here in the Middle Ages. But the Tibetan officials wanted us to leave, so we decided to make a try for China via the northern plains. The greatest obstacle in this plan was the crossing of the Tsangpo. We knew there were big wooden ferry boats to be found, and we hoped to come on one, for the Brahmaputra at 12,000 feet is already a considerable stream. The previous summer we had swum through the Tsangpo once, when the Tibetans refused us the ferry, but now it was winter and moreover we carried packs of some 90 lb. The commonest way of travelling on the Tsangpo, or crossing it, is in a yak-hide boat. The boatmen carry their heavy boats, weighing some 200 lb. over passes 18,000 feet high to Lhasa or from wherever they come.

We made a dramatic departure from Kyirong, for the Tibetan authorities had not relented, and a close watch was kept on our movements. Again we marched only by night; the temperature never rose higher than −20° C. (−4° F.), and we felt it worst when wading through rivers. Despite the cold, we continued sketching and, since we were passing through absolutely unknown country, Aufschnaiter took the bearings of the mountains. In the first nomad settlement we reached we got new provisions and also bought a yak. It was a wicked animal. I led him with a nose-ring and Aufschnaiter tried every way to increase his speed of 2 miles per hour. He used to rush at me and try and toss me, but fortunately his horns were so wide that I always ended up by sitting on his forehead. We crossed the Himalaya for the fifth time at the pass of Karola (18,000 feet); our yak forced us to an ice-cold bivouac on top of the pass, but we were rewarded with a magnificent view of Mount Everest which stood close to the south in the moonlight, and the first rays of the sun on its summit were an unforgettable experience. After a few more days of walking we reached the Tsangpo valley. The Tsangpo was indicated only by a dotted line on our maps, and we were rather surprised to find a huge chorten at the point at which we struck the river. It was like a miracle to discover that we had arrived at a place where a hanging rope bridge crossed the stream. We strode over ourselves, persuaded the yak to swim, and after a few more passes came again to the big caravan route, leading from Western Tibet to Lhasa. We paused at Sangsang, for here we had to come to a great decision. Our money was running out, it was quite clear that we should never reach China and a great desire to see Lhasa had arisen in us. Along the main caravan route we could have got there in about four weeks' walking, but not daring to do this, we decided to try the northern plains, which Tibetans call Changthang. Sparsely inhabited by nomads and robbers, not even the local people venture to go there during winter time. It

was December 2 when we set out; the inhabitants of Sangsang thought us absolutely mad, and it was certainly a good thing we didn't know what difficulties lay before us. We struck north across the Transhimalaya range and walked on through snow and ice. Not knowing the real danger of brigands we disregarded the warnings of the nomads and this nearly cost us our heads. We walked right into their arms and escaped only with the greatest of luck. The following weeks were the hardest in all my life. We marched 20 to 25 miles daily in temperatures around —40° C. (—40° F.), we hardly ever slept and our food consisted only of dry meal and raw yak meat. We hardly ever slept because of the cold, and it was a relief when we at last reached the northern trade route, called "Gold Caravan Road." Of course there was no sign of a road, but from now on we knew that every now and then we would meet nomads and could buy mutton or beef. Formerly Tibetans used to dig gold in these regions, but their only tools were gazelle horns, and eventually they gave it up. Only the caravan route keeps the name. In the distance we saw the mountains of the Nyenchenthanglha range running up to 24,000 feet, and we wondered how we would overcome this obstacle. We passed by the great Nam Tso Lake and crossed the big range over the Gurring La, 20,000 feet high, and probably one of the highest passes in the world.

On 15 January 1946 we saw the golden roofs of the Potala, gleaming in the distance, and we felt inclined to drop down on our knees like the pilgrims. Almost two years had passed since we broke out of the camp. We had walked on foot about 1500 miles, and crossed sixty-two passes between 17,000 and 20,000 feet. Our first full view of the Potala, that unique palace of the Dalai Lamas, was unforgettable. More than a thousand years ago a castle stood on the same rock, but it was the great fifth Dalai Lama who had it built in its present form. The Dalai Lama died before the Potala was completed, and the government kept his death a secret for many years; the population would not have worked for a regent, for government work gets no pay and is considered a sort of tax. On top of another rock stands the second landmark of Lhasa: the medical college on the Chagpori. The Tibetans have quite a knowledge about herbs and their usefulness, although surgery is entirely unknown.

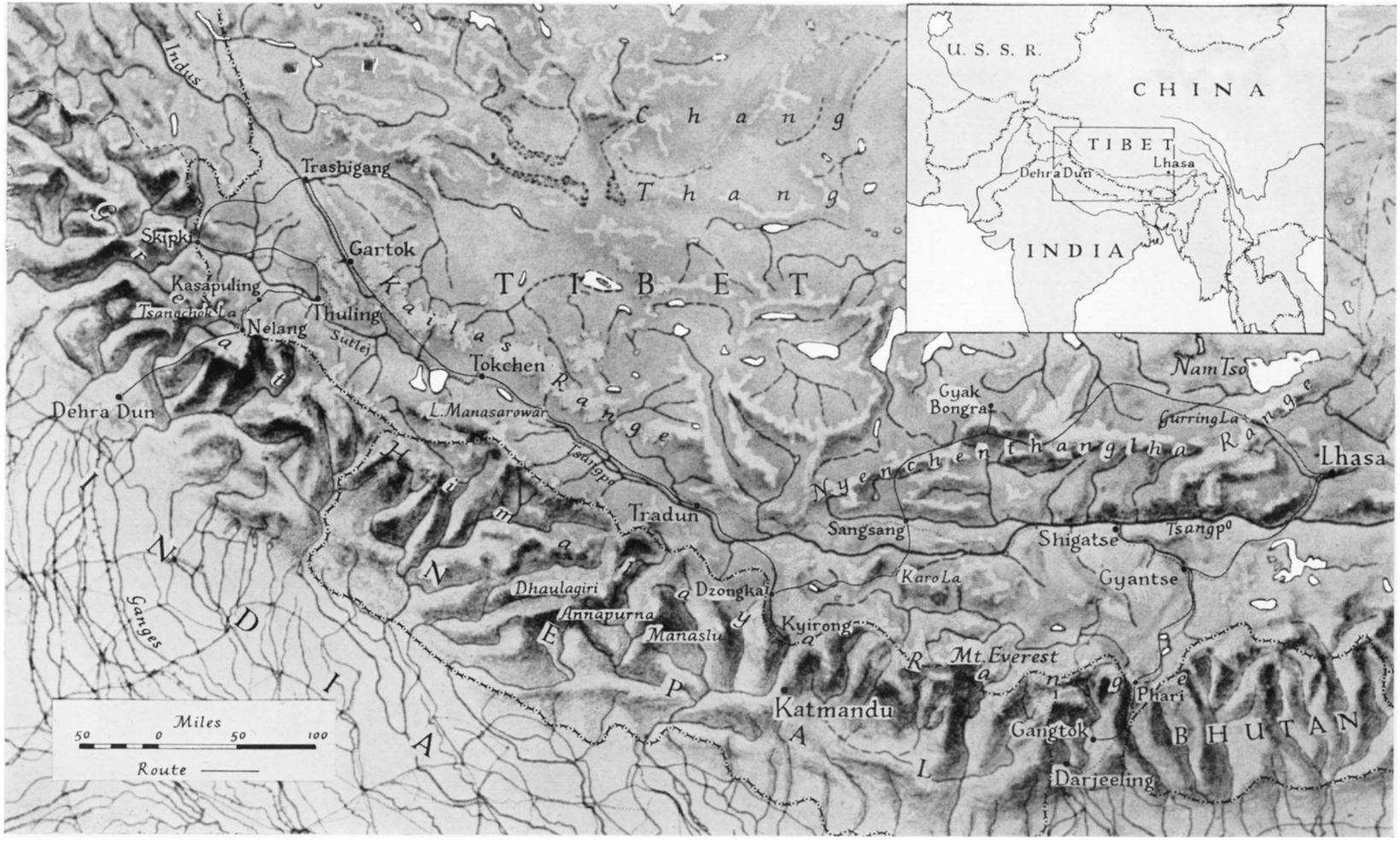
Now at last we stood at the gates of Lhasa. We had often heard of police guarding the entrance to the holy city, but in fact only a few beggars held out their hands to ask for alms. A few steps brought us to the first houses; hesitantly we approached one and asked for refuge. With screams and abuses, we were sent away and only after crossing almost the entire town did we venture again to enter a courtyard. But the same unfriendly reception greeted us. In spite of the uproar we decided to sit down and simply refused to budge: that day we had walked 26 miles without anything to eat, and our blisters had grown to the size of a hand. Presently a change in the atmosphere showed itself: those who had turned us away from their houses when we entered the city now atoned for their inhospitality by approaching us with tea and tsampa-meal. We didn't look very trustworthy, with our huge beards and wearing sheepskin which was in rags. But we were soon surrounded by a huge crowd; then, when we had been there some time, a richly clad Tibetan addressed us in fluent English, and promised to take us to his house, provided the government would give its permission, for even a member of the nobility

could not give us asylum without the permission of the magistrate. Apparently he succeeded, for after a short while servants came to accompany us to the nobleman's house. Here, for the first time, we saw the immense difference between the Lhasa aristocracy and the common people. Servants rushed in and out piling up a variety of food in front of us, which disappeared in a manner contrasting sharply with our noble surroundings, and during the next few days the house was full of visitors. None came without a present, for once you are officially admitted, Tibetan hospitality knows no limits. Although under a kind of house-arrest during these first days, we were soon asked to call on the parents of the Dalai Lama. Our host instructed us how to present the white scarves; for when paying visits or submitting a petition, one has to give silken scarves. The mother of the Dalai Lama received us sitting on a small throne, and though of humble origin, she looked the picture of aristocratic dignity. After their son was discovered to be the incarnation of the Dalai Lama, the closest relatives of the young God-King automatically became the nation's First Family. The government presented them with large estates and a great amount of jewellery; some of it, in solid gold ornaments weighing about 40 lb. Lobsang Samten, the Dalai Lama's elder brother, who did the interpreting, spoke Tibetan quite fluently, yet with the strong mountain accent which we had learned from the nomads and peasants 1000 miles distant, and which could hardly be understood by the Lhasa high society. The Dalai Lama's youngest brother, who was born after our arrival in Lhasa, was also recognised as an incarnation; their father died soon after we arrived in Lhasa. I was amazed how little grief seemed to befall his kin: the Tibetans do not mourn for their dead in our sense of the word. Sorrow at the parting is relieved by the prospect of rebirth, and little respect is shown to the corpse which is dismembered and given to the birds to dispose of. One day's ride from Lhasa is the mountain on the top of which only members of the aristocracy and high lamas are dismembered and given to the vultures.

In the meantime we had moved from our first quarters to the palace of Tsarong, one of the country's richest men who, for his services to the late Dalai Lama, had been presented with large estates. He was married to three sisters, which is extraordinary even for Tibet where you can find any form of legal marriage. Normally, a woman marries all the brothers of a family, thus preventing heritage disputes. Another way to avoid a division of estates is that father and son marry the same woman. Once it took me quite a long time to find out how it was possible that one girl's mother was also her sister-in-law. Women of the Tibetan aristocracy have no political rights whatever, but they enjoy their lives and have a full social existence. They take trouble with their appearance, and always have plenty of magnificent jewellery; I have seen the wives of high-ranking Tibetan officials loaded with gold ornaments, sometimes up to the value of thousands of pounds. Women in less important walks of life, though not allowed to wear pearls, still have fine ornaments and decorate their hair with colourful tassels. There is a big difference between the children one sees begging in the Lhasa streets and the young aristocrats. The children of the Tibetan nobility have each a personal servant, brought from the father's family estate, and given full care of the child's well-being.

As I say, Tsarong owned large estates. But actually he did not own then, since everything—land, mountains, valleys, animals, flowers—belong to the Dalai Lama who is not only the king of the Tibetans but their living god. The way in which, after the death of a Dalai Lama, his successor is found, is certainly one of the last mysteries of our time. Prophecies and oracles play a great part in the selection of the new Dalai Lama, and it would take too long to explain all the details of this procedure. It is a common mistake to assume that the new Dalai Lama has to be born exactly at the hour of death of his predecessor. Often years pass by until the new ruler is found. During this interval, a regent rules the country, but a sigh of relief heaves through the nation when at last the new Dalai Lama enters his residence with oriental pomp. It is a fine sight to see the Dalai Lama riding through the capital in a procession preceded by the cooks wearing similar hats to their European colleagues. Just in front of the Dalai Lama's palanquin, walks the chief abbot, one of the most powerful men in the country, and then follows the richly adorned sedan chair, carried by thirty-six bearers. These processions take place twice a year, in spring and autumn. But the main event in Lhasa is the New Year, the great celebration in which the whole population shares. During the three weeks of New Year festivities, the secular government retires and the capital is ruled only by monks. The population of Lhasa is about 25,000, but during this time monks and pilgrims bring it to three times this figure. Twenty per cent. of the male population of Tibet are monks who live in monasteries. Sometimes the streets of Lhasa are crammed with them, and it is better for a foreigner not to move about too much. During their religious performances they are likely to get into a state of religious ecstacy which may become dangerous. Once you get to know their language however there is nothing fierce about them. I never saw people laugh as much in their daily life as the Tibetans do. The keeping of law and order is entrusted to monk-soldiers, called Dob-Dobs. They pad their shoulders and darken their faces to look even fiercer than they actually behave. They make frequent use of their whip and stick, and I often wondered why the masses take their whipping so patiently. The culminating moment of the New Year celebration is when the State Oracle staggers through the streets in a trance. It is then that this young man is possessed by a god who utters oracles and prophesies through his mouth. These monks die young, for the mental and physical strain of these seances is killing.

There are many more festivities in Lhasa during the year, on one of which a huge banner is displayed on the Potala. This building houses the banner which is hoisted only for two hours every year. Embroidered with gold and silver brocade, it is so heavy that thirty monks are needed to carry it. Below the banner, monks perform a religious dance, wearing ornaments of human bones, and thousands of picturesque masks are to be seen. I would give you a very incomplete picture of the Tibetans if I did not stress the overall importance of religion in their daily life. In no other country in the world do people pray and offer as much as they do in Tibet. The prayer wheels are kept going constantly, rolling in their drums millions of "Om-Mani-Padme-Hum," the Tibetan prayer formula which may be translated as "Hail, oh jewel in the lotus flower!" Sometimes the prayer-wheels are turned by wind, sometimes by water, often by hand. Not all of the three hundred thousand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Lhasa
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Thuling
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Tsangpo
Dehra Dun
Himalaya
Tradun
Nam Tso
Gyak Bongra
Gurring La
Nyenchenthanglha Range
Lhasa
Sangsang
Shigatse
Tsangpo
Karo La
Gyantse
Dhaulagiri
Annapurna
Manaslu
Dzongka
Kyirong
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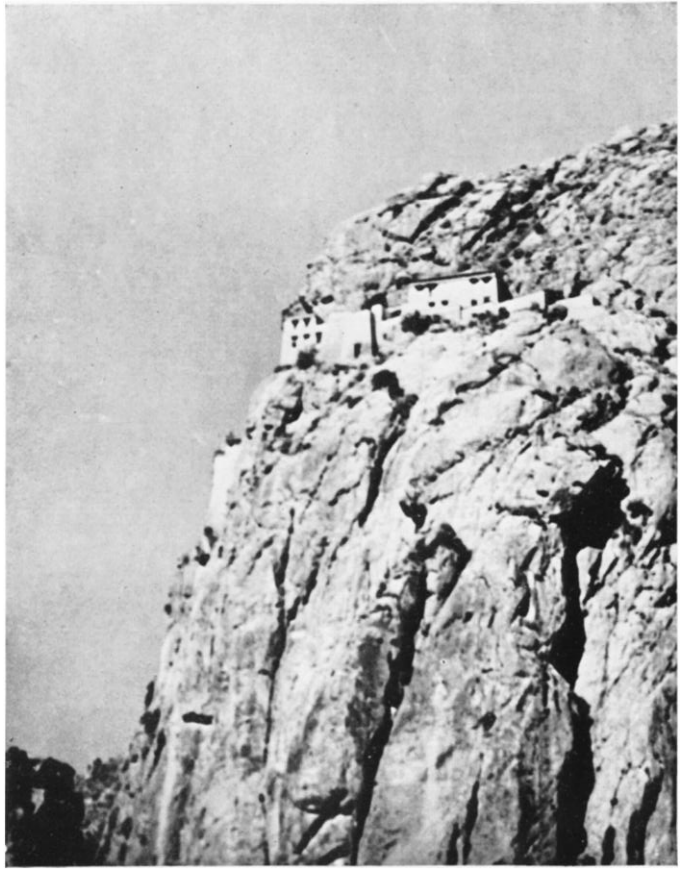
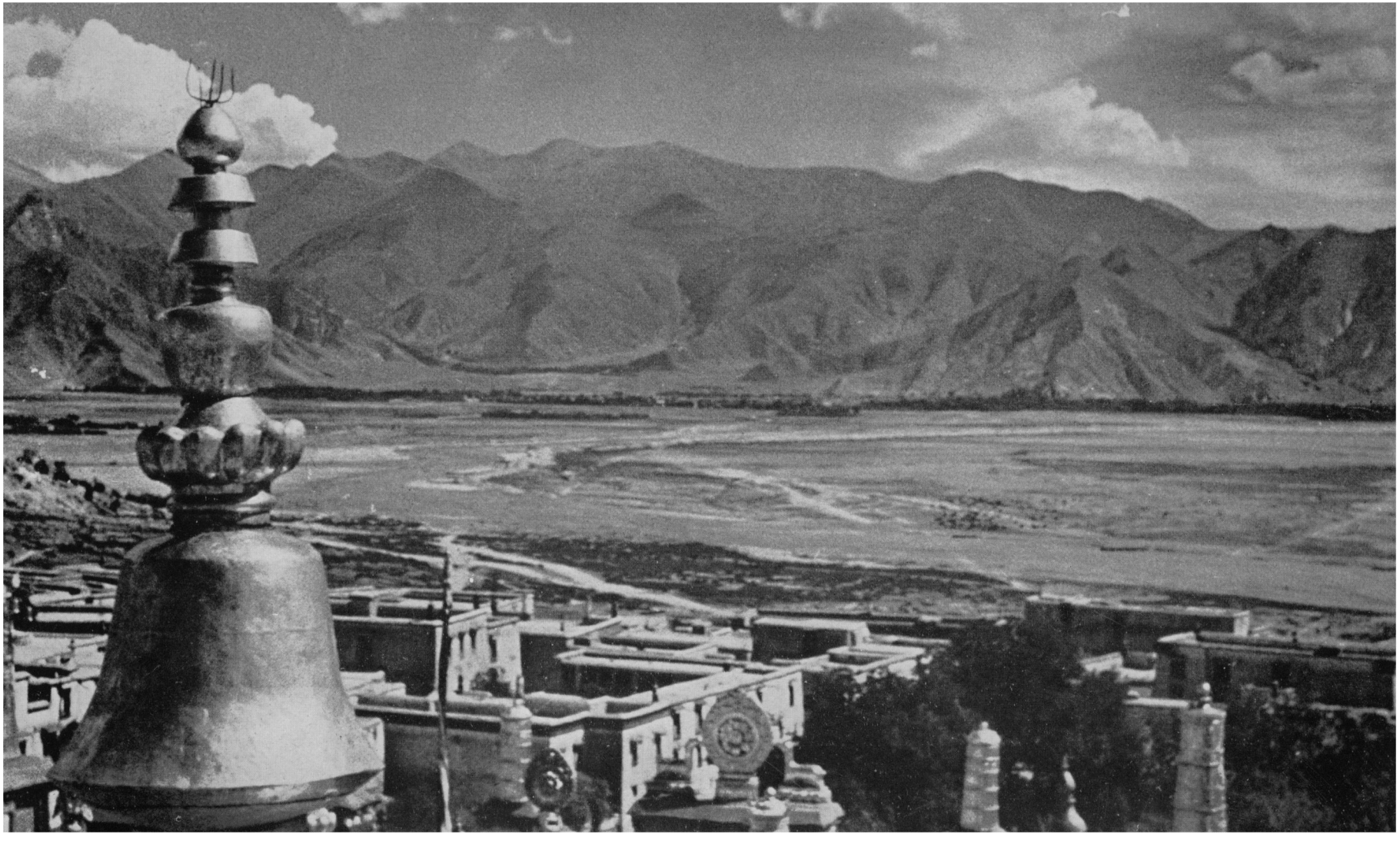
Route

Tibetans with yak hide boat



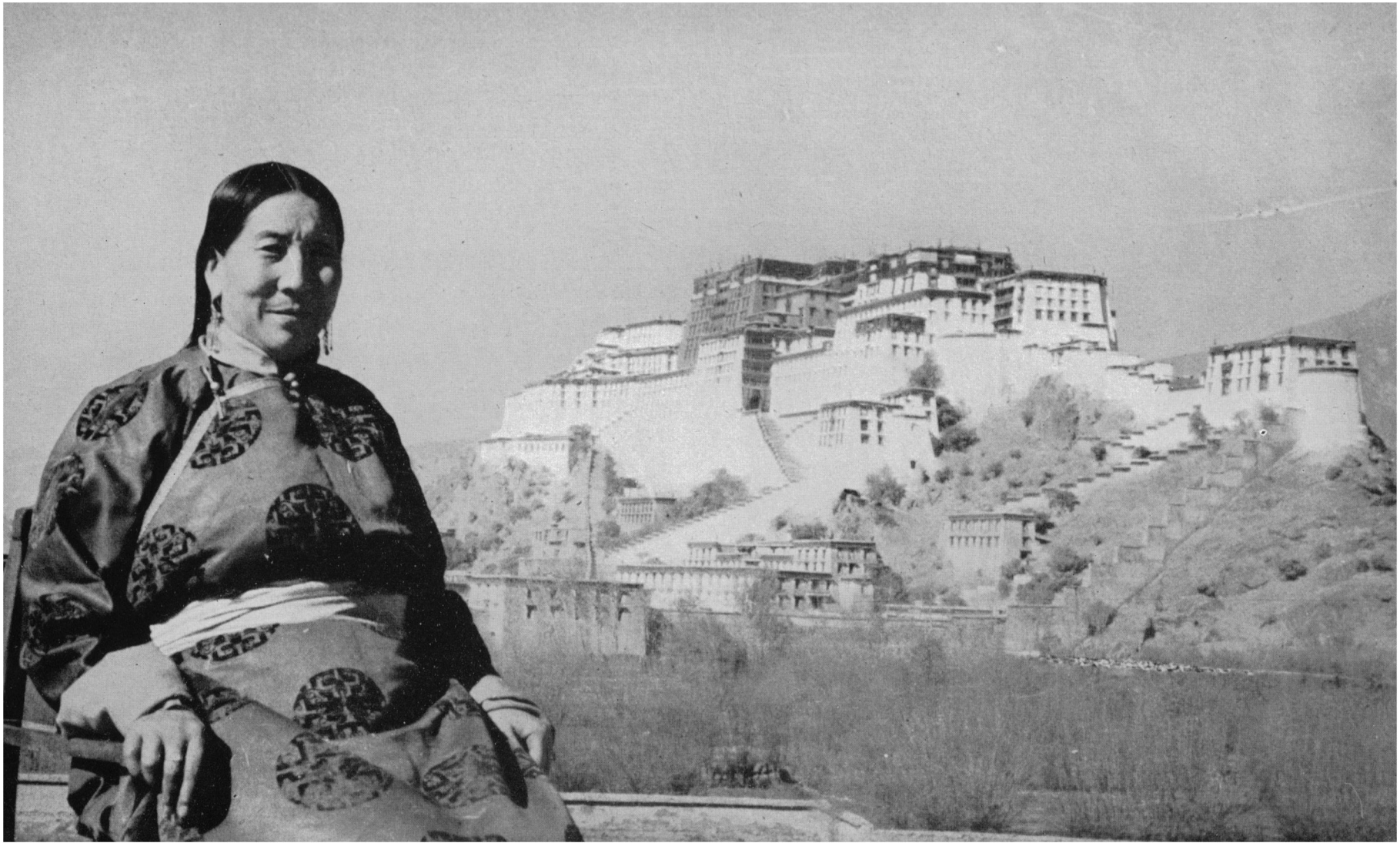
Kyetsang, typical mountain monastery

The plain of Lhasa beyond the golden roofs of Sera Monastery



Heinrich Harrer

The Dalai Lama's sister with Peter Aufschnaiter



The Dalai Lama with his courtiers

Effigy, made of butter, carried in procession

Reviewing the Tibetan army before the Chinese invasion

The flight of the Dalai Lama from Lhasa at dawn

monks in Tibet are scholars and divines; only a few of them actually know the Tibetan scripts, and the majority are servants in the big monasteries. There are religious houses in Tibet which house up to ten thousand monks.

Lhasa street scenes are full of variety, and one has ample opportunity to observe all classes of the Tibetan population, especially during the New Year festivities. The Tibetans are of Mongol race, but their eyes slant less than those of the Japanese or Chinese. The beggars are a great feature of the life of Tibet; there are more than one thousand of them in the capital alone, and their main characteristic is laziness, for they prefer sitting in the sun to hard work. Since nobody turns them away, they earn a day's living by one or two hours of hard begging. On Buddha's birthday, convicts are permitted to beg in the streets, chained together with iron bands. Children of the street, clad in rags, looked pathetic to us at first, but their unkempt look is part of their profession, since they are beggars too. But Lhasa is not entirely a city of mendicants; the shops are full of goods where the well-to-do can obtain everything they want either for use or for amusement. You can buy anything in Lhasa's stores, from binoculars to American gramophone records. In a country where modern sanitation is unknown, Elizabeth Arden cosmetics are most popular and easily available. Everything is man-handled in Lhasa, the invention of the wheel is regarded as too new to be safely adopted; I tried to make my workmen use some kind of wheel-barrow when I was building an embankment, but they preferred to carry the heavy material to and fro.

In all these experiences I enjoyed the wonderful companionship of my friend Peter Aufschnaiter with whom I shared not only the seven years in Tibet but practically my entire time in Asia. For him the lure of the East has proved so strong that he decided not to return to Europe and now lives in India as a cartographer and agricultural engineer. Although he was fourteen years my senior, he stood up to the hardships of our travels often better than I did. We made ourselves useful wherever we could in Lhasa, and even received a monthly salary from the Government, for which we were given letters of payment entitling us to a certain sum of Indian rupees or Tibetan *sangs*. Aufschnaiter was building a water channel, and together we mapped the whole town of Lhasa; there were some drawings of the capital in existence, but Aufschnaiter and I were the first people to survey the capital with theodolite and measuring tape. Our map showed how the main temple, the Tsuglagkhan, stands in the centre of the town and how around it runs the small circular road. The great circular road includes the Potala and is 5 miles long. In a corner of the map I added, in Tibetan handwriting, some of the names of over a thousand houses which I collected. A Tibetan-drawn map would be far more picturesque than ours! Aufschnaiter was an agricultural engineer by profession while I had studied geography. But in Lhasa we had to be jacks-of-all-trades wherever western ideas were to be carried out. And so I built a river embankment protecting the summer gardens of the Dalai Lama and constructed a fountain in the garden of Tsarong's house. The Tibetans love their gardens, and this fountain was much admired.

I made one good friend in Lhasa, a monk officer named Wangdu, whose grandfather had been Regent of Tibet. He was not only very intelligent, but also extremely talented in any kind of sport. He joined me in tennis and

The flight of the Dalai Lama: passing Shigatse on the way to the Indian border

ice-skating, and even accompanied me on my mountain-climbing tours. From the summits near Lhasa we had wonderful views of the surrounding mountains, and we found some beautiful spots—for instance, a lake at 17,000 feet, of which the shores were lined with wild yellow and blue poppies.

The Dalai Lama was an ardent photographer, and it was photography which brought the first contact between us. It is difficult to imagine in how simple, primitive and lonely a way the God-King lived. Nobody was supposed to address him, not even a Cabinet Minister. But it was a sign of his strong will when one day he sent me an order to build a small cinema in his summer garden. At that time I had often used his 16mm. movie camera and it was apparent that he now wanted a chance to look at these films. The camera was a present from the British Mission in Lhasa, the only western diplomatic representation in Tibet. For the Dalai Lama, this cinema must have meant a big change in his routine daily life. Otherwise he was confined to the uppermost storey of the Potala, almost like a prisoner. Just below him, the Regent had his quarters, followed by the Chief Abbot and so on, exactly according to rank. Here the Dalai Lama grew up without family and playmates. His only recreation was a pair of binoculars with which he liked to watch his subjects from afar.

I had often had a glimpse of the Dalai Lama during the processions, but I saw him face to face for the first time during one of the great receptions in the Potala. I sat on a small rug in the throne-room and counted more than seven thousand people filing past their ruler. Everybody was offering presents, poor people just a copper coin while rich merchants carried rolls of gold brocade. Each of them got a blessing from his Holiness and left with a good-luck scarf. During my visit to the Potala I saw the enormous gold statues which were proof of the reverence the Tibetans show towards the Dalai Lamas. One golden Buddha, for instance, is more than nine storeys high.

After having completed the cinema, I was entrusted by the Dalai Lama with handling the projector and showing him the films. And that was the beginning of a real friendship between the fifteen-year-old ruler and myself. I soon found myself teaching him geography, mathematics and English. He was extremely intelligent and eager to learn about our way of living. And although he did put some rather difficult questions, I tried to answer them as well as I could.

Thus my life in Lhasa began to take a new course. But happy though this time was, it was already darkened by political clouds. The Chinese started to threaten Tibet's independence and the Tibetan National Assembly decided to appeal to the United Nations. They took no action however and in the autumn of 1950 the Chinese invaded Tibet. They crossed the border at six different points with a total of twenty thousand troops. Of course it was impossible for the small and outmoded Tibetan army to cope with this enemy and so the Dalai Lama, in December of that year, fled to Gangtok on the Indian border. On this trip I could not help but remember the old saying which I had heard in Lhasa, that the thirteenth would be the last in the succession of Dalai Lamas. Although my friend had been initiated as the fourteenth Dalai Lama, he had to quit the capital. It was his first trip across the country and from near and far his subjects had come to see him, for his

mere presence meant a blessing. Everywhere incense-fires burned and the whole escape route was lined with pebbles to protect the God-King from evil spirits.

When I left Tibet after seven years it was again an escape. This time it was the Communist Chinese I was fleeing from and although I was in a much better state than seven years ago—with servants, luggage and horses—and though I knew that I was returning to my home-country, I felt far from happy. For I probably would never see my friends again. And the Dalai Lama? Officially he is still the ruler of his country. Personally he is a prisoner in his huge palace, a puppet of the new masters of his country. But I hope that perhaps the eternal God of Grace, who is manifested in the person of this young man, will survive this soulless regime as he has survived so many earlier Chinese invasions that over the centuries have swept across the land of Tibet.

DISCUSSION

Evening Meeting, 1 February 1954

Attended by Her Royal Highness the Duchess of Kent, Honorary President

Before the paper the PRESIDENT (Mr. J. M. WORDIE) said: Your Royal Highness, Your Excellency, My Lords, Ladies and Gentlemen—The lecturer tonight is a man of great resource and determination and his climbs in Switzerland are well known. He was the first man to climb the North Wall of the Eiger, regarded as one of the most difficult feats of mountaineering.

Mr. Harrer then read his paper

His Excellency the AUSTRIAN AMBASSADOR: It is my privilege to thank the Royal Geographical Society and your President for the honour they have given to my compatriot. An article which I read yesterday in the *Sunday Times* said that the Royal Geographical Society retains its sympathy for the individual and is still a place in which anyone with serious and original ideas may be assured of serious and informed consideration. I think that is exactly what Harrer is feeling. He is above all a mountaineer who takes his task seriously and one who gets into and out of trouble easily. It is one of the nice things after such an expedition to feel safe, and I cannot imagine any way in which one would feel safer than in coming to England and feeling the atmosphere of freedom and appreciation.

Lt.-Col. F. M. BAILEY: It is nearly fifty years since I left Lhasa on the little expedition to Western Tibet which was referred to by Harrer just now. We travelled, as he did, in mid-winter. Temperatures were down to 25° below zero; in his case it was 40°. We went to heights of up to 19,000 feet; in his case it was 20,000 feet; I know what it all means!

We travelled in considerable comfort—though we did not think so at the time—and had tents and warm clothes and warm boots. He had none of those things, and I am amazed at the way he was able to go through that terrible journey with the results he has shown us, and at the way he has been able to increase our interest by the photographs we have seen.

I want to say one thing about the Tibetan Government. I think they deserve some credit for being good enough to put these two refugees into the position to make their way as they did, and of course we admire them for having taken the opportunity.

SCIENTIFIC ASPECTS OF THE EXPEDITION TO MOUNT EVEREST, 1953

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THE 1953 EXPEDITION to Mount Everest received scientific assistance which was more comprehensive and effective than that given to any previous British Himalayan expedition. Since the last British attempt on Mount Everest in 1938, much more had been learnt about human efficiency in extreme environments, and the results of the personnel research methods used with such great effect during and after the Second World War could be coordinated and applied to the many relevant problems. There was also the accumulation of knowledge from previous expeditions to Everest to be drawn on; and the experience of the Swiss party in the spring of 1952, generously made available by them, was of particular value. Further important information was derived from the physiological data collected on the British expedition to Cho Oyu in 1952. This expedition had been designed, partly with the object of climbing Cho Oyu (26,800 feet), the sixth highest mountain in the world, but mainly with the idea of forming and training a nucleus of climbers capable of attempting the ascent of Mount Everest the following year. A physiologist had accompanied the party* in order to study the effects of supplementary oxygen on men at high altitudes and also problems of nutrition, acclimatization and equipment. The expedition did not succeed in reaching an altitude greater than 22,500 feet but the information which was obtained made an important contribution towards predicting the requirements for the 1953 expedition.

Acclimatization.—The Cho Oyu party, like the Swiss on Everest, went straight up to high altitude within a few days of arrival in Sola Khumbu, and did not return to lower altitudes until after the attempt on the summit.

The party was insufficiently acclimatized, and lost a great deal of weight. They also suffered a high incidence of sickness due to diarrhoea and upper respiratory infections. It was thought probable that these infections were contracted from the local inhabitants and porters, and although hygiene could obviously be considerably improved, it seemed unlikely that the introduction of infection into a party on its arrival in the Himalaya could be altogether prevented. It was therefore urged that the forthcoming expedition to Everest should spend a month in the Sola Khumbu district in order to become acclimatized to altitude and to pass through the stage of initial infections before going on to the mountain itself. Experienced Himalayan climbers hold the view that little is to be gained by spending too much time below 14,000 feet when adaptation is required to altitudes above 18,000 feet,

* The attachment of Dr. Pugh to both the 1952 Cho Oyu Expedition and the 1953 Everest Expedition was made possible by successive generous grants from the Royal Society to the Himalayan Committee of the R.G.S. and the Alpine Club sponsoring these expeditions.

and this view is supported by the observation that Sherpas living at Namche (about 12,000 feet) complain of headaches and shortness of breath in crossing the Nangpa La at 19,000 feet. The plan was therefore adopted of spending three or four weeks on acclimatization, but instead of ascending by slow stages, the party should make short visits to heights of about 18,000 feet and return in the intervals to 13,000 feet to rest. This procedure proved extremely successful, and was thought partly to account for the greatly improved physical condition and freedom from illness shown by the party during the subsequent operations on the mountain.

Oxygen.—Oxygen had been taken on every expedition to Mount Everest except the reconnaissances of 1921 and 1951. The equipment available to prewar expeditions was still however insufficiently developed to be effective and it was not easy to persuade mountaineers of the usefulness of oxygen for their purpose. British parties in 1924 and 1933, and the Swiss in 1952, reached an altitude of about 28,000 feet by their own unaided efforts and were turned back by a combination of factors of which lack of oxygen was only one. Many mountaineers therefore thought (and some still think) that, given ideal conditions, Mount Everest could be climbed without the help of oxygen. Oxygen apparatus was however tried between 23,000 feet and 27,300 feet by Finch in 1922,[1, 11] by Odell in 1924,[4] and by Lloyd in 1938.[3] They each used open circuit apparatus weighing in the region of 28 lb. Finch and Lloyd, using 2·2 litres (NTP) of oxygen per minute, claimed increased speed of climbing and reduction of fatigue, but their companions climbing without oxygen, were not convinced that their own performance had been bettered. Odell, who used 1·0 litres per minute, obtained little benefit from his oxygen and found he went better on the whole without it. The conclusion generally drawn from the prewar experience was that the weight of the apparatus very nearly counterbalanced any benefit derived from the oxygen.[9, 10]

The experimental work done on Cho Oyu provided data permitting a reassessment of the oxygen problem. It became clear that higher flow-rates of the order of 4 litres per minute were needed and much more oxygen would therefore have to be provided than had been taken before. Although the net effect of oxygen on the rate of ascent of men climbing at 20,000 feet was found to be small, it was predicted that, given enough oxygen, above 26,000 feet the rate of ascent would be about doubled because of the elimination of the need for rests every few steps to recover breath. Because of reduction of fatigue, men would be able to do a much longer day with the help of oxygen than without it. The successful use of oxygen would however depend on the ability to overcome the practical difficulties of transporting adequate quantities of it to the higher camps.

Many people in both scientific research establishments and industry were concerned with the preparation of the oxygen equipment for the 1953 expedition. First a choice had to be made between the open and closed circuit types of set.

With open circuit apparatus the climber breathes in a mixture of air and oxygen and exhales to the atmosphere. The partial pressure of oxygen in the inspired gas mixture depends on the altitude, the air temperature, the

flow-rate of oxygen and the minute-volume of lung ventilation. At oxygen flow-rates of 2 and 5 litres per minute which are within the practical range for Mount Everest, a climber near the summit of the mountain inhaling 80 litres of air and oxygen per minute would be getting oxygen at a partial pressure equivalent to that of the oxygen in the atmosphere at about 22,000 feet and 13,500 feet respectively.

Closed circuit apparatus has two outstanding advantages. The climber breathes pure oxygen at a pressure even greater than the pressure of oxygen in the atmosphere at sea level. Secondly, loss of heat from the body via the lungs in warming and humidifying the inspired air is practically eliminated. This factor was considered important, for it was calculated that 50 per cent. of the total metabolic heat production of the body would be lost in this manner in men climbing at 28,000 feet at a temperature of −40° C. (−40° F.). Closed circuit sets are however more difficult to operate than the open circuit type and are liable to develop faults which cannot be identified and corrected under the conditions of use on a mountain. They had already been used in 1935 and 1938 without success.

Existing closed circuit sets designed for fire fighting and mine rescue are unsuitable for mountaineering use as they have neither the endurance required nor the capacity to handle the very high volume of lung ventilation needed in climbing at high altitude. If closed circuit sets were to be used, an entirely new design would have to be developed and it was doubtful if this could be done in the time available. The open circuit type was given first priority (on the advice of the Oxygen Advisory Committee under the Chairmanship of Professor Sir Bryan Matthews) on the grounds of simplicity and reliability, and because Finch and Lloyd had already shown that it could be used successfully under mountaineering conditions. However on account of the great potential advantages of the closed circuit type of set, some of these sets were produced for trial purposes and were taken on the expedition.

The amount of oxygen sent out to Nepal was 193,000 litres. This figure may be compared with the 29,000 litres sent out in 1922 and the 20,000 litres taken by the Swiss party in autumn 1952. Of the 160 cylinders containing the oxygen, seventeen were found to have leaked on arrival; one-third of the remaining 150,000 litres was used for training and a small quantity for experimental purposes. About 16,000 litres were left over at the end of the expedition; this would have been barely enough for a third assault. The climbers were carefully trained in the use of their oxygen equipment. They wore their masks for part of each day on the approach march, and made training ascents with both the open and the closed circuit sets. They also learnt to sleep comfortably wearing lightweight masks and breathing 1 litre of oxygen per minute.

Open circuit sets proved satisfactory apart from a few minor technical difficulties which were overcome and some trouble with ice formation round the mask and its connections. Respiratory resistance, which had always been one of the chief difficulties encountered in oxygen apparatus used on Everest, was reduced to a minimum even at high work rates. For strenuous work, 4 litres of oxygen per minute were needed, but men moving slowly behind a leader making tracks and cutting steps found 2 litres adequate. Using 4 litres

per minute, Hillary and Tenzing climbed at 630 feet per hour from 25,850 feet to 27,300 feet in a track prepared by their support party. The final climb from the top camp (27,900 feet) to the summit, when they only used 3 litres per minute (less than had been intended), took 5 hours.

The closed circuit sets were used successfully under the supervision of Bourdillon, who had been associated with their construction,[13] but even he found difficulty in tracing faults which developed on the South Col. He and Evans used these sets on the first assault and climbed nearly 3000 feet from 25,850 feet to 28,700 feet and back in a day. From 25,850 feet to 27,300 feet they averaged 930 feet per hour making their own track—this, for men carrying 50 lb. loads, must be accepted as an Alpine standard of performance. On the last 700 feet after changing soda lime cannisters, Evans' set gave trouble, but the fault was not identified. Above 26,000 feet the fact that the inspired air was warm and moist proved a great advantage, though at lower altitudes the closed circuit sets were uncomfortably hot.

The most important effect of oxygen was reduction of fatigue and high altitude deterioration. Climbers using oxygen found they could do a much longer day without becoming exhausted. Oxygen at night induced sleep and warmth, and promoted recovery from fatigue. All the climbers commented on the great subjective benefit experienced while climbing; they were able to enjoy climbing again and take an active interest in their surroundings. Climbing rates were not significantly improved up to 22,000 feet but above that altitude the improvement in climbing rate became increasingly apparent. Sudden failure of the apparatus while climbing caused severe breathlessness and weakness, although slow failure was apt to pass unnoticed. No ill effects were noticed on removing the mask, provided the climber first rested and recovered his breath. Hillary removed his mask on top of Mount Everest and was able to take photographs and set the shutter speed of his camera. After ten minutes he noticed his movements were getting clumsy and his thought processes muddled, so he replaced his mask. Bourdillon reported some loss of tolerance of altitude after wearing his closed circuit set for a prolonged period, but there was no evidence of this in the case of Evans.

Nutrition.—Himalayan expeditions have in the past usually subsisted on local foodstuffs supplemented from bulk stores taken out from England (or purchased locally). Below 10,000 feet, rice, *dhal* (a type of lentil) and *atta* (stone-ground wheat flour) are staple foodstuffs, and above 10,000 feet potatoes and *tsampa* (stone-ground parched barley) are eaten. Eggs and chickens are available in limited numbers up to about 13,000 feet and yak and sheep can be purchased between 12,000 feet and 14,000 feet and sent up on the hoof to 18,000 feet.

Most of the food for the day on a Himalayan expedition is consumed at two meals, breakfast and supper, and since the daily intake of Calories is 4000 to 4500—at least at the lower altitudes—these have to be very large meals. Very large quantities of tea are drunk, and with the serving of curry each evening and the strange, bulky diet, a considerable strain is placed on the digestive system. Digestive disturbances are relatively common, and cases of chronic diarrhoea occur which are probably of infective origin but are kept

going by an unsuitable diet. The majority of climbers however eventually become completely adapted to the diet and do well on it.

Cooking is done over wood fires up to 18,000 feet. Above that, fresh problems arise; the production of cooked meals and adequate quantities of liquid becomes increasingly difficult. Paraffin stoves are used, and all water has to be obtained by melting snow. Owing to the reduced boiling-point of water (176° F. at 20,000 feet), pressure cookers are essential if hot meals are to be provided. It is a curious fact that mountaineers have only recently come to accept pressure cookers as an indispensable part of their equipment; as recently as 1951, pressure cookers supplied free by the makers were discarded before the approach march.

Above 18,000 feet diet becomes unpalatable and monotonous. For this reason, and also because of the effect of altitude on the appetite, the food intake of the climbers becomes progressively reduced. Shipton,[8] on the 1935 expedition, obtained records of food consumed between 18,000 feet and 21,200 feet, and the calorific value worked out at between 1500 and 2000 Calories. At these altitudes, the food preferences of climbers undergo a marked change. They develop an increased appetite for sugar and, if sufficient quantities are available, may consume up to 14 oz. per day. The sugar is taken mainly dissolved in beverages, and these, in spite of their very large sugar content, seem to taste less sweet than at sea level. Climbers, while regarding the food provided as dull and unpalatable, often feel they would enjoy well-cooked food such as they would eat at home. Some men develop cravings for foods that are usually not available, such as salmon, sardines and tinned fruit.

Owing to the inefficient cookers and shortages of fuel, parties on Everest and other high mountains have usually had difficulty in satisfying their fluid requirements and there is much indirect evidence in Himalayan literature that parties have suffered from dehydration. This may also be because the sensation of thirst, like the appetite for food, may be impaired at high altitude, and men may suffer less from thirst than they would with a corresponding fluid shortage at sea level.

On the expedition to Cho Oyu in 1952,[5] the energy value of the diet on the approach march was about 4300 Calories, but intake fell to about 3000 Calories at and above 18,000 feet. This was higher than that reported by Shipton in 1935, probably because ample supplies of sugar were available. Between 5 and 7 pints (3 and 4 litres) of fluid per day were taken. Inconvenience and sometimes hardship were caused by shortage of essential stores due to pilfering and over-consumption of favourite items and to the difficulty of distributing and sorting the bulk rations.

In preparing the 1953 expedition, it seemed wise on general physiological grounds to avoid the sudden change to a strange and bulky diet and to provide a more varied and palatable diet than is available to a party living off the country. Some improved method for the sorting and distribution of rations was desirable and better arrangements for cooking and melting snow at high altitudes were necessary. At the high camps where economy of weight is essential, a special ration was needed which would provide a basic diet consisting largely of sugar, as well as catering for individual food

preferences. To meet these requirements it was decided to break with tradition and use composite rations of the type used in the armed forces for supplying troops operating in isolated groups or small units. Special stoves were designed to ensure an adequate supply of water at high camps, and pressure cookers were provided to make possible the cooking of meat and potatoes at and above the base camp (18,000 feet).

The organization of the packing of the rations was undertaken by the Army, and many of the items were made available from Army stocks. The detailed composition of these rations has been published elsewhere.[2, 6] In brief, two types of ration were taken:

(1) A general purpose composite ration packed in 14 and 28 man-day units. Palatability and variety were achieved by the use of tinned foods combined in a different menu for each day. Economy of weight was not a vital consideration in planning this ration, since there would be no shortage of porters in Katmandu at the time of the year when the party would be setting out from there. It was planned to supplement the ration with rice and potatoes purchased locally and later with fresh meat.

(2) An assault ration for use above 20,000 feet. In this every effort was made to economize on weight and bulk. No tins were used and most of the foodstuffs were vacuum packed. By vacuum packing, a soft item like a bag of granulated sugar is reduced to a hard rectangular block, which becomes soft again once the vacuum seal has been broken. This new method of packing offers very important advantages to all expeditions where economy of weight and bulk is important.

In order to cater for the personal idiosyncrasies shown by men at very high altitude, each climber was asked before the expedition to select one or more foods that he thought he would be able to eat at the high camps. These were packed in bulk and called luxury boxes. It was planned that each climber, before going high, should reject such items as he did not require from the assault ration and substitute the foods of his own choosing from the luxury boxes. At base camp the assault rations were further lightened by removal of superfluous protective wrappings and rejection of certain unpopular items such as pemmican and Service biscuits. The composition of the modified assault ration was then as follows:

Rolled oats	2 × 1 oz. packets	Boiled sweets	1 × 2 oz. packet
Milk powder	2 × 3 oz. packets	Salt	2 × 5½ gm. dispensers
Sugar	4 × 2 oz. packets	Cocoa	1 × 1 oz. packet
Jam	1 × 2 oz. packet	Tea	1 × 1½ oz. packet
Sweet biscuits	2 × 3 oz. packets	Soup	1 × 2¼ oz. packet
Cheese	2 × 1 oz. packets	Lemonade powder	2 × 1 oz. packets
Mint bar or banana bar	2 × 2 oz. packets		

Gross weight: 4 lb.

The above rations proved on the whole satisfactory. The general purpose composite rations were eaten at a greater altitude than had been anticipated (up to Camp 4 at 21,200 feet), and were supplemented with yak meat, mutton, rice and potatoes. The Calorie value of the diet eaten in the Western

Cwm between 20,000 feet and 21,200 feet was calculated to be about 3800 Calories per day, compared with 3000 Calories the previous year. During the assault, climbers ate most of the sugar and milk in their assault ration but otherwise subsisted on items such as sardines, salmon, cheese, tinned fruit and French saucissons from the luxury boxes, and Vitawheat, Knäckebrot and honey salvaged from the Swiss expedition of the previous year. Fluid and salt requirements were well met, and there was no evidence of significant fluid deficiency having occurred even during the assault phase.

The greater food consumption in 1953 as compared with 1952 is explained by better acclimatization, the provision for normal cooking at high camps and the improved palatability and variety of the food. It was generally agreed among the five men who had taken part in the 1952 as well as the 1953 expedition that the average level of fitness among the party at all stages of the expedition was higher in 1953 than the previous year. Objective evidence in support of this view is provided by the records of body weight. In 1953 the average loss of weight in the first month after reaching Thyangboche (13,000 feet) was 2 lb., whereas the average loss of weight over the corresponding period in 1952 was 11 lb. During the second month of the 1953 expedition, spent for the most part above 20,000 feet, the average loss of weight in five men for whom records are available was 4 lb.

Climatic considerations.[7]—On the expedition to Cho Oyu in 1952 climatic conditions were studied in relation to problems of protective clothing and equipment. The expedition experienced a wide range of climatic conditions, representing many recognized types of climate; for example, dry heat, moist heat, temperate alpine conditions, wet cold and dry cold. The snow-line from April to May extended down to about 17,500 feet, and it was only above that level that special protective equipment against cold began to be needed. The special features of the climate above the snow-line were fairly intense cold at night and low air temperatures combined with high radiation temperatures during the day. Weather conditions were variable: there were snow storms alternating with fine periods, but even in fine weather the onset of mist and snow in the afternoon was usual. Minimum temperatures at night at between 18,000 feet and 20,000 feet were variable and ranged from −13° C. to −20° C. (+8·6° F. to −4·0° F.). Sun temperatures of 69° C. (156° F.), measured with the black bulb radiation thermometer were observed in association with shade temperatures near freezing point. High winds were occasionally met with, but not of the force to be expected on ridges and cols above 22,000 feet. Although these conditions were not severe by comparison with those to be expected above 22,000 feet, the climbers complained of being cold in their sleeping-bags and suffered from cold feet while climbing. It seemed desirable that use should be made of modern technical developments in the design of protective equipment for cold conditions, due consideration being given to the special requirements for mountaineering which are an economy of weight, freedom of movement, and adjustability to suit variations in metabolic heat production and in environmental cooling power.

With regard to the question of cold on Mount Everest, no records of temperature were available from previous expeditions for altitudes above 24,000 feet. Balloon observations made at hill stations in India indicated that

minimum temperatures of −40° C. (−40° F.) and wind velocities of up to 100 m.p.h. were to be expected at 28,000 feet.[12] However the fact that mountaineers on Everest had not suffered more casualties from cold than they did suggested that, in the fortnight before the monsoon, temperatures were higher than at other times. By extrapolation from the Cho Oyu data, assuming a lapse rate of 3·5° F. per 1000 feet, minimum night temperature at the South Col at 26,000 feet would be between −25° C. (−13° F.) and −32° C. (−26° F.), and at 28,000 feet between −29° C. (−20° F.) and −36° C. (−33° F.).

Wind velocities of 100 m.p.h. would of course put a stop to climbing operations, since in a wind of such velocity even walking on level ground is impossible.

For climbing during the day in fine weather, climbers would have little difficulty in keeping warm as air temperatures by day would be considerably higher than the temperatures at night given above, and they would be gaining a large amount of heat by radiation from the sun. Conditions would however become extremely dangerous if climbers at very high altitudes were overtaken by bad weather or if they were benighted without their sleeping equipment.

Protective equipment—A single cotton-nylon fabric, chosen after extensive laboratory tests, was used in the construction of tents and windproof clothing. The outer windproof smock and trousers were greatly improved in design in the light of experience gained in 1952, and by making use of ideas from Polar practice. Particular attention was paid to the fit of these garments—this had been conspicuously at fault in 1952. The main insulating garments were the quilted down jacket and trousers which were similar to those used by British and Swiss parties the previous year. Silken inner gloves, woollen mitts and outer windproof mitts of ventile cloth were provided for protection of the hands, and a number of pairs of very large Swiss down mitts were taken for the assault parties.

Special boots were provided for use above 20,000 feet. These were of an entirely novel design, having relatively thin microcellular rubber soles and very thick kapok-stuffed uppers to provide the required amount of insulation. Both the inner and outer coverings were waterproof so that the boots conformed to the double vapour-barrier principle. This principle has recently been applied in the design of boots for the Allied forces in Korea. Much attention was paid to economy of weight since metabolic experiments have shown that 1 lb. of weight carried on the feet is equivalent to 4 lb. carried on the back. The boots were not entirely successful because they did in fact get wet (owing to tears in the outer covering), and this increased their weight considerably. In spite of the kapok being damp however the insulation afforded by the boots proved adequate for the conditions encountered. The total weight of the protective clothing, including boots and gloves, was 17 lb., compared with 23 lb. for a corresponding Polar clothing assembly.

Many different patterns of tent were taken. In addition to the British tents, American, French and Swiss patterns were taken for trial purposes, as well as a small experimental tent in which the normal tent poles are replaced by a spring steel frame which keeps the tent fabric under tension as in an

umbrella. The essential properties required in Himalayan tents are as follows: They must be quick and easy to erect and strong enough to resist high winds; they should be large enough to provide reasonable comfort for the number of occupants they are designed to shelter; very strong sewn-in ground sheets are needed to resist tearing when the tents are pitched on rock and ice. Ventilation is very important on account of the intense solar radiation during the day which raises the temperature even in well-ventilated tents to about 80° F. (27° C.); for this reason Himalayan tents should have entrances at both ends. Double walls for protection against low night temperatures are not necessary if the sleeping-bags and mattresses are adequate. Sleeve entrances as used in Polar tents provide a method of closing the entrances which will keep out draughts and wind-driven snow. Economy of weight is important but not an overriding consideration, except in assault tents. Of the tents used on the present expedition the modified Meade tents were the most popular and were used on the South Col and in the top camp. These are extremely easy to erect even in a strong wind. The other general purpose tent, the pyramid tent, was a modification of a pattern developed in 1943–4 for snow and mountain warfare and, though very light in weight relative to the number of men accommodated, suffered from the disadvantage of being difficult to erect in a strong wind. It was unfortunate that one of these tents was taken to the South Col.

Sleeping-bags designed for the Himalaya must have an outer and inner compartment to cover the wide range of climatic conditions encountered. About 8 lb. of down are needed to afford sufficient protection for temperatures down to −40° C. (−40° F.), and the inner bag should weigh about 3 lb. The bags should be long enough to pull over the head and wide enough to allow a man to turn over inside the bag, to which end a slippery nylon lining is an advantage. These requirements were met in most of the bags supplied which were of Canadian, New Zealand and British manufacture, but the briefing of the makers was in some instances incorrect. Sleeping mats were of the inflatable type. An ordinary commercial pattern was taken for use up to base camp. At base camp and above, special mats were provided, based on a design developed during the War which gives better insulation and eliminates the characteristic bouncing effect experienced by a person lying on the ordinary type of mat when he turns over. The special mats had a double layer of inflatable tubes which were constricted at the ends, thus buffering sudden displacements of air from tube to tube. These mats provided good insulation from the ground and were very comfortable. The descriptions by the climbers of their experience on the South Col indicates that they suffered rather severely from cold. This was explained by the fact that in order to save weight they left behind the inner components of their sleeping-bags. Had temperatures of −40° C. (−40° F.) instead of −25° C. (−13° F.) been encountered, their situation would have been dangerous.

The role of science in relation to the 1953 Everest Expedition, of which some account has been given in these pages, has been to reduce the stresses imposed by an extreme environment, to increase the climbers' ability to

maintain themselves under extreme conditions and so to preserve a state of health and efficiency sufficient to enable them to achieve their object. From the scientific, as well as from other points of view, therefore, the ascent of Everest is another milestone in the progress of man's conquest of his environment.

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